

Appendix H

Modeling Analysis – Water Supply and System Operations

APPENDIX H

Modeling Analysis – Water Supply and System Operations

H1 – Hydrologic Modeling Report

H2 – Hydrologic Modeling – Supporting Information

H3 – Temperature Modeling Report

APPENDIX H1

Hydrologic Modeling Conducted for the WSIP Water Supply and System Operations Impact Assessment

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1. Introduction

This technical appendix summarizes the methodology and results of the hydrologic analyses conducted for the water supply and system operations impact assessment for the Program Environmental Impact Report (PEIR) on the Water System Improvement Program (WSIP). It includes descriptions of the analysis conducted by the PEIR consultant team using output data derived from the San Francisco Public Utilities Commission's (SFPUC) water supply planning model, the Hetch Hetchy/Local Simulation Model (HH/LSM) and provided by the SFPUC. This type of analysis is also referred to as "post-processing" of data, since it involves manipulating information following the completion of the model runs. The HH/LSM analyzes system operations based on historical hydrology, including actual hydrological sequences and events, and the model allows the SFPUC to predict the consequences of changes to the system's facilities and/or operations. The SFPUC's model was used to predict potential impacts on water resources in the affected watersheds resulting from the proposed program, variants, and alternatives developed in the PEIR. The HH/LSM is similar to the tools used by other water purveyors in the United States to plan system improvements.

A detailed description of the HH/LSM is provided in the *Water Supply System Modeling Report, Hetch Hetchy/Local Simulation Model* (SFPUC, 2007) and is incorporated herein by this reference. This appendix, Appendix H1, provides descriptions of the model runs and the methods used to post-process and analyze the HH/LSM data. Appendix H2 –Modeling Analysis – Water Supply and System Operations, prepared by the SFPUC, presents further data and explanation of the HH/LSM raw data output as it relates to system operations; modeling data were used to support the PEIR impact assessment of water supply and system operations. Appendix H3, *Temperature Modeling Report*, describes the model and analytical methodology used to predict temperature changes in the Tuolumne River below La Grange Dam, and presents the modeling results. A full compilation of post-processed model data for the proposed program, variants and CEQA alternatives proposed according to the methodology presented in this document and used in the PEIR impact assessment is available for review at the SF Planning Department and the SFPUC offices.

The post-processing effort included summarizing the myriad of data derived from the HH/LSM modeling in a uniform, succinct format to allow for the analysis of potential hydrologic impacts of the proposed program, variants, and alternatives compared to existing conditions. In certain instances the variants and alternatives are also compared to the proposed program. The PEIR team utilized the post-process results to identify potential direct impacts on hydrology (stream flow and reservoir water levels) in the affected watersheds as well as potential indirect impacts on related resources, including geomorphology, surface water quality, groundwater, fisheries, terrestrial biological resources, recreation, and visual resources. In addition to the results of this analysis, the authors of the PEIR relied on additional post-processing and analysis provided by the SFPUC and presented in Appendix H2.

This appendix is organized as follows:

1. **Modeling Scenarios** – An explanation of the model runs analyzed for the PEIR. Further explanation of the model runs is provided in Appendix H2.
2. **Hydrologic Modeling Methodology and Model Output Data** – A brief explanation of the HH/LSM, with reference to the SFPUC’s modeling documentation, *Water Supply System Modeling Report, Hetch Hetchy/Local Simulation Model* (SFPUC, 2007), which provides greater detail on the operation of HH/LSM. Review of the data provided by the HH/LSM, with a focus on data used in the post-processing analysis.
3. **Post-processing Hydrological Analysis Methodology** – Discussion of the analyses performed on the HH/LSM data. Analyses included statistical summaries, calculation of reservoir levels, and hydrologic analyses to predict creek and river flows. Description of the quality control methodology implemented for the analysis of the model results.
4. **Index of Post-processed Model Results** – An index of the hydrological analyses prepared for the PEIR impact assessment.

2. Modeling Scenarios

The scenarios analyzed in the PEIR were developed through collaboration with the SFPUC, San Francisco Planning Department, Major Environmental Analysis (MEA) Division, and the PEIR consultants. The SFPUC provided input regarding the existing conditions, proposed program, and variants as well as the technical feasibility of alternatives. The MEA and PEIR consultants provided input into the baseline conditions, variants and CEQA alternatives. The SFPUC then conducted model runs for the selected scenarios using the HH/LSM and provided the output data to the PEIR team for post-processing analysis.

The scenarios are organized and discussed in the order presented below. The code presented in brackets after each scenario name is the reference used by the SFPUC to denote the model run. Tables 1 through 3 summarize the major assumptions of each scenario.

1. Baseline(s)
 - Existing Conditions with “Calaveras Down” [MEA3CHR]
 - Conditions Prior to 2002 with “Calaveras Up” [MEA2A]
2. Proposed Program
 - WSIP or Proposed Program [MEA5HIN]
3. Variants
 - WSIP Variant 1 – All Tuolumne [MEA4HIN]
 - WSIP Variant 2 – Regional Desalination for Drought [MEA30H]
 - WSIP Variant 3 – 10% Rationing [MEA31H]
4. CEQA Alternatives
 - CEQA Alternative 1 – No Program Alternative [MEA37H]
 - CEQA Alternative 2 – No Purchase Request Increase [MEA40H]
 - CEQA Alternative 3 – Aggressive Conservation/Recycling and Local Groundwater [MEA42H]

2.1 Baseline(s)

The existing conditions or environmental setting, as defined under California Environmental Quality Act (CEQA) Section 15125, represents the physical environmental conditions as they exist at the time of the Notice of Preparation (NOP) and “will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant.” Therefore, it follows that once the physical baseline conditions are established, impacts can be assessed by comparing changes that would result from implementation of the proposed program to the baseline condition. The NOP for the WSIP PEIR was issued in September 2005, and thus the year 2005 conditions generally represent existing (baseline) conditions for the PEIR analysis.

In most cases, the PEIR description of the baseline reflects the regional system facilities and water supply operations in 2005. However, to be meaningful, the baseline must represent the expected variability of environmental conditions that could reasonably be expected in the future, based on the present and historical state of such conditions. In this PEIR, because hydrology varies widely over time and cannot be properly represented at a specific point in time, the baseline for hydrology reflects a sufficiently long record to allow assessment of long-term variability. Therefore, the “existing conditions” in this PEIR are presented in terms of an 82-year depiction of hydrology (1920 to 2002) to provide a depiction of the range of environment conditions that occur within the varying hydrology of California. Current (2005) operating conditions are analyzed using these 82-years of hydrology to determine how the current system would perform over a range of hydrologic conditions.

In addition to the baseline model runs, actual flow data, diversions, reservoir levels and releases were reviewed to aid in the determination of significance impacts.

Existing Conditions with “Calaveras Down” [MEA3CHR]

As described above, the baseline condition used for the PEIR analysis to determine the significance of impacts is generally represented by the SFPUC facilities and system operating conditions in 2005 in all cases but hydrology. Thus, as described in Chapter 2 of the PEIR, the 2005 average annual customer purchase request is estimated at 265 million gallons per day (mgd), and system operations are restricted due to Division of Safety of Dams (DSOD) requirements that limit the storage capacity of Calaveras Reservoir. This baseline, also referred to as “Calaveras Down,” does not represent the SFPUC’s historical operating conditions, since operation of Calaveras Reservoir at its full capacity has been a fundamental part of the regional water system prior to DSOD restrictions.

Conditions Prior to 2002 with “Calaveras Up” [MEA2A]

This baseline scenario was developed to simulate 2005 conditions, except with Calaveras Reservoir at its historical operating capacity. It essentially represents conditions prior to 2002 before the DSOD restriction was in place, and applies the 2005 average annual customer purchase request of 265 mgd. This scenario was not used to determine the significance of impacts, but in some cases was helpful in understanding the variable conditions prior to 2002.

2.2 Proposed Program

The SFPUC's proposed program, also referred to as the WSIP in this PEIR, is described in detail in Chapter 3 of the PEIR. The WSIP is the main focus of the PEIR.

Proposed Program [MEA5HIN]

The proposed program represents conditions in 2030 with 300 mgd average annual customer purchase requests, the WSIP water supply sources in place, and all WSIP facility improvement projects constructed and in operation. It includes supplemental dry-year water sources and a maximum drought rationing policy of 20 percent.

Table 1 provides a summary of the model scenarios analyzed.

2.3 Variants

The WSIP variants are variations of the proposed program that are designed to meet or exceed all WSIP goals and objectives but differ with respect to water supply source or drought-year level of service. The variants are not intended to be alternatives to the proposed program that would lessen or avoid environmental impacts as required by CEQA. The SFPUC requested that the potential environmental impacts of the variants be included in the PEIR. Further detail on the variants is provided in Chapter 8 of the PEIR.

WSIP Variant 1 – All Tuolumne [MEA4HIN]

The water supply for WSIP Variant 1 would be identical to that proposed for the WSIP, except that to accommodate the estimated 35-mgd average annual increase in purchase requests (from 265 to 300 mgd) by the year 2030, customers would predominately be served with additional water from the Tuolumne River watershed. As with the proposed program and existing conditions (2005), local watershed runoff would supplement supply from Tuolumne River watershed. And, similar to the proposed program, water from the Westside Basin Groundwater Program would also serve the purchase requests. The water supply would not include the 10 mgd from implementation of the local groundwater projects, recycled water projects, and additional conservation programs in San Francisco, however does include the conjunctive use and regional groundwater projects. In all other respects, WSIP Variant 1 would include the same water supply sources and construction of nearly all the same facilities as the proposed program.

WSIP Variant 2 – Regional Desalination for Drought [MEA30H]

The water supply for WSIP Variant 2 would be identical to that proposed for the WSIP, except that during drought years the SFPUC would receive water from a proposed regional desalination plant instead of water transfers from the Turlock and Modesto Irrigation Districts (TID and MID). Under this variant, the SFPUC, through its participation in the Bay Area Regional Desalination Project, would receive additional potable water supply during drought periods, either directly or indirectly from the regional desalination plant, to meet the WSIP water supply and delivery

**TABLE 1
SUMMARY OF EXISTING CONDITIONS AND PROPOSED PROGRAM**

Program Element	Existing Condition, 2005, with Calaveras Down (CEQA Baseline) [MEA3CHR]	Existing Condition, Pre-2002 Condition with Calaveras Up [MEA2A]	Proposed Program, 2030 Conditions [MEA5HIN]
Planning Year	2005	2005	2030
Customer Purchase Request (annual average)	265 mgd	265 mgd	300 mgd
Water Supply Sources (during nondrought and drought periods)	<ul style="list-style-type: none"> ▪ Peninsula watershed (with Lower Crystal Springs Reservoir operating at reduced levels based on DSOD restrictions) ▪ Alameda watershed (with Calaveras Reservoir operating at reduced levels based on DSOD restrictions) ▪ Tuolumne River 	<ul style="list-style-type: none"> ▪ Peninsula watershed (with Lower Crystal Springs Reservoir operating at reduced levels based on DSOD restrictions) ▪ Alameda watershed (with Calaveras Reservoir at historical capacity, pre-2002) ▪ Tuolumne River 	<ul style="list-style-type: none"> ▪ Peninsula watershed (with Lower Crystal Springs Reservoir restored) ▪ Alameda watershed (with Calaveras Reservoir restored) ▪ Tuolumne River, with increased annual diversion over 2005 conditions ▪ Recycled water/ groundwater/conservation in San Francisco, 10 mgd
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods)	None	None	<ul style="list-style-type: none"> ▪ Additional Tuolumne River diversions from TID and MID transfers of 23 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)
Maximum Drought Rationing Policy	No defined limit but assumed incidental rationing of up to 25%	No defined limit but assumed incidental rationing of up to 25%	20%
System Firm Yield	219 mgd	223 mgd	256 mgd
WSIP Facility Improvement Projects	None	None	All 22 WSIP PEIR projects

DSOD = Division of Safety of Dams; TID = Turlock Irrigation District; MID = Modesto Irrigation District.

reliability objectives. WSIP Variant 2 would include all the same facilities as the proposed program, with the addition of a regional desalination plant.

WSIP Variant 3 – 10% Rationing [MEA31H]

The water supply sources and facilities for WSIP Variant 3 would be identical to those for the proposed program. This variant would reduce the maximum rationing during drought years from 20 to 10 percent, surpassing the WSIP system performance objective for dry-year delivery. The additional water supplies needed to meet this enhanced performance would come from the Tuolumne River through augmentation of TID and MID transfers during drought years.

Table 2 provides a summary of the WSIP variants.

**TABLE 2
SUMMARY OF WSIP VARIANTS**

Program Element	Variant 1 [MEA4HIN] All Tuolumne	Variant 2 [MEA30H] Regional Desalination for Drought	Variant 3 [MEA31H] 10% Rationing
Planning Year	2030	2030	2030
Customer Purchase Request (annual average)	300 mgd	300 mgd	300 mgd
Water Supply Sources (during nondrought and drought periods)	<ul style="list-style-type: none"> ▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with 5 mgd increased average annual diversion over the Proposed Program 	<ul style="list-style-type: none"> ▪ Local watersheds (with Calaveras and Lower Crystals Springs Reservoirs restored) ▪ Tuolumne River, with 7 mgd less average annual diversion over the Proposed Program ▪ Recycled water/ groundwater/conservation in San Francisco, 10 mgd 	Approximately the same as proposed program (less than 1 mgd average annual increase in diversion from Tuolumne)
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods)	<ul style="list-style-type: none"> ▪ Westside Basin conjunctive use, 6 mgd (average over design drought) [Same as proposed program] 	<ul style="list-style-type: none"> ▪ Potable water from regional desalination plant, 23 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought) 	<ul style="list-style-type: none"> ▪ Additional Tuolumne River diversions from TID and MID transfers of 35 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)
Maximum Drought Rationing Policy	20%	20%	10%
System Firm Yield	256 mgd	256 mgd	268 mgd
Facility Improvement Projects	20 of the 22 WSIP PEIR projects; two projects would not be implemented: local groundwater and recycled water projects in San Francisco	All projects 22 WSIP PEIR projects plus Bay Area Regional Desalination Plant and associated pumping plant(s) and pipelines needed for intertie facilities	All 22 WSIP PEIR projects

TID = Turlock Irrigation District; MID = Modesto Irrigation District.

2.4 CEQA Alternatives

As required under CEQA, alternatives were developed that would feasibly attain most of the WSIP's basic objectives, but that would avoid or substantially lessen any significant adverse environmental effects of the WSIP. The No Program Alternative, also required by CEQA, was also analyzed. Further detail on the CEQA alternatives is provided in Chapter 9 of the PEIR.

CEQA Alternative 1 – No Program Alternative [MEA37H]

Under the No Program Alternative, customer purchase requests from the SFPUC (water demand) would increase from an annual average of 265 mgd in 2005 to 300 mgd in 2030, and the SFPUC would continue to rely on water supply sources from local watersheds and the Tuolumne River. The SFPUC would construct only those WSIP facility improvement projects that are mandated by or previously agreed upon with regulatory agencies to represent the likely scenario that would occur in the event the WSIP is not implemented. There would be no supplemental dry-year water supply sources. The additional water demand would be served, to the extent possible, from increased diversions from the Tuolumne River as well as the increased use of local watershed supplies, primarily associated with the restoration of storage at Calaveras Reservoir.

CEQA Alternative 2 – No Purchase Request Increase [MEA40H]

Under the No Purchase Request Increase Alternative, the total customer purchase requests to be served by the regional system by 2030 would be limited to 275 mgd, consisting of 184 mgd for the wholesale customers and 91 mgd for the retail customers. The increased water demand would be served through additional Tuolumne River diversions, increased use of local watershed supplies from restoration of Calaveras Reservoir, and 10 mgd from recycled water, groundwater, and conservation projects in San Francisco. During drought sequences, this supply would be supplemented by additional Tuolumne River diversions through a water transfer with TID and MID as well as through implementation of the Westside Basin Groundwater Program. This alternative assumes that 21 of the 22 WSIP facility improvement projects would be built, with the exception being the Lower Crystal Springs Dam Improvements project.

CEQA Alternative 3 – Aggressive Conservation/Recycling and Local Groundwater [MEA42H]

Under the Aggressive Conservation/Recycling and Local Groundwater Alternative, the customer purchase requests in 2030 would be 300 mgd, which would be met in large part through additional water conservation, water recycling, and groundwater programs beyond those already assumed in the 2030 demand projections. Up to 19 mgd of the demand would be met through regional recycled water/groundwater/conservation projects within the regional service area but outside of San Francisco, and 10 mgd of recycled water/groundwater/conservation in San Francisco. There would be no supplemental dry-year supply sources. This alternative assumes that 20 of the 22 WSIP facility improvement projects would be built, with the exceptions being the Lower Crystal Springs Dam Improvements project and the Westside Basin Groundwater Program.

Table 3 provides a summary of the WSIP CEQA alternatives analyzed.

Further detail on the modeling scenarios analyzed for the PEIR is provided in Appendix H2.

**TABLE 3
SUMMARY OF WSIP CEQA ALTERNATIVES**

Program Element	No Program Alternative [MEA37H]	No Increased Purchase Request Alternative [MEA40H]	Aggressive Conservation and Water Recycling Alternative [MEA42H]
Planning Year	2030	2030	2030
Customer Purchase Request (annual average)	300 mgd	275 mgd	300 mgd
Water Supply Sources (during nondrought and drought periods)	<ul style="list-style-type: none"> ▪ Local watersheds (with Calaveras Reservoir restored and Crystal Springs Reservoir at its existing capacity) ▪ Tuolumne River, with 8 mgd increased average annual diversion over 2005 conditions 	<ul style="list-style-type: none"> ▪ Local watersheds (with Calaveras Reservoir restored and Crystal Springs Reservoir at its existing capacity) ▪ Tuolumne River, with 3 mgd increased average annual diversion over 2005 conditions ▪ Recycled water/groundwater/conservation in San Francisco, 10 mgd 	<ul style="list-style-type: none"> ▪ Local watersheds (with Calaveras Reservoir restored and Crystal Springs Reservoir at its existing capacity) ▪ Tuolumne River, with 5 mgd increased average annual diversion over 2005 conditions ▪ Recycled water/groundwater/conservation in San Francisco, 10 mgd ▪ Regional recycled water/groundwater/conservation, in service area outside of San Francisco, 19 mgd
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods)	None	<ul style="list-style-type: none"> ▪ Additional Tuolumne River diversions from TID and MID transfers of 1 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought) 	None
Maximum Drought Rationing Policy	No defined limit, but assumed incidental rationing up to 30%	20%	20%
System Firm Yield	226 mgd	233 mgd	226 mgd
Facility Improvement Projects	4 of 22 WSIP PEIR projects	21 of 22 WSIP PEIR projects	20 of 22 WSIP PEIR projects plus regional recycled water and groundwater projects outside of San Francisco

TID = Turlock Irrigation District; MID = Modesto Irrigation District.

3. Water Supply Planning Model

3.1 Model Description

The data analysis for the PEIR was performed on output data from the SFPUC's HH/LSM. The following is a brief review of the HH/LSM. For a comprehensive discussion of HH/LSM design and operation, refer to *Water Supply System Modeling Report, Hetch Hetchy/Local Simulation Model* (SFPUC, 2007).

The HH/LSM is a computerized mathematical model used by the SFPUC to assist in the evaluation of its water system operations. The HH/LSM incorporates information about key aspects of the SFPUC regional water system, including facilities (i.e., reservoir and conveyance capacities) and operating procedures and "rules" that determine how and when water is moved through the system to the SFPUC's customers. The operating procedures and rules include responses to seasonal variation in demand, allocation of demand to customer groups, and procedures to maximize the use of local watershed supplies, while "rules" include responses to regulatory requirements for instream flows and compliance with Raker Act obligations. Operation of the regional water system can be generally delineated between rules and strategies affecting the operation of the Bay Area water system, and rules and strategies affecting the operation of the Hetch Hetchy system.

The HH/LSM is personal-computer-based and is written in Fortran code, with spreadsheet input and output interfaces. The model can be modified to incorporate changes in operation assumptions or to allow the testing of possible modifications to the infrastructure and/or operation of San Francisco facilities, or other facilities affecting regional system operations (i.e., TID's and MID's operation of Don Pedro Reservoir). Certain hydrologic and hydraulic parameters are "input driven," allowing the user to modify hydrology and the representation of physical characteristics such as reservoir capacity, preferred operational storage levels, water demands and certain operational decisions.

The model simulates system operations over the course of an 82-year sequential hydrologic period from July 1920 through September 2002. The model incorporates actual historical information about the hydrology (the amount of runoff as snowmelt and/or rainfall) that occurred in each year over the 82-year record for each of the three watershed areas under consideration: the Tuolumne River, the Alameda Creek, and the Peninsula watersheds. This 82-year period includes many different types and sequences of actual hydrological events that occurred, ranging from flood events to droughts of different magnitude and duration. The long-term 82-year historical record is used in the model to represent the range of hydrologic conditions that could occur in the future and to assess how the system would perform in terms of an assumed system configuration and assumed operational objectives.

The model uses a watershed runoff forecasting routine (for snowmelt and rainfall) that projects the amount of runoff in the Tuolumne River Basin. The amount of expected runoff is then compared against the availability of reservoir storage to capture the runoff and the expected releases required from the reservoir to meet downstream requirements and diversions to San

Francisco. If a reservoir is projected to spill, the model can simulate operational releases that would likely be made in those situations in order to enhance power generation from the system. This forecasting and decision process occurs continuously each month of the period being modeled.

The model simulates sequential hydrologic events on a monthly time step. That is, the model simulates the operation of facilities on a continuum, from one month to the next, one year to the next for 82 years. This method of modeling allows the investigation of sequential hydrologic events varying in duration as well as varying in distribution of runoff. However, because the input and results are depicted as monthly volumes of water, a drawback of this monthly time-step approach is that the results may not adequately depict the day-to-day variations of operations, hydrology, or operational decisions that can occur in less than monthly intervals. In these instances, additional supplemental analysis is developed.

The HH/LSM is used iteratively; that is, the model input is adjusted following a review of the results from a model study. The model simulates system performance and operations for a recurrence of historical hydrologic events. Parameters reviewed are typically the simulated delivery of water to San Francisco customers and reservoir levels and releases. Model inputs that affect model decisions are adjusted until a simulation achieves an accepted, or desired, performance of the scenario being modeled. Results from the scenarios described above were compared to illustrate the effects of alternative system objectives and requirements, operational assumptions, and system configurations.

System operations during drought periods require more complex planning and system management than during nondrought years, and the SFPUC's drought planning uses as a backdrop the concept of a "design drought" and "system firm yield." System firm yield is a measure of the amount of water that can be delivered to customers without shortages during all anticipated hydrologic sequences. This yield is also comparable to the amount of delivery that would occur on average across the design drought period. The design drought is a planning tool developed by the SFPUC to anticipate and plan for drought. For planning purposes, the SFPUC uses a design drought that contemplates a more severe drought than historical events, and evaluates the system firm yield assuming the system is experiencing the design drought. This premise is founded on experience that illustrates that drought sequences can get more extreme as our hydrologic record lengthens. Studies suggest that there is a 30 percent chance that the SFPUC system will experience a drought in the next 75 years equal to or more severe than the 1987–1992 drought (Beck, 1994). The SFPUC uses a design drought based on the hydrology of the six years of the worst historical drought (1977–1992) plus the 2.5 years of the 1976–1977 drought, for a combined total of an 8.5-year design drought sequence.

For the purposes of the PEIR, the HH/LSM is the best available tool to predict potential impacts on water resources in the affected watersheds resulting from the proposed program, variants, and alternatives. HH/LSM output was used to provide quantitative estimates of changes that would occur with implementation of the WSIP compared to the existing condition.

The HH/LSM is typical of water supply planning models utilized in California. With its diversity in weather—ranging from flood events to multi-year sequences of drought—California hydrology warrants the evaluation of water supply projects over a long sequence of years to measure system performance and reliability. The SFPUC, like other major California water purveyors, employs models to evaluate the effect of California hydrology on its ability to provide water supply (and to evaluate its system’s effect on the environment). The East Bay Municipal Utility District and other municipal water purveyors use comparable models for the purpose of water supply planning. The California Department of Water Resources and U.S. Bureau of Reclamation use the CalSim II model, which employs the same approach as the HH/LSM to evaluate the statewide water supply. Appropriately, the HH/LSM focuses narrowly on the SFPUC water system, but provides information that integrates into the overall California river system. In fact, the Department of Water Resources and Bureau of Reclamation use results from the HH/LSM in the evaluation of statewide water resources.

3.2 Model Limitations

The HH/LSM model is the best available tool for depicting the overall regional water system operations, and a number of limitations inherent in the model have been supplemented by additional data.

For example, HH/LSM was used to estimate baseline and with-WSIP water levels in all of the SFPUC’s reservoirs except Pilarcitos Reservoir. Model results for the Pilarcitos watershed were not directly used to analyze existing and projected water levels in Pilarcitos Reservoir or flows in Pilarcitos Creek. The model does not currently reflect a complete contemporary depiction of the physical operation of the watershed’s facilities. Although adequate for SFPUC systemwide water supply planning purposes, HH/LSM results for the Pilarcitos watershed at times requires supplemental refinement and analysis.

HH/LSM was also used to estimate baseline and with-WSIP flows in the Tuolumne River and Alameda Creek. However, the model results were not solely relied upon when evaluating flows in creeks immediately downstream of SFPUC reservoirs that are normally minimal or affected by SFPUC operations for time periods less than a month in duration. This is because the model uses a monthly time interval. The model does not simulate day-to-day variations in water levels or releases to a stream, but instead provides an average water level and an average release in a given month. The inability of the model to illustrate short-term variations is generally not problematic when simulating continuous phenomena like storage or water level in a reservoir or flow in a perennial stream. The modeling limitation requires additional considerations such as operator experience when simulating intermittent phenomena such as infrequent spills or releases from reservoirs that may last only a few days.

Flow in San Mateo Creek downstream of Lower Crystal Springs Dam provides an example. The SFPUC system operators rarely release water from Crystal Springs Reservoir to San Mateo Creek, and flow in the creek below the dam typically occurs only from seepage from the dam and groundwater infiltration. Because releases to the creek are not required, the SFPUC operators

attempt to capture and retain as much runoff as possible from the upper San Mateo Creek watershed in Crystal Springs Reservoir. In all but wet years, the SFPUC captures all of the runoff from the upper watershed. In wet months of wet years, 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 operator's decisions with respect to reservoir management are made on a day-to-day, sometimes hour-to-hour, basis. In certain circumstances during wet hydrologic conditions the operators will release to the creek due to a lack of predictability of the weather and an ability to manage the reservoir and other system-wide facilities through the event without releases.

Because the HH/LSM does not simulate, on a monthly time step, the day-to-day changes in operations which give rise to releases from Crystal Springs Reservoir to San Mateo Creek cannot be modeled. Consequently, the model does not always provide a refined absolute prediction of the magnitude and timing of infrequent and short-term releases from the reservoir. Similarly, the model does not provide a precise prediction of the magnitude and timing of release from San Antonio Reservoir and flow in San Antonio Creek downstream of the reservoir. However, HH/LSM results were sufficient to provide general trends of the effects of the WSIP upon these parameters.

For the reasons noted above, HH/LSM results were not used to predict water levels in Pilarcitos Reservoir, flows in Pilarcitos Creek, or the magnitude and timing of spills or releases from Crystal Springs and San Antonio Reservoirs. In these cases, the likely effects of the WSIP were determined by a review of historical data and consultation with individuals cognizant of past and predicted future reservoir operating practices.

In additional instances such as the analyses of flow effects below Hetch Hetchy Reservoir and Alameda Creek Diversion Dam, HH/LSM results have been refined or tiered from to provide additional insight to the effects of the WSIP upon stream flow for time periods less than a month in duration.

3.3 Model Output Data

The HH/LSM outputs data in a monthly time-step for each model simulation. Once the operation of the system is modeled under a particular set of assumptions, the model provides output information about how the system performs under that scenario in terms of water in reservoir storage, releases, water deliveries, and other parameters associated with the system's reservoirs, conveyance facilities, and treatment plants. The model provides information representing monthly volumes of water, although certain parameters have been converted to flow rates.

The SFPUC conducted the model runs analyzed in the PEIR. Model runs were provided to the PEIR team in spreadsheet format. Multiple revisions of the model runs occurred through an iterative process with the PEIR consultant team in order to ensure that the appropriate assumptions were used under each scenario, consistent with the PEIR impact analysis.

Table 4 lists key output information calculated by the model. Highlighted rows denote data that were used in the post-processing analysis.

TABLE 4
HH/LSM OUTPUT PARAMETERS
(Data provided as monthly time step for 82 years of historical hydrology)

Feature	Output Parameter
TUOLUMNE RIVER SYSTEM	
Unimpaired Inflow	Inflow to Hetch Hetchy Reservoir Inflow to Lake Lloyd Inflow to Lake Eleanor Unregulated Flow below Hetch Hetchy Reservoir
End-of-Month Storage	Hetch Hetchy Reservoir Storage Lake Lloyd Storage Lake Eleanor Storage Don Pedro Water Bank Account Storage Don Pedro Reservoir Storage Total Up-Country Reservoir Storage Total Hetch Hetchy System Storage
Releases	Hetch Hetchy Reservoir Release to Stream Hetch Hetchy Reservoir Release to Canyon Tunnel Lake Lloyd Release to Stream Lake Lloyd Release to Holm Powerhouse Lake Eleanor Release to Stream Lake Eleanor Tunnel to Lake Lloyd
Evaporation	Hetch Hetchy Reservoir Lake Lloyd Lake Eleanor
San Joaquin Pipeline	SJPL Flow from Lower Cherry Aqueduct Total SJPL
Power Production	Moccasin Powerhouse Kirkwood Powerhouse Holm Powerhouse Total
Unimpaired Runoff	Unimpaired Runoff at La Grange Dam TID, MID, and SFPUC Rights and Entitlements Unimpaired Runoff Available to San Francisco
Don Pedro Operations	Inflow Storage Don Pedro Reservoir Flood Control Limit Don Pedro Reservoir Evaporation (San Francisco) Total Don Pedro Reservoir Evaporation Don Pedro Reservoir Power – MWh Total MID Diversion at La Grange Dam Total TID Diversion at La Grange Dam La Grange Minimum Release Requirement Total La Grange Dam Release to River Total Release from Don Pedro Reservoir
Water Bank Account	Water Bank Account Maximum Water Bank Account Balance Transfer to Water Bank Account
Miscellaneous	SFPUC Shortage Level Hetch Hetchy Precipitation – Accumulated Hetch Hetchy Minimum Stream Release (acre-feet)
LOCAL SYSTEM (ALAMEDA CREEK AND PENINSULA WATERSHEDS)	
Calaveras	Calaveras Reservoir Storage Calaveras Reservoir Inflow from Arroyo Hondo Calaveras Reservoir Inflow from Upper Alameda Creek Calaveras Reservoir Release to San Antonio Reservoir Calaveras Reservoir Release to Sunol Valley WTP Calaveras Reservoir Release to Calaveras Creek Calaveras Reservoir Spill to Calaveras Creek Calaveras Reservoir Evaporation
San Antonio	San Antonio Reservoir Storage San Antonio Reservoir Inflow from San Antonio Creek

TABLE 4 (Continued)
HH/LSM OUTPUT PARAMETERS
(Data provided as monthly time step for 82 years of historical hydrology)

Feature	Output Parameter
San Antonio (cont.)	San Antonio Reservoir Inflow from Calaveras Reservoir/SJPL
	San Antonio Reservoir Release to Sunol Valley WTP
	San Antonio Reservoir Release to San Antonio Creek
	Calaveras Reservoir Spill to Calaveras Creek
Crystal Springs	San Antonio Reservoir Evaporation
	Crystal Springs Reservoir Storage
	Crystal Springs Reservoir Inflow from San Mateo Creek
	Crystal Springs Reservoir Inflow from San Andreas Reservoir
	Crystal Springs Reservoir Inflow from Bay Division Pipelines
	Crystal Springs Reservoir Pumping to San Andreas Reservoir
	Crystal Springs Reservoir Pumping to Coastside CWD
	Crystal Springs Reservoir Release to San Mateo Creek
San Andreas	Crystal Springs Reservoir Spill to San Mateo Creek
	Crystal Springs Reservoir Evaporation
	San Andreas Reservoir Storage
	San Andreas Reservoir Inflow from Watershed
	San Andreas Reservoir Inflow from Crystal Springs, San Mateo Creek & Pilarcitos
	San Andreas Reservoir Release to Harry Tracy WTP
Pilarcitos	San Andreas Reservoir Release to San Mateo Creek
	San Andreas Reservoir Spill to San Mateo Creek
	San Andreas Reservoir Evaporation
	Pilarcitos Reservoir Storage
	Pilarcitos Reservoir Inflow
	Pilarcitos Reservoir Release to San Andreas Reservoir
	Pilarcitos Reservoir Release for Stone Dam Diversion to Coastside CWD
Pilarcitos Reservoir Pre-Release to Pilarcitos Creek	
Stone Dam (MG)	Pilarcitos Reservoir Spill to Pilarcitos Creek
	Pilarcitos Reservoir Evaporation
	Stone Dam Inflow (Accretion)
Reservoir Storage (MG)	Stone Dam Release to Coastside CWD
	Stone Dam Release to Crystal Springs Reservoir
	Total Reservoir Storage – East Bay
	Total Reservoir Storage – Peninsula
Demand (MGD)	Total Local Storage
	Maximum Targeted Total Local Storage
	Delivery to South Bay Demand Center
	Delivery to Crystal Springs Demand Center
	Delivery to San Andreas Demand Center
Demand (MG)	Delivery to In-City Demand Center
	Total Delivery to Demand Centers (not including Coastside CWD)
	Delivery to South Bay Demand Center
	Delivery to Crystal Springs Demand Center
	Delivery to San Andreas Demand Center
San Joaquin Pipelines	Delivery to In-City Demand Center
	Total Delivery to Demand Centers (not including Coastside CWD)
SJPL (MG)	SJPL Flow – MG
	SJPL Flow – MGD
West Basin Reservoir (MG)	SJPL Flow to Crystal Springs Reservoir – MG
	SJPL Flow to San Antonio Reservoir – MG
	Beginning of Month Storage
	West Basin Reservoir – Input Resulting from San Andreas Gradient Deliveries
Desalination Project (MG)	West Basin Reservoir – Input Resulting from Crystal Springs Gradient Deliveries
	End of Month Storage
Treatment Plant Delivery (MGD)	Input from Desalination Project
	Calaveras Reservoir Flow to Sunol Valley WTP
	San Antonio Reservoir Flow to Sunol Valley WTP
	Sunol Valley WTP Production
	Harry Tracy WTP Production

Indicates data used in the PEIR analysis

Coastside CWD = Coastside County Water District; MG = million gallons; MGD = million gallons per day; MWh = megawatt-hours; MID = Modesto Irrigation District; SJPL = San Joaquin Pipelines; TID = Turlock Irrigation District; WTP = water treatment plant.

4. Hydrologic Computations and Data Presentation

4.1 Hydrologic Year Types

The HH/LSM produces a set of results for a hydrologic sequence of 82 years, 12 months each year. While at times it is necessary to evaluate the results from month to month and year to year, in many instances the illustration and understanding of results can be achieved by a grouping within water year types. Each year in the 82-year period of historical hydrology was ranked and grouped into hydrologic year types according to an appropriate wetness indicator. Three different groupings (referred to as indices) were used in the PEIR analysis according to the specific hydrologic system in which the affected facilities are located. The hydrologic year types are defined differently for different areas affected by the WSIP in order to accurately reflect each area's unique hydrology.

Each index contains five hydrologic year-type categories. The three indices and corresponding year-type categories are as follows:

Tuolumne Index	Wet (W) Above Normal (AN) Normal (N) Below Normal (BN) Dry (D)
San Joaquin Index (Reflects the existing San Joaquin Valley Water Year Hydrologic Classification)	Wet (W) Above Normal (AN) Below Normal (BN) Dry (D) Critically Dry (CD)
Five Reservoir Index	Wet (W) Above Normal (AN) Normal (N) Below Normal (BN) Dry (D)

Tuolumne Index

Hydrologic year types for the Tuolumne River above Don Pedro Reservoir were developed for this analysis. The year types were classified based on the SFPUC's calculation of unimpaired flow for the Tuolumne River at La Grange Dam. The years were ranked as simple percentiles. The 20 percent of years when unimpaired inflow to Don Pedro Reservoir was lowest were designated dry years; the next driest 20 percent of years were designated below-normal years, and so on.

San Joaquin Index

Hydrologic year types for the Tuolumne River below La Grange Dam and Don Pedro Reservoir are classified according to the Department of Water Resources' San Joaquin Valley Water Year Classification (San Joaquin Index). The San Joaquin Index was used to analyze Don Pedro and La Grange operations because release requirements from Don Pedro Reservoir at La Grange are tied to this index. The San Joaquin Index was not readily applicable to the entire Tuolumne River system because this index is based on all inflow into the San Joaquin River, not just contributions from the Tuolumne River. As such, the San Joaquin Index ranking of year types is at times inconsistent with runoff from the Tuolumne system alone.

Five Reservoir Index

Hydrologic year types for the Alameda Creek and Peninsula watersheds are also classified by the 20 percent grouping technique and are based on local stream gauge data and the SFPUC's estimation of flow into its five San Francisco Bay Area reservoirs (Calaveras, San Antonio, Crystal Springs, Pilarcitos, and San Andreas Reservoirs). Annual flow into each of the reservoirs was aggregated for each water year. The 20 percent of years when total runoff into the five reservoirs was lowest were designated dry years; the next driest 20 percent of years were designated below-normal years, and so on.

Table 5 illustrates how these hydrologic year types apply over the historical record. Note that the table is organized according to rank, and that the water year corresponding to a given rank may vary from index to index. For instance, for all three indices, 1983 is ranked as the wettest year; however, the second-ranked year in the Tuolumne Index is 1995, in the San Joaquin Index is 1969, and in the Five Reservoir Index is 1998. The differences in rank reflect the differences in hydrology between the upper Tuolumne River watershed, the San Joaquin Valley, and the Bay Area.

4.2 Computations and Data Presentation

General Approach

The analysis of HH/LSM data focused on reservoir storage, releases, diversions, and deliveries. Data were analyzed according to the three portions of the regional system, the Tuolumne River, Alameda, and Peninsula systems, which correspond to the three respective watersheds that would be affected by the proposed water supply and system operations changes. The following sections outline the general approach to the analysis of each system. Specific data sets were extracted from the model output and then ranked, statistically analyzed, summarized, and charted. The ultimate use of these data was to allow for comparison between the existing condition and the WSIP, WSIP variant, or CEQA alternative. As such, seven separate discrete comparisons were performed:

1. Existing Condition [MEA3CHR] vs WSIP [MEA5HIN]
2. Existing Condition [MEA3CHR] vs Variant 1, All Tuolumne [MEA4HIN]
3. Existing Condition [MEA3CHR] vs Variant 2, Regional Desalination for Drought [MEA30H]

**TABLE 5
COMPARISON OF HYDROLOGIC YEAR TYPES**

TUOLUMNE INDEX			SAN JOAQUIN INDEX			5 RESERVOIR INDEX		
Rank	Water Year	TUOL Yr Type	Rank	Water year	SJ Yr Type	Rank	Water Year	5RES Yr Type
1	1983	W	1	1983	W	1	1983	W
2	1995	W	2	1969	W	2	1998	W
3	1969	W	3	1995	W	3	1958	W
4	1982	W	4	1938	W	4	1941	W
5	1938	W	5	1998	W	5	1982	W
6	1998	W	6	1982	W	6	1995	W
7	1997	W	7	1967	W	7	1956	W
8	1956	W	8	1952	W	8	1952	W
9	1967	W	9	1958	W	9	1938	W
10	1980	W	10	1980	W	10	1997	W
11	1986	W	11	1978	W	11	1969	W
12	1952	W	12	1922	W	12	1973	W
13	1978	W	13	1956	W	13	1986	W
14	1965	W	14	1942	W	14	1980	W
15	1958	W	15	1941	W	15	1942	W
16	1993	W	16	1986	W	16	1967	W
17	1941	AN	17	1993	W	17	1963	AN
18	1951	AN	18	1997	W	18	1940	AN
19	1922	AN	19	1996	W	19	1965	AN
20	1984	AN	20	1943	W	20	1996	AN
21	1943	AN	21	1937	W	21	1922	AN
22	1942	AN	22	1974	W	22	1975	AN
23	1996	AN	23	1975	W	23	1974	AN
24	1974	AN	24	1965	W	24	1978	AN
25	1940	AN	25	1936	AN	25	1993	AN
26	1936	AN	26	1984	AN	26	1951	AN
27	1932	AN	27	1979	AN	27	1943	AN
28	1935	AN	28	1945	AN	28	1927	AN
29	1999	AN	29	1999	AN	29	1937	AN
30	1945	AN	30	1963	AN	30	2000	AN
31	1927	AN	31	1927	AN	31	1921	AN
32	1963	AN	32	1935	AN	32	1999	AN
33	1975	AN	33	1923	AN	33	1923	AN
34	1973	N	34	1973	AN	34	1953	N
35	1921	N	35	1932	AN	35	1928	N
36	1937	N	36	2000	AN	36	1970	N
37	1970	N	37	1940	AN	37	1984	N
38	2000	N	38	1946	AN	38	1946	N
39	1925	N	39	1921	AN	39	1926	N
40	1979	N	40	1970	AN	40	1936	N
41	1946	N	41	1951	AN	41	1945	N
42	1923	N	42	1962	BN	42	1971	N
43	1962	N	43	1953	BN	43	1935	N
44	1971	N	44	1957	BN	44	1932	N
45	1950	N	45	1925	BN	45	1979	N
46	1953	N	46	1971	BN	46	1962	N
47	1928	N	47	1950	BN	47	1949	N
48	1954	N	48	1944	BN	48	1992	N
49	2002	N	49	1954	BN	49	1981	N
50	1957	BN	50	1948	BN	50	2001	BN
51	1948	BN	51	1928	BN	51	1930	BN
52	1989	BN	52	1949	BN	52	1954	BN
53	1966	BN	53	1966	BN	53	1968	BN
54	1944	BN	54	1933	D	54	1959	BN
55	1949	BN	55	1981	D	55	1925	BN
56	1985	BN	56	1985	D	56	1944	BN
57	1972	BN	57	2002	D	57	2002	BN
58	1930	BN	58	1926	D	58	1950	BN
59	1964	BN	59	1955	D	59	1966	BN
60	1955	BN	60	1959	D	60	1955	BN
61	1926	BN	61	1968	D	61	1957	BN
62	1933	BN	62	1939	D	62	1934	BN
63	1991	BN	63	2001	D	63	1985	BN
64	2001	BN	64	1964	D	64	1991	BN
65	1947	BN	65	1947	D	65	1929	BN
66	1960	BN	66	1972	D	66	1964	BN
67	1981	D	67	1994	C	67	1947	D
68	1968	D	68	1930	C	68	1994	D
69	1959	D	69	1929	C	69	1939	D
70	1939	D	70	1989	C	70	1948	D
71	1929	D	71	1991	C	71	1960	D
72	1990	D	72	1987	C	72	1972	D
73	1992	D	73	1960	C	73	1933	D
74	1994	D	74	1976	C	74	1961	D
75	1988	D	75	1992	C	75	1990	D
76	1934	D	76	1990	C	76	1987	D
77	1961	D	77	1988	C	77	1988	D
78	1976	D	78	1934	C	78	1989	D
79	1987	D	79	1924	C	79	1931	D
80	1931	D	80	1961	C	80	1976	D
81	1924	D	81	1931	C	81	1977	D
82	1977	D	82	1977	C	82	1924	D

4. Existing Condition [MEA3CHR] vs Variant 3, 10% Rationing [MEA31H]
5. Existing Condition [MEA3CHR] vs CEQA Alternative 1, No Program Alternative [MEA37H]
6. Existing Condition [MEA3CHR] vs CEQA Alternative 2, No Purchase Request Increase [MEA40H]
7. Existing Condition [MEA3CHR] vs CEQA Alternative 3, Aggressive Conservation and Water Recycling [MEA42H]

Comparisons were made by generating annual and monthly statistics for all years in the sequence as well as for each of the indexed year types (e.g., wet, above normal, etc.). The analysis performed can generally be divided into two primary hydrologic regimes: reservoir releases to rivers/creeks and reservoir storage.

Reservoir Releases/Spills to Rivers and Creeks

The HH/LSM predicts both reservoir releases and spills. Reservoir releases involve a release of impounded water through a reservoir's adit to the watercourse downstream of the dam. Releases are generally made to control water levels in the reservoir or to meet minimum flow requirements in the watercourse below the reservoir. Reservoir spills happen when impounded water discharges from a dam's spillway. Spills generally occur during periods of high flow when the reservoir is full. Reservoirs are usually operated to avoid spills by releasing water through the adits. For the purpose of this analysis, releases and spills were aggregated for each month of model output and reported as a release from each respective reservoir. Spills and releases were not considered separately, since both contribute to flow in the watercourse downstream of the reservoir.

Each comparison of reservoir releases to watercourses included a comparison of baseline data and WSIP/variant/alternative data related to annual average releases, monthly average releases, and changes in monthly releases for all months and each year type over the 82 years of historical hydrology analyzed. The monthly value for a given year type was calculated as the average of all values for a given month within that year type. An example of a monthly comparison is provided in **Table 6**. Statistics were also generated for each monthly release including average, minimum, maximum, median and standard deviation. Comprehensive tables were also generated detailing the monthly release for all 82-years of hydrology for both the existing condition and the WSIP/variant/alternative being analyzed as well as the changes to releases in any given month. This full data set essentially gave the reviewer access to the full model output in a compact format to aid in identifying trends or single-year anomalies and extremes in the data.

Monthly averages were charted, as were the 82-years of chronological releases, to visually detect trends and regularly occurring changes between the existing condition and the WSIP/variant/alternative being reviewed. Where relevant, additional charting was developed to highlight the percentage of monthly change for the 82-year hydrologic sequence, highlighting trends or single anomalies and extremes.

TABLE 6
EXAMPLE OF RESERVOIR RELEASE COMPARISON
(Estimated average monthly flows from O'Shaughnessy Dam to the
Tuolumne River under various conditions [cubic feet per second])

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition, MEA3CHR (2005)						
Oct	55	55	54	55	53	54
Nov	51	96	54	55	53	62
Dec	51	88	50	46	44	56
Jan	180	66	51	43	40	75
Feb	88	88	74	51	44	69
Mar	93	86	74	63	50	73
Apr	148	131	98	91	64	107
May	2,518	1,273	1,479	758	224	1,245
June	4,534	3,092	1,913	768	168	2,091
July	2,034	379	167	113	86	548
Aug	184	125	122	111	86	125
Sept	90	89	86	73	65	81
Future with WSIP, MEA5HIN (2030)						
Oct	55	55	54	55	53	54
Nov	51	89	54	55	53	61
Dec	51	88	50	46	44	56
Jan	167	66	55	43	40	74
Feb	88	88	74	51	44	69
Mar	84	94	74	63	50	73
Apr	144	131	98	88	56	103
May	2,416	1,187	1,260	564	157	1,111
June	4,548	3,095	1,907	709	139	2,075
July	2,034	379	167	113	86	548
Aug	184	125	122	111	86	125
Sept	89	89	86	73	65	81
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)						
Oct	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Nov	0 [0%]	-8 [-8%]	0 [0%]	0 [0%]	0 [0%]	-2 [-3%]
Dec	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Jan	-12 [-7%]	0 [0%]	4 [8%]	0 [0%]	0 [0%]	-2 [-2%]
Feb	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Mar	-9 [-9%]	8 [9%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Apr	-4 [-3%]	0 [0%]	0 [0%]	-4 [-4%]	-8 [-12%]	-3 [-3%]
May	-103 [-4%]	-86 [-7%]	-220 [-15%]	-195 [-26%]	-67 [-30%]	-134 [-11%]
June	14 [0%]	3 [0%]	-6 [0%]	-59 [-8%]	-29 [-17%]	-16 [-1%]
July	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Aug	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]
Sept	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]	0 [0%]

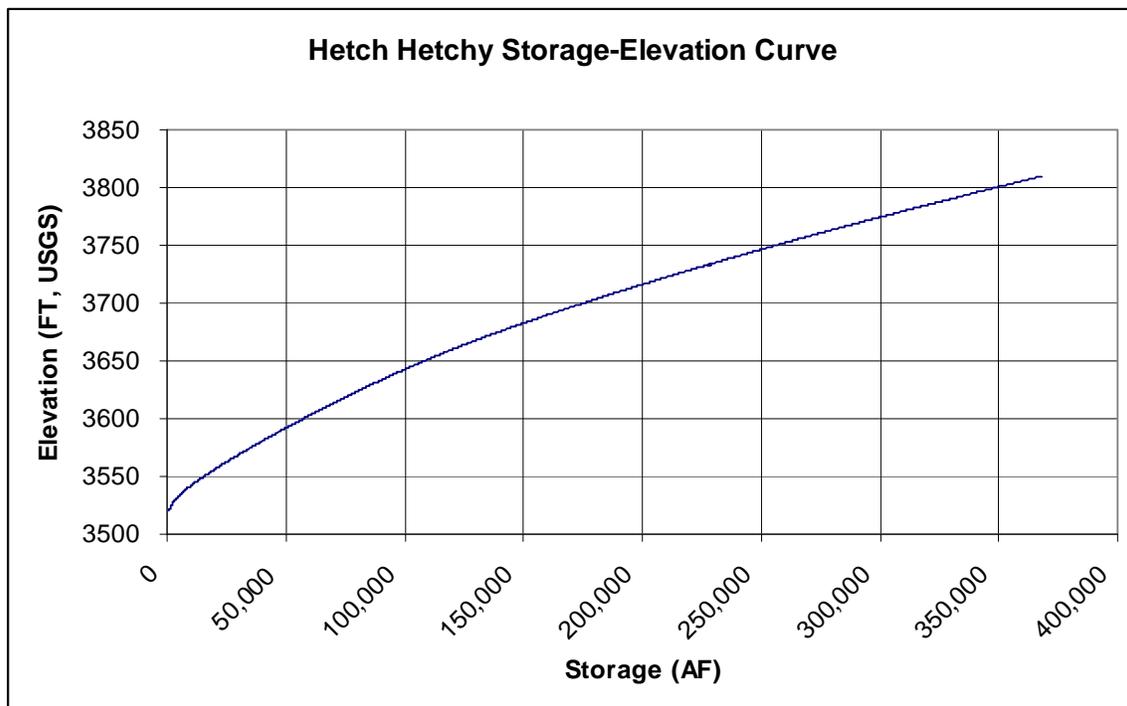
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Reservoir Storage and Water Surface Elevation

Reservoir storage was presented on a monthly basis for each hydrologic year type and as an average for all years. This exercise was performed for all reservoirs in the SFPUC system as well as for Don Pedro Reservoir. Impoundments at the Alameda Creek Diversion Dam and Stone Dam do not have sufficient storage to warrant the exercise. Percent change between the existing condition and WSIP were also calculated and tabulated, including highlighting of months within year types with a change from the existing condition. An example of a monthly comparison for reservoir water surface elevation is provided in **Table 7**.

Reservoir water surface elevations were generated based on storage-elevation data provided by the SFPUC for each reservoir. Storage-elevation data did not generally include datum information, and several curves were incomplete. Datums were assumed to be U.S. Geological Survey (USGS) National Geodetic Vertical Datum 29; however, it is likely that some elevation data were provided on Crystal Springs Datum, which is 3.75 feet lower than the USGS datum. In the case of incomplete curve data, data extrapolations were performed to extend the curve over the full operating range of the reservoir, which was considered sufficient for the analysis being performed. **Figure 1** presents an example of a storage-elevation curve used to generate reservoir elevation data.

Similar to the release data, monthly data were provided in tabular format for all months in the 82-year sequence to give the reviewer access to the full data set.

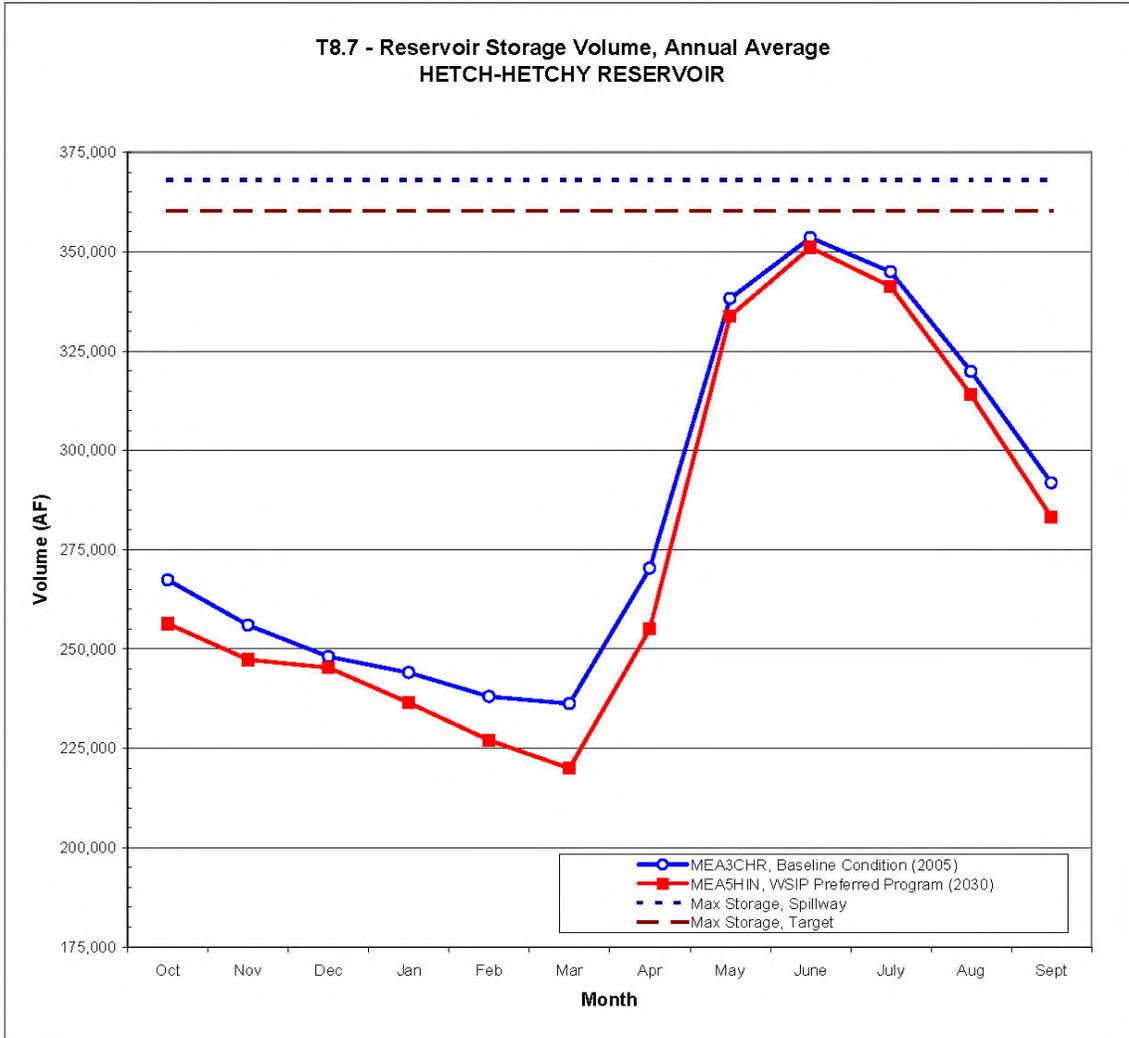


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Figure 1
Example of a Storage Elevation Curve

**TABLE 7
EXAMPLE OF RESERVOIR SURFACE ELEVATION COMPARISON**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
MEA3CHR, Baseline Condition (2005)												
All	267,350	255,970	248,055	244,033	238,026	236,250	270,308	338,205	353,575	344,926	319,840	291,861
Wet	254,797	247,599	261,665	276,607	274,771	276,682	315,327	355,450	360,400	360,400	353,795	332,896
Above Normal	271,112	265,309	254,326	239,804	227,800	216,027	236,381	340,710	360,400	359,021	334,026	303,926
Normal	268,076	255,293	245,741	247,678	242,092	243,199	284,841	352,393	360,400	355,019	325,020	293,980
Below Normal	269,065	255,550	241,448	231,143	225,328	223,980	257,796	321,660	355,655	342,155	310,136	280,095
Dry	273,356	255,542	237,118	226,005	221,571	223,393	260,099	321,689	330,462	307,326	275,944	248,388
MEA5HIN, WSIP Preferred Program (2030)												
All	256,342	247,285	245,298	236,492	227,024	219,969	255,079	333,845	351,079	341,276	313,972	283,204
Wet	243,060	237,479	256,288	268,743	267,145	269,817	307,705	356,276	360,400	360,400	352,226	328,585
Above Normal	259,753	258,029	255,119	237,665	224,720	210,962	231,343	340,911	360,400	358,887	331,608	298,488
Normal	256,760	248,368	244,486	239,566	230,227	224,956	267,857	352,038	360,400	353,965	321,684	287,746
Below Normal	259,020	247,487	240,041	223,889	211,467	201,013	237,323	314,402	355,477	339,673	305,027	272,715
Dry	262,736	244,375	230,270	213,311	202,678	194,847	233,761	306,370	317,660	292,453	258,773	228,185
Percent Change, MEA3CHR vs MEA5HIN												
All	-4%	-3%	-1%	-3%	-5%	-7%	-6%	-1%	-1%	-1%	-2%	-3%
Wet	-5%	-4%	-2%	-3%	-3%	-2%	-2%	0%	0%	0%	0%	-1%
Above Normal	-4%	-3%	0%	-1%	-1%	-2%	-2%	0%	0%	0%	-1%	-2%
Normal	-4%	-3%	-1%	-3%	-5%	-8%	-6%	0%	0%	0%	-1%	-2%
Below Normal	-4%	-3%	-1%	-3%	-6%	-10%	-8%	-2%	0%	-1%	-2%	-3%
Dry	-4%	-4%	-3%	-6%	-9%	-13%	-10%	-5%	-4%	-5%	-6%	-8%



Tuolumne River System

The Tuolumne River system encompasses SFPUC facilities within the Tuolumne River watershed. These included Hetch Hetchy Reservoir, Lake Lloyd, Lake Eleanor, Kirkwood and Holm Powerhouses, and the diversion/power tunnels. Don Pedro Reservoir is also included in the system. Although this reservoir is not an SFPUC-operated facility, the SFPUC maintains a water bank in Don Pedro Reservoir, and Tuolumne system operations are directly linked to the water rights and entitlements of TID and MID, which own and operate Don Pedro Reservoir. Also, SFPUC operations affect water availability at Don Pedro Reservoir and thus have an indirect influence upon Don Pedro Reservoir releases to the Tuolumne River below La Grange Dam.

The following is a list of locations within the Tuolumne River system analyzed using HH/LSM data.

Releases to Rivers/Creeks

1. Hetch Hetchy Reservoir releases to the Tuolumne River
2. Don Pedro Reservoir releases at La Grange Dam to the Tuolumne River
3. Lake Lloyd releases to Cherry Creek
4. Lake Eleanor releases to Eleanor Creek
5. Kirkwood Powerhouse releases to the Tuolumne River at Early Intake
6. Holm Powerhouse releases to Cherry Creek
7. Sum of Releases calculated at the Cherry Creek confluence

Reservoir Storage

8. Hetch Hetchy Reservoir storage and water levels
9. Lake Lloyd storage and water levels
10. Lake Eleanor storage and water levels
11. Don Pedro Reservoir storage and water levels

These analysis locations are shown in **Figure 2**.

Data for releases from each of the reservoirs were obtained directly from the HH/LSM output data. Reservoir releases presented in this analysis include both spills and releases from the respective dam.

Kirkwood Powerhouse releases, which represent flow returned to the Tuolumne River at Early Intake, were calculated based on the capacity of Mountain Tunnel. The instantaneous capacity of Mountain Tunnel was assumed to be 650 cubic feet per second (cfs) and scaled to a monthly capacity. Releases from Kirkwood Powerhouse were calculated as the difference between flow in Canyon Power Tunnel (upstream of Kirkwood) and the monthly capacity of Mountain Tunnel (downstream of Kirkwood). Holm Powerhouse releases were assumed to be the same as diversions from Lake Lloyd to Cherry Power Tunnel, which is an HH/LSM output.

Releases at the Cherry Creek confluence are a summation of all reservoir and powerhouse releases to the Tuolumne River. Each of the releases on the Tuolumne River above the Cherry Creek confluence or on Cherry Creek or Eleanor Creek is implemented such that all SFPUC-controlled flow of the Tuolumne River occurs upstream from the confluence where Cherry Creek

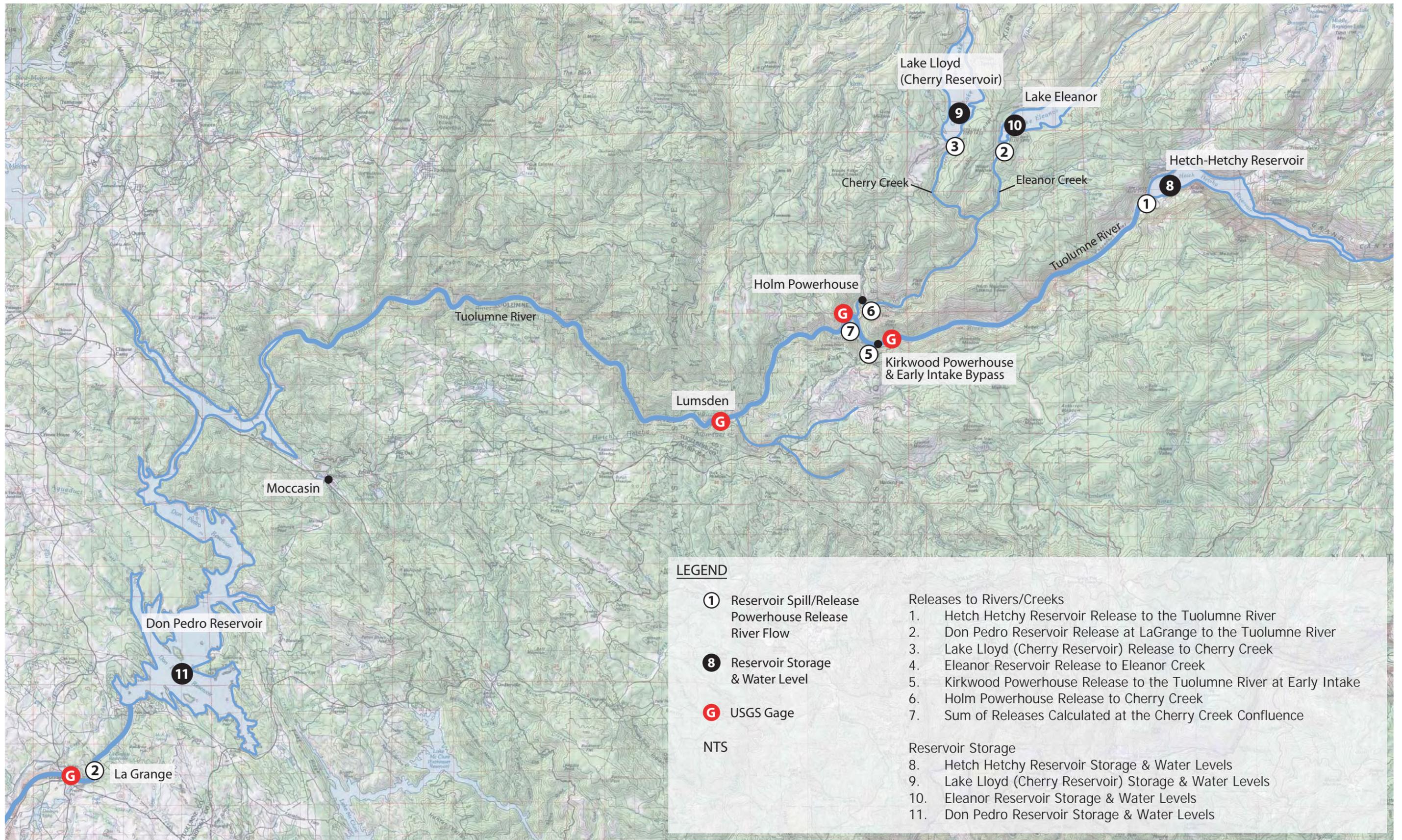


Figure 2 (Model Appendix 1)
 Tuolumne System Flow and Storage Analysis Locations

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joins the Tuolumne River. The summation of controlled releases was made to provide a point of comparison for the reach of the Tuolumne River between the Cherry Creek confluence and Don Pedro Reservoir. Absent from the calculation are monthly accretions over the 82-year record from the watersheds between the dams and the confluence, as these data were not readily available. These accretions would not be affected by system operations and thus would not change from model run to model run. Therefore, the calculation of absolute flows at the Cherry Creek confluence is lower than actual flow, but any change in flow rates between scenarios identified by the calculation is accurate.

Reservoir storage was readily available from HH/LSM output, and water surface elevations were calculated using SFPUC-supplied storage-elevation curves.

In addition to the analyses listed above for the Tuolumne River system, statistics were developed for the summary tables. The summary tables provide a single-page review of pertinent statistics, allowing comparison across the WSIP, variants, and CEQA alternative model runs. Most statistics presented in the Tuolumne River system summary table are self-explanatory.

Additional calculations were performed using HH/LSM output to develop minimum release statistics. Releases from each of the reservoirs were compared against monthly minimum release requirements. The number of months in the record where releases were at minimum flow requirements was calculated as a point of comparison between model runs. For instance, in the existing condition, releases from Hetch Hetchy Reservoir are at minimum levels in 837 months out of 987 in the record. For the proposed program, 846 months out of the record would have releases occurring at the minimum requirements, representing an increase in the frequency of minimum flow conditions of 0.9 percent.

Calculations were also made as part of the cumulative analysis for additional releases to the Tuolumne River at La Grange Dam for the proposed TID Regional Surface Water Supply Project. For the TID project, it was assumed that 66 cfs would be released from La Grange Dam year-round to supply water to the downstream infiltration gallery and treatment plant, and an additional 34 cfs could be released from La Grange Dam during the irrigation season, diverted at the infiltration gallery, and conveyed to the Ceres Main Canal for agricultural use. The release for agricultural purposes was assumed to occur from mid-March to mid-October. Releases at La Grange under the proposed program, as predicted by the HH/LSM, and estimated releases for the proposed TID project were aggregated and compared against the existing condition for the cumulative analysis presented in Chapter 5, Section 5.7, of the PEIR.

Alameda Creek System

The Alameda Creek system encompasses SFPUC facilities in the Sunol Valley region. These include Calaveras Reservoir, Alameda Creek Diversion Dam, and San Antonio Reservoir. Local watercourses include Alameda Creek, Arroyo Hondo, Calaveras Creek, and San Antonio Creek. The following is a list of locations within the Alameda system analyzed using HH/LSM data.

Releases to Rivers/Creeks

1. Diversions from upper Alameda Creek to Calaveras Reservoir
2. Calaveras Reservoir releases to Calaveras Creek
3. San Antonio Reservoir releases to San Antonio Creek
4. Flow in Alameda Creek below the diversion dam (1)
5. Flow in Alameda Creek below the Calaveras Creek confluence (2)
6. Flow in Alameda Creek below the San Antonio Creek confluence (3)

Reservoir Storage

7. Calaveras Reservoir storage and water levels
8. San Antonio Reservoir storage and water levels

These analysis locations are shown in **Figure 3**, and the three flow locations in Alameda Creek (numbers shown in parenthesis after analysis locations 4, 5, and 6) are described in more detail below and in **Figure 4**.

Data for releases from Calaveras and San Antonio Reservoirs were obtained directly from the HH/LSM output data. Reservoir releases presented in this analysis include both spills and releases from the respective dam. The HH/LSM also provided output data on diversions from the Alameda Creek Diversion Dam to Calaveras Reservoir.

In addition to the releases and diversions, average monthly flow in Alameda Creek was estimated at three locations to aid in the impact analysis. Calculations were made for the following three locations:

1. Below the diversion dam
2. Below the Calaveras Creek confluence (below Calaveras Reservoir)
3. Below the San Antonio Creek confluence (below San Antonio Reservoir)

Figure 4 presents a flow schematic of the major components of the water balance on Alameda Creek. Evaporative and groundwater losses were not included in the balance, since these losses are not expected to vary substantially among the scenarios.

Flow at each of these locations was derived from HH/LSM output data combined with calculated flow for runoff volumes, using the methodology provided by the SFPUC (Hannaford, 2004). The basis of calculations for the flow at each location is shown in **Table 8**.

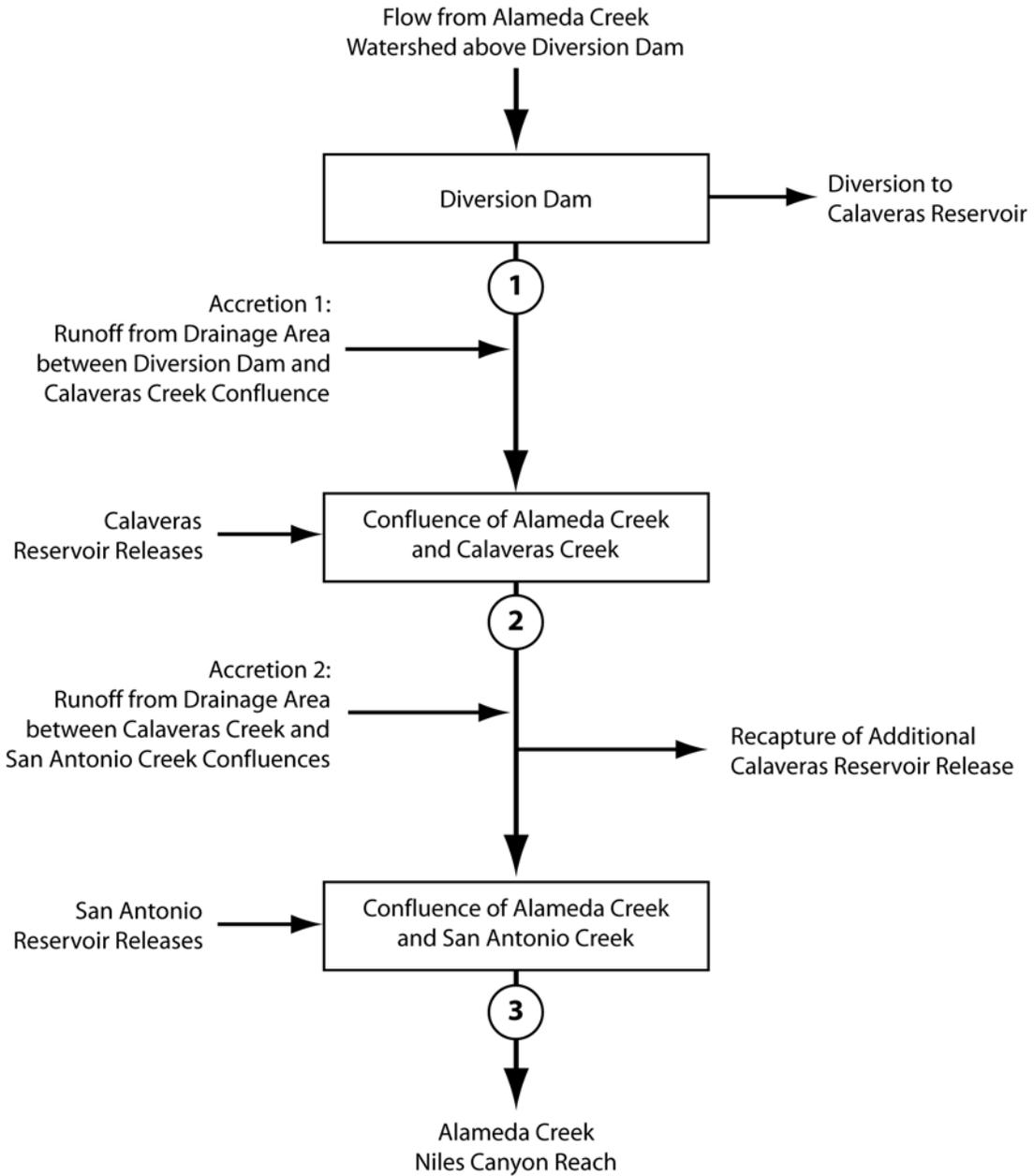
Reservoir storage was readily available from HH/LSM output data, and water surface elevations were calculated using SFPUC-supplied storage-elevation curves.

In addition to the analyses listed above for the Alameda Creek system, statistics were developed for the summary tables. Statistics presented in the Alameda Creek system summary table are self-explanatory.



Figure 3 (Model Appendix 1)

Alameda System Flow and Storage Analysis Locations



SOURCE: WRE, 2006, modified to include recapture and flow locations.

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Figure 4
Alameda Creek Water Balance Flowchart

**TABLE 8
CALCULATION OF FLOWS IN ALAMEDA CREEK**

Alameda Creek Flow Location	Unimpaired Flow	Current Impaired and Proposed Flows
1. Below the Diversion Dam	SFPUC Calculation Data Source: ^a	= (Unimpaired Flow) – (Diversion to Calaveras Reservoir) Data Source: ^{a,b}
2. Below the Calaveras Creek Confluence	= (Unimpaired Flow at 1) + (Accretion 1) + (Calaveras Reservoir inflow) Data Source: ^{a,b,c}	= (Flow at 1) + (Accretion 1) + (Calaveras Reservoir Release) + (Calaveras Reservoir Spill) Data Source: ^{b,c}
3. Below the San Antonio Creek Confluence	= (Unimpaired Flow at 2) + (Accretion 2) + (San Antonio Reservoir inflow) Data Source: ^{b,c}	= (Flow at 2) + (Accretion 2) + (San Antonio Reservoir Release) + (San Antonio Reservoir Spill) – (Calaveras Reservoir Release/Recapture) Data Source: ^{b,c}

Data Source Notes:

^a Unimpaired flow at Alameda Creek Diversion Dam is from the SFPUC, file "AlamedaCkOnlyAtDiversion.xls."

^b HH/LSM output source of data for existing and proposed program conditions for: diversion to Calaveras Reservoir; Calaveras Reservoir inflow; Calaveras Reservoir release/recapture; Calaveras Reservoir spill; San Antonio Reservoir inflow; San Antonio Reservoir release; San Antonio Reservoir spill.

^c Accretion 1 = average monthly runoff volume from drainage area between diversion dam and confluence of Alameda and Calaveras Creeks = (unimpaired inflow to San Antonio Reservoir) x (0.253).
Accretion 2 = average monthly runoff volume from drainage area between Calaveras/Alameda Creek and San Antonio/Alameda Creek confluences = (unimpaired inflow to San Antonio Reservoir) x (0.221).

Peninsula Watershed System

The Peninsula watershed system encompasses SFPUC facilities in the Peninsula watershed. These include Upper and Lower Crystal Springs Reservoirs, San Andreas Reservoir, Pilarcitos Reservoir, and Stone Dam. Local watercourses include San Mateo Creek and Pilarcitos Creek. The following is a list of locations within the Peninsula system analyzed using HH/LSM data.

Releases to Rivers/Creeks

1. Lower Crystal Springs Reservoir releases to San Mateo Creek

Reservoir Storage

2. Upper/Lower Crystal Springs Reservoir storage and water levels
3. San Andreas Reservoir storage and water levels

These analysis locations are shown in **Figure 5**.

Data for releases from Upper/Lower Crystal Springs to San Mateo Creek were readily available from the HH/LSM output data. Releases from Upper/Lower Crystal Springs Reservoir presented in this analysis include both spills and releases from the dam. San Antonio Reservoir releases/spills to San Mateo Creek (which flows to Lower Crystal Springs Reservoir) did not occur in the 82 years of hydrology, so tables were not generated for this location. Additionally, as discussed above in Section 3.2, Model Limitations, Pilarcitos Reservoir storage and release as

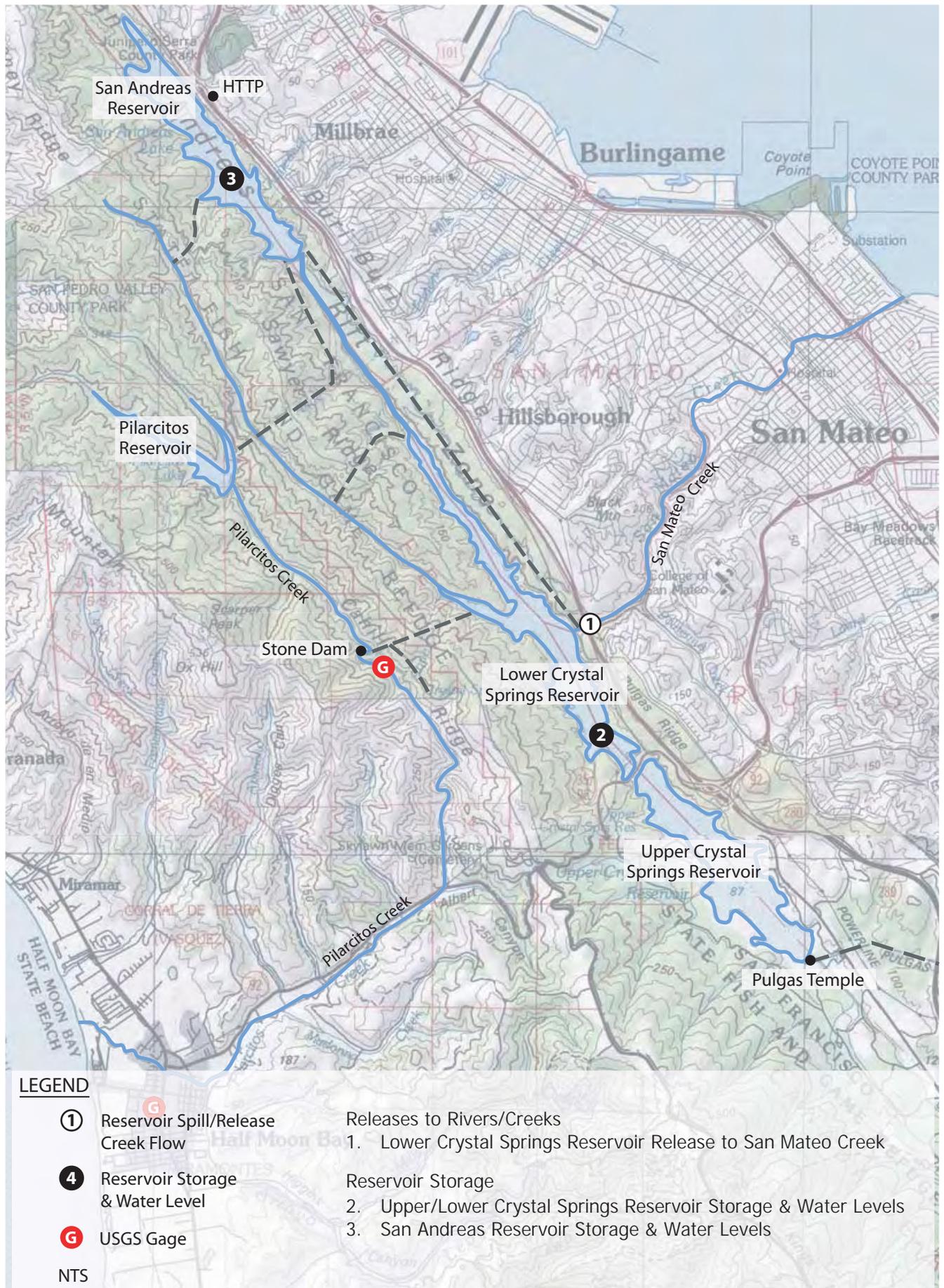


Figure 5 (Appendix H1)
 Peninsula System Flow and Storage Analysis Locations

well as Stone Dam release predicted by the HH/LSM model were not analyzed due to inaccuracies in the model for these two facilities. Supplemental analysis of these two facilities, as well as all facilities in the Peninsula System, is provided in Appendix H2, Hydrologic Modeling Assumptions and Results.

Reservoir storage data for Upper/Lower Crystal Springs and San Andreas were readily available from HH/LSM output, and water surface elevations were calculated using SFPUC-supplied storage-elevation curves.

In addition to the analyses listed above for the Peninsula watershed system, statistics were developed for the summary tables. Statistics presented in the Peninsula watershed system summary table are self-explanatory.

5. Post-processed Model Outputs

Summaries of the analyses performed according the methodology outlined in this document are provided in **Tables 9, 10, and 11**. The tables correspond to each of the three systems, Tuolumne, Alameda and Peninsula, respectively.

Complete results from the HH/LSM model output analysis are available for review at the SF Planning Department and the SFPUC offices. An index of these tables and a table of contents for each system analysis is provided below.

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Table 9 Summary of Tuolumne System Analysis

Summary of H/LSM Output		Base:	MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)							
		Future Condition:	MEA5HIN, WSIP Preferred Program (2030)				MEA4HIN, WSIP Variant, All Tuolumne Alternative (2030)				MEA30H, WSIP Variant, Desal for Drought (2030)				MEA31, WSIP Variant, 10% Rationing (2030)				MEA37H, WSIP CEQA Alt, No Program (2030)				MEA40H, WSIP CEQA Alt, No Purchase Request Inc. (2030)				MEA42H, WSIP CEQA Alt, Aggressive Conservation (2030)			
RESERVOIR LEVELS			Base (Cal Down)	Future Condition	Compared Delta	% Change	Base (Cal Down)	Future Condition	Compared Delta	% Change	Base (Cal Down)	Future Condition	Compared Delta	% Change	Base (Cal Down)	Future Condition	Compared Delta	% Change	Base (Cal Down)	Future Condition	Compared Delta	% Change	Base (Cal Down)	Future Condition	Compared Delta	% Change	Base (Cal Down)	Future Condition	Compared Delta	% Change
Lake Lloyd (Cherry)																														
Average Monthly Storage, All Years		Max AF	271,747	270,458	-1,289	-0.5%	271,747	271,205	-542	-0.2%	271,747	269,481	-2,266	-0.8%	271,747	271,489	-258	-0.1%	271,747	271,904	157	0.1%	271,747	270,611	-1,136	-0.4%	271,747	271,399	-348	-0.1%
		Min AF	203,512	201,773	-1,739	-0.9%	203,512	202,519	-993	-0.5%	203,512	200,162	-3,350	-1.6%	203,512	203,376	-136	-0.1%	204,203	203,861	-343	-0.2%	203,512	201,736	-1,776	-0.9%	203,512	202,657	-855	-0.4%
		Avg AF	240,319	238,996	-1,323	-0.6%	240,319	239,640	-679	-0.3%	240,319	237,911	-2,408	-1.0%	240,319	240,083	-236	-0.1%	240,426	240,457	31	0.0%	240,319	239,074	-1,245	-0.5%	240,319	239,794	-525	-0.2%
Avg Monthly Water Surface Elev, All Years		Max FT	4,702	4,701	-1	0.0%	4,702	4,701	0	0.0%	4,702	4,700	-2	0.0%	4,702	4,701	-1	0.0%	4,702	4,702	0	0.0%	4,702	4,701	-1	0.0%	4,702	4,701	-1	0.0%
		Min FT	4,661	4,660	-1	0.0%	4,661	4,661	0	0.0%	4,661	4,659	-2	0.0%	4,661	4,661	0	0.0%	4,662	4,662	0	0.0%	4,661	4,660	-1	0.0%	4,661	4,661	0	0.0%
		Avg FT	4,683	4,683	0	0.0%	4,683	4,683	0	0.0%	4,683	4,682	-1	0.0%	4,683	4,683	0	0.0%	4,683	4,683	0	0.0%	4,683	4,683	0	0.0%	4,683	4,683	0	0.0%
Lake Eleanor																														
Average Monthly Storage, All Years		Max AF	27,100	27,100	0	0.0%	27,100	27,100	0	0.0%	27,100	27,100	0	0.0%	27,100	27,100	0	0.0%	27,100	27,100	0	0.0%	27,100	27,100	0	0.0%	27,100	27,100	0	0.0%
		Min AF	13,860	13,860	0	0.0%	13,860	13,860	0	0.0%	13,860	13,860	0	0.0%	13,860	13,860	0	0.0%	13,860	13,860	0	0.0%	13,860	13,860	0	0.0%	13,860	13,860	0	0.0%
		Avg AF	22,201	22,191	-10	0.0%	22,201	22,191	-10	0.0%	22,201	22,191	-10	0.0%	22,201	22,191	-10	0.0%	22,201	22,201	0	0.0%	22,201	22,191	-10	0.0%	22,201	22,191	-10	0.0%
Avg Monthly Water Surface Elev, All Years		Max FT	4,661	4,661	0	0.0%	4,661	4,661	0	0.0%	4,661	4,661	0	0.0%	4,661	4,661	0	0.0%	4,661	4,661	0	0.0%	4,661	4,661	0	0.0%	4,661	4,661	0	0.0%
		Min FT	4,646	4,646	0	0.0%	4,646	4,646	0	0.0%	4,646	4,646	0	0.0%	4,646	4,646	0	0.0%	4,646	4,646	0	0.0%	4,646	4,646	0	0.0%	4,646	4,646	0	0.0%
		Avg FT	4,656	4,656	0	0.0%	4,656	4,656	0	0.0%	4,656	4,656	0	0.0%	4,656	4,656	0	0.0%	4,656	4,656	0	0.0%	4,656	4,656	0	0.0%	4,656	4,656	0	0.0%
Hetch Hetchy Reservoir																														
Avg Monthly Water Surface Elev, Dry Years	Level in Month of Max Reduction	FT	3,731	3,713	-18		3,731	3,710	-21		3,731	3,718	-13		3,731	3,714	-17		3,760	3,758	-2		3,731	3,725	-6		3,731	3,722	-9	Mar
Avg Monthly Water Surface Elev, All Years	Level in Month of Max Reduction	FT	3,738	3,729	-9		3,738	3,726	-12		3,738	3,731	-7		3,738	3,729	-9		3,738	3,736	-2		3,770	3,768	-2		3,738	3,736	-2	Mar
	Level in Month of Min Reduction	FT	3,802	3,801	-1		3,802	3,801	-1		3,802	3,802	0		3,802	3,801	-1		3,745	3,752	7		3,745	3,750	5		3,745	3,749	4	Dec
Storage April 1999	Volume in Storage	AF	190,000	175,000	-15,000		190,000	167,000	-23,000		190,000	173,000	-17,000		190,000	173,000	-17,000		190,000	183,000	-7,000		190,000	180,000	-10,000		190,000	180,000	-10,000	
	Refill Volume Required	AF	160,000	175,000	15,000		160,000	183,000	23,000		160,000	177,000	17,000		160,000	177,000	17,000		160,000	167,000	7,000		160,000	170,000	10,000		160,000	170,000	10,000	
Maximum Reduction	Level in Month of Max Reduction	FT	3717	3654	-63		3717	3669	-48		3701	3662	-39		3717	3655	-62		3788	3771	-17		3701	3677	-24		3701	3677	-24	Mar-34
Don Pedro Reservoir																														
Avg Monthly Water Surface Elev, Any Monthly Avg in Yr type summaries	Level in Month of Max Reduction	FT	721	711	-10		721	710	-10		754	748	-6		721	709	-11		754	753	-1		754	752	-2		754	751	-3	Sep, Dry
	Level in Month of Min Reduction	FT	804	804	0		804	804	0		804	804	0		804	804	0		774	774	0		774	773	-1		774	773	-1	Sep, Wet
Maximum Reduction	Level in Month of Max Reduction	FT	720	690	-30		718	681	-37		720	704	-16		708	670	-38		756	752	-4		762	754	-8		762	753	-9	Feb-35
FLOWS AND RELEASES																														
Cherry Ck Below Lake Lloyd (Cherry)																														
Frequency, Flowrate	is Minimum Release	MON	889	888	-1		889	887	-2		889	884	-5		889	886	-3		889	885	-4		889	886	-3		889	887	-2	
	Total Months in Record	MON	987	988	1		987	987	0		987	987	0		987	987	0		987	987	0		987	987	0		987	987	0	
	%	%	90.1%	89.9%	-0.2%		90.1%	89.9%	-0.2%		90.1%	89.6%	-0.5%		90.1%	89.8%	-0.3%		90.1%	89.7%	-0.4%		90.1%	89.8%	-0.3%		90.1%	0.0%	-90.1%	
Eleanor Ck Below Lake Eleanor																														
Frequency, Flowrate	is Minimum Release	MON	702	702	0		702	702	0		702	702	0		702	702	0		702	702	0		702	702	0		702	702	0	
	Total Months in Record	MON	987	988	1		987	987	0		987	987	0		987	987	0		987	987	0		987	987	0		987	987	0	
	%	%	71.1%	71.1%	0.0%		71.1%	71.1%	0.0%		71.1%	71.1%	0.0%		71.1%	71.1%	0.0%		71.1%	71.1%	0.0%		71.1%	71.1%	0.0%		71.1%	0.0%	-71.1%	
Tuolumne below Hetch Hetchy																														
Change in Monthly Flowrate by Year Type	Max Change Mo/Yr Type	CFS	224	157	-67	-30.0%	224	150	-74	-33.1%	224	157	-67	-29.9%	224	157	-67	-29.9%	224	186	62	27.7%	224	167	-57	-25.6%	224	160	-64	-28.7%
			May, Dry				May, Dry			May, Dry				May, Dry				May, Dry				May, Dry				May, Dry				
Change in Monthly Flowrate, Max Delta	Max Change in 82 Year Record	CFS	520	50	-470	-90.4%	520	50	-470	-90.4%	520	50	-470	-90.4%	520	50	-470	-90.4%	313	144	-169	-54.0%	520	50	-470	-90.4%	520	53	-468	-90.0%
Frequency, Flowrate	Springs with Reductions >30%	YRS	-	19	19		-	27	27		-	19	19		-	20	20		-	7	7		-	8	8		-	9	9	
	Total Springs in Record	YRS	-	82	82		-	82	82		-	82	82		-	82	82		-	82	82		-	82	82		-	82	82	
	% of Springs with Reduction >30%	%	-	23.2%	23.2%		-	32.9%	32.9%		-	24.4%	24.4%		-	24.4%	24.4%		-	8.5%	8.5%		-	9.8%	9.8%		-	11.0%	11.0%	
	is Minimum Release	MON	837	846	9		837	849	12		837	845	8		837	846	9		837	838	1		837	837	0		837	837	0	
	Total Months in Record	MON	987	987	0		987	987	0		987	987	0		987	987	0		987	987	0		987	987	0		987	987	0	
	%	%	84.8%	85.7%	0.9%		84.8%	86.0%	1.2%		84.8%	85.6%	0.8%		84.8%	85.7%	0.9%		84.8%	84.9%	0.1%		84.8%	84.8%	0.0%		84.8%	0.0%	-84.8%	
Tuolumne below LaGrange																														
Change in Monthly Flowrate by Year Type	Max Change Mo/Yr Type	CFS	408	306	-102	-25%	408	277	-131	-32%	408	322	-86	-21%	408	306	-101	-25%	408	342	34	8.3%	1,969	1,876	-93	-5				

Table 10 Summary of Alameda System Analysis

Summary of HHL/SLM Output		Base:	MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)				MEA3CHR, Baseline Condition (2005)								
		Future Condition:	MEAS3HN, WSIP Prop. Program (2030), Calaveras Up				MEAS4HN, WSIP Variant, All Tuolumne Alternative (2030)				MEAS30H, WSIP Variant, Desal for Drought (2030)				MEAS31, WSIP Variant, 10% Rationing (2030)				MEAS37H, WSIP CEQA Alt, No Program (2030)				MEAS40H, WSIP CEQA Alt, No Purchase Request Inc. (2030)				MEAS42H, WSIP CEQA Alt, Aggressive Conservation (2030)				
RESERVOIR LEVELS			Base	Future	Compared		Base	Future	Compared		Base	Future	Compared		Base	Future	Compared		Base	Future	Compared		Base	Future	Compared						
			(Cal Down)	Condition	Delta	% Change	(Cal Down)	Condition	Delta	% Change	(Cal Down)	Condition	Delta	% Change	(Cal Down)	Condition	Delta	% Change	(Cal Down)	Condition	Delta	% Change	(Cal Down)	Condition	Delta	% Change					
Calaveras Reservoir																															
Storage, Average Monthly of All Years		Max	AF	35,681	91,498	55,817	156%	35,681	91,517	55,836	156%	35,681	91,394	55,714	156%	35,681	91,187	55,506	156%	35,681	82,153	46,472	130%	35,681	91,534	55,853	157%	35,681	91,456	55,775	156%
		Min	AF	31,090	79,512	48,421	156%	31,090	79,411	48,321	155%	31,090	79,334	48,243	155%	31,090	79,156	48,065	155%	31,090	68,628	37,538	121%	31,090	79,822	48,732	157%	31,090	79,767	48,677	157%
		Avg	AF	33,680	86,913	53,232	158%	33,680	86,717	53,037	157%	33,680	86,794	53,114	158%	33,680	86,588	52,908	157%	33,680	76,154	42,474	126%	33,680	87,176	53,496	159%	33,680	87,089	53,409	159%
		Range	AF	4,590	11,986	7,396	161%	4,590	12,105	7,515	164%	4,590	12,061	7,470	163%	4,590	12,031	7,441	162%	4,590	13,524	8,934	195%	4,590	11,712	7,122	155%	4,590	11,689	7,099	155%
Water Surf Elev, Avg Monthly of All Years		Max	FT	702	752	50		702	752	50		702	752	50		702	752	50		702	745	43		702	752	50		702	752	50	
		Min	FT	697	743	46		697	743	46		697	743	46		697	743	46		697	734	37		697	743	46		697	743	46	
		Avg	FT	700	749	49		700	748	49		700	749	49		700	749	49		700	740	40		700	749	49		700	749	49	
		Range	FT	5	9	4		5	9	4		5	9	4		5	9	4		5	11	6		5	9	4		5	9	4	
Water Surf Elev, Max Difference in Range in Any One Year		Max	FT	705	756			705	756			705	756			705	756			705	754			705	756			705	756		
		Min	FT	693	721			693	723			693	720			693	720			693	701			693	731			693	731		
		Range	FT	12	35			12	33			12	36			12	36			12	53			12	25			12	25		
		Year (Same)	YR	1978	1978			1978	1978			1978	1978			1978	1978			1978	1978			1978	1978			1978	1978		
San Antonio Reservoir																															
Storage, Average Monthly of All Years		Max	AF	45,426	47,245	1,819	4%	45,426	46,855	1,429	3%	45,426	48,057	2,631	6%	45,426	46,696	1,270	3%	45,426	37,177	-8,248	-18%	45,426	49,109	3,683	8%	45,426	48,589	3,163	7%
		Min	AF	40,426	42,613	2,186	5%	40,426	41,527	1,101	3%	40,426	42,816	2,390	6%	40,426	41,145	719	2%	40,426	25,535	-14,891	-37%	40,426	46,208	5,782	14%	40,426	45,899	5,473	14%
		Avg	AF	43,222	44,901	1,679	4%	43,222	43,982	760	2%	43,222	45,706	2,484	6%	43,222	44,104	882	2%	43,222	31,853	-11,369	-26%	43,222	47,826	4,604	11%	43,222	47,397	4,175	10%
		Range	AF	4,999	4,632	-367	-7%	4,999	5,328	328	7%	4,999	5,241	242	5%	4,999	5,551	552	11%	4,999	11,642	6,643	133%	4,999	2,901	-2,098	-42%	4,999	2,690	-2,310	-46%
Water Surf Elev, Avg Monthly of All Years		Max	FT	461	463	2		461	463	2		461	464	3		461	463	2		461	450	-11		461	466	5		461	465	4	
		Min	FT	455	458	3		455	456	1		455	458	3		455	456	1		455	431	-24		455	462	7		455	462	7	
		Avg	FT	459	461	2		459	460	1		459	462	3		459	460	1		459	442	-17		459	464	6		459	464	6	
		Range	FT	6	5	-1		6	7	1		6	6	0		6	7	1		6	19	13		6	4	-2		6	3	-3	
Water Surf Elev, Max Difference in Range in Any One Year		Max	FT	457	462			454	457			464	467			468	468			468	463			468	468			454	463		
		Min	FT	446	441			441	433			444	426			455	399			446	368			441	463			441	447		
		Range	FT	11	21			13	24			20	41			13	69			22	95			27	5			13	16		
		Year (Same)	YR	1977	1977			1930	1930			1935	1935			1978	1978			1973	1973			1956	1956			1930	1930		
FLOWS AND RELEASES																															
AC below Diversion Dam																															
Annual Flow Past ACDD (Majority-All flow occurs Nov-May)		Avg (All Years)	AF/Y	8,849	7,636	-1,213	-14%	8,849	7,615	-1,234	-14%	8,849	7,642	-1,208	-14%	8,849	7,634	-1,215	-14%	8,849	6,739	-2,110	-24%	8,849	7,746	-1,103	-12%	8,849	7,734	-1,115	-13%
		CFS		12.1	10.5	-2	-14%	12.1	10.4	-2	-14%	12.1	10.5	-2	-14%	12.1	10.5	-2	-14%	12.1	9.2	-3	-24%	12.1	10.6	-2	-12%	12.1	10.6	-2	-13%
		Avg (Wet Years)	AF/Y	25,331	24,389	-942	-4%	25,331	24,389	-942	-4%	25,331	24,389	-942	-4%	25,331	24,389	-942	-4%	25,331	23,291	-2,040	-8%	25,331	24,570	-762	-3%	25,331	24,544	-788	-3%
		CFS		34.7	33.4	-1	-4%	34.7	33.4	-1	-4%	34.7	33.4	-1	-4%	34.7	33.4	-1	-4%	34.7	31.9	-3	-8%	34.7	33.6	-1	-3%	34.7	33.6	-1	-3%
Freq of Flow Past ACDD		Months with Flow >5 CFS	No Mon	129	124	-5	-4%	129	124	-5	-4%	129	124	-5	-4%	129	124	-5	-4%	129	117	-12	-9%	129	124	-5	-4%	129	123	-6	-5%
		Total Months	No Mon	984	984			984	984			984	984			984	984			984	984			984	984			984	984		
		%	%	13.1%	12.6%		-1%	13.1%	12.6%		-1%	13.1%	12.6%		-1%	13.1%	12.6%		-1%	13.1%	11.9%		-1%	13.1%	12.6%		-1%	13.1%	12.5%		-1%
Calaveras Ck below Calaveras Dam																															
Total Annual Spills/Releases from Calaveras		Max	AF/Y	91,236	86,268	-4,968	-5%	91,236	86,268	-4,968	-5%	91,236	86,268	-4,968	-5%	91,236	86,268	-4,968	-5%	91,236	86,268	-4,968	-5%	91,236	86,268	-4,968	-5%	91,236	86,268	-4,968	-5%
		Min	AF/Y	0	4,227	4,227	+999%	0	4,227	4,227	+999%	0	4,227	4,227	+999%	0	4,227	4,227	+999%	0	4,227	4,227	+999%	0	4,227	4,227	+999%	0	4,227	4,227	+999%
		Avg	AF/Y	11,232	13,149	1,918	17%	11,232	13,038	1,806	16%	11,232	13,186	1,955	17%	11,232	13,136	1,904	17%	11,232	11,426	194	2%	11,232	13,084	1,853	16%	11,232	13,049	1,817	16%
Frequency of Spill (Non-MOU Releases)		No Months of Spill	No Mon	83	61	-22	-27%	83	60	-23	-28%	83	60	-23	-28%	83	60	-23	-28%	83	47	-36	-43%	83	59	-24	-29%	83	59	-24	-29%
		Total Months	No Mon	984	984			984	984			984	984			984	984			984	984			984	984			984	987		
		%	%	8%	6%		-2%	8%	6%		-2%	8%	6%		-2%	8%	6%		-2%	8%	5%		-4%	8%	6%		-2%	8%	6%		-2%
AC below Calaveras Creek Confl.																															
Annual Flow at Confluence, All Years		Avg Annual	AF/Y	21,998	22,703	704	3%	21,998	22,570	572	3%	21,998	22,746	747	3%	21,998	22,687	689	3%	21,998	20,082	-1,916	-9%	21,998	22,748	749	3%	21,998	22,701	702	3%
		Max Annual	AF/Y	146,366	141,163	-5,203	-4%	146,366	141,163	-5,203	-4%	146,366	141,163	-5,203	-4%	146,366	141,163	-5,203	-4%	146,366	142,085	-4,281	-3%	146,366	142,085	-4,281	-3%	146,366	142,085	-4,281	-3%
		Min Annual	AF/Y	0	6,310	6,310	+999%	0	6,310	6,310	+999%	0	6,310	6,310	+999%	0	6,310	6,310	+999%	0	184	184	+999%	0	6,310	6,310	+999%	0	6,310	6,310	+999%
Winter Flow at Confl, Wet Years		Avg Winter, Jan-Mar	CFS	338	302	-36	-11%	338	301	-37	-11%	338	303	-36	-11%	338	302	-36	-11%	338	273	-65	-19%	338	300	-38	-11%	338	300	-38	-11%
		Avg Winter, Jan-Mar	CFS	146	72	-74	-51%	146	72	-74	-51%	146	72	-74	-51%	146	72	-74													

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APPENDIX H2

Hydrologic Modeling – Supporting Information

H2-1: HH/LSM Assumptions and Results – Proposed WSIP

H2-2: Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir

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[Additional discussion on water resources modeling was prepared as part of the Comments and Responses document. Please refer to Section 13.3, Updated Water System Assumptions and Modeling (Vol. 7, Chapter 13), and to Appendix O, Hydrologic Modeling – Additional Supporting Information (Vol. 8).]

APPENDIX H2-1

Memorandum

Subject: HH/LSM Assumptions and Results – Proposed WSIP
From: Daniel B. Steiner
Date: March 18, 2007

1. Introduction

This memorandum summarizes assumptions for, and discusses the interpretation of, Hetch Hetchy Local Simulation Model (HH/LSM) results for the simulation of the Water System Improvement Program (“WSIP” or the “proposed program”). Table 1-1 and Table 1-2 summarize the program/setting characteristics and modeling assumptions, and the performance and hydrologic results, respectively, for the WSIP as they compare to the modeled existing setting (2005, with Calaveras Reservoir constrained by the California Division of Safety of Dams (DSOD) restrictions) and the pre-2002 setting (with Calaveras Reservoir operation prior to DSOD restrictions).

The hydrology of the proposed program is primarily discussed in terms of a comparison to the baseline condition of the Program Environmental Impact Report (PEIR), i.e., the simulated current (2005) operation of the regional system, assuming that the operation of Calaveras and Crystal Springs Reservoirs is constrained by DSOD restrictions. Primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and additional parameters that assist in identifying causes of hydrologic changes are also described as needed. Key hydrologic factors that lead to environmental impact assessment are illustrated.

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 1/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP ³
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ¹ - Calaveras Unconstrained	
Time Horizon for Setting of Analysis / Date ⁴		2005	2005	2030
HH/LSM Simulation Study Name ⁵		MEA3CHR	MEA2A	MEA5HIN
System Wide Parameters				
Customer Purchase Request (Demand Level) ⁶	MGD	265	265	300
Demand Level Supplied from Other Sources⁷				
Regional Recycled Water/Conservation/Groundwater in SF	MGD	0	0	10
Other Regional Recycled Water/Conservation/Groundwater	MGD	0	0	0
Demand Level Supplied from Tuolumne + Local Watersheds ⁸	MGD	265	265	290
Average Annual Deliveries and Supplies⁹				
Deliveries from Tuolumne + Local Watersheds (Average Annual)	MGD	258	259	287
Supply or Deliveries from Other Sources - Regional Recl/Cons/GW	MGD	0	0	10
Total Deliveries and Supply for Demand Level (Average Annual)	MGD	258	259	297
Features and Facilities¹⁰				
Regional Reclaimed Water/Conservation/Groundwater - SF				•
Regional Reclaimed Water/Conservation/Groundwater - Other				
Calaveras Reservoir - 12.4 BG (Constrained)		•		
Calaveras Reservoir - 31.6 BG (Restored/Unconstrained)			•	•
Calaveras Reservoir Release for Fish				•
Calaveras Reservoir Release for Fish & Flow Recapture				•
Crystal Springs Reservoir - 19.0 BG (Constrained)		•	•	
Crystal Springs Reservoir - 22.6 BG (Restored/Unconstrained)				•
Sunol Valley Water Treatment Plant Expansion				•
Sunol Valley Water Treatment Plant Feed from SJPL				•
Harry Tracy Water Treatment Plant Expansion				•
Bay Division Pipeline Increased Conveyance				•
San Joaquin Pipeline Increased Conveyance				•
Desalination Project				•
Westside Groundwater Project				•
Tuolumne River Transfer				•
Water Supply Reliability¹¹				
Action	Level	Rationing %	Rationing %	Rationing %
Implement Drought Water Supply Action (Westside GW or Desal)	1	NA	NA	GW
Rationing (Level 1)	2	10	10	10
Rationing (Level 2)	3	20	20	20
Rationing (Level 3)	4	25	25	25
Years	Action Level	Action Level	Action Level	Action Level
1921				
1924	2	2		1
1925				1
1926				1
1929				1
1930				1
1931	3	2		2
1932				
1933				
1934	2	2		1
1935				
1939				
1944				
1946				
1947				
1948				1
1949				
1950				1
1953				
1954				
1955				1
1957				
1959				
1960	2	2		1
1961	3	3		2
1962				
1964				1
1966				
1968				
1971				
1972				1
1976	2	2		1
1977	3	3		2
1979				
1981				
1984				
1985				1
1987	2	2		1
1988	3	3		2
1989	3	2		2
1990	3	3		3
1991	3	3		2
1992	3	3		3
1994	2	2		1
DD1993	4	3		3
DD1994	4	3		3
Max Drought Rationing - Policy Cap¹²				
DD		Incidental 25%	Incidental 20%	20%
Historical		Incidental 20%	Incidental 20%	20%

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 2/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained	
System Wide Parameters				
Incremental Supply - Average¹³				
System Customer Purchase Request Level	MGD	265	265	300
Demand Level Supplied from Other Sources	MGD	0	0	10
Demand Level Supplied from Tuolumne + Local Watersheds	MGD	265	265	290
System Deliveries	MGD	258	259	287
Regional Desalination	MGD	0	0	0
San Joaquin Pipelines (Tuolumne Diversion)	MGD	218	215	245
Inferred Local Watershed Production	MGD	40	44	42
Add'l Tuolumne Diversion (Compared to Calaveras Constrained)	MGD	218	215	27
Add'l Tuolumne Diversion (Compared to Calaveras pre-2002)	MGD	218	215	30
Incremental Design Drought Supply¹⁴				
From Other Sources - Regional Recl/Cons/GW (Every Year)	MGD	0	0	10
Restoration of Calaveras Reservoir Capacity (w/ flow recapture)	MGD	0	0	7
Restoration of Crystal Springs Capacity	MGD	0	0	1
MID/TID Transfer to SFPUC (Results in additional diversion from TR)	MGD	0	0	23
Westside Basin Conjunctive Use (8,100 acre-feet Storage)	MGD	0	0	6
Regional Desalination (26 mgd)	MGD	0	0	0
Sum of Incremental Supplies	MGD	0	0	47
Yield - Without Other Sources Added (Compared to Calaveras Constrained)	MGD	219	226	256
Yield - With Other Sources Added (Compared to Calaveras Constrained)	MGD	219	226	266
Design Drought Delivery Calculator¹⁵				
	MGD	2	3	4
Average Annual Delivery During Year 1	Year 1	265	265	290
Average Annual Delivery During Year 2	Year 2	239	239	290
Average Annual Delivery During Year 3	Year 3	212	212	261
Average Annual Delivery During Year 4	Year 4	212	239	261
Average Annual Delivery During Year 5	Year 5	212	212	232
Average Annual Delivery During Year 6	Year 6	212	212	261
Average Annual Delivery During Year 7	Year 7	212	212	232
Average Annual Delivery During Year 8	Year 8	199	212	232
Average Annual Delivery During Last 6 Mo	Last 6 Mo	99	106	116
Firm Yield (Nominal) Not Including Other Sources	DD Ave	219	224	256
	MGD	219	226	256
Local System Operational Parameters				
Crystal Springs Reservoir Operation				
Storage - Minimum/Maximum	BG	5.4 - 19.0		5.4 - 22.6
	TAF	16.6 - 58.4		16.6 - 69.3
Fall/Winter Operation Storage		17.0 BG (52.2 TAF)		19.0 BG (58.3 TAF)
Stream Release		Up to 250 cfs to not exceed 19 BG		Up to 250 cfs to not exceed 21 BG
Calaveras Reservoir Operation				
Storage - Minimum/Maximum	BG	8.4 - 12.4	8.4 - 31.5	8.4 - 31.5
	TAF	25.7 - 38.0	25.7 - 96.8	25.7 - 96.8
Fall/Winter Operation Storage		10.3 BG (31.6 TAF)	27.0 BG (82.9 TAF)	27.0 BG (82.9 TAF)
Alameda Creek Release/Recapture ¹⁶	AFY	0		Up to 6,300
San Andreas Reservoir Operation				
Storage - Minimum/Maximum	BG	3.0 - 6.2		3.0 - 6.2
	TAF	9.2 - 19.0		9.2 - 19.0
Fall/Winter Operation Storage		5.6 BG (17.2 TAF)		5.6 BG (17.2 TAF)
San Antonio Reservoir Operation				
Storage - Minimum/Maximum	BG	1.0 - 16.5		1.0 - 16.5
	TAF	3.1 - 50.5		3.1 - 50.5
Fall/Winter Operation Storage		15.9 BG (48.8 TAF)		15.9 BG (48.8 TAF)
Pilarcitos Reservoir Operation				
Storage - Minimum/Maximum	BG	0.65 - 0.97		0.65 - 0.97
	TAF	2.0 - 3.0		2.0 - 3.0
Fall/Winter Operation Storage		0.75 BG (2.2 TAF)		0.75 BG (2.2 TAF)
Water Treatment Plants				
Sunol Valley Water Treatment Plant Maximum	MGD	120		160
		90 MGD from Calaveras		90 frm Calvrs + Flw Rec
Sunol Valley Water Treatment Plant Minimum	MGD	20		20
		Calvrs & SA Res & SJPL	Cal & SA Res	Frm Calvrs & SA & SJPL
Harry Tracy Water Treatment Plant Maximum	MGD	120		140
Harry Tracy Water Treatment Plant Minimum	MGD	20		20
Conveyance				
Bay Division Pipeline Maximum		340 MGD Jun - Sep 320 MGD Apr, May & Oct 290 MGD Nov - Mar		380 MGD Apr - Oct 320 MGD Nov - Mar
Bay Division Pipeline Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 230 MGD		Same as Baselines, except maximum 320 MGD

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 3/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained	
Tuolumne River System Operational Parameters				
Hetch Hetchy Reservoir Operation				
Storage - Minimum/Maximum	TAF	26.1 - 360.4		26.1 - 360.4
Fall/Winter Operation Storage		30 TAF winter buffer		30 TAF winter buffer
1987 Stipulation Minimum Release Flows		Yes		Yes
1987 Stipulation Supplemental Release Flows		No		No
Cherry Reservoir Operation				
Storage - Minimum/Maximum	TAF	1.0 - 273.3		1.0 - 273.3
Fall/Winter Operation Storage		25.3 TAF winter buffer		25.3 TAF winter buffer
Eleanor Reservoir Operation				
Storage - Minimum/Maximum	TAF	0.0 - 27.1		0.0 - 27.1
Fall/Winter Operation Storage		Required Minimum Storage		Reqrd Minimum Stor
New Don Pedro Water Bank Account				
Storage - Minimum/Maximum	TAF	0.0 - 570.0		0.0 - 570.0
		Temporary storage up to 740 TAF during Apr - Sep		Temp stor up to 740 TAF during Apr - Sep
Conveyance				
San Joaquin Pipelines Maximum	MGD	290		314
San Joaquin Pipelines Minimum	MGD	70		70
San Joaquin Pipelines Flow Rate Changes		11 Stepwise		17 Stepwise
		Surrogate minimum changes by allowing only 7 changes in a year		Allow up to 7 changes in a year (surrogate)
San Joaquin Pipelines Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 210 MGD		Cyclic 5-year maintenance, maximum capacity available Apr - Oct all years 271 MGD available all other months except 0 MGD available Year 5 Nov - Dec and 135.5 MGD available Year 1 and Year 3 Dec
TID/MID Operational Parameters				
Districts' Tuolumne Diversion ¹⁷		Varies annually based on land use and water availability Annual average 867 TAF		Set equal to baseline conditions SFPUC diversion effects measured by the result of reducing inflow to New Don Pedro Reservoir and its effect upon La Grange releases to the Tuolumne River
Tuolumne River La Grange Flow Releases				
Don Pedro, 1996 FERC		X	X	X
VAMP - considered but not modeled ¹⁸		X	X	X

**Table 1-2
Summary of Modeling Results (Part 1/2)**

HH/LSM Simulation Results	Units	Baselines		Proposed WSIP
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained	
Design Drought Production & Disposition¹⁹				
San Joaquin Pipeline Diversion	MGD	206.9	206.4	232.5
Bay-Area Deliveries	MGD	218.3	223.9	248.9
Added Groveland & Coastside Delivery	MGD	2.6	2.6	3.6
Local Reservoir Evaporation	MGD	10.2	10.6	12.3
Inflow from ACDD	MGD	2.3	2.5	2.5
Flow Recapture	MGD	0	0	5.3
Local Reservoir Stream Release	MGD	0.1	0.2	5.5
Desalination	MGD	0	0	0
Westside Basin	MGD	0	0	5.6
District Transfer to NDP Water Bank	MGD	0	0	22.7
Local Storage - Begin	MG	53,725	72,505	77,708
Local Storage - End	MG	20,044	19,133	18,846
Study Average Production & Disposition (1921-02)²⁰				
Tuolumne River System				
Reservoirs				
Hetch Hetchy				
Inflow	AF	749,605	749,605	749,605
River	AF	277,018	277,714	267,446
Stream Minimum Release	AF	65,731	65,912	65,547
Tunnel	AF	468,975	468,279	478,524
Evaporation	AF	3,896	3,868	3,868
Reservoir	AF	284,033	287,056	275,905
Cherry				
Inflow	AF	279,293	279,293	279,293
Eleanor Gravity	AF	199	199	289
Eleanor Pump	AF	118,270	118,188	118,299
River	AF	44,659	44,001	45,978
Stream Minimum Release	AF			
Tunnel	AF	349,596	350,171	348,403
Evaporation	AF	3,507	3,508	3,499
Reservoir	AF	240,426	240,602	239,298
Eleanor				
Inflow	AF	169,617	169,617	169,617
Eleanor Gravity	AF	199	199	289
Eleanor Pump	AF	118,270	118,188	118,299
River	AF	49,243	49,325	49,124
Stream Minimum Release	AF			
Evaporation	AF	1,905	1,905	1,906
Reservoir	AF	22,201	22,201	22,191
Don Pedro Reservoir				
Inflow	AF	1,591,144	1,594,967	1,561,409
MID Diversion	AF	303,546	303,546	303,546
TID Diversion	AF	563,497	563,497	563,497
LaGrange Total Stream	AF	680,091	684,124	652,299
LaGrange Minimum Stream Release	AF	221,361	221,361	221,361
Total Evaporation	AF	44,024	44,092	43,106
Reservoir	AF	1,492,181	1,495,055	1,453,662
Water Bank Account				
Balance	AF	518,149	520,327	517,209
Transfer	AF	0	0	27,000
San Joaquin Pipelines				
Volume (AF)	AF	244,165	240,340	273,887
Volume (MG)	MG	79,562	78,315	89,246
Rate (MGD)	MGD	218	215	245
Max Rate (MGD)	MGD	290	290	314
Min Rate (MGD)	MGD	70	0	0
East Bay System				
Reservoirs				
Calaveras				
Inflow	MG	12,368	12,368	12,368
From ACDD	MG	1,352	2,023	1,748
Stream	MG	3,660	2,242	4,285
Stream Flow Recapture	MG	0	0	1,555
To SVWTP	MG	9,049	10,616	9,694
To San Antonio	MG	0	0	0
Evaporation	MG	1,023	1,591	1,709
Reservoir	MG	10,975	25,116	28,320
San Antonio				
Inflow	MG	2,468	2,468	2,468
From Calaveras/SJPL	MG	1,053	1,525	1,278
Stream	MG	555	521	548
To SVWTP	MG	2,061	2,511	2,239
Evaporation	MG	956	971	976
Reservoir	MG	14,084	14,447	14,631
Alameda Creek Diversion Dam				
Inflow	MG	4,197	4,197	4,197
To Calaveras Reservoir	MG	1,352	2,023	1,748
Spill	MG	2,845	2,174	2,449
Alameda Creek Confluence				
Accretion	MG	1,918	1,918	1,918
From ACDD	MG	2,845	2,174	2,449
From Calaveras Dam	MG	3,660	2,242	4,285
At Confluence	MG	8,422	6,333	8,652
Treatment Plants				
SVWTP Total	MG	13,752	13,267	14,313
From Calaveras	MG	9,049	10,616	9,694
From San Antonio	MG	2,061	2,511	2,239
From SJPL	MG	2,642	141	2,380
SVWTP Total MGD	MGD	38	36	39
SVWTP Max MGD	MGD	117	120	160
SVWTP Min MGD	MGD	20	20	20

**Table 1-2
Summary of Modeling Results (Part 2/2)**

HH/LSM Simulation Results	Units	Baselines		Proposed WSIP
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained	
Peninsula System				
Reservoirs				
Crystal Springs				
Inflow	MG	3,722	3,722	3,722
From San Andreas	MG	0	0	0
From Pilarcitos and SJPL	MG	6,751	8,545	8,508
Stream	MG	448	409	316
Pump to San Andreas	MG	8,832	10,540	10,311
Pump to Coastside	MG	54	55	239
Evaporation	MG	1,189	1,261	1,407
Reservoir	MG	16,102	16,907	18,962
San Andreas				
Inflow	MG	1,428	1,428	1,428
From other Streams	MG	9,271	10,992	10,656
Stream	MG	0	0	0
To HTWTP	MG	10,168	11,890	11,553
Evaporation	MG	530	530	530
Reservoir	MG	5,893	5,846	5,861
Pilarcitos				
Inflow		1,297	1,297	1,297
To San Andreas	MG	439	452	345
For Stone Diversion	MG	444	444	607
Stream other than Diversion	MG	327	314	278
Evaporation	MG	89	89	72
Reservoir	MG	623	623	469
Stone Dam				
Accretion blw Pilarcitos	MG	603	603	603
Pilarcitos non-diversion Release	MG	327	314	278
Pilarcitos Release for Diversions	MG	930	917	880
Diversion to Coastside	MG	178	178	236
Diversion to Crystal Springs	MG	180	200	181
Spill past Stone	MG	1,502	1,455	1,343
Treatment Plants				
HTWTP Total	MG	10,168	11,890	11,553
HTWTP Total MGD	MGD	28	33	32
HTWTP Max MGD	MGD	149	149	106
HTWTP Min MGD	MGD	20	20	20
Other Facilities				
Westside Basin Net	MG	0	0	11
Desalination Input	MG	0	0	0
Additional Information				
Total Local Reservoir Stream Release	MG	4,990	3,486	5,427
Total Local Reservoir Stream Evaporation	MG	3,788	4,442	4,694
Deliveries				
In-City	MG	29,589	29,667	26,686
South Bay	MG	43,106	43,221	52,906
Crystal Springs	MG	15,120	15,160	16,931
San Andreas	MG	5,400	5,414	6,604
Coastside	MG	675	678	1,082
Groveland	MG	365	365	365
Total Deliveries	MG	94,255	94,502	104,574
Total Deliveries	MGD	258	259	287
Storage				
Total Local Storage Begin	MG	23,240	23,488	26,150
Total Local Storage End	MG	18,915	23,358	22,188
Residual Difference during 82-year Simulation	MGD	0.14	0.00	0.13
Westside Storage Begin	MG	0	0	23,474
Westside Storage End	MG	0	0	24,363
Residual Difference during 82-year Simulation	MGD	0.00	0.00	0.03

Notes for Table 1-1 and Table 1-2

1. Baseline condition represents the existing conditions at the time of NOP publication in September 2005. This is the baseline used to assess WSIP program impact and impact significance. This setting indicates DSOD restrictions on Calaveras and Crystal Springs Reservoirs.
2. This baseline condition represents a system configuration and operation prior to the DSOD storage restriction (pre-2002).
3. More features and elements of the WSIP exist. Only features affecting the hydrologic analysis are illustrated.
4. The time horizon for the setting of the scenario. The baseline condition scenarios are depicted for recent conditions, while the proposed WSIP, variants, and alternatives are depicted for the future at full buildout and implementation, i.e., conditions in the year 2030.
5. HH/LSM model simulation study name.
6. The customer purchase request (demand) information is based on the demand and request studies prepared by the SFPUC in coordination with the wholesale customers (SFPUC/URS 2004). This demand on the regional water system includes both the SFPUC retail customers and wholesale customers. The current (2005) average annual demand is 265 mgd and the projected 2030 average annual demand is 300 mgd, assuming the SFPUC adopts the updated wholesale customer purchase requests as part of the Master Sales Agreement renewal with these customers (due in 2009).
7. Certain scenarios include the development of additional water supply from a combination of recycled water projects, groundwater projects, and conservation, utilized every year and not subject to reduction during drought.
8. The average annual demand for supplies from the combination of the SFPUC local watershed and Tuolumne River, as well as programs not included in the regional water conservation, reclamation, and groundwater programs shown.
9. Modeled results for SFPUC deliveries, with supplies added for regional water conservation, reclamation, and groundwater programs. Total deliveries and supply will be less than full customer purchase requests due to rationing in some years.
10. Shows only the features that affect hydrologic results of the system operation simulations. Additional projects are included in the WSIP, variants, and alternatives.
11. Illustrates the frequency and severity of water supply action or severity of system-wide rationing. Only years in which variable water supply component is implemented or rationing occurs are shown. "DD" illustrates the shortage results for years included in the prospective drought period of the SFPUC Design Drought. These years contribute to establishing system operation protocols, but are not included in the hydrologic assessment analyses.
12. Rationing policy cap: The SFPUC WSIP level of service goal is to maintain rationing on the regional system at no more than 20% during any one year of drought. Some alternatives do not achieve this level of service goal. Performance is indicated for both the Design Drought ("DD") sequence and "Historical" hydrologic sequence.
13. Water supply elements develop water in different amounts from year to year, and, in some instances, they only develop water during dry years. This information is provided to compare local watershed supplies, Tuolumne River supplies, and other identifiable water supplies used to meet system purchase requests. Values are stated in units of average annual quantities during the simulated historical sequence.
14. Results from HH/LSM analysis of each scenario. Values represent the average annual production of each element of supply during the design drought period.
15. Simplified calculation of system deliveries during the SFPUC design drought. The value represents the application of system-wide shortages to the demand level being met with SFPUC local watershed, Tuolumne, and other developed supplies, and does not include supplies from regional water conservation or from recycled water or groundwater projects. Average value may be slightly misstated (up to 3 mgd) due to metric of analysis that does not account for differences in residual storage between studies. "Nominal" firm yield represents the yield of each scenario after adjustment for minor residual storage differences.
16. Supplemental releases from Calaveras Reservoir for fisheries (1997 MOU) of up to 6,300 AFY and the Alameda Creek Recapture project are tied to implementation of the Calaveras Dam replacement project. When the dam is replaced and capacity restored, both the flow release and recapture will occur. The release requirement is based on the supplementation of other occurring flows below Calaveras Reservoir, sometimes not requiring the full 6,300 acre-feet.
17. SFPUC actions are assumed to leave MID/TID diversions unchanged so that the SFPUC effects on the Tuolumne River below La Grange Dam are isolated and possibly overstated. The Districts' diversions are assumed to be constant among the scenarios to provide comparable results of SFPUC-alone effects.
18. Participation in the San Joaquin River Agreement is assumed. Although the agreement expires after 2010, it is assumed that a subsequent similar agreement or requirement of the Districts will occur. HH/LSM does not explicitly model the Districts' participation in the agreement; however, its participation if modeled would result in only minor differences in results and would not change impact conclusions.
19. From HH/LSM results for modeling the SFPUC Design Drought Period.
20. From HH/LSM results for modeling the system operations for the historical hydrologic period 1921-2002. Values indicate average annual quantities during the simulated historical period.

2. Proposed WSIP

The San Francisco Public Utilities Commission (SFPUC) proposes to adopt and implement the WSIP to increase the reliability of the Regional Water System. The WSIP is a program to implement the service goals and system performance objectives established by the SFPUC for the Regional Water System in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2030.

The WSIP level of service objectives for water supply are to: (1) fully meet customer purchase requests in non-drought years through planning year 2030, estimated at 300 million gallons per day (mgd) average annual delivery; and (2) provide drought-year delivery with a maximum system-wide delivery reduction (rationing) of 20 percent in any one year of a drought. These objectives correspond to a required system firm yield of 256 mgd in 2030. System firm yield is defined as the average annual water delivery that can be sustained throughout an extended drought. The current firm yield of the system is 219 mgd under the current restricted operating conditions that limit storage levels in Calaveras and Crystal Springs Reservoirs. In the setting prior to restrictions to the operation of the reservoirs, the system firm yield is estimated to be 226 mgd.

During non-drought years, the SFPUC would serve the increased 35 mgd in purchase requests through a combination of conservation, water recycling, groundwater supply programs, increased diversions from the Tuolumne River, and greater utilization of Bay Area watershed supplies associated with the restoration of operational storage capacity (primarily at Calaveras Reservoir). The SFPUC would implement conservation, water recycling, and groundwater supply programs in the SFPUC retail service area to achieve the equivalent of 10 mgd of supply per year, in all years. These programs would be in addition to demand management and conservation measures already accounted for in the 2030 purchase request for the retail service area.

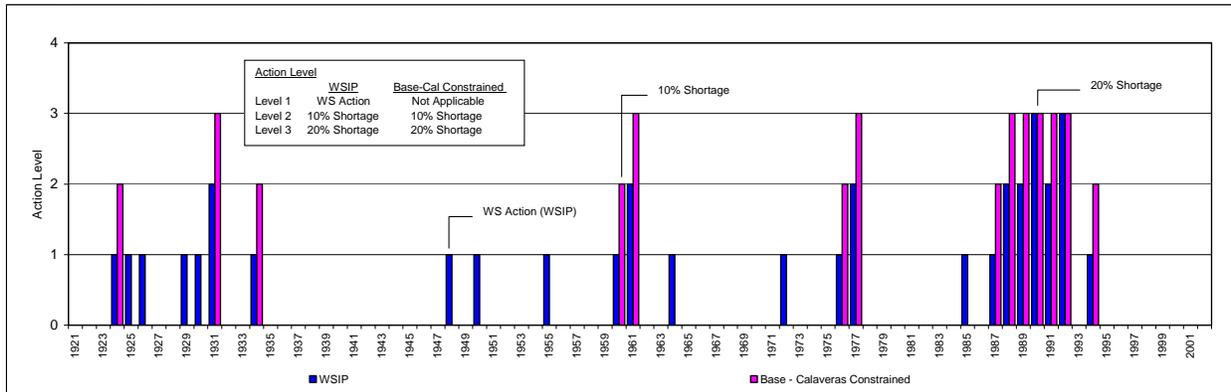
In most years, the SFPUC could serve the projected 2030 water purchases of 300 mgd with its existing sources of water supply; however, these sources alone have not allowed for full water deliveries during past droughts, and they would be insufficient during future droughts as purchase requests increase. The SFPUC proposes to serve this 2030 need for increased system firm yield (i.e., water supply during a drought scenario) with a combination of conservation, water recycling, and groundwater programs in the SFPUC retail service area; water transfers from the Turlock Irrigation District (TID) and Modesto Irrigation District (MID); a groundwater conjunctive-use program, incorporating the Westside Basin Groundwater Program; and restoration of reservoir operating capacity at Crystal Springs and Calaveras Reservoirs. System-wide rationing is limited to no more than 20 percent in any year, with a firm yield of 256 mgd throughout an extended drought.

2.1 Water Deliveries and Drought Response Actions

With a current system-wide purchase request of approximately 265 mgd, the Regional Water System cannot provide full deliveries during all anticipated drought sequences. Drought response actions (delivery shortages) are necessary at the onset of a drought to provide a viable, albeit reduced, supply throughout the duration of drought. Because the Regional Water System has limited current resources, rationing of the SFPUC supply by more than 20 percent may be required during an extended drought. With the proposed program, the purchase requests would increase from 265 mgd to 300 mgd, with 10 mgd of this request satisfied by conservation, recycling, and groundwater programs in the city of San Francisco. In the future, the Regional Water System would experience a net demand of 290 mgd. The additional net demand and increase in the water supply reliability of the Regional Water System would be served by the water supply programs described above. Table 1-1 compares the drought response actions for the proposed program and base-Calaveras constrained settings. Figure 2.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002).

In Figure 2.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In the WSIP setting, the action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. The water transfer from MID/TID is also occurring during these periods. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers.

**Figure 2.1-1
Drought Response Actions – WSIP and Base-Calaveras Constrained**



In modeling parlance, there is no level 1 action level in the base setting. Without supplemental resources, the existing system only has the delivery shortage measure available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the WSIP and the base settings for these action levels. As evidenced in Figure 2.1-1, rationing would be required more frequently and with greater severity in the base-Calaveras constrained setting (level 2 and level 3 actions).

Figure 2.1-2 illustrates the same information in comparing the WSIP setting to the base-Calaveras unconstrained setting. The same general differences occur between the WSIP and the base-Calaveras unconstrained settings. The WSIP would decrease the frequency of imposed water delivery shortages, and at times reduce the severity of shortages.

**Figure 2.1-2
Drought Response Actions – WSIP and Base-Calaveras Unconstrained**

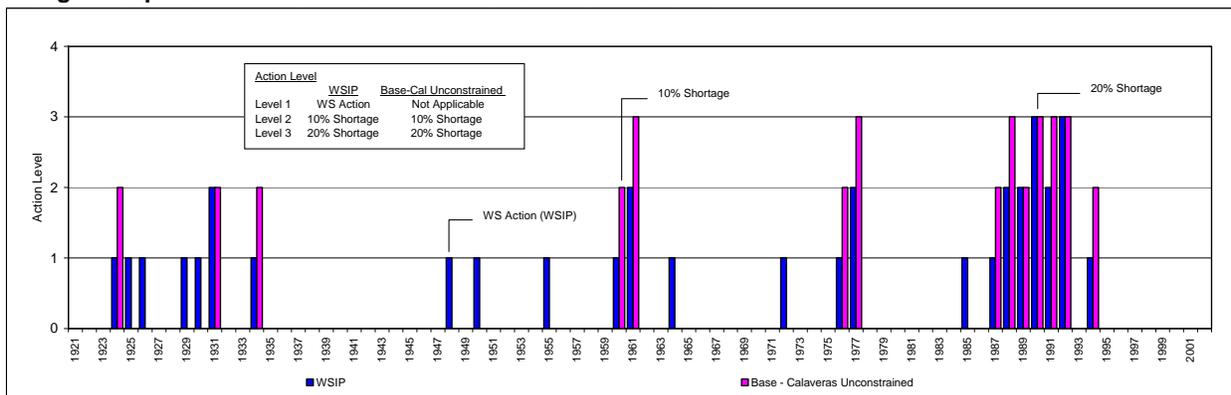


Figure 2.1-1 and Figure 2.1-2 illustrate that, when compared to the base settings, the WSIP setting triggers the supplemental resource (Westside Basin Groundwater Program) at an early indication of drought and during periods, when in the base settings there were no supplemental resources available to the system. The utilization of the supplemental resource during these times results in the elimination or reduction, or at least a non-increase in the severity, of delivery shortage.

Although not illustrated in Figure 2.1-1 or Figure 2.1-2, Table 1-1 shows the delivery shortages anticipated during the entire SFPUC Design Drought. Shortages during the Design Drought with the WSIP are maintained within the objective to limit the severity of shortage to no more than 20 percent. With the existing system (Calaveras and Crystal Springs Reservoirs constrained), the 20-percent-limitation (cap) objective cannot be achieved during the last 18 months of the Design Drought, and a 25-percent shortage is applied. The system’s yield in this setting is 219 mgd. In the base-Calaveras

unconstrained setting, the 20-percent limitation could be achieved; however, the frequency of imposing that level of rationing exceeds the SFPUC objective for the Design Drought.

The difference in water deliveries between the proposed program and the base-Calaveras constrained settings is shown chronologically for the 82-year simulation in Table 2.1-1. The differences all indicate an increase in deliveries due to an increase in the level of purchase requests, and an increase in the reliability of delivery. The annual (fiscal year-based) increase of approximately 9,100 million gallons represents the basic increase in delivery associated with an increase in purchase request from 265 mgd to 290 mgd. The annual increase of approximately 6,500 mgd indicates years during which the Westside Basin Groundwater Program provides a supplemental supply to the system and offsets the demand needed from other SFPUC resources. The positive difference following this period, approximately 11,800 million gallons per year, represents years when replenishment of the Westside Basin Groundwater Program is necessary after the draw from the program. The years that show other levels of additional deliveries represent years when shortages are reduced in the WSIP setting compared to the base-Calaveras constrained setting.

Table 2.1-2 presents the same information in comparing the WSIP setting with the base-Calaveras unconstrained settings. The results for system-wide deliveries are predominantly the same, except for periods when the base-Calaveras unconstrained setting has slightly improved water supply reliability (less rationing) than the base-Calaveras constrained setting. During these periods, the increase in deliveries due to the WSIP would be slightly less than that of the base-Calaveras constrained setting.

2.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin is the flow through the San Joaquin Pipeline (SJPL). Table 2.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the base-Calaveras constrained settings. Evident in the operation is the increase in summer diversions associated with the increase in the conveyance capacity of the SJPL. Regardless of an increase in purchase requests, the availability of increased conveyance capacity would increase diversions during the summer to retain storage in the Bay Area reservoirs, typically exercising the SJPL at its maximum capacity. The increase in purchase requests would require the utilization of the maximum capacity for a longer period into the fall. Generally, fewer diversions would occur during the late fall and early winter because of the lesser drawdown of the Bay Area reservoirs (requiring less replenishment), and because systematic maintenance within Hetch Hetchy facilities (lessening available conveyance capacity) would impair diversions in the WSIP setting. The increase in diversions during the winter and spring would result from the need to replenish Bay Area reservoir storage after the maintenance period, serve increased purchase requests and top off Bay Area reservoir storage prior to summer. The difference in SJPL diversions between the WSIP setting and the base-Calaveras constrained setting is illustrated in Figure 2.2-1. The difference in average monthly diversion through the SJPL is shown by year type for the 82-year simulation period.

Table 2.2-2 illustrates the average monthly diversion through the SJPL, by year type, for the 82-year simulation period for the proposed program and the base-Calaveras constrained settings. The table illustrates a trend of less diversion of water from the Tuolumne River Basin in wetter years (as Bay Area reservoir watersheds provide more supply during those years) than in drier years. Table 2.2-3 illustrates the same form of information in comparing diversions through the SJPL between the WSIP and the base-Calaveras unconstrained settings.

Table 2.1-1

Difference in Total System-wide Delivery (MG)													WSIP minus Base - Calaveras Constrained		
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
1921	1,034	828	685	599	437	609	727	907	1,008	1,145	1,095	940	10,014	10,679	
1922	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1923	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1924	810	611	461	374	437	609	727	907	1,008	2,041	1,988	1,671	11,644	9,124	
1925	1,403	996	710	537	693	1,078	1,365	1,714	772	839	821	702	11,629	14,967	
1926	586	409	278	216	260	410	508	685	772	839	821	702	6,485	6,485	
1927	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1928	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1929	1,034	828	685	599	640	833	944	1,131	1,225	839	821	702	10,280	11,764	
1930	586	409	278	216	260	410	508	685	772	839	821	702	6,485	6,485	
1931	586	409	278	216	260	410	508	685	772	1,702	1,672	1,473	8,970	6,485	
1932	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	1,369	1,319	1,157	14,215	15,216	
1933	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1934	1,034	828	685	599	640	833	944	1,131	1,225	2,041	1,988	1,671	13,618	11,764	
1935	1,403	996	710	537	693	1,078	1,365	1,714	772	1,369	1,319	1,157	13,113	14,967	
1936	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1937	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1938	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
1939	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1940	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1941	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1942	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1943	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1944	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1945	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1946	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1947	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1948	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124	
1949	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1950	1,034	828	685	599	640	833	944	1,131	1,225	839	821	702	10,280	11,764	
1951	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1952	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
1953	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1954	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1955	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124	
1956	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1957	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
1958	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1959	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1960	810	611	461	374	437	609	727	907	1,008	2,041	1,988	1,671	11,644	9,124	
1961	1,403	996	710	537	693	1,078	1,365	1,714	1,914	1,702	1,672	1,473	15,256	16,109	
1962	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	1,369	1,319	1,157	14,215	15,216	
1963	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1964	1,034	828	685	599	640	833	944	1,131	1,225	839	821	702	10,280	11,764	
1965	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1966	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
1967	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1968	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1969	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1970	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1971	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1972	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124	
1973	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1974	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
1975	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1976	810	611	461	374	437	609	727	907	1,008	2,041	1,988	1,671	11,644	9,124	
1977	1,403	996	710	537	693	1,078	1,365	1,714	1,914	1,702	1,672	1,473	15,256	16,109	
1978	1,323	1,057	891	789	829	1,110	1,260	1,499	-499	1,369	1,319	1,157	12,104	13,106	
1979	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1980	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
1981	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1982	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1983	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1984	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
1985	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124	
1986	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485	
1987	1,034	828	685	599	640	833	944	1,131	1,225	2,041	1,988	1,671	13,618	11,764	
1988	1,403	996	710	537	693	1,078	1,365	1,714	1,914	1,702	1,672	1,473	15,256	16,109	
1989	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	1,702	1,672	1,473	15,216	15,216	
1990	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	579	571	495	12,014	15,216	
1991	421	307	219	179	204	304	367	487	539	1,702	1,672	1,473	7,874	4,671	
1992	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	579	571	495	12,014	15,216	
1993	421	307	219	179	204	304	367	487	-1,571	1,369	1,319	1,157	4,762	2,561	
1994	1,034	828	685	599	640	833	944	1,131	1,225	2,041	1,988	1,671	13,618	11,764	
1995	1,403	996	710	537	693	1,078	1,365	1,714	772	1,369	1,319	1,157	11,227	13,082	
1996	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1997	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1998	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
1999	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
2000	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764	
2001	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764	
2002	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124	
Avg (21-02)	922	706	551	461	516	714	830	1,025	1,049	1,266	1,222	1,056	10,318	10,326	

Table 2.1-2

Difference in Total System-wide Delivery (MG)													WSIP minus Base - Calaveras Unconstrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	1,034	828	685	599	437	609	727	907	1,008	1,145	1,095	940	10,014	10,679
1922	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1923	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1924	810	611	461	374	437	609	727	907	1,008	2,041	1,988	1,671	11,644	9,124
1925	1,403	996	710	537	693	1,078	1,365	1,714	772	839	821	702	11,629	14,967
1926	586	409	278	216	260	410	508	685	772	839	821	702	6,485	6,485
1927	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1928	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1929	1,034	828	685	599	640	833	944	1,131	1,225	839	821	702	10,280	11,764
1930	586	409	278	216	260	410	508	685	772	839	821	702	6,485	6,485
1931	586	409	278	216	260	410	508	685	772	689	678	589	6,080	6,485
1932	499	366	264	212	243	365	436	581	643	1,369	1,319	1,157	7,454	5,565
1933	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1934	1,034	828	685	599	640	833	944	1,131	1,225	2,041	1,988	1,671	13,618	11,764
1935	1,403	996	710	537	693	1,078	1,365	1,714	772	1,369	1,319	1,157	13,113	14,967
1936	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1937	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1938	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
1939	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1940	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1941	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1942	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1943	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1944	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1945	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1946	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1947	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1948	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124
1949	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1950	1,034	828	685	599	640	833	944	1,131	1,225	839	821	702	10,280	11,764
1951	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1952	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
1953	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1954	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1955	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124
1956	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1957	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
1958	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1959	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1960	810	611	461	374	437	609	727	907	1,008	2,041	1,988	1,671	11,644	9,124
1961	1,403	996	710	537	693	1,078	1,365	1,714	1,914	1,702	1,672	1,473	15,256	16,109
1962	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	1,369	1,319	1,157	14,215	15,216
1963	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1964	1,034	828	685	599	640	833	944	1,131	1,225	839	821	702	10,280	11,764
1965	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1966	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
1967	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1968	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1969	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1970	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1971	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1972	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124
1973	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1974	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
1975	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1976	810	611	461	374	437	609	727	907	1,008	2,041	1,988	1,671	11,644	9,124
1977	1,403	996	710	537	693	1,078	1,365	1,714	1,914	1,702	1,672	1,473	15,256	16,109
1978	1,323	1,057	891	789	829	1,110	1,260	1,499	-499	1,369	1,319	1,157	12,104	13,106
1979	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1980	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
1981	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1982	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1983	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1984	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
1985	810	611	461	374	437	609	727	907	1,008	839	821	702	8,306	9,124
1986	586	409	278	216	260	410	508	685	772	1,369	1,319	1,157	7,968	6,485
1987	1,034	828	685	599	640	833	944	1,131	1,225	2,041	1,988	1,671	13,618	11,764
1988	1,403	996	710	537	693	1,078	1,365	1,714	1,914	1,702	1,672	1,473	15,256	16,109
1989	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	689	678	589	12,326	15,216
1990	499	366	264	212	243	365	436	581	643	579	571	495	5,253	5,565
1991	421	307	219	179	204	304	367	487	539	1,702	1,672	1,473	7,874	4,671
1992	1,323	1,057	891	789	829	1,110	1,260	1,499	1,611	579	571	495	12,014	15,216
1993	421	307	219	179	204	304	367	487	-1,571	1,369	1,319	1,157	4,762	2,561
1994	1,034	828	685	599	640	833	944	1,131	1,225	2,041	1,988	1,671	13,618	11,764
1995	1,403	996	710	537	693	1,078	1,365	1,714	772	1,369	1,319	1,157	10,126	11,981
1996	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1997	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1998	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
1999	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
2000	1,034	828	685	599	640	833	944	1,131	1,225	1,369	1,319	1,157	11,764	11,764
2001	1,034	828	685	599	640	833	944	1,131	1,225	1,145	1,095	940	11,099	11,764
2002	810	611	461	374	437	609	727	907	1,008	1,145	1,095	940	9,124	9,124
Avg (21-02)	902	689	536	447	497	688	810	1,003	1,025	1,241	1,198	1,035	10,069	10,077

Table 2.2-1

Difference in Total SJPL (Acre-feet)				WSIP minus Base - Calaveras Constrained											
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
1921	952	-921	0	0	0	14,270	2,210	2,284	2,210	2,284	2,284	2,210	27,783	32,018	
1922	-951	0	0	6,659	0	0	7,365	5,138	4,972	2,284	2,284	2,210	29,961	29,961	
1923	0	-2,762	0	0	0	15,317	2,210	2,284	2,210	2,284	2,284	2,210	26,037	26,037	
1924	1,047	0	-952	-952	-859	5,803	2,210	2,284	2,210	2,284	2,284	2,210	17,569	17,569	
1925	2,284	-19,334	-15,222	5,803	17,272	15,317	2,210	2,284	2,210	2,284	2,284	2,210	19,602	19,602	
1926	5,138	5,616	-7,088	5,803	7,734	15,317	2,210	2,284	2,210	2,284	2,284	2,210	46,002	46,002	
1927	2,949	921	-952	7,801	0	3,805	0	2,284	2,210	2,284	2,284	4,972	28,558	25,796	
1928	2,854	0	-1,379	4,757	4,297	7,610	1,841	2,284	2,210	2,284	2,284	4,972	34,014	34,014	
1929	4,757	0	0	4,757	4,297	10,560	2,210	2,284	2,210	2,284	2,284	2,210	37,853	40,615	
1930	2,284	-19,334	-19,979	5,803	5,242	15,317	2,210	2,284	2,210	2,284	2,284	2,210	2,815	2,815	
1931	2,284	5,616	-7,088	5,803	9,538	5,803	2,210	2,284	2,210	2,284	2,284	2,210	35,438	35,438	
1932	6,659	7,365	-7,326	4,281	6,874	16,459	2,210	7,992	7,734	2,284	2,284	2,210	59,026	59,026	
1933	1,047	0	-7,088	7,611	6,875	10,560	2,210	2,284	2,210	2,284	2,284	2,210	32,487	32,487	
1934	2,284	5,616	4,756	7,611	10,312	10,560	2,210	2,284	2,210	2,284	2,284	2,210	54,621	54,621	
1935	2,284	-19,334	-19,979	16,459	14,866	10,560	2,210	7,992	7,734	2,284	2,284	2,210	29,570	29,570	
1936	7,040	4,603	-7,088	12,368	859	15,317	2,210	2,284	2,210	2,284	2,284	2,210	46,581	46,581	
1937	2,854	1,841	-952	5,709	0	2,663	1,842	5,138	4,972	2,284	2,284	2,210	30,845	30,845	
1938	3,901	0	-1,142	5,708	0	0	7,365	5,138	4,972	2,284	2,284	4,972	35,482	32,720	
1939	-952	-921	0	3,805	3,437	10,560	2,210	2,284	2,210	2,284	2,284	2,210	29,411	32,173	
1940	2,284	-19,334	-19,979	11,512	9,452	12,367	6,444	5,138	4,972	2,284	2,284	2,210	19,634	19,634	
1941	-952	-921	-1,142	0	0	0	0	2,854	2,762	2,284	2,284	2,210	9,379	9,379	
1942	1,903	-921	-1,712	0	0	3,805	5,524	2,854	2,762	2,284	2,284	2,210	20,993	20,993	
1943	2,949	1,841	-7,088	0	0	7,610	4,972	5,138	4,972	2,284	2,284	2,210	27,172	27,172	
1944	0	-921	-2,855	4,757	8,765	14,270	2,210	2,284	2,210	2,284	2,284	2,210	37,498	37,498	
1945	-1,807	-19,334	-19,979	5,803	13,749	15,317	2,210	2,284	2,210	2,284	2,284	2,210	7,231	7,231	
1946	5,708	1,841	0	0	0	11,512	2,210	2,284	2,210	2,284	2,284	2,210	32,543	32,543	
1947	952	0	1,902	4,757	4,296	10,560	2,210	2,284	2,210	2,284	2,284	2,210	35,949	35,949	
1948	2,284	5,616	-7,088	4,756	4,297	5,803	2,210	2,284	2,210	2,284	2,284	2,210	29,150	29,150	
1949	2,284	5,616	0	0	0	-4,757	2,210	2,284	2,210	2,284	2,284	4,972	19,387	16,625	
1950	2,949	-19,334	-19,979	18,171	16,413	10,560	2,210	2,284	2,210	2,284	2,284	2,210	22,262	25,024	
1951	2,284	2,762	0	0	0	6,659	2,210	2,284	2,210	2,284	2,284	4,972	27,949	25,187	
1952	2,949	0	0	0	0	0	11,048	5,138	4,972	2,284	2,284	2,210	30,885	33,647	
1953	0	-921	-951	0	0	15,317	2,210	2,284	2,210	2,284	2,284	2,210	26,927	26,927	
1954	-2,854	-921	-2,855	8,562	7,046	15,317	2,210	2,284	2,210	2,284	2,284	2,210	37,777	37,777	
1955	-1,807	-19,334	-15,222	18,171	16,413	5,803	2,210	2,284	2,210	2,284	2,284	2,210	17,506	17,506	
1956	2,284	5,616	-3,805	0	0	3,805	2,210	5,138	4,972	2,284	2,284	2,210	26,998	26,998	
1957	1,902	0	-952	4,757	8,765	10,560	2,210	2,284	2,210	2,284	2,284	2,210	38,514	38,514	
1958	3,806	2,762	-2,331	3,805	0	0	0	2,949	2,854	2,284	2,284	2,210	20,623	20,623	
1959	1,902	-921	-2,855	8,562	0	15,317	2,210	2,284	2,210	2,284	2,284	2,210	35,487	35,487	
1960	2,284	-19,334	-19,979	5,803	9,538	5,803	2,210	2,284	2,210	2,284	2,284	2,210	-2,403	-2,403	
1961	2,284	5,616	-8,515	5,328	10,398	5,803	2,210	2,284	2,210	2,284	2,284	14,178	46,364	34,396	
1962	14,651	-368	-4,282	2,379	11,171	18,171	2,210	7,992	7,734	2,284	2,284	4,972	69,198	78,404	
1963	5,233	4,603	-2,331	2,663	0	4,757	5,524	1,902	1,841	2,284	2,284	2,210	30,970	33,732	
1964	7,040	3,682	-2,855	9,513	8,593	5,803	2,210	2,284	2,210	2,284	2,284	2,210	45,258	45,258	
1965	2,284	-19,334	-15,222	5,708	5,156	15,317	4,603	952	921	2,284	2,284	4,972	9,925	7,163	
1966	1,902	1,841	-1,902	8,562	7,734	10,560	2,210	2,284	2,210	2,284	2,284	2,210	42,179	44,941	
1967	2,284	5,616	-7,611	0	0	2,854	2,762	0	0	2,284	2,284	2,210	12,683	12,683	
1968	5,708	0	-7,088	8,562	7,734	10,560	2,210	2,284	2,210	2,284	2,284	2,210	38,958	38,958	
1969	2,284	2,762	1,902	0	0	0	7,734	5,138	4,972	2,284	2,284	2,210	31,570	31,570	
1970	0	-19,334	-15,222	12,367	11,171	14,270	2,210	2,284	2,210	2,284	2,284	2,210	16,734	16,734	
1971	2,949	3,682	-951	0	0	10,560	2,210	2,284	2,210	2,284	2,284	2,210	29,722	29,722	
1972	2,284	5,616	0	4,757	4,296	5,803	2,210	2,284	2,210	2,284	2,284	2,210	36,238	36,238	
1973	2,284	5,616	-7,088	0	0	0	6,813	2,284	2,210	2,284	2,284	4,972	21,659	18,897	
1974	1,902	0	0	0	0	8,562	5,524	5,138	4,972	2,284	2,284	4,972	35,638	35,638	
1975	-952	-19,334	-19,979	11,512	7,734	3,805	8,286	5,138	4,972	2,284	2,284	2,210	7,960	10,722	
1976	0	-921	-7,611	6,659	6,015	5,803	2,210	2,284	2,210	2,284	2,284	2,210	23,427	23,427	
1977	2,284	5,616	0	1,427	6,875	5,803	2,210	2,284	2,210	-3,900	-3,900	-1,012	19,897	35,487	
1978	3,710	4,235	-8,515	9,037	6,874	8,562	10,311	6,659	6,445	2,284	2,284	2,210	54,096	38,506	
1979	0	0	-952	8,562	0	12,368	2,210	2,284	2,210	2,284	2,284	2,210	33,460	33,460	
1980	5,708	-19,334	-15,222	15,221	0	8,562	4,972	5,138	4,972	2,284	2,284	2,210	16,795	16,795	
1981	1,902	0	-7,088	5,708	5,156	15,317	2,210	2,284	2,210	2,284	2,284	2,210	34,477	34,477	
1982	2,284	3,682	-2,854	0	0	951	0	8,854	2,762	2,284	2,284	2,210	16,457	16,457	
1983	2,949	1,841	-2,663	0	0	0	2,946	2,854	2,762	2,284	2,284	2,210	17,467	17,467	
1984	3,806	0	0	0	0	5,803	2,210	2,284	2,210	2,284	2,284	2,210	23,091	23,091	
1985	2,284	-14,731	-15,222	5,803	9,538	10,560	2,210	2,284	2,210	2,284	2,284	2,210	11,714	11,714	
1986	2,284	5,616	-7,088	5,803	2,406	5,708	7,365	5,138	4,972	2,284	2,284	2,210	38,982	38,982	
1987	1,902	-921	-952	3,805	3,437	10,560	2,210	2,284	2,210	2,284	2,284	2,210	31,313	31,313	
1988	2,284	5,616	-7,088	5,803	8,593	5,803	2,210	2,284	2,210	5,138	7,040	4,972	44,865	34,493	
1989	4,756	6,444	0	4,757	4,297	10,560	2,210	2,284	2,210	7,992	5,708	-1,841	49,377	54,668	
1990	1,902	-14,731	-15,222	11,512	10,398	10,560	2,210	2,284	2,210	7,992	5,708	1,841	26,664	22,982	
1991	-952	3,682	-2,854	-4,757	860	17,124	2,210	-2,854	-2,762	7,992	4,757	4,603	27,049	25,238	
1992	4,757	0	952	9,704	3,437	18,171	2,210	7,992	7,734	0	952	1,841	57,750	72,309	
1993	1,902	-921	1,903	0	0	0	9,206	952	921	2,284	2,284	2,210	20,741	16,756	
1994	1,902	-921	-2,855	4,757	7,734	10,560	2,210	2,284	2,210	2,284	2,284	4,972	37,421	34,659	
1995	7,040	-19,334	-19,979	10,464	7,734	0	9,206	3,805	3,683	2,284	2,284	4,972	12,159	12,159	
1996	1,902	-921	-2,331	0	0	0	6,813	2,284	2,210	2,284	2,284	4,972	19,497	19,497	
1997	3,901	921	0	0	0	11,512	2,210	2,284	2,210	2,284	2,284	2,210	29,816	32,578	
1998	952	1,841	-1,379	0	0	951	7,365	3,901	3,775	2,284	2,284	4,972	26,946	24,184	
1999	952	-921	1,902	8,562	0	11,416	921	5,138	4,972	2,284	2,284	4,972	42,482	42,482	
2000	1,902	-19,334	-19,979	15,317	9,452	13,510	2,210	2,284	2,210	2,284	2,284	4,972	17,112	17,112	
2001	4,756	1,841	-7,088	8,563	14,270	14,270	2,210	2,284	2						

Figure 2.2-1
SJPL Diversions – WSIP and Base-Calaveras Constrained

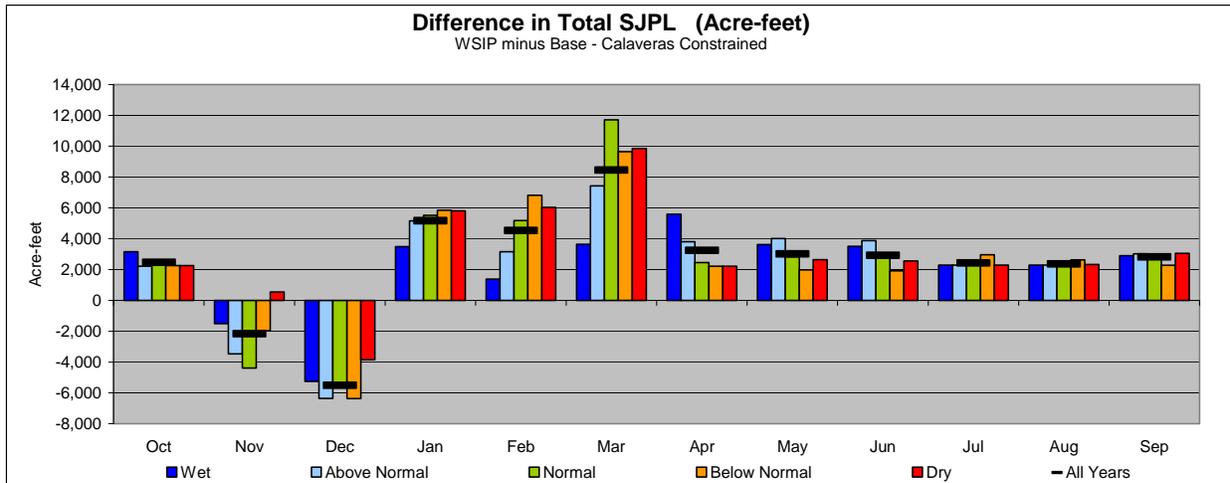


Table 2.2-2

Total SJPL (Acre-feet)													WSIP	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	27,417	16,624	8,533	11,512	7,401	11,072	21,613	26,698	25,836	29,873	29,873	28,909	245,359	242,680
Above Normal	26,381	14,460	7,852	14,254	9,306	16,705	24,111	28,687	27,761	29,873	29,873	28,909	258,169	258,169
Normal	25,830	14,656	8,776	15,448	12,041	22,339	28,403	29,873	28,909	29,873	29,873	28,909	274,929	274,849
Below Normal	27,220	15,998	11,595	21,574	18,621	24,976	28,909	29,571	28,617	29,873	29,548	27,945	294,447	295,146
Dry	25,931	19,593	14,583	19,883	17,417	25,782	28,909	29,873	28,909	29,165	28,904	27,281	296,229	298,165
All Years	26,562	16,241	10,254	16,568	12,982	20,191	26,392	28,945	28,011	29,735	29,617	28,391	273,887	273,872

Total SJPL (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258	218,975
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776	230,776
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601	243,681
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263	264,595
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509	262,015
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165	244,098

Difference in Total SJPL (Acre-feet)													WSIP minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	3,158	-1,502	-5,250	3,484	1,386	3,639	5,581	3,627	3,510	2,284	2,284	2,901	25,102	23,706
Above Normal	2,205	-3,466	-6,352	5,154	3,149	7,426	3,802	4,007	3,878	2,284	2,284	3,022	27,394	27,394
Normal	2,462	-4,391	-5,613	5,518	5,177	11,708	2,452	2,819	2,728	2,284	2,284	2,901	30,328	31,168
Below Normal	2,261	-1,982	-6,369	5,848	6,814	9,642	2,210	1,982	1,918	2,956	2,631	2,275	30,185	30,552
Dry	2,265	547	-3,850	5,803	6,031	9,846	2,210	2,641	2,555	2,290	2,326	3,056	35,720	36,150
All Years	2,464	-2,173	-5,508	5,170	4,523	8,454	3,245	3,015	2,917	2,424	2,364	2,826	29,722	29,774

Table 2.2-3

Total SJPL (Acre-feet)													WSIP	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	27,417	16,624	8,533	11,512	7,401	11,072	21,613	26,698	25,836	29,873	29,873	28,909	245,359	242,680
Above Normal	26,381	14,460	7,852	14,254	9,306	16,705	24,111	28,687	27,761	29,873	29,873	28,909	258,169	258,169
Normal	25,830	14,656	8,776	15,448	12,041	22,339	28,403	29,873	28,909	29,873	29,873	28,909	274,929	274,849
Below Normal	27,220	15,998	11,595	21,574	18,621	24,976	28,909	29,571	28,617	29,873	29,548	27,945	294,447	295,146
Dry	25,931	19,593	14,583	19,883	17,417	25,782	28,909	29,873	28,909	29,165	28,904	27,281	296,229	298,165
All Years	26,562	16,241	10,254	16,568	12,982	20,191	26,392	28,945	28,011	29,735	29,617	28,391	273,887	273,872

Total SJPL (Acre-feet)													Base - Calaveras Unconstrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	24,438	18,701	0	9,502	6,337	8,325	16,561	22,595	21,866	27,589	27,589	26,526	210,028	207,997
Above Normal	25,798	17,980	0	14,595	8,431	13,263	19,984	23,728	22,962	27,589	27,589	26,699	228,619	228,457
Normal	24,378	18,471	0	15,103	11,117	16,292	25,318	26,459	25,606	27,589	27,589	26,699	244,622	243,230
Below Normal	25,071	18,792	0	19,979	17,742	19,979	26,537	26,694	25,833	27,421	27,421	25,670	261,138	261,030
Dry	24,022	19,046	0	19,979	17,239	19,384	26,699	27,113	26,239	27,054	26,876	23,074	256,725	260,149
All Years	24,758	18,593	0	15,867	12,196	15,477	23,025	25,315	24,498	27,450	27,415	25,745	240,340	240,284

Difference in Total SJPL (Acre-feet)													WSIP minus Base - Calaveras Unconstrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	2,979	-2,077	8,533	2,010	1,063	2,747	5,052	4,103	3,971	2,284	2,284	2,383	35,331	34,683
Above Normal	582	-3,520	7,852	-341	874	3,441	4,127	4,959	4,799	2,284	2,284	2,210	29,550	29,712
Normal	1,451	-3,815	8,776	345	924	6,047	3,085	3,414	3,303	2,284	2,284	2,210	30,307	31,619
Below Normal	2,149	-2,795	11,595	1,595	880	4,997	2,372	2,877	2,784	2,452	2,127	2,275	33,309	34,117
Dry	1,909	547	14,583	-96	178	6,398	2,210	2,760	2,670	2,112	2,028	4,207	39,504	38,016
All Years	1,803	-2,352	10,254	700	786	4,714	3,366	3,630	3,512	2,285	2,202	2,647	33,547	33,588

2.3 Hetch Hetchy Reservoir and Releases

The additional draw of water for the additional deliveries of the WSIP will generally result in an increase in draw from Hetch Hetchy Reservoir. Figure 2.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 2.3-1 are the results for the WSIP, base-Calaveras constrained (“Base – Calaveras Constrained”) and base-Calaveras unconstrained (“Base – Calaveras Unconstrained”) settings. Supplementing the Figure 2.3-1 representation of Hetch Hetchy Reservoir storage are Table 2.3-1 Hetch Hetchy Reservoir Storage (WSIP), Table 2.3-2 Hetch Hetchy Reservoir Storage (Base - Calaveras Constrained), and Table 2.3-3 Difference in Hetch Hetchy Reservoir Storage (WSIP minus Base – Calaveras Constrained).

Table 2.3-3 illustrates the difference in Hetch Hetchy Reservoir storage between the WSIP and base-Calaveras constrained settings. Immediately after Hetch Hetchy Reservoir is filled (May or June, and then continuing through July), occasional differences in storage would occur, typically during a multi-year drought sequence or during an occasional single year when the reservoir does not fill. No reduction in yearly storage during that period would indicate that the same amount of water is being passed through the reservoir, regardless of the size of the conveyance capacity of the SJPL or the purchase request. Water not diverted to the SJPL would return to the Tuolumne River at Kirkwood Powerhouse or Moccasin Reservoir and flow to Don Pedro Reservoir. In the late summer and early fall, storage levels would consistently be slightly different (lower) between the two settings, as additional diversions to the SJPL would retain Bay Area reservoir storage. The additional storage depletion would be somewhat ameliorated later in the fall and into winter as SJPL diversions are reduced because of lower Bay Area reservoir replenishment needs and conveyance system maintenance. The storage difference would become almost neutral in December with the WSIP setting because of the additional conveyance maintenance that would occur in the WSIP (and which does not occur in the base-Calaveras constrained setting). The maintenance impairs diversions to the SJPL. After December, storage in the reservoir associated with the WSIP setting again would be affected as replenishment of Bay Area reservoir storage resumes following the maintenance period and because of increased purchase requests. During drier years, there is a difference in storage between the WSIP and base-Calaveras constrained settings; the alternative setting results in a lower amount of storage in the reservoir by the end of April. Figure 2.3-2 illustrates the reservoir storage, averaged by year type, for the WSIP setting. Figure 2.3-3 illustrates the average difference in storage, averaged by year type, for the two settings during the 82-year simulation. Figure 2.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base-Calaveras constrained settings.

The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the WSIP would manifest into differences in releases from O’Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the WSIP would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream (which is above minimum release requirements). Figure 2.3-1 illustrates the stream release from O’Shaughnessy Dam for the WSIP and base settings. Supplementing Figure 2.3-1 are Table 2.3-4 and Table 2.3-5, which illustrate the stream release from O’Shaughnessy Dam for the WSIP and base-Calaveras constrained settings. Table 2.3-6 illustrates the difference in stream releases between the WSIP and base-Calaveras constrained settings. Compared to the base-Calaveras constrained setting, the WSIP setting typically results in a lesser stream release, predominantly during May or June, which reflects the months when releases to the stream above minimum release requirements are made in anticipation of the reservoir being filled. In a few exceptions to this circumstance, an increase in release to the stream occurs. Several of these exceptions are considered anomalous within modeling, the results of only shifting releases from one month to another. The other exceptions occur due to the balancing of reservoir storage among the Hetch Hetchy system and the Bay Area reservoirs. The decrease in releases is the result of a more depleted reservoir, which is the result of greater demands between the settings.

**Figure 2.3-1
Hetch Hetchy Reservoir Storage and Stream Release**

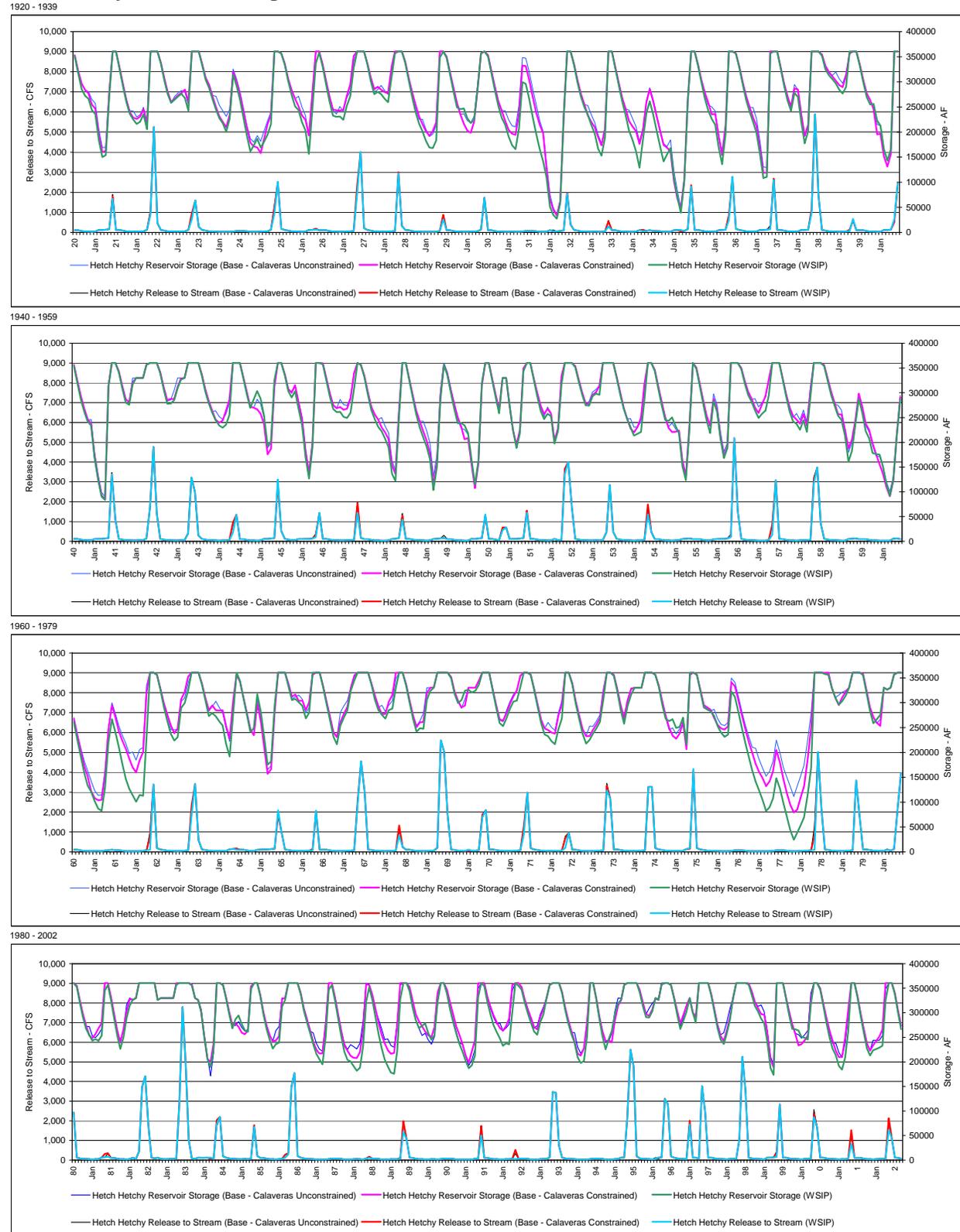


Table 2.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,212	265,854	243,679	235,730	183,131	150,102	154,083	270,998	360,400	360,400	326,716	291,641
1922	260,017	235,936	225,012	216,071	220,532	235,108	205,422	360,400	360,400	360,400	335,987	302,666
1923	275,632	258,180	264,257	270,969	276,110	267,395	242,750	360,400	360,400	360,400	333,091	304,054
1924	287,909	265,274	244,743	227,762	217,516	200,947	226,335	313,797	291,963	263,927	228,573	192,617
1925	161,496	173,531	186,568	169,497	181,122	195,112	215,423	360,400	360,400	356,465	334,115	301,240
1926	273,802	251,145	243,620	219,652	203,282	156,192	244,974	336,634	358,000	330,739	295,220	261,181
1927	232,632	230,302	230,939	224,241	251,810	270,898	327,581	360,400	360,400	360,400	333,623	301,044
1928	275,347	280,001	275,359	266,381	259,381	309,939	356,775	360,400	360,400	337,001	302,499	269,162
1929	239,425	216,620	201,515	182,739	169,077	168,044	183,509	347,948	360,400	348,007	314,236	280,955
1930	249,116	245,546	246,876	227,370	217,938	224,416	285,686	356,465	360,400	350,673	316,536	283,142
1931	252,621	228,300	214,607	191,032	173,741	165,859	207,051	299,235	295,885	265,896	230,558	196,275
1932	166,254	141,968	108,624	51,576	34,804	27,502	58,360	229,750	360,400	360,400	332,994	299,731
1933	270,827	249,318	234,552	213,938	196,774	166,223	153,096	188,750	360,400	360,400	326,498	293,195
1934	260,679	234,062	202,956	183,568	161,386	128,818	185,180	237,597	261,314	234,993	202,895	171,557
1935	141,478	155,200	167,988	108,234	72,493	39,306	100,061	259,139	360,400	360,400	331,693	299,135
1936	266,804	242,416	226,072	214,618	169,794	136,016	195,669	360,400	360,400	356,465	327,758	293,923
1937	263,258	239,922	220,528	198,592	156,392	108,310	110,656	356,408	360,400	360,400	327,117	292,284
1938	262,588	242,187	277,814	270,001	219,089	177,586	201,634	360,400	360,400	360,400	351,934	324,527
1939	313,230	305,433	296,949	284,402	276,549	290,033	360,400	360,400	360,400	332,062	299,302	270,045
1940	254,832	255,868	222,545	212,796	165,425	143,400	166,068	360,400	360,400	354,356	320,123	286,028
1941	261,347	241,787	234,144	168,334	124,378	90,323	83,423	312,783	360,400	360,400	341,196	308,861
1942	280,534	275,676	316,612	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,434	306,775
1943	277,834	278,290	285,202	309,631	326,722	330,000	360,400	360,400	360,400	360,400	334,725	302,903
1944	278,957	260,161	244,775	234,057	229,556	235,278	255,261	360,400	360,400	360,400	329,195	297,258
1945	269,594	286,466	303,391	288,236	253,700	192,916	201,894	325,435	360,400	360,400	334,833	302,981
1946	290,629	303,058	267,626	233,689	169,219	126,757	189,566	360,400	360,400	357,172	323,951	292,953
1947	267,302	261,048	261,651	251,424	249,312	259,119	307,974	360,400	356,592	332,752	297,801	265,047
1948	246,881	231,142	222,253	207,832	189,798	136,522	121,769	246,854	360,400	360,400	325,679	290,875
1949	257,155	230,043	210,351	191,360	165,907	103,444	151,449	286,217	356,592	335,945	301,138	267,891
1950	238,302	239,272	233,940	218,468	163,874	114,732	162,958	320,001	360,400	359,505	323,659	289,647
1951	258,661	330,000	330,000	273,739	223,537	188,600	217,740	343,707	360,400	360,400	326,685	293,016
1952	263,532	246,844	257,770	252,854	197,413	223,120	317,085	360,400	360,400	360,400	351,556	322,024
1953	296,142	274,941	274,019	293,074	298,536	295,862	360,095	360,400	360,400	360,400	330,041	296,984
1954	267,877	246,868	229,980	213,382	217,141	220,828	286,535	360,400	360,400	343,861	308,637	274,661
1955	245,158	243,209	250,427	232,593	218,869	151,555	123,312	222,529	360,400	348,403	313,548	278,581
1956	244,439	218,424	283,804	261,732	206,903	168,220	188,432	360,400	360,400	360,400	347,696	319,103
1957	295,940	282,110	264,718	249,070	257,623	263,923	295,093	360,400	360,400	360,400	326,728	292,510
1958	262,110	242,027	237,007	225,108	244,617	221,109	292,913	360,400	360,400	360,400	353,805	323,723
1959	295,240	273,752	254,105	245,284	213,696	161,127	182,231	235,467	287,846	259,305	222,628	207,712
1960	178,409	176,252	175,096	150,690	115,751	91,900	123,736	215,354	287,027	260,692	225,395	191,086
1961	158,157	133,346	121,240	102,042	87,316	82,200	129,149	221,278	266,879	240,690	210,599	177,543
1962	146,426	126,777	114,005	100,855	114,374	112,611	231,046	360,400	360,400	356,465	326,284	291,944
1963	263,525	237,000	223,881	230,563	289,186	299,242	324,537	360,400	360,400	360,400	336,301	304,839
1964	273,386	279,133	272,347	262,295	254,165	216,943	191,753	276,738	360,400	343,655	309,219	275,614
1965	241,436	248,743	317,082	281,745	230,783	175,442	181,773	294,420	360,400	360,400	360,400	333,096
1966	305,307	307,670	300,943	293,396	268,438	279,703	360,400	360,400	360,400	331,355	297,781	265,039
1967	231,529	216,381	253,632	269,858	284,791	324,593	344,126	360,400	360,400	360,400	360,400	335,676
1968	305,198	284,641	275,671	268,002	284,962	288,019	330,134	360,400	360,400	334,230	299,647	267,169
1969	241,770	248,709	247,430	305,815	323,485	330,000	360,400	360,400	360,400	360,400	349,331	317,590
1970	299,109	305,471	324,248	326,065	320,846	323,844	335,624	360,400	360,400	360,400	325,921	290,573
1971	259,109	252,707	268,931	287,804	302,524	304,076	331,376	360,400	360,400	356,465	325,669	292,259
1972	258,557	236,088	222,878	216,488	246,700	246,700	268,011	360,400	360,400	336,331	298,810	267,683
1973	237,812	217,831	225,249	238,096	248,774	261,422	306,780	360,400	360,400	353,895	322,638	285,845
1974	257,512	293,218	316,222	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,455	295,000
1975	267,677	262,890	266,892	249,208	251,420	270,142	216,550	360,400	360,400	356,465	324,067	290,292
1976	286,149	282,281	273,766	252,600	239,720	231,421	235,679	322,419	311,776	281,614	249,822	219,836
1977	190,805	164,307	141,524	123,723	104,154	82,557	89,725	107,373	148,407	127,479	98,702	71,356
1978	44,138	24,460	38,242	53,329	69,672	114,812	168,593	360,400	360,400	360,400	357,774	356,219
1979	330,000	310,323	296,034	303,033	313,915	330,000	360,400	360,400	360,400	356,002	320,543	284,032
1980	258,680	266,832	275,490	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,634	320,226
1981	290,609	267,554	254,678	243,125	246,527	243,029	253,653	345,334	356,592	326,286	288,639	253,673
1982	226,369	250,404	289,261	314,387	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,878
1984	330,000	326,192	301,515	251,330	205,725	189,676	226,912	360,400	360,400	356,465	328,867	296,270
1985	268,090	286,622	294,695	277,075	264,192	261,404	348,453	360,400	360,400	333,440	296,675	266,441
1986	245,025	227,275	236,097	238,964	312,444	326,065	360,400	360,400	360,400	360,400	337,395	304,410
1987	281,007	259,483	236,297	216,538	205,386	195,078	251,137	347,208	356,556	324,828	288,222	252,390
1988	221,048	204,111	200,855	191,081	181,990	188,083	230,852	322,256	351,607	325,661	290,794	257,070
1989	228,073	204,737	190,690	178,343	175,662	221,683	328,113	360,400	360,400	343,879	310,198	285,098
1990	268,790	273,511	278,290	258,918	244,935	254,745	322,352	360,400	360,400	330,067	307,034	280,546
1991	257,352	236,658	221,201	202,049	187,037	193,387	212,656	332,085	360,400	354,334	321,620	296,626
1992	274,381	260,899	247,962	232,665	238,267	235,667	302,099	360,400	354,930	347,198	320,400	298,656
1993	279,702	262,114	255,135	281,069	296,384	330,000	356,592	360,400	360,400	360,400	339,589	305,807
1994	278,527	256,433	239,168	209,495	197,633	201,926	250,691	360,400	360,400	328,011	288,314	253,017
1995	225,731	246,319	262,918	296,356	319,234	326,065	356,592	360,400	360,400	360,400	360,400	341,143
1996	313,010	291,009	290,227	303,212	330,000	326,065	357,776	360,400	360,400	356,465	329,174	295,620
1997	267,055	283,869	302,446	330,000	300,695	280,067	360,400	360,400				

Table 2.3-2

Hetch Hetchy Reservoir Storage (Acre-feet)

Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	284,123	276,845	254,669	246,727	194,135	159,730	162,202	277,799	360,400	360,400	328,999	296,132
1922	263,554	239,474	228,550	226,270	230,738	245,314	215,627	360,400	360,400	360,400	338,270	307,157
1923	280,121	259,907	265,984	272,697	277,839	284,441	259,796	360,400	360,400	360,400	335,374	308,545
1924	293,444	270,810	249,327	231,398	220,294	209,529	233,996	319,907	300,277	274,514	241,424	207,664
1925	178,818	171,519	169,334	158,055	186,943	216,250	233,961	360,400	360,400	356,465	336,398	305,731
1926	283,429	266,388	251,261	233,101	224,226	193,028	276,699	360,400	360,400	335,420	302,178	270,343
1927	244,738	243,329	243,015	244,124	271,705	294,599	351,281	360,400	360,400	360,400	335,906	308,297
1928	285,451	290,105	284,084	279,866	277,170	330,000	360,400	360,400	360,400	339,284	307,062	278,693
1929	253,709	230,904	215,798	201,787	192,432	201,960	219,634	360,400	360,400	350,290	318,800	287,725
1930	258,166	235,262	216,614	202,893	198,689	220,483	283,964	356,465	360,400	352,956	321,099	289,912
1931	261,671	242,966	222,186	204,418	196,672	194,593	237,996	332,445	331,278	303,529	270,420	238,300
1932	214,915	197,994	125,942	66,003	45,176	33,919	62,013	232,389	360,400	360,400	335,277	304,222
1933	276,362	254,854	233,000	219,997	209,710	189,719	173,443	205,787	360,400	360,400	328,781	297,686
1934	267,451	246,451	221,992	210,837	201,526	176,415	204,744	259,433	285,334	261,258	231,397	202,237
1935	174,422	168,811	161,620	102,887	68,320	47,214	105,172	263,017	360,400	360,400	333,976	303,626
1936	278,333	258,549	235,112	236,086	190,913	154,325	211,131	360,400	360,400	356,465	330,041	298,414
1937	270,601	249,107	228,767	212,531	168,750	118,672	119,294	360,400	360,400	360,400	329,400	296,775
1938	270,978	250,577	286,885	284,785	233,880	192,377	214,647	360,400	360,400	360,400	354,217	331,780
1939	319,529	310,811	302,327	293,587	289,176	313,220	356,592	360,400	360,400	334,345	303,865	276,815
1940	263,881	245,583	195,221	196,968	151,390	131,258	156,118	360,400	360,400	356,639	324,687	292,798
1941	267,162	246,682	237,081	171,273	126,888	92,426	85,026	313,980	360,400	360,400	343,479	313,352
1942	286,926	281,147	320,371	330,000	330,000	330,000	356,592	360,400	360,400	360,400	341,717	311,266
1943	285,272	287,570	287,394	311,824	328,916	330,000	360,400	360,400	360,400	360,400	337,008	307,394
1944	283,446	263,729	245,490	239,529	243,796	263,788	285,981	360,400	360,400	360,400	331,478	301,749
1945	272,276	269,834	266,760	257,391	236,587	175,803	186,832	312,263	360,400	360,400	337,116	307,472
1946	300,826	315,097	279,665	245,734	181,271	137,100	198,297	360,400	360,400	359,455	329,525	299,722
1947	275,020	268,766	271,273	265,807	268,000	288,368	339,432	360,400	356,592	335,035	302,365	271,816
1948	255,930	245,807	229,831	220,170	206,440	153,592	136,183	258,923	360,400	360,400	327,962	295,366
1949	263,928	242,431	222,739	203,721	178,274	113,920	159,848	293,245	356,592	338,228	305,702	277,423
1950	250,778	232,413	206,179	208,609	155,076	107,349	156,859	314,887	360,400	360,400	326,837	295,032
1951	266,327	330,000	330,000	273,739	223,537	195,259	223,591	349,555	360,400	360,400	328,968	300,269
1952	273,732	257,043	267,969	257,959	202,522	228,229	333,242	360,400	360,400	360,400	353,839	326,515
1953	300,631	278,509	276,637	295,692	301,156	313,798	360,400	360,400	360,400	360,400	332,324	301,476
1954	269,513	247,582	227,840	219,803	230,612	249,616	317,533	360,400	360,400	346,144	313,200	281,430
1955	250,117	228,834	220,830	221,150	223,832	162,322	132,398	230,121	360,400	350,686	318,112	285,351
1956	253,489	233,090	288,149	266,080	211,253	172,022	191,635	360,400	360,400	360,400	349,979	323,594
1957	302,332	288,502	270,158	259,271	276,594	293,455	326,834	360,400	360,400	360,400	329,011	297,001
1958	270,405	253,084	245,733	237,644	257,160	233,653	305,456	360,400	360,400	360,400	356,088	328,214
1959	301,632	279,224	256,723	256,465	224,883	187,632	205,060	243,798	298,377	272,105	237,689	224,965
1960	197,935	176,445	155,310	136,693	109,750	90,960	123,020	217,281	291,161	267,103	234,078	201,968
1961	171,317	152,122	122,114	108,244	103,924	104,611	153,770	246,891	294,672	270,725	242,865	223,950
1962	207,457	187,440	170,386	159,676	184,438	200,846	321,490	360,400	360,400	356,465	328,567	299,197
1963	276,008	254,086	238,636	247,990	306,623	321,436	352,256	360,400	360,400	360,400	338,584	309,330
1964	284,915	294,345	284,705	284,172	284,647	253,229	227,945	302,737	356,592	342,134	309,983	278,588
1965	246,691	234,684	297,938	262,593	211,621	157,081	166,277	281,195	360,400	360,400	360,400	338,068
1966	312,180	316,384	303,397	304,413	285,402	300,776	356,592	360,400	360,400	333,638	302,345	271,809
1967	240,578	231,046	260,686	276,916	291,853	330,000	352,295	360,400	360,400	360,400	360,400	337,886
1968	313,115	292,558	276,501	277,394	302,093	315,710	360,034	360,400	360,400	360,400	336,513	304,211
1969	250,819	260,520	261,144	319,537	330,000	330,000	360,400	360,400	360,400	360,400	351,614	322,081
1970	303,598	290,627	294,181	330,000	330,000	330,000	343,990	360,400	360,400	360,400	328,204	295,064
1971	266,547	263,828	279,101	297,979	312,703	324,816	354,325	360,400	360,400	356,465	327,952	296,750
1972	265,329	248,476	245,025	240,031	237,947	273,962	297,543	360,400	360,400	360,614	303,374	274,452
1973	246,861	232,496	232,826	245,678	256,360	269,008	321,179	360,400	360,400	356,178	327,202	295,376
1974	268,943	304,648	327,652	330,000	330,000	330,000	360,400	360,400	360,400	356,465	333,738	302,253
1975	273,975	249,855	233,878	227,686	237,619	260,147	206,555	356,465	360,400	356,465	326,350	294,783
1976	290,639	285,849	269,723	255,215	248,352	245,855	252,323	341,337	332,889	304,985	275,445	247,639
1977	220,874	199,993	177,210	160,866	148,212	132,419	141,796	161,660	204,774	179,831	147,007	118,521
1978	94,963	79,520	84,788	108,941	132,205	185,907	249,999	360,400	360,400	360,400	360,057	360,400
1979	330,000	310,323	295,083	310,643	321,529	330,000	360,400	360,400	360,400	358,285	325,107	290,802
1980	271,155	259,973	253,409	330,000	326,446	330,000	356,592	360,400	360,400	360,400	354,917	324,717
1981	297,001	273,946	253,982	248,138	256,698	268,517	279,140	360,400	360,400	332,373	297,002	264,239
1982	239,211	266,929	302,932	328,064	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	359,897	360,400	360,400	360,400	360,400	358,088
1984	330,000	326,192	301,515	251,330	205,725	199,414	238,663	360,400	360,400	356,465	331,150	300,761
1985	274,862	278,663	271,515	259,687	256,332	264,105	353,363	360,400	360,400	335,723	301,239	273,210
1986	254,074	241,940	243,674	252,349	328,243	330,000	360,400	360,400	360,400	360,400	339,678	308,901
1987	287,399	264,954	240,817	224,866	217,156	217,408	275,676	360,400	360,400	330,951	296,621	263,532
1988	233,926	222,605	212,262	208,298	207,809	219,705	264,684	358,352	356,592	335,777	307,938	279,172
1989	254,919	238,028	223,981	216,409	218,047	274,627	360,400	360,400	360,400	351,870	323,888	296,935
1990	282,525	272,515	262,073	254,204	250,615	270,985	340,802	360,400	360,400	347,058	320,725	296,066
1991	271,914	254,902	236,592	212,691	198,545	222,019	243,498	360,055	360,400	360,400	332,436	312,037
1992	294,543	281,061	269,075	263,494	272,551	288,122	356,763	360,400	360,400	352,662	326,809	306,901
1993	289,846	271,337	266,261	292,201	307,522	330,000	356,592	360,400	360,400	360,400	341,872	310,298
1994	284,919	261,904	241,785	216,870	212,746	227,600	278,574	360,400	360,400	330,294	292,878	262,548
1995	242,297	243,550	240,171	284,061	314,667	326,065	356,592	360,400	360,400	360,400	360,400	346,115
1996	319,883	296,960	293,848	306,835	330,000	326,065	357,776	360,400	360,400	356,465	331,457	302,874
1997	278,205	295,940	314,517	330,000	300,695	291,579	360,400					

Table 2.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-11,911	-10,991	-10,990	-10,997	-11,004	-9,628	-8,119	-6,801	0	0	-2,283	-4,491
1922	-3,537	-3,538	-3,538	-10,199	-10,206	-10,206	-10,205	0	0	0	-2,283	-4,491
1923	-4,489	-1,727	-1,727	-1,729	-1,729	-17,046	-17,046	0	0	0	-2,283	-4,491
1924	-5,535	-5,536	-4,584	-3,636	-2,778	-8,582	-7,661	-6,110	-8,314	-10,587	-12,851	-15,047
1925	-17,322	2,012	17,234	11,442	-5,821	-21,138	-18,538	0	0	0	-2,283	-4,491
1926	-9,627	-15,243	-7,641	-13,449	-20,944	-36,836	-31,725	-23,766	-2,400	-4,681	-6,958	-9,162
1927	-12,106	-13,027	-12,076	-19,883	-19,895	-23,701	-23,700	0	0	0	-2,283	-7,253
1928	-10,104	-10,104	-8,725	-13,485	-17,789	-20,061	-3,625	0	0	-2,283	-4,563	-9,531
1929	-14,284	-14,284	-14,283	-19,048	-23,355	-33,916	-36,125	-12,452	0	-2,283	-4,564	-6,770
1930	-9,050	10,284	30,262	24,477	19,249	3,933	1,722	0	0	-2,283	-4,563	-6,770
1931	-9,050	-14,666	-7,579	-13,386	-22,931	-28,734	-30,945	-33,210	-35,393	-37,633	-39,862	-42,025
1932	-48,661	-56,026	-17,318	-14,427	-10,372	-6,417	-3,653	-2,639	0	0	-2,283	-4,491
1933	-5,535	-5,536	1,552	-6,059	-12,936	-23,496	-20,347	-17,037	0	0	-2,283	-4,491
1934	-6,772	-12,389	-19,036	-27,269	-40,140	-47,597	-19,564	-21,836	-24,020	-26,265	-28,502	-30,680
1935	-32,944	-13,611	6,368	5,347	4,173	-7,908	-5,111	-3,878	0	0	-2,283	-4,491
1936	-11,529	-16,133	-9,040	-21,468	-21,119	-18,309	-15,462	0	0	0	-2,283	-4,491
1937	-7,343	-9,185	-8,239	-13,939	-12,358	-10,362	-8,638	-3,992	0	0	-2,283	-4,491
1938	-8,390	-8,390	-9,071	-14,784	-14,791	-14,791	-13,013	0	0	0	-2,283	-7,253
1939	-6,299	-5,378	-5,378	-9,185	-12,627	-23,187	-3,808	0	0	-2,283	-4,563	-6,770
1940	-9,049	10,285	27,324	15,828	14,035	11,782	9,950	0	0	-2,283	-4,564	-6,770
1941	-5,815	-4,895	-2,937	-2,939	-2,510	-2,103	-1,603	-1,197	0	0	-2,283	-4,491
1942	-6,392	-5,471	-3,759	0	0	0	0	0	0	0	-2,283	-4,491
1943	-7,438	-9,280	-2,192	-2,193	-2,194	0	0	0	0	0	-2,283	-4,491
1944	-4,489	-3,568	-715	-5,472	-14,240	-28,510	-30,720	0	0	0	-2,283	-4,491
1945	-2,682	16,652	36,631	30,845	17,113	17,113	15,062	13,172	0	0	-2,283	-4,491
1946	-10,197	-12,039	-12,039	-12,045	-12,052	-10,343	-8,731	0	0	-2,283	-4,564	-6,769
1947	-7,718	-7,718	-9,622	-14,383	-18,688	-29,249	-31,458	0	0	-2,283	-4,564	-6,769
1948	-9,049	-14,665	-7,578	-12,338	-16,642	-17,070	-14,414	-12,069	0	0	-2,283	-4,491
1949	-6,773	-12,388	-12,388	-12,361	-12,367	-10,476	-8,399	-7,028	0	-2,283	-4,564	-9,531
1950	-12,476	6,859	27,761	9,859	8,798	7,383	6,099	5,114	0	-895	-3,178	-5,385
1951	-7,666	0	0	0	0	-6,659	-5,851	-5,848	0	0	-2,283	-7,253
1952	-10,200	-10,199	-10,199	-5,105	-5,109	-5,109	-16,157	0	0	0	-2,283	-4,491
1953	-4,489	-3,568	-2,618	-2,618	-2,620	-17,936	-305	0	0	0	-2,283	-4,492
1954	-1,636	-714	2,140	-6,421	-13,471	-28,788	-30,998	0	0	-2,283	-4,563	-6,769
1955	-4,959	14,375	29,597	11,443	-4,963	-10,767	-9,086	-7,592	0	-2,283	-4,564	-6,770
1956	-9,050	-14,666	-4,345	-4,348	-4,350	-3,802	-3,203	0	0	0	-2,283	-4,491
1957	-6,392	-6,392	-5,440	-10,201	-18,971	-29,532	-31,741	0	0	0	-2,283	-4,491
1958	-8,295	-11,057	-8,726	-12,536	-12,543	-12,544	-12,543	0	0	0	-2,283	-4,491
1959	-6,392	-5,472	-2,618	-11,181	-11,187	-26,505	-22,829	-8,331	-10,531	-12,800	-15,061	-17,253
1960	-19,526	-193	19,786	13,997	6,001	940	716	-1,927	-4,134	-6,411	-8,683	-10,882
1961	-13,160	-18,776	-874	-6,202	-16,608	-22,411	-24,621	-25,613	-27,793	-30,035	-32,266	-46,407
1962	-61,031	-60,663	-56,381	-58,821	-70,064	-88,235	-90,444	0	0	0	-2,283	-7,253
1963	-12,483	-17,086	-14,755	-17,427	-17,437	-22,194	-27,719	0	0	0	-2,283	-4,491
1964	-11,529	-15,212	-12,358	-21,877	-30,482	-36,286	-36,192	-25,999	3,808	1,521	-764	-2,974
1965	-5,255	14,079	19,144	19,152	19,162	18,361	15,496	13,225	0	0	0	-4,972
1966	-6,873	-8,714	-2,454	-11,017	-16,964	-21,073	3,808	0	0	-2,283	-4,564	-6,770
1967	-9,049	-14,665	-7,054	-7,058	-7,062	-5,407	-8,169	0	0	0	-2,210	-6,770
1968	-7,917	-7,917	-830	-9,392	-17,131	-27,691	-29,900	0	0	-2,283	-4,564	-6,770
1969	-9,049	-11,811	-13,714	-13,722	-6,515	0	0	0	0	0	-2,283	-4,491
1970	-4,489	14,844	30,067	-3,935	-9,154	-6,156	-8,366	0	0	0	-2,283	-4,491
1971	-7,438	-11,121	-10,170	-10,175	-10,179	-20,740	-22,949	0	0	0	-2,283	-4,491
1972	-6,772	-12,388	-12,389	-17,153	-21,459	-27,262	-29,472	0	0	-2,283	-4,564	-6,769
1973	-9,049	-14,665	-7,577	-7,582	-7,586	-7,586	-14,399	0	0	-2,283	-4,564	-9,531
1974	-11,431	-11,430	-11,430	0	0	0	0	0	0	0	-2,283	-7,253
1975	-6,298	13,035	33,014	21,522	13,801	9,995	9,995	3,935	0	0	-2,283	-4,491
1976	-4,490	-3,568	4,043	-2,615	-8,632	-14,434	-16,644	-18,918	-21,113	-23,371	-25,623	-27,803
1977	-30,069	-35,686	-35,686	-37,143	-44,058	-49,862	-52,071	-54,287	-56,367	-52,352	-48,305	-47,165
1978	-50,825	-55,060	-46,546	-55,612	-62,533	-71,095	-81,406	0	0	0	-2,283	-4,181
1979	0	0	951	-7,610	-7,614	0	0	0	0	-2,283	-4,564	-6,770
1980	-12,475	6,859	22,081	0	0	0	0	0	0	0	-2,283	-4,491
1981	-6,392	-6,392	696	-5,013	-10,171	-25,488	-25,487	-15,066	-3,808	-6,087	-8,363	-10,566
1982	-12,842	-16,525	-13,671	-13,677	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-2,946	0	0	0	0	-2,210
1984	0	0	0	0	0	-9,738	-11,751	0	0	0	-2,283	-4,491
1985	-6,772	7,959	23,180	17,388	7,860	-2,701	-4,910	0	0	-2,283	-4,564	-6,769
1986	-9,049	-14,665	-7,577	-13,385	-15,799	-3,935	0	0	0	0	-2,283	-4,491
1987	-6,392	-5,471	-4,520	-8,328	-11,770	-22,330	-24,539	-13,192	-3,844	-6,123	-8,399	-10,602
1988	-12,878	-18,494	-11,407	-17,217	-25,819	-31,622	-33,832	-36,096	-4,985	-10,116	-17,144	-22,102
1989	-26,846	-33,291	-33,291	-38,066	-42,385	-52,944	-32,287	0	0	-7,991	-13,690	-11,837
1990	-13,735	996	16,217	4,714	-5,680	-16,240	-18,450	0	0	-7,991	-13,691	-15,520
1991	-14,562	-18,244	-15,391	-10,642	-11,508	-28,632	-30,842	-27,970	0	-6,066	-10,816	-15,411
1992	-20,162	-20,162	-21,113	-30,829	-34,284	-52,455	-54,664	0	-5,470	-5,464	-6,409	-8,245
1993	-10,144	-9,223	-11,126	-11,132	-11,138	0	0	0	0	0	-2,283	-4,491
1994	-6,392	-5,471	-2,617	-7,375	-15,113	-25,674	-27,883	0	0	-2,283	-4,564	-9,531
1995	-16,566	2,769	22,747	12,295	4,567	0	0	0	0	0	0	-4,972
1996	-6,873	-5,951	-3,621	-3,623	0	0	0	0	0	0	-2,283	-7,254
1997	-11,150	-12,071	-12,071	0	0	-11,512	0	0	0	0	-2,283	-4,491
1998	-5,440	-7,282	-5,902	-5,906	-5,909	0	0	0	0	0	-2,283	-7,253
1999	-8,201	-7,281	-9,184	-17,750	-17,758	-17,758	-15,605	-122	0	0	-2,283	-7,253
2000	-9,153	10,181	30,160	14,861	5,417	-8,093	-10,302	0	0	-2,283	-4,563	-9,532
2001	-14,284	-16,126	-9,037	-17,605	-26,208	-40,478	-42,688	0	-306	-2,589	-4,869	-7,075
2002	-9,925	-9,925	-9,924	-16,590	-22,615	-33,174	-35,384	0	0	-2,283	-4,564	-6,770
Avg (21-02)	-11,007	-8,685	-2,758	-7,541	-11,002	-16,281	-15,229	-4,360	-2,496	-3,650	-5,868	-8,657

Figure 2.3-2

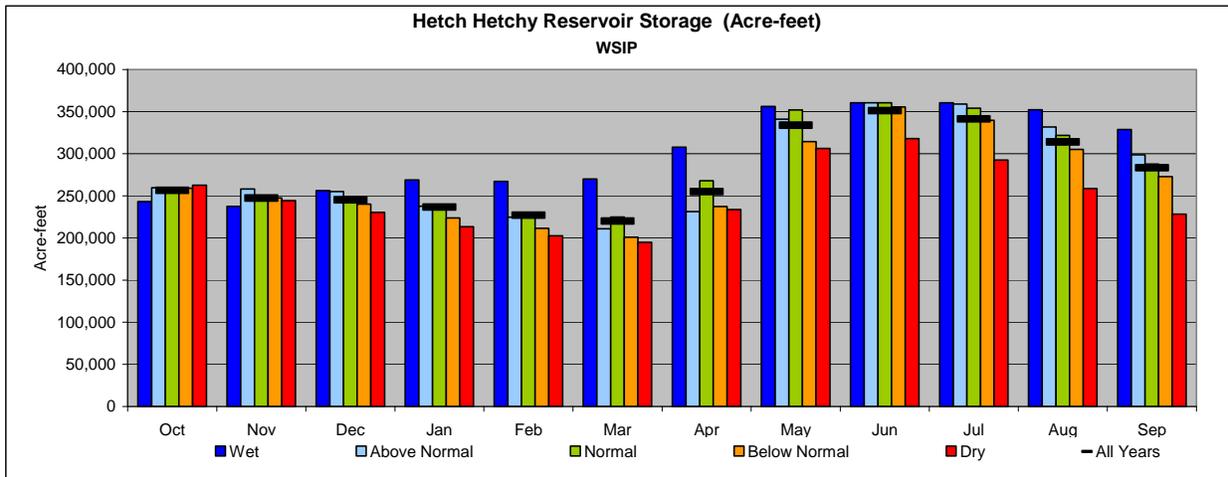


Figure 2.3-3

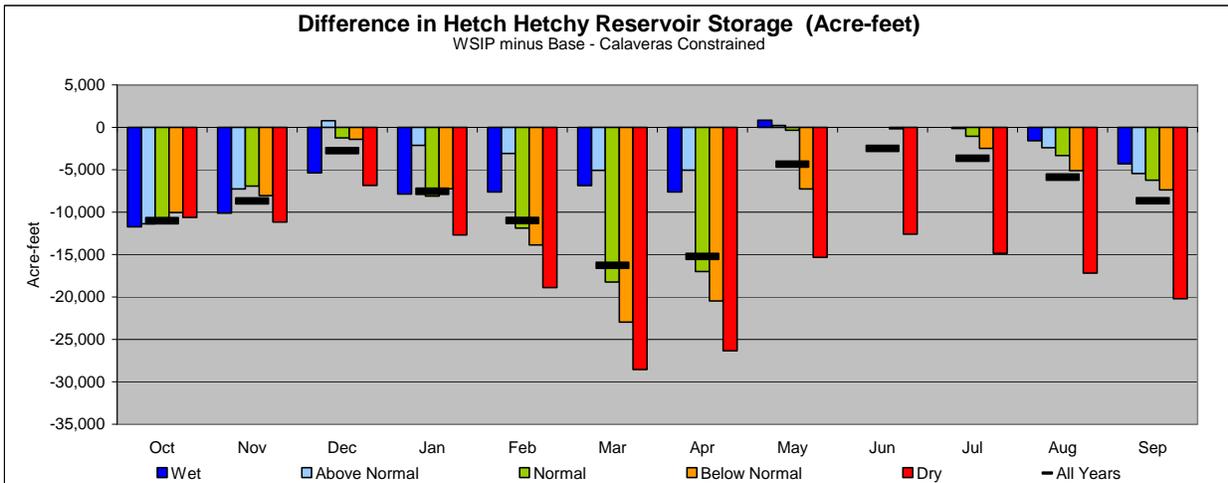


Figure 2.3-4

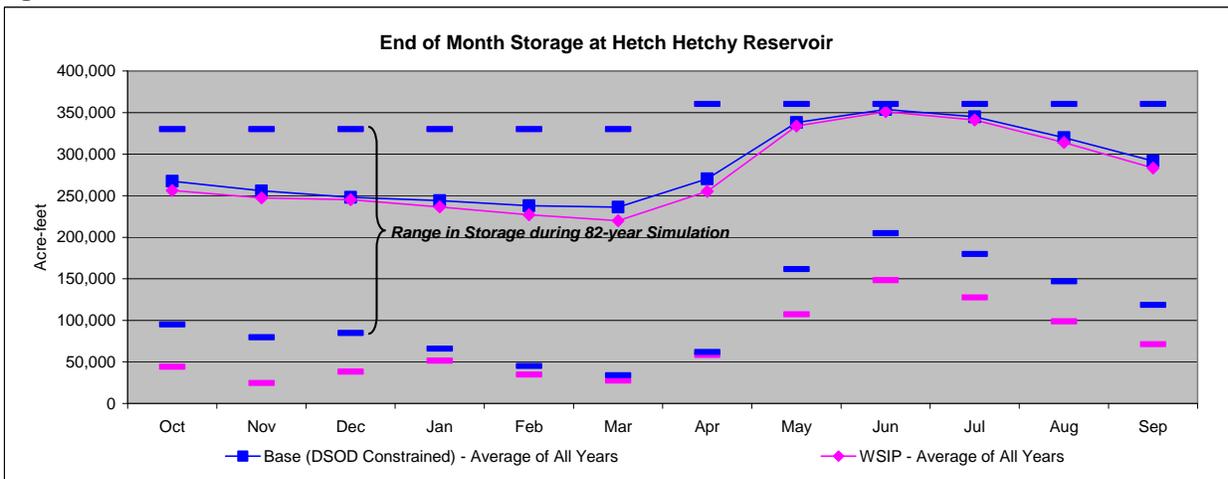


Table 2.3-4

Hetch Hetchy Release to Stream (Acre-feet)													WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	99,564	7,686	7,686	5,316	164,730	
1922	3,689	3,570	3,074	3,074	3,362	3,689	8,271	55,204	312,197	28,813	7,686	5,316	437,945	
1923	3,689	3,570	3,074	3,074	3,362	3,689	7,676	40,770	95,231	16,928	7,686	5,316	194,065	
1924	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111	
1925	2,152	2,083	2,152	3,074	3,362	3,689	8,271	57,635	149,864	11,621	7,686	5,316	256,905	
1926	3,689	3,570	3,074	2,460	2,802	7,624	7,676	8,854	6,545	6,764	6,764	4,284	64,106	
1927	3,074	2,975	2,460	3,074	3,362	3,689	4,463	118,075	238,640	13,543	7,686	5,316	406,357	
1928	3,689	3,570	3,074	3,074	3,362	3,689	4,463	180,585	19,601	7,686	6,764	4,284	243,841	
1929	3,074	2,975	2,460	2,460	1,961	2,152	2,083	4,919	38,907	6,764	6,764	4,284	78,803	
1930	3,074	2,975	2,460	2,152	2,802	3,074	3,868	8,854	102,907	6,764	6,764	4,284	149,978	
1931	3,074	2,975	2,460	2,152	2,802	2,152	2,083	3,074	4,463	4,612	4,612	3,669	38,128	
1932	2,152	2,083	2,152	7,009	3,362	3,689	4,463	6,149	115,006	24,366	7,686	5,316	183,433	
1933	3,689	3,570	3,074	2,152	2,802	2,152	2,083	3,074	18,146	6,764	6,764	4,284	58,554	
1934	3,074	2,975	2,460	2,460	2,802	7,009	3,868	4,919	6,545	4,612	4,612	3,669	49,005	
1935	2,152	2,083	2,152	7,009	6,916	7,624	4,463	10,084	135,857	7,686	7,686	5,316	199,028	
1936	3,689	3,570	3,074	2,460	6,356	7,624	8,271	37,899	164,181	11,621	7,686	5,316	261,747	
1937	3,689	3,570	3,074	3,074	6,916	7,624	8,271	10,084	155,401	7,686	7,686	5,316	222,391	
1938	3,689	3,570	3,074	3,074	6,916	7,624	8,271	59,689	350,036	112,643	7,686	5,316	571,588	
1939	3,689	3,570	3,074	2,460	2,802	3,074	3,868	41,832	6,545	6,764	6,764	4,284	88,726	
1940	3,074	2,975	2,460	2,460	6,916	7,624	8,271	40,085	145,292	7,686	7,686	5,316	239,845	
1941	3,689	3,570	3,074	7,009	6,916	7,624	8,271	10,084	201,267	67,763	7,686	5,316	332,269	
1942	3,689	3,570	3,074	3,074	3,362	3,689	8,271	105,473	283,373	86,094	7,686	5,316	516,671	
1943	3,689	3,570	3,074	3,074	3,362	3,689	23,247	197,709	148,920	18,174	7,686	5,316	421,510	
1944	3,689	3,570	3,074	2,460	2,802	3,074	3,868	26,182	79,627	6,764	6,764	4,284	146,158	
1945	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	185,512	31,926	7,686	5,316	274,918	
1946	3,689	3,570	7,009	7,009	6,916	7,624	8,271	12,838	85,083	7,686	7,686	5,316	162,697	
1947	3,689	3,570	3,074	3,074	3,362	3,689	4,463	88,557	10,353	6,764	6,764	4,284	141,643	
1948	3,074	2,975	2,460	2,460	2,802	7,009	7,676	10,084	65,186	7,686	7,686	5,316	124,414	
1949	3,689	3,570	3,074	2,460	2,802	7,009	7,676	8,854	10,353	6,764	6,764	4,284	67,299	
1950	3,074	2,975	2,460	2,460	6,916	7,009	8,271	10,084	80,554	7,686	7,686	5,316	144,491	
1951	3,689	33,633	42,960	7,009	6,916	7,624	8,271	10,084	85,948	7,686	7,686	5,316	226,822	
1952	3,689	3,570	3,074	3,074	6,916	3,689	4,463	208,310	238,065	106,256	7,686	5,316	594,108	
1953	3,689	3,570	3,074	3,074	3,362	3,074	3,868	27,989	168,768	29,365	7,686	5,316	262,835	
1954	3,689	3,570	3,074	2,460	2,802	3,074	4,463	83,197	27,809	6,764	6,764	4,284	151,950	
1955	3,074	2,975	2,460	3,074	3,362	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,841	
1956	3,074	2,975	6,395	7,009	6,916	7,624	8,271	12,620	310,301	94,682	7,686	5,316	472,869	
1957	3,689	3,570	3,074	2,152	1,961	2,152	3,868	19,557	183,319	7,686	6,764	4,284	242,076	
1958	3,074	2,975	2,460	3,074	3,362	3,689	4,463	179,135	221,860	55,443	7,686	5,316	492,537	
1959	3,689	3,570	3,074	2,152	1,961	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,342	
1960	3,074	2,975	2,460	2,152	1,961	2,152	7,676	8,854	6,545	6,764	6,764	4,284	55,661	
1961	3,074	2,975	2,460	3,074	2,802	2,152	3,868	4,919	6,545	4,612	4,612	3,669	44,762	
1962	2,152	2,083	2,152	2,460	1,961	3,689	4,463	6,149	202,079	11,621	7,686	5,316	251,811	
1963	3,689	3,570	3,074	2,152	2,802	3,689	4,463	113,021	203,340	36,602	7,686	5,316	389,404	
1964	3,689	3,570	3,074	3,074	3,362	3,074	7,676	8,854	6,545	6,764	6,764	4,284	60,730	
1965	3,074	2,975	6,395	7,009	6,916	7,624	8,271	10,084	124,701	61,519	7,686	5,316	251,570	
1966	3,689	3,570	3,074	3,074	3,362	3,689	3,868	127,600	6,545	6,764	6,764	4,284	176,283	
1967	3,074	2,975	2,460	3,074	3,362	3,689	4,463	147,278	270,669	185,208	7,686	5,316	639,254	
1968	3,689	3,570	3,074	2,460	2,802	3,074	3,868	50,600	14,833	6,764	6,764	4,284	105,772	
1969	3,074	2,975	2,460	3,074	3,362	3,689	12,681	344,502	300,076	115,876	7,686	5,316	804,771	
1970	3,689	3,570	3,074	7,009	3,362	3,689	4,463	106,382	124,926	7,686	7,686	5,316	280,852	
1971	3,689	3,570	3,074	3,074	3,362	3,689	4,463	53,512	177,149	11,621	7,686	5,316	280,205	
1972	3,689	3,570	3,074	3,074	3,362	3,074	3,868	12,829	57,109	6,764	6,764	4,284	111,461	
1973	3,074	2,975	2,460	3,074	3,362	3,689	4,463	190,360	159,403	7,686	7,686	5,316	393,548	
1974	3,689	3,570	3,074	3,074	3,362	3,689	4,463	201,034	194,704	11,621	7,686	5,316	445,282	
1975	3,689	3,570	3,074	3,074	2,802	3,689	8,271	12,443	247,984	11,621	7,686	5,316	313,219	
1976	3,689	3,570	3,074	3,074	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	40,033	
1977	2,152	2,083	2,152	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	35,165	
1978	2,152	2,083	2,152	3,074	3,362	3,689	4,463	6,149	298,570	132,949	7,686	5,316	471,645	
1979	3,689	3,570	3,074	2,460	3,362	3,689	4,463	220,976	107,368	7,686	7,686	5,316	373,339	
1980	3,689	3,570	3,074	3,074	6,916	3,689	8,271	133,323	235,879	148,920	7,686	5,316	563,407	
1981	3,689	3,570	3,074	2,152	2,802	3,074	7,676	8,854	10,353	6,764	6,764	4,284	63,056	
1982	3,074	2,975	2,460	3,074	6,916	3,689	26,103	228,913	254,131	108,434	7,686	5,316	652,771	
1983	7,624	3,570	3,074	3,074	3,362	3,689	4,463	177,176	463,488	302,677	61,509	5,316	1,039,022	
1984	3,689	7,378	7,009	7,009	6,916	7,624	4,463	112,921	130,916	11,621	7,686	5,316	312,548	
1985	3,689	3,570	3,074	3,074	3,362	3,074	4,463	103,803	12,733	6,764	6,764	4,284	158,654	
1986	3,074	2,975	2,460	3,074	3,362	7,624	17,050	228,842	263,786	12,678	7,686	5,316	557,927	
1987	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111	
1988	2,152	2,083	2,152	3,074	3,362	3,074	2,083	4,919	6,545	4,612	4,612	3,669	42,337	
1989	2,152	2,083	2,152	3,074	2,802	3,074	4,463	88,702	62,889	7,686	6,764	4,284	190,125	
1990	3,074	2,975	2,460	2,460	2,802	3,074	2,083	3,074	4,463	4,612	4,612	3,669	39,358	
1991	2,152	2,083	2,152	2,152	1,961	2,152	3,868	4,919	74,892	6,764	6,764	4,284	114,143	
1992	3,074	2,975	2,460	2,460	2,802	3,074	3,868	3,074	4,463	4,612	4,612	3,669	41,143	
1993	2,152	2,083	2,152	3,074	3,362	3,689	8,271	213,205	204,082	44,068	7,686	5,316	499,140	
1994	3,689	3,570	3,074	2,460	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,419	
1995	2,152	2,083	2,152	3,074	3,362	7,624	8,271	131,296	334,396	294,086	11,843	5,316	805,655	
1996	3,689	3,570	3,074	2,460	3,362	7,624	8,271	190,622	169,121	11,621	7,686	5,316	416,416	
1997	3,689	3,570	3,074	111,273	6,916	7,624	4,463	231,648	146,890	7,686	7,686	5,316	539,835	
1998	3,689	3,570	3,074	2,460	3,362	3,689	4,463	64,194	312,909	217,820	7,686	5,316	632,232	
1999	3,689	3,570	3,074	2,460	6,916	7,624	8,271	10,084	168,859	7,686	7,686	5,316	235,235	
2000	3,689	3,570	3,074	2,152	3,362	3,689	4,463	134,499	97,677	7,686	7,686	5,316	276,863	
2001	3,689	3,570	3,074	2,460	2,802	3,074	3,868	50,785	6,545	6,764	6,764	4,284	97,679	
2002	3,074	2,975	2,460	3,074	3,362	3,689	4,463	94,194	64,					

Table 2.3-5

Hetch Hetchy Release to Stream (Acre-feet)													Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	106,358	7,686	7,686	5,316	171,524	
1922	3,689	3,570	3,074	3,074	3,362	3,689	8,271	64,089	312,197	28,813	7,686	5,316	446,830	
1923	3,689	3,570	3,074	3,074	3,362	3,689	7,676	57,807	95,231	16,928	7,686	5,316	211,102	
1924	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111	
1925	2,152	2,083	2,152	3,074	3,362	3,689	8,271	75,868	149,864	11,621	7,686	5,316	275,138	
1926	3,689	3,570	3,074	2,460	2,802	7,624	7,676	11,767	6,545	6,764	6,764	4,284	67,019	
1927	3,074	2,975	2,460	3,074	3,362	3,689	4,463	142,263	238,640	13,543	7,686	5,316	430,545	
1928	3,689	3,570	3,074	3,074	3,362	3,689	4,463	184,434	19,601	7,686	6,764	4,284	247,690	
1929	3,074	2,975	2,460	2,460	1,961	2,152	2,083	4,919	52,130	6,764	6,764	4,284	92,026	
1930	3,074	2,975	2,460	2,152	2,802	3,074	3,868	8,854	102,907	6,764	6,764	4,284	149,978	
1931	3,074	2,975	2,460	2,152	2,802	2,152	2,083	3,074	4,463	4,612	4,612	3,669	38,128	
1932	2,152	2,083	2,152	7,009	3,362	3,689	4,463	6,149	117,642	24,366	7,686	5,316	186,069	
1933	3,689	3,570	3,074	2,152	2,802	2,152	2,083	3,074	33,096	6,764	6,764	4,284	73,504	
1934	3,074	2,975	2,460	2,460	2,802	7,009	7,676	4,919	6,545	4,612	4,612	3,669	52,813	
1935	2,152	2,083	2,152	7,009	6,916	3,689	4,463	10,084	139,731	7,686	7,686	5,316	198,967	
1936	3,689	3,570	3,074	2,460	6,356	7,624	8,271	51,409	164,181	11,621	7,686	5,316	275,257	
1937	3,689	3,570	3,074	3,074	6,916	7,624	8,271	13,227	159,632	7,686	7,686	5,316	229,765	
1938	3,689	3,570	3,074	3,074	6,916	7,624	8,271	71,028	350,036	112,643	7,686	5,316	582,927	
1939	3,689	3,570	3,074	2,460	2,802	3,074	7,676	37,787	6,545	6,764	6,764	4,284	88,489	
1940	3,074	2,975	2,460	2,460	6,916	7,624	8,271	31,737	145,292	7,686	7,686	5,316	231,497	
1941	3,689	3,570	3,074	7,009	6,916	7,624	8,271	10,084	202,464	67,763	7,686	5,316	333,466	
1942	3,689	3,570	3,074	3,074	3,362	3,689	8,271	105,473	283,373	86,094	7,686	5,316	516,671	
1943	3,689	3,570	3,074	3,074	3,362	3,689	23,247	197,709	148,920	18,174	7,686	5,316	421,510	
1944	3,689	3,570	3,074	2,460	2,802	3,074	3,868	56,885	79,627	6,764	6,764	4,284	176,861	
1945	3,074	2,975	2,460	3,074	6,916	7,624	8,271	10,084	172,351	31,926	7,686	5,316	261,757	
1946	3,689	3,570	7,009	7,009	6,916	7,624	8,271	20,474	85,083	7,686	7,686	5,316	170,333	
1947	3,689	3,570	3,074	3,074	3,362	3,689	4,463	120,003	10,353	6,764	6,764	4,284	173,089	
1948	3,074	2,975	2,460	2,460	2,802	7,009	7,676	10,084	77,241	7,686	7,686	5,316	136,469	
1949	3,689	3,570	3,074	2,460	2,802	7,009	7,676	8,854	10,353	6,764	6,764	4,284	67,299	
1950	3,074	2,975	2,460	2,460	6,916	7,009	8,271	10,084	75,444	7,686	7,686	5,316	139,381	
1951	3,689	41,299	42,960	7,009	6,916	7,624	8,271	10,084	92,161	7,686	7,686	5,316	240,701	
1952	3,689	3,570	3,074	3,074	6,916	3,689	4,463	224,460	238,065	106,256	7,686	5,316	610,258	
1953	3,689	3,570	3,074	3,074	3,362	3,074	3,868	28,311	168,768	29,365	7,686	5,316	263,157	
1954	3,689	3,570	3,074	2,460	2,802	3,074	4,463	114,181	27,809	6,764	6,764	4,284	182,934	
1955	3,074	2,975	2,460	3,074	3,362	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,841	
1956	3,074	2,975	6,395	7,009	6,916	7,624	8,271	15,426	310,301	94,682	7,686	5,316	475,675	
1957	3,689	3,570	3,074	2,152	1,961	2,152	3,868	51,285	183,319	7,686	6,764	4,284	273,804	
1958	3,074	2,975	2,460	3,074	3,362	3,689	4,463	191,673	221,860	55,443	7,686	5,316	505,075	
1959	3,689	3,570	3,074	2,152	1,961	7,009	7,676	8,854	6,545	6,764	6,764	4,284	62,342	
1960	3,074	2,975	2,460	2,152	1,961	2,152	7,676	8,854	6,545	6,764	6,764	4,284	55,661	
1961	3,074	2,975	2,460	3,074	2,802	2,152	3,868	4,919	6,545	4,612	4,612	3,669	44,762	
1962	2,152	2,083	2,152	2,460	1,961	3,689	4,463	47,803	202,079	11,621	7,686	5,316	293,465	
1963	3,689	3,570	3,074	2,152	2,802	3,689	4,463	141,289	203,340	36,602	7,686	5,316	417,672	
1964	3,689	3,570	3,074	3,074	3,362	3,074	7,676	8,854	10,353	6,764	6,764	4,284	64,538	
1965	3,074	2,975	6,395	7,009	6,916	7,624	8,271	10,084	111,487	61,519	7,686	5,316	238,356	
1966	3,689	3,570	3,074	3,074	3,362	3,689	7,676	123,555	6,545	6,764	6,764	4,284	176,046	
1967	3,074	2,975	2,460	3,074	3,362	3,689	4,463	156,001	270,669	185,208	7,686	5,316	647,977	
1968	3,689	3,570	3,074	2,460	2,802	3,074	3,868	81,548	14,833	6,764	6,764	4,284	136,730	
1969	3,074	2,975	2,460	3,074	3,362	3,689	12,681	344,502	300,076	115,876	7,686	5,316	804,771	
1970	3,689	3,570	3,074	3,074	3,362	3,689	4,463	114,745	124,926	7,686	7,686	5,316	285,280	
1971	3,689	3,570	3,074	3,074	3,362	3,689	4,463	77,148	177,149	11,621	7,686	5,316	303,841	
1972	3,689	3,570	3,074	3,074	3,362	3,074	3,868	42,286	57,109	6,764	6,764	4,284	140,918	
1973	3,074	2,975	2,460	3,074	3,362	3,689	4,463	204,754	159,403	7,686	7,686	5,316	407,942	
1974	3,689	3,570	3,074	3,074	3,362	3,689	4,463	201,034	194,704	11,621	7,686	5,316	445,282	
1975	3,689	3,570	3,074	3,074	2,802	3,689	8,271	10,084	243,813	11,621	7,686	5,316	306,689	
1976	3,689	3,570	3,074	3,074	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	40,033	
1977	2,152	2,083	2,152	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	35,165	
1978	2,152	2,083	2,152	3,074	3,362	3,689	4,463	52,739	298,570	132,949	7,686	5,626	518,545	
1979	3,689	3,570	3,074	2,460	3,362	3,689	4,463	220,976	107,368	7,686	7,686	5,316	373,339	
1980	3,689	3,570	3,074	3,074	6,916	3,689	8,271	133,323	235,879	148,920	7,686	5,316	563,407	
1981	3,689	3,570	3,074	2,152	2,802	3,074	7,676	19,261	20,663	6,764	6,764	4,284	83,773	
1982	3,074	2,975	2,460	3,074	6,916	3,689	26,103	228,913	254,131	108,434	7,686	5,316	652,771	
1983	7,624	3,570	3,074	3,074	3,362	3,689	4,463	180,307	463,488	302,677	61,509	5,316	1,042,153	
1984	3,689	7,378	7,009	7,009	6,916	3,689	4,463	124,666	130,916	11,621	7,686	5,316	320,358	
1985	3,689	3,570	3,074	3,074	3,362	3,074	4,463	109,038	12,733	6,764	6,764	4,284	163,889	
1986	3,074	2,975	2,460	3,074	3,362	16,102	20,985	228,842	263,786	12,678	7,686	5,316	570,340	
1987	3,689	3,570	3,074	2,152	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,111	
1988	2,152	2,083	2,152	3,074	3,362	3,074	2,083	4,919	10,353	4,612	4,612	3,669	46,145	
1989	2,152	2,083	2,152	3,074	2,802	3,074	4,463	122,056	62,889	7,686	6,764	4,284	223,479	
1990	3,074	2,975	2,460	2,460	2,802	3,074	2,083	3,074	4,463	4,612	4,612	3,669	39,358	
1991	2,152	2,083	2,152	2,152	1,961	2,152	3,868	4,919	103,866	6,764	6,764	4,284	143,117	
1992	3,074	2,975	2,460	2,460	2,802	3,074	3,868	31,992	4,463	4,612	4,612	3,669	70,061	
1993	2,152	2,083	2,152	3,074	3,362	3,689	8,271	213,205	204,082	44,068	7,686	5,316	499,140	
1994	3,689	3,570	3,074	2,460	1,961	2,152	2,083	3,074	4,463	4,612	4,612	3,669	39,419	
1995	2,152	2,083	2,152	3,074	3,362	7,624	8,271	131,296	334,396	294,066	11,843	5,316	805,655	
1996	3,689	3,570	3,074	2,460	3,362	7,624	8,271	190,622	169,121	11,621	7,686	5,316	416,416	
1997	3,689	3,570	3,074	123,349	6,916	7,624	4,463	231,648	146,890	7,686	7,686	5,316	551,911	
1998	3,689	3,570	3,074	2,460	3,362	3,689	4,463	64,194	312,909	217,820	7,686	5,316	632,232	
1999	3,689	3,570	3,074	2,460	6,916	7,624	8,271	23,575	168,986	7,686	7,686	5,316	248,853	
2000	3,689	3,570	3,074	2,152	3,362	3,689	4,463	144,797	97,677	7,686	7,686	5,316	287,161	
2001	3,689	3,570	3,074	2,460	2,802	3,074	3,868	93,452	6,545	6,764	6,764	4,284	140,346	
2002	3,074	2,975	2,460	3,074	3,362	3,689	4,463							

Table 2.3-6

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-6,794	0	0	0	-6,794
1922	0	0	0	0	0	0	0	-8,885	0	0	0	0	-8,885
1923	0	0	0	0	0	0	0	-17,037	0	0	0	0	-17,037
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-18,233	0	0	0	0	-18,233
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-24,188	0	0	0	0	-24,188
1928	0	0	0	0	0	0	0	-3,849	0	0	0	0	-3,849
1929	0	0	0	0	0	0	0	0	-13,223	0	0	0	-13,223
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	-2,636	0	0	0	-2,636
1933	0	0	0	0	0	0	0	0	-14,950	0	0	0	-14,950
1934	0	0	0	0	0	0	-3,808	0	0	0	0	0	-3,808
1935	0	0	0	0	0	3,935	0	0	-3,874	0	0	0	61
1936	0	0	0	0	0	0	0	-13,510	0	0	0	0	-13,510
1937	0	0	0	0	0	0	0	-3,143	-4,231	0	0	0	-7,374
1938	0	0	0	0	0	0	0	-11,339	0	0	0	0	-11,339
1939	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1940	0	0	0	0	0	0	0	8,348	0	0	0	0	8,348
1941	0	0	0	0	0	0	0	0	-1,197	0	0	0	-1,197
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-30,703	0	0	0	0	-30,703
1945	0	0	0	0	0	0	0	0	13,161	0	0	0	13,161
1946	0	0	0	0	0	0	0	-7,636	0	0	0	0	-7,636
1947	0	0	0	0	0	0	0	-31,446	0	0	0	0	-31,446
1948	0	0	0	0	0	0	0	0	-12,055	0	0	0	-12,055
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	5,110	0	0	0	5,110
1951	0	-7,666	0	0	0	0	0	0	-6,213	0	0	0	-13,879
1952	0	0	0	0	0	0	0	-16,150	0	0	0	0	-16,150
1953	0	0	0	0	0	0	0	-322	0	0	0	0	-322
1954	0	0	0	0	0	0	0	-30,984	0	0	0	0	-30,984
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-2,806	0	0	0	0	-2,806
1957	0	0	0	0	0	0	0	-31,728	0	0	0	0	-31,728
1958	0	0	0	0	0	0	0	-12,538	0	0	0	0	-12,538
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-41,654	0	0	0	0	-41,654
1963	0	0	0	0	0	0	0	-28,268	0	0	0	0	-28,268
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	13,214	0	0	0	13,214
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1967	0	0	0	0	0	0	0	-8,723	0	0	0	0	-8,723
1968	0	0	0	0	0	0	0	-30,948	0	0	0	0	-30,948
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	-8,363	0	0	0	0	-4,428
1971	0	0	0	0	0	0	0	-23,636	0	0	0	0	-23,636
1972	0	0	0	0	0	0	0	-29,457	0	0	0	0	-29,457
1973	0	0	0	0	0	0	0	-14,394	0	0	0	0	-14,394
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	2,359	4,171	0	0	0	6,530
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-46,590	0	0	0	-310	-46,900
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-10,407	-10,310	0	0	0	-20,717
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-3,131	0	0	0	0	-3,131
1984	0	0	0	0	0	3,935	0	-11,745	0	0	0	0	-7,810
1985	0	0	0	0	0	0	0	-5,235	0	0	0	0	-5,235
1986	0	0	0	0	0	-8,478	-3,935	0	0	0	0	0	-12,413
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1989	0	0	0	0	0	0	0	-33,354	0	0	0	0	-33,354
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-28,974	0	0	0	-28,974
1992	0	0	0	0	0	0	0	-28,918	0	0	0	0	-28,918
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-12,076	0	0	0	0	0	0	0	0	-12,076
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-13,491	-127	0	0	0	-13,618
2000	0	0	0	0	0	0	0	-10,298	0	0	0	0	-10,298
2001	0	0	0	0	0	0	0	-42,667	0	0	0	0	-42,667
2002	0	0	0	0	0	0	0	-36,448	0	0	0	0	-36,448
Avg (21-02)	0	-93	0	-99	0	-7	-187	-8,248	-933	0	0	-4	-9,573

Table 2.3-6 illustrates the difference in stream release between the WSIP and base-Calaveras constrained settings, expressed in terms of a monthly volume (acre-feet) of flow. The difference in monthly flow below O'Shaughnessy Dam indicates a potential change in releases between the WSIP and base-Calaveras constrained settings, ranging from a decrease of approximately 46,000 acre-feet to an increase of approximately 13,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (in cubic feet per second [cfs]) is not always meaningful.¹ Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from O'Shaughnessy Dam between the WSIP and base-Calaveras constrained settings would range from delayed releases up to 8 days to an addition of up to 2 days of release. Normally, the effect of a delay in release would not affect the year's peak stream release rate during a year.

2.4 Lake Lloyd and Lake Eleanor

Compared to the operation in the base-Calaveras constrained setting, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different in the WSIP setting. Figure 2.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Figure 2.4-1 shows the results for the WSIP and base settings. The operation resulting for the WSIP setting is essentially the same as for the base-Calaveras constrained setting, except during the prolonged drought of 1987-1992. During this drought period, there is a greater draw from Hetch Hetchy Reservoir in the WSIP setting compared to the base-Calaveras constrained setting. The additional draw of water reduces the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the WSIP setting, which, to satisfy MID/TID entitlements to inflow, is met with additional releases from Lake Lloyd.

Figure 2.4-2 illustrates an almost identical operation of Lake Eleanor between the WSIP and base-Calaveras constrained settings. Also shown in Figure 2.4-2 is the operation for the base-Calaveras unconstrained setting. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is associated more with modeling discretion than with any substantive likely difference in operation.

Supplementing the Figure 2.4-1 representation of Lake Lloyd stream releases is Table 2.4-1, which illustrates the differences in stream release between the WSIP and base-Calaveras constrained settings. The one notable difference in operation of the 82-year simulation occurs during the year following the rare 1987-1992 drought sequence, when the additional draw from Lake Lloyd storage described above would require replenishment. In this one occurrence, the release to the stream above the minimum release requirement that would occur in the base-Calaveras constrained setting would not occur in the WSIP setting. Table 2.4-2 illustrates releases for the WSIP and base-Calaveras constrained settings, and shows almost no difference in releases between the two settings.

2.5 Flow below Tuolumne River and Cherry River Confluence

The flow that occurs below the confluence of the Tuolumne River and Cherry River is considered important to recreational activity (white water rafting) during the May-through-September period. To estimate the affect of WSIP on the occurrence of flow at this location, HH/LSM monthly volumetric flow results were post-processed to reflect the daily and hourly shaping potential currently exercised by Hetch Hetchy operators to satisfy water and power objectives while accommodating the desires of recreational interests. Figure 2.5-1 and Figure 2.5-2 illustrate the controlled flow below Hetch Hetchy facilities below the confluence of the Tuolumne River and Cherry River, averaged by year type, for the WSIP and base-Calaveras constrained settings. Illustrated are the combined flow elements of: 1) stream releases from O'Shaughnessy Dam, Lake Lloyd, and Lake Eleanor; 2) the return of Canyon Tunnel diversions through Kirkwood Powerhouse that exceed the Mountain Tunnel diversion; and 3) diversions through Holm Powerhouse. For this analysis, the monthly volumes of diversion through Holm Powerhouse have been shaped into a release of 4 hours per day for 6 days a week. The other flow elements represent the

¹ See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir", Memorandum by Daniel B. Steiner, December 31, 2006.

**Figure 2.4-1
Lake Lloyd Storage and Stream Release**

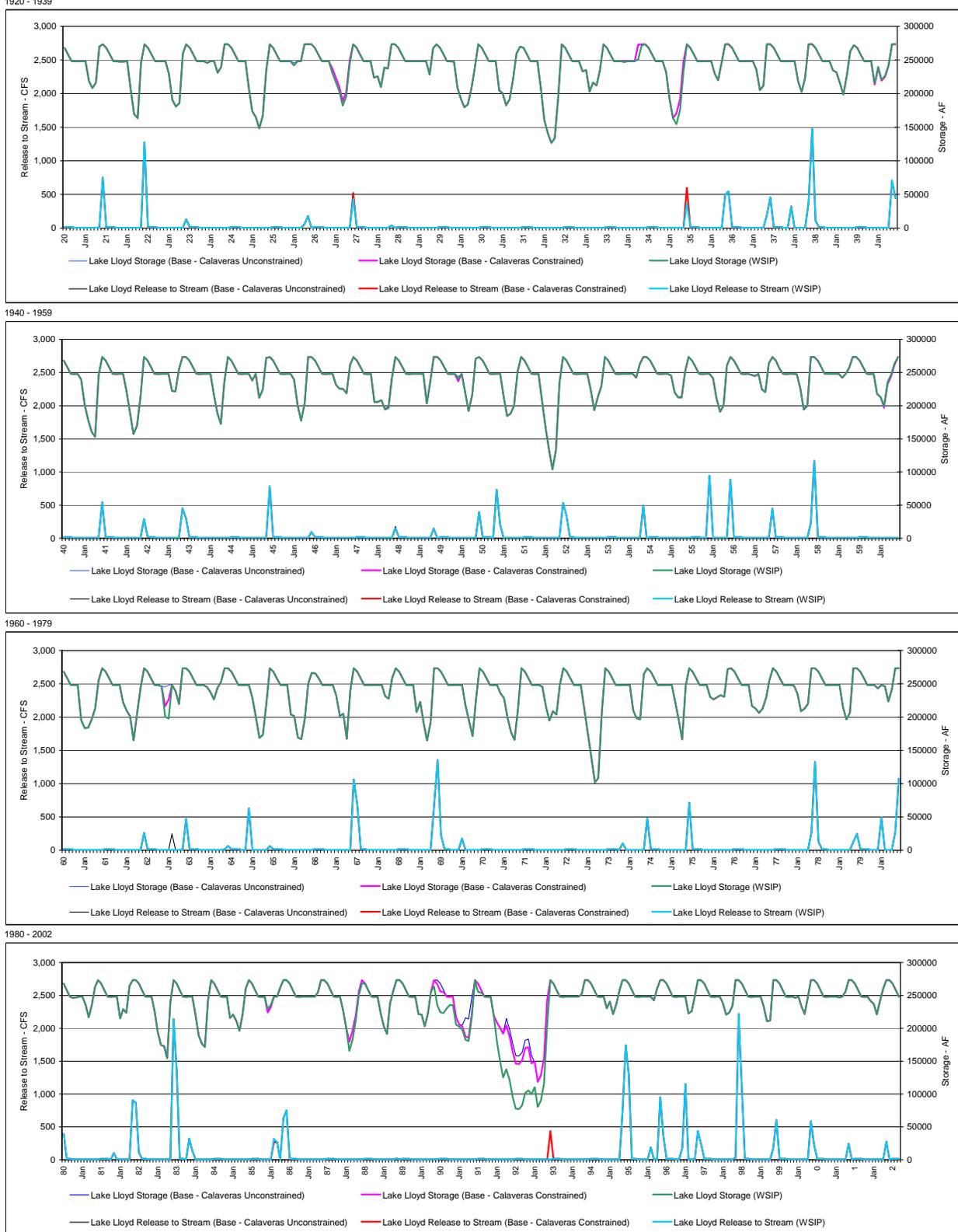


Figure 2.4-2
Lake Eleanor Storage and Stream Release



Table 2.4-1

Water Year	WSIP minus Base - Calaveras Constrained												WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	-5,164	0	0	0	-5,164
1928	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	-14,010	0	0	0	-14,010
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	1,070	0	0	0	0	1,070
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	2,941	0	0	0	0	0	0	0	0	2,941
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	9	0	0	0	0	0	0	-25,595	0	0	0	0	-25,586
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	0	0	36	0	0	13	-546	0	0	0	0	-497

Table 2.4-2

Lake Lloyd Release to Stream (Acre-feet)													WSIP	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WSIP	WY Total
Wet	334	653	8,224	6,566	1,362	1,319	298	17,483	62,931	22,325	953	922	922	123,370
Above Normal	307	4,282	1,525	307	870	307	298	10,285	26,639	993	953	922	922	47,689
Normal	307	298	307	953	278	307	298	6,734	9,633	953	953	922	922	21,943
Below Normal	307	298	307	307	278	307	485	2,383	2,551	953	953	922	922	10,051
Dry	307	298	307	307	278	307	298	307	298	953	953	922	922	5,535
All Years	312	1,193	2,104	1,654	612	505	337	7,412	20,268	5,131	953	922	922	41,404

Lake Lloyd Release to Stream (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Base - Calaveras Constrained	WY Total
Wet	334	653	8,224	6,566	1,179	1,319	298	17,483	64,530	22,325	953	922	922	124,786
Above Normal	307	4,282	1,525	307	870	307	298	10,222	27,767	993	953	922	922	48,754
Normal	307	298	307	953	278	307	298	6,734	9,633	953	953	922	922	21,943
Below Normal	307	298	307	307	278	307	485	2,383	2,551	953	953	922	922	10,051
Dry	307	298	307	307	278	307	298	307	298	953	953	922	922	5,535
All Years	312	1,193	2,104	1,654	577	505	337	7,399	20,814	5,131	953	922	922	41,901

Difference in Lake Lloyd Release to Stream (Acre-feet)													WSIP minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													WSIP minus Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WSIP minus Base - Calaveras Constrained	WY Total
Wet	0	1	0	0	184	0	0	0	-1,600	0	0	0	0	-1,415
Above Normal	0	0	0	0	0	0	0	63	-1,128	0	0	0	0	-1,065
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	36	0	0	13	-546	0	0	0	0	-497

Figure 2.5-1

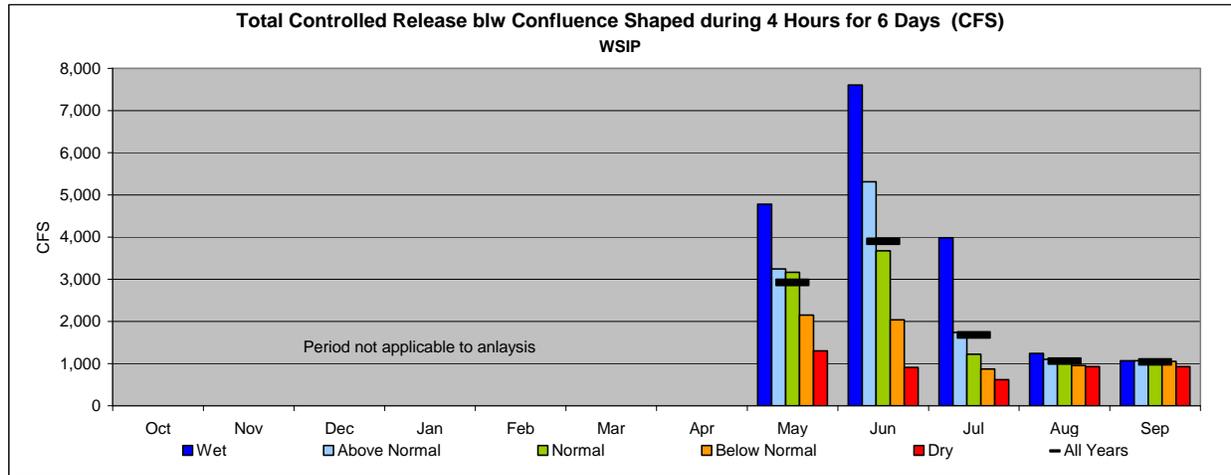
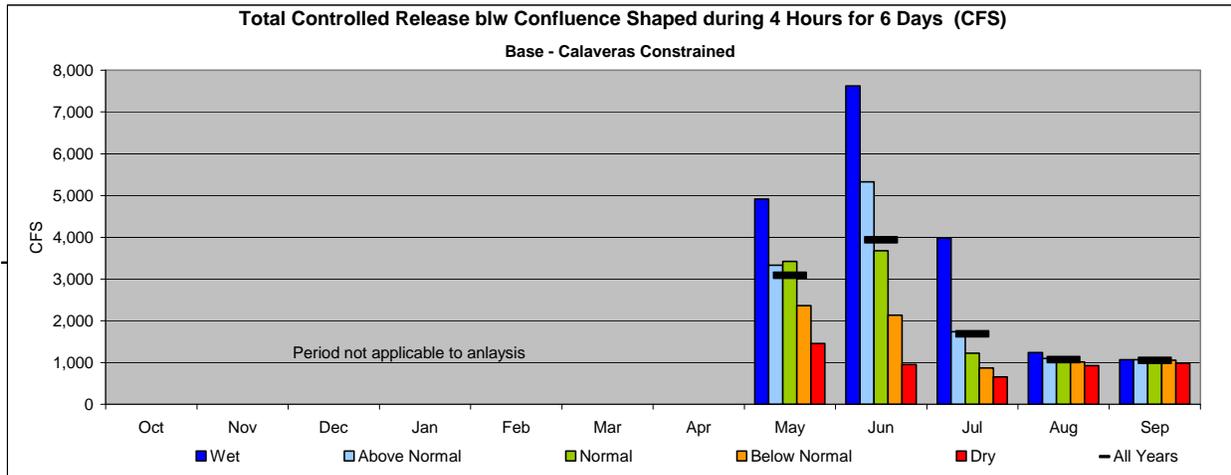
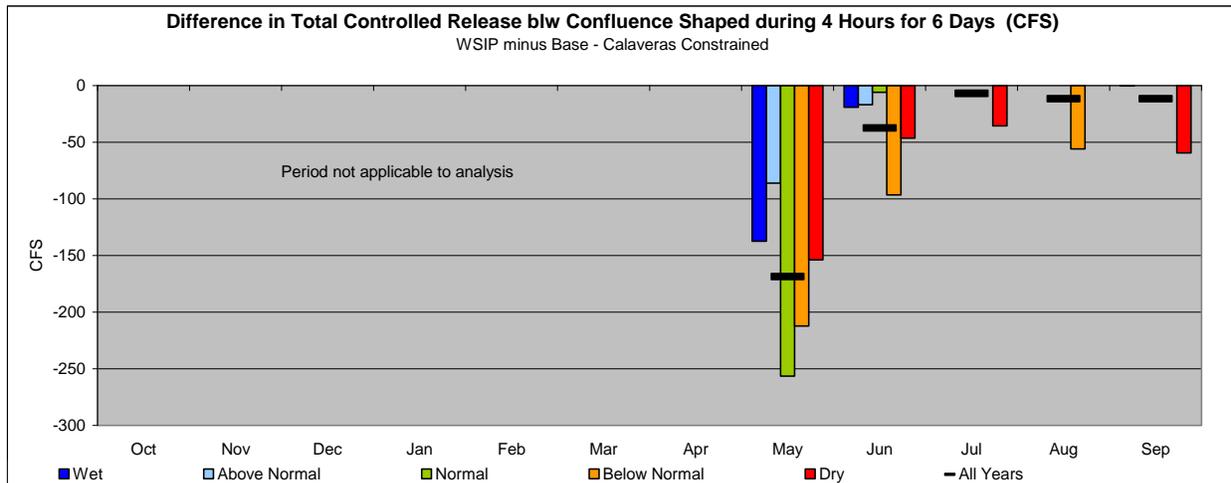


Figure 2.5-2



average daily flow rate associated with the monthly volume of flow. Figure 2.5-1 and Figure 2.5-2 illustrate that the HH/LSM operation protocols for reservoir operation incidentally result in approximately 1,000 cfs of flow below the confluence if Holm Powerhouse releases are shaped. This opportunity occurs in both the WSIP and base-Calaveras constrained settings. The flow rates illustrated in this analysis do not reflect either the occasional shaping opportunities that occur with Kirkwood Powerhouse releases or the unregulated flow that enters the streams below O'Shaughnessy Dam, Lake Lloyd, and Lake Eleanor; both of these factors would increase the illustrated flow rate. The difference in flow between the two settings that could occur during the concentrated period of flow is illustrated in Figure 2.5-3.

Figure 2.5-3



More detailed review of the 82-year simulation of operations indicates that, in only 2 months of the simulation do circumstances in the WSIP setting result in the shaped flow crossing the threshold to below 1,000 cfs, compared to levels greater than 1,000 cfs in the base-Calaveras constrained setting. In both the WSIP and base-Calaveras constrained settings, in some dry and critical years, circumstances could result in a shaped flow of less than 1,000 cfs; however, results indicate that the WSIP setting would rarely increase the frequency of such an occurrence.

2.6 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities, described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 2.6-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Figure 2.6-1 presents the results for the WSIP and base settings.

Supplementing the Figure 2.6-1 representation of Don Pedro Reservoir storage are Table 2.6-1 Don Pedro Reservoir Storage (WSIP), Table 2.6-2 Don Pedro Reservoir (Base – Calaveras Constrained), and Table 2.6-3 Difference in Don Pedro Reservoir Storage (WSIP minus Calaveras Constrained). The results illustrate that, throughout many years, the storage in Don Pedro Reservoir associated with the WSIP setting would differ from the storage in the WSIP setting, and that this difference would almost always be less storage. Compared to the base-Calaveras constrained setting, the differences in storage indicate the decreases to the inflow of Don Pedro Reservoir due to greater SFPUC demands and SJPL diversions in the WSIP setting. The decreases in inflow typically occur from winter through early summer. Table 2.6-4 illustrates the difference in inflow to Don Pedro Reservoir between the WSIP and base-Calaveras constrained settings. Generally, the difference is an annual amount of about 30,000 acre-feet, approximating the additional delivery of the SFPUC. The season of inflow reduction is associated with the direct increase in diversion to the SJPL and the replenishment operation of Hetch Hetchy Reservoir. Figure 2.6-2 illustrates the seasonal change in Don Pedro Reservoir inflow, averaged by year type.

Figure 2.6-1
Don Pedro Reservoir Storage and Release below La Grange Dam

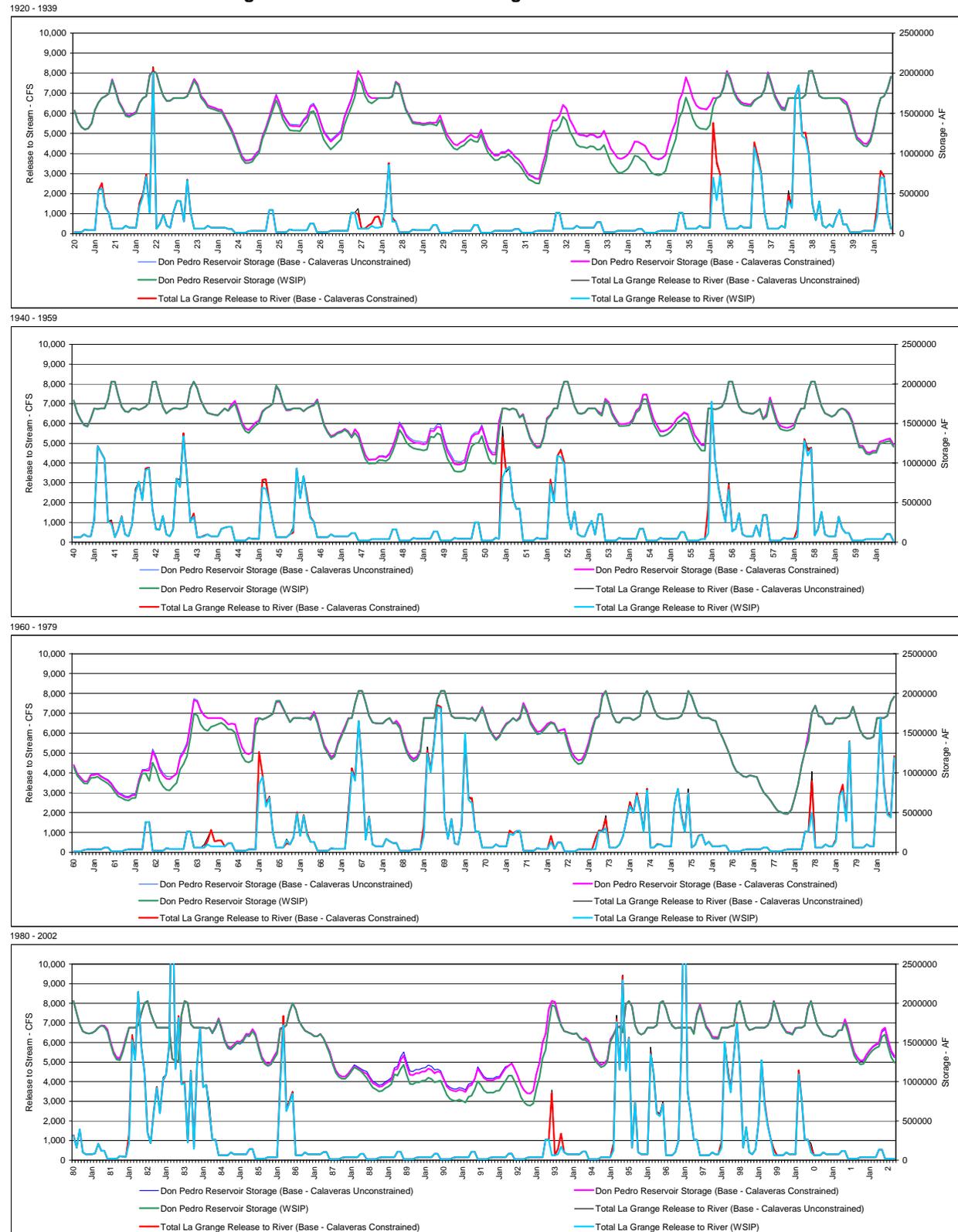


Table 2.6-1

Don Pedro Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,154	1,909,912	1,779,947	1,631,674	1,555,087
1922	1,469,116	1,454,308	1,478,601	1,498,765	1,627,062	1,690,000	1,713,000	1,967,567	2,030,000	1,998,041	1,838,188	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,800,909	1,907,182	1,839,107	1,696,444	1,644,854
1924	1,575,009	1,559,343	1,545,325	1,526,919	1,521,632	1,436,947	1,351,927	1,269,310	1,161,839	1,043,035	934,362	880,179
1925	882,358	896,470	960,259	1,002,527	1,178,845	1,285,699	1,415,416	1,536,955	1,665,322	1,567,081	1,426,669	1,354,700
1926	1,290,841	1,282,495	1,282,912	1,276,824	1,347,431	1,393,215	1,513,431	1,529,132	1,430,876	1,291,382	1,169,168	1,105,402
1927	1,050,185	1,089,842	1,136,351	1,175,906	1,353,820	1,468,562	1,577,769	1,698,023	1,948,492	1,868,718	1,722,803	1,645,689
1928	1,624,412	1,655,738	1,690,000	1,690,000	1,690,000	1,689,998	1,690,000	1,705,499	1,881,986	1,844,539	1,680,590	1,460,504
1929	1,376,925	1,368,595	1,365,702	1,352,493	1,361,347	1,369,756	1,363,320	1,347,224	1,419,566	1,296,940	1,183,629	1,119,702
1930	1,063,576	1,047,412	1,082,926	1,102,916	1,146,887	1,178,330	1,151,470	1,143,227	1,235,412	1,119,051	1,014,293	961,444
1931	916,788	919,127	956,563	954,741	986,269	952,973	899,411	865,472	809,514	735,646	675,830	656,304
1932	630,168	625,030	769,521	913,534	1,153,444	1,289,825	1,280,793	1,334,069	1,458,021	1,410,599	1,274,962	1,198,076
1933	1,109,046	1,083,648	1,081,347	1,066,810	1,091,460	1,083,362	1,048,132	1,053,363	1,104,947	995,152	884,663	825,690
1934	768,284	756,532	778,426	811,719	879,231	973,527	961,019	918,806	892,463	818,740	757,348	738,059
1935	727,382	741,020	780,535	934,617	1,058,518	1,183,873	1,442,298	1,526,908	1,697,122	1,581,812	1,437,108	1,350,153
1936	1,313,964	1,305,527	1,299,545	1,353,079	1,589,109	1,690,000	1,713,000	1,808,162	2,006,603	1,908,135	1,758,193	1,675,358
1937	1,622,051	1,600,732	1,594,212	1,588,128	1,654,812	1,690,000	1,713,000	1,792,193	1,987,140	1,852,386	1,706,269	1,621,556
1938	1,547,436	1,538,874	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,640,136	1,609,346	1,485,747	1,318,522	1,176,804	1,138,053
1940	1,095,829	1,088,559	1,152,400	1,306,261	1,540,227	1,690,000	1,713,000	1,807,723	1,954,652	1,788,947	1,638,725	1,550,117
1941	1,479,514	1,463,206	1,562,630	1,689,993	1,683,096	1,690,000	1,690,000	1,803,646	2,030,000	2,027,475	1,857,774	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,650	2,030,000	1,944,494	1,798,476	1,708,539
1944	1,635,548	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,707,586	1,750,208	1,623,490	1,481,831	1,404,426
1945	1,379,794	1,427,821	1,474,257	1,500,550	1,640,388	1,690,000	1,713,000	1,750,490	1,979,080	1,915,904	1,761,716	1,673,833
1946	1,676,003	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,923	1,791,308	1,626,984	1,471,391	1,384,998
1947	1,325,797	1,342,234	1,375,560	1,387,779	1,418,570	1,388,085	1,320,233	1,380,276	1,321,244	1,180,640	1,055,294	992,073
1948	995,836	997,103	1,035,726	1,034,852	1,022,922	1,055,342	1,146,487	1,267,945	1,418,033	1,353,141	1,259,749	1,215,428
1949	1,186,203	1,170,472	1,170,472	1,158,924	1,171,007	1,335,110	1,324,533	1,376,033	1,357,651	1,195,392	1,052,328	977,511
1950	899,485	889,413	892,224	916,879	1,074,192	1,209,417	1,247,067	1,254,186	1,342,400	1,193,086	1,052,952	994,465
1951	991,837	1,395,953	1,689,996	1,689,971	1,673,951	1,690,000	1,671,280	1,576,052	1,604,719	1,451,209	1,311,422	1,232,085
1952	1,190,739	1,198,448	1,320,040	1,549,021	1,599,117	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,597,670	1,787,254	1,742,396	1,609,381	1,534,414
1954	1,468,628	1,467,830	1,471,472	1,478,272	1,527,241	1,636,809	1,674,641	1,806,537	1,806,600	1,646,548	1,500,604	1,422,171
1955	1,342,774	1,342,526	1,360,811	1,393,387	1,443,658	1,509,285	1,536,773	1,574,515	1,539,789	1,404,270	1,279,178	1,220,548
1956	1,157,629	1,156,262	1,690,000	1,689,942	1,678,244	1,690,000	1,713,000	1,804,719	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,585,676	1,792,847	1,645,523	1,505,651	1,431,990
1958	1,415,635	1,408,082	1,420,790	1,443,748	1,585,696	1,683,150	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,209	1,607,868	1,505,353	1,304,209	1,196,857	1,196,565
1960	1,118,661	1,107,237	1,130,464	1,130,153	1,243,532	1,256,171	1,271,114	1,278,736	1,204,810	1,074,160	965,400	916,155
1961	868,272	867,480	938,355	940,051	952,205	918,282	893,177	866,136	823,008	758,324	704,730	685,442
1962	659,505	654,417	682,152	686,096	873,196	994,305	994,447	900,271	1,129,751	1,038,952	902,181	829,505
1963	786,793	780,752	831,071	876,126	1,043,308	1,111,390	1,211,258	1,448,431	1,743,224	1,723,618	1,607,530	1,548,750
1964	1,530,117	1,579,681	1,595,347	1,613,453	1,629,939	1,600,004	1,547,600	1,544,300	1,506,555	1,351,609	1,216,652	1,145,766
1965	1,132,274	1,155,586	1,587,084	1,689,972	1,672,299	1,690,000	1,713,000	1,744,617	1,904,454	1,906,417	1,816,850	1,723,010
1966	1,638,053	1,690,000	1,689,998	1,689,996	1,685,995	1,690,000	1,666,092	1,743,542	1,626,186	1,462,164	1,318,555	1,247,974
1967	1,172,070	1,205,602	1,359,294	1,458,308	1,556,141	1,679,371	1,690,000	1,880,000	2,030,000	2,030,000	1,885,243	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,938	1,666,603	1,690,000	1,620,006	1,623,104	1,560,312	1,393,242	1,257,826	1,180,125
1969	1,143,709	1,173,021	1,262,503	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,894	1,817,297	1,687,171	1,550,130	1,472,003
1971	1,411,974	1,454,887	1,541,936	1,607,844	1,641,860	1,690,000	1,654,817	1,684,314	1,852,122	1,751,886	1,618,308	1,548,737
1972	1,486,524	1,495,072	1,538,668	1,589,139	1,627,917	1,610,864	1,516,947	1,496,024	1,505,254	1,347,538	1,216,200	1,149,557
1973	1,110,879	1,123,889	1,205,959	1,334,754	1,514,370	1,676,817	1,708,199	1,954,560	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,440	2,030,000	1,947,206	1,804,319	1,717,373
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,822,763	2,030,000	1,959,911	1,829,200	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,702	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,400,571	1,761,000	1,845,209	1,711,253	1,699,232
1979	1,613,622	1,616,696	1,615,753	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,211	1,682,213	1,538,195	1,461,600
1980	1,430,197	1,432,910	1,452,944	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,713,995	1,699,243	1,639,415	1,478,412	1,349,907	1,281,733
1982	1,272,860	1,379,771	1,530,515	1,689,994	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,873,946	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,394	1,735,008
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,426	1,791,689	1,663,465	1,516,873	1,433,460
1985	1,418,439	1,453,549	1,497,928	1,488,516	1,523,571	1,591,651	1,584,754	1,644,256	1,582,430	1,421,974	1,290,376	1,226,486
1986	1,199,500	1,220,692	1,292,278	1,357,285	1,669,715	1,690,000	1,717,600	1,888,300	2,001,400	1,921,826	1,777,583	1,709,211
1987	1,650,077	1,628,032	1,609,483	1,578,362	1,577,562	1,606,421	1,550,898	1,452,868	1,354,008	1,222,826	1,114,464	1,061,192
1988	1,038,470	1,037,567	1,073,751	1,127,570	1,183,427	1,160,444	1,					

Table 2.6-2

Don Pedro Reservoir Storage (Acre-feet)

Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,298,116	1,312,166	1,374,846	1,543,388	1,634,035	1,690,000	1,713,000	1,745,744	1,922,480	1,794,738	1,646,401	1,569,766
1922	1,483,764	1,468,948	1,493,242	1,513,410	1,632,921	1,690,000	1,713,000	1,977,208	2,030,000	2,000,320	1,839,774	1,715,715
1923	1,653,078	1,658,406	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,820,205	1,928,620	1,862,730	1,719,964	1,668,299
1924	1,598,406	1,582,728	1,568,711	1,550,312	1,545,026	1,460,333	1,378,419	1,299,558	1,191,983	1,073,043	964,229	909,938
1925	912,051	926,145	989,936	1,032,212	1,208,533	1,315,376	1,449,872	1,592,106	1,722,494	1,626,279	1,485,599	1,413,429
1926	1,349,447	1,341,068	1,342,001	1,335,930	1,406,789	1,451,975	1,579,452	1,605,196	1,530,198	1,390,251	1,267,579	1,203,484
1927	1,148,064	1,187,666	1,227,580	1,267,160	1,445,082	1,559,790	1,668,910	1,815,946	2,030,000	1,952,155	1,805,231	1,718,301
1928	1,690,000	1,690,000	1,689,999	1,690,000	1,689,999	1,690,000	1,690,000	1,713,000	1,895,368	1,860,082	1,696,367	1,553,839
1929	1,392,250	1,383,911	1,381,019	1,367,814	1,376,669	1,385,072	1,378,621	1,388,388	1,475,214	1,352,334	1,238,768	1,174,656
1930	1,118,416	1,102,222	1,137,738	1,157,744	1,201,718	1,233,141	1,206,229	1,198,406	1,292,609	1,175,991	1,070,973	1,017,929
1931	973,151	975,457	1,012,896	1,011,091	1,042,623	1,009,306	955,687	921,592	865,431	791,298	731,212	711,489
1932	685,236	680,066	855,944	1,007,181	1,258,036	1,414,788	1,410,604	1,472,532	1,606,361	1,560,550	1,424,224	1,346,829
1933	1,257,492	1,232,011	1,229,716	1,215,222	1,239,883	1,231,730	1,201,713	1,212,118	1,282,354	1,174,034	1,062,712	1,003,113
1934	945,319	933,463	952,031	986,209	1,051,192	1,148,525	1,144,916	1,121,547	1,096,288	1,021,604	959,237	939,233
1935	928,117	941,636	981,161	1,150,737	1,288,340	1,396,009	1,659,231	1,753,551	1,949,593	1,835,467	1,689,641	1,601,844
1936	1,565,134	1,556,556	1,550,590	1,604,141	1,689,990	1,690,000	1,713,000	1,825,876	2,026,466	1,930,192	1,697,248	1,697,248
1937	1,643,897	1,622,565	1,616,040	1,609,976	1,663,235	1,690,000	1,713,000	1,801,952	2,005,813	1,873,257	1,727,048	1,642,270
1938	1,568,107	1,559,534	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,669,327	1,636,942	1,515,456	1,348,095	1,206,241	1,167,392
1940	1,125,107	1,117,821	1,181,093	1,334,247	1,549,893	1,690,000	1,713,000	1,801,778	1,953,690	1,787,989	1,637,771	1,549,166
1941	1,478,565	1,462,258	1,562,498	1,689,993	1,683,010	1,690,000	1,690,000	1,806,900	2,030,000	2,029,753	1,859,361	1,712,171
1942	1,653,599	1,645,971	1,689,999	1,689,981	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,944,781	2,030,000	1,946,772	1,800,744	1,708,535
1944	1,635,544	1,622,060	1,610,317	1,603,271	1,647,454	1,690,000	1,658,867	1,740,532	1,785,253	1,660,664	1,518,838	1,441,309
1945	1,416,600	1,464,606	1,511,043	1,537,346	1,655,108	1,690,000	1,713,000	1,750,891	1,968,546	1,907,693	1,753,542	1,665,684
1946	1,667,870	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,737,919	1,804,474	1,640,094	1,441,331	1,398,004
1947	1,338,776	1,355,205	1,388,532	1,400,755	1,431,546	1,401,057	1,333,192	1,426,886	1,369,899	1,229,070	1,103,503	1,040,119
1948	1,043,781	1,045,021	1,083,645	1,082,785	1,070,859	1,108,634	1,204,592	1,330,504	1,494,586	1,431,653	1,337,895	1,293,308
1949	1,263,923	1,253,389	1,248,152	1,236,661	1,248,749	1,409,959	1,403,593	1,458,528	1,449,077	1,286,396	1,142,917	1,067,793
1950	989,574	979,449	986,869	1,008,124	1,180,789	1,325,119	1,363,581	1,371,695	1,456,605	1,308,149	1,167,490	1,108,617
1951	1,105,750	1,520,227	1,689,993	1,689,971	1,673,951	1,690,000	1,674,296	1,580,080	1,618,032	1,466,740	1,326,882	1,247,492
1952	1,206,114	1,213,815	1,335,408	1,569,493	1,607,306	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,647,636	1,620,036	1,811,754	1,769,068	1,635,938	1,560,884
1954	1,495,044	1,494,231	1,497,874	1,504,682	1,553,652	1,663,210	1,701,018	1,866,077	1,868,149	1,707,833	1,651,614	1,482,978
1955	1,403,454	1,403,172	1,421,459	1,454,053	1,504,329	1,569,934	1,599,724	1,641,321	1,617,417	1,481,549	1,356,100	1,297,208
1956	1,234,131	1,232,721	1,689,998	1,689,942	1,678,244	1,690,000	1,713,000	1,813,047	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,619,645	1,828,911	1,683,711	1,543,668	1,469,881
1958	1,453,447	1,445,872	1,458,581	1,481,551	1,600,819	1,689,196	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,673,092	1,630,483	1,527,892	1,362,645	1,219,188	1,218,822
1960	1,140,872	1,129,435	1,152,664	1,152,359	1,269,185	1,283,225	1,299,668	1,306,406	1,230,714	1,099,946	991,067	941,733
1961	893,793	892,985	973,250	974,956	987,113	953,177	928,036	902,160	858,902	794,048	740,282	720,867
1962	694,851	689,743	717,480	721,434	908,537	1,029,633	1,029,740	1,033,729	1,270,469	1,181,313	1,043,881	970,704
1963	927,682	921,558	956,090	988,740	1,184,189	1,252,220	1,351,952	1,618,330	1,914,402	1,896,333	1,779,493	1,720,157
1964	1,690,000	1,690,000	1,690,000	1,689,998	1,689,999	1,660,043	1,609,884	1,618,868	1,612,810	1,457,385	1,321,936	1,250,696
1965	1,236,988	1,260,242	1,681,588	1,689,959	1,671,262	1,690,000	1,713,000	1,743,310	1,890,878	1,895,178	1,807,939	1,723,024
1966	1,638,067	1,690,000	1,689,998	1,689,996	1,685,637	1,690,000	1,693,170	1,769,033	1,653,800	1,489,654	1,345,919	1,275,244
1967	1,199,284	1,232,801	1,386,494	1,485,516	1,583,351	1,689,346	1,690,000	1,880,000	2,030,000	2,030,000	1,887,521	1,717,653
1968	1,636,798	1,624,593	1,622,729	1,622,934	1,666,601	1,690,000	1,620,006	1,655,235	1,594,542	1,427,317	1,291,743	1,213,928
1969	1,177,443	1,206,736	1,296,220	1,689,989	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,955	1,678,444	1,690,000	1,655,509	1,736,527	1,830,101	1,702,198	1,565,091	1,486,913
1971	1,426,854	1,469,758	1,556,808	1,622,720	1,647,812	1,690,000	1,654,817	1,709,507	1,879,438	1,781,361	1,647,656	1,577,988
1972	1,515,715	1,524,247	1,567,844	1,618,323	1,639,592	1,622,536	1,528,607	1,539,355	1,550,642	1,392,720	1,261,172	1,194,378
1973	1,155,608	1,168,592	1,250,664	1,379,472	1,559,092	1,690,000	1,717,600	1,980,594	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,982	1,662,881	1,690,000	1,717,600	1,962,884	2,030,000	1,949,484	1,806,587	1,717,369
1975	1,688,936	1,679,039	1,677,494	1,682,832	1,684,940	1,690,000	1,717,600	1,821,847	2,030,000	1,962,190	1,831,507	1,720,613
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,707	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,488,474	1,761,000	1,847,487	1,713,521	1,701,803
1979	1,620,362	1,623,433	1,622,490	1,689,997	1,684,438	1,690,000	1,690,000	1,717,600	1,834,417	1,684,409	1,540,382	1,463,780
1980	1,432,372	1,435,084	1,455,118	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,716,204	1,714,121	1,667,678	1,506,550	1,377,916	1,309,646
1982	1,300,713	1,407,609	1,558,354	1,689,990	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,876,224	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,004,672	1,735,004
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,418	1,705,632	1,808,055	1,682,404	1,535,365	1,451,890
1985	1,436,830	1,471,930	1,516,310	1,506,903	1,541,959	1,610,032	1,603,118	1,669,756	1,610,051	1,449,470	1,317,745	1,253,762
1986	1,226,720	1,247,897	1,325,042	1,388,140	1,680,601	1,690,000	1,717,600	1,888,300	2,001,400	1,924,104	1,779,851	1,711,472
1987	1,652,333	1,630,287	1,611,738	1,580,618	1,579,818	1,608,676	1,553,151	1,468,714	1,381,326	1,250,018	1,141,533	1,088,170
1988	1,065,391	1,064,473										

Table 2.6-3

Difference in Don Pedro Reservoir Storage (Acre-feet)

WSIP minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-197	-197	-197	-197	-79	0	0	-3,590	-12,568	-14,791	-14,727	-14,679
1922	-14,648	-14,640	-14,641	-14,645	-5,859	0	0	-9,641	0	-2,279	-1,586	3
1923	3	2	0	0	0	0	0	-19,296	-21,438	-23,623	-23,520	-23,445
1924	-23,397	-23,385	-23,386	-23,393	-23,394	-23,386	-26,492	-30,248	-30,144	-30,008	-29,867	-29,759
1925	-29,693	-29,675	-29,677	-29,685	-29,688	-29,677	-34,456	-55,151	-57,172	-59,198	-58,930	-58,729
1926	-58,606	-58,573	-59,089	-59,106	-59,358	-58,760	-66,021	-76,064	-99,322	-98,869	-98,411	-98,082
1927	-97,879	-97,824	-91,229	-91,254	-91,262	-91,228	-91,141	-117,923	-81,508	-83,437	-82,428	-72,612
1928	-65,588	-34,262	1	0	0	0	-7,501	-13,382	-15,543	-15,477	-15,407	-15,357
1929	-15,325	-15,316	-15,317	-15,321	-15,322	-15,316	-15,301	-41,164	-55,648	-55,394	-55,139	-54,954
1930	-54,840	-54,810	-54,812	-54,828	-54,831	-54,811	-54,759	-55,179	-57,197	-56,940	-56,680	-56,485
1931	-56,363	-56,330	-56,333	-56,350	-56,354	-56,333	-56,276	-56,120	-55,917	-55,652	-55,382	-55,185
1932	-55,068	-55,036	-86,423	-93,647	-104,592	-124,963	-129,811	-138,463	-148,340	-149,951	-149,262	-148,753
1933	-148,446	-148,363	-148,369	-148,412	-148,423	-148,368	-153,581	-158,755	-177,407	-178,882	-178,049	-177,423
1934	-177,035	-176,931	-173,605	-174,490	-171,961	-174,998	-183,897	-202,741	-203,825	-202,864	-201,889	-201,174
1935	-200,735	-200,616	-200,626	-216,120	-229,822	-212,136	-216,933	-226,643	-252,471	-253,655	-252,533	-251,691
1936	-251,170	-251,029	-251,045	-251,062	-100,881	0	0	-17,714	-19,863	-22,057	-21,959	-21,890
1937	-21,846	-21,833	-21,828	-21,848	-8,423	0	0	-9,759	-18,673	-20,871	-20,779	-20,714
1938	-20,671	-20,660	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	-29,191	-27,596	-29,709	-29,573	-29,437	-29,339
1940	-29,278	-29,262	-28,693	-27,986	-9,666	0	0	5,945	962	958	954	951
1941	949	948	132	0	86	0	0	-3,254	0	-2,278	-1,587	3
1942	3	3	0	1	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	-5,131	0	-2,278	-2,268	4
1944	4	4	4	3	2	0	0	-32,946	-35,045	-37,174	-37,007	-36,883
1945	-36,806	-36,785	-36,786	-36,796	-14,720	0	0	-401	10,534	8,211	8,174	8,149
1946	8,133	0	0	0	0	0	0	-10,996	-13,166	-13,110	-13,050	-13,006
1947	-12,979	-12,971	-12,972	-12,976	-12,976	-12,972	-12,959	-46,610	-48,655	-48,430	-48,209	-48,046
1948	-47,945	-47,918	-47,919	-47,933	-47,937	-53,292	-58,105	-62,559	-76,583	-78,512	-78,146	-77,880
1949	-77,720	-77,677	-77,680	-77,737	-77,742	-74,849	-79,060	-82,495	-91,426	-91,004	-90,589	-90,282
1950	-90,089	-90,036	-94,645	-91,245	-106,597	-115,702	-116,514	-117,509	-114,205	-115,063	-114,538	-114,152
1951	-113,913	-124,274	3	0	0	0	-3,016	-4,028	-13,313	-15,531	-15,460	-15,407
1952	-15,375	-15,367	-15,368	-20,472	-8,189	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	-19,831	-22,366	-24,500	-26,672	-26,557	-26,470
1954	-26,416	-26,401	-26,402	-26,410	-26,411	-26,401	-26,377	-59,540	-61,549	-61,285	-61,010	-60,808
1955	-60,680	-60,646	-60,648	-60,666	-60,671	-60,649	-62,951	-66,806	-77,628	-77,279	-76,922	-76,660
1956	-76,502	-76,459	2	0	0	0	0	-8,328	0	0	0	0
1957	0	0	0	0	0	0	0	-33,969	-36,064	-38,188	-38,017	-37,891
1958	-37,812	-37,790	-37,791	-37,803	-15,123	-6,046	0	0	0	0	0	0
1959	0	0	0	0	0	0	-5,883	-22,615	-22,539	-22,436	-22,331	-22,257
1960	-22,211	-22,198	-22,200	-22,206	-25,653	-27,054	-28,554	-27,670	-25,904	-25,786	-25,667	-25,578
1961	-25,521	-25,505	-34,895	-34,905	-34,908	-34,895	-34,859	-36,024	-35,894	-35,724	-35,552	-35,425
1962	-35,346	-35,326	-35,328	-35,341	-35,341	-35,328	-35,293	-133,458	-140,718	-142,361	-141,700	-141,199
1963	-140,889	-140,806	-125,019	-112,614	-140,881	-140,830	-140,694	-169,899	-171,178	-172,715	-171,963	-171,407
1964	-159,883	-110,319	-94,653	-76,545	-60,060	-60,039	-62,284	-74,568	-106,255	-105,776	-105,284	-104,930
1965	-104,714	-104,656	-94,504	13	1,037	0	0	1,307	13,576	11,239	8,911	-14
1966	-14	0	0	0	358	0	-27,078	-25,491	-27,614	-27,490	-27,364	-27,270
1967	-27,214	-27,199	-27,200	-27,208	-27,210	-9,975	0	0	0	0	-2,278	3
1968	4	4	4	4	2	0	0	-32,131	-34,230	-34,075	-33,917	-33,803
1969	-33,734	-33,715	-33,717	5	0	0	0	0	0	0	0	0
1970	0	-3	0	-3	1,189	0	0	-10,633	-12,804	-15,027	-14,961	-14,910
1971	-14,880	-14,871	-14,872	-14,876	-5,952	0	0	-25,193	-27,316	-29,475	-29,348	-29,251
1972	-29,191	-29,175	-29,176	-29,184	-11,675	-11,672	-11,660	-43,331	-45,388	-45,182	-44,972	-44,821
1973	-44,729	-44,703	-44,705	-44,718	-44,722	-13,183	-9,401	-26,034	0	0	0	0
1974	0	0	0	1	1	0	0	556	0	-2,278	-2,268	4
1975	4	4	3	3	1	0	0	916	0	-2,279	-1,587	2
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-87,903	0	-2,278	-2,268	-2,571
1979	-6,740	-6,737	-6,737	1	1	0	0	0	-2,206	-2,196	-2,187	-2,180
1980	-2,175	-2,174	-2,174	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-2,209	-14,878	-28,263	-28,138	-28,009	-27,913
1982	-27,853	-27,838	-27,839	4	0	0	0	0	0	0	-2,278	0
1983	0	0	0	0	0	0	0	0	0	0	-2,278	4
1984	0	0	0	0	0	0	-197	-14,206	-16,366	-18,575	-18,492	-18,430
1985	-18,391	-18,381	-18,382	-18,387	-18,388	-18,381	-18,364	-25,500	-27,621	-27,496	-27,369	-27,276
1986	-27,220	-27,205	-32,764	-30,855	-10,886	0	0	0	0	-2,278	-2,268	-2,261
1987	-2,256	-2,255	-2,255	-2,256	-2,256	-2,255	-2,253	-15,846	-27,318	-27,192	-27,069	-26,978
1988	-26,921	-26,906	-26,907	-26,915	-13,257	-13,252	-18,816	-21,115	-54,986	-59,724	-59,441	-59,232
1989	-59,101	-59,065	-59,069	-59,087	-59,091	-59,069	-81,869	-116,170	-117,977	-117,445	-116,906	-116,506
1990	-116,262	-116,195	-116,201	-116,234	-116,243	-116,200	-116,087	-126,675	-106,389	-105,899	-105,387	-118,902
1991	-124,026	-123,954	-125,482	-133,392	-134,944	-134,892	-134,754	-131,338	-160,604	-149,168	-157,291	-160,514
1992	-160,164	-160,071	-160,078	-160,126	-160,138	-160,079	-128,954	-155,586	-155,052	-154,339	-153,596	-153,052
1993	-152,720	-152,625	-166,612	-182,255	-182,306	-193,618	-202,804	-203,260	-54,228	-54,228	-39,184	63
1994	63	63	63	63	63	63	63	-30,049	-32,153	-32,007	-31,856	-31,749
1995	-31,683	-31,666	-31,667	-31,676	-12,672	0	-9,203	0	0	0	-2,278	3
1996	4	3	4	4	0	0	0	0	0	-2,278	-2,269	-2,262
1997	-2,257	0	0	2	0	0	-13,714	-15,961	-18,115	-20,316	-20,228	-20,163
1998	-20,123	-20,112	-20,113	3	0	0	1,472	0	0	0	0	0
1999	0	0	0	0	0	0	0	-20,586	-9,366	-11,604	-11,553	-11,516
2000	-11,493	-11,487	-11,488	-11,490	0	0	0	-12,565	0	0	0	0
2001	0	0	0	0	0	0	0	-44,895	-46,651	-46,443	-46,229	-46,071
2002	-45,974	-45,948	-45,950	-45,964	-45,967	-45,951	-45,906	-83,394	-85,322	-84,942	-84,551	-84,260
Avg (21-02)	-41,238	-40,428	-37,503	-35,445	-31,952	-29,469	-31,384	-43,349	-42,637	-43,282	-43,091	-42,454

Table 2.6-4

Difference in Don Pedro Reservoir Inflow (Acre-feet)												WSIP minus Base - Calaveras Constrained		
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	-15,646	-3,719	-3,595	-9,004	-2,284	0	0	-34,248	
1922	0	0	0	0	0	0	-7,366	-15,337	-4,972	-2,284	0	0	-29,959	
1923	0	0	0	0	0	0	-2,209	-19,320	-2,209	-2,284	0	0	-26,022	
1924	0	0	0	0	0	0	-3,130	-3,830	0	0	0	0	-6,960	
1925	0	0	0	0	0	0	-4,810	-20,810	-2,210	-2,283	0	0	-30,113	
1926	0	0	-515	0	-246	576	-7,321	-10,224	-23,557	0	0	0	-41,287	
1927	0	0	6,599	0	0	0	0	-27,040	-7,742	-2,284	0	0	-30,467	
1928	0	0	0	0	0	-5,339	-18,278	-5,907	-2,210	0	0	0	-31,734	
1929	0	0	0	0	0	0	0	-25,937	-14,652	0	0	0	-40,589	
1930	0	0	0	0	0	0	0	-562	-2,210	0	0	0	-2,772	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	-31,384	-7,196	-10,937	-20,414	-4,973	-9,004	-10,370	-2,284	0	0	-96,562	
1933	0	0	0	0	0	0	-5,359	-5,578	-19,227	-2,284	0	0	-32,448	
1934	0	0	3,334	-832	2,543	-3,103	-9,075	-19,352	-1,802	0	0	0	-28,287	
1935	0	0	0	-15,432	-13,685	17,605	-5,006	-10,269	-26,617	-2,284	0	0	-55,688	
1936	0	0	-6	55	-1,220	-18,127	-5,058	-17,736	-2,210	-2,283	0	0	-46,585	
1937	0	0	6	-14	-1,588	-4,659	-3,565	-9,771	-8,961	-2,284	0	0	-30,836	
1938	0	0	1,823	0	0	0	-9,143	-18,144	-4,972	-2,284	0	0	-32,720	
1939	0	0	0	0	0	0	-29,205	1,523	-2,210	0	0	0	-29,892	
1940	0	0	570	715	-7,651	-9,830	-4,388	5,952	-4,972	0	0	0	-19,604	
1941	0	0	-815	0	-431	-407	-500	-3,259	-3,959	-2,284	0	0	-11,655	
1942	0	0	0	-3,760	0	-3,806	-5,524	-2,854	-2,762	-2,284	0	0	-20,990	
1943	0	0	0	0	0	-9,805	-4,972	-5,137	-4,972	-2,284	0	0	-27,170	
1944	0	0	0	0	0	0	0	-32,986	-2,210	-2,284	0	0	-37,480	
1945	0	0	0	0	0	-15,317	-159	-402	10,952	-2,284	0	0	-7,210	
1946	0	0	0	0	0	-13,221	-3,822	-11,009	-2,210	0	0	0	-30,262	
1947	0	0	0	0	0	0	0	-33,729	-2,210	0	0	0	-35,939	
1948	0	0	0	0	0	-5,375	-4,865	-4,609	-14,265	-2,284	0	0	-31,398	
1949	0	0	0	-35	0	2,865	-4,286	-3,647	-9,232	0	0	0	-14,335	
1950	0	0	-4,604	3,429	-15,345	-9,146	-925	-1,303	2,900	-1,388	0	0	-26,382	
1951	0	-10,428	0	0	0	0	-3,018	-1,020	-9,315	-2,284	0	0	-26,065	
1952	0	0	0	-5,099	0	0	0	-21,287	-4,972	-2,284	0	0	-33,642	
1953	0	0	0	0	0	0	-19,840	-2,589	-2,210	-2,284	0	0	-26,923	
1954	0	0	0	0	0	0	0	-33,268	-2,210	0	0	0	-35,478	
1955	0	0	0	0	0	0	-2,361	-4,019	-11,066	0	0	0	-17,446	
1956	0	0	-6,515	0	0	-4,354	-2,808	-8,339	-4,971	-2,284	0	0	-29,271	
1957	0	0	0	0	0	0	0	-34,012	-2,209	-2,284	0	0	-38,505	
1958	0	0	0	0	0	0	0	-15,488	-2,854	-2,284	0	0	-20,626	
1959	0	0	0	0	0	0	-5,886	-16,768	0	0	0	0	-22,654	
1960	0	0	0	0	-3,446	-1,411	-1,528	811	1,675	0	0	0	-3,899	
1961	0	0	-9,388	0	0	0	0	-1,263	0	0	0	0	-10,651	
1962	0	0	0	0	0	0	0	-98,391	-7,734	-2,283	0	0	-108,408	
1963	0	0	15,794	12,440	-28,258	0	0	-29,610	-1,841	-2,284	0	0	-33,759	
1964	0	0	0	0	0	0	-2,303	-12,456	-31,993	0	0	0	-46,752	
1965	0	0	10,157	-5,708	-5,156	-14,516	-1,738	1,308	12,293	-2,284	-2,283	0	-7,927	
1966	0	0	-4,357	0	-1,791	-6,452	-27,091	1,523	-2,210	0	0	0	-40,378	
1967	0	0	0	0	0	-4,509	0	-8,166	0	-2,284	-2,283	0	-17,242	
1968	0	0	0	0	0	0	0	-32,172	-2,209	0	0	0	-34,381	
1969	0	0	0	0	-7,212	-6,516	-7,734	-5,137	-4,972	-2,284	0	0	-33,855	
1970	0	0	0	21,646	-5,953	-17,268	0	-10,645	-2,210	-2,284	0	0	-16,714	
1971	0	0	0	0	0	0	0	-25,223	-2,209	-2,283	0	0	-29,715	
1972	0	0	0	0	0	0	0	-31,740	-2,210	0	0	0	-33,950	
1973	0	0	0	0	0	0	0	-16,677	-2,209	0	0	0	-18,886	
1974	0	0	0	-11,435	0	-8,562	-5,524	-5,138	-4,971	-2,283	0	0	-37,913	
1975	0	0	0	0	0	0	-8,286	917	-1,039	-2,283	0	0	-10,691	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	-88,018	-6,444	-2,284	0	-310	-97,056	
1979	-4,179	0	0	0	0	-19,981	-2,209	-2,283	-2,210	0	0	0	-30,862	
1980	0	0	0	6,872	0	-8,562	-4,972	-5,137	-4,972	-2,284	0	0	-19,055	
1981	0	0	0	0	0	0	-2,209	-12,690	-13,456	0	0	0	-28,355	
1982	0	0	0	0	-13,682	-951	0	-2,854	-2,762	-2,284	-2,283	-2,210	-27,026	
1983	-2,949	-1,841	2,664	0	0	0	0	-5,799	-2,762	-2,284	-2,283	0	-15,254	
1984	-6,014	0	0	0	0	3,935	-197	-14,028	-2,210	-2,283	0	0	-20,797	
1985	0	0	0	0	0	0	0	-7,192	-2,209	0	0	0	-9,401	
1986	0	0	-5,558	1,919	3,643	-17,572	-11,300	-5,137	-4,972	-2,284	0	0	-41,261	
1987	0	0	0	0	0	0	0	-13,616	-11,547	0	0	0	-25,163	
1988	0	0	0	0	13,660	0	-5,580	-2,350	-34,003	-5,001	0	0	-33,274	
1989	0	0	0	0	0	0	-22,867	-34,558	-2,210	0	0	0	-59,635	
1990	0	0	0	0	0	0	0	-10,905	19,882	0	0	-13,914	-4,937	
1991	-5,388	0	-1,522	-7,871	-1,541	0	0	3,054	-29,777	10,725	-8,844	-3,783	-44,947	
1992	0	0	0	0	0	0	30,985	-27,000	0	0	0	0	3,985	
1993	0	5	-13,980	-15,590	-37	-11,382	-9,377	-962	-39,351	-2,284	0	0	-92,958	
1994	0	0	0	0	0	0	0	-30,151	-2,210	0	0	0	-32,361	
1995	0	0	0	0	0	4,567	-9,206	-3,806	-3,682	-2,284	-2,283	0	-16,694	
1996	0	0	0	0	-3,624	0	-6,813	-2,284	-2,210	-2,283	0	0	-17,214	
1997	0	0	0	-12,077	0	0	-13,721	-2,283	-2,210	-2,284	0	0	-32,575	
1998	0	0	0	0	0	-6,861	-7,366	-3,900	-3,775	-2,284	0	0	-24,186	
1999	0	0	0	0	0	-11,416	-3,074	-20,611	-5,093	-2,284	0	0	-42,478	
2000	0	0	0	0	0	0	0	-12,581	-2,210	0	0	0	-14,791	
2001	0	0	0	0	0	0	0	-44,951	-1,904	0	0	0	-46,855	
2002	0	0	0	0	0	0	0	-37,653	-2,210	0	0	0	-39,863	
Avg (21-02)	-226	-150	-460	-463	-1,243	-2,987	-3,703	-13,542	-5,295	-1,173	-247	-247	-29,736	

Figure 2.6-2

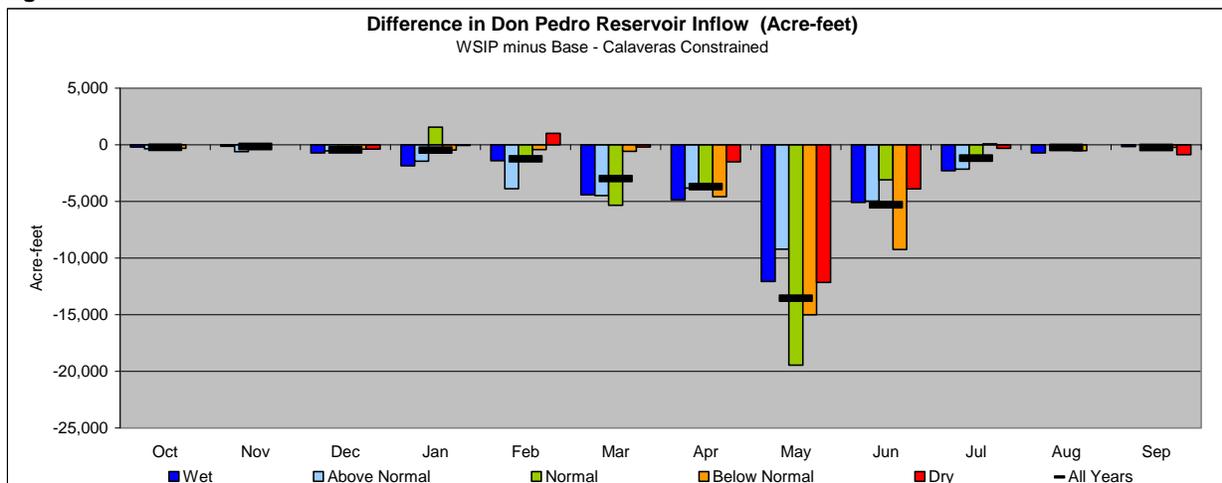


Figure 2.6-1 and Table 2.6-3 illustrate that, during drought sequences, the reduction in inflow to Don Pedro Reservoir can accumulate from year to year. Compared to the base setting, the WSIP would result in lower Don Pedro Reservoir storage during some part of most years, and more predominantly during multi-year drought periods. Figure 2.6-3 illustrates the Don Pedro Reservoir storage for the WSIP setting, averaged by year type. Figure 2.6-4 illustrates the difference in reservoir storage, averaged by year type, in comparing the WSIP and base-Calaveras constrained settings. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 2.6-3 illustrates that, in some years (approximately one-third of the years, i.e., the wettest of years), the storage in Don Pedro Reservoir would not be substantially different, because large inflows to the reservoir during these years would require the management of storage (release of flow above minimum stream requirements) to satisfy flood control requirements. During the other years, the reduction in storage could range from a single year's additional diversions by the SFPUC to over 200,000 acre-feet (1993) from the accumulation of several years of additional diversions by the SFPUC. For example, the greatest draw from reservoir storage occurs during the drought of 1976-1977 (during which the WSIP would not cause an incremental additional draw from storage), and the greatest difference in reservoir draw between the base-Calaveras constrained setting and the WSIP occurs during the year of the 1987-1992 drought.

Figure 2.6-5 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base-Calaveras constrained settings. The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the WSIP would affect releases from La Grange Dam to the stream. A difference in the amount of available reservoir space in the winter and spring due to the WSIP would lead to a difference in the ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow would directly manifest as a change in release from La Grange Dam (a change in either more or less flow). Figure 2.6-1 illustrates the stream release from La Grange Dam for the WSIP and base settings.

Figure 2.6-3

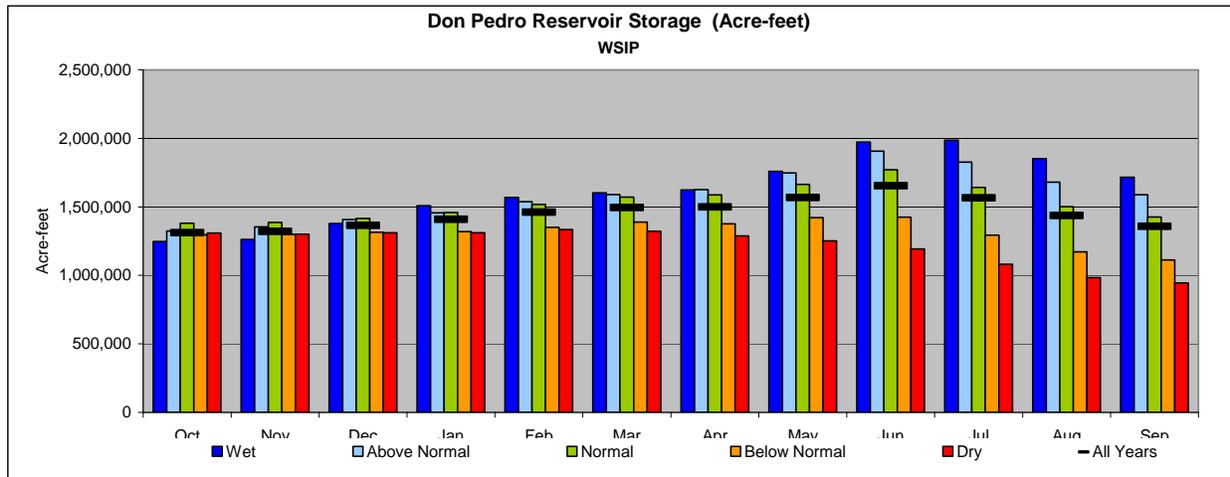


Figure 2.6-4

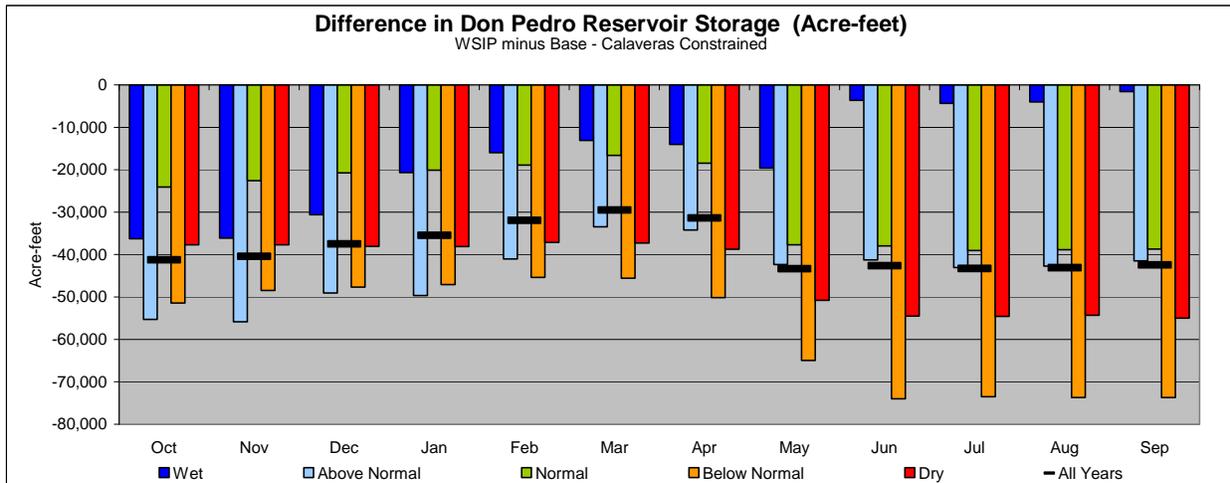
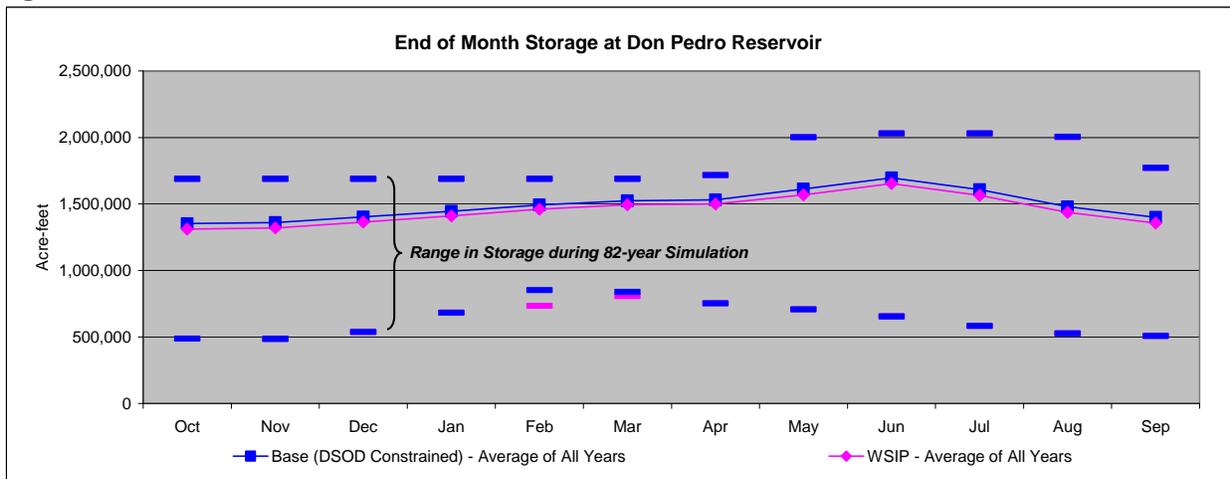


Figure 2.6-5



Supplementing Figure 2.6-1 are Table 2.6-5 and Table 2.6-6, which illustrate the releases to the Tuolumne River from La Grange Dam for the WSIP and base-Calaveras constrained settings. Table 2.6-7 shows the difference in stream releases between the WSIP and base-Calaveras constrained settings. Consistent with the periods showing changes in Don Pedro Reservoir storage, stream releases following the draw down periods would indicate a reduction. The additional depletion of reservoir storage would manifest as a reduction in subsequent releases below La Grange Dam to replenish reservoir storage. The same information shown in Table 2.6-7 is illustrated in Table 2.6-8, arranged in descending order of San Joaquin River index. The differences in releases to the Tuolumne River from La Grange Dam would occur only when there would otherwise be releases in excess of minimum Federal Energy Regulatory Commission (FERC) flow requirements, typically during wetter years. Occasional minor reductions in releases would also occur during winter, when the direct diversion of additional water by the SFPUC would lead to a commensurate reduction in inflow to Don Pedro Reservoir. If Don Pedro Reservoir is passing inflow for flood control, a similar commensurate reduction in release would occur. Table 2.6-7 illustrates the decrease in monthly flow below La Grange Dam that would occur, up to approximately 188,000 acre-feet in one month (June 1993). This reduction is associated with the additional replenishment of Don Pedro Reservoir caused by the additional diversions of the SFPUC during the drought of 1987-1992. The effects of the SFPUC diversions accumulate in Don Pedro Reservoir throughout the drought period. Using an assumption that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day means that the difference in stream release from La Grange Dam between the WSIP and the base-Calaveras-constrained settings would be a delay in releases above minimum FERC flow requirements up to an entire month. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, and, in this instance (the WSIP's affect upon stream releases), an elimination of all flows could occur during this year (rather than an exceedance of minimum FERC flow requirements). Such a large and lengthy reduction in flow would not be common, and would occur only because of the multi-year droughts.

Comparing the WSIP and base-Calaveras constrained settings, Table 2.6-9 illustrates the releases to the Tuolumne River below La Grange Dam; their differences are provided in terms of monthly volumetric flow averaged within year types.

Table 2.6-5

Total La Grange Release to River (Acre-feet)

Water Year	WSIP												WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	12,744	10,711	11,068	11,068	119,250	139,412	75,681	64,123	14,876	15,372	15,372	14,876	504,553
1922	24,397	17,852	18,447	18,447	74,949	114,271	168,922	64,123	477,629	15,372	29,587	56,752	1,080,748
1923	24,397	17,852	67,861	101,025	90,321	37,878	158,031	64,123	14,876	15,372	15,372	14,876	621,984
1924	24,397	17,852	18,447	18,447	16,661	18,447	14,380	14,859	2,975	3,074	3,074	2,975	155,588
1925	7,736	8,926	9,223	9,223	8,331	9,223	70,201	72,541	4,463	4,612	4,612	4,463	213,554
1926	13,240	10,413	10,760	10,760	9,719	10,760	30,499	31,516	4,463	4,612	4,612	4,463	145,817
1927	9,223	8,926	9,223	9,223	8,331	9,223	62,054	64,123	14,876	15,372	15,372	14,876	240,822
1928	24,397	17,852	18,652	21,575	71,119	211,449	35,952	37,150	4,463	4,612	4,612	4,463	456,296
1929	12,744	10,711	11,068	11,068	9,997	11,068	25,929	26,793	2,975	3,074	3,074	2,975	131,476
1930	9,223	8,926	9,223	9,223	8,331	9,223	26,195	27,068	2,975	3,074	3,074	2,975	119,510
1931	9,223	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	95,486
1932	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	14,876	15,372	15,372	14,876	239,335
1933	24,397	17,852	18,447	18,447	16,661	18,447	34,489	35,639	4,463	4,612	4,612	4,463	202,529
1934	9,223	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	95,486
1935	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	14,876	15,372	15,372	14,876	239,335
1936	24,397	17,852	18,447	18,447	155,223	102,499	170,989	64,123	14,876	15,372	15,372	14,876	632,473
1937	24,397	17,852	18,447	18,447	238,549	223,620	177,377	64,123	14,876	15,372	15,372	14,876	843,308
1938	24,397	17,852	99,508	79,596	381,104	454,618	289,194	291,774	231,959	89,978	41,064	95,616	2,096,660
1939	25,528	17,852	28,534	20,573	46,130	73,525	27,601	28,521	4,463	4,612	4,612	4,463	286,414
1940	9,223	8,926	9,223	9,223	49,847	172,147	165,734	64,123	14,876	15,372	15,372	14,876	548,942
1941	24,397	17,852	18,447	68,093	269,269	278,100	249,758	64,123	54,687	15,372	38,718	76,339	1,175,155
1942	24,397	17,852	53,648	153,449	169,872	130,509	216,086	229,147	96,134	39,236	39,175	78,580	1,248,085
1943	24,397	17,852	40,024	197,464	155,298	329,240	197,076	64,123	76,506	15,372	15,372	17,040	1,149,764
1944	24,397	17,852	18,447	18,447	37,057	45,140	46,127	47,665	4,463	4,612	4,612	4,463	273,282
1945	13,240	10,413	10,760	10,760	153,054	165,782	121,381	64,123	14,876	15,372	15,372	14,876	610,009
1946	24,397	36,825	229,316	136,983	185,079	133,267	72,379	64,123	14,876	15,372	15,372	14,876	942,865
1947	24,397	17,852	18,447	18,447	16,661	18,447	27,152	28,057	4,463	4,612	4,612	4,463	187,610
1948	9,223	8,926	9,223	9,223	8,331	9,223	38,569	39,855	4,463	4,612	4,612	4,463	150,723
1949	12,744	10,711	11,068	11,068	9,997	11,068	31,965	33,051	4,463	4,612	4,612	4,463	149,842
1950	12,744	10,711	11,068	11,068	9,997	11,068	59,264	61,239	4,463	4,612	4,612	4,463	205,309
1951	13,240	10,413	201,087	225,258	211,857	136,669	100,446	103,794	4,463	4,612	4,612	4,463	1,020,914
1952	13,240	10,413	10,760	10,760	162,881	122,880	259,828	264,497	234,858	87,333	40,200	91,911	1,309,561
1953	24,397	17,852	18,447	45,961	60,044	22,985	83,992	86,792	4,463	4,612	4,612	4,463	378,620
1954	13,240	10,413	10,760	10,760	9,719	10,760	39,961	41,293	4,463	4,612	4,612	4,463	165,056
1955	13,240	10,413	10,760	10,760	9,719	10,760	30,489	31,505	4,463	4,612	4,612	4,463	145,796
1956	9,223	8,926	27,316	436,179	230,645	165,845	105,870	64,123	158,051	33,028	41,789	86,855	1,367,850
1957	24,397	17,852	18,447	18,447	46,972	18,447	81,508	84,225	4,463	4,612	4,612	4,463	328,445
1958	13,240	10,413	10,760	10,760	14,341	187,337	304,463	269,071	281,406	20,886	40,371	90,848	1,253,696
1959	24,397	17,852	18,447	18,447	71,548	43,235	27,886	28,815	4,463	4,612	4,612	4,463	268,777
1960	9,223	8,926	9,223	9,223	8,331	9,223	24,142	24,947	2,975	3,074	3,074	2,975	115,336
1961	7,736	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	93,999
1962	7,736	8,926	9,223	9,223	8,331	9,223	90,974	94,006	4,463	4,612	4,612	4,463	255,792
1963	13,240	10,413	10,760	10,760	9,719	10,760	62,054	64,123	14,876	15,372	15,372	14,876	252,325
1964	24,397	17,852	18,447	18,447	16,661	18,447	27,261	28,170	4,463	4,612	4,612	4,463	187,832
1965	9,223	8,926	9,223	210,251	211,389	141,209	162,554	64,123	14,876	15,372	15,372	36,063	898,581
1966	24,397	44,828	120,084	51,266	102,057	53,115	31,225	32,266	4,463	4,612	4,612	4,463	477,388
1967	12,744	10,711	11,068	11,068	9,997	106,843	241,982	221,647	393,186	261,291	39,448	104,716	1,424,701
1968	24,397	17,852	18,447	18,447	37,788	34,555	28,042	28,977	4,463	4,612	4,612	4,463	226,655
1969	9,223	8,926	9,223	51,827	276,918	247,910	324,217	450,113	430,359	105,856	42,046	99,739	2,056,357
1970	27,493	23,285	82,113	369,830	146,490	152,248	62,054	64,123	14,876	15,372	15,372	14,876	988,132
1971	24,397	17,852	18,447	18,447	51,836	53,278	63,878	66,007	4,463	4,612	4,612	4,463	332,292
1972	13,240	10,413	10,760	10,760	28,466	10,760	29,559	30,544	2,975	3,074	3,074	2,975	156,600
1973	9,223	8,926	9,223	9,223	8,331	9,223	62,054	64,123	73,119	15,372	15,372	14,876	299,065
1974	24,397	48,640	100,199	143,757	111,341	175,409	126,659	64,123	186,262	15,372	15,372	22,883	1,034,414
1975	24,397	17,852	18,447	18,447	134,788	196,370	104,412	64,123	176,978	15,372	22,420	48,485	842,091
1976	55,557	22,988	33,098	18,447	16,661	18,447	20,107	20,777	2,975	3,074	3,074	2,975	218,180
1977	7,736	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	93,999
1978	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	119,357	15,372	15,372	14,876	343,816
1979	24,397	17,852	18,447	33,234	156,508	190,095	93,045	341,647	14,876	15,372	15,372	14,876	935,721
1980	24,397	17,852	18,447	192,487	376,595	202,895	113,083	107,786	283,094	76,055	39,175	93,167	1,545,033
1981	24,397	17,852	18,447	18,447	19,348	51,333	28,382	29,328	4,463	4,612	4,612	4,463	225,684
1982	12,744	10,711	11,068	51,750	339,671	313,814	510,575	351,576	264,599	84,326	53,224	143,705	2,147,763
1983	226,858	142,160	253,127	268,146	324,750	929,999	277,119	446,281	229,787	240,194	55,448	269,439	3,663,308
1984	35,724	285,481	413,016	228,905	213,251	152,003	62,054	64,123	14,876	15,372	15,372	14,876	1,515,053
1985	24,397	17,852	18,447	18,447	16,661	18,447	33,423	34,537	4,463	4,612	4,612	4,463	200,361
1986	9,223	8,926	9,223	9,223	213,998	423,685	148,537	178,759	202,001	15,372	15,372	14,876	1,249,195
1987	24,397	17,852	18,447	18,447	16,661	18,447	24,245	25,054	2,975	3,074	3,074	2,975	175,648
1988	7,736	8,926	9,223	9,223	8,331	9,223	18,809	19,436	2,975	3,074	3,074	2,975	103,005
1989	7,736	8,926	9,223	9,223	8,331	9,223	25,689	26,546	2,975	3,074	3,074	2,975	116,995
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,351	19,996	2,975	3,074	3,074	2,975	104,107
1991	7,736	8,926	9,223	9,223	8,331	9,223	25,574	26,426	2,975	3,074	3,074	2,975	116,760
1992	7,736	8,926	9,223	9,223	8,331	9,223	19,956	20,621	2,975	3,074	3,074	2,975	105,337
1993	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	14,876	15,372	15,372	14,876	268,695
1994	24,397	17,852	18,447	18,447	16,661	18,447	25,933	26,798	2,975	3,074	3,074	2,975	179,080
1995	9,223	8,926	9,223	9,223	27,784	434,063	274,679	564,368	270,506	382,280	39,175	176,310	2,205,760
1996	24,397	17,852	18,447	18,447	300,445	273,865	140,899	137,734	170,892	15,372	15,372	14,876	1,148,598
1997	24,397	55,332	363,466	950,499	195,855	144,914	62,054	64,123	14,876	15,372	15,372	14,876	1,921,136
1998	24,397	17,852	18,447	38,386	334,716								

Table 2.6-6

Total La Grange Release to River (Acre-feet)													Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	12,744	10,711	11,068	11,068	119,368	155,136	79,399	64,123	14,876	15,372	15,372	14,876	524,113	
1922	24,397	17,852	18,447	18,447	83,736	120,129	176,287	69,807	492,225	15,372	30,271	58,339	1,125,309	
1923	24,397	17,852	67,858	101,025	90,321	37,878	160,240	64,123	14,876	15,372	15,372	14,876	624,190	
1924	24,397	17,852	18,447	18,447	16,661	18,447	14,380	14,859	2,975	3,074	3,074	2,975	155,588	
1925	7,736	8,926	9,223	9,223	8,331	9,223	70,201	72,541	4,463	4,612	4,612	4,463	213,554	
1926	13,240	10,413	10,760	10,760	9,719	10,760	30,499	31,516	4,463	4,612	4,612	4,463	145,817	
1927	9,223	8,926	9,223	9,223	8,331	9,223	62,054	64,123	58,704	15,372	16,016	24,445	294,863	
1928	31,283	49,151	52,916	21,575	71,119	216,788	46,725	37,150	4,463	4,612	4,612	4,463	544,857	
1929	12,744	10,711	11,068	11,068	9,997	11,068	25,929	26,793	2,975	3,074	3,074	2,975	131,476	
1930	9,223	8,926	9,223	9,223	8,331	9,223	26,195	27,068	2,975	3,074	3,074	2,975	119,510	
1931	9,223	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	95,486	
1932	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	14,876	15,372	15,372	14,876	239,335	
1933	24,397	17,852	18,447	18,447	16,661	18,447	34,489	35,639	4,463	4,612	4,612	4,463	202,529	
1934	9,223	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	95,486	
1935	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	14,876	15,372	15,372	14,876	239,335	
1936	24,397	17,852	18,447	18,447	306,637	221,489	176,046	64,123	14,876	15,372	15,372	14,876	907,934	
1937	24,397	17,852	18,447	18,447	253,564	236,700	180,943	64,123	14,876	15,372	15,372	14,876	874,969	
1938	24,397	17,852	118,346	79,596	381,104	454,618	298,338	309,917	236,931	92,262	41,064	95,616	2,150,041	
1939	25,528	17,852	28,534	20,573	46,130	73,525	27,601	28,521	4,463	4,612	4,612	4,463	286,414	
1940	9,223	8,926	9,223	9,223	75,820	191,640	170,122	64,123	14,876	15,372	15,372	14,876	598,796	
1941	24,397	17,852	18,447	67,960	269,787	278,421	250,259	64,123	61,895	15,372	39,401	77,925	1,185,839	
1942	24,397	17,852	53,646	157,210	169,872	134,314	221,610	232,002	98,896	41,519	39,175	78,580	1,269,073	
1943	24,397	17,852	40,024	197,464	155,298	339,045	202,047	64,123	86,600	15,372	15,372	19,308	1,176,902	
1944	24,397	17,852	18,447	18,447	37,055	45,139	46,127	47,665	4,463	4,612	4,612	4,463	273,279	
1945	13,240	10,413	10,760	10,760	175,132	195,817	121,540	64,123	14,876	15,372	15,372	14,876	662,281	
1946	24,397	28,694	229,316	136,983	185,079	146,489	76,200	64,123	14,876	15,372	15,372	14,876	951,777	
1947	24,397	17,852	18,447	18,447	16,661	18,447	27,152	28,057	4,463	4,612	4,612	4,463	187,610	
1948	9,223	8,926	9,223	9,223	8,331	9,223	38,569	39,855	4,463	4,612	4,612	4,463	150,723	
1949	12,744	10,711	11,068	11,068	9,997	11,068	31,965	33,051	4,463	4,612	4,612	4,463	149,842	
1950	12,744	10,711	11,068	11,068	9,997	11,068	59,264	61,239	4,463	4,612	4,612	4,463	205,309	
1951	13,240	10,413	325,365	225,256	211,857	136,669	100,446	103,794	4,463	4,612	4,612	4,463	1,145,190	
1952	13,240	10,413	10,760	10,760	175,164	131,068	259,828	285,785	239,830	89,617	40,200	91,911	1,358,576	
1953	24,397	17,852	18,447	45,961	60,044	22,985	83,992	86,792	4,463	4,612	4,612	4,463	378,720	
1954	13,240	10,413	10,760	10,760	9,719	10,760	39,961	41,293	4,463	4,612	4,612	4,463	165,056	
1955	13,240	10,413	10,760	10,760	9,719	10,760	30,489	31,505	4,463	4,612	4,612	4,463	145,796	
1956	9,223	8,926	110,294	436,177	230,645	170,199	108,677	64,123	171,338	35,311	41,789	86,855	1,473,557	
1957	24,397	17,852	18,447	18,447	46,972	18,447	81,508	84,225	4,463	4,612	4,612	4,463	328,445	
1958	13,240	10,413	10,760	10,760	37,022	196,411	310,506	284,559	284,260	22,969	40,371	90,848	1,312,119	
1959	24,397	17,852	18,447	18,447	71,548	43,235	27,886	28,815	4,463	4,612	4,612	4,463	268,777	
1960	9,223	8,926	9,223	9,223	8,331	9,223	24,142	24,947	2,975	3,074	3,074	2,975	115,336	
1961	7,736	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	93,999	
1962	7,736	8,926	9,223	9,223	8,331	9,223	90,974	94,006	4,463	4,612	4,612	4,463	255,792	
1963	13,240	10,413	10,760	10,760	9,719	10,760	62,054	64,123	14,876	15,372	15,372	14,876	252,325	
1964	35,586	67,343	34,117	36,579	33,150	18,447	27,261	28,170	4,463	4,612	4,612	4,463	298,803	
1965	9,223	8,926	9,223	310,490	217,567	154,689	164,292	64,123	14,876	15,372	15,372	27,153	1,011,306	
1966	24,397	44,842	124,441	51,266	104,206	59,209	31,225	32,266	4,463	4,612	4,612	4,463	490,002	
1967	12,744	10,711	11,068	11,068	9,997	128,580	251,953	229,813	393,186	263,574	39,448	106,995	1,469,137	
1968	24,397	17,852	18,447	18,447	37,786	34,554	28,042	28,977	4,463	4,612	4,612	4,463	226,652	
1969	9,223	8,926	9,223	85,553	284,125	254,425	331,950	455,251	435,331	108,139	42,046	99,739	2,123,931	
1970	27,493	23,285	82,113	348,180	153,636	168,327	62,054	64,123	14,876	15,372	15,372	14,876	989,707	
1971	24,397	17,852	18,447	18,447	60,762	59,228	63,878	66,007	4,463	4,612	4,612	4,463	347,168	
1972	13,240	10,413	10,760	10,760	45,977	10,760	29,559	30,544	2,975	3,074	3,074	2,975	174,111	
1973	9,223	8,926	9,223	9,223	8,331	40,751	65,826	64,123	101,320	15,372	15,372	14,876	362,566	
1974	24,397	48,640	100,199	155,194	111,340	183,971	132,183	69,817	190,678	15,372	15,372	25,151	1,072,314	
1975	24,397	17,852	18,447	18,447	134,786	196,369	112,698	64,123	177,103	15,372	23,104	50,071	852,769	
1976	55,555	22,988	33,098	18,447	16,661	18,447	20,107	20,777	2,975	3,074	3,074	2,975	218,178	
1977	7,736	8,926	9,223	9,223	8,331	9,223	14,380	14,859	2,975	3,074	3,074	2,975	93,999	
1978	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	213,557	15,372	15,372	14,876	438,016	
1979	24,397	17,852	18,447	39,973	156,508	210,076	95,255	343,931	14,876	15,372	15,372	14,876	966,935	
1980	24,397	17,852	18,447	187,788	376,596	211,457	118,055	112,924	288,066	78,339	39,175	93,167	1,566,263	
1981	24,397	17,852	18,447	18,447	19,348	51,333	28,382	29,328	4,463	4,612	4,612	4,463	225,684	
1982	12,744	10,711	11,068	79,596	353,350	314,764	510,575	354,430	267,361	86,609	53,224	148,189	2,202,621	
1983	229,807	144,001	250,463	268,146	324,750	929,999	277,119	452,080	232,549	242,477	55,448	271,717	3,678,556	
1984	41,734	285,481	413,016	228,905	213,251	148,068	62,054	64,123	14,876	15,372	15,372	14,876	1,517,128	
1985	24,397	17,852	18,447	18,447	16,661	18,447	33,423	34,537	4,463	4,612	4,612	4,463	200,361	
1986	9,223	8,926	9,223	9,223	230,324	452,141	159,837	183,896	206,972	15,372	15,372	14,876	1,315,385	
1987	24,397	17,852	18,447	18,447	16,661	18,447	24,245	25,054	2,975	3,074	3,074	2,975	175,648	
1988	7,736	8,926	9,223	9,223	8,331	9,223	18,809	19,436	2,975	3,074	3,074	2,975	103,005	
1989	7,736	8,926	9,223	9,223	8,331	9,223	25,689	26,546	2,975	3,074	3,074	2,975	116,995	
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,351	19,996	2,975	3,074	3,074	2,975	104,107	
1991	7,736	8,926	9,223	9,223	8,331	9,223	25,574	26,426	2,975	3,074	3,074	2,975	116,760	
1992	7,736	8,926	9,223	9,223	8,331	9,223	19,956	20,621	2,975	3,074	3,074	2,975	105,337	
1993	7,736	8,926	9,223	9,223	8,331	9,223	62,054	64,123	202,838	15,372	35,406	80,270	512,725	
1994	24,397	17,852	18,447	18,447	16,661	18,447	25,933	26,798	2,975	3,074	3,074	2,975	179,080	
1995	9,223	8,926	9,223	9,223	46,790	442,165	274,679	577,365	274,189	384,563	39,175	178,588	2,254,109	
1996	24,397	17,852	18,447	18,447	304,065	273,865	147,712	140,017	173,102	15,372	15,372	14,876	1,163,524	
1997	24,397	57,588	363,466	962,577	195,853	144,914	62,054	64,123	14,876	15,372	15,372	14,876	1,935,468	
1998	24,397	17,852	18,447	58,505	334,713	278,508	214,200							

Table 2.6-7

Difference in Total La Grange Release to River (Acre-feet)

WSIP minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	-118	-15,724	-3,718	0	0	0	0	0	-19,560
1922	0	0	0	0	-8,787	-5,858	-7,365	-5,684	-14,596	0	-684	-1,587	-44,561
1923	0	0	3	0	0	0	-2,209	0	0	0	0	0	-2,206
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-43,828	0	-644	-9,569	-54,041
1928	-6,886	-31,299	-34,264	0	0	-5,339	-10,773	0	0	0	0	0	-88,561
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-151,414	-118,990	-5,057	0	0	0	0	0	-275,461
1937	0	0	0	0	-15,015	-13,080	-3,566	0	0	0	0	0	-31,661
1938	0	0	-18,838	0	0	0	-9,144	-18,143	-4,972	-2,284	0	0	-53,381
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-25,973	-19,493	-4,388	0	0	0	0	0	-49,854
1941	0	0	0	133	-518	-321	-501	0	-7,208	0	-683	-1,586	-10,684
1942	0	0	2	-3,761	0	-3,805	-5,524	-2,855	-2,762	-2,283	0	0	-20,988
1943	0	0	0	0	0	-9,805	-4,971	0	-10,094	0	0	-2,268	-27,138
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1945	0	0	0	0	-22,078	-30,035	-159	0	0	0	0	0	-52,272
1946	0	8,131	0	0	0	-13,222	-3,821	0	0	0	0	0	-8,912
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-124,278	2	0	0	0	0	0	0	0	0	-124,276
1952	0	0	0	0	-12,283	-8,188	0	-21,288	-4,972	-2,284	0	0	-49,015
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-82,978	2	0	-4,354	-2,807	0	-13,287	-2,283	0	0	-105,707
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-22,681	-9,074	-6,043	-15,488	-2,854	-2,283	0	0	-58,423
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-49,491	-15,670	-18,132	-16,489	0	0	0	0	0	0	0	-110,971
1965	0	0	0	-100,239	-6,178	-13,480	-1,738	0	0	0	0	8,910	-112,725
1966	0	-14	-4,357	0	-2,149	-6,094	0	0	0	0	0	0	-12,614
1967	0	0	0	0	0	-21,737	-9,971	-8,166	0	-2,283	0	-2,279	-44,436
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1969	0	0	0	-33,726	-7,207	-6,515	-7,733	-5,138	-4,972	-2,283	0	0	-67,574
1970	0	0	0	21,650	-7,146	-16,079	0	0	0	0	0	0	-1,575
1971	0	0	0	0	-8,926	-5,950	0	0	0	0	0	0	-14,876
1972	0	0	0	0	-17,511	0	0	0	0	0	0	0	-17,511
1973	0	0	0	0	0	-31,528	-3,772	0	-28,201	0	0	0	-63,501
1974	0	0	0	-11,437	1	-8,562	-5,524	-5,694	-4,416	0	0	-2,268	-37,900
1975	0	0	0	0	2	1	-8,286	0	-125	0	-684	-1,586	-10,678
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-94,200	0	0	0	-94,200
1979	0	0	0	-6,739	0	-19,981	-2,210	-2,284	0	0	0	0	-31,214
1980	0	0	0	4,699	-1	-8,562	-4,972	-5,138	-4,972	-2,284	0	0	-21,230
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-27,846	-13,679	-950	0	-2,854	-2,762	-2,283	0	-4,484	-54,858
1983	-2,949	-1,841	2,664	0	0	0	0	-5,799	-2,762	-2,283	0	-2,278	-15,248
1984	-6,010	0	0	0	0	3,935	0	0	0	0	0	0	-2,075
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-16,326	-28,456	-11,300	-5,137	-4,971	0	0	0	-66,190
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-187,962	0	-16,883	-39,185	-244,030
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-19,006	-8,102	0	-12,997	-3,683	-2,283	0	-2,278	-48,349
1996	0	0	0	0	-3,620	0	-6,813	-2,283	-2,210	0	0	0	-14,926
1997	0	-2,256	0	-12,078	2	0	0	0	0	0	0	0	-14,332
1998	0	0	0	-20,119	3	-6,861	-8,839	-2,430	-3,774	-2,283	0	0	-44,303
1999	0	0	0	0	0	-11,417	-3,074	0	-16,264	0	0	0	-30,755
2000	0	0	0	0	-11,491	0	0	0	-14,755	0	0	0	-26,246
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-330	-936	-3,387	-2,532	-4,739	-5,459	-1,759	-1,480	-5,861	-334	-239	-737	-27,793

Table 2.6-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

WSIP minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	-2,949	-1,841	2,664	0	0	0	0	-5,799	-2,762	-2,283	0	-2,278	-15,248
1969	0	0	0	-33,726	-7,207	-6,515	-7,733	-5,138	-4,972	-2,283	0	0	-67,574
1995	0	0	0	0	-19,006	-8,102	0	-12,997	-3,683	-2,283	0	-2,278	-48,349
1938	0	0	-18,838	0	0	0	-9,144	-18,143	-4,972	-2,284	0	0	-53,381
1998	0	0	0	-20,119	3	-6,861	-8,839	-2,430	-3,774	-2,283	0	0	-44,303
1982	0	0	0	-27,846	-13,679	-950	0	-2,854	-2,762	-2,283	0	-4,484	-54,858
1967	0	0	0	0	0	-21,737	-9,971	-8,166	0	-2,283	0	-2,279	-44,436
1952	0	0	0	0	-12,283	-8,188	0	-21,288	-4,972	-2,284	0	0	-49,015
1958	0	0	0	0	-22,681	-9,074	-6,043	-15,488	-2,854	-2,283	0	0	-58,423
1980	0	0	0	4,699	-1	-8,562	-4,972	-5,138	-4,972	-2,284	0	0	-21,230
1978	0	0	0	0	0	0	0	0	-94,200	0	0	0	-94,200
1922	0	0	0	0	-8,787	-5,858	-7,365	-5,684	-14,596	0	-684	-1,587	-44,561
1956	0	0	-82,978	2	0	-4,354	-2,807	0	-13,287	-2,283	0	0	-105,707
1942	0	0	2	-3,761	0	-3,805	-5,524	-2,855	-2,762	-2,283	0	0	-20,988
1941	0	0	0	133	-518	-321	-501	0	-7,208	0	-683	-1,586	-10,684
1986	0	0	0	0	-16,326	-28,456	-11,300	-5,137	-4,971	0	0	0	-66,190
1993	0	0	0	0	0	0	0	0	-187,962	0	-16,883	-39,185	-244,030
1997	0	-2,256	0	-12,078	2	0	0	0	0	0	0	0	-14,332
1996	0	0	0	0	-3,620	0	-6,813	-2,283	-2,210	0	0	0	-14,926
1943	0	0	0	0	0	-9,805	-4,971	0	-10,094	0	0	-2,268	-27,138
1937	0	0	0	0	-15,015	-13,080	-3,566	0	0	0	0	0	-31,661
1974	0	0	0	-11,437	1	-8,562	-5,524	-5,694	-4,416	0	0	-2,268	-37,900
1975	0	0	0	0	2	1	-8,286	0	-125	0	-684	-1,586	-10,678
1965	0	0	0	-100,239	-6,178	-13,480	-1,738	0	0	0	0	8,910	-112,725
1936	0	0	0	0	-151,414	-118,990	-5,057	0	0	0	0	0	-275,461
1984	-6,010	0	0	0	0	3,935	0	0	0	0	0	0	-2,075
1979	0	0	0	-6,739	0	-19,981	-2,210	-2,284	0	0	0	0	-31,214
1945	0	0	0	0	-22,078	-30,035	-159	0	0	0	0	0	-52,272
1999	0	0	0	0	0	-11,417	-3,074	0	-16,264	0	0	0	-30,755
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-43,828	0	-644	-9,569	-54,041
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	8,131	0	0	0	-13,222	-3,821	0	0	0	0	0	-8,912
1973	0	0	0	0	0	-31,528	-3,772	0	-28,201	0	0	0	-63,501
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	-11,491	0	0	0	-14,755	0	0	0	-26,246
1940	0	0	0	0	-25,973	-19,493	-4,388	0	0	0	0	0	-49,854
1923	0	0	3	0	0	0	-2,209	0	0	0	0	0	-2,206
1921	0	0	0	0	-118	-15,724	-3,718	0	0	0	0	0	-19,560
1970	0	0	0	21,650	-7,146	-16,079	0	0	0	0	0	0	-1,575
1951	0	0	-124,278	2	0	0	0	0	0	0	0	0	-124,276
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	-8,926	-5,950	0	0	0	0	0	0	-14,876
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	-6,886	-31,299	-34,264	0	0	-5,339	-10,773	0	0	0	0	0	-88,561
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-14	-4,357	0	-2,149	-6,094	0	0	0	0	0	0	-12,614
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-49,491	-15,670	-18,132	-16,489	0	0	0	0	0	0	0	-110,971
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-17,511	0	0	0	0	0	0	0	-17,511
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.6-9

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	26,382	22,058	48,559	124,381	190,492	245,312	199,367	189,426	200,479	78,816	30,940	75,154	1,431,366
Above Normal	17,953	30,672	68,307	78,195	120,577	105,010	91,605	82,782	18,190	14,739	14,739	14,263	657,034
Below Normal	17,484	16,058	22,757	19,559	35,316	38,748	56,136	58,008	4,463	4,612	4,612	4,463	282,217
Dry	20,742	15,449	16,739	16,127	24,181	25,876	29,552	30,537	4,349	4,494	4,494	4,349	196,887
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,126	19,875	36,808	60,307	91,806	105,614	94,241	90,065	64,371	28,111	14,098	26,876	652,299

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	26,505	22,228	52,690	132,897	195,713	251,883	203,746	194,388	216,210	79,958	31,729	77,274	1,485,222
Above Normal	18,307	30,194	75,617	77,318	133,414	121,042	93,276	82,916	24,252	14,739	14,777	14,826	700,678
Below Normal	18,058	18,668	25,976	19,559	36,239	40,197	57,034	58,008	4,463	4,612	4,612	4,463	291,887
Dry	21,603	19,256	17,945	17,522	26,796	25,876	29,552	30,537	4,349	4,494	4,494	4,349	206,770
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,249
All Years	20,456	20,812	40,195	62,838	96,544	111,073	96,000	91,545	70,232	28,445	14,337	27,614	680,091

Difference in Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	-123	-171	-4,131	-8,516	-5,221	-6,571	-4,379	-4,962	-15,731	-1,142	-789	-2,120	-53,856
Above Normal	-354	478	-7,310	877	-12,836	-16,031	-1,671	-134	-6,062	0	-38	-563	-43,644
Below Normal	-574	-2,609	-3,218	0	-923	-1,449	-898	0	0	0	0	0	-9,671
Dry	-861	-3,807	-1,205	-1,395	-2,615	0	0	0	0	0	0	0	-9,883
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-330	-936	-3,387	-2,532	-4,739	-5,459	-1,759	-1,480	-5,861	-334	-239	-737	-27,793

2.7 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

Compared to the base-Calaveras constrained setting, Calaveras Reservoir operations would substantively change in the WSIP setting. With the restoration of Calaveras Reservoir operating capacity, the reservoir would operate with a larger storage capacity. Compared to the base-Calaveras unconstrained setting, the WSIP operation of Calaveras Reservoir would generally be the same, but its range of reservoir fluctuation would typically be less. Figure 2.7-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 2.7-1 are the results for the WSIP and base settings.

The current operation of Calaveras Reservoir (base-Calaveras constrained setting) is modeled to be greatly constrained, to vary only within a limited storage range. Although a within-year cyclic operation occurs for the conservation of local watershed runoff, there is relatively little reservoir storage available for year-to-year carryover and multi-year drought use. In the WSIP setting, a greater within-year cyclic operation occurs, providing for a greater use of local watershed runoff. Also, during prolonged periods of drought (i.e., multiple years in duration), reservoir storage would be drawn to supplement runoff available to the regional system and other water supply resources.

When compared to the base-Calaveras unconstrained setting, the WSIP operation retains greater storage within a year and for longer periods during a drought. Although greater purchase requests and a greater level of water supply delivery occur in the WSIP setting, Calaveras Reservoir storage would incidentally be operated “fuller” than before. Within a year, more storage would be retained in Calaveras Reservoir during the summer because of additional conveyance capacity in the SJPL, lessening the burden of storage releases from the Bay Area reservoirs. Although the target storage (operational buffer) for the fall draw down of the reservoir would sometimes result in the same amount of storage in either setting, storage during the summer in the WSIP setting would be greater, for a longer period of time. Retained storage also occurs in the WSIP setting because of the reduced use of Calaveras Reservoir and San Antonio Reservoir supplies for the maintenance of desired minimum water production at Sunol Valley Water Treatment Plant (Sunol Valley WTP). In the WSIP setting, water required for Sunol Valley WTP production can be acquired from the SJPL.

Figure 2.7-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base-Calaveras constrained settings. Figure 2.7-3 illustrates the same form of information for the WSIP and base-Calaveras unconstrained settings.

Figure 2.7-1
Calaveras Reservoir Storage and Stream Release

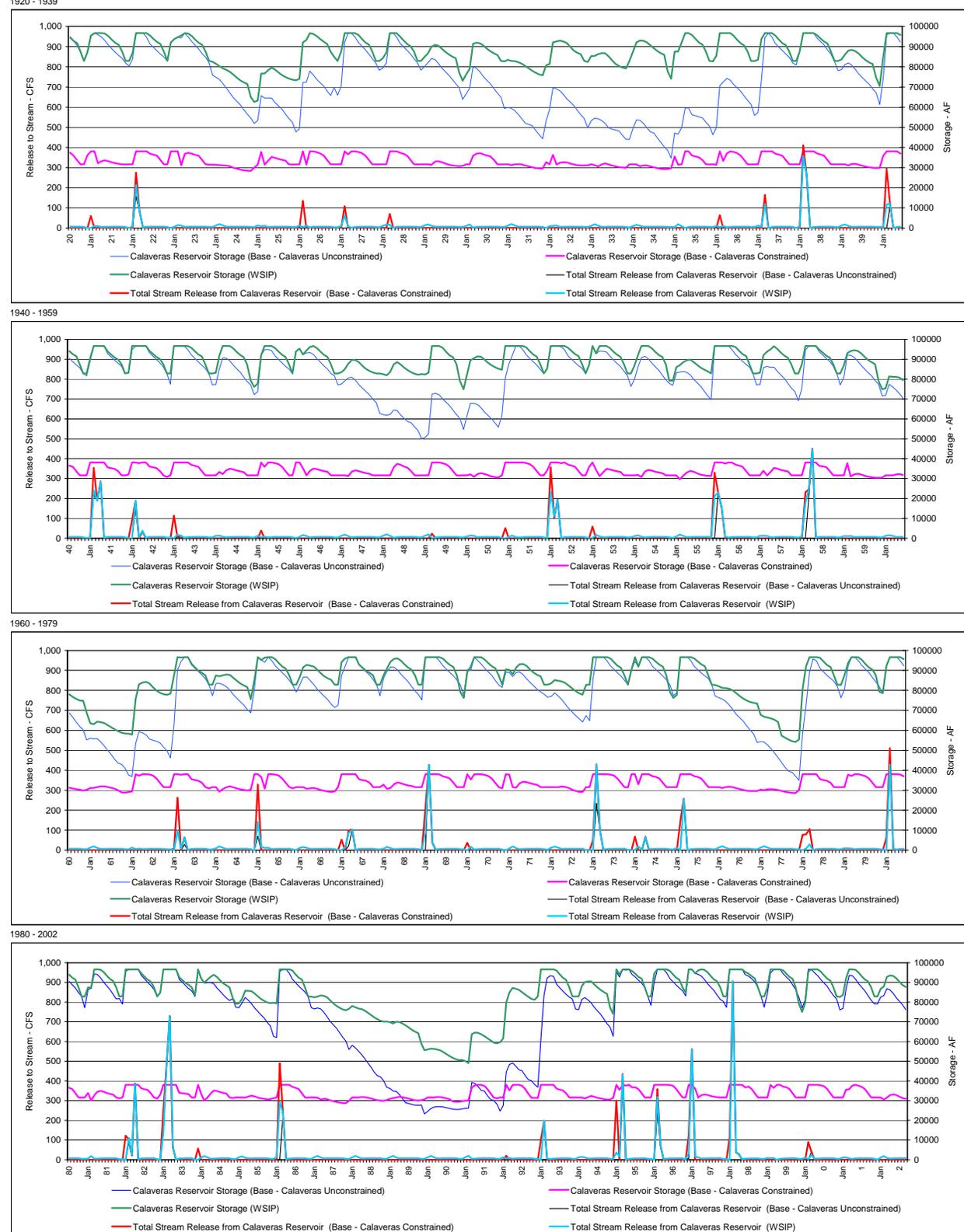


Figure 2.7-2

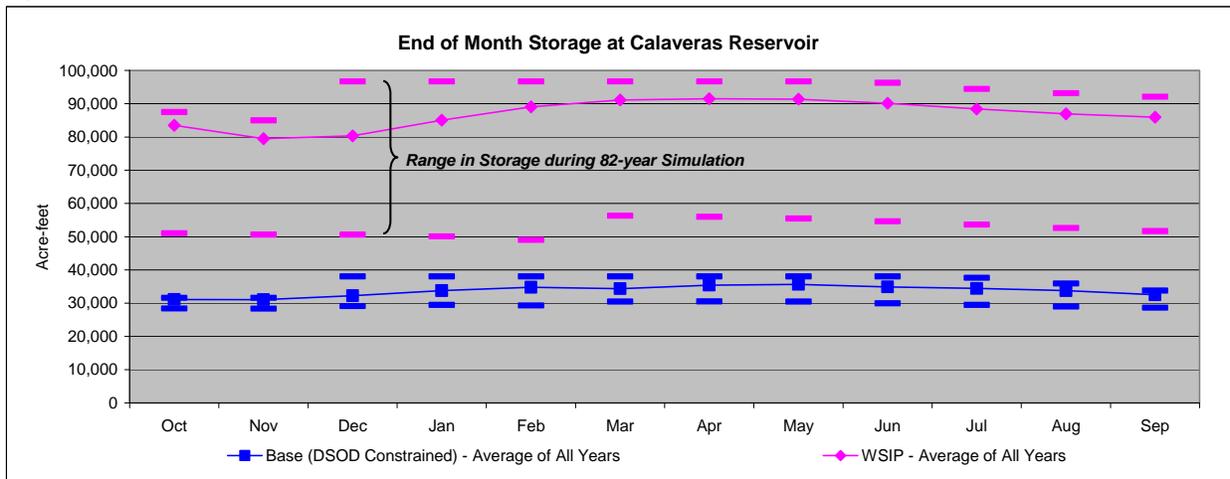
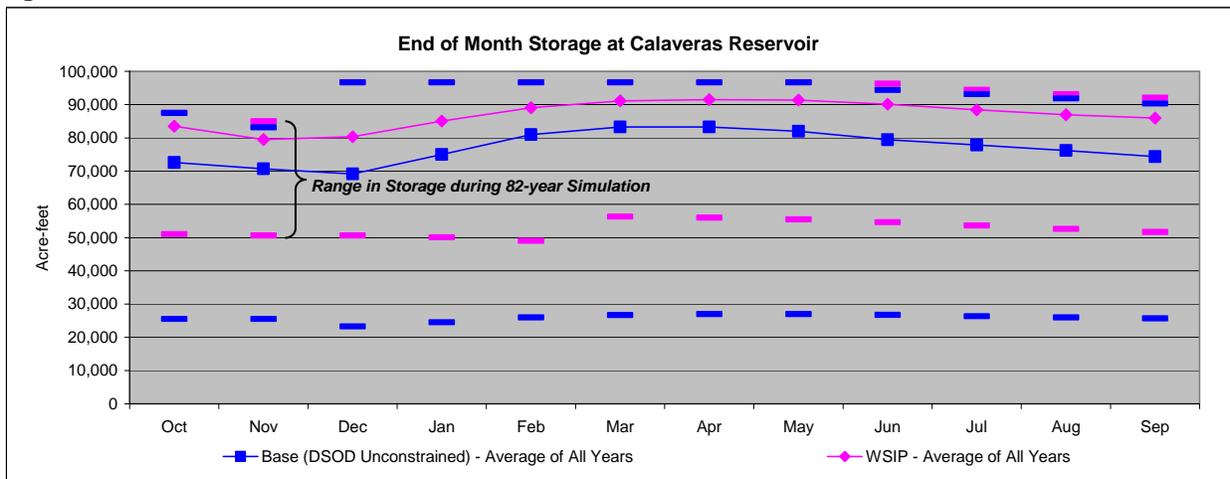


Figure 2.7-3



In the WSIP setting (as compared to the base-Calaveras constrained setting), there would be two categorical changes in releases to Calaveras Creek below Calaveras Dam: the addition of flows representing the flow objectives associated with the 1997 Memorandum of Understanding (MOU); and the reduction of stream releases during wetter-year/wetter-season flows due to the restored operational capacity of Calaveras Reservoir. Supplementing the Figure 2.7-1 representation of Calaveras Dam stream releases is Table 2.7-1, illustrating releases for the WSIP and base-Calaveras constrained settings and the difference in releases between the two.

Table 2.7-2 illustrates the same form of information for Calaveras Dam releases to the stream in comparing the WSIP setting to the base-Calaveras unconstrained setting. The difference in releases between the settings is, again, the result of two factors: the additional flows representing the flow objectives associated with the 1997 MOU; and the reduction of stream releases during wetter-year/wetter-season flows due to restored Calaveras Reservoir operational capacity.

Compared to the base-Calaveras constrained setting, diversions from Alameda Creek to Calaveras Reservoir would increase in the WSIP setting. With the current constraints on Calaveras Reservoir storage, diversions to Calaveras Creek are rejected. With the restoration of operational storage in the reservoir, the opportunity to divert water into the reservoir would increase.

Table 2.7-1

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	1,065	5,085	15,137	10,007	5,085	255	387	417	425	415	38,955
Above Normal	425	258	172	811	3,666	2,849	637	327	396	423	428	417	10,808
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	387	1,558	4,240	2,921	1,321	350	403	426	428	417	13,149

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	-671	-4,136	-1,504	39	61	255	387	417	425	415	-3,636
Above Normal	425	258	-12	-1,920	-2,246	-247	178	327	396	423	428	417	-1,574
Normal	429	275	-22	184	-157	204	264	370	408	428	430	417	3,231
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	-32	-878	-404	265	245	350	403	426	428	417	1,918

Table 2.7-2

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	1,065	5,085	15,137	10,007	5,085	255	387	417	425	415	38,955
Above Normal	425	258	172	811	3,666	2,849	637	327	396	423	428	417	10,808
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	387	1,558	4,240	2,921	1,321	350	403	426	428	417	13,149

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	29	4,472	12,303	9,322	4,975	0	0	0	0	0	31,102
Above Normal	0	0	0	253	1,312	2,035	309	0	0	0	0	0	3,910
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	6	925	2,673	2,241	1,035	0	0	0	0	0	6,879

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	1,036	613	2,834	685	110	255	387	417	425	415	7,853
Above Normal	425	258	172	558	2,353	814	328	327	396	423	428	417	6,898
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	382	634	1,568	680	286	350	403	426	428	417	6,270

To provide a context to the amount of water diverted at Alameda Creek Diversion Dam, Table 2.7-3 illustrates the estimated runoff (inflow) to the dam, averaged by year type. Table 2.7-4 compares diversions to Calaveras Reservoir in the WSIP and base-Calaveras constrained settings. An increase in diversions during the winter season due to WSIP operation would generally occur during normal or wetter year types, as reservoir storage space would accommodate diversions. During summer in all years and during all periods in below normal and normal years, diversions would continue as they do currently. A few exceptions would occur when diversions would be reduced from that of the base-Calaveras constrained setting.

Table 2.7-3

Total Inflow to ACDD (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	7	156	2,472	7,382	8,284	6,064	3,608	1,035	227	42	18	12	29,308
Above Normal	18	183	1,817	4,394	5,619	3,692	1,976	542	139	23	11	7	18,420
Normal	7	41	1,589	1,840	2,684	2,029	939	332	87	8	5	3	9,564
Below Normal	7	42	554	1,069	1,689	1,271	395	246	64	6	4	3	5,350
Dry	7	16	222	314	531	382	238	124	38	3	3	2	1,880
All Years	9	88	1,327	2,993	3,759	2,683	1,425	454	111	17	8	5	12,880

Table 2.7-4

Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	7	128	1,093	1,210	302	314	647	919	227	42	18	12	12	4,919
Above Normal	11	159	1,117	1,861	1,601	597	1,007	542	139	23	11	7	7	7,076
Normal	9	37	1,229	1,691	1,791	1,618	881	326	96	8	5	3	3	7,695
Below Normal	8	44	541	1,029	1,584	1,279	393	259	68	9	5	4	4	5,224
Dry	7	16	205	318	367	487	232	126	38	3	3	2	2	1,805
All Years	8	78	837	1,227	1,141	861	634	434	113	17	8	6	6	5,363

Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	7	128	1,093	415	185	307	637	904	227	42	18	12	12	3,977
Above Normal	11	159	633	722	326	596	1,284	542	139	23	11	7	7	4,453
Normal	9	37	691	1,087	899	1,172	872	326	96	8	5	3	3	5,205
Below Normal	8	44	541	1,029	1,584	1,279	393	259	68	9	5	4	4	5,224
Dry	7	16	205	318	367	487	232	126	38	3	3	2	2	1,805
All Years	8	78	632	718	679	772	687	431	113	17	8	6	6	4,150

Difference in Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)													WSIP minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	794	117	6	10	15	0	0	0	0	0	942
Above Normal	0	0	484	1,140	1,275	1	-277	0	0	0	0	0	0	2,623
Normal	0	0	537	604	892	447	10	0	0	0	0	0	0	2,490
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	205	509	461	89	-54	3	0	0	0	0	0	1,213

Table 2.7-5 illustrates the same form of information in comparing diversions to Calaveras Reservoir between the WSIP and base-Calaveras unconstrained settings. In this comparison, less water would be diverted to Calaveras Reservoir in the WSIP setting, because of the greater amount of storage retained by the reservoir than in the base-Calaveras unconstrained setting. As described above with regard to Calaveras Reservoir storage, even with an increase in deliveries and releases for the downstream fishery the reduction in Sunol Valley WTP diversions would result in a greater retention of storage in the reservoir. A fuller reservoir would result in a greater frequency of periods when diversions from Alameda Creek would be rejected.

Table 2.7-5

Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	7	128	1,093	1,210	302	314	647	919	227	42	18	12	12	4,919
Above Normal	11	159	1,117	1,861	1,601	597	1,007	542	139	23	11	7	7	7,076
Normal	9	37	1,229	1,691	1,791	1,618	881	326	96	8	5	3	3	7,695
Below Normal	8	44	541	1,029	1,584	1,279	393	259	68	9	5	4	4	5,224
Dry	7	16	205	318	367	487	232	126	38	3	3	2	2	1,805
All Years	8	78	837	1,227	1,141	861	634	434	113	17	8	6	6	5,363

Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)													Base - Calaveras Unconstrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Unconstrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	7	128	1,093	2,252	302	314	647	861	227	42	18	12	12	5,904
Above Normal	11	159	1,338	2,464	2,772	1,284	1,114	542	139	23	11	7	7	9,864
Normal	9	37	1,268	1,691	2,014	1,731	894	326	96	8	5	3	3	8,082
Below Normal	8	44	541	1,029	1,584	1,279	393	259	68	9	5	4	4	5,224
Dry	7	16	205	318	367	487	232	126	38	3	3	2	2	1,805
All Years	8	78	890	1,556	1,427	1,025	658	422	113	17	8	6	6	6,209

Difference in Calaveras Reservoir Inflow from Upper Alameda Creek (Acre-feet)													WSIP minus Base - Calaveras Unconstrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Unconstrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	-1,042	0	0	0	58	0	0	0	0	0	-985
Above Normal	0	0	-221	-603	-1,170	-687	-107	0	0	0	0	0	0	-2,788
Normal	0	0	-39	0	-223	-113	-13	0	0	0	0	0	0	-388
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-53	-328	-286	-164	-25	11	0	0	0	0	0	-846

Commensurate with changes in diversions from Alameda Creek to Calaveras Reservoir would be changes to the flow below the Alameda Creek Diversion Dam. Table 2.7-6 illustrates the flow below the Alameda Creek Diversion Dam for the WSIP and base-Calaveras constrained settings. Table 2.7-6 illustrates that, opposed to diversions to Calaveras Reservoir, flow passing Alameda Creek Diversion Dam would decrease in the WSIP setting. With operational capacity restored at Calaveras Reservoir, there would be more opportunity (and need) to divert Alameda Creek flows; thus, flow passing the dam would be reduced.

Comparing the WSIP and base-Calaveras unconstrained setting, there would more flow passing Alameda Creek Diversion Dam in the WSIP setting. As described above concerning diversions of these settings, a

more frequent rejection of the diversions in the WSIP setting would occur than in the base-Calaveras unconstrained setting. Table 2.7-7 illustrates these modeling results.

The increase or decrease in flow passing the Alameda Creek Diversion Dam would occur non-systematically, not necessarily at the beginning or end of a winter season. The month (or shorter period) during which the change would occur would be governed by the coincidence of many factors, including reservoir storage, system-wide conveyance maintenance, and current hydrology.

Table 2.7-6

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389	
Above Normal	7	23	700	2,532	4,017	3,095	969	0	0	0	0	0	11,345	
Normal	0	6	377	264	893	459	117	6	0	0	0	0	2,122	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	495	1,790	2,618	1,893	803	24	0	0	0	0	7,636	

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331	
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968	
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	-794	-117	-6	-10	-15	0	0	0	0	-942	
Above Normal	0	0	-484	-1,140	-1,275	-1	277	0	0	0	0	0	-2,623	
Normal	0	0	-537	-604	-892	-447	-10	0	0	0	0	0	-2,490	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-205	-509	-461	-89	54	-3	0	0	0	0	-1,213	

Table 2.7-7

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389	
Above Normal	7	23	700	2,532	4,017	3,095	969	0	0	0	0	0	11,345	
Normal	0	6	377	264	893	459	117	6	0	0	0	0	2,122	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	495	1,790	2,618	1,893	803	24	0	0	0	0	7,636	

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Unconstrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	5,130	7,982	5,751	2,962	173	0	0	0	0	23,405	
Above Normal	7	23	479	1,929	2,847	2,408	863	0	0	0	0	0	8,556	
Normal	0	6	338	264	670	346	104	6	0	0	0	0	1,734	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	441	1,462	2,332	1,728	778	35	0	0	0	0	6,790	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Unconstrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	1,042	0	0	0	-58	0	0	0	0	985	
Above Normal	0	0	221	603	1,170	687	107	0	0	0	0	0	2,788	
Normal	0	0	39	0	223	113	13	0	0	0	0	0	388	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	53	328	286	164	25	-11	0	0	0	0	846	

Flow below the confluence of Alameda Creek and Calaveras Creek is affected by releases from Calaveras Dam to the stream, flow passing Alameda Creek Diversion Dam, and unregulated flow below Alameda Creek Diversion Dam and Calaveras Dam. Table 2.7-8 illustrates the flow below the confluence for the WSIP and base-Calaveras constrained settings, and the difference in inflow between the two. The notable differences between the WSIP and the base-Calaveras constrained settings are the addition of stream flows representing the 1997 MOU and the reduction of wetter-year/wet-season flows due to the restoration of Calaveras Reservoir storage.

Table 2.7-8

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	430	326	2,789	12,266	24,307	16,744	8,649	548	417	430	430	417	67,751
Above Normal	437	327	1,116	3,941	8,459	6,506	1,917	430	417	430	430	417	24,826
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502
All Years	431	310	1,062	3,758	7,388	5,246	2,360	454	417	430	430	417	22,703

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep	WY Total
Wet	1	80	3,460	17,197	25,928	16,711	8,598	307	30	12	4	2	72,329
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023
Normal	1	29	1,356	1,501	3,053	1,586	284	65	9	2	0	0	7,886
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457
All Years	3	41	1,298	5,145	8,254	5,069	2,061	107	14	4	1	1	21,999

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base - Calaveras Constrained Sep	WY Total
Wet	429	246	-671	-4,930	-1,621	33	51	241	387	417	425	415	-4,578
Above Normal	425	258	-496	-3,060	-3,520	-248	454	327	396	423	428	417	-4,197
Normal	429	275	-559	-420	-1,049	-243	255	370	408	428	430	417	741
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	-237	-1,387	-865	177	298	347	403	426	428	417	704

Table 2.7-9 illustrates the same form of information in comparing flows below the confluence for the WSIP and base-Calaveras unconstrained settings. As described above, in the WSIP setting, Calaveras Reservoir would retain more storage than in the base-Calaveras unconstrained setting, which would lead to additional rejection of water from Alameda Creek and an increase in spills of Calaveras Creek water from Calaveras Reservoir. In combination with fishery releases from Calaveras Dam to Calaveras Creek, more flow in all years would occur below the confluence.

Table 2.7-9

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	430	326	2,789	12,266	24,307	16,744	8,649	548	417	430	430	417	67,751
Above Normal	437	327	1,116	3,941	8,459	6,506	1,917	430	417	430	430	417	24,826
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502
All Years	431	310	1,062	3,758	7,388	5,246	2,360	454	417	430	430	417	22,703

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Unconstrained Sep	WY Total
Wet	1	80	1,752	10,611	21,473	16,059	8,539	350	30	12	4	2	58,913
Above Normal	12	68	723	2,780	4,936	5,005	1,482	103	22	6	2	1	15,139
Normal	1	29	564	533	1,056	674	262	65	9	2	0	0	3,194
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457
All Years	3	41	626	2,796	5,535	4,401	2,049	115	14	4	1	1	15,587

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP minus Base - Calaveras Unconstrained Sep	WY Total
Wet	429	246	1,036	1,655	2,834	685	110	198	387	417	425	415	8,838
Above Normal	425	258	393	1,161	3,524	1,501	434	327	396	423	428	417	9,687
Normal	429	275	234	548	948	669	277	370	408	428	430	417	5,434
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	435	962	1,854	845	310	338	403	426	428	417	7,116

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the WSIP setting. This facility is assumed to recapture flows explicitly released from Calaveras Dam in the representation of the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir. Flows below this diversion have been estimated and noted as the flow above the Alameda and San Antonio Creek confluence. Table 2.7-10 illustrates the flow at this location for the WSIP and base-Calaveras constrained settings. The flows identified at this location indicate flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated unregulated stream accretions between the Alameda-Calaveras Creek confluence and the Alameda-San Antonio Creek confluence minus the water assumed to be recaptured (diverted) by the SFPUC from the creek. The same form of information is illustrated in Table 2.7-11 in comparing the WSIP and base-Calaveras unconstrained settings.

Table 2.7-10

Alameda Creek Flow abv San Antonio Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,180	13,613	25,832	17,847	9,299	498	76	33	15	9	70,563
Above Normal	19	150	1,312	4,459	9,146	6,916	2,168	217	54	20	9	6	24,477
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,128	3,862	7,502	5,333	2,407	197	38	14	7	4	20,588

Alameda Creek Flow abv San Antonio Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	-788	-5,055	-1,860	-131	-59	-15	0	0	0	0	-7,907
Above Normal	0	0	-668	-3,360	-3,914	-550	306	0	0	0	0	0	-8,186
Normal	0	0	-753	-968	-1,774	-738	-10	0	0	0	0	0	-4,244
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-439	-1,872	-1,521	-284	50	-3	0	0	0	0	-4,068

Table 2.7-11

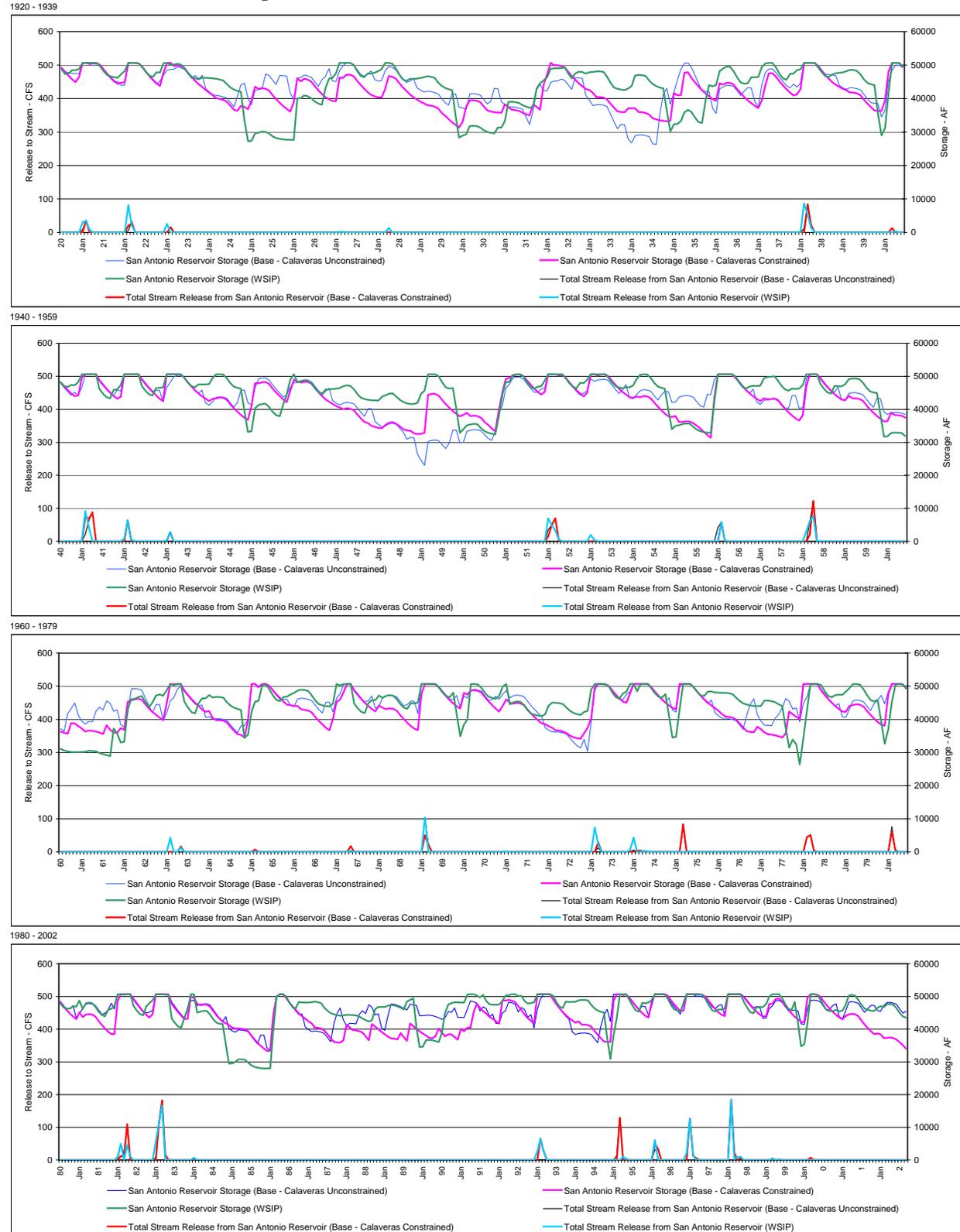
Alameda Creek Flow abv San Antonio Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,180	13,613	25,832	17,847	9,299	498	76	33	15	9	70,563
Above Normal	19	150	1,312	4,459	9,146	6,916	2,168	217	54	20	9	6	24,477
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,128	3,862	7,502	5,333	2,407	197	38	14	7	4	20,588

Alameda Creek Flow abv San Antonio Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	2,261	12,082	23,237	17,326	9,299	556	76	33	15	9	65,054
Above Normal	19	150	1,091	3,597	6,016	5,718	1,881	217	54	20	9	6	18,780
Normal	7	64	883	913	1,614	1,095	456	134	28	9	4	3	5,209
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	895	3,384	6,303	4,949	2,345	208	38	14	7	4	18,244

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	920	1,531	2,594	521	0	-58	0	0	0	0	5,508
Above Normal	0	0	221	862	3,130	1,199	286	0	0	0	0	0	5,698
Normal	0	0	39	0	223	174	13	0	0	0	0	0	449
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	233	477	1,199	384	62	-11	0	0	0	0	2,344

The difference in San Antonio Reservoir storage between the WSIP and base-Calaveras constrained settings is the result of several factors, and is predominantly due to the restoration of the operational capacity of Calaveras Reservoir, the use of SJPL flow for maintenance of Sunol Valley WTP production, and the maintenance of Hetch Hetchy conveyance. Figure 2.7-4 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from the dam. Shown in Figure 2.7-4 are the results for the WSIP and base settings. In the base-Calaveras constrained setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that draws relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. The resultant effect is that the WSIP setting would retain more storage in San Antonio Reservoir than in the base-Calaveras constrained setting. The exception to this outcome is during cyclic maintenance of Hetch Hetchy conveyance that will constrain Hetch Hetchy diversions every year, but most dramatically every fifth year. During these periods, additional water will be drawn from San Antonio Reservoir and the other Bay Area reservoirs to serve system-wide deliveries when limited or no water will be available from Hetch Hetchy. The coincidence of wet local Bay Area watershed hydrology, reservoir storage balancing among the Bay Area reservoirs, and maintenance affects the severity of draw down and rate of replenishment of San Antonio Reservoir.

Figure 2.7-4
San Antonio Reservoir Storage and Stream Release



Also affecting the magnitude of draw from San Antonio Reservoir are modeling assumptions for the balancing of total Bay Area reservoir storage among the five major SFPUC reservoirs. The model balances storage between reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary input in the model, and the logic and relative percentages are meant to mimic the current practice and discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security. The logic currently favors the retention of storage in the peninsula reservoirs for security reasons, and thus the provision of additional water between the settings is balanced between San Antonio and Calaveras Reservoir.

Compared to the base-Calaveras unconstrained setting, relative changes in San Antonio Reservoir operations in the WSIP generally lead to conclusions that mirror the differences experienced for the comparison to the base-Calaveras constrained operation. The WSIP setting would typically result in a reservoir less drawn upon, except during periods when system-wide conveyance maintenance would additionally burden Bay Area reservoir storage. Figure 2.7-5 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base-Calaveras constrained settings. Figure 2.7-6 illustrates the same form of information in comparing the WSIP and base-Calaveras unconstrained settings.

Figure 2.7-5

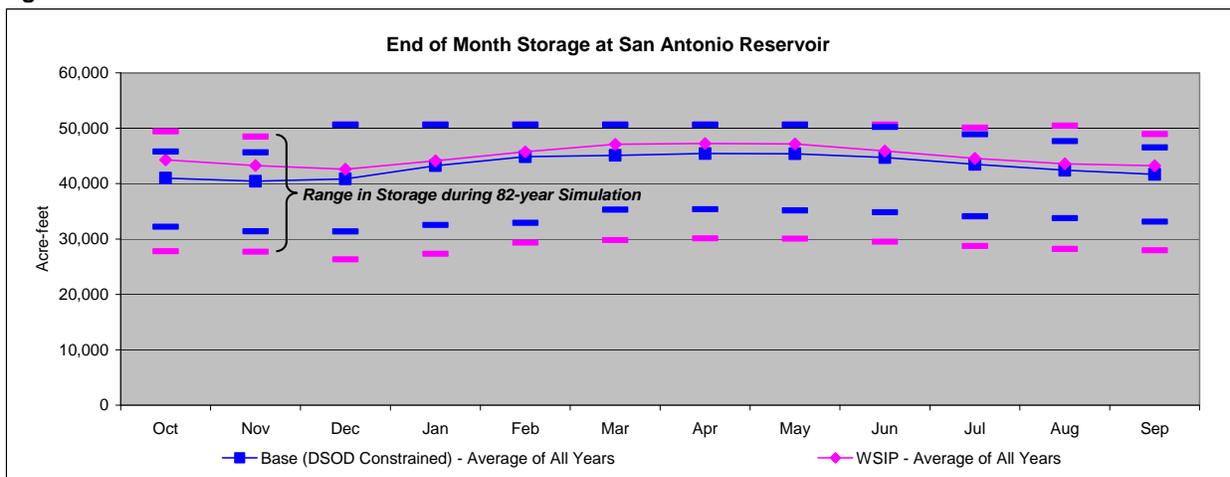
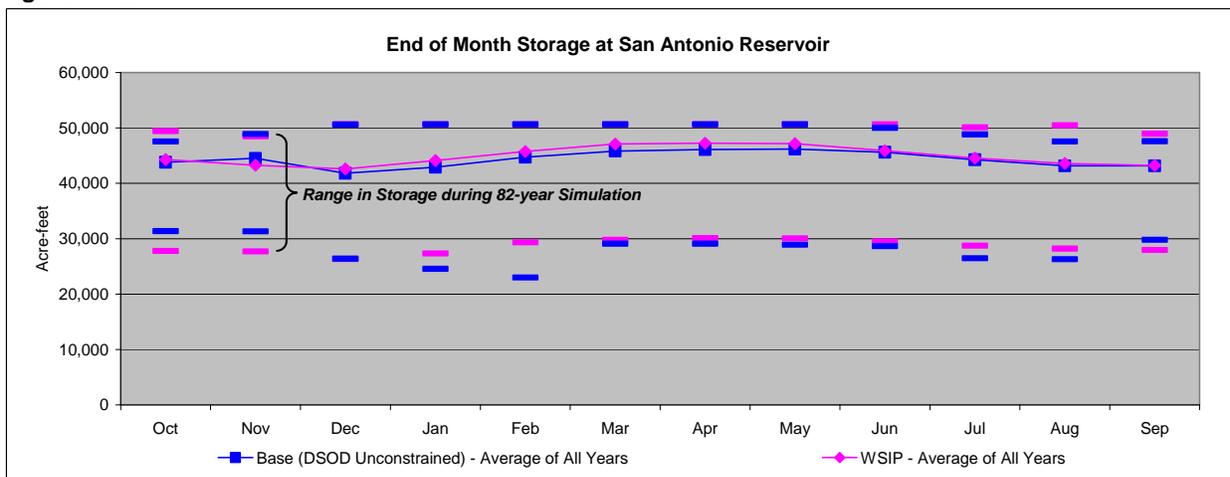


Figure 2.7-6



There would very little change in stream releases below San Antonio Reservoir between the WSIP and base settings. With storage conditions lower at some times and higher at other times, a difference in the ability to regulate reservoir inflow and avoid stream releases is expected. Given the sometimes rigid

constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the WSIP setting and base-Calaveras constrained setting are shown in Table 2.7-12. The differences among the two settings range from increases to decreases in flow. This modeled circumstance reflects the different resulting storage operation between the two settings as seen in Figure 2.7-4. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor. Table 2.7-13 illustrates the same form of information in comparing the WSIP and base-Calaveras unconstrained settings.

Table 2.7-12

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	82	1,046	3,176	1,482	592	115	0	0	0	0	0	6,493
Above Normal	0	0	19	456	1,025	237	29	73	0	0	0	0	0	1,841
Normal	0	0	0	105	16	0	50	0	0	0	0	0	0	172
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	20	319	835	338	131	38	0	0	0	0	0	1,682

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	82	508	826	-999	-732	28	0	0	0	0	-287	
Above Normal	0	0	19	456	145	-647	17	15	0	0	0	0	6	
Normal	0	0	0	105	16	0	50	0	0	0	0	0	172	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	20	214	194	-329	-129	8	0	0	0	0	-21	

Table 2.7-13

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	82	1,046	3,176	1,482	592	115	0	0	0	0	6,493	
Above Normal	0	0	19	456	1,025	237	29	73	0	0	0	0	1,841	
Normal	0	0	0	105	16	0	50	0	0	0	0	0	172	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	20	319	835	338	131	38	0	0	0	0	1,682	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Unconstrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	805	2,624	2,557	1,327	18	0	0	0	0	7,330	
Above Normal	0	0	0	51	251	509	0	0	0	0	0	0	811	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	168	564	604	259	3	0	0	0	0	1,598	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Unconstrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	82	242	551	-1,075	-735	98	0	0	0	0	-837	
Above Normal	0	0	19	405	775	-272	29	73	0	0	0	0	1,030	
Normal	0	0	0	105	16	0	50	0	0	0	0	0	172	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	20	152	271	-266	-127	34	0	0	0	0	84	

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Reservoir and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 2.7-14 illustrates the flow below the confluence for the WSIP and base-Calaveras constrained settings, and the differences in flow between the two. The differences are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity in the WSIP setting. The same form of information for the flow below the San Antonio Creek and Alameda

Creek confluence is illustrated in Table 2.7-15 in comparing the WSIP and base-Calaveras unconstrained settings.

Table 2.7-14

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,262	14,659	29,007	19,329	9,890	614	76	33	15	9	77,055	
Above Normal	19	150	1,332	4,916	10,171	7,153	2,197	290	54	20	9	6	26,318	
Normal	7	64	922	1,019	1,853	1,269	519	134	28	9	4	3	5,830	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,148	4,181	8,337	5,671	2,538	234	38	14	7	4	22,270	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250	
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498	
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	-706	-4,547	-1,034	-1,129	-791	13	0	0	0	0	-8,194	
Above Normal	0	0	-649	-2,903	-3,770	-1,197	324	15	0	0	0	0	-8,180	
Normal	0	0	-753	-863	-1,759	-738	41	0	0	0	0	0	-4,072	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-419	-1,657	-1,327	-612	-79	6	0	0	0	0	-4,089	

Table 2.7-15

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,262	14,659	29,007	19,329	9,890	614	76	33	15	9	77,055	
Above Normal	19	150	1,332	4,916	10,171	7,153	2,197	290	54	20	9	6	26,318	
Normal	7	64	922	1,019	1,853	1,269	519	134	28	9	4	3	5,830	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,148	4,181	8,337	5,671	2,538	234	38	14	7	4	22,270	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Unconstrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Unconstrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	2,261	12,887	25,861	19,882	10,625	574	76	33	15	9	72,384	
Above Normal	19	150	1,091	3,648	6,266	6,227	1,881	217	54	20	9	6	19,590	
Normal	7	64	883	913	1,614	1,095	456	134	28	9	4	3	5,209	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	895	3,552	6,867	5,553	2,603	211	38	14	7	4	19,842	

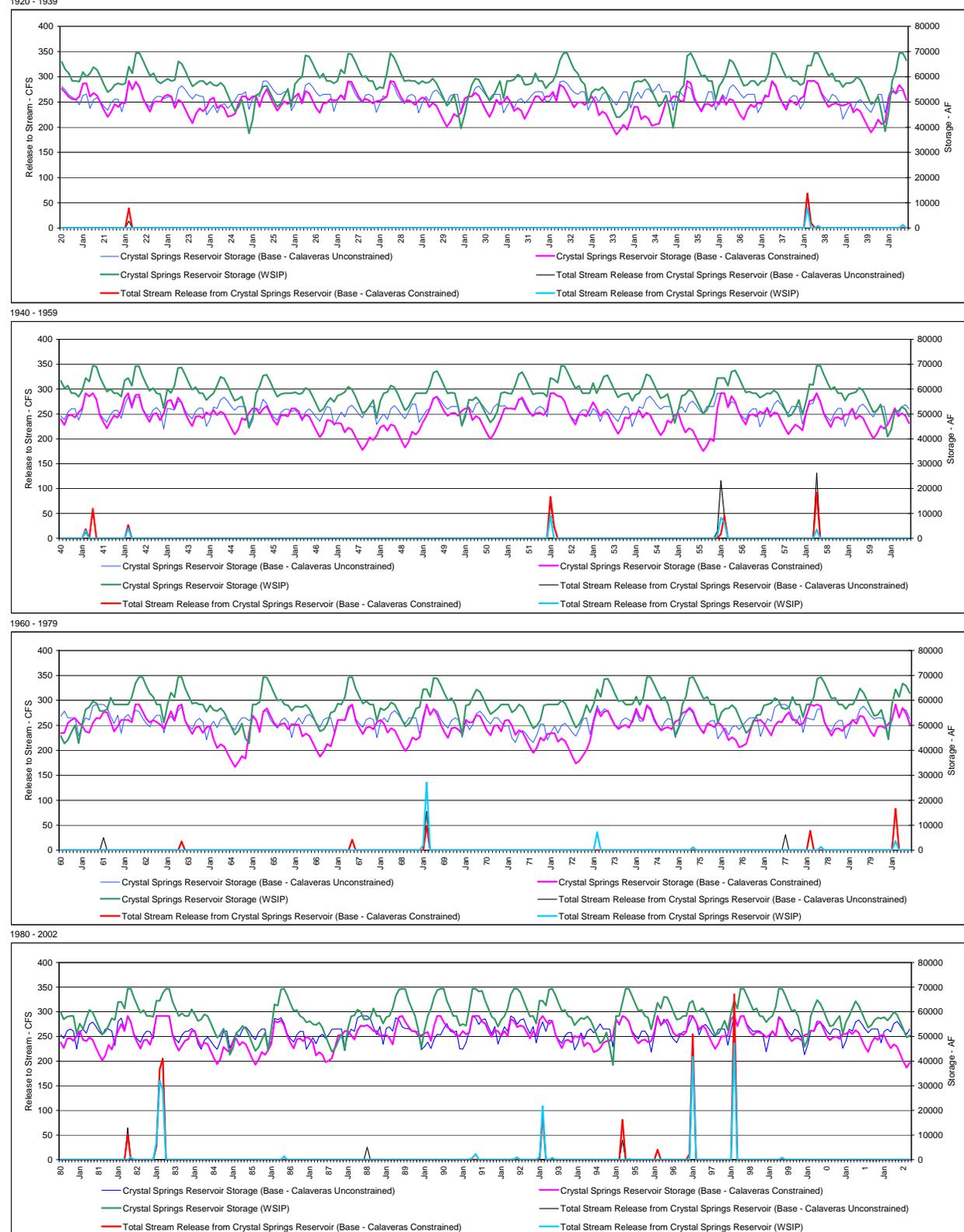
Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP minus Base - Calaveras Unconstrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP minus Base - Calaveras Unconstrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	1,001	1,772	3,146	-554	-735	40	0	0	0	0	4,671	
Above Normal	0	0	240	1,267	3,904	927	316	73	0	0	0	0	6,728	
Normal	0	0	39	105	239	174	63	0	0	0	0	0	621	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	253	629	1,470	118	-66	23	0	0	0	0	2,427	

2.8 Crystal Springs and San Andreas Reservoirs

Fundamental to the difference in storage operations between the WSIP setting and the base settings is the restoration of reservoir operation capacity in the WSIP setting, which does not occur in the base settings. The result is the operation of Crystal Springs Reservoir at a higher maximum storage in the WSIP setting. Figure 2.8-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Springs Dam. Shown in Figure 2.8-1 are the results for the WSIP and base settings.

Compared to the base-Calaveras constrained setting, the WSIP setting would generally result in a shifting of the maximum storage level and the range of reservoir operation to a greater volume (elevation); the lower end of the monthly operating range would normally be greater in storage than in the base-Calaveras constrained setting. In some years, the variation from maximum storage to minimum storage may increase in the WSIP setting.

Figure 2.8-1
Crystal Springs Reservoir Storage and Release



The comparison of the WSIP setting to the base-Calaveras unconstrained setting is about the same as for the comparison to the base-Calaveras constrained setting. The differences are slightly less pronounced because the base-Calaveras unconstrained setting results in a less exercised reservoir than the base-Calaveras constrained setting. The base-Calaveras unconstrained setting typically draws less water cyclically from Crystal Springs Reservoir due to the ability of Calaveras Reservoir to serve system-wide deliveries.

Figure 2.8-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base-Calaveras constrained settings. Consistent with the discussion above, the WSIP setting would result in reservoir storage operating at a higher average and higher upper-range than the base-Calaveras constrained setting. This circumstance predominantly occurs due to the restoration of the operating capacity of Crystal Springs Reservoir. The same form of information is illustrated in Figure 2.8-3 in comparing the WSIP and base-Calaveras unconstrained settings.

There is minimal difference in stream releases between the WSIP and base settings (which could be either an increase or decrease in the release). The potential difference is attributed to whether the different resulting storage in the reservoir is higher or lower between the two settings. Part of the difference in modeled Crystal Springs Reservoir storage is due to modeling assumptions for the proportionate management of storage among the Bay Area reservoirs, and the coincidence of constrained conveyance flow rates. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting and essentially no difference would occur between the WSIP and base settings.

Table 2.8-1 illustrates the stream releases for the WSIP and base-Calaveras constrained settings, and the difference in modeled flows between the two settings. A greater operating range in Crystal Springs Reservoir operation would lead to an increased potential to regulate reservoir inflow, which would lead to less risk in needing to make stream releases. However, as described above, actual system operations will attempt to minimize releases under any setting; thus, the difference in releases between the variant and base setting will be minimal, if any. Table 2.8-2 illustrates the same form of information in comparing modeled stream releases between the WSIP and base-Calaveras unconstrained settings.

San Andreas Reservoir operations would generally be the same between the WSIP and base settings. Reservoir storage would follow a systematic filling and lowering each year in managing runoff. Figure 2.8-4 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the WSIP and base-Calaveras constrained settings. Figure 2.8-5 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from Springs Dam. Shown in Figure 2.8-5 are the results for the WSIP and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Notable in Figure 2.8-5 is the difference in storage operation every fifth year. The WSIP setting storage operation differs from the base settings. The differences in operation arise from the assumed difference in Hetch Hetchy conveyance maintenance in each setting. In the WSIP setting, the maintenance occurs systematically every year, and to a greater degree every fifth year, which constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy Water Treatment Plant (Harry Tracy WTP) associated with WSIP or the base-Calaveras unconstrained setting exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. The model assumes that the conveyance capacity from Crystal Springs Reservoir is the same among all of the settings. The additional water demand of the WSIP setting and the current demand of the base-Calaveras unconstrained setting require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir.

Figure 2.8-2

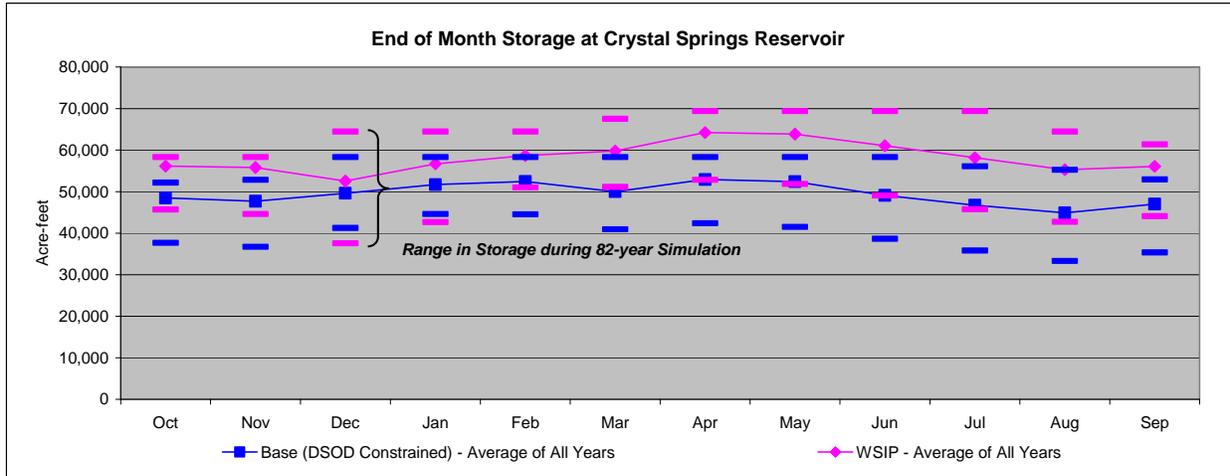


Figure 2.8-3

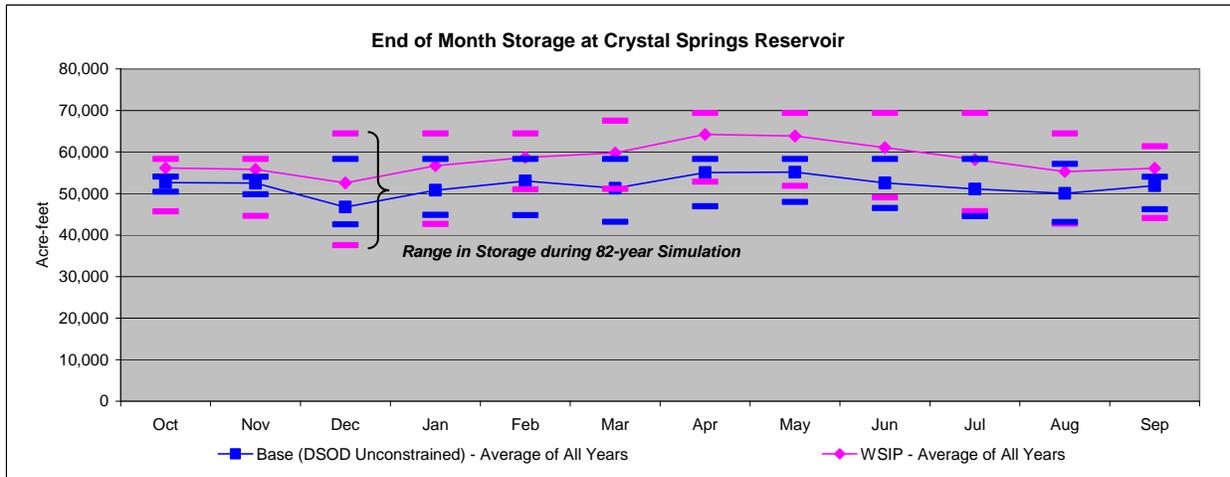


Table 2.8-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)												WSIP		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												Sep	WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	17	1,309	2,398	542	65	65	0	0	0	0	0	4,397
Above Normal	0	0	0	18	354	0	0	99	0	0	0	0	0	472
Normal	0	0	0	0	0	0	0	5	15	0	0	0	0	20
Below Normal	0	0	0	0	0	0	13	40	0	0	0	0	0	53
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	3	259	541	106	15	43	3	0	0	0	0	971

Total Stream Release from Crystal Springs Reservoir (Acre-feet)												Base - Calaveras Constrained		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												Sep	WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	0	6,336
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	0	671
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	280	690	221	147	29	0	0	0	0	0	1,375

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)												WSIP minus Base - Calaveras Constrained		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												Sep	WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	-27	-124	-491	-592	-691	-15	0	0	0	0	0	-1,939
Above Normal	0	0	0	18	-254	0	0	37	0	0	0	0	0	-199
Normal	0	0	0	0	0	0	0	5	15	0	0	0	0	20
Below Normal	0	0	0	0	0	0	13	40	0	0	0	0	0	53
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-5	-20	-148	-115	-132	14	3	0	0	0	0	-405

Table 2.8-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP	WY Total
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	17	1,309	2,398	542	65	65	0	0	0	0	0	4,397
Above Normal	0	0	0	18	354	0	0	99	0	0	0	0	0	472
Normal	0	0	0	0	0	0	0	5	15	0	0	0	0	20
Below Normal	0	0	0	0	0	0	13	40	0	0	0	0	0	53
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	3	259	541	106	15	43	3	0	0	0	0	971

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP	WY Total
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	52	1,612	2,497	975	942	0	0	0	0	0	0	6,079
Above Normal	0	0	0	0	46	0	0	0	0	0	0	0	0	46
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	313	0	0	0	313
All Years	0	0	10	315	497	190	184	0	0	61	0	0	0	1,257

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP minus Base - Calaveras Unconstrained	WY Total
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	-35	-303	-99	-433	-877	65	0	0	0	0	0	-1,682
Above Normal	0	0	0	18	308	0	0	99	0	0	0	0	0	426
Normal	0	0	0	0	0	0	0	5	15	0	0	0	0	20
Below Normal	0	0	0	0	0	0	13	40	0	0	0	0	0	53
Dry	0	0	0	0	0	0	0	0	0	-313	0	0	0	-313
All Years	0	0	-7	-55	45	-85	-168	43	3	-61	0	0	0	-286

Figure 2.8-4

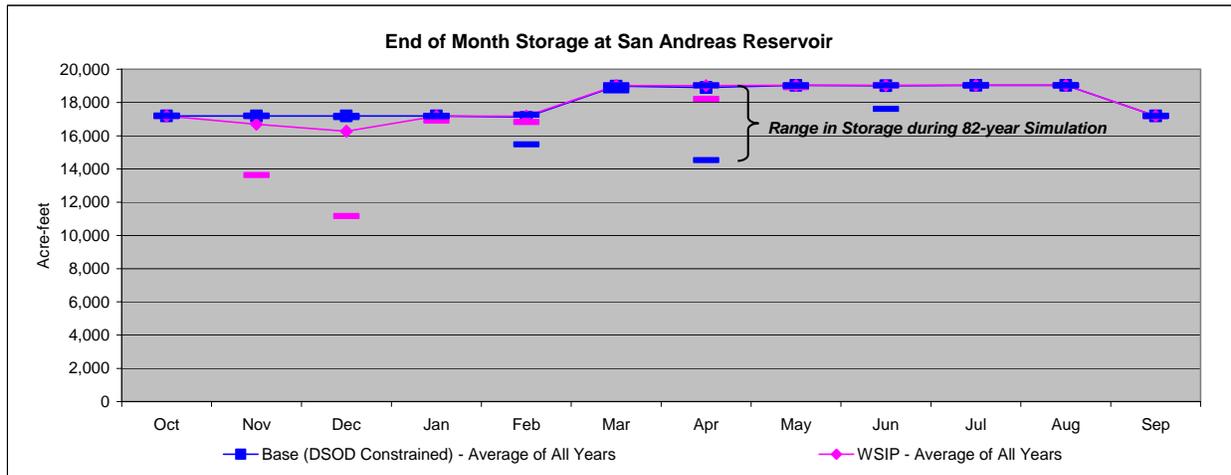
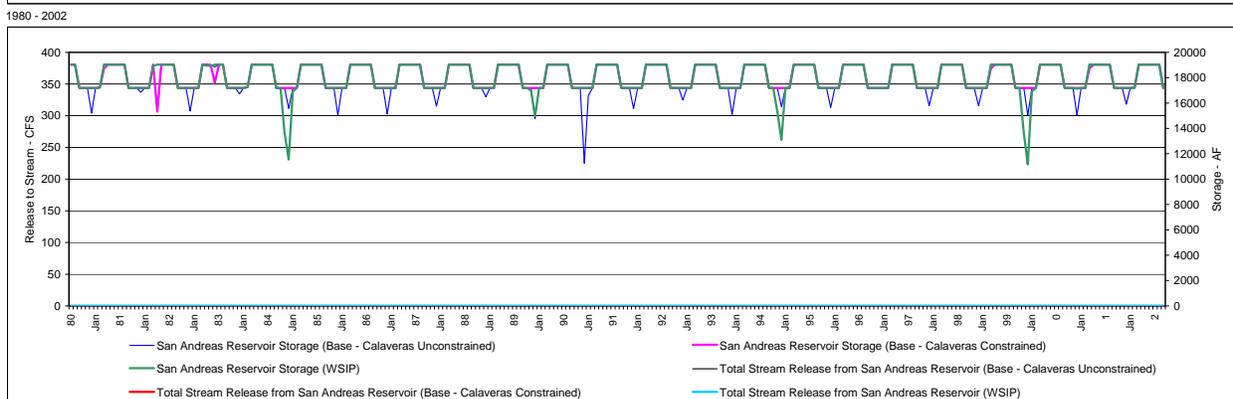
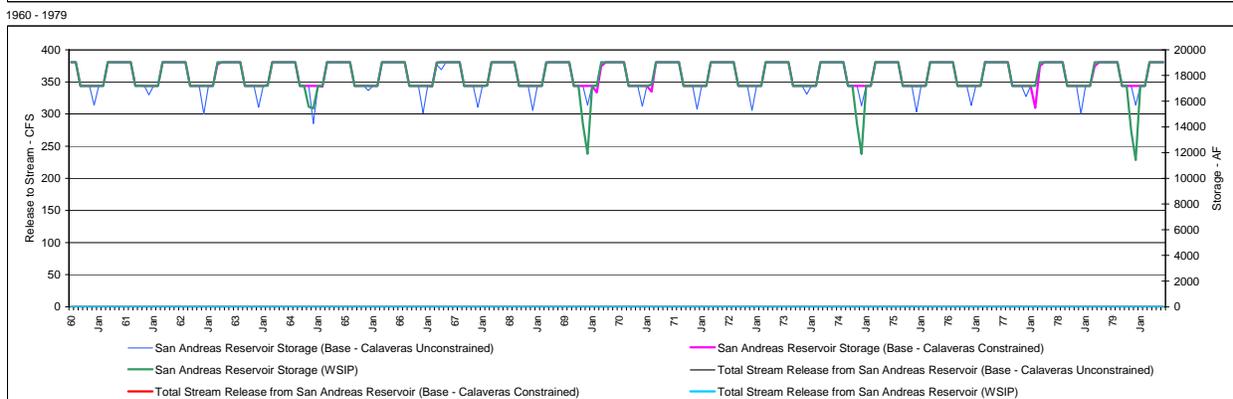
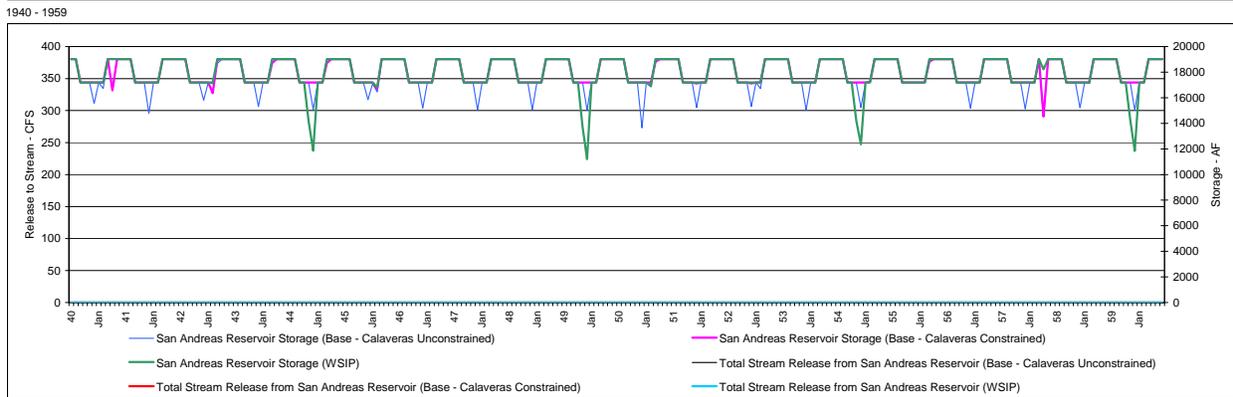
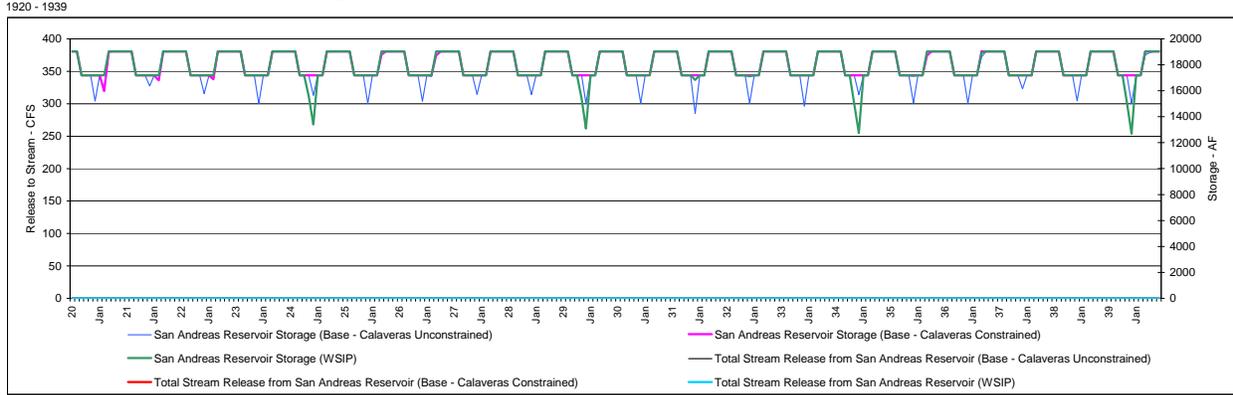


Figure 2.8-5
San Andreas Reservoir Storage and Stream Release



2.9 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD's) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated to amount to about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Considering the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request (and the resultant potential changes to the operation of SFPUC facilities and their affected environs) are uncertain.²

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following are potential hydrologic effects to SFPUC facilities and their affected environs:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

² See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

APPENDIX H2-2

Memorandum

Subject: Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir
From: Daniel B. Steiner
Date: December 31, 2006

1. Introduction

The simulation of San Francisco Public Utilities Commission (SFPUC) Regional Water System daily operations over a long-term record of hydrology is currently not available with existing modeling tools. The Hetch Hetchy Local Simulation Model (HH/LSM) performs analyses using a monthly time-step, with input and results depicted by monthly volumes of water. As such, the day-to-day variation of operations, or an operational decision that can occur in less than monthly intervals cannot always be adequately represented or depicted by “monthly” HH/LSM results. One such hydrologic parameter that suggests an alternative interpretation is the stream release that is simulated to occur below O’Shaughnessy Dam. This occurs as either a fairly constant release through the low-level outlet for fishery maintenance or varying controlled releases through the dam’s outlet valves and through the spillway. The release from the dam during the year is typically limited to the amount of flow required to meet fishery stream flow commitments. However, during many years, an amount of water above minimum flow commitments requires release to the stream. These flows are managed on a day-to-day basis to balance inflow, reservoir storage, and diversions to water supply and power operations. During the runoff season, operations can change daily as prevailing conditions warrant.

HH/LSM simulations cannot fully depict the within-month changes that can occur. For instance, although the model will accurately depict that several thousand acre-feet of reservoir spill would occur in a month (e.g., 24,000 acre-feet in a month), the model results do not provide sufficient information regarding the daily magnitude or duration of the release during that month. A 24,000-acre-foot release during a month could occur as a constant release of 400 cubic feet per second (cfs) per day, or it could occur as an 800 cfs release during half of the days during a month. By looking solely at the average monthly results provided by HH/LSM, the effects of the operational and system changes may not be fully understood. This memorandum illustrates the adaptation of HH/LSM monthly results into an estimate of the projected change in daily releases to the stream below the dam as a result of the Water System Improvement Program (WSIP).

2. Approach

The record of recent historical operations at O’Shaughnessy Dam serves as the backdrop for this analysis. Also incorporated are the HH/LSM simulated operation of the existing system and the simulation of system operations after implementation of the WSIP. Upon tracing historical operations, the modeled incremental changes between the existing system operation and the operation of the system with the WSIP are layered. The modeled operation captured in the analysis is the change in Hetch Hetchy Reservoir storage that occurs from one year to the next due to the WSIP. That change in storage would be subsequently replenished by a change in diversions to Canyon Tunnel or spills to the river below the dam.

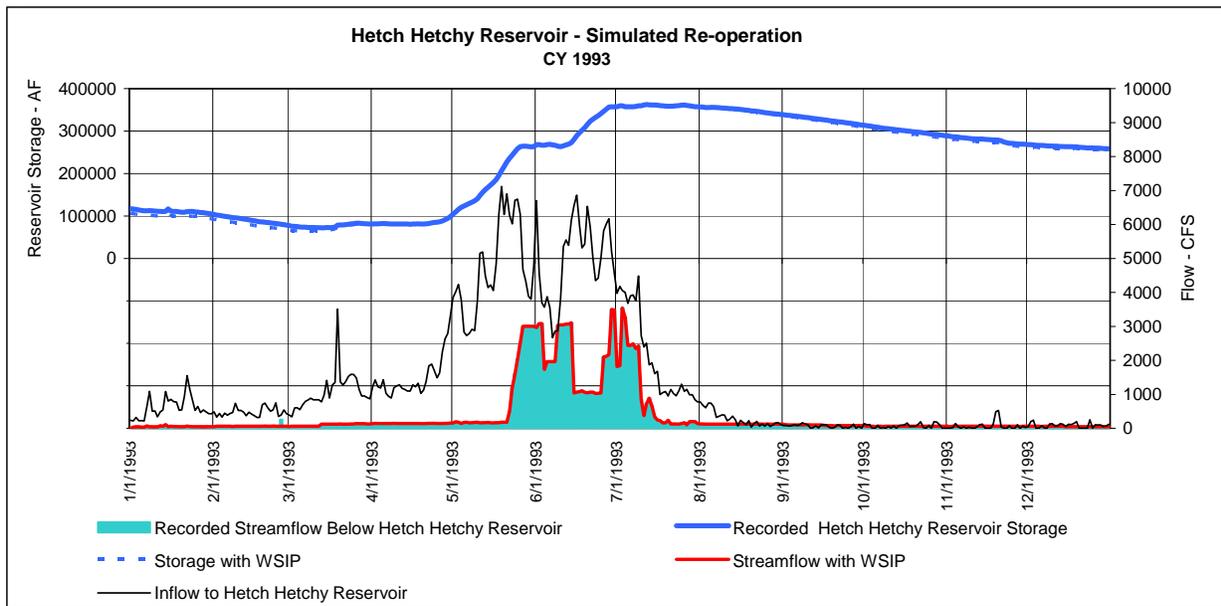
This analysis has been limited to evaluating only the most recent record of operations, those that have occurred since the 1987-1992 drought. Operations subsequent to that period incorporate additional emphasis on carryover storage to safeguard water supply yield, consistent with modeled operations. This period also represents a generally stable level of current system water demand, again consistent with modeled operations. Both of these factors make the modeled results of the existing system a more comparable representation to recent historical operations.

3. Analysis

Analyses of the WSIP have illustrated that additional diversion from Hetch Hetchy Reservoir to provide for additional SFPUC Regional Water System water deliveries would additionally deplete the reservoir in most years. To replenish this storage, spills to the river either from Kirkwood Powerhouse or from the dam would be subsequently reduced.

Figure 1 illustrates a trace of the recorded storage in Hetch Hetchy Reservoir (solid blue line), inflow to the reservoir (daily varying black solid line), and releases to the stream below the dam (area graph shown in aqua blue) for calendar year 1993. Also shown in Figure 1 is the adjusted Hetch Hetchy Reservoir storage (dashed blue line) subsequent to the WSIP. The solid red line depicts the estimated daily release below the dam subsequent to the WSIP.

Figure 1



The adjusted Hetch Hetchy Reservoir storage is depicted by layering onto the historical record of reservoir storage the change in modeled storage between existing conditions and the WSIP condition. The premise is that, although the absolute depiction of reservoir storage through modeling may differ from recorded operations (due to several anomalies that occur in the actual operation that cannot be fully captured by modeling), the relative difference between the two modeled conditions will be adequately representative of the change that would have occurred to historical operations. Because HH/LSM only develops monthly results, the model change in storage in the reservoir was evenly distributed during a month to provide the daily adjustment to the recorded daily historical storage.

The change in storage from month to month is derived from HH/LSM results and is applied to the historical record of storage. In this “re-operation” of 1993, there is approximately 11,000 acre-feet less storage in the reservoir at the end of February, with the deficit eliminated by the end of March (dashed blue line). The deficit is due to additional water supply diversions in the previous year under the WSIP. Both the modeled operation and recorded operation release no more than minimum flows below the dam for this period, indicating that the replenishment of storage in this particular year would have occurred through a reduction in Canyon Tunnel diversions (spills to the river from Kirkwood Powerhouse). With this replenishment occurring prior to the spill period, the remainder of the stream release operation through the spill period (solid red line) would remain the same as the historical operation. In this example, the WSIP would not affect the magnitude or duration of the spill hydrograph for 1993.

The effect of the WSIP varies by year. Calendar year 1994 is another example illustrating that, at times, the WSIP is anticipated to have no effect on the stream releases below the dam. Figure 2 provides a trace of 1994 actual operations. Although reservoir storage is depicted to be diminished prior to and through May, only minimum releases to the stream occurred during the year; therefore, the WSIP would have no effect on stream releases below the dam in this year. During this year of operation, the deficit of storage would be replenished prior to the end of the runoff season by a reduction in Canyon Tunnel diversions. Subsequent to the reservoir being filled, the additional diminishment of storage would begin again and the effect would be carried into the next year.

Figure 2

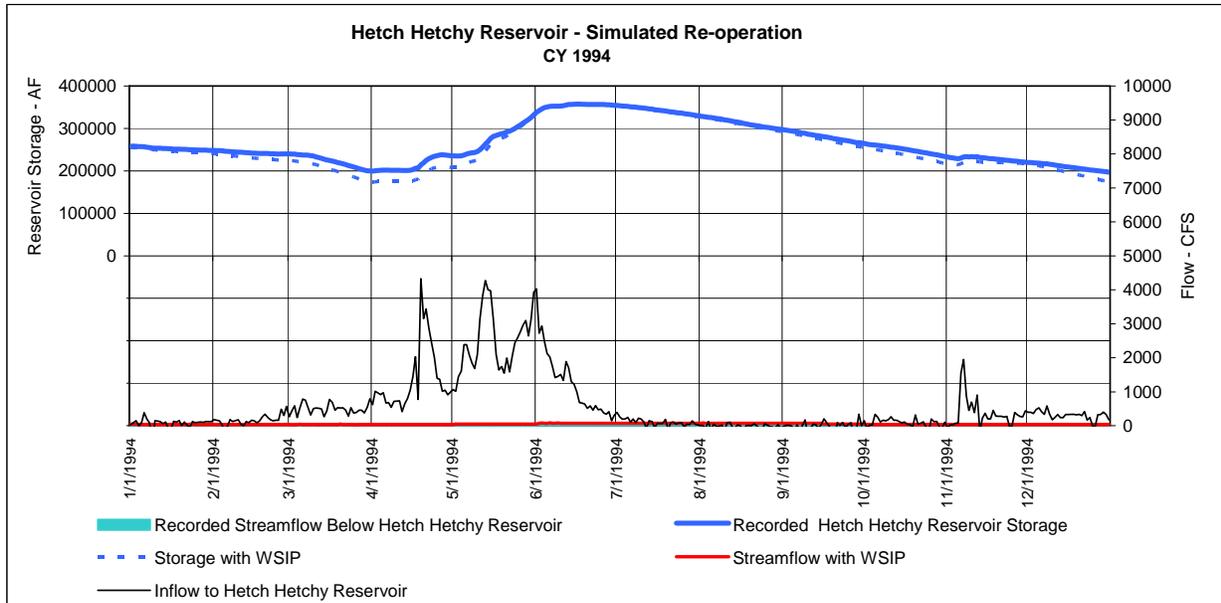


Figure 3 (1995), Figure 4 (1996), Figure 5 (1997), and Figure 6 (1998) each illustrate additional years of actual and projected operations. In each of these example years, there would be no WSIP affect on stream releases below the dam. In each instance, the storage deficit developed by the WSIP would have been replenished by reductions to Canyon Tunnel diversions well prior to spills into the river.

Figure 3

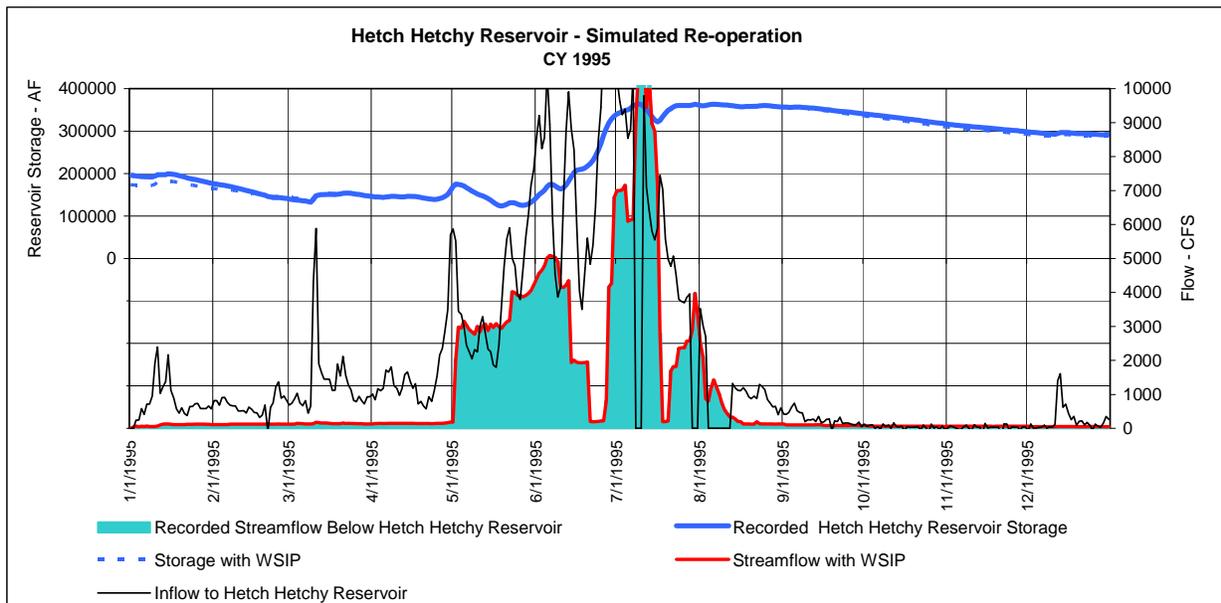


Figure 4

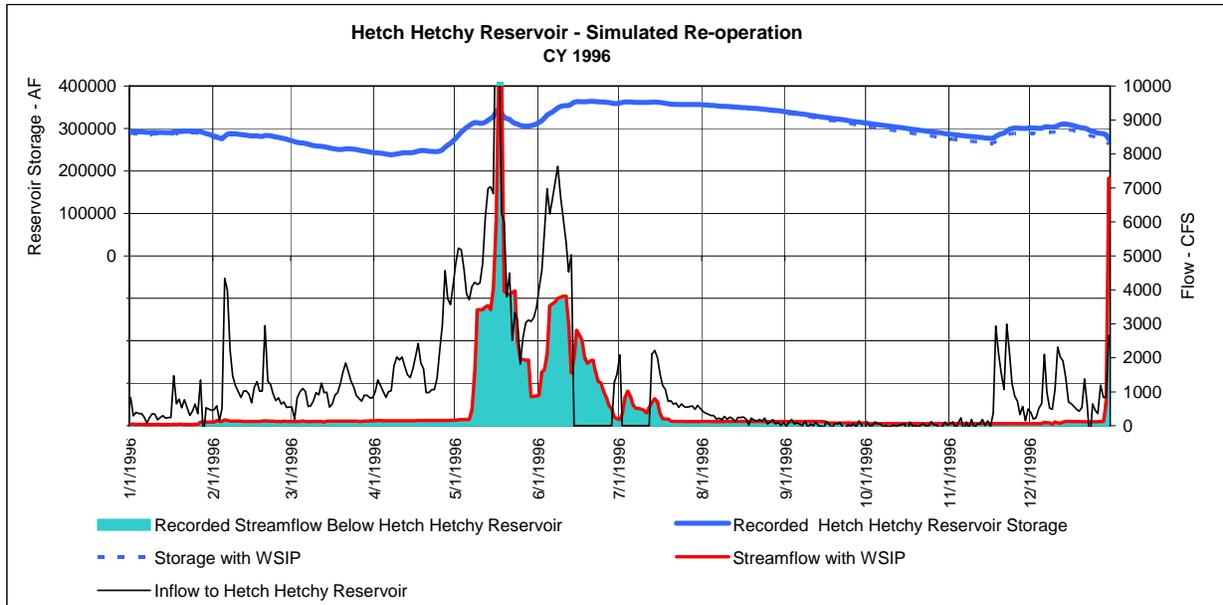


Figure 5

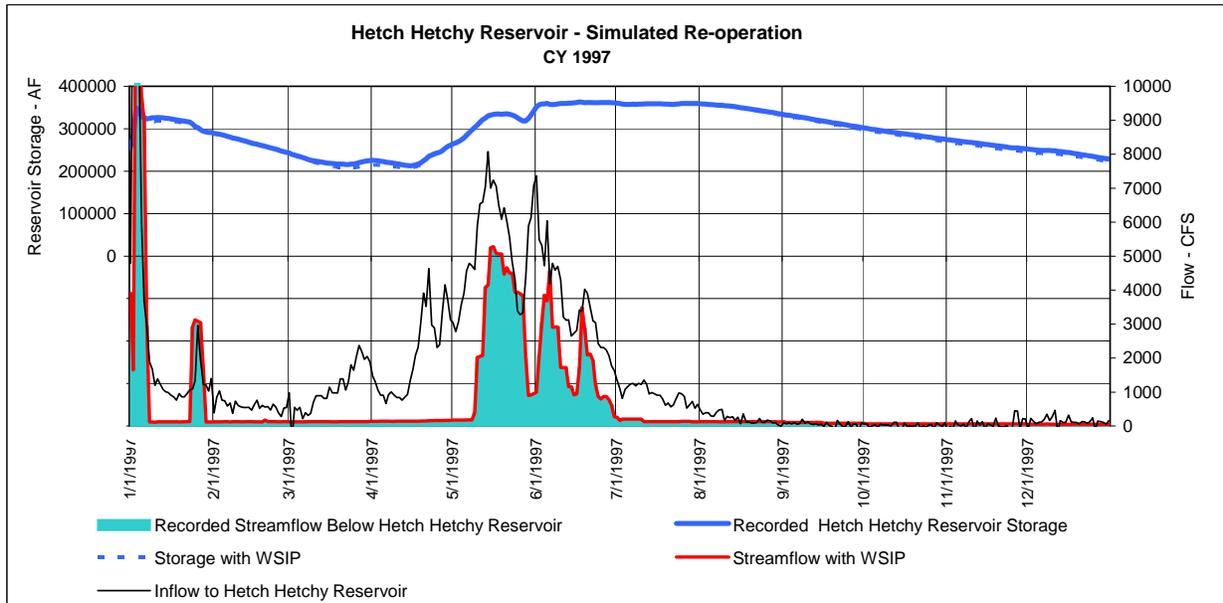
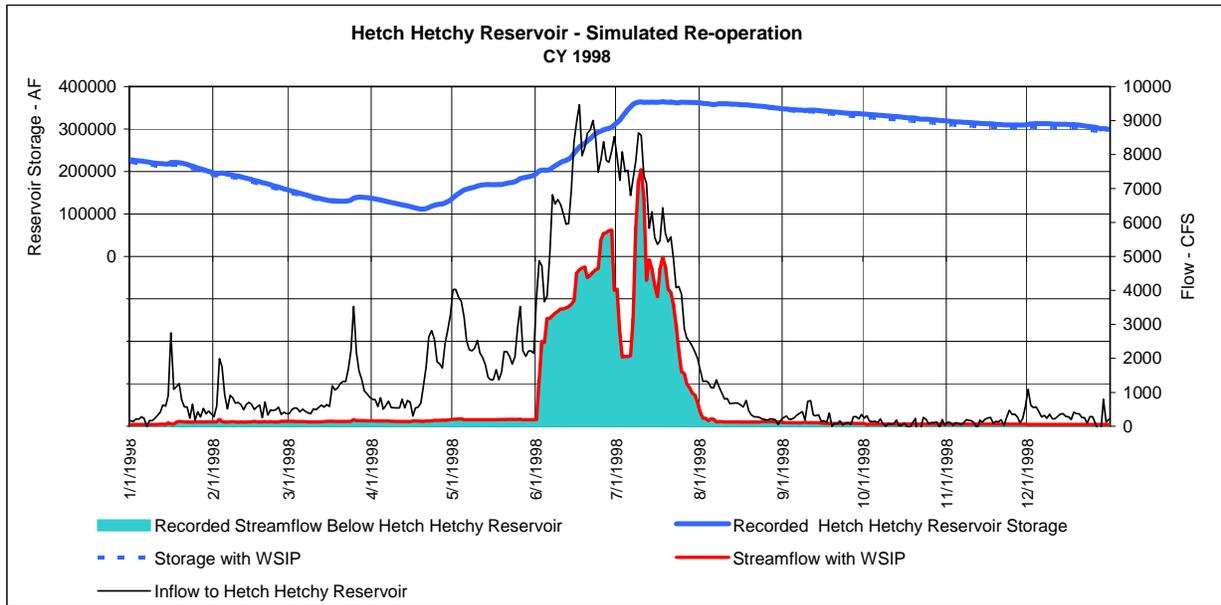


Figure 6



Calendar years 1999 and 2000 illustrate instances when the WSIP may affect stream releases below the dam. Figure 7 illustrates the trace of historical and projected operations for 1999. An incremental storage deficit from the WSIP could occur during the time that the reservoir would otherwise be releasing in excess of minimum flows, leading to a delay in the day that such excess releases would occur (illustrated by the solid red line). In this instance, the analysis indicates a 3-day delay in spills due to the effect of the WSIP. Figure 8 illustrates the same form of effects during calendar year 2000, with a 1 day delay in excess releases due to the WSIP.

Figure 7

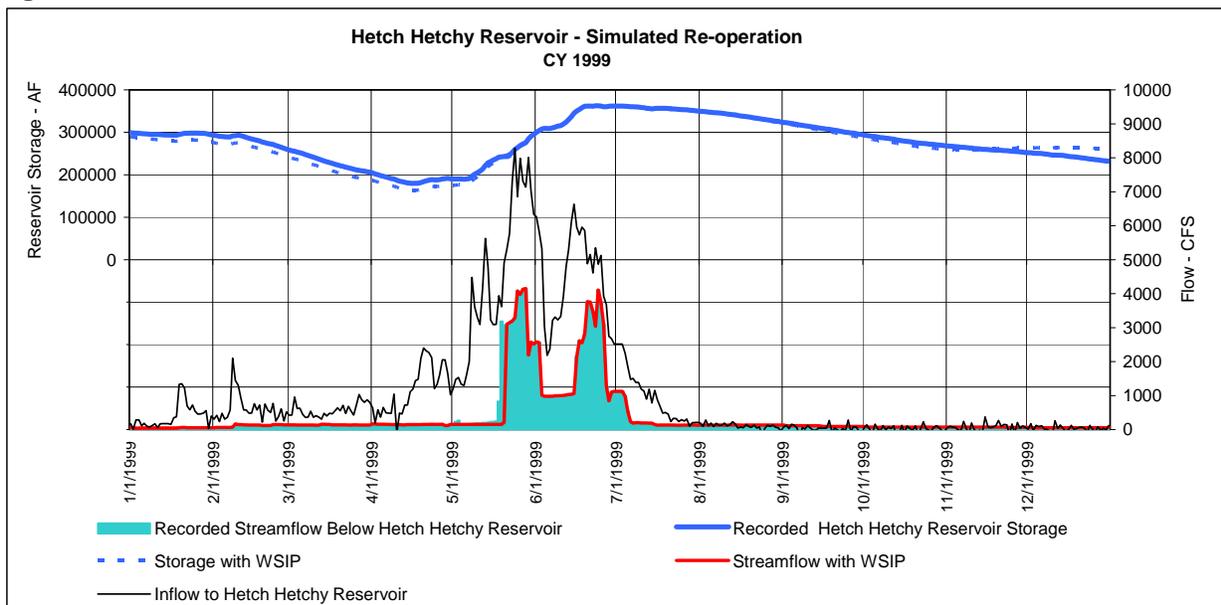
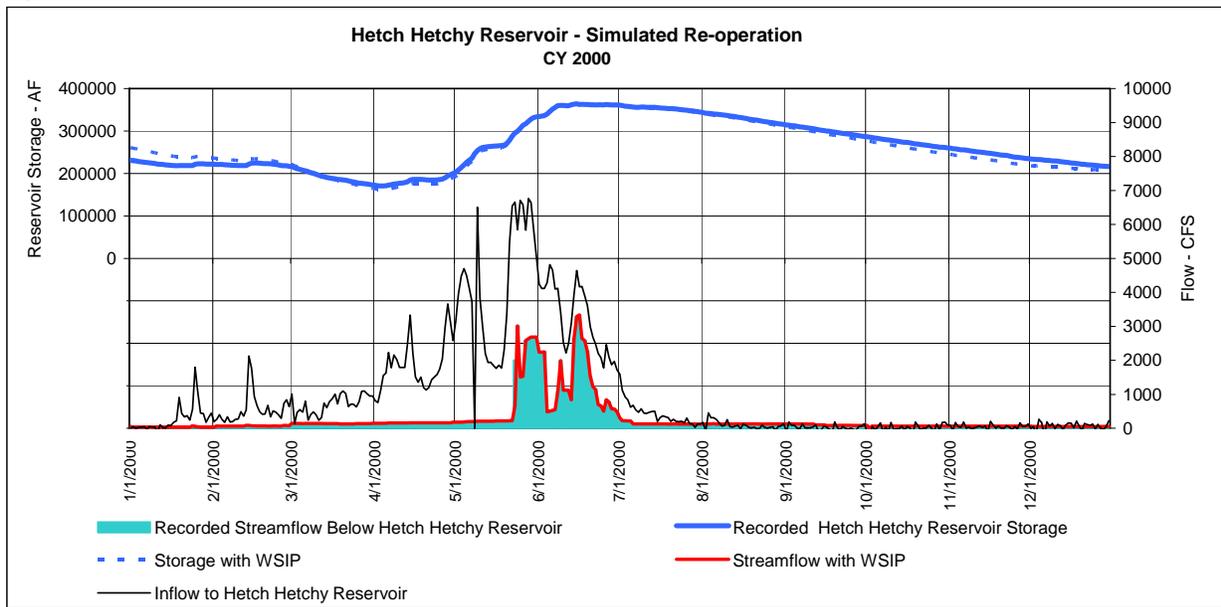


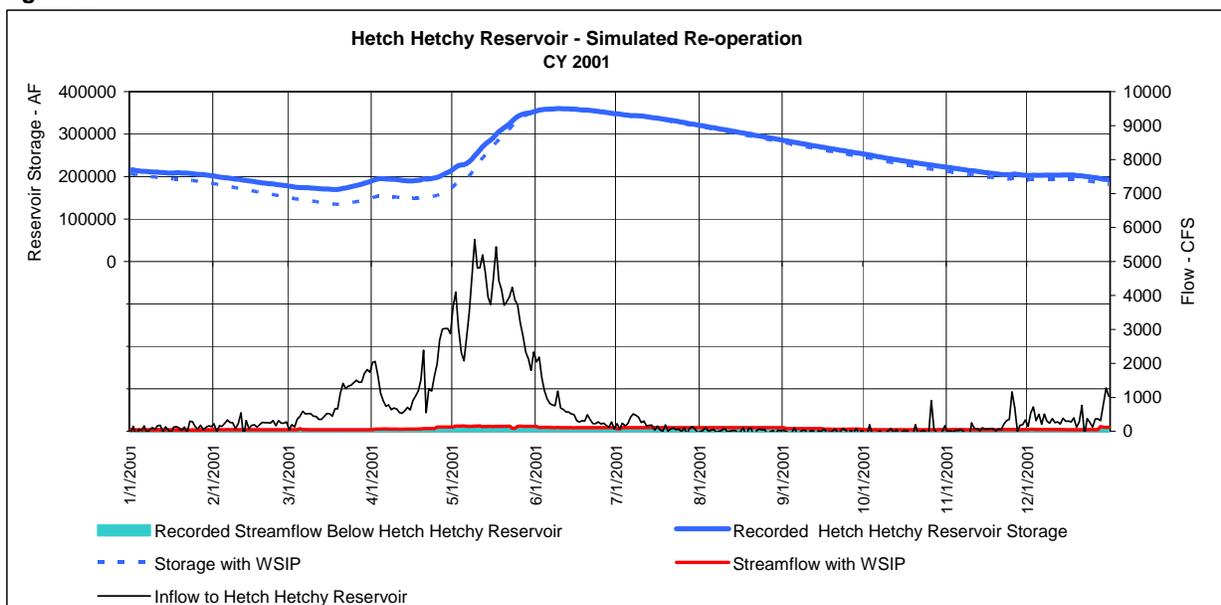
Figure 8



In each of these examples, the spill that would have occurred otherwise was diminished in volume. However, subsequent to storage being replenished, the spill hydrograph returns to what would have occurred regardless of the WSIP, typically for a substantial portion of the time that would have occurred and at a peak magnitude that would be greater than what flows levels were reduced.

Figure 9 illustrates that calendar year 2001 is similar to conditions during 1994. No spills above minimum stream commitments occurred during 2001. Although there is an incremental deficit in storage due to the WSIP, replenishment of the storage by the end of the runoff season would occur through a reduction in Canyon Tunnel diversions. Stream flow below the dam would be unaffected.

Figure 9



Calendar year 2002 (Figure 10) illustrates a low-frequency event in Hetch Hetchy Reservoir operations. During 2002, the reservoir was filled during the early days of June. The spills that occurred were due to the reservoir being full and diversions to Canyon Tunnel maximized. With no ability to store or divert additional water, minor spills occurred at the reservoir until inflow receded. The WSIP would not affect this spill event because reservoir storage would already have been replenished by adjustment of Canyon Tunnel diversions.

Figure 10

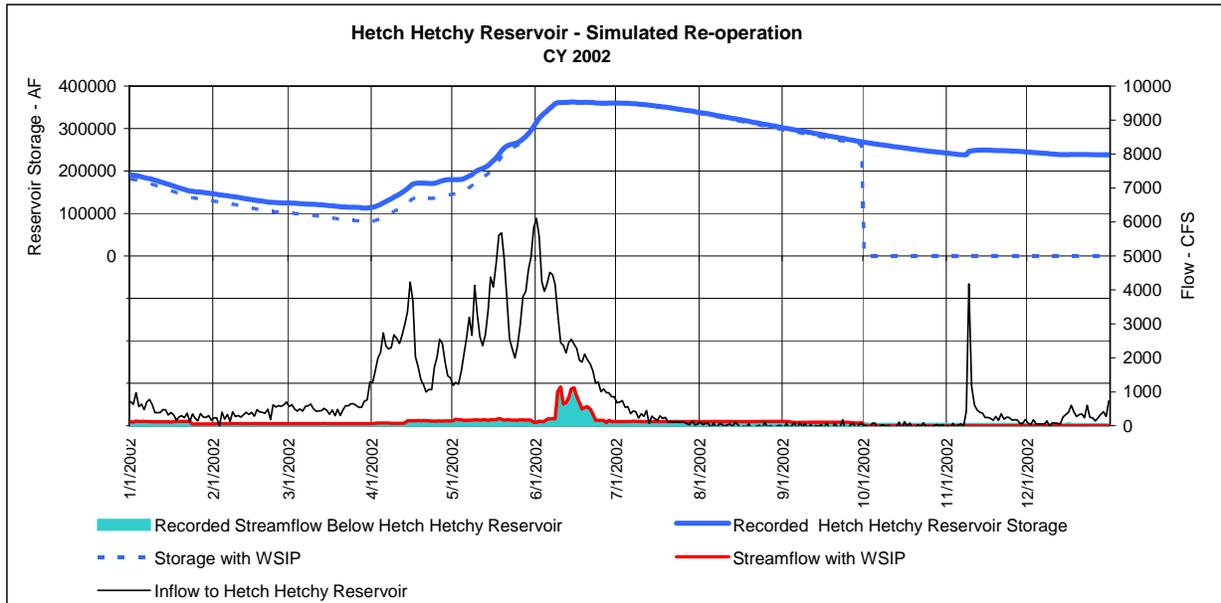
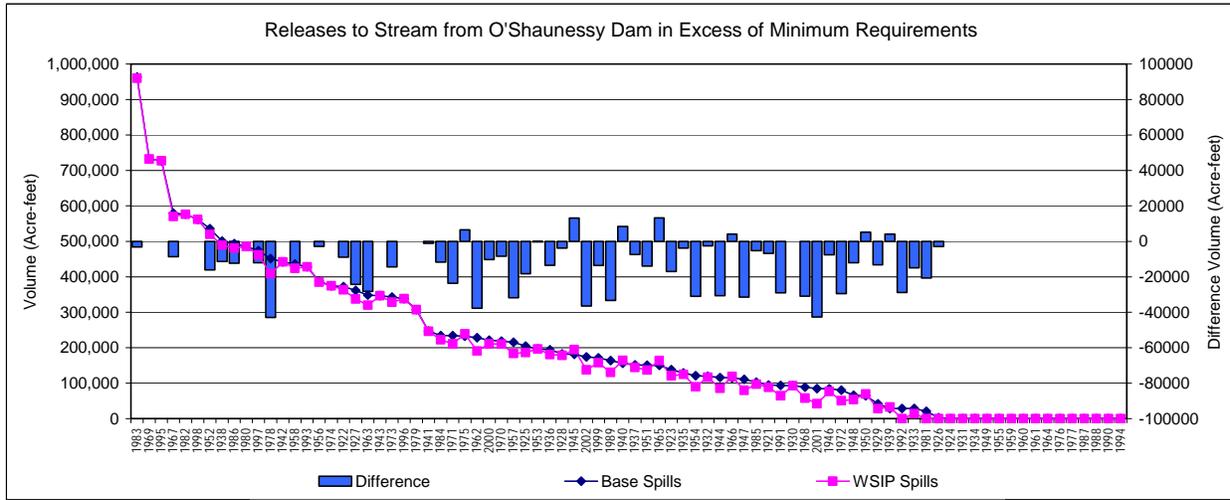


Figure 11 illustrates the annual volume of spill from the dam (releases to the stream in excess of minimum commitments), simulated for existing conditions and with the WSIP. Under existing conditions, the reservoir would not spill in 15 years (out of 82 years); when spilling, the volume normally would exceed 100,000 acre-feet. The spills typically occur during May through July, normally during May and June. With the WSIP, three additional years of spill could be eliminated. During these types of years, there would have been minimal spills otherwise occurring under existing conditions. When a reduction in the volume of spills occurs due to the WSIP in the other years of simulation, it is anticipated that the reduction would occur in the form of a delayed spill period, as demonstrated by this analysis of the historical operation. As an example of the potential delay in releases, recent historical operations have shown that it is typical to initially establish dam releases at 3,000 cfs or more. A 3,000-cfs release would equate to approximately 6,000 acre-feet in a day. With such a release otherwise occurring, a diminished storage effect in the reservoir of 24,000 acre-feet would be ameliorated in about 4 days due to a delay in the release.

Figure 11



APPENDIX H2-3

Memorandum

Subject: Analysis of SFPUC Pilarcitos and
Coastside County Water District Operations

From: Daniel B. Steiner

Date: March 8, 2007

1. Introduction

Pilarcitos Creek has provided water supply to San Francisco since the 19th century. Pilarcitos Reservoir, Stone Dam, and associated facilities are an integral part of San Francisco Public Utilities Commission (SFPUC) Regional Water System operations. Watershed runoff regulated at these SFPUC facilities serves the Coastside County Water District (Coastside CWD) purchase request, and is also diverted to the San Mateo Creek watershed for integration into the rest of the SFPUC system.

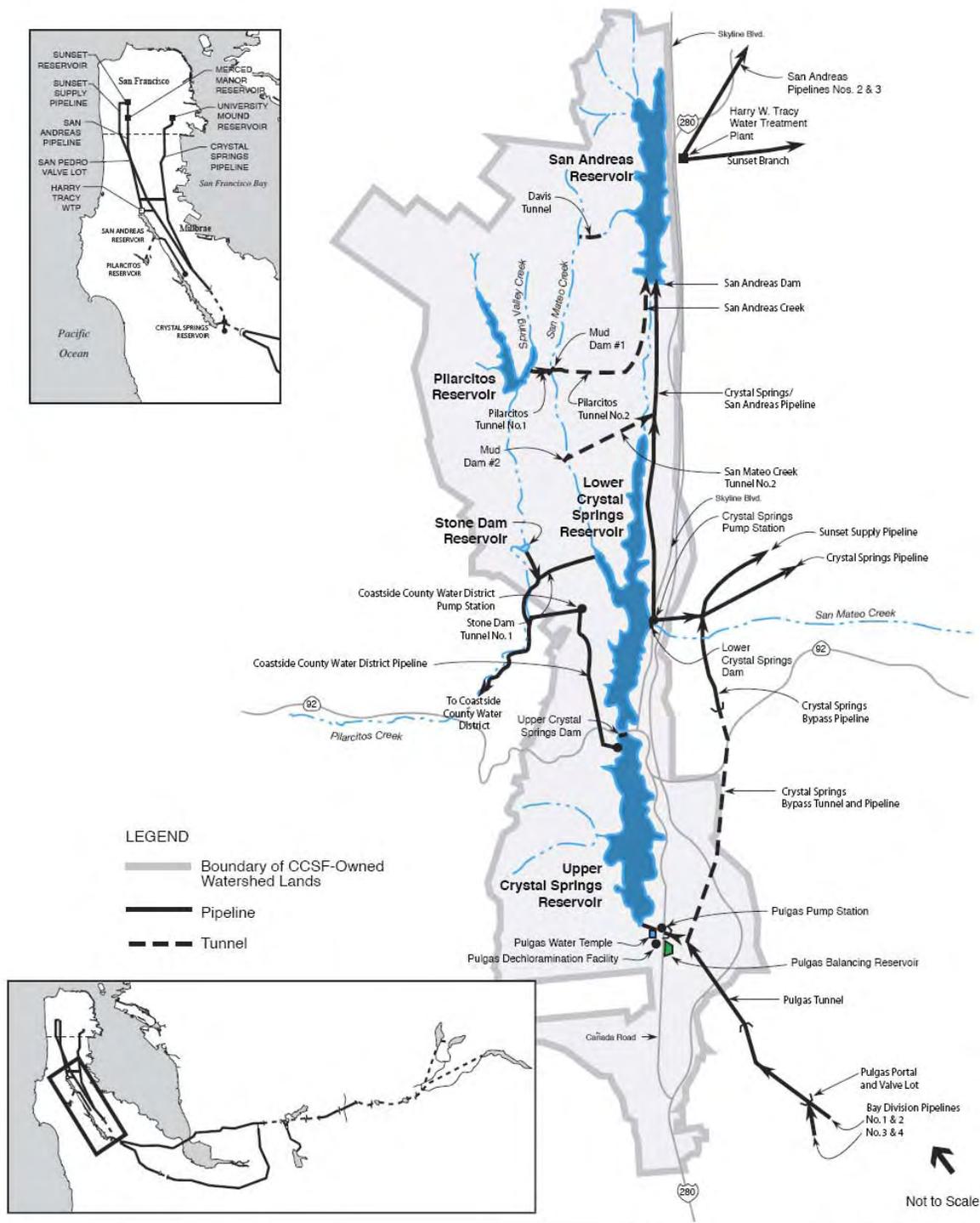
The purpose of this memorandum is to provide a brief description of the operation of SFPUC facilities in the Pilarcitos Creek watershed, both in the context of deliveries to Coastside CWD and integration into the SFPUC Regional Water System. Also described are illustrations of the potential changes in operations and hydrologic outcome that may be associated with implementation of the Water System Improvement Program (WSIP) as it is affected by an increase in Coastside CWD's purchase request.

2. System Description

Major SFPUC facilities located on the peninsula are shown in Figure 1. Pilarcitos Reservoir (maximum storage capacity of approximately 3,000 acre-feet) regulates watershed runoff into the reservoir for release to Pilarcitos Creek for redirection at Stone Dam. Excess water in the watershed is diverted to the San Mateo watershed from Pilarcitos Reservoir through the Pilarcitos Tunnel No. 1, and at Stone Dam through Stone Dam Tunnel No. 1. The annual average runoff to Pilarcitos Reservoir is estimated to be approximately 3,980 acre-feet per year, and has ranged from little or no runoff to over 15,000 acre-feet in a year. Inflow to the reservoir occurs predominantly from rainfall during December through April. Additional runoff enters the stream reach below Pilarcitos Dam and above Stone Dam from several tributaries. This runoff is estimated to be an average annual 1,849 acre-feet. Flow at Stone Dam that exceeds the diversion needs to Coastside CWD and the ability to divert water to Crystal Springs Reservoir spills over Stone Dam and continues downstream in Pilarcitos Creek.

Current operations of the SFPUC Pilarcitos watershed facilities focus on the management of runoff. The tools available to manage the runoff are Pilarcitos Reservoir and the diversion works at Pilarcitos Reservoir and Stone Dam. An underlying objective for the operation is the conservation of runoff for the delivery of water to Coastside CWD and diversion into the SFPUC Regional Water System, minimizing releases past Stone Dam. This objective is achieved beginning with the drawing of storage in Pilarcitos Reservoir before the rainy season. By early fall, Pilarcitos Reservoir storage will typically be incidentally drawn down to the minimum level that passes water through the stream outlet works. This draw occurs because of releases made for deliveries to Coastside CWD from Pilarcitos Reservoir. During the ensuing rainy season, storm runoff is regulated in the reservoir with diversions made to Coastside CWD deliveries and transfers to the San Mateo Creek watershed via Pilarcitos Tunnel No. 1. Adequate available reservoir storage space in the reservoir is retained to regulate storm runoff, minimizing spills past Stone Dam. At the end of the rainy season, mid-April or sometimes earlier, transfers to the San Mateo Creek watershed will be curtailed in an effort to fill Pilarcitos Reservoir for maximum carry over into the summer season. Releases from Pilarcitos Reservoir will typically be reduced to only those requested by Coastside CWD for diversion at Stone Dam. During the summer, releases continue to be maintained at the request of Coastside CWD for diversion at Stone Dam. Current delivery requests by Coastside CWD can often deplete Pilarcitos Reservoir by late summer to a reservoir level when the outlet gates are opened to pass reservoir inflow. During these times, the reservoir release is typically less than that needed by Coastside CWD and the district exercises its Crystal Springs Reservoir diversion for delivery of the SFPUC supply.

Figure 1
Major SFPUC Peninsula Watershed Facilities



SOURCE: San Francisco Planning Department, 2001

During the wettest of years, storm runoff can exceed the regulation efforts of the SFPUC, and spills past Pilarcitos Dam will occur. These events could be as short as a matter of days to as long as 1 or 2 months. At times, transfers to the San Mateo Creek facilities may cease in circumstances when the SFPUC San Mateo Creek watershed facilities are already operating at maximum capacity managing their own watershed's runoff. Although it is more desirable to transfer water from Pilarcitos Reservoir to the San Mateo Creek watershed directly to San Andreas Reservoir, reservoir or conveyance constraints may warrant that the transfer occur to Crystal Springs Reservoir, either through diversions to Pilarcitos Tunnel No. 1 or from the diversion at Stone Dam.

Accretions and depletions of the stream reach between Pilarcitos Dam and Stone Dam enter the calculus of releases from Pilarcitos Dam and diversions at Stone Dam. Coastside CWD's delivery from Pilarcitos Creek is through the Pilarcitos Canyon Pipeline, which is connected to a SFPUC pipeline connecting to the diversion from Stone Dam. The SFPUC diversion works provide the headwater for Coastside CWD's delivery, with diversions in excess of Coastside CWD's need or capacity flowing to Crystal Springs Reservoir. Releases from Pilarcitos Reservoir are typically established based on the delivery request of Coastside CWD, accounting for the intervening flow or depletion of flow below Pilarcitos Dam. Any estimation errors in the hydrology of the intervening reach result in the delivery request of Coastside CWD slightly shorted at Stone Dam, or in excess flow being diverted to Crystal Springs Reservoir. Flow past Stone Dam to Pilarcitos Creek in either circumstance remains no more than seeps or leaks past the dam, with tributary flows adding to Pilarcitos Creek below the dam. There may be circumstances in which Stone Dam spills to Pilarcitos Creek when Pilarcitos Reservoir is not releasing to the creek. This can occur when the runoff from the intervening reach exceeds the delivery of water to Coastside CWD at Stone Dam and the transfer of water to Crystal Springs Reservoir.

3. Recent Historical Operations

The Figure 2 series of charts illustrate historical hydrologic information (1986-2005) for Pilarcitos Reservoir and deliveries to Coastside CWD from the SFPUC. Also included are observed flow values for Pilarcitos Creek at two locations, below Stone Dam and near Half Moon Bay. Figure 2 illustrates the daily storage in Pilarcitos Reservoir. Evident is the annually cyclic operation of storage, operated to achieve maximum storage in April or May, being drawn during the summer and fall, and then varying in storage throughout the winter in reaction to winter storm runoff and subsequent evacuation of storage until the spring-time filling cycle. Also shown are the deliveries to Coastside CWD from SFPUC facilities. The shaded "bars" illustrate the average daily deliveries to Coastside CWD from Stone Dam for a month. Typically, the pattern of deliveries indicates that Coastside CWD shapes the SFPUC delivery throughout the year in a distribution that reflects their total system demand, greatest during the summer and less during the winter. Periods when no delivery from Stone Dam occur reflect insufficient water deliveries from Pilarcitos Reservoir (typically reflective of minimal reservoir storage to sustain sufficient releases to the creek for subsequent diversion), whereby Coastside CWD opts to switch its SFPUC delivery to pumping from Crystal Springs Reservoir.

The creek flow information shown in Figure 2 is for Pilarcitos Creek just below Stone Dam, and for a downstream location near Half Moon Bay. The flow record below Stone Dam typically indicates a circumstance whereby flow occurring above the dam is diverted to Coastside CWD and Crystal Springs Reservoir. The flow at Half Moon Bay occurs predominantly from tributaries below Stone Dam. Significant flow at either location indicates periods of runoff from storm events. The occurrence of storm events is also reflected in changes in Pilarcitos Reservoir storage.

Deliveries from Crystal Springs Reservoir and total production from Coastside CWD sources are also illustrated in Figure 2. Coastside CWD's portfolio of resources includes deliveries from the SFPUC from Pilarcitos Creek (Stone Dam), from the SFPUC through pumping from Crystal Springs Reservoir, the district's Pilarcitos wells, and surface and groundwater supplies associated with the district's Denniston Project. Recent annual water production from Coastside CWD's non-SFPUC supplies is illustrated in Figure 3. Production from Coastside CWD's Denniston Project sources appears fairly constant for the past several years, with the annual variation generally reactive to the wetness of a year. Annual production from the district's Pilarcitos wells appears to have declined in recent years, with the production occurring during their permitted period of pumping November through March.

Figure 2a
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 1998

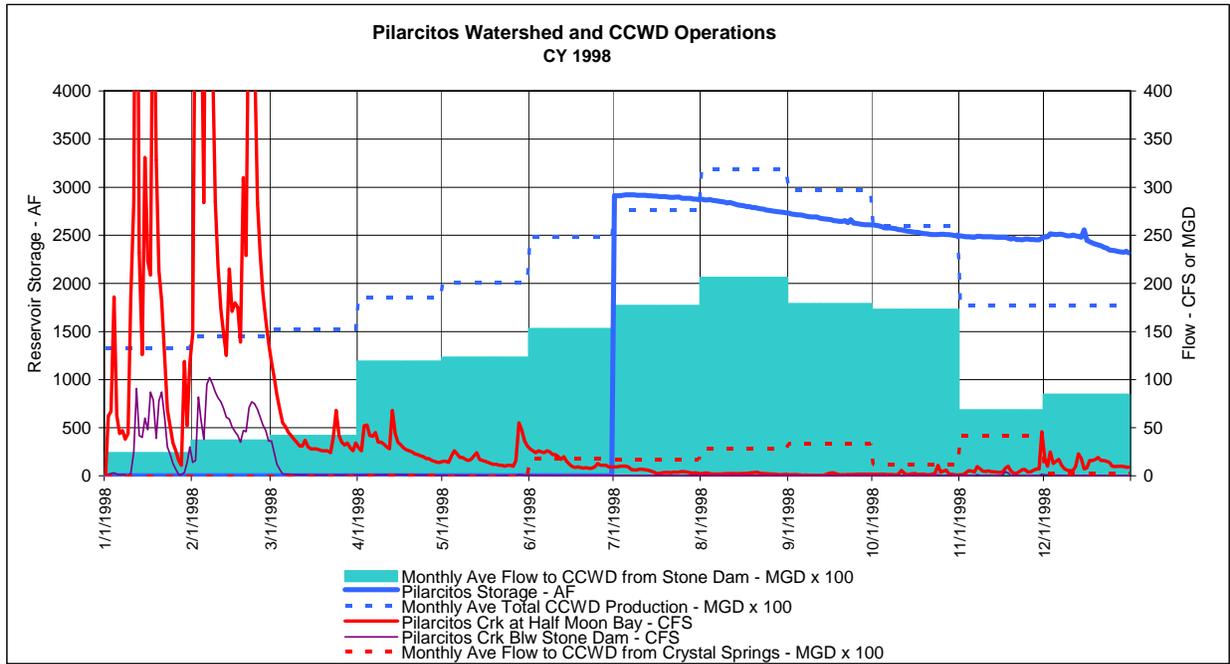


Figure 2b
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 1999

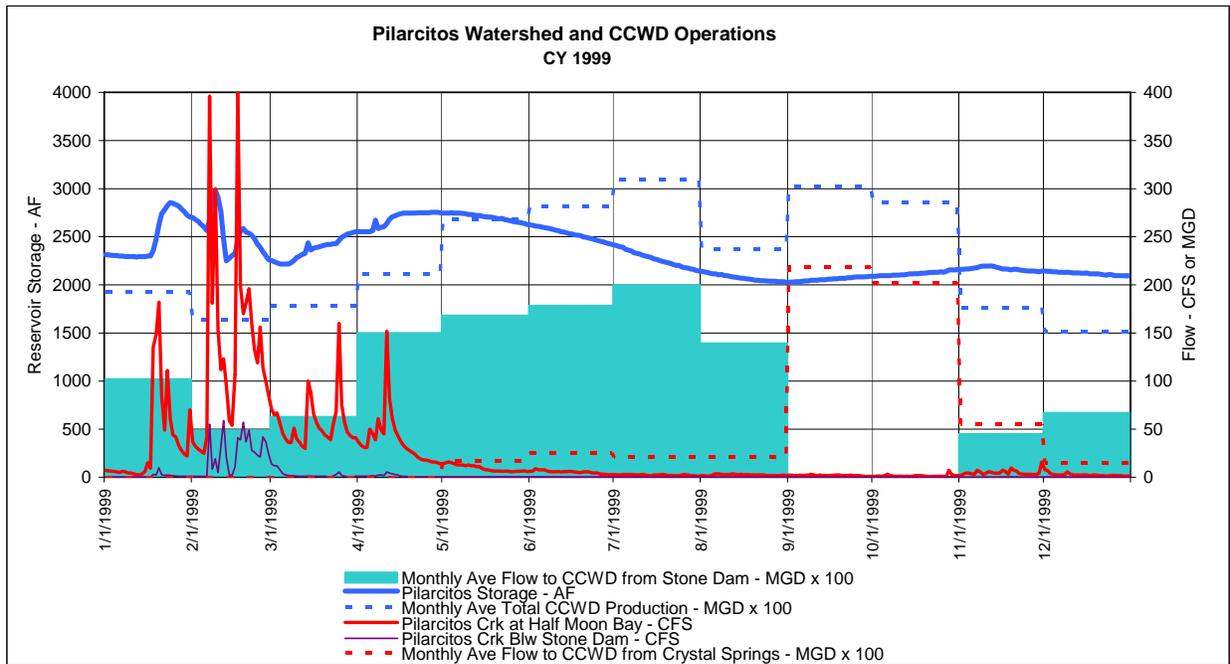


Figure 2c
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 2000

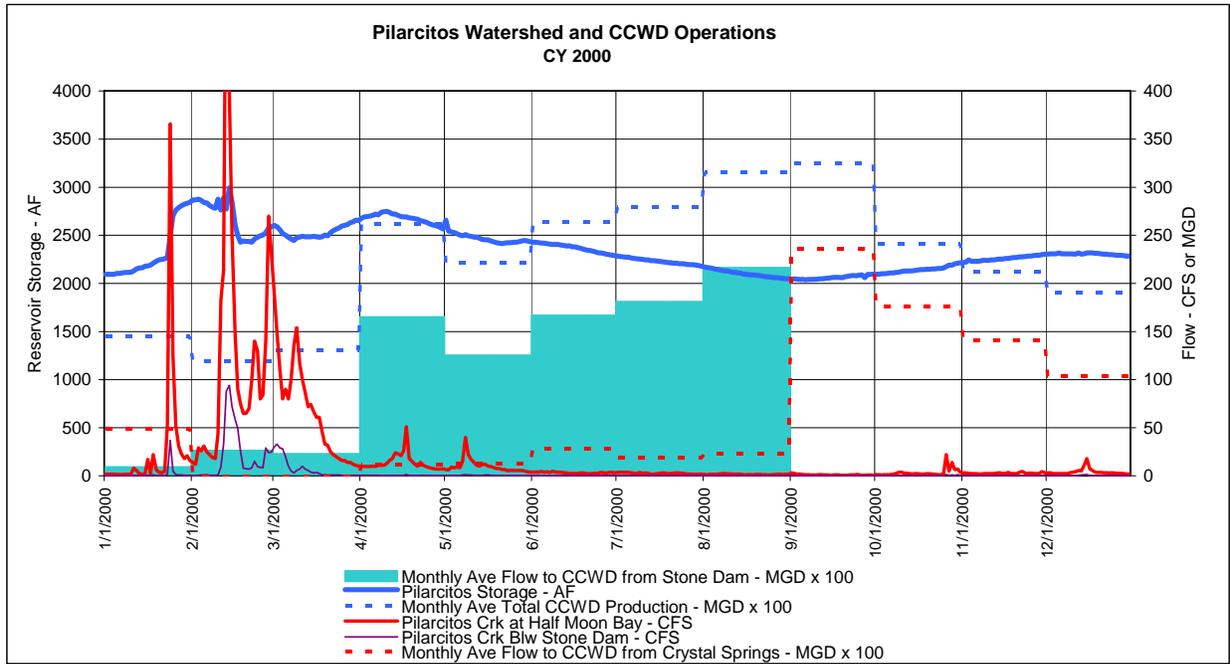


Figure 2d
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 2001

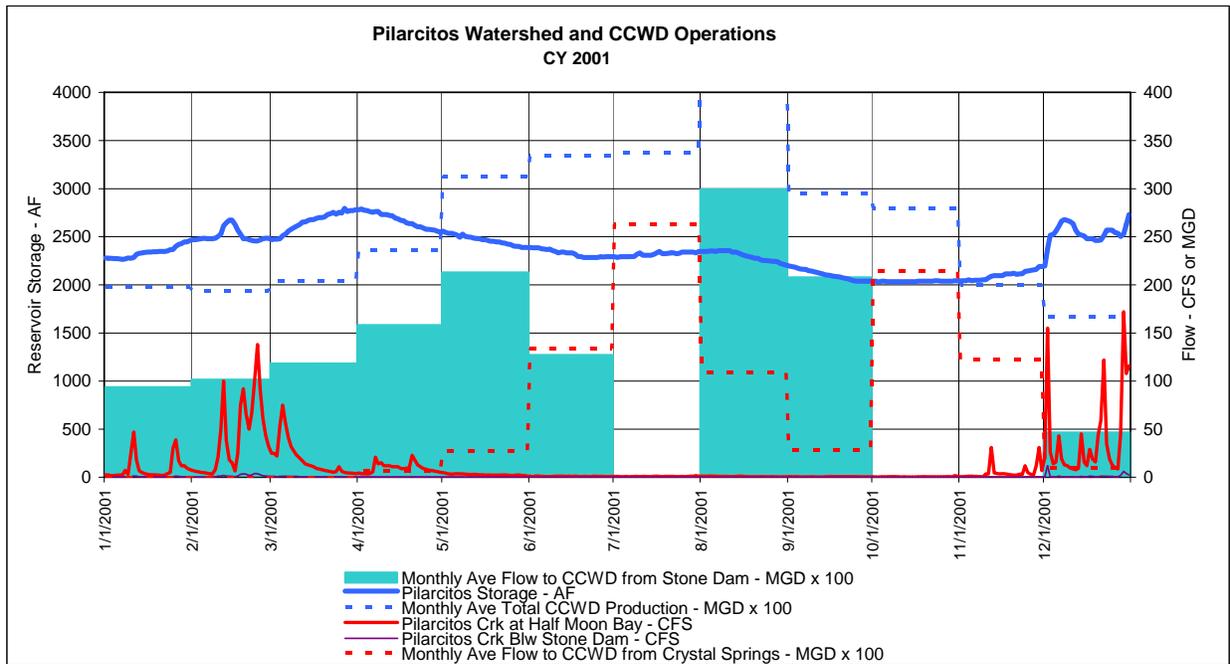


Figure 2e
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 2002

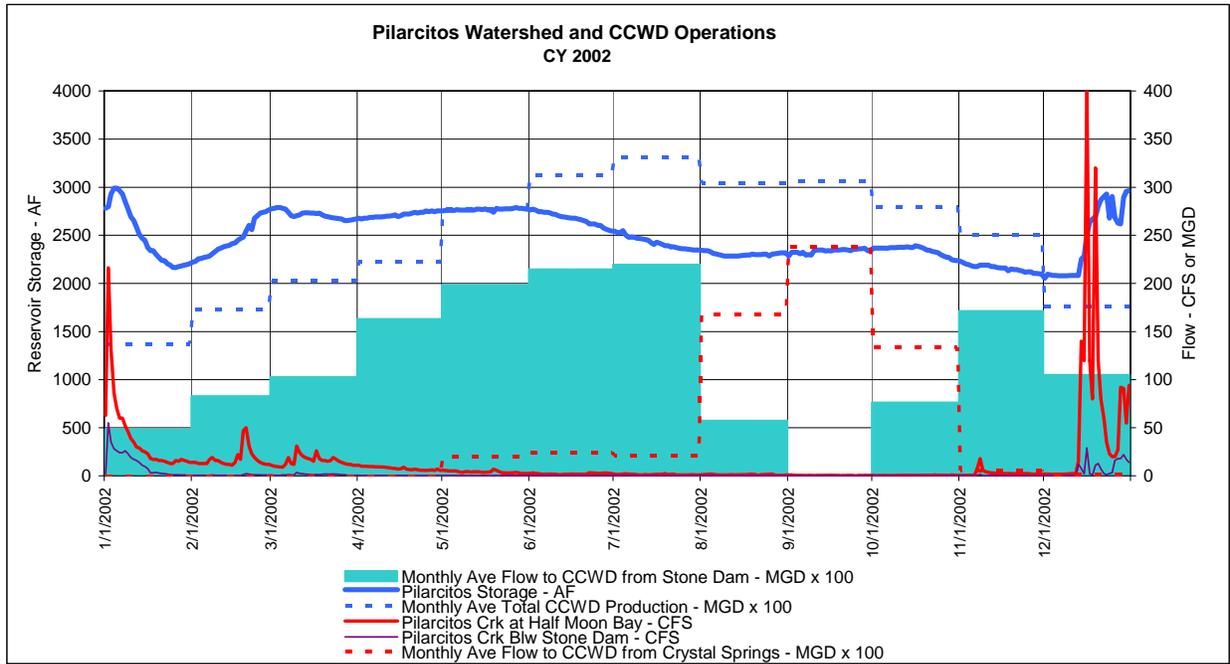


Figure 2f
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 2003

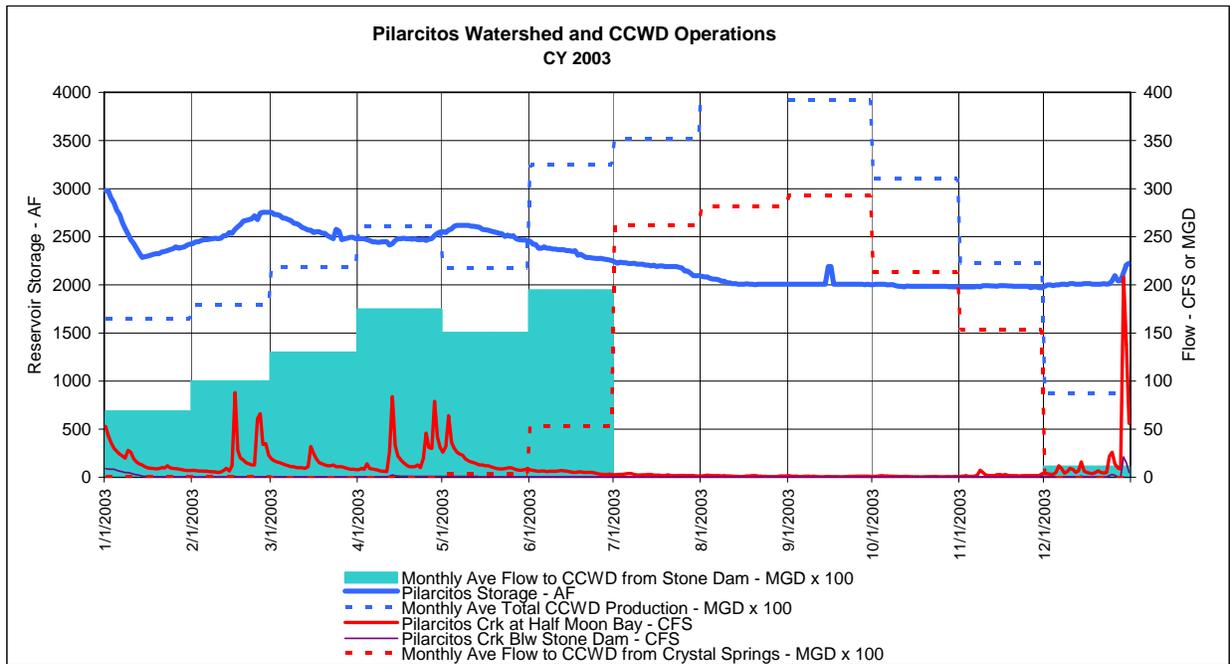


Figure 2g
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 2004

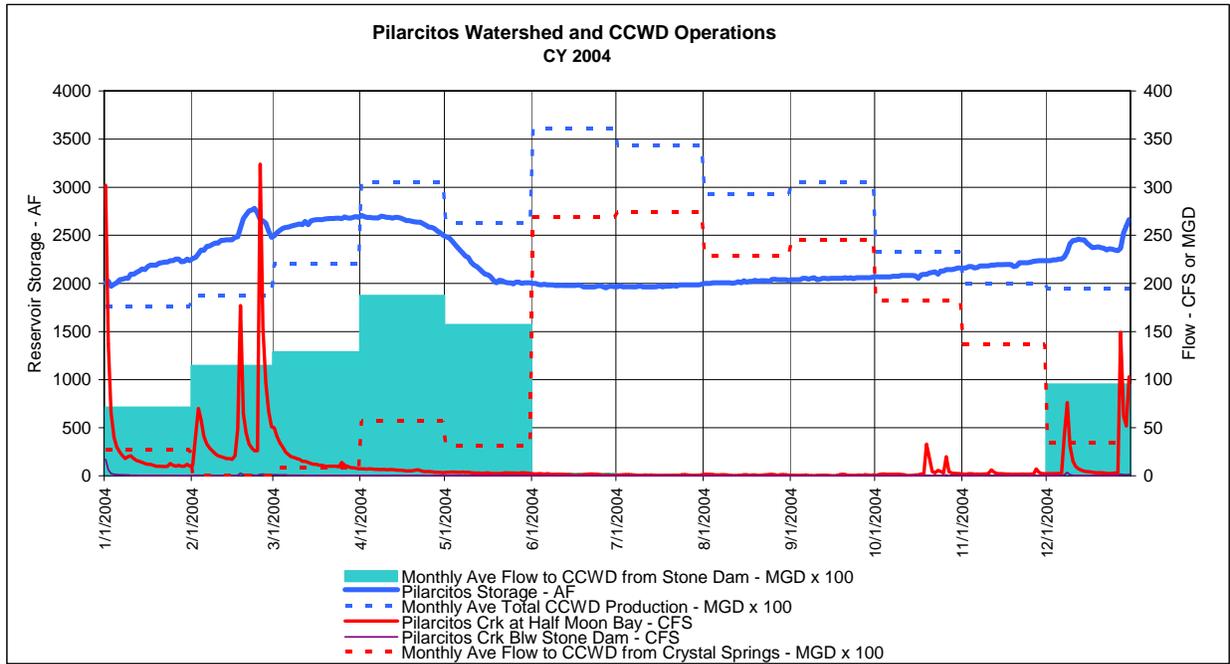


Figure 2h
Historical Record of SFPUC Deliveries to Coastside CWD, Pilarcitos Reservoir and Pilarcitos Creek Flow 2005

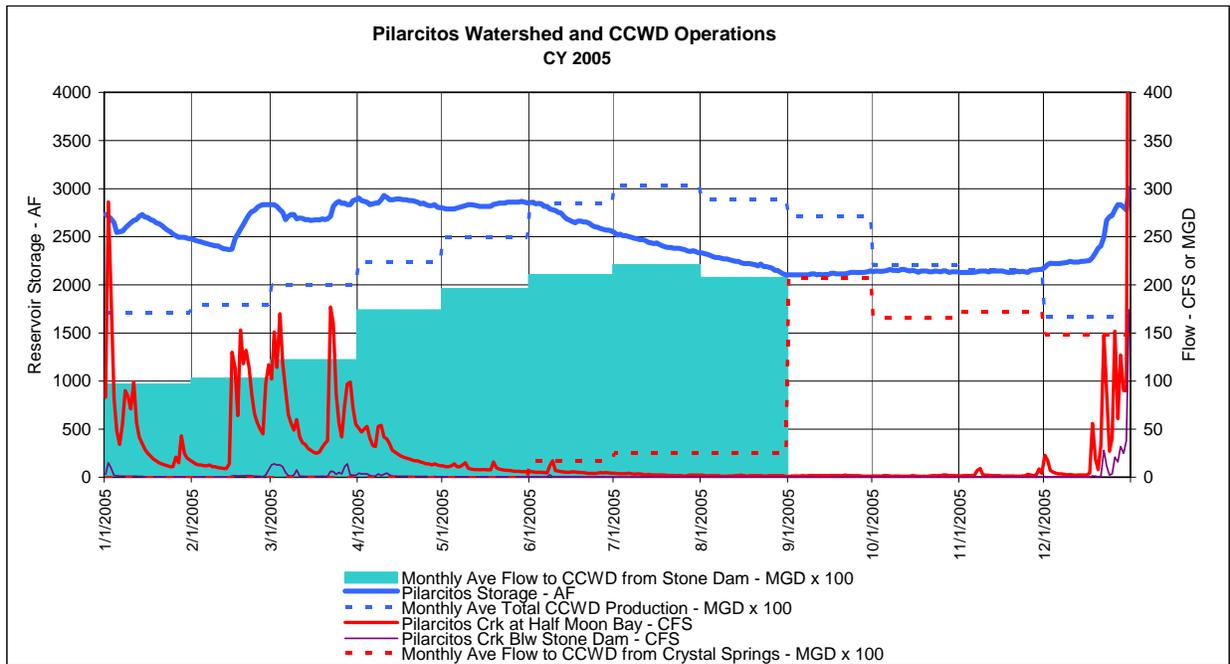


Figure 3
Coastside CWD Non-SFPUC Supplies (MG)
1986-2005

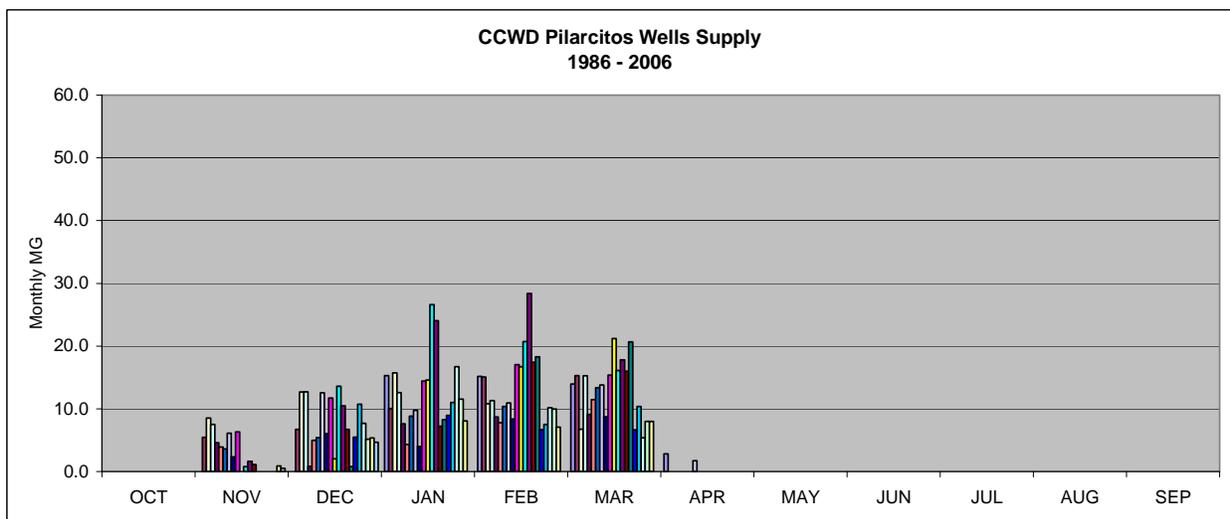
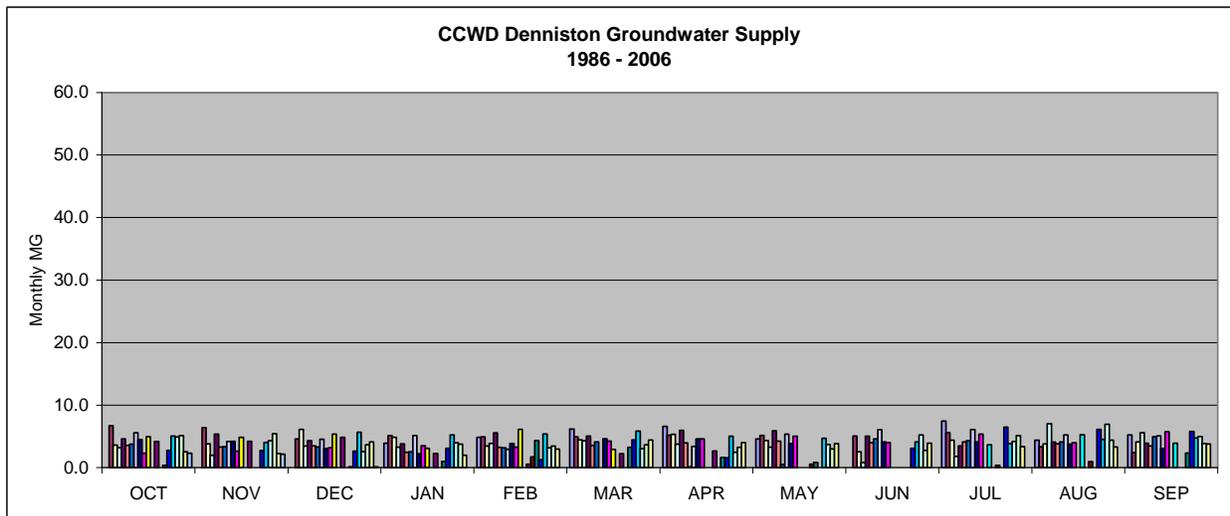
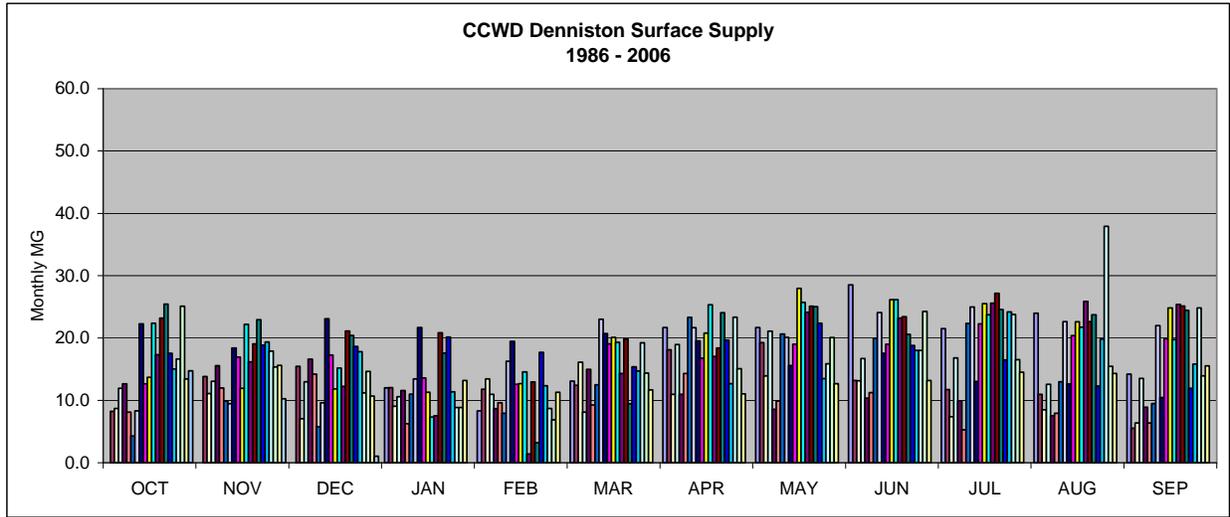
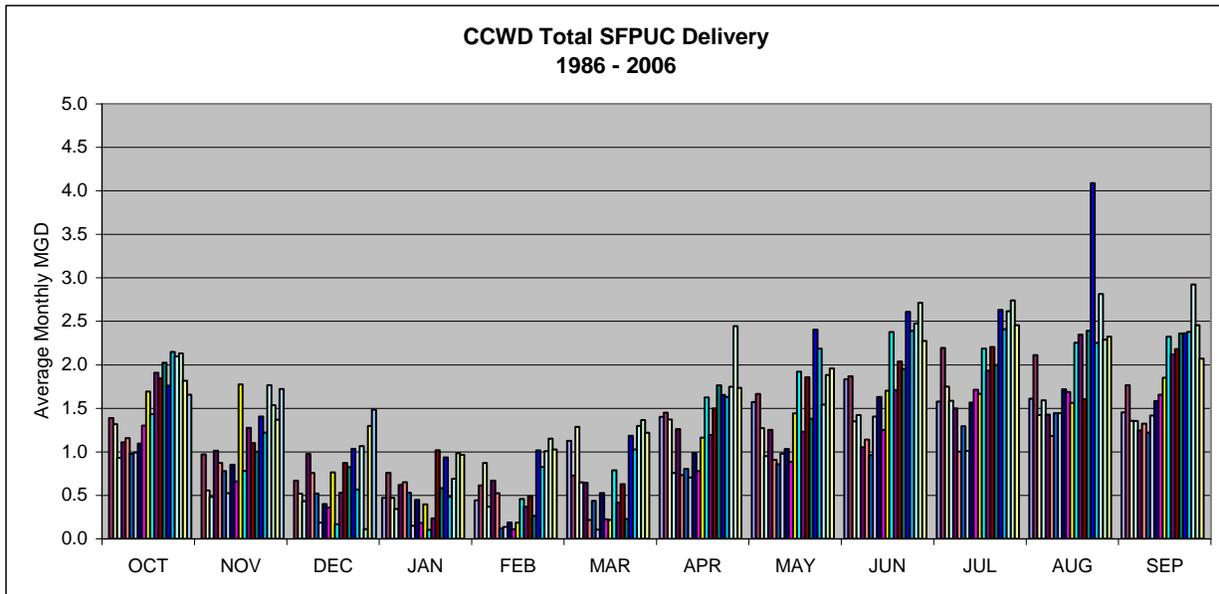
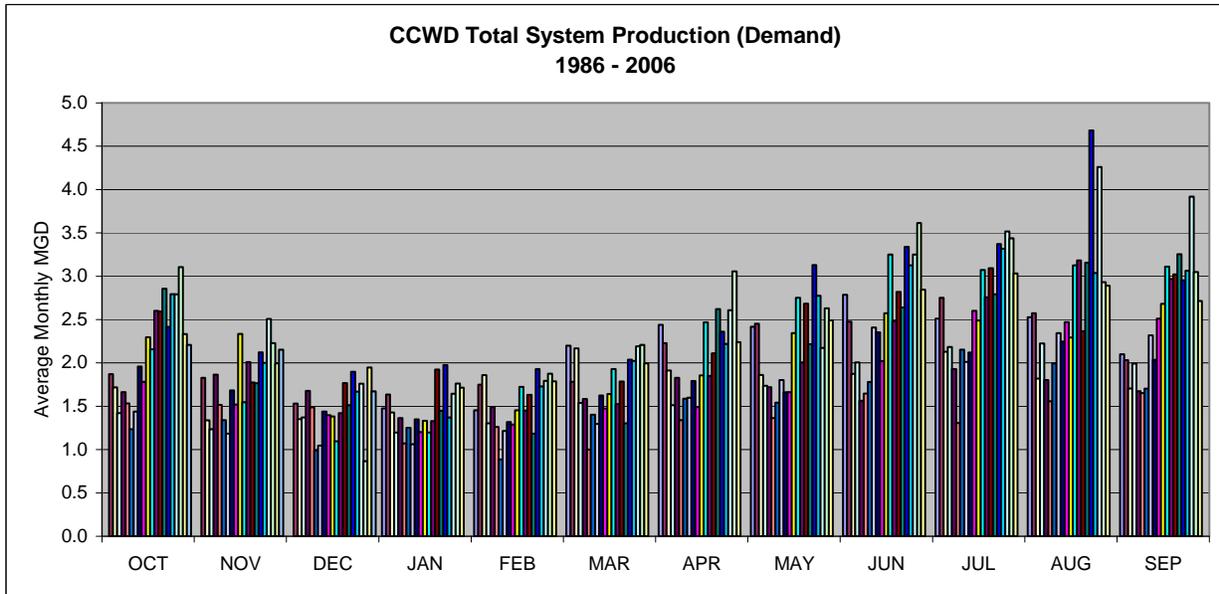


Figure 4 provides an insight to Coastside CWD's total water production (representative of total system demand) and the proportion provided by SFPUC deliveries. Supplementing Figure 4 is Table 1, which reports the district's total production. The district's annual water production has averaged 2.5 million gallons per day (mgd) over the past 5 years. Table 2 illustrates the district's delivery of water from the SFPUC, indicating a fairly constant receipt of about 1.8 mgd over the past 5 years. The delivery of water

Figure 4
Coastside CWD Total Production and SFPUC Delivery – MGD
1986-2005



**Table 1
Coastside CWD Total Production - MGD
1986-2006**

WY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WY Total	Jul-Jun Total	CY Total
1986				1.5	1.5	2.2	2.4	2.4	2.8	2.5	2.5	2.1		2.1	2.1
1987	1.9	1.8	1.5	1.6	1.7	1.8	2.2	2.5	2.5	2.8	2.6	2.0	2.1	1.9	2.0
1988	1.7	1.3	1.4	1.4	1.9	2.2	1.9	1.9	1.9	2.1	1.8	1.7	1.8	1.6	1.7
1989	1.4	1.2	1.4	1.2	1.3	1.5	1.5	1.7	2.0	2.2	2.2	2.0	1.6	1.8	1.7
1990	1.7	1.9	1.7	1.4	1.5	1.6	1.8	1.7	1.6	1.9	1.8	1.7	1.7	1.5	1.6
1991	1.5	1.5	1.5	1.1	1.3	1.0	1.3	1.4	1.6	1.3	1.6	1.7	1.4	1.4	1.3
1992	1.2	1.3	1.0	1.3	0.9	1.4	1.6	1.5	1.8	2.2	2.0	1.7	1.5	1.6	1.5
1993	1.4	1.2	1.0	1.1	1.2	1.3	1.6	1.8	2.4	2.0	2.3	2.3	1.6	1.8	1.8
1994	2.0	1.7	1.4	1.3	1.3	1.6	1.8	1.7	2.4	2.1	2.2	2.0	1.8	1.7	1.8
1995	1.8	1.5	1.4	1.2	1.3	1.5	1.5	1.7	2.0	2.6	2.5	2.5	1.8	2.1	1.9
1996	2.3	2.3	1.4	1.3	1.5	1.6	1.9	2.3	2.6	2.5	2.3	2.7	2.1	2.1	2.0
1997	2.2	1.5	1.1	1.2	1.7	1.9	2.5	2.8	3.3	3.1	3.1	3.1	2.3	2.2	2.4
1998	2.6	2.0	1.4	1.3	1.5	1.5	1.8	2.0	2.5	2.8	3.2	3.0	2.1	2.3	2.1
1999	2.6	1.8	1.8	1.9	1.6	1.8	2.1	2.7	2.8	3.1	2.4	3.0	2.3	2.2	2.3
2000	2.9	1.8	1.5	1.4	1.2	1.3	2.6	2.2	2.6	2.8	3.2	3.3	2.2	2.5	2.3
2001	2.4	2.1	1.9	2.0	1.9	2.0	2.4	3.1	3.3	3.4	4.7	3.0	2.7	2.6	2.7
2002	2.8	2.0	1.7	1.4	1.7	2.0	2.2	2.8	3.1	3.3	3.0	3.1	2.4	2.5	2.5
2003	2.8	2.5	1.8	1.6	1.8	2.2	2.6	2.2	3.3	3.5	4.3	3.9	2.7	2.8	2.6
2004	3.1	2.2	0.9	1.8	1.9	2.2	3.1	2.6	3.6	3.4	2.9	3.0	2.6	2.4	2.6
2005	2.3	2.0	1.9	1.7	1.8	2.0	2.2	2.5	2.8	3.0	2.9	2.7	2.3		2.3
2006	2.2	2.2	1.7												

**Table 2
Coastside CWD Deliveries from SFPUC - MGD
1986-2006**

WY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WY Total	Jul-Jun Total	CY Total
1986				0.5	0.4	1.1	1.4	1.6	1.8	1.6	1.6	1.5		1.2	1.2
1987	1.4	1.0	0.7	0.8	0.6	0.7	1.5	1.7	1.9	2.2	2.1	1.8	1.4	1.3	1.3
1988	1.3	0.6	0.5	0.5	0.9	1.3	1.4	1.3	1.4	1.8	1.4	1.4	1.1	0.9	1.1
1989	0.9	0.5	0.4	0.3	0.4	0.6	0.8	1.0	1.4	1.6	1.6	1.4	0.9	1.1	1.0
1990	1.1	1.0	1.0	0.6	0.7	0.6	1.3	1.3	1.1	1.5	1.4	1.2	1.1	0.9	1.0
1991	1.2	0.9	0.8	0.7	0.5	0.2	0.7	0.9	1.1	1.0	1.2	1.3	0.9	0.8	0.8
1992	1.0	0.8	0.5	0.5	0.1	0.4	0.8	0.9	1.0	1.3	1.4	1.2	0.8	0.8	0.8
1993	1.0	0.5	0.2	0.2	0.1	0.1	0.7	1.0	1.4	1.0	1.4	1.4	0.8	0.9	0.8
1994	1.1	0.9	0.4	0.4	0.2	0.5	1.0	1.0	1.6	1.6	1.7	1.6	1.0	0.9	1.0
1995	1.3	0.7	0.4	0.2	0.1	0.2	0.8	0.9	1.3	1.7	1.7	1.7	0.9	1.2	1.1
1996	1.7	1.8	0.8	0.4	0.2	0.2	1.2	1.4	1.7	1.7	1.6	1.9	1.2	1.2	1.1
1997	1.4	0.8	0.2	0.1	0.5	0.8	1.6	1.9	2.4	2.2	2.3	2.3	1.4	1.3	1.5
1998	1.9	1.3	0.5	0.2	0.4	0.4	1.2	1.2	1.7	1.9	2.3	2.1	1.3	1.5	1.3
1999	1.8	1.1	0.9	1.0	0.5	0.6	1.5	1.9	2.0	2.2	1.6	2.2	1.5	1.3	1.5
2000	2.0	1.0	0.8	0.6	0.3	0.2	1.8	1.4	2.0	2.0	2.4	2.4	1.4	1.7	1.4
2001	1.8	1.4	1.0	0.9	1.0	1.2	1.7	2.4	2.6	2.6	4.1	2.4	1.9	1.8	1.9
2002	2.1	1.2	0.6	0.5	0.8	1.0	1.6	2.2	2.4	2.4	2.3	2.4	1.6	1.7	1.7
2003	2.1	1.8	1.1	0.7	1.0	1.3	1.7	1.5	2.5	2.6	2.8	2.9	1.8	1.9	1.7
2004	2.1	1.5	0.1	1.0	1.2	1.4	2.4	1.9	2.7	2.7	2.3	2.5	1.8	1.8	1.9
2005	1.8	1.4	1.3	1.0	1.0	1.2	1.7	2.0	2.3	2.5	2.3	2.1	1.7		1.7
2006	1.7	1.7	1.5												

from SFPUC sources to Coastside CWD is illustrated in Figure 5, showing the seasonal trend and magnitude of deliveries from Stone Dam and Crystal Springs Reservoir. The data illustrate that deliveries from the Stone Dam diversion have generally peaked in recent years during May through September, typically representing an average monthly delivery rate of 2 mgd. The estimated capacity of the turnout is slightly greater than historical records indicate; however, the record indicates the typical maximum average monthly performance of the diversion facilities. Deliveries during this period may actually be less than the maximum diversion rate due to either limited water availability from Pilarcitos Reservoir or a need to serve a greater rate of delivery that can be accommodated by diversions from Crystal Springs Reservoir. Deliveries from Pilarcitos Reservoir are reduced during the winter as the district's demand is less and the district utilizes other resources. The district's average delivery of SFPUC water from the Stone Dam diversion has averaged about 1 mgd over the past 5 years, with another 0.8 mgd originating from Crystal Springs Reservoir. Table 3 and Table 4 report the SFPUC deliveries to the district from each source.

Figure 5
SFPUC Deliveries to Coastside CWD from Stone Dam and Crystal Springs Reservoir – MGD
1986-2006

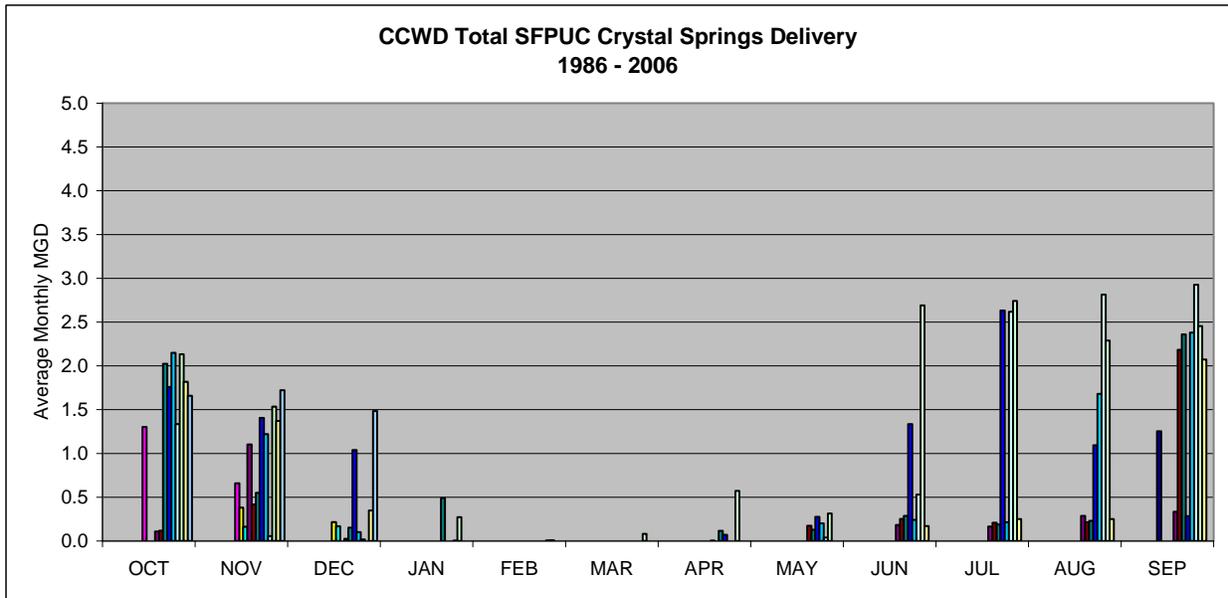
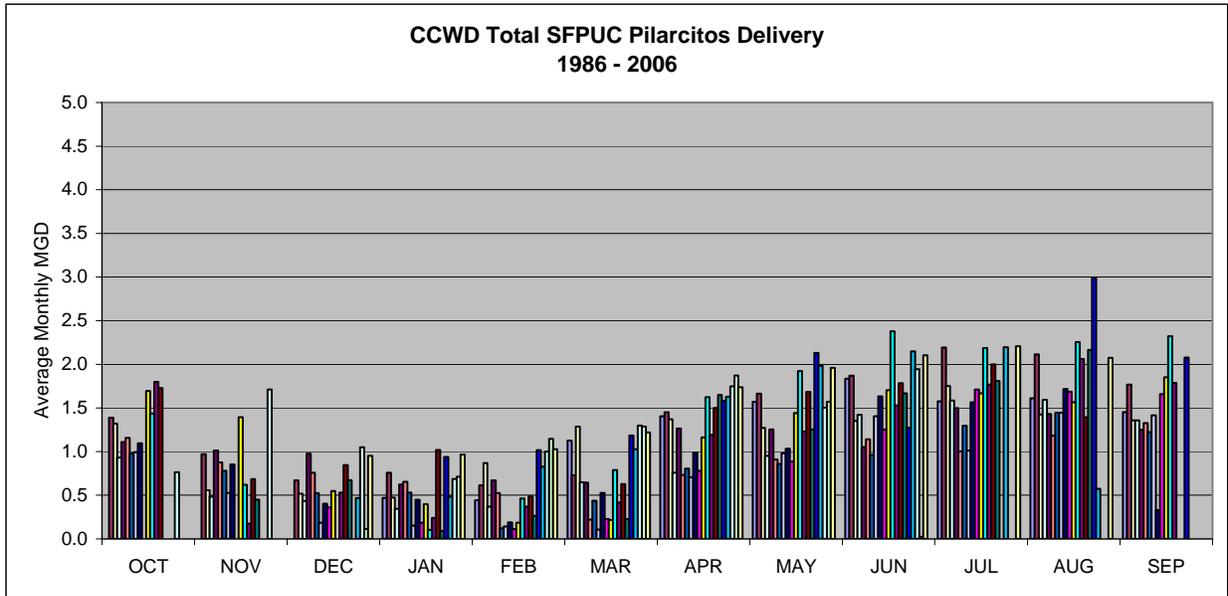


Table 3
Deliveries from SFPUC Stone Dam Diversion to Coastside CWD - MGD
1986-2006

WY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WY Total	Jul-Jun Total	CY Total
1986	0.0	0.0	0.0	0.5	0.4	1.1	1.4	1.6	1.8	1.6	1.6	1.5		1.2	1.2
1987	1.4	1.0	0.7	0.8	0.6	0.7	1.5	1.7	1.9	2.2	2.1	1.8	1.4	1.3	1.3
1988	1.3	0.6	0.5	0.5	0.9	1.3	1.4	1.3	1.4	1.8	1.4	1.4	1.1	0.9	1.1
1989	0.9	0.5	0.4	0.3	0.4	0.6	0.8	1.0	1.4	1.6	1.6	1.4	0.9	1.1	1.0
1990	1.1	1.0	1.0	0.6	0.7	0.6	1.3	1.3	1.1	1.5	1.4	1.2	1.1	0.9	1.0
1991	1.2	0.9	0.8	0.7	0.5	0.2	0.7	0.9	1.1	1.0	1.2	1.3	0.9	0.8	0.8
1992	1.0	0.8	0.5	0.5	0.1	0.4	0.8	0.9	1.0	1.3	1.4	1.2	0.8	0.8	0.8
1993	1.0	0.5	0.2	0.2	0.1	0.1	0.7	1.0	1.4	1.0	1.4	1.4	0.8	0.9	0.8
1994	1.1	0.9	0.4	0.4	0.2	0.5	1.0	1.0	1.6	1.6	1.7	0.3	0.9	0.6	0.7
1995	0.0	0.0	0.4	0.2	0.1	0.2	0.8	0.9	1.3	1.7	1.7	1.7	0.7	1.2	1.0
1996	1.7	1.4	0.5	0.4	0.2	0.2	1.2	1.4	1.7	1.7	1.6	1.9	1.2	1.2	1.0
1997	1.4	0.6	0.0	0.1	0.5	0.8	1.6	1.9	2.4	2.2	2.3	2.3	1.3	1.2	1.4
1998	1.8	0.2	0.5	0.2	0.4	0.4	1.2	1.2	1.5	1.8	2.1	1.8	1.1	1.3	1.2
1999	1.7	0.7	0.8	1.0	0.5	0.6	1.5	1.7	1.8	2.0	1.4	0.0	1.2	0.8	1.0
2000	0.0	0.5	0.7	0.1	0.3	0.2	1.6	1.3	1.7	1.8	2.2	0.0	0.9	1.0	0.8
2001	0.0	0.0	0.0	0.9	1.0	1.2	1.6	2.1	1.3	0.0	3.0	2.1	1.1	1.1	1.1
2002	0.0	0.0	0.5	0.5	0.8	1.0	1.6	2.0	2.1	2.2	0.6	0.0	0.9	1.2	1.2
2003	0.8	1.7	1.1	0.7	1.0	1.3	1.7	1.5	1.9	0.0	0.0	0.0	1.0	0.6	0.7
2004	0.0	0.0	0.1	0.7	1.1	1.3	1.9	1.6	0.0	0.0	0.0	0.0	0.6	0.8	0.6
2005	0.0	0.0	1.0	1.0	1.0	1.2	1.7	2.0	2.1	2.2	2.1	0.0	1.2		1.1
2006	0.0	0.0	0.0												

Table 4
Deliveries from SFPUC Crystal Springs Reservoir to Coastside CWD - MGD
1986-2006

WY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	WY Total	Jul-Jun Total	CY Total
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1	0.3	0.3
1995	1.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
1996	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
1998	0.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.2	0.1	0.1
1999	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.2	2.2	0.3	0.5	0.5
2000	2.0	0.6	0.2	0.5	0.0	0.0	0.1	0.1	0.3	0.2	0.2	2.4	0.5	0.7	0.7
2001	1.8	1.4	1.0	0.0	0.0	0.0	0.1	0.3	1.3	2.6	1.1	0.3	0.8	0.7	0.8
2002	2.1	1.2	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.2	1.7	2.4	0.7	0.5	0.5
2003	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.6	2.8	2.9	0.9	1.3	1.1
2004	2.1	1.5	0.0	0.3	0.0	0.1	0.6	0.3	2.7	2.7	2.3	2.5	1.3	0.9	1.3
2005	1.8	1.4	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	2.1	0.5		0.6
2006	1.7	1.7	1.5												

Long-term planning model (Hetch Hetchy Local Simulation Model) results indicate that, under existing operations and demands, Pilarcitos Reservoir would fill to maximum capacity in the spring during about 50 percent of the years, and, in about 60 percent of the years, Coastside CWD deliveries from Pilarcitos would draw the reservoir down to minimum pool at the stream outlet works by the end of September. The recent record of operations (1998-2005) indicates that the minimum pool was reached during 7 of the past 8 years of operation.

4. Estimation of Potential Effects of Increased Deliveries to Coastside CWD

Coastside CWD's water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated to be about 3 mgd.¹ This projected purchase request is approximately 1 mgd greater than its current purchase request.

¹ SFPUC Water System Improvement Program EIR, Chapter 3, 2007.

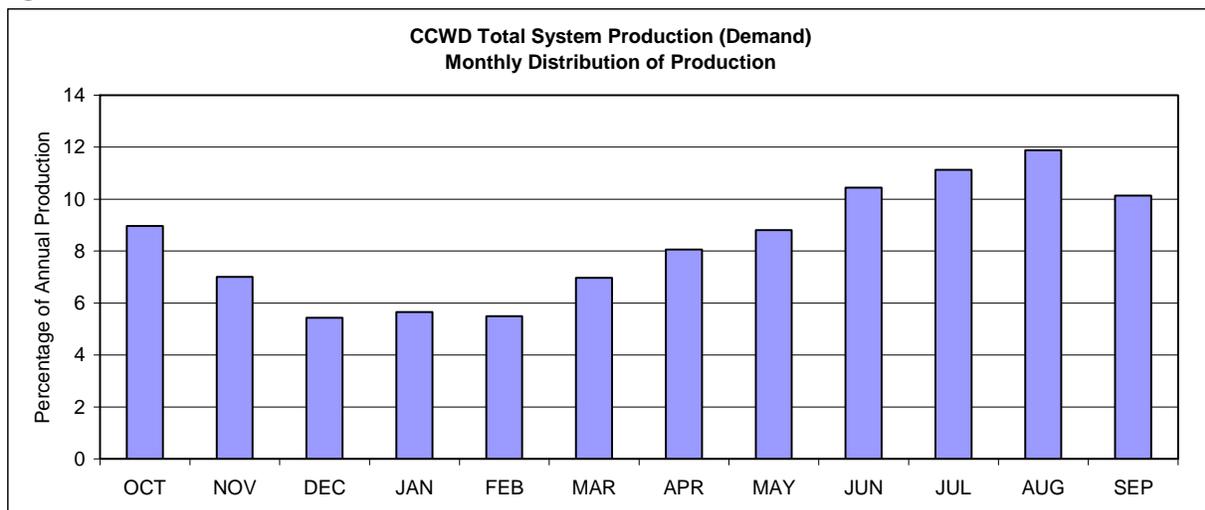
A definitive description for the temporal distribution of Coastside CWD's future SFPUC purchase request is not currently known. The district is currently evaluating how to best manage its future demand with its available resources, and the SFPUC and the district are involved in forums concerning the management of the Pilarcitos Creek watershed. The recent historical record of SFPUC deliveries to the district sheds light on how the current level of delivery affects Pilarcitos Reservoir operation and watershed hydrology. That record also illustrates the hydrologic constraints of the water supply (e.g., the finite amount of water available at Pilarcitos Reservoir) and physical constraints of conveying water to the district (e.g., delivery rate constraint from the Stone Dam diversion). How the additional supply from the SFPUC will manifest as a change in deliveries from the regional system (both source and seasonal pattern) will unfold sometime in the future, and at a minimum be a subject of inquiry during the negotiation of a new water supply contact.

Although it is uncertain how serving Coastside CWD's additional purchase request will specifically change the operation of SFPUC facilities and affect their environs, a range of potential hydrologic effects can be described through development of reasonable assumptions for the manner in which the additional purchase occurs. The following describes several potential postulated delivery scenarios and resultant hydrologic outcomes.

Proportional Load-shape Increase

In this delivery scenario, Coastside CWD's seasonal SFPUC delivery would increase in proportion to the shape of the district's total system production. Figure 6 illustrates the monthly distribution of Coastside CWD's total system production (a surrogate of demand). The temporal shape of the production indicates a demand that is affected by urban use, including domestic irrigation, and irrigation deliveries by the district.

Figure 6



Coastside CWD's current deliveries from the SFPUC are slightly less than those under contract. Recent deliveries (2001-2005) have been approximately 1.9 mgd annually, compared to Coastside CWD's contractual amount of about 2.2 mgd. Figure 7 and Figure 8 illustrate the change in temporal deliveries from current deliveries to the scenario that assumes the district's future purchase request of 2.99 mgd.

Figure 7

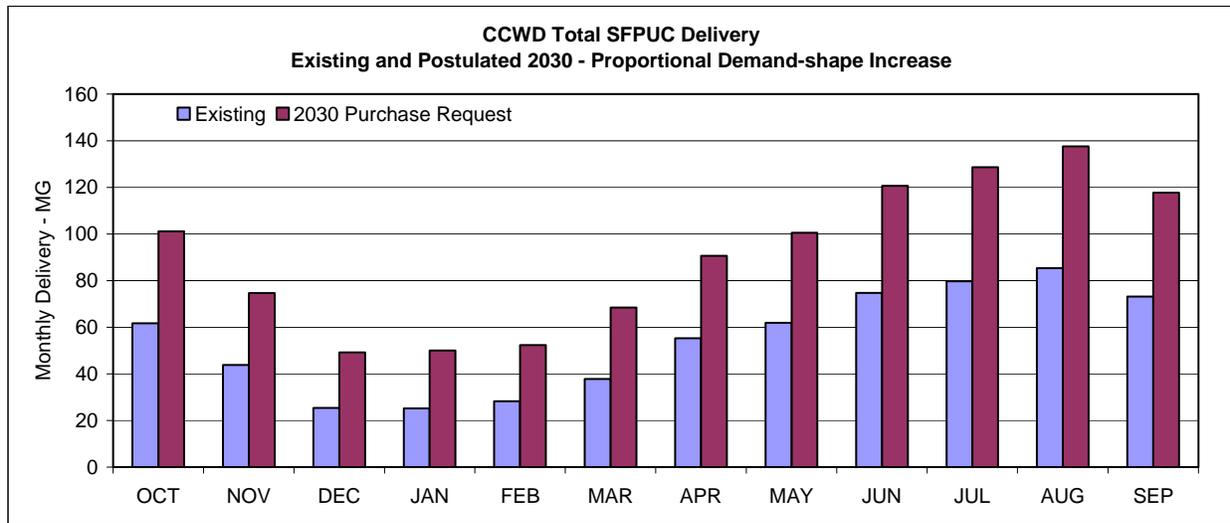
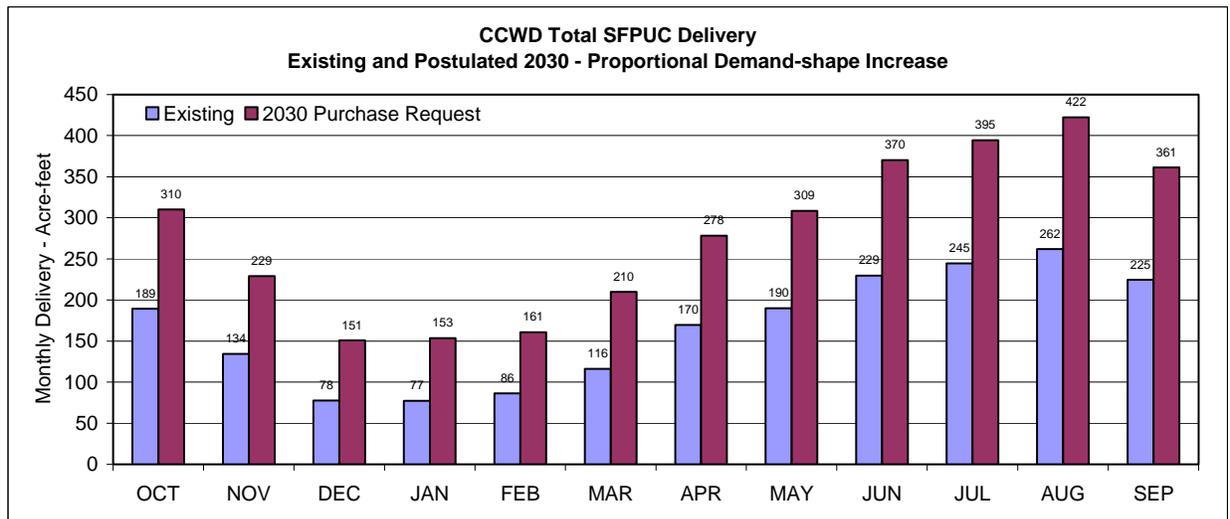
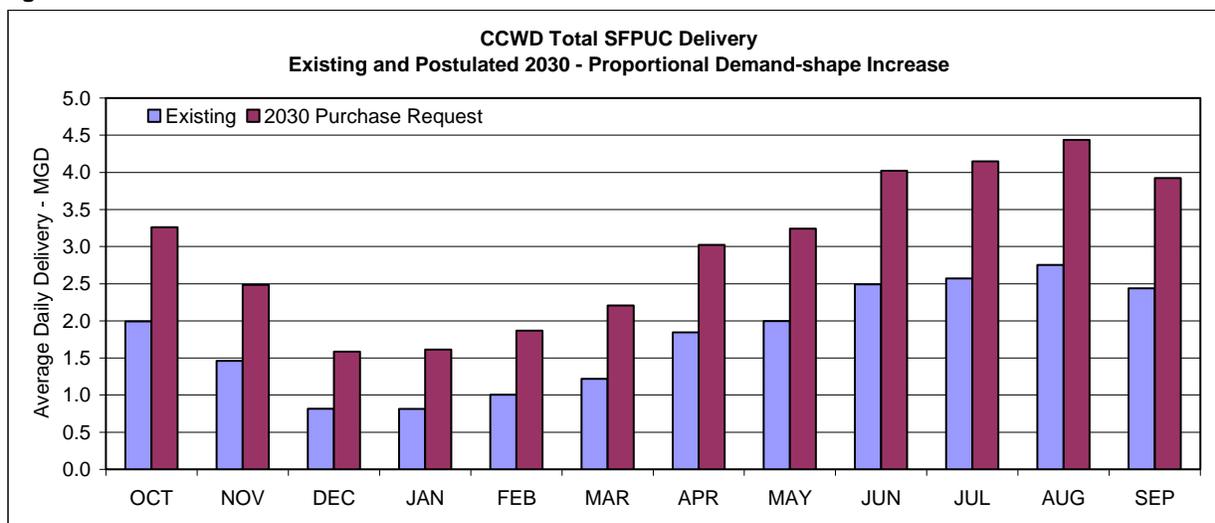


Figure 8



To illustrate potential delivery conveyance constraints, Figure 9 illustrates the average daily flow rate of monthly deliveries associated with current and projected Coastside CWD deliveries from the SFPUC. For recent years, Coastside CWD has been receiving deliveries at a rate of 2 mgd or greater for the period of May through September. This rate of delivery has shown to be a general limitation for deliveries from the Stone Dam diversion, if there is water supply to divert from this source (refer to Figure 5). If Coastside CWD ultimately increases its delivery from the SFPUC in the distribution postulated, the current conveyance constraint of the Stone Dam diversion would require the district to divert the additional water from Crystal Springs Reservoir, possibly requiring facility improvements to effectuate simultaneous deliveries from both sources. Additional deliveries during this season from Crystal Springs Reservoir would not affect the Pilarcitos Reservoir operation if the district is currently already exercising a maximum delivery rate from the Reservoir as constrained by the diversion at Stone Dam. During November through April, Coastside CWD could increase its delivery of Pilarcitos water within the existing capacity of the

Figure 9



Stone Dam diversion. If water was available from Pilarcitos Reservoir (inflow plus storage above the minimum pool of the outlet works), such an increase in delivery would deplete storage in the reservoir or delay the replenishment of the reservoir. While releases from the dam would increase to serve the additional delivery, transfers to the San Mateo Creek watershed would be reduced, and in wetter years the occasional spill to the stream would be delayed if it were to occur at all.

Within any specific year, an additional delivery from Pilarcitos Reservoir could lead to the accelerated draw of storage as compared to current conditions. If, in the current condition, the reservoir is depleted to the minimum pool of the outlet works, the additional delivery would increase the release to the stream until storage is depleted, which would occur at an earlier date. Or, the additional delivery could draw storage to the minimum pool of the outlet works in a year that it would not have occurred in the current condition. Flow in the stream subsequent to this point would be the passage of reservoir inflow, which would occur earlier than in the current condition.

If Coastside CWD were to increase the rate at which it could take delivery of water from Pilarcitos Creek by increasing the size of the Pilarcitos Canyon Pipeline, there would be a potential of an accelerated draw of storage from Pilarcitos Reservoir. The accelerated draw of storage would lead to an increase in the number of days that the stream below Pilarcitos Dam would incur only the passage of inflow to the reservoir. During the period in which the additional level of delivery occurs, the stream flow would increase compared to current conditions. The additional draw of storage could lead to a reduction of water transferred to the San Mateo Creek watershed, and reduce the occasional spill from the reservoir to the stream.

Any purchase request by Coastside CWD not met with Pilarcitos Creek diversions would continue to be met from deliveries from Crystal Springs Reservoir.

Increasing Winter-season Deliveries

An alternative outcome for the postulated temporal distribution of increased water deliveries would be a request that the increase in delivery predominantly occur during the winter season. Assuming the postulated seasonally proportional growth in delivery request, analysis indicates that the distribution of the future level of deliveries would not accommodate the full increase in annual delivery during the winter (November through April) period. Also, if the delivery to Coastside CWD from the Stone Dam diversion continues to be constrained at about 2 mgd, the full future purchase request for the district cannot be fully met from Pilarcitos Creek, even if unlimited water were available from the watershed.

The concentration of additional deliveries to the winter period would increase the draw of water from Pilarcitos Reservoir when it is available. As described previously, an increase in draw during this period

would deplete storage in the reservoir or delay the replenishment of the reservoir. While releases from the dam would increase to serve the additional delivery, transfers to the San Mateo Creek watershed would be reduced, and, in wetter years, spill to the stream would be delayed if it occurred at all. During years in which water is not transferred to the San Mateo Creek watershed and water is not spilled from the reservoir (a year when Pilarcitos Reservoir may not fill to maximum carry over storage), the additional draw of water in the winter season would affect the amount of water available for delivery from Pilarcitos Creek during the subsequent summer. Shifting deliveries to earlier in the year would increase flows to meet the increased deliveries, but would accelerate the time when storage is depleted from the reservoir, and the stream would incur only the passage of inflow to the reservoir. Deliveries from Crystal Springs Reservoir would be initiated earlier in the year under these circumstances.

5. Potential Measures to Avoid or Reduce Hydrologic Effects in Pilarcitos Operations

Compared to the current hydrologic condition resulting from the SFPUC's Pilarcitos Creek operations, increased deliveries to Coastside CWD would likely have some level of hydrologic effect to the reservoir and stream. If the basis of comparison is the current condition of the reservoir and stream, and the maintenance of this condition is an objective, several operational measures could avoid or reduce potential hydrologic effects of an increased delivery to Coastside CWD.

- A reservoir operation protocol could be developed that identifies specific storage levels to be retained during seasons of the year. The purpose of the storage levels would be to generally replicate the recent historical operation of the reservoir, leading to a general replication of the frequency and magnitude of stream releases and reservoir storage. Operation to these storage levels could at times limit the seasonal amount of release from Pilarcitos Reservoir and subsequent re-diversion of water to Coastside CWD from Pilarcitos Creek. The purchase request of Coastside CWD not served from Pilarcitos Creek would be served from Crystal Springs Reservoir.
- Rate of delivery constraints within the Coastside CWD contract could be established that would serve as a limitation upon the seasonal or annual amount of water delivered from Pilarcitos Creek. These limitations could be fashioned to reflect recent historical deliveries from the SFPUC from Pilarcitos Creek. For instance, summertime deliveries could be limited to no more than currently delivered, up to about 2 mgd. During the winter, deliveries could be limited to no more than 1 mgd. The effect of limiting deliveries would result in releases for deliveries from Pilarcitos Reservoir no greater than those in recent history. In effect, the increased delivery level would be served from Crystal Springs Reservoir.

6. References

Balance Hydrologics, Inc. Pilarcitos Creek Alternative Point of CCWD Diversion Study. Prepared for Coastside County Water District. July 1997.

Coastside County Water District. Water Supply Evaluation Report Calendar Year 2005. March 2006.

APPENDIX H2-4

Memorandum

Subject: HH/LSM Assumptions and Results – WSIP Variants
From: Daniel B. Steiner
Date: February 20, 2007

1. Introduction

This memorandum summarizes assumptions for, and describes the interpretation of, Hetch Hetchy Local Simulation Model (HH/LSM) results for the simulation of the Water System Improvement Program (WSIP) variants that are incorporated into the Program Environmental Impact Report (PEIR). Three WSIP variants have been evaluated: WSIP Variant 1 - All Tuolumne; WSIP Variant 2 - Regional Desalination for Drought; and WSIP Variant 3 - 10% Rationing. Major difference between the variants and the proposed program (WSIP) occur either in the proposed source(s) of water supply or in the drought-year rationing level of service. Table 1-1 and Table 1-2 summarize the components, various modeling assumptions, and performance and hydrologic results for the variants as compared with the modeled existing setting (2005) with Calaveras Reservoir constrained by California Division of Safety of Dams (DSOD) restrictions, the pre-2002 setting (with a Calaveras Reservoir operation prior to DSOD restrictions), and the WSIP setting.

The hydrology of each variant is primarily discussed in terms of a comparison to the proposed program (WSIP) and contrasted to the baseline condition of the PEIR, i.e., the simulated current (2005) operation of the Regional Water System assuming DSOD constraints on operations of both the Calaveras and Crystal Springs Reservoirs. Only primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and only those parameters identified as key hydrologic factors that lead to environmental impact assessment are illustrated.

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 1/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP	WSIP Variants ³		
		Baseline Conditions - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		All Tuolumne	Regional Desalination for Drought	10% Rationing
Time Horizon for Setting of Analysis / Date ⁴		2005	2005	2030	2030	2030	2030
HH/LSM Simulation Study Name ⁵		MEA3CHR	MEA2A	MEA5HIN	MEA4HIN	MEA30H	MEA31H
System Wide Parameters							
Customer Purchase Request (Demand Level) ⁶	MGD	265	265	300	300	300	300
Demand Level Supplied from Other Sources ⁷							
Regional Recycled Water/Conservation/Groundwater in SF	MGD	0	0	10	0	10	10
Other Regional Recycled Water/Conservation/Groundwater	MGD	0	0	0	0	0	0
Demand Level Supplied from Tuolumne + Local Watersheds ⁸	MGD	265	265	290	300	290	290
Average Annual Deliveries and Supplies ⁹							
Deliveries from Tuolumne + Local Watersheds (Average Annual)	MGD	258	259	287	293	287	287
Supply or Deliveries from Other Sources - Regional Recl/Cons/GW	MGD	0	0	10	0	10	10
Total Deliveries and Supply for Demand Level (Average Annual)	MGD	258	259	297	293	297	297
Features and Facilities¹⁰							
Regional Reclaimed Water/Conservation/Groundwater - SF				•		•	•
Regional Reclaimed Water/Conservation/Groundwater - Other							
Calaveras Reservoir - 12.4 BG (Constrained)		•					
Calaveras Reservoir - 31.6 BG (Restored/Unconstrained)			•	•	•	•	•
Calaveras Reservoir Release for Fish				•	•	•	•
Calaveras Reservoir Release for Fish & Flow Recapture				•	•	•	•
Crystal Springs Reservoir - 19.0 BG (Constrained)		•	•				
Crystal Springs Reservoir - 22.6 BG (Restored/Unconstrained)				•	•	•	•
Sunol Valley Water Treatment Plant Expansion				•	•	•	•
Sunol Valley Water Treatment Plant Feed from SJPL				•	•	•	•
Harry Tracy Water Treatment Plant Expansion				•	•	•	•
Bay Division Pipeline Increased Conveyance				•	•	•	•
San Joaquin Pipeline Increased Conveyance				•	•	•	•
Desalination Project					•		
Westside Groundwater Project				•	•	•	•
Tuolumne River Transfer				•	•	•	•
Water Supply Reliability¹¹							
Action	Level	Rationing %	Rationing %	Rationing %	Rationing %	Rationing %	Rationing %
Implement Drought Water Supply Action (Westside GW or Desal)	1	NA	NA	GW	GW	Desalination	GW
Rationing (Level 1)	2	10	10	10	10	10	10
Rationing (Level 2)	3	20	20	20	20	20	20
Rationing (Level 3)	4	25	25	25	25	25	25
Years	Action Level	Action Level	Action Level	Action Level	Action Level	Action Level	Action Level
1921				1			
1924	2	2		1	2	1	1
1925				1			1
1926				1	1	1	1
1929				1	1	1	1
1930				1	1	1	1
1931	3	2		2	2	2	2
1932							
1933					1		1
1934	2	2		1	2	1	1
1935					1		
1939							
1944							
1946							
1947							
1948				1	1	1	1
1949							
1950				1	1	1	1
1953							
1954							
1955				1			1
1957							
1959							
1960	2	2		1	2	1	1
1961	3	3		2	3	2	2
1962							
1964				1	1	1	1
1966							
1968							
1971							
1972				1		1	1
1976	2	2		1	2	1	1
1977	3	3		2	3	2	2
1979							
1981							
1984							
1985				1	1	1	1
1987	2	2		1	2	1	1
1988	3	3		2	3	2	2
1989	3	2		2	2	2	2
1990	3	3		3	3	3	2
1991	3	3		2	3	2	2
1992	3	3		3	3	3	2
1994	2	2		1	2	1	1
DD1993	4	3		3	3	3	2
DD1994	4	3		3	3	3	2
Max Drought Rationing - Policy Cap¹²							
DD Historical		Incidental 25% Incidental 20%	Incidental 20% Incidental 20%	20% 20%	20% 20%	20% 20%	10% 10%

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 2/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP	WSIP Variants ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		All Tuolumne	Regional Desalination for Drought	10% Rationing
System Wide Parameters							
Incremental Supply - Average¹³							
System Customer Purchase Request Level	MGD	265	265	300	300	300	300
Demand Level Supplied from Other Sources	MGD	0	0	10	0	10	10
Demand Level Supplied from Tuolumne + Local Watersheds	MGD	265	265	290	300	290	290
System Deliveries	MGD	258	259	287	293	287	287
Regional Desalination	MGD	0	0	0	0	7	0
San Joaquin Pipelines (Tuolumne Diversion)	MGD	218	215	245	250	238	245
Inferred Local Watershed Production	MGD	40	44	42	43	41	42
Add'l Tuolumne Diversion (Compared to Calaveras Constrained)	MGD	218	215	27	32	20	27
Add'l Tuolumne Diversion (Compared to Calaveras pre-2002)	MGD	218	215	30	35	23	31
Incremental Design Drought Supply¹⁴							
From Other Sources - Regional Recl/Cons/GW (Every Year)	MGD	0	0	10	0	10	10
Restoration of Calaveras Reservoir Capacity (w/ flow recapture)	MGD	0	0	7	7	7	7
Restoration of Crystal Springs Capacity	MGD	0	0	1	1	1	1
MID/TID Transfer to SFPUC (Results in additional diversion from TR)	MGD	0	0	23	23	0	35
Westside Basin Conjunctive Use (8,100 acre-feet Storage)	MGD	0	0	6	6	6	6
Regional Desalination (26 mgd)	MGD	0	0	0	0	23	0
Sum of Incremental Supplies	MGD	0	0	47	37	47	59
Yield - Without Other Sources Added (Compared to Calaveras Constrained)	MGD	219	226	256	256	256	268
Yield - With Other Sources Added (Compared to Calaveras Constrained)	MGD	219	226	266	256	266	278
Design Drought Delivery Calculator¹⁵							
	MGD	2	3	4	5	6	7
Average Annual Delivery During Year 1		265	265	290	300	290	290
Average Annual Delivery During Year 2		239	239	290	270	290	290
Average Annual Delivery During Year 3		212	212	261	240	261	261
Average Annual Delivery During Year 4		212	239	261	270	261	261
Average Annual Delivery During Year 5		212	212	232	240	232	261
Average Annual Delivery During Year 6		212	212	261	240	261	261
Average Annual Delivery During Year 7		212	212	232	240	232	261
Average Annual Delivery During Year 8		199	212	232	240	232	261
Average Annual Delivery During Last 6 Mo		99	106	116	120	116	131
Firm Yield (Nominal) Not Including Other Sources	DD Ave	219	224	256	254	256	268
	MGD	219	226	256	256	256	268
Local System Operational Parameters							
Crystal Springs Reservoir Operation							
Storage - Minimum/Maximum	BG TAF	5.4 - 19.0 16.6 - 58.4			5.4 - 22.6 16.6 - 69.3		
Fall/Winter Operation Storage		17.0 BG (52.2 TAF)			19.0 BG (58.3 TAF)		
Stream Release		Up to 250 cfs to not exceed 19 BG			Up to 250 cfs to not exceed 21 BG		
Calaveras Reservoir Operation							
Storage - Minimum/Maximum	BG TAF	8.4 - 12.4 25.7 - 38.0	8.4 - 31.5 25.7 - 96.8		8.4 - 31.5 25.7 - 96.8		
Fall/Winter Operation Storage		10.3 BG (31.6 TAF)	27.0 BG (82.9 TAF)		27.0 BG (82.9 TAF)		
Alameda Creek Release/Recapture ¹⁶	AFY	0			Up to 6,300		
San Andreas Reservoir Operation							
Storage - Minimum/Maximum	BG TAF	3.0 - 6.2 9.2 - 19.0			3.0 - 6.2 9.2 - 19.0		
Fall/Winter Operation Storage		5.6 BG (17.2 TAF)			5.6 BG (17.2 TAF)		
San Antonio Reservoir Operation							
Storage - Minimum/Maximum	BG TAF	1.0 - 16.5 3.1 - 50.5			1.0 - 16.5 3.1 - 50.5		
Fall/Winter Operation Storage		15.9 BG (48.8 TAF)			15.9 BG (48.8 TAF)		
Pilarcitos Reservoir Operation							
Storage - Minimum/Maximum	BG TAF	0.65 - 0.97 2.0 - 3.0			0.65 - 0.97 2.0 - 3.0		
Fall/Winter Operation Storage		0.75 BG (2.2 TAF)			0.75 BG (2.2 TAF)		
Water Treatment Plants							
Sunol Valley Water Treatment Plant Maximum	MGD	120			160		
		90 MGD from Calaveras			90 MGD from Calaveras + Flow Recapture		
Sunol Valley Water Treatment Plant Minimum	MGD	20			20		
		Cal & SA Res & SJPL	Cal & SA Res		From Calavers & San Antonio Reservoirs & SJPL		
Harry Tracy Water Treatment Plant Maximum	MGD	120			140		
Harry Tracy Water Treatment Plant Minimum	MGD	20			20		
Conveyance							
Bay Division Pipeline Maximum		340 MGD Jun - Sep 320 MGD Apr, May & Oct 290 MGD Nov - Mar			380 MGD Apr - Oct 320 MGD Nov - Mar		
Bay Division Pipeline Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 230 MGD			Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 320 MGD		

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 3/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP	WSIP Variants ³		
		Baseline Conditions - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		All Tuolumne	Regional Desalination for Drought	10% Rationing
Tuolumne River System Operational Parameters							
Hetch Hetchy Reservoir Operation							
Storage - Minimum/Maximum	TAF	26.1 - 360.4			26.1 - 360.4		
Fall/Winter Operation Storage		30 TAF winter buffer			30 TAF winter buffer		
1987 Stipulation Minimum Release Flows		Yes			Yes		
1987 Stipulation Supplemental Release Flows		No			No		
Cherry Reservoir Operation							
Storage - Minimum/Maximum	TAF	1.0 - 273.3			1.0 - 273.3		
Fall/Winter Operation Storage		25.3 TAF winter buffer			25.3 TAF winter buffer		
Eleanor Reservoir Operation							
Storage - Minimum/Maximum	TAF	0.0 - 27.1			0.0 - 27.1		
Fall/Winter Operation Storage		Required Minimum Storage			Required Minimum Storage		
New Don Pedro Water Bank Account							
Storage - Minimum/Maximum	TAF	0.0 - 570.0			0.0 - 570.0		
		Temporary storage up to 740 TAF during Apr - Sep			Temporary storage up to 740 TAF during Apr - Sep		
Conveyance							
San Joaquin Pipelines Maximum	MGD	290		314	314	313	
San Joaquin Pipelines Minimum	MGD	70			70		
San Joaquin Pipelines Flow Rate Changes		11 Stepwise			17 Stepwise		
		Surrogate minimum changes by allowing only 7 changes in a year			Surrogate minimum changes by allowing only 7 changes in a year		
San Joaquin Pipelines Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 210 MGD			Cyclic 5-year maintenance, maximum capacity available Apr - Oct all years 271 MGD available all other months except 0 MGD available Year 5 Nov - Dec and 135.5 MGD available Year 1 and Year 3 Dec		
TID/MID Operational Parameters							
Districts' Tuolumne Diversion¹⁷							
		Varies annually based on land use and water availability Annual average 867 TAF			Set equal to baseline conditions SFPUC diversion effects measured by the result of reducing inflow to New Don Pedro Reservoir and its effect upon La Grange releases to the Tuolumne River		
Tuolumne River La Grange Flow Releases							
Don Pedro, 1996 FERC		X	X	X	X	X	X
VAMP - considered but not modeled ¹⁸		X	X	X	X	X	X

**Table 1-2
Summary of Modeling Results (Part 1/2)**

HH/LSM Simulation Results	Units	Baselines		Proposed WSIP	WSIP Variants ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		All Tuolumne	Regional Desalination for Drought	10% Rationing
Design Drought Production & Disposition^{1b}							
San Joaquin Pipeline Diversion	MGD	206.9	206.4	232.5	232.1	210.4	245
Bay-Area Deliveries	MGD	218.3	223.9	248.9	247.3	248.9	260.6
Added Groveland & Coastside Delivery	MGD	2.6	2.6	3.6	3.5	3.6	3.7
Local Reservoir Evaporation	MGD	10.2	10.6	12.3	12.3	12.5	12.3
Inflow from ACDD	MGD	2.3	2.5	2.5	2.5	2.5	2.5
Flow Recapture	MGD	0	0	5.3	5.3	5.3	5.3
Local Reservoir Stream Release	MGD	0.1	0.2	5.5	5.4	5.3	5.3
Desalination	MGD	0	0	0	0	22.9	0
Westside Basin	MGD	0	0	5.6	5.6	0	5.6
District Transfer to NDP Water Bank	MGD	0	0	22.7	22.7	0	35.3
Local Storage - Begin	MG	53,725	72,505	77,708	77,496	77,673	77,708
Local Storage - End	MG	20,044	19,133	18,846	22,808	21,303	21,672
Study Average Production & Disposition (1921-02)^{2b}							
Tuolumne River System							
Reservoirs							
Hetch Hetchy							
Inflow	AF	749,605	749,605	749,605	749,605	749,605	749,605
River	AF	277,018	277,714	267,446	264,222	269,172	267,073
Stream Minimum Release	AF	65,731	65,912	65,547	65,551	65,686	65,547
Tunnel	AF	468,975	468,279	478,524	481,733	476,791	478,892
Evaporation	AF	3,896	3,886	3,868	3,867	3,873	3,871
Reservoir	AF	284,033	287,056	275,905	273,571	278,946	276,175
Cherry							
Inflow	AF	279,293	279,293	279,293	279,293	279,293	279,293
Eleanor Gravity	AF	199	199	289	289	289	289
Eleanor Pump	AF	118,270	118,188	118,299	118,269	118,582	118,074
River	AF	44,659	44,001	45,978	44,437	46,435	43,928
Stream Minimum Release	AF						
Tunnel	AF	349,596	350,171	348,403	349,910	348,236	350,221
Evaporation	AF	3,507	3,508	3,499	3,504	3,493	3,507
Reservoir	AF	240,426	240,602	239,298	239,814	238,382	240,139
Eleanor							
Inflow	AF	169,617	169,617	169,617	169,617	169,617	169,617
Eleanor Gravity	AF	199	199	289	289	289	289
Eleanor Pump	AF	118,270	118,188	118,299	118,269	118,582	118,074
River	AF	49,243	49,325	49,124	49,154	48,840	49,348
Stream Minimum Release	AF						
Evaporation	AF	1,905	1,905	1,906	1,906	1,906	1,906
Reservoir	AF	22,201	22,201	22,191	22,191	22,191	22,191
Don Pedro Reservoir							
Inflow	AF	1,591,144	1,594,967	1,561,409	1,555,539	1,568,786	1,560,686
MID Diversion	AF	303,546	303,546	303,546	303,546	303,546	303,546
TID Diversion	AF	563,497	563,497	563,497	563,497	563,497	563,497
LaGrange Total Stream	AF	680,091	684,124	652,299	646,860	659,360	651,632
LaGrange Minimum Stream Release	AF	221,361	221,361	221,361	221,361	221,361	221,361
Total Evaporation	AF	44,024	44,092	43,106	42,960	43,429	43,056
Reservoir	AF	1,492,181	1,495,055	1,453,662	1,447,722	1,467,488	1,451,840
Water Bank Account							
Balance	AF	518,149	520,327	517,209	516,614	507,638	524,298
Transfer	AF	0	0	27,000	27,000	0	42,000
San Joaquin Pipelines							
Volume (AF)	AF	244,165	240,340	273,887	279,737	266,510	274,599
Volume (MG)	MG	79,562	78,315	89,246	91,152	86,842	89,477
Rate (MGD)	MGD	218	215	245	250	238	245
Max Rate (MGD)	MGD	290	290	314	313	313	313
Min Rate (MGD)	MGD	70	0	0	0	0	0
East Bay System							
Reservoirs							
Calaveras							
Inflow	MG	12,368	12,368	12,368	12,368	12,368	12,368
From ACDD	MG	1,352	2,023	1,748	1,755	1,746	1,748
Stream	MG	3,660	2,242	4,285	4,248	4,297	4,280
Stream Flow Recapture	MG	0	0	1,555	1,555	1,555	1,555
To SWWTP	MG	9,049	10,616	9,694	9,740	9,682	9,703
To San Antonio	MG	0	0	0	0	0	0
Evaporation	MG	1,023	1,591	1,709	1,706	1,707	1,705
Reservoir	MG	10,975	25,116	28,320	28,257	28,282	28,215
San Antonio							
Inflow	MG	2,468	2,468	2,468	2,468	2,468	2,468
From Calaveras/SJPL	MG	1,053	1,525	1,278	1,543	1,674	1,655
Stream	MG	555	521	548	494	632	567
To SWWTP	MG	2,061	2,511	2,239	2,572	2,529	2,604
Evaporation	MG	956	971	976	963	994	967
Reservoir	MG	14,084	14,447	14,631	14,331	14,893	14,371
Alameda Creek Diversion Dam							
Inflow	MG	4,197	4,197	4,197	4,197	4,197	4,197
To Calaveras Reservoir	MG	1,352	2,023	1,748	1,755	1,746	1,748
Spill	MG	2,845	2,174	2,449	2,442	2,451	2,449
Alameda Creek Confluence							
Accretion	MG	1,918	1,918	1,918	1,918	1,918	1,918
From ACDD	MG	2,845	2,174	2,449	2,442	2,451	2,449
From Calaveras Dam	MG	3,660	2,242	4,285	4,248	4,297	4,280
At Confluence	MG	8,422	6,333	8,652	8,609	8,666	8,647
Treatment Plants							
SWWTP Total	MG	13,752	13,267	14,313	14,522	14,604	14,648
From Calaveras	MG	9,049	10,616	9,694	9,740	9,682	9,703
From San Antonio	MG	2,061	2,511	2,239	2,572	2,529	2,604
From SJPL	MG	2,642	141	2,380	2,210	2,393	2,341
SWWTP Total MGD	MGD	38	36	39	40	40	40
SWWTP Max MGD	MGD	117	120	160	160	160	160
SWWTP Min MGD	MGD	20	20	20	20	20	20

**Table 1-2
Summary of Modeling Results (Part 2/2)**

HH/LSM Simulation Results	Units	Baselines		Proposed WSIP	WSIP Variants ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		All Tuolumne	Regional Desalination for Drought	10% Rationing
Peninsula System							
Reservoirs							
Crystal Springs							
Inflow	MG	3,722	3,722	3,722	3,722	3,722	3,722
From San Andreas	MG	0	0	0	0	0	0
From Pilarcitos and SJPL	MG	6,751	8,545	8,508	8,402	8,701	8,486
Stream	MG	448	409	316	220	438	303
Pump to San Andreas	MG	8,832	10,540	10,311	10,358	10,364	10,298
Pump to Coastside	MG	54	55	239	228	239	240
Evaporation	MG	1,189	1,261	1,407	1,373	1,429	1,413
Reservoir	MG	16,102	16,907	18,962	18,488	19,293	19,075
San Andreas							
Inflow	MG	1,428	1,428	1,428	1,428	1,428	1,428
From other Streams	MG	9,271	10,992	10,656	10,781	10,724	10,657
Stream	MG	0	0	0	0	0	0
To HTWTP	MG	10,168	11,890	11,553	11,678	11,621	11,555
Evaporation	MG	530	530	530	530	530	530
Reservoir	MG	5,893	5,846	5,861	5,853	5,868	5,861
Pilarcitos							
Inflow		1,297	1,297	1,297	1,297	1,297	1,297
To San Andreas	MG	439	452	345	423	360	359
For Stone Diversion	MG	444	444	607	605	607	608
Stream other than Diversion	MG	327	314	278	201	263	263
Evaporation	MG	89	89	72	72	72	71
Reservoir	MG	623	623	469	471	469	467
Stone Dam							
Accretion blw Pilarcitos	MG	603	603	603	603	603	603
Pilarcitos non-diversion Release	MG	327	314	278	201	263	263
Pilarcitos Release for Diversions	MG	930	917	880	804	866	866
Diversion to Coastside	MG	178	178	236	235	236	236
Diversion to Crystal Springs	MG	180	200	181	214	166	184
Spill past Stone	MG	1,502	1,455	1,343	1,159	1,329	1,311
Treatment Plants							
HTWTP Total	MG	10,168	11,890	11,553	11,678	11,621	11,555
HTWTP Total MGD	MGD	28	33	32	32	32	32
HTWTP Max MGD	MGD	149	149	106	145	106	106
HTWTP Min MGD	MGD	20	20	20	20	20	20
Other Facilities							
Westside Basin Net	MG	0	0	11	11	11	11
Desalination Input	MG	0	0	0	0	2,662	0
Additional Information							
Total Local Reservoir Stream Release	MG	4,990	3,486	5,427	5,164	5,630	5,413
Total Local Reservoir Stream Evaporation	MG	3,788	4,442	4,694	4,644	4,733	4,686
Deliveries							
In-City	MG	29,589	29,667	26,686	29,982	26,686	26,751
South Bay	MG	43,106	43,221	52,906	52,206	52,906	53,037
Crystal Springs	MG	15,120	15,160	16,931	16,687	16,931	16,973
San Andreas	MG	5,400	5,414	6,604	6,535	6,604	6,621
Coastside	MG	675	678	1,082	1,082	1,082	1,084
Groveland	MG	365	365	365	365	365	365
Total Deliveries	MG	94,255	94,502	104,574	106,857	104,574	104,829
Total Deliveries	MGD	258	259	287	293	287	287
Storage							
Total Local Storage Begin	MG	23,240	23,488	26,150	26,150	26,150	26,150
Total Local Storage End	MG	18,915	23,358	22,188	21,241	21,957	21,957
Residual Difference during 82-year Simulation	MGD	0.14	0.00	0.13	0.16	0.14	0.14
Westside Storage Begin	MG	0	0	23,474	23,474	23,474	23,474
Westside Storage End	MG	0	0	24,363	24,363	24,363	24,363
Residual Difference during 82-year Simulation	MGD	0.00	0.00	0.03	0.03	0.03	0.03

Notes for Table 1-1 and Table 1-2

1. Baseline condition represents the existing conditions at the time of NOP publication in September 2005. This is the baseline used to assess WSIP program impact and impact significance. This setting indicates DSOD restrictions on Calaveras and Crystal Springs Reservoirs.
2. This baseline condition represents a system configuration and operation prior to the DSOD storage restriction (pre-2002).
3. These three scenarios are variations on the proposed WSIP. The attributes of these scenarios are largely the same as the proposed WSIP, except for variations in water supply source(s) or objectives for water delivery rationing.
4. The time horizon for the setting of the scenario. The baseline condition scenarios are depicted for recent conditions, while the proposed WSIP, variants, and alternatives are depicted for the future at full buildout and implementation, i.e., conditions in the year 2030.
5. HH/LSM model simulation study name.
6. The customer purchase request (demand) information is based on the demand and request studies prepared by the SFPUC in coordination with the wholesale customers (SFPUC/URS 2004). This demand on the regional water system includes both the SFPUC retail customers and wholesale customers. The current (2005) average annual demand is 265 mgd and the projected 2030 average annual demand is 300 mgd, assuming the SFPUC adopts the updated wholesale customer purchase requests as part of the Master Sales Agreement renewal with these customers (due in 2009).
7. Certain scenarios include the development of additional water supply from a combination of recycled water projects, groundwater projects, and conservation, utilized every year and not subject to reduction during drought.
8. The average annual demand for supplies from the combination of the SFPUC local watershed and Tuolumne River, as well as programs not included in the regional water conservation, reclamation, and groundwater programs shown.
9. Modeled results for SFPUC deliveries, with supplies added for regional water conservation, reclamation, and groundwater programs. Total deliveries and supply will be less than full customer purchase requests due to rationing in some years.
10. Shows only the features that affect hydrologic results of the system operation simulations. Additional projects are included in the WSIP, variants, and alternatives.
11. Illustrates the frequency and severity of water supply action or severity of system-wide rationing. Only years in which variable water supply component is implemented or rationing occurs are shown. "DD" illustrates the shortage results for years included in the prospective drought period of the SFPUC Design Drought. These years contribute to establishing system operation protocols but are not included in the hydrologic assessment analyses.
12. Rationing policy cap: The SFPUC WSIP level of service goal is to maintain rationing on the regional system at no more than 20% during any one year of the drought. Some alternatives do not achieve this level of service goal. Performance is indicated for both the Design Drought ("DD") sequence and "Historical" hydrologic sequence.
13. Water supply elements develop water in different amounts from year to year, and, in some instances, they only develop water during dry years. This information is provided to compare local watershed supplies, Tuolumne River supplies, and other identifiable water supplies used to meet system purchase requests. Values are stated in units of average annual quantities during the simulated historical sequence.
14. Results from HH/LSM analysis of each scenario. Values represent the average annual production of each element of supply during the design drought period.
15. Simplified calculation of system deliveries during the SFPUC design drought. The value represents the application of system-wide shortages to the demand level being met with SFPUC local watershed, Tuolumne, and other developed supplies, and does not include supplies from regional water conservation or from recycled water or groundwater projects. Average value may be slightly misstated (up to 3 mgd) due to metric of analysis that does not account for differences in residual storage between studies. "Nominal" firm yield represents the yield of each scenario after adjustment for minor residual storage differences.
16. Supplemental releases from Calaveras Reservoir for fisheries (1997 MOU) of up to 6,300 AFY and the Alameda Creek Recapture project are tied to implementation of the Calaveras Dam replacement project. When the dam is replaced and capacity restored, both the flow release and recapture will occur. The release requirement is based on the supplementation of other occurring flows below Calaveras Reservoir, sometimes not requiring the full 6,300 acre-feet.
17. SFPUC actions are assumed to leave MID/TID diversions unchanged so that the SFPUC effects on the Tuolumne River below La Grange Dam are isolated and possibly overstated. The Districts' diversions are assumed to be constant among the scenarios to provide comparable results of SFPUC-alone effects.
18. Participation in the San Joaquin River Agreement is assumed. Although the agreement expires after 2010, it is assumed that a subsequent similar agreement or requirement of the Districts will occur. HH/LSM does not explicitly model the Districts' participation in the agreement; however, its participation if modeled would result in only minor differences in results and would not change impact conclusions.
19. From HH/LSM results for modeling the SFPUC Design Drought Period.
20. From HH/LSM results for modeling the system operations for the historical hydrologic period 1921-2002. Values indicate average annual quantities during the simulated historical period.

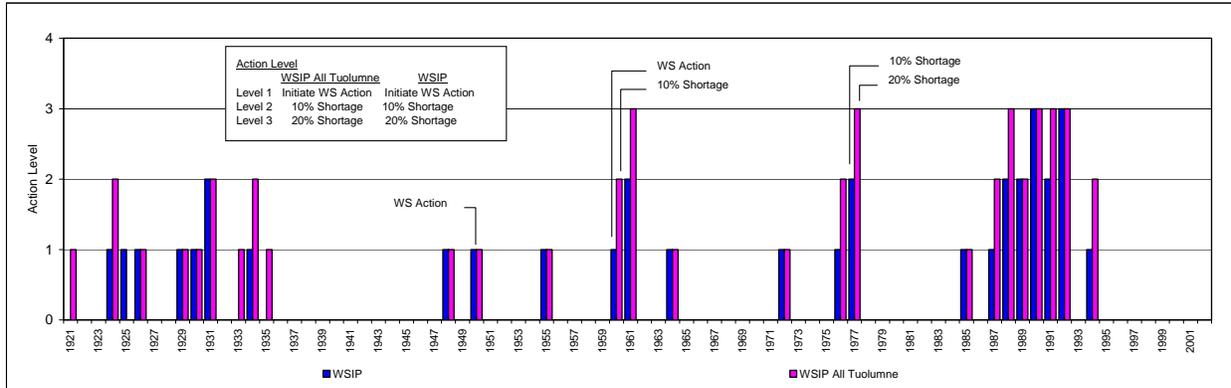
2. WSIP Variant 1 - All Tuolumne

WSIP Variant 1 - All Tuolumne variant would be identical to the proposed program (WSIP), except that the programs used to serve the increase in purchase request (from 265 to 300 million gallons per day [mgd]) and improvement in supply reliability would not include a supply of 10 mgd from implementation of the Recycled Water Projects (SF-3), Local Groundwater Projects (a component of SF-2, Groundwater Projects), and additional conservation programs (collectively referred to in this memorandum as RRGWC). In effect, the absence of the 10 mgd of RRGWC requires the Regional Water System's resources to serve a 300-mgd demand instead of a net 290-mgd demand. In all other aspects, this variant would include the same water supply sources as the WSIP, and would incorporate the same restored storage features of Calaveras and Crystal Springs Reservoir and the integration of the Westside Basin Groundwater Program. Identical to the WSIP, also included is a supplemental water supply for delivery during drought obtained from Tuolumne River diversions through transfers from the Turlock Irrigation District (TID) and Modesto Irrigation District (MID).

2.1 Water Deliveries and Drought Response Actions

The same amount of MID/TID Tuolumne River water transfer (27,000 acre-feet) is modeled for both the proposed program and the variant. With the absence of 10 mgd of RRGWC, the Regional Water System's resources are required to serve a 300-mgd demand instead of a net 290-mgd demand. This greater demand being served with the same amount of supply leads to a more frequent implementation of rationing and a greater severity of rationing during drought periods. This rationing is applied to the 300-mgd level of demand as opposed to the 290-mgd level of demand. Table 1-1 compares the drought response actions of the proposed program and the variant. Figure 2.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002) for the variant and WSIP settings.

**Figure 2.1-1
Drought Response Actions – WSIP and All Tuolumne Variant**



In Figure 2.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In these scenarios, the water supply action is the use of the Westside Basin Groundwater Program to supplement San Francisco Public Utilities Commission (SFPUC) water deliveries. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers. The initiation of supplemental supplies from the Westside Basin Groundwater Program, frequency of imposed delivery shortages, and severity of shortages all increase in the variant setting.

The same form of information is shown in Figure 2.1-2 in comparing the variant and the “Base - Calaveras Constrained” (existing) settings. In modeling parlance, there is no level 1 action level in the base setting. Without supplemental resources, the existing system has only delivery shortage measures available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the variant and base setting for these action levels, although they are applied to different levels of water demand. In the variant, the system's water demand is an average annual net 300 mgd; in the base setting, the water demand is 265 mgd.

**Figure 2.1-2
Drought Response Actions – Base and All Tuolumne Variant**

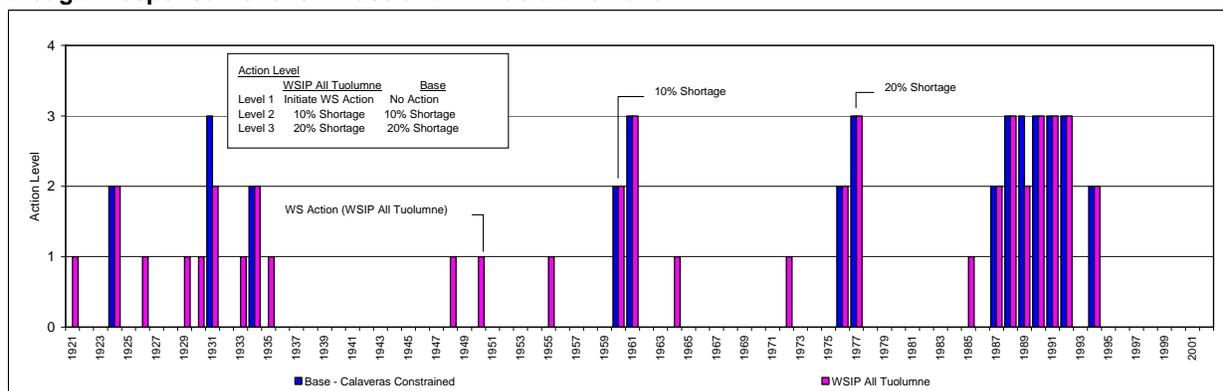


Figure 2.1-2 illustrates that, when compared to the base setting, the variant triggers supplemental resources at an early indication of drought, during periods when in the current setting there is no supplemental resource available to the system. The use of the supplemental resource during these times results in the lessening of (or at least a non-increase in) the severity of delivery shortage, even with an increase in deliveries.

Not illustrated in Figure 2.1-2, but shown in Table 1-1, are the delivery shortages anticipated during the entire SFPUC Design Drought. Shortages during the Design Drought with the variant are maintained within the objective to limit the severity of shortage to no more than 20 percent. This objective is also achieved with the WSIP. However, with the variant, an additional 10 percent of shortage occurs during 3 more years than with the WSIP, but the shortages occur to a larger demand (300 mgd). Over the Design Drought, approximately the same amount of water is delivered to SFPUC customers for the proposed program and the variant. With the existing system, the 20-percent-limitation (cap) objective cannot be achieved during the last 18 months of the Design Drought, and a 25 percent shortage is applied.

The difference in water deliveries between the proposed program and the variant is shown chronologically for the 82-year simulation in Table 2.1-1. The years indicating positive differences amounting to approximately 3,600 million gallons indicate periods when 10 mgd of demand is being met from the regional system (which, in the proposed program, is being met from RRGWC). The years showing positive differences of approximately 6,300 million gallons represent years when additional replenishment of the Westside Basin Groundwater Program was necessary after an additional draw from the program was needed to partially offset the absence of the 10 mgd of RRGWC. The years showing a reduction of deliveries of approximately 7,000 million gallons represent years of additional shortages with the variant.

2.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin is the flow through the San Joaquin Pipeline (SJPL). Inherent to this variant is the draw of additional water from the Tuolumne River Basin to replace the 10 mgd of RRGWC that was included in the proposed program. Table 2.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the variant. The differences appear much less systematic than the system deliveries shown in Table 2.1-1 because system storage buffers the change in deliveries; however, the reductions in SJPL diversions are generally associated with periods of reduced system-wide deliveries, and the increases are due to additional water diversions to offset the absence of the 10 mgd of RRGWC included in the proposed program. The additional diversion typically occurs from October through March when unused capacity is available in the SJPL. During the spring and summer, the SJPL is modeled in both settings to be diverting at maximum capacity to minimize the amount of storage drawn from local Bay Area reservoirs. Table 2.2-2 illustrates the average monthly diversion through the SJPL, by year type, for the 82-year simulation period for the proposed program and the variant.

Table 2.1-1

Difference in Total System-wide Delivery (MG)														WSIP All Tuolumne minus WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
1921	307	276	282	276	260	304	327	341	336	7	42	69	2,826	3,644	
1922	83	74	99	118	84	105	108	119	100	537	540	523	2,489	1,005	
1923	531	493	506	500	463	528	544	565	553	313	316	306	5,619	6,284	
1924	307	276	282	276	260	304	327	341	336	-1,073	-1,027	-809	-200	3,644	
1925	-628	-385	-191	-71	-209	-438	-635	-826	-974	844	815	760	-1,937	-7,265	
1926	756	695	690	659	640	727	763	787	789	313	316	306	7,440	8,923	
1927	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1928	307	276	282	276	260	304	327	341	336	89	92	89	2,979	3,644	
1929	83	59	58	52	58	80	110	117	119	313	316	306	1,670	1,005	
1930	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1931	307	276	282	276	260	304	327	341	336	279	282	273	3,543	3,644	
1932	276	246	254	254	241	276	294	307	297	313	316	306	3,380	3,279	
1933	307	276	282	276	260	304	327	341	336	-217	-183	-148	2,161	3,644	
1934	-142	-143	-126	-107	-119	-120	-109	-105	-117	-1,073	-1,027	-809	-3,995	-1,635	
1935	-628	-385	-191	-71	-209	-438	-635	-826	-974	-217	-183	-148	-4,904	-7,265	
1936	-142	-143	-126	-107	-119	-120	-109	-105	-117	313	316	306	-151	-1,635	
1937	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1938	307	276	282	276	260	304	327	341	336	537	540	523	4,310	3,644	
1939	531	493	506	500	463	528	544	565	553	537	540	523	6,284	6,284	
1940	531	493	506	500	463	528	544	565	553	537	540	523	6,284	6,284	
1941	531	493	506	500	463	528	544	565	553	313	316	306	5,619	6,284	
1942	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1943	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1944	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1945	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1946	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1947	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1948	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1949	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1950	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1951	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1952	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1953	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1954	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1955	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1956	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1957	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1958	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1959	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1960	307	276	282	276	260	304	327	341	336	-1,073	-1,027	-809	-200	3,644	
1961	-628	-385	-191	-71	-209	-438	-635	-826	-974	-876	-850	-735	-6,816	-7,265	
1962	-657	-531	-443	-384	-417	-561	-632	-740	-802	313	316	306	-4,232	-7,627	
1963	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1964	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1965	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1966	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1967	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1968	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1969	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1970	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1971	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1972	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1973	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1974	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1975	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1976	307	276	282	276	260	304	327	341	336	-1,073	-1,027	-809	-200	3,644	
1977	-628	-385	-191	-71	-209	-438	-635	-826	-974	-876	-850	-735	-6,816	-7,265	
1978	-657	-531	-443	-384	-417	-561	-632	-740	-802	313	316	306	-4,232	-7,627	
1979	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1980	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1981	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1982	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1983	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1984	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1985	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1986	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1987	307	276	282	276	260	304	327	341	336	-1,073	-1,027	-809	-200	3,644	
1988	-628	-385	-191	-71	-209	-438	-635	-826	-974	-876	-850	-735	-6,816	-7,265	
1989	-657	-531	-443	-384	-417	-561	-632	-740	-802	279	282	273	-4,333	-7,627	
1990	276	246	254	254	241	276	294	307	297	248	251	243	3,187	3,279	
1991	245	219	229	226	207	245	261	273	270	-876	-850	-735	-285	2,918	
1992	-657	-531	-443	-384	-417	-561	-632	-740	-802	248	251	243	-4,425	-7,627	
1993	245	219	229	226	207	245	261	273	270	313	316	306	3,111	2,918	
1994	307	276	282	276	260	304	327	341	336	-1,073	-1,027	-809	-200	3,644	
1995	-628	-385	-191	-71	-209	-438	-635	-826	-974	313	316	306	-3,421	-7,265	
1996	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1997	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1998	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
1999	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
2000	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
2001	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
2002	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644	
Avg (21-02)	189	187	211	218	192	206	207	200	182	149	157	171	2,270	2,270	

Table 2.2-1

Difference in Total SJPL (Acre-feet)

WSIP All Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	1,902	0	951	0	0	1,047	0	0	0	0	0	0	3,900	5,189
1922	1,903	1,841	0	1,903	0	0	0	0	0	0	0	0	5,647	5,647
1923	5,708	2,762	0	0	0	0	0	0	0	0	0	0	8,470	8,470
1924	4,091	5,616	2,854	2,854	2,578	0	0	0	0	0	0	0	17,993	17,993
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	4,091	4,603	2,854	1,903	0	2,854	1,841	0	0	0	0	0	18,146	18,146
1928	3,806	1,841	0	2,854	2,578	0	0	0	0	0	0	0	11,079	11,079
1929	1,903	1,841	0	0	0	0	0	0	0	0	0	0	3,744	3,744
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	3,235	2,854	13,034	7,135	-1,718	0	0	0	0	0	0	0	24,540	24,540
1933	4,091	5,616	0	2,854	2,578	0	0	0	0	0	0	0	15,139	15,139
1934	0	0	0	0	-1,719	0	0	0	0	0	0	0	-1,719	-1,719
1935	-3,235	0	0	0	0	0	0	-2,284	-2,210	0	0	0	-7,729	-7,729
1936	-7,040	-5,524	0	-2,854	-859	0	0	0	0	0	0	0	-16,277	-16,277
1937	952	0	952	1,902	0	3,045	460	0	0	0	0	0	7,311	7,311
1938	4,091	1,841	1,142	1,902	0	0	0	0	0	0	0	0	8,976	8,976
1939	6,660	2,762	1,902	952	859	0	0	0	0	0	0	0	13,135	13,135
1940	0	0	0	0	7,820	6,755	2,762	0	0	0	0	0	17,337	17,337
1941	6,660	2,762	1,142	951	0	0	3,682	1,902	1,841	0	0	0	18,940	18,940
1942	1,903	2,762	0	0	0	1,903	1,841	1,047	1,013	0	0	0	10,469	10,469
1943	2,759	1,841	0	0	0	952	0	0	0	0	0	0	5,552	5,552
1944	4,756	2,762	1,903	0	0	1,047	0	0	0	0	0	0	10,468	10,468
1945	4,091	0	0	0	3,523	0	0	0	0	0	0	0	7,614	7,614
1946	1,332	3,775	3,805	951	859	0	0	0	0	0	0	0	10,722	10,722
1947	1,332	5,616	4,757	1,902	1,719	0	0	0	0	0	0	0	15,326	15,326
1948	0	0	0	1,047	945	0	0	0	0	0	0	0	1,992	1,992
1949	0	0	5,803	5,803	4,297	3,805	0	0	0	0	0	0	19,708	19,708
1950	4,091	0	0	0	0	0	0	0	0	0	0	0	4,091	4,091
1951	0	2,854	5,708	2,663	2,406	1,903	0	0	0	0	0	0	15,534	15,534
1952	4,091	1,841	1,712	0	0	0	1,841	0	0	0	0	0	9,485	9,485
1953	3,805	921	951	0	0	0	0	0	0	0	0	0	5,677	5,677
1954	5,138	2,762	2,855	952	0	0	0	0	0	0	0	0	11,707	11,707
1955	4,091	0	0	0	0	0	0	0	0	0	0	0	4,091	4,091
1956	0	0	5,708	0	0	1,903	0	0	0	0	0	0	7,611	7,611
1957	3,806	2,762	952	952	859	0	0	0	0	0	0	0	9,331	9,331
1958	1,332	2,854	0	3,806	0	0	0	856	829	0	0	0	9,677	9,677
1959	2,379	921	1,903	952	1,547	0	0	0	0	0	0	0	7,702	7,702
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	2,378	2,378	0	0	0	0	0	0	0	-2,670	2,086	4,756
1962	-7,040	368	-4,281	-3,330	-6,015	-1,047	0	-4,091	-3,959	0	0	0	-29,395	-32,065
1963	475	0	0	1,142	0	4,756	0	952	921	0	0	0	8,246	8,246
1964	0	2,762	2,855	0	0	0	0	0	0	0	0	0	5,617	5,617
1965	0	0	0	6,659	2,578	0	2,210	1,332	1,289	0	0	0	14,068	14,068
1966	3,806	1,841	523	952	859	0	0	0	0	0	0	0	7,981	7,981
1967	0	0	6,659	0	0	4,757	1,841	1,902	1,841	0	0	0	17,000	17,000
1968	1,332	1,841	0	1,902	1,718	0	0	0	0	0	0	0	6,793	6,793
1969	0	2,854	2,855	0	0	951	0	0	0	0	0	0	6,660	6,660
1970	4,281	0	0	2,854	2,578	1,047	0	0	0	0	0	0	10,760	10,760
1971	4,091	921	951	951	859	0	0	0	0	0	0	0	7,773	7,773
1972	0	0	6,659	2,854	2,578	0	0	0	0	0	0	0	12,091	12,091
1973	0	0	0	5,708	0	0	0	0	0	0	0	0	5,708	5,708
1974	3,806	1,841	0	0	0	3,805	0	0	0	0	0	0	9,452	9,452
1975	3,901	0	0	0	3,437	1,903	1,841	0	0	0	0	0	11,082	11,082
1976	2,854	921	523	952	859	0	0	0	0	0	0	0	6,109	6,109
1977	0	-1,013	-2,855	-475	-2,578	0	0	0	0	1,046	1,046	-5,432	-10,261	-6,921
1978	-5,613	-1,473	2,378	-5,232	-6,015	-5,899	-921	-3,805	-3,683	0	0	0	-30,263	-33,603
1979	4,281	1,841	0	952	859	1,902	0	0	0	0	0	0	9,835	9,835
1980	1,332	0	0	3,901	0	1,902	0	0	0	0	0	0	7,135	7,135
1981	3,806	1,841	0	2,854	2,578	0	0	0	0	0	0	0	11,079	11,079
1982	0	3,683	1,902	0	0	4,757	0	0	0	0	0	0	10,342	10,342
1983	2,759	1,841	951	0	0	0	6,444	1,903	1,841	0	0	0	15,739	15,739
1984	1,332	1,841	0	0	0	0	0	0	0	0	0	0	3,173	3,173
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	8,765	6,659	921	0	0	0	0	0	16,345	16,345
1987	2,854	2,762	0	2,854	2,578	0	0	0	0	0	0	0	11,048	11,048
1988	-1,332	-1,013	0	-3,901	-4,297	0	0	0	0	-2,284	-2,284	-7,734	-22,845	-10,543
1989	-4,756	-2,762	-952	-1,903	-1,719	0	0	-1,332	-2,210	-2,284	0	0	-17,918	-27,936
1990	952	0	0	0	0	0	0	0	0	0	2,284	2,762	5,998	-1,332
1991	2,854	0	523	1,902	1,718	1,047	0	0	0	-5,138	-1,903	1,841	2,844	13,090
1992	-952	-2,762	-952	-1,903	-1,031	-1,047	0	-5,138	-4,972	0	1,902	2,762	-14,093	-23,957
1993	1,903	0	0	0	0	0	1,842	0	0	0	0	0	3,745	8,409
1994	2,379	2,762	1,903	0	859	0	0	0	0	0	0	0	7,903	7,903
1995	-1,332	0	0	-2,854	-2,578	0	-2,762	-1,903	-1,842	0	0	0	-13,271	-13,271
1996	1,047	2,762	0	951	0	2,663	0	0	0	0	0	0	7,423	7,423
1997	4,091	1,841	0	0	0	0	0	0	0	0	0	0	5,932	5,932
1998	1,332	3,775	0	951	0	1,712	921	856	829	0	0	0	10,376	10,376
1999	2,949	2,762	0	1,902	0	0	1,841	0	0	0	0	0	9,454	9,454
2000	2,379	0	0	0	4,297	2,949	0	0	0	0	0	0	9,625	9,625
2001	2,284	2,762	0	1,902	2,578	1,047	0	0	0	0	0	0	10,573	10,573
2002	2,284	4,603	0	2,855	2,578	0	0	0	0	0	0	0	12,320	12,320
Avg (21-02)	1,562	1,218	1,011	843	565	720	324	-95	-103	-106	13	-103	5,849	5,865

Table 2.2-2

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP All Tuolumne			
											Aug	Sep	WY Total	FY Total
Wet	28,291	17,815	9,989	12,083	7,573	12,118	22,384	26,769	25,905	29,873	29,873	28,909	251,582	248,985
Above Normal	28,021	15,824	9,189	15,177	10,165	18,322	24,923	28,782	27,853	29,873	29,873	28,909	266,911	266,911
Normal	28,143	15,893	9,163	16,488	12,578	22,898	28,431	29,617	28,662	29,873	29,873	28,909	280,528	280,361
Below Normal	28,530	17,254	12,950	22,648	19,587	25,385	28,909	29,492	28,487	29,436	29,436	28,053	300,167	300,880
Dry	27,613	20,623	15,061	20,472	17,664	25,717	28,909	29,552	28,598	29,088	29,088	26,636	299,021	301,027
All Years	28,123	17,459	11,266	17,411	13,546	20,911	26,716	28,850	27,907	29,629	29,629	28,288	279,737	279,737

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP			
											Aug	Sep	WY Total	FY Total
Wet	27,417	16,624	8,533	11,512	7,401	11,072	21,613	26,698	25,836	29,873	29,873	28,909	245,359	242,680
Above Normal	26,381	14,460	7,852	14,254	9,306	16,705	24,111	28,687	27,761	29,873	29,873	28,909	258,169	258,169
Normal	25,830	14,656	8,776	15,448	12,041	22,339	28,403	29,873	28,909	29,873	29,873	28,909	274,929	274,849
Below Normal	27,220	15,998	11,595	21,574	18,621	24,976	28,909	29,571	28,617	29,873	29,548	27,945	294,447	295,146
Dry	25,931	19,593	14,583	19,883	17,417	25,782	28,909	29,873	28,909	29,165	28,904	27,281	296,229	298,165
All Years	26,562	16,241	10,254	16,568	12,982	20,191	26,392	28,945	28,011	29,735	29,617	28,391	273,887	273,872

Difference in Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP All Tuolumne minus WSIP			
											Aug	Sep	WY Total	FY Total
Wet	874	1,191	1,457	571	172	1,046	771	71	69	0	0	0	6,222	6,305
Above Normal	1,640	1,365	1,338	923	859	1,617	812	95	92	0	0	0	8,741	8,741
Normal	2,313	1,237	387	1,041	537	559	29	-256	-247	0	0	0	5,599	5,513
Below Normal	1,310	1,256	1,354	1,074	965	409	0	-78	-130	-437	-112	108	5,720	5,734
Dry	1,683	1,030	479	589	247	-65	0	-321	-311	-77	184	-645	2,792	2,862
All Years	1,562	1,218	1,011	843	565	720	324	-95	-103	-106	13	-103	5,849	5,865

2.3 Hetch Hetchy Reservoir and Releases

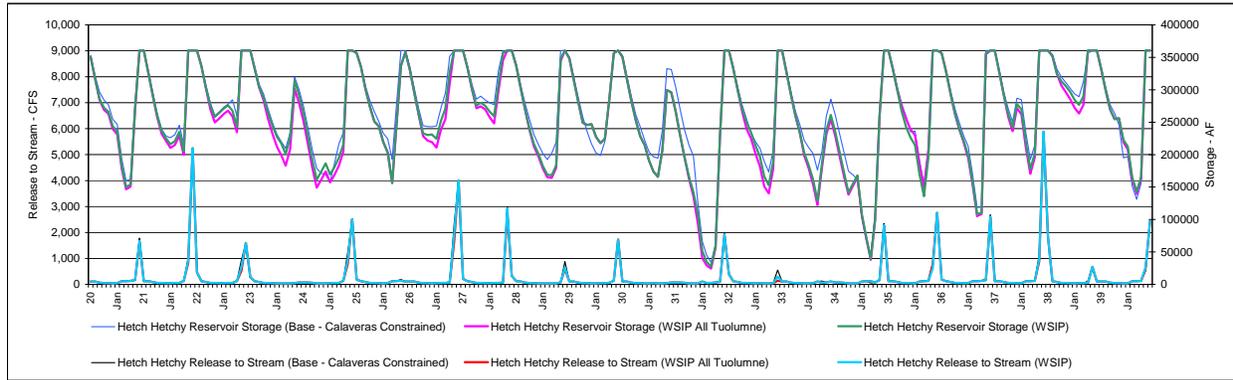
The additional draw of water for the SJPL will cause an increase in draw from Hetch Hetchy Reservoir; however, the additional draw of storage does not occur every year, and the largest differences are due to the accumulation of additional draw over a series of years. Figure 2.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 2.3-1 are the results for the WSIP, variant (“WSIP All Tuolumne”), and base (“Base – Calaveras Constrained”) settings. Supplementing the Figure 2.3-1 representation of Hetch Hetchy Reservoir storage are Table 2.3-1 Hetch Hetchy Reservoir Storage (All Tuolumne), Table 2.3-2 Hetch Hetchy Reservoir Storage (WSIP), and Table 2.3-3 Difference in Hetch Hetchy Reservoir Storage (All Tuolumne minus WSIP). Table 2.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Table 2.3-3 illustrates that, throughout the summer and into the fall, storage in Hetch Hetchy Reservoir in the variant setting would differ from the storage in the WSIP setting only in some years, and this difference could be more or less storage. Although Hetch Hetchy Reservoir would typically be lower in storage during the fall and winter, generally coincident with the additional diversion to the SJPL, Hetch Hetchy Reservoir normally fills by the end of May, which would negate the additional draw from storage carrying into the next summer. The greatest draw from reservoir storage occurs during the droughts of the 1930s and 1976-1977, which is not coincident with the year of greatest difference in reservoir draw between the base setting and either the WSIP or variant setting. There are exceptions to the additional draw when the variant causes a greater level of rationing (e.g., 1987-1988), which then reduces diversion from Hetch Hetchy. This results in greater storage in the variant setting than in the WSIP setting. Figure 2.3-2 illustrates the difference in reservoir storage, averaged by year type, to compare the variant to the WSIP setting. Also shown is the average difference in storage for the two settings. Figure 2.3-3 illustrates the same information in comparing the variant and base settings. Figure 2.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

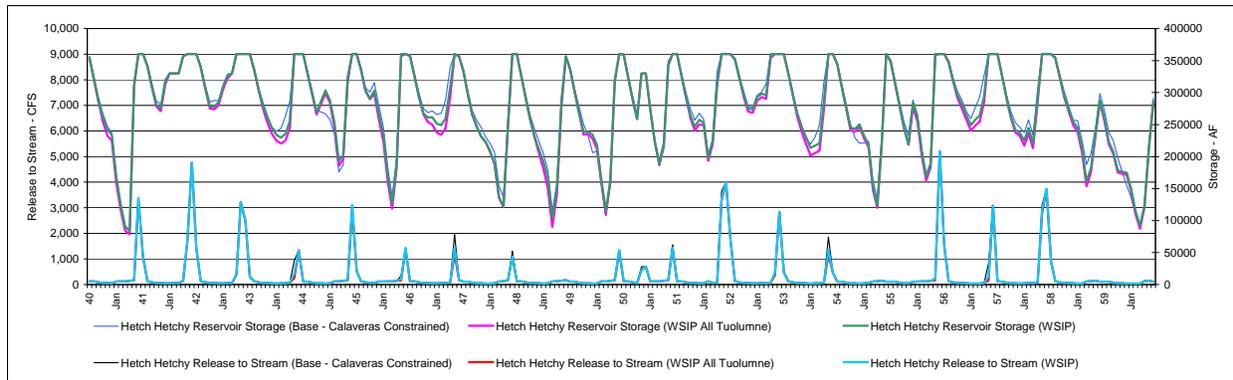
The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the variant would manifest into differences in releases from the reservoir to the stream. A different amount of available reservoir space in the winter and spring due to the variant would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream (which is above minimum release requirements). Figure 2.3-1 illustrates the stream release from the dam for the WSIP, variant, and base settings. Table 2.3-5 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant typically exhibits an incrementally larger reduction in stream releases, predominantly during May or June, which reflects the months when releases to the stream above minimum release requirements are made in anticipation of filling the reservoir. There are exceptions to the reductions (increases) during periods when the variant causes incrementally greater delivery shortages, thereby leaving greater storage in the reservoir.

Figure 2.3-1
Hetch Hetchy Reservoir Storage and Stream Release

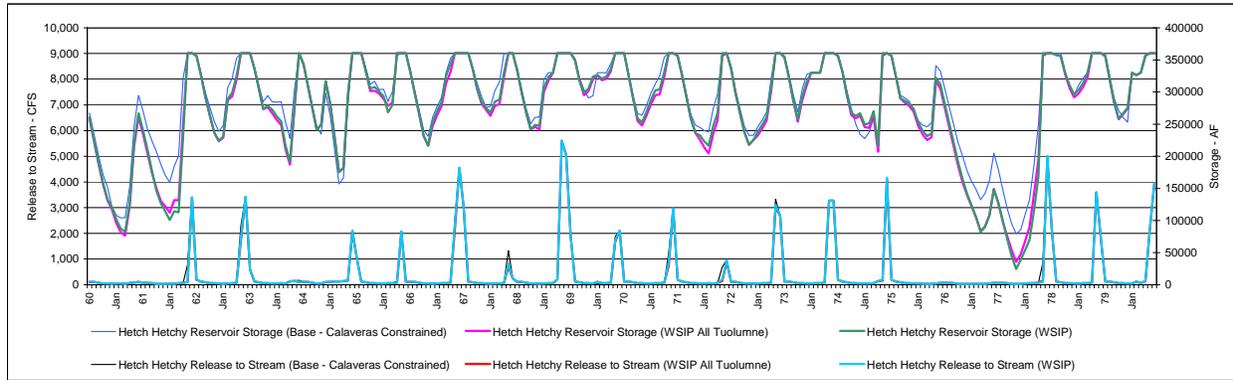
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

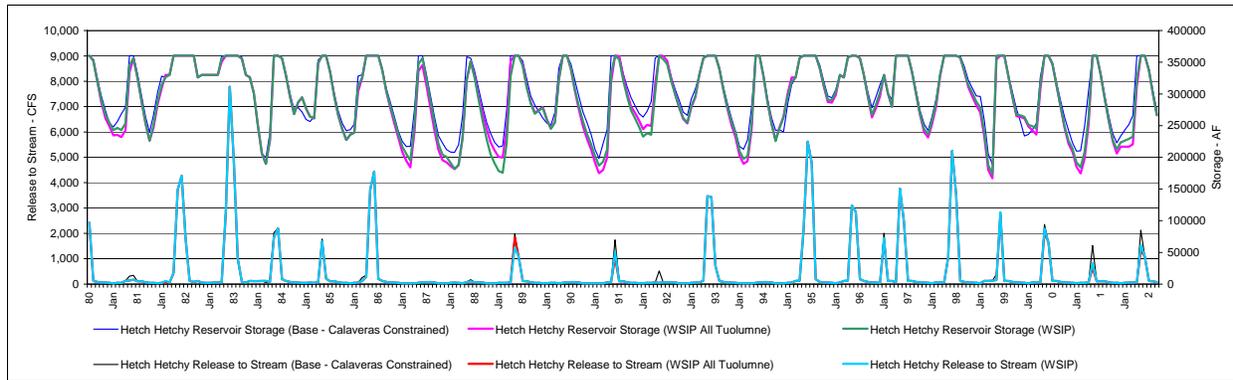


Table 2.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP All Tuolumne

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	269,021	262,663	239,536	231,585	178,984	146,462	151,001	268,414	360,400	360,400	326,716	291,641
1922	258,114	232,192	221,268	210,422	214,880	229,456	199,769	360,400	360,400	360,400	335,987	302,666
1923	269,924	249,710	255,787	262,493	267,630	258,915	234,270	360,400	360,400	360,400	333,091	304,054
1924	283,818	255,568	232,182	212,340	199,507	182,938	208,326	301,473	279,649	251,630	216,298	180,357
1925	149,243	161,278	174,315	157,236	168,851	182,842	204,635	360,400	360,400	356,465	334,115	301,240
1926	273,802	251,145	243,620	219,652	203,282	156,192	244,974	336,634	358,000	330,739	295,220	261,181
1927	228,541	221,608	219,391	210,783	238,345	254,579	309,420	360,400	360,400	360,400	333,623	301,044
1928	271,542	274,354	269,712	257,877	248,294	298,852	345,688	360,400	360,400	337,001	302,499	269,162
1929	237,523	212,876	197,771	178,993	165,328	164,296	179,761	344,202	360,400	348,007	314,236	280,955
1930	249,116	245,546	246,876	227,370	217,938	224,416	285,686	356,465	360,400	350,673	316,536	283,142
1931	252,621	228,300	214,607	191,032	173,741	165,859	207,051	299,235	295,885	265,896	230,558	196,275
1932	163,019	135,879	94,041	40,484	29,319	24,348	56,658	228,585	360,400	360,400	332,994	299,731
1933	266,736	239,611	224,845	201,372	181,623	151,072	140,298	178,017	360,400	360,400	326,498	293,195
1934	260,679	234,062	198,472	178,886	153,783	122,447	178,808	231,230	254,953	228,644	196,557	165,226
1935	138,385	152,108	164,896	105,649	70,473	37,798	99,143	258,440	360,400	360,400	331,693	299,135
1936	273,844	254,980	238,631	230,020	184,844	149,010	206,639	360,400	360,400	356,465	327,758	293,923
1937	262,306	238,971	218,644	194,748	152,975	105,445	108,472	354,599	360,400	360,400	327,117	292,284
1938	258,497	236,255	271,729	262,010	211,093	170,458	195,532	360,400	360,400	360,400	351,934	324,527
1939	306,571	296,011	285,625	272,121	263,403	276,887	360,400	360,400	360,400	332,062	299,302	270,045
1940	254,832	255,868	219,052	208,272	161,417	139,664	163,230	360,400	360,400	354,356	320,123	286,028
1941	254,687	228,366	225,151	159,336	116,680	83,905	165,859	207,051	309,124	360,400	360,400	341,196
1942	278,631	271,011	311,947	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,434	306,775
1943	275,075	273,690	280,602	305,028	322,117	330,000	360,400	360,400	360,400	360,400	334,725	302,903
1944	274,200	252,642	235,354	224,630	220,124	224,799	244,782	360,400	360,400	360,400	329,195	297,258
1945	265,504	282,396	299,300	284,144	246,398	185,615	195,482	319,826	360,400	360,400	334,833	302,981
1946	289,297	297,952	258,863	223,969	159,494	118,596	182,694	357,139	360,400	357,172	325,391	292,953
1947	265,970	254,100	249,947	237,809	233,971	243,778	292,633	360,400	356,592	332,752	297,801	265,047
1948	246,881	231,142	222,253	206,785	187,806	135,526	120,925	246,146	360,400	360,400	325,679	290,875
1949	257,155	230,043	204,547	179,767	150,009	90,098	141,240	277,654	356,592	335,945	301,138	267,891
1950	234,211	235,181	227,964	212,235	158,290	110,039	159,044	316,713	360,400	359,505	323,659	289,647
1951	258,661	330,000	330,000	273,739	223,537	186,697	216,066	342,246	360,400	360,400	326,685	293,016
1952	259,441	240,912	250,125	249,027	193,584	119,291	311,415	360,400	360,400	360,400	351,556	322,024
1953	292,337	270,214	268,342	287,393	292,853	290,178	354,411	360,400	360,400	360,400	330,041	296,984
1954	262,740	238,969	219,226	201,671	205,423	209,110	274,818	360,400	360,400	343,861	308,637	274,661
1955	241,068	239,118	246,336	228,500	214,774	147,460	119,847	219,624	360,400	348,403	313,548	278,581
1956	244,439	218,424	277,281	255,207	200,374	162,516	183,620	358,724	360,400	360,400	347,696	319,103
1957	292,134	275,543	257,199	240,595	248,284	254,584	285,754	360,400	360,400	360,400	326,728	292,510
1958	260,779	237,841	232,821	217,114	236,618	213,111	284,914	360,400	360,400	360,400	353,805	323,723
1959	292,862	270,453	248,904	239,128	205,989	153,421	175,734	232,223	284,605	256,069	219,398	204,485
1960	175,184	173,028	171,871	147,463	110,995	87,148	120,108	213,545	285,220	258,887	223,594	189,286
1961	156,359	131,548	117,963	96,382	81,648	76,532	123,481	215,618	261,225	235,046	204,965	174,585
1962	150,510	130,493	122,002	112,193	131,743	131,026	249,461	360,400	360,400	356,465	326,284	291,944
1963	263,050	236,524	223,406	228,945	287,567	292,866	318,162	360,400	360,400	360,400	336,301	304,839
1964	273,386	276,371	266,731	256,676	248,542	211,321	186,849	272,184	360,400	343,655	309,219	275,614
1965	241,436	248,743	317,082	281,745	230,783	175,442	181,773	294,420	360,400	360,400	360,400	333,096
1966	301,502	302,024	297,596	289,096	278,655	283,468	360,400	360,400	360,400	331,355	297,781	265,039
1967	231,529	216,381	246,973	263,194	278,123	313,169	330,860	360,400	360,400	360,400	360,400	335,676
1968	303,866	281,468	272,498	262,925	278,163	281,220	323,335	360,400	360,400	334,230	299,647	267,169
1969	241,770	245,855	241,722	300,104	317,771	330,000	360,400	360,400	360,400	360,400	349,331	317,590
1970	294,827	301,190	319,967	326,065	318,268	320,219	332,000	360,400	360,400	360,400	325,921	290,573
1971	255,018	247,696	262,968	280,886	294,743	296,296	323,596	360,400	360,400	356,465	325,669	292,259
1972	258,557	236,088	225,977	213,361	204,387	234,599	255,971	356,465	360,400	336,331	268,810	267,983
1973	237,812	217,831	225,249	232,388	243,063	255,710	301,068	360,400	360,400	353,895	322,638	285,845
1974	253,707	287,571	310,575	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,455	295,000
1975	263,776	258,990	262,991	245,305	244,078	260,897	297,305	356,465	360,400	356,465	324,067	290,292
1976	283,295	278,506	269,468	247,348	233,606	225,307	229,564	316,309	305,670	275,516	243,732	213,753
1977	184,725	159,241	139,312	121,983	104,990	83,394	90,561	108,209	149,240	127,263	97,441	75,530
1978	53,923	35,718	47,122	67,447	89,813	140,851	195,553	356,465	360,400	360,400	357,774	356,219
1979	327,392	305,873	291,584	297,630	307,651	322,742	360,400	360,400	360,400	356,002	320,543	284,032
1980	257,348	265,500	274,159	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,634	320,226
1981	286,804	261,907	249,031	234,621	235,440	231,943	242,566	334,253	356,592	326,286	288,639	253,673
1982	226,369	246,721	283,675	308,799	330,000	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	350,506	360,400	360,400	360,400	360,400	355,878
1984	330,000	326,192	301,515	251,330	205,725	189,676	226,912	360,400	360,400	356,465	328,867	296,270
1985	268,090	286,622	294,695	277,075	264,192	261,404	348,453	360,400	360,400	333,440	296,675	266,441
1986	245,025	227,275	236,097	238,964	303,680	326,065	360,400	360,400	360,400	360,400	337,395	304,410
1987	278,153	253,867	230,681	208,065	194,330	184,022	240,081	336,159	345,515	313,800	277,207	241,926
1988	211,382	195,457	192,202	186,324	181,527	187,619	230,388	321,793	351,144	327,482	294,895	268,902
1989	244,654	224,081	210,985	200,552	199,603	245,623	352,054	360,400	360,400	346,162	312,478	287,376
1990	270,116	274,837	279,616	260,245	246,263	256,072	323,680	360,400	360,400	339,067	304,751	275,502
1991	249,457	228,762	212,783	191,723	174,987	180,290	199,559	318,996	360,400	359,471	328,654	301,814
1992	280,518	269,798	257,812	244,423	251,063	249,510	315,941	360,400	359,902	352,164	323,458	298,949
1993	278,092	260,504	253,525	279,458	294,773	330,000	356,592	360,400	360,400	360,400	339,589	305,807
1994	276,149	251,292	232,125	202,448	189,722	194,016	242,781	360,400	360,400	328,011	288,314	253,017
1995	227,063	247,651	264,250	300,543	326,001	326,065	356,592	360,400	360,400	360,400	360,400	341,143
1996	311,964	287,200	286,419	298,451	330,000	326,065	357,776	360,400	360,400	356,465	329,174	295,620
1997	262,964	277,936	296,513	330,000	300,695	280,067	360,400	360,400				

Table 2.3-2

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,212	265,854	243,679	235,730	183,131	150,102	154,083	270,998	360,400	360,400	326,716	291,641
1922	260,017	235,936	225,012	216,071	220,532	235,108	205,422	360,400	360,400	360,400	335,987	302,666
1923	275,632	258,180	264,257	270,969	276,110	267,395	242,750	360,400	360,400	360,400	333,091	304,054
1924	287,909	265,274	244,743	227,762	217,516	200,947	226,335	313,797	291,963	263,927	228,573	192,617
1925	161,496	173,531	186,568	169,497	181,122	195,112	215,423	360,400	360,400	356,465	334,115	301,240
1926	273,802	251,145	243,620	219,652	203,282	156,192	244,974	336,634	358,000	330,739	295,220	261,181
1927	232,632	230,302	230,939	224,241	251,810	270,898	327,581	360,400	360,400	360,400	333,623	301,044
1928	275,347	280,001	275,359	266,381	259,381	309,939	356,775	360,400	360,400	337,001	302,499	269,162
1929	239,425	216,620	201,515	182,739	169,077	168,044	183,509	347,948	360,400	348,007	314,236	280,955
1930	249,116	245,546	246,876	227,370	217,938	224,416	285,686	356,465	360,400	350,673	316,536	283,142
1931	252,621	228,300	214,607	191,032	173,741	165,859	207,051	299,235	295,885	265,896	230,558	196,275
1932	166,254	141,968	108,624	51,576	34,804	27,502	58,360	229,750	360,400	360,400	332,994	299,731
1933	270,827	249,318	234,552	213,938	196,774	166,223	153,096	188,750	360,400	360,400	326,498	293,195
1934	260,679	234,062	202,956	183,568	161,386	128,818	185,180	237,597	261,314	234,993	202,895	171,557
1935	141,478	155,200	167,988	108,234	72,493	39,306	100,061	259,139	360,400	360,400	331,693	299,135
1936	266,804	242,416	226,072	214,618	169,794	136,016	195,669	360,400	360,400	356,465	327,758	293,923
1937	263,258	239,922	220,528	198,592	156,392	108,310	110,656	356,408	360,400	360,400	327,117	292,284
1938	262,588	242,187	277,814	270,001	219,089	177,586	201,634	360,400	360,400	360,400	351,934	324,527
1939	313,230	305,433	296,949	284,402	276,549	290,033	360,400	360,400	360,400	332,062	299,302	270,045
1940	254,832	255,868	222,545	212,796	165,425	143,040	166,068	360,400	360,400	354,356	320,123	286,028
1941	261,347	241,787	234,144	168,334	124,378	90,323	83,423	312,783	360,400	360,400	341,196	308,861
1942	280,534	275,676	316,612	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,434	306,775
1943	277,834	278,290	285,202	309,631	326,722	330,000	360,400	360,400	360,400	360,400	334,725	302,903
1944	278,957	260,161	244,775	234,057	229,556	235,278	255,261	360,400	360,400	360,400	329,195	297,258
1945	269,594	286,466	303,391	288,236	253,700	192,916	201,894	325,435	360,400	360,400	334,833	302,981
1946	290,629	303,058	267,626	233,689	169,219	126,757	189,566	360,400	360,400	357,172	325,391	292,953
1947	267,302	261,048	261,651	251,424	249,312	259,119	307,974	360,400	356,592	332,752	297,801	265,047
1948	246,881	231,142	222,253	207,832	189,798	136,522	121,769	246,854	360,400	360,400	326,679	290,875
1949	257,155	230,043	210,351	191,360	165,907	103,444	151,449	286,217	356,592	335,945	301,138	267,891
1950	238,302	239,272	233,940	218,468	163,874	114,732	162,958	320,001	360,400	359,505	323,659	289,647
1951	258,661	330,000	330,000	273,739	223,537	188,600	217,740	343,707	360,400	360,400	326,685	293,016
1952	263,532	246,844	257,770	252,854	197,413	223,120	317,085	360,400	360,400	360,400	351,556	322,024
1953	296,142	274,941	274,019	293,074	298,536	295,862	360,095	360,400	360,400	360,400	330,041	296,984
1954	267,877	246,868	229,980	213,382	217,141	220,828	286,535	360,400	360,400	343,861	308,637	274,661
1955	245,158	243,209	250,427	232,593	218,869	151,555	123,312	222,529	360,400	348,403	313,548	278,581
1956	244,439	218,424	283,804	261,732	206,903	168,220	188,432	360,400	360,400	360,400	347,696	319,103
1957	295,940	282,110	264,718	249,070	257,623	263,923	295,093	360,400	360,400	360,400	326,728	292,510
1958	262,110	242,027	237,007	225,108	244,617	221,109	292,913	360,400	360,400	360,400	353,805	323,723
1959	295,240	273,752	254,105	245,284	213,696	161,127	182,231	235,467	287,846	259,305	222,628	207,712
1960	178,409	176,252	175,096	150,690	115,751	91,900	123,736	215,354	287,027	260,692	225,395	191,086
1961	158,157	133,346	121,240	102,042	87,316	82,200	129,149	221,278	266,879	240,690	210,599	177,543
1962	146,426	126,777	114,005	100,855	114,374	112,611	231,046	360,400	360,400	356,465	326,284	291,944
1963	263,525	237,000	223,881	230,563	289,186	299,242	324,537	360,400	360,400	360,400	336,301	304,839
1964	273,386	279,133	272,347	262,295	254,165	216,943	191,753	276,738	360,400	343,655	309,219	275,614
1965	241,436	248,743	317,082	281,745	230,783	175,442	181,773	294,420	360,400	360,400	360,400	333,096
1966	305,307	307,700	300,943	293,396	268,438	279,703	360,400	360,400	360,400	331,355	297,781	265,039
1967	231,529	216,381	253,632	269,858	284,791	324,126	360,400	360,400	360,400	360,400	360,400	335,676
1968	305,198	284,641	275,671	268,002	284,962	288,019	330,134	360,400	360,400	334,230	299,647	267,169
1969	241,770	248,709	247,430	305,815	323,485	330,000	360,400	360,400	360,400	360,400	349,331	317,590
1970	299,109	305,471	324,248	326,065	320,846	323,844	335,624	360,400	360,400	360,400	325,921	290,573
1971	259,109	252,707	268,931	287,804	302,524	304,076	331,376	360,400	360,400	356,465	325,669	292,259
1972	258,557	236,088	222,878	216,488	246,707	246,707	268,071	360,400	360,400	360,400	336,331	298,810
1973	237,812	217,831	225,249	238,096	248,774	261,422	306,780	360,400	360,400	353,895	322,638	285,845
1974	257,512	293,218	316,222	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,455	295,000
1975	267,677	262,890	266,892	249,208	251,420	270,142	216,550	360,400	360,400	356,465	324,067	290,292
1976	286,149	282,281	273,766	252,600	239,720	231,421	235,679	322,419	311,776	281,614	249,822	219,836
1977	190,805	164,307	141,524	123,723	104,154	82,557	89,725	107,373	148,407	127,479	98,702	71,356
1978	44,138	24,460	38,242	53,329	69,672	114,812	168,593	360,400	360,400	360,400	357,774	356,219
1979	330,000	310,323	296,034	303,033	313,915	330,000	360,400	360,400	360,400	356,002	320,543	284,032
1980	258,680	266,832	275,490	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,634	320,226
1981	290,609	267,554	254,678	243,125	246,527	243,029	253,653	345,334	356,592	326,286	288,639	253,673
1982	226,369	250,404	289,261	314,387	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,878
1984	330,000	326,192	301,515	251,330	205,725	189,676	226,912	360,400	360,400	356,465	328,867	296,270
1985	268,090	286,622	294,695	277,075	264,192	261,404	348,453	360,400	360,400	333,440	296,675	266,441
1986	245,025	227,275	236,097	238,964	312,444	326,065	360,400	360,400	360,400	360,400	337,395	304,410
1987	281,007	259,483	236,297	216,538	205,386	195,078	251,137	347,208	356,556	324,828	288,222	252,930
1988	221,048	204,111	200,855	191,081	181,990	188,083	230,852	322,256	351,607	325,661	290,794	257,070
1989	228,073	204,737	190,690	178,343	175,662	221,683	328,113	360,400	360,400	343,879	310,198	285,098
1990	268,790	273,511	278,290	258,918	244,935	254,745	322,352	360,400	360,400	339,067	307,304	280,546
1991	257,352	236,658	221,201	202,049	187,037	193,387	212,656	332,085	360,400	354,334	321,620	296,626
1992	274,381	260,899	247,962	232,665	238,267	235,667	302,099	360,400	354,930	347,198	320,400	298,656
1993	279,702	262,114	255,135	281,069	296,384	330,000	356,592	360,400	360,400	360,400	339,589	305,807
1994	278,527	256,433	239,168	209,495	197,633	201,926	250,691	360,400	360,400	328,011	288,314	253,017
1995	225,731	246,319	262,918	296,356	319,234	326,065	356,592	360,400	360,400	360,400	360,400	341,143
1996	313,010	291,009	290,227	303,212	330,000	326,065	357,776	360,400	360,400	356,465	329,174	295,620
1997	267,055	283,869	302,446	330,000	300,695	280,067	360,400	360,400				

Table 2.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP All Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-3,191	-3,191	-4,143	-4,145	-4,147	-3,640	-3,082	-2,584	0	0	0	0
1922	-1,903	-3,744	-3,744	-5,649	-5,652	-5,652	-5,653	0	0	0	0	0
1923	-5,708	-8,470	-8,470	-8,476	-8,480	-8,480	-8,480	0	0	0	0	0
1924	-4,091	-9,706	-12,561	-15,422	-18,009	-18,009	-18,009	-12,324	-12,314	-12,297	-12,275	-12,260
1925	-12,253	-12,253	-12,253	-12,261	-12,271	-12,270	-10,788	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	-4,091	-8,694	-11,548	-13,458	-13,465	-16,319	-18,161	0	0	0	0	0
1928	-3,805	-5,647	-5,647	-8,504	-11,087	-11,087	-11,087	0	0	0	0	0
1929	-1,902	-3,744	-3,744	-3,746	-3,749	-3,748	-3,748	-3,746	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	-3,235	-6,089	-14,583	-11,092	-5,485	-3,154	-1,702	-1,165	0	0	0	0
1933	-4,091	-9,707	-9,707	-12,566	-15,151	-15,151	-12,798	-10,733	0	0	0	0
1934	0	0	-4,484	-4,682	-7,603	-6,371	-6,372	-6,367	-6,361	-6,349	-6,338	-6,331
1935	-3,093	-3,092	-3,092	-2,585	-2,020	-1,508	-918	-699	0	0	0	0
1936	7,040	12,564	12,559	15,402	15,050	12,994	10,970	0	0	0	0	0
1937	-952	-951	-1,884	-3,844	-3,417	-2,865	-2,184	-1,809	0	0	0	0
1938	-4,091	-5,932	-6,085	-7,991	-7,996	-7,128	-6,102	0	0	0	0	0
1939	-6,659	-9,422	-11,324	-12,281	-13,146	-13,146	0	0	0	0	0	0
1940	0	0	-3,493	-4,524	-4,008	-3,376	-2,838	0	0	0	0	0
1941	-6,660	-9,421	-8,993	-8,998	-7,698	-6,418	-4,882	-3,659	0	0	0	0
1942	-1,903	-4,665	-4,665	0	0	0	0	0	0	0	0	0
1943	-2,759	-4,600	-4,600	-4,603	-4,605	0	0	0	0	0	0	0
1944	-4,757	-7,519	-9,421	-9,427	-9,432	-10,479	-10,479	0	0	0	0	0
1945	-4,090	-4,090	-4,091	-4,092	-7,302	-7,301	-6,412	-5,609	0	0	0	0
1946	-1,332	-5,106	-8,763	-9,720	-9,725	-8,161	-6,872	-3,261	0	0	0	0
1947	-1,332	-6,948	-11,704	-13,615	-15,341	-15,341	-15,341	0	0	0	0	0
1948	0	0	0	-1,047	-1,992	-996	-844	-708	0	0	0	0
1949	0	0	-5,804	-11,593	-15,898	-13,346	-10,209	-8,563	0	0	0	0
1950	-4,091	-4,091	-5,976	-6,233	-5,584	-4,693	-3,914	-3,288	0	0	0	0
1951	0	0	0	0	0	-1,903	-1,674	-1,461	0	0	0	0
1952	-4,091	-5,932	-7,645	-3,827	-3,829	-3,829	-5,670	0	0	0	0	0
1953	-3,805	-4,727	-5,677	-5,681	-5,683	-5,684	-5,684	0	0	0	0	0
1954	-5,137	-7,899	-10,754	-11,711	-11,718	-11,718	-11,717	0	0	0	0	0
1955	-4,090	-4,091	-4,091	-4,093	-4,095	-4,095	-3,465	-2,905	0	0	0	0
1956	0	0	-6,523	-6,525	-6,529	-5,704	-4,812	-1,676	0	0	0	0
1957	-3,806	-6,567	-7,519	-8,475	-9,339	-9,339	-9,339	0	0	0	0	0
1958	-1,331	-4,186	-4,186	-7,994	-7,999	-7,998	-7,999	0	0	0	0	0
1959	-2,378	-3,299	-5,201	-6,156	-7,707	-7,706	-6,497	-3,244	-3,241	-3,236	-3,230	-3,227
1960	-3,225	-3,224	-3,225	-3,227	-4,756	-4,752	-3,628	-1,809	-1,807	-1,805	-1,801	-1,800
1961	-1,798	-1,798	-3,277	-5,660	-5,668	-5,668	-5,668	-5,660	-5,654	-5,644	-5,634	-2,958
1962	4,084	3,716	7,997	11,338	17,369	18,415	18,415	0	0	0	0	0
1963	-475	-476	-475	-1,618	-1,619	-6,376	-6,375	0	0	0	0	0
1964	0	-2,762	-5,616	-5,619	-5,623	-5,622	-4,904	-4,554	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0
1966	-3,805	-5,646	-3,347	-4,300	10,217	3,765	0	0	0	0	0	0
1967	0	0	-6,659	-6,664	-6,668	-11,424	-13,266	0	0	0	0	0
1968	-1,332	-3,173	-3,173	-5,077	-6,799	-6,799	-6,799	0	0	0	0	0
1969	0	-2,854	-5,708	-5,711	-5,714	0	0	0	0	0	0	0
1970	-4,282	-4,281	-4,281	0	-2,578	-3,625	-3,624	0	0	0	0	0
1971	-4,091	-5,011	-5,963	-6,918	-7,781	-7,780	-7,780	0	0	0	0	0
1972	0	0	-6,659	-9,517	-12,101	-12,101	-12,100	-3,935	0	0	0	0
1973	0	0	0	-5,708	-5,711	-5,712	-5,712	0	0	0	0	0
1974	-3,805	-5,647	-5,647	0	0	0	0	0	0	0	0	0
1975	-3,901	-3,900	-3,901	-3,903	-7,342	-9,245	-9,245	-3,935	0	0	0	0
1976	-2,854	-3,775	-4,298	-5,252	-6,114	-6,114	-6,115	-6,110	-6,106	-6,098	-6,090	-6,083
1977	-6,080	-5,066	-2,212	-1,740	836	836	836	836	833	-216	-1,261	4,174
1978	9,785	11,258	8,880	14,118	20,141	26,039	26,960	-3,935	0	0	0	0
1979	-2,608	-4,450	-4,450	-5,403	-6,264	-7,258	0	0	0	0	0	0
1980	-1,332	-1,332	0	0	0	0	0	0	0	0	0	0
1981	-3,805	-5,647	-5,647	-8,504	-11,087	-11,086	-11,087	-11,081	0	0	0	0
1982	0	-3,683	-5,586	-5,588	3,554	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-6,445	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-8,764	0	0	0	0	0	0	0
1987	-2,854	-5,616	-5,616	-8,473	-11,056	-11,056	-11,056	-11,049	-11,041	-11,028	-11,015	-11,004
1988	-9,666	-8,654	-8,653	-4,757	-463	-464	-464	-463	0	1,821	4,101	11,832
1989	16,581	19,344	20,295	22,209	23,941	23,940	23,941	0	0	2,283	2,280	2,278
1990	-1,326	-1,326	1,326	1,327	1,328	1,327	1,328	0	0	0	-2,283	-5,044
1991	-7,895	-7,896	-8,418	-10,326	-12,050	-13,097	-13,097	-13,089	0	5,137	7,034	5,188
1992	6,137	8,899	9,850	11,758	12,796	13,843	13,842	0	4,972	4,966	3,058	293
1993	-1,610	-1,610	-1,610	-1,611	-1,611	0	0	0	0	0	0	0
1994	-2,378	-5,141	-7,043	-7,047	-7,911	-7,910	-7,910	0	0	0	0	0
1995	1,332	1,332	1,332	4,187	6,767	0	0	0	0	0	0	0
1996	-1,046	-3,809	-3,808	-4,761	0	0	0	0	0	0	0	0
1997	-4,091	-5,933	-5,933	0	0	0	0	0	0	0	0	0
1998	-1,332	-5,106	-5,107	-6,061	-6,065	-2,140	0	0	0	0	0	0
1999	-2,949	-5,711	-5,711	-7,617	-7,620	-7,621	-6,711	-5,615	0	0	0	0
2000	-2,378	-2,378	-2,379	-2,380	-6,678	-9,626	-9,627	0	0	0	0	0
2001	-2,284	-5,045	-5,046	-6,951	-9,533	-10,579	-10,579	0	0	0	0	0
2002	-2,283	-6,886	-6,887	-9,745	-12,328	-12,328	-12,328	0	0	0	0	0
Avg (21-02)	-1,811	-2,949	-3,876	-4,083	-4,123	-4,071	-3,731	-1,759	-502	-396	-408	-304

Table 2.3-4

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP All Tuolumne minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-15,102	-14,182	-15,133	-15,142	-15,151	-13,268	-11,201	-9,385	0	0	-2,283	-4,491
1922	-5,440	-7,282	-7,282	-15,848	-15,858	-15,858	-15,858	0	0	0	-2,283	-4,491
1923	-10,197	-10,197	-10,197	-10,204	-10,209	-25,526	-25,526	0	0	0	-2,283	-4,491
1924	-9,626	-15,242	-17,145	-19,058	-20,787	-26,591	-25,670	-18,434	-20,628	-22,884	-25,126	-27,307
1925	-29,575	-10,241	4,981	-819	-18,092	-33,408	-29,326	0	0	0	-2,283	-4,491
1926	-9,627	-15,243	-7,641	-13,449	-20,944	-36,836	-31,725	-23,766	-2,400	-4,681	-6,958	-9,162
1927	-16,197	-21,721	-23,624	-33,341	-33,360	-40,020	-41,861	0	0	0	-2,283	-7,253
1928	-13,909	-15,751	-14,372	-21,989	-28,876	-31,148	-14,712	0	0	-2,283	-4,563	-9,531
1929	-16,186	-18,028	-18,027	-22,794	-27,104	-37,664	-39,873	-16,198	0	-2,283	-4,564	-6,770
1930	-9,050	10,284	30,262	24,477	19,249	3,933	1,722	0	0	-2,283	-4,563	-6,770
1931	-9,050	-14,666	-7,579	-13,386	-22,931	-28,734	-30,945	-33,210	-35,393	-37,633	-39,862	-42,025
1932	-51,896	-62,115	-31,901	-25,519	-15,857	-9,571	-5,355	-3,804	0	0	-2,283	-4,491
1933	-9,626	-15,243	-8,155	-18,625	-28,087	-38,647	-33,145	-27,770	0	0	-2,283	-4,491
1934	-6,772	-12,389	-23,520	-31,951	-47,743	-53,968	-25,936	-28,203	-30,381	-32,614	-34,840	-37,011
1935	-36,037	-16,703	3,276	2,762	2,153	-9,416	-6,029	-4,577	0	0	-2,283	-4,491
1936	-4,489	-3,569	-3,569	-6,066	-6,069	-5,315	-4,492	0	0	0	-2,283	-4,491
1937	-8,295	-10,136	-10,123	-17,783	-15,775	-13,227	-10,822	-5,801	0	0	-2,283	-4,491
1938	-12,481	-14,322	-15,156	-22,775	-22,787	-21,919	-19,115	0	0	0	-2,283	-7,253
1939	-12,958	-14,800	-16,702	-21,466	-25,773	-36,333	3,808	0	0	-2,283	-4,563	-6,770
1940	-9,049	10,285	23,831	11,304	10,027	8,406	7,112	0	0	-2,283	-4,564	-6,770
1941	-12,475	-14,316	-11,930	-11,937	-10,208	-8,521	-6,485	-4,856	0	0	-2,283	-4,491
1942	-8,295	-10,136	-8,424	0	0	0	0	0	0	0	-2,283	-4,491
1943	-10,197	-13,880	-6,792	-6,796	-6,799	0	0	0	0	0	-2,283	-4,491
1944	-9,246	-11,087	-10,136	-14,899	-23,672	-38,989	-41,199	0	0	0	-2,283	-4,491
1945	-6,772	12,562	32,540	26,753	9,811	9,812	8,650	7,563	0	0	-2,283	-4,491
1946	-11,529	-17,145	-20,802	-21,765	-21,777	-18,504	-15,603	-3,261	0	-2,283	-4,564	-6,769
1947	-9,050	-14,666	-21,326	-27,998	-34,029	-44,590	-46,799	0	0	-2,283	-4,564	-6,769
1948	-9,049	-14,665	-7,578	-13,385	-18,634	-18,066	-15,258	-12,777	0	0	-2,283	-4,491
1949	-6,773	-12,388	-18,192	-23,954	-28,265	-23,822	-18,608	-15,591	0	-2,283	-4,564	-9,532
1950	-16,567	2,768	21,785	3,626	3,214	2,690	2,185	1,826	0	-895	-3,178	-5,385
1951	-7,666	0	0	0	0	-8,562	-7,525	-7,309	0	0	-2,283	-7,253
1952	-14,291	-16,131	-17,844	-8,932	-8,938	-8,938	-21,827	0	0	0	-2,283	-4,491
1953	-8,294	-8,295	-8,295	-8,299	-8,303	-23,620	-5,989	0	0	0	-2,283	-4,492
1954	-6,773	-8,613	-8,614	-18,132	-25,189	-40,506	-42,715	0	0	-2,283	-4,563	-6,769
1955	-9,049	10,284	25,506	7,350	-9,058	-14,862	-12,551	-10,497	0	-2,283	-4,564	-6,770
1956	-9,050	-14,666	-10,868	-10,873	-10,879	-9,506	-8,015	-1,676	0	0	-2,283	-4,491
1957	-10,198	-12,959	-12,959	-18,676	-28,310	-38,871	-41,080	0	0	0	-2,283	-4,491
1958	-9,626	-15,243	-12,912	-20,530	-20,542	-20,542	-20,542	0	0	0	-2,283	-4,491
1959	-8,770	-8,771	-7,819	-17,337	-18,894	-34,211	-29,326	-11,575	-13,772	-16,036	-18,291	-20,480
1960	-22,751	-3,417	16,561	10,770	1,245	-3,812	-2,912	-3,736	-5,941	-8,216	-10,484	-12,682
1961	-14,958	-20,574	-4,151	-11,862	-22,276	-28,079	-30,289	-31,273	-33,447	-35,679	-37,900	-49,365
1962	-56,947	-56,947	-48,384	-47,483	-52,695	-69,820	-72,029	0	0	0	-2,283	-7,253
1963	-12,958	-17,562	-15,230	-19,045	-19,056	-28,570	-34,094	0	0	0	-2,283	-4,491
1964	-11,529	-17,974	-17,974	-27,496	-36,105	-41,908	-41,096	-30,553	3,808	1,521	-764	-2,974
1965	-5,255	14,079	19,144	19,152	19,162	18,361	15,496	13,225	0	0	0	-4,972
1966	-10,678	-14,360	-5,801	-15,317	-6,747	-17,308	3,808	0	0	-2,283	-4,564	-6,770
1967	-9,049	-14,665	-13,713	-13,722	-13,730	-16,831	-21,435	0	0	0	-2,210	-0
1968	-9,249	-11,090	-4,003	-14,469	-23,930	-34,490	-36,699	0	0	-2,283	-4,564	-6,770
1969	-9,049	-14,665	-19,422	-19,433	-12,229	0	0	0	0	0	-2,283	-4,491
1970	-8,771	10,563	25,786	-3,935	-11,732	-9,781	-11,990	0	0	0	-2,283	-4,491
1971	-11,529	-16,132	-16,133	-17,093	-17,960	-28,520	-30,729	0	0	0	-2,283	-4,491
1972	-6,772	-12,388	-19,048	-26,670	-33,560	-39,363	-41,572	-3,935	0	-2,283	-4,564	-6,769
1973	-9,049	-14,665	-7,577	-13,290	-13,297	-13,298	-20,111	0	0	-2,283	-4,564	-9,531
1974	-15,236	-17,077	-17,077	0	0	0	0	0	0	0	-2,283	-7,253
1975	-10,199	9,135	29,113	17,619	6,459	750	750	0	0	0	-2,283	-4,491
1976	-7,344	-7,343	-255	-7,867	-14,746	-20,548	-22,759	-25,028	-27,219	-29,469	-31,713	-33,886
1977	-36,149	-40,752	-37,898	-38,883	-43,222	-49,025	-51,235	-53,451	-55,534	-52,568	-49,566	-42,991
1978	-41,040	-43,802	-37,666	-41,494	-42,392	-45,056	-54,446	-3,935	0	0	-2,283	-4,181
1979	-2,608	-4,450	-3,499	-13,013	-13,878	-7,258	0	0	0	-2,283	-4,564	-6,770
1980	-13,807	5,527	20,750	0	0	0	0	0	0	0	-2,283	-4,491
1981	-10,197	-12,039	-4,951	-13,517	-21,258	-36,574	-36,574	-26,147	-3,808	-6,087	-8,363	-10,566
1982	-12,842	-20,208	-19,257	-19,265	3,554	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-9,391	0	0	0	0	-2,210
1984	0	0	0	0	0	-9,738	-11,751	0	0	0	-2,283	-4,491
1985	-6,772	7,959	23,180	17,388	7,860	-2,701	-4,910	0	0	-2,283	-4,564	-6,769
1986	-9,049	-14,665	-7,577	-13,385	-24,563	-3,935	0	0	0	0	-2,283	-4,491
1987	-9,246	-11,087	-10,136	-16,801	-22,826	-33,386	-35,595	-24,241	-14,885	-17,151	-19,414	-21,606
1988	-22,544	-27,148	-20,060	-21,974	-26,282	-32,086	-34,296	-36,559	-5,448	-8,295	-13,043	-10,270
1989	-10,265	-13,947	-12,996	-15,857	-18,444	-29,004	-8,346	0	0	-5,708	-11,410	-9,559
1990	-12,409	2,322	17,543	6,041	-4,352	-14,913	-17,122	0	0	-7,991	-15,974	-20,564
1991	-22,457	-26,140	-23,809	-20,968	-23,558	-41,729	-43,939	-41,059	0	-929	-3,782	-10,223
1992	-14,025	-11,263	-11,263	-19,071	-21,488	-38,612	-40,822	0	-498	-498	-3,351	-7,952
1993	-11,754	-10,833	-12,736	-12,743	-12,749	0	0	0	0	0	-2,283	-4,491
1994	-8,770	-10,612	-9,660	-14,422	-23,024	-33,584	-35,793	0	0	-2,283	-4,564	-9,531
1995	-15,234	4,101	24,079	16,482	11,334	0	0	0	0	0	0	-4,972
1996	-7,919	-9,760	-7,429	-8,384	0	0	0	0	0	0	-2,283	-7,254
1997	-15,241	-18,004	-18,004	0	0	-11,512	0	0	0	0	-2,283	-4,491
1998	-6,772	-12,388	-11,009	-11,967	-11,974	-2,140	0	0	0	0	-2,283	-7,253
1999	-11,150	-12,992	-14,895	-25,367	-25,378	-25,379	-22,316	-5,737	0	0	-2,283	-7,253
2000	-11,531	7,803	27,781	12,481	-1,261	-17,719	-19,929	0	0	-2,283	-4,563	-9,532
2001	-16,568	-21,171	-14,083	-24,556	-35,741	-51,057	-53,267	0	-306	-2,589	-4,869	-9,075
2002	-12,208	-16,811	-16,811	-26,335	-34,943	-45,502	-47,712	0	0	-2,283	-4,564	-6,770
Avg (21-02)	-12,818	-11,635	-6,633	-11,624	-15,125	-20,352	-18,960	-6,119	-2,998	-4,046	-6,276	-8,961

Figure 2.3-2

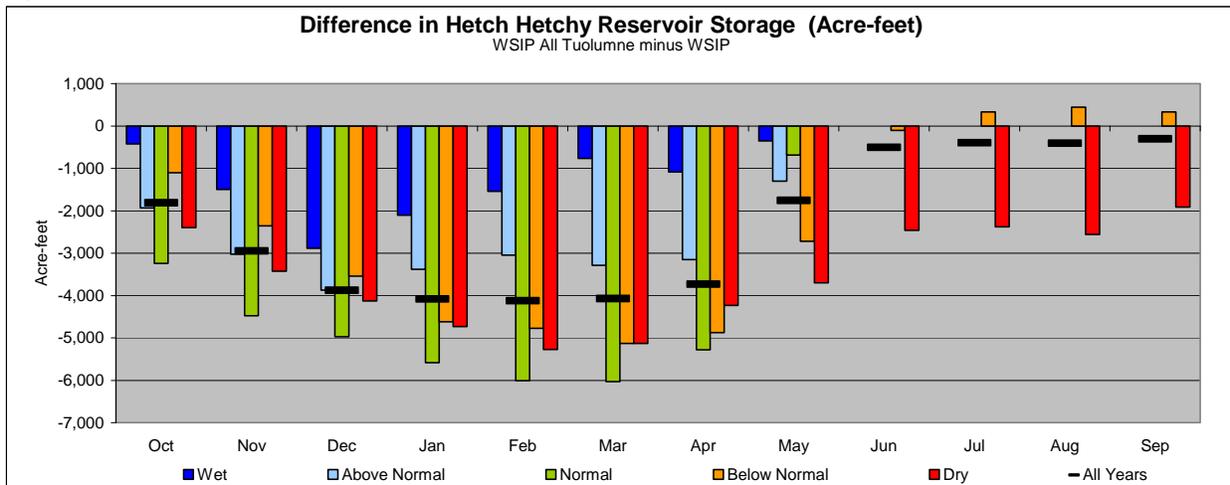


Figure 2.3-3

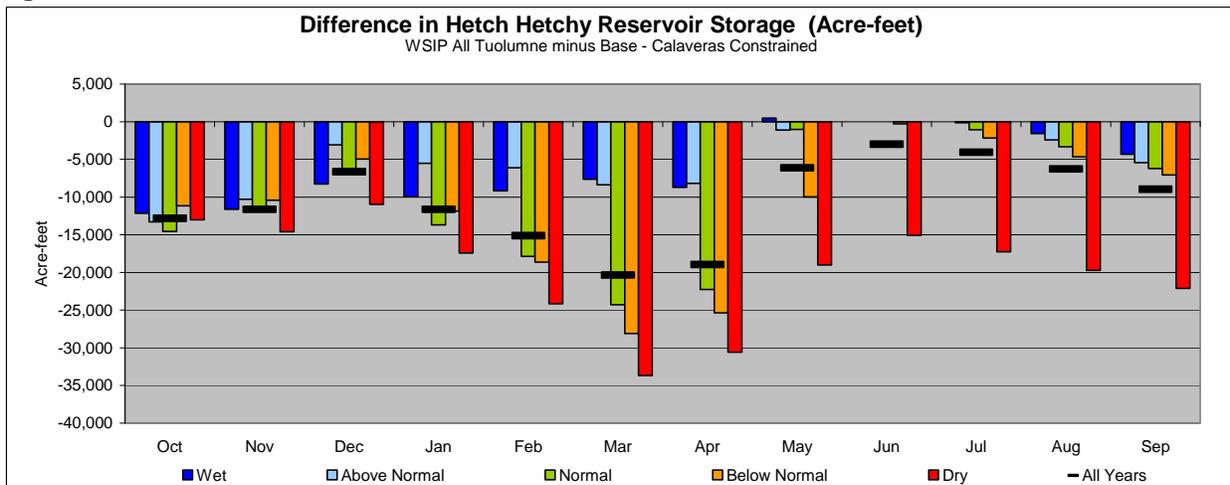


Figure 2.3-4

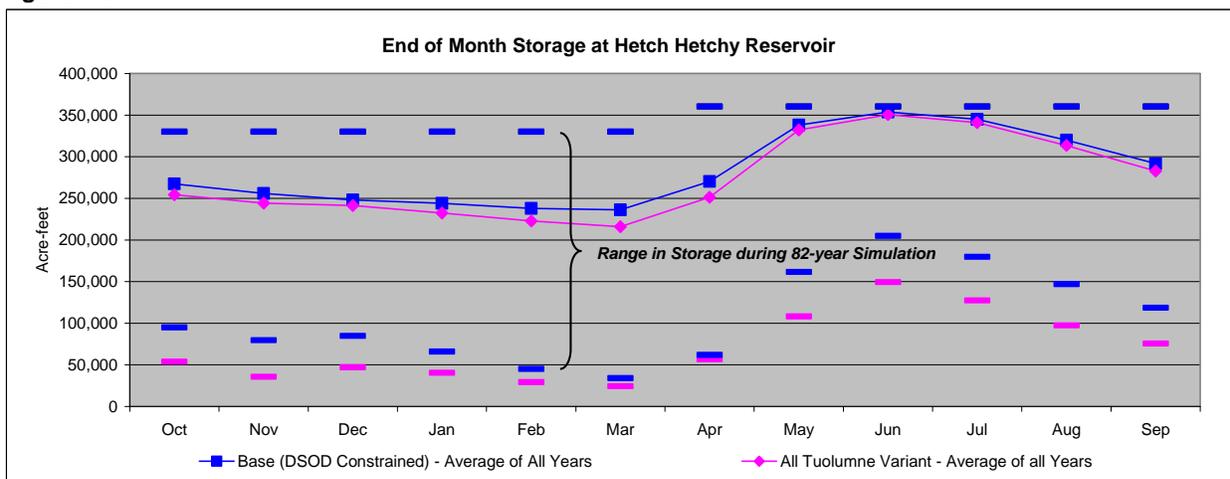


Table 2.3-5

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP All Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-2,581	0	0	0	-2,581
1922	0	0	0	0	0	0	0	-4,936	0	0	0	0	-4,936
1923	0	0	0	0	0	0	0	-8,475	0	0	0	0	-8,475
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-9,394	0	0	0	0	-9,394
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	-18,153	0	0	0	0	-18,153
1928	0	0	0	0	0	0	0	-11,821	0	0	0	0	-11,821
1929	0	0	0	0	0	0	0	0	-3,996	0	0	0	-3,996
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	-1,164	0	0	0	-1,164
1933	0	0	0	0	0	0	0	0	-9,440	0	0	0	-9,440
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	-698	0	0	0	-698
1936	0	0	0	0	0	0	0	9,587	0	0	0	0	9,587
1937	0	0	0	0	0	0	0	0	-1,920	0	0	0	-1,920
1938	0	0	0	0	0	0	0	-5,339	0	0	0	0	-5,339
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	-2,386	0	0	0	0	-2,386
1941	0	0	0	0	0	0	0	0	-3,656	0	0	0	-3,656
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-10,472	0	0	0	0	-10,472
1945	0	0	0	0	0	0	0	0	-5,605	0	0	0	-5,605
1946	0	0	0	0	0	0	0	-2,754	-3,455	0	0	0	-6,209
1947	0	0	0	0	0	0	0	-15,334	0	0	0	0	-15,334
1948	0	0	0	0	0	0	0	0	-707	0	0	0	-707
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	-3,286	0	0	0	-3,286
1951	0	0	0	0	0	0	0	0	-1,460	0	0	0	-1,460
1952	0	0	0	0	0	0	0	-5,668	0	0	0	0	-5,668
1953	0	0	0	0	0	0	0	-6,043	0	0	0	0	-6,043
1954	0	0	0	0	0	0	0	-11,712	0	0	0	0	-11,712
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-2,536	-1,774	0	0	0	-4,310
1957	0	0	0	0	0	0	0	-9,335	0	0	0	0	-9,335
1958	0	0	0	0	0	0	0	-7,995	0	0	0	0	-7,995
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	-6,373	0	0	0	0	-6,373
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	-13,267	0	0	0	0	-13,267
1968	0	0	0	0	0	0	0	-6,796	0	0	0	0	-6,796
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	-3,623	0	0	0	0	-3,623
1971	0	0	0	0	0	0	0	-7,777	0	0	0	0	-7,777
1972	0	0	0	0	0	0	0	-3,975	-4,171	0	0	0	-8,146
1973	0	0	0	0	0	0	0	-5,709	0	0	0	0	-5,709
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	-2,359	-4,171	0	0	0	-6,530
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	3,935	-4,171	0	0	0	-236
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	-3,554	0	0	0	0	0	0	0	-3,554
1983	0	0	0	0	0	0	0	-6,862	0	0	0	0	-6,862
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	24,479	0	0	0	0	24,479
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-13,079	0	0	0	-13,079
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	46	0	0	0	0	46
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-5,935	0	0	0	0	0	0	0	0	-5,935
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	-5,956	0	0	0	-5,956
2000	0	0	0	0	0	0	0	-9,623	0	0	0	0	-9,623
2001	0	0	0	0	0	0	0	-10,573	0	0	0	0	-10,573
2002	0	0	0	0	0	0	0	-12,323	0	0	0	0	-12,323
Avg (21-02)	0	0	0	-72	-43	0	0	-2,239	-869	0	0	0	-3,224

Table 2.3-5 illustrates the difference in stream release between the variant and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.3-6 illustrates the same information and the average monthly stream release for the variant and WSIP setting, expressed in average monthly flow (in cubic feet per second [cfs]). Table 2.3-7 illustrates the same form of information in comparing the variant and base settings.

Table 2.3-5 illustrates that the difference in monthly flow below O'Shaughnessy Dam could range from an increase of approximately 24,000 acre-feet to a decrease of approximately 18,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful.¹ When comparing the variant to the WSIP setting, a change in the volume of release from O'Shaughnessy Dam to the stream would likely result in the delay or earlier initiation of the release by a matter of days. Typical springtime releases, when initiated, amount to a release up to 3,000 cfs (approximately 6,000 acre-feet over the span of a day). Assuming that a change in release volume equates to a delay or earlier initiation of a 6,000 acre-feet-per-day release, the difference in stream release from O'Shaughnessy Dam between the variant and WSIP would be a delay up to 3 days or up to an added 4 days of release. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. Comparing the variant and WSIP setting, a change (increase or decrease) in stream release would occur in approximately 60 percent of the years simulated.

Compared to the base setting, the variant's effect to stream flow is very similar to the effect caused by the WSIP, but at times slightly greater. Table 2.3-8 illustrates the difference in stream release between the variant and base settings, expressed in terms of a month-to-month volume (acre-feet) of flow. Assuming the type of effect to releases described above, the releases above minimum requirements below the dam could be delayed by up to 9 days or initiated earlier by up to 2 days.

2.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different in the variant. Figure 2.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 2.4-1 are the results for the WSIP, variant, and base setting. The operation resulting from the variant is essentially the same as the WSIP, except during the prolonged drought of 1987-1992. The difference is explained by modeling assumptions for the discretionary judgment used by system operations to balance reservoir operations within the system, and the modeled differences are not likely to occur. HH/LSM model logic estimates the amount of water to be released from Lake Lloyd based on the condition of Hetch Hetchy Reservoir, the Don Pedro Water Bank Account, and Lake Eleanor and Lake Lloyd storage in comparison to demands. In this instance, Hetch Hetchy Reservoir storage is slightly lower in the variant at the later stage of the drought, and larger demands are anticipated within the variant. The model logic retains more storage in Lake Lloyd (in anticipation of a larger need) than in the WSIP setting. The model logic is not very refined, and a small change in computation can result in a large difference in Lake Lloyd release (in this instance, through Holm Powerhouse). Overall, the Lake Lloyd operation would be discretionary, and the outcome would likely be very similar if not the same between the variant and the WSIP settings.

Figure 2.4-2 illustrates the almost identical operation of Lake Eleanor for the variant and WSIP settings. Also shown in Figure 2.4-2 is the operation for the base setting. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is associated more with modeling discretion than with any substantive difference in operation.

Supplementing the Figure 2.4-1 representation of Lake Lloyd stream releases is Table 2.4-1, which illustrates releases for the variant and WSIP settings and the difference in releases between the two. Table 2.4-2 provides the same form of information for the variant and base settings.

¹ See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir", Memorandum by Daniel B. Steiner, December 31, 2006.

Table 2.3-6

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	161	85	84	144	2,377	4,542	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,164	3,073	379	125	89
Normal	54	54	50	55	74	74	98	1,169	1,895	167	122	86
Below Normal	55	55	46	43	51	63	88	540	682	113	111	73
Dry	53	53	44	40	44	50	56	150	135	86	86	65
All Years	54	61	56	72	69	73	103	1,074	2,061	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	167	89	84	144	2,415	4,548	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,187	3,095	379	125	89
Normal	54	54	50	55	74	74	98	1,260	1,907	167	122	86
Below Normal	55	55	46	43	51	63	88	564	709	113	111	73
Dry	53	53	44	40	44	50	56	157	139	86	86	65
All Years	54	61	56	74	70	73	103	1,111	2,075	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	-6	-4	0	0	-38	-6	0	0	0
Above Normal	0	0	0	0	0	0	0	-24	-22	0	0	0
Normal	0	0	0	0	0	0	0	-91	-12	0	0	0
Below Normal	0	0	0	0	0	0	0	-24	-27	0	0	0
Dry	0	0	0	0	0	0	0	-7	-4	0	0	0
All Years	0	0	0	-1	-1	0	0	-36	-15	0	0	0

Table 2.3-7

Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	3,378	3,031	3,124	9,919	4,695	5,165	8,544	146,165	270,243	125,059	11,310	5,316	595,948
Above Normal	3,400	5,282	5,435	4,033	4,936	5,772	7,808	71,555	182,847	23,302	7,686	5,316	327,372
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	71,880	112,760	10,299	7,513	5,123	235,062
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,212	33,177	40,552	6,927	6,818	4,345	115,835
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,340	9,229	8,033	5,285	5,285	3,861	52,221
All Years	3,351	3,609	3,449	4,450	3,818	4,506	6,153	66,059	122,614	33,709	7,711	4,793	264,222

Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	3,378	3,031	3,124	11,045	4,917	5,695	8,790	154,853	269,789	125,059	11,310	5,335	606,325
Above Normal	3,400	5,733	5,435	4,033	4,936	5,309	7,808	78,261	183,990	23,302	7,686	5,316	335,208
Normal	3,343	3,235	3,051	3,109	4,128	4,557	5,817	90,958	113,833	10,299	7,513	5,123	254,966
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,436	46,628	45,681	6,927	6,818	4,345	134,639
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,816	13,790	9,991	5,285	5,285	3,861	59,217
All Years	3,351	3,703	3,449	4,621	3,861	4,514	6,340	76,545	124,417	33,709	7,711	4,797	277,018

Difference in Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	-1,126	-222	-530	-246	-8,688	454	0	0	-19	-10,377
Above Normal	0	-451	0	0	0	463	0	-6,706	-1,143	0	0	0	-7,837
Normal	0	0	0	246	0	0	0	-19,078	-1,072	0	0	0	-19,905
Below Normal	0	0	0	0	0	0	-224	-13,451	-5,128	0	0	0	-18,804
Dry	0	0	0	0	0	0	-476	-4,561	-1,959	0	0	0	-6,996
All Years	0	-93	0	-172	-43	-7	-187	-10,487	-1,803	0	0	-4	-12,797

Table 2.3-8

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP All Tuolumne minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-9,375	0	0	0	-9,375
1922	0	0	0	0	0	0	0	-13,821	0	0	0	0	-13,821
1923	0	0	0	0	0	0	0	-25,512	0	0	0	0	-25,512
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-27,627	0	0	0	0	-27,627
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-42,341	0	0	0	0	-42,341
1928	0	0	0	0	0	0	0	-15,670	0	0	0	0	-15,670
1929	0	0	0	0	0	0	0	0	-17,219	0	0	0	-17,219
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	-3,800	0	0	0	-3,800
1933	0	0	0	0	0	0	0	0	-24,390	0	0	0	-24,390
1934	0	0	0	0	0	0	-3,808	0	0	0	0	0	-3,808
1935	0	0	0	0	0	3,935	0	0	-4,572	0	0	0	-637
1936	0	0	0	0	0	0	0	-3,923	0	0	0	0	-3,923
1937	0	0	0	0	0	0	0	-3,143	-6,151	0	0	0	-9,294
1938	0	0	0	0	0	0	0	-16,678	0	0	0	0	-16,678
1939	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1940	0	0	0	0	0	0	0	5,962	0	0	0	0	5,962
1941	0	0	0	0	0	0	0	0	-4,853	0	0	0	-4,853
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-41,175	0	0	0	0	-41,175
1945	0	0	0	0	0	0	0	0	7,556	0	0	0	7,556
1946	0	0	0	0	0	0	0	-10,390	-3,455	0	0	0	-13,845
1947	0	0	0	0	0	0	0	-46,780	0	0	0	0	-46,780
1948	0	0	0	0	0	0	0	0	-12,762	0	0	0	-12,762
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	1,824	0	0	0	1,824
1951	0	-7,666	0	0	0	0	0	0	-7,673	0	0	0	-15,339
1952	0	0	0	0	0	0	0	-21,818	0	0	0	0	-21,818
1953	0	0	0	0	0	0	0	-6,365	0	0	0	0	-6,365
1954	0	0	0	0	0	0	0	-42,696	0	0	0	0	-42,696
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-5,342	-1,774	0	0	0	-7,116
1957	0	0	0	0	0	0	0	-41,063	0	0	0	0	-41,063
1958	0	0	0	0	0	0	0	-20,533	0	0	0	0	-20,533
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-41,654	0	0	0	0	-41,654
1963	0	0	0	0	0	0	0	-34,641	0	0	0	0	-34,641
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	13,214	0	0	0	13,214
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1967	0	0	0	0	0	0	0	-21,990	0	0	0	0	-21,990
1968	0	0	0	0	0	0	0	-37,744	0	0	0	0	-37,744
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	-11,986	0	0	0	0	-8,051
1971	0	0	0	0	0	0	0	-31,413	0	0	0	0	-31,413
1972	0	0	0	0	0	0	0	-33,432	-4,171	0	0	0	-37,603
1973	0	0	0	0	0	0	0	-20,103	0	0	0	0	-20,103
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-42,655	-4,171	0	0	-310	-47,136
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-10,407	-10,310	0	0	0	-20,717
1982	0	0	0	0	-3,554	0	0	0	0	0	0	0	-3,554
1983	0	0	0	0	0	0	0	-9,993	0	0	0	0	-9,993
1984	0	0	0	0	0	3,935	0	-11,745	0	0	0	0	-7,810
1985	0	0	0	0	0	0	0	-5,235	0	0	0	0	-5,235
1986	0	0	0	0	0	-8,478	-3,935	0	0	0	0	0	-12,413
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1989	0	0	0	0	0	0	0	-8,875	0	0	0	0	-8,875
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-42,053	0	0	0	-42,053
1992	0	0	0	0	0	0	0	-28,918	0	0	0	0	-28,918
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	46	0	0	0	0	46
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-18,011	0	0	0	0	0	0	0	0	-18,011
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-13,491	-6,083	0	0	0	-19,574
2000	0	0	0	0	0	0	0	-19,921	0	0	0	0	-19,921
2001	0	0	0	0	0	0	0	-53,240	0	0	0	0	-53,240
2002	0	0	0	0	0	0	0	-48,771	0	0	0	0	-48,771
Avg (21-02)	0	-93	0	-172	-43	-7	-187	-10,487	-1,803	0	0	-4	-12,797

**Figure 2.4-1
Lake Lloyd Storage and Stream Release**

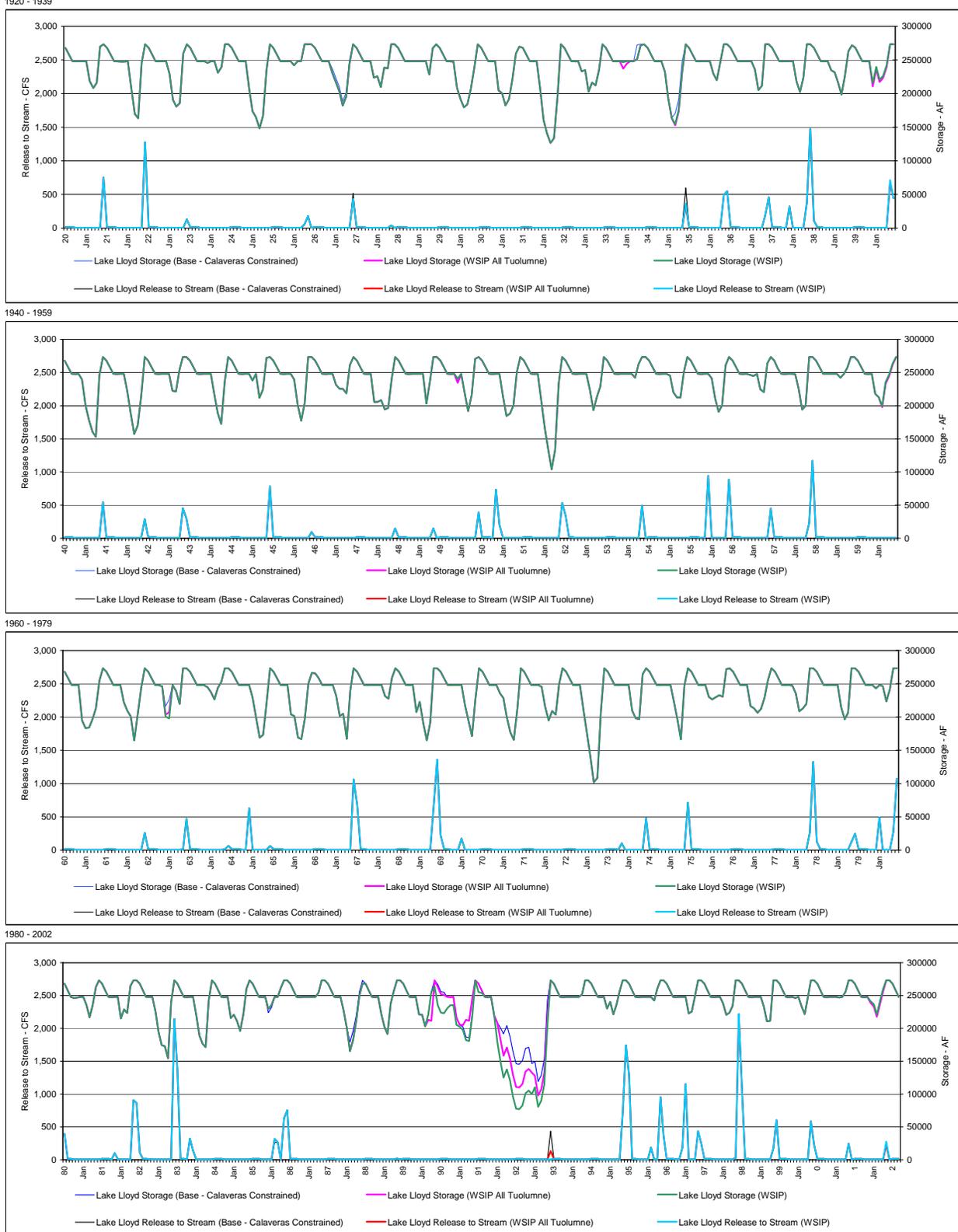


Figure 2.4-2
Lake Eleanor Storage and Stream Release

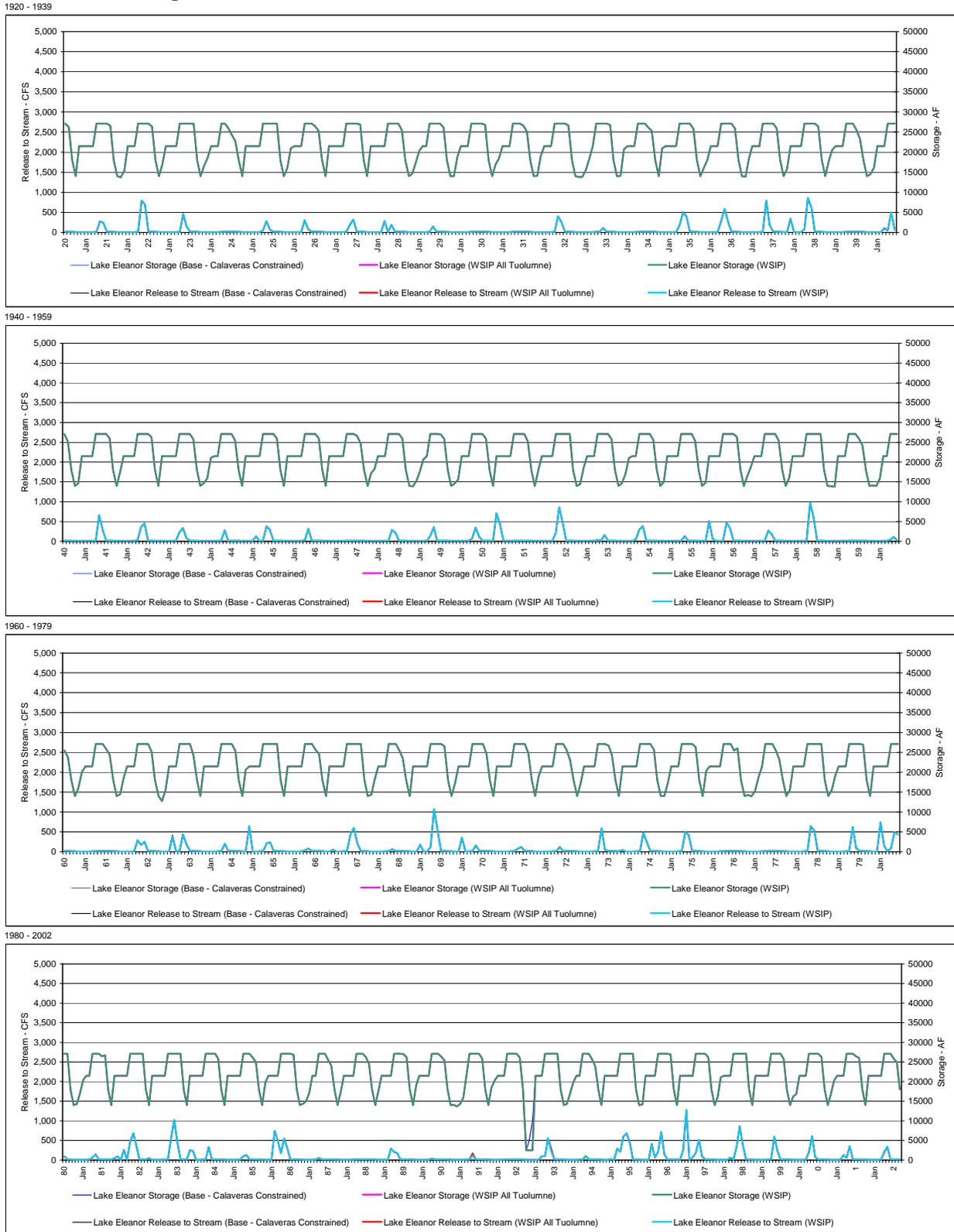


Table 2.4-1

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,066	363	15	15
Above Normal	5	72	25	5	16	5	5	165	446	16	15	15
Normal	5	5	5	16	5	5	5	107	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	120	342	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	448	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	121	341	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP All Tuolumne minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	0	0	0	0	8	0	0	0
Above Normal	0	0	0	0	0	0	0	-2	-2	0	0	0
Normal	0	0	0	0	0	0	0	-3	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	-1	1	0	0	0

Table 2.4-2

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,066	363	15	15
Above Normal	5	72	25	5	16	5	5	165	446	16	15	15
Normal	5	5	5	16	5	5	5	107	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	120	342	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	21	21	5	284	1,084	363	15	15
Above Normal	5	72	25	5	16	5	5	166	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	350	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP All Tuolumne minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	3	0	0	0	-19	0	0	0
Above Normal	0	0	0	0	0	0	0	-1	-21	0	0	0
Normal	0	0	0	0	0	0	0	-3	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	1	0	0	-1	-8	0	0	0

2.5 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities, described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 2.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 2.5-1 are the results for the WSIP, variant, and base settings.

Supplementing the Figure 2.5-1 representation of Don Pedro Reservoir storage are Table 2.5-1 Don Pedro Reservoir Storage (All Tuolumne), Table 2.5-2 Don Pedro Reservoir Storage (WSIP), and Table 2.5-3 Difference in Don Pedro Reservoir Storage (All Tuolumne minus WSIP). Table 2.5-4 illustrates the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Table 2.5-3 illustrates that, throughout many years, the storage in Don Pedro Reservoir associated with the variant setting would differ from the storage in the WSIP setting, and that this difference could be more or less storage. When there is a change, the change occurs because inflow to the reservoir differs between the two settings in a month or series of months when Don Pedro Reservoir is below the flood control storage limitation and can regulate inflow with storage. When no storage difference occurs for months or other periods of time, either inflow to the reservoir did not change between the settings or (if inflow was different while storage was at the flood control storage limitation) the change in inflow manifests as a change in release to the Tuolumne River below La Grange Dam (discussed later).

The greatest draw from reservoir storage occurs during the drought of 1976-1977, which does not coincide with the year of greatest difference in reservoir draw between the base setting and either the WSIP or variant settings, the drought of the 1930s. There are exceptions to reductions in storage (due to a reduction in inflow) when the variant causes a greater level of SFPUC rationing (e.g., 1987-1988), which then reduces the SFPUC's upstream diversion from the Tuolumne and leads to greater inflow to Don Pedro Reservoir in a subsequent period. Figure 2.5-2 illustrates the difference in reservoir storage, averaged by year type, in comparing the variant to the WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.5-3 illustrates the same information in comparing the variant and base settings.

Figure 2.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the variant would manifest into differences in releases from La Grange Dam to the stream. A different amount of available reservoir space in the winter and spring due to the variant would lead to a different ability to additionally regulate inflow, thus potentially changing the amount of water released to the stream, which is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow directly manifests as a change in release from La Grange Dam (a change in either more or less flow). Figure 2.5-1 illustrates the stream release from La Grange Dam for the WSIP, variant, and base settings.

Figure 2.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

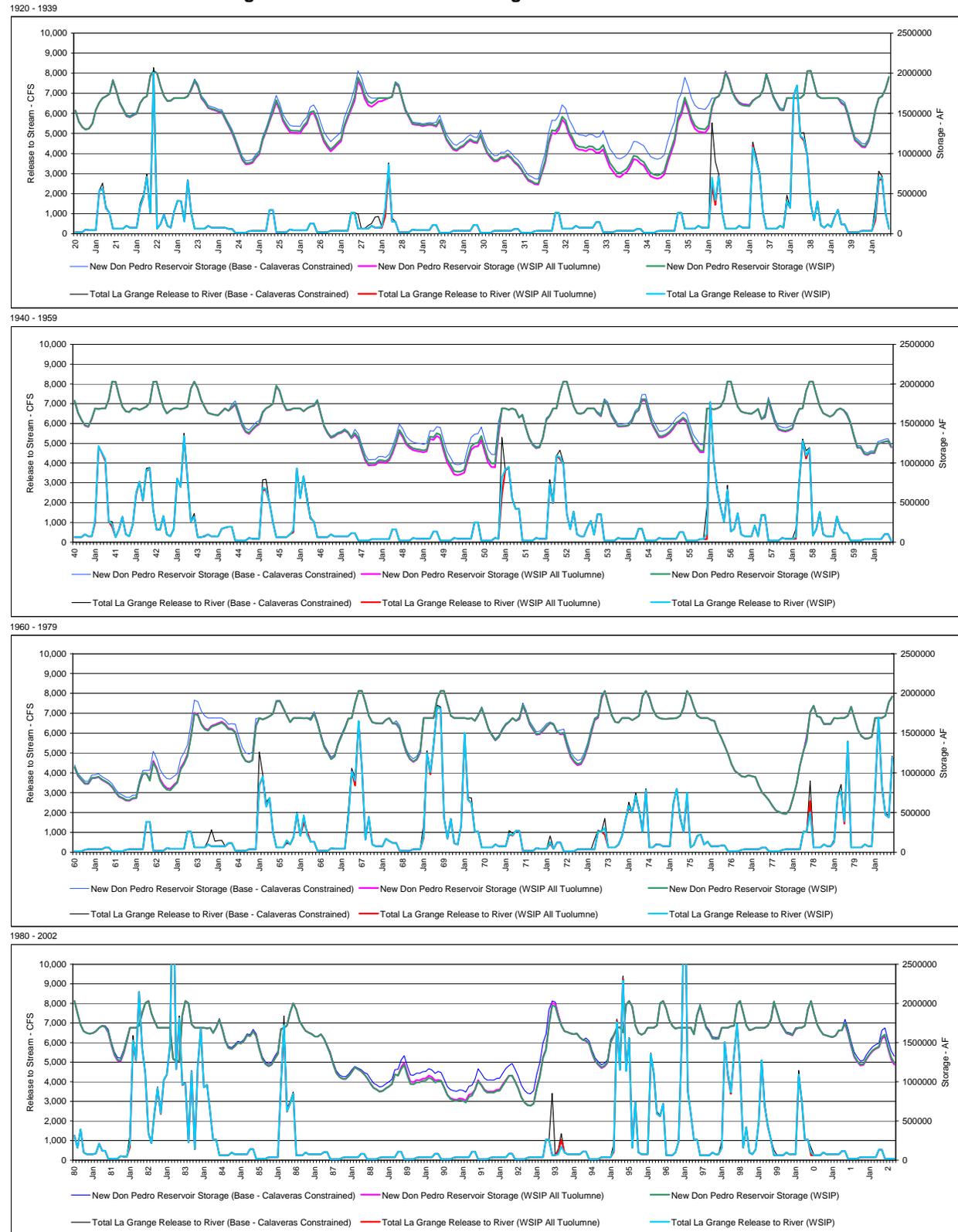


Table 2.5-1

Don Pedro Reservoir Storage (Acre-feet)

WSIP All Tuolumne

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,741,659	1,906,842	1,776,891	1,628,631	1,552,054
1922	1,466,089	1,451,283	1,475,576	1,495,739	1,625,852	1,690,000	1,713,000	1,961,925	2,030,000	1,998,041	1,838,188	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,792,444	1,898,745	1,808,707	1,688,080	1,636,517
1924	1,566,689	1,551,028	1,537,009	1,518,601	1,513,314	1,428,632	1,343,620	1,255,358	1,147,933	1,029,192	920,586	866,452
1925	868,661	882,781	946,570	988,833	1,165,150	1,272,010	1,400,260	1,511,068	1,639,522	1,541,395	1,401,100	1,329,217
1926	1,265,417	1,257,081	1,257,496	1,251,401	1,322,007	1,367,800	1,488,041	1,503,806	1,405,637	1,266,259	1,144,159	1,080,478
1927	1,025,313	1,064,983	1,111,492	1,151,039	1,328,952	1,443,703	1,552,933	1,655,120	1,905,730	1,826,141	1,680,413	1,603,435
1928	1,582,244	1,613,593	1,648,059	1,651,176	1,674,569	1,690,000	1,705,499	1,870,918	1,833,506	1,669,905	1,527,496	1,449,605
1929	1,366,048	1,357,725	1,354,831	1,341,619	1,350,472	1,358,885	1,352,459	1,336,392	1,405,035	1,282,476	1,169,231	1,105,352
1930	1,049,256	1,033,100	1,068,613	1,088,600	1,132,569	1,164,017	1,137,172	1,128,965	1,221,199	1,104,902	1,000,210	947,410
1931	902,784	905,132	942,567	940,741	972,268	938,978	885,430	851,529	795,621	721,819	662,071	642,591
1932	616,484	611,354	751,305	884,666	1,120,678	1,254,740	1,244,289	1,297,126	1,420,045	1,372,796	1,237,336	1,160,575
1933	1,071,623	1,046,247	1,043,944	1,029,396	1,054,043	1,045,958	1,008,412	1,011,698	1,052,725	943,170	832,935	774,144
1934	716,849	705,128	741,064	768,854	837,120	930,201	917,736	875,643	849,458	775,939	714,751	695,614
1935	685,032	698,696	738,209	891,769	1,015,097	1,141,876	1,399,752	1,486,535	1,656,480	1,541,350	1,396,830	1,310,012
1936	1,273,907	1,265,494	1,259,515	1,313,055	1,572,854	1,690,000	1,713,000	1,819,113	2,017,518	1,919,004	1,769,014	1,686,144
1937	1,632,816	1,611,490	1,604,952	1,598,928	1,659,219	1,690,000	1,713,000	1,791,821	1,984,965	1,850,220	1,704,112	1,619,407
1938	1,545,291	1,536,731	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,690,224	1,690,000	1,690,000	1,689,999	1,690,000	1,626,996	1,596,239	1,472,685	1,305,520	1,163,860	1,125,153
1940	1,082,956	1,075,694	1,148,029	1,301,630	1,540,042	1,690,000	1,713,000	1,802,316	1,949,263	1,783,582	1,633,383	1,544,792
1941	1,474,200	1,457,895	1,555,749	1,689,994	1,683,358	1,690,000	1,690,000	1,800,527	2,030,000	2,027,475	1,857,774	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,446	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,650	2,030,000	1,944,494	1,798,476	1,708,539
1944	1,635,548	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,697,126	1,739,782	1,613,109	1,471,496	1,394,127
1945	1,369,516	1,417,549	1,463,984	1,490,274	1,636,340	1,690,000	1,713,000	1,749,692	1,972,689	1,909,540	1,755,381	1,667,517
1946	1,669,700	1,690,000	1,689,996	1,689,984	1,655,318	1,690,000	1,713,000	1,723,320	1,784,464	1,620,170	1,464,606	1,378,237
1947	1,319,050	1,335,491	1,368,817	1,381,034	1,411,824	1,381,342	1,313,496	1,358,242	1,299,289	1,158,782	1,033,537	970,391
1948	974,201	975,480	1,014,102	1,013,221	1,001,290	1,032,721	1,123,736	1,245,117	1,394,551	1,329,796	1,236,512	1,192,269
1949	1,163,092	1,152,614	1,147,373	1,135,802	1,147,883	1,305,639	1,291,956	1,341,908	1,315,106	1,153,040	1,010,170	935,499
1950	857,566	847,519	858,385	877,311	1,033,968	1,168,317	1,205,228	1,211,788	1,296,712	1,147,604	1,007,678	949,348
1951	946,817	1,348,105	1,689,997	1,689,971	1,674,432	1,690,000	1,671,050	1,575,613	1,602,823	1,449,321	1,309,544	1,230,213
1952	1,188,870	1,196,581	1,318,173	1,543,330	1,596,840	1,689,552	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,591,996	1,781,598	1,736,764	1,603,774	1,528,825
1954	1,463,051	1,462,256	1,465,898	1,472,697	1,521,664	1,631,234	1,669,072	1,789,284	1,789,404	1,629,426	1,483,558	1,405,183
1955	1,325,821	1,325,583	1,343,867	1,376,438	1,426,708	1,492,341	1,519,216	1,556,447	1,518,886	1,383,461	1,258,466	1,199,906
1956	1,137,029	1,135,673	1,688,318	1,689,942	1,678,244	1,690,000	1,713,000	1,801,590	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,576,353	1,783,554	1,636,270	1,496,439	1,422,810
1958	1,406,474	1,398,925	1,411,633	1,434,589	1,581,158	1,681,336	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,666,000	1,603,418	1,500,918	1,335,794	1,192,463	1,192,185
1960	1,114,290	1,102,869	1,126,096	1,125,784	1,242,608	1,255,912	1,269,274	1,274,637	1,199,054	1,068,430	959,696	910,471
1961	862,601	861,812	931,788	933,481	945,635	911,714	886,616	859,594	816,489	751,836	698,273	679,009
1962	653,086	648,001	675,736	679,678	866,777	987,889	988,038	916,344	1,149,720	1,058,831	921,965	849,218
1963	806,463	800,410	847,806	886,533	1,062,979	1,131,054	1,230,903	1,460,709	1,754,542	1,734,888	1,618,751	1,559,934
1964	1,541,278	1,590,836	1,606,502	1,624,612	1,641,098	1,611,160	1,558,027	1,554,355	1,512,032	1,357,062	1,222,080	1,151,175
1965	1,137,672	1,160,980	1,592,480	1,689,973	1,672,815	1,690,000	1,713,000	1,743,287	1,901,841	1,903,816	1,814,260	1,723,014
1966	1,638,057	1,690,000	1,689,998	1,689,996	1,689,070	1,690,000	1,669,855	1,747,296	1,629,928	1,465,889	1,322,263	1,251,669
1967	1,175,758	1,209,287	1,362,980	1,461,995	1,559,828	1,680,844	1,690,000	1,880,000	2,030,000	2,030,000	1,885,243	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,938	1,666,603	1,690,000	1,620,006	1,616,316	1,553,547	1,386,507	1,251,123	1,173,444
1969	1,137,042	1,166,357	1,255,840	1,689,995	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,953	1,679,634	1,690,000	1,655,509	1,722,276	1,813,690	1,683,580	1,546,555	1,468,439
1971	1,408,419	1,451,334	1,538,382	1,604,289	1,640,438	1,690,000	1,654,817	1,676,546	1,844,379	1,744,178	1,610,633	1,541,087
1972	1,478,889	1,487,442	1,531,038	1,581,506	1,624,864	1,607,812	1,513,898	1,484,835	1,490,177	1,332,530	1,201,263	1,134,669
1973	1,096,022	1,109,040	1,191,110	1,319,901	1,499,515	1,661,968	1,693,363	1,934,059	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,984	1,662,882	1,690,000	1,717,600	1,963,440	2,030,000	1,947,206	1,804,319	1,717,373
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,817,465	2,030,000	1,959,911	1,829,920	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,435,209	1,761,000	1,845,208	1,711,253	1,699,232
1979	1,611,950	1,615,026	1,614,082	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,211	1,682,213	1,538,195	1,461,600
1980	1,430,197	1,432,910	1,452,944	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,713,995	1,699,243	1,628,361	1,467,408	1,338,954	1,270,817
1982	1,261,967	1,368,885	1,519,628	1,689,996	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,873,946	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,394	1,735,008
1984	1,690,000	1,690,000	1,689,992	1,689,972	1,681,440	1,690,000	1,622,221	1,691,426	1,791,689	1,663,465	1,516,873	1,433,460
1985	1,418,439	1,453,549	1,497,928	1,488,516	1,523,571	1,591,651	1,584,754	1,644,256	1,582,430	1,421,974	1,290,376	1,226,486
1986	1,199,500	1,220,692	1,292,278	1,357,285	1,669,715	1,690,000	1,717,600	1,888,300	2,001,400	1,921,826	1,777,583	1,709,211
1987	1,650,077	1,628,032	1,609,483	1,578,362	1,577,562	1,606,421	1,550,898	1,452,868	1,354,008	1,222,826	1,114,464	1,061,192
1988	1,038,470	1,037,567	1,073,751	1,127,570	1,183,427	1,160,444						

Table 2.5-2

Don Pedro Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,154	1,909,912	1,779,947	1,631,674	1,555,087
1922	1,469,116	1,454,308	1,478,601	1,498,765	1,627,062	1,690,000	1,713,000	1,967,567	2,030,000	1,998,041	1,838,188	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,800,909	1,907,182	1,839,107	1,696,444	1,644,854
1924	1,575,009	1,559,343	1,545,325	1,526,919	1,521,632	1,436,947	1,351,927	1,269,310	1,161,839	1,043,035	934,362	880,179
1925	882,358	896,470	960,259	1,002,527	1,178,845	1,285,699	1,415,416	1,536,955	1,665,322	1,567,081	1,426,669	1,354,700
1926	1,290,841	1,282,495	1,282,912	1,276,824	1,347,431	1,393,215	1,513,431	1,529,132	1,430,876	1,291,382	1,169,168	1,105,402
1927	1,050,185	1,089,842	1,136,351	1,175,906	1,353,820	1,468,562	1,577,769	1,698,023	1,948,492	1,868,718	1,722,803	1,645,689
1928	1,624,412	1,655,738	1,690,000	1,690,000	1,690,000	1,689,998	1,690,000	1,705,499	1,881,986	1,844,539	1,680,590	1,460,504
1929	1,376,925	1,368,595	1,365,702	1,352,493	1,361,347	1,369,756	1,363,320	1,347,224	1,419,566	1,296,940	1,183,629	1,119,702
1930	1,063,576	1,047,412	1,082,926	1,102,916	1,146,887	1,178,330	1,151,470	1,143,227	1,235,412	1,119,051	1,014,293	961,444
1931	916,788	919,127	956,563	954,741	986,269	952,973	899,411	865,472	809,514	735,646	675,830	656,304
1932	630,168	625,030	769,521	913,534	1,153,444	1,289,825	1,280,793	1,334,069	1,458,021	1,410,599	1,274,962	1,198,076
1933	1,109,046	1,083,648	1,081,347	1,066,810	1,091,460	1,083,362	1,048,132	1,053,363	1,104,947	995,152	884,663	825,690
1934	768,284	756,532	778,426	811,719	879,231	973,527	961,019	918,806	892,463	818,740	757,348	738,059
1935	727,382	741,020	780,535	934,617	1,058,518	1,183,873	1,442,298	1,526,908	1,697,122	1,581,812	1,437,108	1,350,153
1936	1,313,964	1,305,527	1,299,545	1,353,079	1,589,109	1,690,000	1,713,000	1,808,162	2,006,603	1,908,135	1,758,193	1,675,358
1937	1,622,051	1,600,732	1,594,212	1,588,128	1,654,812	1,690,000	1,713,000	1,792,193	1,987,140	1,852,386	1,706,269	1,621,556
1938	1,547,436	1,538,874	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,699,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,640,136	1,609,346	1,485,747	1,318,522	1,176,804	1,138,053
1940	1,095,829	1,088,559	1,152,400	1,306,261	1,540,227	1,690,000	1,713,000	1,807,723	1,954,652	1,788,947	1,638,725	1,550,117
1941	1,479,514	1,463,206	1,562,630	1,689,993	1,683,096	1,690,000	1,690,000	1,803,646	2,030,000	2,027,475	1,857,774	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,650	2,030,000	1,944,494	1,798,476	1,708,539
1944	1,635,548	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,707,586	1,750,208	1,623,490	1,481,831	1,404,426
1945	1,379,794	1,427,821	1,474,257	1,500,550	1,640,388	1,690,000	1,713,000	1,750,490	1,979,080	1,915,904	1,761,716	1,673,833
1946	1,676,003	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,923	1,791,308	1,626,984	1,471,391	1,384,998
1947	1,325,797	1,342,234	1,375,560	1,387,779	1,418,570	1,388,085	1,320,233	1,380,276	1,321,244	1,180,640	1,055,294	992,073
1948	995,836	997,103	1,035,726	1,034,852	1,022,922	1,055,342	1,146,487	1,267,945	1,418,033	1,353,141	1,259,749	1,215,428
1949	1,186,203	1,175,712	1,170,472	1,158,924	1,171,007	1,335,110	1,324,533	1,376,033	1,357,651	1,195,392	1,052,328	977,511
1950	899,485	889,413	892,224	916,879	1,074,192	1,209,417	1,247,067	1,254,186	1,342,400	1,193,086	1,052,952	994,465
1951	991,837	1,395,953	1,689,996	1,689,971	1,673,951	1,690,000	1,671,280	1,576,052	1,604,719	1,451,209	1,311,422	1,232,085
1952	1,190,739	1,198,448	1,320,040	1,549,021	1,599,117	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,899,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,597,670	1,787,254	1,742,396	1,609,381	1,534,414
1954	1,468,628	1,467,830	1,471,472	1,478,272	1,527,241	1,636,809	1,674,641	1,806,537	1,806,600	1,646,548	1,500,604	1,422,171
1955	1,342,774	1,342,526	1,360,811	1,393,387	1,443,658	1,509,285	1,536,773	1,574,515	1,539,789	1,404,270	1,279,178	1,220,548
1956	1,157,629	1,156,262	1,690,000	1,689,942	1,678,244	1,690,000	1,713,000	1,804,719	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,545,764	1,585,676	1,792,847	1,645,523	1,505,651	1,431,990
1958	1,415,635	1,408,082	1,420,790	1,443,748	1,585,696	1,683,150	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,209	1,607,868	1,505,353	1,304,209	1,196,857	1,196,565
1960	1,118,661	1,107,237	1,130,464	1,130,153	1,243,532	1,256,171	1,271,114	1,278,736	1,204,810	1,074,160	965,400	916,155
1961	868,272	867,480	938,355	940,051	952,205	918,282	893,177	866,136	823,008	758,324	704,730	685,442
1962	659,505	654,417	682,152	686,096	687,196	994,305	900,271	1,129,751	1,038,952	902,181	829,505	829,505
1963	786,793	780,752	831,071	876,126	1,043,308	1,111,390	1,211,258	1,448,431	1,743,224	1,723,618	1,607,530	1,548,750
1964	1,530,117	1,579,681	1,595,347	1,613,453	1,629,939	1,600,004	1,547,600	1,544,300	1,506,555	1,351,609	1,216,652	1,145,766
1965	1,132,274	1,155,586	1,587,084	1,689,972	1,672,299	1,690,000	1,713,000	1,744,617	1,904,454	1,906,417	1,816,850	1,723,010
1966	1,638,053	1,690,000	1,689,998	1,689,996	1,685,995	1,690,000	1,666,092	1,743,542	1,626,186	1,462,164	1,318,555	1,247,974
1967	1,172,070	1,205,602	1,359,294	1,458,308	1,556,141	1,679,371	1,690,000	1,880,000	2,030,000	2,030,000	1,885,243	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,938	1,666,603	1,690,000	1,620,006	1,623,104	1,560,312	1,393,242	1,257,826	1,180,125
1969	1,143,709	1,173,021	1,262,503	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,894	1,817,297	1,687,171	1,550,130	1,472,003
1971	1,411,974	1,454,887	1,541,936	1,607,844	1,641,860	1,690,000	1,654,817	1,684,314	1,852,122	1,751,886	1,618,308	1,548,737
1972	1,486,524	1,495,072	1,538,668	1,589,139	1,627,917	1,610,864	1,516,947	1,496,024	1,505,254	1,347,538	1,216,200	1,149,557
1973	1,110,879	1,123,889	1,205,959	1,334,754	1,514,370	1,676,817	1,708,199	1,954,560	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,440	2,030,000	1,947,206	1,804,319	1,717,373
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,822,763	2,030,000	1,959,911	1,829,920	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,400,571	1,761,000	1,845,209	1,711,253	1,699,232
1979	1,613,622	1,616,696	1,615,753	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,211	1,682,213	1,538,195	1,461,600
1980	1,430,197	1,432,910	1,452,944	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,713,995	1,699,243	1,639,415	1,478,412	1,349,907	1,281,733
1982	1,272,860	1,379,771	1,530,515	1,689,994	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,873,946	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,394	1,735,008
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,426	1,791,689	1,663,465	1,516,873	1,433,460
1985	1,418,439	1,453,549	1,497,928	1,488,516	1,523,571	1,591,651	1,584,754	1,644,256	1,582,430	1,421,974	1,290,376	1,226,486
1986	1,199,500	1,220,692	1,292,278	1,357,285	1,669,715	1,690,000	1,717,600	1,888,300	2,001,400	1,921,826	1,777,583	1,709,211
1987	1,650,077	1,628,032	1,609,483	1,578,362	1,577,562	1,606,421	1,550,898	1,452,868	1,354,008	1,222,826	1,114,464	1,061,192
1988	1,038,470	1,037,567	1,073,751	1,127,570	1,183,427	1,160,444	1,					

Table 2.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet)

WSIP All Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	-495	-3,070	-3,056	-3,043	-3,033
1922	-3,027	-3,025	-3,025	-3,026	-1,210	0	0	-5,642	0	0	0	0
1923	0	0	0	0	0	0	0	-8,465	-8,437	-8,400	-8,364	-8,337
1924	-8,320	-8,315	-8,316	-8,318	-8,318	-8,315	-8,307	-13,952	-13,906	-13,843	-13,776	-13,727
1925	-13,697	-13,689	-13,689	-13,694	-13,695	-13,689	-15,156	-25,887	-25,800	-25,686	-25,569	-25,483
1926	-25,429	-25,414	-25,416	-25,423	-25,424	-25,415	-25,390	-25,326	-25,239	-25,123	-25,009	-24,924
1927	-24,872	-24,859	-24,859	-24,867	-24,868	-24,859	-24,836	-42,903	-42,762	-42,577	-42,390	-42,254
1928	-42,168	-42,145	-41,941	-38,824	-15,429	0	0	-11,068	-11,033	-10,985	-10,936	-10,899
1929	-10,877	-10,870	-10,871	-10,874	-10,875	-10,871	-10,861	-10,832	-14,531	-14,464	-14,398	-14,350
1930	-14,320	-14,312	-14,313	-14,316	-14,318	-14,313	-14,298	-14,262	-14,213	-14,149	-14,083	-14,034
1931	-14,004	-13,995	-13,996	-14,000	-14,001	-13,995	-13,981	-13,943	-13,893	-13,827	-13,759	-13,713
1932	-13,684	-13,676	-18,216	-28,868	-32,766	-35,085	-36,504	-36,943	-37,976	-37,803	-37,626	-37,501
1933	-37,423	-37,401	-37,403	-37,414	-37,417	-37,404	-37,720	-41,665	-52,222	-51,982	-51,728	-51,546
1934	-51,435	-51,404	-37,362	-42,865	-42,111	-43,326	-43,283	-43,163	-43,005	-42,801	-42,597	-42,445
1935	-42,350	-42,324	-42,326	-42,848	-43,421	-41,997	-42,546	-40,373	-40,642	-40,462	-40,278	-40,141
1936	-40,057	-40,033	-40,030	-40,024	-16,255	0	0	10,951	10,915	10,869	10,821	10,786
1937	10,765	10,758	10,740	10,800	4,407	0	0	-372	-2,175	-2,166	-2,157	-2,149
1938	-2,145	-2,143	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	-13,140	-13,107	-13,062	-13,002	-12,944	-12,900
1940	-12,873	-12,865	-4,371	-4,631	-185	0	0	-5,407	-5,389	-5,365	-5,342	-5,325
1941	-5,314	-5,311	-6,881	1	262	0	0	-3,119	0	0	0	0
1942	0	0	0	0	1	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-10,460	-10,426	-10,381	-10,335	-10,299
1945	-10,278	-10,272	-10,273	-10,276	-4,048	0	0	-798	-6,391	-6,364	-6,335	-6,316
1946	-6,303	0	0	0	172	0	0	-3,603	-6,844	-6,814	-6,785	-6,761
1947	-6,747	-6,743	-6,743	-6,745	-6,746	-6,743	-6,737	-22,034	-21,955	-21,858	-21,757	-21,682
1948	-21,635	-21,623	-21,624	-21,631	-21,632	-22,621	-22,751	-22,828	-23,452	-23,345	-23,237	-23,159
1949	-23,111	-23,098	-23,099	-23,122	-23,124	-29,471	-32,577	-34,125	-42,545	-42,352	-42,158	-42,012
1950	-41,919	-41,894	-33,839	-39,568	-40,224	-41,100	-41,839	-42,398	-45,688	-45,482	-45,274	-45,117
1951	-45,020	-47,848	1	0	481	0	-230	-439	-1,896	-1,888	-1,878	-1,872
1952	-1,869	-1,867	-1,867	-5,691	-2,277	-448	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	-5,674	-5,656	-5,632	-5,607	-5,589
1954	-5,577	-5,574	-5,574	-5,575	-5,577	-5,575	-5,569	-17,253	-17,196	-17,122	-17,046	-16,988
1955	-16,953	-16,943	-16,944	-16,949	-16,950	-16,944	-17,557	-18,068	-20,903	-20,809	-20,712	-20,642
1956	-20,600	-20,589	-1,682	0	0	0	0	-3,129	0	0	0	0
1957	0	0	0	0	0	0	0	-9,323	-9,293	-9,253	-9,212	-9,180
1958	-9,161	-9,157	-9,157	-9,159	-4,538	-1,814	0	0	0	0	0	0
1959	0	0	0	0	0	0	-1,209	-4,450	-4,435	-4,415	-4,394	-4,380
1960	-4,371	-4,368	-4,368	-4,369	-924	-259	-1,840	-4,099	-5,756	-5,730	-5,704	-5,684
1961	-5,671	-5,668	-6,567	-6,570	-6,570	-6,568	-6,561	-6,542	-6,519	-6,488	-6,457	-6,433
1962	-6,419	-6,416	-6,416	-6,418	-6,419	-6,416	-6,409	-6,403	-6,379	-6,348	-6,317	-6,293
1963	19,670	19,658	16,735	10,407	19,671	19,664	19,645	12,278	11,318	11,270	11,221	11,184
1964	11,161	11,155	11,155	11,159	11,159	11,156	10,427	10,055	5,477	5,453	5,428	5,409
1965	5,398	5,394	5,396	1	516	0	0	-1,330	-2,613	-2,601	-2,590	-2,580
1966	4	0	0	0	3,075	0	3,763	3,754	3,742	3,725	3,708	3,695
1967	3,688	3,685	3,686	3,687	3,687	1,473	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	-6,788	-6,765	-6,735	-6,703	-6,681
1969	-6,667	-6,664	-6,663	1	0	0	0	0	0	0	0	0
1970	0	0	0	1	1	0	0	-3,618	-3,607	-3,591	-3,575	-3,564
1971	-3,555	-3,553	-3,554	-3,555	-1,422	0	0	-7,768	-7,743	-7,708	-7,675	-7,650
1972	-7,635	-7,630	-7,630	-7,633	-3,053	-3,052	-3,049	-11,189	-15,077	-15,008	-14,937	-14,888
1973	-14,857	-14,849	-14,849	-14,853	-14,855	-14,849	-14,836	-20,501	0	0	0	0
1974	0	0	0	1	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	-5,298	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	34,638	0	-1	0	0
1979	-1,672	-1,670	-1,671	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	-11,054	-11,004	-10,953	-10,916
1982	-10,893	-10,886	-10,887	2	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	1	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	25,230	27,351	27,226	27,101	27,007
1990	26,949	26,933	26,935	26,942	26,944	26,934	26,908	18,354	148	148	147	10,139
1991	15,500	15,491	17,014	24,892	26,434	26,425	26,398	181	14,771	2,082	10,895	14,632
1992	14,599	14,590	14,591	14,595	14,596	14,592	273	272	272	271	269	269
1993	268	268	267	15,860	15,899	14,403	12,639	12,639	29,728	29,600	20,611	-33
1994	-33	-33	-33	-33	-33	-33	-33	-7,929	-7,901	-7,865	-7,829	-7,803
1995	-7,787	-7,782	-7,783	-7,785	-3,114	0	2,761	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	1	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	612	0	0	0	0	0
1999	0	0	0	0	0	0	0	-1,090	-6,688	-6,659	-6,630	-6,609
2000	-6,596	-6,593	-6,592	-6,595	0	0	0	-9,611	-1,081	-1,076	-1,071	-1,068
2001	-1,066	-1,065	-1,065	-1,066	-1,065	-1,065	-1,064	-11,622	-11,584	-11,533	-11,479	-11,439
2002	-11,416	-11,410	-9,018	-7,990	-7,992	-6,969	-7,876	-23,687	-23,607	-23,501	-23,393	-23,314
Avg (21-02)	-6,729	-6,683	-5,541	-5,332	-4,190	-3,885	-4,326	-6,441	-6,955	-7,078	-7,046	-7,073

Table 2.5-4

Difference in Don Pedro Reservoir Storage (Acre-feet)												WSIP All Tuolumne minus Base - Calaveras Constrained
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-197	-197	-197	-197	-79	0	0	-4,085	-15,638	-17,847	-17,770	-17,712
1922	-17,675	-17,665	-17,666	-17,671	-7,069	0	0	-15,283	0	-2,279	-1,586	3
1923	3	2	0	0	0	0	0	-27,761	-29,875	-32,023	-31,884	-31,782
1924	-31,717	-31,700	-31,702	-31,711	-31,712	-31,701	-34,799	-44,200	-44,050	-43,851	-43,643	-43,486
1925	-43,390	-43,364	-43,366	-43,379	-43,383	-43,366	-49,612	-81,038	-82,972	-84,884	-84,499	-84,212
1926	-84,035	-83,987	-84,505	-84,529	-84,782	-84,175	-91,411	-101,390	-124,561	-123,992	-123,420	-123,006
1927	-122,751	-122,683	-116,088	-116,121	-116,130	-116,087	-115,977	-160,826	-124,270	-126,014	-124,818	-114,866
1928	-107,756	-76,407	-41,940	-38,824	-15,429	0	-7,501	-24,450	-26,576	-26,462	-26,343	-26,256
1929	-26,202	-26,186	-26,188	-26,195	-26,197	-26,187	-26,162	-51,996	-70,179	-69,858	-69,537	-69,304
1930	-69,160	-69,122	-69,125	-69,144	-69,149	-69,124	-69,057	-69,441	-71,410	-71,089	-70,763	-70,519
1931	-70,367	-70,325	-70,329	-70,350	-70,355	-70,328	-70,257	-70,063	-69,810	-69,479	-69,141	-68,898
1932	-68,752	-68,712	-104,639	-122,515	-137,358	-160,048	-166,315	-175,406	-186,316	-187,754	-186,888	-186,254
1933	-185,869	-185,764	-185,772	-185,826	-185,840	-185,772	-193,301	-200,420	-229,629	-230,864	-228,777	-228,969
1934	-228,470	-228,335	-210,967	-217,355	-214,072	-218,324	-227,180	-245,904	-246,830	-245,665	-244,486	-243,619
1935	-243,085	-242,940	-242,952	-258,968	-273,243	-254,133	-259,479	-267,016	-293,113	-294,117	-292,811	-291,832
1936	-291,227	-291,062	-291,075	-291,086	-117,136	0	0	-6,763	-8,948	-11,188	-11,138	-11,104
1937	-11,081	-11,075	-11,088	-11,048	-4,016	0	0	-10,131	-20,848	-23,037	-22,936	-22,863
1938	-22,816	-22,803	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	-42,331	-40,703	-42,771	-42,575	-42,239
1940	-42,151	-42,127	-33,064	-32,617	-9,851	0	0	538	-4,427	-4,407	-4,388	-4,374
1941	-4,365	-4,363	-6,749	1	348	0	0	-6,373	0	-2,278	-1,587	3
1942	3	3	0	1	1	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	-5,131	0	-2,278	-2,268	4
1944	4	4	4	3	2	0	0	-43,406	-45,471	-47,555	-47,342	-47,182
1945	-47,084	-47,057	-47,059	-47,072	-18,768	0	0	-1,199	4,143	1,847	1,839	1,833
1946	1,830	0	0	0	172	0	0	-14,599	-20,010	-19,924	-19,835	-19,767
1947	-19,726	-19,714	-19,715	-19,721	-19,722	-19,715	-19,696	-68,644	-70,610	-70,288	-69,966	-69,728
1948	-69,580	-69,541	-69,543	-69,564	-69,569	-75,913	-80,856	-85,387	-100,035	-101,857	-101,383	-101,039
1949	-100,831	-100,775	-100,779	-100,859	-100,866	-104,320	-111,637	-116,620	-133,971	-133,356	-132,747	-132,294
1950	-132,008	-131,930	-128,484	-130,813	-146,821	-156,802	-158,353	-159,907	-159,893	-160,545	-159,812	-159,269
1951	-158,933	-172,122	4	0	481	0	-3,246	-4,467	-15,209	-17,419	-17,338	-17,279
1952	-17,244	-17,234	-17,235	-26,163	-10,466	-448	0	0	0	0	0	0
1953	0	0	0	0	0	0	-19,831	-28,040	-30,156	-32,304	-32,164	-32,059
1954	-31,993	-31,975	-31,976	-31,985	-31,988	-31,976	-31,946	-76,793	-78,745	-78,407	-78,056	-77,796
1955	-77,633	-77,589	-77,592	-77,615	-77,621	-77,593	-80,508	-84,874	-98,531	-98,088	-97,634	-97,302
1956	-97,102	-97,048	-1,680	0	0	0	0	-11,457	0	0	0	0
1957	0	0	0	0	0	0	0	-43,292	-45,357	-47,441	-47,229	-47,071
1958	-46,973	-46,947	-46,948	-46,962	-19,661	-7,860	0	0	0	0	0	0
1959	0	0	0	0	0	0	-7,092	-27,065	-26,974	-26,851	-26,725	-26,637
1960	-26,582	-26,566	-26,568	-26,575	-26,577	-27,313	-30,394	-31,769	-31,660	-31,516	-31,371	-31,262
1961	-31,192	-31,173	-41,462	-41,475	-41,478	-41,463	-41,420	-42,566	-42,413	-42,212	-42,009	-41,858
1962	-41,765	-41,744	-41,744	-41,756	-41,760	-41,742	-41,702	-117,385	-120,749	-122,482	-121,916	-121,486
1963	-121,219	-121,148	-108,284	-102,207	-121,210	-121,166	-121,049	-157,621	-159,860	-161,445	-160,742	-160,223
1964	-148,722	-99,164	-83,498	-65,386	-48,901	-48,883	-51,857	-64,513	-100,778	-100,323	-99,856	-99,521
1965	-99,316	-99,262	-89,108	14	1,553	0	0	-23	10,963	8,638	6,321	-10
1966	-10	0	0	0	3,433	0	-23,315	-21,737	-23,872	-23,765	-23,656	-23,575
1967	-23,526	-23,514	-23,514	-23,521	-23,523	-8,502	0	0	0	0	0	3
1968	4	4	4	4	2	0	0	-38,919	-40,995	-40,810	-40,620	-40,484
1969	-40,401	-40,379	-40,380	6	0	0	0	0	0	0	0	0
1970	0	0	-2	1,190	0	0	0	-14,251	-16,411	-18,618	-18,536	-18,474
1971	-18,435	-18,424	-18,426	-18,431	-7,374	0	0	-32,961	-35,059	-37,183	-37,023	-36,901
1972	-36,826	-36,805	-36,806	-36,817	-14,728	-14,724	-14,709	-54,520	-60,465	-60,190	-59,909	-59,709
1973	-59,586	-59,552	-59,554	-59,571	-59,577	-28,032	-24,237	-46,535	0	0	0	0
1974	0	0	0	2	1	0	0	556	0	-2,278	-2,268	4
1975	4	4	3	3	1	0	0	-4,382	0	-2,279	-1,587	2
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-53,265	0	-2,279	-2,268	-2,571
1979	-8,412	-8,407	-8,408	1	1	0	0	0	-2,206	-2,196	-2,187	-2,180
1980	-2,175	-2,174	-2,174	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-2,209	-14,878	-39,317	-39,142	-38,962	-38,829
1982	-38,746	-38,724	-38,726	6	0	0	0	0	0	0	-2,278	0
1983	0	0	0	0	0	0	0	0	0	0	-2,278	4
1984	0	0	0	1	0	0	-197	-14,206	-16,366	-18,575	-18,492	-18,430
1985	-18,391	-18,381	-18,382	-18,387	-18,388	-18,381	-18,364	-25,500	-27,621	-27,496	-27,369	-27,276
1986	-27,220	-27,205	-32,764	-30,855	-10,886	0	0	0	0	-2,278	-2,268	-2,261
1987	-2,256	-2,255	-2,255	-2,256	-2,256	-2,255	-2,253	-15,846	-27,318	-27,192	-27,069	-26,978
1988	-26,921	-26,906	-26,907	-26,915	-13,257	-13,252	-18,816	-21,115	-54,986	-59,724	-59,441	-59,232
1989	-59,101	-59,065	-59,069	-59,087	-59,091	-59,069	-81,869	-90,940	-90,626	-90,219	-89,805	-89,499
1990	-89,313	-89,262	-89,266	-89,292	-89,299	-89,266	-89,179	-108,321	-106,241	-105,751	-105,240	-108,763
1991	-108,526	-108,463	-108,468	-108,500	-108,510	-108,467	-108,356	-131,157	-145,833	-147,086	-146,396	-145,882
1992	-145,565	-145,481	-145,487	-145,531	-145,542	-145,487	-128,681	-155,314	-154,780	-154,068	-153,327	-152,783
1993	-152,452	-152,357	-166,345	-166,395	-166,407	-179,215	-190,143	-190,621	-24,500	-26,674	-18,573	30
1994	30	30	30	30	30	30	30	-37,978	-40,054	-39,872	-39,685	-39,552
1995	-39,470	-39,448	-39,450	-39,461	-15,786	0	-6,442	0	0	0	-2,278	3
1996	4	3	4	4	0	0	0	0	0	-2,278	-2,269	-2,262
1997	-2,257	0	0	3	0	0	-13,714	-15,961	-18,115	-20,316	-20,228	-20,163
1998	-20,123	-20,113	-20,113	3	0	0	2,084	0	0	0	0	0
1999	0	0	0	0	0	0	0	-21,676	-16,054	-18,263	-18,183	-18,125
2000	-18,089	-18,080	-18,080	-18,085	0	0	0	-22,176	-1,081	-1,076	-1,071	-1,068
2001	-1,066	-1,065	-1,065	-1,065	-1,065	-1,065	-1,064	-56,517	-58,235	-57,976	-57,708	-57,510
2002	-57,390	-57,358	-54,968	-53,954	-53,959	-52,920	-53,782	-107,081	-108,929	-108,443	-107,944	-107,574
Avg (21-02)	-47,968	-47,112	-43,044	-40,777	-36,142	-33,354	-35,710	-49,790	-49,593	-50,360	-50,137	-49,528

Figure 2.5-2

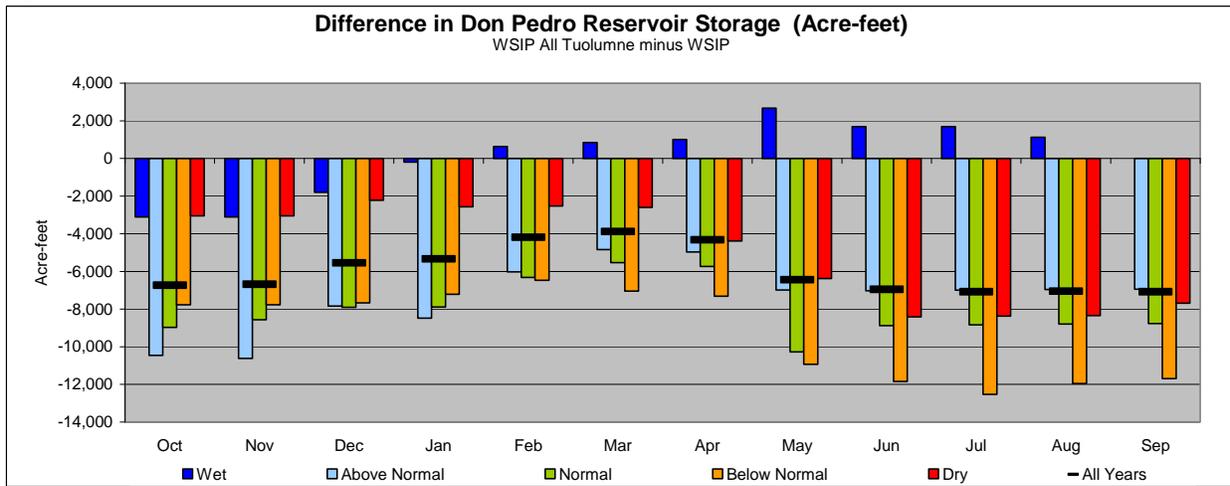


Figure 2.5-3

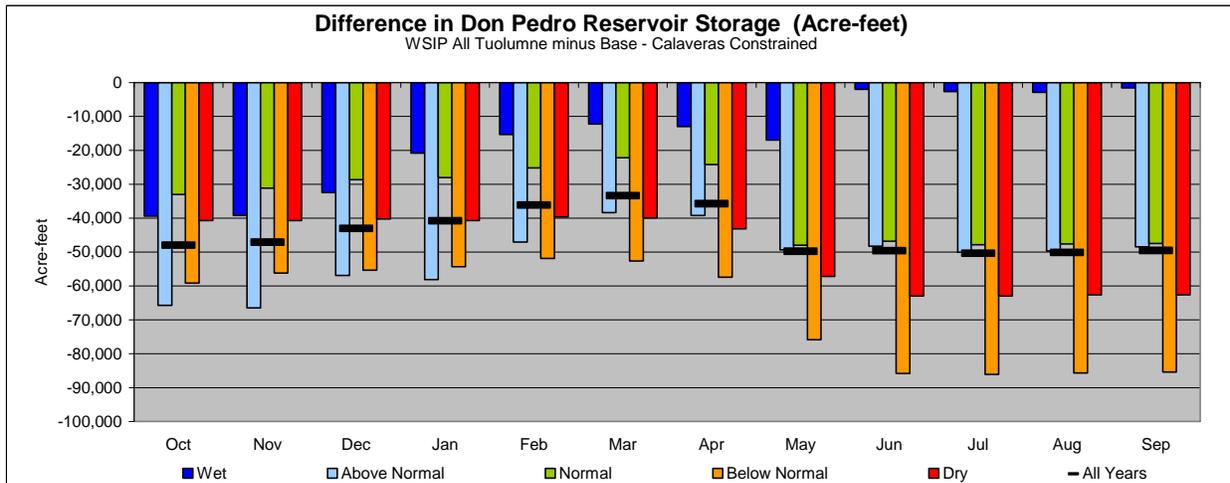


Figure 2.5-4

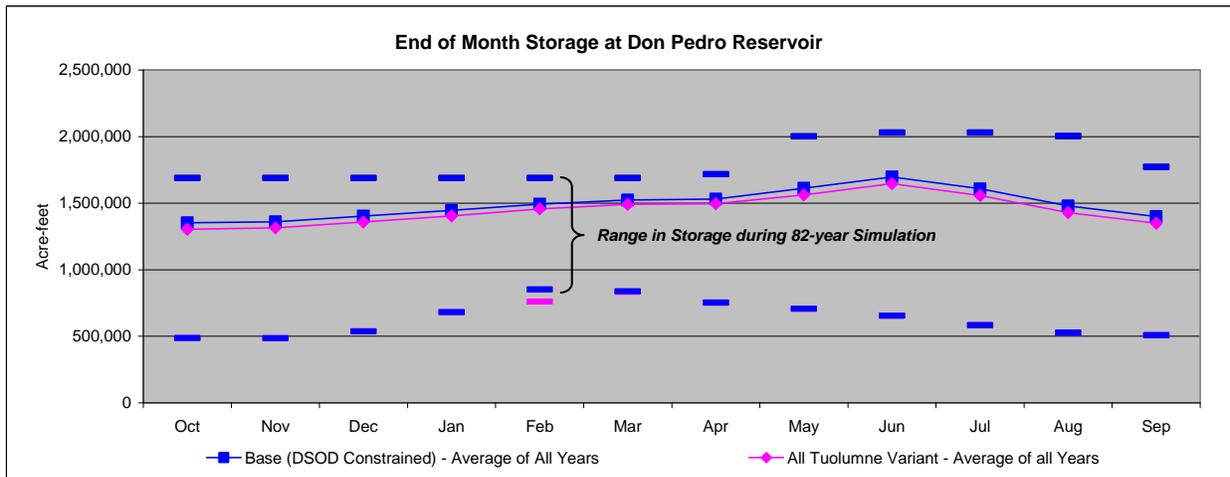


Table 2.5-5 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant typically exhibits an incrementally larger reduction in stream releases, predominantly during early winter through June, which reflects the months when releases to the stream above minimum release requirements are made, due to flood control or in anticipation of filling the reservoir. Increase in releases to the stream sometimes occur, during periods when the variant causes incrementally greater delivery shortages, which thereby provides greater inflow to the reservoir (and subsequent additional release) as compared to the WSIP setting. Table 2.5-6 illustrates the same information in comparing the variant and WSIP settings, with years ranked by descending order of the San Joaquin River Index. The table shows the finding that differences in releases to the Tuolumne River from La Grange Dam would occur only with releases above minimum Federal Energy Regulatory Commission (FERC) flow requirements. This circumstance typically occurs only in above normal and wet years, and predominantly during early winter through June. During other year types and during the summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting.

Table 2.5-5 illustrates the difference in stream release between the variant and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.5-7 illustrates the same information and the average monthly stream release for the variant and WSIP settings, expressed in average monthly flow (cfs). Table 2.5-5 illustrates that the difference in monthly flow below La Grange Dam could range from an increase of approximately 21,000 acre-feet to a decrease of approximately 54,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful. Similar to the operation of releases below O'Shaughnessy Dam, a change in the volume of release from La Grange Dam to the stream would likely result in the delay or earlier initiation of the release by a matter of days. Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the variant and WSIP would be a delay in releases up to 9 days or up to an added 3 days of release. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, the variant's effect on stream releases could manifest as an elimination of all flows above minimum FERC flow requirements within a year. This would occur after the experience of an extended drought period. Comparing the variant and WSIP settings, a change (increase or decrease) in stream release would occur in approximately 50 percent of the years simulated.

Table 2.5-8 illustrates the releases to the Tuolumne River below La Grange Dam and their differences for the variant and base settings, provided in terms of average monthly flow (cfs) averaged within year types. Table 2.5-9 illustrates the results for the comparison of the variant and the base settings, in the same format as Table 2.5-5, showing the simulated month-to-month flow (volume) changes between the two settings. Compared to the base setting, the variant's effect to stream flow is very similar to the effect caused by the WSIP, but at times slightly greater. Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the variant and base would typically be a delay in releases up to a few days. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, following a prolonged multi-year drought period, the variant's effect on stream releases could manifest as an elimination of all flows above minimum FERC flow requirements within a year.

Table 2.5-5

Difference in Total La Grange Release to River (Acre-feet)

WSIP All Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	-1,554	-558	0	0	0	0	0	-2,112
1922	0	0	0	0	-1,816	-1,210	0	0	-5,633	0	0	0	-8,659
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	-205	-3,128	-23,397	-15,426	0	0	0	0	0	0	-42,156
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-22,552	-14,196	2,024	0	0	0	0	0	-34,724
1937	0	0	0	0	5,964	808	-1,140	0	0	0	0	0	5,632
1938	0	0	-3,133	0	0	-868	-1,025	-6,099	0	0	0	0	-11,125
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-12,784	-8,211	-3,802	0	0	0	0	0	-24,797
1941	0	0	0	-7,835	-1,567	-1,017	-5,219	0	-8,611	0	0	0	-24,249
1942	0	0	0	-4,668	1	-1,903	-1,841	-1,046	-1,013	0	0	0	-10,470
1943	0	0	0	0	0	-5,556	0	0	0	0	0	0	-5,556
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-6,545	-4,047	-889	0	0	0	0	0	-11,481
1946	0	-6,302	-149	0	-1,031	-1,392	-1,289	0	0	0	0	0	-10,163
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-53,559	-2,663	-2,887	481	0	0	0	0	0	0	-58,628
1952	0	0	0	0	-3,415	-1,828	-448	-5,668	0	0	0	0	-11,359
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-18,093	-1,682	0	-2,727	-894	0	-4,798	0	0	0	-28,194
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-4,622	-2,723	-1,813	-8,851	-829	0	0	0	-18,838
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	-1,264	-3,094	516	-2,209	0	0	0	0	-2,590	-8,641
1966	0	4	-2,823	0	-18,453	9,527	0	0	0	0	0	0	-11,745
1967	0	0	0	0	0	2,212	1,474	-15,163	-1,842	0	0	0	-13,319
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-6,666	1	-6,665	0	0	0	0	0	0	-13,330
1970	0	0	0	-7,138	1	0	0	0	0	0	0	0	-7,137
1971	0	0	0	0	-2,133	-1,422	0	0	0	0	0	0	-3,555
1972	0	0	0	0	-4,579	0	0	0	0	0	0	0	-4,579
1973	0	0	0	0	0	0	0	0	-20,468	0	0	0	-20,468
1974	0	0	0	-5,650	0	-3,805	0	0	0	0	0	0	-9,455
1975	0	0	0	0	0	0	-1,841	0	-9,222	0	0	0	-11,063
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	34,331	0	0	0	34,331
1979	0	0	0	-1,671	0	-909	-7,258	0	0	0	0	0	-9,838
1980	0	0	0	-5,234	1	-1,903	0	0	0	0	0	0	-7,136
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-10,890	-9,144	-1,202	0	0	0	0	0	0	-21,236
1983	-2,759	-1,842	-952	-1	0	0	0	-8,345	-1,842	0	0	0	-15,741
1984	-1,332	-1,841	0	0	0	0	0	0	0	0	0	0	-3,173
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	-15,425	-921	0	0	0	0	0	-16,346
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	8,881	20,611	0	29,492
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-4,671	3,652	0	4,660	1,842	0	0	0	5,483
1996	0	0	0	0	-4,764	-2,663	0	0	0	0	0	0	-7,427
1997	0	0	0	-5,935	1	0	0	0	0	0	0	0	-5,934
1998	0	0	0	0	0	-5,637	-3,672	-245	-829	0	0	0	-10,383
1999	0	0	0	0	0	0	-2,751	0	0	0	0	0	-2,751
2000	0	0	0	0	-6,595	1	0	0	-8,513	0	0	0	-15,107
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-50	-122	-962	-786	-1,562	-1,038	-416	-497	-334	0	108	220	-5,438

Table 2.5-6

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

WSIP All Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	-2,759	-1,842	-952	-1	0	0	0	-8,345	-1,842	0	0	0	-15,741
1969	0	0	0	-6,666	1	-6,665	0	0	0	0	0	0	-13,330
1995	0	0	0	0	-4,671	3,652	0	4,660	1,842	0	0	0	5,483
1938	0	0	-3,133	0	0	-868	-1,025	-6,099	0	0	0	0	-11,125
1998	0	0	0	0	0	-5,637	-3,672	-245	-829	0	0	0	-10,383
1982	0	0	0	-10,890	-9,144	-1,202	0	0	0	0	0	0	-21,236
1967	0	0	0	0	0	2,212	1,474	-15,163	-1,842	0	0	0	-13,319
1952	0	0	0	0	-3,415	-1,828	-448	-5,668	0	0	0	0	-11,359
1958	0	0	0	0	-4,622	-2,723	-1,813	-8,851	-829	0	0	0	-18,838
1980	0	0	0	-5,234	1	-1,903	0	0	0	0	0	0	-7,136
1978	0	0	0	0	0	0	0	0	34,331	0	0	0	34,331
1922	0	0	0	0	-1,816	-1,210	0	0	-5,633	0	0	0	-8,659
1956	0	0	-18,093	-1,682	0	-2,727	-894	0	-4,798	0	0	0	-28,194
1942	0	0	0	-4,668	1	-1,903	-1,841	-1,046	-1,013	0	0	0	-10,470
1941	0	0	0	-7,835	-1,567	-1,017	-5,219	0	-8,611	0	0	0	-24,249
1986	0	0	0	0	0	-15,425	-921	0	0	0	0	0	-16,346
1993	0	0	0	0	0	0	0	0	0	0	8,881	20,611	29,492
1997	0	0	0	-5,935	1	0	0	0	0	0	0	0	-5,934
1996	0	0	0	0	-4,764	-2,663	0	0	0	0	0	0	-7,427
1943	0	0	0	0	0	-5,556	0	0	0	0	0	0	-5,556
1937	0	0	0	0	5,964	808	-1,140	0	0	0	0	0	5,632
1974	0	0	0	-5,650	0	-3,805	0	0	0	0	0	0	-9,455
1975	0	0	0	0	0	0	-1,841	0	-9,222	0	0	0	-11,063
1965	0	0	0	-1,264	-3,094	516	-2,209	0	0	0	0	-2,590	-8,641
1936	0	0	0	0	-22,552	-14,196	2,024	0	0	0	0	0	-34,724
1984	-1,332	-1,841	0	0	0	0	0	0	0	0	0	0	-3,173
1979	0	0	0	-1,671	0	-909	-7,258	0	0	0	0	0	-9,838
1945	0	0	0	0	-6,545	-4,047	-889	0	0	0	0	0	-11,481
1999	0	0	0	0	0	0	-2,751	0	0	0	0	0	-2,751
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	-6,302	-149	0	-1,031	-1,392	-1,289	0	0	0	0	0	-10,163
1973	0	0	0	0	0	0	0	0	-20,468	0	0	0	-20,468
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	-6,595	1	0	0	-8,513	0	0	0	-15,107
1940	0	0	0	0	-12,784	-8,211	-3,802	0	0	0	0	0	-24,797
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	0	0	0	0	0	-1,554	-558	0	0	0	0	0	-2,112
1970	0	0	0	-7,138	1	0	0	0	0	0	0	0	-7,137
1951	0	0	-53,559	-2,663	-2,887	481	0	0	0	0	0	0	-58,628
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	-2,133	-1,422	0	0	0	0	0	0	-3,555
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	-205	-3,128	-23,397	-15,426	0	0	0	0	0	0	-42,156
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	4	-2,823	0	-18,453	9,527	0	0	0	0	0	0	-11,745
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-4,579	0	0	0	0	0	0	0	-4,579
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.5-7

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	442	372	871	2,355	3,480	4,202	3,565	3,817	3,764	1,773	569	1,567
Above Normal	313	536	898	1,193	2,398	2,288	2,137	1,308	1,337	263	305	448
Normal	300	259	569	835	1,562	1,413	1,290	1,303	202	163	163	163
Below Normal	278	253	321	258	366	295	565	565	68	68	68	68
Dry	302	232	252	229	349	358	355	355	56	56	56	56
All Years	327	332	583	968	1,625	1,701	1,577	1,457	1,076	457	231	455

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	445	374	894	2,387	3,508	4,235	3,575	3,857	3,737	1,773	560	1,548
Above Normal	315	538	949	1,213	2,454	2,328	2,151	1,309	1,362	263	305	448
Normal	300	265	569	847	1,593	1,433	1,301	1,303	233	163	163	163
Below Normal	278	253	324	258	391	285	565	565	68	68	68	68
Dry	302	232	252	229	349	358	355	355	56	56	56	56
All Years	327	334	599	981	1,653	1,718	1,584	1,465	1,082	457	229	452

Difference in Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP All Tuolumne minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	-3	-2	-23	-32	-28	-33	-10	-40	27	0	9	19
Above Normal	-1	-2	-51	-20	-56	-40	-14	-1	-24	0	0	0
Normal	0	-7	0	-12	-31	-20	-11	0	-30	0	0	0
Below Normal	0	0	-3	0	-24	9	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-1	-2	-16	-13	-28	-17	-7	-8	-6	0	2	4

Table 2.5-8

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)											WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	427	369	775	1,989	3,410	3,957	3,337	3,053	3,370	1,282	509	1,276
Above Normal	291	507	1,060	1,261	2,116	1,679	1,525	1,346	277	240	240	240
Below Normal	284	270	366	314	570	620	943	943	75	75	75	75
Dry	337	260	272	262	429	421	497	497	73	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50	50
All Years	327	332	583	968	1,625	1,701	1,577	1,457	1,076	457	231	455

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	431	374	857	2,161	3,524	4,096	3,424	3,161	3,634	1,300	516	1,299
Above Normal	298	507	1,230	1,257	2,402	1,969	1,568	1,348	408	240	240	249
Below Normal	294	314	422	318	653	654	958	943	75	75	75	75
Dry	351	324	292	285	482	421	497	497	73	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50	50
All Years	333	350	654	1,022	1,738	1,806	1,613	1,489	1,180	463	233	464

Difference in Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)											WSIP All Tuolumne minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	-4	-4	-82	-172	-114	-139	-87	-108	-263	-19	-7	-23
Above Normal	-7	0	-170	3	-287	-289	-42	-2	-131	0	-1	-9
Below Normal	-9	-44	-56	-4	-83	-33	-15	0	0	0	0	0
Dry	-14	-64	-20	-23	-53	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-6	-18	-71	-54	-113	-106	-37	-32	-104	-5	-2	-9

Table 2.5-9

Difference in Total La Grange Release to River (Acre-feet)

WSIP All Tuolumne minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	-118	-17,278	-4,276	0	0	0	0	0	-21,672
1922	0	0	0	0	-10,603	-7,068	-7,365	-5,684	-20,229	0	-684	-1,587	-53,220
1923	0	0	3	0	0	0	-2,209	0	0	0	0	0	-2,206
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-43,828	0	-644	-9,569	-54,041
1928	-6,886	-31,299	-34,469	-3,128	-23,397	-20,765	-10,773	0	0	0	0	0	-130,717
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-173,966	-133,186	-3,033	0	0	0	0	0	-310,185
1937	0	0	0	0	-9,051	-12,272	-4,706	0	0	0	0	0	-26,029
1938	0	0	-21,971	0	0	-868	-10,169	-24,242	-4,972	-2,284	0	0	-64,506
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-38,757	-27,704	-8,190	0	0	0	0	0	-74,651
1941	0	0	0	-7,702	-2,085	-1,338	-5,720	0	-15,819	0	-683	-1,586	-34,933
1942	0	0	2	-8,429	1	-5,708	-7,365	-3,901	-3,775	-2,283	0	0	-31,458
1943	0	0	0	0	0	-15,361	-4,971	0	-10,094	0	0	-2,268	-32,694
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1945	0	0	0	0	-28,623	-34,082	-1,048	0	0	0	0	0	-63,753
1946	0	1,829	-149	0	-1,031	-14,614	-5,110	0	0	0	0	0	-19,075
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-177,837	-2,661	-2,887	481	0	0	0	0	0	0	-182,904
1952	0	0	0	0	-15,698	-10,016	-448	-26,956	-4,972	-2,284	0	0	-60,374
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-101,071	-1,680	0	-7,081	-3,701	0	-18,085	-2,283	0	0	-133,901
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-27,303	-11,797	-7,856	-24,339	-3,683	-2,283	0	0	-77,261
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-49,491	-15,670	-18,132	-16,489	0	0	0	0	0	0	0	-110,971
1965	0	0	0	-101,503	-9,272	-12,964	-3,947	0	0	0	0	6,320	-121,366
1966	0	-10	-7,180	0	-20,602	3,433	0	0	0	0	0	0	-24,359
1967	0	0	0	0	0	-19,525	-8,497	-23,329	-1,842	-2,283	0	-2,279	-57,755
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1969	0	0	0	-40,392	-7,206	-13,180	-7,733	-5,138	-4,972	-2,283	0	0	-80,904
1970	0	0	0	14,512	-7,145	-16,079	0	0	0	0	0	0	-8,712
1971	0	0	0	0	-11,059	-7,372	0	0	0	0	0	0	-18,431
1972	0	0	0	0	-22,090	0	0	0	0	0	0	0	-22,090
1973	0	0	0	0	0	-31,528	-3,772	0	-48,669	0	0	0	-83,969
1974	0	0	0	-17,087	1	-12,367	-5,524	-5,694	-4,416	0	0	-2,268	-47,355
1975	0	0	0	0	2	1	-10,127	0	-9,347	0	-684	-1,586	-21,741
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-59,869	0	0	0	-59,869
1979	0	0	0	-8,410	0	-20,890	-9,468	-2,284	0	0	0	0	-41,052
1980	0	0	0	-535	0	-10,465	-4,972	-5,138	-4,972	-2,284	0	0	-28,366
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-38,736	-22,823	-2,152	0	-2,854	-2,762	-2,283	0	-4,484	-76,094
1983	-5,708	-3,683	1,712	-1	0	0	0	-14,144	-4,604	-2,283	0	-2,278	-30,989
1984	-7,342	-1,841	0	0	0	3,935	0	0	0	0	0	0	-5,248
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-16,326	-43,881	-12,221	-5,137	-4,971	0	0	0	-82,536
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-187,962	0	-8,002	-18,574	-214,538
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-23,677	-4,450	0	-8,337	-1,841	-2,283	0	-2,278	-42,866
1996	0	0	0	0	-8,384	-2,663	-6,813	-2,283	-2,210	0	0	0	-22,353
1997	0	-2,256	0	-18,013	3	0	0	0	0	0	0	0	-20,266
1998	0	0	0	-20,119	3	-12,498	-12,511	-2,675	-4,603	-2,283	0	0	-54,686
1999	0	0	0	0	0	-11,417	-5,825	0	-16,264	0	0	0	-33,506
2000	0	0	0	0	-18,086	1	0	0	-23,268	0	0	0	-41,353
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-380	-1,058	-4,349	-3,317	-6,301	-6,497	-2,175	-1,977	-6,195	-334	-130	-518	-33,231

2.6 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

There is only a slight difference in Calaveras Reservoir operations between the variant and WSIP settings. Figure 2.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 2.6-1 are the results for the WSIP, variant, and base settings. The difference in Calaveras Reservoir storage between the variant and WSIP settings is mostly caused by the interaction of the increased demand served by the system's resources (300 mgd for the variant and a net 290 demand for the WSIP) and the operation of the SJPL. Generally, the systematic minor decrease in reservoir storage in most years is due to the additional demand drawing slightly more water from Calaveras Reservoir during the summer when the SJPL is operating at maximum capacity. In a few instances, storage is greater in the variant setting. This occurs when greater water delivery reductions are required in the variant setting, thus reducing the draw from Calaveras Reservoir as compared to the WSIP setting. The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Figure 2.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

There is essentially no change (i.e., change occurs infrequently) in releases to Calaveras Creek below Calaveras Dam between the variant and WSIP settings. Both settings have fishery releases that are not included in the base setting. Table 2.6-1 illustrates the difference in releases to Calaveras Creek between the variant and WSIP settings. Supplementing the Figure 2.6-1 representation of Calaveras Dam stream releases and Table 2.6-1 is Table 2.6-2, illustrating releases for the variant and WSIP settings, and the difference in releases between the two. Table 2.6-3 provides the same form of information for the variant and base settings. The notable difference in releases between the variant and base settings is the addition of the flows associated with the 1997 Memorandum of Understanding (MOU) and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There is essentially no change (i.e., minor difference occur during 2 months of the 82-year simulation) in Alameda Creek diversions to Calaveras Reservoir between the variant and the WSIP settings. With almost no change in Calaveras Reservoir storage between the two settings, there would be no change in the diversion operation at the Alameda Creek Diversion Dam. Water would only be diverted to Calaveras Reservoir when the diversion would not contribute to releases below Calaveras Dam that are above minimum required flows. Coincidentally, with no change in the diversion at Alameda Creek Diversion Dam, flow spilling past the diversion dam would be the same in both the variant and WSIP settings. Table 2.6-4 illustrates the flow below the Alameda Creek Diversion Dam for the variant and base settings. The notable difference between the variant and the base settings is the reduction of wetter-year water flowing past the diversion dam. This occurs because, in the variant setting, the restoration of Calaveras Reservoir storage allows a greater frequency of diversion from Alameda Creek to Calaveras Reservoir.

Comparing the variant and WSIP settings, with no differences in releases from Calaveras Dam to the stream, and no differences to spills at Alameda Creek Diversion Dam, flow below the Alameda Creek and Calaveras Creek confluence will be the same for each setting. Table 2.6-5 illustrates the flow below the confluence for the variant and WSIP settings, and the similarity in flow between the two. Table 2.6-6 provides the same form of information for the variant and base settings. The notable differences between the variant and the base settings (comparable to the difference between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year/wet-season flows due to the restoration of Calaveras Reservoir storage.

Figure 2.6-1
Calaveras Reservoir Storage and Stream Release

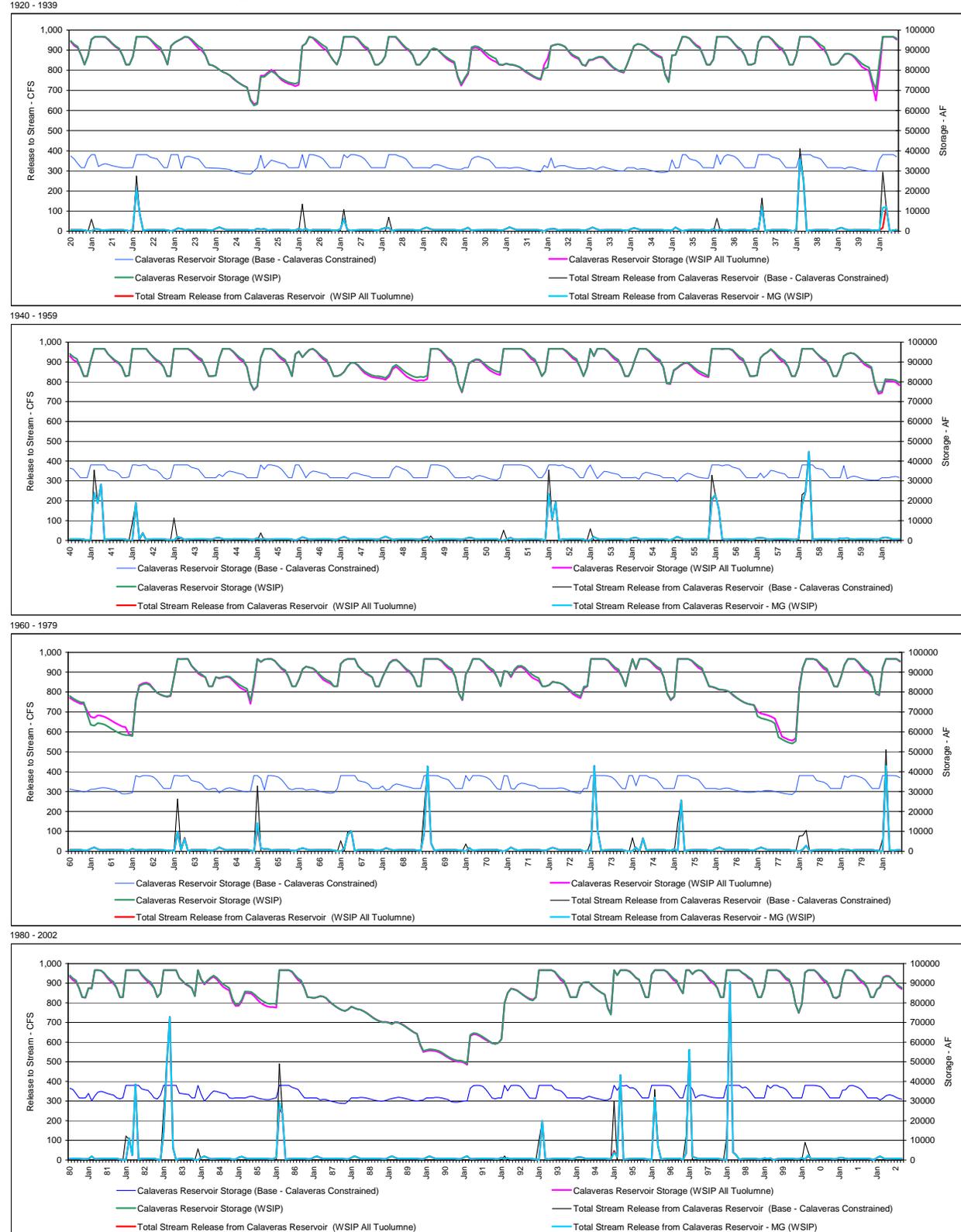


Figure 2.6-2

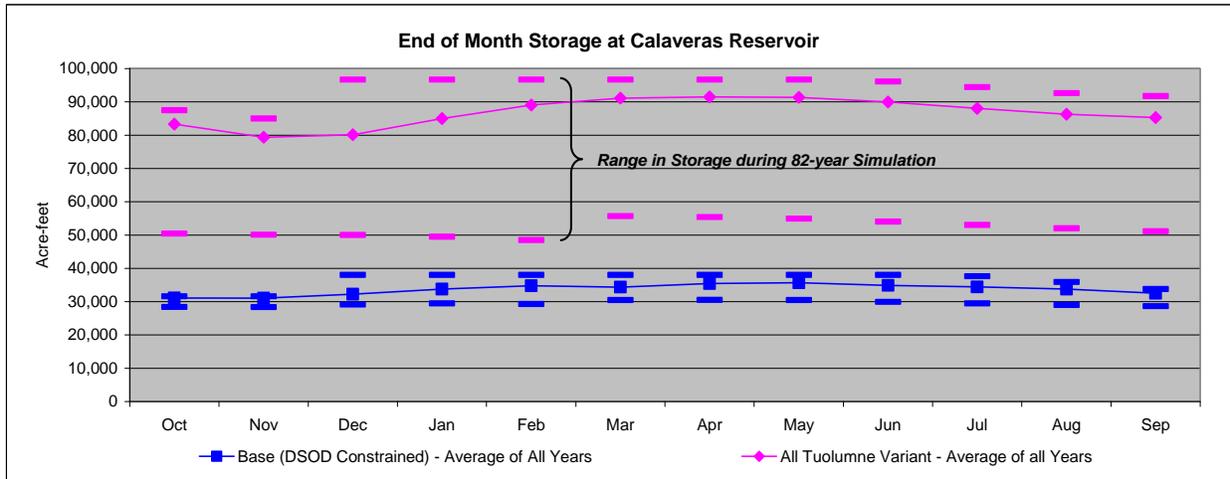


Table 2.6-1

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)										WSIP All Tuolumne minus WSIP			
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	24	0	0	0	0	0	0	0	24
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-5,532	0	0	0	0	0	0	0	-5,532
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-486	0	0	0	0	0	0	0	0	0	-486
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	-59	0	216	0	0	0	0	0	157
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	-1,458	0	0	0	0	0	0	0	0	-1,458
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	-259	0	0	0	0	0	0	0	-259
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-1,832	0	0	0	0	0	0	0	-1,832
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	525	0	0	0	0	0	0	0	0	525
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	-259	0	0	0	0	0	0	-259
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-6	-11	-93	-3	3	0	0	0	0	0	-111

Table 2.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,035	5,118	15,008	10,007	5,085	255	387	417	425	415	38,828	
Above Normal	425	258	172	725	3,337	2,834	650	327	396	423	428	417	10,391	
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	382	1,547	4,147	2,918	1,323	350	403	426	428	417	13,038	

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,065	5,085	15,137	10,007	5,085	255	387	417	425	415	38,955	
Above Normal	425	258	172	811	3,666	2,849	637	327	396	423	428	417	10,808	
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	387	1,558	4,240	2,921	1,321	350	403	426	428	417	13,149	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-30	33	-129	0	0	0	0	0	0	0	-127	
Above Normal	0	0	0	-86	-329	-15	13	0	0	0	0	0	-417	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-6	-11	-93	-3	3	0	0	0	0	0	-111	

Table 2.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,035	5,118	15,008	10,007	5,085	255	387	417	425	415	38,828	
Above Normal	425	258	172	725	3,337	2,834	650	327	396	423	428	417	10,391	
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	382	1,547	4,147	2,918	1,323	350	403	426	428	417	13,038	

Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590	
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382	
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	-701	-4,103	-1,633	39	61	255	387	417	425	415	-3,762	
Above Normal	425	258	-12	-2,006	-2,574	-262	190	327	396	423	428	417	-1,992	
Normal	429	275	-22	184	-157	204	264	370	408	428	430	417	3,231	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	-38	-889	-498	262	248	350	403	426	428	417	1,806	

Table 2.6-4

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389	
Above Normal	7	23	628	2,532	4,002	3,075	969	0	0	0	0	0	11,237	
Normal	0	6	377	264	900	459	117	6	0	0	0	0	2,129	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	480	1,790	2,616	1,889	803	24	0	0	0	0	7,615	

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331	
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968	
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	-794	-117	-6	-10	-15	0	0	0	0	-942	
Above Normal	0	0	-556	-1,140	-1,290	-21	277	0	0	0	0	0	-2,731	
Normal	0	0	-537	-604	-885	-447	-10	0	0	0	0	0	-2,482	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-220	-509	-463	-93	54	-3	0	0	0	0	-1,234	

Table 2.6-5

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP All Tuolumne		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	430	326	2,758	12,299	24,178	16,744	8,649	548	417	429	430	417	67,624		
Above Normal	437	327	1,044	3,855	8,115	6,470	1,929	430	417	430	430	417	24,301		
Normal	428	301	781	966	2,011	1,294	481	435	409	430	430	417	8,383		
Below Normal	428	295	319	853	1,216	809	419	417	413	427	428	416	6,442		
Dry	429	298	324	809	1,274	712	423	428	417	430	430	417	6,391		
All Years	430	309	1,036	3,723	7,293	5,167	2,351	451	415	429	429	417	22,451		

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,789	12,266	24,307	16,744	8,649	548	417	429	430	417	67,751	
Above Normal	437	327	1,116	3,941	8,459	6,506	1,917	430	417	430	430	417	24,826	
Normal	428	301	781	966	2,004	1,294	481	435	409	430	430	417	8,375	
Below Normal	428	295	319	853	1,216	809	419	417	413	427	428	416	6,442	
Dry	429	298	324	809	1,274	712	423	428	417	430	430	417	6,391	
All Years	430	309	1,057	3,734	7,388	5,175	2,348	451	415	429	429	417	22,583	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP All Tuolumne minus WSIP		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	-30	33	-129	0	0	0	0	0	0	0	-127		
Above Normal	0	0	-72	-86	-344	-36	13	0	0	0	0	0	-525		
Normal	0	0	0	0	7	0	0	0	0	0	0	0	7		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	-21	-11	-95	-7	3	0	0	0	0	0	-132		

Table 2.6-6

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP All Tuolumne		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	430	326	2,758	12,299	24,178	16,744	8,649	548	417	429	430	417	67,624		
Above Normal	437	327	1,044	3,855	8,115	6,470	1,929	430	417	430	430	417	24,301		
Normal	428	301	781	966	2,011	1,294	481	435	409	430	430	417	8,383		
Below Normal	428	295	319	853	1,216	809	419	417	413	427	428	416	6,442		
Dry	429	298	324	809	1,274	712	423	428	417	430	430	417	6,391		
All Years	430	309	1,036	3,723	7,293	5,167	2,351	451	415	429	429	417	22,451		

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Base - Calaveras Constrained		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	1	80	3,460	17,197	25,927	16,711	8,598	307	30	12	4	2	72,328		
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023		
Normal	-1	26	1,340	1,386	3,053	1,537	226	65	1	2	0	0	7,634		
Below Normal	-1	19	73	182	341	213	74	28	3	-2	-2	-1	927		
Dry	0	6	43	31	230	-35	49	21	1	0	0	0	346		
All Years	2	40	1,294	5,121	8,254	4,998	2,050	104	11	4	1	0	21,879		

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP All Tuolumne minus Base - Calaveras Constrained		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	429	246	-701	-4,898	-1,750	33	51	241	387	417	425	415	-4,704		
Above Normal	425	258	-568	-3,146	-3,865	-284	467	327	396	423	428	417	-4,722		
Normal	429	275	-559	-420	-1,042	-243	255	370	408	428	430	417	748		
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515		
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045		
All Years	428	269	-258	-1,399	-961	169	301	347	403	426	428	417	572		

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the variant and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Table 2.6-7 illustrates the flow below the confluence and upstream of the Alameda and San Antonio Creek confluence for the variant and WSIP settings, and the similarity in flow between the two. Table 2.6-8 provides the same form of information for the variant and base settings. The flows at this location are indicative of flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, minus the water assumed to be recaptured (diverted) from the creek by the SFPUC.

Table 2.6-7

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP All Tuolumne	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,150	13,646	25,702	17,847	9,299	498	76	33	15	9	70,436	
Above Normal	19	150	1,240	4,373	8,802	6,881	2,180	217	54	20	9	6	23,952	
Normal	7	64	922	913	1,844	1,269	469	134	28	9	4	3	5,665	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,107	3,850	7,407	5,325	2,409	197	38	14	7	4	20,456	

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,180	13,613	25,832	17,847	9,299	498	76	33	15	9	70,563	
Above Normal	19	150	1,312	4,459	9,146	6,916	2,168	217	54	20	9	6	24,477	
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,128	3,862	7,502	5,333	2,407	197	38	14	7	4	20,588	

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP All Tuolumne minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	-30	33	-129	0	0	0	0	0	0	0	-127	
Above Normal	0	0	-72	-86	-344	-36	13	0	0	0	0	0	-525	
Normal	0	0	0	0	7	0	0	0	0	0	0	0	7	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-21	-11	-95	-7	3	0	0	0	0	0	-132	

Table 2.6-8

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP All Tuolumne	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,150	13,646	25,702	17,847	9,299	498	76	33	15	9	70,436	
Above Normal	19	150	1,240	4,373	8,802	6,881	2,180	217	54	20	9	6	23,952	
Normal	7	64	922	913	1,844	1,269	469	134	28	9	4	3	5,665	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,107	3,850	7,407	5,325	2,409	197	38	14	7	4	20,456	

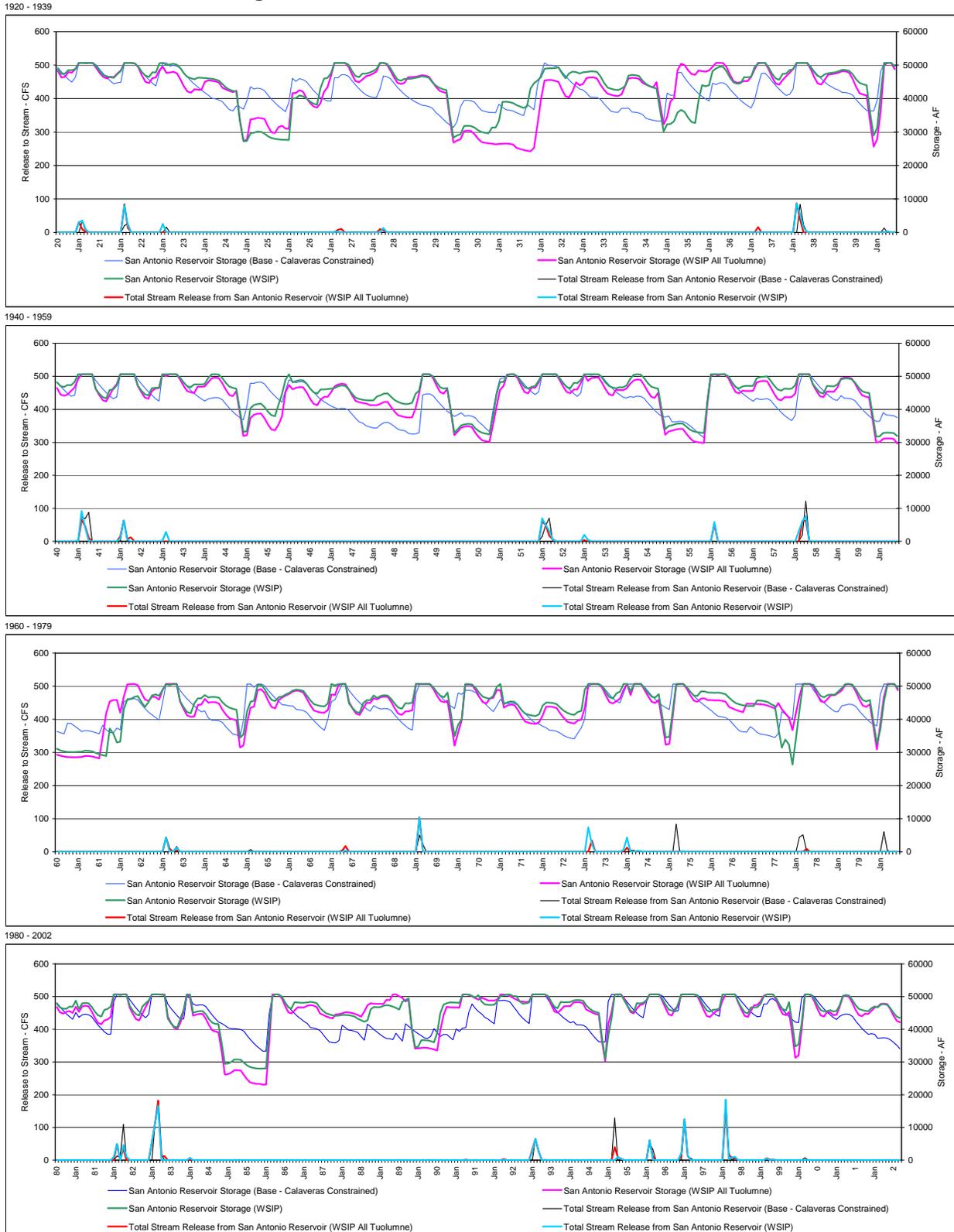
Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470	
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664	
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656	

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP All Tuolumne minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	-818	-5,022	-1,989	-131	-59	-15	0	0	0	0	-8,034	
Above Normal	0	0	-740	-3,445	-4,259	-586	319	0	0	0	0	0	-8,711	
Normal	0	0	-753	-968	-1,767	-738	-10	0	0	0	0	0	-4,236	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-460	-1,883	-1,616	-291	53	-3	0	0	0	0	-4,200	

Compared to the WSIP setting, San Antonio Reservoir operations in the variant setting generally mirror the changes experienced for Calaveras Reservoir operations. Figure 2.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from the dam. Shown in Figure 2.6-3 are the results for the WSIP, variant, and base settings. The difference in San Antonio Reservoir storage between the variant and WSIP settings is mostly caused by the interaction of the increased demand served by the system's resources (300 mgd for the variant and a net 290 demand for the WSIP) and the operation of the SJPL. Mirroring the Calaveras Reservoir effect, the systematic minor decrease in reservoir storage in most years is due to the additional demand drawing slightly more water from the Bay Area reservoirs during the summer when the SJPL is operating at maximum capacity. In a few instances, storage is greater in the variant setting. This occurs when greater water delivery reductions are required in the variant setting, thus reducing the draw from Bay Area reservoirs as compared to the WSIP setting.

The effect of the difference in San Antonio Reservoir storage depends on modeling assumptions for the balancing of total Bay Area reservoir storage among the five major SFPUC reservoirs. The model balances storage between reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary input in the model, and the logic and relative percentages are meant to mimic the current practice and

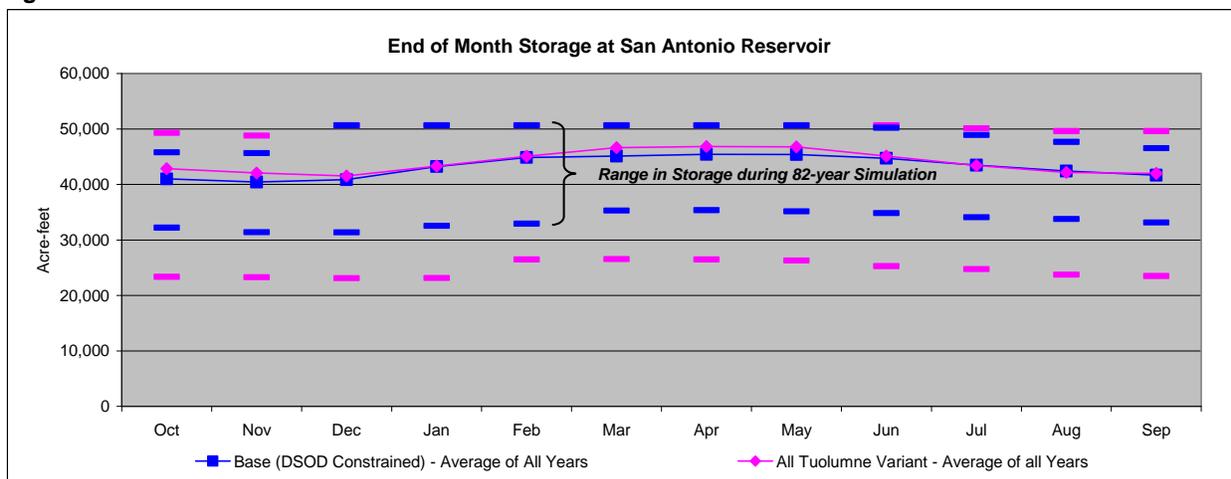
Figure 2.6-3
San Antonio Reservoir Storage and Stream Release



discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security.

The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras leads to a different operation at San Antonio Reservoir, one that provides relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained because of limited storage. There is also a notable difference in storage operation between the variant and WSIP settings and the base setting every fifth year. Assumed systematic maintenance of Hetch Hetchy conveyance facilities occurs in the simulation that constrains diversions to the Bay Area from Hetch Hetchy every fifth year. The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by additional water draws from the Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the variant and WSIP settings. Figure 2.6-4 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 2.6-4



There would very little change in stream releases below San Antonio Reservoir between the variant and WSIP settings. Table 2.6-9 illustrates the modeled release to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a slightly lower reservoir operation at times during the winter, as seen in Figure 2.6-4, an increase in the ability to regulate reservoir inflow and avoid stream releases would be expected. Given the sometimes rigid constraints of the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely serve to avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the variant and base setting are shown in Table 2.6-10. The differences among the two settings range from increases to decreases in flow. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 2.6-3. In some circumstances, the base setting storage at San Antonio Reservoir could be higher than projected for the variant setting during the same period. This circumstance could lead to an occasionally greater modeled release for the base setting, which would be reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 2.6-11 illustrates the flow below the confluence for the variant and WSIP settings, and the differences in flow between the two.

Table 2.6-9

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	44	976	2,593	1,695	584	149	0	0	0	0	6,041	6,041
Above Normal	0	0	0	268	848	329	82	16	0	0	0	0	1,544	1,544
Normal	0	0	0	13	0	37	34	0	0	0	0	0	84	84
Below Normal	0	0	0	0	0	0	3	0	0	0	0	0	3	3
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	249	682	406	138	32	0	0	0	0	1,516	1,516

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	82	1,046	3,176	1,482	592	115	0	0	0	0	6,493	6,493
Above Normal	0	0	19	456	1,025	237	29	73	0	0	0	0	1,841	1,841
Normal	0	0	0	105	16	0	50	0	0	0	0	0	172	172
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	20	319	835	338	131	38	0	0	0	0	1,682	1,682

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	-38	-71	-582	214	-7	34	0	0	0	0	-451	-451
Above Normal	0	0	-19	-188	-177	93	53	-57	0	0	0	0	-296	-296
Normal	0	0	0	-92	-16	37	-17	0	0	0	0	0	-89	-89
Below Normal	0	0	0	0	0	0	3	0	0	0	0	0	3	3
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-11	-71	-153	68	7	-5	0	0	0	0	-166	-166

Table 2.6-10

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	44	976	2,593	1,695	584	149	0	0	0	0	6,041	6,041
Above Normal	0	0	0	268	848	329	82	16	0	0	0	0	1,544	1,544
Normal	0	0	0	13	0	37	34	0	0	0	0	0	84	84
Below Normal	0	0	0	0	0	0	3	0	0	0	0	0	3	3
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	249	682	406	138	32	0	0	0	0	1,516	1,516

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	6,780
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	1,835
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	1,703

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	44	437	243	-785	-739	61	0	0	0	0	-739	-739
Above Normal	0	0	0	268	-33	-554	70	-42	0	0	0	0	-290	-290
Normal	0	0	0	13	-1	37	34	0	0	0	0	0	83	83
Below Normal	0	0	0	0	0	0	3	0	0	0	0	0	3	3
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	143	41	-261	-122	3	0	0	0	0	-187	-187

Table 2.6-11

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	6	154	3,194	14,621	28,296	19,542	9,883	647	76	33	15	9	76,477	76,477
Above Normal	19	150	1,240	4,642	9,649	7,210	2,263	233	54	20	9	6	25,497	25,497
Normal	7	64	922	926	1,844	1,306	503	134	28	9	4	3	5,749	5,749
Below Normal	7	56	183	404	682	678	160	91	20	5	3	2	2,292	2,292
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	853
All Years	9	89	1,115	4,099	8,088	5,732	2,547	229	38	14	7	4	21,972	21,972

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	6	154	3,262	14,659	29,007	19,329	9,890	614	76	33	15	9	77,055	77,055
Above Normal	19	150	1,332	4,916	10,171	7,153	2,197	290	54	20	9	6	26,318	26,318
Normal	7	64	922	1,019	1,853	1,269	519	134	28	9	4	3	5,830	5,830
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	853
All Years	9	89	1,148	4,181	8,337	5,671	2,538	234	38	14	7	4	22,270	22,270

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP All Tuolumne minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
Wet	0	0	-68	-38	-711	214	-7	34	0	0	0	0	-578	-578
Above Normal	0	0	-92	-274	-521	57	66	-57	0	0	0	0	-821	-821
Normal	0	0	0	-92	-9	37	-17	0	0	0	0	0	-81	-81
Below Normal	0	0	0	0	0	0	3	0	0	0	0	0	3	3
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-32	-82	-249	61	10	-5	0	0	0	0	-298	-298

Table 2.6-12 illustrates the same information in comparing the variant and base settings. Table 2.6-11 illustrates the minor modeled differences in flow that occur between the variant and WSIP settings, while Table 2.6-12 illustrates the relatively larger differences in flow that could occur between the variant and base settings. The difference is particularly due to the effects of the restoration of Calaveras Reservoir operating capacity in the variant setting.

Table 2.6-12

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP All Tuolumne			
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Jul	Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	6	154	3,194	14,621	28,296	19,542	9,883	647	76	33	15	9	76,477			
Above Normal	19	150	1,240	4,642	9,649	7,210	2,263	233	54	20	9	6	25,497			
Normal	7	64	922	926	1,844	1,306	503	134	28	9	4	3	5,749			
Below Normal	7	56	183	404	682	678	160	91	20	5	3	2	2,292			
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853			
All Years	9	89	1,115	4,099	8,088	5,732	2,547	229	38	14	7	4	21,972			

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Constrained			
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Jul	Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250			
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498			
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902			
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288			
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853			
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359			

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP All Tuolumne minus Base - Calaveras Constrained			
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Jul	Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	-774	-4,585	-1,746	-916	-798	47	0	0	0	0	-8,772			
Above Normal	0	0	-740	-3,177	-4,291	-1,140	389	-42	0	0	0	0	-9,001			
Normal	0	0	-753	-955	-1,768	-701	24	0	0	0	0	0	-4,154			
Below Normal	0	0	0	0	0	0	3	0	0	0	0	0	3			
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0			
All Years	0	0	-452	-1,740	-1,575	-552	-70	0	0	0	0	0	-4,388			

2.7 Crystal Springs and San Andreas Reservoirs

There are differences in Crystal Springs Reservoir operations between the variant and WSIP settings. Figure 2.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 2.7-1 are the results for the WSIP, variant, and base settings. The difference in Crystal Springs Reservoir storage between the variant and WSIP setting is caused by the interaction of the increased demand served by the system's resources (300 mgd for the variant and a net 290 demand for the WSIP) and the operation of the SJPL and Bay Diversion Pipelines (BDPL). Generally, the systematic decrease in reservoir storage is due to the additional demand drawing more water from the Bay Area system reservoirs during the summer when the SJPL is operating at maximum capacity. A portion of this additional draw is focused on Crystal Springs Reservoir. Subsequent to the additional draw of storage, Hetch Hetchy would attempt to replenish the Bay Area system reservoirs. However, there are modeled circumstances in which the coincidence of SJPL or BDPL capacity constraints would inhibit the ability to replenish Crystal Springs Reservoir storage. During these periods, Crystal Springs Reservoir storage would be lower in the variant setting than in the WSIP setting. The exception to the lower storage condition would be during periods when the variant condition leads to greater delivery shortages (rationing, and therefore less delivery) or the initiation of drought water supplies (in this setting, the offset of demand with the Westside Groundwater Program). During these periods, Crystal Springs Reservoir storage becomes greater in the variant setting than in the WSIP setting because of the lesser need for water from the reservoirs. The magnitude of the additional draw of storage from Crystal Springs Reservoir and the lesser draw from storage during drought partially depends on the discretionary assumptions of the model that proportion the use of storage among the Bay Area system reservoirs. In actual operations, some of the differences in result may not occur as system operators and prevailing hydraulic and hydrologic conditions may direct the operational effect of the different demand to an alternative apportionment of effect among the reservoirs. Figure 2.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and WSIP settings.

Figure 2.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings. Consistent with the comparison of the WSIP and base settings, the variant setting would result in reservoir storage operating at a higher

Figure 2.7-1
Crystal Springs Reservoir Storage and Release

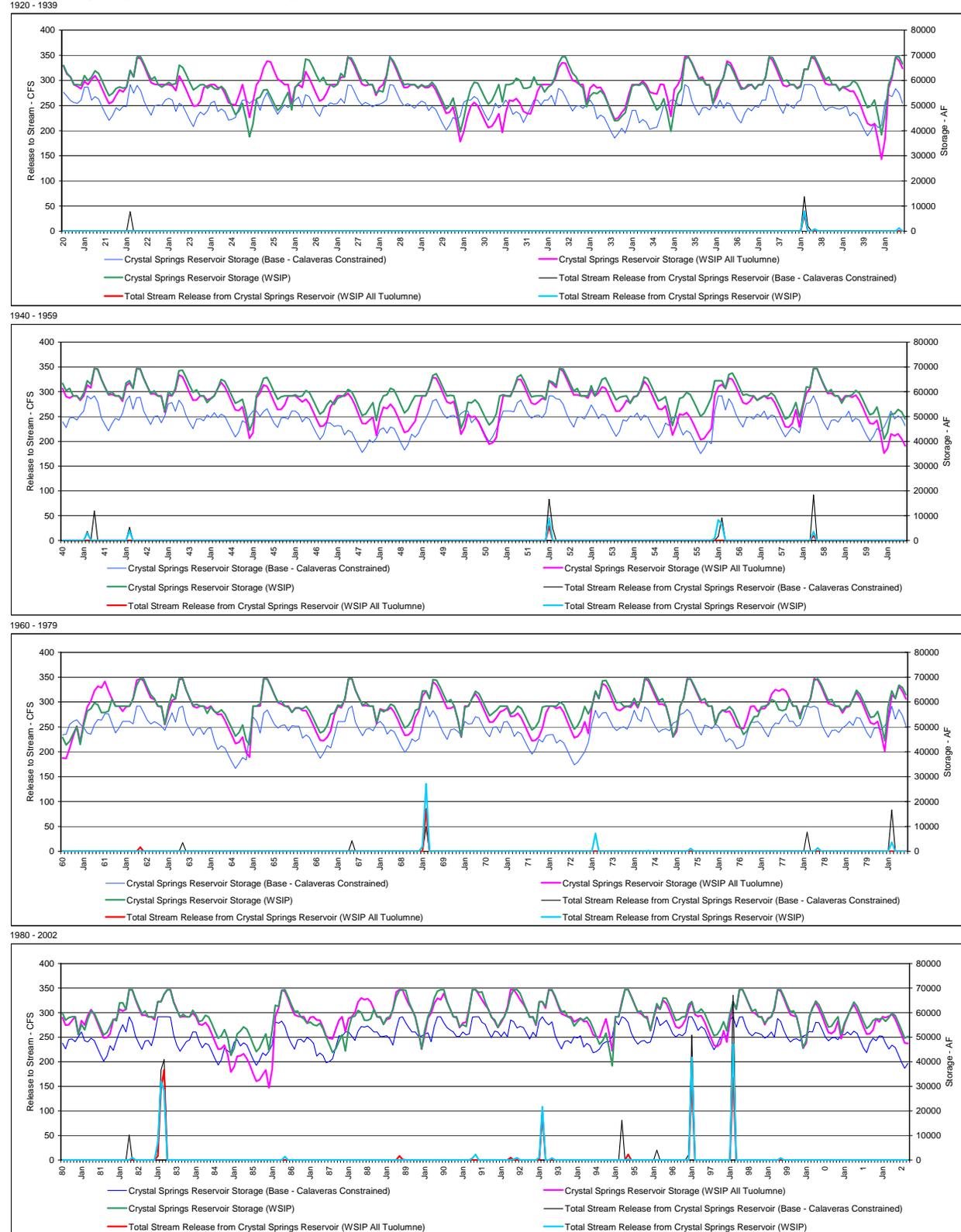


Figure 2.7-2

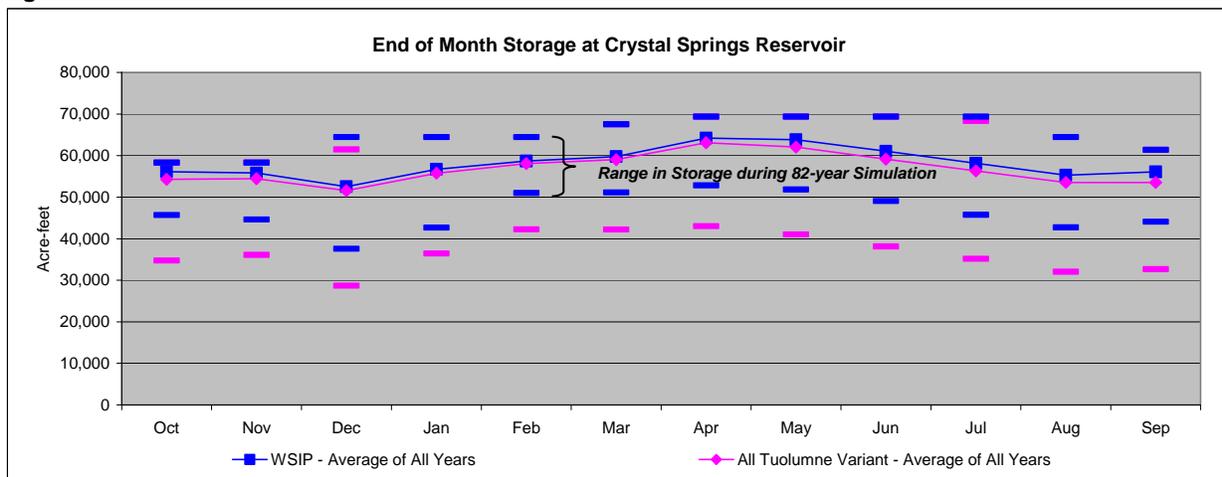
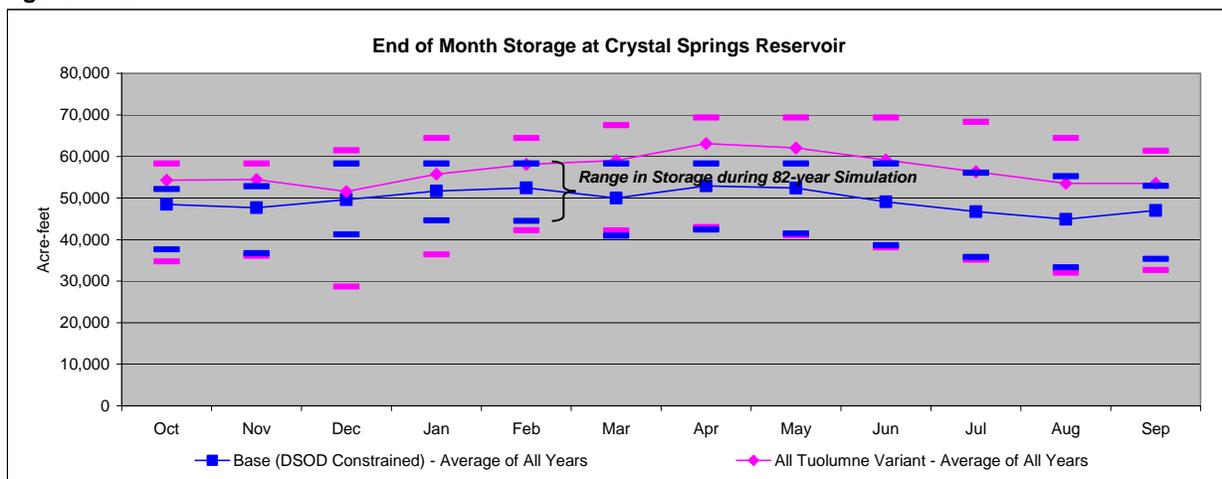


Figure 2.7-3



average and higher upper-range than the base setting. This occurs due to the restoration of the operating capacity of Crystal Springs Reservoir.

Table 2.7-1 illustrates the modeled variant and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that, within a month, either an increase or decrease in the occasional release could occur. The potential difference is attributed to whether the different resulting storage in the reservoir is higher or lower between the two settings. Part of the difference in modeled Crystal Springs Reservoir storage is due to modeling assumptions for the proportionate balancing of storage among the Bay Area reservoirs, and the coincidence of assumed system-wide maintenance with less than favorable hydrologic conditions. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting, with the effect of essentially no difference between the variant and WSIP settings. Modeling results indicate that there would be releases in only 16 months of the 6-month January-through-May period of the 82-years of simulation.

Table 2.7-2 illustrates the stream releases for the variant and base settings and the difference in modeled flows between the two settings. A greater operating range in Crystal Springs Reservoir operation would lead to an increased potential to regulate reservoir inflow, which would lead to less risk in needing to make stream releases. However, as described above, actual system operations would attempt to minimize releases under any setting; thus, the difference in releases between the variant and base setting would be minimal, if any.

Table 2.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP All Tuolumne		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	0	768	1,496	704	35	46	0	0	0	0	3,049		
Above Normal	0	0	0	0	314	0	0	0	0	0	0	0	314		
Normal	0	0	0	0	0	0	18	32	0	0	0	0	50		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	32	3	0	0	0	35		
All Years	0	0	0	150	357	137	10	21	1	0	0	0	677		

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	17	1,309	2,398	542	65	65	0	0	0	0	4,397		
Above Normal	0	0	0	18	354	0	0	99	0	0	0	0	472		
Normal	0	0	0	0	0	0	0	5	15	0	0	0	20		
Below Normal	0	0	0	0	0	0	13	40	0	0	0	0	53		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	3	259	541	106	15	43	3	0	0	0	971		

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP All Tuolumne minus WSIP		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	-17	-541	-902	162	-30	-20	0	0	0	0	-1,348		
Above Normal	0	0	0	-18	-40	0	0	-99	0	0	0	0	-157		
Normal	0	0	0	0	0	0	18	27	-15	0	0	0	29		
Below Normal	0	0	0	0	0	0	-13	-40	0	0	0	0	-53		
Dry	0	0	0	0	0	0	0	32	3	0	0	0	35		
All Years	0	0	-3	-109	-184	32	-5	-21	-2	0	0	0	-294		

Table 2.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP All Tuolumne		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	0	768	1,496	704	35	46	0	0	0	0	3,049		
Above Normal	0	0	0	0	314	0	0	0	0	0	0	0	314		
Normal	0	0	0	0	0	0	18	32	0	0	0	0	50		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	32	3	0	0	0	35		
All Years	0	0	0	150	357	137	10	21	1	0	0	0	677		

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													Base - Calaveras Constrained		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	6,336		
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	671		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	9	280	690	221	147	29	0	0	0	0	1,375		

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP All Tuolumne minus Base - Calaveras Constrained		
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	0	0	-44	-665	-1,393	-430	-721	-35	0	0	0	0	-3,287		
Above Normal	0	0	0	0	-294	0	0	-63	0	0	0	0	-357		
Normal	0	0	0	0	0	0	18	32	0	0	0	0	50		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	32	3	0	0	0	35		
All Years	0	0	-9	-130	-333	-84	-137	-7	1	0	0	0	-699		

San Andreas Reservoir operations would generally be the same between the variant and WSIP settings. Reservoir storage would follow a systematic filling and lowering each year. Figure 2.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from San Andreas Dam. Shown in Figure 2.7-4 are the results for the WSIP, variant, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Notable in Figure 2.7-4 is the difference in storage operation every fifth year. Both the variant and WSIP setting storage operation differ from the base setting. This is due to the assumption that Hetch Hetchy conveyance maintenance occurs systematically every fifth year, which constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy Water Treatment Plant (Harry Tracy WTP) associated with WSIP or the variant exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be the same among all of the settings. The additional water demand of the WSIP and variant require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir. Figure 2.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 2.7-4
San Andreas Reservoir Storage and Stream Release

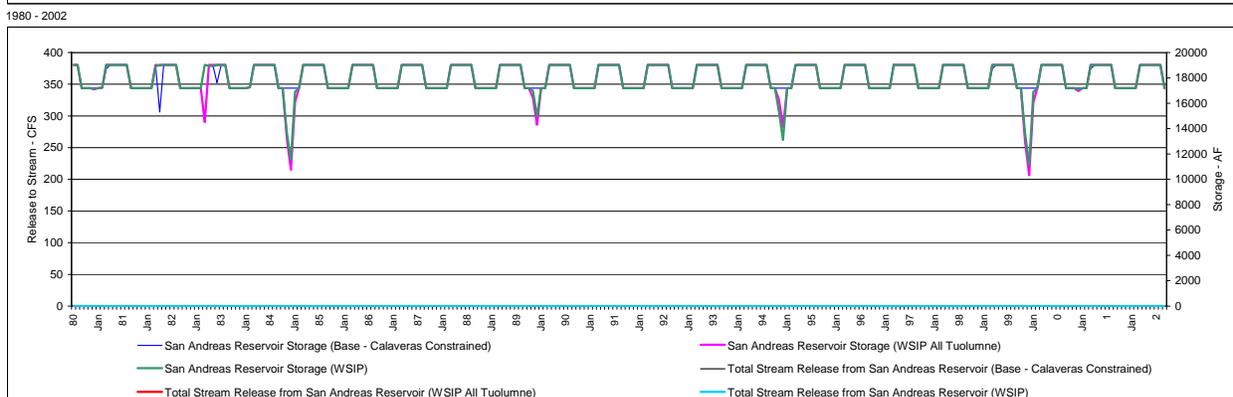
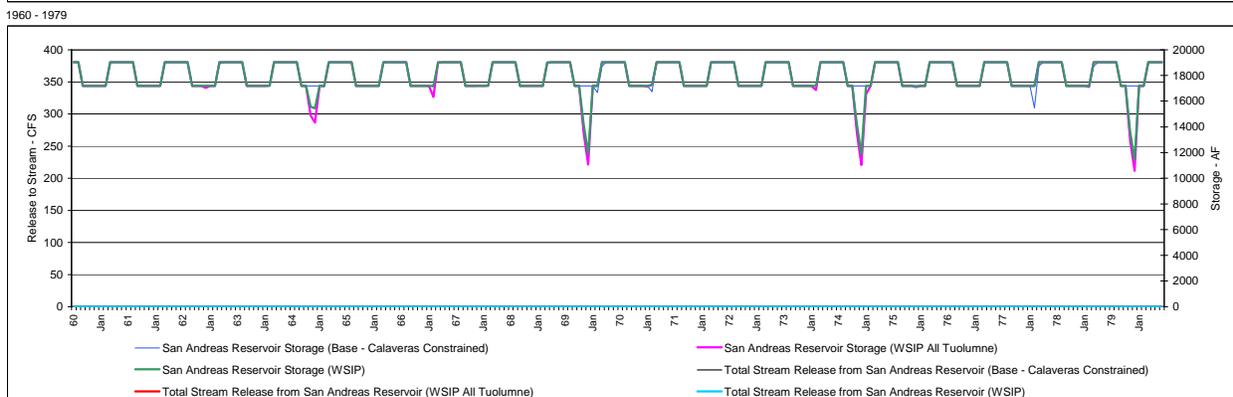
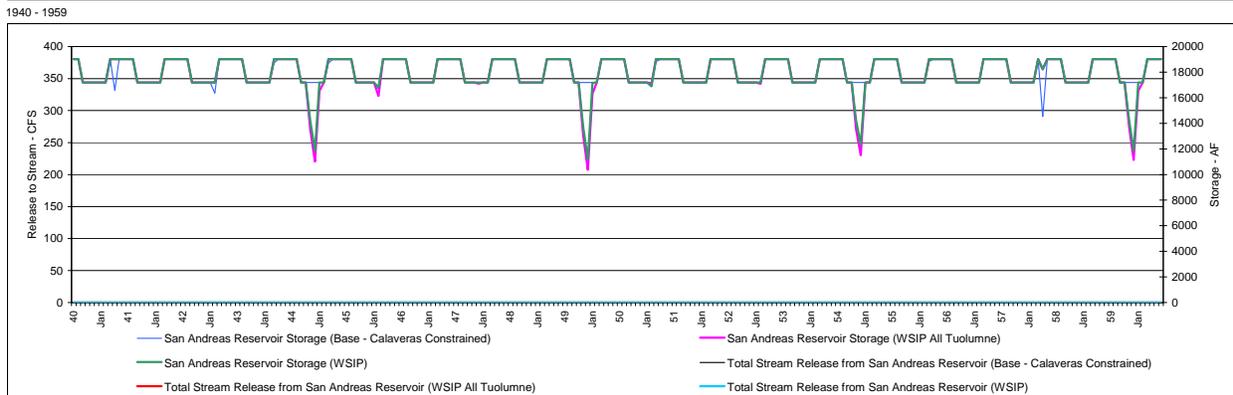
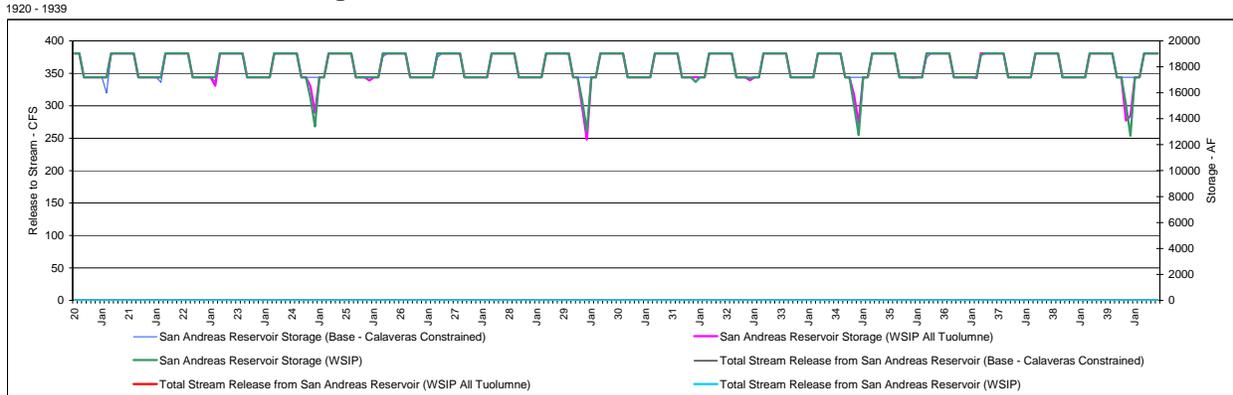
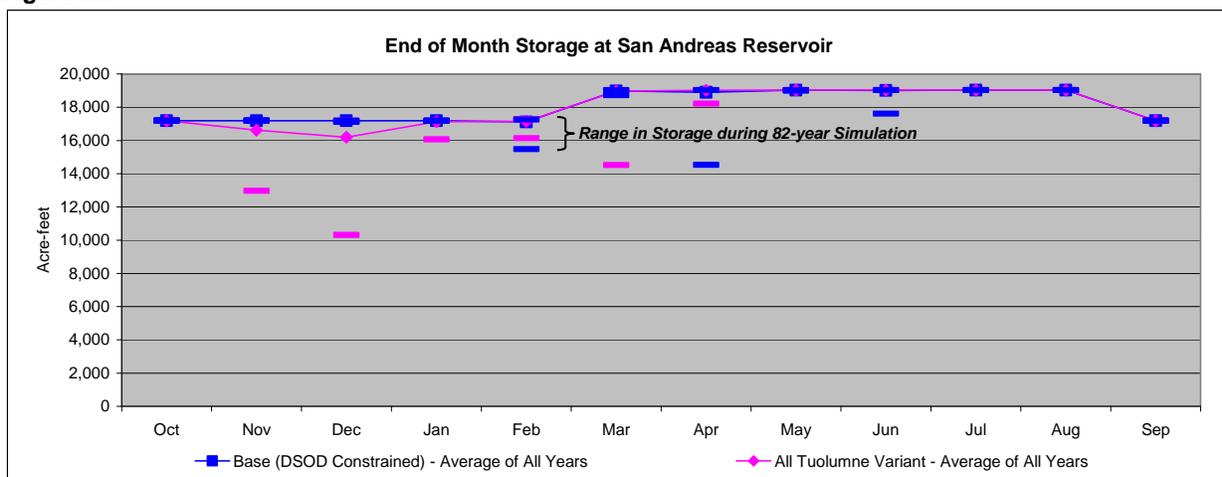


Figure 2.7-5



2.8 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD's) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated to amount to about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, there is uncertainty as to the precise manner in which Coastside CWD's additional purchase request would be served and the resultant potential changes to the operation of SFPUC facilities and their affected environs.²

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs are identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

The variant setting could result in the same potential effects to the Pilarcitos Creek watershed as the WSIP setting.

² See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

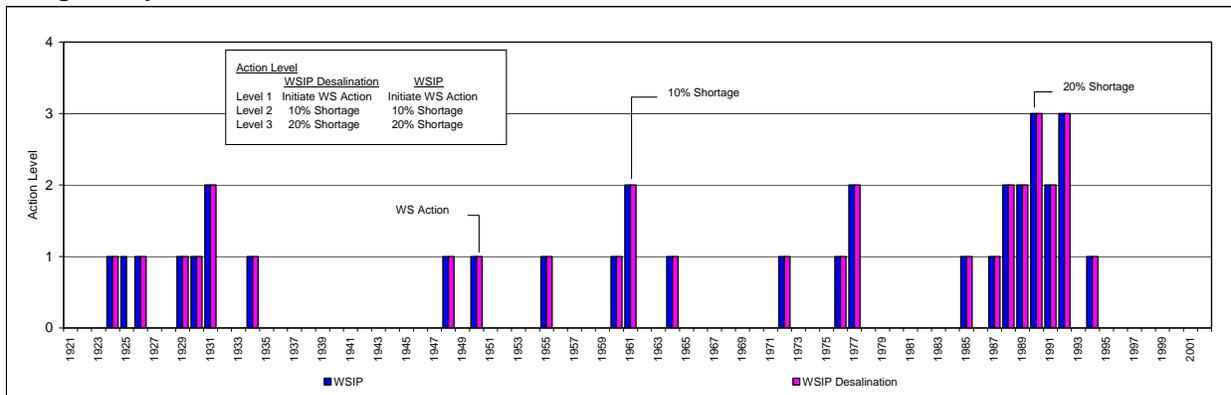
3. WSIP Variant 2 – Regional Desalination for Drought

WSIP Variant 2 – Regional Desalination for Drought (Desalination) variant programs would be the same as the WSIP programs, except that water production during drought from a desalination plant would substitute for the purchase from TID/MID. As with the WSIP, the purchase request increases from 265 mgd to 300 mgd and increase in delivery reliability would be served with a supply of 10 mgd from implementation of the Recycled Water Projects (SF-3), Local Groundwater Projects (a component of SF-2, Groundwater Projects), and additional conservation programs (RRGWC). In effect, the 10 mgd of RRGWC requires the Regional Water System’s resources to serve a net 290 mgd demand. In all other aspects, this variant would include the same water supply sources as the proposed program, and integrate the same restored storage features of Calaveras and Crystal Springs Reservoirs and the incorporation of the Westside Basin Groundwater Program.

3.1 Water Deliveries and Drought Response Actions

In the WSIP, the MID/TID Tuolumne River water transfer (27,000 acre-feet) is modeled to occur each year. In the variant, this transfer does not occur, but instead 27,000 acre-feet of water offsets demand during the onset of anticipated drought. Table 1-1 compares the drought response actions for the proposed program and variant. Figure 3.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002).

**Figure 3.1-1
Drought Response Actions – WSIP and All Tuolumne Variant**



In Figure 3.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In both scenarios, the action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. In the variant setting, demand offset by desalination production also occurs. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers. The initiation of supplemental supplies from the groundwater project and desalination occur one additional time during the 82-year simulation. The frequency of imposed delivery shortages and the severity of shortages remain the same between the variant and WSIP settings.

The same form of information is shown in Figure 3.-1-2 in comparing the variant and “Base - Calaveras Constrained” (existing) settings. In modeling parlance, there is no level 1 action level in the base setting. Without supplemental resources, the existing system only has the delivery shortage measure available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the variant and the base setting for these action levels.

**Figure 3.1-2
Drought Response Actions – Base and All Tuolumne Variant**

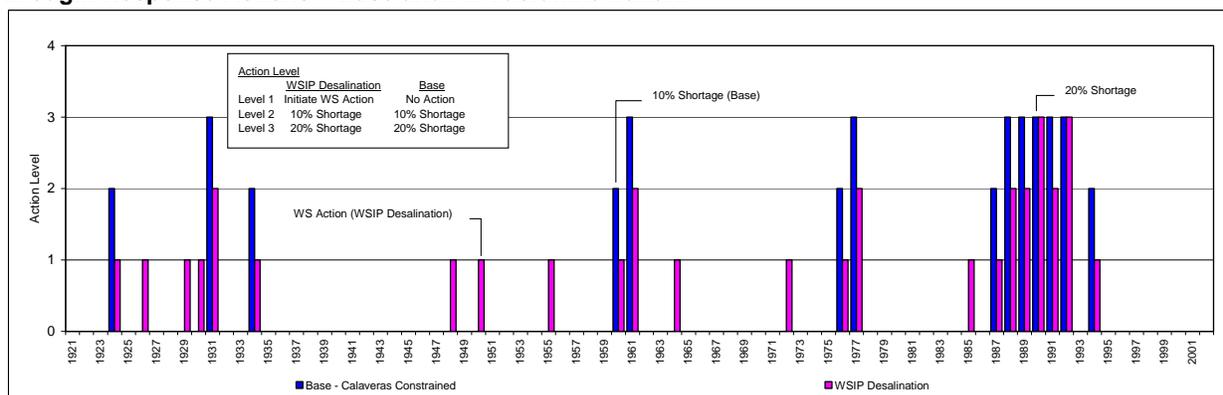


Figure 3.1-2 illustrates that, when compared to the base setting, the variant triggers the supplemental resources at an early indication of drought, during periods when in the current setting no supplemental resource is available to the system. The utilization of the supplemental resource during these times results in the lessening of (or at least a non-increase in) the severity of delivery shortage.

Not illustrated in Figure 3.1-2, but shown in Table 1-1, are the delivery shortages anticipated during the entire SFPUC Design Drought. Shortages during the Design Drought with the variant are maintained within the objective to limit the severity of shortage to no more than 20 percent, and the frequency and severity of shortages during the Design Drought are identical between the variant and WSIP settings. With the existing system, the 20 percent limitation (cap) objective cannot be achieved during the last 18 months of the Design Drought, and a 25 percent shortage is applied.

The difference in water deliveries between the proposed program and the variant is shown chronologically for the 82-year simulation in Table 3.1-1. Deliveries are almost identical between the variant and WSIP settings. The differences occur during 1925-1926 when an additional year of supplemental supply through the Westside Groundwater Program provides an offset to deliveries, and then an “increase” in demand during immediate subsequent years (1928-1929 and 1937-1938), indicating replenishment of the groundwater basin through additional deliveries to the program’s participants.

3.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin is the flow through the SJPL. Table 3.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the variant settings. As demonstrated in Table 3.1-1, water deliveries do not substantially differ between the two scenarios. However, the water supplies for the deliveries differ. During non-drought periods, the increase in deliveries associated with the WSIP would still predominantly be met with increased diversion from the Tuolumne River in both the WSIP and variant setting. The absence of the MID/TID transfer during these years does not affect the amount of water the SFPUC can divert from the Tuolumne River, because the SFPUC has adequate rights and entitlements to do so without the TID/MID transfer water. Thus, the diversions to the SJPL during non-drought periods remain essentially the same between the two settings. The differences would occur during years when the water supply action is triggered during drought. When triggered, the offset in deliveries provided by the desalination supply reduces the need for diversions from the Tuolumne River, and thus reduces the diversion to the SJPL as compared to the WSIP setting. The effect of substituting the variant’s month-to-month desalination supply for the WSIP’s transfer supply does not directly modify the corresponding SJPL month-to-month diversion. Other system-wide storage and conveyance factors affecting the SJPL diversion rate result in the difference in diversion manifesting in less than every month in the year, but the effect would occur over the course of several years within the drought period. Table 3.2-2 illustrates the average monthly diversion through the SJPL, by year type, for the 82-year simulation period for the proposed program and the variant. Table 3.2-3 illustrates the average monthly diversion through the SJPL, by year type, for the variant and the base settings.

Table 3.1-1

Water Year	WSIP minus WSIP Desalination												WY Total	FY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	-530	-499	-454	-1,484	0	0
1926	-449	-419	-408	-383	-379	-423	-436	-446	-453	0	0	0	-3,795	-5,279	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	224	224	217	665	0	0
1929	224	217	224	224	203	224	217	224	217	0	0	0	1,974	2,640	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	224	224	217	665	0	0
1938	224	217	224	224	203	224	217	224	217	0	0	0	1,974	2,640	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	0	1	0	0	0	0	0	-1	-1	0	0	0	0

Table 3.2-1

Difference in Total SJPL (Acre-feet)				WSIP Desalination minus WSIP										WY Total	FY Total
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	-1,237	0	0	0	-945	0	0	0	0	0	0	0	-2,182	-2,182	
1926	0	0	0	0	-6,875	0	0	0	0	0	0	-1,197	-8,072	-6,875	
1927	-7,135	-4,604	-3,805	-2,854	0	-3,805	-2,762	-1,237	-1,197	0	0	0	-27,399	-28,596	
1928	0	-921	-523	-952	-859	0	1,841	0	0	0	0	0	-1,414	-1,414	
1929	-2,379	0	-952	0	0	0	0	0	0	0	0	0	-3,331	-3,331	
1930	-5,043	0	0	0	0	0	0	0	0	0	0	-4,880	-9,923	-5,043	
1931	-7,897	-10,219	0	-8,658	-7,820	0	0	0	0	0	-2,189	-9,483	-46,266	-39,474	
1932	-8,562	-5,524	3,521	-8,753	-4,468	-1,047	0	-3,996	-3,867	0	0	0	-32,696	-44,368	
1933	-856	0	0	0	0	0	0	0	0	0	0	0	-856	-856	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	-10,275	0	0	0	0	0	0	-2,189	-2,118	0	0	0	-14,582	-14,582	
1936	-5,043	-4,603	0	-952	-859	0	0	0	0	0	0	0	-11,457	-11,457	
1937	-1,427	0	0	-952	0	1,142	0	0	0	0	0	0	-1,237	-1,237	
1938	-2,949	-921	0	-1,902	0	0	-1,841	0	0	0	0	0	-7,613	-7,613	
1939	-952	0	952	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	0	0	-921	0	0	0	0	0	-921	-921	
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	-3,140	-3,775	-4,757	-2,855	-2,578	-4,757	0	-2,189	-2,118	0	0	0	-26,169	-26,169	
1950	-1,903	0	0	0	0	0	0	0	0	0	0	0	-1,903	-1,903	
1951	0	-9,206	0	0	0	-10,464	0	-2,189	-2,118	0	0	0	-23,977	-23,977	
1952	0	-921	-951	0	0	0	0	0	0	0	0	0	-1,872	-1,872	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	-1,013	0	0	0	-2,854	0	-2,189	-2,118	0	0	0	-8,174	-8,174	
1957	0	-921	-1,903	952	0	0	0	0	0	0	0	0	-1,872	-1,872	
1958	-1,237	0	0	0	0	0	0	0	0	0	0	0	-1,237	-1,237	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	-6,905	-951	-1,998	-2,664	0	0	0	0	0	-1,237	-7,642	-21,397	-12,518	
1962	-10,751	-2,394	-9,514	-6,660	-4,297	0	0	-3,140	-3,038	0	0	0	-39,794	-48,673	
1963	-1,332	-1,841	-523	5,899	0	952	921	0	0	0	0	0	4,076	4,076	
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1965	-2,189	0	0	-5,708	-5,156	0	-7,826	-1,903	-1,841	0	0	0	-24,623	-24,623	
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1967	0	0	-1,902	0	0	0	0	0	0	0	0	0	-1,902	-1,902	
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1973	-2,189	-5,616	-523	0	0	0	-2,118	-2,664	-2,578	0	0	0	-15,688	-15,688	
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	-2,664	-2,854	-6,659	-3,806	-2,578	0	0	0	0	-7,136	-3,140	-5,801	-34,638	-18,561	
1978	-4,757	-1,934	-951	-3,806	0	-2,854	-2,762	-2,949	-2,854	0	0	0	-22,867	-38,944	
1979	0	921	0	0	0	0	0	0	0	0	0	0	921	921	
1980	-1,237	0	0	0	0	1,902	0	0	0	0	0	0	665	665	
1981	0	-921	0	-1,902	-1,718	0	0	0	0	0	0	0	-4,541	-4,541	
1982	1,237	0	1,903	0	0	0	0	0	0	0	0	0	3,140	3,140	
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	-1,047	-3,437	-7,610	-5,524	-3,140	-3,038	0	0	0	-23,796	-23,796	
1987	0	921	0	0	0	0	0	0	0	0	0	0	921	921	
1988	-1,237	-2,854	0	-6,755	-5,156	0	0	0	0	-3,140	-9,483	-28,625	-16,002	-16,002	
1989	-5,708	-4,603	-2,854	-1,902	-1,718	0	0	-2,189	-2,118	-3,140	-5,043	-5,524	-34,799	-33,715	
1990	-4,757	0	0	-2,664	0	0	0	0	0	-5,043	-7,610	-6,444	-26,518	-21,128	
1991	-4,757	-3,682	0	-2,854	-2,578	-2,854	-2,118	-2,854	-2,762	-2,664	-1,903	-921	-29,947	-43,556	
1992	-952	-2,762	-4,756	-1,902	-2,578	-1,047	-1,197	-5,043	-4,880	0	-2,854	-1,841	-29,812	-30,605	
1993	-1,902	-3,682	-3,045	0	0	0	-4,603	-2,854	-2,762	0	0	0	-18,848	-23,543	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	-3,140	0	0	-7,801	-5,328	0	-4,603	-1,903	-1,842	0	0	0	-24,617	-24,617	
1996	-1,902	921	0	951	0	0	0	0	0	0	0	0	-30	-30	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	-1,320	-975	-466	-808	-784	-406	-409	-520	-503	-219	-331	-649	-7,389	-7,389	

Table 3.2-2

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP Desalination			
											Aug	Sep	WY Total	FY Total
Wet	26,347	16,094	8,223	10,245	6,595	10,584	19,863	25,669	24,841	29,778	29,778	28,817	236,835	233,262
Above Normal	24,691	13,323	7,703	13,918	8,992	15,860	24,013	28,043	27,138	29,778	29,778	28,817	252,054	251,297
Normal	25,080	14,213	8,105	15,091	11,713	22,476	28,190	29,415	28,466	29,778	29,778	28,817	271,122	270,492
Below Normal	26,191	15,343	11,371	21,131	17,712	24,590	28,692	29,056	28,118	29,437	29,185	27,127	287,953	288,133
Dry	24,688	17,993	14,021	18,201	15,897	25,717	28,742	29,463	28,512	28,702	27,560	24,657	284,151	288,892
All Years	25,400	15,367	9,876	15,761	12,210	19,855	25,911	28,335	27,420	29,497	29,222	27,655	266,510	266,496

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP			
											Aug	Sep	WY Total	FY Total
Wet	27,358	16,624	8,533	11,512	7,465	11,298	21,561	26,603	25,744	29,778	29,778	28,817	245,069	242,794
Above Normal	26,705	14,785	7,751	14,254	9,306	16,705	24,176	28,608	27,685	29,778	29,778	28,817	258,347	258,347
Normal	26,174	14,713	8,765	15,626	12,095	22,405	28,207	29,778	28,817	29,778	29,778	28,817	274,953	274,878
Below Normal	27,338	16,106	11,931	21,523	18,520	25,038	28,817	29,481	28,530	29,778	29,593	27,864	294,520	295,079
Dry	25,990	19,593	14,794	19,764	17,471	25,782	28,817	29,778	28,817	29,463	28,821	27,200	296,289	297,969
All Years	26,721	16,342	10,342	16,569	12,994	20,261	26,320	28,854	27,923	29,717	29,553	28,304	273,899	273,884

Difference in Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP Desalination minus WSIP			
											Aug	Sep	WY Total	FY Total
Wet	-1,011	-529	-309	-1,267	-870	-714	-1,697	-934	-903	0	0	0	-8,234	-9,532
Above Normal	-2,015	-1,462	-47	-336	-313	-845	-162	-565	-547	0	0	0	-6,293	-7,050
Normal	-1,094	-501	-660	-535	-381	71	-17	-363	-351	0	0	0	-3,831	-4,386
Below Normal	-1,147	-764	-560	-392	-809	-448	-125	-425	-412	-341	-409	-737	-6,567	-6,946
Dry	-1,302	-1,600	-773	-1,564	-1,574	-65	-75	-315	-305	-761	-1,261	-2,543	-12,138	-9,077
All Years	-1,320	-975	-466	-808	-784	-406	-409	-520	-503	-219	-331	-649	-7,389	-7,389

Table 3.2-3

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP Desalination			
											Aug	Sep	WY Total	FY Total
Wet	26,347	16,094	8,223	10,245	6,595	10,584	19,863	25,669	24,841	29,778	29,778	28,817	236,835	233,262
Above Normal	24,691	13,323	7,703	13,918	8,992	15,860	24,013	28,043	27,138	29,778	29,778	28,817	252,054	251,297
Normal	25,080	14,213	8,105	15,091	11,713	22,476	28,190	29,415	28,466	29,778	29,778	28,817	271,122	270,492
Below Normal	26,191	15,343	11,371	21,131	17,712	24,590	28,692	29,056	28,118	29,437	29,185	27,127	287,953	288,133
Dry	24,688	17,993	14,021	18,201	15,897	25,717	28,742	29,463	28,512	28,702	27,560	24,657	284,151	288,892
All Years	25,400	15,367	9,876	15,761	12,210	19,855	25,911	28,335	27,420	29,497	29,222	27,655	266,510	266,496

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Base - Calaveras Constrained			
											Aug	Sep	WY Total	FY Total
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258	218,975
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776	230,776
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601	243,681
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263	264,595
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509	262,015
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165	244,098

Difference in Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP Desalination minus Base - Calaveras Constrained			
											Aug	Sep	WY Total	FY Total
Wet	2,087	-2,031	-5,560	2,218	580	3,151	3,832	2,599	2,515	2,189	2,189	2,809	16,578	14,287
Above Normal	515	-4,603	-6,500	4,818	2,836	6,581	3,704	3,364	3,255	2,189	2,189	2,930	21,278	20,521
Normal	1,712	-4,834	-6,285	5,161	4,850	11,844	2,239	2,361	2,285	2,189	2,189	2,809	26,520	26,811
Below Normal	1,231	-2,638	-6,593	5,406	5,904	9,256	1,993	1,467	1,419	2,519	2,267	1,457	23,690	23,538
Dry	1,023	-1,053	-4,412	4,120	4,511	9,781	2,043	2,231	2,158	1,826	982	432	23,642	26,877
All Years	1,303	-3,046	-5,886	4,363	3,752	8,118	2,765	2,405	2,327	2,187	1,970	2,090	22,345	22,398

The results shown in Table 3.2-3 illustrate that, when comparing the variant setting to the base setting, similar to the WSIP setting, additional diversions from the Tuolumne River would occur to serve the increase in purchase request and improvement in delivery reliability. The difference between the variant and WSIP results would occur during drier years, when less increase in deliveries and reliability would manifest as increases in diversions from the Tuolumne River.

3.3 Hetch Hetchy Reservoir and Releases

The difference between the variant and WSIP operation of Hetch Hetchy during non-drought years is inconsequential, consistent with the similarity occurring in SJPL operation. However, during drought periods, there is less draw of storage because of the reduction in SJPL diversion due to the substitution of the desalination supply in the variant setting. Figure 3.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 3.3-1 are the results for the WSIP, variant (“WSIP All Tuolumne”), and base (“Base – Calaveras Constrained”) settings. Supplementing the Figure 3.3-1 representation of Hetch Hetchy Reservoir storage are Table 3.3-1 Hetch Hetchy Reservoir Storage (Desalination) and Table 3.3-2 Difference in Hetch Hetchy Reservoir Storage (Desalination minus WSIP). Table 3.3-3 is provided to illustrate the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Table 3.3-2 illustrates that, throughout the summer and into the fall in some years, storage in Hetch Hetchy Reservoir associated with the variant would differ from that of the WSIP,

**Figure 3.3-1
Hetch Hetchy Reservoir Storage and Stream Release**

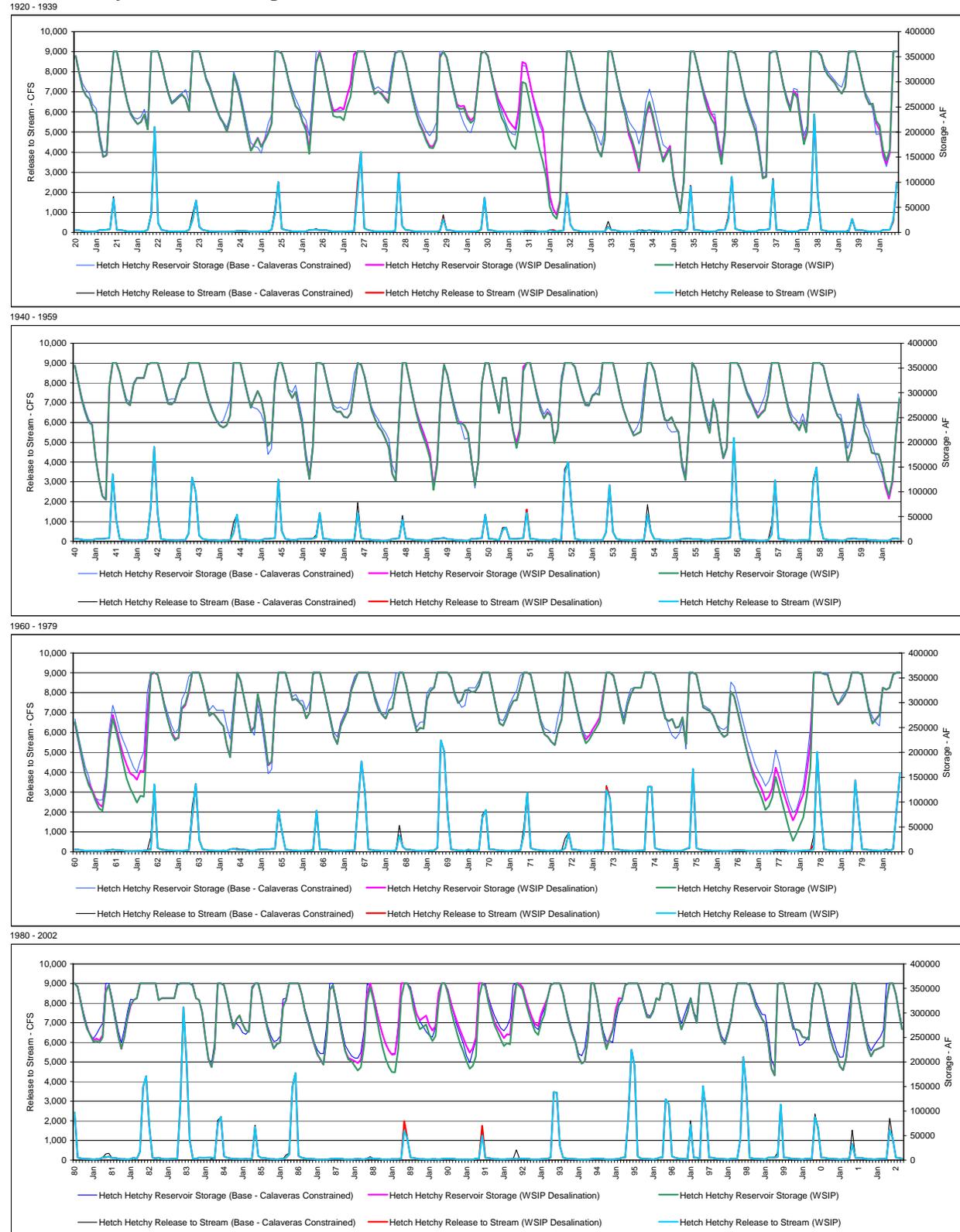


Table 3.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP Desalination

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,402	266,044	243,868	235,920	183,321	150,269	154,224	271,116	360,400	360,400	326,811	291,828
1922	259,728	235,648	224,723	215,782	220,244	234,819	205,133	360,400	360,400	360,400	336,082	302,853
1923	275,819	256,526	262,603	269,313	274,454	265,738	241,094	360,400	360,400	360,400	333,186	304,241
1924	288,096	265,462	244,930	227,949	217,703	201,135	226,615	314,032	292,290	264,348	229,088	193,225
1925	163,435	175,470	188,507	171,437	184,008	197,999	217,964	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	210,370	163,280	250,959	339,718	360,400	333,232	297,804	265,052
1927	242,305	244,578	249,021	245,187	272,768	295,662	355,106	360,400	360,400	360,400	333,718	301,231
1928	275,534	281,108	276,990	268,012	261,013	311,571	358,408	360,400	360,400	337,096	302,689	269,444
1929	241,610	218,805	204,651	185,877	172,216	171,184	186,741	351,273	360,400	348,102	314,426	281,237
1930	254,535	250,965	252,296	232,792	223,363	229,841	291,204	356,465	360,400	350,768	316,726	288,304
1931	265,772	251,670	237,977	223,073	213,619	205,737	247,022	339,278	335,987	306,045	272,933	248,175
1932	224,785	206,022	132,424	73,586	47,145	35,173	62,787	232,945	360,400	360,400	333,089	299,918
1933	271,014	247,664	232,897	212,283	195,118	164,567	151,695	187,575	360,400	360,400	326,593	293,382
1934	260,961	234,344	194,788	175,294	148,471	122,088	178,542	231,058	254,874	228,660	196,668	165,430
1935	145,724	159,447	172,234	111,792	75,509	41,545	101,479	260,217	360,400	360,400	331,788	299,322
1936	272,128	252,344	235,929	225,470	180,292	145,017	203,263	360,400	360,400	356,465	327,853	294,110
1937	263,920	240,585	221,178	200,180	157,802	109,489	111,641	357,223	360,400	360,400	327,212	292,471
1938	265,724	246,244	281,195	273,384	222,473	180,971	204,620	360,400	360,400	360,400	352,029	324,714
1939	313,417	305,620	297,136	284,589	276,736	290,220	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	217,355	204,352	157,941	136,749	160,763	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	235,298	169,490	125,366	91,151	84,054	313,255	360,400	360,400	341,291	309,048
1942	280,721	274,942	315,878	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	278,021	276,636	283,548	307,975	325,066	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	279,144	260,348	244,962	234,244	229,744	234,419	254,494	360,400	360,400	360,400	329,920	297,445
1945	269,782	286,673	303,578	288,423	253,887	193,103	202,059	325,579	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,823	360,400	360,400	357,267	325,581	293,235
1947	267,584	261,329	261,933	251,706	249,594	259,401	308,348	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	207,163	189,129	136,187	121,486	246,616	360,400	360,400	325,774	291,062
1949	260,577	237,239	218,264	200,289	174,433	110,569	157,033	290,911	356,592	336,040	301,328	268,173
1950	239,630	240,600	233,163	217,437	162,871	113,888	162,254	319,409	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	199,065	226,940	352,902	360,400	360,400	326,780	293,203
1952	264,766	248,998	260,875	254,408	198,969	224,676	318,641	360,400	360,400	360,400	351,651	322,211
1953	296,329	275,128	274,206	293,261	298,723	296,049	360,374	360,400	360,400	360,400	330,136	297,172
1954	268,064	247,055	230,167	213,569	217,328	221,015	286,815	360,400	360,400	343,956	308,827	274,943
1955	245,440	243,491	250,709	232,875	219,152	151,838	123,551	222,728	360,400	348,498	313,738	278,863
1956	244,816	219,814	282,653	260,582	205,752	167,213	187,582	360,400	360,400	360,400	347,791	319,290
1957	296,127	283,218	267,728	251,131	259,685	265,985	297,247	360,400	360,400	360,400	326,823	292,697
1958	262,298	242,214	237,194	225,295	244,804	221,297	293,100	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,939	254,292	245,472	213,883	161,315	182,390	235,642	288,112	259,667	223,084	208,259
1960	179,051	176,894	175,738	151,333	109,788	86,147	119,346	213,260	285,028	258,790	223,592	189,377
1961	156,544	138,638	124,838	107,642	95,588	90,471	137,512	229,726	275,410	249,301	220,527	195,193
1962	174,911	157,656	153,446	145,101	162,975	161,212	279,739	356,465	360,400	360,400	326,579	292,131
1963	265,044	240,360	227,765	228,550	287,172	294,374	319,669	360,400	360,400	360,400	336,396	305,026
1964	273,668	279,416	270,727	260,673	252,543	215,321	190,335	275,763	360,400	343,750	309,409	275,896
1965	244,001	251,308	315,754	280,416	229,453	174,113	180,638	293,425	360,400	360,400	360,400	333,188
1966	305,400	307,762	300,989	293,442	268,461	279,726	360,400	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	254,009	270,235	285,168	324,970	344,503	360,400	360,400	360,400	360,400	335,768
1968	305,290	284,733	275,763	268,094	285,055	288,111	330,318	360,400	360,400	334,325	299,837	267,451
1969	242,147	249,086	247,807	306,192	323,862	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	258,440	253,880	270,103	288,977	303,697	305,250	332,642	360,400	360,400	356,465	325,704	292,446
1972	258,839	236,370	231,016	221,257	214,866	245,077	266,541	360,400	360,400	360,400	326,426	299,001
1973	240,378	226,012	233,953	246,805	257,489	270,136	317,704	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	267,864	263,077	267,079	249,395	251,607	270,330	216,738	360,400	360,400	356,465	324,162	290,479
1976	286,336	282,468	273,429	252,264	239,384	231,084	235,434	322,270	311,719	281,653	249,955	220,061
1977	193,788	170,145	152,119	140,036	124,785	103,188	110,448	128,166	169,234	149,302	123,682	102,160
1978	81,003	63,258	77,992	98,811	115,187	163,180	219,723	360,400	360,400	360,400	357,869	356,406
1979	329,957	310,280	295,991	302,990	313,872	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	258,962	267,114	275,772	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	268,662	255,785	244,234	247,636	244,138	254,762	346,442	356,592	326,381	288,829	253,955
1982	226,746	250,781	289,638	314,765	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	240,387	316,275	326,509	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	258,749	235,564	215,804	204,652	194,343	250,494	346,661	356,101	324,469	287,959	252,759
1988	222,209	208,126	204,870	201,853	197,924	204,017	246,877	338,368	360,400	334,539	302,895	278,737
1989	255,435	236,703	223,607	215,084	215,862	261,882	360,400	360,400	360,400	347,113	316,283	296,702
1990	285,145	289,866	294,646	275,281	263,971	273,781	341,481	360,400	360,400	344,204	319,777	299,722
1991	280,325	263,314	247,857	231,574	219,157	228,361	249,840	360,400	360,400	357,093	326,278	302,202
1992	280,906	270,186	260,102	248,618	256,808	255,254	322,974	360,400	359,902	352,164	328,215	308,305
1993	291,250	277,344	273,410	299,354	314,678	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	256,620	239,355	209,682	196,961	201,254	250,111	360,400	360,400	328,106	288,504	253,299
1995	229,248	249,835	266,435	307,676	330,000	329,098	356,592	360,400	360,400	360,400	360,400	341,235
1996	315,005	292,083	291,301	303,336	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	280,067	360,400	360,				

Table 3.3-2

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP Desalination minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	1,237	1,237	1,237	1,237	2,184	2,184	1,922	0	0	0	0	0
1926	0	0	0	0	6,874	6,874	5,805	2,899	2,123	2,121	2,118	3,313
1927	10,447	15,050	18,856	21,721	21,733	25,539	28,300	0	0	0	0	0
1928	0	920	1,444	2,396	3,256	3,256	3,256	1,415	0	0	0	0
1929	2,378	2,379	3,330	3,332	3,333	3,334	3,334	3,331	0	0	0	0
1930	5,042	5,042	5,043	5,045	5,048	5,048	5,048	0	0	0	0	4,880
1931	12,774	22,993	22,993	31,664	39,501	39,501	39,501	39,478	39,446	39,399	41,531	50,965
1932	59,499	65,022	24,042	22,211	12,491	7,761	4,476	3,230	0	0	0	0
1933	857	856	856	857	857	857	726	609	0	0	0	0
1934	0	0	-7,454	-7,636	-11,339	-5,404	-5,404	-5,401	-5,394	-5,385	-5,375	-5,369
1935	4,909	4,909	4,909	4,115	3,452	2,564	1,616	1,229	0	0	0	0
1936	5,042	9,645	9,584	10,586	10,263	8,805	7,427	0	0	0	0	0
1937	1,427	1,427	1,399	2,319	2,059	1,723	1,408	1,165	0	0	0	0
1938	2,949	3,870	3,225	5,130	5,132	5,088	4,490	0	0	0	0	0
1939	951	952	0	0	0	0	0	0	0	0	0	0
1940	0	0	-5,405	-8,660	-7,675	-6,451	-5,440	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	3,140	6,914	7,631	8,656	8,253	6,895	5,428	4,547	0	0	0	0
1950	1,902	1,903	-287	-287	-258	-217	-182	-153	0	0	0	0
1951	0	0	0	0	0	10,465	9,200	9,195	0	0	0	0
1952	0	920	1,872	937	938	938	938	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	1,013	-1,311	-1,310	-1,311	-1,147	-968	0	0	0	0	0
1957	0	921	2,823	1,874	1,875	1,874	1,874	0	0	0	0	0
1958	1,237	1,236	1,237	1,237	1,238	1,238	1,238	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	-6,606	-6,396	-4,880	-2,434	-2,430	-2,427	-2,423	-2,420
1961	-2,419	4,486	3,195	5,196	7,868	7,867	7,867	7,857	7,849	7,835	9,058	16,690
1962	27,430	29,824	39,337	46,045	50,402	50,402	50,402	-3,935	0	0	0	0
1963	1,332	3,173	3,697	-2,200	-2,201	-3,152	-4,073	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0
1965	2,188	2,188	-1,705	-1,706	-1,707	-1,707	-1,468	-1,288	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	1,903	1,904	1,905	1,904	1,905	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	2,188	7,804	8,327	8,332	8,338	8,337	10,455	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	2,663	5,518	12,178	15,995	18,594	18,593	18,593	18,570	18,519	25,610	28,656	34,379
1978	39,106	41,039	41,991	45,823	45,856	48,709	51,471	0	0	0	0	0
1979	0	-921	-921	-921	-922	0	0	0	0	0	0	0
1980	1,237	1,237	1,236	0	0	0	0	0	0	0	0	0
1981	0	921	920	2,824	4,544	4,544	4,544	4,542	0	0	0	0
1982	-1,236	-1,237	-3,139	-3,141	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	1,046	4,484	444	0	0	0	0	0	0
1987	0	-921	-920	-921	-921	-922	-922	-921	-921	-919	-918	-918
1988	320	3,174	3,174	9,930	15,091	15,092	15,091	15,083	7,673	7,664	10,794	20,268
1989	25,965	30,568	33,422	35,344	37,083	37,083	29,078	0	0	3,139	8,178	13,696
1990	18,445	18,446	18,446	18,454	21,129	21,129	21,129	0	0	5,042	12,647	19,082
1991	23,829	27,513	27,512	30,382	32,977	35,831	37,950	29,080	0	2,664	4,563	5,481
1992	6,430	9,192	13,948	15,859	18,447	19,493	20,689	0	4,880	4,874	7,723	9,557
1993	11,456	15,139	18,183	18,194	18,202	18,202	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	3,140	3,139	3,140	10,943	10,388	3,033	0	0	0	0	0	0
1996	1,903	982	982	32	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	3,387	4,250	3,914	4,425	4,767	4,646	4,512	1,545	875	1,093	1,421	2,068

Table 3.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP Desalination minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-11,721	-10,801	-10,801	-10,807	-10,814	-9,461	-7,978	-6,683	0	0	-2,188	-4,304
1922	-3,826	-3,826	-3,827	-10,488	-10,494	-10,495	-10,494	0	0	0	-2,188	-4,304
1923	-4,302	-3,381	-3,381	-3,384	-3,385	-18,703	-18,702	0	0	0	-2,188	-4,304
1924	-5,348	-5,348	-4,397	-3,449	-2,591	-8,394	-7,381	-5,875	-7,987	-10,166	-12,336	-14,439
1925	-15,383	3,951	19,173	13,382	-2,935	-18,251	-15,997	0	0	0	-2,188	-4,304
1926	-9,344	-14,961	-7,378	-13,185	-13,856	-29,748	-25,740	-20,682	0	-2,188	-4,374	-5,291
1927	-2,433	1,249	6,006	1,063	1,063	1,063	3,825	0	0	0	-2,188	-7,066
1928	-9,917	-8,997	-7,094	-11,854	-16,157	-18,429	-1,992	0	0	-2,188	-4,373	-9,249
1929	-12,099	-12,099	-11,147	-15,910	-20,216	-30,776	-32,893	-9,127	0	-2,188	-4,374	-6,488
1930	-3,631	15,703	35,682	29,899	24,674	9,358	7,240	0	0	-2,188	-4,373	-1,608
1931	4,101	8,704	15,791	18,655	16,947	11,144	9,026	6,833	4,709	2,516	2,513	9,875
1932	9,870	8,028	6,482	7,583	1,969	1,254	774	556	0	0	-2,188	-4,304
1933	-5,348	-7,190	-103	-7,714	-14,592	-25,152	-21,748	-18,212	0	0	-2,188	-4,304
1934	-6,490	-12,107	-27,204	-35,543	-53,055	-54,327	-26,202	-28,375	-30,460	-32,598	-34,729	-36,807
1935	-28,698	-9,364	10,614	8,905	7,189	-5,669	-3,693	-2,800	0	0	-2,188	-4,304
1936	-6,205	-6,205	817	-10,616	-10,621	-9,308	-7,868	0	0	0	-2,188	-4,304
1937	-6,681	-8,522	-7,589	-12,351	-10,948	-9,183	-7,653	-3,177	0	0	-2,188	-4,304
1938	-5,254	-4,333	-5,690	-11,401	-11,407	-11,406	-10,027	0	0	0	-2,188	-7,066
1939	-6,112	-5,191	-5,191	-8,998	-12,440	-23,000	3,808	0	0	-2,188	-4,373	-6,488
1940	-8,672	10,662	22,134	7,384	6,551	5,491	4,645	0	0	-2,188	-4,374	-6,488
1941	-6,484	-5,564	-1,783	-1,783	-1,522	-1,275	-972	-725	0	0	-2,188	-4,304
1942	-6,205	-6,205	-4,493	0	0	0	0	0	0	0	-2,188	-4,304
1943	-7,251	-10,934	-3,846	-3,849	-3,850	0	0	0	0	0	-2,188	-4,304
1944	-4,302	-3,381	-528	-5,285	-14,052	-29,369	-31,487	0	0	0	-2,188	-4,304
1945	-2,494	16,839	36,818	31,032	17,300	17,300	15,227	13,316	0	0	-2,188	-4,304
1946	-11,247	-13,088	-13,089	-13,096	-13,103	-11,224	-9,474	0	0	-2,188	-4,374	-6,487
1947	-7,436	-7,437	-9,340	-14,101	-18,406	-28,967	-31,084	0	0	-2,188	-4,374	-6,487
1948	-8,672	-14,288	-7,201	-13,007	-17,311	-17,405	-14,697	-12,307	0	0	-2,188	-4,304
1949	-3,351	-5,192	-4,475	-3,432	-3,841	-3,351	-2,795	-2,334	0	-2,188	-4,374	-9,250
1950	-11,148	8,187	26,984	8,828	7,795	6,539	5,395	4,522	0	-800	-2,988	-5,103
1951	-7,289	0	0	0	0	3,806	3,349	3,347	0	0	-2,188	-7,066
1952	-8,966	-8,045	-7,094	-3,551	-3,553	-3,553	-14,601	0	0	0	-2,188	-4,304
1953	-4,302	-3,381	-2,431	-2,431	-2,433	-17,749	-26	0	0	0	-2,188	-4,304
1954	-1,449	-527	2,327	-6,234	-13,284	-28,601	-30,718	0	-2,188	-4,373	-6,487	-9,249
1955	-4,677	14,657	29,879	11,725	-4,680	-10,484	-8,847	-7,393	0	-2,188	-4,374	-6,488
1956	-8,673	-13,276	-5,496	-5,498	-5,501	-4,809	-4,053	0	0	0	-2,188	-4,304
1957	-6,205	-5,284	-2,430	-8,140	-16,909	-27,470	-29,587	0	0	0	-2,188	-4,304
1958	-8,107	-10,870	-8,539	-12,349	-12,356	-12,356	-12,356	0	0	0	-2,188	-4,304
1959	-6,205	-5,285	-2,431	-10,993	-11,000	-26,317	-22,670	-8,156	-10,265	-12,438	-14,605	-16,706
1960	-18,884	449	20,428	14,640	38	-4,813	-3,674	-4,021	-6,133	-8,313	-10,486	-12,591
1961	-14,773	-13,484	2,724	-602	-8,336	-14,140	-16,258	-17,165	-19,262	-21,424	-22,338	-28,575
1962	-32,546	-29,784	-16,940	-14,575	-21,463	-39,634	-41,751	-3,935	0	0	-2,188	-7,066
1963	-10,964	-13,726	-10,871	-19,440	-19,451	-27,062	-32,587	0	0	0	-2,188	-4,304
1964	-11,247	-14,929	-13,978	-23,499	-32,104	-37,908	-37,610	-26,974	3,808	1,616	-574	-2,692
1965	-2,690	16,644	17,816	17,823	17,832	17,032	14,361	12,230	0	0	0	-4,880
1966	-6,780	-8,622	-2,408	-10,971	-16,941	-21,050	3,808	0	0	-2,188	-4,373	-6,488
1967	-8,672	-14,288	-6,677	-6,681	-6,685	-5,030	-7,792	0	0	0	-2,188	-4,304
1968	-7,825	-7,825	-738	-9,300	-17,038	-27,599	-29,716	0	0	-2,188	-4,374	-6,488
1969	-8,672	-11,434	-13,337	-13,345	-6,138	0	0	0	0	0	-2,188	-4,304
1970	-4,302	15,032	30,254	-3,935	-9,154	-7,203	-9,320	0	0	0	-2,188	-4,304
1971	-8,107	-9,948	-8,998	-9,002	-9,006	-19,566	-21,683	0	0	0	-2,188	-4,304
1972	-6,490	-12,106	-14,009	-18,774	-23,081	-28,885	-31,002	0	-2,188	-4,373	-6,487	-9,249
1973	-6,483	-6,484	1,127	1,127	1,129	1,128	-3,475	0	0	-2,188	-4,374	-9,249
1974	-11,149	-11,148	-11,149	0	0	0	0	0	0	0	-2,188	-7,066
1975	-6,111	13,222	33,201	21,709	13,988	10,183	10,183	3,935	0	0	-2,188	-4,304
1976	-4,303	-3,381	3,706	-2,951	-8,968	-14,771	-16,889	-19,067	-21,170	-23,332	-25,490	-27,578
1977	-27,086	-29,848	-25,091	-20,830	-23,427	-29,231	-31,348	-33,494	-35,540	-30,529	-23,325	-16,361
1978	-13,960	-16,262	-6,796	-10,130	-17,018	-22,727	-30,276	0	0	0	-2,188	-3,994
1979	-43	-43	908	-7,653	-7,657	0	0	0	0	-2,188	-4,373	-6,488
1980	-12,193	7,141	22,363	0	0	0	0	0	0	0	-2,188	-4,304
1981	-6,205	-5,284	1,803	-3,904	-9,062	-24,379	-24,378	-13,958	-3,808	-5,992	-8,173	-10,284
1982	-12,465	-16,148	-13,294	-13,299	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-2,946	0	0	0	0	-2,118
1984	0	0	0	0	0	-9,738	-11,659	0	0	0	0	-2,188
1985	-6,490	8,241	23,462	17,670	8,142	-2,418	-4,535	0	-2,188	-4,374	-6,487	-9,249
1986	-8,672	-14,288	-7,200	-11,962	-11,968	-3,491	0	0	0	0	-2,188	-4,304
1987	-6,205	-6,205	-5,253	-9,062	-12,504	-23,065	-25,182	-13,739	-4,299	-6,482	-8,662	-10,773
1988	-11,717	-14,479	-7,392	-6,445	-9,885	-15,688	-17,807	-19,984	3,808	-1,238	-5,043	-436
1989	516	-1,325	-374	-1,325	-2,185	-12,745	0	0	0	-4,757	-7,605	-233
1990	2,620	17,351	32,573	21,077	13,356	2,796	679	0	-2,854	-948	3,656	3,656
1991	8,411	8,412	11,265	18,883	20,612	6,342	6,342	345	0	-3,307	-6,158	-9,835
1992	-13,637	-10,875	-8,973	-14,876	-15,743	-32,866	-33,789	0	-498	-498	1,406	1,404
1993	1,404	6,007	7,145	7,153	7,156	0	0	0	0	0	-2,188	-4,304
1994	-6,205	-5,284	-2,430	-7,185	-15,785	-26,346	-28,463	0	-2,188	-4,374	-9,249	-12,439
1995	-13,049	6,285	26,264	23,615	15,333	3,033	0	0	0	0	0	-4,880
1996	-4,878	-4,877	-2,547	-3,499	0	0	0	0	0	0	-2,188	-7,066
1997	-11,820	-12,740	-12,741	0	0	-11,512	0	0	0	0	-2,188	-4,304
1998	-5,253	-7,095	-5,715	-5,719	-5,722	0	0	0	0	0	-2,188	-7,066
1999	-8,014	-8,014	-9,917	-18,484	-18,492	-18,493	-16,251	-661	0	0	-2,188	-7,066
2000	-8,966	-10,365	30,347	15,048	5,604	-7,905	-10,022	0	0	-2,188	-4,373	-9,250
2001	-14,954	-16,795	-9,707	-18,275	-26,878	-41,148	-43,266	0	-214	-2,402	-4,587	-6,701
2002	-9,551	-11,392	-10,250	-16,916	-22,941	-33,501	-35,619	0	0	-2,188	-4,374	-6,488
Avg (21-02)	-7,565	-4,464	1,028	-3,230	-6,416	-11,850	-10,858	-2,851	-1,553	-2,521	-4,353	-6,408

and that this difference could be more or less storage, but typically would be more storage. These years would be associated with drought periods. During drought periods, Hetch Hetchy Reservoir would typically have greater storage during the fall and winter, generally coincident with less diversion to the SJPL. Even during drought, Hetch Hetchy Reservoir could fill by the end of May, which would negate the relative gain in storage from carrying into the following summer. Figure 3.3-2 illustrates the difference in reservoir storage, averaged by year type, in comparing the variant to the WSIP setting. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 3.3-3 illustrates the same information in comparing the variant and base settings.

Figure 3.3-2

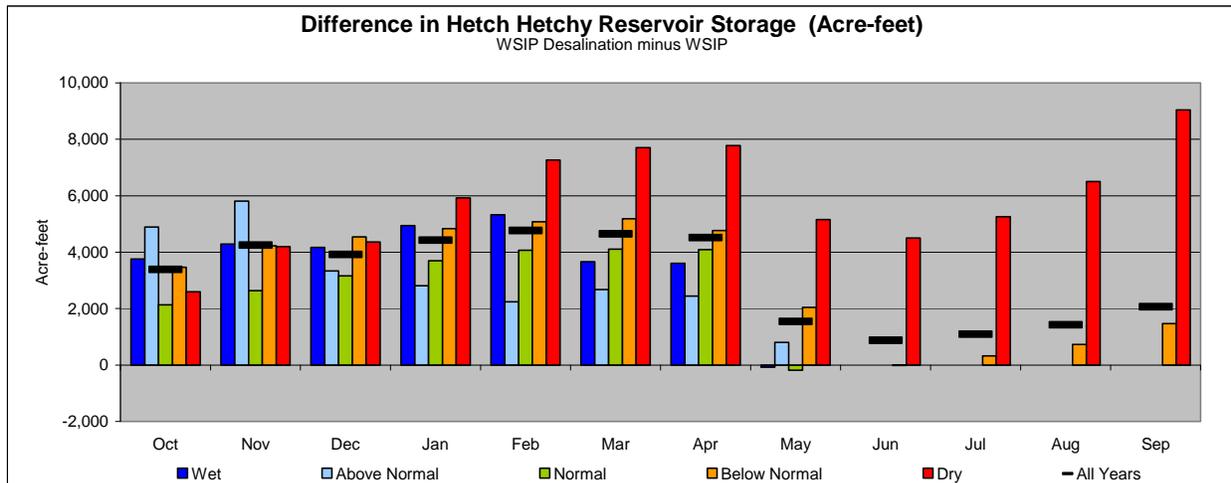
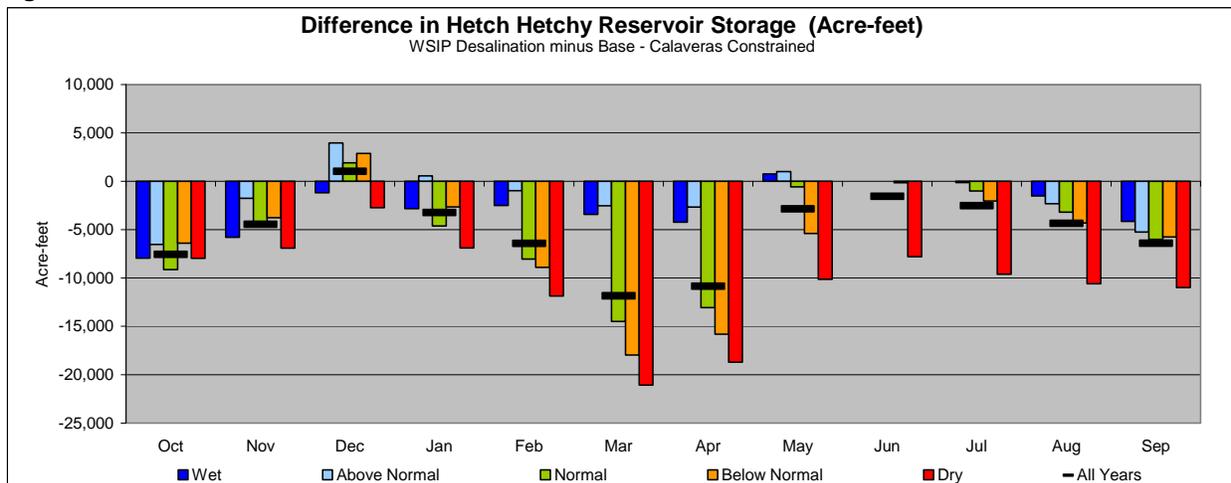
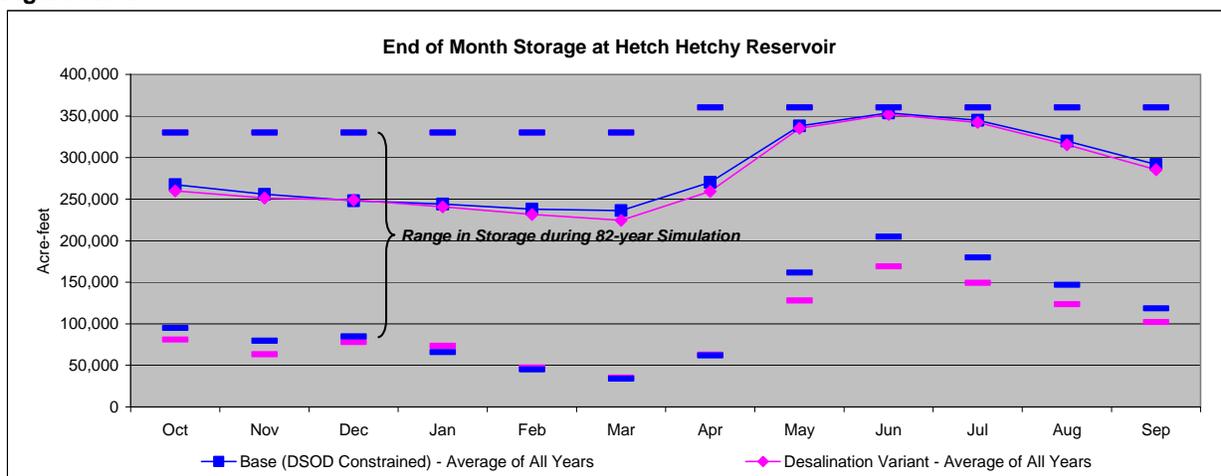


Figure 3.2-3



Compared to the base setting, Hetch Hetchy Reservoir storage would normally be the same during the summer, as diversions for the SJPL are at maximum in both settings. Similar to the WSIP setting, storage begins to be systematically lower in early fall into early winter as the effects of increased system purchases draw additional water from the reservoir. Average storage during the early winter would be approximately the same in both settings as system-wide maintenance in the variant setting decreases diversions to the SJPL compared to the base setting. During late winter and during spring, the variant would typically draw additional water from Hetch Hetchy to serve a larger purchase request and replenish Bay Area reservoirs. Figure 3.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 3.3-4



The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the variant would then manifest into differences in releases from O’Shaughnessy Dam to the stream. Compared to the WSIP, a lesser amount of available reservoir space in the winter and spring of some years due to the variant would lead to a lesser ability to regulate inflow, thus potentially increasing the amount of water released to the stream above minimum release requirements. Figure 3.3-1 illustrates the stream release from O’Shaughnessy Dam for the WSIP, variant, and base settings. Table 3.3-4 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant typically exhibits an incrementally larger stream release, predominantly during May or June, which reflects the months when releases to the stream above minimum release requirements are made in anticipation of filling the reservoir.

Table 3.3-4 illustrates the difference in stream release between the variant and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 3.3-5 illustrates the same form of information for the difference in stream release between the variant and base settings. Table 3.3-6 illustrates the same information and the average monthly stream release for the variant and WSIP settings, expressed in average monthly flow (cfs), and Table 3.3-7 illustrates the same form of information for the variant and base settings.

Table 3.3-4 illustrates that the difference in monthly flow below O’Shaughnessy Dam could range from an increase of approximately 30,000 acre-feet to a decrease of approximately 4,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful.³ When comparing the variant to the WSIP setting, a change in the volume of release from O’Shaughnessy Dam to the stream would likely result in the release being delayed or initiated earlier by a matter of days. Assuming that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day, the difference in stream release from O’Shaughnessy Dam between the variant and WSIP would be an earlier release up to 5 days or a delay of up to an added day. Normally, the effect of the delay in release would not affect the year’s peak stream release rate during a year. Comparing the variant and WSIP settings, a change (increase or decrease) in stream release would occur in approximately 32 percent of the years simulated.

Compared to the base setting, the variant’s effect to stream flow is very similar to the effect caused by the WSIP, but for years following drought the effect would be less. Assuming the type of effect to releases described above, releases above minimum requirements below the dam could be delayed by up to 7 days or initiated earlier by up to 2 days.

³ See “Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir”, Memorandum by Daniel B. Steiner, December 31, 2006.

Table 3.3-4

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP Desalination minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	1,707	0	0	0	0	1,707
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	29,036	0	0	0	0	29,036
1928	0	0	0	0	0	0	0	1,504	0	0	0	0	1,504
1929	0	0	0	0	0	0	0	0	3,546	0	0	0	3,546
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	3,554	0	0	0	3,226	0	0	0	6,780
1933	0	0	0	0	0	0	0	0	535	0	0	0	535
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	1,228	0	0	0	1,228
1936	0	0	0	0	0	0	0	6,494	0	0	0	0	6,494
1937	0	0	0	0	0	0	0	0	1,237	0	0	0	1,237
1938	0	0	0	0	0	0	0	3,920	0	0	0	0	3,920
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	-4,577	0	0	0	0	-4,577
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	-152	0	0	0	-152
1951	0	0	0	0	0	0	0	0	9,772	0	0	0	9,772
1952	0	0	0	0	0	0	0	938	0	0	0	0	938
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-847	0	0	0	0	-847
1957	0	0	0	0	0	0	0	1,874	0	0	0	0	1,874
1958	0	0	0	0	0	0	0	1,238	0	0	0	0	1,238
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	3,935	-4,171	0	0	0	-236
1963	0	0	0	0	0	0	0	-4,071	0	0	0	0	-4,071
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	-1,287	0	0	0	-1,287
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	1,937	0	0	0	0	1,937
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	10,450	0	0	0	0	10,450
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	16,331	0	0	0	0	16,331
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	445	0	0	0	0	0	445
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	30,146	0	0	0	0	30,146
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	30,103	0	0	0	30,103
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	0	0	43	0	5	1,220	537	0	0	0	1,806

Table 3.3-5

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP Desalination minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-6,676	0	0	0	-6,676
1922	0	0	0	0	0	0	0	-9,137	0	0	0	0	-9,137
1923	0	0	0	0	0	0	0	-18,692	0	0	0	0	-18,692
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-15,988	0	0	0	0	-15,988
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	4,073	0	0	0	0	4,073
1928	0	0	0	0	0	0	0	-2,114	0	0	0	0	-2,114
1929	0	0	0	0	0	0	0	0	-9,685	0	0	0	-9,685
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	3,554	0	0	0	555	0	0	0	4,109
1933	0	0	0	0	0	0	0	0	-15,982	0	0	0	-15,982
1934	0	0	0	0	0	0	-3,808	0	0	0	0	0	-3,808
1935	0	0	0	0	0	3,935	0	0	-2,796	0	0	0	1,139
1936	0	0	0	0	0	0	0	-6,870	0	0	0	0	-6,870
1937	0	0	0	0	0	0	0	-3,143	-3,366	0	0	0	-6,509
1938	0	0	0	0	0	0	0	-8,733	0	0	0	0	-8,733
1939	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1940	0	0	0	0	0	0	0	3,885	0	0	0	0	3,885
1941	0	0	0	0	0	0	0	0	-725	0	0	0	-725
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-31,469	0	0	0	0	-31,469
1945	0	0	0	0	0	0	0	0	13,305	0	0	0	13,305
1946	0	0	0	0	0	0	0	-8,285	0	0	0	0	-8,285
1947	0	0	0	0	0	0	0	-31,072	0	0	0	0	-31,072
1948	0	0	0	0	0	0	0	0	-12,293	0	0	0	-12,293
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	4,518	0	0	0	4,518
1951	0	-7,289	0	0	0	0	0	0	3,559	0	0	0	-3,730
1952	0	0	0	0	0	0	0	-14,595	0	0	0	0	-14,595
1953	0	0	0	0	0	0	0	-26	0	0	0	0	-26
1954	0	0	0	0	0	0	0	-30,705	0	0	0	0	-30,705
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-3,550	0	0	0	0	-3,550
1957	0	0	0	0	0	0	0	-29,575	0	0	0	0	-29,575
1958	0	0	0	0	0	0	0	-12,351	0	0	0	0	-12,351
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-37,719	-4,171	0	0	0	-41,890
1963	0	0	0	0	0	0	0	-33,134	0	0	0	0	-33,134
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	12,219	0	0	0	12,219
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1967	0	0	0	0	0	0	0	-8,319	0	0	0	0	-8,319
1968	0	0	0	0	0	0	0	-30,764	0	0	0	0	-30,764
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	-9,317	0	0	0	0	-5,382
1971	0	0	0	0	0	0	0	-22,371	0	0	0	0	-22,371
1972	0	0	0	0	0	0	0	-30,986	0	0	0	0	-30,986
1973	0	0	0	0	0	0	0	-3,474	0	0	0	0	-3,474
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	2,521	4,171	0	0	0	6,692
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-30,259	0	0	0	-310	-30,569
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-10,407	-10,310	0	0	0	-20,717
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-3,131	0	0	0	0	-3,131
1984	0	0	0	0	0	3,935	0	-11,653	0	0	0	0	-7,718
1985	0	0	0	0	0	0	0	-4,835	0	0	0	0	-4,835
1986	0	0	0	0	0	-8,478	-3,490	0	0	0	0	0	-11,968
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	364	0	0	0	364
1992	0	0	0	0	0	0	0	-28,918	0	0	0	0	-28,918
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-12,746	0	0	0	0	0	0	0	0	-12,746
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-13,491	-698	0	0	0	-14,189
2000	0	0	0	0	0	0	0	-10,019	0	0	0	0	-10,019
2001	0	0	0	0	0	0	0	-43,245	0	0	0	0	-43,245
2002	0	0	0	0	0	0	0	-36,682	0	0	0	0	-36,682
Avg (21-02)	0	-89	0	-107	43	-7	-182	-7,066	-434	0	0	-4	-7,846

Table 3.3-6

Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	3,378	3,031	3,124	10,248	4,917	5,165	8,572	149,794	270,553	125,059	11,310	5,316	600,466
Above Normal	3,400	5,305	5,435	4,033	5,145	5,772	7,808	74,508	185,012	23,302	7,686	5,316	332,720
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	78,550	113,227	10,299	7,513	5,123	242,198
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,212	36,625	43,815	6,927	6,818	4,345	122,546
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,340	9,662	8,504	5,285	5,285	3,861	53,125
All Years	3,351	3,614	3,449	4,514	3,904	4,506	6,158	69,480	123,983	33,709	7,711	4,793	269,172

Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	3,378	3,031	3,124	10,248	4,917	5,165	8,544	148,324	270,633	125,059	11,310	5,316	599,048
Above Normal	3,400	5,305	5,435	4,033	4,936	5,772	7,808	72,926	184,175	23,302	7,686	5,316	330,093
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	77,450	113,420	10,299	7,513	5,123	241,291
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,212	34,741	42,013	6,927	6,818	4,345	118,860
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,340	9,662	8,282	5,285	5,285	3,861	52,904
All Years	3,351	3,614	3,449	4,514	3,861	4,506	6,153	68,260	123,446	33,709	7,711	4,793	267,367

Difference in Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	WSIP Desalination minus WSIP Jul	Aug	Sep	WY Total
Wet	0	0	0	0	0	0	28	1,470	-80	0	0	0	1,417
Above Normal	0	0	0	0	209	0	0	1,581	837	0	0	0	2,627
Normal	0	0	0	0	0	0	0	1,100	-193	0	0	0	907
Below Normal	0	0	0	0	0	0	0	1,884	1,802	0	0	0	3,686
Dry	0	0	0	0	0	0	0	0	222	0	0	0	222
All Years	0	0	0	0	43	0	5	1,220	537	0	0	0	1,806

Table 3.3-7

Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	3,378	3,031	3,124	10,248	4,917	5,165	8,572	149,794	270,553	125,059	11,310	5,316	600,466
Above Normal	3,400	5,305	5,435	4,033	5,145	5,772	7,808	74,508	185,012	23,302	7,686	5,316	332,720
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	78,550	113,227	10,299	7,513	5,123	242,198
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,212	36,625	43,815	6,927	6,818	4,345	122,546
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,340	9,662	8,504	5,285	5,285	3,861	53,125
All Years	3,351	3,614	3,449	4,514	3,904	4,506	6,158	69,480	123,983	33,709	7,711	4,793	269,172

Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Base - Calaveras Constrained Jul	Aug	Sep	WY Total
Wet	3,378	3,031	3,124	11,045	4,917	5,695	8,790	154,853	269,789	125,059	11,310	5,335	606,325
Above Normal	3,400	5,733	5,435	4,033	4,936	5,309	7,808	78,261	183,990	23,302	7,686	5,316	335,208
Normal	3,343	3,235	3,051	3,109	4,128	4,557	5,817	90,958	113,833	10,299	7,513	5,123	254,966
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,436	46,628	45,681	6,927	6,818	4,345	134,639
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,816	13,790	9,991	5,285	5,285	3,861	59,217
All Years	3,351	3,703	3,449	4,621	3,861	4,514	6,340	76,545	124,417	33,709	7,711	4,797	277,018

Difference in Hetch Hetchy Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	WSIP Desalination minus Base - Calaveras Constrained Jul	Aug	Sep	WY Total
Wet	0	0	0	-797	0	-530	-218	-5,059	764	0	0	-19	-5,859
Above Normal	0	-429	0	0	209	463	0	-3,753	1,022	0	0	0	-2,488
Normal	0	0	0	246	0	0	0	-12,408	-606	0	0	0	-12,768
Below Normal	0	0	0	0	0	0	-224	-10,003	-1,866	0	0	0	-12,093
Dry	0	0	0	0	0	0	-476	-4,128	-1,488	0	0	0	-6,091
All Years	0	-89	0	-107	43	-7	-182	-7,066	-434	0	0	-4	-7,846

3.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different in the variant setting. Figure 3.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 3.4-1 are the results for the WSIP, variant, and base settings. The operation resulting from the variant is essentially the same as the WSIP, except during the prolonged drought of 1987-1992, and to a small extent during the other drought periods. The difference is explained as modeling discretion, and is not likely a difference that would occur in actual operations. HH/LSM model logic estimates the amount of water to be released from Lake Lloyd based on the condition of Hetch Hetchy Reservoir, Don Pedro Water Bank Account, and Lake Eleanor and Lake Lloyd storage in comparison to demands. In these instances, Hetch Hetchy Reservoir storage is different between the variant and the WSIP settings, typically slightly higher in the variant during drought. The model logic is not very refined, and a small change in computation result can result in a large difference in Lake Lloyd release (in this instance, through Holm Powerhouse). Overall, the Lake Lloyd operation would be discretionary and the outcome would likely be the same among the variant and the WSIP settings.

Figure 3.4-2 illustrates the almost identical operation of Lake Eleanor for the variant and WSIP settings. Also shown in Figure 3.4-2 is the operation for the base setting. Any difference that occurs in the Lake

**Figure 3.4-1
Lake Lloyd Storage and Stream Release**

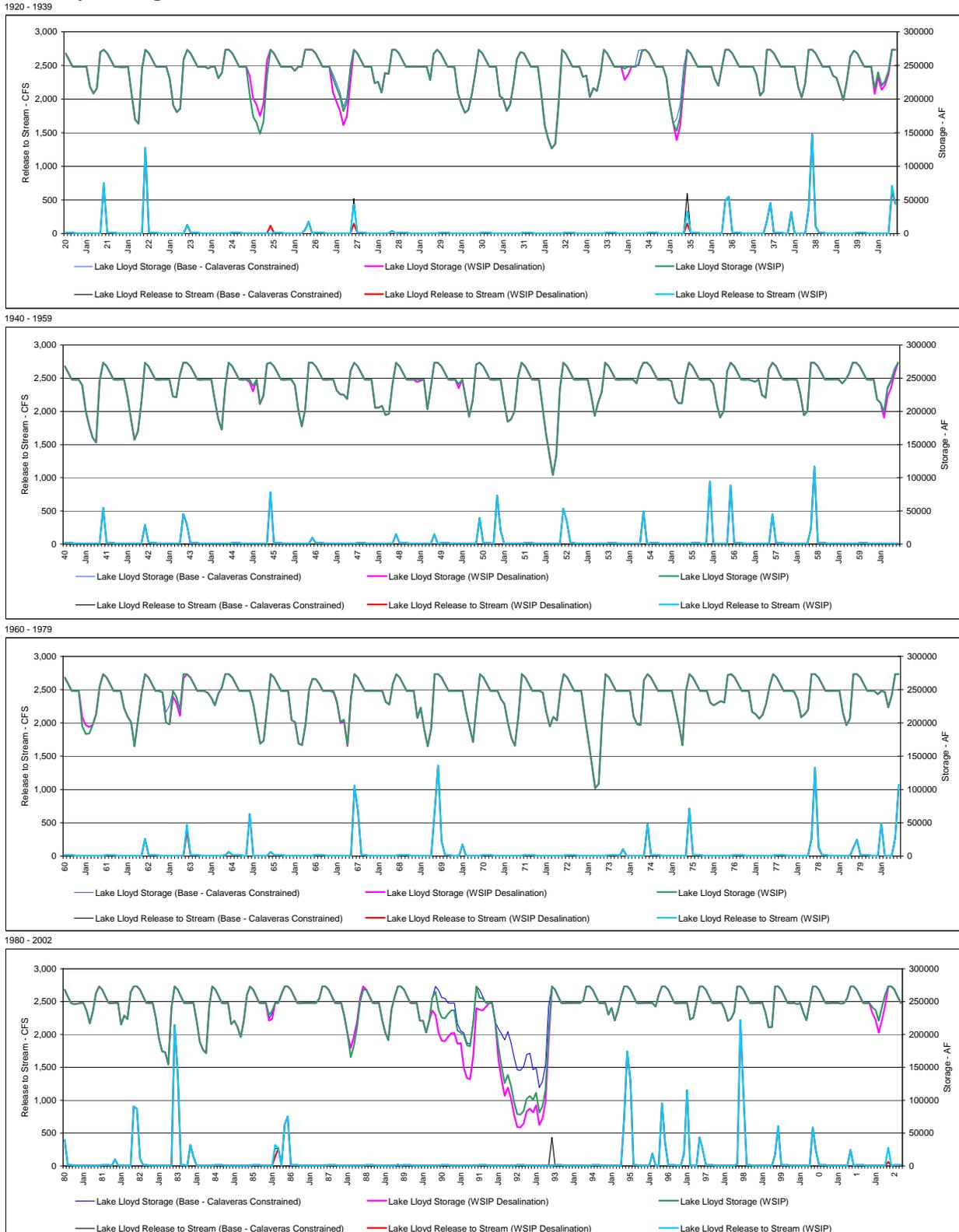
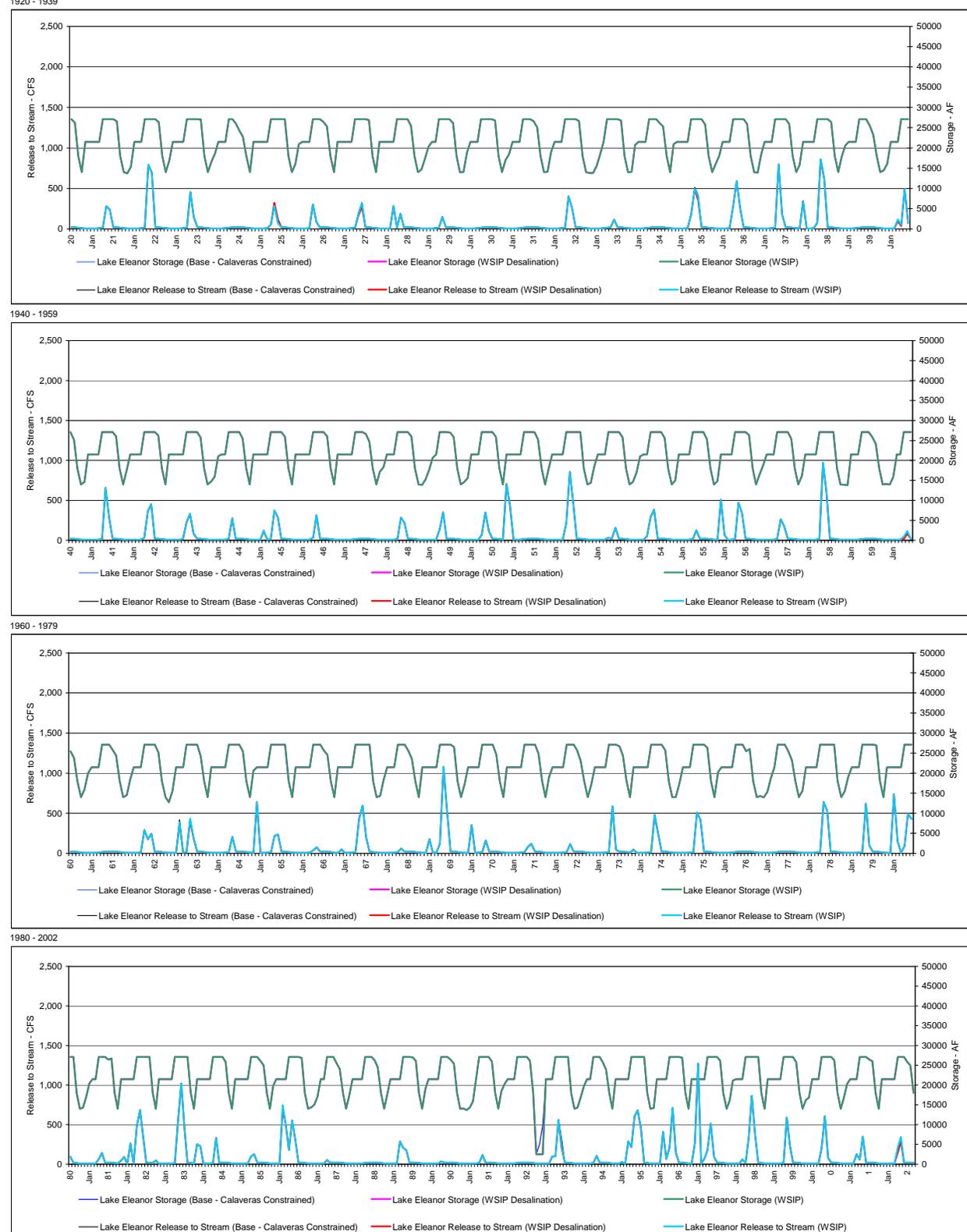


Figure 3.4-2
Lake Eleanor Storage and Stream Release



Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more associated with modeling discretion as opposed to any substantive difference in operation.

Supplementing the Figure 3.4-1 representation of Lake Lloyd stream releases is Table 3.4-1, illustrating releases for the variant and WSIP settings, and the difference in releases between the two. Table 3.4-2 provides the same form of information for the variant and base settings.

Table 3.4-1

Lake Lloyd Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP Desalination		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	334	653	8,227	6,566	754	1,319	298	17,483	62,808	22,325	953	922	122,642
Above Normal	307	4,282	1,525	307	870	307	298	9,999	24,492	993	953	922	45,256
Normal	307	298	307	953	278	307	298	5,917	10,046	953	953	922	21,540
Below Normal	307	298	307	307	278	307	485	2,383	2,551	951	951	920	10,045
Dry	307	298	307	307	278	307	298	307	298	949	949	918	5,524
All Years	312	1,193	2,105	1,654	494	505	337	7,193	19,880	5,130	952	921	40,676

Lake Lloyd Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	334	653	8,227	6,566	1,362	1,319	298	17,483	62,931	22,325	953	922	123,373
Above Normal	307	4,282	1,525	307	870	307	298	10,285	26,534	993	953	922	47,584
Normal	307	298	307	953	278	307	298	6,734	9,633	953	953	922	21,943
Below Normal	307	298	307	307	278	307	485	2,383	2,551	951	951	920	10,046
Dry	307	298	307	307	278	307	298	307	298	949	949	918	5,524
All Years	312	1,193	2,105	1,654	612	505	337	7,412	20,247	5,130	952	921	41,380

Difference in Lake Lloyd Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP Desalination minus WSIP		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	0	-608	0	0	0	-123	0	0	0	-731
Above Normal	0	0	0	0	0	0	0	-286	-2,043	0	0	0	-2,329
Normal	0	0	0	0	0	0	0	-817	414	0	0	0	-404
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	-119	0	0	-219	-367	0	0	0	-704

Table 3.4-2

Lake Lloyd Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP Desalination		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	334	653	8,224	6,566	754	1,319	298	17,483	62,808	22,325	953	922	122,642
Above Normal	307	4,282	1,525	307	870	307	298	9,999	24,492	993	953	922	45,256
Normal	307	298	307	953	278	307	298	5,917	10,046	953	953	922	21,540
Below Normal	307	298	307	307	278	307	485	2,383	2,551	951	951	920	10,045
Dry	307	298	307	307	278	307	298	307	298	949	949	918	5,524
All Years	312	1,193	2,105	1,654	494	505	337	7,193	19,880	5,130	952	921	40,676

Lake Lloyd Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											Base - Calaveras Constrained		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	334	653	8,224	6,566	1,179	1,319	298	17,483	64,530	22,325	953	922	124,786
Above Normal	307	4,282	1,525	307	870	307	298	10,222	27,767	993	953	922	48,754
Normal	307	298	307	953	278	307	298	6,734	9,633	953	953	922	21,943
Below Normal	307	298	307	307	278	307	485	2,383	2,551	953	953	922	10,051
Dry	307	298	307	307	278	307	298	307	298	953	953	922	5,535
All Years	312	1,193	2,104	1,654	577	505	337	7,399	20,814	5,131	953	922	41,901

Difference in Lake Lloyd Release to Stream (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP Desalination minus Base - Calaveras Constrained		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	3	0	-425	0	0	0	-1,722	0	0	0	-2,144
Above Normal	0	0	0	0	0	0	0	-223	-3,276	0	0	0	-3,499
Normal	0	0	0	0	0	0	0	-817	414	0	0	0	-404
Below Normal	0	0	0	0	0	0	0	0	0	-2	-2	-2	-5
Dry	0	0	0	0	0	0	0	0	0	-4	-4	-4	-11
All Years	0	0	1	0	-83	0	0	-206	-934	-1	-1	-1	-1,226

3.5 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 3.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 3.5-1 are the results for the WSIP, variant, and base settings.

Supplementing the Figure 3.5-1 representation of Don Pedro Reservoir storage are Table 3.5-1 Don Pedro Reservoir Storage (Desalination) and Table 3.5-2 Difference in Don Pedro Reservoir Storage (Desalination minus WSIP). Table 3.5-3 illustrates the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Figure 3.5-1 and Table 3.5-2 illustrate that, throughout many years, the storage in Don Pedro Reservoir in the variant setting would not differ greatly from storage in the WSIP setting. These periods generally occur during non-drought periods when the upstream operation of SFPUC facilities does not differ due to the absence of the TID/MID transfer. The differences primarily occur during periods of drought when a substitution of the desalination supply for the TID/MID transfer occurs. Any changes that do occur are due to the different inflow to the reservoir between the two settings in a month or series of months when Don Pedro Reservoir is below the flood control storage limitation and has an ability to regulate inflow with storage. When no storage difference occurs for months or other periods of time, either inflow to the reservoir did not change between the settings or the flood control storage limitation was reached and the change in inflow resulted in a change in release to the Tuolumne River below La Grange Dam (discussed later). As described above, the variant would divert less water from the Tuolumne River during drought than would occur in the WSIP setting, thus leading to less accumulated depletion of storage from Don Pedro Reservoir. However, the additional depletion effect in Don Pedro Reservoir is not completely eliminated when compared to the base setting.

The greatest draw down of reservoir storage occurs during the drought of the 1976-1977, which is not coincident with the year of greatest difference in reservoir draw between the base setting and either the WSIP or variant settings, the drought of the 1930s. Figure 3.5-2 illustrates the difference in reservoir storage, averaged by year type, in comparing the variant to the WSIP setting. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 3.5-3 illustrates the same information in comparing the variant and base settings.

Figure 3.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the variant would manifest in differences in releases from La Grange Dam to the stream. As opposed to the WSIP setting, less available reservoir space in the winter and spring due to the variant would lead to greater frequency of water released to the stream at levels above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow would directly manifest as a change in release from La Grange Dam. Figure 3.5-1 illustrates the stream release from La Grange Dam for the WSIP, variant, and base settings.

Table 3.5-4 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant typically exhibits an incrementally larger stream release, predominantly during early winter through June, which reflects the months when releases to the stream above minimum release requirements are made due to flood control or in anticipation of filling the reservoir. Table 3.5-5 illustrates the same information in comparing the variant and WSIP settings, with years ranked in descending order of the San Joaquin River Index. The table shows that differences in releases to the Tuolumne River from La Grange Dam occur only when there are releases above minimum FERC flow requirements. This typically occurs only in above normal and wet years, and predominantly during early winter through June. During other year types and during the summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting. Table 3.5-6 illustrates the difference in stream releases between the variant and base settings.

Figure 3.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

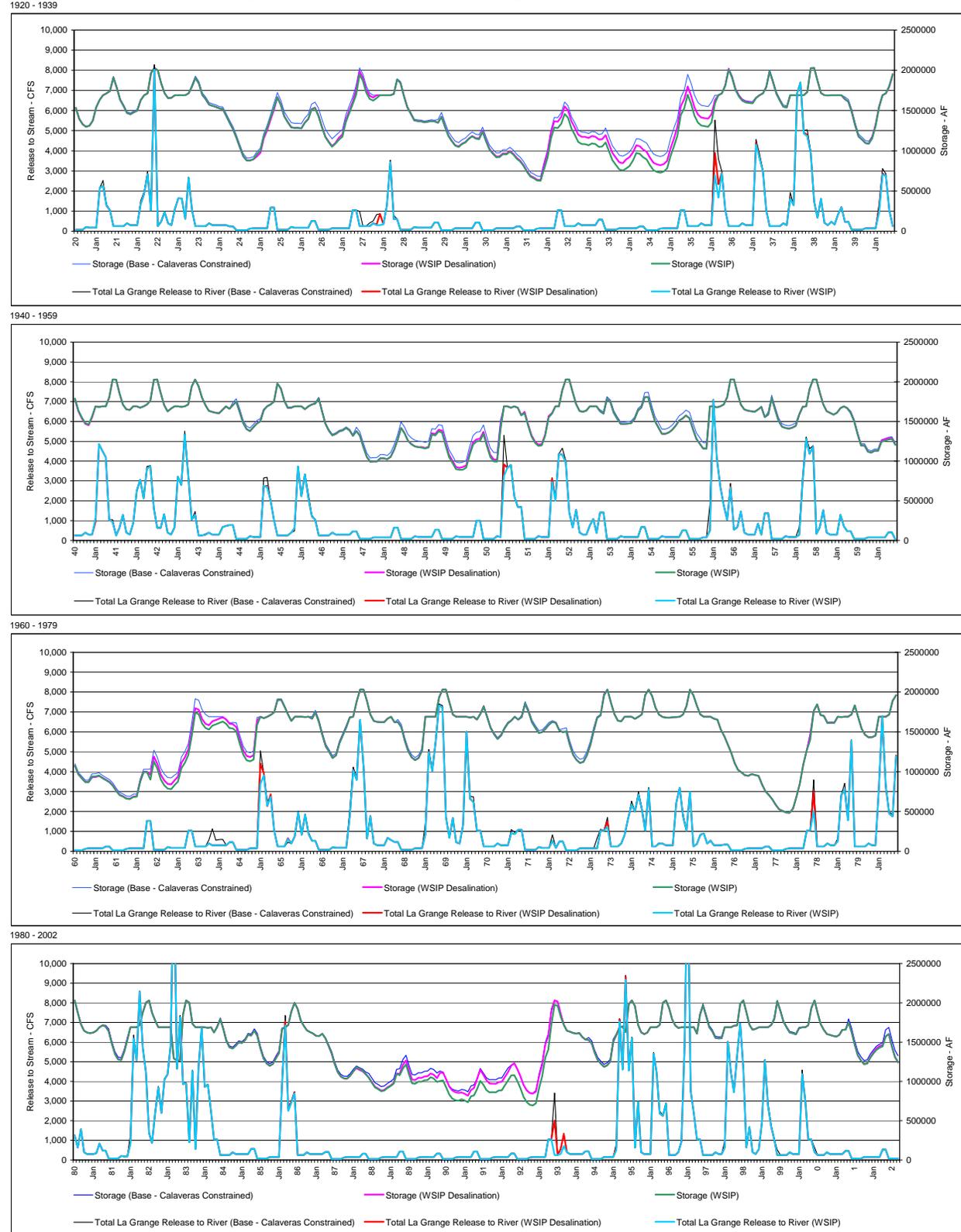


Table 3.5-1

Don Pedro Reservoir Storage (Acre-feet)

WSIP Desalination

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,271	1,910,239	1,780,368	1,632,093	1,555,504
1922	1,469,532	1,454,724	1,479,018	1,499,182	1,627,229	1,690,000	1,713,000	1,967,374	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,799,350	1,905,720	1,837,747	1,695,090	1,643,504
1924	1,573,662	1,557,997	1,543,979	1,525,572	1,520,285	1,435,601	1,350,582	1,268,108	1,160,641	1,041,842	933,176	878,997
1925	881,178	895,290	931,846	974,106	1,151,060	1,257,925	1,388,107	1,515,656	1,667,420	1,569,265	1,428,844	1,356,866
1926	1,293,003	1,284,656	1,285,092	1,279,004	1,349,662	1,395,445	1,516,853	1,535,534	1,438,028	1,298,502	1,176,256	1,112,466
1927	1,057,235	1,096,887	1,164,236	1,203,799	1,381,716	1,496,447	1,605,627	1,753,729	1,985,397	1,905,559	1,759,483	1,682,252
1928	1,660,901	1,690,000	1,689,999	1,690,000	1,689,998	1,690,000	1,705,499	1,883,712	1,846,350	1,682,693	1,540,227	1,462,294
1929	1,378,711	1,370,380	1,367,487	1,354,278	1,363,132	1,371,541	1,365,102	1,349,002	1,424,746	1,302,097	1,188,763	1,124,819
1930	1,068,682	1,052,515	1,088,029	1,108,021	1,151,992	1,183,433	1,156,568	1,153,914	1,246,156	1,129,746	1,024,939	972,053
1931	927,374	929,706	967,143	965,324	996,853	963,554	909,980	876,012	820,016	746,098	687,231	666,670
1932	640,513	635,369	816,597	971,200	1,225,265	1,367,335	1,361,561	1,419,938	1,550,732	1,502,987	1,366,923	1,289,724
1933	1,200,506	1,175,057	1,172,760	1,158,249	1,182,906	1,174,774	1,139,293	1,144,158	1,194,350	1,084,244	973,334	914,045
1934	856,446	844,643	893,199	920,392	980,563	1,068,636	1,056,034	1,013,568	986,884	912,707	850,865	831,247
1935	820,368	833,951	873,471	1,028,272	1,152,727	1,294,297	1,553,524	1,640,469	1,798,164	1,682,512	1,537,356	1,450,063
1936	1,413,664	1,405,171	1,399,264	1,452,789	1,628,755	1,690,000	1,713,000	1,815,837	2,014,345	1,915,939	1,765,962	1,683,103
1937	1,629,780	1,608,457	1,601,950	1,595,882	1,657,878	1,690,000	1,713,000	1,792,456	1,988,308	1,853,643	1,707,521	1,622,804
1938	1,548,681	1,540,119	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,640,415	1,609,719	1,486,211	1,318,984	1,177,264	1,138,511
1940	1,096,286	1,089,016	1,166,352	1,322,462	1,546,901	1,690,000	1,713,000	1,797,680	1,944,734	1,779,072	1,628,893	1,540,317
1941	1,469,734	1,453,431	1,552,744	1,689,994	1,683,062	1,690,000	1,690,000	1,803,805	2,030,000	2,027,570	1,857,440	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,745	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,706,915	1,749,631	1,623,011	1,481,354	1,403,951
1945	1,379,320	1,427,347	1,477,717	1,508,008	1,644,340	1,690,000	1,713,000	1,750,416	1,978,550	1,915,470	1,761,285	1,673,403
1946	1,675,574	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,277	1,790,756	1,626,434	1,470,843	1,384,452
1947	1,325,252	1,341,690	1,375,016	1,387,235	1,418,025	1,387,541	1,319,689	1,380,202	1,321,263	1,180,658	1,055,313	992,092
1948	995,855	997,122	1,035,745	1,034,871	1,022,941	1,055,025	1,146,212	1,267,720	1,417,634	1,352,869	1,259,478	1,215,157
1949	1,185,933	1,175,442	1,177,951	1,166,449	1,179,606	1,349,863	1,340,884	1,395,525	1,383,963	1,221,582	1,078,398	1,015,493
1950	925,411	915,323	925,485	945,157	1,102,443	1,237,499	1,275,073	1,282,104	1,369,722	1,220,281	1,080,022	1,021,444
1951	1,018,758	1,430,600	1,689,995	1,689,971	1,673,951	1,690,000	1,672,636	1,579,686	1,619,718	1,466,235	1,326,380	1,246,991
1952	1,205,614	1,213,315	1,334,908	1,565,446	1,605,688	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,598,044	1,787,718	1,742,953	1,609,936	1,534,967
1954	1,469,181	1,468,382	1,472,024	1,478,824	1,527,793	1,637,361	1,675,192	1,807,461	1,807,613	1,647,557	1,501,608	1,423,171
1955	1,343,773	1,343,524	1,361,809	1,394,386	1,444,656	1,510,283	1,537,906	1,575,778	1,541,339	1,405,813	1,280,713	1,222,079
1956	1,159,157	1,157,788	1,690,000	1,689,941	1,678,244	1,690,000	1,713,000	1,806,151	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,587,922	1,795,177	1,647,938	1,508,055	1,434,387
1958	1,418,027	1,410,472	1,423,180	1,446,139	1,586,653	1,683,533	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,329	1,608,068	1,505,552	1,340,406	1,197,054	1,196,761
1960	1,118,856	1,107,432	1,130,660	1,130,349	1,259,387	1,275,928	1,287,863	1,287,845	1,207,869	1,077,205	968,431	919,175
1961	871,285	870,491	930,440	932,133	948,188	923,951	898,840	871,784	828,635	763,925	710,303	690,995
1962	665,046	659,956	687,691	691,636	878,736	999,844	999,980	961,550	1,190,017	1,099,040	961,986	889,906
1963	846,254	840,178	890,501	935,573	1,111,580	1,179,637	1,279,440	1,509,426	1,797,369	1,777,626	1,661,304	1,602,347
1964	1,583,605	1,633,140	1,648,808	1,666,929	1,683,419	1,653,465	1,600,898	1,597,117	1,558,312	1,403,132	1,267,934	1,196,877
1965	1,183,279	1,206,562	1,641,957	1,689,964	1,671,265	1,690,000	1,713,000	1,746,379	1,907,054	1,909,101	1,819,617	1,723,006
1966	1,638,048	1,690,000	1,689,998	1,689,996	1,685,990	1,690,000	1,666,206	1,743,752	1,626,487	1,462,463	1,318,853	1,248,271
1967	1,172,366	1,205,898	1,361,691	1,460,706	1,558,538	1,680,329	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,623,382	1,560,682	1,393,610	1,258,193	1,180,490
1969	1,144,074	1,173,385	1,262,868	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,036	1,816,534	1,686,506	1,549,469	1,471,343
1971	1,411,316	1,454,230	1,541,278	1,607,186	1,641,597	1,690,000	1,654,817	1,685,672	1,853,567	1,753,420	1,619,836	1,550,260
1972	1,488,043	1,496,591	1,540,187	1,590,658	1,628,525	1,611,472	1,517,554	1,495,198	1,504,521	1,466,809	1,215,475	1,148,834
1973	1,110,158	1,123,168	1,205,238	1,334,033	1,513,648	1,676,096	1,707,479	1,967,503	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,536	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,823,045	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,455,404	1,761,000	1,845,304	1,711,347	1,699,327
1979	1,612,045	1,615,120	1,614,177	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,303	1,682,304	1,538,286	1,461,691
1980	1,430,288	1,433,000	1,453,035	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,714,087	1,699,430	1,640,799	1,479,790	1,351,278	1,283,100
1982	1,274,224	1,381,134	1,531,878	1,689,994	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,612	1,791,967	1,663,838	1,517,244	1,433,830
1985	1,418,807	1,453,917	1,498,296	1,488,884	1,523,939	1,592,019	1,585,122	1,645,091	1,583,355	1,422,894	1,291,292	1,227,399
1986	1,200,412	1,221,603	1,301,584	1,370,256	1,670,077	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,677	1,709,305
1987	1,650,170	1,628,126	1,609,576	1,578,456	1,577,656	1,606,514	1,550,992	1,452,961	1,354,101	1,222,918	1,114,556	1,061,284
1988	1,038,561	1,037,658	1,073,842	1,127,662	1,169,858							

Table 3.5-2

Difference in Don Pedro Reservoir Storage (Acre-feet)

WSIP Desalination minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	-27,234	-27,241	-26,605	-26,595	-26,307	-21,012	2,292	2,282	2,273	2,264
1926	2,260	2,258	2,259	2,259	2,259	2,259	3,325	6,216	6,966	6,935	6,904	6,880
1927	6,866	6,862	27,702	27,710	27,713	27,702	27,675	56,202	37,308	37,147	36,984	36,867
1928	36,792	34,565	97	0	0	0	0	1,414	1,408	1,402	1,396	1,392
1929	1,389	1,388	1,388	1,388	1,388	1,388	1,386	1,382	4,701	4,680	4,658	4,643
1930	4,633	4,630	4,631	4,632	4,632	4,631	4,626	9,652	9,621	9,577	9,533	9,500
1931	9,479	9,473	9,474	9,476	9,478	9,474	9,464	9,438	9,404	9,359	9,314	9,282
1932	9,263	9,258	46,721	57,352	71,558	77,307	80,515	85,535	92,321	91,905	91,481	91,170
1933	90,982	90,931	90,935	90,961	90,968	90,934	90,978	90,858	91,152	90,738	90,310	89,988
1934	89,792	89,739	114,073	109,382	101,103	95,130	95,036	94,783	94,442	93,987	93,537	93,209
1935	93,007	92,952	92,956	93,782	94,458	108,864	109,704	111,994	101,452	101,013	100,559	100,220
1936	100,010	99,953	100,019	100,004	39,769	0	0	7,414	7,390	7,358	7,325	7,302
1937	7,287	7,284	7,312	7,346	2,886	0	0	240	1,403	1,396	1,390	1,385
1938	1,383	1,381	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	1	0	0	0	0	0
1940	0	0	13,333	15,582	6,431	0	0	-10,273	-10,239	-10,195	-10,151	-10,117
1941	-10,096	-10,092	-10,091	1	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	3,935	7,933	4,142	0	0	-190	-881	-878	-874	-871
1946	-870	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	7,748	7,785	8,859	14,970	16,422	19,440	26,020	25,900	25,781	25,694
1950	25,639	25,623	33,750	27,821	27,794	27,743	27,680	27,580	27,331	27,204	27,080	26,989
1951	26,930	36,120	-1	0	0	0	1,264	3,447	14,722	14,655	14,588	14,538
1952	14,508	14,499	14,500	15,440	6,178	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	1,219	0	0	0	0
1957	0	0	0	0	0	0	0	1,872	1,866	1,857	1,849	1,844
1958	1,840	1,839	1,839	1,839	736	294	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	15,660	19,561	16,308	8,425	2,377	2,366	2,355	2,347
1961	2,341	2,340	-8,989	-8,992	-5,092	4,595	4,590	4,578	4,561	4,540	4,517	4,501
1962	4,491	4,489	4,489	4,490	4,491	4,489	4,489	61,844	60,737	60,462	60,178	59,962
1963	59,832	59,797	59,800	59,818	68,643	68,618	68,552	62,158	55,304	55,066	54,828	54,647
1964	54,537	54,506	54,509	54,524	54,528	54,509	54,457	54,319	54,136	53,890	53,638	53,459
1965	53,349	53,319	57,215	-9	-1,034	0	0	1,721	2,268	2,258	2,249	-3
1966	-4	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	2,101	2,102	2,101	840	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	13,098	0	0	1	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	54,318	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	4,531	4,511	4,489	4,474
1982	4,465	4,462	4,462	-1	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	8,396	12,060	-2	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	-13,661	-13,655	-8,065	-5,697	2,418	7,395	7,360	7,334
1989	7,318	7,313	7,314	7,316	7,317	7,314	15,309	46,483	48,439	48,220	47,998	47,832
1990	47,730	47,703	47,705	47,719	47,722	47,705	47,659	103,602	103,244	102,768	102,271	101,910
1991	101,688	101,628	86,828	82,710	81,671	81,640	93,104	128,227	142,790	127,200	126,599	113,918
1992	107,905	107,725	107,729	107,725	107,734	107,693	125,622	152,263	151,740	151,041	150,314	149,782
1993	149,457	149,364	149,370	149,197	149,096	167,095	171,402	171,151	53,066	52,838	36,792	-59
1994	-59	-59	-59	-59	-59	-59	-59	-59	-59	-58	-59	-58
1995	-58	-58	-58	-58	-1,201	0	7,633	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	8,993	14,804	18,218	20,250	16,447	-44	-45	-44	-44	-43
Avg (21-02)	13,464	13,551	13,721	13,254	12,316	12,252	12,917	16,507	14,685	14,497	14,237	13,563

Table 3.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet)												WSIP Desalination minus Base - Calaveras Constrained
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-197	-197	-197	-197	-79	0	0	-3,473	-12,241	-14,370	-14,308	-14,262
1922	-14,232	-14,224	-14,224	-14,228	-5,692	0	0	-9,834	0	-2,184	-1,520	3
1923	3	2	0	0	0	0	0	-20,855	-22,900	-24,983	-24,874	-24,795
1924	-24,744	-24,731	-24,732	-24,740	-24,741	-24,732	-27,837	-31,450	-31,342	-31,201	-31,053	-30,941
1925	-30,873	-30,855	-58,090	-58,106	-57,473	-57,451	-61,765	-76,450	-55,074	-57,014	-56,755	-56,563
1926	-56,444	-56,412	-56,909	-56,926	-57,127	-56,530	-62,599	-69,662	-92,170	-91,749	-91,323	-91,018
1927	-90,829	-90,779	-63,344	-63,361	-63,366	-63,343	-63,283	-62,217	-44,603	-46,596	-45,748	-36,049
1928	-29,099	0	0	0	0	0	0	-7,501	-11,656	-13,732	-13,612	-13,567
1929	-13,539	-13,531	-13,532	-13,536	-13,537	-13,531	-13,519	-39,386	-50,468	-50,237	-50,005	-49,837
1930	-49,734	-49,707	-49,709	-49,723	-49,726	-49,708	-49,661	-44,492	-46,453	-46,245	-46,034	-45,876
1931	-45,777	-45,751	-45,753	-45,767	-45,770	-45,752	-45,707	-45,580	-45,415	-45,200	-44,981	-44,819
1932	-44,723	-44,697	-39,347	-35,981	-32,771	-47,453	-49,043	-52,594	-55,629	-57,563	-57,301	-57,105
1933	-56,986	-56,954	-56,956	-56,973	-56,977	-56,956	-62,420	-67,960	-88,004	-89,790	-89,378	-89,068
1934	-88,873	-88,820	-58,832	-65,817	-70,629	-79,889	-88,882	-107,979	-109,404	-108,897	-108,372	-107,986
1935	-107,749	-107,685	-107,690	-122,465	-135,613	-101,712	-105,707	-113,082	-151,429	-152,955	-152,285	-151,781
1936	-151,470	-151,385	-151,326	-151,352	-61,235	0	0	-10,039	-12,121	-14,253	-14,190	-14,145
1937	-14,117	-14,108	-14,090	-14,094	-5,357	0	0	-9,496	-17,505	-19,614	-19,527	-19,466
1938	-19,426	-19,415	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	-28,912	-27,223	-29,245	-29,111	-28,977
1940	-28,821	-28,805	-14,741	-11,785	-2,992	0	0	-4,098	-8,956	-8,917	-8,878	-8,849
1941	-8,831	-8,827	-9,754	1	52	0	0	-3,095	0	-2,183	-1,521	3
1942	3	3	0	1	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	-5,036	0	-2,183	-2,174	4
1944	3	4	4	3	2	0	0	-33,617	-35,622	-37,653	-37,484	-37,358
1945	-37,280	-37,259	-33,326	-29,338	-10,768	0	0	-475	10,004	7,777	7,743	7,719
1946	7,704	0	0	0	0	0	0	-11,642	-13,718	-13,660	-13,598	-13,552
1947	-13,524	-13,515	-13,516	-13,520	-13,521	-13,516	-13,503	-46,684	-48,636	-48,412	-48,190	-48,027
1948	-47,926	-47,899	-47,900	-47,914	-47,918	-53,609	-58,380	-62,784	-76,952	-78,784	-78,417	-78,151
1949	-77,990	-77,947	-70,201	-70,212	-69,143	-60,096	-62,709	-63,003	-65,114	-64,814	-64,519	-64,300
1950	-64,163	-64,126	-61,384	-62,967	-78,346	-87,620	-88,508	-89,591	-86,883	-87,868	-87,468	-87,173
1951	-86,992	-89,627	2	0	0	0	-1,660	-394	1,686	-505	-502	-501
1952	-500	-500	-500	-4,047	-1,618	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	-19,831	-21,992	-24,036	-26,115	-26,002	-25,917
1954	-25,863	-25,849	-25,850	-25,858	-25,859	-25,849	-25,826	-58,616	-60,536	-60,276	-60,006	-59,807
1955	-59,681	-59,648	-59,650	-59,667	-59,673	-59,651	-61,818	-65,543	-76,078	-75,736	-75,387	-75,129
1956	-74,974	-74,933	2	-1	0	0	0	-6,896	0	0	0	0
1957	0	0	0	0	0	0	0	-31,723	-33,734	-35,773	-35,613	-35,494
1958	-35,420	-35,400	-35,401	-35,412	-14,166	-5,663	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	-5,763	-22,415	-22,340	-22,239	-22,134
1960	-22,016	-22,003	-22,004	-22,010	-9,798	-7,297	-11,805	-18,561	-22,845	-22,741	-22,636	-22,558
1961	-22,508	-22,494	-42,810	-42,823	-38,925	-29,226	-29,196	-30,376	-30,267	-30,123	-29,979	-29,872
1962	-29,803	-29,787	-29,789	-29,798	-29,801	-29,789	-29,760	-72,179	-80,452	-82,273	-81,895	-81,608
1963	-81,428	-81,380	-65,589	-53,167	-72,609	-72,583	-72,512	-108,904	-117,033	-118,707	-118,189	-117,810
1964	-106,395	-56,860	-41,192	-23,069	-6,580	-6,578	-8,986	-21,751	-54,498	-54,253	-54,002	-53,819
1965	-53,709	-53,680	-39,631	5	3	0	0	3,069	16,176	13,923	11,678	-18
1966	-19	0	0	0	353	0	-26,964	-25,281	-27,313	-27,191	-27,066	-26,973
1967	-26,918	-26,903	-24,803	-24,810	-24,813	-9,017	0	0	0	0	-2,183	3
1968	4	4	4	3	2	0	0	-31,853	-33,860	-33,707	-33,550	-33,438
1969	-33,369	-33,351	-33,352	5	0	0	0	0	0	0	0	0
1970	0	0	0	-3	1,189	0	0	-11,491	-13,567	-15,692	-15,622	-15,570
1971	-15,538	-15,528	-15,530	-15,534	-6,215	0	0	-23,835	-25,871	-27,941	-27,820	-27,728
1972	-27,672	-27,656	-27,657	-27,665	-11,067	-11,064	-11,053	-44,157	-46,121	-45,911	-45,697	-45,544
1973	-45,450	-45,424	-45,426	-45,439	-45,444	-13,904	-10,121	-13,091	0	0	0	0
1974	0	0	0	1	1	0	0	652	0	-2,184	-2,174	3
1975	4	4	3	3	1	0	0	1,198	0	-2,184	-1,521	2
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-33,070	0	-2,183	-2,174	-2,476
1979	-8,317	-8,313	-8,313	1	1	0	0	0	-2,114	-2,105	-2,096	-2,089
1980	-2,084	-2,084	-2,083	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-2,117	-14,691	-26,879	-26,760	-26,638	-26,546
1982	-26,489	-26,475	-26,476	4	0	0	0	0	0	0	-2,183	0
1983	0	0	0	0	0	0	0	0	0	0	-2,183	3
1984	0	0	0	0	0	0	-197	-14,020	-16,088	-18,202	-18,121	-18,060
1985	-18,023	-18,013	-18,014	-18,019	-18,020	-18,013	-17,996	-24,665	-26,696	-26,576	-26,453	-26,363
1986	-26,308	-26,294	-23,458	-17,884	-10,524	0	0	0	0	-2,183	-2,174	-2,167
1987	-2,163	-2,161	-2,162	-2,162	-2,162	-2,162	-2,159	-15,753	-27,225	-27,100	-26,977	-26,886
1988	-26,830	-26,815	-26,816	-26,823	-26,826	-26,815	-26,790	-26,721	-52,478	-52,239	-51,991	-51,808
1989	-51,694	-51,663	-51,663	-51,681	-51,685	-51,666	-66,471	-66,300	-66,070	-65,773	-65,472	-65,250
1990	-65,115	-65,077	-65,081	-65,099	-65,105	-65,080	-65,017	-22,960	-3,033	-3,020	-3,005	-16,882
1991	-22,228	-22,215	-37,806	-49,466	-51,873	-51,852	-40,252	-3,002	-17,000	-21,860	-30,584	-45,788
1992	-51,453	-51,541	-51,543	-51,596	-51,599	-51,580	-3,223	-3,214	-3,203	-3,190	-3,174	-3,162
1993	-3,156	-3,154	-17,135	-32,732	-32,739	-26,096	-30,969	-31,673	0	-2,184	-1,520	3
1994	3	2	2	2	3	3	3	-30,594	-32,603	-32,455	-32,303	-32,194
1995	-32,127	-32,109	-32,111	-32,120	-14,027	0	0	-1,570	0	0	-2,184	3
1996	4	3	4	4	0	0	0	0	0	-2,183	-2,174	-2,167
1997	-2,163	0	0	0	0	0	-13,622	-15,774	-17,837	-19,944	-19,858	-19,794
1998	-19,754	-19,744	-19,745	3	0	0	1,472	0	0	0	0	0
1999	0	0	0	0	0	0	0	-20,597	-9,823	-11,964	-11,912	-11,874
2000	-11,850	-11,844	-11,844	-11,847	0	0	0	-12,191	0	0	0	0
2001	0	0	0	0	0	0	0	-45,377	-47,131	-46,922	-46,706	-46,548
2002	-46,447	-46,422	-37,431	-31,633	-28,223	-26,174	-29,932	-84,049	-85,883	-85,500	-85,107	-84,814
Avg (21-02)	-27,733	-26,860	-23,737	-22,065	-19,520	-17,097	-18,342	-26,735	-27,907	-28,711	-28,781	-28,836

Figure 3.5-2

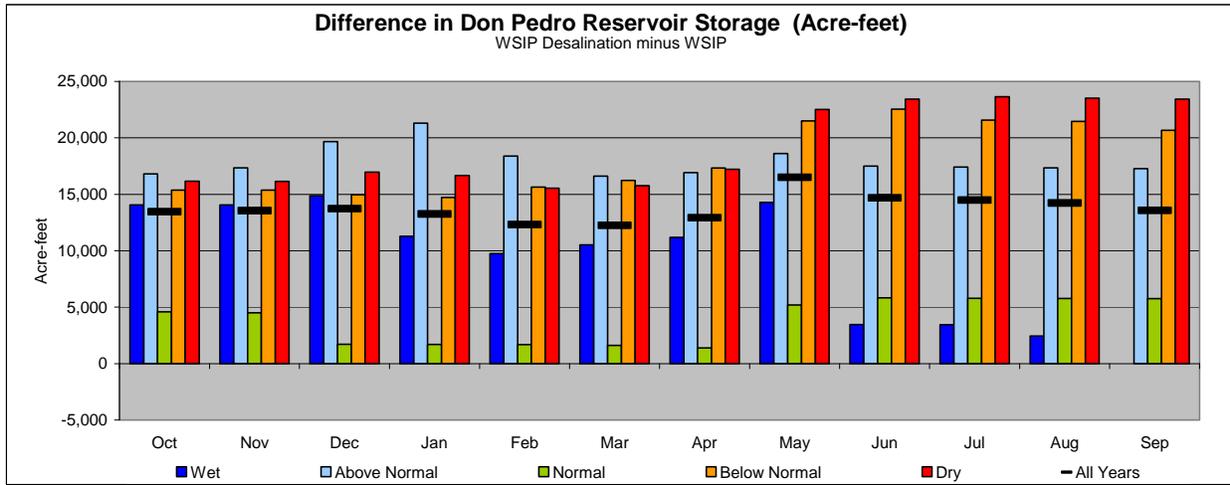


Figure 3.5-3

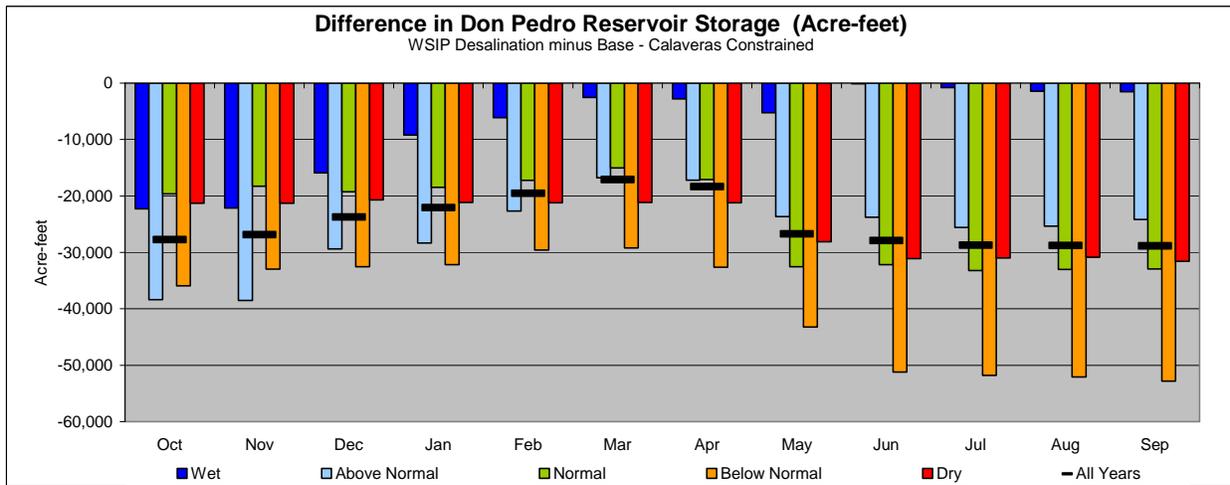


Figure 3.5-4

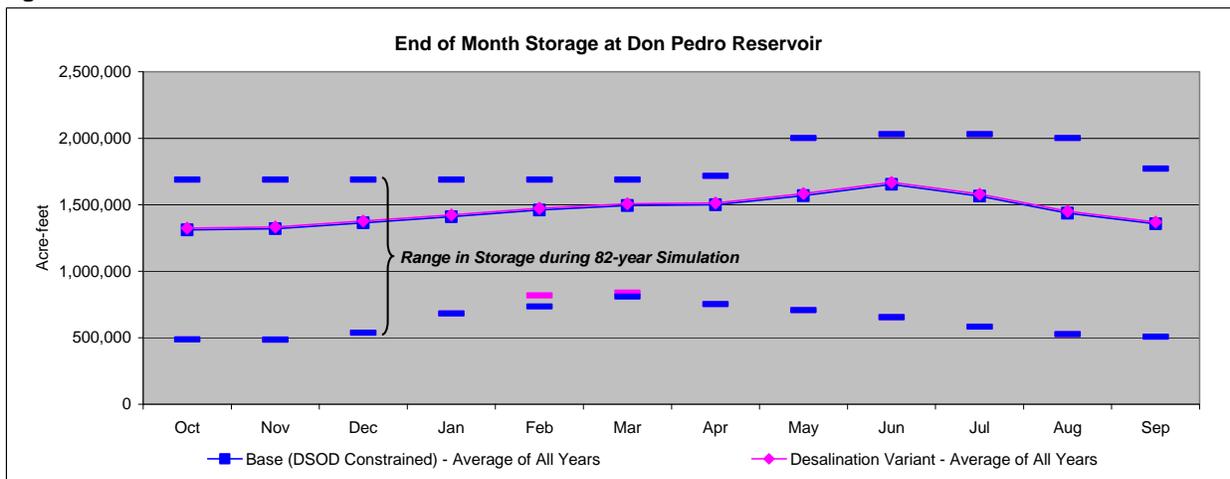


Table 3.5-4

Difference in Total La Grange Release to River (Acre-feet)												WSIP Desalination minus WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	2,208	34,469	97	0	0	0	0	0	0	0	0	36,774
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	61,428	41,220	1,378	0	0	0	0	0	104,026
1937	0	0	0	0	4,721	2,080	316	0	0	0	0	0	7,117
1938	0	0	2,027	0	0	45	2,439	4,487	0	0	0	0	8,998
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	8,162	4,075	-1,036	0	0	0	0	0	11,201
1941	0	0	0	-10,095	1	1	0	0	0	0	0	0	-10,093
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-3,260	4,141	0	0	0	0	0	0	881
1946	0	-869	0	0	0	0	0	0	0	0	0	0	-869
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	36,122	0	0	0	0	0	0	0	0	0	36,122
1952	0	0	0	0	9,265	6,176	0	937	0	0	0	0	16,378
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	2,323	0	0	2,690	-178	0	3,335	0	0	0	8,170
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	1,103	441	294	1,237	0	0	0	0	3,075
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	62,939	6,182	-1,034	7,587	0	0	0	0	2,249	77,923
1966	0	-4	0	0	0	0	0	0	0	0	0	0	-4
1967	0	0	0	0	0	1,261	839	1,904	-2,100	0	0	0	1,904
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	15,654	0	0	0	15,654
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	57,081	0	0	0	57,081
1979	0	0	0	0	0	-921	0	0	0	0	0	0	-921
1980	0	0	0	1,237	0	-1,903	0	0	0	0	0	0	-666
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	4,464	-3,143	0	0	0	0	0	0	0	1,321
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-4	11,648	5,968	3,140	3,038	0	0	0	23,790
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	104,600	15,852	36,792	0	157,244
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	7,029	6,155	0	9,526	1,842	0	0	0	24,552
1996	0	0	0	0	31	0	0	0	0	0	0	0	31
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	16	914	715	1,116	928	215	259	2,237	0	193	476	7,069

Table 3.5-5

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

WSIP Desalination minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	7,029	6,155	0	9,526	1,842	0	0	0	24,552
1938	0	0	2,027	0	0	45	2,439	4,487	0	0	0	0	8,998
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	4,464	-3,143	0	0	0	0	0	0	0	1,321
1967	0	0	0	0	0	1,261	839	1,904	-2,100	0	0	0	1,904
1952	0	0	0	0	9,265	6,176	0	937	0	0	0	0	16,378
1958	0	0	0	0	1,103	441	294	1,237	0	0	0	0	3,075
1980	0	0	0	1,237	0	-1,903	0	0	0	0	0	0	-666
1978	0	0	0	0	0	0	0	0	57,081	0	0	0	57,081
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	2,323	0	0	2,690	-178	0	3,335	0	0	0	8,170
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	-10,095	1	1	0	0	0	0	0	0	-10,093
1986	0	0	0	0	-4	11,648	5,968	3,140	3,038	0	0	0	23,790
1993	0	0	0	0	0	0	0	0	104,600	0	15,852	36,792	157,244
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	31	0	0	0	0	0	0	0	31
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	4,721	2,080	316	0	0	0	0	0	7,117
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	62,939	6,182	-1,034	7,587	0	0	0	0	2,249	77,923
1936	0	0	0	0	61,428	41,220	1,378	0	0	0	0	0	104,026
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	-921	0	0	0	0	0	0	-921
1945	0	0	0	0	-3,260	4,141	0	0	0	0	0	0	881
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	-869	0	0	0	0	0	0	0	0	0	0	-869
1973	0	0	0	0	0	0	0	0	15,654	0	0	0	15,654
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	8,162	4,075	-1,036	0	0	0	0	0	11,201
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	36,122	0	0	0	0	0	0	0	0	0	36,122
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	2,208	34,469	97	0	0	0	0	0	0	0	0	36,774
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-4	0	0	0	0	0	0	0	0	0	0	-4
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.5-6

Difference in Total La Grange Release to River (Acre-feet)													WSIP Desalination minus Base - Calaveras Constrained
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	-118	-15,701	-3,600	0	0	0	0	0	-19,419
1922	0	0	0	0	-8,537	-5,691	-7,365	-5,684	-14,697	0	-655	-1,521	-44,150
1923	0	0	3	0	0	0	-2,117	0	0	0	0	0	-2,114
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-43,828	0	-644	-9,569	-54,041
1928	-6,886	-29,091	0	0	0	-5,339	-10,773	0	0	0	0	0	-52,089
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-90,125	-77,855	-3,557	0	0	0	0	0	-171,537
1937	0	0	0	0	-10,148	-10,926	-3,371	0	0	0	0	0	-24,445
1938	0	0	-16,917	0	0	0	-6,904	-15,064	-4,880	-2,189	0	0	-45,954
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-17,410	-15,145	-6,320	0	0	0	0	0	-38,875
1941	0	0	0	-9,757	-314	-194	-304	0	-6,578	0	-655	-1,520	-19,322
1942	0	0	2	-4,495	0	-3,805	-5,524	-2,855	-2,762	-2,188	0	0	-21,627
1943	0	0	0	0	0	-11,461	-4,879	0	-9,907	0	0	-2,173	-28,420
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1945	0	0	0	0	-25,623	-26,084	-45	0	0	0	0	0	-51,752
1946	0	7,702	0	0	0	-13,392	-3,867	0	0	0	0	0	-9,557
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-89,630	2	0	0	0	0	0	0	0	0	-89,628
1952	0	0	0	0	-2,428	-1,618	0	-19,638	-4,879	-2,188	0	0	-30,751
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-78,911	2	0	-1,644	-2,872	0	-9,647	-2,188	0	0	-95,260
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-21,247	-8,500	-5,661	-15,301	-2,854	-2,188	0	0	-55,751
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-49,491	-15,670	-18,132	-16,489	0	0	0	0	0	0	0	-110,971
1965	0	0	0	-39,643	4	-14,514	6,354	0	0	0	0	11,678	-36,121
1966	0	-19	-4,311	0	-2,121	-6,099	0	0	0	0	0	0	-12,550
1967	0	0	0	0	0	-20,299	-9,013	-7,789	-2,100	-2,188	0	-2,184	-43,573
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1969	0	0	0	-33,361	-7,207	-6,138	-7,641	-5,043	-4,879	-2,188	0	0	-66,457
1970	0	0	0	21,837	-7,145	-16,079	0	0	0	0	0	0	-1,387
1971	0	0	0	0	-9,321	-6,213	0	0	0	0	0	0	-15,534
1972	0	0	0	0	-16,599	0	0	0	0	0	0	0	-16,599
1973	0	0	0	0	0	-31,528	-3,772	0	-12,609	0	0	0	-47,909
1974	0	0	0	-11,155	1	-8,562	-5,524	-5,694	-4,229	0	0	-2,174	-37,337
1975	0	0	0	0	2	1	-8,286	0	248	0	-655	-1,520	-10,210
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-35,776	0	0	0	-35,776
1979	0	0	0	-8,316	0	-20,024	-2,118	-2,189	0	0	0	0	-32,647
1980	0	0	0	5,071	-1	-10,465	-4,880	-5,042	-4,880	-2,188	0	0	-22,385
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-26,483	-13,302	-2,663	0	-2,854	-2,762	-2,188	0	-4,297	-54,549
1983	-2,949	-1,841	2,664	0	0	0	0	-5,799	-2,762	-2,188	0	-2,183	-15,058
1984	-7,155	0	0	0	0	3,935	0	0	0	0	0	0	-3,220
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-15,784	-19,000	-5,332	-1,902	-1,841	0	0	0	-43,859
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-83,362	0	-655	-1,521	-85,538
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-12,209	-1,724	0	-3,471	-1,841	-2,188	0	-2,183	-23,616
1996	0	0	0	0	-3,497	0	-6,721	-2,188	-2,118	0	0	0	-14,524
1997	0	-2,162	0	-12,747	2	0	0	0	0	0	0	0	-14,907
1998	0	0	0	-19,751	3	-6,674	-8,839	-2,430	-3,774	-2,188	0	0	-43,653
1999	0	0	0	0	0	-9,514	-5,004	0	-16,264	0	0	0	-30,782
2000	0	0	0	0	-11,848	0	0	0	-14,290	0	0	0	-26,138
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-344	-913	-2,473	-1,914	-3,554	-4,548	-1,560	-1,255	-3,576	-320	-40	-234	-20,732

Table 3.5-4 illustrates the difference in stream release between the variant and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 3.5-7 illustrates the same information and the average monthly stream release for the variant and WSIP setting, expressed in average monthly flow (cfs). Table 3.5-4 illustrates that the difference in monthly flow below La Grange Dam could range from an increase of approximately 105,000 acre-feet to a minor decrease of approximately 3,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful. Assuming that a change in release volume equates to a delay or earlier initiation of a 6,000 acre-feet release per day, the difference in stream release from La Grange Dam between the variant and WSIP settings would be an almost unnoticeable delay in release or up to an added 18 days of release when compared to the WSIP (and possibly more, depending on the management of spills at Don Pedro Reservoir over a period of time).

Normally, the effect of reduced releases would not affect the year's peak stream release rate during a year. However, infrequently, the variant's effect on stream releases could manifest as an elimination of all flow above minimum FERC flow requirements within a month. This would occur after the experience of an extended drought period. Comparing the variant and WSIP settings, a change (increase or decrease) in stream release would occur in approximately 28 percent of the years simulated. Compared to the base setting, the variant's effect to stream flow is similar to the effect caused by the WSIP, but following drought would be less.

Compared to the base setting, there would be some reduction of release, but a lesser effect than occurs in the WSIP setting. Table 3.5-6 illustrates that the difference in monthly flow below La Grange Dam could range from an increase of approximately 13,000 acre-feet to a decrease of approximately 43,000 acre-feet. Using the same assumption described above for the effect of a changed release, compared to the base setting, the variant setting would result in release changes ranging from an additional 2 days of release to a decrease of 7 days of release in excess of minimum release requirements. Table 3.5-8 illustrates the releases to the Tuolumne River below La Grange Dam and their differences for the variant and base settings, provided in terms of average monthly flow (cfs) averaged within year types.

Table 3.5-7

Total La Grange Release to River (CFS)											
(Average within Year Type - Grouped by SJR Index Year Type)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP Desalination
Wet	429	371	794	2,058	3,453	4,006	3,363	3,093	3,489	1,283	Sep
Above Normal	291	515	1,144	1,270	2,241	1,757	1,537	1,346	322	240	240
Below Normal	284	273	417	318	635	630	943	943	75	75	75
Dry	337	260	272	262	437	421	497	497	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50
All Years	327	334	613	991	1,674	1,732	1,587	1,468	1,120	457	233
Total La Grange Release to River (CFS)											
(Average within Year Type - Grouped by SJR Index Year Type)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP
Wet	429	371	791	2,018	3,434	3,987	3,351	3,079	3,372	1,283	Sep
Above Normal	291	516	1,109	1,270	2,171	1,710	1,537	1,346	306	240	240
Below Normal	284	270	370	318	635	630	943	943	75	75	75
Dry	337	260	272	262	437	421	497	497	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50
All Years	327	334	599	979	1,654	1,717	1,584	1,464	1,083	457	229
Difference in Total La Grange Release to River (CFS)											
(Average within Year Type - Grouped by SJR Index Year Type)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	WSIP Desalination minus WSIP
Wet	0	0	3	40	19	19	12	14	117	0	Sep
Above Normal	0	-1	35	0	70	46	0	0	15	0	0
Below Normal	0	3	47	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	15	12	20	15	4	4	38	0	3

Table 3.5-8

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												WSIP Desalination
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	429	371	794	2,058	3,453	4,006	3,363	3,093	3,489	1,283	514	1,292
Above Normal	291	515	1,144	1,270	2,241	1,757	1,537	1,346	322	240	240	240
Below Normal	284	273	417	318	635	630	943	943	75	75	75	75
Dry	337	260	272	262	437	421	497	497	73	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50	50
All Years	327	334	613	991	1,674	1,732	1,587	1,468	1,120	457	233	460
Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	431	374	857	2,161	3,524	4,096	3,424	3,161	3,634	1,300	516	1,299
Above Normal	298	507	1,230	1,257	2,402	1,969	1,568	1,348	408	240	240	249
Below Normal	294	314	422	318	653	654	958	943	75	75	75	75
Dry	351	324	292	285	482	421	497	497	73	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50	50
All Years	333	350	654	1,022	1,738	1,806	1,613	1,489	1,180	463	233	464
Difference in Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												WSIP Desalination minus Base - Calaveras Constrained
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	-2	-3	-63	-103	-71	-91	-61	-68	-144	-18	-2	-7
Above Normal	-7	8	-86	13	-161	-212	-30	-2	-86	0	-1	-9
Below Normal	-9	-41	-6	0	-17	-24	-15	0	0	0	0	0
Dry	-14	-64	-20	-23	-46	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-6	-15	-40	-31	-64	-74	-26	-20	-60	-5	-1	-4

3.6 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

There are only a few modeled differences in Calaveras Reservoir operations between the variant and WSIP settings. Figure 3.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 3.6-1 are the results for the WSIP, variant, and base settings. Generally, the differences in reservoir storage are partially due to the dependence on modeling assumptions to balance total Bay Area reservoir storage among the five major SFPUC reservoirs and to balance storage between the Bay Areas reservoirs and Hetch Hetchy. The model balances storage between reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary input in the model, and the logic and relative percentages are meant to mimic the current practice and discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security. Generally, during drought, the draw of water for deliveries from Hetch Hetchy is lessened with the variant (compared to the WSIP setting), leaving Bay Area reservoir storage less drawn upon due to conveyance limitations. During these circumstances, some of the storage gain is proportionately left in Calaveras Reservoir.

The notable difference in storage between the variant and WSIP settings is during the drought of the 1960s; Calaveras Reservoir storage is modeled to be lower in the variant than in the WSIP setting. This circumstance is primarily the result of modeling assumptions for the balancing of storage among Calaveras Reservoir and San Antonio Reservoir. For the results that indicate Calaveras Reservoir storage is lower than the WSIP setting, the results will coincidentally indicate that San Antonio Reservoir storage is higher than in the WSIP setting. There is little net difference in combined storage for the two reservoirs in comparison to the WSIP setting. It is concluded that little, if any, difference in Calaveras Reservoir storage occurs between the variant and WSIP settings, except for slight increases during drought. The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Figure 3.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 3.6-1
Calaveras Reservoir Storage and Stream Release

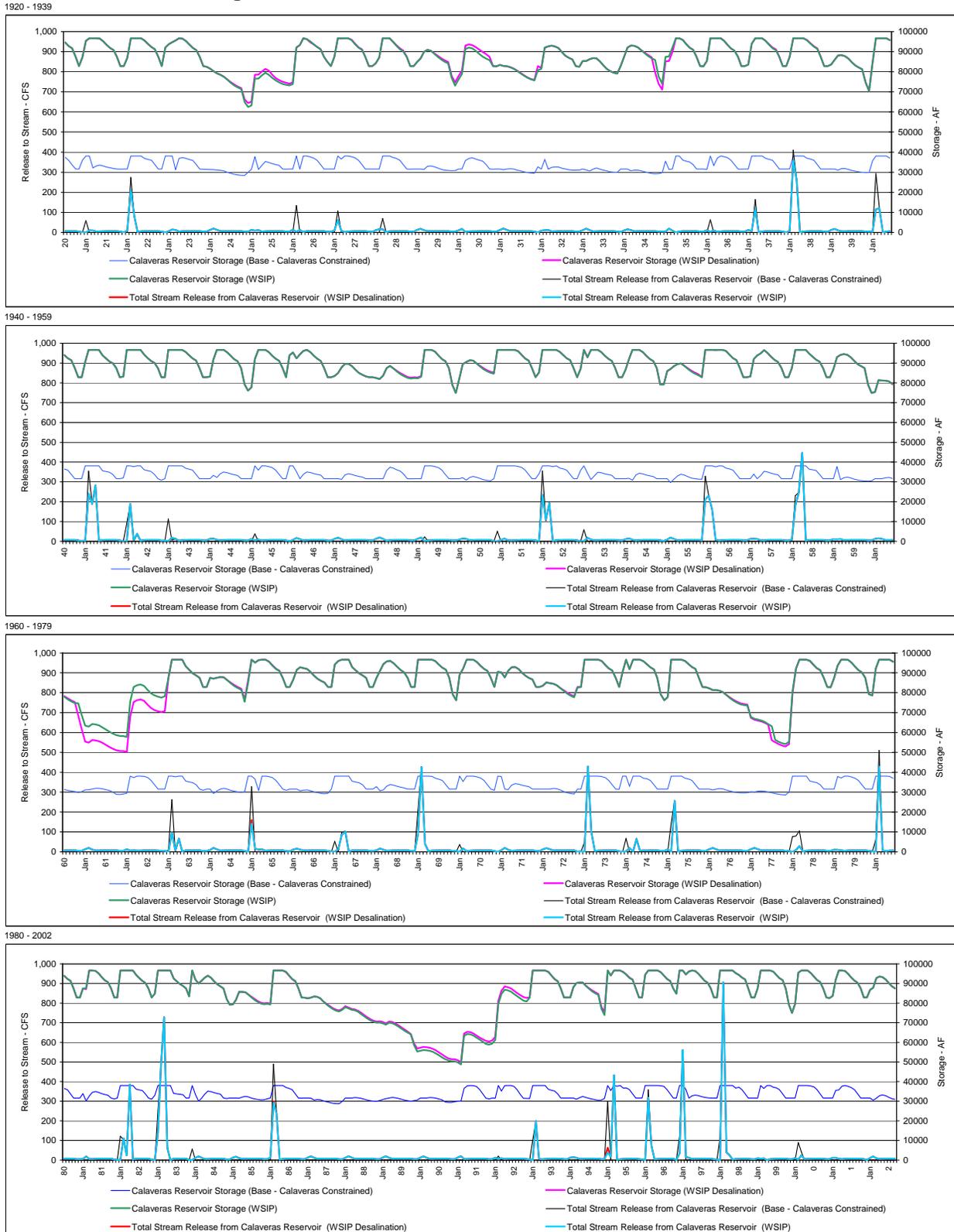
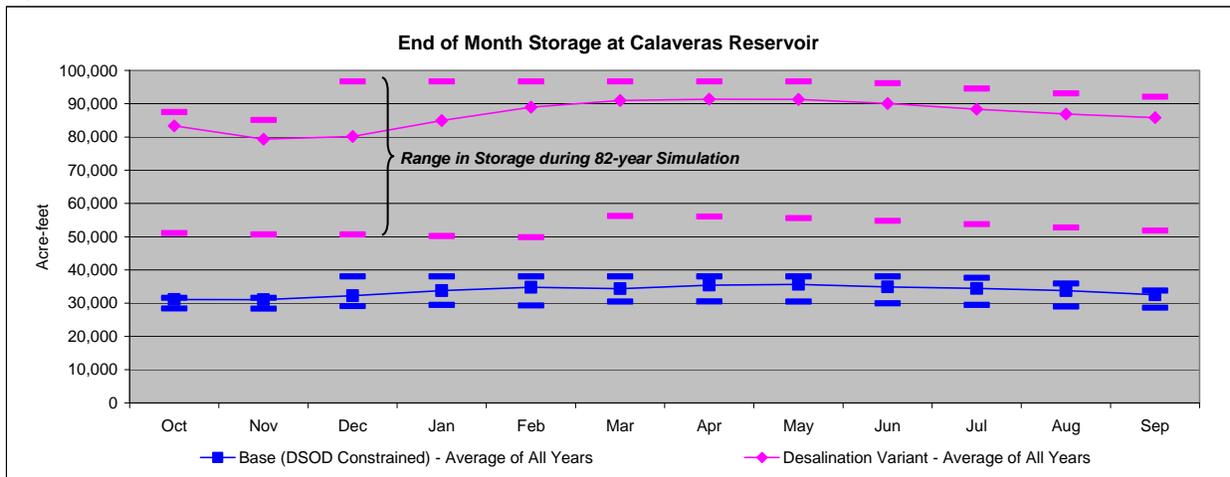


Figure 3.6-2



There is essentially no change in releases (i.e., infrequent slight increases) to Calaveras Creek below Calaveras Dam between the variant and WSIP settings. Both settings have fishery releases that are not included in the base setting. Table 3.6-1 illustrates the difference in releases to Calaveras Creek between the variant and WSIP settings. Supplementing the Figure 3.6-1 representation of Calaveras Dam stream releases and Table 3.6-1 is Table 3.6-2, illustrating releases for the variant and WSIP settings, and the difference in releases between the two. Table 3.6-3 provides the same form of information for the variant and base settings. The notable difference in releases between the variant and base settings is the addition of the flows representing the 1997 MOU and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There is essentially no change (minor differences during 5 months of the 82-year simulation) in Alameda Creek diversions to Calaveras Reservoir between the variant and the WSIP settings. With almost no change in Calaveras Reservoir storage between the two settings, there would be no change in the diversion operation at the Alameda Creek Diversion Dam. Water would only be diverted to Calaveras Reservoir when the diversion would not contribute to releases in excess of minimum required flows below Calaveras Dam. Coincidentally, with no change in the diversion at Alameda Creek Diversion Dam, flow spilling past the diversion dam would experience no differences between the variant and WSIP settings. Table 3.6-4 illustrates the flow below the Alameda Creek Diversion Dam for the variant and base settings. The notable difference between the variant and base settings is the reduction of wetter-year water flowing past the diversion dam. This occurs because, in the variant setting, the restoration of Calaveras Reservoir storage allows a greater frequency of diversion from Alameda Creek to Calaveras Reservoir.

Table 3.6-1

Water Year	Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)											WSIP Desalination minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	-85	0	0	0	0	0	0	0	-85
1940	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	1,180	0	0	0	0	0	0	0	0	1,180
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	463	0	0	0	0	0	0	0	463
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	1,598	0	0	0	0	0	0	0	0	1,598
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	0	34	5	0	0	0	0	0	0	0	38

Table 3.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	429	246	1,065	5,183	15,157	10,007	5,085	255	387	417	425	415	39,073
Above Normal	425	258	172	875	3,657	2,849	650	327	396	423	428	417	10,877
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	387	1,591	4,242	2,921	1,323	350	403	426	428	417	13,186

Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	429	246	1,065	5,083	15,133	10,007	5,085	255	387	417	425	415	38,949
Above Normal	425	258	172	806	3,657	2,849	650	327	396	423	428	417	10,807
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	387	1,557	4,238	2,921	1,323	350	403	426	428	417	13,148

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus WSIP Sep	WY Total
Wet	0	0	0	100	24	0	0	0	0	0	0	0	123
Above Normal	0	0	0	69	0	0	0	0	0	0	0	0	69
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	34	5	0	0	0	0	0	0	0	38

Table 3.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	429	246	1,065	5,183	15,157	10,007	5,085	255	387	417	425	415	39,073
Above Normal	425	258	172	875	3,657	2,849	650	327	396	423	428	417	10,877
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	387	1,591	4,242	2,921	1,323	350	403	426	428	417	13,186

Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep	WY Total
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus Base - Calaveras Constrained Sep	WY Total
Wet	429	246	-671	-4,038	-1,484	39	61	255	387	417	425	415	-3,517
Above Normal	425	258	-12	-1,856	-2,254	-247	190	327	396	423	428	417	-1,506
Normal	429	275	-22	184	-157	204	264	370	408	428	430	417	3,231
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	-32	-846	-402	265	248	350	403	426	428	417	1,955

Table 3.6-4

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389
Above Normal	7	23	722	2,532	4,017	3,095	968	0	0	0	0	0	11,366
Normal	0	6	377	264	893	466	117	6	0	0	0	0	2,128
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	499	1,790	2,618	1,894	803	24	0	0	0	0	7,642

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep	WY Total
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus Base - Calaveras Constrained Sep	WY Total
Wet	0	0	0	-794	-117	-6	-10	-15	0	0	0	0	-942
Above Normal	0	0	-461	-1,140	-1,275	-1	276	0	0	0	0	0	-2,601
Normal	0	0	-537	-604	-892	-440	-10	0	0	0	0	0	-2,483
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-200	-509	-461	-87	53	-3	0	0	0	0	-1,208

Comparing the variant and WSIP settings, with essentially no differences (albeit slight increases) in releases from Calaveras Dam to the stream and no differences to spills at Alameda Creek Diversion Dam (albeit slight increases), flow below the Alameda Creek and Calaveras Creek confluence will be the same for each setting, or slightly larger for the variant setting. Table 3.6-5 illustrates the flow below the confluence for the variant and WSIP settings, and the near similarity in flow between the two. Table 3.6-6 provides the same form of information for the variant and base settings. The notable differences between the variant and base settings (comparable to the difference between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year/wet-season flows due to the restoration of Calaveras Reservoir storage.

Table 3.6-5

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	430	326	2,789	12,365	24,327	16,744	8,649	548	417	430	430	417	67,869
Above Normal	437	327	1,138	4,005	8,451	6,506	1,929	430	417	430	430	417	24,917
Normal	430	304	798	1,081	2,004	1,349	539	435	417	430	430	417	8,634
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502
All Years	431	310	1,066	3,791	7,391	5,247	2,362	454	417	430	430	417	22,746

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	430	326	2,789	12,265	24,303	16,744	8,649	548	417	430	430	417	67,746
Above Normal	437	327	1,111	3,929	8,451	6,502	1,929	430	417	430	430	417	24,810
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502
All Years	431	310	1,061	3,755	7,386	5,245	2,362	454	417	430	430	417	22,699

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus WSIP Sep	WY Total
Wet	0	0	0	100	24	0	0	0	0	0	0	0	123
Above Normal	0	0	27	76	0	4	-1	0	0	0	0	0	106
Normal	0	0	0	0	0	7	0	0	0	0	0	0	7
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	6	35	5	2	0	0	0	0	0	0	47

Table 3.6-6

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	430	326	2,789	12,365	24,327	16,744	8,649	548	417	430	430	417	67,869
Above Normal	437	327	1,138	4,005	8,451	6,506	1,929	430	417	430	430	417	24,917
Normal	430	304	798	1,081	2,004	1,349	539	435	417	430	430	417	8,634
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502
All Years	431	310	1,066	3,791	7,391	5,247	2,362	454	417	430	430	417	22,746

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep	WY Total
Wet	1	80	3,460	17,197	25,928	16,711	8,598	307	30	12	4	2	72,329
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023
Normal	1	29	1,356	1,501	3,053	1,586	284	65	9	2	0	0	7,886
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457
All Years	3	41	1,298	5,145	8,254	5,069	2,061	107	14	4	1	1	21,999

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus Base - Calaveras Constrained Sep	WY Total
Wet	429	246	-671	-4,832	-1,601	33	51	241	387	417	425	415	-4,460
Above Normal	425	258	-474	-2,996	-3,529	-248	466	327	396	423	428	417	-4,107
Normal	429	275	-559	-420	-1,049	-236	255	370	408	428	430	417	748
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	-232	-1,355	-863	178	301	347	403	426	428	417	747

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the variant and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Table 3.6-7 illustrates the flow below the confluence and above the Alameda and San Antonio Creek confluence for the variant and WSIP settings, and the near similarity in flow between the two. Table 3.6-8 provides the same form of information for the variant and base

settings. The flows identified at this location are indicative of flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, minus the water assumed to be recaptured (diverted) by the SFPUC from the creek.

Table 3.6-7

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	6	154	3,180	13,711	25,851	17,847	9,299	498	76	33	15	9	70,681
Above Normal	19	150	1,335	4,524	9,137	6,916	2,180	217	54	20	9	6	24,568
Normal	7	64	922	913	1,837	1,275	469	134	28	9	4	3	5,665
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,132	3,894	7,504	5,334	2,409	197	38	14	7	4	20,631

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,180	13,611	25,828	17,847	9,299	498	76	33	15	9	70,558
Above Normal	19	150	1,308	4,448	9,137	6,913	2,180	217	54	20	9	6	24,462
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,127	3,859	7,499	5,332	2,409	197	38	14	7	4	20,583

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus WSIP Sep	WY Total
Wet	0	0	0	100	24	0	0	0	0	0	0	0	123
Above Normal	0	0	27	76	0	4	-1	0	0	0	0	0	106
Normal	0	0	0	0	0	7	0	0	0	0	0	0	7
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	6	35	5	2	0	0	0	0	0	0	47

Table 3.6-8

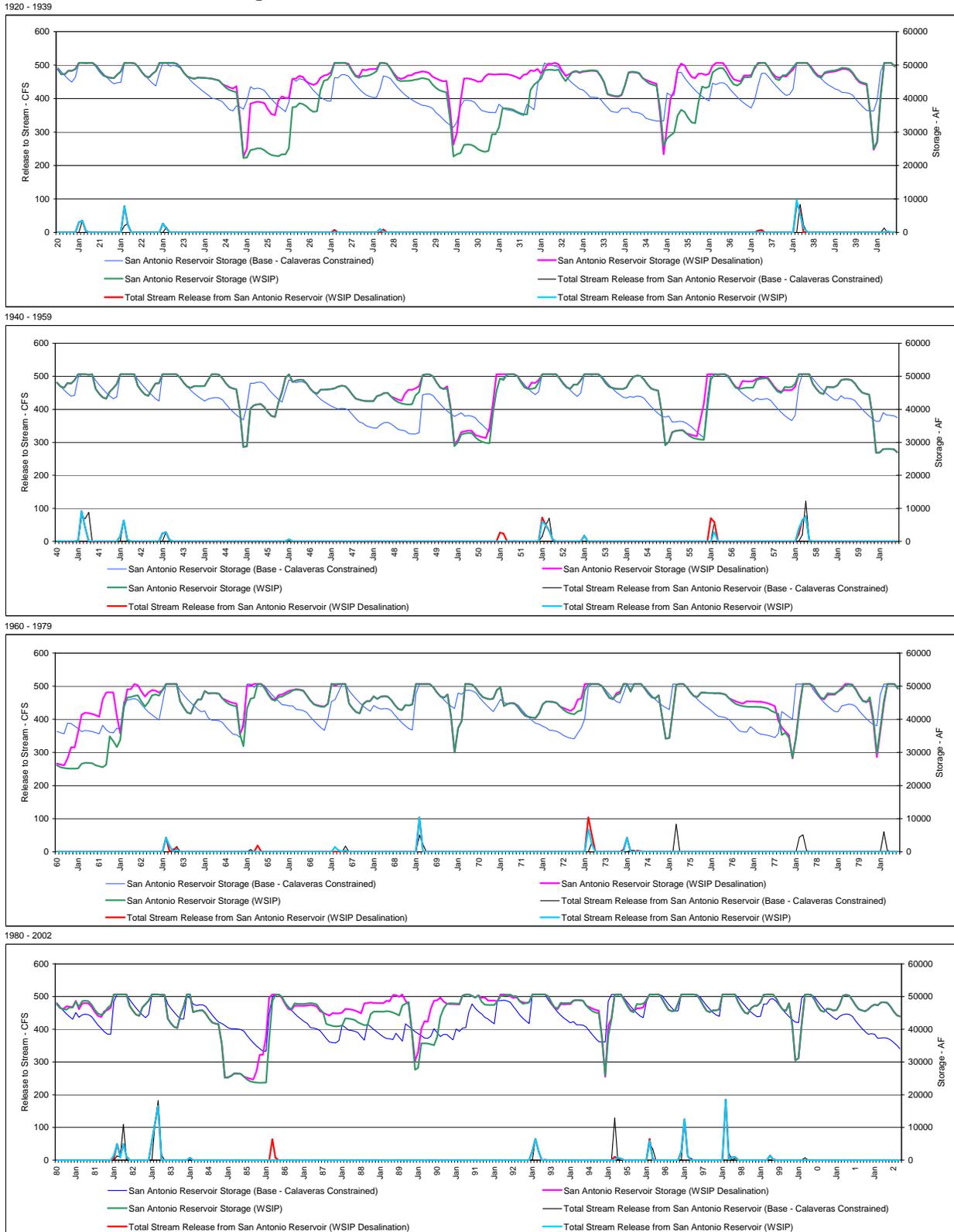
Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination Sep	WY Total
Wet	6	154	3,180	13,711	25,851	17,847	9,299	498	76	33	15	9	70,681
Above Normal	19	150	1,335	4,524	9,137	6,916	2,180	217	54	20	9	6	24,568
Normal	7	64	922	913	1,837	1,275	469	134	28	9	4	3	5,665
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,132	3,894	7,504	5,334	2,409	197	38	14	7	4	20,631

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep	WY Total
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Desalination minus Base - Calaveras Constrained Sep	WY Total
Wet	0	0	-788	-4,957	-1,840	-131	-59	-15	0	0	0	0	-7,789
Above Normal	0	0	-646	-3,295	-3,923	-550	318	0	0	0	0	0	-8,096
Normal	0	0	-753	-968	-1,774	-732	-10	0	0	0	0	0	-4,237
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-435	-1,839	-1,518	-282	53	-3	0	0	0	0	-4,025

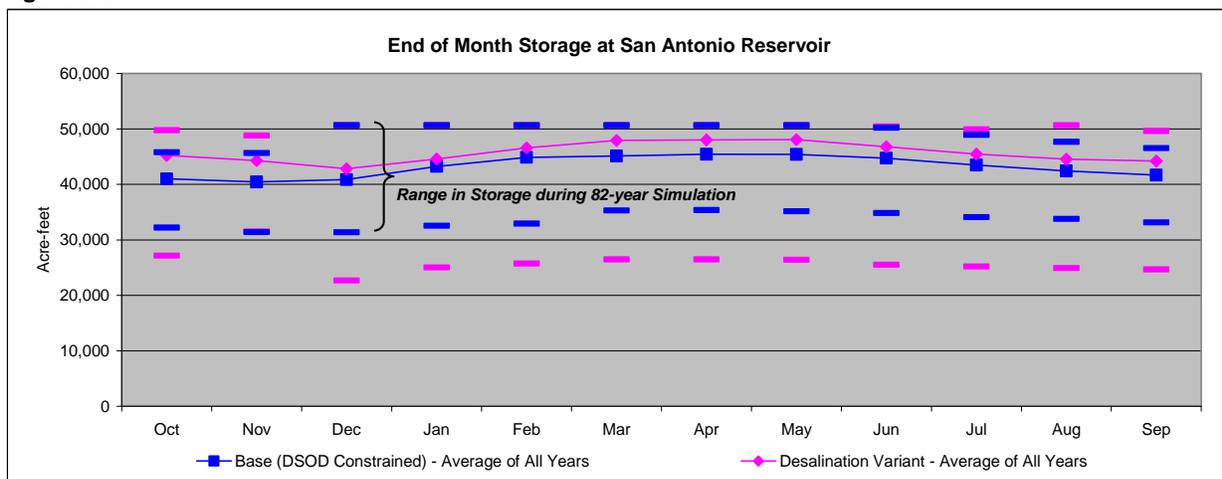
Compared to the WSIP setting, San Antonio Reservoir operations in the variant setting generally mirror the changes experienced for Calaveras Reservoir operations. Figure 3.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from the dam. Shown in Figure 3.6-3 are the results for the WSIP, variant, and base settings. The difference in San Antonio Reservoir storage between the variant and WSIP setting is mostly caused by the increase in Bay Area reservoir storage due to the desalination supply offsetting some of the draw of reservoir storage during drought periods when Hetch Hetchy imports are at maximum capacity. The magnitude of effect in the difference in San Antonio Reservoir storage depends on modeling assumptions to balance total Bay Area reservoir storage among the five major SFPUC reservoirs. The model balances storage between reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary input in the model, and the logic and relative percentages are meant to mimic the current practice and discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security.

Figure 3.6-3
San Antonio Reservoir Storage and Stream Release



The difference in storage between the variant and WSIP settings and the base settings is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras leads to a different operation at San Antonio Reservoir, one that provides relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the variant and WSIP settings and the base setting every fifth year. Assumed systematic maintenance of Hetch Hetchy conveyance facilities occurs in the simulation that constrains diversions to the Bay Area from Hetch Hetchy every fifth year. The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by drawing additional water from the Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the variant and WSIP settings. Figure 3.6-4 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 3.6-4



There would be very little change in stream releases below San Antonio Reservoir between the variant and WSIP settings. Table 3.6-9 illustrates the modeled release to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a slightly higher reservoir operation at times during the winter, as seen in Figure 3.6-4, a greater frequency in stream releases is expected. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the variant and base settings are shown in Table 3.6-10. The differences between the two settings range from increases to decreases in flow. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 3.6-3. In some circumstances, the base setting storage at San Antonio Reservoir could be higher than projected for the variant setting during the same period. This circumstance could lead to an occasionally greater modeled release for the base setting, which would be reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting, and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 3.6-11 illustrates the flow below the confluence for the variant and WSIP settings, and the differences in flow between the two.

Table 3.6-9

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP Desalination	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	101	1,327	3,248	1,983	568	112	0	0	0	0	7,339	
Above Normal	0	0	23	642	1,164	238	171	70	0	0	0	0	2,308	
Normal	0	0	0	113	0	0	33	0	0	0	0	0	146	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	24	414	875	436	153	37	0	0	0	0	1,939	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	1,054	3,168	1,543	605	121	0	0	0	0	6,586	
Above Normal	0	0	0	540	1,045	277	67	44	0	0	0	0	1,974	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	366	132	33	0	0	0	0	1,724	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP Desalination minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	6	272	80	440	-37	-8	0	0	0	0	752	
Above Normal	0	0	23	102	120	-39	103	26	0	0	0	0	335	
Normal	0	0	0	0	0	-40	33	0	0	0	0	0	-6	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	6	74	40	70	21	4	0	0	0	0	215	

Table 3.6-10

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP Desalination	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	101	1,327	3,248	1,983	568	112	0	0	0	0	7,339	
Above Normal	0	0	23	642	1,164	238	171	70	0	0	0	0	2,308	
Normal	0	0	0	113	0	0	33	0	0	0	0	0	146	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	24	414	875	436	153	37	0	0	0	0	1,939	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP Desalination minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	101	788	898	-497	-756	25	0	0	0	0	559	
Above Normal	0	0	23	642	284	-645	158	12	0	0	0	0	474	
Normal	0	0	0	113	-1	0	33	0	0	0	0	0	145	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	24	309	234	-231	-108	7	0	0	0	0	236	

Table 3.6-11

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP Desalination	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,281	15,038	29,100	19,830	9,866	611	76	33	15	9	78,020	
Above Normal	19	150	1,357	5,165	10,302	7,155	2,350	288	54	20	9	6	26,876	
Normal	7	64	922	1,026	1,837	1,275	502	134	28	9	4	3	5,811	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,157	4,308	8,379	5,770	2,562	233	38	14	7	4	22,570	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,276	14,666	28,996	19,390	9,903	619	76	33	15	9	77,144	
Above Normal	19	150	1,308	4,987	10,182	7,190	2,248	262	54	20	9	6	26,435	
Normal	7	64	922	1,026	1,837	1,308	469	134	28	9	4	3	5,810	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,145	4,199	8,334	5,698	2,541	229	38	14	7	4	22,307	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP Desalination minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	6	372	103	440	-37	-8	0	0	0	0	876	
Above Normal	0	0	50	178	120	-35	102	26	0	0	0	0	441	
Normal	0	0	0	0	0	-33	33	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	11	110	45	72	20	4	0	0	0	0	262	

Table 3.6-12 illustrates the same information in comparing the variant and base settings. Table 3.6-11 illustrates the minor modeled differences in flow that occur between the variant and WSIP settings, while Table 3.6-12 illustrates the relatively larger differences in flow that could occur between the variant and base settings. The difference is particularly due to the effects of the restoration of Calaveras Reservoir operating capacity in the variant setting.

Table 3.6-12

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,281	15,038	29,100	19,830	9,866	611	76	33	15	9	78,020
Above Normal	19	150	1,357	5,165	10,302	7,155	2,350	288	54	20	9	6	26,876
Normal	7	64	922	1,026	1,837	1,275	502	134	28	9	4	3	5,811
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,157	4,308	8,379	5,770	2,562	233	38	14	7	4	22,570

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-687	-4,169	-942	-628	-815	10	0	0	0	0	-7,230
Above Normal	0	0	-623	-2,653	-3,639	-1,195	477	12	0	0	0	0	-7,622
Normal	0	0	-753	-855	-1,775	-732	23	0	0	0	0	0	-4,092
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-410	-1,530	-1,285	-513	-56	4	0	0	0	0	-3,789

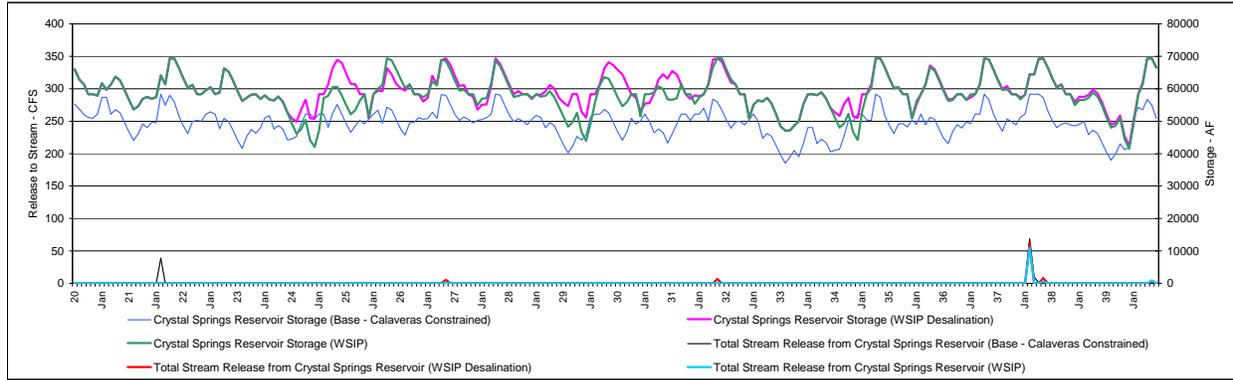
3.7 Crystal Springs and San Andreas Reservoirs

There are differences in Crystal Springs Reservoir operations between the variant and WSIP setting. Figure 3.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Springs Dam. Shown in Figure 3.7-1 are the results for the WSIP, variant, and base settings.

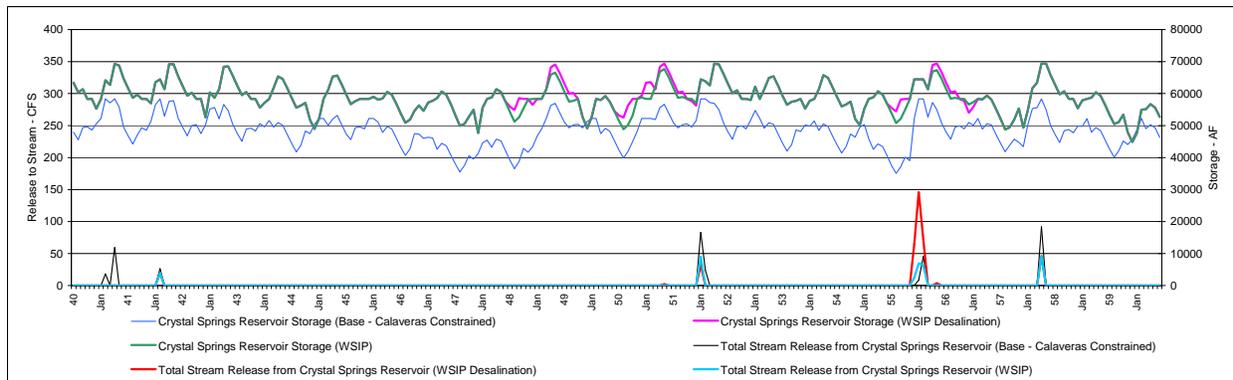
The difference in Crystal Springs Reservoir storage between the variant and WSIP settings is largely due to the increase in Bay Area reservoir storage that results from the desalination supply offsetting some of the draw during drought periods (when Hetch Hetchy imports are at maximum capacity). The effect of the difference in storage at Crystal Springs Reservoir depends on modeling assumptions for balancing total Bay Area reservoir storage among the five major SFPUC reservoirs. The model balances storage between reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary input in the model, and the logic and relative percentages are meant to mimic the current practice and discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security. In actual operations, some of the differences in result may not occur, as system operators and prevailing hydraulic and hydrologic conditions may direct the operational effect of the different demand to an alternative apportionment of effect among the reservoirs. Figure 3.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and WSIP settings. Figure 3.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings. Consistent with the comparison of the WSIP and base settings, the variant setting would result in reservoir storage operating at a higher average and higher upper-range than the base setting. This is due to the restoration of the operating capacity of Crystal Springs Reservoir.

Figure 3.7-1
Crystal Springs Reservoir Storage and Stream Release

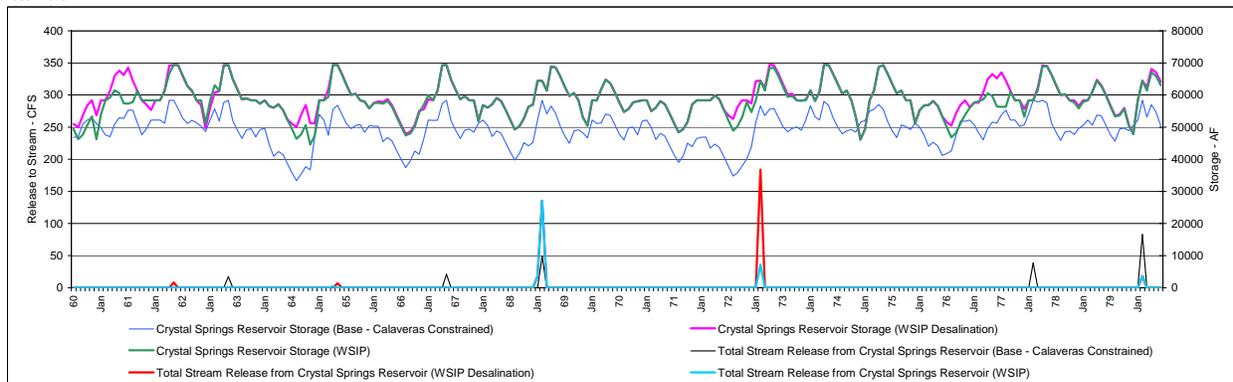
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

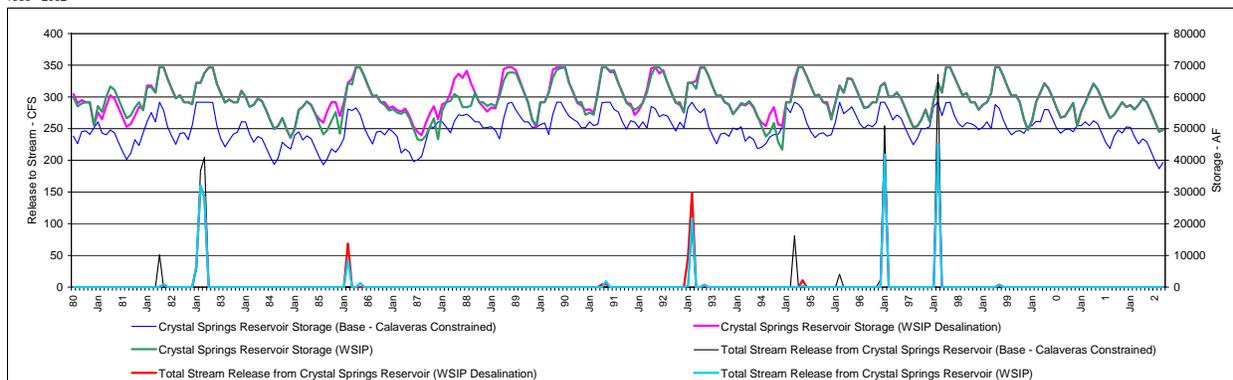


Figure 3.7-2

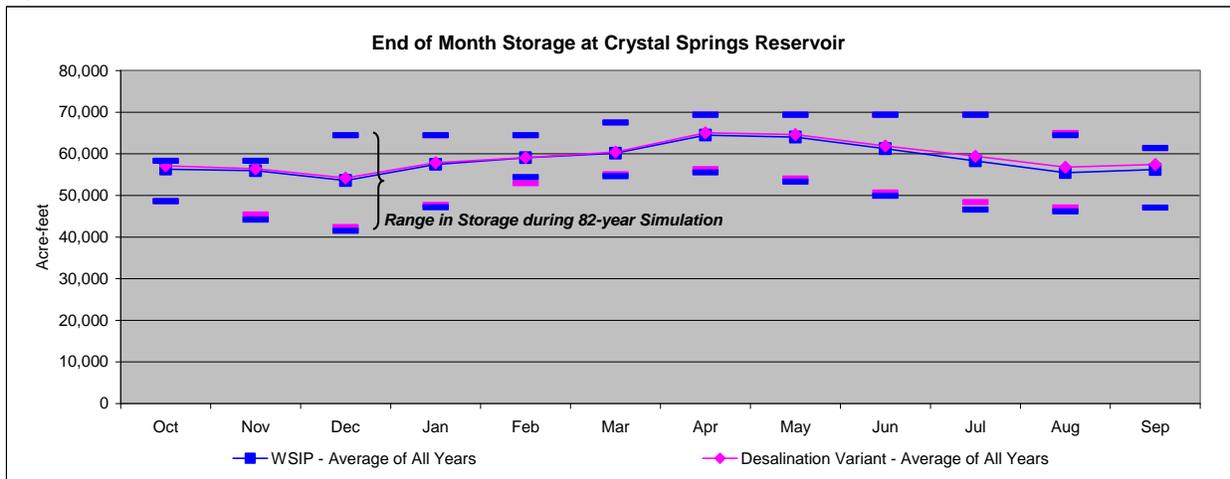


Figure 3.7-3

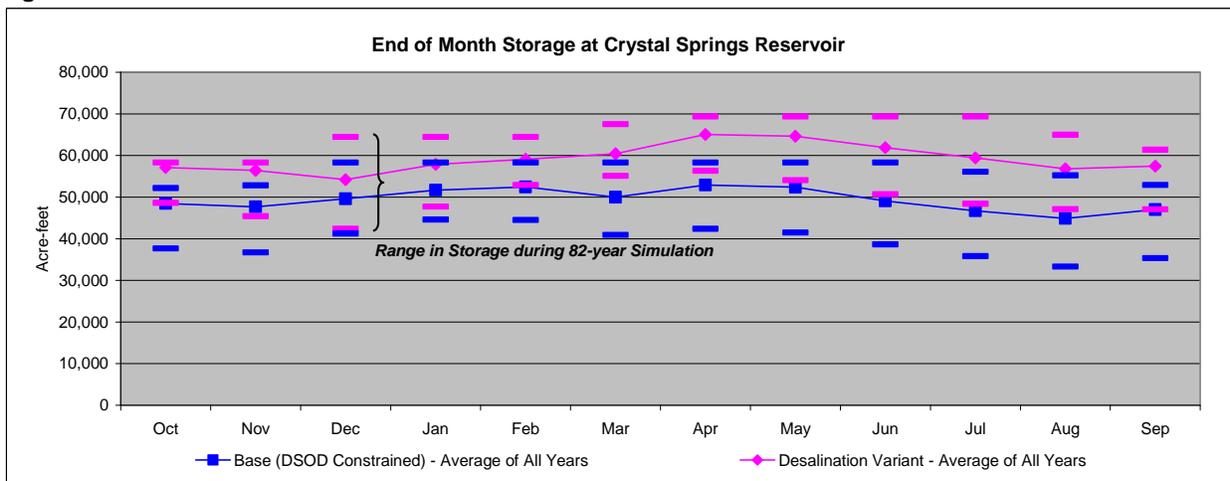


Table 3.7-1 illustrates the modeled variant and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that an occasional increase in releases could occur. The potential difference is attributed to slightly higher reservoir storage in the variant setting. Part of the difference in modeled Crystal Springs Reservoir storage is due to modeling assumptions for the proportionate management of storage among the Bay Area reservoirs, and the coincidence of assumed system-wide maintenance with less than favorable hydrologic conditions. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting, with the effect of essentially no difference between the variant and WSIP settings. Modeling results indicate that there would be releases in only 23 months (in the 6-month January-through-May period) during the 82-year simulation.

Table 3.7-2 illustrates the stream releases for the variant and base settings, and the difference in modeled flows between the two settings. A greater operating range in Crystal Springs Reservoir operation would lead to an increased potential to regulate reservoir inflow, which would lead to less risk in making needed stream releases. However, as described above, actual system operations would attempt to minimize releases under any setting; thus, the difference in releases between the variant and base setting would be minimal, if any.

Table 3.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP Desalination	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	247	1,677	3,279	542	170	101	0	0	0	0	6,017	
Above Normal	0	0	0	169	485	0	0	82	0	0	0	0	737	
Normal	0	0	0	0	0	0	0	56	0	0	0	0	56	
Below Normal	0	0	0	0	0	0	14	18	0	0	0	0	31	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	48	362	740	106	36	51	0	0	0	0	1,344	

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	47	1,296	2,512	542	170	54	0	0	0	0	4,623	
Above Normal	0	0	0	8	354	0	8	42	0	0	0	0	412	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	33	0	0	0	0	33	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	9	254	564	106	35	26	0	0	0	0	994	

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP Desalination minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	200	381	767	0	0	46	0	0	0	0	1,394	
Above Normal	0	0	0	162	131	0	-8	39	0	0	0	0	325	
Normal	0	0	0	0	0	0	0	56	0	0	0	0	56	
Below Normal	0	0	0	0	0	0	14	-15	0	0	0	0	-1	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	39	108	177	0	1	25	0	0	0	0	350	

Table 3.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP Desalination	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	247	1,677	3,279	542	170	101	0	0	0	0	6,017	
Above Normal	0	0	0	169	485	0	0	82	0	0	0	0	737	
Normal	0	0	0	0	0	0	0	56	0	0	0	0	56	
Below Normal	0	0	0	0	0	0	14	18	0	0	0	0	31	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	48	362	740	106	36	51	0	0	0	0	1,344	

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	Base - Calaveras Constrained
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	6,336	
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	671	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	9	280	690	221	147	29	0	0	0	0	1,375	

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP Desalination minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	203	244	391	-592	-586	20	0	0	0	0	-320	
Above Normal	0	0	0	169	-123	0	0	19	0	0	0	0	65	
Normal	0	0	0	0	0	0	0	56	0	0	0	0	56	
Below Normal	0	0	0	0	0	0	14	18	0	0	0	0	31	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	40	83	51	-115	-111	23	0	0	0	0	-31	

San Andreas Reservoir operations would generally be the same between the variant and WSIP settings. Reservoir storage would follow a systematic filling and lowering each year. Figure 3.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from Springs Dam. Shown in Figure 3.7-4 are the results for the WSIP, variant, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Notable in Figure 3.7-4 is the difference in storage operation every fifth year. Both the variant and WSIP setting storage operation differ from the base setting. This operation is based on the assumption that Hetch Hetchy conveyance maintenance occurs systematically every fifth year, which constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy WTP associated with WSIP or the variant exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be the same among all of the settings. The additional water demand of the WSIP and variant requires additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir. The draw down of storage due to the variant would be slightly less than for the WSIP setting. Figure 3.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 3.7-4
San Andreas Reservoir Storage and Stream Release

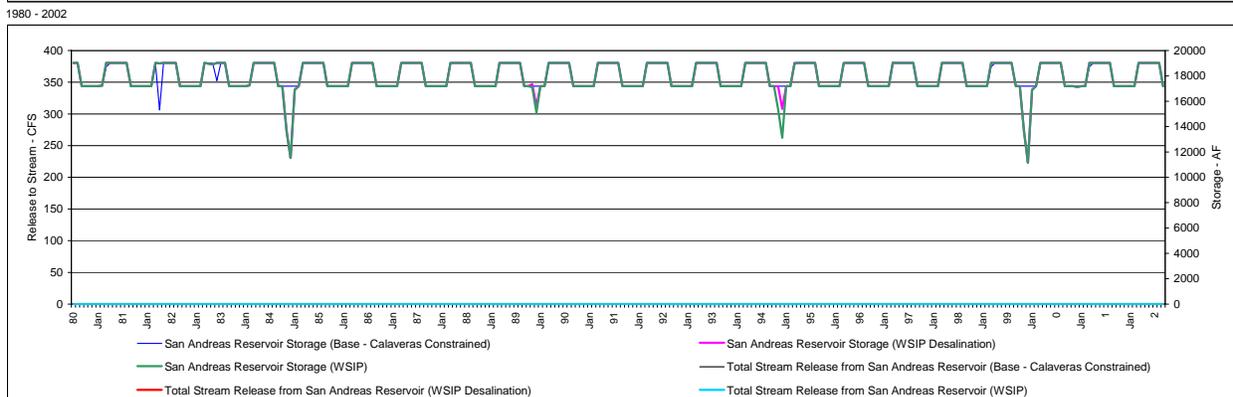
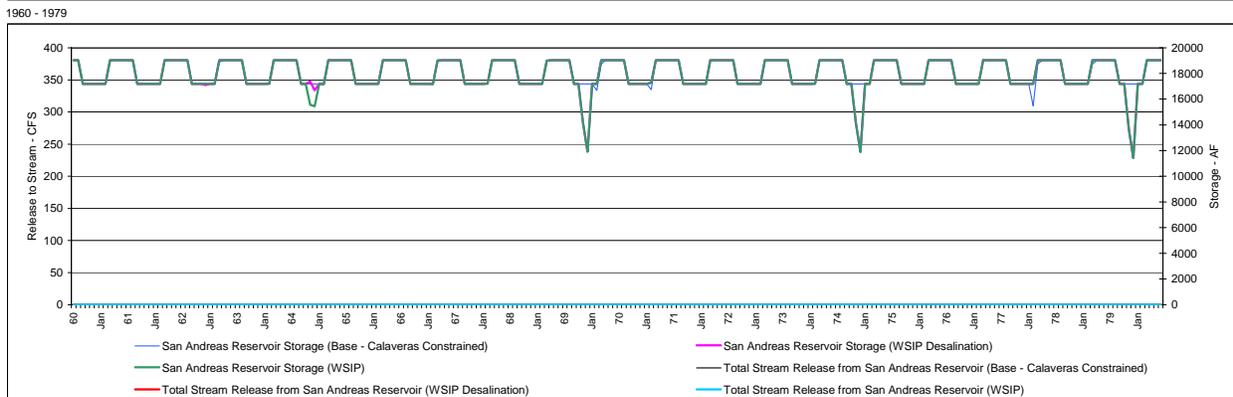
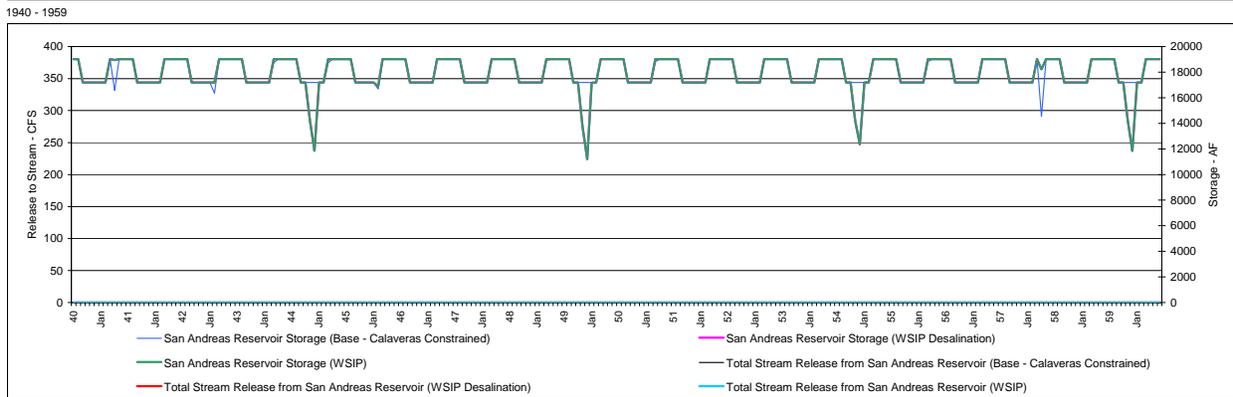
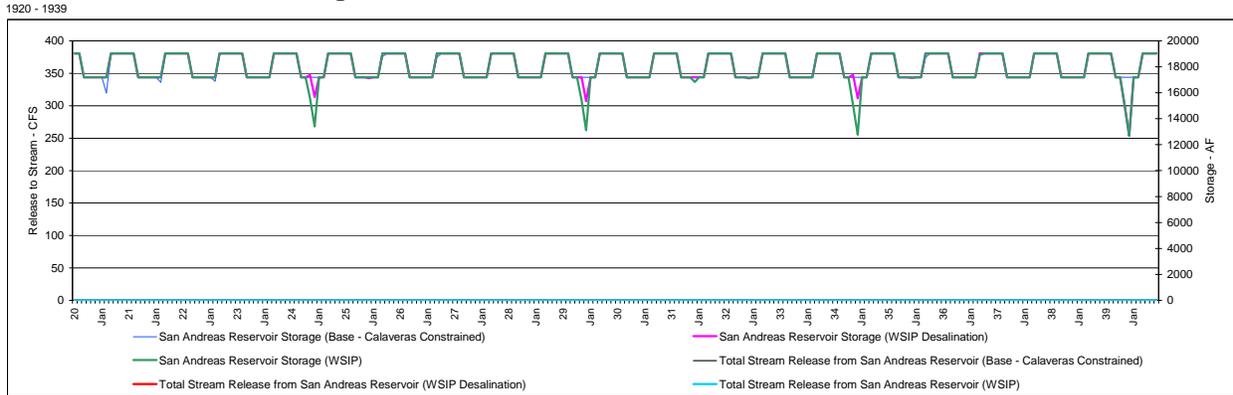
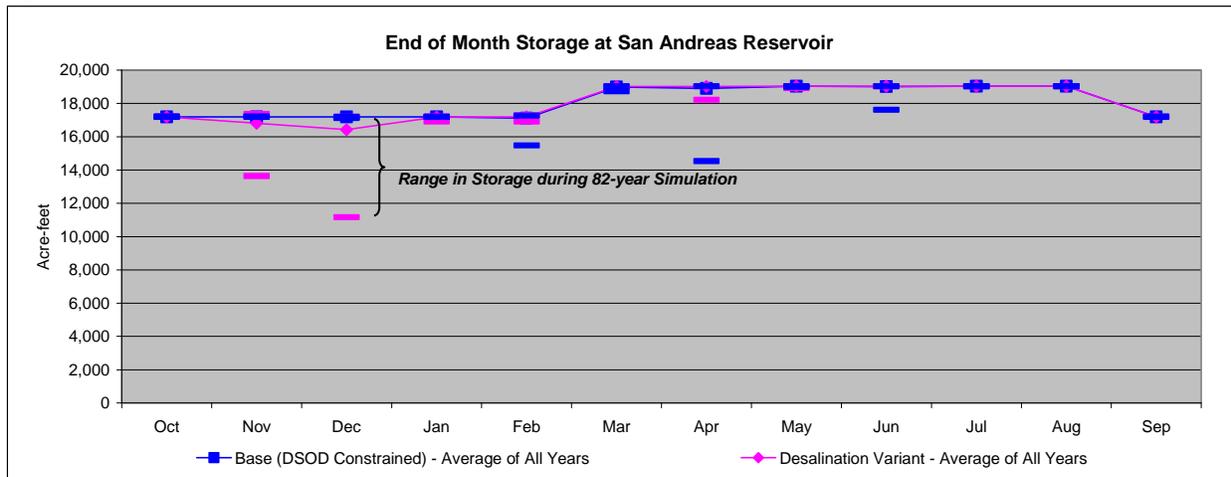


Figure 3.7-4



3.8 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated at about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, there is uncertainty as to the precise manner in which Coastside CWD's additional purchase request would be served and the resultant potential changes to the operation of SFPUC facilities and their affected environs.⁴

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs are identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

The variant setting could result in the same potential effects to the Pilarcitos Creek watershed as the WSIP setting.

⁴ See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

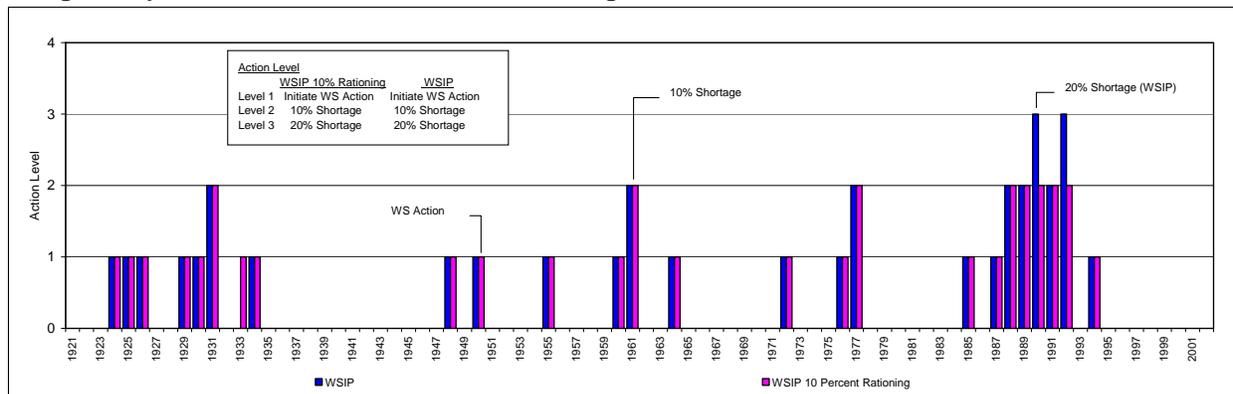
4. WSIP Variant 3 – 10% Rationing

WSIP Variant 3 – 10% Rationing variant programs would be identical to the programs proposed for the WSIP, except that the drought response program would limit delivery shortages (rationing) to no more than 10 percent. The resources that would be needed to serve the increase in purchase request (from 265 to 300 mgd) and the improvement in supply reliability include: 1) a supply of 10 mgd from implementation of the Recycled Water Projects (SF-3), Local Groundwater Projects (a component of SF-2, Groundwater Projects), and additional conservation programs (RRGWC); 2) the same restored storage features of Calaveras and Crystal Springs Reservoirs; and 3) the incorporation of the Westside Basin Groundwater Program. Also included is a supplemental water supply for delivery during drought obtained from Tuolumne River diversions through transfers from the TID and MID.

4.1 Water Deliveries and Drought Response Actions

The same form of MID/TID Tuolumne River water transfer is modeled for both the proposed program and the variant. However, the volume of water transferred is increased from 27,000 acre-feet per year (afy) to 42,000 afy for use during drought. The additional transfer volume is needed in the variant setting to provide the supplemental water necessary to accommodate the goal of limiting delivery shortages to no more than 10 percent in any year including during the Design Drought. Table 1-1 compares the drought response actions for the WSIP and variant. Figure 4.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002).

**Figure 4.1-1
Drought Response Actions – WSIP and 10% Rationing Variant**



In Figure 4.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In these scenarios, the action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers. Rationing is not greater than 10 percent in the variant setting. Compared to the WSIP setting, the 10-percent rationing limit of the variant requires the triggering of an additional year of utilization of supplemental water from the Westside Basin Groundwater Program; this rationing limit could not be achieved without the increase in transfer from MID/TID.

The same form of information is shown in Figure 4.1-2 in comparing the variant and “Base - Calaveras Constrained” (existing) settings. In modeling parlance, there is no level 1 action level in the base setting. Without supplemental resources, the existing system has only the delivery shortage measure available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the variant and base setting for these action levels.

**Figure 4.1-2
Drought Response Actions – Base and 10% Rationing Variant**

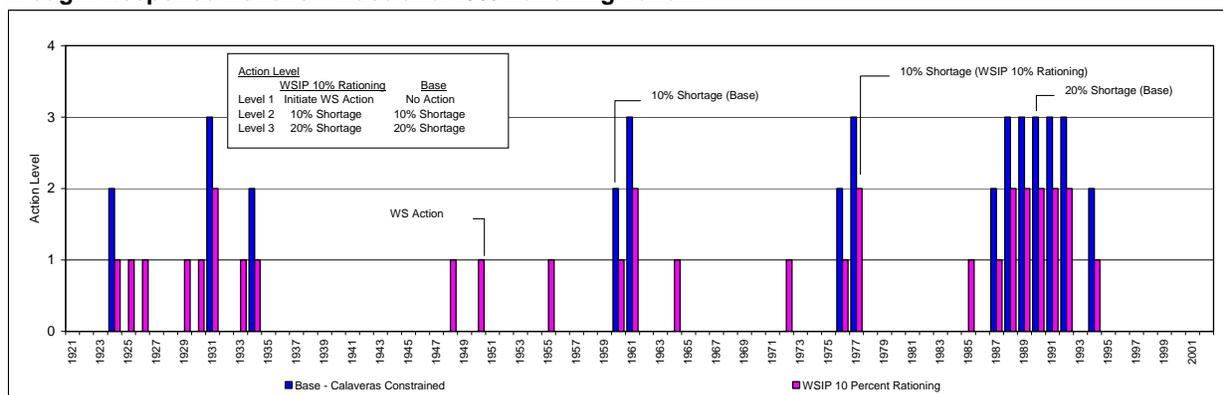


Figure 4.1-2 illustrates that, when compared to the base setting, the variant triggers the supplemental resource (Westside Basin Groundwater Program) at an early indication of drought, during periods when in the current setting there is no supplemental resource available to the system. The utilization of the supplemental resource during these times results in the lessening of (or at least a non-increase in) the severity of delivery shortage.

Not illustrated in Figure 4.1-2, but shown in Table 1-1, are the delivery shortages anticipated during the entire SFPUC Design Drought. Shortages during the Design Drought with the variant are maintained within the objective of limiting the severity of shortage to no more than 10 percent. With the existing system, the WSIP’s 20 percent limitation (cap) objective cannot be achieved during the last 18 months of the Design Drought, and a 25 percent shortage is applied.

The difference in water deliveries between the proposed program and the variant is shown chronologically for the 82-year simulation in Table 4.1-1. The negative differences indicated for 1934-1935 reflect the triggering of an additional year of supplement supply from the Westside Groundwater Program. In effect, the use of the resource offsets the demand needed from other SFPUC resources. The positive differences following this period of approximately 2,600 million gallons per year represent years when additional replenishment of the Westside Basin Groundwater Program was necessary after the additional draw from the program. The years showing additional deliveries of approximately 10,000 million gallons during the 1990s represent years when shortages were reduced to 10 percent in the variant setting.

4.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin is the flow through the SJPL. Table 4.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the variant settings. The year-to-year shift in diversions to the SJPL during the 1930s reflects the minor change in system deliveries shown in Table 4.1-1 that are due to the additional operation of the Westside Groundwater Program. The net difference during the period is negligible. A similar shifting of diversions between years is modeled to occur during the 1960s and 1970s, both attributable to modeling assumptions that balance storage among SFPUC reservoirs and the setting of the flow rate of the SJPL. These changes are not considered to be meaningful. The additional diversions indicated during the 1990s represent the additional water supply provided from the Tuolumne River to serve the additional deliveries associated with the 10 percent rationing limit. In the WSIP setting, the diversion would be less because its 20-percent rationing goal requires fewer water deliveries. Table 4.2-2 illustrates the average monthly diversion through the SJPL, by year type, for the 82-year simulation period for the proposed program and the variant settings.

Table 4.1-1

Water Year	WSIP 10 Percent Rationing minus WSIP												WY Total	FY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	-530	-499	-454	-1,484	0	0
1934	-449	-419	-408	-383	-379	-423	-436	-446	-453	0	0	0	-3,795	-5,279	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	224	224	217	665	0
1939	224	217	224	224	203	224	217	224	217	224	224	217	2,640	2,640	0
1940	224	217	224	224	203	224	217	224	217	0	0	0	1,974	2,640	0
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	1,124	1,101	978	3,202	0	0
1991	901	750	672	610	624	806	893	1,013	1,072	0	0	0	7,343	10,545	0
1992	0	0	0	0	0	0	0	0	0	1,124	1,101	978	3,202	0	0
1993	901	750	672	610	624	806	893	1,013	1,072	0	0	0	7,343	10,545	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	22	18	17	16	16	20	22	25	26	26	26	24	257	257	0

Table 4.2-1

Water Year	Difference in Total SJPL (Acre-feet)												WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	-6,905	3,996	-2,854	0	0	0	0	0	0	0	0	-5,763
1933	-856	2,762	0	0	0	0	0	0	0	0	0	0	1,906
1934	0	0	-4,756	-2,854	-2,578	0	0	0	0	0	0	0	-10,188
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	-1,841	0	0	0	0	0	0	0	0	0	0	-1,841
1937	0	0	0	-952	0	1,142	0	0	0	0	0	0	190
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	1,902	0	2,854	0	0	0	0	0	0	0	0	0	4,756
1940	0	0	0	0	4,297	3,806	0	0	0	0	0	0	8,103
1941	1,902	0	0	0	0	0	0	0	0	0	0	0	1,902
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	-6,905	-951	-951	0	0	0	0	0	0	0	0	-8,807
1962	0	-921	1,998	95	2,578	0	0	0	0	0	0	0	3,750
1963	1,427	0	0	3,045	0	0	0	0	0	0	0	0	4,472
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	-7,135	-952	0	0	0	0	0	-7,136	-952	-921	-17,096
1978	285	-921	-951	4,852	7,734	4,757	1,841	0	0	0	0	0	17,597
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	-1,237	0	0	0	0	1,902	0	0	0	0	0	0	665
1981	0	-921	0	0	0	0	0	0	0	0	0	0	-921
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	2,189	5,064	7,253	7,253
1991	4,756	2,762	523	3,805	3,437	1,047	0	5,043	4,880	-1,237	0	0	25,016
1992	0	0	-1,902	1,903	0	0	0	0	0	3,806	2,949	2,762	9,518
1993	2,855	921	523	0	0	0	4,880	2,949	2,854	0	0	0	14,982
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	1,903	0	0	0	0	0	0	0	0	1,903
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	135	-146	-71	86	189	154	82	97	94	-56	51	84	700

Table 4.2-2

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														WSIP 10 Percent Rationing	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,477	16,624	8,506	11,934	7,948	11,714	21,981	26,787	25,923	29,778	29,778	28,817	247,266	245,023	
Above Normal	26,901	14,270	7,986	14,265	9,558	16,929	24,176	28,608	27,685	29,778	29,778	28,817	258,752	258,752	
Normal	26,174	14,656	8,889	15,573	12,256	22,476	28,207	29,778	28,817	29,778	29,778	28,817	275,199	275,124	
Below Normal	27,567	16,431	11,962	21,747	18,723	25,099	28,817	29,778	28,817	29,705	29,593	27,864	296,103	297,162	
Dry	26,109	19,104	14,050	19,586	17,309	25,782	28,817	29,778	28,817	29,255	29,082	27,632	295,321	296,439	
All Years	26,855	16,196	10,271	16,655	13,183	20,415	26,402	28,952	28,018	29,661	29,604	28,388	274,599	274,584	

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,358	16,624	8,533	11,512	7,465	11,298	21,561	26,603	25,744	29,778	29,778	28,817	245,069	242,794	
Above Normal	26,705	14,785	7,751	14,254	9,306	16,705	24,176	28,608	27,685	29,778	29,778	28,817	258,347	258,347	
Normal	26,174	14,713	8,765	15,626	12,095	22,405	28,207	29,778	28,817	29,778	29,778	28,817	274,953	274,878	
Below Normal	27,338	16,106	11,931	21,523	18,520	25,038	28,817	29,481	28,530	29,778	29,593	27,864	294,520	295,079	
Dry	25,990	19,593	14,794	19,764	17,471	25,782	28,817	29,778	28,817	29,463	28,821	27,200	296,289	297,969	
All Years	26,721	16,342	10,342	16,569	12,994	20,261	26,320	28,854	27,923	29,717	29,553	28,304	273,899	273,884	

Difference in Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														WSIP 10 Percent Rationing minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	119	0	-27	422	483	416	420	184	178	0	0	0	2,197	2,228	
Above Normal	196	-514	235	11	253	224	0	0	0	0	0	0	404	404	
Normal	0	-58	125	-54	161	71	0	0	0	0	0	0	246	246	
Below Normal	229	325	31	224	202	62	0	297	287	-73	0	0	1,584	2,083	
Dry	119	-489	-743	-178	-161	0	0	0	0	-208	262	432	-968	-1,530	
All Years	135	-146	-71	86	189	154	82	97	94	-56	51	84	700	700	

4.3 Hetch Hetchy Reservoir and Releases

The additional draw of water for the additional deliveries of the variant would increase the draw from Hetch Hetchy Reservoir; however, this draw essentially only occurs during one period of the simulation. Figure 4.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 4.3-1 are the results for the WSIP, variant (“WSIP All Tuolumne”), and base (“Base – Calaveras Constrained”) settings. Supplementing the Figure 4.3-1 representation of Hetch Hetchy Reservoir storage are Table 4.3-1 Hetch Hetchy Reservoir Storage (10% Rationing) and Table 4.3-2 Difference in Hetch Hetchy Reservoir Storage (10% Rationing minus WSIP). Table 4.3-3 illustrates the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Table 4.3-2 illustrates that, throughout the summer and into the fall, storage in Hetch Hetchy Reservoir associated with the variant would differ from the storage in the WSIP setting only in some years, and this difference could be more or less storage. The occasional difference in storage at Hetch Hetchy Reservoir is coincident with the changes that are modeled for the SJPL diversion. Only the changes associated with the difference in Westside Groundwater Program operations (1930s) and the diversion of additional water for the 10 percent rationing objective (1990s) are meaningful. The other modeled differences are attributable to assumptions for reservoir balancing and flow rates of the SJPL, which are discretionary in the model, and the differences may not occur in actual operations. The minor changes that would occur to Hetch Hetchy Reservoir storage during the winter and spring would typically be negated by the end of May with the filling of the reservoir. Figure 4.3-1 illustrates that the greatest draw from reservoir storage occurs during the droughts of the 1930s and 1976-1977 for both the variant and the base settings, and that there is not much difference between the two. Figure 4.3-2 illustrates the difference in reservoir storage, averaged by year type, in comparing the variant and WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 4.3-3 illustrates the same information in comparing the variant and base setting. Figure 4.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

The infrequent minor differences in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the variant manifest into differences in releases from O’Shaughnessy Dam to the stream. A difference in the amount of available reservoir space in the winter and spring would lead to a difference in how inflow is regulated at O’Shaughnessy Dam. Figure 4.3-1 illustrates the stream release from O’Shaughnessy Dam for the WSIP, variant, and base settings. Table 4.3-4 illustrates the difference in stream releases between the variant and WSIP settings. Compared to the WSIP setting, the variant exhibits almost no change in stream releases. The one meaningful exception occurs during the drought of the 1990s, when additional water is diverted for additional deliveries and the effect manifests as a reduction to releases to the stream in one subsequent month (June). Table 4.3-5 illustrates the same information in comparing the variant and base settings.

**Figure 4.3-1
Hetch Hetchy Reservoir Storage and Stream Release**

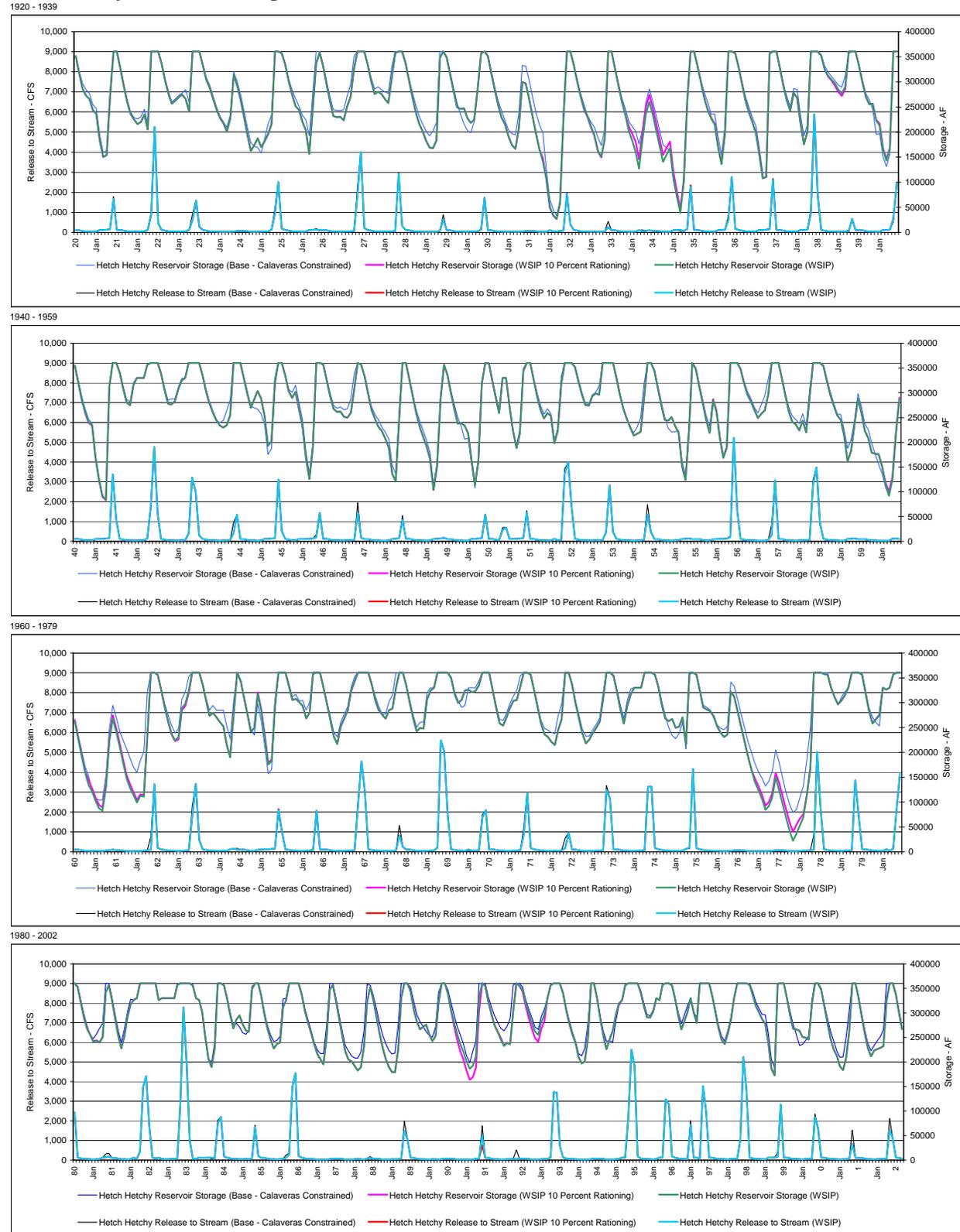


Table 4.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)												WSIP 10 Percent Rationing	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	272,402	266,044	243,868	235,920	183,321	150,269	154,224	271,116	360,400	360,400	326,811	291,828	
1922	259,728	235,648	224,723	215,782	220,244	234,819	205,133	360,400	360,400	360,400	336,082	302,853	
1923	275,819	256,526	262,603	269,313	274,454	265,738	241,094	360,400	360,400	360,400	333,186	304,241	
1924	288,096	265,462	244,930	227,949	217,703	201,135	226,615	314,032	292,290	264,348	229,088	193,225	
1925	162,198	174,233	187,270	170,200	181,824	195,815	216,042	360,400	360,400	356,465	334,210	301,427	
1926	274,085	251,427	243,883	219,916	203,496	156,406	245,154	336,819	358,277	331,111	295,686	261,739	
1927	231,858	229,528	230,165	223,466	251,035	270,123	326,806	360,400	360,400	360,400	333,718	301,231	
1928	275,534	280,188	275,546	265,616	257,757	308,315	356,993	360,400	360,400	337,096	302,689	269,444	
1929	239,232	216,426	201,321	182,545	168,883	167,850	183,407	347,942	360,400	348,102	314,426	281,237	
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424	
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210	
1932	165,286	147,905	106,113	49,644	33,394	26,649	57,902	229,418	360,400	360,400	333,089	299,918	
1933	271,014	244,902	230,135	209,520	192,353	161,802	149,351	185,608	360,400	360,400	326,593	293,382	
1934	260,961	234,344	211,518	196,653	180,728	145,826	197,881	250,386	274,180	247,932	215,906	184,646	
1935	154,653	168,376	181,163	119,522	82,042	46,446	104,675	262,641	360,400	360,400	331,788	299,322	
1936	267,086	244,540	228,122	216,707	171,639	137,560	196,977	360,400	360,400	356,465	327,853	294,110	
1937	262,493	239,158	219,779	198,812	156,588	108,473	110,793	356,521	360,400	360,400	327,212	292,471	
1938	262,775	242,374	277,970	268,254	217,341	175,883	200,130	360,400	360,400	360,400	352,029	324,714	
1939	310,563	302,766	292,380	279,830	271,975	285,459	360,400	360,400	360,400	332,157	299,492	270,327	
1940	255,209	256,245	224,385	216,543	168,721	145,791	168,387	360,400	360,400	354,451	320,313	286,310	
1941	258,775	239,215	233,713	167,903	124,010	90,014	83,187	312,606	360,400	360,400	341,291	309,048	
1942	280,721	274,942	315,878	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962	
1943	278,021	276,636	283,548	307,975	325,066	330,000	360,400	360,400	360,400	360,400	334,820	303,090	
1944	279,144	260,348	244,962	234,244	229,744	234,419	254,494	360,400	360,400	360,400	329,290	297,445	
1945	269,782	286,673	303,578	288,423	253,887	193,103	202,059	325,579	360,400	360,400	334,928	303,168	
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,825	360,400	360,400	357,267	325,581	293,235	
1947	267,584	261,329	261,933	251,706	249,594	259,401	308,348	360,400	356,592	332,847	297,991	265,329	
1948	247,258	231,519	222,630	207,163	189,129	136,187	121,486	246,616	360,400	360,400	325,774	291,062	
1949	257,437	230,325	210,633	191,633	166,180	103,674	151,625	286,364	356,592	336,040	301,328	268,173	
1950	237,728	238,697	233,450	217,724	163,129	114,105	162,436	319,562	360,400	359,600	323,849	289,929	
1951	259,038	330,000	330,000	273,739	223,537	188,600	217,740	343,707	360,400	360,400	326,780	293,203	
1952	264,766	248,078	259,003	253,471	198,031	223,738	317,703	360,400	360,400	360,400	351,651	322,211	
1953	296,329	275,128	274,206	293,261	298,723	296,049	360,374	360,400	360,400	360,400	330,136	297,172	
1954	268,064	247,055	230,167	213,569	217,328	221,015	286,815	360,400	360,400	343,956	308,827	274,943	
1955	245,440	243,491	250,709	232,875	219,152	151,838	123,551	222,728	360,400	348,498	313,738	278,863	
1956	244,816	218,801	286,194	264,124	209,296	170,313	190,196	360,400	360,400	360,400	347,791	319,290	
1957	296,127	282,297	264,905	249,257	257,810	264,111	295,373	360,400	360,400	360,400	326,823	292,697	
1958	261,061	240,978	235,957	224,058	243,566	220,059	291,862	360,400	360,400	360,400	353,900	323,910	
1959	295,427	273,939	254,292	245,472	213,883	161,315	182,390	235,642	288,112	259,667	223,084	208,259	
1960	179,051	176,894	175,738	151,333	119,223	100,133	130,026	218,505	290,266	264,021	228,814	194,592	
1961	161,757	143,851	127,444	109,206	94,990	89,373	136,414	228,629	274,314	248,207	218,199	185,225	
1962	154,199	135,470	119,749	104,609	115,556	113,793	232,320	360,400	360,400	356,465	326,379	292,131	
1963	262,285	235,760	222,641	226,278	284,898	293,051	319,268	360,400	360,400	360,400	336,396	305,026	
1964	273,668	279,416	270,727	260,673	252,543	215,321	190,335	275,763	360,400	343,750	309,409	275,896	
1965	241,813	249,120	320,973	285,638	234,677	179,337	185,211	297,432	360,400	360,400	360,400	333,188	
1966	305,400	307,762	300,989	293,442	268,461	279,726	360,400	360,400	360,400	331,450	297,972	265,321	
1967	231,906	216,758	252,106	268,331	283,263	323,066	342,598	360,400	360,400	360,400	360,400	335,768	
1968	305,290	284,733	275,763	268,094	285,055	288,111	330,318	360,400	360,400	334,325	299,837	267,451	
1969	242,147	249,086	247,807	306,192	323,862	330,000	360,400	360,400	360,400	360,400	349,426	317,777	
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760	
1971	258,440	253,880	270,103	288,977	303,697	305,250	323,642	360,400	360,400	356,465	325,704	292,446	
1972	258,839	236,370	231,016	221,257	214,866	245,077	266,541	360,400	360,400	360,400	329,001	267,965	
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127	
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187	
1975	267,864	263,077	267,079	249,395	251,607	270,330	216,738	360,400	360,400	356,465	324,162	290,479	
1976	286,336	282,468	273,429	252,264	239,384	231,084	235,434	322,270	311,719	281,653	249,955	220,061	
1977	191,125	164,627	147,077	132,136	114,297	92,700	99,960	117,692	158,788	138,879	111,106	84,739	
1978	58,559	39,802	54,535	66,684	75,301	115,684	167,623	360,400	360,400	360,400	357,869	356,406	
1979	329,957	311,201	296,912	303,911	314,794	330,000	360,400	360,400	360,400	356,097	320,734	284,314	
1980	258,962	267,114	275,772	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413	
1981	290,796	268,662	255,785	242,331	244,014	240,516	251,139	342,822	356,592	326,381	288,829	253,955	
1982	227,982	252,018	292,777	317,906	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400	
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,970	
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457	
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723	
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597	
1987	281,194	259,670	236,484	216,725	205,573	195,265	251,416	347,582	357,022	325,388	288,877	253,677	
1988	221,889	204,952	201,696	191,923	182,833	188,925	231,786	323,285	352,727	326,875	292,101	258,469	
1989	229,470	206,135	190,185	179,740	178,779	224,799	331,322	360,400	360,400	343,974	308,105	283,006	
1990	266,700	271,420	276,200	256,827	242,842	252,652	320,352	360,400	360,400	360,400	340,941	273,390	
1991	244,492	221,036	205,056	182,089	163,629	168,932	188,293	302,693	360,400	355,666	322,950	297,956	
1992	275,710	262,228	249,291	233,995	239,598	236,997	303,521	360,400	355,022	343,485	313,742	289,241	
1993	267,437	248,928	241,426	267,352	282,660	330,000	356,592	360,400	360,400	360,400	339,684	305,994	
1994	278,714	256,620	239,355	209,682	196,961	201,254	250,111	360,400	360,400	328,106	288,504	253,299	
1995	226,108	246,696	263,295	294,831	317,708	326,065	356,592	360,400	360,400	360,400	360,400	341,235	
1996	313,102	291,101	290,319	303,304	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808	
1997	266,385	283,200	301,776	330,000	300,695	280,067	360,400	360,400	360,400	360,400	334,509	301,549</	

Table 4.3-2

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP 10 Percent Rationing minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	6,905	-2,269	-1,731	-1,260	-763	-409	-297	0	0	0	0
1933	857	-1,906	-1,906	-1,906	-1,908	-1,908	-1,618	-1,358	0	0	0	0
1934	0	0	9,276	13,723	20,918	18,334	13,935	13,927	13,912	13,887	13,863	13,847
1935	13,838	13,838	13,838	11,845	9,985	7,465	4,812	3,653	0	0	0	0
1936	0	1,841	1,777	1,823	1,610	1,348	1,141	0	0	0	0	0
1937	0	0	0	951	845	707	560	463	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0
1939	-1,903	-1,902	-4,756	-4,759	-4,761	-4,761	0	0	0	0	0	0
1940	0	0	1,625	3,531	3,105	2,591	2,184	0	0	0	0	0
1941	-1,903	-1,903	-1,585	-1,587	-1,356	-1,137	-867	-649	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	2,230	2,232	2,233	1,953	1,646	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	2,829	7,590	5,800	2,811	2,808	2,804	2,799	2,795
1961	2,794	9,699	5,801	6,760	6,770	6,769	6,769	6,760	6,753	6,741	6,730	6,722
1962	6,718	7,638	5,640	5,553	2,983	2,983	2,983	0	0	0	0	0
1963	-1,427	-1,427	-1,427	-4,472	-4,475	-4,475	-4,474	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	3,514	3,516	3,517	3,517	3,105	2,719	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	7,136	8,095	8,106	8,105	8,105	8,096	8,073	15,187	16,080	16,958
1978	16,662	17,583	18,534	13,696	5,970	1,213	-629	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	1,237	1,237	1,236	0	0	0	0	0	0	0	0	0
1981	0	921	920	921	922	922	921	922	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	-2,189	-7,250
1991	-12,004	-14,765	-15,289	-19,103	-22,551	-23,598	-23,597	-28,627	0	1,237	1,235	1,235
1992	1,234	1,234	3,137	1,236	1,237	1,236	1,236	0	0	-3,805	-6,750	-9,507
1993	-12,357	-13,277	-13,801	-13,801	-13,801	-13,801	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	-1,902	-1,904	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	168	314	410	300	232	343	263	103	385	440	387	302

Table 4.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP 10 Percent Rationing minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-11,721	-10,801	-10,801	-10,807	-10,814	-9,461	-7,978	-6,683	0	0	-2,188	-4,304
1922	-3,826	-3,826	-3,827	-10,488	-10,494	-10,495	-10,494	0	0	0	-2,188	-4,304
1923	-4,302	-3,381	-3,381	-3,384	-3,385	-18,703	-18,702	0	0	0	-2,188	-4,304
1924	-5,348	-5,348	-4,397	-3,449	-2,591	-8,394	-7,381	-5,875	-7,987	-10,166	-12,336	-14,439
1925	-16,620	2,714	17,936	12,145	-5,119	-20,435	-17,919	0	0	0	-2,188	-4,304
1926	-9,344	-14,961	-7,378	-13,185	-20,730	-36,622	-31,545	-23,581	-2,123	-4,309	-6,492	-8,604
1927	-12,880	-13,801	-12,850	-20,658	-20,670	-24,476	-24,475	0	0	0	-2,188	-7,066
1928	-9,917	-9,917	-8,538	-14,250	-19,413	-21,685	-3,407	0	0	-2,188	-4,373	-9,249
1929	-14,477	-14,478	-14,477	-19,242	-23,549	-34,110	-36,227	-12,458	0	-2,188	-4,374	-6,488
1930	-8,673	10,661	30,639	24,854	19,626	4,310	2,192	0	0	-2,188	-4,373	-6,488
1931	-8,673	-14,289	-7,202	-13,009	-22,554	-28,357	-30,475	-32,645	-34,737	-36,883	-39,018	-41,090
1932	-49,629	-50,089	-19,829	-16,359	-11,782	-7,270	-4,111	-2,971	0	0	-2,188	-4,304
1933	-5,348	-9,952	-2,865	-10,477	-17,357	-27,917	-24,092	-20,179	0	0	-2,188	-4,304
1934	-6,490	-12,107	-10,474	-14,184	-20,798	-30,589	-6,863	-9,047	-11,154	-13,326	-15,491	-17,591
1935	-19,769	-435	19,543	16,635	13,722	-768	-497	-376	0	0	-2,188	-4,304
1936	-11,247	-14,009	-6,990	-19,379	-19,274	-16,765	-14,154	0	0	0	-2,188	-4,304
1937	-8,108	-9,949	-8,988	-13,719	-12,162	-10,199	-8,501	-3,879	0	0	-2,188	-4,304
1938	-8,203	-8,203	-8,915	-16,531	-16,539	-16,494	-14,517	0	0	0	-2,188	-7,066
1939	-8,966	-8,045	-9,947	-13,757	-17,201	-27,761	3,808	0	0	-2,188	-4,373	-6,488
1940	-8,672	10,662	29,164	19,575	17,331	14,533	12,269	0	0	-2,188	-4,374	-6,488
1941	-8,387	-7,467	-3,368	-3,370	-2,878	-2,412	-1,839	-1,374	0	0	-2,188	-4,304
1942	-6,205	-6,205	-4,493	0	0	0	0	0	0	0	-2,188	-4,304
1943	-7,251	-10,934	-3,846	-3,849	-3,850	0	0	0	0	0	-2,188	-4,304
1944	-4,302	-3,381	-528	-5,285	-14,052	-29,369	-31,487	0	0	0	-2,188	-4,304
1945	-2,494	16,839	36,818	31,032	17,300	17,300	15,227	13,316	0	0	-2,188	-4,304
1946	-11,247	-13,088	-13,089	-13,096	-13,103	-11,224	-9,474	0	0	-2,188	-4,374	-6,487
1947	-7,436	-7,437	-9,340	-14,101	-18,406	-28,967	-31,084	0	0	-2,188	-4,374	-6,487
1948	-8,672	-14,288	-7,201	-13,007	-17,311	-17,405	-14,697	-12,307	0	0	-2,188	-4,304
1949	-6,491	-12,106	-12,106	-12,088	-12,094	-10,246	-8,223	-6,881	0	-2,188	-4,374	-9,250
1950	-13,050	6,284	27,271	9,115	8,053	6,756	5,577	4,675	0	-800	-2,988	-5,103
1951	-7,289	0	0	0	0	-6,659	-5,851	-5,848	0	0	-2,188	-7,066
1952	-8,966	-8,965	-8,966	-4,488	-4,491	-15,539	-15,539	0	0	0	-2,188	-4,304
1953	-4,302	-3,381	-2,431	-2,431	-2,433	-17,749	-26	0	0	0	-2,188	-4,304
1954	-1,449	-527	2,327	-6,234	-13,284	-28,601	-30,718	0	0	-2,188	-4,373	-6,487
1955	-4,677	14,657	29,879	11,725	-4,680	-10,484	-8,847	-7,393	0	-2,188	-4,374	-6,488
1956	-8,673	-14,289	-1,955	-1,956	-1,957	-1,709	-1,439	0	0	0	-2,188	-4,304
1957	-6,205	-6,205	-5,253	-10,014	-18,784	-29,344	-31,461	0	0	0	-2,188	-4,304
1958	-9,344	-12,106	-9,776	-13,586	-13,594	-13,594	-13,594	0	0	0	-2,188	-4,304
1959	-6,205	-5,285	-2,431	-10,993	-11,000	-26,317	-22,670	-8,156	-10,265	-12,438	-14,605	-16,706
1960	-18,884	449	20,428	14,640	9,473	9,173	7,006	1,224	-895	-3,082	-5,264	-7,376
1961	-9,560	-8,271	5,330	962	-9,434	-15,238	-17,356	-18,262	-20,358	-22,518	-24,666	-38,725
1962	-53,258	-51,970	-50,637	-55,067	-68,882	-87,053	-89,170	0	0	0	-2,188	-7,066
1963	-13,723	-18,326	-15,995	-21,712	-21,725	-28,385	-32,988	0	0	0	-2,188	-4,304
1964	-11,247	-14,929	-13,978	-23,499	-32,104	-37,908	-37,610	-26,974	3,808	1,616	-574	-2,692
1965	-4,878	14,456	23,035	23,045	23,056	22,256	18,934	16,237	0	0	0	-4,880
1966	-6,780	-8,622	-2,408	-10,971	-16,941	-21,050	3,808	0	0	-2,188	-4,373	-6,488
1967	-8,672	-14,288	-8,580	-8,585	-8,590	-6,934	-9,697	0	0	0	-2,118	-4,304
1968	-7,825	-7,825	-738	-9,300	-17,038	-27,599	-29,716	0	0	-2,188	-4,374	-6,488
1969	-8,672	-11,434	-13,337	-13,345	-6,138	0	0	0	0	0	-2,188	-4,304
1970	-4,302	-15,032	30,254	-3,935	-9,154	-7,203	-9,320	0	0	0	-2,188	-4,304
1971	-8,107	-9,948	-8,998	-9,002	-9,006	-19,566	-21,683	0	0	0	-2,188	-4,304
1972	-6,490	-12,106	-14,009	-18,774	-23,081	-28,885	-31,002	0	0	-2,188	-4,373	-6,487
1973	-8,671	-14,288	-7,200	-7,205	-7,209	-7,209	-13,930	0	0	-2,188	-4,374	-9,249
1974	-11,149	-11,148	-11,149	0	0	0	0	0	0	0	-2,188	-7,066
1975	-6,111	13,222	33,201	21,709	13,988	10,183	10,183	3,935	0	0	-2,188	-4,304
1976	-4,303	-3,381	3,706	-2,951	-8,968	-14,771	-16,889	-19,067	-21,170	-23,332	-25,490	-27,578
1977	-29,749	-35,366	-30,133	-28,730	-33,915	-39,719	-41,836	-43,968	-45,986	-40,952	-35,901	-33,782
1978	-36,404	-39,718	-30,253	-42,257	-56,904	-70,223	-82,376	0	0	0	-2,188	-3,994
1979	-43	878	1,829	-6,732	-6,735	0	0	0	0	-2,188	-4,373	-6,488
1980	-12,193	7,141	22,363	0	0	0	0	0	0	0	-2,188	-4,304
1981	-6,205	-5,284	1,803	-5,807	-12,684	-28,001	-28,001	-17,578	-3,808	-5,992	-8,173	-10,284
1982	-11,229	-14,911	-10,155	-10,158	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-2,946	0	0	0	0	-2,118
1984	0	0	0	0	0	-9,738	-11,659	0	0	0	0	-2,188
1985	-6,490	8,241	23,462	17,670	8,142	-2,418	-4,535	0	0	-2,188	-4,374	-6,487
1986	-8,672	-14,288	-7,200	-13,006	-16,452	-3,935	0	0	0	0	-2,188	-4,304
1987	-6,205	-5,284	-4,333	-8,141	-11,583	-22,143	-24,260	-12,818	-3,378	-5,563	-7,744	-9,855
1988	-12,037	-17,653	-10,566	-16,375	-24,976	-30,780	-32,898	-35,067	-3,865	-8,902	-15,837	-20,703
1989	-25,449	-31,893	-33,796	-36,669	-39,268	-49,828	-29,078	0	0	-7,896	-15,783	-13,929
1990	-15,825	-1,095	14,127	2,623	-7,773	-18,333	-20,450	0	0	-7,896	-15,784	-22,674
1991	-27,422	-33,866	-31,536	-30,602	-34,916	-53,087	-55,205	-57,362	0	-4,734	-9,486	-14,081
1992	-18,833	-18,833	-19,784	-29,499	-32,953	-51,125	-53,242	0	-5,378	-9,177	-13,067	-17,660
1993	-22,409	-22,409	-24,835	-24,835	-24,862	0	0	0	0	0	-2,188	-4,304
1994	-6,205	-5,284	-2,430	-7,188	-15,785	-26,346	-28,463	0	0	-2,188	-4,374	-9,249
1995	-16,189	3,146	23,124	10,770	3,041	0	0	0	0	0	0	-4,880
1996	-6,781	-5,859	-3,529	-3,531	0	0	0	0	0	0	-2,188	-7,066
1997	-11,820	-12,740	-12,741	0	0	-11,512	0	0	0	0	-2,188	-4,304
1998	-5,253	-7,095	-5,715	-5,719	-5,722	0	0	0	0	0	-2,188	-7,066
1999	-8,014	-8,014	-9,917	-18,484	-18,492	-18,493	-16,251	-661	0	0	-2,188	-7,066
2000	-8,966	-10,366	30,347	15,048	5,604	-7,905	-10,022	0	0	-2,188	-4,373	-9,250
2001	-14,954	-16,795	-9,707	-18,275	-26,878	-41,148	-43,266	0	-214	-2,402	-4,587	-6,701
2002	-9,551	-11,392	-10,250	-16,916	-22,941	-33,501	-35,619	0	0	-2,188	-4,374	-6,488
Avg (21-02)	-10,785	-8,400	-2,475	-7,355	-10,953	-16,154	-15,107	-4,293	-2,043	-3,175	-5,387	-8,174

Figure 4.3-2

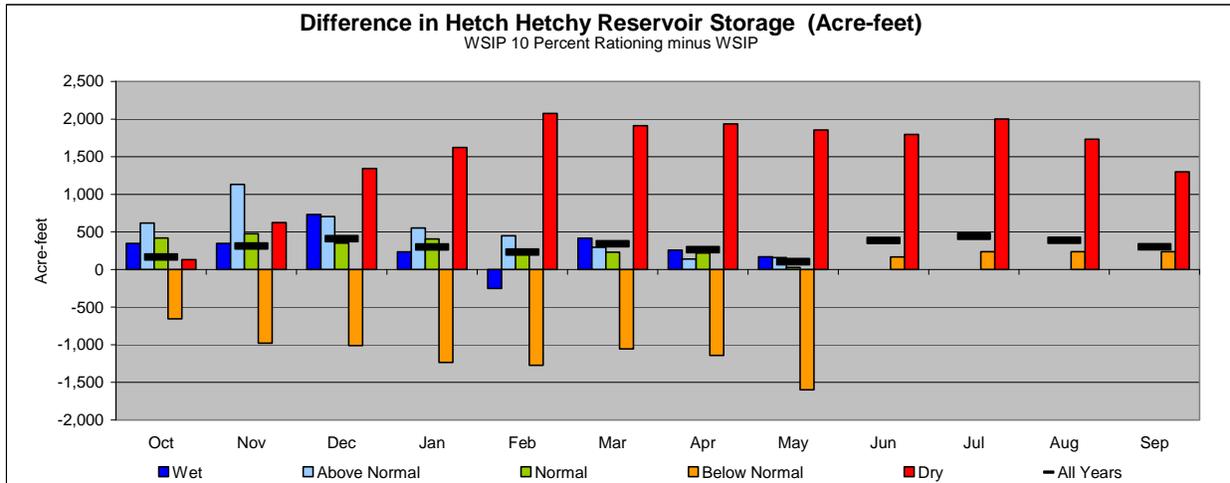


Figure 4.3-3

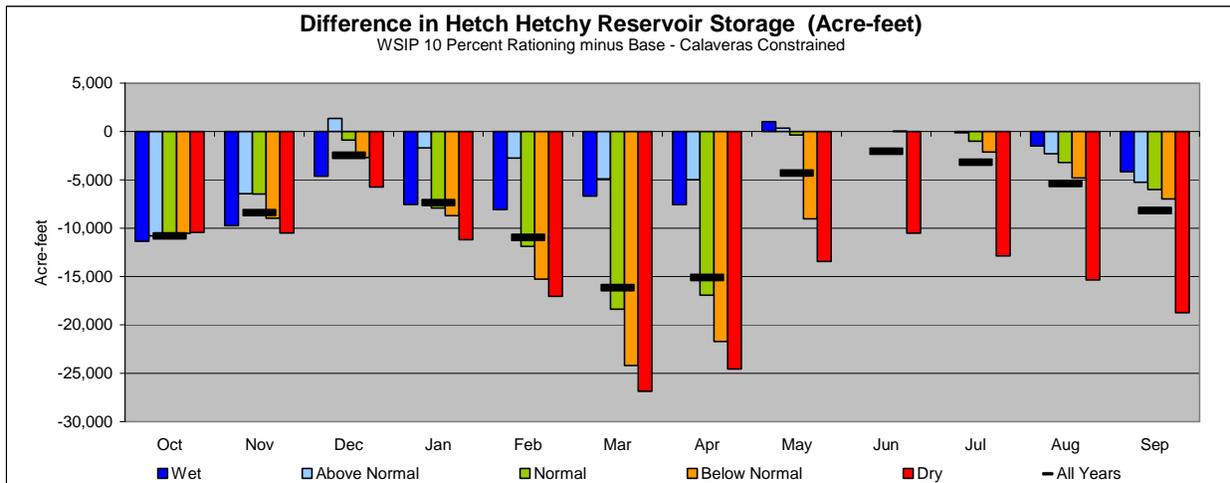


Figure 4.3-4

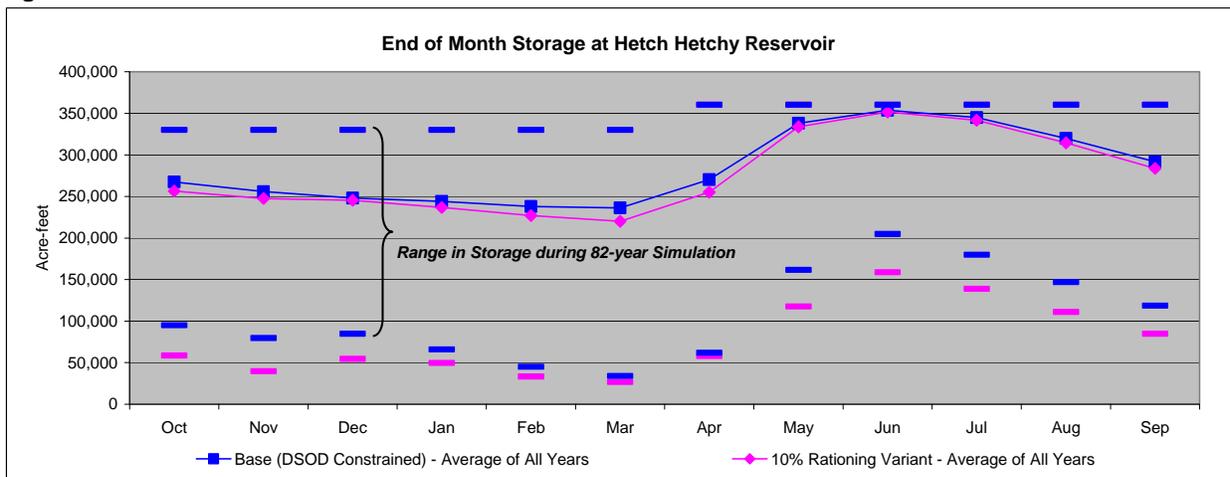


Table 4.3-4

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP 10 Percent Rationing minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	-297	0	0	0	-297
1933	0	0	0	0	0	0	0	0	-1,193	0	0	0	-1,193
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	3,648	0	0	0	3,648
1936	0	0	0	0	0	0	0	999	0	0	0	0	999
1937	0	0	0	0	0	0	0	0	492	0	0	0	492
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	1,816	0	0	0	0	1,816
1941	0	0	0	0	0	0	0	0	-648	0	0	0	-648
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	1,439	0	0	0	0	1,439
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	-4,473	0	0	0	0	-4,473
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	2,717	0	0	0	2,717
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-28,603	0	0	0	-28,603
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	0	0	0	0	0	-3	-291	0	0	0	-294

Table 4.3-5

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP 10 Percent Rationing minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-6,676	0	0	0	-6,676
1922	0	0	0	0	0	0	0	-9,137	0	0	0	0	-9,137
1923	0	0	0	0	0	0	0	-18,692	0	0	0	0	-18,692
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-17,695	0	0	0	0	-17,695
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-24,963	0	0	0	0	-24,963
1928	0	0	0	0	0	0	0	-3,618	0	0	0	0	-3,618
1929	0	0	0	0	0	0	0	0	-13,231	0	0	0	-13,231
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	-2,968	0	0	0	-2,968
1933	0	0	0	0	0	0	0	0	-17,710	0	0	0	-17,710
1934	0	0	0	0	0	0	-3,808	0	0	0	0	0	-3,808
1935	0	0	0	0	0	3,935	0	0	-376	0	0	0	3,559
1936	0	0	0	0	0	0	0	-12,365	0	0	0	0	-12,365
1937	0	0	0	0	0	0	0	-3,143	-4,111	0	0	0	-7,254
1938	0	0	0	0	0	0	0	-12,653	0	0	0	0	-12,653
1939	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1940	0	0	0	0	0	0	0	10,278	0	0	0	0	10,278
1941	0	0	0	0	0	0	0	0	-1,373	0	0	0	-1,373
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-31,469	0	0	0	0	-31,469
1945	0	0	0	0	0	0	0	0	13,305	0	0	0	13,305
1946	0	0	0	0	0	0	0	-8,285	0	0	0	0	-8,285
1947	0	0	0	0	0	0	0	-31,072	0	0	0	0	-31,072
1948	0	0	0	0	0	0	0	0	-12,293	0	0	0	-12,293
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	4,670	0	0	0	4,670
1951	0	-7,289	0	0	0	0	0	0	-6,213	0	0	0	-13,502
1952	0	0	0	0	0	0	0	-15,533	0	0	0	0	-15,533
1953	0	0	0	0	0	0	0	-26	0	0	0	0	-26
1954	0	0	0	0	0	0	0	-30,705	0	0	0	0	-30,705
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-1,264	0	0	0	0	-1,264
1957	0	0	0	0	0	0	0	-31,449	0	0	0	0	-31,449
1958	0	0	0	0	0	0	0	-13,589	0	0	0	0	-13,589
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-41,654	0	0	0	0	-41,654
1963	0	0	0	0	0	0	0	-33,536	0	0	0	0	-33,536
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	16,223	0	0	0	16,223
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237
1967	0	0	0	0	0	0	0	-10,256	0	0	0	0	-10,256
1968	0	0	0	0	0	0	0	-30,764	0	0	0	0	-30,764
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	-9,317	0	0	0	0	-5,382
1971	0	0	0	0	0	0	0	-22,371	0	0	0	0	-22,371
1972	0	0	0	0	0	0	0	-30,986	0	0	0	0	-30,986
1973	0	0	0	0	0	0	0	-13,924	0	0	0	0	-13,924
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	2,521	4,171	0	0	0	6,692
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-46,590	0	0	0	-310	-46,900
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-10,407	-10,310	0	0	0	-20,717
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-3,131	0	0	0	0	-3,131
1984	0	0	0	0	0	3,935	0	-11,653	0	0	0	0	-7,718
1985	0	0	0	0	0	0	0	-4,835	0	0	0	0	-4,835
1986	0	0	0	0	0	-8,478	-3,935	0	0	0	0	0	-12,413
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1989	0	0	0	0	0	0	0	-30,146	0	0	0	0	-30,146
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	-58,342	0	0	0	-58,342
1992	0	0	0	0	0	0	0	-28,918	0	0	0	0	-28,918
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-12,746	0	0	0	0	0	0	0	0	-12,746
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-13,491	-698	0	0	0	-14,189
2000	0	0	0	0	0	0	0	-10,019	0	0	0	0	-10,019
2001	0	0	0	0	0	0	0	-43,245	0	0	0	0	-43,245
2002	0	0	0	0	0	0	0	-36,682	0	0	0	0	-36,682
Avg (21-02)	0	-89	0	-107	0	-7	-187	-8,288	-1,263	0	0	-4	-9,946

Table 4.3-4 illustrates the difference in stream release between the variant and WSIP settings, expressed in terms of a month-to-month change in volume (acre-feet) of flow. The one notable difference in monthly flow below O'Shaughnessy Dam indicates a potential decrease of approximately 29,000 acre-feet between the variant and WSIP settings. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful.⁵ Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from O'Shaughnessy Dam between the variant and WSIP would be a delay in releases up to 5 days. Normally, the effect of a delay in release would not affect the year's peak stream release rate during a year. Compared to the base setting, the variant's effect to stream flow is almost identical to the effect caused by the WSIP.

Compared to the base setting, Table 4.3-5 illustrates that the variant could potentially decrease releases by up to 58,000 acre-feet in one monthly instance, or increase releases by up to 10,000 acre-feet during a month. These changes would equate to an effect ranging from a delay in release of up to 10 days to an earlier initiation of releases by 2 days.

4.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different in the variant. Figure 4.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 4.4-1 are the results for the WSIP, variant, and base settings. The operation resulting from the variant is essentially the same as in the WSIP setting, except during the prolonged drought of 1987-1992. The difference is explained as modeling discretion, and would not likely occur. HH/LSM model logic estimates the amount of water to be released from Lake Lloyd based on the condition of Hetch Hetchy Reservoir, the Don Pedro Water Bank Account, and Lake Eleanor and Lake Lloyd storage in comparison to demands. In this instance, the model logic retains more water in Lake Lloyd as compared to the WSIP setting. By the end of the drought, this water is utilized, and the storage between the two settings is comparable. The end result is the same storage at the end of the period, and only the rate at which it changes is different. The model logic is not very refined, and a small change in computation result can result in a large difference in Lake Lloyd release (in this instance, through Holm Powerhouse). Overall, the Lake Lloyd operation would be discretionary, and the outcome would likely be the same among the variant and the WSIP settings.

Figure 4.4-2 illustrates an almost identical operation of Lake Eleanor for the variant and WSIP settings. Also shown in Figure 4.4-2 is the operation for the base setting. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more associated with modeling discretion than with any substantive likely difference in operation.

Supplementing the Figure 4.4-1 representation of Lake Lloyd stream releases is Table 4.4-1, which illustrates releases for the variant and WSIP settings and the almost no difference in releases between the two. Table 4.4-2 provides the same form of information for the variant and base settings, also showing almost no difference between the variant and the base settings.

⁵ See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir", Memorandum by Daniel B. Steiner, December 31, 2006.

**Figure 4.4-1
Lake Lloyd Storage and Stream Release**

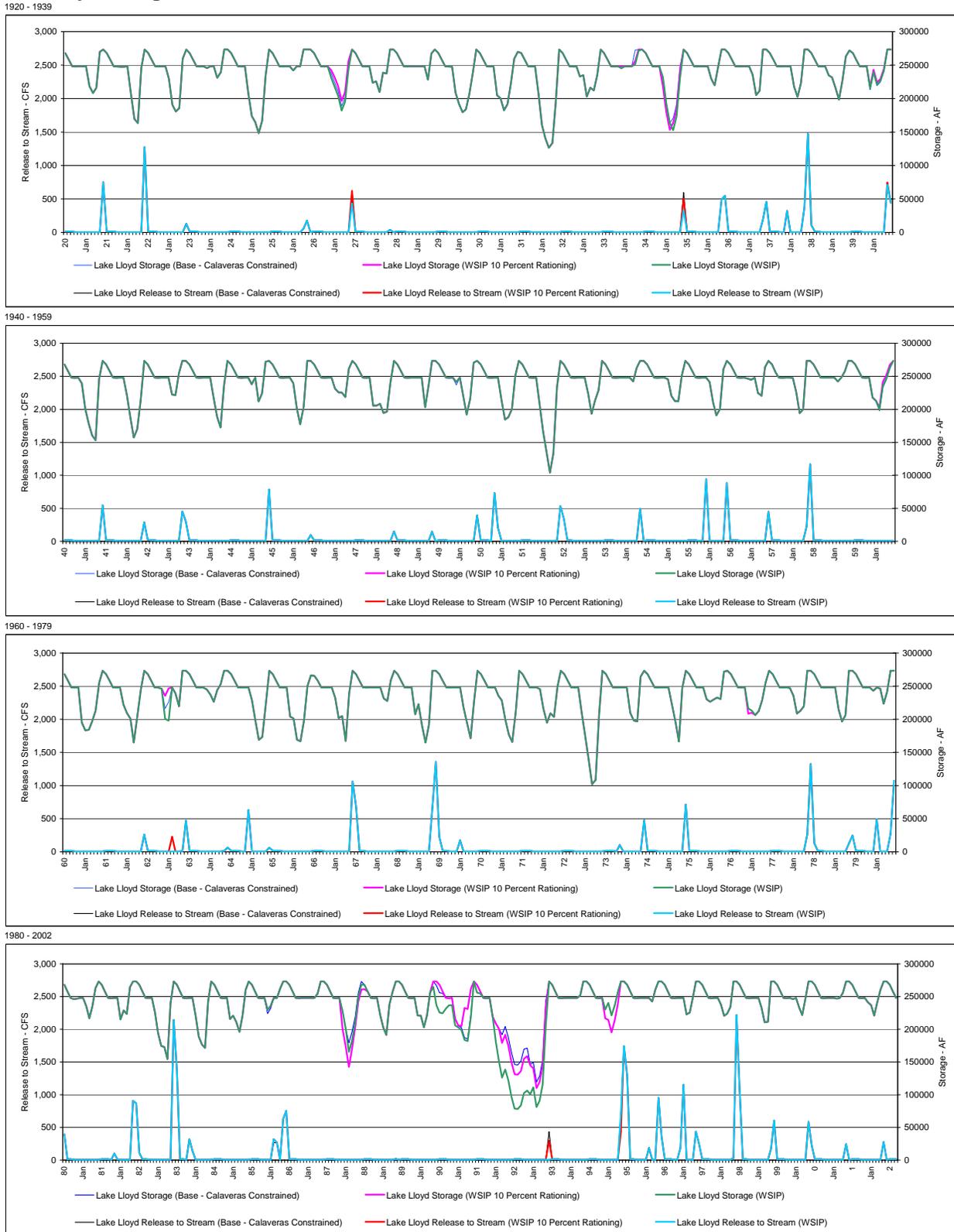


Figure 4.4-2
Lake Eleanor Storage and Stream Release



Table 4.4-1

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP 10 Percent Rationing	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	267	1,076	363	15	15
Above Normal	5	72	25	5	29	5	5	169	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	14	8	6	118	348	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	121	340	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP 10 Percent Rationing minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	0	0	0	-18	18	0	0	0
Above Normal	0	0	0	0	13	0	0	2	21	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	3	0	0	-3	8	0	0	0

Table 4.4-2

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP 10 Percent Rationing	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	267	1,076	363	15	15
Above Normal	5	72	25	5	29	5	5	169	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	14	8	6	118	348	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	21	21	5	284	1,084	363	15	15
Above Normal	5	72	25	5	16	5	5	166	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	350	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	3	0	0	-18	-9	0	0	0
Above Normal	0	0	0	0	13	0	0	3	1	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	3	0	0	-3	-2	0	0	0

4.5 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 4.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 4.5-1 are the results for the WSIP, variant, and base settings.

Supplementing the Figure 4.5-1 representation of Don Pedro Reservoir storage are Table 4.5-1 Don Pedro Reservoir Storage (10% Rationing) and Table 4.5-2 Difference in Don Pedro Reservoir Storage (10% Rationing minus WSIP). Table 4.5-3 is provided to illustrate the difference in Hetch Hetchy Reservoir storage between the base and variant settings.

Table 4.5-2 illustrates that, throughout many years, the storage in Don Pedro Reservoir associated with the variant would not differ from the storage in the WSIP setting. Minor changes in storage occur during

Figure 4.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

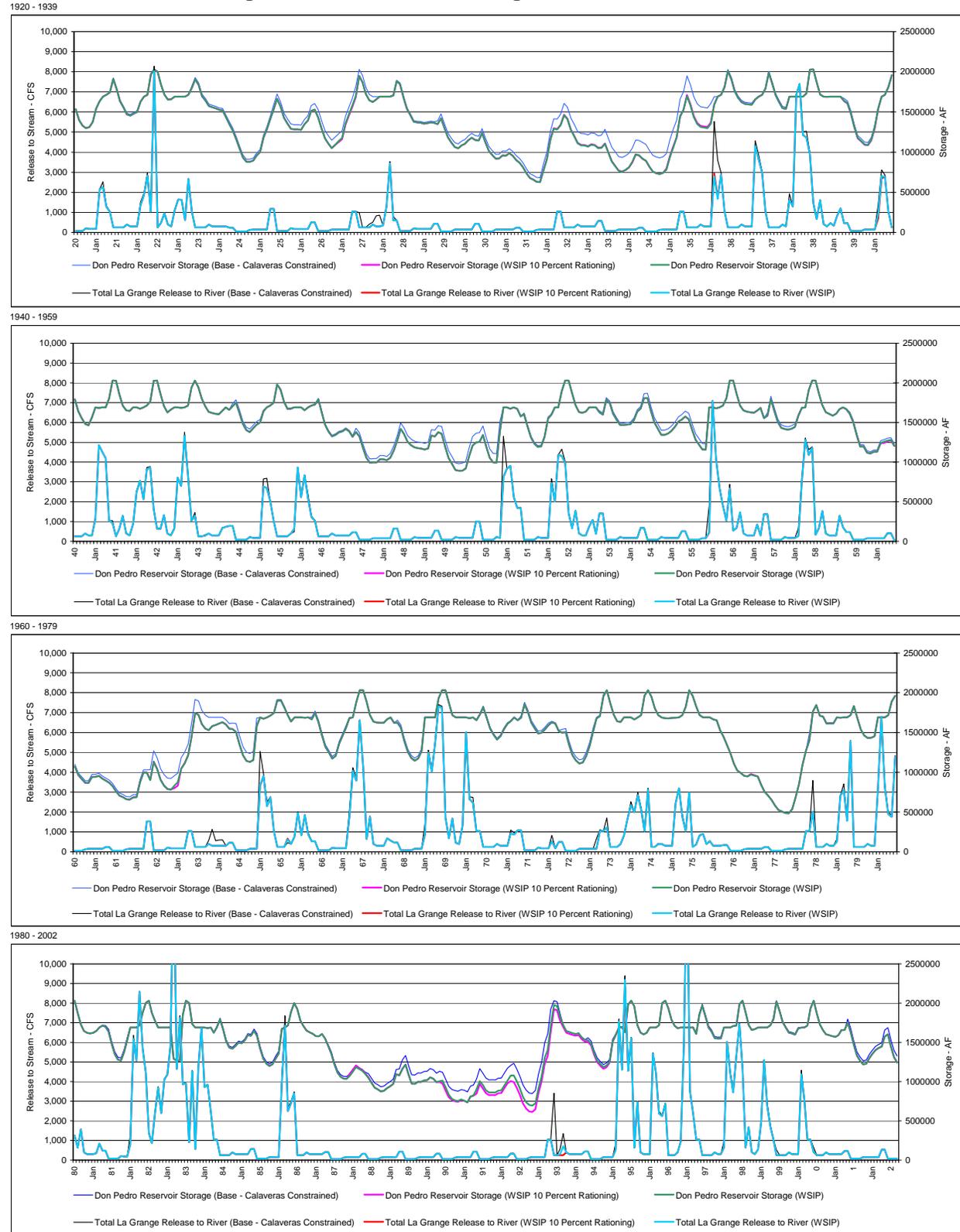


Table 4.5-1

Don Pedro Reservoir Storage (Acre-feet)

WSIP 10 Percent Rationing

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,271	1,910,239	1,780,368	1,632,093	1,555,504
1922	1,469,532	1,454,724	1,479,018	1,499,182	1,627,229	1,690,000	1,713,000	1,967,374	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,799,350	1,837,747	1,905,720	1,837,747	1,643,504
1924	1,573,662	1,557,997	1,543,979	1,525,572	1,520,285	1,435,601	1,350,582	1,268,108	1,160,641	1,041,842	933,176	878,997
1925	881,178	895,290	959,080	1,001,347	1,177,665	1,284,520	1,414,414	1,536,668	1,665,128	1,566,983	1,426,571	1,354,602
1926	1,290,743	1,282,398	1,282,833	1,276,745	1,347,403	1,393,186	1,513,528	1,529,318	1,431,062	1,291,567	1,169,352	1,105,586
1927	1,050,369	1,090,025	1,124,968	1,161,721	1,339,634	1,454,381	1,563,601	1,685,574	1,948,150	1,868,472	1,722,559	1,645,445
1928	1,624,169	1,655,495	1,689,962	1,690,000	1,689,998	1,690,000	1,705,499	1,882,298	1,844,942	1,681,291	1,538,831	1,460,902
1929	1,377,322	1,368,992	1,366,099	1,352,890	1,361,744	1,370,153	1,363,716	1,347,620	1,420,045	1,297,417	1,184,105	1,120,176
1930	1,064,049	1,047,885	1,083,398	1,103,389	1,147,360	1,178,802	1,151,942	1,144,262	1,236,535	1,120,169	1,015,406	962,553
1931	917,895	920,233	957,669	955,848	987,375	954,080	900,516	866,574	810,612	736,739	676,917	657,388
1932	631,250	626,111	775,055	921,341	1,160,729	1,296,550	1,287,208	1,340,437	1,464,128	1,416,773	1,281,107	1,204,200
1933	1,115,158	1,089,757	1,087,456	1,072,920	1,097,571	1,089,471	1,053,650	1,058,364	1,106,890	997,181	886,682	827,702
1934	770,291	758,539	775,466	808,538	872,379	969,011	956,055	916,896	892,359	818,637	757,246	737,956
1935	727,280	740,918	794,093	948,977	1,072,447	1,180,619	1,441,663	1,527,535	1,710,444	1,595,170	1,450,406	1,363,406
1936	1,327,188	1,318,744	1,312,836	1,366,335	1,594,364	1,690,000	1,713,000	1,809,562	2,008,091	1,909,712	1,759,622	1,676,922
1937	1,623,613	1,602,292	1,595,757	1,589,655	1,655,418	1,690,000	1,713,000	1,792,311	1,987,462	1,852,802	1,706,683	1,621,969
1938	1,547,848	1,539,286	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,635,656	1,604,973	1,481,480	1,314,275	1,172,576	1,133,839
1940	1,091,624	1,084,357	1,144,602	1,295,283	1,536,604	1,690,000	1,713,000	1,812,499	1,959,504	1,793,778	1,643,535	1,554,911
1941	1,484,298	1,467,987	1,566,983	1,689,992	1,683,108	1,690,000	1,690,000	1,803,587	2,030,000	2,027,570	1,857,470	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,745	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,706,915	1,749,631	1,623,011	1,481,354	1,403,951
1945	1,379,320	1,427,347	1,473,782	1,500,075	1,640,198	1,690,000	1,713,000	1,750,606	1,979,431	1,916,348	1,762,159	1,674,274
1946	1,676,444	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,277	1,790,756	1,626,434	1,470,843	1,384,452
1947	1,325,252	1,341,690	1,375,016	1,387,235	1,418,025	1,387,541	1,319,689	1,380,202	1,321,263	1,180,658	1,055,313	992,092
1948	995,855	997,122	1,035,745	1,034,871	1,022,941	1,055,025	1,146,212	1,267,720	1,417,634	1,352,869	1,259,478	1,215,157
1949	1,185,933	1,175,442	1,170,203	1,158,664	1,170,747	1,334,893	1,324,462	1,376,085	1,357,943	1,375,682	1,052,617	977,799
1950	899,772	889,700	891,735	917,336	1,074,649	1,209,756	1,247,393	1,254,524	1,342,391	1,193,077	1,052,942	994,455
1951	991,828	1,394,480	1,689,996	1,689,971	1,673,951	1,690,000	1,671,372	1,576,239	1,604,996	1,451,580	1,311,792	1,232,453
1952	1,191,106	1,198,816	1,320,408	1,550,006	1,599,510	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,598,044	1,787,718	1,742,953	1,609,936	1,534,967
1954	1,469,181	1,468,382	1,472,024	1,478,824	1,527,793	1,637,361	1,675,192	1,807,461	1,807,613	1,647,557	1,501,608	1,423,172
1955	1,343,773	1,343,524	1,361,809	1,394,386	1,444,656	1,510,283	1,537,906	1,575,778	1,541,339	1,405,813	1,280,713	1,222,079
1956	1,159,157	1,157,788	1,690,000	1,689,942	1,678,244	1,690,000	1,713,000	1,806,575	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,586,050	1,793,311	1,646,081	1,506,206	1,432,543
1958	1,416,187	1,408,633	1,421,341	1,444,300	1,585,917	1,683,239	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,329	1,608,068	1,505,552	1,340,406	1,197,054	1,196,761
1960	1,118,856	1,107,432	1,130,660	1,130,349	1,237,617	1,242,541	1,260,703	1,272,649	1,202,722	1,072,082	963,331	914,093
1961	866,214	865,423	941,551	943,248	955,402	921,478	896,370	869,320	826,181	761,482	707,872	688,573
1962	662,629	657,540	685,275	689,219	876,319	997,428	997,567	904,748	1,134,305	1,043,580	906,787	834,095
1963	791,372	785,329	800,877	831,757	1,047,914	1,115,994	1,215,858	1,447,758	1,742,553	1,723,046	1,606,960	1,548,182
1964	1,529,550	1,579,114	1,594,780	1,612,886	1,629,372	1,599,437	1,546,921	1,543,278	1,504,654	1,349,718	1,214,770	1,143,889
1965	1,130,401	1,153,714	1,581,698	1,689,973	1,672,299	1,690,000	1,713,000	1,745,040	1,907,880	1,909,923	1,820,436	1,723,004
1966	1,638,047	1,690,000	1,689,998	1,689,996	1,685,990	1,690,000	1,666,206	1,743,752	1,626,487	1,462,463	1,318,853	1,248,271
1967	1,172,366	1,205,898	1,359,590	1,458,604	1,556,437	1,679,489	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,623,382	1,560,682	1,393,610	1,258,193	1,180,490
1969	1,144,074	1,173,385	1,262,868	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,036	1,816,534	1,686,506	1,549,469	1,471,343
1971	1,411,316	1,454,230	1,541,278	1,607,186	1,641,597	1,690,000	1,654,817	1,685,672	1,853,567	1,753,420	1,619,836	1,550,260
1972	1,488,043	1,496,591	1,540,187	1,590,658	1,628,525	1,611,472	1,517,554	1,495,198	1,504,521	1,346,809	1,215,475	1,148,834
1973	1,110,158	1,123,168	1,205,238	1,334,033	1,513,648	1,676,096	1,707,479	1,954,405	2,030,000	1,868,018	1,723,819	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,536	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,823,045	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	978,997	961,854	947,174	838,577	752,499	707,492	653,826	583,542	526,716	507,831
1978	487,410	485,142	537,428	682,530	851,420	1,090,270	1,269,012	1,400,455	1,761,000	1,845,303	1,711,347	1,699,327
1979	1,612,044	1,615,120	1,614,176	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,303	1,682,304	1,538,286	1,461,691
1980	1,430,288	1,433,000	1,453,035	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,714,087	1,699,430	1,637,187	1,476,194	1,347,699	1,279,533
1982	1,270,664	1,377,577	1,528,321	1,689,995	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,612	1,791,967	1,663,838	1,517,244	1,433,830
1985	1,418,807	1,453,917	1,498,296	1,488,884	1,523,939	1,592,019	1,585,122	1,645,091	1,583,355	1,422,894	1,291,292	1,227,399
1986	1,200,412	1,221,603	1,293,188	1,358,196	1,670,079	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,677	1,709,305
1987	1,650,170	1,628,126	1,609,576	1,578,456	1,577,656	1,606,514	1,550,992	1,452,961	1,354,101	1,222,918	1,114,556	1,061,284
1988	1,038,561	1,037,658	1,101,076	1,154,903	1,206,529	1,173,122						

Table 4.5-2

Difference in Don Pedro Reservoir Storage (Acre-feet)

WSIP 10 Percent Rationing minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	-11,566	-14,368	-14,369	-14,364	-14,351	-11,953	61	60	60	60
1928	60	60	60	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	5,179	7,493	7,022	6,522	6,162	6,034	5,717	5,691	5,665	5,646
1933	5,634	5,631	5,631	5,632	5,633	5,631	5,335	5,064	3,692	3,675	3,658	3,645
1934	3,637	3,635	-3,660	-2,472	-7,081	-4,495	-4,943	-1,889	-83	-83	-82	-82
1935	-81	-81	13,578	14,487	14,178	-4,814	-2,157	-940	13,732	13,671	13,609	13,563
1936	13,534	13,526	13,591	13,550	5,378	0	0	1,139	1,136	1,131	1,125	1,121
1937	1,120	1,119	1,119	1,119	426	0	0	95	557	555	552	550
1938	550	548	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	-4,758	-4,746	-4,731	-4,709	-4,688	-4,672
1940	-4,662	-4,659	-8,417	-11,597	-3,866	0	0	4,546	4,531	4,511	4,491	4,477
1941	4,468	4,464	4,148	-1	46	0	0	-218	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	1	0	0	0	1,643	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	-6,110	-13,826	-10,852	-6,771	-2,770	-2,757	-2,745	-2,735
1961	-2,730	-2,728	2,122	2,123	2,122	2,122	2,120	2,114	2,107	2,097	2,086	2,079
1962	2,074	2,073	2,073	2,074	2,074	2,073	2,074	5,042	5,025	5,002	4,979	4,961
1963	4,950	4,948	-29,824	-43,998	4,977	4,975	4,970	490	488	486	484	482
1964	482	480	481	481	481	481	480	480	478	476	474	471
1965	471	471	-3,044	0	0	0	0	382	3,094	3,080	3,068	-5
1966	-5	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	8,219	3,004	-2	-3	-4	-4	-4	-4	-4	-4
1978	-4	-4	-4	-4	-4	-4	-4	-631	0	-1	0	0
1979	-1	0	-1	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	919	915	910	907
1982	905	905	905	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	27,234	27,241	23,010	12,586	7,532	7,513	7,487	6,705	-96	-95
1989	-95	-95	-94	-95	-95	-95	-94	-95	-94	-94	-93	-93
1990	-93	-93	-93	-93	-93	-93	-92	-8,513	-36,768	-42,401	-33,050	-16,093
1991	-10,677	-10,671	-9,886	-2,384	-1,027	-1,027	-1,026	-54,232	-32,973	-44,736	-35,695	-32,493
1992	-32,423	-32,403	-32,406	-32,415	-32,417	-32,405	-69,095	-83,896	-83,600	-83,198	-82,801	-82,505
1993	-82,327	-82,276	-74,166	-58,814	-58,786	-72,381	-77,022	-79,764	-53,695	-53,466	-49,711	-22,515
1994	-22,471	-22,458	-22,459	-22,465	-22,468	-22,459	-22,438	-22,380	-22,304	-22,202	-22,099	-22,024
1995	-21,979	-21,968	-8,308	3,998	1,599	0	-3,974	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-1,703	-1,702	-1,458	-1,311	-968	-1,605	-2,221	-2,945	-2,293	-2,507	-2,316	-1,773

Table 4.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet)												WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	-197	-197	-197	-197	-79	0	0	-3,473	-12,241	-14,370	-14,308	-14,262	
1922	-14,232	-14,224	-14,224	-14,228	-5,692	0	0	-9,834	0	-2,184	-1,520	3	
1923	3	2	0	0	0	0	0	-20,855	-22,900	-24,983	-24,874	-24,795	
1924	-24,744	-24,731	-24,732	-24,740	-24,741	-24,732	-27,837	-31,450	-31,342	-31,201	-31,053	-30,941	
1925	-30,873	-30,855	-30,856	-30,865	-30,868	-30,856	-35,458	-55,438	-57,366	-59,296	-59,028	-58,827	
1926	-58,704	-58,670	-59,168	-59,185	-59,386	-58,789	-65,924	-75,878	-99,136	-98,684	-98,227	-97,898	
1927	-97,695	-97,641	-102,612	-105,439	-105,448	-105,409	-105,309	-130,372	-81,850	-83,683	-82,672	-72,856	
1928	-65,831	-34,505	-37	0	0	0	0	-7,501	-13,070	-15,140	-15,076	-14,959	
1929	-14,928	-14,919	-14,920	-14,924	-14,925	-14,919	-14,905	-40,768	-55,169	-54,917	-54,663	-54,480	
1930	-54,367	-54,337	-54,340	-54,355	-54,358	-54,339	-54,287	-54,144	-56,074	-55,822	-55,567	-55,376	
1931	-55,256	-55,224	-55,227	-55,243	-55,248	-55,226	-55,171	-55,018	-54,819	-54,559	-54,295	-54,101	
1932	-53,986	-53,955	-80,889	-85,840	-97,307	-118,238	-123,396	-132,095	-142,233	-143,777	-143,117	-142,629	
1933	-142,334	-142,254	-142,260	-142,302	-142,312	-142,259	-148,063	-153,754	-175,464	-176,853	-176,030	-175,411	
1934	-175,028	-174,924	-176,565	-177,671	-178,813	-179,514	-188,861	-204,651	-203,929	-202,967	-201,991	-201,277	
1935	-200,837	-200,718	-187,068	-201,760	-215,893	-215,390	-217,568	-226,016	-239,149	-240,297	-239,235	-238,438	
1936	-237,946	-237,812	-237,754	-237,806	-95,626	0	0	-16,314	-18,375	-20,480	-20,390	-20,326	
1937	-20,284	-20,273	-20,283	-20,321	-7,817	0	0	-9,641	-18,351	-20,455	-20,365	-20,301	
1938	-20,259	-20,248	0	0	0	0	0	0	0	0	0	0	
1939	0	0	0	0	0	0	0	-33,671	-31,969	-33,976	-33,820	-33,553	
1940	-33,483	-33,464	-36,491	-38,964	-13,289	0	0	10,721	5,814	5,789	5,764	5,745	
1941	5,733	5,729	4,485	-1	98	0	0	-3,313	0	-2,183	-1,521	3	
1942	3	3	0	1	0	0	0	0	0	0	0	0	
1943	0	0	0	0	0	0	0	-5,036	0	-2,183	-2,174	4	
1944	3	4	4	3	2	0	0	-33,617	-35,622	-37,653	-37,484	-37,358	
1945	-37,280	-37,259	-37,261	-37,271	-14,910	0	0	-285	10,885	8,655	8,617	8,590	
1946	8,574	0	0	0	0	0	0	-11,642	-13,718	-13,660	-13,598	-13,552	
1947	-13,524	-13,515	-13,516	-13,520	-13,521	-13,516	-13,503	-46,684	-48,636	-48,412	-48,190	-48,027	
1948	-47,926	-47,899	-47,900	-47,914	-47,918	-53,609	-58,380	-62,784	-76,952	-78,784	-78,417	-78,151	
1949	-77,990	-77,947	-77,949	-77,997	-78,002	-75,066	-79,131	-82,443	-91,334	-90,714	-90,300	-89,994	
1950	-89,802	-89,749	-95,134	-90,788	-106,140	-115,363	-116,188	-117,171	-114,214	-115,072	-114,548	-114,162	
1951	-113,922	-125,747	3	0	0	0	-2,924	-3,841	-13,036	-15,160	-15,090	-15,039	
1952	-15,008	-14,999	-15,000	-19,487	-7,796	0	0	0	0	0	0	0	
1953	0	0	0	0	0	0	-19,831	-21,992	-24,036	-26,115	-26,002	-25,917	
1954	-25,863	-25,849	-25,850	-25,858	-25,859	-25,849	-25,826	-58,616	-60,536	-60,276	-60,006	-59,807	
1955	-59,681	-59,648	-59,650	-59,667	-59,673	-59,651	-61,818	-65,543	-76,078	-75,736	-75,387	-75,129	
1956	-74,974	-74,933	2	0	0	0	0	-6,472	0	0	0	0	
1957	0	0	0	0	0	0	0	-33,595	-35,600	-37,630	-37,462	-37,338	
1958	-37,260	-37,239	-37,240	-37,251	-14,902	-5,957	0	0	0	0	0	0	
1959	0	0	0	0	0	0	-5,763	-22,415	-22,340	-22,239	-22,134	-22,061	
1960	-22,016	-22,003	-22,004	-22,010	-31,568	-40,684	-38,965	-33,757	-27,992	-27,864	-27,736	-27,640	
1961	-27,579	-27,562	-31,699	-31,708	-31,711	-31,699	-31,666	-32,840	-32,721	-32,566	-32,410	-32,294	
1962	-32,222	-32,203	-32,205	-32,215	-32,218	-32,205	-32,173	-128,981	-136,164	-137,733	-137,094	-136,609	
1963	-136,310	-136,229	-155,213	-156,983	-136,275	-136,226	-136,094	-170,572	-171,849	-173,287	-172,533	-171,975	
1964	-160,450	-110,886	-95,220	-77,112	-60,627	-60,606	-62,963	-75,590	-108,156	-107,667	-107,166	-106,807	
1965	-106,587	-106,528	-99,890	14	1,037	0	0	1,730	17,002	14,745	12,497	-20	
1966	-20	0	0	0	353	0	-26,964	-25,281	-27,313	-27,191	-27,066	-26,973	
1967	-26,918	-26,903	-26,904	-26,912	-26,914	-9,857	0	0	0	0	-2,183	3	
1968	4	4	4	3	2	0	0	-31,853	-33,860	-33,707	-33,550	-33,438	
1969	-33,369	-33,351	-33,352	5	0	0	0	0	0	0	0	0	
1970	0	0	-3	0	1,189	0	0	-11,491	-13,567	-15,692	-15,622	-15,570	
1971	-15,538	-15,528	-15,530	-15,534	-6,215	0	0	-23,835	-25,871	-27,941	-27,820	-27,728	
1972	-27,672	-27,656	-27,657	-27,665	-11,067	-11,064	-11,053	-44,157	-46,121	-45,911	-45,697	-45,544	
1973	-45,450	-45,424	-45,426	-45,439	-45,444	-13,904	-10,121	-26,189	0	0	-1	0	
1974	0	0	0	1	1	0	0	652	0	-2,184	-2,174	3	
1975	4	4	3	3	1	0	0	1,198	0	-2,184	-1,521	2	
1976	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	8,219	3,004	-2	-3	-4	-4	-4	-4	-4	-4	
1978	-4	-4	-4	-4	-4	-4	-4	-88,019	0	-2,184	-2,174	-2,476	
1979	-8,318	-8,313	-8,314	1	1	0	0	0	-2,114	-2,105	-2,096	-2,089	
1980	-2,084	-2,084	-2,083	0	0	0	0	0	0	0	0	0	
1981	0	0	0	0	0	0	-2,117	-14,691	-30,491	-30,356	-30,217	-30,113	
1982	-30,049	-30,032	-30,033	5	0	0	0	0	0	0	-2,183	0	
1983	0	0	0	0	0	0	0	0	0	0	-2,183	3	
1984	0	0	0	0	0	0	-197	-14,020	-16,088	-18,202	-18,121	-18,060	
1985	-18,023	-18,013	-18,014	-18,019	-18,020	-18,013	-17,996	-24,665	-26,696	-26,576	-26,453	-26,363	
1986	-26,308	-26,294	-31,854	-29,944	-10,522	-2,162	0	0	0	-2,183	-2,174	-2,167	
1987	-2,163	-2,161	-2,162	-2,162	-2,162	-2,162	-2,159	-15,753	-27,225	-27,100	-26,977	-26,886	
1988	-26,830	-26,815	418	418	9,845	-574	-11,193	-13,511	-47,409	-52,929	-59,447	-59,237	
1989	-59,107	-59,071	-59,074	-59,092	-59,097	-59,075	-81,874	-112,878	-114,603	-114,087	-113,563	-113,175	
1990	-112,938	-112,873	-112,879	-112,911	-112,920	-112,878	-112,768	-135,075	-143,045	-148,189	-138,326	-134,885	
1991	-134,593	-134,514	-134,520	-134,560	-134,571	-134,519	-134,382	-185,461	-192,763	-193,796	-192,878	-192,199	
1992	-191,781	-191,669	-191,678	-191,736	-191,750	-191,678	-197,940	-239,373	-238,543	-237,429	-236,289	-235,449	
1993	-234,940	-234,794	-240,671	-240,743	-240,761	-240,761	-265,572	-279,393	-282,588	-106,761	-108,488	-88,023	
1994	-22,409	-22,397	-22,398	-22,404	-22,406	-22,397	-22,376	-52,915	-54,848	-54,599	-54,343	-54,160	
1995	-54,048	-54,019	-40,361	-28,064	-11,227	0	-13,177	0	0	0	-2,184	3	
1996	4	3	4	4	0	0	0	0	0	0	-2,183	-2,174	
1997	-2,163	0	0	2	0	0	-13,622	-15,774	-17,837	-19,944	-19,858	-19,794	
1998	-19,754	-19,744	-19,745	3	0	0	1,472	0	0	0	0	0	
1999	0	0	0	0	0	0	0	-20,597	-9,823	-11,964	-11,912	-11,874	
2000	-11,850	-11,844	-11,844	-11,847	0	0	0	-12,191	0	0	0	0	
2001	0	0	0	0	0	0	0	-45,377	-47,131	-46,922	-46,706	-46,548	
2002	-46,447	-46,422	-46,424	-46,437	-46,441	-46,424	-46,379	-84,005	-85,838	-85,456	-85,063	-84,771	
Avg (21-02)	-42,900	-42,114	-38,916	-36,630	-32,804	-30,954	-33,481	-46,187	-44,885	-45,716	-45,334	-44,172	

the 1930s and 1960s, and then sporadically in other years. These changes are due to slight changes in the upstream operation of SFPUC facilities, which have previously been described as modeling discretion; this has led to the conclusion that little or no change in actual operations would occur during these periods. The one notable change in Don Pedro Reservoir storage occurs during the 1990s, while the variant's 10% shortage limitation requires additional diversion from the Tuolumne River. The storage difference manifesting in Don Pedro Reservoir is the result of the MID/TID transfer facilitating the addition diversion of water to the SJPL.

The greatest draw from reservoir storage occurs during the drought of the 1976-1977, which is the same for the variant, WSIP, and base settings. The year of greatest difference in reservoir draw between the base setting and variant occurs during the 1987-1992 drought. Figure 4.5-2 illustrates the difference in reservoir storage, averaged by year type, in comparing the variant to the WSIP setting; almost no difference between the two settings is illustrated, except during dry years (associated with the 1987-1992 drought period). Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 4.5-3 illustrates the same information in comparing the variant and base setting. These results are almost identical to the comparison of the WSIP and base settings.

Figure 4.5-2

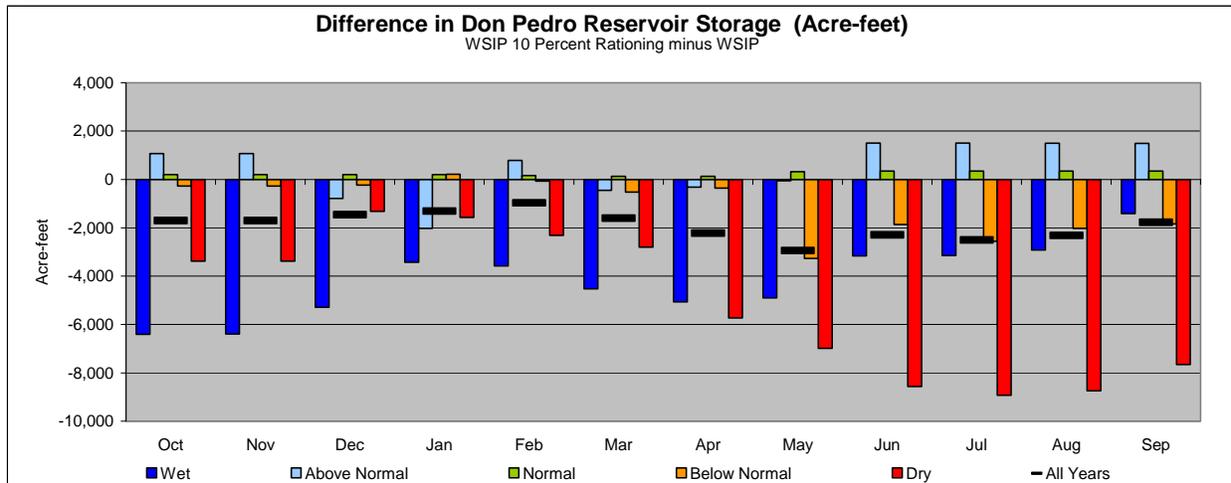


Figure 4.5-3

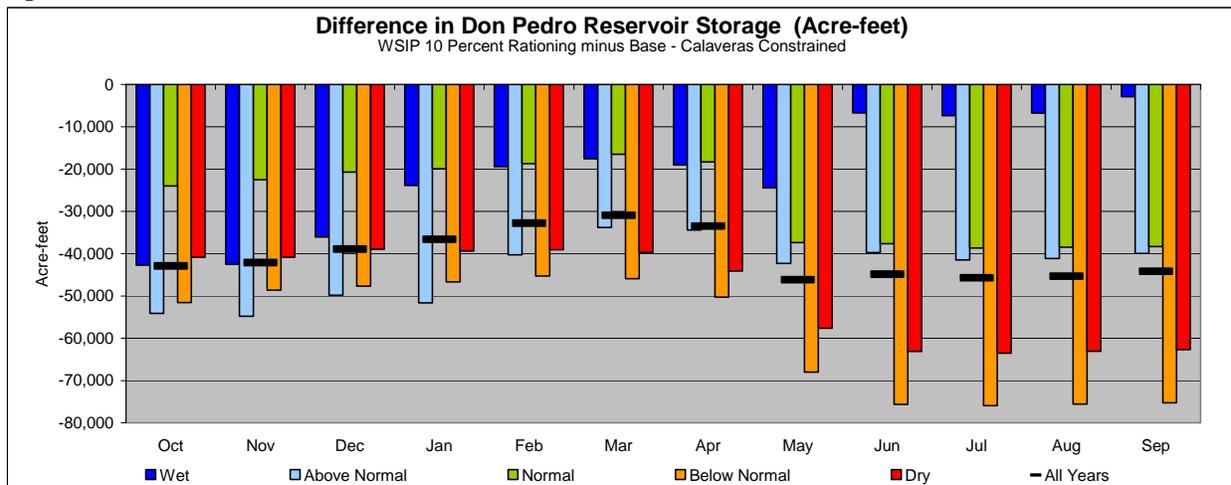


Figure 4.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings. The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the variant would manifest into differences in releases from La Grange Dam to the stream. A difference in the amount of available reservoir space in

the winter and spring due to the variant would lead to a difference in the ability to regulate inflow, thus potentially changing the amount of water released to the stream, which is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow would directly manifest as a change in release from La Grange Dam (a change in either more or less flow). Figure 4.5-1 illustrates the stream release from La Grange Dam for the WSIP, variant, and base settings.

Figure 4.5-4

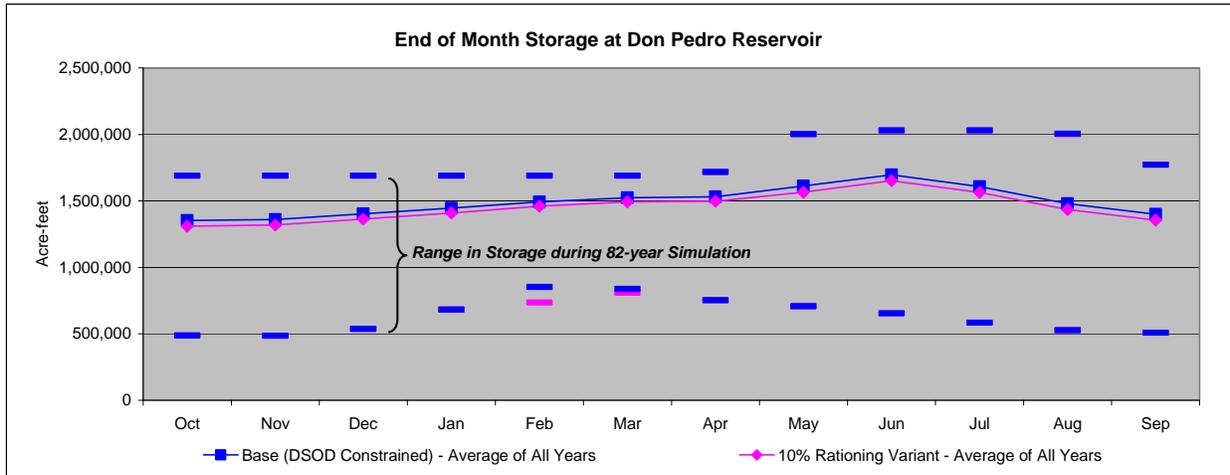


Table 4.5-4 illustrates the difference in stream releases between the variant and WSIP settings. Consistent with the near absence of changes in Don Pedro Reservoir storage, stream releases between the variant and WSIP settings are almost identical, except for a period following the droughts of the 1930s and 1987-1992. In both instances, additional diversions to the SJPL lead to additional depletion of Don Pedro Reservoir storage. The additional depletion of reservoir storage manifests as a reduction in subsequent releases below La Grange Dam to replenish the reservoir storage. The differences in releases to the Tuolumne River from La Grange Dam would occur only when there are releases above minimum FERC flow requirements. Table 4.5-4 illustrates that the difference in monthly flow below La Grange Dam ranged up to a decrease of approximately 23,000 acre-feet in one month. Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the variant and WSIP would be a delay in releases up to 4 days in that month. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, the variant's effect on stream releases could manifest as an elimination of all flows above minimum FERC flow requirements within a month or year. This would occur after the experience of an extended drought period.

Table 4.5-5 illustrates differences in releases between the variant and base settings. Compared to the base setting, the variant's effect on stream flow is very similar to the effect caused by the WSIP, but at times slightly greater. Using the same assumption that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the variant and base would typically be a delay in releases up to a few days. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, following a prolonged multi-year drought period, the variant's effect on stream releases could manifest as an elimination of all flows above minimum FERC flow requirements within a year.

Table 4.5-6 illustrates releases to the Tuolumne River below La Grange Dam and their differences, in terms of average monthly flow (cfs) averaged within year types, in comparing the variant and WSIP settings. The same form of information is provided for the variant and base settings in Table 4.5-7.

Table 4.5-4

Water Year	WSIP 10 Percent Rationing minus WSIP												WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	59	1	0	0	0	0	0	0	0	0	60
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	8,387	5,639	206	0	0	0	0	0	0	14,232
1937	0	0	0	0	800	-578	148	0	0	0	0	0	0	370
1938	0	0	549	0	0	0	0	0	0	0	0	0	0	549
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-11,600	-6,577	863	0	0	0	0	0	0	-17,314
1941	0	0	0	4,149	-278	-173	-270	0	-865	0	0	0	0	2,563
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-2,231	0	0	281	307	0	1,641	0	0	0	0	-2
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	-3,045	0	1	412	0	0	0	0	3,067	0	435
1966	0	-5	0	0	0	0	0	0	0	0	0	0	0	-5
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-630	0	0	0	0	-630
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	1,237	0	-1,903	0	0	0	0	0	0	0	-666
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	906	0	0	0	0	0	0	0	0	0	906
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	-3,527	-27,081	0	-30,608
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	2,399	-3,646	0	-22,629	0	0	0	0	0	-23,876
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-21	40	-4	-85	20	-276	2	0	-43	-293	0	-658

Table 4.5-5

Difference in Total La Grange Release to River (Acre-feet)

WSIP 10 Percent Rationing minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	-118	-15,701	-3,600	0	0	0	0	0	-19,419
1922	0	0	0	0	-8,537	-5,691	-7,365	-5,684	-14,697	0	-655	-1,521	-44,150
1923	0	0	3	0	0	0	-2,117	0	0	0	0	0	-2,114
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-43,828	0	-644	-9,569	-54,041
1928	-6,886	-31,299	-34,469	-38	1	-5,339	-10,773	0	0	0	0	0	-88,803
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-143,166	-113,436	-4,729	0	0	0	0	0	-261,331
1937	0	0	0	0	-14,069	-13,584	-3,539	0	0	0	0	0	-31,192
1938	0	0	-18,395	0	0	-45	-9,343	-19,551	-4,880	-2,189	0	0	-54,403
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-37,172	-25,797	-4,421	0	0	0	0	0	-67,390
1941	0	0	0	4,487	-593	-368	-574	0	-7,443	0	-655	-1,520	-6,666
1942	0	0	2	-4,495	0	-3,805	-5,524	-2,855	-2,762	-2,188	0	0	-21,627
1943	0	0	0	0	0	-11,461	-4,879	0	-9,907	0	0	-2,173	-28,420
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1945	0	0	0	0	-22,363	-30,225	-45	0	0	0	0	0	-52,633
1946	0	8,571	0	0	0	-13,392	-3,867	0	0	0	0	0	-8,688
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-125,752	2	0	0	0	0	0	0	0	0	-125,750
1952	0	0	0	0	-11,693	-7,794	0	-20,575	-4,879	-2,188	0	0	-47,129
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-83,465	2	0	-4,053	-2,387	0	-11,341	-2,188	0	0	-103,432
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-22,350	-8,941	-5,955	-16,538	-2,854	-2,188	0	0	-58,826
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-49,491	-15,670	-18,132	-16,489	0	0	0	0	0	0	0	-110,971
1965	0	0	0	-105,627	-6,178	-13,479	-821	0	0	0	0	12,496	-113,609
1966	0	-20	-4,311	0	-2,121	-6,099	0	0	0	0	0	0	-12,551
1967	0	0	0	0	0	-21,560	-9,852	-9,693	0	-2,188	0	-2,184	-45,477
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1969	0	0	0	-33,361	-7,207	-6,138	-7,641	-5,043	-4,879	-2,188	0	0	-66,457
1970	0	0	0	21,837	-7,145	-16,079	0	0	0	0	0	0	-1,387
1971	0	0	0	0	-9,321	-6,213	0	0	0	0	0	0	-15,534
1972	0	0	0	0	-16,599	0	0	0	0	0	0	0	-16,599
1973	0	0	0	0	0	-31,528	-3,772	0	-28,263	0	0	0	-63,563
1974	0	0	0	-11,155	1	-8,562	-5,524	-5,694	-4,229	0	0	-2,174	-37,337
1975	0	0	0	0	2	1	-8,286	0	248	0	-655	-1,520	-10,210
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-93,487	0	0	0	-93,487
1979	0	0	0	-8,316	0	-19,103	-2,118	-2,189	0	0	0	0	-31,726
1980	0	0	0	5,071	-1	-10,465	-4,880	-5,042	-4,880	-2,188	0	0	-22,385
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-30,041	-10,159	-2,663	0	-2,854	-2,762	-2,188	0	-4,297	-54,964
1983	-2,949	-1,841	2,664	0	0	0	0	-5,799	-2,762	-2,188	0	-2,183	-15,058
1984	-7,155	0	0	0	0	3,935	0	0	0	0	0	0	-3,220
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-15,780	-30,648	-11,300	-5,042	-4,879	0	0	0	-67,649
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	-187,962	0	-20,034	-65,394	-273,390
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-16,839	-11,525	0	-35,626	-3,683	-2,188	0	-2,183	-72,044
1996	0	0	0	0	-3,528	0	-6,721	-2,188	-2,118	0	0	0	-14,555
1997	0	-2,162	0	-12,747	2	0	0	0	0	0	0	0	-14,907
1998	0	0	0	-19,751	3	-6,674	-8,839	-2,430	-3,774	-2,188	0	0	-43,653
1999	0	0	0	0	0	-9,514	-5,004	0	-16,264	0	0	0	-30,782
2000	0	0	0	0	-11,848	0	0	0	-14,290	0	0	0	-26,138
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-344	-930	-3,407	-2,589	-4,674	-5,560	-1,755	-1,790	-5,812	-320	-276	-1,003	-28,459

Table 4.5-6

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	429	371	790	2,021	3,436	3,983	3,352	3,063	3,372	1,283	501	1,248
Above Normal	291	516	1,109	1,270	2,167	1,709	1,538	1,346	306	240	240	240
Below Normal	284	270	370	318	635	630	943	943	75	75	75	75
Dry	337	260	272	262	437	421	497	497	73	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50	50
All Years	327	334	598	980	1,654	1,716	1,584	1,460	1,083	457	229	447

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	429	371	790	2,023	3,430	3,990	3,350	3,081	3,369	1,282	503	1,263
Above Normal	292	515	1,111	1,272	2,171	1,708	1,539	1,346	306	240	240	240
Below Normal	284	270	370	318	636	630	943	943	75	75	75	75
Dry	337	260	272	262	435	421	497	497	73	73	73	73
Critical	236	195	204	189	189	189	344	344	50	50	50	50
All Years	327	334	599	981	1,653	1,718	1,584	1,465	1,082	457	229	452

Difference in Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	-2	6	-7	1	-17	3	1	-2	-15
Above Normal	-1	0	-1	-1	-4	2	-1	0	0	0	0	0
Below Normal	0	0	0	0	-1	0	0	0	0	0	0	0
Dry	0	0	0	0	1	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	-1	1	-2	0	-5	1	0	-1	-4

Table 4.5-7

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	26,382	22,062	48,557	124,246	190,841	244,906	199,437	188,363	200,630	78,864	30,812	74,247
Above Normal	17,886	30,698	68,220	78,114	120,366	105,110	91,530	82,787	18,214	14,739	14,739	14,263
Below Normal	17,484	16,058	22,744	19,556	35,285	38,726	56,136	58,008	4,463	4,612	4,612	4,463
Dry	20,742	15,449	16,739	16,127	24,251	25,876	29,552	30,537	4,349	4,494	4,494	4,349
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975
All Years	20,112	19,882	36,788	60,250	91,870	105,512	94,246	89,755	64,420	28,125	14,061	26,611

Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	26,505	22,228	52,690	132,897	195,713	251,883	203,746	194,388	216,210	79,958	31,729	77,274
Above Normal	18,307	30,194	75,617	77,318	133,414	121,042	93,276	82,916	24,252	14,739	14,777	14,826
Below Normal	18,058	18,668	25,976	19,559	36,239	40,197	57,034	58,008	4,463	4,612	4,612	4,463
Dry	21,603	19,256	17,945	17,522	26,796	25,876	29,552	30,537	4,349	4,494	4,494	4,349
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975
All Years	20,456	20,812	40,195	62,838	96,544	111,073	96,000	91,545	70,232	28,445	14,337	27,614

Difference in Total La Grange Release to River (CFS)												
(Average within Year Type - Grouped by SJR Index Year Type)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	-123	-167	-4,133	-8,651	-4,872	-6,977	-4,310	-6,026	-15,580	-1,094	-917	-3,027
Above Normal	-421	504	-7,397	795	-13,048	-15,932	-1,745	-129	-6,038	0	-38	-563
Below Normal	-574	-2,610	-3,232	-3	-953	-1,471	-898	0	0	0	0	0
Dry	-861	-3,807	-1,205	-1,395	-2,545	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-344	-930	-3,407	-2,589	-4,674	-5,560	-1,755	-1,790	-5,812	-320	-276	-1,003

4.6 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

There are only slight differences in Calaveras Reservoir operations between the variant and WSIP settings. Figure 4.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 4.6-1 are the results for the WSIP, variant, and base settings. The differences in Calaveras Reservoir storage between the variant and WSIP settings during the 1930s, 1960s, and 1976-1977 are due to the modeled difference in SJPL diversions during those periods. These differences are mostly due to model logic that selects the rate at which diversions occur to the pipelines, and to reservoir balancing logic. During each of these periods, results indicate that the differences are negated prior to reservoir spill, which indicates that the differences are due to discretionary logic and may not occur in actual operations. The operation of Calaveras Reservoir between the variant and WSIP settings would be the essentially the same.

The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Figure 4.6-2 illustrates the average

monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

There is essentially no change in releases to Calaveras Creek below Calaveras Dam between the variant and WSIP settings. A change was indicated in only one month of the 82-year simulation, and that was attributed to discretionary modeling assumptions. The difference is almost unnoticeable during February 1940, as shown in Figure 4.6-1. Both settings have fishery releases that are not included in the base setting. Supplementing the Figure 4.6-1 representation of Calaveras Dam stream releases is Table 4.6-1, illustrating releases for the variant and base settings, and the difference in releases between the two. The notable difference in releases between the variant and base settings is the addition of the flows representing the 1997 MOU and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There is essentially no change (one month of minor change during the 82-year simulation) in Alameda Creek diversions to Calaveras Reservoir between the variant and the WSIP settings. With almost no change in Calaveras Reservoir storage between the two settings, there would be no change in the diversion operation at the Alameda Creek Diversion Dam. Water would only be diverted to Calaveras Reservoir when the diversion would not contribute to releases in excess of minimum required flows below Calaveras Dam. Coincidentally, with no change in the diversion at Alameda Creek Diversion Dam, flow spilling past the diversion dam would experience no differences between the variant and WSIP settings. Table 4.6-2 illustrates the flow below the Alameda Creek Diversion Dam for the variant and base settings. The notable difference between the variant and the base settings is the reduction of wetter-year water flowing past the diversion dam. This occurs because, in the variant setting, the restoration of Calaveras Reservoir storage allows a greater frequency of diversion from Alameda Creek to Calaveras Reservoir.

Comparing the variant and WSIP setting, with no differences in releases from Calaveras Dam to the stream, and no differences to spills at Alameda Creek Diversion Dam, flow below the Alameda Creek and Calaveras Creek confluence will be the same for each setting. Table 4.6-3 illustrates the flow below the confluence for the variant and base settings, and the difference in flow between the two. The notable differences between the variant and the base settings (comparable to the difference between the WSIP and base settings) are the addition of stream flows for the 1997 MOU and the reduction of wetter-year/wet season flows due to the restoration of Calaveras Reservoir storage.

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the variant and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Flows below this diversion have been estimated and noted as the flow above the Alameda and San Antonio Creek confluence. With no changes noted for stream releases from Calaveras Reservoir or flow past Alameda Creek Diversion Dam between the variant and WSIP settings, the flow at this location will be the same among the variant and WSIP settings. Table 4.6-4 illustrates the flow at this location for the variant and base settings. The flows identified at this location indicate flow below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated stream accretions between the Alameda-Calaveras Creek confluence and the Alameda-San Antonio Creek confluence, minus the water assumed to be recaptured (diverted) by the SFPUC from the creek.

Figure 4.6-1
Calaveras Reservoir Storage and Stream Release

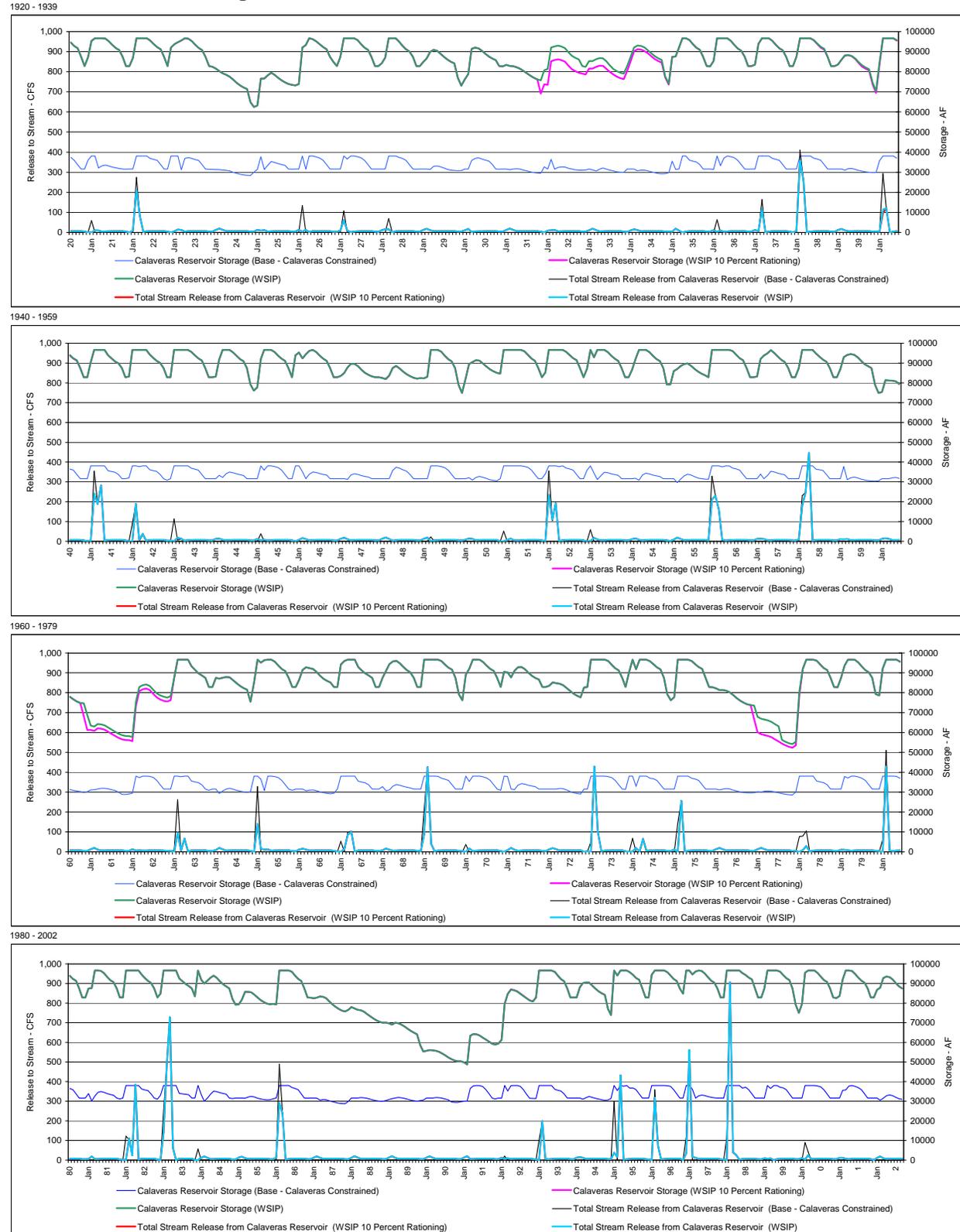


Figure 4.6-2

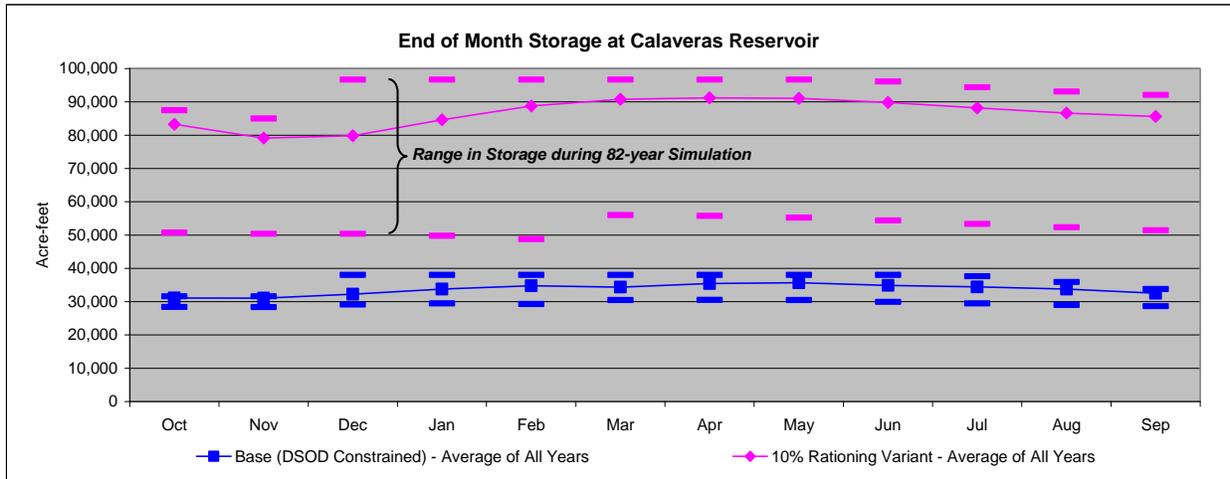


Table 4.6-1

Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												WSIP 10 Percent Rationing	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	1,065	5,083	15,133	10,007	5,085	255	387	417	425	415	38,949
Above Normal	425	258	172	806	3,598	2,849	650	327	396	423	428	417	10,748
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	387	1,557	4,226	2,921	1,323	350	403	426	428	417	13,136

Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	429	246	-671	-4,138	-1,507	39	61	255	387	417	425	415	-3,641
Above Normal	425	258	-12	-1,925	-2,313	-247	190	327	396	423	428	417	-1,634
Normal	429	275	-22	184	-157	204	264	370	408	428	430	417	3,231
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045
All Years	428	269	-32	-879	-419	265	248	350	403	426	428	417	1,904

Table 4.6-2

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												WSIP 10 Percent Rationing	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389
Above Normal	7	23	695	2,532	4,017	3,092	969	0	0	0	0	0	11,336
Normal	0	6	377	264	893	459	117	6	0	0	0	0	2,122
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	494	1,790	2,618	1,892	803	24	0	0	0	0	7,634

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	-794	-117	-6	-10	-15	0	0	0	0	-942
Above Normal	0	0	-489	-1,140	-1,275	-5	277	0	0	0	0	0	-2,632
Normal	0	0	-537	-604	-892	-447	-10	0	0	0	0	0	-2,490
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-206	-509	-461	-89	54	-3	0	0	0	0	-1,215

Table 4.6-3

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP 10 Percent Rationing	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,789	12,265	24,303	16,744	8,649	548	417	430	430	417	67,746	
Above Normal	437	327	1,111	3,936	8,392	6,502	1,929	430	417	430	430	417	24,757	
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,061	3,757	7,374	5,245	2,362	454	417	430	430	417	22,688	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	1	80	3,460	17,197	25,928	16,711	8,598	307	30	12	4	2	72,329	
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023	
Normal	1	29	1,356	1,501	3,053	1,586	284	65	9	2	0	0	7,886	
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161	
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457	
All Years	3	41	1,298	5,145	8,254	5,069	2,061	107	14	4	1	1	21,999	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	-671	-4,932	-1,624	33	51	241	387	417	425	415	-4,583	
Above Normal	425	258	-501	-3,065	-3,588	-252	467	327	396	423	428	417	-4,266	
Normal	429	275	-559	-420	-1,049	-243	255	370	408	428	430	417	741	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	-238	-1,389	-880	176	301	347	403	426	428	417	689	

Table 4.6-4

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP 10 Percent Rationing	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,180	13,611	25,828	17,847	9,299	498	76	33	15	9	70,558	
Above Normal	19	150	1,308	4,454	9,078	6,913	2,180	217	54	20	9	6	24,409	
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,127	3,860	7,487	5,332	2,409	197	38	14	7	4	20,572	

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470	
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664	
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656	

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-788	-5,057	-1,864	-131	-59	-15	0	0	0	0	-7,912	
Above Normal	0	0	-673	-3,365	-3,982	-554	319	0	0	0	0	0	-8,255	
Normal	0	0	-753	-968	-1,774	-738	-10	0	0	0	0	0	-4,244	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-440	-1,873	-1,535	-284	53	-3	0	0	0	0	-4,083	

Compared to the WSIP setting, San Antonio Reservoir operations in the variant setting generally mirror the changes experienced for Calaveras Reservoir operations. Figure 4.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from the dam. Shown in Figure 4.6-3 are the results for the WSIP, variant, and base settings. The difference in San Antonio Reservoir storage between the variant and WSIP settings during the 1930s, 1960s, and 1976-1977 are due to the same modeling nuances described for Calaveras Reservoir differences. These differences are mostly due to model-selected flow rates for the SJPL and to reservoir balancing logic. During each of these periods, results indicate that the differences are negated prior to reservoir spill, indicating that the differences are due to discretionary logic and may not occur in actual operations. The operation of San Antonio Reservoir between the variant and WSIP settings would be essentially the same.

The magnitude of effect in the difference in San Antonio Reservoir storage depends on modeling assumptions for the balancing of total Bay Area reservoir storage among the five major SFPUC reservoirs. The model balances storage between reservoirs by way of an input file by the modeler concerning the relative draw (percentage) from each reservoir under various storage conditions. These are discretionary input in the model, and the logic and relative percentages are meant to mimic the current practice and discretion of the system operators based on recognition of the physical conveyance constraints within the system and the ability of each reservoir to provide yield and water delivery security.

The logic currently favors the retention of storage in the peninsula reservoirs for security reasons; thus, the provision of additional water between the settings is balanced between San Antonio and Calaveras Reservoir.

The difference in storage between the variant and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras leads to a different operation at San Antonio Reservoir, one that provides relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the variant and WSIP settings and the base setting every fifth year. Assumed systematic maintenance of Hetch Hetchy conveyance facilities occurs in the simulation, and constrains diversions to the Bay Area from Hetch Hetchy every fifth year. The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by the drawing of additional water from the Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the variant and WSIP settings. Figure 4.6-4 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

There would very little change in stream releases below San Antonio Reservoir between the variant and WSIP settings. Table 4.6-5 illustrates the modeled release to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a slightly lower reservoir operation at times, an increase in the ability to regulate reservoir inflow and avoid stream releases would be expected. Given the sometimes rigid constraints within the modeling assumptions, the model overestimates the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the variant and base settings are shown in Table 4.6-6. The differences among the two settings range from increases to decreases in flow. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 4.6-3. In some circumstances, the base setting storage at San Antonio Reservoir during a period could be higher than projected for the variant setting during the same period. This could lead to an occasionally greater modeled release for the base setting, which would be reflected in the results. As described above, the model overestimates the frequency and magnitude of releases from San Antonio Reservoir; the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 4.6-7 illustrates the flow below the confluence for the variant and base settings, and the differences in flow between the two. The differences are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity in the variant setting.

Figure 4.6-3
San Antonio Reservoir Storage and Stream Release

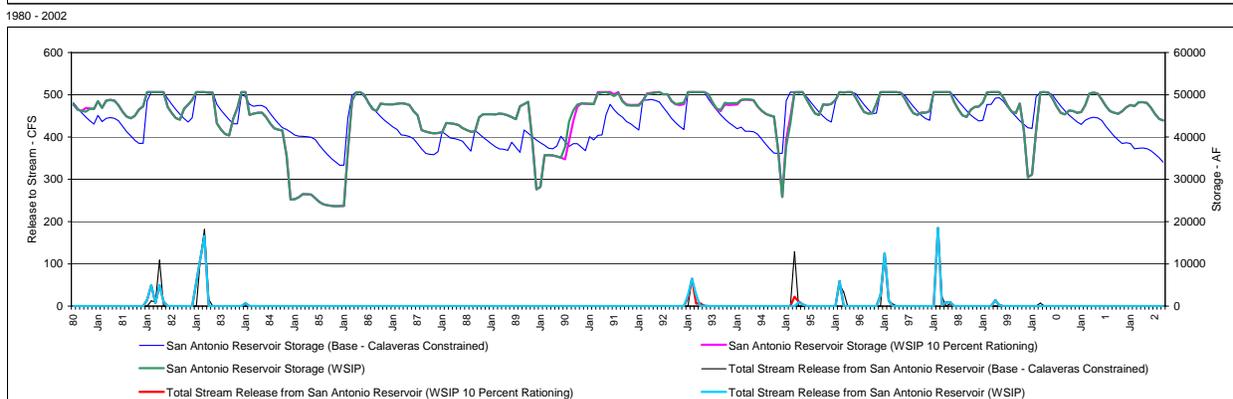
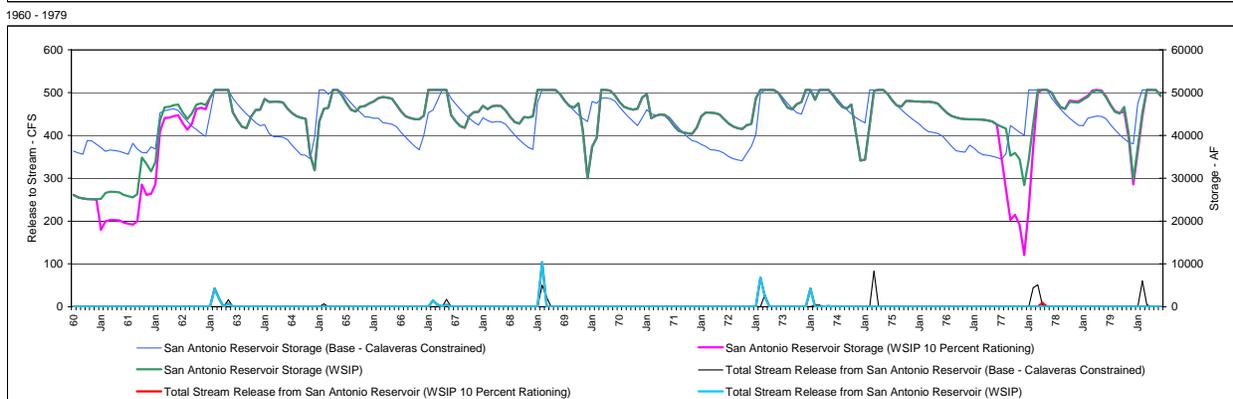
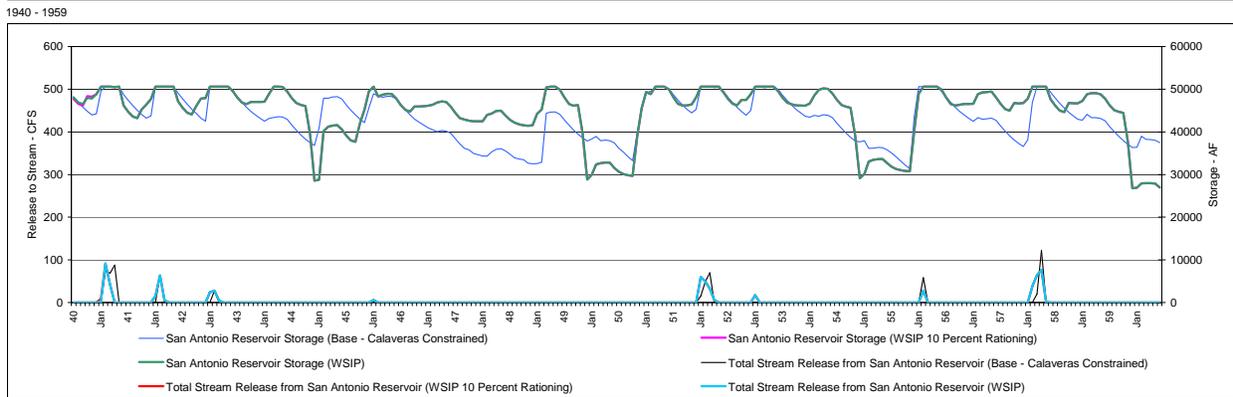
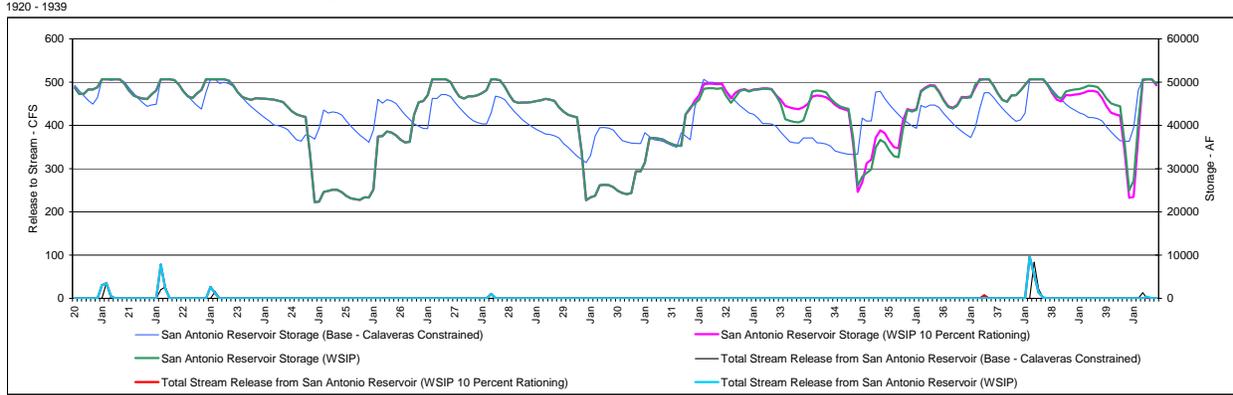


Figure 4.6-4

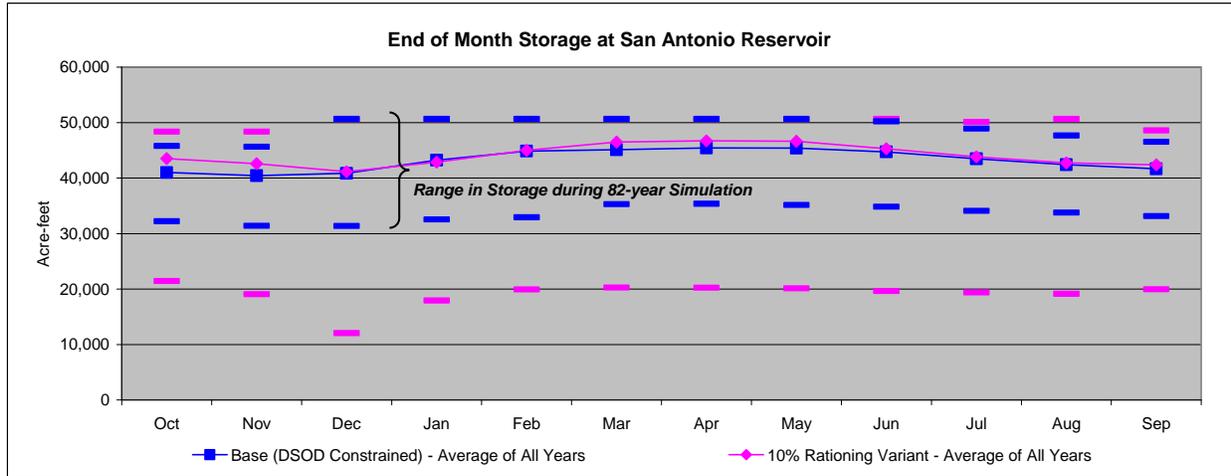


Table 4.6-5

Total Stream Release from San Antonio Reservoir (Acre-feet)													WSIP 10 Percent Rationing	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	1,078	3,168	1,626	614	121	0	0	0	0	6,702	
Above Normal	0	0	0	517	1,045	204	128	43	0	0	0	0	1,937	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	367	146	32	0	0	0	0	1,739	

Total Stream Release from San Antonio Reservoir (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	1,054	3,168	1,543	605	121	0	0	0	0	6,586	
Above Normal	0	0	0	540	1,045	277	67	44	0	0	0	0	1,974	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	366	132	33	0	0	0	0	1,724	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)													WSIP 10 Percent Rationing minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	23	0	83	9	0	0	0	0	0	116	
Above Normal	0	0	0	-23	0	-73	61	-1	0	0	0	0	-36	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	0	0	1	14	0	0	0	0	0	15	

Table 4.6-6

Total Stream Release from San Antonio Reservoir (Acre-feet)													WSIP 10 Percent Rationing	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	1,078	3,168	1,626	614	121	0	0	0	0	6,702	
Above Normal	0	0	0	517	1,045	204	128	43	0	0	0	0	1,937	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	367	146	32	0	0	0	0	1,739	

Total Stream Release from San Antonio Reservoir (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)													WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	539	819	-854	-710	33	0	0	0	0	-78	
Above Normal	0	0	0	517	164	-680	116	-15	0	0	0	0	103	
Normal	0	0	0	113	-1	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	234	194	-300	-114	3	0	0	0	0	36	

Table 4.6-7

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP 10 Percent Rationing	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,276	14,689	28,996	19,473	9,912	619	76	33	15	9	77,259	
Above Normal	19	150	1,308	4,971	10,123	7,117	2,308	260	54	20	9	6	26,346	
Normal	7	64	922	1,026	1,837	1,308	469	134	28	9	4	3	5,810	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,145	4,200	8,322	5,699	2,555	229	38	14	7	4	22,311	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250	
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498	
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-692	-4,517	-1,045	-985	-769	18	0	0	0	0	-7,990	
Above Normal	0	0	-673	-2,848	-3,818	-1,234	435	-15	0	0	0	0	-8,152	
Normal	0	0	-753	-855	-1,775	-699	-10	0	0	0	0	0	-4,092	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-422	-1,639	-1,342	-584	-62	0	0	0	0	0	-4,048	

4.7 Crystal Springs and San Andreas Reservoirs

There are essentially no differences in Crystal Springs Reservoir operations between the variant and WSIP settings. Figure 4.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 4.7-1 are the results for the WSIP, variant, and base settings. The slight differences in Crystal Springs Reservoir storage between the variant and WSIP setting are caused by the coincidence of reservoir balancing logic in the model, conveyance constraints, and selected flow rates for the SJPL. In actual operations, results may not differ as system operators and prevailing hydraulic and hydrologic conditions may direct the operational effect of the different demand to an alternative apportionment of effect among the reservoirs.

Figure 4.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings. Consistent with the comparison of the WSIP and base settings, the variant setting would result in reservoir storage operating at a higher average and higher upper-range than the base setting. This is due to the restoration of the operating capacity of Crystal Springs Reservoir.

Comparing the variant to WSIP settings, differences in stream releases are infrequent (9 months during the 82-year simulation), and could be either an increase or decrease in the release. The potential difference is attributed to whether the different resulting storage in the reservoir was higher or lower between the two settings. Part of the difference in modeled Crystal Springs Reservoir storage is due to modeling assumptions for the proportionate management of storage among the Bay Area reservoirs, and the coincidence of constrained conveyance flow rates. In actual operations, it is anticipated that system operators would manage the reservoir system, whereby stream releases would be minimal under any setting, with the result of essentially no difference between the variant and WSIP settings.

Table 4.7-1 illustrates the stream releases for the variant and base settings, and the difference in modeled flows between the two settings. A greater operating range in Crystal Springs Reservoir operation would lead to an increased potential to regulate reservoir inflow, which would lead to less risk in needing to make stream releases. However, as described above, actual system operations would attempt to minimize releases under any setting; thus, the difference in releases between the variant and base setting would be minimal, if any.

San Andreas Reservoir operations would generally be the same between the variant and WSIP settings. Reservoir storage would follow a systematic filling and lowering each year. Figure 4.7-3 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases. Shown in Figure 4.7-3 are the results for the WSIP, variant, and base settings. There are no projected stream

Figure 4.7-1
Crystal Springs Reservoir Storage and Release

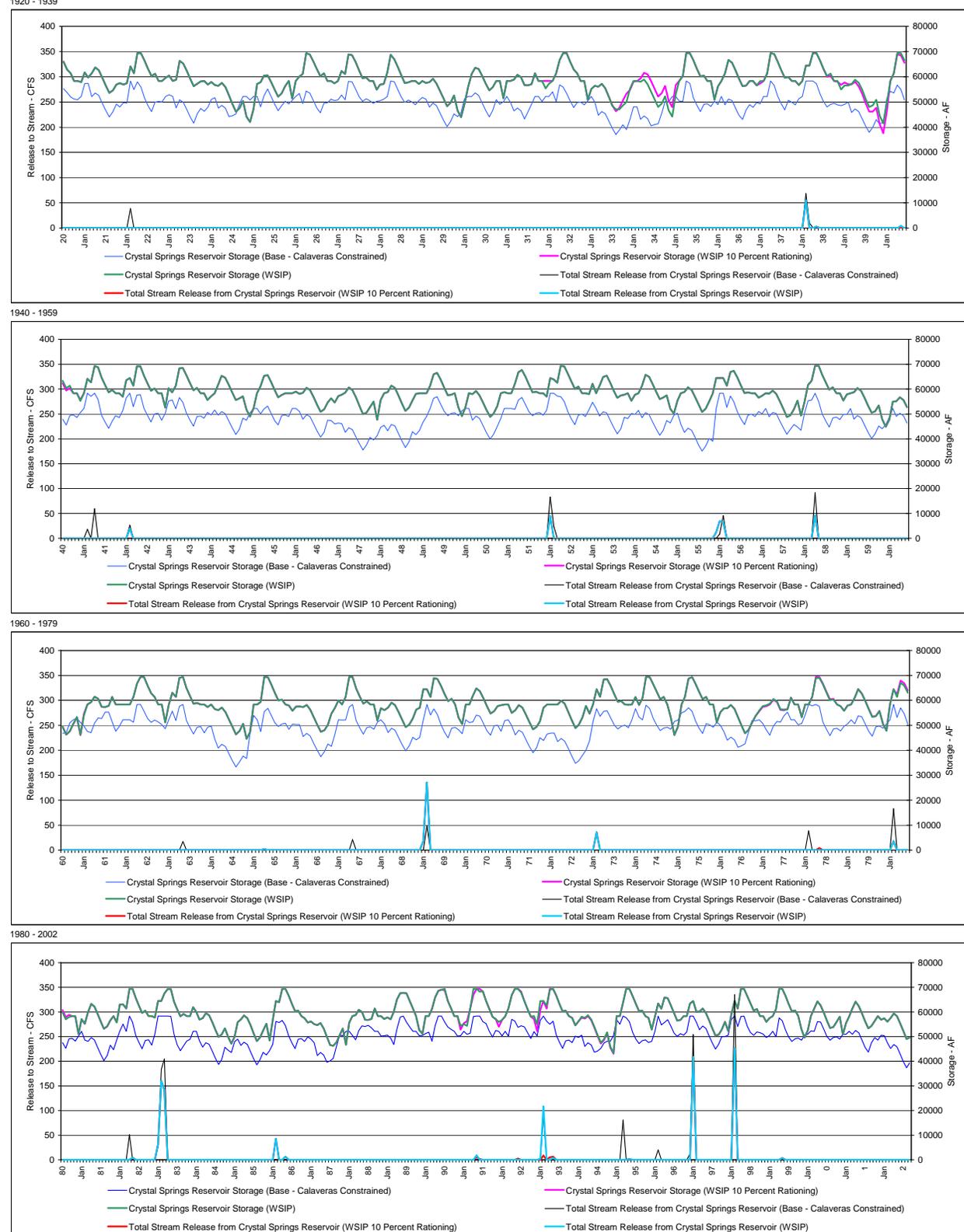


Figure 4.7-2

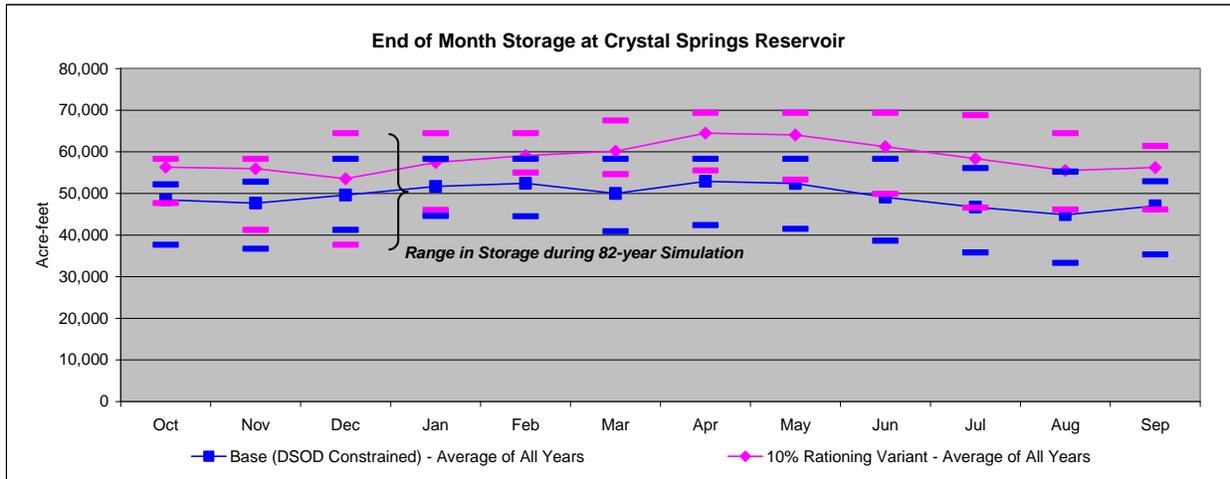


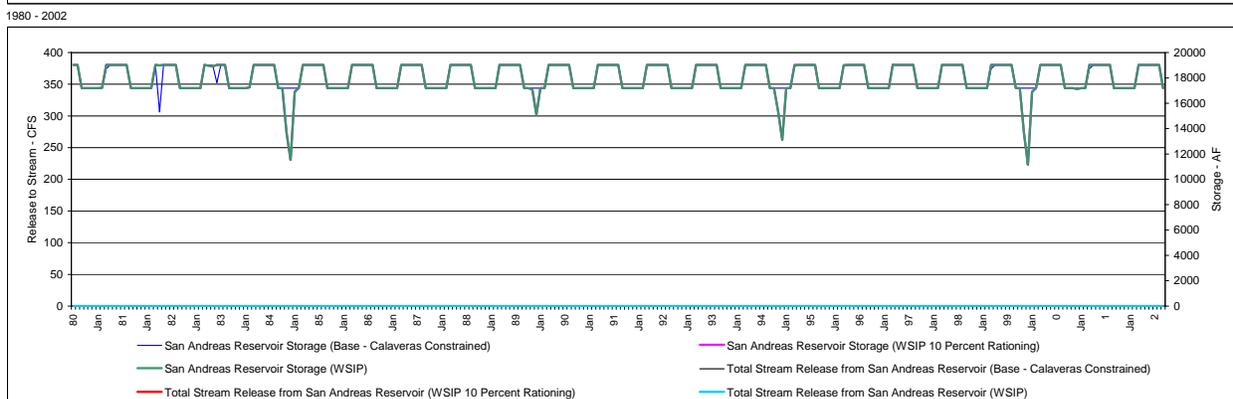
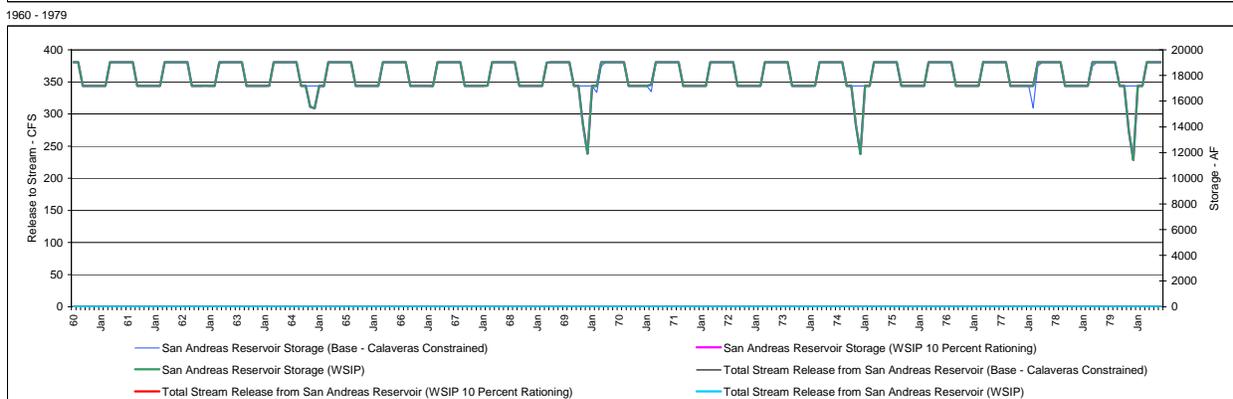
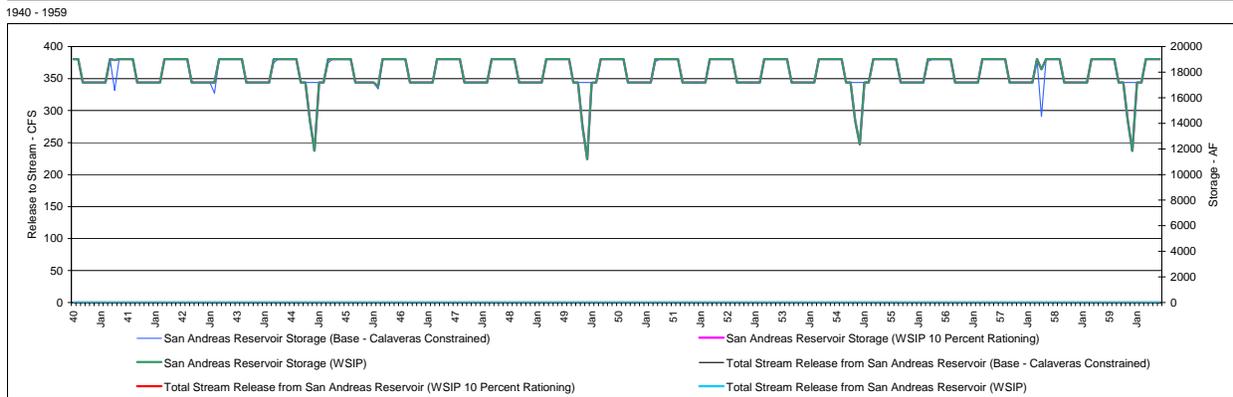
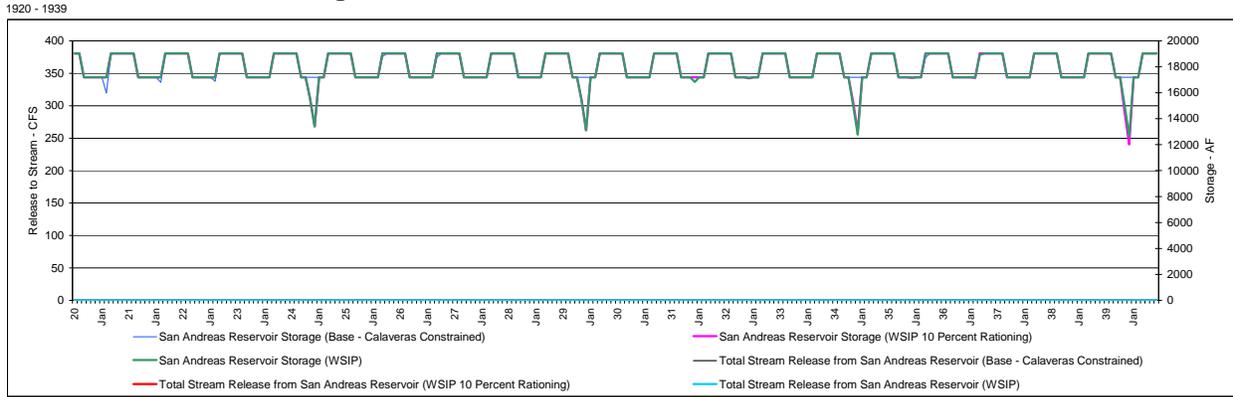
Table 4.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												WSIP 10 Percent Rationing	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	47	1,296	2,512	542	170	54	0	0	0	0	4,623
Above Normal	0	0	0	0	28	0	26	50	0	0	0	0	103
Normal	0	0	0	0	0	0	0	0	8	0	0	0	8
Below Normal	0	0	0	0	0	0	0	19	5	0	0	0	24
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	253	496	106	39	25	3	0	0	0	930

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	6,336
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	671
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	280	690	221	147	29	0	0	0	0	1,375

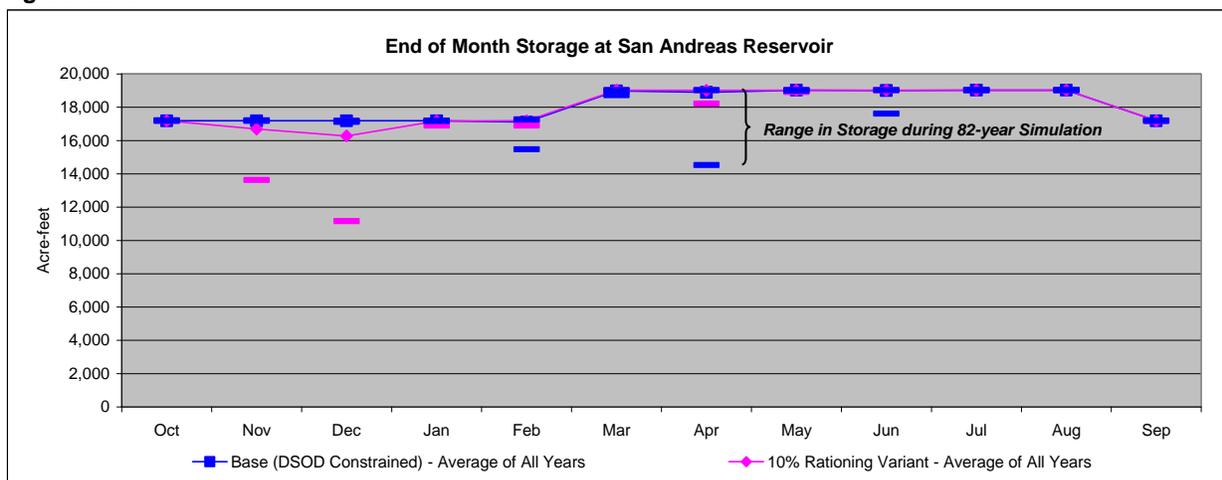
Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)												WSIP 10 Percent Rationing minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	3	-137	-376	-592	-586	-26	0	0	0	0	-1,713
Above Normal	0	0	0	0	-581	0	26	-13	0	0	0	0	-568
Normal	0	0	0	0	0	0	0	0	8	0	0	0	8
Below Normal	0	0	0	0	0	0	0	19	5	0	0	0	24
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	1	-27	-194	-115	-109	-4	3	0	0	0	-446

Figure 4.7-3
San Andreas Reservoir Storage and Stream Release



releases from San Andreas Reservoir in any setting. Notable in Figure 4.7-3 is the difference in storage operation every fifth year. Both the variant and WSIP setting storage operation differ from the base setting. This operation is the result of the assumption that Hetch Hetchy conveyance maintenance occurs systematically every fifth year, which constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy WTP associated with WSIP or the variant exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be the same among all of the settings. The additional water demand of the WSIP and variant require additional draw from Harry Tracy WTP to the San Andreas Reservoir. Figure 4.7-4 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 4.7-4



4.8 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. Within the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated at about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, there is uncertainty as to the precise manner in which Coastside CWD's additional purchase request would be served and the resultant potential changes to the operation of SFPUC facilities and their affected environs.⁶

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs have been identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.

⁶ See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

The variant setting could result in essentially the same potential effects to the Pilarcitos Creek watershed as under the WSIP setting. In the variant setting, there would be a slightly higher delivery to Coastside CWD during prolonged drought due to the greater reliability of 10 percent maximum rationing. In contrast to the WSIP setting, during these periods, the effect on the Pilarcitos Creek watershed could be slightly greater.

APPENDIX H2-5

Memorandum

Subject: HH/LSM Assumptions and Results – CEQA Alternatives
From: Daniel B. Steiner
Date: April 2, 2007

1. Introduction

This memorandum summarizes assumptions for and describes the interpretation of Hetch Hetchy Local Simulation Model (HH/LSM) results for the simulation of the California Environmental Quality Act (CEQA) Alternatives that are incorporated into the Program Environmental Impact Report (PEIR). Five CEQA alternatives are analyzed: 1) No Program; 2) No Purchase Request Increase; 3) Aggressive Conservation and Water Recycling; 4) Lower Tuolumne River Diversion; and 5) Desalination within San Francisco. A sixth alternative, Regional Desalination for Drought, was identified as a CEQA alternative; its hydrologic analysis is described in a separate memorandum.¹ These scenarios represent CEQA program alternatives that vary from the proposed program (Water System Improvement Program [WSIP]) on key program components in a manner expected to avoid or reduce potentially significant effects of the proposed program. Table 1-1 and Table 1-2 summarize the components, various modeling assumptions, and performance and hydrologic results for Alternatives 1, 2, and 3 in comparison to the modeled existing setting (2005) with Calaveras Reservoir constrained by California Division of Safety of Dams (DSOD) restrictions, the pre-2002 setting (with a Calaveras Reservoir operation prior to DSOD restrictions), and the WSIP setting. Alternative 3, Aggressive Conservation, has additionally been analyzed in terms of alternative objectives of performance (level of service [LOS]) and effect to Tuolumne River hydrology, with those results mostly described qualitatively. Alternative 4, Lower Tuolumne River Diversion, and Alternative 5, Desalination within San Francisco, are discussed partly quantitatively and partly qualitatively.

The hydrology of each alternative is primarily compared to the proposed program and contrasted to the baseline condition of the PEIR, namely the simulated current (2005) operation of the regional system, assuming the Calaveras and Crystal Springs Reservoirs operation being constrained by DSOD restrictions. Only primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and only those parameters that have been identified as key hydrologic factors that lead to environmental impact assessment are illustrated.

Note Regarding Crystal Springs Reservoir Modeling Assumptions

This memorandum describes results for several studies performed with HH/LSM during the past several years. A number of the HH/LSM studies concerning the CEQA Alternatives considered for the WSIP PEIR reflect an assumption that the WSIP Lower Crystal Springs Dam Improvements (LCSDI) project would not be implemented. These modeling studies were conducted in such a manner because early drafts of those alternatives proposed this assumption. Upon further investigation, the SFPUC concluded that the LCSDI project is required in all future scenarios due to a number of factors such as DSOD regulations and public health and safety, in addition to its role in meeting WSIP reliability objectives.

When illustrated for the CEQA Alternatives described in this memorandum, the results for the Crystal Springs Reservoir operation may reflect the assumed constraint to operations that limits the reservoir's maximum storage to approximately 58,300 acre-feet. Some results of those operations would be different when assuming that under each CEQA Alternative the reservoir would be operated to its restored operational capacity of 69,300 acre-feet. Little or no change would occur in hydrologic effects for almost all of the hydrologic parameters compared. The substantive change to the alternative's operation would be the range of Crystal Springs Reservoir storage, which would be comparable to the range which occurs in the WSIP. The text and illustrations contained in this memorandum, for some of the alternatives, have not been modified to reflect this revised assumption for the LCSDI project.

¹ See "HH/LSM Assumptions and Results – WSIP Variants", Memorandum by Daniel B. Steiner, February 20, 2007.

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 1/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP	CEQA Alternatives ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		No Program	No Increased Purchase	Aggressive Conservation
Time Horizon for Setting of Analysis / Date ⁴		2005	2005	2030	2030	2030	2030
HH/LSM Simulation Study Name ⁵		MEA3CHR	MEA2A	MEA6HIN	MEA37H	MEA40H	MEA42H
System Wide Parameters							
Customer Purchase Request (Demand Level) ⁶	MGD	265	265	300	300	275	300
Demand Level Supplied from Other Sources ⁷							
Regional Recycled Water/Conservation/Groundwater in SF	MGD	0	0	10	0	10	10
Other Regional Recycled Water/Conservation/Groundwater	MGD	0	0	0	0	0	19
Demand Level Supplied from Tuolumne + Local Watersheds ⁸	MGD	265	265	290	300	265	271
Average Annual Deliveries and Supplies ⁹							
Deliveries from Tuolumne + Local Watersheds (Average Annual)	MGD	258	259	287	275	262	264
Supply or Deliveries from Other Sources - Regional Recl/Cons/GW	MGD	0	0	10	0	10	29
Total Deliveries and Supply for Demand Level (Average Annual)	MGD	258	259	297	275	272	293
Features and Facilities¹⁰							
Regional Reclaimed Water/Conservation/Groundwater - SF				•		•	•
Regional Reclaimed Water/Conservation/Groundwater - Other							•
Calaveras Reservoir - 12.4 BG (Constrained)		•					•
Calaveras Reservoir - 31.6 BG (Restored/Unconstrained)			•	•	•	•	•
Calaveras Reservoir Release for Fish				•	•	•	•
Calaveras Reservoir Release for Fish & Flow Recapture				•	•	•	•
Crystal Springs Reservoir - 19.0 BG (Constrained)		•	•				
Crystal Springs Reservoir - 22.6 BG (Restored/Unconstrained)				•	Note 21	Note 21	Note 21
Sunol Valley Water Treatment Plant Expansion				•		•	•
Sunol Valley Water Treatment Plant Feed from SJPL				•	•	•	•
Harry Tracy Water Treatment Plant Expansion				•		•	•
Bay Division Pipeline Increased Conveyance				•		•	•
San Joaquin Pipeline Increased Conveyance				•		•	•
Desalination Project							
Westside Groundwater Project				•		•	
Tuolumne River Transfer				•		•	
Water Supply Reliability¹¹							
Action	Level	Rationing %	Rationing %	Rationing %	Rationing %	Rationing %	Rationing %
Implement Drought Water Supply Action (Westside GW or Desal)	1	NA	NA	GW	NA	GW	NA
Rationing (Level 1)	2	10	10	10	10	10	10
Rationing (Level 2)	3	20	20	20	20	20	20
Rationing (Level 3)	4	25	25	25	30	25	25
Years	Action Level	Action Level	Action Level	Action Level	Action Level	Action Level	Action Level
1921							
1924	2	2		1	3	2	2
1925				1	3		
1926				1	2		
1929				1	3		
1930				1	2	1	
1931	3	2		2	4	2	3
1932					2		
1933					2		
1934	2	2		1	3	1	2
1935							
1939					2		
1944					2		
1946					2		
1947					3		
1948				1	2		
1949					2		
1950				1	3		
1953					2		
1954					2		
1955				1	2	1	
1957					2		
1959					2		
1960	2	2		1	3	2	2
1961	3	3		2	4	2	3
1962					2		
1964				1	2		
1966					2		
1968					2		
1971					2		
1972				1	2	1	
1976	2	2		1	3	2	2
1977	3	3		2	4	2	3
1979					2		
1981					2		
1984					2		
1985				1	2		2
1987	2	2		1	3	1	2
1988	3	3		2	4	2	3
1989	3	2		2	4	2	3
1990	3	3		3	4	3	3
1991	3	3		2	4	2	3
1992	3	3		3	4	3	3
1994	2	2		1	3	1	2
DD1993	4	3		3	4	3	3
DD1994	4	3		3	4	3	3
Max Drought Rationing - Policy Cap ¹²	DD Historical	Incidental 25% Incidental 20%	Incidental 20% Incidental 20%	20% 20%	Incidental 30% Incidental 30%	20% 20%	20% 20%

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 2/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP	CEQA Alternatives ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		No Program	No Increased Purchase	Aggressive Conservation
System Wide Parameters							
Incremental Supply - Average¹³							
System Customer Purchase Request Level	MGD	265	265	300	300	275	300
Demand Level Supplied from Other Sources	MGD	0	0	10	0	10	29
Demand Level Supplied from Tuolumne + Local Watersheds	MGD	265	265	290	300	265	271
System Deliveries	MGD	258	259	287	275	262	264
Regional Desalination	MGD	0	0	0	0	0	0
San Joaquin Pipelines (Tuolumne Diversion)	MGD	218	215	245	226	221	223
Inferred Local Watershed Production	MGD	40	44	42	49	41	41
Addr1 Tuolumne Diversion (Compared to Calaveras Constrained)	MGD	218	215	27	8	3	5
Addr1 Tuolumne Diversion (Compared to Calaveras pre-2002)	MGD	218	215	30	12	7	8
Incremental Design Drought Supply¹⁴							
From Other Sources - Regional Recl/Cons/GW (Every Year)	MGD	0	0	10	0	10	29
Restoration of Calaveras Reservoir Capacity (w/ flow recapture)	MGD	0	0	7	7	7	7
Restoration of Crystal Springs Capacity ²¹	MGD	0	0	1	0	0	0
MID/TID Transfer to SFPUC (Results in additional diversion from TR)	MGD	0	0	23	0	1	0
Westside Basin Conjunctive Use (8,100 acre-feet Storage)	MGD	0	0	6	0	6	0
Regional Desalination (26 mgd)	MGD	0	0	0	0	0	0
Sum of Incremental Supplies	MGD	0	0	47	7	24	36
Yield - Without Other Sources Added (Compared to Calaveras Constrained)	MGD	219	226	256	226	233	226
Yield - With Other Sources Added (Compared to Calaveras Constrained)	MGD	219	226	266	226	243	255
Design Drought Delivery Calculator¹⁵							
	MGD	2	3	4	8	9	10
Average Annual Delivery During Year 1		265	265	290	300	265	271
Average Annual Delivery During Year 2		239	239	290	240	265	244
Average Annual Delivery During Year 3		212	212	261	210	239	217
Average Annual Delivery During Year 4		212	239	261	210	239	217
Average Annual Delivery During Year 5		212	212	232	210	212	217
Average Annual Delivery During Year 6		212	212	261	210	239	217
Average Annual Delivery During Year 7		212	212	232	210	212	217
Average Annual Delivery During Year 8		199	212	232	210	212	217
Average Annual Delivery During Last 6 Mo		99	106	116	105	106	108
Firm Yield (Nominal) Not Including Other Sources	DD Ave	219	224	256	224	234	226
	MGD	219	226	256	226	234	226
Local System Operational Parameters							
Crystal Springs Reservoir Operation							
Storage - Minimum/Maximum	BG	5.4 - 19.0		5.4 - 22.6	Modeling was conducted assuming the same constrained capacity as occurs in Baselines		
	TAF	16.6 - 58.4		16.6 - 69.3			
Fall/Winter Operation Storage		17.0 BG (52.2 TAF)		19.0 BG (58.3 TAF)	Alternatives would include LCSDI project with restored reservoir capacity		
Stream Release		Up to 250 cfs to not exceed 19 BG		Up to 250 cfs to not exceed 21 BG			
Calaveras Reservoir Operation							
Storage - Minimum/Maximum	BG	8.4 - 12.4	8.4 - 31.5	8.4 - 31.5	Same as WSIP		
	TAF	25.7 - 38.0	25.7 - 96.8	25.7 - 96.8			
Fall/Winter Operation Storage		10.3 BG (31.6 TAF)	27.0 BG (82.9 TAF)	27.0 BG (82.9 TAF)	Same as WSIP		
Alameda Creek Release/Recapture ¹⁶	AFY	0		Up to 6,300			
San Andreas Reservoir Operation							
Storage - Minimum/Maximum	BG	3.0 - 6.2		3.0 - 6.2	Same as Baselines and WSIP		
	TAF	9.2 - 19.0		9.2 - 19.0			
Fall/Winter Operation Storage		5.6 BG (17.2 TAF)		5.6 BG (17.2 TAF)	Same as WSIP		
San Antonio Reservoir Operation							
Storage - Minimum/Maximum	BG	1.0 - 16.5		1.0 - 16.5	Same as Baselines and WSIP		
	TAF	3.1 - 50.5		3.1 - 50.5			
Fall/Winter Operation Storage		15.9 BG (48.8 TAF)		15.9 BG (48.8 TAF)	Same as WSIP		
Pilarcitos Reservoir Operation							
Storage - Minimum/Maximum	BG	0.65 - 0.97		0.65 - 0.97	Same as Baselines and WSIP		
	TAF	2.0 - 3.0		2.0 - 3.0			
Fall/Winter Operation Storage		0.75 BG (2.2 TAF)		0.75 BG (2.2 TAF)	Same as WSIP		
Water Treatment Plants							
Sund Valley Water Treatment Plant Maximum	MGD	120		160	Same as Baselines	Same as WSIP	Same as WSIP
		90 MGD from Calaveras		90 frm Calvrs + Flw Rec	90 MGD from Calaveras + Recapture		
Sund Valley Water Treatment Plant Minimum	MGD	20		20	Same as Baselines and WSIP		
		Calvrs & SA Res & SJPL	Cal & SA Res	Frm Calvrs & SA & SJPL	From Calaveras & San Antonio & SJPL		
Harry Tracy Water Treatment Plant Maximum	MGD	120		140	Same as Baselines	Same as WSIP	Same as WSIP
Harry Tracy Water Treatment Plant Minimum	MGD	20		20	Same as WSIP		
Conveyance							
Bay Division Pipeline Maximum		340 MGD Jun - Sep 320 MGD Apr, May & Oct 290 MGD Nov - Mar		380 MGD Apr - Oct 320 MGD Nov - Mar	Same as Baselines	Same as WSIP	
Bay Division Pipeline Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 230 MGD		Same as Baselines, except maximum 320 MGD	Same as Baselines	Same as WSIP	

**Table 1-1
Setting Characteristics and Modeling Assumptions (Part 3/3)**

Assumptions and Characteristics of Setting and/or Program	Units	Baselines		Proposed WSIP	CEQA Alternatives ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		No Program	No Increased Purchase	Aggressive Conservation
Tuolumne River System Operational Parameters							
Hetch Hetchy Reservoir Operation							
Storage - Minimum/Maximum	TAF	26.1 - 360.4		26.1 - 360.4	Same as Baselines and WSIP		
Fall/Winter Operation Storage		30 TAF winter buffer		30 TAF winter buffer			
1987 Stipulation Minimum Release Flows		Yes		Yes			
1987 Stipulation Supplemental Release Flows		No		No			
Cherry Reservoir Operation							
Storage - Minimum/Maximum	TAF	1.0 - 273.3		1.0 - 273.3	Same as Baselines and WSIP		
Fall/Winter Operation Storage		25.3 TAF winter buffer		25.3 TAF winter buffer			
Eleanor Reservoir Operation							
Storage - Minimum/Maximum	TAF	0.0 - 27.1		0.0 - 27.1	Same as Baselines and WSIP		
Fall/Winter Operation Storage		Required Minimum Storage		Reqrd Minimum Stor			
New Don Pedro Water Bank Account							
Storage - Minimum/Maximum	TAF	0.0 - 570.0		0.0 - 570.0	Same as Baselines and WSIP		
		Temporary storage up to 740 TAF during Apr - Sep		Temp stor up to 740 TAF during Apr - Sep			
Conveyance							
San Joaquin Pipelines Maximum	MGD	290		314	Same as Baselines	313	
San Joaquin Pipelines Minimum	MGD	70		70	Same as Baselines	Same as WSIP	
San Joaquin Pipelines Flow Rate Changes		11 Stepwise		17 Stepwise	Same as Baselines	Same as WSIP	
		Surrogate minimum changes by allowing only 7 changes in a year		Allow up to 7 changes in a year (surrogate)	Same as Baselines	Same as WSIP	
San Joaquin Pipelines Maintenance		Cycle one pipeline out Nov - Mar each year (average remaining capacity rotation) maximum 210 MGD		Cyclic 5-year maintenance (see note)	Same as Baselines with No December	Same as WSIP	
<p>Note: Cyclic 5-year maintenance, maximum capacity available Apr - Oct all years, 271 MGD available all other months except 0 MGD available Year 5 Nov - Dec and 135.5 MGD available Year 1 and Year 3 Dec</p>							
TID/MID Operational Parameters							
Districts' Tuolumne Diversion¹⁷							
		Varies annually based on land use and water availability			Set equal to baseline conditions		
		Annual average 867 TAF			SFPUC diversion effects measured by the result of reducing inflow to New Don Pedro Reservoir and its effect upon La Grange releases to the Tuolumne River		
Tuolumne River La Grange Flow Releases							
Don Pedro, 1996 FERC		X	X	X	X	X	X
VAMP - considered but not modeled ¹⁸		X	X	X	X	X	X

**Table 1-2
Summary of Modeling Results (Part 1/2)**

HH/LSM Simulation Results	Units	Baselines		Proposed WSIP	CEQA Alternatives ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		No Program	No Increased Purchase	Aggressive Conservation
Design Drought Production & Disposition¹⁹							
San Joaquin Pipeline Diversion	MGD	206.9	206.4	232.5	206.8	211.3	208.9
Bay-Area Deliveries	MGD	218.3	223.9	248.9	223	226.8	224.9
Added Groveland & Coastside Delivery	MGD	2.6	2.6	3.6	3.3	2.6	3.5
Local Reservoir Evaporation	MGD	10.2	10.6	12.3	10.7	11.8	11.7
Inflow from ACDD	MGD	2.3	2.5	2.5	2.5	2.5	2.5
Flow Recapture	MGD	0	0	5.3	5.2	5.3	5.3
Local Reservoir Stream Release	MGD	0.1	0.2	5.5	5.2	5.3	5.3
Desalination	MGD	0	0	0	0	0	0
Westside Basin	MGD	0	0	5.6	0	6.4	0
District Transfer to NDP Water Bank	MGD	0	0	22.7	0	1.3	0
Local Storage - Begin	MG	53,725	72,505	77,708	71,883	73,362	73,331
Local Storage - End	MG	20,044	19,133	18,846	20,682	22,596	19,272
Study Average Production & Disposition (1921-02)²⁰							
Tuolumne River System							
Reservoirs							
Hetch Hetchy							
Inflow	AF	749,605	749,605	749,605	749,605	749,605	749,605
River	AF	277,018	277,714	267,446	273,433	276,158	274,836
Stream Minimum Release	AF	65,731	65,912	65,547	65,824	65,740	65,735
Tunnel	AF	468,975	468,279	478,524	472,503	469,826	471,186
Evaporation	AF	3,896	3,886	3,868	3,887	3,882	3,879
Reservoir	AF	284,033	287,056	275,905	284,419	284,544	283,443
Cherry							
Inflow	AF	279,293	279,293	279,293	279,293	279,293	279,293
Eleanor Gravity	AF	199	199	289	199	289	289
Eleanor Pump	AF	118,270	118,188	118,299	118,295	118,337	118,306
River	AF	44,659	44,001	45,978	43,925	45,810	41,514
Stream Minimum Release	AF						
Tunnel	AF	349,596	350,171	348,403	350,353	348,608	352,756
Evaporation	AF	3,507	3,508	3,499	3,508	3,500	3,505
Reservoir	AF	240,426	240,602	239,298	240,457	239,407	239,794
Eleanor							
Inflow	AF	169,617	169,617	169,617	169,617	169,617	169,617
Eleanor Gravity	AF	199	199	289	199	289	289
Eleanor Pump	AF	118,270	118,188	118,299	118,295	118,337	118,306
River	AF	49,243	49,325	49,124	49,219	49,086	49,116
Stream Minimum Release	AF						
Evaporation	AF	1,905	1,905	1,906	1,905	1,906	1,906
Reservoir	AF	22,201	22,201	22,191	22,201	22,191	22,191
Don Pedro Reservoir							
Inflow	AF	1,591,144	1,594,967	1,561,409	1,581,846	1,587,455	1,585,545
MID Diversion	AF	303,546	303,546	303,546	303,546	303,546	303,546
TID Diversion	AF	563,497	563,497	563,497	563,497	563,497	563,497
LaGrange Total Stream	AF	680,091	684,124	652,299	671,218	677,049	675,258
LaGrange Minimum Stream Release	AF	221,361	221,361	221,361	221,361	221,361	221,361
Total Evaporation	AF	44,024	44,092	43,106	43,945	43,846	43,783
Reservoir	AF	1,492,181	1,495,055	1,453,662	1,489,120	1,484,587	1,482,183
Water Bank Account							
Balance	AF	518,149	520,327	517,209	518,066	514,804	513,675
Transfer	AF	0	0	27,000	0	1,500	0
San Joaquin Pipelines							
Volume (AF)	AF	244,165	240,340	273,887	253,403	247,854	249,796
Volume (MG)	MG	79,562	78,315	89,246	82,572	80,763	81,398
Rate (MGD)	MGD	218	215	245	226	221	223
Max Rate (MGD)	MGD	290	290	314	290	313	313
Min Rate (MGD)	MGD	70	0	0	0	0	0
East Bay System							
Reservoirs							
Calaveras							
Inflow	MG	12,368	12,368	12,368	12,368	12,368	12,368
From ACDD	MG	1,352	2,023	1,748	2,040	1,712	1,716
Stream	MG	3,660	2,242	4,285	3,723	4,263	4,252
Stream Flow Recapture	MG	0	0	1,555	1,511	1,555	1,555
To SWWTP	MG	9,049	10,616	9,694	10,666	9,673	9,690
To San Antonio	MG	0	0	0	0	0	0
Evaporation	MG	1,023	1,591	1,709	1,579	1,712	1,711
Reservoir	MG	10,975	25,116	28,320	24,815	28,406	28,378
San Antonio							
Inflow	MG	2,468	2,468	2,468	2,468	2,468	2,468
From Calaveras/SJPL	MG	1,053	1,525	1,278	3,035	626	618
Stream	MG	555	521	548	74	897	797
To SWWTP	MG	2,061	2,511	2,239	4,848	1,173	1,277
Evaporation	MG	956	971	976	757	1,028	1,020
Reservoir	MG	14,084	14,447	14,631	10,379	15,584	15,444
Alameda Creek Diversion Dam							
Inflow	MG	4,197	4,197	4,197	4,197	4,197	4,197
To Calaveras Reservoir	MG	1,352	2,023	1,748	2,040	1,712	1,716
Spill	MG	2,845	2,174	2,449	2,157	2,485	2,481
Alameda Creek Confluence							
Accretion	MG	1,918	1,918	1,918	1,918	1,918	1,918
From ACDD	MG	2,845	2,174	2,449	2,157	2,485	2,481
From Calaveras Dam	MG	3,660	2,242	4,285	3,723	4,263	4,252
At Confluence	MG	8,422	6,333	8,652	7,798	8,666	8,651
Treatment Plants							
SWWTP Total	MG	13,752	13,267	14,313	16,123	13,885	14,002
From Calaveras	MG	9,049	10,616	9,694	10,666	9,673	9,690
From San Antonio	MG	2,061	2,511	2,239	4,848	1,173	1,277
From SJPL	MG	2,642	141	2,380	609	3,039	3,035
SWWTP Total MGD	MGD	38	36	39	44	38	38
SWWTP Max MGD	MGD	117	120	160	120	120	120
SWWTP Min MGD	MGD	20	20	20	20	20	20

**Table 1-2
Summary of Modeling Results (Part 2/2)**

HH/LSM Simulation Results	Units	Baselines		Proposed WSIP	CEQA Alternatives ³		
		Baseline Conditions ¹ - Calaveras Constrained	Baseline Conditions ² - Calaveras Unconstrained		No Program	No Increased Purchase	Aggressive Conservation
Peninsula System							
Reservoirs							
Crystal Springs							
Inflow	MG	3,722	3,722	3,722	3,722	3,722	3,722
From San Andreas	MG	0	0	0	0	0	0
From Pilarcitos and SJPL	MG	6,751	8,545	8,508	9,193	8,306	8,277
Stream	MG	448	409	316	117	661	685
Pump to San Andreas	MG	8,832	10,540	10,311	11,497	10,034	9,983
Pump to Coastside	MG	54	55	239	183	58	54
Evaporation	MG	1,189	1,261	1,407	1,140	1,274	1,275
Reservoir	MG	16,102	16,907	18,962	15,117	17,026	17,035
San Andreas							
Inflow	MG	1,428	1,428	1,428	1,428	1,428	1,428
From other Streams	MG	9,271	10,992	10,656	11,963	10,430	10,377
Stream	MG	0	0	0	0	0	0
To HTWTP	MG	10,168	11,890	11,553	12,861	11,328	11,275
Evaporation	MG	530	530	530	529	530	530
Reservoir	MG	5,893	5,846	5,861	5,820	5,844	5,847
Pilarcitos							
Inflow		1,297	1,297	1,297	1,297	1,297	1,297
To San Andreas	MG	439	452	345	465	396	394
For Stone Diversion	MG	444	444	607	591	446	443
Stream other than Diversion	MG	327	314	278	171	369	373
Evaporation	MG	89	89	72	74	89	89
Reservoir	MG	623	623	469	485	623	625
Stone Dam							
Accretion blw Pilarcitos	MG	603	603	603	603	603	603
Pilarcitos non-diversion Release	MG	327	314	278	171	369	373
Pilarcitos Release for Diversions	MG	930	917	880	774	971	975
Diversion to Coastside	MG	178	178	236	230	179	178
Diversion to Crystal Springs	MG	180	200	181	232	169	167
Spill past Stone	MG	1,502	1,455	1,343	1,085	1,595	1,606
Treatment Plants							
HTWTP Total	MG	10,168	11,890	11,553	12,861	11,328	11,275
HTWTP Total MGD	MGD	28	33	32	35	31	31
HTWTP Max MGD	MGD	149	149	106	185	147	147
HTWTP Min MGD	MGD	20	20	20	20	20	20
Other Facilities							
Westside Basin Net	MG	0	0	11	0	11	0
Desalination Input	MG	0	0	0	0	0	0
Additional Information							
Total Local Reservoir Stream Release	MG	4,990	3,486	5,427	4,084	6,191	5,908
Total Local Reservoir Stream Evaporation	MG	3,788	4,442	4,694	4,078	4,632	4,604
Deliveries							
In-City	MG	29,589	29,667	26,686	28,520	27,418	26,273
South Bay	MG	43,106	43,221	52,906	48,603	45,073	46,408
Crystal Springs	MG	15,120	15,160	16,931	15,721	15,844	16,146
San Andreas	MG	5,400	5,414	6,604	6,108	5,839	5,961
Coastside	MG	675	678	1,082	991	683	1,082
Groveland	MG	365	365	365	365	365	365
Total Deliveries	MG	94,255	94,502	104,574	100,398	95,621	96,235
Total Deliveries	MGD	258	259	287	275	262	264
Storage							
Total Local Storage Begin	MG	23,240	23,488	26,150	21,433	23,263	23,150
Total Local Storage End	MG	18,915	23,358	22,188	19,257	23,088	22,577
Residual Difference during 82-year Simulation	MGD	0.14	0.00	0.13	0.07	0.01	0.02
Westside Storage Begin	MG	0	0	23,474	0	23,474	0
Westside Storage End	MG	0	0	24,363	0	24,399	0
Residual Difference during 82-year Simulation	MGD	0.00	0.00	0.03	0.00	0.03	0.00

Notes for Table 1-1 and Table 1-2

1. Baseline condition represents the existing conditions at the time of NOP publication in September 2005. This is the baseline used to assess WSIP program impact and impact significance. This setting indicates DSOD restrictions on Calaveras and Crystal Springs Reservoirs.
2. This baseline condition represents a system configuration and operation prior to the DSOD storage restriction (pre-2002).
3. These scenarios represent CEQA program alternatives that vary from the proposed WSIP program on key components in a manner expected to avoid or reduce potentially significant effects of the proposed program.
4. The time horizon for the setting of the scenario. The baseline condition scenarios are depicted for recent conditions, while the proposed WSIP, variants, and alternatives are depicted for the future at full buildout and implementation, i.e., conditions in the year 2030.
5. HH/LSM model simulation study name.
6. The customer purchase request (demand) information is based on the demand and request studies prepared by the SFPUC in coordination with the wholesale customers (SFPUC/URS 2004). This demand on the regional water system includes both the SFPUC retail customers and wholesale customers. The current (2005) average annual demand is 265 mgd, and the projected 2030 average annual demand is 300 mgd, assuming the SFPUC adopts the updated wholesale customer purchase requests as part of the Master Sales Agreement renewal with these customers (due in 2009).
7. Certain scenarios include the development of additional water supply from a combination of recycled water projects, groundwater projects, and conservation, utilized every year and not subject to reduction during drought.
8. The average annual demand for supplies from the combination of the SFPUC local watershed and Tuolumne River, as well as programs not included in the regional water conservation, reclamation, and groundwater programs shown.
9. Modeled results for SFPUC deliveries, with supplies added for regional water conservation, reclamation, and groundwater programs. Total deliveries and supply will be less than full customer purchase requests due to rationing in some years.
10. Shows only the features that affect hydrologic results of the system operation simulations. Additional projects are included in the WSIP, variants, and alternatives.
11. Illustrates the frequency and severity of water supply action or severity of system wide rationing. Only years in which variable water supply component is implemented or rationing occurs are shown. "DD" illustrates the shortage results for years included in the prospective drought period of the SFPUC Design Drought. These years contribute to establishing system operation protocols, but are not included in the hydrologic assessment analyses.
12. Rationing policy cap: The SFPUC WSIP level of service goal is to maintain rationing on the regional system at no more than 20% during any one year of drought. Some alternatives do not achieve this level of service goal. Performance is indicated for both the Design Drought ("DD") sequence and for the "Historical" hydrologic sequence.
13. Water supply elements develop water in different amounts from year-to-year, and in some instances, they only develop water during dry years. This information is provided to compare local watershed supplies, Tuolumne River supplies, and other identifiable water supplies used to meet system purchase requests. Values are stated in units of average annual quantities during the simulated historical sequence.
14. Results from HH/LSM analysis of each scenario. Values represent the average annual production of each element of supply during the design drought period.
15. Simplified calculation of system deliveries during the SFPUC design drought. The value represents the application of system-wide shortages to the demand level being met with SFPUC local watershed, Tuolumne, and other developed supplies, and does not include supplies from regional water conservation, or from recycled water or groundwater projects. Average value may be slightly misstated (up to 3 mgd) due to metric of analysis that does not account for differences in residual storage between studies. "Nominal" firm yield represents the yield of each scenario after adjustment for minor residual storage differences.
16. Supplemental releases from Calaveras Reservoir for fisheries (1997 MOU) of up to 6,300 AFY and the Alameda Creek Recapture project are tied to implementation of the Calaveras Dam replacement project. When the dam is replaced and capacity restored, both the flow release and recapture will occur. The release requirement is based on the supplementation of other occurring flows below Calaveras Reservoir, sometimes not requiring the full 6,300 acre-feet.
17. SFPUC actions are assumed to leave MID/TID diversions unchanged so that the SFPUC effects on the Tuolumne River below La Grange Dam are isolated and possibly overstated. The Districts' diversions are assumed to be constant among the scenarios to provide comparable results of SFPUC-alone effects.
18. Participation in the San Joaquin River Agreement is assumed. Although the agreement expires after 2010, it is assumed that a subsequent similar agreement or requirement of the Districts will occur. HH/LSM does not explicitly model the Districts' participation in the agreement; however, its participation if modeled would result in only minor differences in results and would not change impact conclusions.
19. From HH/LSM results for modeling the SFPUC Design Drought Period.
20. From HH/LSM results for modeling the system operations for the historical hydrologic period 1921-2002. Values indicate average annual quantities during the simulated historical period.
21. Modeling did not include inclusion of LSCDI project. Inclusion of the project in alternatives would develop 1 mgd of system firm yield.

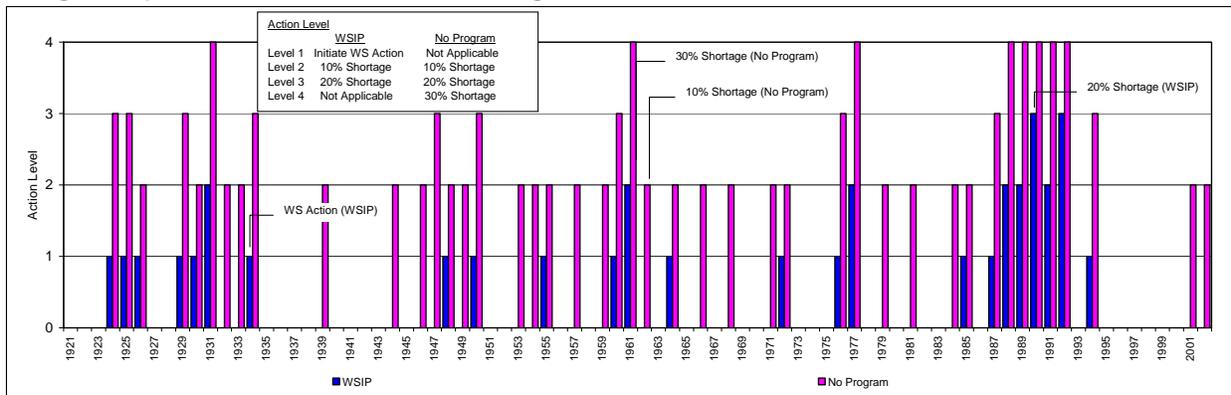
2. CEQA Alternative 1 – No Program

CEQA Alternative 1 – No Program Alternative would implement only those WSIP facility improvement projects that are mandated by, or previously agreed upon with, regulatory agencies. Those projects affecting hydrology include Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2).² Under the No Program Alternative, customer purchase requests for water from the San Francisco Public Utilities Commission (SFPUC) (water demand) would increase from an average annual demand of 265 million gallons per day (mgd) in 2005 to 300 mgd in 2030. There would be no supplemental water supply sources from regional groundwater development, recycled water projects or conservation (collectively referred herein for the WSIP as Regional Recycled/Ground Water and Conservation [RRGWC]), restoration of Crystal Springs Reservoir capacity, water transfers, or the Westside Basin Groundwater Program. The additional water demand would be served, to the extent possible, from increased diversions from the Tuolumne River, as well as from the increased use of local watershed supplies, primarily associated with the restoration of Calaveras Reservoir.

2.1 Water Deliveries and Drought Response Actions

Compared to the WSIP setting, with the absence of 10 mgd of RRGWC, the regional system’s resources are required to serve a 300-mgd demand instead of a net 290-mgd demand. Combined with a lesser supply as compared to the WSIP setting, this circumstance leads to a more frequent implementation of rationing and a greater severity of rationing during drought periods. The rationing is applied to the 300-mgd level of demand as opposed to a 290-mgd level of demand. Table 1-1 compares the drought response actions for the proposed program and the alternative. Figure 2.1-1 illustrates the occurrence of drought response actions for the simulated 82-year historical period (1921-2002).

**Figure 2.1-1
Drought Response Actions – WSIP and No Program**



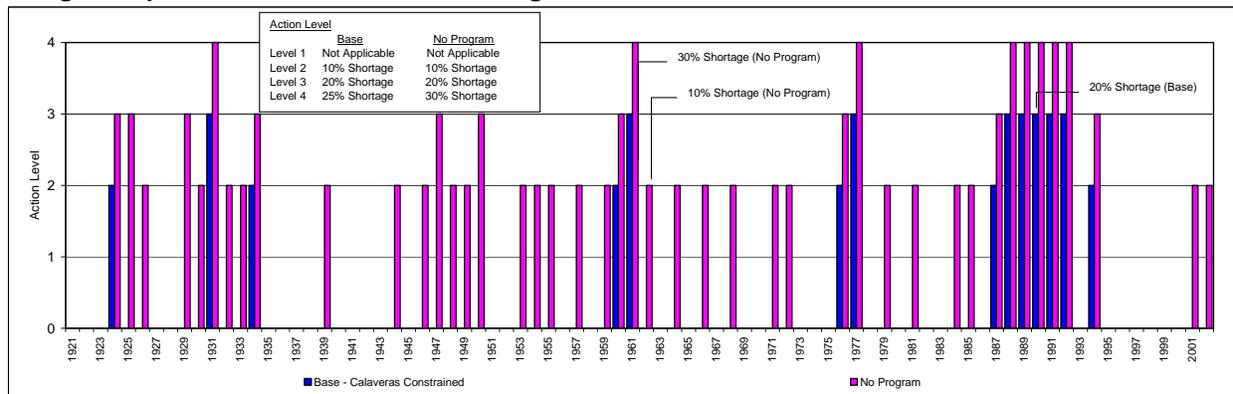
In Figure 2.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In the WSIP setting, the water supply action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. Also occurring in the WSIP setting is the water transfer supplemental supply from MID/TID. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers. Without supplemental resources, the alternative only has delivery shortage measures available to cope with drought. This shortage measure is imposed during level 2 (10 percent), level 3 (20 percent), and level 4 (an assumed 30 percent shortage). The frequency of imposed delivery shortages and severity of shortages all increase in the alternative setting.

The same form of information is shown in Figure 2.1-2 in comparing the alternative and “Base - Calaveras Constrained” (existing) settings. As illustrated above, there is no level 1 action level in the alternative setting or base setting. Without supplemental resources, the existing system only has delivery shortage

² The Lower Crystal Springs Dam Improvements project is also included in the No Program Alternative but was not included in the HH/LSM modeling.

measures available to cope with drought. In the base setting, the shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the alternative and the base setting for these action levels, although they are applied to different levels of water demand. In the alternative, the system's water demand is an average annual 300 mgd; in the base setting, the water demand is 265 mgd. Rationing above 20 percent is not required in the base setting; however, for the same simulation period, a 30-percent level of rationing is needed for the alternative to be viable.

**Figure 2.1-2
Drought Response Actions – Base and No Program**



Not illustrated in Figure 2.1-2 but shown in Table 1-1 are the delivery shortages anticipated during the entire SFPUC Design Drought. During the Design Drought, neither the base setting nor the alternative setting has a viable operation without exceeding a 20-percent shortage level. The base setting exceeds the 20-percent shortage level (requires 25 percent rationing) during the last 18 months of the Design Drought. The alternative exceeds the 20-percent shortage level (requires 35 percent rationing) 6½ years out of the 8½ year Design Drought, and 3 other years within the simulation.

The difference in water deliveries between the proposed program and the alternative is shown chronologically for the 82-year simulation in Table 2.1-1. The years indicating positive differences amounting to approximately 3,600 million gallons illustrate 10 mgd of demand being met from the regional system, which, in the proposed program, was being met from RRGWC. This indicates that the regional system serves an average annual demand of 300 mgd in the alternative setting compared to the regional system serving an average annual net demand of 290 mgd in the WSIP setting. During about 23 percent of the years, the alternative can fully serve the 300 mgd of demand. During another 23 percent of the years, the alternative would provide some amount of additional water greater than base setting deliveries, but not the full amount associated with a 300-mgd level of demand. During the remaining 50 percent of years, water deliveries in the alternative setting would be less than the deliveries provided in the base setting. This reduction in reliability is due to the need to initiate shortages on the higher level of demand in many more years in anticipation of potential prolonged drought. Comparing the alternative setting to the base setting, Table 2.1-2 illustrates the difference in water deliveries between the two settings. The alternative setting would provide greater deliveries in most years. This indicates that an increase in system deliveries can be accommodated with the existing system.

2.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin (Tuolumne) is the flow through the San Joaquin Pipeline (SJPL). Inherent to this alternative is the draw of additional water from the Tuolumne. Table 2.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the alternative settings. Compared to the base setting, the constrained conveyance capacity of the SJPL in the alternative (only equal to the existing capacity) is evident. During the summer, the SJPL would convey less water in the alternative setting. In some years, this reduction in flow is offset during the winter with an increase in diversion when capacity is available in the SJPL. With only the

Table 2.1-1

Difference in Total System-wide Delivery (MG)													No Program minus WSP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	83	59	58	52	260	304	327	341	336	313	316	306	2,755	2,090
1922	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1923	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1924	307	276	282	276	260	304	327	341	336	-1,936	-1,900	-1,595	-2,722	3,644
1925	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	-1,936	-1,900	-1,595	-15,718	-15,718
1926	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	-782	-765	-587	-12,420	-15,718
1927	-416	-195	-20	72	-46	-257	-431	-623	-753	89	92	89	-2,398	-4,802
1928	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
1929	83	59	58	52	58	80	110	117	119	-1,936	-1,900	-1,595	-4,696	1,005
1930	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	-782	-765	-587	-12,420	-15,718
1931	-416	-195	-20	72	-46	-257	-431	-623	-753	-1,994	-1,813	-1,553	-8,028	-4,802
1932	-1,368	-1,047	-842	-718	-808	-1,153	-1,361	-1,627	-1,770	-1,312	-1,264	-1,041	-14,310	-16,052
1933	-865	-613	-428	-310	-425	-680	-867	-1,069	-1,206	-1,312	-1,264	-1,041	-10,081	-10,081
1934	-865	-613	-428	-310	-425	-680	-867	-1,069	-1,206	-1,936	-1,900	-1,595	-11,895	-10,081
1935	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	89	92	89	-10,017	-15,718
1936	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
1937	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
1938	83	59	58	52	58	80	110	117	119	313	316	306	1,670	1,005
1939	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1940	-641	-397	-204	-86	-223	-456	-650	-845	336	313	316	306	-2,229	-6,116
1941	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1942	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1943	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1944	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1945	-641	-397	-204	-86	-223	-456	-650	-845	-989	313	316	306	-3,554	-7,442
1946	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1947	-641	-397	-204	-86	-223	-456	-650	-845	-989	-2,243	-2,175	-1,832	-10,739	-7,442
1948	-1,576	-1,177	-901	-724	-881	-1,290	-1,576	-1,891	-2,092	-782	-765	-587	-14,242	-18,357
1949	-416	-195	-20	72	-46	-257	-431	-623	-753	-1,312	-1,264	-1,041	-6,286	-4,802
1950	-865	-613	-428	-310	-425	-680	-867	-1,069	-1,206	-1,936	-1,900	-1,595	-11,895	-10,081
1951	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	89	92	89	-10,017	-15,718
1952	83	59	58	52	58	80	110	117	119	313	316	306	1,670	1,005
1953	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1954	-641	-397	-204	-86	-223	-456	-650	-845	-989	-1,088	-1,040	-824	-7,442	-7,442
1955	-641	-397	-204	-86	-223	-456	-650	-845	-989	-782	-765	-587	-6,623	-7,442
1956	-416	-195	-20	72	-46	-257	-431	-623	572	89	92	89	-1,073	-3,477
1957	83	59	58	52	58	80	110	117	119	-1,088	-1,040	-824	-2,217	1,005
1958	-641	-397	-204	-86	-223	-456	-650	-845	336	313	316	306	-2,229	-6,116
1959	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1960	-641	-397	-204	-86	-223	-456	-650	-845	-989	-1,936	-1,900	-1,595	-9,921	-7,442
1961	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	-1,994	-1,813	-1,553	-15,646	-15,718
1962	-1,368	-1,047	-842	-718	-808	-1,153	-1,361	-1,627	-1,770	-1,312	-1,264	-1,041	-14,310	-16,052
1963	-865	-613	-428	-310	-425	-680	-867	-1,069	-1,206	89	92	89	-6,194	-10,081
1964	83	59	58	52	58	80	110	117	119	-782	-765	-587	-1,399	1,005
1965	-416	-195	-20	72	-46	-257	-431	-623	-753	89	92	89	-2,398	-4,802
1966	83	59	58	52	58	80	110	117	119	-1,088	-1,040	-824	-2,217	1,005
1967	-641	-397	-204	-86	-223	-456	-650	-845	336	313	316	306	-2,229	-6,116
1968	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1969	-641	-397	-204	-86	-223	-456	-650	-845	336	313	316	306	-2,229	-6,116
1970	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1971	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1972	-641	-397	-204	-86	-223	-456	-650	-845	-989	-782	-765	-587	-6,623	-7,442
1973	-416	-195	-20	72	-46	-257	-431	-623	572	89	92	89	-1,073	-3,477
1974	83	59	58	52	58	80	110	117	119	313	316	306	1,670	1,005
1975	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1976	307	276	282	276	260	304	327	341	336	-1,936	-1,900	-1,595	-2,722	3,644
1977	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	-1,994	-1,813	-1,553	-15,646	-15,718
1978	-1,368	-1,047	-842	-718	-808	-1,153	-1,361	-1,627	-1,770	89	92	89	-10,423	-16,052
1979	83	59	58	52	58	80	110	117	119	-1,312	-1,264	-1,041	-2,882	1,005
1980	-865	-613	-428	-310	-425	-680	-867	-1,069	-1,206	313	316	306	-4,203	-8,756
1981	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1982	-641	-397	-204	-86	-223	-456	-650	-845	336	313	316	306	-2,229	-6,116
1983	307	276	282	276	260	304	327	341	336	313	316	306	3,644	3,644
1984	307	276	282	276	260	304	327	341	336	-1,088	-1,040	-824	-243	3,644
1985	-641	-397	-204	-86	-223	-456	-650	-845	-989	-782	-765	-587	-6,623	-7,442
1986	-416	-195	-20	72	-46	-257	-431	-623	572	89	92	89	-1,073	-3,477
1987	83	59	58	52	58	80	110	117	119	-1,936	-1,900	-1,595	-4,696	1,005
1988	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	-1,994	-1,813	-1,553	-15,646	-15,718
1989	-1,368	-1,047	-842	-718	-808	-1,153	-1,361	-1,627	-1,770	-1,994	-1,813	-1,553	-16,052	-16,052
1990	-1,368	-1,047	-842	-718	-808	-1,153	-1,361	-1,627	-1,770	-870	-712	-575	-12,850	-16,052
1991	-466	-296	-170	-108	-184	-346	-467	-614	-698	-1,994	-1,813	-1,553	-8,710	-5,507
1992	-1,368	-1,047	-842	-718	-808	-1,153	-1,361	-1,627	-1,770	-870	-712	-575	-12,850	-16,052
1993	-466	-296	-170	-108	-184	-346	-467	-614	-698	89	92	89	-3,080	-5,507
1994	83	59	58	52	58	80	110	117	119	-1,936	-1,900	-1,595	-4,696	1,005
1995	-1,352	-975	-717	-566	-704	-1,091	-1,357	-1,670	-1,855	89	92	89	-10,017	-15,718
1996	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
1997	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
1998	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
1999	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
2000	83	59	58	52	58	80	110	117	119	89	92	89	1,005	1,005
2001	83	59	58	52	58	80	110	117	119	-1,088	-1,040	-824	-2,217	1,005
2002	-641	-397	-204	-86	-223	-456	-650	-845	-989	-1,088	-1,040	-824	-7,442	-7,442
Avg (21-02)	-378	-244	-136	-76	-140	-271	-366	-482	-415	-646	-610	-488	-4,253	-4,214

Table 2.1-2

Difference in Total System-wide Delivery (MG)													No Program minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1922	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1923	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1924	1,117	887	743	650	697	913	1,054	1,248	1,344	104	87	77	8,922	12,769
1925	51	22	-7	-29	-11	-12	8	44	-1,083	-1,098	-1,080	-892	-4,089	-751
1926	-766	-566	-440	-350	-444	-681	-849	-985	-1,083	57	55	116	-5,935	-9,233
1927	169	215	257	288	214	153	77	62	19	1,458	1,411	1,246	5,570	1,683
1928	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1929	1,117	887	743	650	697	913	1,054	1,248	1,344	-1,098	-1,080	-892	5,584	12,769
1930	-766	-566	-440	-350	-444	-681	-849	-985	-1,083	57	55	116	-5,935	-9,233
1931	169	215	257	288	214	153	77	62	19	-291	-141	-80	942	1,683
1932	-45	10	50	71	20	-43	-101	-128	-159	57	55	116	-96	-836
1933	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
1934	169	215	257	288	214	153	77	62	19	104	87	77	1,723	1,683
1935	51	22	-7	-29	-11	-12	8	44	-1,083	1,458	1,411	1,246	3,096	-751
1936	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1937	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1938	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1939	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1940	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1941	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1942	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1943	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1944	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1945	169	215	257	288	214	153	77	62	19	1,458	1,411	1,246	5,570	1,683
1946	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1947	169	215	257	288	214	153	77	62	19	-1,098	-1,080	-892	-1,615	1,683
1948	-766	-566	-440	-350	-444	-681	-849	-985	-1,083	57	55	116	-5,935	-9,233
1949	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
1950	169	215	257	288	214	153	77	62	19	-1,098	-1,080	-892	-1,615	1,683
1951	-766	-566	-440	-350	-444	-681	-849	-985	-1,083	1,458	1,411	1,246	-2,048	-9,233
1952	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1953	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1954	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
1955	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
1956	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1957	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1958	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1959	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1960	169	215	257	288	214	153	77	62	19	104	87	77	1,723	1,683
1961	51	22	-7	-29	-11	-12	8	44	59	-291	-141	-80	-390	391
1962	-45	10	50	71	20	-43	-101	-128	-159	57	55	116	-96	-836
1963	169	215	257	288	214	153	77	62	19	1,458	1,411	1,246	5,570	1,683
1964	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1965	169	215	257	288	214	153	77	62	19	1,458	1,411	1,246	5,570	1,683
1966	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1967	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1968	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1969	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1970	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1971	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1972	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
1973	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1974	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1975	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1976	1,117	887	743	650	697	913	1,054	1,248	1,344	104	87	77	8,922	12,769
1977	51	22	-7	-29	-11	-12	8	44	59	-291	-141	-80	-390	391
1978	-45	10	50	71	20	-43	-101	-128	-2,269	1,458	1,411	1,246	1,681	-2,946
1979	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1980	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1981	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1982	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1983	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1984	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
1985	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
1986	169	215	257	288	214	153	77	62	1,344	1,458	1,411	1,246	6,895	3,008
1987	1,117	887	743	650	697	913	1,054	1,248	1,344	104	87	77	8,922	12,769
1988	51	22	-7	-29	-11	-12	8	44	59	-291	-141	-80	-390	391
1989	-45	10	50	71	20	-43	-101	-128	-159	-291	-141	-80	-836	-836
1990	-45	10	50	71	20	-43	-101	-128	-159	-291	-141	-80	-836	-836
1991	-45	10	50	71	20	-43	-101	-128	-159	-291	-141	-80	-836	-836
1992	-45	10	50	71	20	-43	-101	-128	-159	-291	-141	-80	-836	-836
1993	-45	10	50	71	20	-43	-101	-128	-2,269	1,458	1,411	1,246	1,681	-2,946
1994	1,117	887	743	650	697	913	1,054	1,248	1,344	104	87	77	8,922	12,769
1995	51	22	-7	-29	-11	-12	-849	-985	-1,083	1,458	1,411	1,246	1,211	-2,636
1996	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1997	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1998	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
1999	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
2000	1,117	887	743	650	697	913	1,054	1,248	1,344	1,458	1,411	1,246	12,769	12,769
2001	1,117	887	743	650	697	913	1,054	1,248	1,344	57	55	116	8,881	12,769
2002	169	215	257	288	214	153	77	62	19	57	55	116	1,683	1,683
Avg (21-02)	545	462	415	385	376	442	464	543	633	619	612	568	6,064	6,112

Table 2.2-1

Difference in Total SJPL (Acre-feet)												No Program minus WSIP				WY Total	FY Total
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep					
1921	4,756	-3,682	-6,660	3,805	3,437	-9,513	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-20,778	-19,581			
1922	475	0	-10,465	2,855	12,030	8,562	0	-2,189	-2,118	-2,189	-2,189	-2,118	2,654	2,654			
1923	4,756	921	-6,660	8,562	7,734	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-3,411	-3,411			
1924	1,807	0	-19,027	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-34,133	-34,133			
1925	-2,189	19,334	0	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-12,624	-12,624			
1926	-2,189	-5,616	-12,891	-5,803	4,296	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-40,927	-40,927			
1927	-2,379	4,603	-14,270	2,855	3,437	5,709	1,841	-5,043	-4,880	-2,189	-2,189	-2,118	-14,623	-14,623			
1928	2,854	0	-12,891	0	0	5,709	4,603	-2,189	-2,118	-2,189	-2,189	-2,118	-10,528	-10,528			
1929	475	0	-15,222	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-31,660	-31,660			
1930	-2,189	19,334	0	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-12,624	-12,624			
1931	-2,189	-5,616	-12,891	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,567	-2,567	-2,483	-51,586	-50,465			
1932	-1,330	-2,762	-3,139	9,038	-3,437	-5,803	-4,880	-9,799	-9,483	-2,189	-2,189	-2,118	-38,091	-39,212			
1933	951	-1,841	-12,891	-1,902	-1,719	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-36,126	-36,126			
1934	-2,189	-5,616	-24,735	-1,902	-1,719	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-54,885	-54,885			
1935	-2,189	19,334	0	-5,803	-5,242	-5,803	-2,118	-5,043	-4,880	-2,189	-2,189	-2,118	-18,240	-18,240			
1936	-2,189	-4,603	-12,891	-2,854	11,171	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-30,090	-30,090			
1937	-952	-1,841	-19,027	0	12,030	10,656	920	-2,189	-2,118	-2,189	-2,189	-2,118	-9,017	-9,017			
1938	1,807	0	-9,323	5,709	12,030	13,319	5,524	-2,189	-2,118	-2,189	-2,189	-2,118	18,263	18,263			
1939	4,756	921	-14,270	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-25,506	-25,506			
1940	-2,189	19,334	0	-5,803	2,578	952	4,603	-6,945	-6,721	-2,189	-2,189	-2,118	-687	-687			
1941	4,756	921	-7,611	13,319	0	951	920	0	0	-2,189	-2,189	-2,118	6,760	6,760			
1942	951	0	-7,611	8,562	0	4,757	0	0	0	-2,189	-2,189	-2,118	163	163			
1943	1,807	921	-12,891	8,562	7,734	952	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-5,836	-5,836			
1944	4,756	921	-17,124	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-28,360	-28,360			
1945	1,807	19,334	0	-5,803	-1,719	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-5,105	-5,105			
1946	-2,189	-1,841	-6,660	13,319	12,030	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-4,065	-4,065			
1947	-952	0	-17,124	0	0	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-36,800	-36,800			
1948	-2,189	-5,616	-12,891	-5,803	-4,297	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-49,520	-49,520			
1949	-2,189	-5,616	-19,979	0	0	4,757	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-35,948	-35,948			
1950	951	19,334	0	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-9,484	-9,484			
1951	-2,189	-4,603	-6,660	7,610	6,874	-6,659	-2,118	-7,897	-7,642	-2,189	-2,189	-2,118	-29,780	-29,780			
1952	2,854	0	-7,611	0	0	0	-3,683	-5,043	-4,880	-2,189	-2,189	-2,118	-24,859	-24,859			
1953	4,756	921	-6,660	8,562	7,734	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-3,411	-3,411			
1954	2,854	921	-17,124	952	2,578	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-28,543	-28,543			
1955	1,807	19,334	0	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-8,628	-8,628			
1956	-2,189	-5,616	-6,660	3,805	0	3,805	-2,118	-5,043	-4,880	-2,189	-2,189	-2,118	-25,392	-25,392			
1957	2,854	0	-19,027	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-33,086	-33,086			
1958	-2,189	-2,762	-12,891	952	12,030	13,319	0	-3,901	-3,775	-2,189	-2,189	-2,118	-5,713	-5,713			
1959	2,854	921	-17,124	952	11,171	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-19,950	-19,950			
1960	-2,189	19,334	0	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-12,624	-12,624			
1961	-2,189	-5,616	-6,707	381	-5,242	-5,803	-2,118	-2,189	-2,118	-2,567	-2,567	-2,483	-39,218	-38,097			
1962	-5,421	368	-16,649	1,427	-7,734	-10,560	-2,118	-9,799	-9,483	-2,189	-2,189	-2,118	-66,465	-67,586			
1963	-2,379	-4,603	-12,891	10,656	3,437	5,709	-4,603	-1,902	-1,841	-2,189	-2,189	-2,118	-14,913	-14,913			
1964	-2,189	921	-19,027	2,855	2,578	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-33,586	-33,586			
1965	-2,189	19,334	0	2,854	2,578	-5,803	460	-5,708	-5,524	-2,189	-2,189	-2,118	-494	-494			
1966	2,854	2,762	-12,368	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-23,665	-23,665			
1967	-2,189	-5,616	-14,270	13,319	12,030	9,514	2,762	0	0	-2,189	-2,189	-2,118	9,054	9,054			
1968	-952	0	-12,891	4,757	4,296	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-23,514	-23,514			
1969	-2,189	-2,762	-17,124	13,319	2,406	7,610	-4,880	-5,043	-4,880	-2,189	-2,189	-2,118	-20,039	-20,039			
1970	4,756	19,334	0	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	7,177	7,177			
1971	951	2,762	-6,660	13,319	12,030	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	3,678	3,678			
1972	-2,189	-5,616	-17,124	0	0	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-43,653	-43,653			
1973	-2,189	-5,616	-12,891	13,319	12,030	8,562	-2,118	-5,043	-4,880	-2,189	-2,189	-2,118	-5,322	-5,322			
1974	2,854	4,603	-6,660	8,562	7,734	4,757	-4,603	-5,043	-4,880	-2,189	-2,189	-2,118	828	828			
1975	5,708	19,334	0	-5,803	4,296	3,805	-921	-5,043	-4,880	-2,189	-2,189	-2,118	10,000	10,000			
1976	5,708	921	-12,891	-1,902	-1,719	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-28,607	-28,607			
1977	-2,189	-5,616	-21,881	6,184	0	-5,803	-2,118	-2,189	-2,118	-2,567	3,617	3,501	-31,179	-42,226			
1978	4,854	368	-6,707	475	-6,015	-4,757	0	-5,803	-5,616	-2,189	-2,189	-2,118	-29,697	-18,650			
1979	2,854	921	-19,027	952	12,030	-2,854	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-18,045	-18,045			
1980	-2,189	19,334	0	-1,902	0	-5,899	-2,118	-6,945	-6,721	-2,189	-2,189	-2,118	-12,936	-12,936			
1981	2,854	0	-12,891	5,709	5,156	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-17,896	-17,896			
1982	-952	921	-10,465	13,319	6,874	5,899	0	-4,756	-4,603	-2,189	-2,189	-2,118	-259	-259			
1983	1,807	2,762	-6,660	3,805	0	0	2,762	2,855	2,762	-2,189	-2,189	-2,118	3,597	3,597			
1984	-2,189	4,603	-6,660	8,562	7,734	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-6,674	-6,674			
1985	-2,189	19,334	0	-5,803	-5,242	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-12,624	-12,624			
1986	-2,189	-5,616	-12,891	-5,803	4,297	952	-2,762	-6,945	-6,721	-2,189	-2,189	-2,118	-44,174	-44,174			
1987	2,854	921	-19,027	952	859	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-32,165	-32,165			
1988	-2,189	-5,616	-12,891	-5,803	-4,297	-5,803	-2,118	-2,189	-2,118	-2,567	-2,567	-2,483	-50,641	-49,520			
1989	2,476	-1,841	-17,124	2,855	2,578	-5,803	-2,118	-9,799	-9,483	-5,421	-5,421	-1,286	-50,387	-45,876			
1990	-2,281	19,334	0	-5,803	-5,242	-5,803	-2,118	-6,945	-6,721	-5,421	-5,232	-2,207	-26,439	-27,707			
1991	-379	921	-12,368	4,757	4,296	-4,756	-6,721	-4,756	-4,603	-5,421	-2,281	-366	-31,677	-34,469			
1992	-379	-4,603	-17,124	2,855	-1,031	-10,560	-4,880	-9,799	-9,483	-378	1,524	2,396	-51,462	-63,072			
1993	2,476	-3,682	-12,368	2,663	0	3,805	-4,603	-2,854	-2,762	-2,189	-2,189	-2,118	-23,821	-13,783			
1994	2,854	921	-17,124	0	0	-5,803	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-32,073	-32,073			
1995	-2,189	19,334	0	-6,659	-4,297	0	-10,127	-6,659	-6,445	-2,189	-2,189	-2,118	-23,538	-23,538			
1996	2,854	921	-12,891	8,562	0	951	-4,880	-5,043	-4,880	-2,189	-2,189	-2,118	-20,902	-20,902			
1997	951	4,603	-6,660	0	0	-10,560	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-24,587	-24,587			
1998	-952	-1,841	-12,891	13,319	0	0	-6,444	-1,047	-1,013	-2,189	-2,189	-2,118	-17,365	-17,365			
1999	4,756	0	-17,124	4,757	7,734	0	-1,841	-2,189	-2,118	-2,189	-2,189	-2,118	-12,521	-12,521			
2000	2,854	19,334	0	-5,803	2,578	-7,611	-2,118	-2,189	-2,118	-2,189	-2,189	-2,118	-1,569	-1,569			
2001	-952	-1															

existing capacity of the SJPL available in the alternative, and with scheduled maintenance for the facility, the additional demand on the system would require the SJPL to operate on an average annual basis of approximately 95 percent of its capacity, and in many years full capacity. Overall, compared to the WSIP setting, the alternative setting would divert less water from the Tuolumne.

Table 2.2-2 illustrates the difference in diversions to the SJPL between the alternative and base settings. During many springs and summers, there is little or no difference in diversions to the SJPL alternative and base settings. This indicates that the SJPL is conveying water at maximum capacity in both settings, attempting to retain storage in the Bay Area reservoirs. During the fall and winter, the increase in diversions to the SJPL indicates the system's need to serve additional demand and replenish Bay Area reservoirs. The reduction in diversion during December indicates the implementation of annual system-wide maintenance within the Hetch Hetchy conveyance facilities that currently does not occur. Overall, there would be an increase in average annual diversions to the SJPL in the alternative setting.

The average monthly diversion through the SJPL by year type for the 82-year simulation period for the proposed program and the alternative settings, and the difference between the two settings, are illustrated in Table 2.2-3. Table 2.2-4 presents the same information for the alternative and base settings.

2.3 Hetch Hetchy Reservoir and Releases

Compared to the WSIP setting, the alternative setting would draw less water from the Tuolumne in most years. This circumstance would lead to less draw from Hetch Hetchy Reservoir in most years. Figure 2.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 2.3-1 are the results for the WSIP, alternative ("No Program"), and base ("Base – Calaveras Constrained") settings. Supplementing the Figure 2.3-1 representation of Hetch Hetchy Reservoir storage are Table 2.3-1 Hetch Hetchy Reservoir Storage (No Program), Table 2.3-2 Hetch Hetchy Reservoir Storage (WSIP), and Table 2.3-3 Difference in Hetch Hetchy Reservoir Storage (No Program minus WSIP). Table 2.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the base and alternative settings.

Table 2.3-3 shows that, by the end of summer, storage in Hetch Hetchy Reservoir associated with the alternative setting would be greater than the storage in the WSIP setting, albeit typically an increase of less than 10,000 acre-feet. In about 16 percent of the years, storage would be greater by 10,000 acre-feet or more. The relatively minor increases in storage are attributable to less water being diverted during the summer to the SJPL due to a lesser conveyance capacity. The lesser capacity does not always lead to an increase in storage because, in many years, the same release from Hetch Hetchy Reservoir (via Canyon Tunnel) occurs regardless of the diversion to the SJPL, with any flow not being diverted to the SJPL flowing to Don Pedro Reservoir. The larger increases in storage are associated with years or periods during which the increase in severity of water delivery shortages between the WSIP and alternative settings require less water to be diverted to the SJPL. Through the fall and winter, storage in Hetch Hetchy Reservoir would typically be higher, but could be lower depending on the system's need to replenish Bay Area reservoir storage, which is lower due to the lesser conveyance capacity of the SJPL. Hetch Hetchy Reservoir would fill by the end of May during approximately 61 percent of the years, which would negate any difference in storage from carrying into the next summer. Figure 2.3-2 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the WSIP setting. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 2.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the alternative and base settings. Throughout the summer and early fall, there would be very little difference in storage levels between the two settings. Beginning in fall, storage would slightly decrease in the alternative setting, as additional diversions to the SJPL would be needed to replenish Bay Area reservoir storage, which would be affected by the additional demand of the alternative setting during the summer. Storage becomes greater in December of the alternative setting due to the assumed system-wide maintenance that occurs in the alternative (no water being conveyed through the SJPL), which does not occur in the base setting. After December, storage in the alternative setting again becomes affected as Bay Area reservoir storage begins to replenish. In most years, there is a difference in storage between the alternative and base settings; the alternative setting results in a lower storage in the reservoir by the end of April.

Table 2.2-2

Difference in Total SJPL (Acre-feet)												No Program minus Base - Calaveras Constrained				WY Total	FY Total
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep					
1921	5,708	-4,603	-6,660	3,805	3,437	4,757	0	0	0	0	0	0	6,444	11,968			
1922	0	0	-10,465	9,514	12,030	8,562	7,365	2,854	2,762	0	0	0	32,622	32,622			
1923	4,756	0	-6,660	8,562	7,734	9,514	0	0	0	0	0	0	23,906	23,906			
1924	2,854	0	-19,979	0	0	0	0	0	0	0	0	0	-17,125	-17,125			
1925	0	0	-15,222	0	12,030	9,514	0	0	0	0	0	0	6,322	6,322			
1926	2,854	0	-19,979	0	12,030	9,514	0	0	0	0	0	0	4,419	4,419			
1927	1,902	5,524	-15,222	10,656	3,437	9,514	1,841	-2,854	-2,762	0	0	2,762	14,798	12,036			
1928	5,708	0	-14,270	5,709	5,156	13,319	4,603	0	0	0	0	2,762	22,987	22,987			
1929	5,708	0	-15,222	5,709	5,156	4,757	0	0	0	0	0	0	6,108	8,870			
1930	0	0	-19,979	0	0	9,514	0	0	0	0	0	0	-10,465	-10,465			
1931	0	0	-19,979	0	4,296	0	0	0	0	-378	-378	-365	-16,804	-15,683			
1932	7,232	4,603	-10,465	13,319	3,437	10,656	-2,762	-1,902	-1,841	0	0	0	22,277	21,156			
1933	2,854	0	-19,979	5,709	5,156	4,757	0	0	0	0	0	0	-1,503	-1,503			
1934	0	0	-19,979	5,709	8,593	4,757	0	0	0	0	0	0	-920	-920			
1935	0	0	-19,979	10,656	9,624	4,757	0	2,854	2,762	0	0	0	10,674	10,674			
1936	4,756	0	-19,979	9,514	12,030	9,514	0	0	0	0	0	0	15,835	15,835			
1937	2,854	0	-19,979	5,709	12,030	13,319	2,762	2,854	2,762	0	0	0	22,311	22,311			
1938	5,708	0	-10,465	13,319	12,030	13,319	12,889	2,854	2,762	0	0	2,762	55,178	52,416			
1939	4,756	0	-15,222	4,757	4,296	4,757	0	0	0	0	0	0	3,344	6,106			
1940	0	0	-19,979	5,709	12,030	13,319	11,968	-1,902	-1,841	0	0	0	19,304	19,304			
1941	4,756	0	-10,465	13,319	0	951	920	2,854	2,762	0	0	0	15,097	15,097			
1942	2,854	0	-9,323	8,562	0	8,562	5,524	2,854	2,762	0	0	0	21,795	21,795			
1943	4,756	4,603	-19,979	8,562	7,734	8,562	2,762	2,854	2,762	0	0	0	22,616	22,616			
1944	4,756	0	-19,979	5,709	9,624	9,514	0	0	0	0	0	0	9,624	9,624			
1945	0	0	-19,979	0	12,030	9,514	0	0	0	0	0	0	1,565	1,565			
1946	4,756	0	-6,660	13,319	12,030	5,709	0	0	0	0	0	0	29,154	29,154			
1947	0	0	-15,222	4,757	4,296	4,757	0	0	0	0	0	0	-1,412	-1,412			
1948	0	0	-19,979	0	0	0	0	0	0	0	0	0	-19,979	-19,979			
1949	0	0	-19,979	0	0	0	0	0	0	0	0	2,762	-17,217	-19,979			
1950	4,756	0	-19,979	12,368	11,171	4,757	0	0	0	0	0	0	13,073	15,835			
1951	0	0	-6,660	7,610	6,874	0	0	-5,708	-5,524	0	0	2,762	-646	-3,408			
1952	4,756	0	-7,611	0	0	0	7,365	0	0	0	0	0	4,510	7,272			
1953	4,756	0	-7,611	8,562	7,734	9,514	0	0	0	0	0	0	22,955	22,955			
1954	0	0	-19,979	9,514	9,624	9,514	0	0	0	0	0	0	8,673	8,673			
1955	0	0	-15,222	12,368	11,171	0	0	0	0	0	0	0	8,317	8,317			
1956	0	0	-10,465	3,805	0	7,610	0	0	0	0	0	0	950	950			
1957	4,756	0	-19,979	5,709	9,624	4,757	0	0	0	0	0	0	4,867	4,867			
1958	2,854	0	-15,222	4,757	12,030	13,319	0	-952	-921	0	0	0	15,865	15,865			
1959	4,756	0	-19,979	9,514	11,171	9,514	0	0	0	0	0	0	14,976	14,976			
1960	0	0	-19,979	0	4,296	0	0	0	0	0	0	0	-15,683	-15,683			
1961	0	0	-15,222	5,709	5,156	0	0	0	0	-378	-378	11,603	6,490	-4,357			
1962	9,135	0	-19,979	5,709	3,437	7,611	0	-1,902	-1,841	0	0	2,762	4,932	13,017			
1963	2,854	0	-15,222	13,319	3,437	12,368	0	0	0	0	0	0	16,756	19,518			
1964	4,756	4,603	-19,979	12,368	11,171	0	0	0	0	0	0	0	12,919	12,919			
1965	0	0	-15,222	8,562	7,734	9,514	4,603	-4,756	-4,603	0	0	2,762	8,594	5,832			
1966	4,756	4,603	-14,270	9,514	8,593	4,757	0	0	0	0	0	0	17,953	20,715			
1967	0	0	-19,979	13,319	12,030	12,368	5,524	0	0	0	0	0	23,262	23,262			
1968	4,756	0	-19,979	13,319	12,030	4,757	0	0	0	0	0	0	14,883	14,883			
1969	0	0	-15,222	13,319	2,406	7,610	2,762	0	0	0	0	0	10,875	10,875			
1970	4,756	0	-15,222	13,319	12,030	9,514	0	0	0	0	0	0	24,397	24,397			
1971	4,756	4,603	-7,611	13,319	12,030	4,757	0	0	0	0	0	0	31,854	31,854			
1972	0	0	-15,222	4,757	4,296	0	0	0	0	0	0	0	-6,169	-6,169			
1973	0	0	-19,979	13,319	12,030	8,562	4,603	-2,854	-2,762	0	0	2,762	15,681	12,919			
1974	4,756	4,603	-6,660	8,562	7,734	13,319	921	0	0	0	0	2,762	35,997	35,997			
1975	4,756	0	-19,979	5,709	12,030	7,610	7,365	0	0	0	0	0	17,491	20,253			
1976	5,708	0	-19,979	4,757	4,296	0	0	0	0	0	0	0	-5,218	-5,218			
1977	0	0	-19,979	5,709	5,156	0	0	0	0	0	-378	-378	2,397	-7,473			
1978	7,232	4,603	-15,222	7,610	859	3,805	10,311	0	0	0	0	0	19,198	20,839			
1979	4,756	0	-19,979	9,514	12,030	9,514	0	0	0	0	0	0	15,835	15,835			
1980	4,756	0	-15,222	13,319	0	2,663	2,762	-1,902	-1,841	0	0	0	4,535	4,535			
1981	4,756	0	-19,979	13,319	12,030	9,514	0	0	0	0	0	0	19,640	19,640			
1982	0	4,603	-15,222	13,319	6,874	8,562	0	-1,902	-1,841	0	0	0	14,393	14,393			
1983	4,756	4,603	-9,323	3,805	0	0	5,708	5,709	5,524	0	0	0	20,782	20,782			
1984	2,854	4,603	-6,660	8,562	7,734	0	0	0	0	0	0	0	17,093	17,093			
1985	0	4,603	-15,222	0	4,296	4,757	0	0	0	0	0	0	-1,566	-1,566			
1986	0	0	-19,979	0	7,734	8,562	4,603	-1,902	-1,841	0	0	0	-2,823	-2,823			
1987	4,756	0	-19,979	4,757	4,296	4,757	0	0	0	0	0	0	-1,413	-1,413			
1988	0	0	-19,979	0	4,296	0	0	0	0	2,476	4,378	2,397	-6,432	-15,683			
1989	7,232	4,603	-15,222	5,709	5,156	4,757	0	-7,610	-7,365	2,476	2,476	-3,127	-915	6,511			
1990	-379	4,603	-15,222	5,709	5,156	4,757	0	-4,756	-4,603	2,476	2,476	2,476	-366	-2,910			
1991	-379	4,603	-15,222	0	5,156	12,368	-4,603	-7,610	-7,365	2,476	2,476	4,237	-3,863	-8,466			
1992	4,378	-4,603	-14,270	10,656	2,406	7,611	-2,762	-1,902	-1,841	-378	2,476	4,237	6,008	8,862			
1993	4,378	-4,603	-10,465	2,663	0	3,805	4,603	-1,902	-1,841	0	0	0	-3,362	2,973			
1994	4,756	0	-19,979	4,757	8,593	4,757	0	0	0	0	0	2,762	5,646	2,884			
1995	4,756	0	-19,979	3,805	3,437	0	-921	-2,854	-2,762	0	0	2,762	-11,756	-11,756			
1996	4,756	0	-15,222	8,562	0	951	1,841	-2,854	-2,762	0	0	2,762	-1,966	-1,966			
1997	5,708	5,524	-6,660	0	0	952	0	0	0	0	0	0	5,524	8,286			
1998	0	0	-14,270	13,319	0	951	921	2,854	2,762	0	0	2,762	9,299	6,537			
1999	5,708	0	-15,222	13,319	7,734	9,514	921	2,854	2,762	0	0	2,762	30,352	30,352			
2000	4,756	0	-19,979	9,514	12,030	5,899	0	0	0	0	0	2,762	14,982	14,982			
2001	4,756	0	-19,979	5,709	11,171	9,514	0	0	0	0	0	0	11,171	13,933			
2002	2,854	0	-10,465	9,514	8,593	4,757	0	0	0	0	0	0	15,253	15,253			
Avg (21-02)	2,979	752	-15,763	7,059	6,575	5,977	1,273	-325	-314	102	160	762	9,238	9,305			

Table 2.2-3

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Program	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,066	19,046	0	15,210	10,086	13,248	19,852	22,773	22,038	27,589	27,589	26,699	231,197	230,239	
Above Normal	27,231	19,334	0	18,244	13,092	16,789	22,583	24,791	23,991	27,589	27,589	26,699	247,932	247,866	
Normal	27,387	19,046	0	18,790	16,434	18,790	26,699	26,935	26,066	27,589	27,589	26,699	262,024	261,954	
Below Normal	27,097	19,334	0	19,979	18,045	19,979	26,428	26,694	25,833	27,209	27,209	25,898	263,704	264,364	
Dry	26,590	19,046	0	19,979	17,444	19,682	26,526	26,816	25,951	27,091	27,091	25,641	261,857	262,252	
All Years	27,076	19,166	0	18,457	15,033	17,714	24,420	25,605	24,779	27,413	27,413	26,327	253,403	253,403	

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,358	16,624	8,533	11,512	7,465	11,298	21,561	26,603	25,744	29,778	29,778	28,817	245,069	242,794	
Above Normal	26,705	14,785	7,751	14,254	9,306	16,705	24,176	28,608	27,685	29,778	29,778	28,817	258,347	258,347	
Normal	26,174	14,713	8,765	15,626	12,095	22,405	28,207	29,778	28,817	29,778	29,778	28,817	274,953	274,878	
Below Normal	27,338	16,106	11,931	21,523	18,520	25,038	28,817	29,481	28,530	29,778	29,593	27,864	294,520	295,079	
Dry	25,990	19,593	14,794	19,764	17,471	25,782	28,817	29,778	28,817	29,463	28,821	27,200	296,289	297,969	
All Years	26,721	16,342	10,342	16,569	12,994	20,261	26,320	28,854	27,923	29,717	29,553	28,304	273,899	273,884	

Difference in Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Program minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	-292	2,423	-8,533	3,698	2,621	1,950	-1,709	-3,829	-3,706	-2,189	-2,189	-2,118	-13,873	-12,555	
Above Normal	526	4,549	-7,751	3,990	3,786	84	-1,592	-3,817	-3,694	-2,189	-2,189	-2,118	-10,415	-10,481	
Normal	1,213	4,333	-8,765	3,163	4,339	-3,615	-1,508	-2,843	-2,751	-2,189	-2,189	-2,118	-12,929	-12,924	
Below Normal	-241	3,228	-11,931	-1,544	-475	-5,059	-2,389	-2,788	-2,697	-2,569	-2,385	-1,966	-30,816	-30,715	
Dry	600	-547	-14,794	215	-27	-6,100	-2,291	-2,962	-2,866	-2,372	-1,730	-1,559	-34,432	-35,717	
All Years	356	2,824	-10,342	1,888	2,039	-2,546	-1,900	-3,249	-3,144	-2,304	-2,140	-1,977	-20,496	-20,481	

Table 2.2-4

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Program	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,066	19,046	0	15,210	10,086	13,248	19,852	22,773	22,038	27,589	27,589	26,699	231,197	230,239	
Above Normal	27,231	19,334	0	18,244	13,092	16,789	22,583	24,791	23,991	27,589	27,589	26,699	247,932	247,866	
Normal	27,387	19,046	0	18,790	16,434	18,790	26,699	26,935	26,066	27,589	27,589	26,699	262,024	261,954	
Below Normal	27,097	19,334	0	19,979	18,045	19,979	26,428	26,694	25,833	27,209	27,209	25,898	263,704	264,364	
Dry	26,590	19,046	0	19,979	17,444	19,682	26,526	26,816	25,951	27,091	27,091	25,641	261,857	262,252	
All Years	27,076	19,166	0	18,457	15,033	17,714	24,420	25,605	24,779	27,413	27,413	26,327	253,403	253,403	

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258	218,975	
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776	230,776	
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601	243,681	
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263	264,595	
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509	262,015	
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165	244,098	

Difference in Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Program minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	2,807	921	-13,783	7,183	4,071	5,815	3,821	-297	-288	0	0	691	10,939	11,265	
Above Normal	3,055	1,408	-14,204	9,144	6,935	7,510	2,274	112	108	0	0	812	17,156	17,091	
Normal	4,019	0	-14,390	8,860	9,570	8,158	748	-119	-115	0	0	691	17,422	18,273	
Below Normal	2,138	1,354	-17,964	4,253	6,237	4,645	-271	-895	-866	291	291	228	-559	-230	
Dry	2,925	0	-18,433	5,899	6,058	3,746	-173	-416	-403	215	512	1,417	1,348	237	
All Years	2,979	752	-15,763	7,059	6,575	5,977	1,273	-325	-314	102	160	762	9,238	9,305	

**Figure 2.3-1
Hetch Hetchy Reservoir Storage and Stream Release**

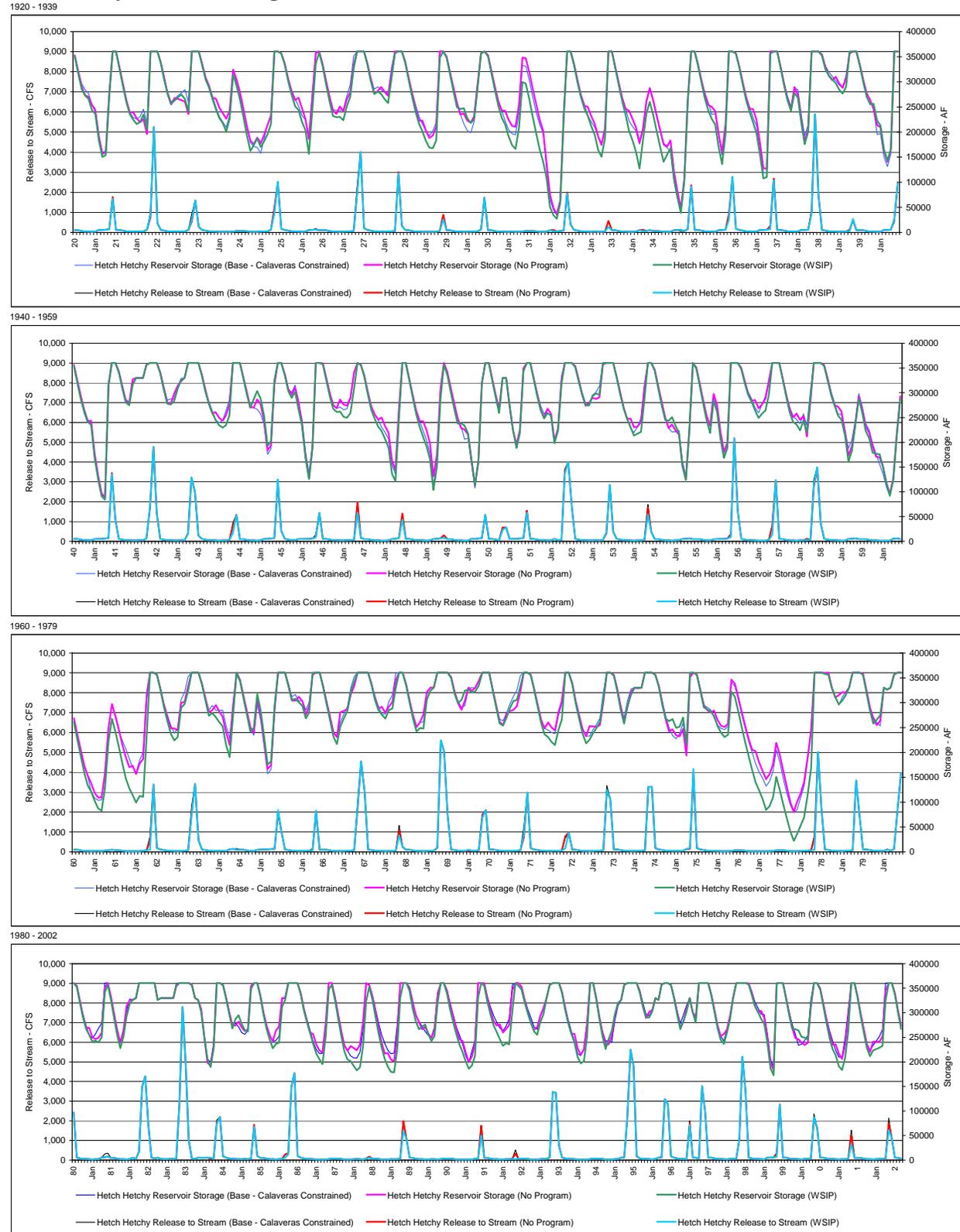


Table 2.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	No Program
1921	272,893	270,218	254,702	242,954	190,360	156,433	159,427	275,467	360,400	360,400	328,999	296,132	
1922	263,554	239,474	239,015	227,228	219,665	225,679	195,992	360,400	360,400	360,400	338,270	307,157	
1923	275,365	255,150	267,887	266,038	263,443	260,531	235,886	360,400	360,400	360,400	335,374	308,545	
1924	290,590	267,956	266,452	248,532	237,439	226,674	242,568	324,188	304,555	278,786	245,691	211,925	
1925	183,077	175,778	188,815	177,549	194,420	214,214	232,180	360,400	360,400	356,465	336,398	305,731	
1926	280,575	263,534	268,396	247,076	225,673	186,028	270,552	357,169	360,400	335,420	302,178	270,343	
1927	242,836	235,902	250,810	241,269	265,411	278,790	333,632	360,400	360,400	360,400	335,906	305,535	
1928	276,982	281,636	289,885	279,962	272,110	316,960	360,400	360,400	360,400	339,284	307,062	275,931	
1929	245,240	222,435	222,551	202,836	188,326	193,097	210,771	360,400	360,400	350,290	318,800	287,725	
1930	258,166	235,262	236,592	222,883	218,690	230,971	294,451	356,465	360,400	352,956	321,099	289,912	
1931	261,671	242,966	242,164	224,408	212,377	210,298	253,701	348,141	346,961	319,572	286,822	255,051	
1932	224,424	202,899	138,042	76,171	49,127	36,436	63,563	233,502	360,400	360,400	335,277	304,222	
1933	273,508	252,000	250,124	231,423	215,987	191,239	174,783	206,904	360,400	360,400	328,781	297,686	
1934	267,451	246,451	242,318	225,701	208,569	178,613	206,684	261,373	287,271	263,192	233,328	204,166	
1935	176,349	170,738	183,525	121,596	83,814	47,773	105,533	263,279	360,400	360,400	333,976	303,626	
1936	273,576	253,792	250,223	241,701	196,532	159,238	215,269	360,400	360,400	356,465	330,041	298,414	
1937	267,747	246,253	245,892	223,957	179,565	127,909	127,074	360,400	360,400	360,400	329,400	296,775	
1938	265,270	244,869	289,372	273,954	223,044	181,541	205,123	360,400	360,400	360,400	354,217	329,018	
1939	312,011	303,293	310,032	296,538	287,831	307,118	356,592	360,400	360,400	334,345	303,865	276,815	
1940	263,881	245,583	213,652	209,702	162,684	140,732	164,120	360,400	360,400	356,639	324,687	292,798	
1941	262,405	241,925	243,582	177,778	132,539	97,152	88,617	316,680	360,400	360,400	343,479	313,352	
1942	284,072	278,293	326,840	330,000	330,000	330,000	356,592	360,400	360,400	360,400	341,717	311,266	
1943	280,515	278,210	298,012	313,885	323,244	330,000	360,400	360,400	360,400	360,400	337,008	307,394	
1944	278,689	258,972	260,712	249,051	243,700	254,179	276,371	360,400	360,400	360,400	331,478	301,749	
1945	272,276	269,834	286,738	277,380	244,557	183,773	193,861	318,405	360,400	360,400	337,116	307,472	
1946	296,069	310,340	281,567	234,319	169,849	127,285	190,011	360,400	360,400	359,455	329,955	299,722	
1947	275,020	268,766	286,494	276,280	274,182	289,793	340,857	360,400	356,592	335,035	302,365	271,816	
1948	255,930	245,807	249,809	232,949	219,226	162,391	143,608	265,138	360,400	360,400	327,962	295,366	
1949	263,928	242,431	242,718	223,741	198,306	131,467	174,578	305,581	360,400	342,032	309,501	278,457	
1950	247,055	228,690	225,372	215,939	161,548	112,773	161,325	318,626	360,400	360,400	326,837	295,032	
1951	266,327	330,000	330,000	273,739	223,537	195,259	223,591	349,555	360,400	360,400	328,968	297,507	
1952	266,214	249,526	268,062	258,006	202,569	228,275	325,923	360,400	360,400	360,400	353,839	326,515	
1953	295,875	273,752	279,491	289,986	287,713	290,842	357,284	360,400	360,400	360,400	332,324	301,476	
1954	269,513	247,582	247,819	230,280	231,471	240,961	308,878	360,400	360,400	346,144	313,200	281,430	
1955	250,117	228,834	236,051	224,013	215,526	154,015	125,390	224,268	360,400	350,686	318,112	285,351	
1956	253,489	233,090	297,509	275,444	220,623	180,544	199,031	360,400	360,400	360,400	349,979	323,594	
1957	297,575	283,746	285,380	268,792	276,497	288,601	321,980	360,400	360,400	360,400	329,011	297,001	
1958	267,551	250,230	258,100	245,262	252,753	211,991	283,794	360,400	360,400	360,400	356,088	328,214	
1959	296,875	274,467	271,944	262,183	219,433	172,666	191,966	238,160	292,746	266,482	232,075	219,357	
1960	192,331	170,840	169,684	151,078	118,247	95,935	126,803	219,167	293,045	268,985	235,957	203,844	
1961	173,192	153,997	138,273	118,717	109,255	109,942	159,101	249,552	297,330	273,757	246,270	215,748	
1962	190,124	170,107	173,032	156,616	177,938	186,735	307,379	360,400	360,400	356,465	328,565	296,435	
1963	270,393	248,471	248,243	244,284	299,477	301,922	332,742	360,400	360,400	360,400	338,584	309,330	
1964	280,158	284,985	295,324	282,428	271,731	240,313	215,029	290,647	360,400	345,938	313,783	282,384	
1965	250,486	238,458	308,616	273,276	222,309	166,969	174,620	288,158	360,400	360,400	360,400	335,306	
1966	304,662	304,263	311,607	303,113	275,509	292,577	356,592	360,400	360,400	333,638	302,345	271,809	
1967	240,578	231,046	280,665	283,586	286,496	316,785	333,556	360,400	360,400	360,400	360,400	337,886	
1968	308,358	287,801	291,722	279,304	291,974	300,834	345,158	360,400	360,400	360,400	336,513	304,211	273,939
1969	250,819	260,520	276,366	321,448	330,000	330,000	360,400	360,400	360,400	360,400	351,614	322,081	
1970	298,841	285,870	304,646	330,000	323,923	330,000	343,990	360,400	360,400	360,400	328,204	295,064	
1971	261,790	254,468	277,352	282,910	285,597	292,953	322,462	360,400	360,400	356,465	327,952	296,750	
1972	265,329	248,476	260,246	250,505	244,130	280,145	303,727	360,400	360,400	360,400	338,614	303,374	274,452
1973	246,861	232,496	252,805	252,349	251,005	255,091	302,658	360,400	360,400	356,178	327,202	292,614	
1974	261,425	292,527	322,190	330,000	329,186	330,000	360,400	360,400	360,400	356,465	333,738	299,491	
1975	266,458	242,337	246,339	234,446	232,353	247,270	193,678	351,382	360,400	356,465	326,350	294,783	
1976	284,930	280,141	283,994	264,736	253,582	251,085	257,553	346,564	338,111	310,201	280,655	252,844	
1977	226,077	205,195	202,391	180,353	162,557	146,764	156,141	175,991	219,085	194,496	162,023	131,115	
1978	100,307	80,261	100,751	117,310	139,726	189,623	243,404	360,400	360,400	360,400	360,057	360,400	
1979	330,000	310,323	315,061	321,117	319,976	330,000	360,400	360,400	360,400	358,285	325,107	290,802	
1980	266,398	255,216	263,874	330,000	326,446	330,000	356,592	360,400	360,400	360,400	354,917	324,717	
1981	292,244	269,189	269,204	250,049	246,580	248,886	259,509	351,187	360,400	332,373	297,002	264,239	
1982	239,211	262,326	313,550	325,368	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400	
1983	326,065	330,000	330,000	330,000	330,000	330,000	354,189	360,400	360,400	360,400	360,400	358,088	
1984	330,000	326,192	307,348	251,605	198,266	191,955	231,204	360,400	360,400	356,465	331,150	300,761	
1985	274,862	274,060	282,133	270,311	262,666	265,682	354,940	360,400	360,400	335,723	301,239	273,210	
1986	254,074	241,940	263,652	272,339	330,000	330,000	360,400	360,400	360,400	360,400	339,678	308,901	
1987	282,642	260,198	256,039	235,340	223,339	218,834	277,103	360,400	360,400	330,951	296,621	263,532	
1988	233,926	222,605	232,241	228,288	223,514	235,410	280,389	360,400	360,400	356,592	333,301	301,086	269,930
1989	238,448	216,954	218,129	204,846	201,321	253,145	360,400	360,400	360,400	349,394	318,939	295,118	
1990	281,087	266,473	271,253	257,681	248,938	264,551	334,369	360,400	360,400	344,582	315,776	291,487	
1991	267,715	246,099	243,011	219,114	199,815	210,922	237,004	360,400	360,400	359,849	329,410	304,776	
1992	282,905	274,027	276,311	260,079	266,729	274,688	346,092	360,400	360,400	353,040	324,711	300,566	
1993	279,136	265,230	270,619	293,898	309,220	330,000	356,592	360,400	360,400	360,400	341,872	310,298	
1994	280,162	257,147	257,007	227,344	214,633	224,730	275,704	360,400	360,400	330,294	292,878	259,786	
1995	234,780	236,033	252,633	292,724	319,897	326,065	356,592	360,400	360,400	360,40			

Table 2.3-2

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,402	266,044	243,868	235,920	183,321	150,269	154,224	271,116	360,400	360,400	326,811	291,828
1922	259,728	235,648	224,723	215,782	220,244	234,819	205,133	360,400	360,400	360,400	336,082	302,853
1923	275,819	256,526	262,603	269,313	274,454	265,738	241,094	360,400	360,400	360,400	333,186	304,241
1924	288,096	265,462	244,930	227,949	217,703	201,135	226,615	314,032	292,290	264,348	229,088	193,225
1925	162,198	174,233	187,270	170,200	181,824	195,815	216,042	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	203,496	156,406	245,154	336,819	358,277	331,111	295,686	261,739
1927	231,858	229,528	230,165	223,466	251,035	270,123	326,806	360,400	360,400	360,400	333,718	301,231
1928	275,534	280,188	275,546	265,616	257,757	308,315	356,993	360,400	360,400	337,096	302,689	269,444
1929	239,232	216,426	201,321	182,545	168,883	167,850	183,407	347,942	360,400	348,102	314,426	281,237
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210
1932	165,286	141,000	108,382	51,375	34,654	27,412	58,311	229,715	360,400	360,400	333,089	299,918
1933	270,157	246,808	232,041	211,426	194,261	163,710	150,969	186,966	360,400	360,400	326,593	293,382
1934	260,961	234,344	202,242	182,930	159,810	127,492	183,946	236,459	260,268	234,045	202,043	170,799
1935	140,815	154,538	167,325	107,677	72,057	38,981	99,863	258,988	360,400	360,400	331,788	299,322
1936	267,086	242,699	226,345	214,884	170,029	136,212	195,836	360,400	360,400	356,465	327,853	294,110
1937	262,493	239,158	219,779	197,861	155,743	107,766	110,233	356,058	360,400	360,400	327,212	292,471
1938	262,775	242,374	277,970	268,254	217,341	175,883	200,130	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	297,136	284,589	276,736	290,220	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	222,760	213,012	165,616	143,200	166,203	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	235,298	169,490	125,366	91,151	84,054	313,255	360,400	360,400	341,291	309,048
1942	280,721	274,942	315,878	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	278,021	276,636	283,548	307,975	325,066	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	279,144	260,348	244,962	234,244	229,744	234,419	254,494	360,400	360,400	360,400	329,920	297,445
1945	269,782	286,673	303,578	288,423	253,887	193,103	202,059	325,579	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,825	360,400	360,400	357,267	325,581	293,235
1947	267,584	261,329	261,933	251,706	249,594	259,401	308,348	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	207,163	189,129	136,187	121,486	246,616	360,400	360,400	325,774	291,062
1949	257,437	230,325	210,633	191,633	166,180	103,674	151,625	286,364	356,592	336,040	301,328	268,173
1950	237,728	238,697	233,450	217,724	163,129	114,105	162,436	319,562	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	188,600	217,740	343,707	360,400	360,400	326,780	293,203
1952	264,766	248,078	259,003	253,471	198,031	223,738	317,703	360,400	360,400	360,400	351,651	322,211
1953	296,329	275,128	274,206	293,261	298,723	296,049	360,374	360,400	360,400	360,400	330,136	297,172
1954	268,064	247,055	230,167	213,569	217,328	221,015	286,815	360,400	360,400	343,956	308,827	274,943
1955	245,440	243,491	250,709	232,875	219,152	151,838	123,551	222,728	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,550	188,550	360,400	360,400	360,400	347,791	319,290
1957	296,127	282,297	264,905	249,257	257,810	264,111	295,373	360,400	360,400	360,400	326,823	292,697
1958	261,061	240,978	235,957	224,058	243,566	220,059	291,862	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,939	254,292	245,472	213,883	161,315	182,390	235,642	288,112	259,667	223,084	208,259
1960	179,051	176,894	175,738	151,333	116,394	92,543	124,226	215,694	287,458	261,217	226,015	191,797
1961	158,963	134,152	121,643	102,446	87,720	82,604	129,645	221,869	267,561	241,466	211,469	178,503
1962	147,481	127,832	114,109	99,056	112,573	110,810	229,337	360,400	360,400	360,400	326,739	292,131
1963	263,712	237,187	224,068	230,750	289,373	297,526	323,742	360,400	360,400	360,400	336,396	305,026
1964	273,668	279,416	270,727	260,673	252,543	215,321	190,335	275,763	360,400	343,750	309,409	275,896
1965	241,813	249,120	317,459	282,122	231,160	175,820	182,106	294,713	360,400	360,400	360,400	333,188
1966	305,400	307,762	300,989	293,442	268,461	279,726	360,400	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	252,106	268,331	283,263	323,066	342,598	360,400	360,400	360,400	360,400	335,768
1968	305,290	284,733	275,763	268,094	285,055	288,111	330,318	360,400	360,400	334,325	299,837	267,451
1969	242,147	249,086	247,807	306,192	323,862	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	258,440	253,880	270,103	288,977	303,697	305,250	323,642	360,400	360,400	356,465	325,764	292,446
1972	258,839	236,370	231,016	221,257	214,866	245,077	266,541	360,400	360,400	360,426	299,001	267,965
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	267,864	263,077	267,079	249,395	251,607	270,330	216,738	360,400	360,400	356,465	324,162	290,479
1976	286,336	282,468	273,429	252,264	239,384	231,084	235,434	322,270	311,719	281,653	249,955	220,061
1977	191,125	164,627	139,941	124,041	106,191	84,595	91,855	109,596	150,715	123,692	95,026	67,781
1978	41,897	22,219	36,001	52,988	69,331	114,471	168,252	360,400	360,400	360,400	357,869	356,406
1979	329,957	311,201	296,912	303,911	314,794	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	257,725	265,877	274,536	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	267,741	254,865	241,410	243,092	239,594	250,218	341,900	356,592	326,381	288,829	253,955
1982	227,982	252,018	292,777	317,906	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	259,670	236,484	216,725	205,573	195,265	251,416	347,582	357,022	325,388	288,877	253,677
1988	221,889	204,952	201,696	191,923	182,833	188,925	231,786	323,285	352,727	326,875	292,101	258,469
1989	229,470	206,135	190,185	179,740	178,779	224,799	331,322	360,400	360,400	343,974	308,105	283,006
1990	266,700	271,420	276,200	256,827	242,842	252,652	320,352	360,400	360,400	339,162	307,130	280,640
1991	256,496	235,801	220,345	201,192	186,180	192,530	211,890	331,320	360,400	354,429	321,715	296,721
1992	274,476	260,994	246,154	232,759	238,361	235,761	302,285	360,400	355,022	347,290	320,492	298,748
1993	279,794	262,205	255,227	281,160	296,476	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	256,620	239,355	209,682	196,961	201,254	250,111	360,400	360,400	328,106	288,504	253,299
1995	226,108	246,696	263,295	296,733	319,612	326,065	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	291,101	290,319	303,304	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	280,067	360,400	360,400	36			

Table 2.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

No Program minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	491	4,174	10,834	7,034	7,039	6,164	5,203	4,351	0	0	2,188	4,304
1922	3,826	3,826	14,292	11,446	-579	-9,140	-9,141	0	0	0	2,188	4,304
1923	-454	-1,376	5,284	-3,275	-11,011	-5,207	-5,208	0	0	0	2,188	4,304
1924	2,494	2,494	21,522	20,583	19,736	25,539	15,953	10,156	12,265	14,438	16,603	18,700
1925	20,879	1,545	1,545	7,349	12,596	18,399	16,138	0	0	0	2,188	4,304
1926	6,490	12,107	24,513	27,160	22,177	29,622	25,398	20,350	2,123	4,309	6,492	8,604
1927	10,978	6,374	20,645	17,803	14,376	8,667	6,826	0	0	0	2,188	4,304
1928	1,448	1,448	14,339	14,346	14,353	8,645	3,407	0	0	2,188	4,373	6,487
1929	6,008	6,009	21,230	20,291	19,443	25,247	27,364	12,458	0	2,188	4,374	6,488
1930	8,673	-10,661	-10,661	-4,864	375	6,178	8,295	0	0	2,188	4,373	6,488
1931	8,673	14,289	27,180	32,999	38,259	44,062	46,180	48,341	50,420	52,926	55,420	57,841
1932	59,138	61,899	29,660	24,796	14,473	9,024	5,252	3,787	0	0	2,188	4,304
1933	3,351	5,192	18,083	19,997	21,726	27,529	23,814	19,938	0	0	2,188	4,304
1934	6,490	12,107	40,076	42,771	48,759	51,121	22,738	24,914	27,003	29,147	31,285	33,367
1935	35,534	16,200	16,200	13,919	11,757	8,792	5,670	4,291	0	0	2,188	4,304
1936	6,490	11,093	23,878	26,817	26,503	23,026	19,433	0	0	0	2,188	4,304
1937	5,254	7,095	26,113	26,096	23,822	20,143	16,841	4,342	0	0	2,188	4,304
1938	2,495	2,495	11,402	5,700	5,703	5,658	4,993	0	0	0	2,188	4,304
1939	-455	-1,375	12,896	11,949	11,095	16,898	-3,808	0	0	2,188	4,373	6,488
1940	8,672	-10,662	-9,108	-3,310	-2,932	-2,468	-2,083	0	0	2,188	4,374	6,488
1941	1,727	807	8,284	7,173	6,001	4,563	3,425	0	0	0	2,188	4,304
1942	3,351	3,351	10,962	0	0	0	0	0	0	0	2,188	4,304
1943	2,494	1,574	14,464	5,910	-1,822	0	0	0	0	0	2,188	4,304
1944	-455	-1,376	15,750	14,807	13,956	19,760	21,877	0	0	0	2,188	4,304
1945	2,494	-16,839	-16,840	-11,043	-9,330	-9,330	-8,198	-7,174	0	0	2,188	4,304
1946	6,490	8,331	14,991	1,681	1,409	1,188	1,188	0	0	2,188	4,374	6,487
1947	7,436	7,437	24,561	24,574	24,588	30,392	32,509	0	0	2,188	4,374	6,487
1948	8,672	14,288	27,179	25,786	30,097	26,204	22,122	18,522	0	0	2,188	4,304
1949	6,491	12,106	32,085	32,108	32,126	27,793	22,953	19,217	3,808	5,992	8,173	10,284
1950	9,327	-10,007	-8,078	-1,785	-1,581	-1,332	-1,111	-936	0	800	2,988	5,103
1951	7,289	0	0	0	0	6,659	5,851	5,848	0	0	2,188	4,304
1952	1,448	1,448	9,059	4,535	4,538	4,537	8,220	0	0	0	2,188	4,304
1953	-454	-1,376	5,285	-3,275	-11,010	-5,207	-3,090	0	0	0	2,188	4,304
1954	1,449	527	17,652	16,711	14,143	19,946	22,063	0	0	2,188	4,373	6,487
1955	4,677	-14,657	-14,658	-8,862	-3,626	2,177	1,839	1,540	0	2,188	4,374	6,488
1956	8,673	14,289	13,545	13,552	13,560	12,184	10,481	0	0	0	2,188	4,304
1957	1,448	1,449	20,475	19,535	18,687	24,490	26,607	0	0	0	2,188	4,304
1958	6,490	9,252	22,143	21,204	9,187	-8,068	-8,068	0	0	0	2,188	4,304
1959	1,448	528	17,652	16,711	5,550	11,353	9,576	2,518	4,634	6,815	8,991	11,098
1960	13,280	-6,054	-6,054	-255	1,853	3,392	2,577	3,473	5,587	7,768	9,942	12,047
1961	14,229	19,845	16,630	16,271	21,535	27,338	29,456	27,683	29,769	32,291	34,801	37,245
1962	42,643	42,275	58,923	57,560	65,365	75,925	78,042	0	0	0	2,188	4,304
1963	6,681	11,284	24,175	13,534	10,104	4,396	9,000	0	0	0	2,188	4,304
1964	6,490	5,569	24,597	21,755	19,188	24,992	24,694	14,884	0	2,188	4,374	6,488
1965	8,673	-10,662	-8,843	-8,846	-8,851	-8,851	-7,486	-6,555	0	0	0	2,118
1966	-738	-3,499	10,618	9,671	7,048	12,851	-3,808	0	0	2,188	4,373	6,488
1967	8,672	14,288	28,559	15,255	3,233	-6,281	-9,042	0	0	0	2,118	4,304
1968	3,068	3,068	15,959	11,210	6,919	12,723	14,840	0	0	2,188	4,374	6,488
1969	8,672	11,434	28,559	15,256	6,138	0	0	0	0	0	2,188	4,304
1970	-455	-19,785	-19,789	3,935	3,077	7,203	9,320	0	0	0	2,188	4,304
1971	3,350	588	7,249	-6,067	-18,100	-12,297	-10,180	0	0	0	2,188	4,304
1972	6,490	12,106	29,230	29,248	29,264	35,068	37,186	0	0	2,188	4,373	6,487
1973	8,671	14,288	27,179	13,876	1,854	-6,708	-4,591	0	0	2,188	4,374	6,487
1974	3,631	-973	5,687	0	-814	0	0	0	0	0	2,188	4,304
1975	-1,406	-20,740	-20,740	-14,949	-19,254	-23,060	-23,060	-9,018	0	0	2,188	4,304
1976	-1,406	-2,327	10,565	12,472	14,198	20,001	22,119	24,294	26,392	28,548	30,700	32,783
1977	34,952	40,568	62,450	56,312	56,366	62,169	64,286	66,395	68,370	70,804	66,997	63,334
1978	58,410	58,042	64,750	64,322	70,395	75,152	75,152	0	0	0	2,188	3,994
1979	43	-878	18,149	17,206	5,182	0	0	0	0	2,188	4,373	6,488
1980	8,673	-10,661	-10,662	0	0	0	0	0	0	0	2,188	4,304
1981	1,448	1,448	14,339	8,639	3,488	9,292	9,291	9,287	3,808	5,992	8,173	10,284
1982	11,229	10,308	20,773	7,462	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-2,762	0	0	0	0	2,118
1984	0	0	5,833	275	-7,459	2,279	4,200	0	0	0	2,188	4,304
1985	6,490	-12,844	-12,844	-7,046	-1,808	3,995	6,112	0	0	2,188	4,374	6,487
1986	8,672	14,288	27,178	32,998	18,209	3,935	0	0	0	0	2,188	4,304
1987	1,448	528	19,555	18,615	17,766	23,569	25,687	12,818	3,378	5,563	7,744	9,855
1988	12,037	17,653	30,545	36,368	40,681	46,485	48,603	37,115	3,865	6,426	8,985	11,461
1989	8,978	10,819	27,944	25,106	22,542	28,346	29,078	0	0	5,420	10,834	12,112
1990	14,387	-4,947	-4,947	854	6,096	11,899	14,017	0	0	5,420	8,646	10,847
1991	11,219	10,298	22,666	17,922	13,635	18,392	25,114	29,080	0	5,420	7,695	8,055
1992	8,429	13,033	30,157	27,320	28,368	38,927	43,807	0	5,378	5,750	4,219	1,818
1993	-658	3,025	15,392	12,738	12,744	0	0	0	0	0	2,188	4,304
1994	1,448	527	17,652	17,662	17,672	23,476	25,593	0	0	2,188	4,374	6,487
1995	8,672	-10,663	-10,662	-4,005	285	0	0	0	0	0	0	2,118
1996	-737	-1,658	11,233	2,676	0	0	0	0	0	0	2,188	4,304
1997	3,351	-1,253	5,407	0	0	10,560	0	0	0	0	2,188	4,304
1998	5,253	7,095	19,986	6,679	6,682	0	0	0	0	0	2,188	4,304
1999	-455	-455	16,670	11,920	11,926	11,926	10,485	661	0	0	2,188	4,304
2000	1,448	-17,886	-17,886	-12,093	-14,678	-7,068	-4,950	0	0	2,188	4,373	6,488
2001	7,436	9,277	22,168	25,038	22,471	27,228	29,345	0	214	2,402	4,587	6,701
2002	6,697	8,538	17,861	15,017	12,448	18,252	20,370	0	0	2,188	4,374	6,488
Avg (21-02)	7,639	4,760	14,398	13,073	11,356	12,956	12,136	4,951	3,012	4,120	6,118	8,059

Table 2.3-4

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

No Program minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-11,230	-6,627	33	-3,773	-3,775	-3,297	-2,775	-2,332	0	0	0	0
1922	0	0	10,465	958	-11,073	-19,635	-19,635	0	0	0	0	0
1923	-4,756	-4,757	1,903	-6,659	-14,396	-23,910	-23,910	0	0	0	0	0
1924	-2,854	-2,854	17,125	17,134	17,145	17,145	8,572	4,281	4,278	4,272	4,267	4,261
1925	4,259	4,259	19,481	19,494	7,477	-2,036	-1,781	0	0	0	0	0
1926	-2,854	-2,854	17,135	13,975	1,447	-7,000	-6,147	-3,231	0	0	0	0
1927	-1,902	-7,427	7,795	-2,855	-6,294	-15,809	-17,649	0	0	0	0	-2,762
1928	-8,469	-8,469	5,801	96	-5,060	-13,040	0	0	0	0	0	-2,762
1929	-8,469	-8,469	6,753	1,049	-4,106	-8,863	-8,863	0	0	0	0	0
1930	0	0	19,978	19,990	20,001	10,488	10,487	0	0	0	0	0
1931	0	0	19,978	19,990	15,705	15,705	15,705	15,696	15,683	16,043	16,402	16,751
1932	9,509	4,905	12,100	10,168	3,951	2,517	1,550	1,113	0	0	0	0
1933	-2,854	-2,854	17,124	11,426	6,277	1,520	1,340	1,117	0	0	0	0
1934	0	0	20,326	14,864	7,043	2,198	1,940	1,940	1,937	1,934	1,931	1,929
1935	1,927	1,927	21,905	18,709	15,494	559	361	262	0	0	0	0
1936	-4,757	-4,757	15,111	5,615	5,619	4,913	4,138	0	0	0	0	0
1937	-2,854	-2,854	17,125	11,426	10,815	9,237	7,780	0	0	0	0	0
1938	-5,708	-5,708	2,487	-10,831	-10,836	-10,836	-9,524	0	0	0	0	-2,762
1939	-7,518	-7,518	7,705	2,951	-1,345	-6,102	0	0	0	0	0	0
1940	0	0	18,431	12,734	11,294	9,474	8,002	0	0	0	0	0
1941	-4,757	-4,757	6,501	6,505	5,651	4,726	3,591	2,700	0	0	0	0
1942	-2,854	-2,854	6,469	0	0	0	0	0	0	0	0	0
1943	-4,757	-9,360	10,618	2,061	-5,672	0	0	0	0	0	0	0
1944	-4,757	-4,757	15,222	9,522	-96	-9,609	-9,610	0	0	0	0	0
1945	0	0	19,978	19,989	7,970	7,970	7,029	6,142	0	0	0	0
1946	-4,757	-4,757	1,902	-11,415	-11,422	-9,815	-8,286	0	0	0	0	0
1947	0	0	15,221	10,473	6,182	1,425	1,425	0	0	0	0	0
1948	0	0	19,978	12,779	12,786	8,799	7,425	6,215	0	0	0	0
1949	0	0	19,979	20,020	20,032	17,547	14,730	12,336	3,808	3,804	3,799	1,034
1950	-3,723	-3,723	19,193	7,330	6,472	5,424	4,466	3,739	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	-2,762
1952	-7,518	-7,517	93	47	47	46	-7,319	0	0	0	0	0
1953	-4,756	-4,757	2,854	-5,706	-13,443	-22,956	-3,116	0	0	0	0	0
1954	0	0	19,979	10,477	859	-8,655	-8,655	0	0	0	0	0
1955	0	0	15,221	2,863	-8,306	-8,307	-7,008	-5,853	0	0	0	0
1956	0	0	9,360	9,364	9,370	8,522	7,396	0	0	0	0	0
1957	-4,757	-4,756	15,222	9,521	-97	-4,854	-4,854	0	0	0	0	0
1958	-2,854	-2,854	12,367	7,618	-4,407	-21,662	-21,662	0	0	0	0	0
1959	-4,757	-4,757	15,221	5,718	-5,450	-14,964	-13,094	-5,638	-5,631	-5,623	-5,614	-5,608
1960	-5,604	-5,605	14,374	14,385	8,497	4,975	3,783	1,886	1,884	1,882	1,879	1,876
1961	1,875	1,875	16,159	10,473	5,331	5,331	5,331	2,661	2,658	3,032	3,405	-8,202
1962	-17,333	-17,333	2,646	-3,060	-6,500	-14,111	-14,111	0	0	0	0	-2,762
1963	-5,615	-5,615	9,607	-3,706	-7,146	-19,514	-19,514	0	0	0	0	0
1964	-4,757	-9,360	10,619	-1,744	-12,916	-12,916	-12,916	-12,090	3,808	3,804	3,800	3,796
1965	3,795	3,794	10,678	10,683	10,688	9,888	8,343	6,963	0	0	0	-2,762
1966	-7,518	-12,121	8,210	-1,300	-9,893	-8,199	0	0	0	0	0	0
1967	0	0	19,975	6,670	-5,357	-13,215	-18,739	0	0	0	0	0
1968	-4,757	-4,757	15,221	1,910	-10,119	-14,876	-14,876	0	0	0	0	0
1969	0	0	15,222	1,911	0	0	0	0	0	0	0	0
1970	-4,757	-4,757	10,465	0	-6,077	0	0	0	0	0	0	0
1971	-4,757	-9,360	-1,749	-15,069	-27,106	-31,863	-31,863	0	0	0	0	0
1972	0	0	15,221	10,474	6,183	6,183	6,184	0	0	0	0	0
1973	0	0	19,979	6,671	-5,355	-13,917	-18,521	0	0	0	0	-2,762
1974	-7,518	-12,121	-5,462	0	-814	0	0	0	0	0	0	-2,762
1975	-7,518	-7,518	12,461	6,760	-5,266	-12,877	-12,877	-5,083	0	0	0	0
1976	-5,709	-5,708	14,271	9,521	5,230	5,230	5,230	5,227	5,222	5,216	5,210	5,205
1977	5,203	5,202	25,181	19,487	14,345	14,345	14,345	14,331	14,311	14,665	15,016	12,594
1978	5,344	741	15,963	8,369	7,521	3,716	-6,595	0	0	0	0	0
1979	0	0	19,978	10,474	-1,553	0	0	0	0	0	0	0
1980	-4,757	-4,757	10,465	0	0	0	0	0	0	0	0	0
1981	-4,757	-4,757	15,222	1,911	-10,118	-19,631	-19,631	-9,213	0	0	0	0
1982	0	-4,603	10,618	-2,696	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	-5,708	0	0	0	0	0
1984	0	0	5,833	275	-7,459	-7,459	-7,459	0	0	0	0	0
1985	0	-4,603	10,618	6,334	1,577	1,577	1,577	0	0	0	0	0
1986	0	0	19,978	19,990	1,757	0	0	0	0	0	0	0
1987	-4,757	-4,756	15,222	10,474	6,183	1,426	1,427	0	0	0	0	0
1988	0	0	19,979	19,990	15,705	15,705	15,705	2,048	0	-2,476	-6,852	-9,242
1989	-16,477	-21,074	-5,852	-11,563	-16,726	-21,482	0	0	0	-2,476	-4,949	-1,817
1990	-1,438	-6,042	9,180	3,477	-1,677	-6,433	0	0	0	-2,476	-4,949	-4,579
1991	-4,199	-8,803	6,419	6,423	1,270	-11,097	-6,494	345	0	-551	-3,026	-7,261
1992	-11,638	-7,034	7,236	-3,415	-5,822	-13,434	-10,671	0	0	378	-2,098	-6,335
1993	-10,710	-6,107	4,358	1,697	1,698	0	0	0	0	0	0	0
1994	-4,757	-4,757	15,222	10,474	1,887	-2,870	-2,870	0	0	0	0	-2,762
1995	-7,517	-7,517	12,462	8,663	5,230	0	0	0	0	0	0	-2,762
1996	-7,518	-7,517	7,704	-855	0	0	0	0	0	0	0	-2,762
1997	-8,469	-13,993	-7,334	0	0	-952	0	0	0	0	0	0
1998	0	0	14,271	960	960	0	0	0	0	0	0	-2,762
1999	-8,469	-8,469	6,753	-6,564	-6,566	-6,567	-5,766	0	0	0	0	-2,762
2000	-7,517	-7,518	12,461	2,955	-9,074	-14,973	-14,972	0	0	0	0	-2,762
2001	-7,518	-7,518	12,461	6,760	-4,407	-13,920	-13,921	0	0	0	0	0
2002	-2,854	-2,854	7,611	-1,899	-10,493	-15,249	-15,249	0	0	0	0	0
Avg (21-02)	-3,314	-3,954	11,513	5,417	174	-3,540	-3,234	556	585	505	344	-418

Figure 2.3-2

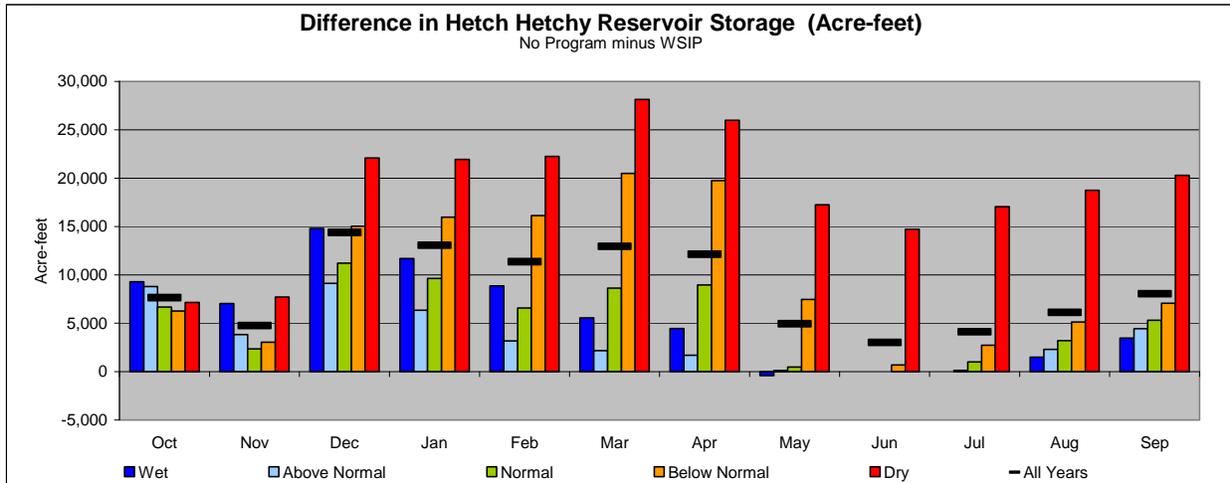


Figure 2.3-3 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the base setting. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

Figure 2.3-3

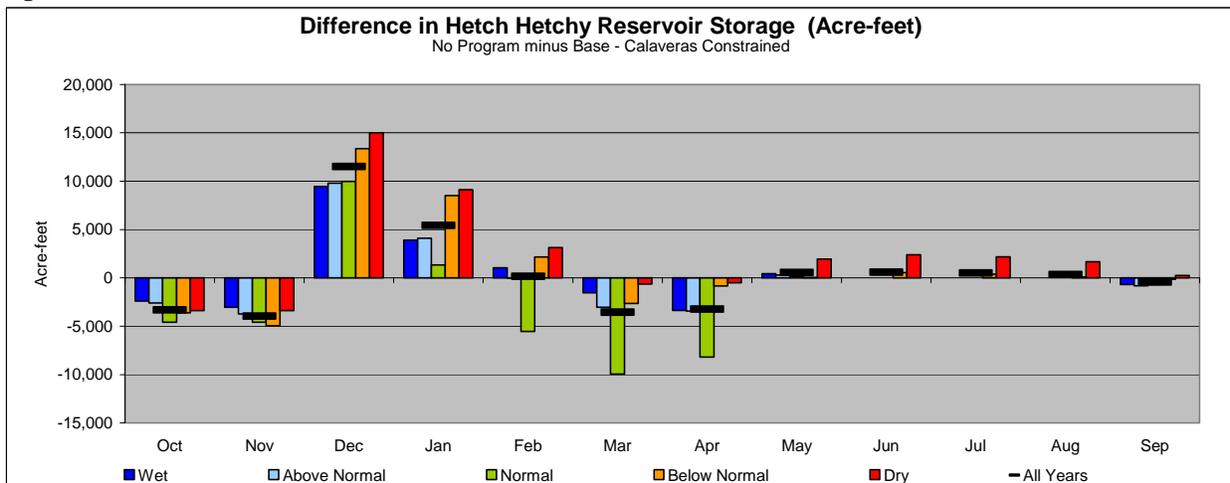
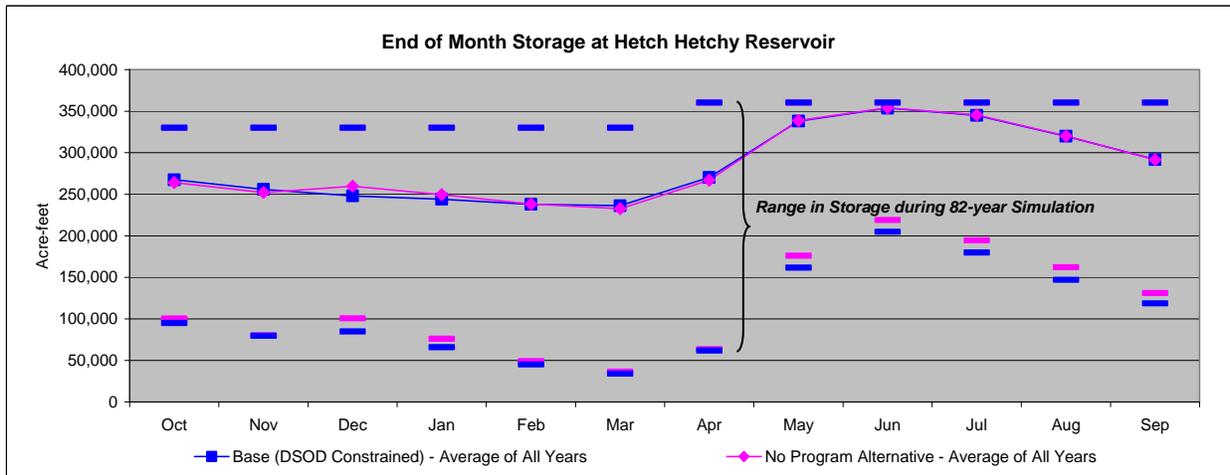


Figure 2.3-4



The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the alternative would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. Figure 2.3-1 illustrates the stream release from O'Shaughnessy Dam for the WSIP, alternative, and base settings. Table 2.3-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative typically exhibits an incrementally greater stream release, predominantly during May or June, which reflects the months when releases to the stream are made above minimum release requirements in anticipation of the reservoir being filled. However, there are exceptions to this circumstance during which incrementally larger reductions in releases to the stream occurs. Whether the change is an increase in releases or a decrease in releases is a matter of whether the reservoir is higher or lower in storage compared to the WSIP setting, which is a matter of coincidence of greater or lesser demands between the settings and the hydrologic sequence of years that leads to the need for Bay Area reservoir storage replenishment from the Tuolumne.

Table 2.3-6 illustrates the difference in stream release between the alternative and base settings. Consistent with the lower storage in Hetch Hetchy Reservoir by the end of April for the alternative setting, releases to the stream below Hetch Hetchy Reservoir would be less compared to the base setting. This circumstance occurs in 32 percent of the years of the 82-year simulation. There are a few exceptions when an increase in release would occur.

Table 2.3-5 illustrates the difference in stream release between the alternative and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.3-7 illustrates the same information and the average monthly stream release for the alternative and WSIP setting, expressed in average monthly flow (in cubic feet per second [cfs]) for each year type. Table 2.3-5 illustrates that the difference in monthly flow below O'Shaughnessy Dam could range from an increase of approximately 30,000 acre-feet to a decrease of approximately 10,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of monthly flow (acre-feet or average cfs) is not always meaningful.³ When comparing the alternative to the WSIP setting, a change in the volume of release from O'Shaughnessy Dam to the stream would likely result in the initiation of the release being delayed or initiated earlier by a matter of days. Typical spring-time releases, when initiated, amount to a release up to 3,000 cfs (approximately 6,000 acre-feet over the span of a day). Assuming that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day, the difference in stream release between the alternative and WSIP settings would be a delay in releases up to 2 days or up to an added 5 days of release. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. Comparing the alternative and WSIP settings, a change (increase or decrease) in stream release would occur in approximately 70 percent of the years simulated. Compared to the base setting, the alternative's effect to stream flow is typically less than the effect caused by the WSIP, but at times could be greater.

Table 2.3-8 illustrates the average monthly stream release for the alternative and base setting, expressed in average monthly flow (cfs), and the differences between the two. Table 2.3-6 illustrates that the difference in monthly flow below O'Shaughnessy Dam between the alternative and base settings could range from an increase of approximately 8,000 acre-feet to a decrease of approximately 33,000 acre-feet. Using the same metric as described above to estimate the delay or addition in the number days of release to the stream, the alternative could lead to an effect ranging from an increase of 1 day of release to a decrease of up to 6 days, compared to the base setting.

³ See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir", Memorandum by Daniel B. Steiner, December 31, 2006.

Table 2.3-5

Difference in Hetch Hetchy Release to Stream (Acre-feet)

No Program minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	4,346	0	0	0	4,346
1922	0	0	0	0	0	0	0	-7,989	0	0	0	0	-7,989
1923	0	0	0	0	0	0	0	-5,204	0	0	0	0	-5,204
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	15,915	0	0	0	0	15,915
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	6,824	0	0	0	0	6,824
1928	0	0	0	0	0	0	0	3,618	0	0	0	0	3,618
1929	0	0	0	0	0	0	0	0	13,231	0	0	0	13,231
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	3,554	0	0	0	3,782	0	0	0	7,336
1933	0	0	0	0	0	0	0	0	17,497	0	0	0	17,497
1934	0	0	0	0	0	0	3,808	0	0	0	0	0	3,808
1935	0	0	0	0	0	0	0	0	4,286	0	0	0	4,286
1936	0	0	0	0	0	0	0	16,952	0	0	0	0	16,952
1937	0	0	0	0	0	0	0	9,651	4,603	0	0	0	14,254
1938	0	0	0	0	0	0	0	4,359	0	0	0	0	4,359
1939	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1940	0	0	0	0	0	0	0	-1,751	0	0	0	0	-1,751
1941	0	0	0	0	0	0	0	0	3,423	0	0	0	3,423
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	21,864	0	0	0	0	21,864
1945	0	0	0	0	0	0	0	0	-7,168	0	0	0	-7,168
1946	0	0	0	0	0	0	0	1,038	0	0	0	0	1,038
1947	0	0	0	0	0	0	0	32,496	0	0	0	0	32,496
1948	0	0	0	0	0	0	0	0	18,501	0	0	0	18,501
1949	0	0	0	0	0	0	0	0	7,688	0	0	0	7,688
1950	0	0	0	0	0	0	0	0	-935	0	0	0	-935
1951	0	7,289	0	0	0	0	0	0	6,213	0	0	0	13,502
1952	0	0	0	0	0	0	0	8,217	0	0	0	0	8,217
1953	0	0	0	0	0	0	0	-3,282	0	0	0	0	-3,282
1954	0	0	0	0	0	0	0	22,054	0	0	0	0	22,054
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	9,166	0	0	0	0	9,166
1957	0	0	0	0	0	0	0	26,597	0	0	0	0	26,597
1958	0	0	0	0	0	3,935	0	-8,063	0	0	0	0	-4,128
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	27,548	0	0	0	0	27,548
1963	0	0	0	0	0	0	0	8,996	0	0	0	0	8,996
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	-6,549	0	0	0	-6,549
1966	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1967	0	0	0	0	0	0	0	-9,039	0	0	0	0	-9,039
1968	0	0	0	0	0	0	0	14,913	0	0	0	0	14,913
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	-3,935	0	0	0	9,317	0	0	0	0	5,382
1971	0	0	0	0	0	0	0	-10,175	0	0	0	0	-10,175
1972	0	0	0	0	0	0	0	37,167	0	0	0	0	37,167
1973	0	0	0	0	0	0	0	-4,589	0	0	0	0	-4,589
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	-2,521	-9,569	0	0	0	-12,090
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	39,998	0	0	0	310	40,308
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	533	0	0	0	533
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-2,939	0	0	0	0	-2,939
1984	0	0	0	0	0	-3,935	0	4,198	0	0	0	0	263
1985	0	0	0	0	0	0	0	6,513	0	0	0	0	6,513
1986	0	0	0	0	0	10,235	3,935	0	0	0	0	0	14,170
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1989	0	0	0	0	0	0	0	30,146	0	0	0	0	30,146
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	30,103	0	0	0	30,103
1992	0	0	0	0	0	0	0	17,542	0	0	0	0	17,542
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	5,409	0	0	0	0	0	0	0	0	5,409
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	8,445	698	0	0	0	9,143
2000	0	0	0	0	0	0	0	-4,948	0	0	0	0	-4,948
2001	0	0	0	0	0	0	0	29,330	0	0	0	0	29,330
2002	0	0	0	0	0	0	0	20,434	0	0	0	0	20,434
Avg (21-02)	0	89	0	18	43	125	187	4,448	1,152	0	0	4	6,066

Table 2.3-6

Difference in Hetch Hetchy Release to Stream (Acre-feet)

No Program minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-2,330	0	0	0	-2,330
1922	0	0	0	0	0	0	0	-17,126	0	0	0	0	-17,126
1923	0	0	0	0	0	0	0	-23,896	0	0	0	0	-23,896
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	-1,780	0	0	0	0	-1,780
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-18,139	0	0	0	0	-18,139
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	3,554	0	0	0	1,111	0	0	0	4,665
1933	0	0	0	0	0	0	0	0	980	0	0	0	980
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	3,935	0	0	262	0	0	0	4,197
1936	0	0	0	0	0	0	0	3,588	0	0	0	0	3,588
1937	0	0	0	0	0	0	0	6,508	0	0	0	0	6,508
1938	0	0	0	0	0	0	0	-8,294	0	0	0	0	-8,294
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	6,711	0	0	0	0	6,711
1941	0	0	0	0	0	0	0	0	2,698	0	0	0	2,698
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-9,605	0	0	0	0	-9,605
1945	0	0	0	0	0	0	0	0	6,137	0	0	0	6,137
1946	0	0	0	0	0	0	0	-7,247	0	0	0	0	-7,247
1947	0	0	0	0	0	0	0	1,424	0	0	0	0	1,424
1948	0	0	0	0	0	0	0	0	6,208	0	0	0	6,208
1949	0	0	0	0	0	0	0	0	7,688	0	0	0	7,688
1950	0	0	0	0	0	0	0	0	3,735	0	0	0	3,735
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	-7,316	0	0	0	0	-7,316
1953	0	0	0	0	0	0	0	-3,308	0	0	0	0	-3,308
1954	0	0	0	0	0	0	0	-8,651	0	0	0	0	-8,651
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	6,463	0	0	0	0	6,463
1957	0	0	0	0	0	0	0	-4,852	0	0	0	0	-4,852
1958	0	0	0	0	0	3,935	0	-21,652	0	0	0	0	-17,717
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-14,106	0	0	0	0	-14,106
1963	0	0	0	0	0	0	0	-20,067	0	0	0	0	-20,067
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	6,957	0	0	0	6,957
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	-19,295	0	0	0	0	-19,295
1968	0	0	0	0	0	0	0	-15,851	0	0	0	0	-15,851
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	-32,546	0	0	0	0	-32,546
1972	0	0	0	0	0	0	0	6,181	0	0	0	0	6,181
1973	0	0	0	0	0	0	0	-18,513	0	0	0	0	-18,513
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	-5,398	0	0	0	-5,398
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-6,592	0	0	0	0	-6,592
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-10,407	-9,777	0	0	0	-20,184
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-6,070	0	0	0	0	-6,070
1984	0	0	0	0	0	0	0	-7,455	0	0	0	0	-7,455
1985	0	0	0	0	0	0	0	1,678	0	0	0	0	1,678
1986	0	0	0	0	0	1,757	0	0	0	0	0	0	1,757
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	364	0	0	0	364
1992	0	0	0	0	0	0	0	-11,376	0	0	0	0	-11,376
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-7,337	0	0	0	0	0	0	0	0	-7,337
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-5,046	0	0	0	0	-5,046
2000	0	0	0	0	0	0	0	-14,967	0	0	0	0	-14,967
2001	0	0	0	0	0	0	0	-13,915	0	0	0	0	-13,915
2002	0	0	0	0	0	0	0	-16,248	0	0	0	0	-16,248
Avg (21-02)	0	0	0	-89	43	117	0	-3,838	181	0	0	0	-3,585

Table 2.3-7

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Program	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	172	89	98	148	2,455	4,541	2,034	184	90
Above Normal	55	96	88	66	93	90	131	1,218	3,097	379	125	89
Normal	54	54	50	51	74	74	98	1,342	1,914	167	122	86
Below Normal	55	55	46	43	51	63	91	737	779	113	111	73
Dry	53	53	44	40	44	50	64	186	158	86	86	65
All Years	54	62	56	74	70	75	107	1,182	2,094	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	167	89	84	144	2,412	4,548	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,186	3,095	379	125	89
Normal	54	54	50	55	74	74	98	1,260	1,906	167	122	86
Below Normal	55	55	46	43	51	63	88	565	706	113	111	73
Dry	53	53	44	40	44	50	56	157	139	86	86	65
All Years	54	61	56	73	70	73	103	1,110	2,075	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Program minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	5	0	14	4	42	-7	0	0	0
Above Normal	0	7	0	0	4	-4	0	32	2	0	0	0
Normal	0	0	0	-4	0	0	0	83	8	0	0	0
Below Normal	0	0	0	0	0	0	4	172	73	0	0	0
Dry	0	0	0	0	0	0	8	29	18	0	0	0
All Years	0	1	0	0	1	2	3	72	19	0	0	0

Table 2.3-8

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Program	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	172	89	98	148	2,455	4,541	2,034	184	90
Above Normal	55	96	88	66	93	90	131	1,218	3,097	379	125	89
Normal	54	54	50	51	74	74	98	1,342	1,914	167	122	86
Below Normal	55	55	46	43	51	63	91	737	779	113	111	73
Dry	53	53	44	40	44	50	64	186	158	86	86	65
All Years	54	62	56	74	70	75	107	1,182	2,094	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	180	89	93	148	2,518	4,534	2,034	184	90
Above Normal	55	96	88	66	89	86	131	1,273	3,092	379	125	89
Normal	54	54	50	51	74	74	98	1,479	1,913	167	122	86
Below Normal	55	55	46	43	51	63	91	758	768	113	111	73
Dry	53	53	44	40	44	50	64	224	168	86	86	65
All Years	54	62	56	75	70	73	107	1,245	2,091	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Program minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	-7	0	6	0	-64	7	0	0	0
Above Normal	0	0	0	0	4	4	0	-55	5	0	0	0
Normal	0	0	0	0	0	0	0	-137	1	0	0	0
Below Normal	0	0	0	0	0	0	0	-21	11	0	0	0
Dry	0	0	0	0	0	0	0	-38	-10	0	0	0
All Years	0	0	0	-1	1	2	0	-62	3	0	0	0

2.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different for the alternative. Figure 2.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 2.4-1 are the results for the WSIP, alternative, and base settings. The operation resulting from the alternative is essentially the same as the WSIP, except during the prolonged drought of 1987-1992. The difference in operation during that drought stems from the delivery of additional water from Hetch Hetchy Reservoir in the WSIP setting. The additional draw of water reduced the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the WSIP setting, which, for satisfaction of MID/TID entitlements to inflow, was met with additional releases from Lake Lloyd. In the alternative setting, SFPUC deliveries during the 1987-1992 drought are nearly identical to the base setting; thus, an additional release from Lake Lloyd is not needed and the reservoir's operation would essentially be identical to the operation in the base setting.

Figure 2.4-2 illustrates the almost identical operation of Lake Eleanor for the alternative and WSIP settings. Also shown in Figure 2.4-2 is the operation for the base setting. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more associated with modeling discretion than with any substantive difference in operation.

Supplementing the Figure 2.4-1 representation of Lake Lloyd stream releases is Table 2.4-1, illustrating releases for the alternative and WSIP settings and the difference in releases between the two settings. Table 2.4-2 provides the same form of information for the alternative and base settings.

2.5 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 2.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 9 are the results for the WSIP, alternative, and base settings.

Supplementing the Figure 2.5-1 representation of Don Pedro Reservoir storage are Table 2.5-1 Don Pedro Reservoir Storage (No Program), Table 2.5-2 Don Pedro Reservoir Storage (WSIP), and Table 2.5-3 Difference in Don Pedro Reservoir Storage (No Program minus WSIP). Table 2.5-4 illustrates the difference in Don Pedro Reservoir storage between the base and alternative settings.

Table 2.5-3 illustrates that, throughout many years, the storage in Don Pedro Reservoir associated with the alternative setting would differ from the storage in the WSIP setting, and that this difference would almost always be more storage. Table 2.5-4 illustrates that the alternative setting results for Don Pedro Reservoir storage are close to the storage results depicted for the base setting. Compared to the WSIP setting, the differences in storage are indicative of the increases to the inflow of Don Pedro Reservoir that are due to lesser SJPL diversions in the alternative setting. The increases in inflow typically occur during winter through early summer. Comparing to the base setting, the alternative would result in typically less inflow to Don Pedro Reservoir, and thus less reservoir storage. As described above concerning SFPUC deliveries and SJPL diversions, when compared to the base setting, the alternative would divert additional water from the Tuolumne in many years. The greatest draw from reservoir storage for both the base and alternative settings occurs during the droughts of the 1930s, 1960s, and 1976-1977.

**Figure 2.4-1
Lake Lloyd Storage and Stream Release**

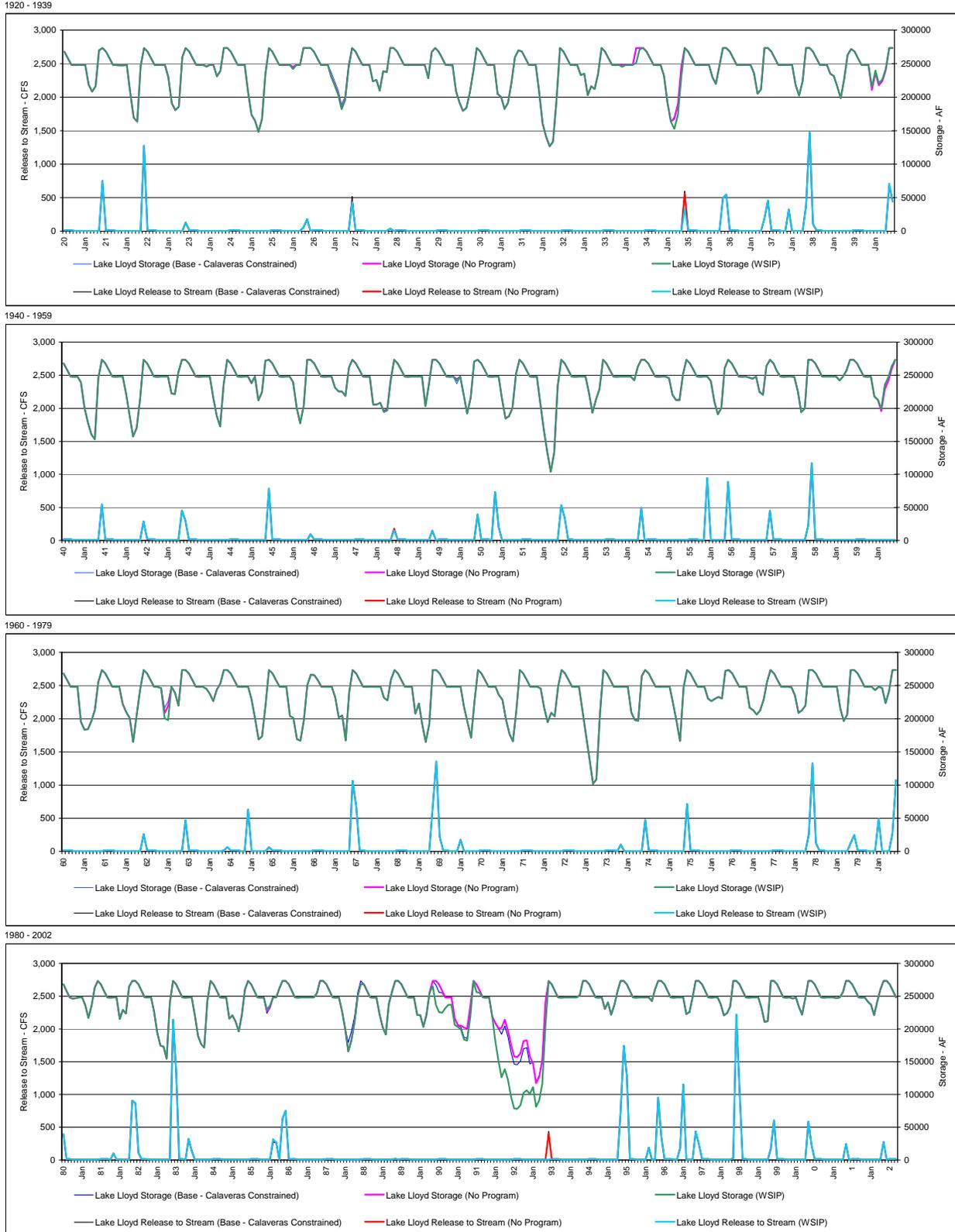


Figure 2.4-2
Lake Eleanor Storage and Stream Release

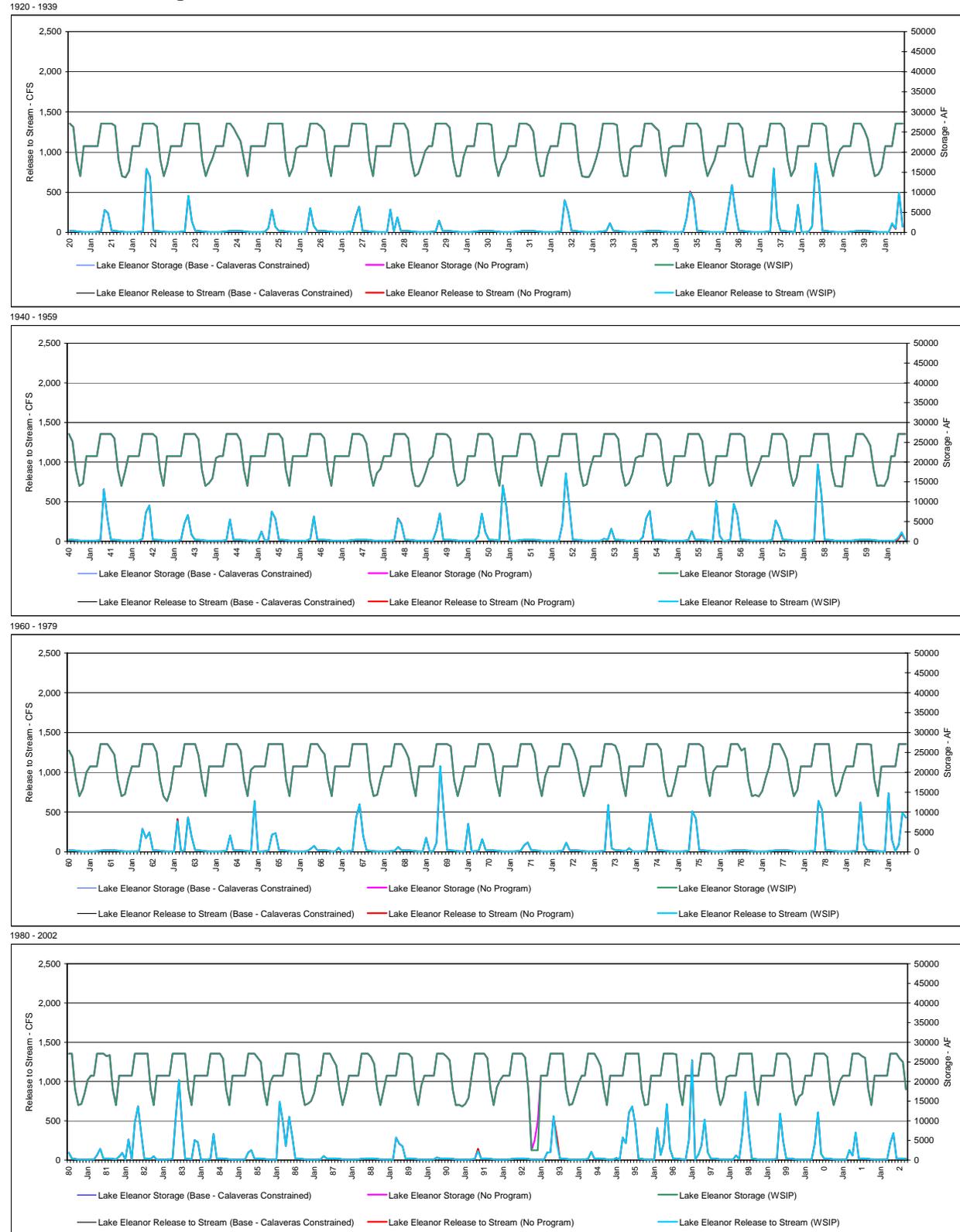


Table 2.4-1

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	22	21	5	284	1,082	363	15	15
Above Normal	5	72	25	5	16	5	5	165	460	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	45	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	120	348	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	121	340	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	No Program minus WSIP Sep
Wet	0	0	0	0	-2	0	0	0	25	0	0	0
Above Normal	0	0	0	0	0	0	0	-2	14	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	2	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	8	0	0	0

Table 2.4-2

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	22	21	5	284	1,082	363	15	15
Above Normal	5	72	25	5	16	5	5	165	460	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	45	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	120	348	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep
Wet	5	11	134	107	21	21	5	284	1,084	363	15	15
Above Normal	5	72	25	5	16	5	5	166	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	350	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	No Program minus Base - Calaveras Constrained Sep
Wet	0	0	0	0	1	0	0	0	-2	0	0	0
Above Normal	0	0	0	0	0	0	0	-1	-6	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	2	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	-1	0	0	0

Figure 2.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

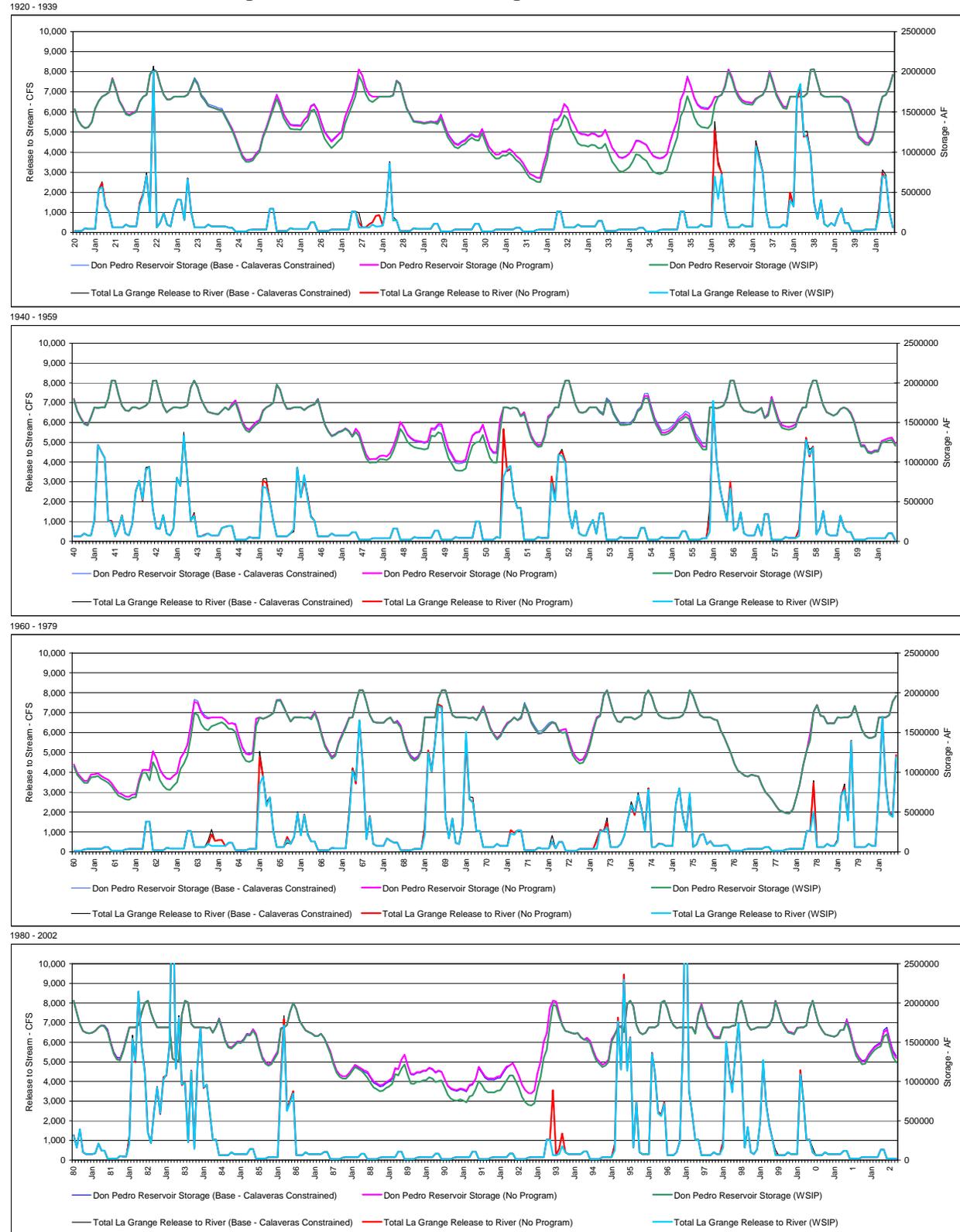


Table 2.5-1

Don Pedro Reservoir Storage (Acre-feet)

Water Year	Don Pedro Reservoir Storage (Acre-feet)												No Program
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	1,298,116	1,312,166	1,374,846	1,543,388	1,634,722	1,690,000	1,713,000	1,745,304	1,919,714	1,791,985	1,643,660	1,567,033	
1922	1,481,037	1,466,223	1,490,517	1,510,684	1,631,831	1,690,000	1,713,000	1,960,435	2,030,000	2,000,320	1,839,774	1,715,715	
1923	1,653,078	1,658,406	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,796,338	1,890,832	1,839,046	1,696,383	1,644,794	
1924	1,574,948	1,559,282	1,545,265	1,526,859	1,521,572	1,436,887	1,363,564	1,289,023	1,181,484	1,062,591	953,826	899,573	
1925	901,708	915,808	979,599	1,021,872	1,198,192	1,305,039	1,439,290	1,579,773	1,710,202	1,614,041	1,473,416	1,401,288	
1926	1,337,330	1,328,958	1,329,880	1,323,832	1,398,341	1,442,464	1,569,098	1,591,959	1,513,782	1,373,910	1,251,315	1,187,274	
1927	1,131,888	1,171,498	1,218,011	1,256,190	1,434,111	1,548,823	1,657,953	1,789,384	2,030,000	1,952,155	1,805,231	1,718,301	
1928	1,690,000	1,690,000	1,689,999	1,690,000	1,689,999	1,690,000	1,706,133	1,888,518	1,853,255	1,689,569	1,547,072	1,469,116	
1929	1,385,519	1,377,184	1,374,291	1,361,084	1,369,939	1,378,345	1,371,900	1,372,838	1,459,717	1,336,908	1,223,414	1,159,354	
1930	1,103,146	1,086,960	1,122,475	1,142,477	1,186,450	1,217,878	1,190,981	1,193,666	1,287,886	1,171,289	1,066,292	1,013,264	
1931	968,496	970,805	1,008,243	1,006,437	1,037,969	1,004,654	951,039	916,957	860,813	786,702	726,638	706,931	
1932	680,688	675,522	854,670	994,532	1,248,172	1,395,708	1,395,270	1,459,574	1,596,395	1,550,629	1,414,347	1,336,986	
1933	1,247,669	1,222,194	1,219,899	1,205,402	1,230,062	1,221,913	1,192,086	1,202,737	1,274,118	1,165,836	1,054,551	994,979	
1934	937,203	925,353	943,572	977,514	1,041,731	1,139,157	1,134,818	1,112,471	1,087,242	1,012,600	950,275	930,302	
1935	919,206	932,731	972,255	1,134,385	1,265,602	1,386,527	1,649,956	1,741,108	1,932,070	1,818,021	1,672,270	1,584,531	
1936	1,547,855	1,539,287	1,533,431	1,586,968	1,684,922	1,690,000	1,713,000	1,830,008	2,030,000	1,933,710	1,783,656	1,700,740	
1937	1,647,382	1,626,049	1,619,524	1,613,461	1,666,911	1,690,000	1,713,000	1,806,861	2,007,948	1,875,383	1,729,165	1,644,380	
1938	1,570,213	1,561,639	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957	
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,663,228	1,630,859	1,509,393	1,342,060	1,200,234	1,161,404	
1940	1,119,132	1,111,850	1,179,301	1,331,138	1,550,766	1,690,000	1,713,000	1,810,751	1,964,472	1,798,724	1,648,460	1,559,820	
1941	1,489,196	1,472,883	1,572,331	1,689,994	1,682,838	1,690,000	1,690,000	1,804,936	2,030,000	2,029,753	1,859,361	1,712,171	
1942	1,653,599	1,645,971	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840	
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,941,931	2,030,000	1,946,772	1,800,744	1,708,535	
1944	1,635,544	1,622,060	1,610,317	1,603,271	1,647,454	1,690,000	1,658,867	1,730,938	1,775,690	1,651,142	1,509,359	1,431,862	
1945	1,407,172	1,455,184	1,501,621	1,527,921	1,651,338	1,690,000	1,713,000	1,751,773	1,975,552	1,941,669	1,760,487	1,672,607	
1946	1,674,780	1,690,000	1,689,996	1,689,984	1,657,552	1,690,000	1,713,000	1,729,648	1,796,230	1,631,885	1,476,289	1,389,860	
1947	1,330,648	1,347,083	1,380,410	1,392,630	1,423,421	1,392,934	1,325,077	1,420,215	1,363,251	1,222,453	1,096,916	1,033,555	
1948	1,037,230	1,038,473	1,077,098	1,083,448	1,071,522	1,111,725	1,208,171	1,335,625	1,507,968	1,444,975	1,351,156	1,306,523	
1949	1,277,110	1,266,568	1,261,333	1,249,816	1,261,905	1,425,593	1,422,028	1,479,296	1,478,277	1,315,462	1,171,851	1,096,630	
1950	1,018,351	1,008,209	1,005,737	1,033,464	1,195,822	1,336,439	1,375,846	1,384,651	1,473,246	1,324,713	1,183,980	1,125,051	
1951	1,122,150	1,536,617	1,689,993	1,689,972	1,675,326	1,690,000	1,674,296	1,585,781	1,629,228	1,477,886	1,337,977	1,258,548	
1952	1,217,148	1,224,843	1,346,436	1,580,571	1,611,738	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140	
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,597,144	1,788,936	1,746,349	1,613,317	1,538,337	
1954	1,472,544	1,471,743	1,475,386	1,482,187	1,531,156	1,640,722	1,678,551	1,835,023	1,837,198	1,677,016	1,530,935	1,452,401	
1955	1,372,941	1,372,676	1,390,962	1,423,547	1,473,820	1,539,436	1,568,682	1,609,093	1,578,859	1,443,164	1,317,892	1,259,130	
1956	1,196,132	1,194,743	1,689,999	1,689,942	1,678,244	1,690,000	1,713,000	1,820,430	2,030,000	2,030,000	1,859,576	1,712,125	
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,614,799	1,824,080	1,768,902	1,538,880	1,465,109	
1958	1,448,685	1,441,112	1,453,822	1,476,790	1,598,914	1,690,000	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418	
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,671,222	1,621,179	1,518,619	1,353,414	1,210,000	1,209,664	
1960	1,131,733	1,120,302	1,143,530	1,143,223	1,263,788	1,283,664	1,300,579	1,307,832	1,229,790	1,099,027	990,152	940,821	
1961	892,883	892,076	973,279	974,984	987,142	953,205	928,064	904,850	861,582	796,716	742,937	723,512	
1962	697,491	692,381	720,118	724,073	911,176	1,032,271	1,032,375	1,024,171	1,262,782	1,173,660	1,036,264	963,113	
1963	920,107	913,988	956,386	988,479	1,176,610	1,244,644	1,344,383	1,591,300	1,887,460	1,869,508	1,752,786	1,693,534	
1964	1,674,608	1,690,000	1,690,000	1,689,998	1,689,999	1,660,043	1,609,884	1,618,050	1,596,133	1,440,783	1,305,411	1,234,228	
1965	1,220,553	1,243,816	1,673,500	1,689,961	1,672,810	1,690,000	1,713,000	1,749,433	1,908,523	1,912,747	1,825,430	1,722,996	
1966	1,638,039	1,690,000	1,689,998	1,689,996	1,685,637	1,690,000	1,684,975	1,760,858	1,645,651	1,481,542	1,337,844	1,267,197	
1967	1,191,253	1,224,774	1,378,467	1,477,487	1,575,321	1,687,038	1,690,000	1,880,000	2,030,000	2,030,000	1,887,521	1,717,653	
1968	1,636,798	1,624,593	1,622,729	1,622,934	1,666,601	1,690,000	1,620,006	1,640,383	1,579,740	1,412,582	1,277,076	1,199,310	
1969	1,162,855	1,192,156	1,281,640	1,689,991	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046	
1970	1,690,000	1,690,000	1,689,999	1,689,955	1,679,635	1,690,000	1,655,509	1,736,527	1,830,101	1,702,198	1,565,091	1,486,913	
1971	1,426,854	1,469,758	1,556,808	1,622,720	1,647,812	1,690,000	1,654,817	1,677,695	1,847,730	1,749,792	1,616,223	1,546,659	
1972	1,484,450	1,492,999	1,536,596	1,587,066	1,627,088	1,610,035	1,516,119	1,533,071	1,544,380	1,386,486	1,254,967	1,188,194	
1973	1,149,437	1,162,425	1,244,497	1,373,303	1,552,922	1,690,000	1,717,600	1,964,954	2,030,000	1,868,018	1,723,820	1,640,583	
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,664,266	1,690,000	1,717,600	1,962,884	2,030,000	1,949,484	1,806,587	1,717,369	
1975	1,688,936	1,679,039	1,677,494	1,682,832	1,684,940	1,690,000	1,717,600	1,814,069	2,030,000	1,962,189	1,831,507	1,712,613	
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425	
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,707	507,835	
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,481,891	1,761,000	1,847,487	1,713,521	1,701,803	
1979	1,615,610	1,618,684	1,617,740	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,834,417	1,684,409	1,540,382	1,463,780	
1980	1,432,372	1,435,084	1,455,118	1,689,977	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346	
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,716,204	1,703,727	1,648,127	1,487,086	1,358,541	1,290,338	
1982	1,281,446	1,388,353	1,539,097	1,689,993	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,876,224	1,772,100	
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,004,672	1,735,004	
1984	1,690,000	1,690,000	1,689,992	1,689,972	1,681,440	1,690,000	1,622,418	1,698,186	1,800,634	1,674,650	1,528,008	1,444,558	
1985	1,429,514	1,464,617	1,508,997	1,499,588	1,534,644	1,602,720	1,595,813	1,664,043	1,604,356	1,443,802	1,312,103	1,248,139	
1986	1,221,109	1,242,289	1,316,508	1,381,523	1,676,254	1,690,000	1,717,600	1,888,300	2,001,400	1,924,104	1,779,851	1,711,472	
1987	1,652,333	1,630,287	1,611,738	1,580,618	1,579,818	1,608,676	1,553,151	1,470,139	1,382,746	1,251,431	1,142,939	1,089,571	
1988	1,066,790	1,065,871											

Table 2.5-2

Don Pedro Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,271	1,910,239	1,780,368	1,632,093	1,555,504
1922	1,469,532	1,454,724	1,479,018	1,499,182	1,627,229	1,690,000	1,713,000	1,967,374	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,799,350	1,905,720	1,837,747	1,695,090	1,643,504
1924	1,573,662	1,557,997	1,543,979	1,525,572	1,520,285	1,435,601	1,350,582	1,268,108	1,160,641	1,041,842	933,176	878,997
1925	881,178	895,290	959,080	1,001,347	1,177,665	1,284,520	1,414,414	1,536,668	1,665,128	1,566,983	1,426,571	1,354,602
1926	1,290,743	1,282,398	1,282,833	1,276,745	1,347,403	1,393,186	1,513,528	1,529,318	1,431,062	1,291,567	1,169,352	1,105,586
1927	1,050,369	1,090,025	1,136,534	1,176,889	1,354,003	1,468,745	1,577,952	1,697,527	1,948,089	1,868,412	1,722,499	1,645,385
1928	1,624,109	1,655,435	1,689,902	1,690,000	1,689,998	1,690,000	1,705,499	1,882,298	1,844,942	1,681,291	1,538,831	1,460,902
1929	1,377,322	1,368,992	1,366,099	1,352,890	1,361,744	1,370,153	1,363,716	1,347,620	1,420,045	1,297,417	1,184,105	1,120,176
1930	1,064,049	1,047,885	1,083,398	1,103,389	1,147,360	1,178,802	1,151,942	1,144,262	1,236,535	1,120,169	1,015,406	962,553
1931	917,895	920,233	957,669	955,848	987,375	954,080	900,516	866,574	810,612	736,739	676,917	657,388
1932	631,250	626,111	769,876	913,848	1,153,707	1,290,028	1,281,046	1,334,403	1,458,411	1,411,082	1,275,442	1,198,554
1933	1,109,524	1,084,126	1,081,825	1,067,288	1,091,938	1,083,840	1,048,315	1,053,300	1,103,198	993,506	883,024	824,057
1934	766,654	754,904	779,126	811,010	879,460	973,506	960,998	918,785	892,442	818,720	757,328	738,038
1935	727,361	740,999	780,515	934,490	1,058,269	1,185,433	1,443,820	1,528,475	1,696,712	1,581,499	1,436,797	1,349,843
1936	1,313,654	1,305,218	1,299,245	1,352,785	1,588,986	1,690,000	1,713,000	1,808,423	2,006,955	1,908,581	1,768,637	1,675,801
1937	1,622,493	1,601,173	1,594,638	1,588,536	1,654,992	1,690,000	1,713,000	1,792,216	1,986,905	1,852,247	1,706,131	1,621,419
1938	1,547,298	1,538,738	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,640,414	1,609,719	1,486,211	1,318,984	1,177,264	1,138,511
1940	1,096,286	1,089,016	1,153,019	1,306,880	1,540,470	1,690,000	1,713,000	1,807,953	1,954,973	1,789,267	1,639,044	1,550,434
1941	1,479,830	1,463,523	1,562,835	1,689,993	1,683,062	1,690,000	1,690,000	1,803,805	2,030,000	2,027,570	1,857,840	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,745	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,706,915	1,749,631	1,623,011	1,481,354	1,403,951
1945	1,379,320	1,427,347	1,473,782	1,500,075	1,640,198	1,690,000	1,713,000	1,750,606	1,979,431	1,916,348	1,762,159	1,674,274
1946	1,676,444	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,277	1,790,756	1,626,434	1,470,843	1,384,452
1947	1,325,252	1,341,690	1,375,016	1,387,235	1,418,025	1,387,541	1,319,689	1,380,202	1,321,263	1,180,658	1,055,313	992,092
1948	995,855	997,122	1,035,745	1,034,871	1,022,941	1,055,025	1,146,212	1,267,720	1,417,634	1,352,869	1,259,478	1,215,157
1949	1,185,933	1,175,442	1,170,203	1,158,664	1,170,747	1,334,893	1,324,462	1,376,085	1,357,943	1,362,682	1,052,617	977,799
1950	899,772	889,700	891,735	917,336	1,074,649	1,209,756	1,247,393	1,254,524	1,342,391	1,193,077	1,052,942	994,455
1951	991,828	1,394,480	1,689,996	1,689,971	1,673,951	1,690,000	1,671,372	1,576,239	1,604,996	1,451,580	1,311,792	1,232,453
1952	1,191,106	1,198,816	1,320,408	1,550,006	1,599,510	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,598,044	1,787,718	1,742,953	1,609,936	1,534,967
1954	1,469,181	1,468,382	1,472,024	1,478,824	1,527,793	1,637,361	1,675,192	1,807,461	1,807,613	1,647,557	1,501,608	1,423,171
1955	1,343,773	1,343,524	1,361,809	1,394,386	1,444,656	1,510,283	1,537,906	1,575,778	1,541,339	1,405,813	1,280,713	1,222,079
1956	1,159,157	1,157,788	1,690,000	1,689,941	1,678,244	1,690,000	1,713,000	1,804,932	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,586,050	1,793,311	1,646,081	1,506,206	1,432,543
1958	1,416,187	1,408,633	1,421,341	1,444,300	1,585,917	1,683,239	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,329	1,608,068	1,505,552	1,340,406	1,197,054	1,196,761
1960	1,118,856	1,107,432	1,130,660	1,130,349	1,243,727	1,256,367	1,271,555	1,279,420	1,205,492	1,074,839	966,076	916,828
1961	868,944	868,151	939,429	941,125	953,280	919,356	894,250	867,206	824,074	759,385	705,786	686,494
1962	660,555	655,467	683,202	687,146	687,245	995,355	995,496	899,706	1,129,280	1,038,578	901,808	829,134
1963	786,422	780,381	830,701	875,755	1,042,937	1,111,019	1,210,888	1,447,268	1,742,065	1,722,560	1,606,476	1,547,700
1964	1,529,068	1,578,634	1,594,299	1,612,405	1,628,891	1,598,956	1,546,441	1,542,798	1,504,176	1,349,242	1,214,296	1,143,418
1965	1,129,930	1,153,243	1,584,742	1,689,973	1,672,299	1,690,000	1,713,000	1,744,658	1,904,786	1,906,843	1,817,368	1,723,009
1966	1,638,052	1,690,000	1,689,998	1,689,996	1,685,990	1,690,000	1,666,206	1,743,752	1,626,487	1,462,463	1,318,853	1,248,271
1967	1,172,366	1,205,898	1,359,590	1,458,604	1,556,437	1,679,489	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,623,382	1,560,682	1,393,610	1,258,193	1,180,490
1969	1,144,074	1,173,385	1,262,868	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,036	1,816,534	1,686,506	1,549,469	1,471,343
1971	1,411,316	1,454,230	1,541,278	1,607,186	1,641,597	1,690,000	1,654,817	1,685,672	1,853,567	1,753,420	1,619,836	1,550,260
1972	1,488,043	1,496,591	1,540,187	1,590,658	1,628,525	1,611,472	1,517,554	1,495,198	1,504,521	1,646,809	1,515,475	1,148,834
1973	1,110,158	1,123,168	1,205,238	1,334,033	1,513,648	1,676,096	1,707,479	1,954,405	2,030,000	1,868,018	1,723,819	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,536	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,823,045	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,401,086	1,761,000	1,845,304	1,711,347	1,699,327
1979	1,612,045	1,615,120	1,614,177	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,303	1,682,304	1,538,286	1,461,691
1980	1,430,288	1,433,000	1,453,035	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,714,087	1,699,430	1,636,268	1,475,279	1,346,789	1,278,626
1982	1,269,759	1,376,672	1,527,416	1,689,995	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,612	1,791,967	1,663,838	1,517,244	1,433,830
1985	1,418,807	1,453,917	1,498,296	1,488,884	1,523,939	1,592,019	1,585,122	1,645,091	1,583,355	1,422,894	1,291,292	1,227,399
1986	1,200,412	1,221,603	1,293,188	1,358,196	1,670,079	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,677	1,709,305
1987	1,650,170	1,628,126	1,609,576	1,578,456	1,577,656	1,606,514	1,550,992	1,452,961	1,354,101	1,222,918	1,114,556	1,061,284
1988	1,038,561	1,037,658	1,073,842	1,127,662	1,183,519	1,160,536	1,					

Table 2.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet)

No Program minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	197	197	197	197	766	0	0	3,033	9,475	11,617	11,567	11,529
1922	11,505	11,499	11,499	11,502	4,602	0	0	-6,939	0	2,184	1,520	-3
1923	-3	-2	0	0	0	0	0	-3,012	-888	1,299	1,293	1,290
1924	1,286	1,285	1,286	1,287	1,287	1,286	12,982	20,915	20,843	20,749	20,650	20,576
1925	20,530	20,518	20,519	20,525	20,527	20,519	24,876	43,105	45,074	47,058	46,845	46,686
1926	46,587	46,560	47,047	47,087	50,938	49,278	55,570	62,641	82,720	82,343	81,963	81,688
1927	81,519	81,473	81,477	80,101	80,108	80,078	80,001	91,857	81,911	83,743	82,732	72,916
1928	65,891	34,565	97	0	0	0	634	6,220	8,313	8,278	8,241	8,214
1929	8,197	8,192	8,192	8,194	8,195	8,192	8,184	25,218	39,672	39,491	39,309	39,178
1930	39,097	39,075	39,077	39,088	39,090	39,076	39,039	49,404	51,351	51,120	50,886	50,711
1931	50,601	50,572	50,574	50,589	50,594	50,574	50,523	50,383	50,201	49,963	49,721	49,543
1932	49,438	49,411	49,411	49,411	49,411	49,411	49,411	49,411	49,411	49,411	49,411	49,411
1933	138,145	138,068	138,074	138,114	138,124	138,073	143,771	149,437	170,920	172,330	171,527	170,922
1934	170,549	170,449	164,446	166,504	162,271	165,651	173,820	193,686	194,800	193,880	192,947	192,264
1935	191,845	191,732	191,740	199,895	207,333	201,094	206,136	212,633	235,358	236,522	235,473	234,688
1936	234,201	234,069	234,186	234,183	95,936	0	0	21,585	23,045	25,129	25,019	24,939
1937	24,889	24,876	24,886	24,925	11,919	0	0	14,645	21,043	23,136	23,034	22,961
1938	22,915	22,901	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	22,814	21,140	23,182	23,076	22,970	22,893
1940	22,846	22,834	26,282	24,258	10,296	0	0	2,798	9,499	9,457	9,416	9,386
1941	9,366	9,360	9,496	1	-224	0	0	1,131	0	2,183	1,521	-3
1942	-3	-3	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	2,186	0	2,183	2,174	-4
1944	-3	-4	-4	-3	-2	0	0	24,023	26,059	28,131	28,005	27,911
1945	27,852	27,837	27,839	27,846	11,140	0	0	1,167	-3,879	-1,679	-1,672	-1,667
1946	-1,664	0	0	0	2,406	0	0	3,371	5,474	5,475	5,426	5,408
1947	5,396	5,393	5,394	5,395	5,396	5,393	5,388	40,013	41,988	41,795	41,603	41,463
1948	41,375	41,351	41,353	48,577	48,581	56,700	61,959	67,905	90,334	92,106	91,678	91,366
1949	91,177	91,126	91,130	91,152	91,158	90,700	97,566	103,211	120,334	119,780	119,234	118,831
1950	118,579	118,509	114,002	116,128	121,173	126,683	128,453	130,127	130,855	131,636	131,038	130,596
1951	130,322	142,137	-3	1	1,375	0	2,924	9,542	24,232	26,306	26,185	26,095
1952	26,022	26,027	26,028	30,565	12,228	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	-900	1,218	3,396	3,381	3,370
1954	3,363	3,361	3,362	3,363	3,363	3,361	3,359	27,562	29,585	29,459	29,327	29,229
1955	29,168	29,152	29,153	29,161	29,164	29,153	30,776	33,315	37,520	37,351	37,179	37,051
1956	36,975	36,955	-1	1	0	0	0	15,498	0	0	0	0
1957	0	0	0	0	0	0	0	28,749	30,769	32,821	32,674	32,566
1958	32,498	32,479	32,481	32,490	12,997	6,761	0	0	0	0	0	0
1959	0	0	0	0	0	0	3,893	13,111	13,067	13,008	12,946	12,903
1960	12,877	12,870	12,870	12,874	20,061	27,297	29,024	28,412	24,298	24,188	24,076	23,993
1961	23,939	23,925	33,850	33,859	33,862	33,849	33,814	37,644	37,508	37,331	37,151	37,018
1962	36,936	36,914	36,916	36,927	36,931	36,916	36,879	124,465	133,502	135,082	134,456	133,979
1963	133,685	133,607	125,685	112,724	133,673	133,625	133,495	144,032	145,395	146,948	146,310	145,834
1964	145,540	111,366	95,701	77,593	61,108	61,087	63,443	75,252	91,957	91,541	91,115	90,810
1965	90,623	90,573	88,758	-12	511	0	0	4,775	3,737	5,904	8,062	-13
1966	-13	0	0	0	-353	0	18,769	17,106	19,164	19,079	18,991	18,926
1967	18,887	18,876	18,877	18,883	18,884	7,549	0	0	0	0	2,183	-3
1968	-4	-4	-4	-3	-2	0	0	17,001	19,058	18,972	18,883	18,820
1969	18,781	18,771	18,772	-3	0	0	0	0	0	0	0	0
1970	0	0	0	3	2	0	0	11,491	13,567	15,692	15,622	15,570
1971	15,538	15,528	15,530	15,534	6,215	0	0	-7,977	-5,837	-3,628	-3,613	-3,601
1972	-3,593	-3,592	-3,591	-3,592	-1,437	-1,437	-1,435	37,873	39,859	39,677	39,492	39,360
1973	39,279	39,257	39,259	39,270	39,274	13,904	10,121	10,549	0	0	1	0
1974	0	0	0	0	1,384	0	0	-652	0	2,184	2,174	-3
1975	-4	-4	-3	-3	-1	0	0	-8,976	-3	2,183	1,521	-2
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	80,805	0	2,183	2,174	2,476
1979	3,565	3,564	3,563	0	0	0	0	0	2,114	2,105	2,096	2,089
1980	2,084	2,084	2,083	1	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	2,117	4,297	11,859	11,807	11,752	11,712
1982	11,687	11,681	11,681	-2	0	0	0	0	0	0	2,183	0
1983	0	0	0	0	0	0	0	0	0	0	2,183	-3
1984	0	0	0	1	0	0	197	6,574	8,667	10,812	10,764	10,728
1985	10,707	10,700	10,701	10,704	10,705	10,701	10,691	18,952	21,001	20,908	20,811	20,740
1986	20,697	20,686	23,320	23,327	6,175	0	0	0	0	2,183	2,174	2,167
1987	2,163	2,161	2,162	2,162	2,162	2,162	2,159	17,178	28,645	28,513	28,383	28,287
1988	28,229	28,213	28,214	28,222	28,224	28,214	28,187	41,744	76,879	76,528	76,167	75,899
1989	75,733	75,688	75,692	75,714	75,720	75,692	77,003	115,620	124,689	124,126	123,557	123,135
1990	122,876	122,806	122,812	122,847	122,857	122,811	122,693	134,881	112,837	106,509	115,143	131,574
1991	136,669	136,589	137,380	144,926	146,295	146,238	146,089	131,521	180,942	168,196	176,231	178,690
1992	178,302	178,198	178,206	178,260	178,273	178,207	129,289	155,920	155,384	154,670	153,925	153,380
1993	153,047	152,952	166,939	196,025	196,072	205,175	209,743	212,079	53,066	55,022	38,312	-62
1994	-62	-61	-61	-61	-62	-62	-62	27,670	29,689	29,554	29,415	29,317
1995	29,256	29,240	29,241	29,249	11,701	0	10,123	0	0	0	2,184	-3
1996	-4	-3	-4	-4	0	0	0	0	0	2,183	2,174	2,167
1997	2,163	0	0	0	0	0	12,671	14,826	16,892	19,003	18,921	18,860
1998	18,822	18,812	18,813	-1	-3	0	-1,288	0	0	0	0	0
1999	0	0	0	0	1	0	0	11,991	9,823	11,964	11,912	11,874
2000	11,850	11,844	11,844	11,847	0	0	0	-2,757	0	0	0	0
2001	0	0	0	0	0	0	0	31,479	33,278	33,130	32,978	32,864
2002	32,796	32,778	32,780	32,789	32,791	32,779	32,747	55,184	57,112	56,858	56,595	56,402
Avg (21-02)	37,850	37,170	34,666	33,072	30,198	27,963	28,943	38,206	38,990	39,467	39,405	38,621

Table 2.5-4

Difference in Don Pedro Reservoir Storage (Acre-feet)

No Program minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	687	0	0	-440	-2,766	-2,753	-2,741	-2,733
1922	-2,727	-2,725	-2,725	-2,726	-1,090	0	0	-16,773	0	0	0	0
1923	0	0	0	0	0	0	0	-23,867	-23,788	-23,684	-23,581	-23,505
1924	-23,458	-23,446	-23,446	-23,453	-23,454	-23,446	-14,855	-10,535	-10,499	-10,452	-10,403	-10,365
1925	-10,343	-10,337	-10,337	-10,340	-10,341	-10,337	-10,582	-12,333	-12,292	-12,238	-12,183	-12,141
1926	-12,117	-12,110	-12,121	-12,098	-8,448	-9,511	-10,354	-13,237	-16,416	-16,341	-16,264	-16,210
1927	-16,176	-16,168	-9,569	-10,970	-10,971	-10,967	-10,957	-26,562	0	0	0	0
1928	0	0	0	0	0	0	0	-6,867	-6,850	-6,827	-6,798	-6,745
1929	-6,731	-6,727	-6,728	-6,730	-6,730	-6,727	-6,721	-15,550	-15,497	-15,426	-15,354	-15,302
1930	-15,270	-15,262	-15,263	-15,267	-15,268	-15,263	-15,248	-4,740	-4,723	-4,702	-4,681	-4,665
1931	-4,655	-4,652	-4,653	-4,654	-4,654	-4,652	-4,648	-4,635	-4,618	-4,596	-4,574	-4,558
1932	-4,548	-4,544	-1,274	-12,649	-9,864	-19,080	-15,334	-12,958	-9,966	-9,921	-9,877	-9,843
1933	-9,823	-9,817	-9,817	-9,820	-9,821	-9,817	-9,817	-9,827	-9,831	-9,828	-9,818	-9,834
1934	-8,116	-8,110	-8,459	-8,695	-9,461	-9,368	-10,098	-9,076	-9,046	-9,004	-8,962	-8,931
1935	-8,911	-8,905	-8,906	-16,352	-22,738	-9,482	-9,275	-12,443	-17,523	-17,446	-17,371	-17,313
1936	-17,279	-17,269	-17,173	-5,068	0	0	0	4,132	3,534	3,534	3,504	3,492
1937	3,485	3,484	3,484	3,485	3,676	0	0	4,909	2,135	2,126	2,117	2,110
1938	2,106	2,105	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	-6,099	-6,083	-6,063	-6,035	-6,007	-5,988
1940	-5,975	-5,971	-1,792	-3,109	873	0	0	8,973	10,782	10,735	10,689	10,654
1941	10,631	10,625	9,833	1	-172	0	0	-1,964	0	0	0	0
1942	0	0	0	1	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	-2,850	0	0	0	0
1944	0	0	0	0	0	0	0	-9,594	-9,563	-9,522	-9,479	-9,447
1945	-9,428	-9,422	-9,422	-9,425	-3,770	0	0	882	7,006	6,976	6,945	6,923
1946	6,910	0	0	0	2,406	0	0	-8,271	-8,244	-8,209	-8,172	-8,144
1947	-8,128	-8,122	-8,122	-8,125	-8,125	-8,123	-8,115	-6,671	-6,648	-6,617	-6,587	-6,564
1948	-6,551	-6,548	-6,547	663	663	3,091	3,579	5,121	13,382	13,322	13,261	13,215
1949	13,187	13,179	13,181	13,155	13,156	15,634	18,435	20,768	29,200	29,066	28,934	28,837
1950	28,777	28,760	18,868	25,340	15,033	11,320	12,265	12,956	16,641	16,564	16,490	16,434
1951	16,400	16,390	0	1	1,375	0	0	5,701	11,196	11,146	11,095	11,056
1952	11,034	11,028	11,028	11,078	4,432	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	-19,831	-22,892	-22,818	-22,719	-22,621	-22,547
1954	-22,500	-22,488	-22,488	-22,495	-22,496	-22,488	-22,467	-31,054	-30,951	-30,817	-30,679	-30,578
1955	-30,513	-30,496	-30,497	-30,506	-30,509	-30,498	-31,042	-32,228	-38,558	-38,385	-38,208	-38,078
1956	-37,999	-37,978	1	0	0	0	0	7,383	0	0	0	0
1957	0	0	0	0	0	0	0	-4,846	-4,831	-4,809	-4,788	-4,772
1958	-4,762	-4,760	-4,759	-4,761	-1,905	804	0	0	0	0	0	0
1959	0	0	0	0	0	0	-1,870	-9,304	-9,273	-9,231	-9,188	-9,158
1960	-9,139	-9,133	-9,134	-9,136	-5,397	439	911	1,426	-924	-919	-915	-912
1961	-910	-909	29	28	29	28	28	2,690	2,680	2,668	2,655	2,645
1962	2,640	2,638	2,638	2,639	2,639	2,638	2,635	-9,558	-7,687	-7,653	-7,617	-7,591
1963	-7,575	-7,570	296	-261	-7,579	-7,576	-7,569	-27,030	-26,942	-26,825	-26,707	-26,623
1964	-15,392	0	0	0	0	0	0	-818	-16,677	-16,602	-16,525	-16,468
1965	-16,435	-16,426	-8,088	2	1,548	0	0	6,123	17,645	17,569	17,491	-28
1966	-28	0	0	0	0	0	-8,195	-8,175	-8,149	-8,112	-8,075	-8,047
1967	-8,031	-8,027	-8,027	-8,029	-8,030	-2,308	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	-14,852	-14,802	-14,735	-14,667	-14,618
1969	-14,588	-14,580	-14,580	2	0	0	0	0	0	0	0	0
1970	0	0	0	0	1,191	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	-31,812	-31,708	-31,569	-31,433	-31,329
1972	-31,265	-31,248	-31,248	-31,257	-12,504	-12,501	-12,488	-6,284	-6,262	-6,234	-6,205	-6,184
1973	-6,171	-6,167	-6,167	-6,169	-6,170	0	0	-15,640	0	0	0	0
1974	0	0	0	1	1,385	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	-7,778	0	-1	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-6,583	0	0	0	0
1979	-4,752	-4,749	-4,750	1	1	0	0	0	0	0	0	0
1980	0	0	0	1	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	-10,394	-19,551	-19,464	-19,375	-19,308
1982	-19,267	-19,256	-19,257	3	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	1	0	0	0	-7,446	-7,421	-7,390	-7,357	-7,332
1985	-7,316	-7,313	-7,313	-7,315	-7,315	-7,312	-7,305	-5,713	-5,695	-5,668	-5,642	-5,623
1986	-5,611	-5,608	-8,534	-6,617	-4,347	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	1,425	1,420	1,413	1,406	1,401
1988	1,399	1,398	1,398	1,399	15,059	15,054	9,462	20,720	21,983	16,894	16,816	16,757
1989	16,721	16,712	16,712	16,717	16,718	16,712	-4,777	2,837	10,180	10,133	10,087	10,053
1990	10,031	10,026	10,026	10,029	10,030	10,026	10,017	8,319	6,560	721	9,867	12,782
1991	12,753	12,746	12,746	12,750	12,751	12,746	12,733	292	21,152	19,136	19,048	18,984
1992	18,944	18,932	18,934	18,939	18,940	18,934	444	443	441	439	437	436
1993	434	434	434	14,096	14,097	11,984	7,372	9,255	0	0	0	0
1994	0	0	0	0	0	0	0	-2,865	-2,855	-2,843	-2,829	-2,819
1995	-2,813	-2,811	-2,812	-2,813	-1,125	0	0	920	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	1	0	0	0	-951	-948	-945	-941	-937
1998	-932	-932	-932	0	0	0	0	184	0	0	0	0
1999	0	0	0	0	1	0	0	-8,606	0	0	0	0
2000	0	0	0	0	0	0	0	-14,948	0	0	0	0
2001	0	0	0	0	0	0	0	-13,898	-13,853	-13,792	-13,728	-13,681
2002	-13,651	-13,644	-13,644	-13,648	-13,650	-13,645	-13,632	-28,821	-28,726	-28,598	-28,468	-28,369
Avg (21-02)	-3,347	-3,241	-2,792	-2,247	-1,638	-1,386	-2,316	-5,036	-3,603	-3,742	-3,613	-3,778

Figure 2.5-2 illustrates the difference in reservoir storage averaged by year type in comparing the alternative to the WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 2.5-3 illustrates the same information in comparing the alternative and the base settings.

Figure 2.5-2

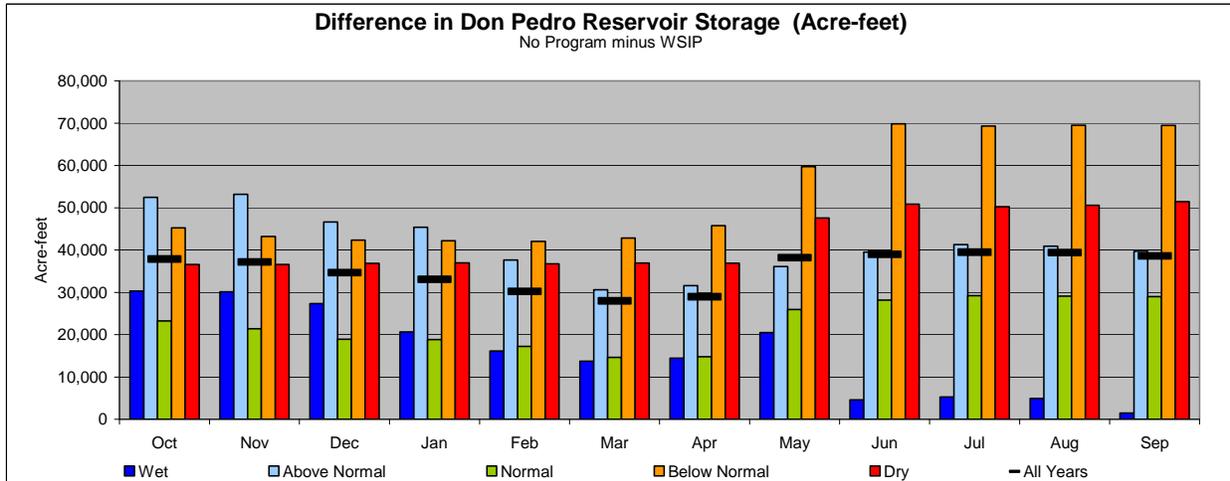


Figure 2.5-3

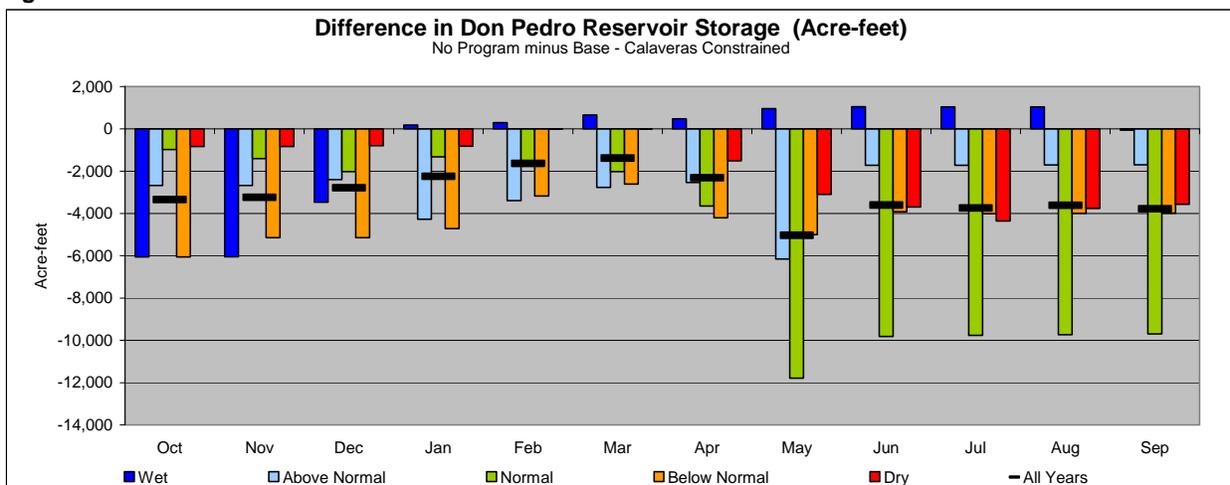


Figure 2.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the alternative would manifest in differences in releases from La Grange Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow directly manifests as a change in release from La Grange Dam (a change of either more or less flow). Figure 2.5-1 illustrates the stream release from La Grange Dam for the WSIP, alternative, and base settings.

Figure 2.5-4

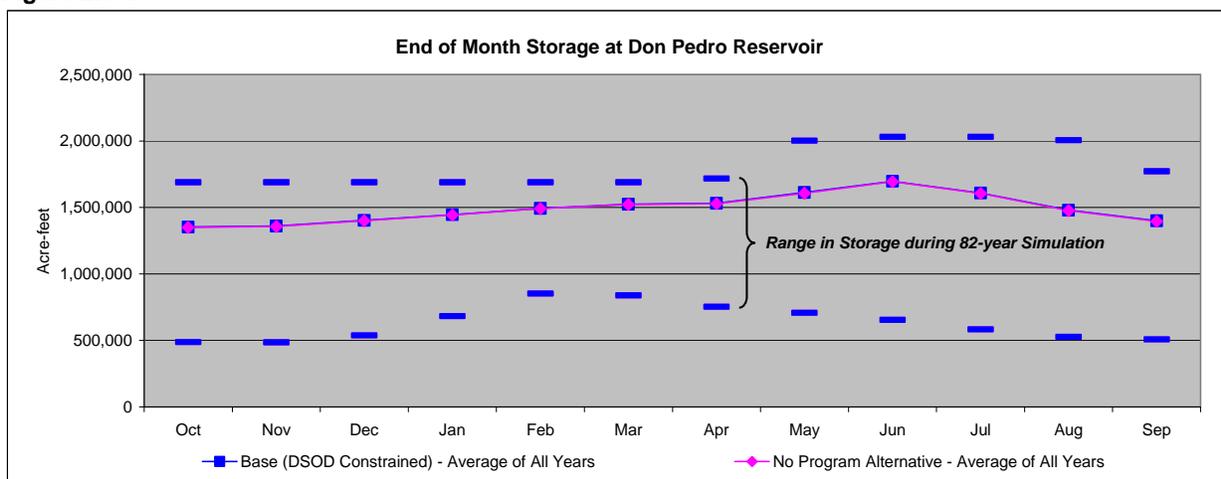


Table 2.5-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative typically exhibits an incrementally larger stream release, predominantly during some months in early winter through June, which reflects the months when releases to the stream are made above minimum release requirements due to flood control or in anticipation of the reservoir being filled. There are exceptions, a decrease in releases to the stream, during certain years when the alternative diverts more water the SJPL to serve more demand as compared to the WSIP setting. Table 2.5-6 illustrates the same information in comparing the alternative and WSIP settings, with years ranked in descending order of the San Joaquin River Index. Illustrated is the finding that differences in releases to the Tuolumne River from La Grange Dam would occur only when there are releases in excess of minimum Federal Energy Regulatory Commission (FERC) flow requirements. This circumstance typically occurs only in above normal and wet years, and predominantly during early winter through June. During July of the wettest of years, additional releases could be associated with the alternative setting. During other year types and during the summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting. Compared to the WSIP setting, the large potential reduction in flow following an extended drought period is ameliorated with the alternative because the amount of water delivered by the SFPUC during these periods is typically about the same as delivered in the base setting, thereby not exacerbating the draw down of Don Pedro Reservoir.

As described above concerning Don Pedro inflow and storage, compared to the base setting, the alternative setting would lead to an additional draw of storage due to SFPUC diversions that are greater than in the base setting in many years. Although the reduction in storage would not greatly accumulate over several years, greater replenishment of Don Pedro Reservoir storage is needed in over 40 percent of the years of the 82-year simulation. Table 2.5-7 illustrates the difference in stream releases between the alternative and base settings, depicting the predominance of reductions to flow. Table 2.5-8 illustrates the same information ranked in descending order of the San Joaquin River Index.

Table 2.5-6 and Table 2.5-7 illustrate the difference in stream release between the alternative, WSIP, and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 2.5-9 illustrates the same information and the average monthly stream release for the alternative and WSIP settings, expressed in average monthly flow (cfs). Table 2.5-10 illustrates the same information in comparing the alternative and base settings. For the comparison of the alternative to the WSIP setting, the difference in monthly flow below La Grange Dam could range from an increase of approximately 197,000 acre-feet to a decrease of approximately 25,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful. Similar to the operation of releases below O'Shaughnessy Dam, a change in the volume of release from La Grange Dam to the stream would likely result in the initiation of the release being delayed or accelerated by a matter of days. Assuming that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the alternative and WSIP would be a delay in releases up to 4 days or up to an added month of release.

Table 2.5-5

Water Year	Difference in Total La Grange Release to River (Acre-feet)												WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	0	0	0	0	-4,006	11,155	3,078	0	0	0	0	0	10,227
1922	0	0	0	0	6,901	4,600	0	0	-4,810	0	655	1,521	8,867
1923	0	0	-3	0	0	0	2,117	0	0	0	0	0	2,114
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	15,734	0	644	9,569	25,947
1928	6,886	31,299	34,469	97	0	0	0	0	0	0	0	0	72,751
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	127,417	105,199	5,710	0	585	0	0	0	238,911
1937	0	0	0	0	3,265	4,940	2,383	0	0	0	0	0	10,588
1938	0	0	23,319	-1	-12,030	-13,274	-4,858	7,178	2,118	2,188	0	0	4,640
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	11,005	8,369	-5,390	0	0	0	0	0	13,984
1941	0	0	0	-3,823	1,344	-3	519	0	4,553	0	655	1,520	4,765
1942	0	0	-2	2,404	0	-4,757	0	0	0	2,188	0	0	-167
1943	0	0	0	0	0	-2,773	2,117	0	4,299	0	0	2,174	5,817
1944	0	0	0	0	-2	-1	0	0	0	0	0	0	-3
1945	0	0	0	0	16,708	16,941	986	0	0	0	0	0	34,635
1946	0	-1,663	0	0	-14,436	8,481	2,339	0	0	0	0	0	-5,279
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	148,803	-7,614	-8,248	1,375	0	0	0	0	0	0	134,316
1952	0	0	0	0	18,340	12,225	0	13,259	4,879	2,188	0	0	50,891
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	44,359	-3,807	0	-2,429	3,821	0	20,353	2,188	0	0	64,485
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	19,494	10,167	6,759	-4,163	3,774	2,188	0	0	38,219
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	34,103	15,670	18,132	16,489	0	0	0	0	0	0	0	84,394
1965	0	0	0	85,928	-3,100	6,315	-1,825	0	0	0	0	8,062	95,380
1966	0	-13	-1,749	0	2,121	-353	0	0	0	0	0	0	6
1967	0	0	0	0	0	11,331	7,545	-9,039	0	2,188	0	2,184	14,209
1968	0	0	0	0	-2	-1	0	0	0	0	0	0	-3
1969	0	0	0	18,777	6,716	-1,473	4,880	5,043	4,879	2,188	0	0	41,010
1970	0	0	0	-24,687	2	1,679	0	0	0	0	0	0	-23,006
1971	0	0	0	0	9,321	6,213	0	0	0	0	0	0	15,534
1972	0	0	0	0	-2,156	0	0	0	0	0	0	0	-2,156
1973	0	0	0	0	0	25,359	3,772	0	15,411	0	0	0	44,542
1974	0	0	0	-2,873	-8,303	-4,187	4,604	5,695	4,229	0	0	2,174	1,339
1975	0	0	0	0	-2	-1	921	0	-13,092	0	655	1,520	-9,999
1976	-2	0	0	0	0	0	0	0	0	0	0	0	-2
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	86,285	0	0	0	86,285
1979	0	0	0	3,565	0	8,037	2,118	2,189	0	0	0	0	15,909
1980	0	0	0	-6,682	1	5,898	2,118	6,944	6,721	2,188	0	0	17,188
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	11,685	589	-5,898	0	4,757	4,603	2,188	0	4,297	22,221
1983	-1,808	-2,762	6,659	-3,806	0	0	0	-5,615	-2,762	2,188	0	2,183	-5,723
1984	4,301	-4,603	827	-3,002	0	-3,935	0	0	0	0	0	0	-6,412
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	25,029	19,497	6,697	6,945	6,721	0	0	0	64,889
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	196,874	0	16,507	38,313	251,694
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	17,550	11,984	0	16,770	6,445	2,188	0	2,183	57,120
1996	0	0	0	0	2,673	-951	4,880	5,043	4,880	0	0	0	16,525
1997	0	2,162	0	5,410	-1	0	0	0	0	0	0	0	7,571
1998	0	0	0	18,818	-3	6,683	7,734	-240	1,012	2,188	0	0	36,192
1999	0	0	0	0	-7,734	0	3,282	0	4,910	0	0	0	458
2000	0	0	0	0	11,848	0	0	0	-634	0	0	0	11,214
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	114	714	3,321	1,323	2,888	3,005	809	668	4,609	320	233	923	18,928

Table 2.5-6

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

No Program minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	-1,808	-2,762	6,659	-3,806	0	0	0	-5,615	-2,762	2,188	0	2,183	-5,723
1969	0	0	0	18,777	6,716	-1,473	4,880	5,043	4,879	2,188	0	0	41,010
1995	0	0	0	0	17,550	11,984	0	16,770	6,445	2,188	0	2,183	57,120
1938	0	0	23,319	-1	-12,030	-13,274	-4,858	7,178	2,118	2,188	0	0	4,640
1998	0	0	0	18,818	-3	6,683	7,734	-240	1,012	2,188	0	0	36,192
1982	0	0	0	11,685	589	-5,898	0	4,757	4,603	2,188	0	4,297	22,221
1967	0	0	0	0	0	11,331	7,545	-9,039	0	2,188	0	2,184	14,209
1952	0	0	0	0	18,340	12,225	0	13,259	4,879	2,188	0	0	50,891
1958	0	0	0	0	19,494	10,167	6,759	-4,163	3,774	2,188	0	0	38,219
1980	0	0	0	-6,682	1	5,898	2,118	6,944	6,721	2,188	0	0	17,188
1978	0	0	0	0	0	0	0	0	86,285	0	0	0	86,285
1922	0	0	0	0	6,901	4,600	0	0	-4,810	0	655	1,521	8,867
1956	0	0	44,359	-3,807	0	-2,429	3,821	0	20,353	2,188	0	0	64,485
1942	0	0	-2	2,404	0	-4,757	0	0	0	2,188	0	0	-167
1941	0	0	0	-3,823	1,344	-3	519	0	4,553	0	655	1,520	4,765
1986	0	0	0	0	25,029	19,497	6,697	6,945	6,721	0	0	0	64,889
1993	0	0	0	0	0	0	0	0	196,874	0	16,507	38,313	251,694
1997	0	2,162	0	5,410	-1	0	0	0	0	0	0	0	7,571
1996	0	0	0	0	2,673	-951	4,880	5,043	4,880	0	0	0	16,525
1943	0	0	0	0	0	-2,773	2,117	0	4,299	0	0	2,174	5,817
1937	0	0	0	0	3,265	4,940	2,383	0	0	0	0	0	10,588
1974	0	0	0	-2,873	-8,303	-4,187	4,604	5,695	4,229	0	0	2,174	1,339
1975	0	0	0	0	-2	-1	921	0	-13,092	0	655	1,520	-9,999
1965	0	0	0	85,928	-3,100	6,315	-1,825	0	0	0	0	8,062	95,380
1936	0	0	0	0	127,417	105,199	5,710	0	585	0	0	0	238,911
1984	4,301	-4,603	827	-3,002	0	-3,935	0	0	0	0	0	0	-6,412
1979	0	0	0	3,565	0	8,037	2,118	2,189	0	0	0	0	15,909
1945	0	0	0	0	16,708	16,941	986	0	0	0	0	0	34,635
1999	0	0	0	0	-7,734	0	3,282	0	4,910	0	0	0	458
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	15,734	0	644	9,569	25,947
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	-1,663	0	0	-14,436	8,481	2,339	0	0	0	0	0	-5,279
1973	0	0	0	0	0	25,359	3,772	0	15,411	0	0	0	44,542
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	11,848	0	0	0	-634	0	0	0	11,214
1940	0	0	0	0	11,005	8,369	-5,390	0	0	0	0	0	13,984
1923	0	0	-3	0	0	0	2,117	0	0	0	0	0	2,114
1921	0	0	0	0	-4,006	11,155	3,078	0	0	0	0	0	10,227
1970	0	0	0	-24,687	2	1,679	0	0	0	0	0	0	-23,006
1951	0	0	148,803	-7,614	-8,248	1,375	0	0	0	0	0	0	134,316
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	9,321	6,213	0	0	0	0	0	0	15,534
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	-2	-1	0	0	0	0	0	0	-3
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	6,886	31,299	34,469	97	0	0	0	0	0	0	0	0	72,751
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-13	-1,749	0	2,121	-353	0	0	0	0	0	0	6
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	-2	-1	0	0	0	0	0	0	-3
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	34,103	15,670	18,132	16,489	0	0	0	0	0	0	0	84,394
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-2,156	0	0	0	0	0	0	0	-2,156
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	-2	0	0	0	0	0	0	0	0	0	0	0	-2
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.5-7

Difference in Total La Grange Release to River (Acre-feet)

No Program minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	-4,124	-4,546	-522	0	0	0	0	0	-9,192
1922	0	0	0	0	-1,636	-1,091	-7,365	-5,684	-19,507	0	0	0	-35,283
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-28,094	0	0	0	-28,094
1928	0	0	0	0	0	-5,339	-10,773	0	0	0	0	0	-16,112
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-24,136	-13,876	775	0	585	0	0	0	-36,652
1937	0	0	0	0	-11,604	-8,066	-1,304	0	0	0	0	0	-20,974
1938	0	0	4,375	-1	-12,030	-13,319	-14,201	-12,373	-2,762	-1	0	0	-50,312
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-14,567	-10,851	-10,674	0	0	0	0	0	-36,092
1941	0	0	0	-3,485	1,029	-198	215	0	-2,025	0	0	0	-4,464
1942	0	0	0	-2,091	0	-8,562	-5,524	-2,855	-2,762	0	0	0	-21,794
1943	0	0	0	0	0	-14,234	-2,762	0	-5,608	0	0	1	-22,603
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-5,655	-13,284	941	0	0	0	0	0	-17,998
1946	0	6,908	0	0	-14,436	-4,911	-1,528	0	0	0	0	0	-13,967
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	23,051	-7,612	-8,248	1,375	0	0	0	0	0	0	8,566
1952	0	0	0	0	6,647	4,431	0	-7,316	0	0	0	0	3,762
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-36,875	-3,805	0	-6,763	1,127	0	7,371	0	0	0	-38,945
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-2,856	1,226	804	-20,701	920	0	0	0	-20,607
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-15,388	0	0	0	0	0	0	0	0	0	0	-26,577
1965	0	0	0	-16,654	-9,278	-7,165	-3,058	0	0	0	0	17,491	-18,664
1966	0	-28	-6,060	0	0	-6,452	0	0	0	0	0	0	-12,540
1967	0	0	0	0	0	-10,229	-2,307	-18,732	0	0	0	0	-31,268
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-14,584	-491	-7,611	-2,761	0	0	0	0	0	-25,447
1970	0	0	0	-2,850	-7,143	-14,400	0	0	0	0	0	0	-24,393
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-18,755	0	0	0	0	0	0	0	-18,755
1973	0	0	0	0	0	-6,169	0	0	-12,852	0	0	0	-19,021
1974	0	0	0	-14,028	-8,302	-12,749	-920	1	0	0	0	0	-35,998
1975	0	0	0	0	0	0	-7,365	0	-12,844	0	0	0	-20,209
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-6,572	0	0	0	-6,572
1979	0	0	0	-4,751	0	-11,066	0	0	0	0	0	0	-15,817
1980	0	0	0	-2,848	0	-2,664	-2,762	1,902	1,841	0	0	0	-4,531
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-19,262	-9,570	-8,561	0	1,903	1,841	0	0	0	-33,649
1983	-4,757	-4,603	9,323	-3,806	0	0	0	-11,414	-5,524	0	0	0	-20,781
1984	-2,854	-4,603	827	-3,002	0	0	0	0	0	0	0	0	-9,632
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	9,249	-11,151	-4,603	1,903	1,842	0	0	0	-2,760
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	8,912	0	0	0	8,912
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-1,688	4,105	0	3,773	2,762	0	0	0	8,952
1996	0	0	0	0	-855	-951	-1,841	2,855	2,762	0	0	0	1,970
1997	0	0	0	-7,337	1	0	0	0	0	0	0	0	-7,336
1998	0	0	0	-933	0	9	-1,105	-2,670	-2,762	0	0	0	-7,461
1999	0	0	0	0	-7,734	-9,514	-1,722	0	-11,354	0	0	0	-30,324
2000	0	0	0	0	0	0	0	0	-14,924	0	0	0	-14,924
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-229	-216	-65	-1,305	-1,783	-2,470	-966	-846	-1,204	0	0	213	-8,873

Table 2.5-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

No Program minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	-4,757	-4,603	9,323	-3,806	0	0	-2,761	-11,414	-5,524	0	0	0	-20,781
1969	0	0	0	-14,584	-491	-7,611	0	0	0	0	0	0	-25,447
1995	0	0	0	0	-1,688	4,105	0	3,773	2,762	0	0	0	8,952
1938	0	0	4,375	-1	-12,030	-13,319	-14,201	-12,373	-2,762	-1	0	0	-50,312
1998	0	0	0	-933	0	9	-1,105	-2,670	-2,762	0	0	0	-7,461
1982	0	0	0	-19,262	-9,570	-8,561	0	1,903	1,841	0	0	0	-33,649
1967	0	0	0	0	0	-10,229	-2,307	-18,732	0	0	0	0	-31,268
1952	0	0	0	0	6,647	4,431	0	-7,316	0	0	0	0	3,762
1958	0	0	0	0	-2,856	1,226	804	-20,701	920	0	0	0	-20,607
1980	0	0	0	-2,848	0	-2,664	-2,762	1,902	1,841	0	0	0	-4,531
1978	0	0	0	0	0	0	0	0	-6,572	0	0	0	-6,572
1922	0	0	0	0	-1,636	-1,091	-7,365	-5,684	-19,507	0	0	0	-35,283
1956	0	0	-36,875	-3,805	0	-6,763	1,127	0	7,371	0	0	0	-38,945
1942	0	0	0	-2,091	0	-8,562	-5,524	-2,855	-2,762	0	0	0	-21,794
1941	0	0	0	-3,485	1,029	-198	215	0	-2,025	0	0	0	-4,464
1986	0	0	0	0	9,249	-11,151	-4,603	1,903	1,842	0	0	0	-2,760
1993	0	0	0	0	0	0	0	0	8,912	0	0	0	8,912
1997	0	0	0	-7,337	1	0	0	0	0	0	0	0	-7,336
1996	0	0	0	0	-855	-951	-1,841	2,855	2,762	0	0	0	1,970
1943	0	0	0	0	0	-14,234	-2,762	0	-5,608	0	0	1	-22,603
1937	0	0	0	0	-11,604	-8,066	-1,304	0	0	0	0	0	-20,974
1974	0	0	0	-14,028	-8,302	-12,749	-920	1	0	0	0	0	-35,998
1975	0	0	0	0	0	0	-7,365	0	-12,844	0	0	0	-20,209
1965	0	0	0	-16,654	-9,278	-7,165	-3,058	0	0	0	0	17,491	-18,664
1936	0	0	0	0	-24,136	-13,876	775	0	585	0	0	0	-36,652
1984	-2,854	-4,603	827	-3,002	0	0	0	0	0	0	0	0	-9,632
1979	0	0	0	-4,751	0	-11,066	0	0	0	0	0	0	-15,817
1945	0	0	0	0	-5,655	-13,284	941	0	0	0	0	0	-17,998
1999	0	0	0	0	-7,734	-9,514	-1,722	0	-11,354	0	0	0	-30,324
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-28,094	0	0	0	-28,094
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	6,908	0	0	-14,436	-4,911	-1,528	0	0	0	0	0	-13,967
1973	0	0	0	0	0	-6,169	0	0	-12,852	0	0	0	-19,021
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	-14,924	0	0	0	-14,924
1940	0	0	0	0	-14,567	-10,851	-10,674	0	0	0	0	0	-36,092
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	0	0	0	0	-4,124	-4,546	-522	0	0	0	0	0	-9,192
1970	0	0	0	-2,850	-7,143	-14,400	0	0	0	0	0	0	-24,393
1951	0	0	23,051	-7,612	-8,248	1,375	0	0	0	0	0	0	8,566
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	-5,339	-10,773	0	0	0	0	0	-16,112
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-28	-6,060	0	0	-6,452	0	0	0	0	0	0	-12,540
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-15,388	0	0	0	0	0	0	0	0	0	0	-26,577
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-18,755	0	0	0	0	0	0	0	-18,755
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.5-9

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,307	22,037	51,724	129,195	193,989	247,569	201,424	191,496	214,872	79,958	31,729	78,003	1,468,303
Above Normal	18,139	30,330	77,022	76,247	128,352	115,910	92,527	82,916	20,332	14,739	14,777	14,826	686,116
Below Normal	18,058	18,666	25,471	19,559	36,239	39,214	56,136	58,008	4,463	4,612	4,612	4,463	289,500
Dry	20,742	18,072	17,945	17,522	25,354	25,876	29,552	30,537	4,349	4,494	4,494	4,349	203,283
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,249
All Years	20,227	20,596	40,130	61,533	94,762	108,602	95,034	90,699	69,028	28,445	14,337	27,827	671,218

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,382	22,062	48,627	124,111	190,719	245,157	199,412	189,305	200,624	78,864	30,959	75,248	1,431,469
Above Normal	17,886	30,698	68,220	78,114	120,555	105,165	91,467	82,787	18,214	14,739	14,739	14,263	656,848
Below Normal	17,484	16,058	22,744	19,551	35,285	38,726	56,136	58,008	4,463	4,612	4,612	4,463	282,142
Dry	20,742	15,449	16,739	16,127	24,251	25,876	29,552	30,537	4,349	4,494	4,494	4,349	196,957
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,112	19,882	36,809	60,209	91,874	105,597	94,225	90,031	64,418	28,125	14,104	26,904	652,291

Difference in Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	-75	-25	3,097	5,085	3,269	2,412	2,012	2,191	14,248	1,094	770	2,755	36,834
Above Normal	253	-369	8,802	-1,867	7,797	10,745	1,060	129	2,118	0	38	563	29,268
Below Normal	574	2,607	2,727	8	953	488	0	0	0	0	0	0	7,357
Dry	0	2,623	1,205	1,395	1,102	0	0	0	0	0	0	0	6,326
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	114	714	3,321	1,323	2,888	3,005	809	668	4,609	320	233	923	18,928

Table 2.5-10

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,307	22,037	51,724	129,195	193,989	247,569	201,424	191,496	214,872	79,958	31,729	78,003	1,468,303
Above Normal	18,139	30,330	77,022	76,247	128,352	115,910	92,527	82,916	20,332	14,739	14,777	14,826	686,116
Below Normal	18,058	18,666	25,471	19,559	36,239	39,214	56,136	58,008	4,463	4,612	4,612	4,463	289,500
Dry	20,742	18,072	17,945	17,522	25,354	25,876	29,552	30,537	4,349	4,494	4,494	4,349	203,283
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,249
All Years	20,227	20,596	40,130	61,533	94,762	108,602	95,034	90,699	69,028	28,445	14,337	27,827	671,218

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,228	52,690	132,897	195,713	251,883	203,746	194,388	216,210	79,958	31,729	77,274	1,485,222
Above Normal	18,307	30,194	75,617	77,318	133,414	121,042	93,276	82,916	24,252	14,739	14,777	14,826	700,678
Below Normal	18,058	18,668	25,976	19,559	36,239	40,197	57,034	58,008	4,463	4,612	4,612	4,463	291,887
Dry	21,603	19,256	17,945	17,522	26,796	25,876	29,552	30,537	4,349	4,494	4,494	4,349	206,770
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,249
All Years	20,456	20,812	40,195	62,838	96,544	111,073	96,000	91,545	70,232	28,445	14,337	27,614	680,091

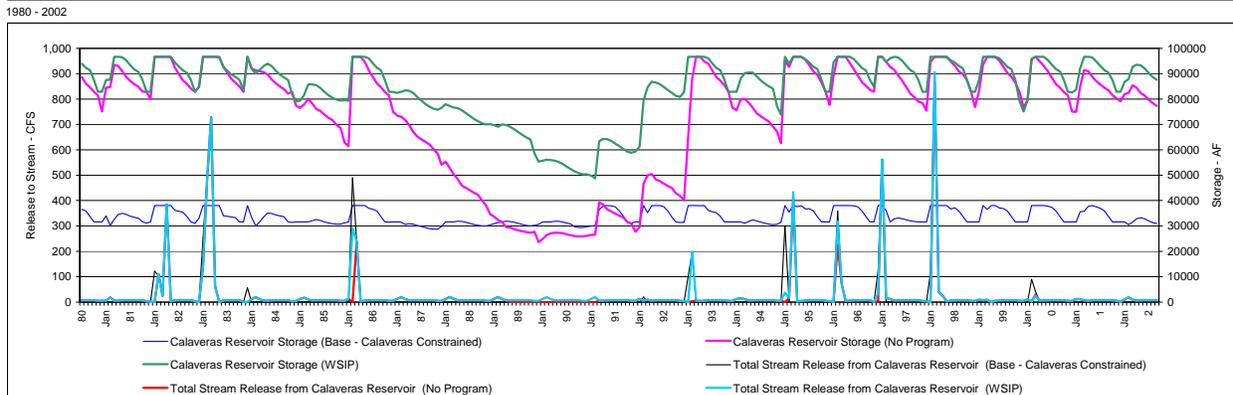
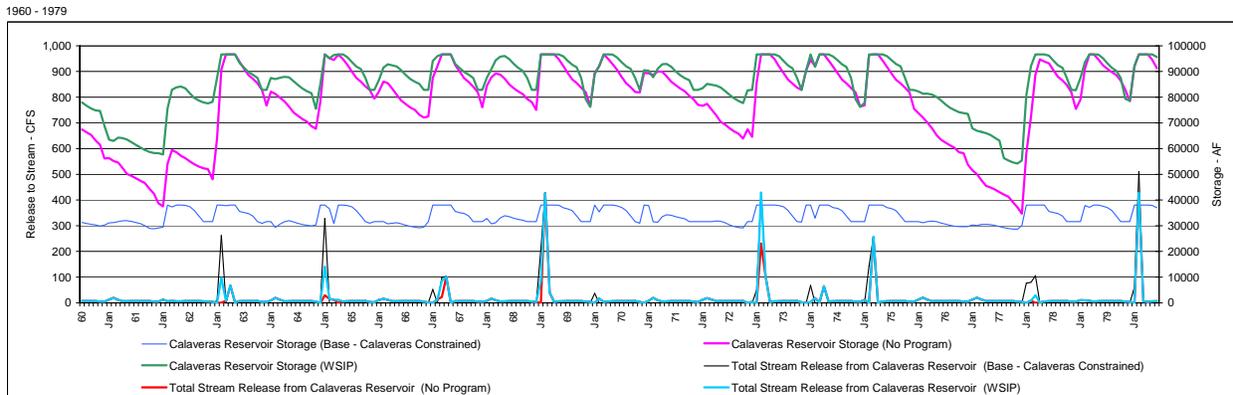
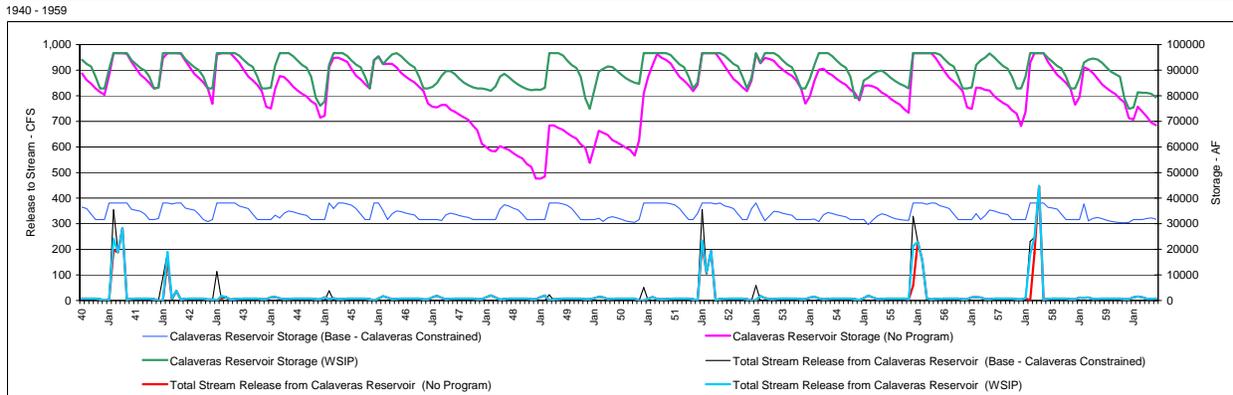
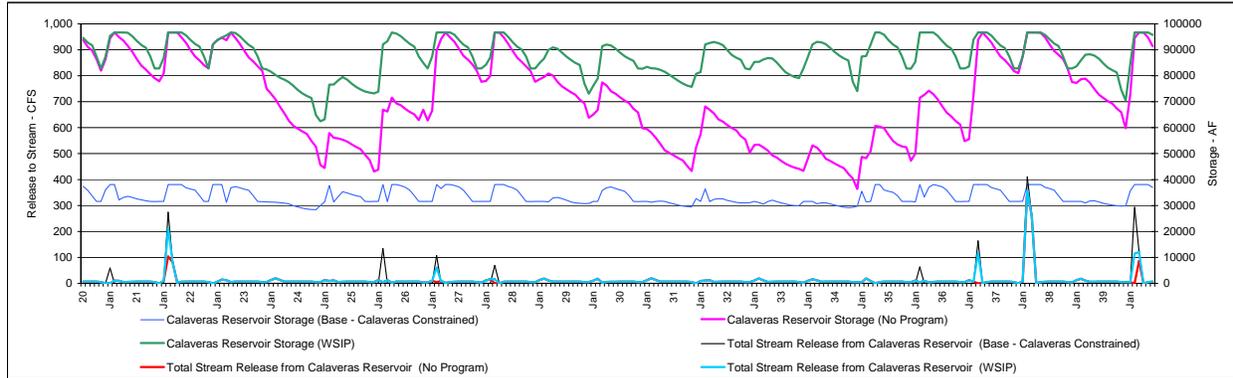
Difference in Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	-198	-192	-966	-3,701	-1,724	-4,314	-2,322	-2,892	-1,338	0	0	729	-16,919
Above Normal	-168	136	1,405	-1,071	-5,061	-5,132	-749	0	-3,920	0	0	0	-14,561
Below Normal	0	-2	-505	0	0	-983	-898	0	0	0	0	0	-2,388
Dry	-861	-1,184	0	0	-1,443	0	0	0	0	0	0	0	-3,487
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-229	-216	-65	-1,305	-1,783	-2,470	-966	-846	-1,204	0	0	213	-8,873

Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, the alternative's effect on stream releases could manifest as an elimination of all flows during a year above minimum FERC flow requirements. Compared to the base setting, the alternative's effect to stream flow ranges from a slight reduction to releases (a potential delay in release of 6 days) to a slight increase in releases (a potential additional day of release).

2.6 Calaveras and San Antonio Reservoirs, Alameda Creek, and Downstream

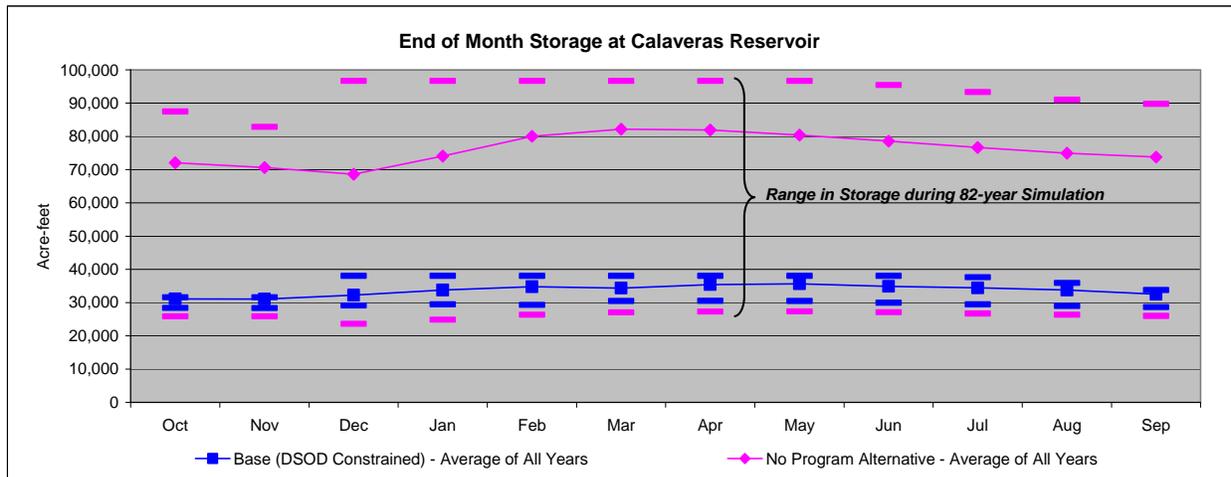
Compared to the WSIP setting, Calaveras Reservoir storage is utilized to a greater extent in the alternative setting. Figure 2.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 2.6-1 are the results for the WSIP, alternative, and base settings. The difference in Calaveras Reservoir storage between the alternative and WSIP settings is mostly caused by the interaction of the increased demand served by the system's resources (300 mgd for the alternative and a net 290-mgd demand for the WSIP for many years), and by the difference in conveyance capacity of the SJPL. Generally, the systematic decrease in reservoir storage beginning in spring and lasting through fall is due to the additional demand and less SJPL conveyance capacity drawing more water from Calaveras Reservoir during the period. This additional draw down occurs each year between annual filling events, and accumulates during drought sequences

**Figure 2.6-1
Calaveras Reservoir Storage and Stream Release**



when the local watershed runoff is minimal. The lesser capacity of the SJPL in the alternative setting would also constrain the ability to offset the need for diversions from Calaveras Reservoir during the replenishment period. The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Under both the alternative and WSIP settings, the full capacity of Calaveras Reservoir would be available, and a greater range in storage operation would occur. Figure 2.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 2.6-2



Compared to the WSIP setting, there would potentially be less release to Calaveras Creek below Calaveras Dam in the alternative setting. Both settings have fishery releases that are not included in the base setting. However, due to a greater draw down of Calaveras Reservoir storage in the alternative setting as compared to the base setting, more regulation of local watershed runoff is possible and fewer and smaller releases in excess of the fishery release would occur. Table 2.6-1 illustrates the difference in releases to Calaveras Creek between the alternative and WSIP settings. Supplementing the Figure 2.6-1 representation of Calaveras Dam stream releases and Table 2.6-1 is Table 2.6-2, illustrating releases for the alternative and WSIP settings, and the difference in releases between the two. Table 2.6-3 provides the same form of information for the alternative and base settings. The notable difference in releases between the alternative and base settings is the addition of the required flows to satisfy the 1997 Memorandum of Understanding (MOU) and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There would be greater Alameda Creek diversions to Calaveras Reservoir in the alternative setting compared to the WSIP setting. This circumstance is related to the occurrence of less Calaveras Reservoir storage in the alternative setting. With lower storage, there are more opportunities and need to divert from the Alameda Creek watershed. Coincidentally, with the increase in the diversion at Alameda Creek Diversion Dam, flow spilling past the diversion dam would decrease in the alternative setting. Table 2.6-4 illustrates the difference in flow below the Alameda Creek Diversion Dam between the alternative and WSIP settings. Table 2.6-5 illustrates the difference in flow below Alameda Creek Diversion Dam between the alternative and base settings. In this comparison, the reduction in flow below the diversion dam is due to the additional diversions to Calaveras Reservoir resulting from the restoration of reservoir operating capacity. Table 2.6-6 and Table 2.6-7 illustrate the flow past the Alameda Creek Diversion Dam comparing the alternative, WSIP, and base settings by year type and the average of all years.

Table 2.6-1

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)												No Program minus WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	-6,018	0	0	0	0	0	0	0	-6,018
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	-3,153	0	0	0	0	0	0	0	-3,153
1928	0	0	0	0	0	-977	0	0	0	0	0	0	-977
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	-7,195	0	0	0	0	0	0	-7,195
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-6,424	-2,094	0	0	0	0	0	0	-8,518
1941	0	0	0	0	-2,494	0	0	0	0	0	0	0	-2,494
1942	0	0	0	0	-1,920	0	0	0	0	0	0	0	-1,920
1943	0	0	0	0	-294	0	0	0	0	0	0	0	-294
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	-1,011	0	0	0	0	0	0	0	0	-1,011
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-9,534	0	0	0	0	0	0	0	0	0	-9,534
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	-9,994	-3,726	0	0	0	0	0	0	-13,720
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	-5,310	0	0	0	0	0	0	0	-5,310
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	-6,857	0	0	-740	0	0	0	0	0	-7,597
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	-3,884	0	0	0	0	0	0	-3,884
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	-5,438	0	0	0	0	0	0	0	0	-5,438
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	-11,013	0	0	0	0	0	0	0	-11,013
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	-274	0	0	0	0	0	0	-274
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	-1,790	0	0	0	0	0	0	-1,790
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	-188	0	0	0	0	0	0	0	-188
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	-46	-78	0	0	0	0	0	0	0	-124
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-16,192	0	0	0	0	0	0	0	-16,192
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	-423	-417	-430	-430	-417	-2,117
1990	-430	-283	-295	-777	-1,068	-775	-397	-414	-417	-430	-430	-417	-6,133
1991	-430	-298	-298	-806	-1,104	0	0	0	0	0	0	0	-2,935
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	-10,830	0	0	0	0	0	0	0	-10,830
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	-2,276	0	-1,406	0	0	0	0	0	0	-3,681
1996	0	0	0	0	-5,149	0	0	0	0	0	0	0	-5,149
1997	0	0	-1,958	0	0	0	0	0	0	0	0	0	-1,958
1998	0	0	0	0	-2,092	0	0	0	0	0	0	0	-2,092
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	310	0	0	0	0	0	0	310
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	-10	-7	-147	-210	-1,016	-266	-14	-10	-10	-10	-10	-10	-1,722

Table 2.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet)													No Program	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	429	246	347	4,535	12,385	9,444	5,085	255	387	417	425	415	34,371	
Above Normal	425	258	172	403	1,471	2,199	606	327	396	423	428	417	7,524	
Normal	429	275	195	548	725	495	264	370	408	428	430	417	4,985	
Below Normal	403	258	229	625	811	596	345	389	411	429	430	417	5,343	
Dry	402	274	263	730	978	698	349	354	364	376	376	365	5,529	
All Years	418	262	240	1,347	3,222	2,655	1,309	339	393	415	418	407	11,426	

Total Stream Release from Calaveras Reservoir (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	429	246	1,065	5,083	15,133	10,007	5,085	255	387	417	425	415	38,949	
Above Normal	425	258	172	806	3,657	2,849	650	327	396	423	428	417	10,807	
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	387	1,557	4,238	2,921	1,323	350	403	426	428	417	13,148	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													No Program minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	-718	-548	-2,748	-563	0	0	0	0	0	0	-4,578	
Above Normal	0	0	0	-403	-2,187	-650	-44	0	0	0	0	0	-3,283	
Normal	0	0	0	0	0	-61	0	0	0	0	0	0	-61	
Below Normal	-25	-18	-18	-47	-65	0	0	0	0	0	0	0	-173	
Dry	-27	-18	-18	-49	-67	-48	-25	-52	-52	-54	-54	-52	-516	
All Years	-10	-7	-147	-210	-1,016	-266	-14	-10	-10	-10	-10	-10	-1,722	

Table 2.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet)													No Program	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	429	246	347	4,535	12,385	9,444	5,085	255	387	417	425	415	34,371	
Above Normal	425	258	172	403	1,471	2,199	606	327	396	423	428	417	7,524	
Normal	429	275	195	548	725	495	264	370	408	428	430	417	4,985	
Below Normal	403	258	229	625	811	596	345	389	411	429	430	417	5,343	
Dry	402	274	263	730	978	698	349	354	364	376	376	365	5,529	
All Years	418	262	240	1,347	3,222	2,655	1,309	339	393	415	418	407	11,426	

Total Stream Release from Calaveras Reservoir (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590	
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382	
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													No Program minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	429	246	-1,389	-4,686	-4,256	-524	61	255	387	417	425	415	-8,219	
Above Normal	425	258	-12	-2,329	-4,441	-897	147	327	396	423	428	417	-4,859	
Normal	429	275	-22	184	-157	143	264	370	408	428	430	417	3,170	
Below Normal	403	258	229	625	811	596	345	389	411	429	430	417	5,343	
Dry	402	274	263	730	978	698	349	354	364	376	376	365	5,529	
All Years	418	262	-179	-1,089	-1,423	-1	234	339	393	415	418	407	194	

Table 2.6-4

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Program minus WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	-921	0	0	0	0	0	0	0	-921	
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	
1927	0	0	0	0	-4,520	0	-373	0	0	0	0	0	-4,893	
1928	0	0	0	0	0	-1,801	0	0	0	0	0	0	-1,801	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-3,566	0	0	0	0	0	0	0	-3,566	
1937	0	0	0	0	0	-4,818	0	0	0	0	0	0	-4,818	
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	-3,186	0	0	0	0	0	0	0	-3,186	
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	
1942	0	0	0	1,922	0	0	0	0	0	0	0	0	1,922	
1943	0	0	0	-5,368	-352	0	0	0	0	0	0	0	-5,719	
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	-3,673	-2,746	-1,764	-2,747	0	0	0	0	0	0	-10,930	
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	
1953	0	0	0	-709	0	0	0	0	0	0	0	0	-709	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	-6,116	0	0	0	0	0	0	0	-6,116	
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	
1969	0	0	0	-2,357	0	0	0	0	0	0	0	0	-2,357	
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	
1973	0	0	0	-586	0	0	0	0	0	0	0	0	-586	
1974	0	0	0	2,096	0	1,320	0	0	0	0	0	0	3,416	
1975	0	0	0	0	-671	0	0	0	0	0	0	0	-671	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	-3,434	0	0	0	0	0	0	-3,434	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	-2,808	0	0	0	0	0	0	0	0	-2,808	
1983	0	0	0	0	0	0	0	922	0	0	0	0	922	
1984	0	0	-627	0	0	0	0	0	0	0	0	0	-627	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	-1,596	0	0	0	0	0	0	0	-1,596	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	-4,146	-4,588	-1,943	0	0	0	0	0	0	-10,677	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	-7,694	0	0	0	0	0	0	0	0	-7,694	
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	-5,374	0	0	0	0	0	0	0	0	-5,374	
1999	0	0	0	0	-1,069	0	0	0	0	0	0	0	-1,069	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	0	0	-52	-339	-346	-164	-5	11	0	0	0	0	-894	

Table 2.6-5

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Program minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	-2,559	-2,274	0	0	0	0	0	0	0	-4,834	
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	
1923	0	0	-2,856	-1,688	-1,004	0	0	0	0	0	0	0	-5,547	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	-3,210	0	0	0	0	0	0	0	-3,210	
1927	0	0	0	0	-4,520	0	0	0	0	0	0	0	-4,520	
1928	0	0	0	0	0	-1,801	-156	0	0	0	0	0	-1,957	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-4,662	0	0	0	0	0	0	0	-4,662	
1937	0	0	0	0	-3,964	-4,818	0	0	0	0	0	0	-8,782	
1938	0	0	0	0	0	0	-156	0	0	0	0	0	-156	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	-3,186	0	-156	0	0	0	0	0	-3,341	
1941	0	0	0	-1,197	0	0	0	0	0	0	0	0	-1,197	
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	
1943	0	0	0	-5,825	-352	0	0	0	0	0	0	0	-6,176	
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945	0	0	0	0	-4,471	0	0	0	0	0	0	0	-4,471	
1946	0	0	-4,651	-1,522	0	0	0	0	0	0	0	0	-6,173	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	-5,524	0	0	0	0	0	0	-5,524	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	-6,184	-2,793	-1,823	-2,848	0	0	0	0	0	0	-13,647	
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	
1953	0	0	0	-4,600	0	0	0	0	0	0	0	0	-4,600	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	-1,919	0	0	0	0	0	0	0	-1,919	
1963	0	0	0	-2,219	-6,116	0	0	0	0	0	0	0	-8,335	
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	
1965	0	0	-1,921	0	0	0	3,250	0	0	0	0	0	1,329	
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	
1967	0	0	0	-1,676	-1,872	0	0	0	0	0	0	0	-3,548	
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	
1969	0	0	0	-2,357	0	0	0	0	0	0	0	0	-2,357	
1970	0	0	0	-4,247	0	-1,623	0	0	0	0	0	0	-5,870	
1971	0	0	-613	0	0	0	0	0	0	0	0	0	-613	
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	
1973	0	0	0	-4,926	0	0	0	0	0	0	0	0	-4,926	
1974	0	0	-1,019	0	0	1,444	0	0	0	0	0	0	425	
1975	0	0	0	0	-5,196	0	-156	0	0	0	0	0	-5,352	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	-4,152	-3,403	-3,434	0	0	0	0	0	0	-10,990	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	-3,360	0	-101	0	0	0	0	0	0	-3,461	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	-2,808	0	0	0	0	0	0	0	0	-2,808	
1983	0	0	0	0	0	0	0	687	0	0	0	0	687	
1984	0	0	-3,959	0	0	0	0	0	0	0	0	0	-3,959	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	-1,596	0	0	0	0	0	0	0	-1,596	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	-3,578	0	0	0	0	0	0	0	-3,578	
1993	0	0	0	-5,180	-4,588	-2,044	0	0	0	0	0	0	-11,812	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	-7,694	0	0	0	0	0	0	0	0	-7,694	
1996	0	0	0	-5,239	0	0	0	0	0	0	0	0	-5,239	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	-5,588	0	0	0	0	0	0	0	0	-5,588	
1999	0	0	0	0	-3,867	0	1,392	0	0	0	0	0	-2,475	
2000	0	0	0	0	-4,567	0	0	0	0	0	0	0	-4,567	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	0	0	-259	-849	-807	-253	49	8	0	0	0	0	-2,110	

Table 2.6-6

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	5,116	7,882	5,751	2,962	173	0	0	0	0	23,291
Above Normal	7	23	479	1,928	2,653	2,408	947	0	0	0	0	0	8,446
Normal	0	6	338	220	670	346	117	6	0	0	0	0	1,703
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	441	1,450	2,272	1,728	799	35	0	0	0	0	6,739

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	6,172	7,882	5,751	2,962	116	0	0	0	0	24,389
Above Normal	7	23	695	2,526	4,017	3,092	969	0	0	0	0	0	11,330
Normal	0	6	377	264	893	459	117	6	0	0	0	0	2,122
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	494	1,789	2,618	1,892	803	24	0	0	0	0	7,633

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	-1,056	-100	0	0	58	0	0	0	0	-1,098
Above Normal	0	0	-216	-598	-1,364	-684	-22	0	0	0	0	0	-2,883
Normal	0	0	-39	-44	-223	-113	0	0	0	0	0	0	-419
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-52	-339	-346	-164	-5	11	0	0	0	0	-894

Table 2.6-7

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	5,116	7,882	5,751	2,962	173	0	0	0	0	23,291
Above Normal	7	23	479	1,928	2,653	2,408	947	0	0	0	0	0	8,446
Normal	0	6	338	220	670	346	117	6	0	0	0	0	1,703
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	441	1,450	2,272	1,728	799	35	0	0	0	0	6,739

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	-1,850	-217	-6	-10	43	0	0	0	0	-2,040
Above Normal	0	0	-705	-1,744	-2,639	-688	255	0	0	0	0	0	-5,521
Normal	0	0	-576	-648	-1,115	-559	-10	0	0	0	0	0	-2,909
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-259	-849	-807	-253	49	8	0	0	0	0	-2,110

Comparing the alternative and WSIP settings, differences in releases from Calaveras Dam to the stream and differences to spills at Alameda Creek Diversion Dam would result in differences in flow below the Alameda Creek and Calaveras Creek confluence. Table 2.6-8 illustrates the flow below the confluence for the alternative and WSIP settings. Fishery releases for the 1997 MOU are assumed in both of the settings; the differences in flow are attributable to the effect of greater draw down of Calaveras Reservoir in the alternative setting. Table 2.6-9 provides the same form of information for the alternative and base settings. The notable differences between the alternative and the base settings (comparable to the difference between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year/wet season flows due to the restoration of Calaveras Reservoir storage.

Table 2.6-8

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Program	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,070	10,660	21,455	16,180	8,649	605	417	430	430	417	62,070	
Above Normal	437	327	895	2,928	4,900	5,169	1,864	430	417	430	430	417	18,643	
Normal	430	304	758	1,037	1,781	1,169	539	435	417	430	430	417	8,148	
Below Normal	404	280	307	811	1,152	1,007	419	430	417	430	430	417	6,504	
Dry	403	280	306	765	1,207	768	398	377	365	376	376	365	5,986	
All Years	421	303	861	3,207	6,024	4,815	2,344	455	407	419	419	407	20,082	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,789	12,265	24,303	16,744	8,649	548	417	430	430	417	67,746	
Above Normal	437	327	1,111	3,929	8,451	6,502	1,929	430	417	430	430	417	24,810	
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,061	3,755	7,386	5,245	2,362	454	417	430	430	417	22,699	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Program minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-718	-1,604	-2,848	-563	0	58	0	0	0	0	-5,676	
Above Normal	0	0	-216	-1,001	-3,551	-1,333	-65	0	0	0	0	0	-6,167	
Normal	0	0	-39	-44	-223	-174	0	0	0	0	0	0	-480	
Below Normal	-25	-18	-18	-47	-65	0	0	0	0	0	0	0	-173	
Dry	-27	-18	-18	-49	-67	-48	-25	-52	-52	-54	-54	-52	-516	
All Years	-10	-7	-200	-549	-1,362	-430	-18	1	-10	-10	-10	-10	-2,616	

Table 2.6-9

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Program	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,070	10,660	21,455	16,180	8,649	605	417	430	430	417	62,070	
Above Normal	437	327	895	2,928	4,900	5,169	1,864	430	417	430	430	417	18,643	
Normal	430	304	758	1,037	1,781	1,169	539	435	417	430	430	417	8,148	
Below Normal	404	280	307	811	1,152	1,007	419	430	417	430	430	417	6,504	
Dry	403	280	306	765	1,207	768	398	377	365	376	376	365	5,986	
All Years	421	303	861	3,207	6,024	4,815	2,344	455	407	419	419	407	20,082	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	1	80	3,460	17,197	25,928	16,711	8,598	307	30	12	4	2	72,329	
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023	
Normal	1	29	1,356	1,501	3,053	1,586	284	65	9	2	0	0	7,886	
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161	
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457	
All Years	3	41	1,298	5,145	8,254	5,069	2,061	107	14	4	1	1	21,999	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Program minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	-1,389	-6,536	-4,472	-530	51	298	387	417	425	415	-10,259	
Above Normal	425	258	-717	-4,073	-7,080	-1,585	402	327	396	423	428	417	-10,380	
Normal	429	275	-598	-464	-1,272	-417	255	370	408	428	430	417	261	
Below Normal	403	258	229	625	811	596	345	389	411	429	430	417	5,343	
Dry	402	274	263	730	978	698	349	354	364	376	376	365	5,529	
All Years	418	262	-438	-1,938	-2,230	-254	283	348	393	415	418	407	-1,916	

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the alternative and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Flows below this diversion have been estimated and noted as the flow above the Alameda and San Antonio confluence. Table 2.6-10 illustrates the flow at this location for the alternative and WSIP settings. Table 2.6-11 provides the same form of information for the alternative and base settings. The flows identified at this location indicate flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, less the water assumed to be recaptured (diverted) by the SFPUC from the creek.

Table 2.6-10

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	2,462	12,007	22,980	17,283	9,299	556	76	33	15	9	64,881
Above Normal	19	150	1,091	3,446	5,586	5,579	2,115	217	54	20	9	6	18,295
Normal	7	64	883	869	1,614	1,095	469	134	28	9	4	3	5,178
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	934	3,330	6,164	4,912	2,396	208	38	14	7	4	18,104

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,180	13,611	25,828	17,847	9,299	498	76	33	15	9	70,558
Above Normal	19	150	1,308	4,448	9,137	6,913	2,180	217	54	20	9	6	24,462
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,127	3,859	7,499	5,332	2,409	197	38	14	7	4	20,583

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-718	-1,604	-2,848	-563	0	58	0	0	0	0	-5,676
Above Normal	0	0	-216	-1,001	-3,551	-1,333	-65	0	0	0	0	0	-6,167
Normal	0	0	-39	-44	-223	-174	0	0	0	0	0	0	-480
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-193	-529	-1,335	-420	-14	11	0	0	0	0	-2,480

Table 2.6-11

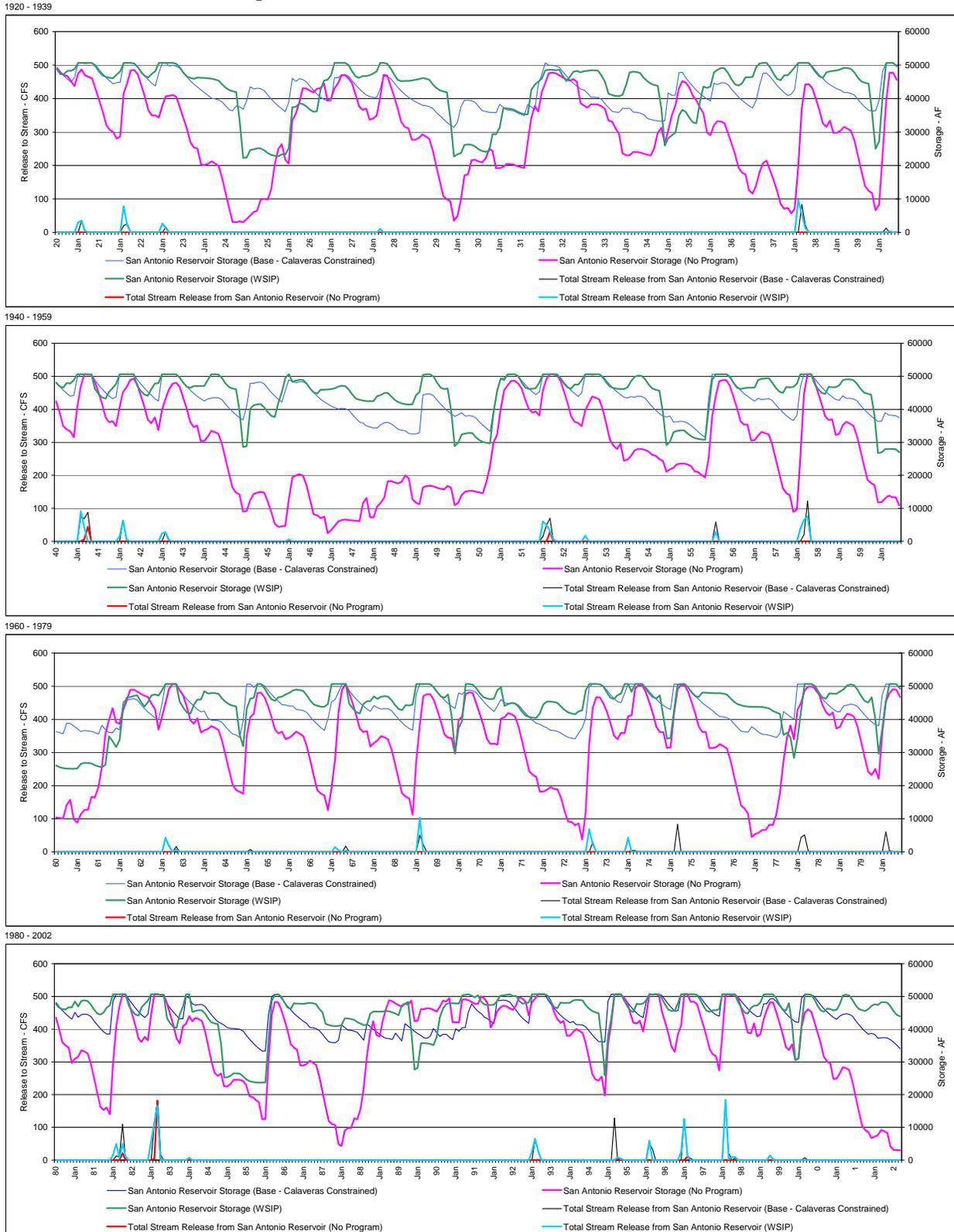
Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	2,462	12,007	22,980	17,283	9,299	556	76	33	15	9	64,881
Above Normal	19	150	1,091	3,446	5,586	5,579	2,115	217	54	20	9	6	18,295
Normal	7	64	883	869	1,614	1,095	469	134	28	9	4	3	5,178
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	934	3,330	6,164	4,912	2,396	208	38	14	7	4	18,104

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-1,506	-6,661	-4,712	-694	-59	43	0	0	0	0	-13,589
Above Normal	0	0	-889	-4,372	-7,474	-1,887	253	0	0	0	0	0	-14,369
Normal	0	0	-793	-1,012	-1,997	-912	-10	0	0	0	0	0	-4,724
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-633	-2,404	-2,858	-705	39	8	0	0	0	0	-6,552

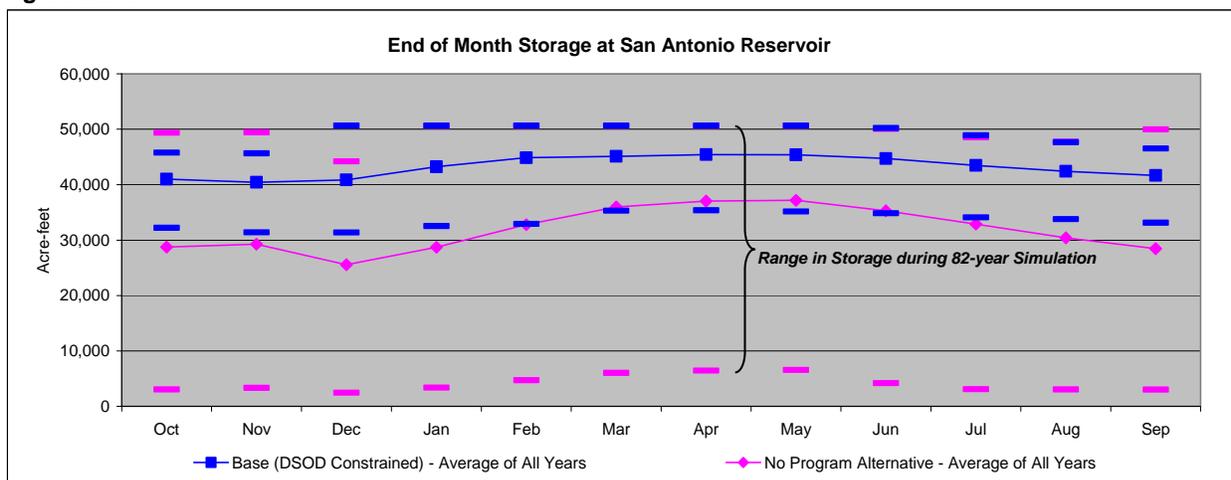
Compared to the WSIP setting, San Antonio Reservoir operations in the alternative setting generally mirror the trend of differences experienced for Calaveras Reservoir operations. Figure 2.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from San Antonio Dam. Shown in Figure 2.6-3 are the results for the WSIP, alternative, and base settings. Similar to the difference in Calaveras Reservoir storage between the alternative and WSIP settings, the difference in San Antonio Reservoir storage between the settings is mostly caused by the interaction of the increased demand served by the system's resources (300 mgd for the variant and a net 290-mgd demand for the WSIP form many years) and the difference in conveyance capacity of the SJPL. Mirroring the Calaveras Reservoir effect, the systematic decrease in reservoir storage in most years is due to the additional demand drawing more water from the Bay Area reservoirs during the summer when the SJPL is operating at maximum capacity. The relative draw down of San Antonio Reservoir storage and Calaveras Reservoir storage is a matter of discretion to a degree. However, operational strategy would draw storage more quickly from San Antonio Reservoir, recognizing that San Antonio Reservoir can be replenished not only from its own watershed but also from diversions from the SJPL and Calaveras Reservoir. Modeling reflects this strategy.

Figure 2.6-3
San Antonio Reservoir Storage and Stream Release



The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras leads to a different operation at San Antonio Reservoir, one that retains relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the alternative and WSIP settings and the base setting due to assumed maintenance. Assumed systematic maintenance of Hetch Hetchy conveyance facilities constrains diversions to the Bay Area from Hetch Hetchy every fifth year in the WSIP setting. In the alternative setting, maintenance occurs, in a different fashion, every year. The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by drawing additional water from the Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the alternative and WSIP settings. Figure 2.6-4 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 2.6-4



Very little change in stream releases below San Antonio Reservoir is anticipated between the alternative and WSIP settings. Table 2.6-12 illustrates the modeled release to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a lower reservoir operation at times during the winter, as seen in Figure 2.6-4, an increase in the ability to regulate reservoir inflow and avoid stream releases is expected. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that would occur in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the alternative and base setting are shown in Table 2.6-13. The differences between the two settings reflect a general decrease in modeled releases. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 2.6-3. In some circumstances, the base setting storage at San Antonio Reservoir during a period could be higher than projected for the alternative setting during the same period. This circumstance could lead to an occasionally greater modeled release for the base setting, which would be reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 2.6-14 illustrates the flow below the confluence for the alternative and WSIP settings, and the differences in flow between the two.

Table 2.6-12

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													No Program	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	0	50	829	253	0	0	0	0	0	1,132	
Above Normal	0	0	0	0	0	2	0	25	0	0	0	0	27	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	0	10	162	49	5	0	0	0	0	226	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	95	1,054	3,168	1,543	605	121	0	0	0	0	6,586	
Above Normal	0	0	0	540	1,045	277	67	44	0	0	0	0	1,974	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	366	132	33	0	0	0	0	1,724	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													No Program minus WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	-95	-1,054	-3,119	-714	-352	-121	0	0	0	0	-5,455	
Above Normal	0	0	0	-540	-1,045	-275	-67	-20	0	0	0	0	-1,947	
Normal	0	0	0	-113	0	-40	0	0	0	0	0	0	-152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-19	-340	-825	-204	-83	-28	0	0	0	0	-1,498	

Table 2.6-13

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													No Program	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	0	50	829	253	0	0	0	0	0	1,132	
Above Normal	0	0	0	0	0	2	0	25	0	0	0	0	27	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	0	10	162	49	5	0	0	0	0	226	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													No Program minus Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	-538	-2,300	-1,652	-1,070	-88	0	0	0	0	-5,648	
Above Normal	0	0	0	0	-881	-882	-12	-34	0	0	0	0	-1,808	
Normal	0	0	0	0	-1	0	0	0	0	0	0	0	-1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	-105	-632	-505	-211	-24	0	0	0	0	-1,477	

Table 2.6-14

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													No Program	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	2,462	12,007	23,030	18,112	9,552	556	76	33	15	9	66,013	
Above Normal	19	150	1,091	3,446	5,586	5,581	2,115	242	54	20	9	6	18,321	
Normal	7	64	883	869	1,614	1,095	469	134	28	9	4	3	5,178	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	934	3,330	6,174	5,074	2,445	213	38	14	7	4	18,330	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	6	154	3,276	14,666	28,996	19,390	9,903	619	76	33	15	9	77,144	
Above Normal	19	150	1,308	4,987	10,182	7,190	2,248	262	54	20	9	6	26,435	
Normal	7	64	922	1,026	1,837	1,308	469	134	28	9	4	3	5,810	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,145	4,199	8,334	5,698	2,541	229	38	14	7	4	22,307	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													No Program minus WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	-814	-2,659	-5,967	-1,278	-352	-63	0	0	0	0	-11,131	
Above Normal	0	0	-216	-1,541	-4,596	-1,609	-133	-20	0	0	0	0	-8,114	
Normal	0	0	-39	-157	-223	-213	0	0	0	0	0	0	-632	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-211	-869	-2,160	-624	-96	-16	0	0	0	0	-3,977	

Table 2.6-15 illustrates the same information in comparing the alternative and base settings. Table 2.6-14 illustrates the modeled differences in flow that occur between the alternative and WSIP settings that are predominantly affected by the greater draw down of East Bay reservoirs in the alternative setting, while Table 2.6-15 illustrates the relatively larger differences in flow that could occur between the alternative and base settings. Those differences are particularly due to the combined effects of the restoration of Calaveras Reservoir operating capacity and the additional East Bay reservoir storage space available in the alternative setting.

Table 2.6-15

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													No Program	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	6	154	2,462	12,007	23,030	18,112	9,552	556	76	33	15	9	66,013	
Above Normal	19	150	1,091	3,446	5,586	5,581	2,115	242	54	20	9	6	18,321	
Normal	7	64	883	869	1,614	1,095	469	134	28	9	4	3	5,178	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	934	3,330	6,174	5,074	2,445	213	38	14	7	4	18,330	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250	
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498	
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													No Program minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug			
Wet	0	0	-1,506	-7,199	-7,012	-2,346	-1,129	-45	0	0	0	0	-19,237	
Above Normal	0	0	-889	-4,372	-8,354	-2,769	241	-34	0	0	0	0	-16,177	
Normal	0	0	-793	-1,012	-1,998	-912	-10	0	0	0	0	0	-4,724	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-633	-2,509	-3,490	-1,210	-172	-16	0	0	0	0	-8,029	

2.7 Crystal Springs and San Andreas Reservoirs

There are differences in Crystal Springs Reservoir operations between the alternative and WSIP settings. Figure 2.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown are the results for the WSIP, alternative, and base settings. Fundamental to the difference in storage operations between the WSIP setting and the alternative and base settings is the restoration of reservoir operation capacity in the WSIP setting, which does not occur in the alternative and base settings.⁴ The result is the operation of Crystal Springs Reservoir at a lower maximum storage in the alternative and base settings. A second difference in Crystal Springs Reservoir storage between the alternative and WSIP setting is caused by the interaction of the increased demand served by the system's resources (300 mgd for the alternative and a net 290-mgd demand for the WSIP in many years) and the lesser conveyance capacity of the SJPL and Bay Division Pipelines (BDPLs). Generally, the systematic decrease in reservoir storage is due to the additional demand drawing more water from the Bay Area system reservoirs during the spring and summer when the SJPL is operating at maximum capacity. A portion of this additional draw is focused on Crystal Springs Reservoir. Subsequent to this additional draw of storage, Hetch Hetchy would attempt to replenish the Bay Area system reservoirs. However, there are modeled circumstances when the coincidence of SJPL or BDPL capacity constraints would inhibit the ability to replenish Crystal Springs Reservoir storage. During these periods, Crystal Springs Reservoir storage would be lower in the alternative setting than in the WSIP setting. The magnitude of the additional draw of storage from Crystal Springs Reservoir is partially dependent on modeling assumptions that proportion the use of storage among the Bay Area system reservoirs. In actual operations, some of the differences in result may not occur as system operators and prevailing hydraulic and hydrologic conditions may direct the operational effect of the different demand to an alternative apportionment of effect among the reservoirs. However, operation strategy prefers the retention of storage in the Peninsula Reservoirs, similar to the strategy used by the model. Figure 2.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and WSIP settings.

⁴ The Lower Crystal Springs Dam Improvements project is included in the alternative, but was not modeled. With the project included in the alternative the hydrologic effects at Crystal Springs Reservoir would be comparable to the WSIP setting.

Figure 2.7-1
Crystal Springs Reservoir Storage and Release

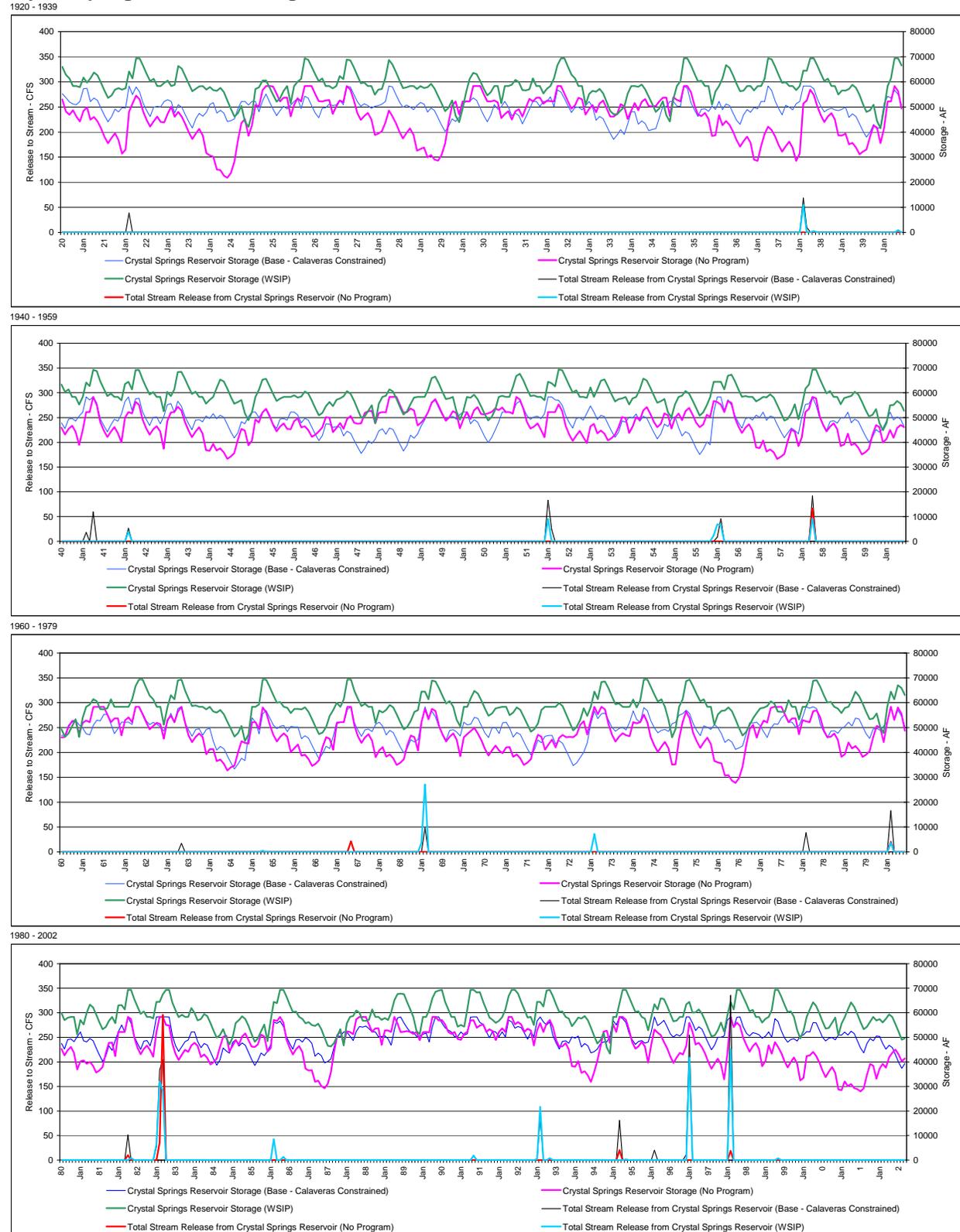


Figure 2.7-2

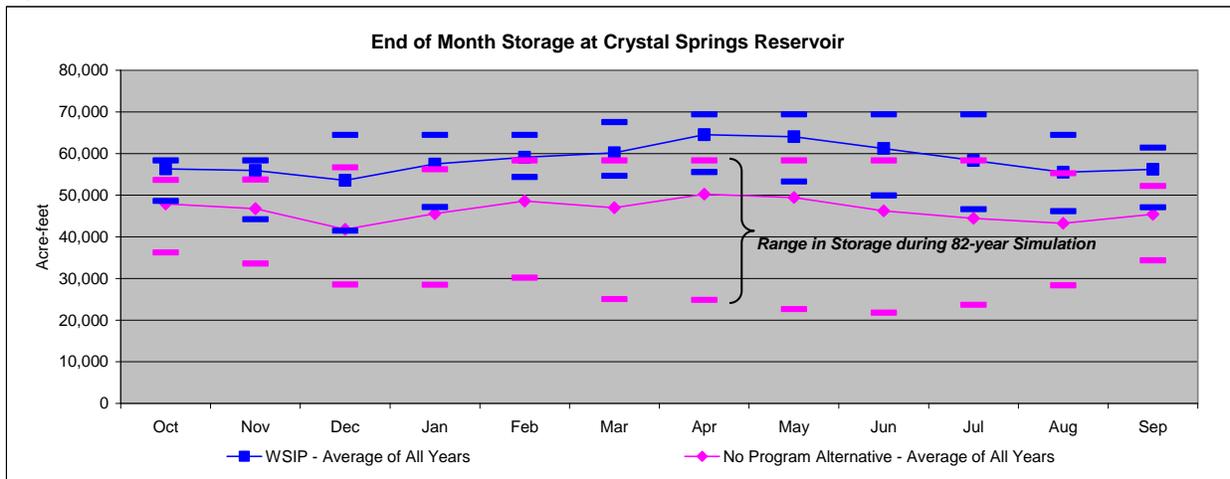


Figure 2.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. The alternative setting would result in reservoir storage operating at a lower average storage than the base setting, and the range of operating storage would have a lower expected minimum in the alternative setting.

Figure 2.7-3

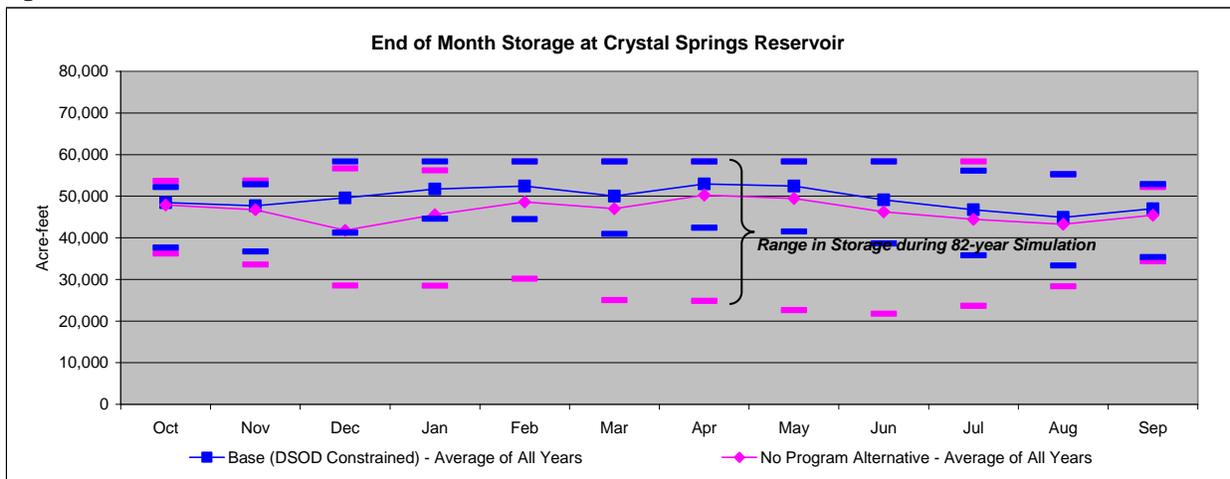


Table 2.7-1 illustrates the modeled alternative and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that, during a month in a year, either an increase or decrease in the occasional release could occur. The potential difference is attributed to whether the different resulting storage in the reservoir was higher or lower within the operating range of the two settings. Part of the difference in modeled Crystal Springs Reservoir storage is due to modeling assumptions for the proportionate balancing of storage among the Bay Area reservoirs, and the coincidence of assumed system-wide maintenance with less than favorable hydrologic conditions. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting, with the effect that essentially no difference would occur between the alternative and WSIP settings. Similarly, Table 2.7-2 illustrates the stream releases for the alternative and base settings, and the difference in modeled flows between the two settings. A greater draw down in Crystal Springs Reservoir storage would lead to an increased potential to regulate reservoir inflow, which would lead to less risk in needing to make stream releases. However, as described above, actual system operations would attempt to minimize releases under any setting; thus, the difference in releases between the alternative and base setting would be minimal, if any.

Table 2.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	0	0	0	0	256	1,212	283	81	0	0	0	0	1,832
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	50	236	55	16	0	0	0	0	358

Total Stream Release from Crystal Springs Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	No Program Sep	WY Total
Wet	0	0	47	1,296	2,512	542	170	54	0	0	0	0	4,623
Above Normal	0	0	0	8	354	0	8	42	0	0	0	0	412
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	33	0	0	0	0	33
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	254	564	106	35	26	0	0	0	0	994

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	No Program minus WSIP Sep	WY Total
Wet	0	0	-47	-1,296	-2,256	670	113	27	0	0	0	0	-2,790
Above Normal	0	0	0	-8	-354	0	-8	-42	0	0	0	0	-412
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	-33	0	0	0	0	-33
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-9	-254	-514	131	20	-10	0	0	0	0	-637

Table 2.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	No Program Sep	WY Total
Wet	0	0	0	0	256	1,212	283	81	0	0	0	0	1,832
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	50	236	55	16	0	0	0	0	358

Total Stream Release from Crystal Springs Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Base - Calaveras Constrained Sep	WY Total
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	6,336
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	671
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	9	280	690	221	147	29	0	0	0	0	1,375

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	No Program minus Base - Calaveras Constrained Sep	WY Total
Wet	0	0	-44	-1,433	-2,632	78	-473	1	0	0	0	0	-4,504
Above Normal	0	0	0	0	-608	0	0	-63	0	0	0	0	-671
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-9	-280	-640	15	-92	-13	0	0	0	0	-1,018

Reservoir storage at San Andreas Reservoir would follow a systematic filling and lowering each year; however, there would be a difference in draw down between the alternative and WSIP settings, primarily due to the effects of different system-wide maintenance within each setting. Figure 2.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from San Andreas Dam. Shown in Figure 2.7-4 are the results for the WSIP, alternative, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Compared to the base setting, Figure 2.7-4 illustrates the difference in storage operation every fifth year for the WSIP setting and every year for the alternative setting. These operations are the result of Hetch Hetchy conveyance maintenance, which is assumed to occur systematically in the alternative and WSIP settings. The maintenance constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy Water Treatment Plant (Harry Tracy WTP) associated with the WSIP or the alternative exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be same among all of the settings. The additional water demand of the WSIP and alternative require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir.

Figure 2.7-4
San Andreas Reservoir Storage and Stream Release

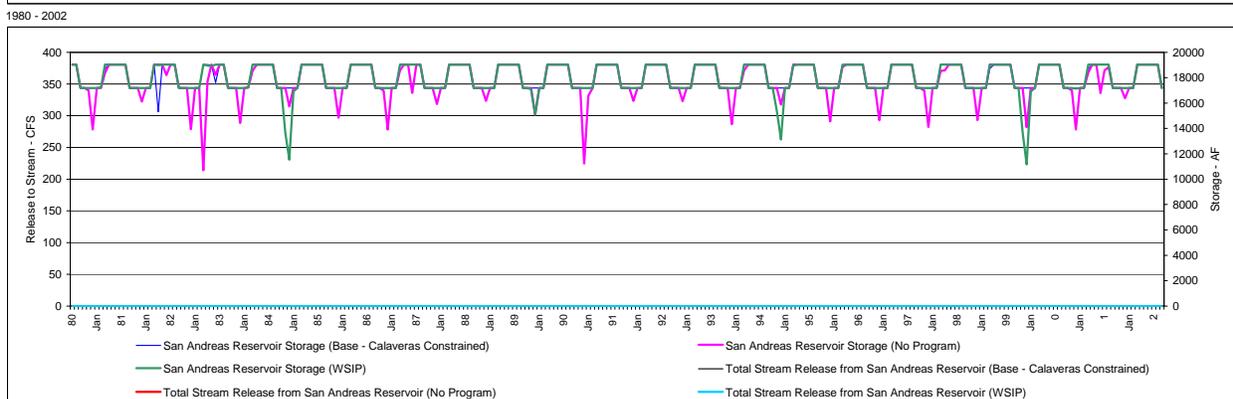
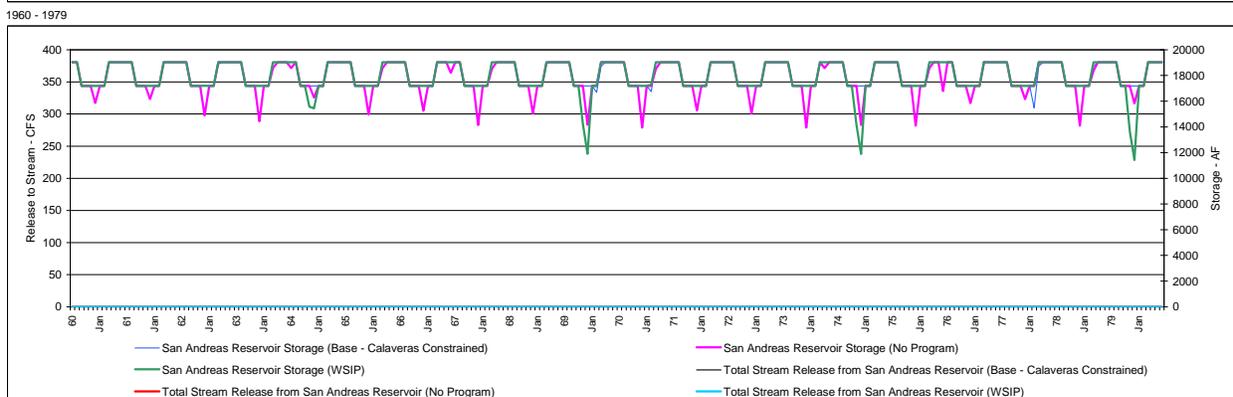
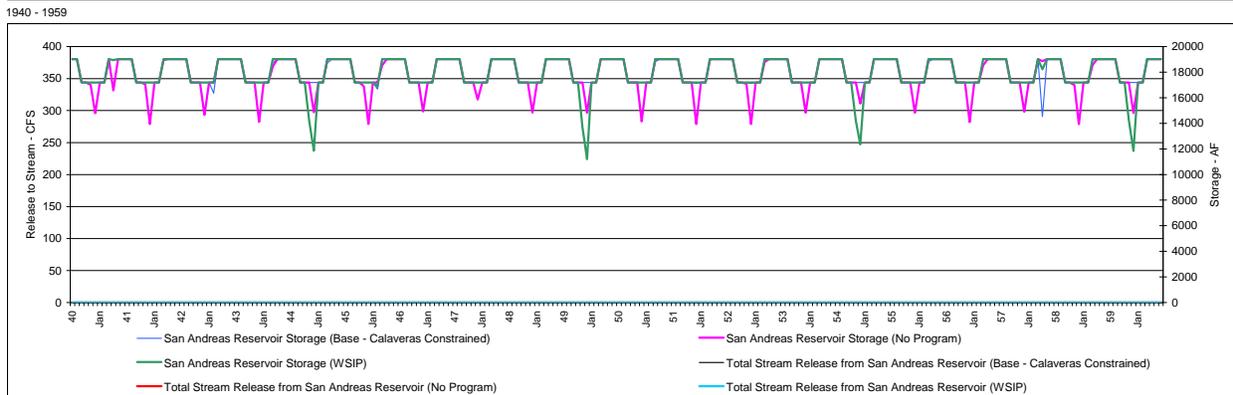
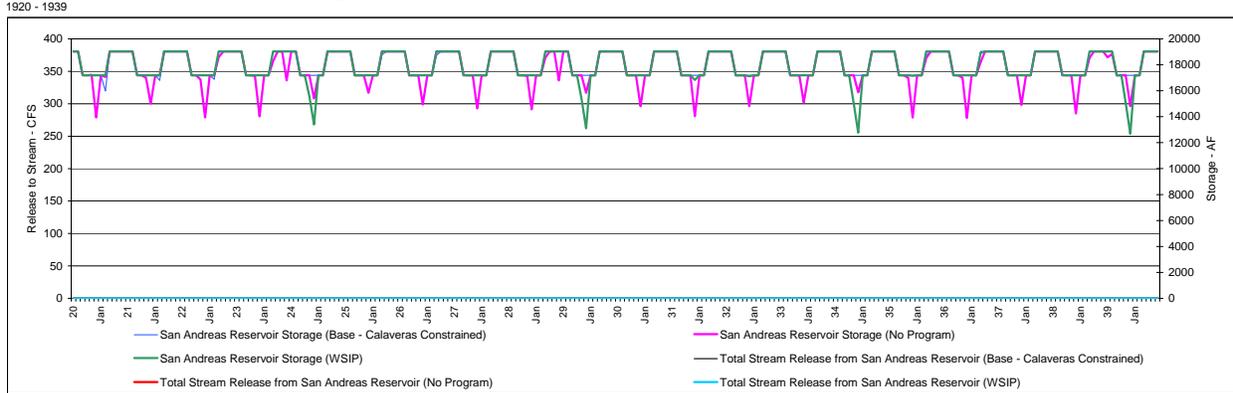
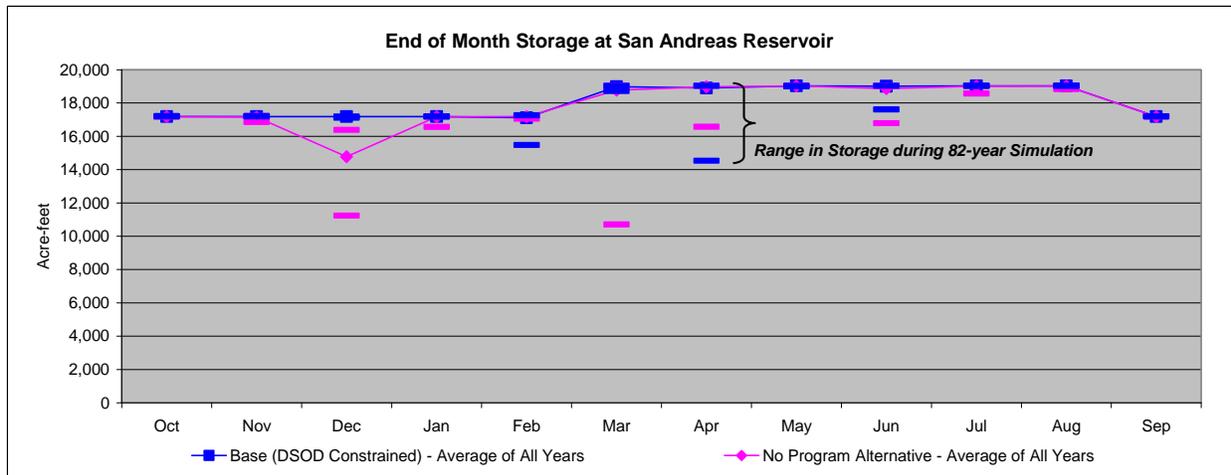


Figure 2.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 2.7-5



2.8 Pilarcitos Reservoir

Coastside County Water District's (Coastside CWD's) water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. With the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated at about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request and the resultant potential changes to the operation of SFPUC facilities and their affected environs are unknown.⁵

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs have been identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

In the No-program setting, Coastside CWD would increase its purchase request to the same level as that of the WSIP setting. Due to an increase in the frequency of system-wide delivery shortages in the alternative setting, less water would be delivered to Coastside CWD; thus, a slight lessening of hydrologic effects would occur with the alternative as compared to the WSIP.

⁵ See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

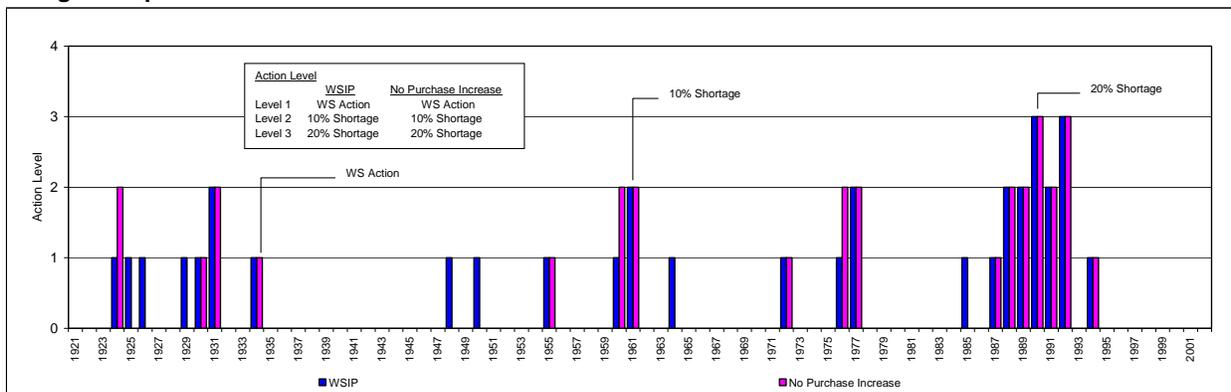
3. CEQA Alternative 2 – No Purchase Request Increase

CEQA Alternative 2 – No Purchase Request Increase Alternative (No Purchase Increase) would limit the SFPUC’s wholesale customers’ future purchases to the terms of the existing Master Water Sales Agreement. Under that agreement, the wholesale customers may purchase up to 184 mgd on an average annual basis, subject to reductions in the event of a drought, water shortage, earthquake, other natural disaster, or rehabilitation and maintenance of the system. Under the alternative, the customer purchase requests for 2030 would be 184 mgd for the wholesale customers instead of 209 mgd. It is assumed that the total customer purchase requests to be served by the regional system by 2030 would be 275 mgd, consisting of 184 mgd for the wholesale customers and 91 mgd for the retail customers. The increased water demand would be served through additional Tuolumne River diversions, increased use of local watershed supplies from restoration of Calaveras Reservoir, and 10 mgd from recycled water, groundwater, and conservation projects in San Francisco (RRGWC). Supplemental supplies would include implementation of the Westside Basin Groundwater Program and a water transfer with the TID/MID similar to the proposed program. Compared to the WSIP setting, the only project not included is the Lower Crystal Springs Dam improvement project (PN-4).⁶

3.1 Water Deliveries and Drought Response Actions

Compared to the WSIP setting, the regional system’s resources are required to serve a net 265-mgd demand (275 mgd purchase request minus 10 mgd of RRGWC) instead of a net 290-mgd demand. As part of the formulation of this alternative, the water transfer from MID/TID was sized to provide the same frequency and severity of water shortages (percentage-wise) for the alternative as that of the WSIP setting during the Design Drought (although system-wide water deliveries are a net 265 mgd in the alternative setting as compared to the WSIP setting delivery of a net 290 mgd). This objective required the water transfer to be sized at 1,500 acre-feet per year. With a water supply formulated about comparable to that provided for the WSIP setting, only proportionately smaller for a lesser demand, the implementation of rationing and the severity of rationing from the SFPUC system during drought periods would be about the same. However, this result does not speak to the regional shortage of water that would occur by the SFPUC system not supplying the full purchase request of 300 mgd. Although the results indicate that SFPUC customers would experience essentially the same shortages in supply from the SFPUC system in the future as they currently experience, the ability of SFPUC customers to cope with these projected shortages in the future may be less depending on the resources and measures implemented by the customers to fill in the gap between their 300-mgd purchase request and the purchase request served in this alternative (275 mgd). Table 1-1 illustrates the comparison of the drought response actions for the proposed program and the alternative. Figure 3.1-1 illustrates the occurrence of drought response actions for the simulated 82-year historical period (1921-2002).

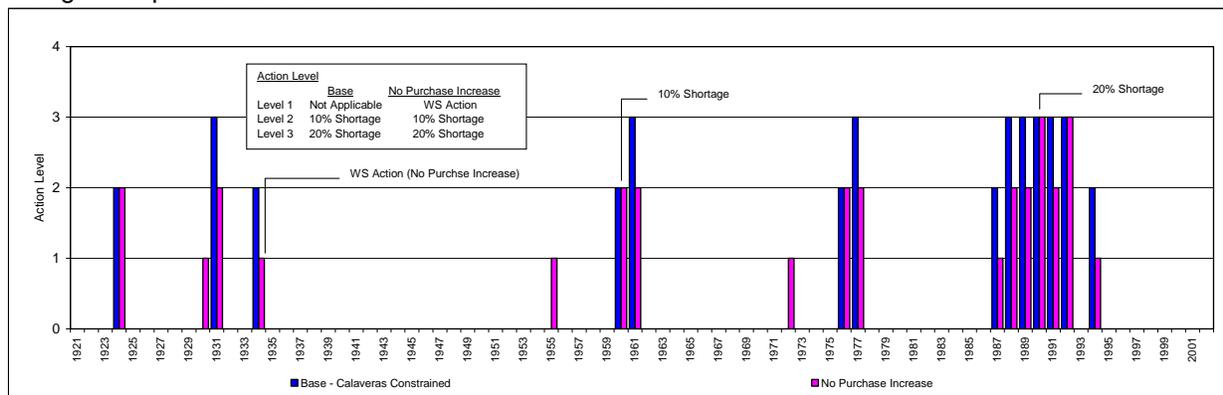
**Figure 3.1-1
Drought Response Actions – WSIP and No Purchase Increase**



⁶ The Lower Crystal Springs Dam Improvements project is also included in the alternative but was not included in the HH/LSM modeling.

In Figure 3.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In both settings, the water supply action is the use of the Westside Groundwater Basin Program to supplement SFPUC water deliveries. Also occurring in both settings is the water transfer supplemental supply from MID/TID. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers. Although SFPUC customers would experience the same frequency and severity of shortages (percentage-wise) during the Design Drought in both settings, the frequency of shortage in other drought periods would slightly increase in the alternative setting. The triggering of the Westside Basin Groundwater Program supplemental supply would occur more frequently in the WSIP setting. Both of these differences are an outcome of a slightly different interaction between differing available supplies and demands. The same form of information is shown in Figure 3.1-2 in comparing the alternative and the “Base - Calaveras Constrained” (existing) settings. There is no level 1 action level in the base setting. Without supplemental resources, the existing system only has delivery shortage measures available to cope with drought. In the base setting, the shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the alternative and the base settings for these action levels, and they are applied to the same level of net water demand (265 mgd). During this simulation period, rationing above 20 percent is not required in either setting; however, in the alternative setting, the occurrence of additional water supplies lessens the frequency and severity of water delivery shortages.

Figure 3.1-2
Drought Response Actions – Base and No Purchase Increase



Not illustrated in Figure 3.1-2 but shown in Table 1-1 are the delivery shortages anticipated during the entire SFPUC Design Drought. During the Design Drought, the base setting does not have a viable operation without exceeding a 20-percent shortage level. The base setting exceeds the 20-percent shortage level (requires 25 percent rationing) during the last 18 months of the Design Drought. The alternative would viably provide deliveries without exceeding a 20-percent shortage level.

The difference in water deliveries between the proposed program and the alternative is shown chronologically for the 82-year simulation in Table 3.1-1. Less water would be delivered to the region by the SFPUC in all years, a result of serving a lesser purchase request (275 mgd instead of 300 mgd, and a lesser net demand 265 mgd instead of 290 mgd). The difference would have to be met from non-SFPUC system water supplies and measures. Comparing the alternative setting to the base setting, Table 3.1-2 illustrates the difference in water deliveries between the two settings. The increases in deliveries in the alternative setting occur due to an improvement in water delivery reliability, which reduces the severity of water shortages. The results also indicate periods in which additional deliveries occur to replenish the Westside Basin Groundwater Program. The occasional reductions in deliveries indicate periods when the Westside Basin Groundwater Program is offsetting SFPUC demands during a level 1 action circumstance. The 265-mgd net demand is being served during these periods; however, the regional system experiences a reduction in delivery associated with the Westside Basin Groundwater Program offsetting demands. The shifting in the pattern of deliveries (evident during years when there is no increase in total annual delivery) indicates the anticipated seasonal effect of RRGWC within the pattern of the projected future, albeit limited, purchase request.

Table 3.1-1

Difference in Total System-wide Delivery (MG)													No Purchase Increase minus WSP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1922	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1923	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1924	-801	-620	-508	-433	-479	-637	-745	-900	-984	-2,291	-2,216	-1,888	-12,502	-9,124
1925	-1,624	-1,207	-931	-751	-897	-1,303	-1,596	-1,929	-2,132	-543	-538	-453	-13,903	-18,764
1926	-352	-201	-100	-51	-100	-213	-309	-455	-531	-767	-762	-669	-4,510	-3,845
1927	-576	-418	-324	-275	-302	-438	-526	-679	-748	-1,298	-1,260	-1,124	-7,968	-6,485
1928	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-1,298	-1,260	-1,124	-11,763	-11,763
1929	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-767	-762	-669	-10,280	-11,763
1930	-576	-418	-324	-275	-302	-438	-526	-679	-748	-1,074	-1,036	-907	-7,303	-6,485
1931	-801	-620	-508	-433	-479	-637	-745	-901	-984	-940	-906	-806	-8,759	-9,124
1932	-720	-577	-485	-426	-448	-589	-667	-796	-861	-1,074	-1,036	-907	-8,586	-8,220
1933	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1934	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1935	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1936	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,298	-1,260	-1,124	-9,789	-9,124
1937	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-1,298	-1,260	-1,124	-11,763	-11,763
1938	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-1,074	-1,036	-907	-11,098	-11,763
1939	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1940	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1941	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1942	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1943	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1944	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1945	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1946	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1947	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1948	-801	-620	-508	-433	-479	-637	-745	-900	-984	-767	-762	-669	-8,306	-9,124
1949	-576	-418	-324	-275	-302	-438	-526	-679	-748	-1,298	-1,260	-1,124	-7,968	-6,485
1950	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-767	-762	-669	-10,280	-11,763
1951	-576	-418	-324	-275	-302	-438	-526	-679	-748	-1,298	-1,260	-1,124	-7,968	-6,485
1952	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-1,074	-1,036	-907	-11,098	-11,763
1953	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1954	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1955	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1956	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-8,671	-8,671
1957	-801	-620	-508	-433	-479	-637	-745	-1,125	-1,201	-1,074	-1,036	-907	-9,565	-9,565
1958	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1959	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1960	-801	-620	-508	-433	-479	-637	-745	-900	-984	-2,291	-2,216	-1,888	-12,502	-9,124
1961	-1,624	-1,207	-931	-751	-897	-1,303	-1,596	-1,929	-2,132	-940	-906	-806	-15,021	-18,764
1962	-720	-577	-485	-426	-448	-589	-667	-796	-861	-1,074	-1,036	-907	-8,586	-8,220
1963	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1964	-801	-620	-508	-433	-479	-637	-745	-901	-984	-767	-762	-669	-8,306	-9,124
1965	-576	-418	-324	-275	-302	-438	-526	-679	-748	-1,298	-1,260	-1,124	-7,968	-6,485
1966	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-1,074	-1,036	-907	-11,098	-11,763
1967	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1968	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1969	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1970	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1971	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1972	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1973	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-8,671	-8,671
1974	-801	-620	-508	-433	-479	-637	-745	-1,125	-1,201	-1,074	-1,036	-907	-9,565	-9,565
1975	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1976	-801	-620	-508	-433	-479	-637	-745	-900	-984	-2,291	-2,216	-1,888	-12,502	-9,124
1977	-1,624	-1,207	-931	-751	-897	-1,303	-1,596	-1,929	-2,132	-940	-906	-806	-15,021	-18,764
1978	-720	-577	-485	-426	-448	-589	-667	-796	-861	-1,074	-1,036	-907	-8,586	-8,220
1979	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1980	-801	-620	-508	-433	-479	-637	-745	-1,125	-1,201	-1,074	-1,036	-907	-9,565	-9,565
1981	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1982	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1983	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1984	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
1985	-801	-620	-508	-433	-479	-637	-745	-900	-984	-767	-762	-669	-8,306	-9,124
1986	-576	-418	-324	-275	-302	-438	-526	-679	-748	-1,298	-1,260	-1,124	-7,968	-6,485
1987	-1,025	-837	-732	-657	-682	-861	-962	-1,125	-1,201	-1,074	-1,036	-907	-11,098	-11,763
1988	-801	-620	-508	-433	-479	-637	-745	-901	-984	-940	-906	-806	-8,759	-9,124
1989	-720	-577	-485	-426	-448	-589	-667	-796	-861	-940	-906	-806	-8,220	-8,220
1990	-720	-577	-485	-426	-448	-589	-667	-796	-861	-832	-808	-708	-7,918	-8,220
1991	-643	-512	-430	-381	-406	-522	-598	-705	-760	-940	-906	-806	-7,808	-7,306
1992	-720	-577	-485	-426	-448	-589	-667	-796	-861	-832	-808	-708	-7,918	-8,220
1993	-643	-512	-430	-381	-406	-522	-598	-705	-760	-1,074	-1,036	-907	-7,973	-7,306
1994	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1995	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1996	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1997	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1998	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
1999	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
2000	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
2001	-801	-620	-508	-433	-479	-637	-745	-901	-984	-1,074	-1,036	-907	-9,124	-9,124
2002	-801	-620	-508	-433	-479	-637	-745	-900	-984	-1,074	-1,036	-907	-9,124	-9,124
Avg (21-02)	-821	-637	-523	-449	-492	-657	-766	-934	-988	-1,095	-1,060	-929	-9,352	-9,352

Table 3.1-2

Difference in Total System-wide Delivery (MG)													No Purchase Increase minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	234	208	178	165	-42	-28	-18	6	24	71	59	33	890	1,555
1922	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1923	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1924	9	-9	-47	-59	-42	-28	-18	6	24	-250	-228	-217	-858	0
1925	-221	-211	-221	-214	-205	-224	-231	-216	-1,360	296	283	250	-2,274	-3,797
1926	234	208	178	165	161	196	199	230	241	71	59	33	1,975	2,640
1927	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1928	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1929	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1930	9	-9	-47	-59	-42	-28	-18	6	24	-235	-216	-205	-818	0
1931	-215	-211	-230	-217	-219	-227	-237	-216	-212	763	766	667	212	-2,639
1932	603	480	406	363	381	521	593	703	750	296	283	250	5,629	6,996
1933	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
1934	234	208	178	165	161	196	199	230	241	967	951	765	4,494	2,640
1935	602	376	202	103	213	442	620	813	-212	296	283	250	3,989	5,843
1936	234	208	178	165	161	196	199	230	241	71	59	33	1,975	2,640
1937	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1938	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1939	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1940	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1941	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1942	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1943	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1944	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1945	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1946	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1947	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1948	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1949	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1950	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1951	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1952	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1953	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1954	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1955	9	-9	-47	-59	-42	-28	-18	6	24	-235	-216	-205	-818	0
1956	-215	-211	-230	-217	-219	-227	-237	-216	241	296	283	250	-702	-2,186
1957	234	208	178	165	161	196	199	6	24	71	59	33	1,534	2,199
1958	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1959	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1960	9	-9	-47	-59	-42	-28	-18	6	24	-250	-228	-217	-858	0
1961	-221	-211	-221	-214	-205	-224	-231	-216	-218	763	766	667	235	-2,656
1962	603	480	406	363	381	521	593	703	750	296	283	250	5,629	6,996
1963	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
1964	234	208	178	165	161	196	199	230	241	71	59	33	1,975	2,640
1965	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1966	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1967	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1968	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1969	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1970	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1971	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1972	9	-9	-47	-59	-42	-28	-18	6	24	-235	-216	-205	-818	0
1973	-215	-211	-230	-217	-219	-227	-237	-216	241	296	283	250	-702	-2,186
1974	234	208	178	165	161	196	199	6	24	71	59	33	1,534	2,199
1975	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1976	9	-9	-47	-59	-42	-28	-18	6	24	-250	-228	-217	-858	0
1977	-221	-211	-221	-214	-205	-224	-231	-216	-218	763	766	667	235	-2,656
1978	603	480	406	363	381	521	593	703	241	296	283	250	5,120	6,487
1979	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
1980	234	208	178	165	161	196	199	6	24	71	59	33	1,534	2,199
1981	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1982	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1983	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1984	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1985	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1986	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
1987	9	-9	-47	-59	-42	-28	-18	6	24	967	951	765	2,520	0
1988	602	376	202	103	213	442	620	813	930	763	766	667	6,498	6,985
1989	603	480	406	363	381	521	593	703	750	763	766	667	6,996	6,996
1990	603	480	406	363	381	521	593	703	750	-254	-237	-214	4,096	6,996
1991	-221	-205	-211	-202	-202	-218	-231	-219	-221	763	766	667	266	-2,634
1992	603	480	406	363	381	521	593	703	750	-254	-237	-214	4,096	6,996
1993	-221	-205	-211	-202	-202	-218	-231	-219	-2,332	296	283	250	-3,212	-4,745
1994	234	208	178	165	161	196	199	230	241	967	951	765	4,494	2,640
1995	602	376	202	103	213	442	-237	-216	-212	296	283	250	2,103	3,958
1996	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
1997	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
1998	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
1999	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
2000	234	208	178	165	161	196	199	230	241	296	283	250	2,640	2,640
2001	234	208	178	165	161	196	199	230	241	71	59	33	1,975	2,640
2002	9	-9	-47	-59	-42	-28	-18	6	24	71	59	33	0	0
Avg (21-02)	101	69	28	12	24	57	64	91	61	170	162	127	966	974

3.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin (Tuolumne) is the flow through the San Joaquin Pipeline (SJPL). Inherent to this alternative is a net water demand essentially equal to the base setting, which is less than the demand served by the proposed program. Table 3.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the alternative settings. In both settings, the conveyance capacity of the SJPL is increased compared to the base setting. During the summer, the SJPL would essentially operate at the same maximum rate in both the alternative and WSIP settings to minimize draw down of Bay Area reservoir storage. A few exceptions occur during the summer of drought periods when the alternative is serving a lesser demand than occurs in the WSIP setting. Overall, compared to the WSIP setting, the alternative setting would divert less water from the Tuolumne.

Table 3.2-2 illustrates the difference in diversions to the SJPL between the alternative and base settings. Evident in the operation is the increase in summer diversions associated with an increase in the conveyance capacity of the SJPL. As described above, with the increase in SJPL conveyance capacity, summer diversions would increase to retain storage in the Bay Area reservoirs. With the demand of the alternative approximately the same as the base setting, the increase in summer diversions to the SJPL result in reduced diversions during the late summer and fall. The differences in December diversions are largely the result of maintenance occurring in the alternative setting (lessening available conveyance capacity), which does not occur in the base setting. The increase in diversion during the winter and spring results from the need to replenish Bay Area reservoir storage after the maintenance, and then from the need to top off Bay Area reservoir storage prior to summer. Overall, there would be an increase in average annual diversions to the SJPL in the alternative setting, which is associated with the improvement in water delivery reliability.

The average monthly diversion through the SJPL by year type for the 82-year simulation for the proposed program and the alternative settings, and the difference between the two settings, is illustrated in Table 3.2-3. Table 3.2-4 illustrates the same information for the alternative and base settings.

Table 3.2-1

Difference in Total SJPL (Acre-feet)				No Purchase Increase minus WSIP											
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
1921	-952	-1,841	0	0	0	-7,611	0	-3,140	-3,038	0	0	-2,118	-18,700	-22,106	
1922	-5,233	-2,762	-1,142	-2,854	0	0	-8,286	-3,996	-3,867	0	0	0	-2,118	-30,258	
1923	-952	-1,841	0	0	0	-6,755	-4,880	-3,140	-3,038	0	0	0	-2,578	-23,184	
1924	-3,901	-2,762	0	-3,805	-3,437	0	0	0	0	-1,237	-1,237	-9,483	-25,862	-16,483	
1925	-9,799	0	0	0	-3,523	0	-1,197	-6,945	-6,721	0	0	0	-28,185	-40,142	
1926	-3,996	-2,854	0	-6,755	-7,734	-3,901	-3,867	-1,237	-1,197	0	0	0	-3,038	-34,579	
1927	-5,233	-2,762	0	-2,854	0	-4,947	-5,524	-2,664	-2,578	0	0	0	-2,578	-29,140	
1928	-2,854	-2,762	-523	-4,757	-4,296	-4,947	-5,524	-3,140	-3,038	0	0	0	-2,118	-33,959	
1929	-5,233	-2,762	0	-4,757	-4,297	0	0	-1,237	0	0	0	0	-2,118	-21,601	
1930	-5,043	0	0	0	0	0	0	0	0	0	0	0	-4,880	-9,923	
1931	-5,043	-6,537	0	-8,658	-7,820	0	0	-1,237	-1,197	-2,189	-2,189	-9,483	-44,353	-35,372	
1932	-8,562	-2,762	7,326	-476	-6,874	-8,658	-1,197	-6,945	-6,721	0	0	-1,197	-36,066	-48,730	
1933	-856	-2,762	0	-2,854	-2,578	0	0	0	0	0	0	0	-9,050	-10,247	
1934	-3,996	-2,854	-7,611	-6,659	-6,015	-1,047	0	0	0	0	0	0	-3,867	-32,049	
1935	-5,043	0	0	-1,047	-3,523	0	-7,642	-5,043	-4,880	0	0	0	-1,197	-28,375	
1936	-6,945	-5,524	0	-5,709	-859	-8,658	-2,118	-2,189	-2,118	0	0	0	-2,578	-36,698	
1937	-6,660	-4,603	0	-4,757	0	-2,663	-9,206	-3,140	-3,038	0	0	0	-2,578	-36,646	
1938	-3,901	-2,762	0	-6,659	0	0	-9,206	-5,043	-4,880	0	0	0	-2,578	-35,029	
1939	-952	-1,841	952	-3,805	-3,437	-1,047	0	0	0	0	0	0	-3,038	-13,168	
1940	-5,043	0	0	0	-9,452	-12,367	-5,524	-5,043	-4,880	0	0	0	-2,118	-44,427	
1941	-952	-1,841	2,854	0	0	0	0	-2,854	-2,762	0	0	0	0	-5,555	
1942	-3,805	-2,762	0	0	0	-3,805	-7,365	-2,854	-2,762	0	0	0	-1,197	-24,550	
1943	-2,949	-3,682	0	0	0	-7,610	-6,721	-3,140	-3,038	0	0	0	-2,578	-29,718	
1944	-952	-1,841	1,903	-4,757	-4,297	-6,755	0	-2,189	-2,118	0	0	0	-2,118	-23,124	
1945	-3,901	0	0	0	-6,015	-2,949	0	-5,043	-4,880	0	0	0	-1,197	-23,985	
1946	-6,945	-4,603	0	0	0	-5,803	0	-2,664	-2,578	0	0	0	-2,578	-25,171	
1947	-6,660	-4,603	0	-4,757	-4,296	0	0	-1,237	-1,197	0	0	0	-2,578	-25,328	
1948	-5,043	-5,616	0	-6,755	-5,156	0	0	-2,189	-2,118	0	0	0	-2,118	-28,995	
1949	-3,996	-3,775	-952	-4,757	-4,296	-2,854	-1,197	-3,996	-3,867	0	0	0	-2,118	-31,808	
1950	-4,757	0	0	0	-2,664	0	0	0	0	0	0	0	-2,118	-9,539	
1951	-3,996	-13,810	0	0	0	-9,513	-2,578	-3,996	-3,867	0	0	0	-2,118	-39,878	
1952	-2,854	-2,762	-951	0	0	0	-9,207	-5,043	-4,880	0	0	0	-2,578	-28,275	
1953	-952	-1,841	0	0	0	-6,755	-2,118	-3,996	-3,867	0	0	0	-2,118	-21,647	
1954	-2,854	-1,841	1,903	-3,805	-2,578	-6,755	-2,118	-2,664	-2,578	0	0	0	-2,578	-25,408	
1955	-3,901	0	0	0	-2,664	0	0	0	0	0	0	0	-3,867	-10,432	
1956	-5,043	-3,775	0	0	0	-3,805	-3,867	-3,996	-3,867	0	0	0	-1,197	-25,550	
1957	-2,854	-921	0	-3,805	-3,437	-1,047	0	-1,237	-1,197	0	0	0	-2,578	-17,076	
1958	-7,897	-5,524	0	-4,757	0	0	0	-2,949	-2,854	0	0	0	-1,197	-25,178	
1959	-2,854	-1,841	1,903	-3,805	-859	-3,901	0	-1,237	-1,197	0	0	0	-2,578	-16,369	
1960	-6,945	0	0	0	0	0	0	0	0	0	-1,237	-7,642	-15,824	-9,523	
1961	-7,897	-6,537	6,184	-4,376	-9,538	-1,047	-1,197	-6,945	-6,721	-1,237	-2,189	-9,483	-50,963	-46,953	
1962	-9,799	368	475	-3,330	-7,734	-8,658	-1,197	-6,945	-6,721	0	0	-1,197	-44,738	-56,450	
1963	-2,379	-5,524	0	-2,663	0	-6,659	-6,444	-2,854	-2,762	0	0	0	-9,285	-30,482	
1964	-3,996	-1,841	0	-4,756	-4,296	0	0	0	0	0	0	-1,197	-16,086	-14,889	
1965	-3,996	0	0	-5,708	-5,156	-3,901	-9,667	-2,759	-2,670	0	0	0	-2,118	-35,975	
1966	-2,854	-1,841	0	-4,757	-4,297	-2,949	0	0	0	0	0	0	-3,038	-19,736	
1967	-5,043	-6,537	-3,805	0	0	-3,805	-6,445	-2,855	-2,762	0	0	-1,197	-32,449	-34,290	
1968	-3,806	-2,762	0	-2,854	-2,578	0	0	-1,237	-1,197	0	0	0	-2,578	-17,012	
1969	-7,897	-5,524	-1,902	0	0	0	-7,642	-3,140	-3,038	0	0	0	-3,038	-32,181	
1970	-2,854	0	0	-4,757	-4,297	-5,803	0	-1,237	-1,197	0	0	0	-3,038	-23,183	
1971	-4,757	-1,841	0	0	0	-1,047	0	-2,189	-2,118	0	0	0	-2,118	-14,070	
1972	-6,945	-6,537	-2,854	-5,709	-5,156	0	0	0	0	0	0	0	-3,867	-31,068	
1973	-5,043	-6,537	-523	0	0	0	-7,642	-5,043	-4,880	0	0	0	0	-29,668	
1974	-1,902	-921	0	0	0	-5,899	-5,524	-5,043	-4,880	0	0	0	-2,578	-26,747	
1975	0	0	0	0	-6,875	-3,805	-7,365	-3,996	-3,867	0	0	0	-3,038	-28,946	
1976	-1,902	-1,841	0	-2,854	-2,578	0	0	0	0	-2,189	-2,664	-9,483	-23,511	-12,213	
1977	-9,799	-5,616	-4,757	475	-5,156	0	-1,197	-5,043	-4,880	-2,664	3,520	-3,499	-38,616	-50,309	
1978	-2,378	368	6,184	-7,135	-6,874	-8,562	-7,365	-3,901	-3,775	0	0	0	-3,438	-36,081	
1979	-1,902	0	952	-3,805	0	-7,611	0	-2,189	-2,118	0	0	0	-1,197	-17,870	
1980	-6,945	0	0	-7,611	0	-8,562	-3,867	-3,140	-3,038	0	0	0	-3,038	-34,360	
1981	-2,854	-2,762	0	-3,805	-3,437	-2,949	0	-2,189	-2,118	0	0	0	-2,118	-22,232	
1982	-6,660	-4,603	1,903	0	0	-2,663	0	-2,854	-2,762	0	0	0	-1,197	-18,836	
1983	-2,949	-1,841	0	0	0	0	-2,946	-1,902	-1,841	0	0	0	0	-11,479	
1984	-6,945	-2,762	0	0	0	-1,047	0	-2,189	-2,118	0	0	0	-2,118	-17,179	
1985	-5,043	0	0	0	-945	0	0	0	0	0	0	0	-2,118	-8,106	
1986	-3,996	-3,775	0	-6,755	-3,437	-7,610	-8,286	-5,043	-4,880	0	0	0	-2,118	-45,900	
1987	-2,854	-1,841	0	-3,805	-3,437	0	0	0	0	0	0	0	-4,880	-16,817	
1988	-5,043	-3,775	0	-8,658	-6,875	0	0	-1,237	-1,197	-2,189	-2,189	-9,483	-40,646	-31,665	
1989	-4,756	-1,841	0	-2,854	-2,578	-1,047	-1,197	-5,043	-4,880	-2,664	-2,664	-2,762	-32,286	-38,057	
1990	-1,902	0	0	0	-945	0	0	-2,664	-2,578	-8,201	-6,012	-3,056	-25,358	-16,179	
1991	-1,256	-1,215	-733	-2,207	-1,994	-6,012	-3,333	-4,110	-3,977	-1,237	951	0	-25,123	-42,106	
1992	0	0	0	-2,854	-1,031	-6,755	-2,578	-5,043	-4,880	-3,158	-1,256	1,547	-26,008	-23,427	
1993	1,599	-3,056	-733	-1,256	-1,134	-1,256	-6,739	-4,110	-3,977	0	0	0	-20,662	-23,529	
1994	-2,854	0	1,903	-4,757	-4,296	0	0	0	0	0	0	0	-3,867	-13,871	
1995	-5,043	0	0	-9,513	-6,875	0	-7,365	-4,757	-4,604	0	0	0	-2,118	-40,275	
1996	-2,854	0	0	0	0	0	-4,880	-3,996	-3,867	0	0	0	-1,197	-16,794	
1997	-4,757	-2,762	0	0	0	-5,803	0	-1,237	-1,197	0	0	0	-1,197	-16,953	
1998	-6,660	-4,603	-523	0	0	-951	-7,365	-3,901	-3,775	0	0	0	-3,038	-30,816	
1999	-952	-2,762	1,903	-2,854	0	-7,611	-7,365	-3,996	-3,867	0	0	0	-1,197	-28,701	
2000	-2,854	0	0	0	-4,296	-10,465	0	-1,237	-1,197	0	0	0	-1,197	-21,246	
2001	-6,660	-2,762	0	-5,709	0	-7,611	0	-1,237	-1,197	0	0	0	-2,578	-26,374	
2002	-5,708	-4,603	0	-2,854	-2,578	-2,949	0	0	0	0	0	0	-3,038	-21,730	
Avg (21-02)	-4,188	-2,550	114	-2,699	-2,543	-3,136	-2,646	-2,691	-2,604	-329	-209	-2,563	-26,045	-26,075	

Table 3.2-2

Difference in Total SJPL (Acre-feet)												No Purchase Increase minus Base - Calaveras Constrained		
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total
1921	0	-2,762	0	0	0	6,659	2,118	-951	-920	2,189	2,189	0	8,522	9,443
1922	-5,708	-2,762	-1,142	3,805	0	0	-921	1,047	2,189	2,189	2,189	0	-290	-290
1923	-952	-2,762	0	0	0	8,562	-2,762	-951	-920	2,189	2,189	-460	4,133	4,593
1924	-2,854	-2,762	-952	-4,757	-4,296	5,803	2,118	2,189	2,118	952	952	-7,365	-8,854	525
1925	-7,610	-19,334	-15,222	5,803	13,749	15,317	921	-4,756	-4,603	2,189	2,189	2,118	-9,239	-21,196
1926	1,047	2,762	-7,088	-952	0	11,416	-1,749	952	921	2,189	2,189	-920	10,767	13,805
1927	-952	-1,841	-952	4,947	0	-1,142	-5,524	-475	-460	2,189	2,189	2,302	281	-2,941
1928	0	-2,762	-1,902	952	860	2,663	-5,524	-951	-920	2,189	2,189	2,762	-444	-904
1929	0	-2,762	0	0	0	10,560	2,118	952	921	2,189	2,189	0	16,167	18,929
1930	-2,854	-19,334	-19,979	5,803	5,242	15,317	2,118	2,189	2,118	2,189	2,189	-2,762	-7,764	-5,002
1931	-2,854	-921	-7,088	-2,855	1,718	5,803	2,118	952	921	0	0	-7,365	-9,571	-590
1932	0	4,603	0	3,805	0	7,801	921	952	921	2,189	2,189	921	24,302	11,638
1933	1,047	-921	-7,088	4,757	4,297	10,560	2,118	2,189	2,118	2,189	2,189	2,118	25,573	24,376
1934	-1,807	2,762	-2,855	952	4,297	9,513	2,118	2,189	2,118	2,189	2,189	-1,749	21,916	25,783
1935	-2,854	-19,334	-19,979	15,412	11,343	10,560	-5,524	2,854	2,762	2,189	2,189	921	539	-2,131
1936	0	-921	-7,088	6,659	0	6,659	0	0	0	2,189	2,189	-460	9,227	10,608
1937	-2,854	-2,762	-952	952	0	0	-7,365	1,903	1,842	2,189	2,189	-460	-5,318	-5,318
1938	0	-2,762	-1,142	951	0	0	-1,841	0	0	2,189	2,189	2,302	1,886	-876
1939	-952	-2,762	0	0	0	9,513	2,118	2,189	2,118	2,189	2,189	-920	15,682	18,904
1940	-2,854	-19,334	-19,979	11,512	0	0	1,841	0	0	2,189	2,189	0	-24,436	-25,356
1941	-952	-2,762	0	0	0	0	0	0	0	2,189	2,189	2,118	2,782	664
1942	-1,902	-2,762	-1,712	0	0	0	-1,841	0	0	2,189	2,189	921	-2,918	-1,721
1943	0	0	-7,088	0	0	0	-1,841	1,903	1,842	2,189	2,189	-460	-1,266	115
1944	-952	-2,762	-952	0	4,468	8,562	2,118	0	0	2,189	2,189	0	14,860	14,400
1945	-5,708	-19,334	-19,979	5,803	7,734	12,368	2,118	-2,854	-2,762	2,189	2,189	921	-17,315	-18,236
1946	0	-2,762	0	0	0	5,709	2,118	-475	-460	2,189	2,189	-460	8,048	9,429
1947	-5,708	-4,603	1,902	0	0	10,560	2,118	952	921	2,189	2,189	-460	10,060	10,060
1948	-2,854	0	-7,088	-952	-859	5,803	2,118	0	0	2,189	2,189	0	546	86
1949	-1,807	1,841	-952	-4,757	-4,296	-7,611	921	-1,807	-1,749	2,189	2,189	2,762	-13,077	-15,839
1950	-952	-19,334	-19,979	18,171	13,749	10,560	2,118	2,189	2,118	2,189	2,189	0	13,018	15,780
1951	-1,807	-9,207	0	0	0	-2,854	-460	-1,807	-1,749	2,189	2,189	2,762	-10,744	-13,506
1952	-952	-2,762	-951	0	0	0	1,841	0	0	2,189	2,189	-460	1,094	4,316
1953	-952	-2,762	-951	0	0	8,562	0	-1,807	-1,749	2,189	2,189	0	4,719	4,259
1954	-5,708	-2,762	-952	4,757	4,468	8,562	0	-475	-460	2,189	2,189	-460	11,348	11,808
1955	-5,708	-19,334	-15,222	18,171	13,749	5,803	2,118	2,189	2,118	2,189	2,189	-1,749	6,513	7,802
1956	-2,854	1,841	-3,805	0	0	0	-1,749	1,047	1,013	2,189	2,189	921	792	-1,878
1957	-952	-921	-952	952	5,328	9,513	2,118	952	921	2,189	2,189	-460	20,877	22,258
1958	-2,854	-2,762	-2,331	-952	0	0	0	0	0	2,189	2,189	921	-3,600	-4,981
1959	-952	-2,762	-952	4,757	-859	11,416	2,118	952	921	2,189	2,189	-460	18,557	19,938
1960	-4,756	-19,334	-19,979	5,803	9,538	5,803	2,118	2,189	2,118	2,189	952	-5,524	-18,883	-12,582
1961	-5,708	-921	-2,331	952	860	4,756	921	-4,756	-4,603	952	0	4,603	-5,275	-13,213
1962	4,757	0	-2,855	952	3,437	9,513	921	952	921	2,189	2,189	3,683	26,659	24,153
1963	2,854	-921	-2,331	0	0	0	-1,841	-952	-921	2,189	2,189	2,118	2,384	3,949
1964	2,949	1,841	-952	4,757	4,297	5,803	2,118	2,189	2,118	2,189	2,189	921	30,419	31,616
1965	-1,807	-19,334	-15,222	0	0	11,416	-5,524	-1,807	-1,749	2,189	2,189	2,762	-26,887	-28,728
1966	-952	0	-1,902	3,805	3,437	7,611	2,118	2,189	2,118	2,189	2,189	-920	21,882	25,564
1967	-2,854	-921	-9,514	0	0	-951	-3,683	-2,855	-2,762	2,189	2,189	921	-18,241	-20,082
1968	1,902	-2,762	-7,088	5,708	5,156	10,560	2,118	952	921	2,189	2,189	-460	21,385	22,766
1969	-5,708	-2,762	0	0	0	0	0	1,903	1,842	2,189	2,189	-920	-1,267	-807
1970	-2,854	-19,334	-15,222	7,610	6,874	9,514	2,118	952	921	2,189	2,189	-920	-5,963	-5,963
1971	-952	0	-951	0	0	9,513	2,118	0	0	2,189	2,189	0	14,106	13,186
1972	-4,756	-921	-952	-952	-860	5,803	2,118	2,189	2,118	2,189	2,189	-1,749	6,416	8,165
1973	-2,854	-921	-7,611	0	0	0	-921	-2,854	-2,762	2,189	2,189	4,880	-8,665	-15,294
1974	0	-921	0	0	0	2,663	0	0	0	2,189	2,189	2,302	8,422	11,000
1975	-952	-19,334	-19,979	11,512	859	0	921	1,047	1,013	2,189	2,189	-920	-21,455	-18,233
1976	-1,902	-2,762	-7,088	3,805	3,437	5,803	2,118	2,189	2,118	0	-475	-7,365	-122	11,176
1977	-7,610	0	-2,855	0	0	5,803	921	-2,854	-2,762	-475	-475	-4,603	-14,910	-17,197
1978	0	4,603	-2,331	0	0	0	2,946	1,902	1,841	2,189	2,189	2,118	15,457	3,408
1979	0	-921	0	4,757	0	4,757	2,118	0	0	2,189	2,189	921	16,010	17,207
1980	0	-19,334	-15,222	7,610	0	0	1,013	1,903	1,842	2,189	2,189	-920	-18,730	-16,889
1981	-952	-2,762	-7,088	3,805	3,437	12,368	2,118	0	0	2,189	2,189	0	15,304	14,384
1982	-5,708	-921	-2,854	0	0	0	0	0	0	2,189	2,189	921	-4,184	-5,105
1983	0	0	-2,663	0	0	0	0	952	921	2,189	2,189	2,118	5,706	4,509
1984	-1,902	-2,762	0	0	0	4,756	2,118	0	0	2,189	2,189	0	6,588	8,706
1985	-2,854	-14,731	-15,222	5,803	8,593	10,560	2,118	2,189	2,118	2,189	2,189	0	2,952	2,952
1986	-1,807	1,841	-7,088	-952	0	0	-921	0	0	2,189	2,189	0	-4,549	-4,549
1987	-952	-2,762	-952	0	0	10,560	2,118	2,189	2,118	2,189	2,189	-2,762	13,935	16,697
1988	-2,854	1,841	-7,088	-2,855	1,718	5,803	2,118	952	921	2,854	4,756	-4,603	3,563	2,172
1989	0	4,603	1,902	0	0	9,513	921	-2,854	-2,762	5,233	5,233	-4,603	17,186	14,330
1990	0	-14,731	-15,222	11,512	9,453	10,560	2,118	-475	-460	-304	-304	-1,215	932	8,618
1991	-1,256	2,467	-3,587	-6,964	-1,134	11,112	-1,215	-6,964	-6,739	6,660	5,708	4,603	2,691	-16,103
1992	4,757	0	2,854	4,947	2,406	11,416	-460	2,854	2,762	-3,158	-304	3,388	31,462	48,507
1993	3,501	-3,977	1,170	-1,256	-1,134	-1,256	2,467	-3,158	-3,056	2,189	2,189	2,118	-203	-6,773
1994	-952	-921	-952	0	4,297	10,560	2,118	2,189	2,118	2,189	2,189	1,013	23,848	24,953
1995	1,902	-19,334	-19,979	951	859	0	1,841	-952	-921	2,189	2,189	2,762	-28,493	-30,242
1996	-952	-921	-2,331	0	0	0	1,841	-1,807	-1,749	2,189	2,189	3,683	2,142	1,221
1997	0	-1,841	0	0	0	5,709	2,118	952	921	2,189	2,189	921	13,158	15,920
1998	-5,708	-2,762	-1,902	0	0	0	0	0	0	2,189	2,189	1,842	-4,152	-5,073
1999	0	-2,762	3,805	5,708	0	1,903	-4,603	1,047	1,013	2,189	2,189	3,683	14,172	12,331
2000	-952	-19,334	-19,979	15,317	5,156	3,045	2,118	952	921	2,189	2,189	3,683	-4,695	-4,695
2001	-952	-921	-7,088	2,854	8,593	6,659	2,118	952	921	2,189	2,189	-460	17,054	21,197
2002	-2,854	-2,762	-1,142	3,805	3,437	7,611	2,118	2,189	2,118	2,189	2,189	-920	17,978	18,438
Avg (21-02)	-1,564	-4,622	-5,307	2,472	1,993	5,387	528	233	225	2,077	2,091	176	3,689	3,712

Table 3.2-3

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Purchase Increase	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	22,707	13,677	8,543	8,425	5,998	8,365	15,938	23,063	22,319	29,778	29,778	27,154	215,744	212,860	
Above Normal	22,782	11,969	8,394	13,168	7,329	11,791	19,556	24,735	23,937	29,778	29,778	27,111	230,329	229,471	
Normal	21,822	12,717	8,907	13,872	10,097	17,541	26,089	26,799	25,934	29,778	29,778	26,906	250,240	248,364	
Below Normal	23,117	13,847	11,776	17,968	15,360	23,145	28,253	28,159	27,251	29,549	29,420	25,129	272,973	273,247	
Dry	22,184	16,860	14,704	15,703	13,362	24,735	28,506	28,024	27,119	28,021	27,932	22,358	269,510	274,662	
All Years	22,533	13,792	10,456	13,870	10,452	17,124	23,674	26,163	25,319	29,388	29,344	25,741	247,854	247,809	

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,358	16,624	8,533	11,512	7,465	11,298	21,561	26,603	25,744	29,778	29,778	28,817	245,069	242,794	
Above Normal	26,705	14,785	7,751	14,254	9,306	16,705	24,176	28,608	27,685	29,778	29,778	28,817	258,347	258,347	
Normal	26,174	14,713	8,765	15,626	12,095	22,405	28,207	29,778	28,817	29,778	29,778	28,817	274,953	274,878	
Below Normal	27,338	16,106	11,931	21,523	18,520	25,038	28,817	29,481	28,530	29,778	29,593	27,864	294,520	295,079	
Dry	25,990	19,593	14,794	19,764	17,471	25,782	28,817	29,778	28,817	29,463	28,821	27,200	296,289	297,969	
All Years	26,721	16,342	10,342	16,569	12,994	20,261	26,320	28,854	27,923	29,717	29,553	28,304	273,899	273,884	

Difference in Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Purchase Increase minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	-4,651	-2,947	11	-3,087	-1,467	-2,932	-5,623	-3,539	-3,425	0	0	-1,663	-29,325	-29,934	
Above Normal	-3,923	-2,816	644	-1,086	-1,976	-4,913	-4,620	-3,873	-3,748	0	0	-1,706	-28,018	-28,876	
Normal	-4,353	-1,997	143	-1,754	-1,998	-4,864	-2,118	-2,979	-2,883	0	0	-1,911	-24,713	-26,514	
Below Normal	-4,221	-2,259	-155	-3,555	-3,160	-1,893	-564	-1,322	-1,279	-229	-174	-2,735	-21,547	-21,832	
Dry	-3,806	-2,733	-89	-4,061	-4,109	-1,047	-311	-1,754	-1,698	-1,442	-889	-4,842	-26,779	-23,308	
All Years	-4,188	-2,550	114	-2,699	-2,543	-3,136	-2,646	-2,691	-2,604	-329	-209	-2,563	-26,045	-26,075	

Table 3.2-4

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Purchase Increase	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	22,707	13,677	8,543	8,425	5,998	8,365	15,938	23,063	22,319	29,778	29,778	27,154	215,744	212,860	
Above Normal	22,782	11,969	8,394	13,168	7,329	11,791	19,556	24,735	23,937	29,778	29,778	27,111	230,329	229,471	
Normal	21,822	12,717	8,907	13,872	10,097	17,541	26,089	26,799	25,934	29,778	29,778	26,906	250,240	248,364	
Below Normal	23,117	13,847	11,776	17,968	15,360	23,145	28,253	28,159	27,251	29,549	29,420	25,129	272,973	273,247	
Dry	22,184	16,860	14,704	15,703	13,362	24,735	28,506	28,024	27,119	28,021	27,932	22,358	269,510	274,662	
All Years	22,533	13,792	10,456	13,870	10,452	17,124	23,674	26,163	25,319	29,388	29,344	25,741	247,854	247,809	

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258	218,975	
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776	230,776	
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601	243,681	
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263	264,595	
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509	262,015	
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165	244,098	

Difference in Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														No Purchase Increase minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	-1,553	-4,449	-5,240	397	-17	932	-93	-7	-7	2,189	2,189	1,145	-4,513	-6,114	
Above Normal	-1,393	-5,957	-5,809	4,068	1,173	2,513	-753	56	54	2,189	2,189	1,224	-446	-1,305	
Normal	-1,546	-6,330	-5,482	3,942	3,233	6,909	138	-255	-247	2,189	2,189	898	5,639	4,683	
Below Normal	-1,842	-4,133	-6,188	2,243	3,553	7,811	1,554	570	552	2,631	2,502	-541	8,710	8,652	
Dry	-1,481	-2,187	-3,729	1,623	1,977	8,800	1,807	791	766	1,146	1,354	-1,866	9,001	12,647	
All Years	-1,564	-4,622	-5,307	2,472	1,993	5,387	528	233	225	2,077	2,091	176	3,689	3,712	

3.3 Hetch Hetchy Reservoir and Releases

Compared to the WSIP setting, the alternative setting would draw less water from the Tuolumne due to the lesser demand. This circumstance would lead to less draw from Hetch Hetchy Reservoir in the alternative setting in all years. Figure 3.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 3.3-1 are the results for the WSIP, alternative (“No Purchase Increase”), and base (“Base – Calaveras Constrained”) setting. Supplementing the Figure 3.3-1 representation of Hetch Hetchy Reservoir storage are Table 3.3-1 Hetch Hetchy Reservoir Storage (No Purchase Increase), Table 3.3-2 Hetch Hetchy Reservoir Storage (WSIP), and Table 3.2-1 Difference in Hetch Hetchy Reservoir Storage (No Purchase Increase minus WSIP). Table 3.2-2 is provided to illustrate the difference in Hetch Hetchy Reservoir storage between the base and alternative settings.

Table 3.3-3 illustrates that, by the end of summer, storage in Hetch Hetchy Reservoir associated with the alternative setting would be greater than the storage in the WSIP setting, although typically an increase of less than 3,000 acre-feet. In about 20 percent of the years, storage would be greater by 3,000 acre-feet or more. The relatively minor increases in storage are attributable to years when summer diversions are the same in both settings (SJPL operating at maximum capacity) but less water is being diverted in the fall due to the lesser water demand. The larger increases in storage are associated with drought periods during which the differences in underlying demand and water delivery shortages between the WSIP and alternative settings are greater.

**Figure 3.3-1
Hetch Hetchy Reservoir Storage and Stream Release**

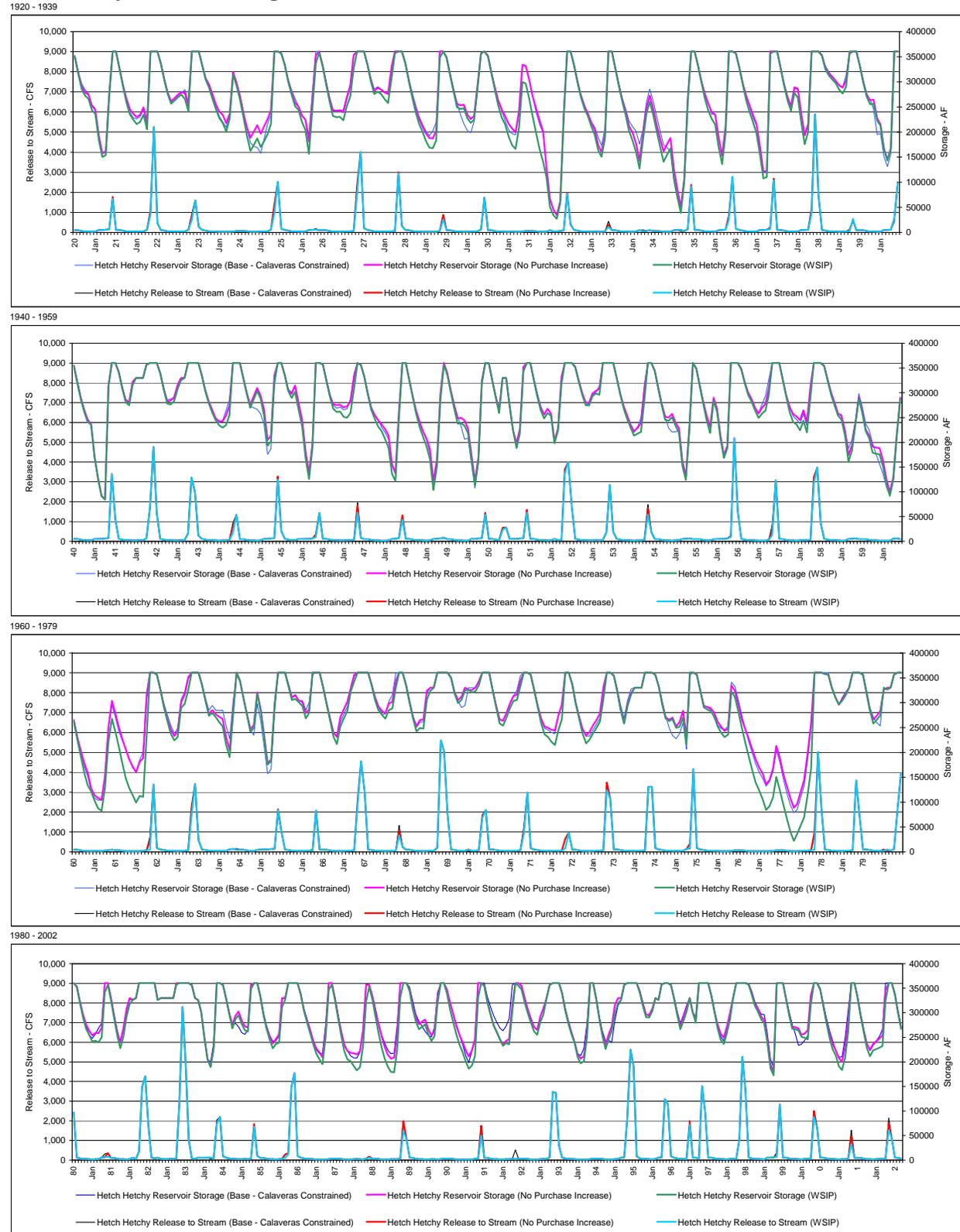


Table 3.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)												No Purchase Increase	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	278,834	274,318	252,143	244,199	191,605	157,527	160,348	276,237	360,400	360,400	326,811	293,946	
1922	267,077	245,759	235,976	229,895	234,365	248,941	219,254	360,400	360,400	360,400	336,082	304,970	
1923	278,887	261,435	267,512	274,226	279,369	277,408	252,763	360,400	360,400	360,400	333,186	306,819	
1924	294,573	274,701	254,169	241,000	234,198	217,630	235,929	318,684	296,938	270,227	236,194	209,805	
1925	188,568	200,603	213,640	196,584	211,749	225,739	243,269	360,400	360,400	356,465	334,210	301,427	
1926	278,080	258,277	250,270	233,060	224,191	181,001	266,125	352,744	360,400	333,232	297,804	266,894	
1927	242,242	242,675	243,312	239,474	267,052	291,087	353,294	360,400	360,400	360,400	333,718	303,809	
1928	280,965	288,381	284,262	279,094	275,538	330,000	360,400	360,400	360,400	337,096	302,689	271,561	
1929	246,580	226,537	211,432	197,418	188,061	187,029	202,586	360,400	360,400	348,102	314,426	283,355	
1930	256,652	253,082	254,412	234,910	225,482	231,960	293,323	356,465	360,400	350,768	316,726	288,304	
1931	262,918	245,133	231,441	216,532	207,075	199,193	240,477	333,974	331,885	304,135	271,026	246,270	
1932	222,881	201,357	127,063	66,943	45,872	34,363	62,287	232,586	360,400	360,400	333,089	301,115	
1933	272,210	251,622	236,856	219,098	204,515	173,964	159,604	194,193	360,400	360,400	326,593	293,382	
1934	264,956	241,194	211,799	198,512	177,717	142,610	195,961	248,467	272,263	246,018	213,996	186,605	
1935	161,653	175,376	188,163	125,661	87,293	50,380	107,252	264,576	360,400	360,400	331,788	300,519	
1936	275,227	256,364	240,014	234,340	189,167	152,795	209,839	360,400	360,400	356,465	327,853	296,688	
1937	271,730	252,998	233,609	216,424	172,176	121,540	121,701	360,400	360,400	360,400	327,212	295,049	
1938	269,253	251,613	289,063	286,013	235,108	193,606	215,731	360,400	360,400	360,400	352,029	327,292	
1939	315,994	310,038	301,554	292,814	288,403	302,933	356,592	360,400	360,400	332,157	299,492	273,366	
1940	263,287	264,323	227,206	215,348	167,666	144,907	167,642	360,400	360,400	354,451	320,313	288,428	
1941	263,745	246,027	236,535	170,727	126,422	92,036	84,729	313,759	360,400	360,400	341,291	309,048	
1942	284,527	281,509	322,446	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	308,159	
1943	282,166	284,464	291,376	315,807	330,000	330,000	360,400	360,400	360,400	360,400	334,820	305,668	
1944	282,672	265,717	248,429	242,470	242,270	253,701	273,775	360,400	360,400	360,400	329,920	299,563	
1945	275,799	292,691	309,595	294,443	265,924	205,141	212,643	334,819	360,400	360,400	334,928	304,365	
1946	297,720	314,753	279,321	245,390	180,927	136,798	198,041	360,400	360,400	357,267	325,581	295,813	
1947	276,820	275,169	275,773	270,310	272,506	282,313	331,260	360,400	356,592	332,847	297,991	267,907	
1948	254,877	244,754	235,865	226,920	214,053	155,402	137,710	260,206	360,400	360,400	325,774	293,180	
1949	263,550	240,212	221,471	207,242	186,093	120,779	165,568	298,057	360,400	339,844	305,128	274,087	
1950	248,395	249,365	244,010	227,028	172,439	121,902	168,949	325,017	360,400	359,600	323,849	292,047	
1951	265,150	330,000	330,000	273,739	223,537	198,113	226,103	352,066	360,400	360,400	326,780	295,321	
1952	269,737	255,810	267,687	257,818	202,381	228,088	331,260	360,400	360,400	360,400	351,651	324,789	
1953	299,857	280,497	279,576	298,633	304,098	308,178	360,400	360,400	360,400	360,400	330,136	299,289	
1954	273,035	253,867	235,076	222,287	228,629	239,070	306,987	360,400	360,400	343,956	308,827	277,529	
1955	251,917	249,968	257,186	239,356	228,300	160,986	131,265	229,177	360,400	348,498	313,738	282,730	
1956	253,724	231,483	289,968	267,900	213,074	173,611	192,971	360,400	360,400	360,400	347,791	320,487	
1957	300,177	287,269	269,876	258,037	270,032	277,379	308,641	360,400	360,400	360,400	326,823	295,275	
1958	271,534	256,975	251,954	244,821	264,341	240,834	312,637	360,400	360,400	360,400	353,900	325,107	
1959	299,477	279,831	258,282	253,268	222,544	173,876	192,982	237,209	290,874	262,424	225,837	213,587	
1960	191,320	189,164	188,007	163,610	125,548	99,254	129,350	218,249	290,010	263,766	229,796	203,215	
1961	178,271	159,996	128,382	113,570	108,398	104,328	152,566	251,047	303,427	278,517	250,645	227,117	
1962	205,866	185,849	171,650	159,989	181,314	188,208	307,932	360,400	360,400	356,465	326,379	293,328	
1963	267,287	246,286	233,167	242,518	301,148	315,960	348,621	360,400	360,400	360,400	336,396	305,026	
1964	277,664	285,253	276,564	271,270	267,442	230,221	204,937	283,418	360,400	343,750	309,409	277,093	
1965	247,005	254,312	320,754	285,419	234,458	179,118	185,018	297,263	360,400	360,400	360,400	335,306	
1966	310,370	314,574	304,395	301,606	279,157	286,920	360,400	360,400	360,400	331,450	297,972	268,360	
1967	239,984	231,374	270,527	286,763	301,704	330,000	355,978	360,400	360,400	360,400	360,400	336,965	
1968	310,292	292,497	283,527	278,716	298,260	301,316	343,523	360,400	360,400	334,325	299,837	270,029	
1969	252,619	265,083	265,707	324,102	330,000	330,000	360,400	360,400	360,400	360,400	349,426	320,816	
1970	305,187	311,550	330,000	326,065	325,142	330,000	341,873	360,400	360,400	360,400	362,016	293,798	
1971	266,233	263,515	279,738	298,617	313,341	315,940	343,332	360,400	360,400	356,465	325,764	294,564	
1972	267,901	251,968	249,468	245,428	244,206	274,418	295,882	360,400	360,400	336,426	299,001	271,831	
1973	247,096	233,652	241,592	254,449	265,137	277,785	330,876	360,400	360,400	353,990	322,828	286,127	
1974	259,697	296,323	319,327	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	297,765	
1975	270,440	265,654	269,656	251,973	261,061	283,589	229,997	360,400	360,400	356,465	324,162	293,517	
1976	291,276	289,249	280,210	261,902	251,605	243,306	247,656	334,485	323,924	296,031	266,978	246,546	
1977	227,394	206,513	186,584	170,245	157,598	136,002	144,458	167,173	213,042	188,560	156,195	132,966	
1978	108,720	88,673	96,272	120,436	143,716	197,418	258,565	360,400	360,400	360,400	357,869	356,406	
1979	330,000	311,243	296,003	306,808	317,692	330,000	360,400	360,400	360,400	356,097	320,734	285,511	
1980	265,867	274,018	282,677	326,065	330,000	330,000	356,592	360,400	360,400	360,400	352,729	323,451	
1981	296,687	276,394	263,518	253,873	259,000	258,452	269,075	360,400	360,400	330,185	292,628	259,869	
1982	240,552	269,191	308,047	330,000	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400	
1983	326,065	330,000	330,000	330,000	330,000	330,000	359,897	360,400	360,400	360,400	360,400	355,970	
1984	330,000	326,192	301,515	251,330	205,725	190,722	227,853	360,400	360,400	356,465	328,962	298,574	
1985	275,531	294,063	302,136	284,519	272,585	269,797	256,938	360,400	360,400	333,535	296,865	268,840	
1986	251,514	237,539	246,360	255,988	330,000	330,000	360,400	360,400	360,400	360,400	337,490	306,714	
1987	286,164	266,482	243,296	227,347	219,638	209,330	265,481	360,400	360,400	328,763	292,248	261,924	
1988	235,173	222,011	218,755	217,649	215,447	221,540	264,401	357,117	356,592	332,923	300,330	276,174	
1989	251,922	230,428	214,478	206,901	208,533	255,600	360,400	360,400	360,400	346,638	313,429	291,088	
1990	276,681	281,401	286,181	266,813	253,779	263,589	331,289	360,400	360,400	347,362	321,333	297,889	
1991	274,992	255,513	240,789	223,855	210,849	223,212	245,906	360,400	360,400	355,666	321,999	297,005	
1992	274,760	261,278	246,438	235,897	242,532	246,686	315,788	360,400	359,902	355,323	329,771	306,472	
1993	285,917	271,385	265,139	292,334	308,790	330,000	356,592	360,400	360,400	360,400	339,684	305,994	
1994	281,568	259,474	240,306	215,391	206,969	211,263	260,120	360,400	360,400	328,106	288,504	257,165	
1995	235,015	255,603	272,202	315,159	330,000	329,098	356,592	360,400	360,400	360,400	360,400	343,353	
1996	318,073	296,072	295,290	308,277	330,000	326,065	357,776	360,400	360,400	356,465	329,269	297,004	
1997	272,339	291,915	310,492	330,000	300,695	285,870	360,400	360,400	360,400	360,400	334,509	302,746	

Table 3.3-2

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,402	266,044	243,868	235,920	183,321	150,269	154,224	271,116	360,400	360,400	326,811	291,828
1922	259,728	235,648	224,723	215,782	220,244	234,819	205,133	360,400	360,400	360,400	336,082	302,853
1923	275,819	256,526	262,603	269,313	274,454	265,738	241,094	360,400	360,400	360,400	333,186	304,241
1924	288,096	265,462	244,930	227,949	217,703	201,135	226,615	314,032	292,290	264,348	229,088	193,225
1925	162,198	174,233	187,270	170,200	181,824	195,815	216,042	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	203,496	156,406	245,154	336,819	358,277	331,111	295,686	261,739
1927	231,858	229,528	230,165	223,466	251,035	270,123	326,806	360,400	360,400	360,400	333,718	301,231
1928	275,534	280,188	275,546	265,616	257,757	308,315	356,993	360,400	360,400	337,096	302,689	269,444
1929	239,232	216,426	201,321	182,545	168,883	167,850	183,407	347,942	360,400	348,102	314,426	281,237
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210
1932	165,286	141,000	108,382	51,375	34,654	27,412	58,311	229,715	360,400	360,400	333,089	299,918
1933	270,157	246,808	232,041	211,426	194,261	163,710	150,969	186,966	360,400	360,400	326,593	293,382
1934	260,961	234,344	202,242	182,930	159,810	127,492	183,946	236,459	260,268	234,045	202,043	170,799
1935	140,815	154,538	167,325	107,677	72,057	38,981	99,863	258,988	360,400	360,400	331,788	299,322
1936	267,086	242,699	226,345	214,884	170,029	136,212	195,836	360,400	360,400	356,465	327,853	294,110
1937	262,493	239,158	219,779	197,861	155,743	107,766	110,233	356,058	360,400	360,400	327,212	292,471
1938	262,775	242,374	277,970	268,254	217,341	175,883	200,130	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	297,136	284,589	276,736	290,220	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	222,760	213,012	165,616	143,200	166,203	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	235,298	169,490	125,366	91,151	84,054	313,255	360,400	360,400	341,291	309,048
1942	280,721	274,942	315,878	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	278,021	276,636	283,548	307,975	325,066	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	279,144	260,348	244,962	234,244	229,744	234,419	254,494	360,400	360,400	360,400	329,290	297,445
1945	269,782	286,673	303,578	288,423	253,887	193,103	202,059	325,579	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,823	360,400	360,400	357,267	325,581	293,235
1947	267,584	261,329	261,933	251,706	249,594	259,401	308,348	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	207,163	189,129	136,187	121,486	246,616	360,400	360,400	325,774	291,062
1949	257,437	230,325	210,633	191,633	166,180	103,674	151,625	286,364	356,592	336,040	301,328	268,173
1950	237,728	238,697	233,450	217,724	163,129	114,105	162,436	319,562	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	188,600	217,740	343,707	360,400	360,400	326,780	293,203
1952	264,766	248,078	259,003	253,471	198,031	223,738	317,703	360,400	360,400	360,400	351,651	322,211
1953	296,329	275,128	274,206	293,261	298,723	296,049	360,374	360,400	360,400	360,400	330,136	297,172
1954	268,064	247,055	230,167	213,569	217,328	221,015	286,815	360,400	360,400	343,956	308,827	274,943
1955	245,440	243,491	250,709	232,875	219,152	151,838	123,551	222,728	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,550	188,550	360,400	360,400	360,400	347,791	319,290
1957	296,127	282,297	264,905	249,257	257,810	264,111	295,373	360,400	360,400	360,400	326,823	292,697
1958	261,061	240,978	235,957	224,058	243,566	220,059	291,862	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,939	254,292	245,472	213,883	161,315	182,390	235,642	288,112	259,667	223,084	208,259
1960	179,051	176,894	175,738	151,333	116,394	92,543	124,226	215,694	287,458	261,217	226,015	191,797
1961	158,963	134,152	121,643	102,446	87,720	82,604	129,645	221,869	267,561	241,466	211,469	178,503
1962	147,481	127,832	114,109	99,056	112,573	110,810	229,337	360,400	360,400	356,465	326,739	292,131
1963	263,712	237,187	224,068	230,750	289,373	297,526	323,742	360,400	360,400	360,400	336,396	305,026
1964	273,668	279,416	270,727	260,673	252,543	215,321	190,335	275,763	360,400	343,750	309,409	275,896
1965	241,813	249,120	317,459	282,122	231,160	175,820	182,106	294,713	360,400	360,400	360,400	333,188
1966	305,400	307,762	300,989	293,442	268,461	279,726	360,400	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	252,106	268,331	283,263	323,066	342,598	360,400	360,400	360,400	360,400	335,768
1968	305,290	284,733	275,763	268,094	285,055	288,111	330,318	360,400	360,400	334,325	299,837	267,451
1969	242,147	249,086	247,807	306,192	323,862	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	258,440	253,880	270,103	288,977	303,697	305,250	323,642	360,400	360,400	356,465	325,704	292,446
1972	258,839	236,370	231,016	221,257	214,866	245,077	266,541	360,400	360,400	360,400	329,001	267,965
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	267,864	263,077	267,079	249,395	251,607	270,330	216,738	360,400	360,400	356,465	324,162	290,479
1976	286,336	282,468	273,429	252,264	239,384	231,084	235,434	322,270	311,719	281,653	249,955	220,061
1977	191,125	164,627	139,941	124,041	106,191	84,595	91,855	109,596	150,715	123,692	95,026	67,781
1978	41,897	22,219	36,001	52,988	69,331	114,471	168,252	360,400	360,400	360,400	357,869	356,406
1979	329,957	311,201	296,912	303,911	314,794	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	257,725	265,877	274,536	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	267,741	254,865	241,410	243,092	239,594	250,218	341,900	356,592	326,381	288,829	253,955
1982	227,982	252,018	292,777	317,906	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	259,670	236,484	216,725	205,573	195,265	251,416	347,582	357,022	325,388	288,877	253,677
1988	221,889	204,952	201,696	191,923	182,833	188,925	231,786	323,285	352,727	326,875	292,101	258,469
1989	229,470	206,135	190,185	179,740	178,779	224,799	331,322	360,400	360,400	343,974	308,105	283,006
1990	266,700	271,420	276,200	256,827	242,842	252,652	320,352	360,400	360,400	360,400	337,162	301,130
1991	256,496	235,801	220,345	201,192	186,180	192,530	211,890	331,320	360,400	354,429	321,715	296,721
1992	274,476	260,994	246,154	232,759	238,361	235,761	302,285	360,400	355,022	347,290	320,492	298,748
1993	279,794	262,205	255,227	281,160	296,476	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	256,620	239,355	209,682	196,961	201,254	250,111	360,400	360,400	328,106	288,504	253,299
1995	226,108	246,696	263,295	296,733	319,612	326,065	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	291,101	290,319	303,304	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	280,067	360,400	360,400	36			

Table 3.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

No Purchase Increase minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	6,432	8,274	8,275	8,279	8,284	7,258	6,124	5,121	0	0	0	2,118
1922	7,349	10,111	11,253	14,113	14,121	14,122	14,121	0	0	0	0	2,117
1923	3,068	4,909	4,909	4,913	4,915	11,670	11,669	0	0	0	0	2,578
1924	6,477	9,239	9,239	13,051	16,495	16,495	9,314	4,652	4,648	5,879	7,106	16,580
1925	26,370	26,370	26,370	26,384	29,925	29,924	27,227	0	0	0	0	0
1926	3,995	6,850	6,387	13,144	20,695	24,595	20,971	15,925	2,123	2,121	2,118	5,155
1927	10,384	13,147	13,147	16,008	16,017	20,964	26,488	0	0	0	0	2,578
1928	5,431	8,193	8,716	13,478	17,781	21,685	3,407	0	0	0	0	2,117
1929	7,348	10,111	10,111	14,873	19,178	19,179	19,179	12,458	0	0	0	2,118
1930	7,159	7,159	7,159	7,163	7,167	7,167	7,167	0	0	0	0	4,880
1931	9,920	16,456	16,457	25,123	32,957	32,957	32,956	34,174	35,344	37,489	39,624	49,060
1932	57,595	60,357	18,681	15,568	11,218	6,951	3,976	2,871	0	0	0	1,197
1933	2,053	4,814	4,815	7,672	10,254	10,254	8,635	7,227	0	0	0	0
1934	3,995	6,850	9,557	15,582	17,907	15,118	12,015	12,008	11,995	11,973	11,953	15,806
1935	20,838	20,838	20,838	17,984	15,236	11,399	7,389	5,588	0	0	0	1,197
1936	8,141	13,665	13,669	19,456	19,138	16,583	14,003	0	0	0	0	2,578
1937	9,237	13,840	13,830	18,563	16,433	13,774	11,468	4,342	0	0	0	2,578
1938	6,478	9,239	11,093	17,759	17,767	17,723	15,601	0	0	0	0	2,578
1939	3,528	5,370	4,418	8,225	11,667	12,713	-3,808	0	0	0	0	3,039
1940	8,078	8,078	4,446	2,336	2,050	1,707	1,439	0	0	0	0	2,118
1941	3,067	4,909	1,237	1,056	885	675	504	0	0	0	0	0
1942	3,806	6,567	6,568	0	0	0	0	0	0	0	0	1,197
1943	4,145	7,828	7,828	7,832	4,934	0	0	0	0	0	0	2,578
1944	3,528	5,369	3,467	8,226	12,526	19,282	19,281	0	0	0	0	2,118
1945	6,017	6,018	6,017	6,020	12,037	12,038	10,584	9,240	0	0	0	1,197
1946	8,141	12,744	12,745	12,752	12,759	10,922	9,218	0	0	0	0	2,578
1947	9,236	13,840	13,840	18,604	22,912	22,912	22,912	0	0	0	0	2,578
1948	7,619	13,235	13,235	19,757	24,924	19,215	16,224	13,590	0	0	0	2,118
1949	6,113	9,887	10,838	15,609	19,913	17,105	13,943	11,693	3,808	3,804	3,800	5,914
1950	10,667	10,668	10,560	9,304	9,310	7,797	6,513	5,455	0	0	0	2,118
1951	6,112	0	0	0	0	9,513	8,363	8,359	0	0	0	2,118
1952	4,971	7,732	8,684	4,347	4,350	4,350	13,557	0	0	0	0	2,578
1953	3,528	5,369	5,370	5,372	5,375	12,129	26	0	0	0	0	2,117
1954	4,971	6,812	4,905	8,718	11,301	18,055	20,172	0	0	0	0	2,578
1955	6,477	6,477	6,477	6,481	9,148	9,148	7,714	6,449	0	0	0	3,867
1956	8,908	12,682	6,004	6,008	6,011	5,251	4,421	0	0	0	0	1,197
1957	4,050	4,972	4,971	8,708	12,222	13,268	13,268	0	0	0	0	2,578
1958	10,473	15,997	15,997	20,763	20,775	20,775	20,775	0	0	0	0	1,197
1959	4,050	5,892	3,990	7,796	8,661	12,561	10,592	1,567	2,762	2,757	2,753	5,328
1960	12,269	12,270	12,269	12,277	9,154	6,711	5,124	2,555	2,552	2,549	3,781	11,418
1961	19,308	25,844	6,739	11,124	20,678	21,724	22,921	29,178	35,866	37,051	39,176	48,614
1962	58,385	58,017	57,541	60,933	68,741	77,398	78,595	0	0	0	0	1,197
1963	3,575	9,099	9,099	11,768	11,775	18,434	24,879	0	0	0	0	0
1964	3,996	5,837	5,837	10,597	14,899	14,900	14,602	7,655	0	0	0	1,197
1965	5,192	5,192	3,295	3,297	3,298	3,298	2,912	2,550	0	0	0	2,118
1966	4,970	6,812	3,406	8,164	10,696	7,194	0	0	0	0	0	3,039
1967	8,078	14,616	18,421	18,432	18,441	6,934	13,380	0	0	0	0	1,197
1968	5,002	7,764	7,764	10,622	13,205	13,205	13,205	0	0	0	0	2,578
1969	10,472	15,997	17,900	17,910	6,138	0	0	0	0	0	0	3,039
1970	5,891	5,891	5,565	0	4,296	7,203	7,203	0	0	0	0	3,038
1971	7,793	9,635	9,635	9,640	9,644	10,690	10,690	0	0	0	0	2,118
1972	9,062	15,598	18,452	24,171	29,340	29,341	29,341	0	0	0	0	3,866
1973	8,906	15,444	15,966	15,976	15,986	15,986	23,627	0	0	0	0	0
1974	1,903	2,823	2,824	0	0	0	0	0	0	0	0	2,578
1975	2,576	2,577	2,577	2,578	9,454	13,259	13,259	0	0	0	0	3,038
1976	4,940	6,781	6,781	9,638	12,221	12,222	12,222	12,215	12,205	14,378	17,023	26,485
1977	36,269	41,886	46,643	46,204	51,407	51,407	52,603	57,577	62,327	64,868	61,169	64,515
1978	66,823	66,454	60,271	67,448	74,385	82,947	90,313	0	0	0	0	0
1979	43	42	-909	2,897	2,898	0	0	0	0	0	0	1,197
1980	8,142	8,141	-3,935	3,554	0	0	0	0	0	0	0	3,038
1981	5,891	8,653	8,653	12,463	15,908	18,858	18,857	18,500	3,808	3,804	3,799	5,914
1982	12,570	17,173	15,270	12,094	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	2,946	0	0	0	0	0
1984	0	0	0	0	0	1,046	849	0	0	0	0	2,117
1985	7,159	7,159	7,159	7,162	8,111	8,110	8,110	0	0	0	0	2,117
1986	6,112	9,887	9,886	16,647	18,209	3,935	0	0	0	0	0	2,117
1987	4,970	6,812	6,812	10,622	14,065	14,065	14,065	12,818	3,378	3,375	3,371	8,247
1988	13,284	17,059	17,059	25,726	32,614	32,615	32,615	33,832	3,865	6,048	8,229	17,705
1989	22,452	24,293	24,293	27,161	29,754	30,801	29,078	0	2,664	5,324	8,082	8,082
1990	9,981	9,981	9,981	10,937	10,937	10,937	10,937	0	8,200	14,203	17,249	17,249
1991	18,496	19,712	20,444	22,663	24,669	30,682	34,016	29,080	0	1,237	284	284
1992	284	284	284	3,138	4,171	10,925	13,503	0	4,880	8,033	9,279	7,724
1993	6,123	9,180	9,912	11,174	12,314	0	0	0	0	0	0	0
1994	2,854	2,854	951	5,709	10,008	10,009	10,009	0	0	0	0	3,866
1995	8,907	8,907	8,907	18,426	10,388	3,033	0	0	0	0	0	2,118
1996	4,971	4,971	4,971	4,973	0	0	0	0	0	0	0	1,196
1997	5,954	8,715	8,716	0	0	5,803	0	0	0	0	0	1,197
1998	7,856	12,460	12,982	12,990	12,997	0	0	0	0	0	0	3,038
1999	3,988	6,750	4,847	7,704	7,708	7,708	6,772	66	0	0	0	1,197
2000	4,051	4,051	4,050	4,053	8,352	18,816	18,816	0	0	0	0	1,197
2001	7,856	10,618	10,618	16,332	16,341	23,952	23,952	0	214	214	213	2,799
2002	8,498	13,100	13,101	15,962	18,549	21,499	21,499	0	0	0	0	3,038
Avg (21-02)	9,459	11,710	10,771	12,585	14,055	14,306	13,515	4,486	2,314	2,640	2,844	5,388

Through the fall and winter, storage in Hetch Hetchy Reservoir would be the same or be higher. Hetch Hetchy Reservoir would fill by the end of May during approximately 72 percent of the years, which would negate any difference in storage from carrying into the next summer. Figure 3.3-2 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the WSIP setting. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 3.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the alternative and base settings. Immediately after Hetch Hetchy Reservoir is filled (May or June, and then continuing through July), there would only be occasional differences in storage at the reservoir, typically a decrease of less than 10,000 acre-feet. This indicates that the same amount of water is being passed through the reservoir, regardless of the size of the conveyance capacity of the SJPL. Water not diverted to the SJPL would return to the Tuolumne River and flow to Don Pedro Reservoir. In the late summer and early fall, there would consistently be a slight difference (lower) in storage levels between the two settings, as additional diversions to the SJPL would retain Bay Area reservoir storage. Some of this additional storage depletion would be ameliorated later in the fall and into winter as SJPL diversions are reduced due to lower Bay Area reservoir replenishment needs and less conveyance system maintenance. Storage becomes greater in November and December of the alternative setting due to the assumed system-wide maintenance that occurs in the alternative and does not occur in the base setting. Subsequent to December, the storage gain occurring in the alternative setting again becomes affected as replenishment of Bay Area reservoir storage resumes. In non-wetter years, there is a difference in storage between the alternative and base settings; the alternative setting results in a lower storage in the reservoir by the end of April. Figure 3.3-3 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the base setting. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 3.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation and the range in storage for each month for the variant and base settings.

The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the alternative would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. Figure 3.3-1 illustrates the stream release from O'Shaughnessy Dam for the WSIP, alternative, and base settings. Table 3.3-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative exhibits an incrementally greater stream release, predominantly during May or June, which reflects the months when releases to the stream above excess of minimum release requirements are made in anticipation of the reservoir being filled. Exceptions during which incrementally larger reductions in releases to the stream occurs are considered anomalous within modeling, the results of only shifting releases from one month to the next. The increase in releases is the result of a less depleted reservoir, which is the result of lesser demands between the settings.

Table 3.3-6 illustrates the difference in stream release between the alternative and base settings. In this comparison, releases could be either greater or lesser than depicted for the base setting, and these differences would occur predominantly during May or June. Generally, Hetch Hetchy Reservoir storage would be slightly lower during non-wetter years, leading to a reduction in stream releases during non-wetter years if a release occurs. During wetter years, the releases are projected to increase. The differences, either increases or decreases, are a result of the coincidence of the several parameters affecting the release of water from the reservoir, including system-wide water demands, conveyance capacity and maintenance assumptions, and the watershed's hydrology.

Table 3.3-5 illustrates the difference in stream release between the alternative and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 3.3-7 illustrates the same information and the average monthly stream release for the alternative and WSIP setting, expressed in average monthly flow (cfs). Table 3.3-5 illustrates that the difference in monthly flow below O'Shaughnessy Dam could range up to an increase of approximately 30,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly

Table 3.3-4

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

No Purchase Increase minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-5,289	-2,527	-2,526	-2,528	-2,530	-2,203	-1,854	-1,562	0	0	-2,188	-2,186
1922	3,523	6,285	7,426	3,625	3,627	3,627	3,627	0	0	0	-2,188	-2,187
1923	-1,234	1,528	1,528	1,529	1,530	-7,033	-7,033	0	0	0	-2,188	-1,726
1924	1,129	3,891	4,842	9,602	13,904	8,101	1,933	-1,223	-3,339	-4,287	-5,230	2,141
1925	9,750	29,084	44,306	38,529	24,806	9,489	9,308	0	0	0	-2,188	-4,304
1926	-5,349	-8,111	-991	-41	-35	-12,027	-10,574	-7,656	0	-2,188	-4,374	-3,449
1927	-2,496	-654	297	-4,650	-4,653	-3,512	2,013	0	0	0	-2,188	-4,488
1928	-4,486	-1,724	178	-772	-1,632	0	0	0	0	-2,188	-4,373	-7,132
1929	-7,129	-4,367	-4,366	-4,369	-4,371	-14,931	-17,048	0	0	-2,188	-4,374	-4,370
1930	-1,514	17,820	37,798	32,017	26,793	11,477	9,359	0	0	-2,188	-4,373	-1,608
1931	1,247	2,167	9,255	12,114	10,403	4,600	2,481	1,529	607	606	606	7,970
1932	7,966	3,363	1,121	940	696	444	274	197	0	0	-2,188	-3,107
1933	-4,152	-3,232	3,856	-899	-5,195	-15,755	-13,839	-11,594	0	0	-2,188	-4,304
1934	-2,495	-5,257	-10,193	-12,325	-23,809	-33,805	-8,783	-10,966	-13,071	-15,240	-17,401	-15,632
1935	-12,769	6,565	26,543	22,774	18,973	3,166	2,080	1,559	0	0	-2,188	-3,107
1936	-3,106	-2,185	4,902	-1,746	-1,746	-1,530	-1,292	0	0	0	-2,188	-1,726
1937	1,129	3,891	4,842	3,893	3,426	2,868	2,407	0	0	0	-2,188	-1,726
1938	-1,725	1,036	2,178	1,228	1,228	1,229	1,084	0	0	0	-2,188	-4,488
1939	-3,535	-773	-773	-773	-773	-10,287	0	0	0	-2,188	-4,373	-3,449
1940	-594	18,740	31,985	18,380	16,276	13,649	11,524	0	0	-2,188	-4,374	-4,370
1941	-3,417	-655	-546	-546	-466	-390	-297	-221	0	0	-2,188	-4,304
1942	-2,399	362	2,075	0	0	0	0	0	0	0	-2,188	-3,107
1943	-3,106	-3,106	3,982	3,983	1,084	0	0	0	0	0	-2,188	-1,726
1944	-774	1,988	2,939	2,941	-1,526	-10,087	-12,206	0	0	0	-2,188	-2,186
1945	3,523	22,857	42,835	37,052	29,337	29,338	25,811	22,556	0	0	-2,188	-3,107
1946	-3,106	-344	-344	-344	-302	-256	0	0	-2,188	-4,374	-3,909	-3,909
1947	1,800	6,403	4,500	4,503	4,506	-6,055	-8,172	0	0	-2,188	-4,374	-3,909
1948	-1,053	-1,053	6,034	6,750	7,613	1,810	1,527	1,283	0	0	-2,188	-2,186
1949	-378	-2,219	-1,268	3,521	7,819	6,859	5,720	4,812	3,808	1,616	-574	-3,336
1950	-2,383	16,952	37,831	18,419	17,363	14,553	12,090	10,130	0	-800	-2,988	-2,985
1951	-1,177	0	0	0	0	2,854	2,512	2,511	0	0	-2,188	-4,948
1952	-3,995	-1,233	-282	-141	-141	-141	-1,982	0	0	0	-1,726	-2,188
1953	-774	1,988	2,939	2,941	2,942	-5,620	0	0	0	0	-2,188	-2,187
1954	3,522	6,285	7,236	2,484	-1,983	-10,546	-10,546	0	-2,188	-4,373	-3,909	-3,909
1955	1,800	21,134	36,356	18,206	4,468	-1,336	-1,133	-944	0	-2,188	-4,374	-2,621
1956	235	-1,607	1,819	1,820	1,821	1,589	1,336	0	0	0	-2,188	-3,107
1957	-2,155	-1,233	-282	-1,234	-6,562	-16,076	-18,193	0	0	0	-1,726	-2,188
1958	1,129	3,891	6,221	7,177	7,181	7,181	7,181	0	0	0	-2,188	-3,107
1959	-2,155	607	1,559	-3,197	-2,339	-13,756	-12,078	-6,589	-7,503	-9,681	-11,852	-11,378
1960	-6,615	12,719	32,697	26,917	15,798	8,294	6,330	968	-1,151	-3,337	-4,282	1,247
1961	6,954	7,874	6,268	5,326	4,474	-283	-1,204	4,156	8,755	7,792	7,780	3,167
1962	-1,591	-1,591	1,264	313	-3,124	-12,638	-13,558	0	0	0	-2,188	-5,869
1963	-8,721	-7,800	-5,469	-5,472	-5,475	-5,476	-3,635	0	0	0	-2,188	-4,304
1964	-7,251	-9,092	-8,141	-12,902	-17,205	-23,008	-23,008	-19,319	3,808	1,616	-574	-1,495
1965	314	19,648	22,816	22,826	22,837	22,037	18,741	16,068	0	0	0	-2,762
1966	-1,810	-1,810	998	-2,807	-6,245	-13,856	3,808	0	-2,188	-4,373	-3,449	-3,449
1967	-594	328	9,841	9,847	9,851	0	3,683	0	0	0	-921	0
1968	-2,823	-61	7,026	1,322	-3,833	-14,394	-16,511	0	0	-2,188	-4,374	-3,910
1969	1,800	4,563	4,563	4,565	0	0	0	0	0	0	-2,188	-1,265
1970	1,588	20,923	35,819	-3,935	-4,858	0	-2,117	0	0	0	-2,188	-1,266
1971	-314	-313	637	638	638	-8,876	-10,993	0	0	0	-2,188	-2,186
1972	2,572	3,492	4,443	5,397	6,259	456	-1,661	0	-2,188	-4,373	-2,621	-2,621
1973	235	1,156	8,766	8,771	8,777	8,777	9,697	0	0	-2,188	-4,374	-9,249
1974	-9,246	-8,325	-8,325	0	0	0	0	0	0	0	-2,188	-4,488
1975	-3,535	15,799	35,778	24,287	23,442	23,442	23,442	3,935	0	0	-2,188	-1,266
1976	637	3,400	10,487	6,687	3,253	-2,549	-4,667	-6,852	-8,965	-8,954	-8,467	-1,093
1977	6,520	9,374	9,374	9,379	9,386	3,583	2,662	5,513	8,268	8,729	9,188	13,775
1978	13,757	9,153	11,484	11,495	11,511	11,511	8,566	0	0	0	-2,188	-3,994
1979	0	920	920	-3,835	-3,837	0	0	0	0	-2,188	-4,373	-5,291
1980	-5,288	14,045	29,268	-3,935	3,554	0	0	0	0	0	-2,188	-1,266
1981	-314	2,448	9,536	5,735	2,302	-10,065	-10,065	0	0	-2,188	-4,374	-4,370
1982	1,341	2,262	5,115	1,936	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	-2,118
1984	0	0	0	0	0	-8,692	-10,810	0	0	0	-2,188	-2,187
1985	669	15,400	30,621	24,832	16,253	5,692	3,575	0	-2,188	-4,374	-4,374	-4,374
1986	-2,560	-4,401	2,686	3,635	1,757	0	0	0	0	0	-2,188	-2,187
1987	-1,235	1,528	2,479	2,481	2,482	-8,078	-10,195	0	0	-2,188	-4,373	-1,608
1988	1,247	-594	6,493	9,351	7,638	1,835	-283	-1,235	0	-2,854	-7,608	-2,998
1989	-2,997	-7,600	-9,503	-9,508	-9,514	-19,027	0	0	0	-5,232	-10,455	-5,847
1990	-5,844	8,886	24,108	12,605	3,164	-7,396	-9,513	0	304	608	1,823	1,823
1991	3,078	611	4,197	11,164	12,304	1,193	2,408	345	0	-4,734	-10,437	-15,032
1992	-19,783	-19,783	-22,637	-27,597	-30,019	-41,436	-40,975	0	-498	2,661	2,962	-429
1993	-3,929	48	-1,122	133	1,268	0	0	0	0	0	-2,188	-4,304
1994	-3,351	-2,430	-1,479	-1,479	-5,777	-16,337	-18,454	0	0	-2,188	-4,374	-5,383
1995	-7,282	12,053	32,031	31,098	15,333	3,033	0	0	0	0	0	-2,762
1996	-1,810	-888	1,442	1,442	0	0	0	0	0	0	-2,188	-5,870
1997	-5,866	-4,025	-4,025	0	0	-5,709	0	0	0	0	-2,188	-3,107
1998	2,603	5,365	7,267	7,271	7,275	0	0	0	0	0	-2,188	-4,028
1999	-4,026	-1,264	-5,070	-10,780	-10,784	-10,785	-9,479	0	0	0	-2,188	-5,869
2000	-4,915	14,415	34,397	19,101	13,956	10,911	8,794	0	0	0	-4,373	-8,053
2001	-7,098	-6,177	911	-1,943	-10,537	-17,196	-19,314	0	0	-2,188	-4,374	-3,910
2002	-1,053	1,708	2,851	-954	-4,392	-12,002	-14,120	0	0	-2,188	-4,374	-3,450
Avg (21-02)	-1,494	2,996	7,886	4,930	2,873	-2,190	-1,852	90	-113	-975	-2,930	-3,089

Figure 3.3-2

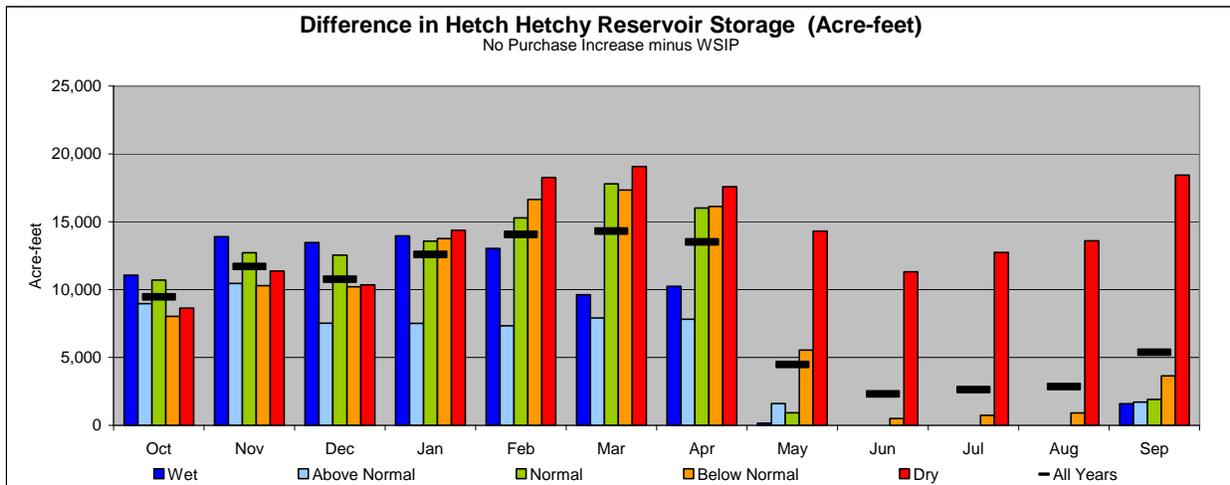


Figure 3.3-3

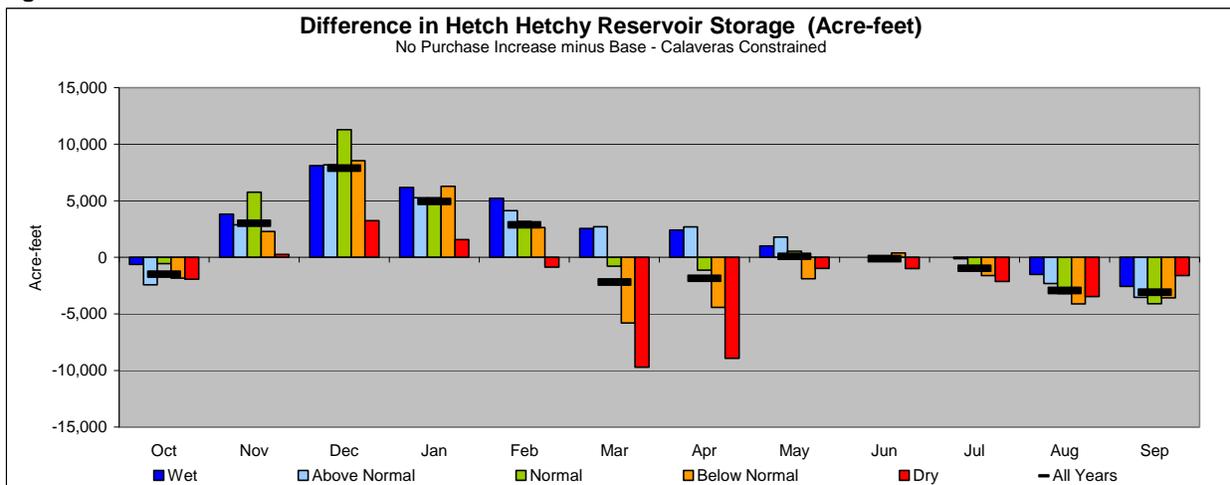


Figure 3.3-4

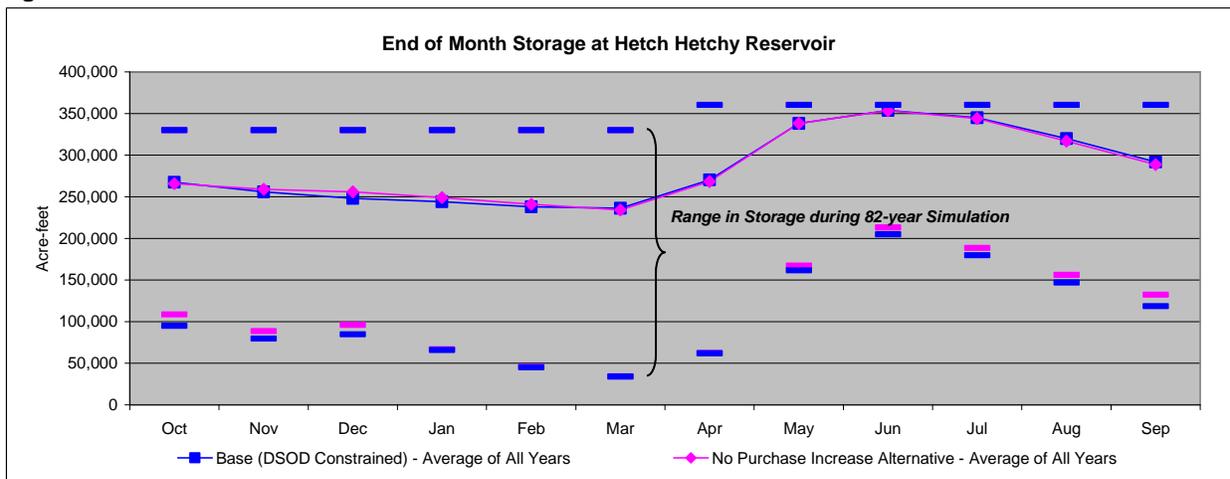


Table 3.3-5

Difference in Hetch Hetchy Release to Stream (Acre-feet)

No Purchase Increase minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	5,115	0	0	0	5,115
1922	0	0	0	0	0	0	0	12,494	0	0	0	0	12,494
1923	0	0	0	0	0	0	0	11,663	0	0	0	0	11,663
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	26,998	0	0	0	0	26,998
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	27,107	0	0	0	0	27,107
1928	0	0	0	0	0	0	0	3,618	0	0	0	0	3,618
1929	0	0	0	0	0	0	0	0	13,231	0	0	0	13,231
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	2,868	0	0	0	2,868
1933	0	0	0	0	0	0	0	0	6,341	0	0	0	6,341
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	5,581	0	0	0	5,581
1936	0	0	0	0	0	0	0	12,237	0	0	0	0	12,237
1937	0	0	0	0	0	0	0	5,152	4,603	0	0	0	9,755
1938	0	0	0	0	0	0	0	13,595	0	0	0	0	13,595
1939	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1940	0	0	0	0	0	0	0	1,192	0	0	0	0	1,192
1941	0	0	0	0	0	0	0	0	503	0	0	0	503
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	19,270	0	0	0	0	19,270
1945	0	0	0	0	0	0	0	0	9,232	0	0	0	9,232
1946	0	0	0	0	0	0	0	8,061	0	0	0	0	8,061
1947	0	0	0	0	0	0	0	22,903	0	0	0	0	22,903
1948	0	0	0	0	0	0	0	0	13,575	0	0	0	13,575
1949	0	0	0	0	0	0	0	0	170	0	0	0	170
1950	0	0	0	0	0	0	0	0	5,451	0	0	0	5,451
1951	0	6,113	0	0	0	0	0	0	8,883	0	0	0	14,996
1952	0	0	0	0	0	0	0	13,551	0	0	0	0	13,551
1953	0	0	0	0	0	0	0	26	0	0	0	0	26
1954	0	0	0	0	0	0	0	20,164	0	0	0	0	20,164
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	3,858	0	0	0	0	3,858
1957	0	0	0	0	0	0	0	13,263	0	0	0	0	13,263
1958	0	0	0	0	0	0	0	20,767	0	0	0	0	20,767
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	28,101	0	0	0	0	28,101
1963	0	0	0	0	0	0	0	25,188	0	0	0	0	25,188
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	2,548	0	0	0	2,548
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	14,176	0	0	0	0	14,176
1968	0	0	0	0	0	0	0	13,200	0	0	0	0	13,200
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	326	0	0	0	0	7,200	0	0	0	0	7,526
1971	0	0	0	0	0	0	0	10,686	0	0	0	0	10,686
1972	0	0	0	0	0	0	0	29,326	0	0	0	0	29,326
1973	0	0	0	0	0	0	0	23,617	0	0	0	0	23,617
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	13,129	0	0	0	0	13,129
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	55,150	0	0	0	0	55,150
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381
1981	0	0	0	0	0	0	0	347	10,310	0	0	0	10,657
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	3,131	0	0	0	0	3,131
1984	0	0	0	0	0	0	0	849	0	0	0	0	849
1985	0	0	0	0	0	0	0	8,639	0	0	0	0	8,639
1986	0	0	0	0	0	10,235	3,935	0	0	0	0	0	14,170
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1989	0	0	0	0	0	0	0	30,146	0	0	0	0	30,146
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	30,103	0	0	0	30,103
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	8,719	0	0	0	0	0	0	0	0	8,719
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	5,189	698	0	0	0	5,887
2000	0	0	0	0	0	0	0	18,809	0	0	0	0	18,809
2001	0	0	0	0	0	0	0	23,939	0	0	0	0	23,939
2002	0	0	0	0	0	0	0	21,642	0	0	0	0	21,642
Avg (21-02)	0	75	4	154	-43	125	94	6,882	1,500	0	0	0	8,791

Table 3.3-6

Difference in Hetch Hetchy Release to Stream (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	0	0	0	-1,561	0	0	0	-1,561	
1922	0	0	0	0	0	0	0	3,357	0	0	0	0	3,357	
1923	0	0	0	0	0	0	0	-7,029	0	0	0	0	-7,029	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	9,303	0	0	0	0	9,303	
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913	
1927	0	0	0	0	0	0	0	2,144	0	0	0	0	2,144	
1928	0	0	0	0	0	0	0	0	0	0	0	0	0	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	197	0	0	0	197	
1933	0	0	0	0	0	0	0	0	-10,176	0	0	0	-10,176	
1934	0	0	0	0	0	0	0	-3,808	0	0	0	0	-3,808	
1935	0	0	0	0	0	3,935	0	0	1,557	0	0	0	5,492	
1936	0	0	0	0	0	0	0	-1,127	0	0	0	0	-1,127	
1937	0	0	0	0	0	0	0	2,009	0	0	0	0	2,009	
1938	0	0	0	0	0	0	0	942	0	0	0	0	942	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	0	0	0	9,654	0	0	0	0	9,654	
1941	0	0	0	0	0	0	0	0	-222	0	0	0	-222	
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	
1944	0	0	0	0	0	0	0	-12,199	0	0	0	0	-12,199	
1945	0	0	0	0	0	0	0	0	22,537	0	0	0	22,537	
1946	0	0	0	0	0	0	0	-224	0	0	0	0	-224	
1947	0	0	0	0	0	0	0	-8,169	0	0	0	0	-8,169	
1948	0	0	0	0	0	0	0	0	1,282	0	0	0	1,282	
1949	0	0	0	0	0	0	0	0	170	0	0	0	170	
1950	0	0	0	0	0	0	0	0	10,121	0	0	0	10,121	
1951	0	-1,176	0	0	0	0	0	0	2,670	0	0	0	1,494	
1952	0	0	0	0	0	0	0	-1,982	0	0	0	0	-1,982	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	-10,541	0	0	0	0	-10,541	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	0	0	0	0	0	1,155	0	0	0	0	1,155	
1957	0	0	0	0	0	0	0	-18,186	0	0	0	0	-18,186	
1958	0	0	0	0	0	0	0	7,178	0	0	0	0	7,178	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	-13,553	0	0	0	0	-13,553	
1963	0	0	0	0	0	0	0	-3,875	0	0	0	0	-3,875	
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808	
1965	0	0	0	0	0	0	0	0	16,054	0	0	0	16,054	
1966	0	0	0	0	0	0	0	-3,808	4,045	0	0	0	237	
1967	0	0	0	0	0	0	0	0	3,920	0	0	0	3,920	
1968	0	0	0	0	0	0	0	-17,564	0	0	0	0	-17,564	
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	
1970	0	0	326	3,935	0	0	0	-2,117	0	0	0	0	2,144	
1971	0	0	0	0	0	0	0	-11,685	0	0	0	0	-11,685	
1972	0	0	0	0	0	0	0	-1,660	0	0	0	0	-1,660	
1973	0	0	0	0	0	0	0	9,693	0	0	0	0	9,693	
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	
1975	0	0	0	0	0	0	0	15,650	4,171	0	0	0	19,821	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	8,560	0	0	0	-310	8,250	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381	
1981	0	0	0	0	0	0	0	-10,060	0	0	0	0	-10,060	
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	
1984	0	0	0	0	0	3,935	0	-10,804	0	0	0	0	-6,869	
1985	0	0	0	0	0	0	0	3,804	0	0	0	0	3,804	
1986	0	0	0	0	1,757	0	0	0	0	0	0	0	1,757	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	364	0	0	0	364	
1992	0	0	0	0	0	0	0	-28,918	0	0	0	0	-28,918	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	-4,027	0	0	0	0	0	0	0	0	-4,027	
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	
1999	0	0	0	0	0	0	0	-8,302	0	0	0	0	-8,302	
2000	0	0	0	0	0	0	0	8,790	0	0	0	0	8,790	
2001	0	0	0	0	0	0	0	-19,306	0	0	0	0	-19,306	
2002	0	0	0	0	0	0	0	-15,040	0	0	0	0	-15,040	
Avg (21-02)	0	-14	4	47	-43	117	-93	-1,403	529	0	0	-4	-860	

Table 3.3-7

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	180	85	94	148	2,539	4,551	2,034	184	89
Above Normal	55	95	88	66	89	94	131	1,279	3,123	379	125	89
Normal	54	54	50	55	74	74	98	1,448	1,922	167	122	86
Below Normal	55	55	46	43	51	63	88	706	756	113	111	73
Dry	53	53	44	40	44	50	60	167	168	86	86	65
All Years	54	62	56	76	69	75	105	1,222	2,100	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	167	89	84	144	2,412	4,548	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,186	3,095	379	125	89
Normal	54	54	50	55	74	74	98	1,260	1,906	167	122	86
Below Normal	55	55	46	43	51	63	88	565	706	113	111	73
Dry	53	53	44	40	44	50	56	157	139	86	86	65
All Years	54	61	56	73	70	73	103	1,110	2,075	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	13	-4	10	4	126	3	0	0	0
Above Normal	0	6	0	0	0	0	0	93	27	0	0	0
Normal	0	0	0	0	0	0	0	189	16	0	0	0
Below Normal	0	0	0	0	0	0	0	141	50	0	0	0
Dry	0	0	0	0	0	0	4	10	29	0	0	0
All Years	0	1	0	3	-1	2	2	112	25	0	0	0

flow (cfs) is not always meaningful.⁷ When comparing the alternative to the WSIP setting, a change in the volume of release from O'Shaughnessy Dam to the stream would likely result in the initiation of the release being delayed or initiated earlier by a matter of days. Typical springtime releases, when initiated, amount to a release up to 3,000 cfs (approximately 6,000 acre-feet over the span of a day). Assuming that a change in release volume equates to a delay or an earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release between the alternative and WSIP would be up to an additional 5 days of release. Normally, the effect of this change in release would not affect the year's peak stream release rate during a year. Table 3.3-8 illustrates the average monthly stream release for the alternative and base setting, and differences, expressed in average monthly flow (cfs). Table 3.3-6 illustrates that the difference in monthly flow below O'Shaughnessy Dam between the alternative and base settings could range from an increase of approximately 16,000 acre-feet to a decrease of approximately 29,000 acre-feet. Using the same metric as described above to estimate the delay or addition in the number days of release to the stream, the alternative could lead to an effect ranging from an increase of 3 days of release to a decrease of up to 5 days, compared to the base setting.

Table 3.3-8

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	180	85	94	148	2,539	4,551	2,034	184	89
Above Normal	55	95	88	66	89	94	131	1,279	3,123	379	125	89
Normal	54	54	50	55	74	74	98	1,448	1,922	167	122	86
Below Normal	55	55	46	43	51	63	88	706	756	113	111	73
Dry	53	53	44	40	44	50	60	167	168	86	86	65
All Years	54	62	56	76	69	75	105	1,222	2,100	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	180	89	93	148	2,518	4,534	2,034	184	90
Above Normal	55	96	88	66	89	86	131	1,273	3,092	379	125	89
Normal	54	54	50	51	74	74	98	1,479	1,913	167	122	86
Below Normal	55	55	46	43	51	63	91	758	768	113	111	73
Dry	53	53	44	40	44	50	64	224	168	86	86	65
All Years	54	62	56	75	70	73	107	1,245	2,091	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	-4	2	0	20	17	0	0	0
Above Normal	0	-1	0	0	0	8	0	6	31	0	0	0
Normal	0	0	0	4	0	0	0	-31	9	0	0	0
Below Normal	0	0	0	0	0	0	-4	-52	-12	0	0	0
Dry	0	0	0	0	0	0	-4	-57	0	0	0	0
All Years	0	0	0	1	-1	2	-2	-23	9	0	0	0

⁷ See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir", Memorandum by Daniel B. Steiner, December 31, 2006.

3.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different for the alternative. Figure 3.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 3.4-1 are the results for the WSIP, alternative, and base settings. The operation resulting from the alternative is essentially the same as the WSIP setting, including during drought. Although the level of delivery between the alternative and base settings is essentially the same (net 265-mgd demand) during the 1987-1992 drought, water delivery reliability has been improved in the alternative setting, resulting in a similarity to the WSIP setting in the draw down of Lake Lloyd during this period. Although less water is delivered during this period in the alternative setting compared to the WSIP setting, more water is delivered in the alternative setting than in the base setting. The additional draw of water reduced the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the alternative setting, which, for satisfaction of MID/TID entitlements to inflow, was met with additional releases from Lake Lloyd, similar to the WSIP setting. The result that the amount of additional release from Lake Lloyd associated with the alternative appears approximately the same as in the WSIP setting in this instance is partially a factor of modeling discretion in that HH/LSM makes release decisions in the form of block amounts of releases. Additional refinement of modeling assumptions would likely produce a result that places Lake Lloyd storage during this drought period more equally between the base setting and WSIP setting results. Otherwise, the results for Lake Lloyd storage are essentially the same between the WSIP and alternative settings.

Figure 3.4-2 illustrates the almost identical operation of Lake Eleanor for the alternative and WSIP settings. Also shown in Figure 3.4-2 is the operation for the base setting. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more associated with modeling discretion than with any substantive difference in operation.

Supplementing the Figure 3.4-1 representation of Lake Lloyd stream releases is Table 3.4-1, illustrating releases for the alternative and WSIP settings, and the difference in releases between the two settings. Table 3.4-2 provides the same form of information for the alternative and base settings. With essentially no change in reservoir operations, stream releases would not be different.

3.5 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities, described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 3.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 3.5-1 are the results for the WSIP, alternative, and base settings. Supplementing the Figure 3.5-1 representation of Don Pedro Reservoir storage are Table 3.5-1 Don Pedro Reservoir Storage (No Purchase Increase), Table 59 Don Pedro Reservoir Storage (WSIP), and Table 3.5-2 Difference in Don Pedro Reservoir Storage (No Purchase Increase minus WSIP). Table 3.5-3 is provided to illustrate the difference in Don Pedro Reservoir storage between the base and alternative settings.

Table 3.5-2 illustrates that, throughout many years, the storage in Don Pedro Reservoir associated with the alternative setting would differ from the storage in the WSIP setting, and that this difference would almost always be more storage. Table 3.5-3 illustrates that the alternative setting results for Don Pedro Reservoir storage are close to the storage results depicted for the base setting, although typically lower than the base setting. Compared to the WSIP setting, the differences in storage indicate increases to the inflow of Don Pedro Reservoir, which are due to lesser demands and SJPL diversions in the alternative setting. The increases in inflow typically occur during the winter through early summer. Compared to the base setting, the alternative would result in typically less inflow to Don Pedro Reservoir during non-wetter years, and particularly during drought periods when more water is diverted to the SJPL in the alternative setting. Less inflow leads to less reservoir storage.

**Figure 3.4-1
Lake Lloyd Storage and Stream Release**

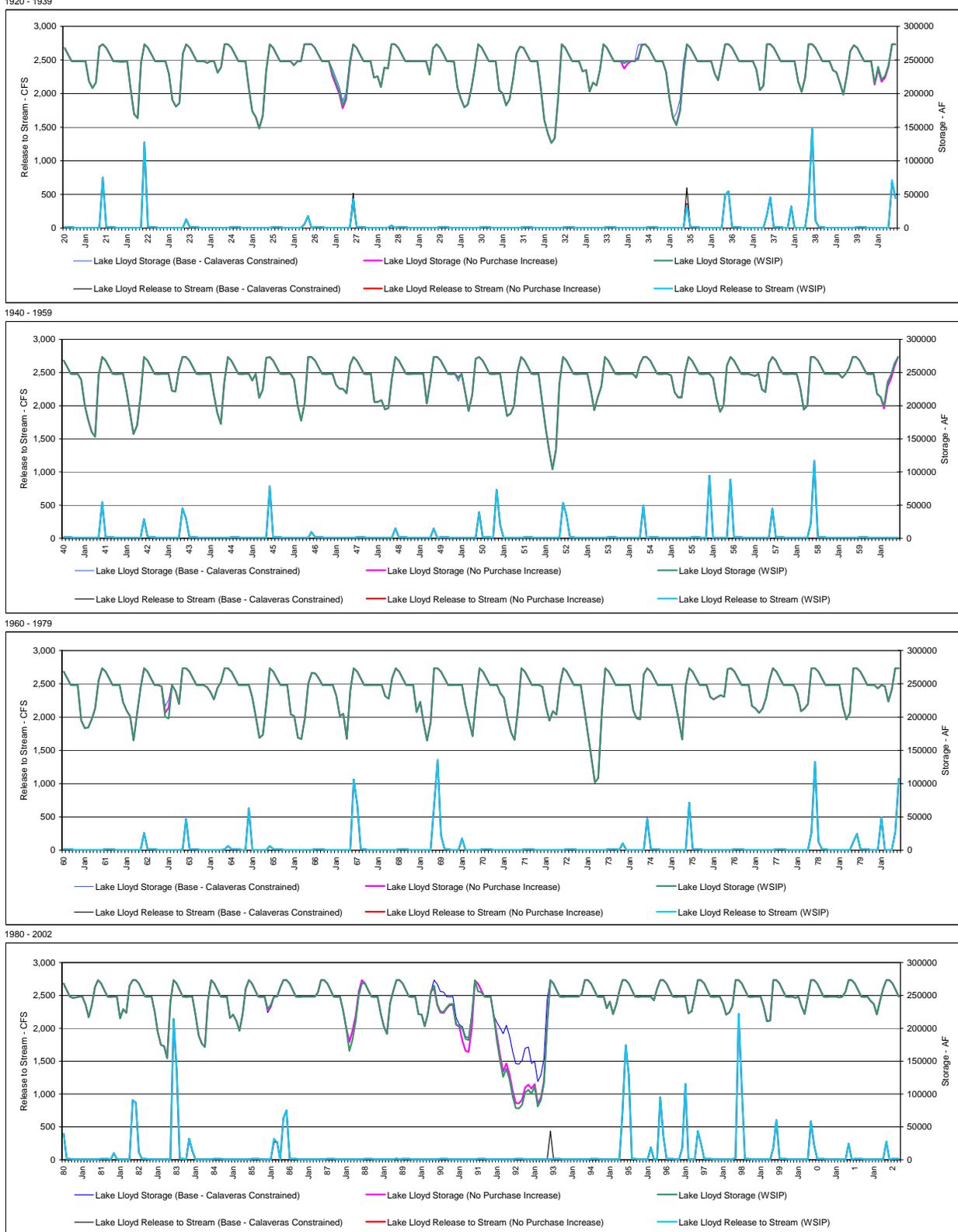


Figure 3.4-2
Lake Eleanor Storage and Stream Release

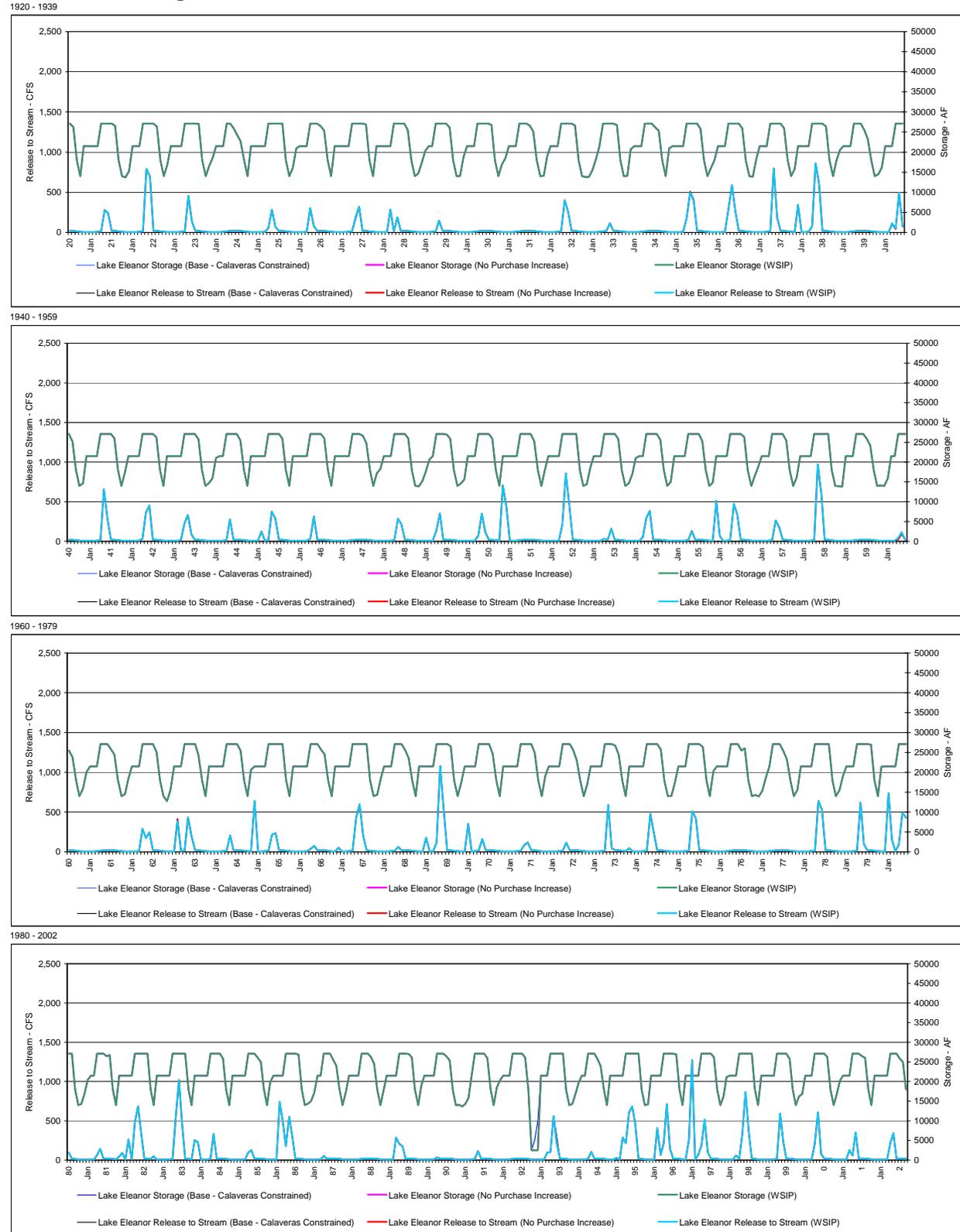


Table 3.4-1

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	22	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	165	445	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	120	340	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	121	340	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	-2	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	-2	-1	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.4-2

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	22	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	165	445	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	120	340	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	21	21	5	284	1,084	363	15	15
Above Normal	5	72	25	5	16	5	5	166	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	350	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)											No Purchase Increase minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	1	0	0	0	-27	0	0	0
Above Normal	0	0	0	0	0	0	0	-1	-22	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	-10	0	0	0

Figure 3.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

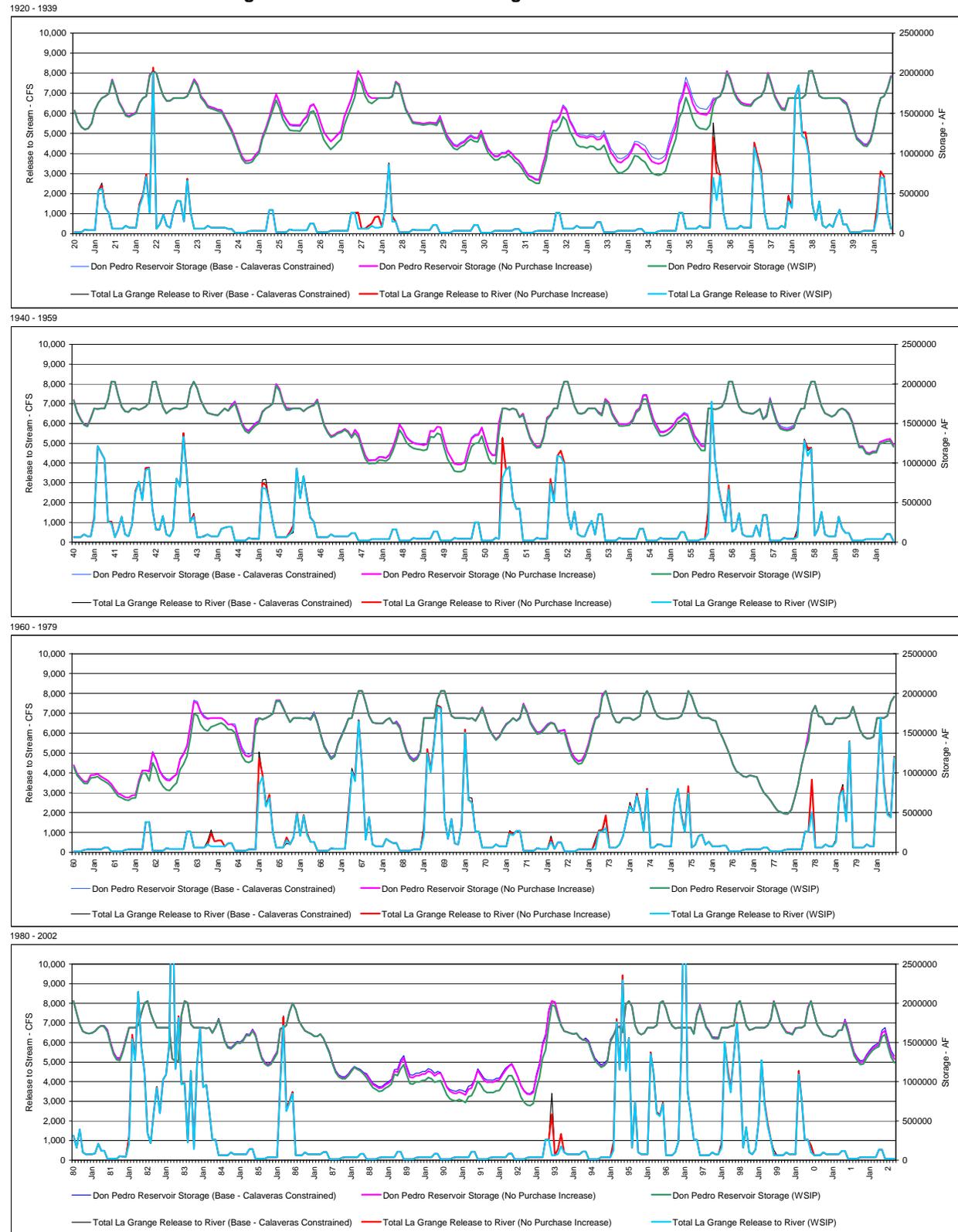


Table 3.5-1

Don Pedro Reservoir Storage (Acre-feet)

No Purchase Increase

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,298,116	1,312,166	1,374,846	1,543,388	1,634,035	1,690,000	1,713,000	1,746,404	1,922,499	1,792,574	1,644,246	1,567,618
1922	1,481,620	1,466,806	1,491,100	1,511,268	1,632,064	1,690,000	1,713,000	1,978,705	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,814,135	1,923,489	1,855,439	1,712,704	1,661,062
1924	1,591,184	1,575,510	1,561,492	1,543,091	1,537,806	1,453,114	1,375,256	1,297,368	1,189,801	1,070,870	962,066	907,784
1925	909,901	923,996	987,787	1,030,063	1,206,383	1,313,228	1,446,986	1,603,269	1,738,215	1,639,750	1,499,010	1,426,795
1926	1,362,785	1,354,398	1,355,300	1,349,233	1,420,087	1,465,844	1,593,604	1,615,453	1,531,864	1,391,910	1,269,231	1,205,130
1927	1,149,707	1,189,308	1,239,681	1,279,265	1,457,187	1,571,891	1,681,000	1,828,869	2,030,000	1,949,971	1,803,700	1,718,303
1928	1,690,000	1,690,000	1,689,999	1,690,000	1,689,999	1,690,000	1,713,000	1,896,318	1,861,948	1,698,225	1,555,689	1,477,704
1929	1,394,089	1,385,750	1,382,857	1,369,653	1,378,508	1,386,911	1,380,458	1,372,253	1,458,215	1,335,413	1,221,926	1,157,870
1930	1,101,665	1,085,480	1,120,995	1,140,996	1,184,970	1,216,398	1,189,503	1,188,879	1,281,001	1,164,436	1,059,470	1,006,465
1931	961,712	964,024	1,001,463	999,654	1,031,185	997,873	944,265	910,202	854,082	780,004	719,971	700,289
1932	674,060	668,988	847,017	994,626	1,245,725	1,394,934	1,390,018	1,451,126	1,584,306	1,536,411	1,400,194	1,322,880
1933	1,233,594	1,208,126	1,205,831	1,191,329	1,215,989	1,207,845	1,173,818	1,179,876	1,236,547	1,126,249	1,015,146	955,711
1934	898,020	886,193	923,553	951,351	1,020,046	1,117,873	1,105,773	1,064,453	1,038,863	964,443	902,347	882,546
1935	871,556	885,109	924,631	1,082,565	1,212,652	1,341,677	1,611,558	1,702,611	1,882,633	1,766,615	1,621,087	1,533,516
1936	1,496,945	1,488,405	1,482,436	1,535,959	1,662,027	1,690,000	1,713,000	1,824,587	2,025,181	1,926,728	1,776,704	1,693,811
1937	1,640,466	1,619,137	1,612,612	1,606,547	1,661,769	1,690,000	1,713,000	1,802,452	2,004,473	1,869,739	1,723,546	1,638,778
1938	1,564,623	1,556,052	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,656,928	1,622,389	1,498,838	1,331,553	1,189,776	1,150,981
1940	1,108,730	1,101,454	1,171,459	1,328,292	1,547,088	1,690,000	1,713,000	1,812,192	1,964,069	1,798,323	1,648,600	1,559,422
1941	1,488,799	1,472,486	1,572,618	1,689,992	1,683,025	1,690,000	1,690,000	1,806,825	2,030,000	2,027,570	1,857,840	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,981	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,369	1,690,000	1,713,000	1,942,881	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,728,347	1,773,108	1,646,387	1,504,625	1,427,144
1945	1,402,464	1,450,478	1,496,915	1,523,214	1,649,455	1,690,000	1,713,000	1,756,978	1,999,871	1,936,700	1,782,422	1,694,472
1946	1,690,000	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,738,139	1,805,152	1,640,770	1,485,114	1,398,674
1947	1,339,445	1,355,874	1,389,201	1,401,424	1,432,216	1,401,726	1,333,860	1,418,444	1,360,567	1,219,782	1,094,257	1,030,905
1948	1,034,586	1,035,830	1,074,455	1,073,831	1,061,904	1,099,683	1,193,815	1,319,997	1,485,394	1,420,320	1,326,614	1,282,066
1949	1,252,704	1,242,176	1,236,940	1,225,413	1,237,500	1,407,283	1,401,139	1,458,788	1,452,080	1,289,385	1,145,893	1,070,759
1950	992,534	982,407	983,129	1,011,446	1,171,429	1,308,014	1,346,837	1,354,759	1,447,718	1,297,917	1,157,305	1,098,466
1951	1,095,620	1,518,131	1,689,993	1,689,971	1,673,951	1,690,000	1,675,098	1,582,685	1,624,879	1,471,374	1,331,494	1,252,088
1952	1,210,700	1,218,399	1,339,992	1,573,938	1,609,085	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,642,019	1,616,238	1,809,714	1,764,854	1,631,742	1,556,702
1954	1,490,870	1,490,060	1,493,703	1,500,509	1,549,479	1,659,039	1,696,851	1,851,866	1,854,445	1,694,189	1,548,031	1,469,440
1955	1,389,944	1,389,670	1,407,956	1,440,546	1,490,821	1,556,431	1,583,914	1,623,180	1,596,281	1,460,508	1,335,156	1,276,335
1956	1,213,302	1,211,903	1,689,998	1,689,942	1,678,244	1,690,000	1,713,000	1,813,336	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,600,532	1,808,940	1,661,643	1,521,698	1,447,984
1958	1,431,596	1,424,033	1,436,742	1,459,706	1,592,080	1,685,702	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,669,298	1,620,274	1,517,717	1,352,516	1,209,107	1,208,774
1960	1,130,844	1,119,414	1,142,642	1,142,334	1,262,899	1,280,955	1,296,528	1,305,063	1,227,031	1,096,280	987,418	938,096
1961	890,165	889,359	973,561	975,267	987,425	953,488	928,346	901,869	858,612	793,760	739,995	720,580
1962	694,566	689,458	717,194	721,149	908,251	1,029,348	1,029,455	1,018,959	1,254,831	1,163,562	1,052,211	953,090
1963	910,112	903,998	948,766	983,022	1,166,614	1,234,651	1,334,401	1,598,146	1,895,203	1,875,034	1,758,287	1,699,018
1964	1,680,082	1,690,000	1,690,000	1,689,998	1,689,999	1,660,043	1,607,767	1,610,899	1,579,683	1,424,407	1,289,110	1,217,982
1965	1,204,341	1,227,613	1,661,012	1,689,962	1,671,264	1,690,000	1,713,000	1,747,772	1,913,099	1,915,120	1,825,610	1,722,996
1966	1,638,039	1,690,000	1,689,998	1,689,996	1,685,637	1,690,000	1,673,397	1,750,925	1,633,636	1,469,580	1,325,938	1,255,331
1967	1,179,412	1,212,940	1,366,632	1,465,649	1,653,482	1,679,244	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,637,801	1,576,247	1,409,104	1,273,615	1,195,861
1969	1,159,413	1,188,716	1,278,199	1,689,992	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,950	1,679,633	1,690,000	1,655,509	1,733,462	1,826,128	1,696,059	1,558,978	1,480,821
1971	1,420,774	1,463,683	1,550,732	1,616,642	1,645,380	1,690,000	1,654,817	1,698,531	1,868,498	1,768,286	1,634,637	1,565,013
1972	1,502,766	1,511,305	1,554,902	1,605,377	1,634,413	1,617,358	1,523,435	1,539,556	1,381,684	1,250,187	1,183,430	1,183,430
1973	1,144,682	1,157,673	1,239,745	1,368,550	1,548,168	1,690,000	1,717,600	1,987,574	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,962,884	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,840,271	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,495,123	1,761,000	1,845,303	1,711,347	1,699,327
1979	1,613,902	1,616,977	1,616,034	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,834,417	1,684,409	1,540,382	1,463,780
1980	1,432,372	1,435,084	1,455,118	1,689,973	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,714,087	1,701,962	1,655,558	1,494,484	1,365,905	1,297,676
1982	1,288,769	1,395,672	1,546,416	1,689,992	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,418	1,694,842	1,797,300	1,669,148	1,522,530	1,439,098
1985	1,424,065	1,459,172	1,503,551	1,494,141	1,529,196	1,597,274	1,590,372	1,658,425	1,596,644	1,436,124	1,304,460	1,240,522
1986	1,213,508	1,234,692	1,308,911	1,373,924	1,674,940	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,678	1,709,305
1987	1,650,171	1,628,126	1,609,576	1,578,456	1,577,656	1,606,515	1,550,992	1,454,198	1,364,747	1,233,515	1,125,104	1,071,797
1988	1,049,052	1,048,144	1,084,328									

Table 3.5-2

Don Pedro Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,271	1,910,239	1,780,368	1,632,093	1,555,504
1922	1,469,532	1,454,724	1,479,018	1,499,182	1,627,229	1,690,000	1,713,000	1,967,374	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,799,350	1,905,720	1,837,747	1,695,090	1,643,504
1924	1,573,662	1,557,997	1,543,979	1,525,572	1,520,285	1,435,601	1,350,582	1,268,108	1,160,641	1,041,842	933,176	878,997
1925	881,178	895,290	959,080	1,001,347	1,177,665	1,284,520	1,414,414	1,536,668	1,665,128	1,566,983	1,426,571	1,354,602
1926	1,290,743	1,282,398	1,282,833	1,276,745	1,347,403	1,393,186	1,513,528	1,529,318	1,431,062	1,291,567	1,169,352	1,105,586
1927	1,050,369	1,090,025	1,136,534	1,176,889	1,354,003	1,468,745	1,577,952	1,697,527	1,948,089	1,868,412	1,722,499	1,645,385
1928	1,624,109	1,655,435	1,689,902	1,690,000	1,689,998	1,690,000	1,705,499	1,882,298	1,844,942	1,681,291	1,538,831	1,460,902
1929	1,377,322	1,368,992	1,366,099	1,352,890	1,361,744	1,370,153	1,363,716	1,347,620	1,420,045	1,297,417	1,184,105	1,120,176
1930	1,064,049	1,047,885	1,083,398	1,103,389	1,147,360	1,178,802	1,151,942	1,144,262	1,236,535	1,120,169	1,015,406	962,553
1931	917,895	920,233	957,669	955,848	987,375	954,080	900,516	866,574	810,612	736,739	676,917	657,388
1932	631,250	626,111	769,876	913,848	1,153,707	1,290,028	1,281,046	1,334,403	1,458,411	1,411,082	1,275,442	1,198,554
1933	1,109,524	1,084,126	1,081,825	1,067,288	1,091,938	1,083,840	1,048,315	1,053,300	1,103,198	993,506	883,024	824,057
1934	766,654	754,904	779,126	811,010	879,460	973,506	960,998	918,785	892,442	818,720	757,328	738,038
1935	727,361	740,999	780,515	934,490	1,058,269	1,185,433	1,443,820	1,528,475	1,696,712	1,581,499	1,436,797	1,349,843
1936	1,313,654	1,305,218	1,299,245	1,352,785	1,588,986	1,690,000	1,713,000	1,808,423	2,006,955	1,908,581	1,768,637	1,675,801
1937	1,622,493	1,601,173	1,594,638	1,588,536	1,654,992	1,690,000	1,713,000	1,792,216	1,986,905	1,852,247	1,706,131	1,621,419
1938	1,547,298	1,538,738	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,640,414	1,609,719	1,486,211	1,318,984	1,177,264	1,138,511
1940	1,096,286	1,089,016	1,153,019	1,306,880	1,540,470	1,690,000	1,713,000	1,807,953	1,954,973	1,789,267	1,639,044	1,550,434
1941	1,479,830	1,463,523	1,562,835	1,689,993	1,683,062	1,690,000	1,690,000	1,803,805	2,030,000	2,027,570	1,857,840	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,745	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,706,915	1,749,631	1,623,011	1,481,354	1,403,951
1945	1,379,320	1,427,347	1,473,782	1,500,075	1,640,198	1,690,000	1,713,000	1,750,606	1,979,431	1,916,348	1,762,159	1,674,274
1946	1,676,444	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,277	1,790,756	1,626,434	1,470,843	1,384,452
1947	1,325,252	1,341,690	1,375,016	1,387,235	1,418,025	1,387,541	1,319,689	1,380,202	1,321,263	1,180,658	1,055,313	992,092
1948	995,855	997,122	1,035,745	1,034,871	1,022,941	1,055,025	1,146,212	1,267,720	1,417,634	1,352,869	1,259,478	1,215,157
1949	1,185,933	1,175,442	1,170,203	1,158,664	1,170,747	1,334,893	1,324,462	1,376,085	1,357,943	1,362,682	1,052,617	977,799
1950	899,772	889,700	891,735	917,336	1,074,649	1,209,756	1,247,393	1,254,524	1,342,391	1,193,077	1,052,942	994,455
1951	991,828	1,394,480	1,689,996	1,689,971	1,673,951	1,690,000	1,671,372	1,576,239	1,604,996	1,451,580	1,311,792	1,232,453
1952	1,191,106	1,198,816	1,320,408	1,550,006	1,599,510	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,598,044	1,787,718	1,742,953	1,609,936	1,534,967
1954	1,469,181	1,468,382	1,472,024	1,478,824	1,527,793	1,637,361	1,675,192	1,807,461	1,807,613	1,647,557	1,501,608	1,423,171
1955	1,343,773	1,343,524	1,361,809	1,394,386	1,444,656	1,510,283	1,537,906	1,575,778	1,541,339	1,405,813	1,280,713	1,222,079
1956	1,159,157	1,157,788	1,690,000	1,689,941	1,678,244	1,690,000	1,713,000	1,804,932	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,586,050	1,793,311	1,646,081	1,506,206	1,432,543
1958	1,416,187	1,408,633	1,421,341	1,444,300	1,585,917	1,683,239	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,329	1,608,068	1,505,552	1,340,406	1,197,054	1,196,761
1960	1,118,856	1,107,432	1,130,660	1,130,349	1,243,727	1,256,367	1,271,555	1,279,420	1,205,492	1,074,839	966,076	916,828
1961	868,944	868,151	939,429	941,125	953,280	919,356	894,250	867,206	824,074	759,385	705,786	686,494
1962	660,555	655,467	683,202	687,146	687,245	995,355	995,496	899,706	1,129,280	1,038,578	901,808	829,134
1963	786,422	780,381	830,701	875,755	1,042,937	1,111,019	1,210,888	1,447,268	1,742,065	1,722,560	1,606,476	1,547,700
1964	1,529,068	1,578,634	1,594,299	1,612,405	1,628,891	1,598,956	1,546,441	1,542,798	1,504,176	1,349,242	1,214,296	1,143,418
1965	1,129,930	1,153,243	1,584,742	1,689,973	1,672,299	1,690,000	1,713,000	1,744,658	1,904,786	1,906,843	1,817,368	1,723,009
1966	1,638,052	1,690,000	1,689,998	1,689,996	1,685,990	1,690,000	1,666,206	1,743,752	1,626,487	1,462,463	1,318,853	1,248,271
1967	1,172,366	1,205,898	1,359,590	1,458,604	1,556,437	1,679,489	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,623,382	1,560,682	1,393,610	1,258,193	1,180,490
1969	1,144,074	1,173,385	1,262,868	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,036	1,816,534	1,686,506	1,549,469	1,471,343
1971	1,411,316	1,454,230	1,541,278	1,607,186	1,641,597	1,690,000	1,654,817	1,685,672	1,853,567	1,753,420	1,619,836	1,550,260
1972	1,488,043	1,496,591	1,540,187	1,590,658	1,628,525	1,611,472	1,517,554	1,495,198	1,504,521	1,646,809	1,515,475	1,148,834
1973	1,110,158	1,123,168	1,205,238	1,334,033	1,513,648	1,676,096	1,707,479	1,954,405	2,030,000	1,868,018	1,723,819	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,536	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,823,045	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,401,086	1,761,000	1,845,304	1,711,347	1,699,327
1979	1,612,045	1,615,120	1,614,177	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,303	1,682,304	1,538,286	1,461,691
1980	1,430,288	1,433,000	1,453,035	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,714,087	1,699,430	1,636,268	1,475,279	1,346,789	1,278,626
1982	1,269,759	1,376,672	1,527,416	1,689,995	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,612	1,791,967	1,663,838	1,517,244	1,433,830
1985	1,418,807	1,453,917	1,498,296	1,488,884	1,523,939	1,592,019	1,585,122	1,645,091	1,583,355	1,422,894	1,291,292	1,227,399
1986	1,200,412	1,221,603	1,293,188	1,358,196	1,670,079	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,677	1,709,305
1987	1,650,170	1,628,126	1,609,576	1,578,456	1,577,656	1,606,514	1,550,992	1,452,961	1,354,101	1,222,918	1,114,556	1,061,284
1988	1,038,561	1,037,658	1,073,842	1,127,662	1,183,519	1,160,536	1,					

Table 3.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet)

No Purchase Increase minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	197	197	197	197	79	0	0	4,133	12,260	12,206	12,153	12,114
1922	12,088	12,082	12,082	12,086	4,835	0	0	11,331	0	0	0	0
1923	0	0	0	0	0	0	0	14,785	17,769	17,692	17,614	17,558
1924	17,522	17,513	17,513	17,519	17,521	17,513	24,674	29,260	29,160	29,028	28,890	28,787
1925	28,723	28,706	28,707	28,716	28,718	28,708	32,572	66,601	73,087	72,767	72,439	72,193
1926	72,042	72,000	72,467	72,488	72,684	72,658	80,076	86,135	100,802	100,343	99,879	99,544
1927	99,338	99,283	103,147	103,176	103,184	103,146	103,048	131,342	81,911	81,559	81,201	72,918
1928	65,891	34,565	97	0	0	0	7,501	14,020	17,006	16,934	16,858	16,802
1929	16,767	16,758	16,758	16,763	16,764	16,758	16,742	24,633	38,170	37,996	37,821	37,694
1930	37,616	37,595	37,597	37,607	37,610	37,596	37,561	44,617	44,466	44,267	44,064	43,912
1931	43,817	43,791	43,794	43,806	43,810	43,793	43,749	43,628	43,470	43,265	43,054	42,901
1932	42,810	42,787	77,141	80,778	92,018	104,906	108,972	116,723	125,895	125,329	124,752	124,326
1933	124,070	124,000	124,006	124,041	124,051	124,005	125,503	126,576	133,349	132,743	132,122	131,654
1934	131,366	131,289	144,427	140,341	140,586	144,367	144,775	145,668	146,421	145,723	145,019	144,508
1935	144,195	144,110	144,116	148,075	154,383	156,244	167,738	174,136	185,921	185,116	184,290	183,673
1936	183,291	183,187	183,191	183,174	73,041	0	0	16,164	18,226	18,147	18,067	18,010
1937	17,973	17,964	17,974	18,011	6,777	0	0	10,236	17,568	17,492	17,415	17,359
1938	17,325	17,314	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	16,514	12,670	12,627	12,569	12,512	12,470
1940	12,444	12,438	18,440	21,412	6,618	0	0	4,239	9,096	9,056	9,016	8,988
1941	8,969	8,963	9,783	-1	-37	0	0	3,020	0	0	0	0
1942	0	0	0	-1	0	0	0	0	0	0	0	0
1943	0	0	0	0	-580	0	0	3,136	0	0	0	0
1944	0	0	0	0	0	0	0	21,432	23,477	23,376	23,271	23,193
1945	23,144	23,131	23,133	23,139	9,257	0	0	6,372	20,440	20,352	20,263	20,198
1946	13,556	0	0	0	0	0	0	11,862	14,396	14,336	14,271	14,222
1947	14,193	14,184	14,185	14,189	14,191	14,185	14,171	38,242	39,304	39,124	38,944	38,813
1948	38,731	38,708	38,710	38,960	38,963	44,658	47,603	52,277	67,760	67,451	67,136	66,909
1949	66,771	66,734	66,737	66,749	66,753	72,390	76,677	82,703	94,137	93,703	93,276	92,960
1950	92,762	92,707	91,394	94,110	96,780	98,258	99,444	100,235	105,327	104,840	104,363	104,011
1951	103,792	123,651	-3	0	0	0	3,726	6,446	19,883	19,794	19,702	19,635
1952	19,594	19,583	19,584	23,932	9,575	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	14,214	18,194	21,996	21,901	21,806	21,735
1954	21,689	21,678	21,679	21,685	21,686	21,678	21,659	44,405	46,832	46,632	46,423	46,268
1955	46,171	46,146	46,147	46,160	46,165	46,148	46,008	47,402	54,942	54,695	54,443	54,256
1956	54,145	54,115	-2	1	0	0	0	8,404	0	0	0	0
1957	0	0	0	0	0	0	0	14,482	15,629	15,562	15,492	15,441
1958	15,409	15,400	15,401	15,406	6,163	2,463	0	0	0	0	0	0
1959	0	0	0	0	0	0	1,969	12,206	12,165	12,110	12,053	12,013
1960	11,988	11,982	11,982	11,985	19,172	24,588	24,973	25,643	21,539	21,441	21,342	21,288
1961	21,221	21,208	34,132	34,142	34,145	34,132	34,096	34,663	34,538	34,375	34,209	34,086
1962	34,011	33,991	33,992	34,003	34,006	33,993	33,959	119,253	125,551	124,984	124,403	123,961
1963	123,690	123,617	118,065	107,267	123,677	123,632	123,513	150,878	153,138	152,474	151,811	151,318
1964	151,014	111,366	95,701	77,593	61,108	61,087	61,326	68,101	75,507	75,165	74,814	74,564
1965	74,411	74,370	76,270	-11	-1,035	0	0	3,114	8,313	8,277	8,242	-13
1966	-13	0	0	0	-353	0	7,191	7,173	7,149	7,117	7,085	7,060
1967	7,042	7,042	7,042	7,045	7,045	-245	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	14,419	15,565	15,494	15,422	15,371
1969	15,339	15,331	15,331	-2	0	0	0	0	0	0	0	0
1970	0	0	0	-2	0	0	0	8,426	9,594	9,553	9,509	9,478
1971	9,458	9,453	9,454	9,456	3,783	0	0	12,859	14,931	14,866	14,801	14,753
1972	14,723	14,714	14,715	14,719	5,888	5,886	5,881	35,154	35,035	34,875	34,712	34,596
1973	34,524	34,505	34,507	34,517	34,520	13,904	10,121	33,169	0	0	1	0
1974	0	0	0	0	0	0	0	-652	0	0	0	0
1975	0	0	0	0	0	0	0	17,226	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	94,037	0	-1	0	0
1979	1,857	1,857	1,857	0	0	0	0	0	2,114	2,105	2,096	2,089
1980	2,084	2,084	2,083	-3	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	2,532	19,290	19,205	19,116	19,050
1982	19,010	19,000	19,000	-3	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	197	3,230	5,333	5,310	5,286	5,268
1985	5,258	5,255	5,255	5,257	5,257	5,255	5,250	13,334	13,289	13,230	13,168	13,123
1986	13,096	13,089	15,723	15,728	4,861	0	0	0	0	0	1	0
1987	1	0	0	0	0	1	0	1,237	10,646	10,597	10,548	10,513
1988	10,491	10,486	10,486	10,488	-3,171	-3,170	2,411	4,752	36,530	41,352	41,155	41,009
1989	40,919	40,894	40,897	40,908	40,912	40,896	43,776	77,727	82,333	81,962	81,586	81,306
1990	81,134	81,088	81,082	81,115	81,121	81,092	81,013	98,471	98,131	97,678	97,205	96,862
1991	96,652	96,595	95,845	95,497	95,316	95,279	95,183	121,700	137,499	123,776	132,016	134,624
1992	134,330	134,251	134,257	134,298	134,309	134,258	119,369	144,528	144,031	143,368	142,676	142,172
1993	141,864	141,775	141,781	145,695	145,727	159,269	165,875	169,573	53,066	52,838	36,792	-59
1994	-59	-59	-59	-59	-59	-59	-59	9,931	9,897	9,852	9,805	9,773
1995	9,753	9,747	9,748	9,750	916	0	10,394	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	-1	0	0	5,800	7,021	8,194	8,158	8,123	8,097
1998	8,081	8,077	8,077	-1	0	0	-1,472	0	0	0	0	0
1999	0	0	0	0	0	0	0	10,090	9,823	9,781	9,738	9,707
2000	9,688	9,682	9,682	9,685	0	0	0	20,020	0	0	0	0
2001	0	0	0	0	0	0	0	25,145	26,045	25,929	25,810	25,721
2002	25,668	25,654	25,655	25,662	25,664	25,654	25,629	47,027	46,869	46,659	46,444	46,285
Avg (21-02)	32,727	31,922	29,768	28,015	25,420	24,206	25,480	35,701	34,725	34,470	34,226	33,501

Figure 3.5-1 and Table 3.5-4 illustrate that, during drought sequences, reduction to inflow to Don Pedro Reservoir can accumulate from year to year. Compared to the base setting, the alternative would result in lower Don Pedro Reservoir storage during drought periods. Figure 3.5-2 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 3.5-3 illustrates the same information for the comparison between the alternative and the base settings.

Figure 3.5-2

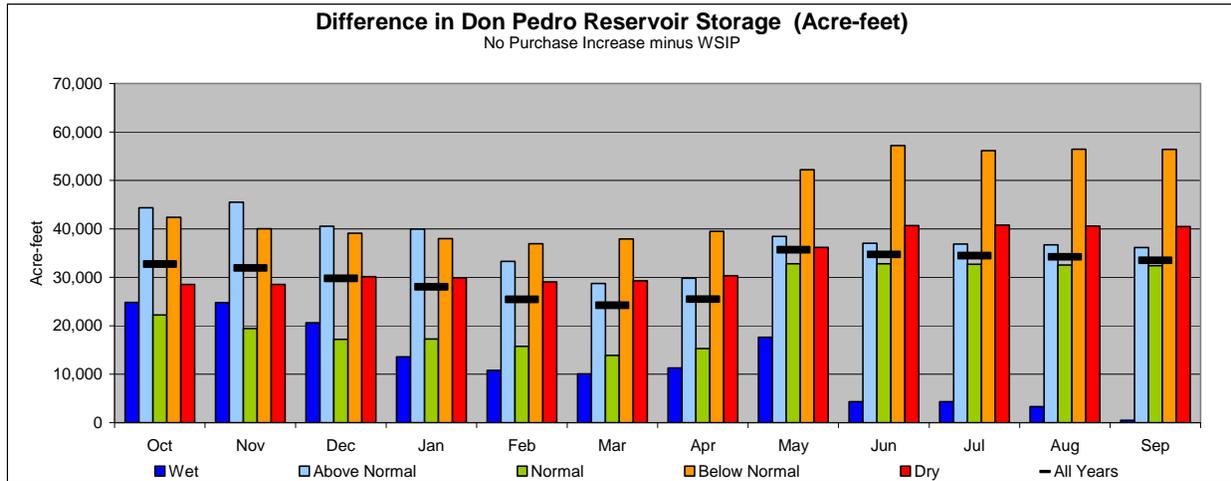


Figure 3.5-3

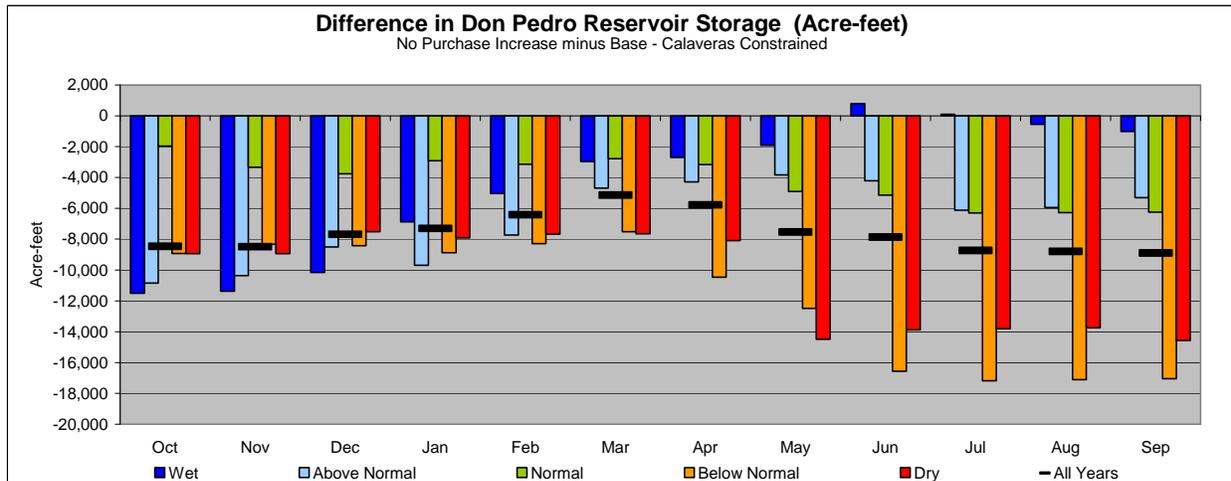


Figure 3.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the alternative would manifest in differences in releases from La Grange Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow directly manifests as a change in release from La Grange Dam (a change of either more or less flow). Figure 3.5-1 illustrates the stream release from La Grange Dam for the WSIP, alternative, and base settings.

Table 3.5-4

Difference in Don Pedro Reservoir Storage (Acre-feet)

No Purchase Increase minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	660	19	-2,164	-2,155	-2,148
1922	-2,144	-2,142	-2,142	-2,142	-857	0	0	1,497	0	-2,184	-1,520	3
1923	3	2	0	0	0	0	0	-6,070	-5,131	-7,291	-7,260	-7,237
1924	-7,222	-7,218	-7,219	-7,221	-7,220	-7,219	-3,163	-2,190	-2,182	-2,173	-2,163	-2,154
1925	-2,150	-2,149	-2,149	-2,149	-2,150	-2,148	-2,886	11,163	15,721	13,471	13,411	13,366
1926	13,338	13,330	13,299	13,303	13,298	13,869	14,152	10,257	1,666	1,659	1,652	1,646
1927	1,643	1,642	12,101	12,105	12,105	12,101	12,090	12,923	0	-2,184	-1,531	2
1928	0	0	0	0	0	0	0	950	1,866	1,858	1,850	1,843
1929	1,839	1,839	1,838	1,839	1,839	1,839	1,837	-16,135	-16,999	-16,921	-16,842	-16,786
1930	-16,751	-16,742	-16,743	-16,748	-16,748	-16,743	-16,726	-9,527	-11,608	-11,555	-11,503	-11,464
1931	-11,439	-11,433	-11,433	-11,437	-11,438	-11,433	-11,422	-11,390	-11,349	-11,294	-11,241	-11,200
1932	-11,176	-11,168	-8,927	-12,555	-12,311	-19,854	-20,586	-21,406	-22,055	-24,139	-24,030	-23,949
1933	-23,898	-23,885	-23,885	-23,893	-23,894	-23,885	-27,895	-32,242	-45,807	-47,785	-47,566	-47,402
1934	-47,299	-47,270	-28,478	-34,858	-31,146	-30,652	-39,143	-57,094	-57,425	-57,161	-56,890	-56,687
1935	-56,561	-56,527	-56,530	-68,172	-75,688	-54,332	-47,673	-50,940	-66,960	-68,852	-68,554	-68,328
1936	-68,189	-68,151	-68,154	-68,182	-27,963	0	0	-1,289	-1,285	-3,464	-3,448	-3,437
1937	-3,431	-3,428	-3,428	-3,429	-1,466	0	0	500	-1,340	-3,518	-3,502	-3,492
1938	-3,484	-3,482	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	-12,399	-14,553	-16,618	-16,542	-16,465	-16,411
1940	-16,377	-16,367	-9,634	-5,955	-2,805	0	0	10,414	10,379	10,334	10,289	10,256
1941	10,234	10,228	10,120	-1	15	0	0	-75	0	-2,183	-1,521	3
1942	3	3	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	-580	0	0	-1,900	0	-2,183	-2,174	4
1944	3	4	4	3	2	0	0	-12,185	-12,145	-14,277	-14,213	-14,165
1945	-14,136	-14,128	-14,128	-14,132	-5,653	0	0	6,087	31,325	29,007	28,880	28,788
1946	22,130	0	0	0	0	0	0	220	678	676	673	670
1947	669	669	669	669	670	669	668	-8,442	-9,332	-9,288	-9,246	-9,214
1948	-9,195	-9,191	-9,190	-8,954	-8,955	-8,951	-10,777	-10,507	-9,192	-11,333	-11,281	-11,242
1949	-11,219	-11,213	-11,213	-11,248	-11,249	-2,676	-2,454	260	3,003	2,976	2,966	2,966
1950	2,960	2,958	-3,740	3,322	-9,360	-17,105	-16,744	-16,936	-8,887	-10,232	-10,185	-10,151
1951	-10,130	-2,096	0	0	0	0	802	2,605	6,847	4,634	4,612	4,596
1952	4,586	4,584	4,584	4,445	1,779	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	-5,617	-3,798	-2,040	-4,214	-4,196	-4,182
1954	-4,174	-4,171	-4,171	-4,173	-4,173	-4,171	-4,167	-14,211	-13,704	-13,644	-13,583	-13,539
1955	-13,510	-13,502	-13,503	-13,507	-13,508	-13,503	-15,810	-18,141	-21,136	-21,041	-20,944	-20,873
1956	-20,829	-20,818	0	0	0	0	0	289	0	0	0	0
1957	0	0	0	0	0	0	0	-19,113	-19,971	-22,068	-21,970	-21,897
1958	-21,851	-21,839	-21,839	-21,845	-8,739	-3,494	0	0	0	0	0	0
1959	0	0	0	0	0	0	-3,794	-10,209	-10,175	-10,129	-10,081	-10,048
1960	-10,028	-10,021	-10,022	-10,025	-6,286	-2,270	-3,140	-1,343	-3,683	-3,666	-3,649	-3,637
1961	-3,628	-3,626	311	311	312	311	310	-291	-290	-288	-287	-287
1962	-285	-285	-286	-285	-285	-285	-285	-14,770	-15,638	-17,751	-17,670	-17,609
1963	-17,570	-17,560	-7,324	-5,718	-17,575	-17,569	-17,551	-20,184	-19,199	-21,299	-21,206	-21,139
1964	-9,918	0	0	0	0	0	-2,117	-7,969	-33,127	-32,978	-32,826	-32,714
1965	-32,647	-32,629	-20,576	3	2	0	0	4,462	22,221	19,942	17,671	-28
1966	-28	0	0	0	0	0	-19,773	-18,108	-20,164	-20,074	-19,981	-19,913
1967	-19,872	-19,861	-19,862	-19,867	-19,869	-10,102	0	0	0	0	-2,183	3
1968	4	4	4	3	2	0	0	-17,434	-18,295	-18,213	-18,128	-18,067
1969	-18,030	-18,020	-18,021	3	0	0	0	0	0	0	0	0
1970	0	0	0	-5	1,189	0	0	-3,065	-3,973	-6,139	-6,113	-6,092
1971	-6,080	-6,075	-6,076	-6,078	-2,432	0	0	-10,976	-10,940	-13,075	-13,019	-12,975
1972	-12,949	-12,942	-12,942	-12,946	-5,179	-5,178	-5,172	-9,003	-11,086	-11,036	-10,985	-10,948
1973	-10,926	-10,919	-10,919	-10,922	-10,924	0	0	6,980	0	0	0	0
1974	0	0	0	1	1	0	0	0	0	-2,184	-2,174	3
1975	4	4	3	3	1	0	0	18,424	0	-2,184	-1,521	2
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	6,649	0	-2,184	-2,174	-2,476
1979	-6,460	-6,456	-6,456	1	1	0	0	0	0	0	0	0
1980	0	0	0	-3	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-2,117	-12,159	-12,120	-12,066	-12,011	-11,970
1982	-11,944	-11,937	-11,938	2	0	0	0	0	0	0	-2,183	0
1983	0	0	0	0	0	0	0	0	0	0	-2,183	3
1984	0	0	0	0	0	0	0	-10,790	-10,755	-12,892	-12,835	-12,792
1985	-12,765	-12,758	-12,759	-12,762	-12,763	-12,758	-12,746	-11,331	-13,407	-13,346	-13,285	-13,240
1986	-13,212	-13,205	-16,131	-14,216	-5,661	0	0	0	0	-2,183	-2,173	-2,167
1987	-2,162	-2,161	-2,162	-2,162	-2,162	-2,161	-2,159	-14,516	-16,579	-16,503	-16,429	-16,373
1988	-16,339	-16,329	-16,330	-16,335	-16,336	-16,330	-16,314	-16,272	-18,366	-18,282	-18,196	-18,133
1989	-18,093	-18,082	-18,083	-18,089	-18,090	-18,084	-38,004	-35,056	-32,176	-32,031	-31,884	-31,776
1990	-31,711	-31,692	-31,694	-31,703	-31,706	-31,693	-31,663	-28,091	-8,146	-8,110	-8,071	-8,030
1991	-27,264	-27,248	-28,789	-36,679	-38,228	-38,213	-38,173	-9,529	-22,291	-25,284	-25,167	-25,082
1992	-25,028	-25,015	-25,015	-25,023	-25,024	-25,015	-9,476	-10,949	-10,912	-10,863	-10,812	-10,772
1993	-10,749	-10,743	-24,724	-36,234	-36,248	-33,922	-36,496	-33,251	0	-2,184	-1,520	3
1994	3	2	2	2	3	3	3	-20,604	-22,647	-22,545	-22,439	-22,363
1995	-22,316	-22,304	-22,305	-22,312	-11,910	0	1,191	0	0	0	-2,184	3
1996	4	3	4	4	0	0	0	0	0	-2,183	-2,174	-2,167
1997	-2,163	0	0	1	0	0	-7,822	-8,753	-9,643	-11,786	-11,735	-11,697
1998	-11,673	-11,667	-11,668	2	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-10,507	0	-2,183	-2,174	-2,167
2000	-2,162	-2,162	-2,162	-2,162	0	0	0	7,829	0	0	0	0
2001	0	0	0	0	0	0	0	-20,232	-21,086	-20,993	-20,896	-20,824
2002	-20,779	-20,768	-20,769	-20,775	-20,777	-20,770	-20,750	-36,976	-38,969	-38,797	-38,619	-38,486
Avg (21-02)	-8,470	-8,489	-7,690	-7,303	-6,416	-5,143	-5,780	-7,541	-7,867	-8,738	-8,792	-8,896

Figure 3.5-4

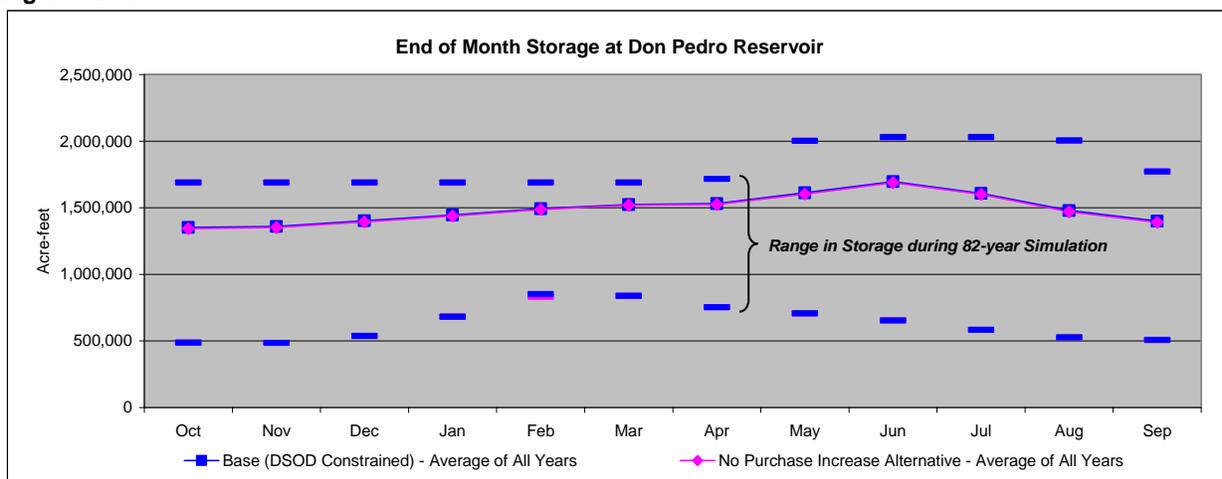


Table 3.5-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative exhibits an incrementally larger stream release, predominantly during some months of the early-winter-through-June period, which reflects the months when releases to the stream above minimum release requirements are made due to flood control or in anticipation of the reservoir being filled. Table 3.5-6 illustrates the same information in comparing the alternative and WSIP settings, with years ranked in descending order of the San Joaquin River Index. Illustrated is the finding that differences in releases to the Tuolumne River from La Grange Dam would occur only when there are releases above minimum FERC flow requirements. This circumstance typically occurs only in above-normal and wet years, and predominantly during early winter through June. During other year types and during summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting. Compared to the WSIP setting, the large potential reduction in flow following an extended drought period is reduced with the alternative because the amount of water delivered by the SFPUC during these periods is less than in the WSIP setting, but is still more than in the base setting.

As described above concerning Don Pedro inflow and storage, compared to the base setting, the alternative setting would lead to an additional draw of storage due to SFPUC diversions that are greater than in the base setting in drought periods. Although the reduction in storage would not greatly accumulate, greater replenishment of Don Pedro Reservoir storage is needed in about 30 percent of the years of the 82-year simulation. Occasionally, an increase in releases would occur. This circumstance would occur because of the shift in timing of SJPL diversions due to the increased conveyance capacity. The effect is an occasional additional release of water from Hetch Hetchy Reservoir in the winter, which then manifests as an additional release from Don Pedro Reservoir. Table 3.5-7 illustrates the difference in stream releases between the alternative and base settings, depicting the predominance of reductions to flow. Table 3.5-8 illustrates the same information, ranked in descending order of the San Joaquin River Index.

Table 3.5-5 and Table 3.5-7 illustrate the difference in stream release between the alternative, WSIP, and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 3.5-9 illustrates the same information and the average monthly stream release for the alternative and WSIP settings, expressed in average monthly flow (cfs). Table 3.5-10 presents the same information in comparing the alternative and base settings. In comparing the alternative to the WSIP setting, the difference in monthly flow below La Grange Dam could range from an increase of approximately 123,000 acre-feet to a decrease of approximately 7,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful. Similar to the operation of releases below O'Shaughnessy Dam, a change in the volume of release from La Grange Dam to the stream would likely result in the initiation of the release being delayed or accelerated by a matter of days. Assuming that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the alternative and WSIP would be an additional day of delay in releases or up to almost an

Table 3.5-5

Difference in Total La Grange Release to River (Acre-feet)

No Purchase Increase minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	118	8,716	1,133	0	0	0	0	0	9,967
1922	0	0	0	0	7,251	4,834	8,286	6,764	15,179	0	0	0	42,314
1923	0	0	0	0	0	0	4,879	0	0	0	0	0	4,879
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	48,358	0	0	8,037	56,395
1928	6,889	31,299	34,469	97	0	1,043	16,297	0	0	0	0	0	90,094
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	111,330	84,242	4,697	0	0	0	0	0	200,269
1937	0	0	0	0	13,375	12,098	11,514	0	0	0	0	0	36,987
1938	0	0	15,461	0	0	45	11,329	20,634	4,880	0	0	0	52,349
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	24,536	18,774	5,356	0	0	0	0	0	48,666
1941	0	0	0	9,785	217	135	211	0	6,282	0	0	0	16,630
1942	0	0	0	6,571	0	3,805	7,365	2,855	2,762	0	0	0	23,358
1943	0	0	0	0	3,481	11,965	6,721	0	6,169	0	0	0	28,336
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	13,884	12,204	1,454	0	0	0	0	0	27,542
1946	6,608	13,553	0	0	0	7,641	1,704	0	0	0	0	0	29,506
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	123,656	-2	0	0	0	0	0	0	0	0	123,654
1952	0	0	0	0	14,360	9,572	0	18,593	4,879	0	0	0	47,404
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	60,795	-1	0	4,566	4,697	0	12,257	0	0	0	82,314
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	9,243	3,697	2,463	23,716	2,854	0	0	0	41,973
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	39,575	15,670	18,132	16,489	0	0	0	0	0	0	0	89,866
1965	0	0	0	81,999	6,180	2,866	10,053	0	0	0	0	8,241	109,339
1966	0	-13	3,406	0	2,121	6,099	0	0	0	0	0	0	11,613
1967	0	0	0	0	0	22,602	-246	16,228	2,762	0	0	0	41,346
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	15,335	11,777	6,138	7,641	3,140	3,038	0	0	0	47,069
1970	0	0	326	10,325	-1	2,896	0	0	0	0	0	0	13,546
1971	0	0	0	0	5,674	3,782	0	0	0	0	0	0	9,456
1972	0	0	0	0	8,831	0	0	0	0	0	0	0	8,831
1973	0	0	0	0	0	20,607	3,772	5,558	37,994	0	0	0	67,931
1974	0	0	0	2,825	0	5,899	5,524	5,694	4,229	0	0	0	24,171
1975	0	0	0	0	0	0	7,366	0	21,066	0	0	0	28,432
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	97,653	0	0	0	97,653
1979	0	0	0	1,858	0	10,509	0	2,189	0	0	0	0	14,556
1980	0	0	0	21,778	-7,494	12,117	3,867	3,139	3,039	0	0	0	36,446
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	22,189	12,097	2,663	0	2,854	2,762	0	0	1,196	43,761
1983	2,949	1,841	0	-1	0	0	0	4,848	1,841	0	0	0	11,478
1984	6,944	2,763	0	0	0	0	0	0	0	0	0	0	9,707
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	10,117	26,744	12,221	5,042	4,879	0	0	0	59,003
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	123,909	0	15,852	36,792	176,553
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	23,754	8,272	0	15,137	4,604	0	0	0	51,767
1996	0	0	0	0	4,975	0	4,880	3,996	3,867	0	0	0	17,718
1997	0	0	0	8,720	-1	0	0	0	0	0	0	0	8,719
1998	0	0	0	8,080	-1	13,949	8,839	2,430	3,774	0	0	0	37,071
1999	0	0	0	0	0	7,611	8,301	0	4,762	0	0	0	20,674
2000	0	0	0	0	9,685	0	0	0	21,186	0	0	0	30,871
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	285	1,086	3,095	2,533	3,683	4,099	1,955	1,742	5,427	0	193	662	24,759

Table 3.5-6

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

No Purchase Increase minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	2,949	1,841	0	-1	0	0	0	4,848	1,841	0	0	0	11,478
1969	0	0	0	15,335	11,777	6,138	7,641	3,140	3,038	0	0	0	47,069
1995	0	0	0	0	23,754	8,272	0	15,137	4,604	0	0	0	51,767
1938	0	0	15,461	0	0	45	11,329	20,634	4,880	0	0	0	52,349
1998	0	0	0	8,080	-1	13,949	8,839	2,430	3,774	0	0	0	37,071
1982	0	0	0	22,189	12,097	2,663	0	2,854	2,762	0	0	1,196	43,761
1967	0	0	0	0	0	22,602	-246	16,228	2,762	0	0	0	41,346
1952	0	0	0	0	14,360	9,572	0	18,593	4,879	0	0	0	47,404
1958	0	0	0	0	9,243	3,697	2,463	23,716	2,854	0	0	0	41,973
1980	0	0	0	21,778	-7,494	12,117	3,867	3,139	3,039	0	0	0	36,446
1978	0	0	0	0	0	0	0	0	97,653	0	0	0	97,653
1922	0	0	0	0	7,251	4,834	8,286	6,764	15,179	0	0	0	42,314
1956	0	0	60,795	-1	0	4,566	4,697	0	12,257	0	0	0	82,314
1942	0	0	0	6,571	0	3,805	7,365	2,855	2,762	0	0	0	23,358
1941	0	0	0	9,785	217	135	211	0	6,282	0	0	0	16,630
1986	0	0	0	0	10,117	26,744	12,221	5,042	4,879	0	0	0	59,003
1993	0	0	0	0	0	0	0	0	123,909	0	15,852	36,792	176,553
1997	0	0	0	8,720	-1	0	0	0	0	0	0	0	8,719
1996	0	0	0	0	4,975	0	4,880	3,996	3,867	0	0	0	17,718
1943	0	0	0	0	3,481	11,965	6,721	0	6,169	0	0	0	28,336
1937	0	0	0	0	13,375	12,098	11,514	0	0	0	0	0	36,987
1974	0	0	0	2,825	0	5,899	5,524	5,694	4,229	0	0	0	24,171
1975	0	0	0	0	0	0	7,366	0	21,066	0	0	0	28,432
1965	0	0	0	81,999	6,180	2,866	10,053	0	0	0	0	8,241	109,339
1936	0	0	0	0	111,330	84,242	4,697	0	0	0	0	0	200,269
1984	6,944	2,763	0	0	0	0	0	0	0	0	0	0	9,707
1979	0	0	0	1,858	0	10,509	0	2,189	0	0	0	0	14,556
1945	0	0	0	0	13,884	12,204	1,454	0	0	0	0	0	27,542
1999	0	0	0	0	0	7,611	8,301	0	4,762	0	0	0	20,674
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	48,358	0	0	8,037	56,395
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	6,608	13,553	0	0	0	7,641	1,704	0	0	0	0	0	29,506
1973	0	0	0	0	0	20,607	3,772	5,558	37,994	0	0	0	67,931
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	9,685	0	0	0	21,186	0	0	0	30,871
1940	0	0	0	0	24,536	18,774	5,356	0	0	0	0	0	48,666
1923	0	0	0	0	0	0	4,879	0	0	0	0	0	4,879
1921	0	0	0	0	118	8,716	1,133	0	0	0	0	0	9,967
1970	0	0	326	10,325	-1	2,896	0	0	0	0	0	0	13,546
1951	0	0	123,656	-2	0	0	0	0	0	0	0	0	123,654
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	5,674	3,782	0	0	0	0	0	0	9,456
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	6,889	31,299	34,469	97	0	1,043	16,297	0	0	0	0	0	90,094
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-13	3,406	0	2,121	6,099	0	0	0	0	0	0	11,613
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	39,575	15,670	18,132	16,489	0	0	0	0	0	0	0	89,866
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	8,831	0	0	0	0	0	0	0	8,831
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.5-7

Difference in Total La Grange Release to River (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	-6,985	-2,467	0	0	0	0	0	-9,452	
1922	0	0	0	0	-1,286	-857	921	1,080	482	0	-655	-1,521	-1,836	
1923	0	0	3	0	0	0	2,762	0	0	0	0	0	2,765	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	
1927	0	0	0	0	0	0	0	0	4,530	0	-644	-1,532	2,354	
1928	3	0	0	0	0	-4,296	5,524	0	0	0	0	0	1,231	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-40,223	-34,833	-238	0	0	0	0	0	-75,294	
1937	0	0	0	0	-1,494	-908	7,827	0	0	0	0	0	5,425	
1938	0	0	-3,483	0	0	0	1,986	1,083	0	-2,189	0	0	-2,603	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	-1,036	-446	72	0	0	0	0	0	-1,410	
1941	0	0	0	10,123	-98	-60	-93	0	-296	0	-655	-1,520	7,401	
1942	0	0	2	2,076	0	0	1,841	0	0	-2,188	0	0	1,731	
1943	0	0	0	0	3,481	504	1,842	0	-3,738	0	0	-2,173	-84	
1944	0	0	0	0	2	1	0	0	0	0	0	0	3	
1945	0	0	0	0	-8,479	-18,021	1,409	0	0	0	0	0	-25,091	
1946	6,608	22,124	0	0	0	-5,751	-2,163	0	0	0	0	0	20,818	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	-2,096	0	0	0	0	0	0	0	0	0	-2,096	
1952	0	0	0	0	2,667	1,778	0	-1,982	0	-2,188	0	0	275	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	-20,439	1	0	232	2,003	0	-725	-2,188	0	0	-21,116	
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	
1958	0	0	0	0	-13,107	-5,244	-3,492	7,178	0	-2,188	0	0	-16,853	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	
1964	-11,189	-9,916	0	0	0	0	0	0	0	0	0	0	-21,105	
1965	0	0	0	-20,583	2	-10,614	8,820	0	0	0	0	17,670	-4,705	
1966	0	-28	-905	0	0	0	0	0	0	0	0	0	-933	
1967	0	0	0	0	0	1,042	-10,098	6,535	2,762	-2,188	0	-2,184	-4,131	
1968	0	0	0	0	2	1	0	0	0	0	0	0	3	
1969	0	0	0	-18,026	4,570	0	0	-1,903	-1,841	-2,188	0	0	-19,388	
1970	0	0	326	32,162	-7,146	-13,183	0	0	0	0	0	0	12,159	
1971	0	0	0	0	-3,647	-2,431	0	0	0	0	0	0	-6,078	
1972	0	0	0	0	-7,768	0	0	0	0	0	0	0	-7,768	
1973	0	0	0	0	0	-10,921	0	5,558	9,731	0	0	0	4,368	
1974	0	0	0	-8,330	1	-2,663	0	0	0	0	0	-2,174	-13,166	
1975	0	0	0	0	2	1	-920	0	21,314	0	-655	-1,520	18,222	
1976	2	0	0	0	0	0	0	0	0	0	0	0	2	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	0	4,796	0	0	0	4,796	
1979	0	0	0	-6,458	0	-8,594	-2,118	0	0	0	0	0	-17,170	
1980	0	0	0	25,612	-7,495	3,555	-1,013	-1,903	-1,841	-2,188	0	0	14,727	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	-8,758	1,938	0	0	0	0	-2,188	0	-3,101	-12,109	
1983	0	0	2,664	-1	0	0	0	-951	-921	-2,188	0	-2,183	-3,580	
1984	-211	2,763	0	0	0	3,935	0	0	0	0	0	0	6,487	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	-5,663	-3,904	921	0	0	0	0	0	-8,646	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	0	0	0	0	0	-64,053	0	-655	-1,521	-66,229	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	4,516	393	0	2,140	921	-2,188	0	-2,183	3,599	
1996	0	0	0	0	1,447	0	-1,841	1,808	1,749	0	0	0	3,163	
1997	0	-2,162	0	-4,027	1	0	0	0	0	0	0	0	-6,188	
1998	0	0	0	-11,671	2	7,275	0	0	0	-2,188	0	0	-6,582	
1999	0	0	0	0	0	-1,903	3,297	0	-11,502	0	0	0	-10,108	
2000	0	0	0	0	-2,163	0	0	0	6,896	0	0	0	4,733	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	-58	156	-292	-96	-987	-1,377	180	227	-387	-320	-40	-48	-3,042	

Table 3.5-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

No Purchase Increase minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	0	0	2,664	-1	0	0	0	-951	-921	-2,188	0	-2,183	-3,580
1969	0	0	0	-18,026	4,570	0	0	-1,903	-1,841	-2,188	0	0	-19,388
1995	0	0	0	0	4,516	393	0	2,140	921	-2,188	0	-2,183	3,599
1938	0	0	-3,483	0	0	0	1,986	1,083	0	-2,189	0	0	-2,603
1998	0	0	0	-11,671	2	7,275	0	0	0	-2,188	0	0	-6,582
1982	0	0	0	-8,758	1,938	0	0	0	0	-2,188	0	-3,101	-12,109
1967	0	0	0	0	0	1,042	-10,098	6,535	2,762	-2,188	0	-2,184	-4,131
1952	0	0	0	0	2,667	1,778	0	-1,982	0	-2,188	0	0	275
1958	0	0	0	0	-13,107	-5,244	-3,492	7,178	0	-2,188	0	0	-16,853
1980	0	0	0	25,612	-7,495	3,555	-1,013	-1,903	-1,841	-2,188	0	0	14,727
1978	0	0	0	0	0	0	0	0	4,796	0	0	0	4,796
1922	0	0	0	0	-1,286	-857	921	1,080	482	0	-655	-1,521	-1,836
1956	0	0	-20,439	1	0	232	2,003	0	-725	-2,188	0	0	-21,116
1942	0	0	2	2,076	0	0	1,841	0	0	-2,188	0	0	1,731
1941	0	0	0	10,123	-98	-60	-93	0	-296	0	-655	-1,520	7,401
1986	0	0	0	0	-5,663	-3,904	921	0	0	0	0	0	-8,646
1993	0	0	0	0	0	0	0	0	-64,053	0	-655	-1,521	-66,229
1997	0	-2,162	0	-4,027	1	0	0	0	0	0	0	0	-6,188
1996	0	0	0	0	1,447	0	-1,841	1,808	1,749	0	0	0	3,163
1943	0	0	0	0	3,481	504	1,842	0	-3,738	0	0	-2,173	-84
1937	0	0	0	0	-1,494	-908	7,827	0	0	0	0	0	5,425
1974	0	0	0	-8,330	1	-2,663	0	0	0	0	0	-2,174	-13,166
1975	0	0	0	0	2	1	-920	0	21,314	0	-655	-1,520	18,222
1965	0	0	0	-20,583	2	-10,614	8,820	0	0	0	0	17,670	-4,705
1936	0	0	0	0	-40,223	-34,833	-238	0	0	0	0	0	-75,294
1984	-211	2,763	0	0	0	3,935	0	0	0	0	0	0	6,487
1979	0	0	0	-6,458	0	-8,594	-2,118	0	0	0	0	0	-17,170
1945	0	0	0	0	-8,479	-18,021	1,409	0	0	0	0	0	-25,091
1999	0	0	0	0	0	-1,903	3,297	0	-11,502	0	0	0	-10,108
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	4,530	0	-644	-1,532	2,354
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	6,608	22,124	0	0	0	-5,751	-2,163	0	0	0	0	0	20,818
1973	0	0	0	0	0	-10,921	0	5,558	9,731	0	0	0	4,368
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	-2,163	0	0	0	6,896	0	0	0	4,733
1940	0	0	0	0	-1,036	-446	72	0	0	0	0	0	-1,410
1923	0	0	3	0	0	0	2,762	0	0	0	0	0	2,765
1921	0	0	0	0	0	-6,985	-2,467	0	0	0	0	0	-9,452
1970	0	0	326	32,162	-7,146	-13,183	0	0	0	0	0	0	12,159
1951	0	0	-2,096	0	0	0	0	0	0	0	0	0	-2,096
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	-3,647	-2,431	0	0	0	0	0	0	-6,078
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	3	0	0	0	0	-4,296	5,524	0	0	0	0	0	1,231
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-28	-905	0	0	0	0	0	0	0	0	0	-933
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-9,916	0	0	0	0	0	0	0	0	0	0	-21,105
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-7,768	0	0	0	0	0	0	0	-7,768
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.5-9

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,138	51,804	131,498	195,275	251,489	204,109	194,933	214,486	78,864	31,620	77,174	1,479,894
Above Normal	18,683	31,658	75,513	78,830	129,940	115,353	93,308	83,243	24,820	14,739	14,739	14,736	695,564
Below Normal	18,058	18,666	25,900	19,559	35,935	39,636	57,494	58,008	4,463	4,612	4,612	4,463	291,406
Dry	20,742	18,493	17,945	17,522	26,199	25,876	29,552	30,537	4,349	4,494	4,494	4,349	204,549
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,398	20,968	39,903	62,742	95,557	109,696	96,180	91,773	69,845	28,125	14,297	27,566	677,049

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,382	22,062	48,627	124,111	190,719	245,157	199,412	189,305	200,624	78,864	30,959	75,248	1,431,469
Above Normal	17,886	30,698	68,220	78,114	120,555	105,165	91,467	82,787	18,214	14,739	14,739	14,263	656,848
Below Normal	17,484	16,058	22,744	19,551	35,285	38,726	56,136	58,008	4,463	4,612	4,612	4,463	282,142
Dry	20,742	15,449	16,739	16,127	24,251	25,876	29,552	30,537	4,349	4,494	4,494	4,349	196,957
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,112	19,882	36,809	60,209	91,874	105,597	94,225	90,031	64,418	28,125	14,104	26,904	652,291

Difference in Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	123	77	3,177	7,387	4,555	6,332	4,697	5,628	13,862	0	661	1,926	48,425
Above Normal	797	960	7,293	717	9,385	10,188	1,841	456	6,606	0	0	473	38,715
Below Normal	574	2,607	3,156	8	650	910	1,358	0	0	0	0	0	9,264
Dry	0	3,044	1,205	1,395	1,948	0	0	0	0	0	0	0	7,592
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	285	1,086	3,095	2,533	3,683	4,099	1,955	1,742	5,427	0	193	662	24,759

Table 3.5-10

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,138	51,804	131,498	195,275	251,489	204,109	194,933	214,486	78,864	31,620	77,174	1,479,894
Above Normal	18,683	31,658	75,513	78,830	129,940	115,353	93,308	83,243	24,820	14,739	14,739	14,736	695,564
Below Normal	18,058	18,666	25,900	19,559	35,935	39,636	57,494	58,008	4,463	4,612	4,612	4,463	291,406
Dry	20,742	18,493	17,945	17,522	26,199	25,876	29,552	30,537	4,349	4,494	4,494	4,349	204,549
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,398	20,968	39,903	62,742	95,557	109,696	96,180	91,773	69,845	28,125	14,297	27,566	677,049

Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,228	52,690	132,897	195,713	251,883	203,746	194,388	216,210	79,958	31,729	77,274	1,485,222
Above Normal	18,307	30,194	75,617	77,318	133,414	121,042	93,276	82,916	24,252	14,739	14,777	14,826	700,678
Below Normal	18,058	18,668	25,976	19,559	36,239	40,197	57,034	58,008	4,463	4,612	4,612	4,463	291,887
Dry	21,603	19,256	17,945	17,522	26,796	25,876	29,552	30,537	4,349	4,494	4,494	4,349	206,770
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,249
All Years	20,456	20,812	40,195	62,838	96,544	111,073	96,000	91,545	70,232	28,445	14,337	27,614	680,091

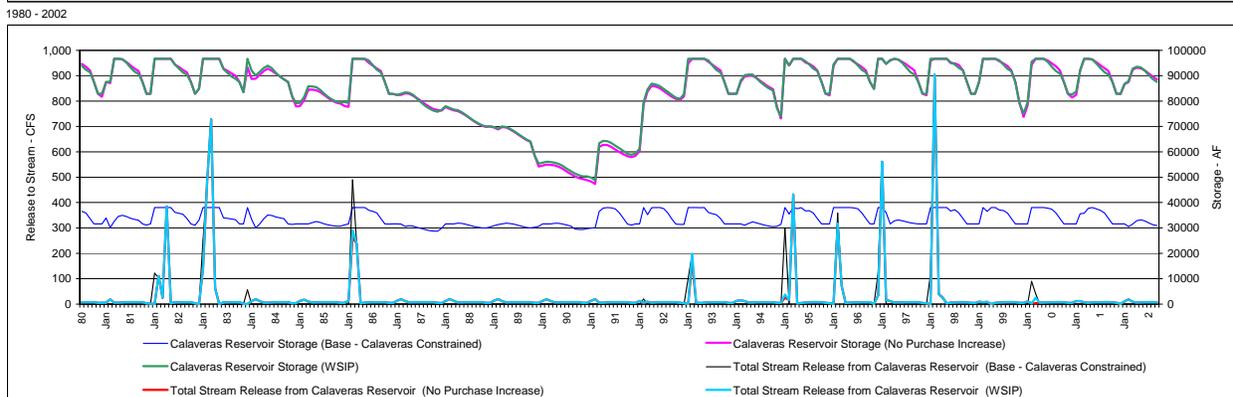
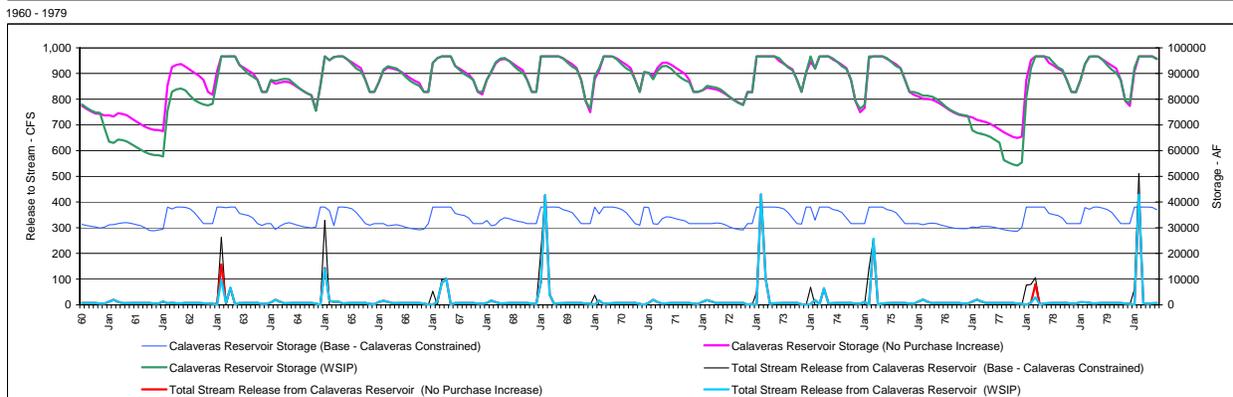
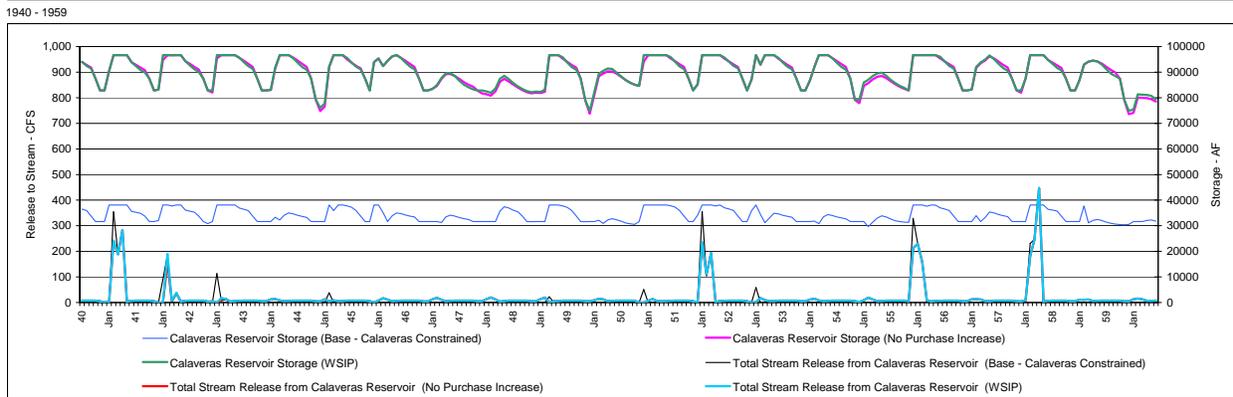
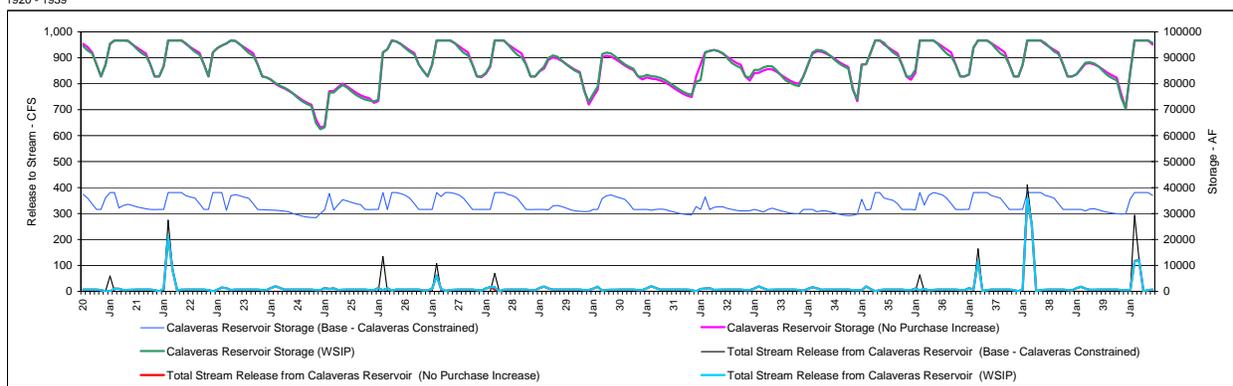
Difference in Total La Grange Release to River (Acre-feet)													
(Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	-90	-886	-1,399	-438	-395	363	545	-1,725	-1,094	-109	-100	-5,328
Above Normal	376	1,464	-104	1,512	-3,473	-5,688	33	327	568	0	-38	-90	-5,114
Below Normal	0	-2	-75	0	-304	-561	460	0	0	0	0	0	-481
Dry	-861	-763	0	0	-597	0	0	0	0	0	0	0	-2,221
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-58	156	-292	-96	-987	-1,377	180	227	-387	-320	-40	-48	-3,042

added month of release. Normally, the effect of a change in release would not affect the year's peak stream release rate during a year. However, infrequently, the alternative's effect on stream releases could manifest as an elimination of all flow during a year or as the only provision of flow that occurs in excess of minimum FERC flow requirements. Compared to the base setting, the alternative's effect to stream flow ranges from a reduction to releases (a potential delay in release of 10 days) to an increase in releases (a potential additional 5 days of release).

3.6 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

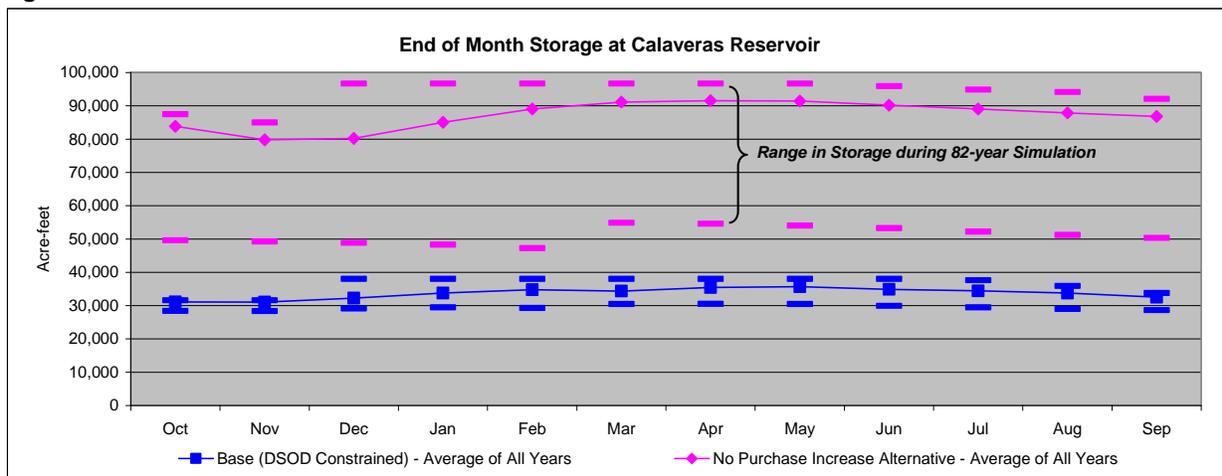
Compared to the WSIP setting, the operation of Calaveras Reservoir in the alternative setting is almost identical. Figure 3.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 3.6-1 are the results for the WSIP, alternative, and base settings. Recognizing the different levels of system-wide deliveries served in each setting, the near identical operation of Calaveras Reservoir resulting from the two settings indicates that Calaveras Reservoir operations are mostly influenced by the principles that manage local watershed production. The differences in reservoir operation during the droughts of the 1960s and 1976-1977 are the result of modeling assumptions that balance reservoir storage among SFPUC reservoirs and the selection of the monthly SJPL conveyance rate. It is anticipated that the difference in Calaveras Reservoir operation in actual operations would be minimal, if at all.

Figure 3.6-1
Calaveras Reservoir Storage and Stream Release



The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Under both the alternative and WSIP settings, the full capacity of Calaveras Reservoir would be available, and a greater range in storage operation would occur. Figure 3.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 3.6-2



Compared to the WSIP setting, there would potentially be more or less release to Calaveras Creek below Calaveras Dam in the alternative setting. Both settings have fishery releases that are not included in the base setting. Calaveras Reservoir storage in the alternative setting is sometimes more and sometimes less than in the WSIP setting; however, in either direction the difference is minor. Table 3.6-1 illustrates the difference in releases to Calaveras Creek between the alternative and WSIP settings (considered non-substantial). Supplementing the Figure 3.6-1 representation of Calaveras Dam stream releases and Table 3.6-1 is Table 3.6-2, illustrating releases for the alternative and WSIP settings, and the difference in releases between the two. Table 3.6-3 provides the same form of information for the alternative and base settings. The notable difference in releases between the alternative and base settings is the addition of the required flows to satisfy the 1997 MOU and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There would be very little if any difference in Alameda Creek diversions to Calaveras Reservoir in the alternative setting compared to the WSIP setting. With essentially the same storage conditions between the two settings, there would be no difference in diversions from the Alameda Creek watershed. With no difference in the diversion at Alameda Creek Diversion Dam, flow spilling past the diversion dam would be the same in the alternative setting. Table 3.6-4 illustrates the difference in flow below the Alameda Creek Diversion Dam between the alternative and WSIP settings (considered non-substantial).

Table 3.6-5 illustrates the difference in flow below Alameda Creek Diversion Dam between the alternative and base settings. In this comparison, the reduction in flow below the diversion dam is due to the additional diversions to Calaveras Reservoir resulting from the restoration of reservoir operating capacity. Table 3.6-6 and Table 3.6-7 illustrate the flow past the Alameda Creek Diversion Dam, comparing the alternative, WSIP, and base settings by year type and the average of all years.

Table 3.6-1

Water Year	Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)											WY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		Sep
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	-56	0	0	0	0	0	0	0	-56
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	-519	0	0	0	0	0	0	-519
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	-157	0	0	0	0	0	0	0	-157
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	91	0	0	0	0	0	0	0	91
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	-1,920	0	-65	0	0	0	0	0	-1,986
1943	0	0	0	0	-294	0	0	0	0	0	0	0	-294
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	3,398	0	-87	0	0	0	0	0	3,311
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	149	0	0	0	0	0	0	0	0	149
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	-114	0	0	0	0	0	-114
1975	0	0	0	0	0	-615	0	0	0	0	0	0	-615
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	3,136	0	0	0	0	0	0	3,136
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	-1,295	0	0	0	0	0	0	0	-1,295
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-1,570	0	0	0	0	0	0	0	-1,570
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	-1,885	0	0	0	0	0	0	0	-1,885
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	-737	0	0	0	0	0	0	0	0	-737
1996	0	0	0	0	-642	0	0	0	0	0	0	0	-642
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	-763	0	0	0	0	0	0	0	-763
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	-1,287	0	0	0	0	0	0	-1,287
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	0	-7	-62	9	-3	0	0	0	0	0	-64

Table 3.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,065	5,037	14,777	10,007	5,081	255	387	417	425	415	38,543	
Above Normal	425	258	172	815	3,693	2,921	638	327	396	423	428	417	10,913	
Normal	429	275	195	548	725	524	264	370	408	428	430	417	5,013	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	387	1,550	4,176	2,930	1,320	350	403	426	428	417	13,084	

Total Stream Release from Calaveras Reservoir (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,065	5,083	15,133	10,007	5,085	255	387	417	425	415	38,549	
Above Normal	425	258	172	806	3,657	2,849	650	327	396	423	428	417	10,807	
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	387	1,557	4,238	2,921	1,323	350	403	426	428	417	13,148	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													No Purchase Increase minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	-46	-357	0	-4	0	0	0	0	0	-407	
Above Normal	0	0	0	9	36	73	-12	0	0	0	0	0	106	
Normal	0	0	0	0	0	-32	0	0	0	0	0	0	-32	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	-7	-62	9	-3	0	0	0	0	0	-64	

Table 3.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,065	5,037	14,777	10,007	5,081	255	387	417	425	415	38,543	
Above Normal	425	258	172	815	3,693	2,921	638	327	396	423	428	417	10,913	
Normal	429	275	195	548	725	524	264	370	408	428	430	417	5,013	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	387	1,550	4,176	2,930	1,320	350	403	426	428	417	13,084	

Total Stream Release from Calaveras Reservoir (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590	
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382	
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	-671	-4,184	-1,864	39	57	255	387	417	425	415	-4,048	
Above Normal	425	258	-12	-1,917	-2,218	-175	179	327	396	423	428	417	-1,470	
Normal	429	275	-22	184	-157	171	264	370	408	428	430	417	3,198	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	-32	-887	-469	274	244	350	403	426	428	417	1,853	

Table 3.6-4

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Purchase Increase minus WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	
1927	0	0	0	0	0	0	0	0	0	0	0	0	0	
1928	0	0	0	0	0	0	0	0	0	0	0	0	0	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-1,164	0	0	0	0	0	0	0	-1,164	
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	
1942	0	0	0	1,922	0	0	0	0	0	0	0	0	1,922	
1943	0	0	0	457	-995	0	0	0	0	0	0	0	-538	
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	2,511	-2,507	0	402	0	0	0	0	0	0	406	
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	
1973	0	0	0	-170	0	0	0	0	0	0	0	0	-170	
1974	0	0	0	2,096	0	1,320	0	0	0	0	0	0	3,416	
1975	0	0	0	0	-671	0	0	0	0	0	0	0	-671	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	
1983	0	0	0	0	0	0	0	922	0	0	0	0	922	
1984	0	0	3,332	0	0	0	0	0	0	0	0	0	3,332	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	1,034	0	752	0	0	0	0	0	0	1,786	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	215	0	0	0	0	0	0	0	0	215	
1999	0	0	0	0	0	0	-178	0	0	0	0	0	-178	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	0	0	71	37	-35	30	-2	11	0	0	0	0	113	

Table 3.6-5

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	-2,559	-1,353	0	0	0	0	0	0	0	-3,913
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	-2,856	-1,688	-1,004	0	0	0	0	0	0	0	-5,547
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	-3,210	0	0	0	0	0	0	0	-3,210
1927	0	0	0	0	0	0	373	0	0	0	0	0	373
1928	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-2,259	0	0	0	0	0	0	0	-2,259
1937	0	0	0	0	-3,964	0	0	0	0	0	0	0	-3,964
1938	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1941	0	0	0	-1,197	0	0	0	0	0	0	0	0	-1,197
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	-995	0	0	0	0	0	0	0	-995
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-4,471	0	0	0	0	0	0	0	-4,471
1946	0	0	-4,651	-1,522	0	0	0	0	0	0	0	0	-6,173
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	-5,524	0	0	0	0	0	0	-5,524
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	-2,553	-59	301	0	0	0	0	0	0	-2,311
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	-3,892	0	0	0	0	0	0	0	0	-3,892
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	-1,919	0	0	0	0	0	0	0	-1,919
1963	0	0	0	-2,219	0	0	0	0	0	0	0	0	-2,219
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	-1,921	0	0	0	3,250	0	0	0	0	0	1,329
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	-1,676	-1,872	0	0	0	0	0	0	0	-3,548
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	-4,247	0	-1,623	0	0	0	0	0	0	-5,870
1971	0	0	-613	0	0	0	0	0	0	0	0	0	-613
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	-4,509	0	0	0	0	0	0	0	0	-4,509
1974	0	0	-1,019	0	0	1,444	0	0	0	0	0	0	425
1975	0	0	0	0	-5,196	0	-156	0	0	0	0	0	-5,352
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	-4,152	-3,403	0	0	0	0	0	0	0	-7,556
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	-3,360	0	-101	0	0	0	0	0	0	-3,462
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	687	0	0	0	0	687
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	-3,578	0	0	0	0	0	0	0	-3,578
1993	0	0	0	0	0	651	0	0	0	0	0	0	651
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	-5,239	0	0	0	0	0	0	0	0	-5,239
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	-2,798	0	1,214	0	0	0	0	0	-1,584
2000	0	0	0	0	-4,567	0	0	0	0	0	0	0	-4,567
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-135	-473	-496	-59	51	8	0	0	0	0	-1,103

Table 3.6-6

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,295	7,982	5,751	2,962	173	0	0	0	0	24,570	
Above Normal	7	23	843	2,589	3,919	3,237	959	0	0	0	0	0	11,578	
Normal	0	6	585	264	820	459	117	6	0	0	0	0	2,257	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	565	1,826	2,584	1,922	801	35	0	0	0	0	7,746	

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389	
Above Normal	7	23	695	2,526	4,017	3,092	969	0	0	0	0	0	11,330	
Normal	0	6	377	264	893	459	117	6	0	0	0	0	2,122	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	494	1,789	2,618	1,892	803	24	0	0	0	0	7,633	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Purchase Increase minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	123	0	0	0	58	0	0	0	0	181	
Above Normal	0	0	148	64	-98	146	-10	0	0	0	0	0	248	
Normal	0	0	208	0	-73	0	0	0	0	0	0	0	136	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	71	37	-35	30	-2	11	0	0	0	0	113	

Table 3.6-7

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,295	7,982	5,751	2,962	173	0	0	0	0	24,570	
Above Normal	7	23	843	2,589	3,919	3,237	959	0	0	0	0	0	11,578	
Normal	0	6	585	264	820	459	117	6	0	0	0	0	2,257	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	565	1,826	2,584	1,922	801	35	0	0	0	0	7,746	

Flow Passing Alameda Creek Diversion Dam (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331	
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968	
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	-671	-117	-6	-10	43	0	0	0	0	-762	
Above Normal	0	0	-341	-1,083	-1,373	141	266	0	0	0	0	0	-2,390	
Normal	0	0	-329	-604	-965	-447	-10	0	0	0	0	0	-2,354	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-135	-473	-496	-59	51	8	0	0	0	0	-1,103	

Comparing the alternative and WSIP settings, differences in releases from Calaveras Dam to the stream and differences to spills at Alameda Creek Diversion Dam would result in differences in flow below the Alameda Creek and Calaveras Creek confluence. Table 3.6-8 illustrates the flow below the confluence for the alternative and WSIP settings. The modeled difference of these parameters has been described above as being non-substantial; thus, the combined effect of the differences at the confluence is considered non-substantial. Fishery releases for the 1997 MOU are assumed in both of the settings. Table 3.6-9 provides the same form of information for the alternative and base settings. The notable differences between the alternative and base settings (comparable to the difference between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year/wet season flows due to the restoration of Calaveras Reservoir storage.

Table 3.6-8

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	430	326	2,789	12,342	23,947	16,744	8,644	605	417	430	430	417	67,520	
Above Normal	437	327	1,259	4,002	8,389	6,720	1,907	430	417	430	430	417	25,164	
Normal	430	304	1,006	1,081	1,931	1,310	539	435	417	430	430	417	8,731	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,132	3,785	7,289	5,284	2,357	465	417	430	430	417	22,748	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	430	326	2,789	12,265	24,303	16,744	8,649	548	417	430	430	417	67,746	
Above Normal	437	327	1,111	3,929	8,451	6,502	1,929	430	417	430	430	417	24,810	
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,061	3,755	7,386	5,245	2,362	454	417	430	430	417	22,699	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Purchase Increase minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	0	0	0	77	-357	0	-4	58	0	0	0	0	-226	
Above Normal	0	0	148	72	-62	218	-22	0	0	0	0	0	354	
Normal	0	0	208	0	-73	-32	0	0	0	0	0	0	103	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	71	30	-97	39	-5	11	0	0	0	0	49	

Table 3.6-9

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	430	326	2,789	12,342	23,947	16,744	8,644	605	417	430	430	417	67,520	
Above Normal	437	327	1,259	4,002	8,389	6,720	1,907	430	417	430	430	417	25,164	
Normal	430	304	1,006	1,081	1,931	1,310	539	435	417	430	430	417	8,731	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,132	3,785	7,289	5,284	2,357	465	417	430	430	417	22,748	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	1	80	3,460	17,197	25,928	16,711	8,598	307	30	12	4	2	72,329	
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023	
Normal	1	29	1,356	1,501	3,053	1,586	284	65	9	2	0	0	7,886	
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161	
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457	
All Years	3	41	1,298	5,145	8,254	5,069	2,061	107	14	4	1	1	21,999	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	429	246	-671	-4,855	-1,981	33	47	298	387	417	425	415	-4,809	
Above Normal	425	258	-353	-3,000	-3,591	-34	445	327	396	423	428	417	-3,859	
Normal	429	275	-351	-420	-1,122	-275	255	370	408	428	430	417	844	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	-167	-1,360	-965	215	296	358	403	426	428	417	749	

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the alternative and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Flows below this diversion have been estimated and noted as the flow above the Alameda and San Antonio confluence. Table 3.6-10 illustrates the flow at this location for the alternative and WSIP settings. The flow changes at this location are consistent with the changes noted for below the confluence of Alameda and Calaveras Creeks. These flow changes are considered non-substantial. Table 3.6-11 provides the same form of information for the alternative and base settings. The flows identified at this location indicate flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, less the water assumed to be recaptured (diverted) by the SFPUC from the creek.

Table 3.6-10

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,180	13,688	25,471	17,847	9,295	556	76	33	15	9	70,331
Above Normal	19	150	1,455	4,520	9,075	7,131	2,158	217	54	20	9	6	24,815
Normal	7	64	1,131	913	1,764	1,236	469	134	28	9	4	3	5,761
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,198	3,889	7,403	5,371	2,404	208	38	14	7	4	20,633

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,180	13,611	25,828	17,847	9,299	498	76	33	15	9	70,558
Above Normal	19	150	1,308	4,448	9,137	6,913	2,180	217	54	20	9	6	24,462
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,127	3,859	7,499	5,332	2,409	197	38	14	7	4	20,583

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	0	77	-357	0	-4	58	0	0	0	0	-226
Above Normal	0	0	148	72	-62	218	-22	0	0	0	0	0	354
Normal	0	0	208	0	-73	-32	0	0	0	0	0	0	103
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	71	30	-97	39	-5	11	0	0	0	0	49

Table 3.6-11

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,180	13,688	25,471	17,847	9,295	556	76	33	15	9	70,331
Above Normal	19	150	1,455	4,520	9,075	7,131	2,158	217	54	20	9	6	24,815
Normal	7	64	1,131	913	1,764	1,236	469	134	28	9	4	3	5,761
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,198	3,889	7,403	5,371	2,404	208	38	14	7	4	20,633

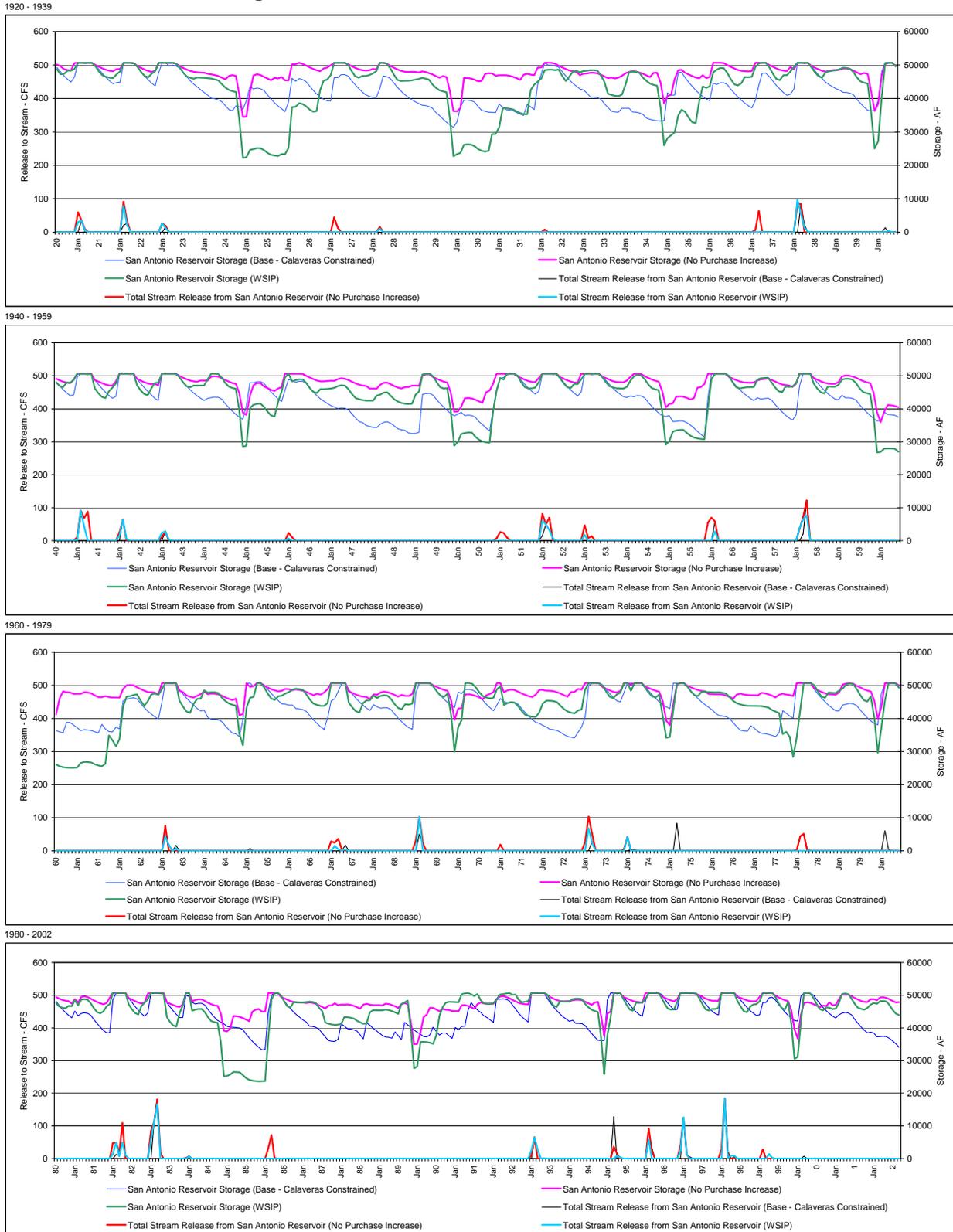
Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	0	-788	-4,980	-2,220	-131	-63	43	0	0	0	0	-8,138
Above Normal	0	0	-525	-3,299	-3,985	-336	297	0	0	0	0	0	-7,848
Normal	0	0	-545	-968	-1,847	-771	-10	0	0	0	0	0	-4,141
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	-369	-1,844	-1,620	-246	47	8	0	0	0	0	-4,023

Compared to the WSIP setting, the alternative’s San Antonio Reservoir operation would draw less from storage on an annual basis, and particularly during cyclic maintenance. Figure 3.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from San Antonio Dam. Shown in Figure 3.6-3 are the results for the WSIP, alternative, and base settings. The difference in San Antonio Reservoir storage between the alternative and WSIP settings is mostly caused by the lesser demand of the alternative. Considering that Calaveras Reservoir storage is essentially the same between the settings, the difference in San Antonio Reservoir storage indicates the operational strategy to affect storage in San Antonio Reservoir more than storage in the other SFPUC Bay Area reservoirs. San Antonio Reservoir would retain more storage in the alternative setting compared to the WSIP setting.

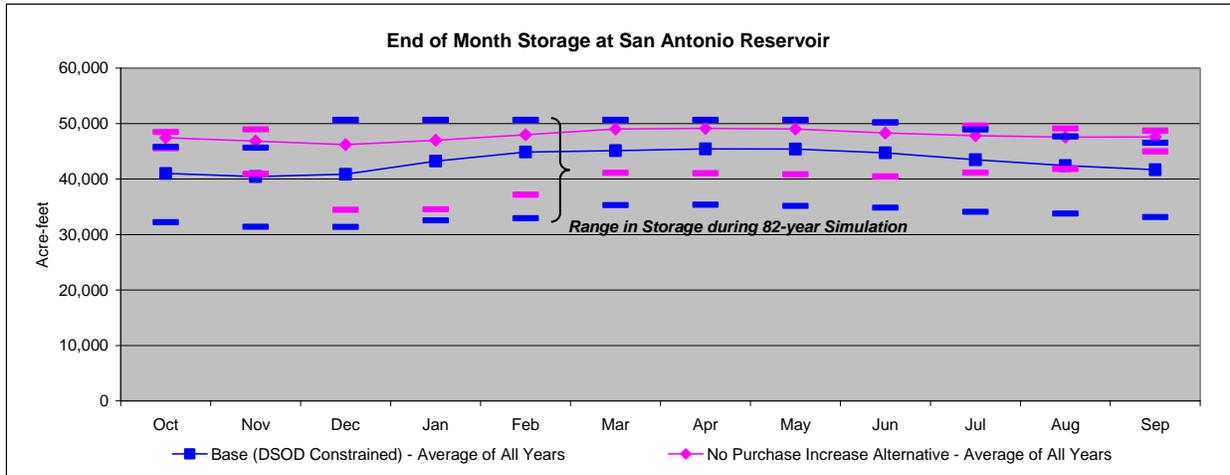
The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that retains relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the alternative and WSIP settings and the base setting due to assumed maintenance. Assumed systematic maintenance of Hetch Hetchy conveyance facilities constrains diversions to the Bay Area from Hetch Hetchy every year, and particularly during every fifth year in the WSIP and alternative settings.

Figure 3.6-3
San Antonio Reservoir Storage and Stream Release



The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by the drawing of additional water from the Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the alternative and WSIP settings. Figure 3.6-4 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. Compared to the base setting, the alternative would draw less storage from San Antonio Reservoir, typically retaining a fuller reservoir.

Figure 3.6-4



Very little change in stream releases below San Antonio Reservoir is anticipated between the alternative and WSIP settings. Table 3.6-12 illustrates the modeled release to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a fuller reservoir operation at times during the winter, as seen in Figure 3.6-4, a decrease in the ability to regulate reservoir inflow and avoid stream releases is expected. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and difference between releases for the alternative and base setting are shown in Table 3.6-13. The differences between the two settings reflect a general increase in modeled releases. This modeled circumstance reflects the different resulting storage operation between the two settings, as seen in Figure 3.6-3. In most circumstances, the alternative setting storage at San Antonio Reservoir would be higher than projected for the base setting during the same period. This circumstance could lead to an occasionally greater modeled release for the alternative setting, which is reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 3.6-14 illustrates the flow below the confluence for the alternative and WSIP settings, and the differences in flow between the two. The difference in flow between the alternative and WSIP settings at this location are the net sum of the differences identified for flow reaching the location from Alameda Creek and San Antonio Creek. The difference in flow from upstream in Alameda Creek has previously been identified as non-substantial. Along with the conclusion that flow differences in San Antonio Creek are non-substantial, modeled differences below the confluence are also considered non-substantial.

Table 3.6-12

Total Stream Release from San Antonio Reservoir (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	362	2,142	3,494	2,777	1,327	6	0	0	0	0	10,108	
Above Normal	0	0	42	642	1,805	741	0	0	0	0	0	0	3,229	
Normal	0	0	7	367	90	110	0	0	0	0	0	0	574	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	81	623	1,074	717	259	1	0	0	0	0	2,754	

Total Stream Release from San Antonio Reservoir (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	1,054	3,168	1,543	605	121	0	0	0	0	6,586	
Above Normal	0	0	0	540	1,045	277	67	44	0	0	0	0	1,974	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	366	132	33	0	0	0	0	1,724	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)													No Purchase Increase minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	266	1,088	325	1,234	722	-115	0	0	0	0	3,521	
Above Normal	0	0	42	102	760	464	-67	-44	0	0	0	0	1,256	
Normal	0	0	7	254	90	70	0	0	0	0	0	0	422	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	62	283	239	351	127	-32	0	0	0	0	1,030	

Table 3.6-13

Total Stream Release from San Antonio Reservoir (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	362	2,142	3,494	2,777	1,327	6	0	0	0	0	10,108	
Above Normal	0	0	42	642	1,805	741	0	0	0	0	0	0	3,229	
Normal	0	0	7	367	90	110	0	0	0	0	0	0	574	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	81	623	1,074	717	259	1	0	0	0	0	2,754	

Total Stream Release from San Antonio Reservoir (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	362	1,604	1,144	297	4	-82	0	0	0	0	3,328	
Above Normal	0	0	42	642	924	-142	-12	-58	0	0	0	0	1,395	
Normal	0	0	7	367	90	110	0	0	0	0	0	0	574	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	81	518	432	50	-2	-28	0	0	0	0	1,050	

Table 3.6-14

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,542	15,830	28,965	20,624	10,622	562	76	33	15	9	80,439	
Above Normal	19	150	1,497	5,162	10,880	7,872	2,158	217	54	20	9	6	28,045	
Normal	7	64	1,138	1,280	1,854	1,346	469	134	28	9	4	3	6,335	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,279	4,512	8,476	6,088	2,663	209	38	14	7	4	23,387	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,276	14,666	28,996	19,390	9,903	619	76	33	15	9	77,144	
Above Normal	19	150	1,308	4,987	10,182	7,190	2,248	262	54	20	9	6	26,435	
Normal	7	64	922	1,026	1,837	1,308	469	134	28	9	4	3	8,810	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,145	4,199	8,334	5,698	2,541	229	38	14	7	4	22,307	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													No Purchase Increase minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	266	1,164	-31	1,234	718	-57	0	0	0	0	3,295	
Above Normal	0	0	189	174	698	682	-90	-44	0	0	0	0	1,610	
Normal	0	0	216	254	18	38	0	0	0	0	0	0	525	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	133	313	142	390	122	-20	0	0	0	0	1,079	

Table 3.6-15 illustrates the same information in comparing the alternative and base settings. Table 3.6-15 illustrates the larger differences in flow that would occur between the alternative and base settings. Those differences are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity and the fuller San Antonio Reservoir in the alternative setting (if the fuller reservoir has any effect on steam releases).

Table 3.6-15

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,542	15,830	28,965	20,624	10,622	562	76	33	15	9	80,439	
Above Normal	19	150	1,497	5,162	10,880	7,872	2,158	217	54	20	9	6	28,045	
Normal	7	64	1,138	1,280	1,854	1,346	469	134	28	9	4	3	6,335	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,279	4,512	8,476	6,088	2,663	209	38	14	7	4	23,387	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250	
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498	
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-426	-3,376	-1,076	166	-59	-39	0	0	0	0	-4,811	
Above Normal	0	0	-484	-2,657	-3,060	-478	285	-58	0	0	0	0	-6,453	
Normal	0	0	-538	-601	-1,757	-661	-10	0	0	0	0	0	-3,567	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-288	-1,327	-1,187	-196	45	-20	0	0	0	0	-2,973	

3.7 Crystal Springs and San Andreas Reservoirs

There are differences in Crystal Springs Reservoir operations between the WSIP setting and the alternative and base settings. Figure 3.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 3.7-1 are the results for the WSIP, alternative, and base settings. Fundamental to the difference in storage operations between the WSIP setting and the alternative and base settings is the restoration of reservoir operation capacity in the WSIP setting, which does not occur in the alternative or base settings.⁸ The result is the operation of Crystal Springs Reservoir at a lower maximum storage in the alternative and base settings. A second difference in Crystal Springs Reservoir storage between the alternative and WSIP setting is caused by the interaction of the increased demand served by the system's resources (a net 265 mgd for the alternative and a net 290-mgd demand for the WSIP in many years), which tends to lessen the operation range of the reservoir in the alternative setting. Replenishment of Crystal Springs Reservoir storage (as well as other Bay Area reservoirs) would be accelerated with less system-wide demand to serve. The alternative setting would provide less carry-over storage at Crystal Springs Reservoir into periods of drought, and thereby cause additional draw from other resources to serve the same delivery. The magnitude of the draw of storage from Crystal Springs Reservoir is partially dependent on the discretionary assumptions of the model that proportion the use of storage among the Bay Area system reservoirs. In actual operations, some of the differences in result may not occur as system operators and prevailing hydraulic and hydrologic conditions may direct the operational effect of the different demand to an alternative apportionment of effect among the reservoirs. However, operation strategy prefers the retention of storage in the Peninsula Reservoirs, similar to the strategy used by the model. Figure 3.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and WSIP settings.

⁸ The Lower Crystal Springs Dam Improvements (LCSDI) project is included in the alternative, but was not modeled. With the LCSDI project included in the alternative the hydrologic effects at Crystal Springs Reservoir would be comparable to the WSIP setting.

**Figure 3.7-1
Crystal Springs Reservoir Storage and Release**

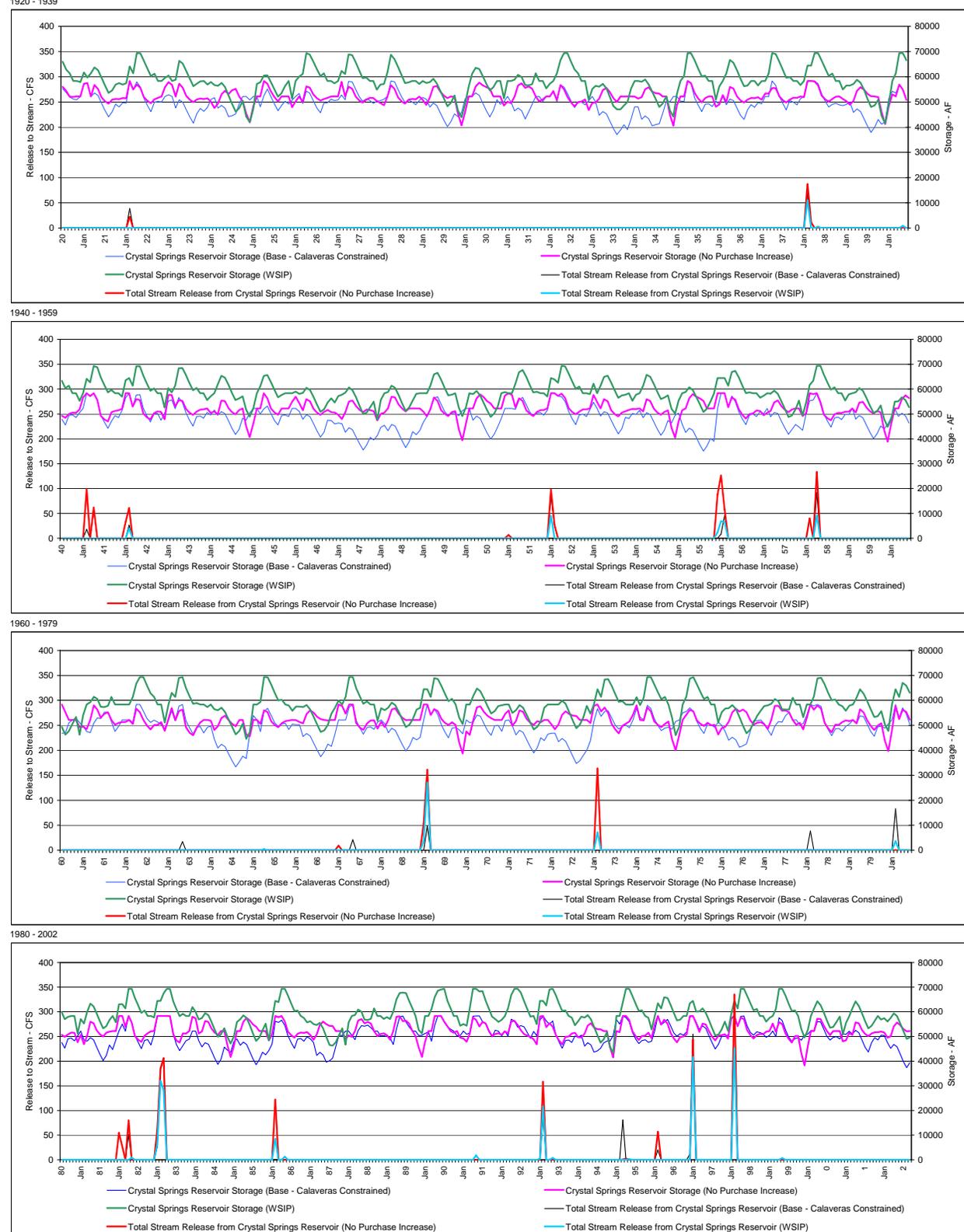


Figure 3.7-2

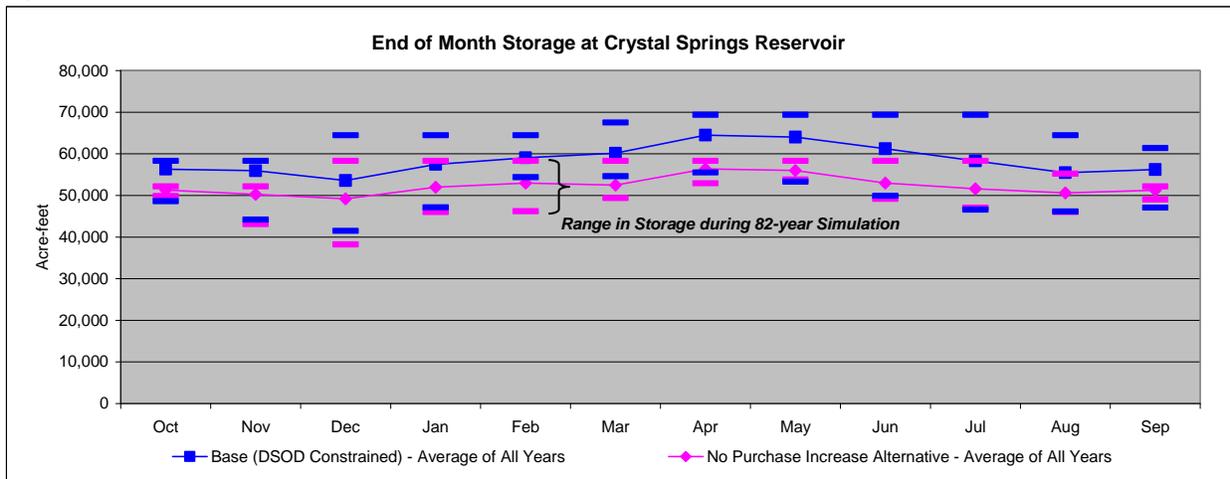


Figure 3.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. The alternative setting would result in reservoir storage operating at a slightly higher average storage during some months, and the range of operating storage would typically be smaller in the alternative setting.

Figure 3.7-3

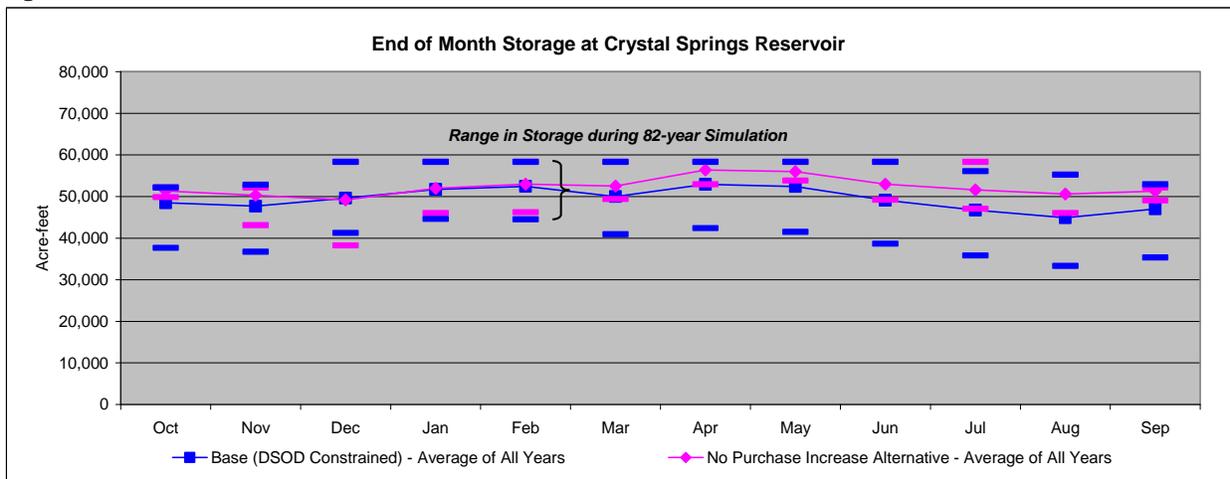


Table 3.7-1 illustrates the modeled alternative and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that an increase in the occasional release could occur. The potential difference is attributed to a narrower operating range of reservoir storage in the alternative setting. This narrower range in storage would lead to a greater potential for stream releases. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting, with the effect of essentially no difference would occur between the alternative and WSIP settings. Similarly, Table 3.7-2 illustrates the stream releases for the alternative and base settings, and the difference in modeled flows between the two settings. A lesser draw down in Crystal Springs Reservoir storage associated with the alternative setting would lead to a decreased potential to regulate reservoir inflow, which would lead to additional risk in needing to make stream releases. However, as described above, actual system operations would attempt to minimize releases under any setting; thus, the difference in releases between the alternative and base setting would be minimal, if any.

Table 3.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	337	2,611	4,735	837	1,030	0	0	0	0	0	9,551	
Above Normal	0	0	0	24	777	0	0	0	0	0	0	0	802	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	66	515	1,085	163	201	0	0	0	0	0	2,030	

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	47	1,296	2,512	542	170	54	0	0	0	0	4,623	
Above Normal	0	0	0	8	354	0	8	42	0	0	0	0	412	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	33	0	0	0	0	33	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	9	254	564	106	35	26	0	0	0	0	994	

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													No Purchase Increase minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	290	1,315	2,223	295	860	-54	0	0	0	0	4,928	
Above Normal	0	0	0	17	423	0	-8	-42	0	0	0	0	390	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	-33	0	0	0	0	-33	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	57	260	522	57	166	-26	0	0	0	0	1,036	

Table 3.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													No Purchase Increase	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	337	2,611	4,735	837	1,030	0	0	0	0	0	9,551	
Above Normal	0	0	0	24	777	0	0	0	0	0	0	0	802	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	66	515	1,085	163	201	0	0	0	0	0	2,030	

Total Stream Release from Crystal Springs Reservoir (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	6,336	
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	671	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	9	280	690	221	147	29	0	0	0	0	1,375	

Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)													No Purchase Increase minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	293	1,179	1,847	-297	274	-81	0	0	0	0	3,215	
Above Normal	0	0	0	24	169	0	0	-63	0	0	0	0	130	
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	57	235	395	-58	54	-29	0	0	0	0	654	

Reservoir storage at San Andreas Reservoir would follow a systematic filling and lowering each year; however, there would be slight differences in draw down between the alternative and WSIP settings, primarily due to the coincidence of the effects of different system-wide maintenance and differing water demands within each setting. Figure 3.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from San Andreas Dam. Shown in Figure 3.7-4 are the results for the WSIP, alternative, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Compared to the base setting, Figure 3.7-4 illustrates the difference in storage operation every fifth year for the WSIP and alternative settings. These operations are the result of Hetch Hetchy conveyance maintenance, which is assumed to occur systematically in the alternative and WSIP settings. The maintenance constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy WTP associated with WSIP or the alternative exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be same among all of the settings. The additional water demand of the WSIP and alternative require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir.

Figure 3.7-4
San Andreas Reservoir Storage and Stream Release

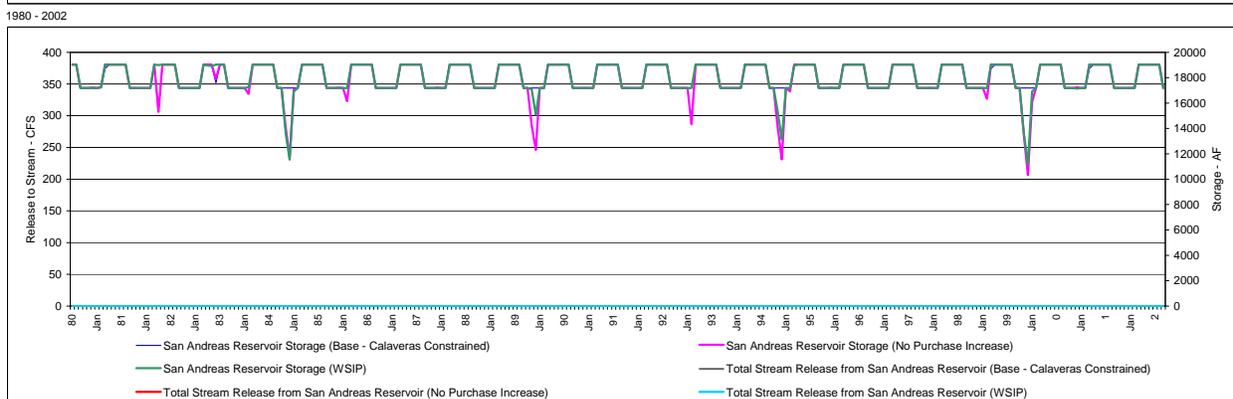
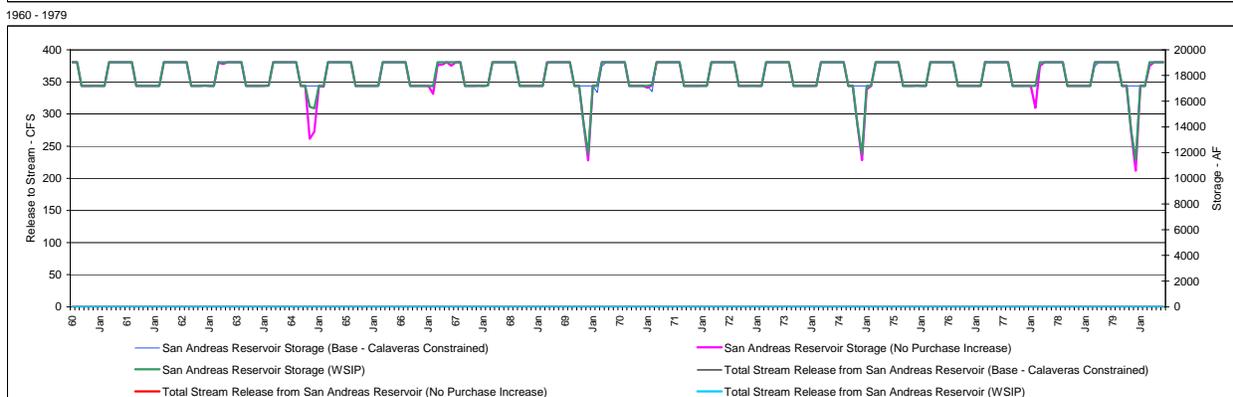
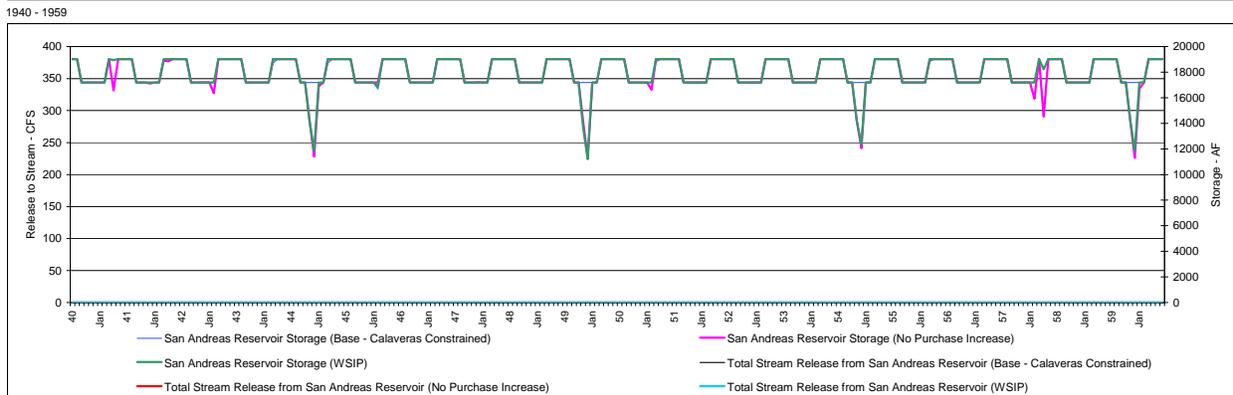
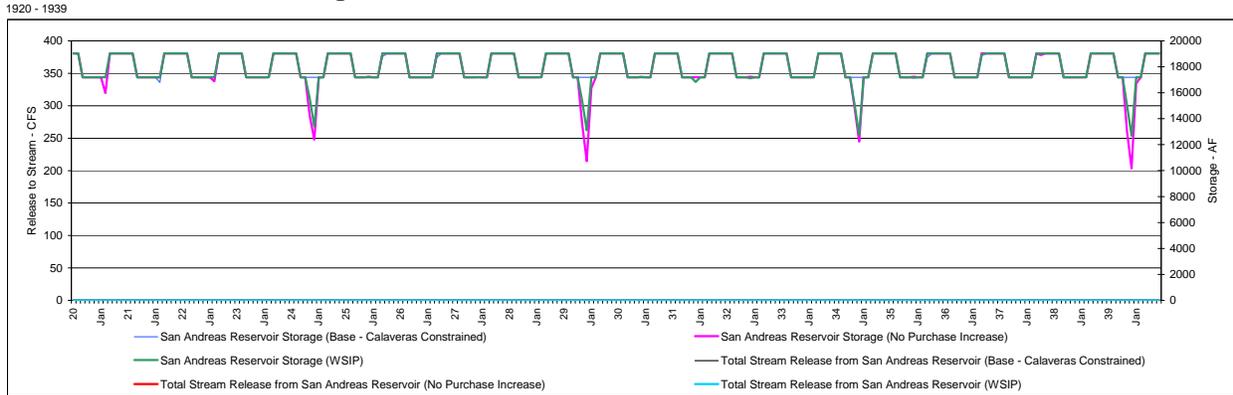
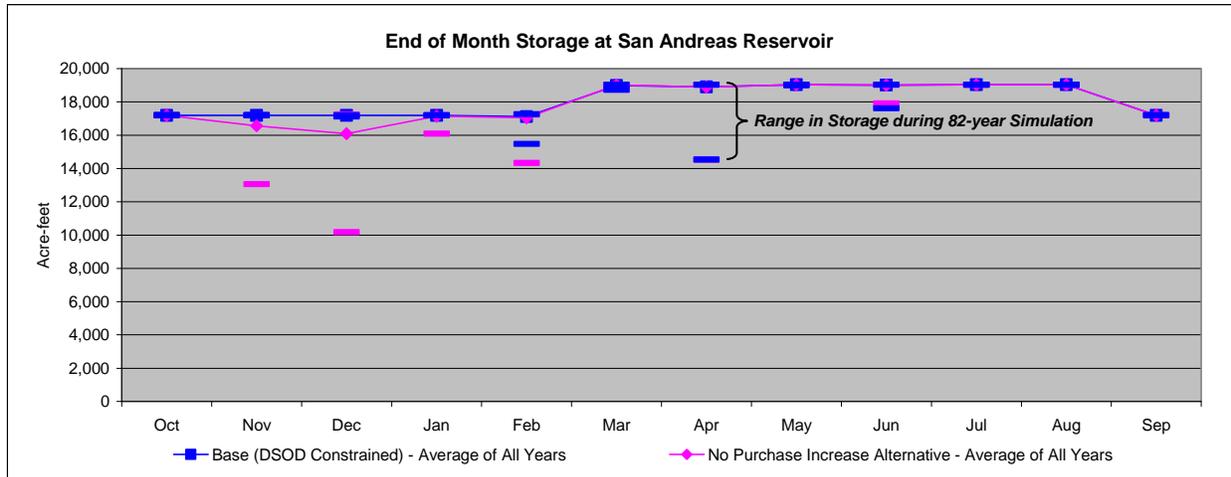


Figure 3.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 3.7-5



3.8 Pilarcitos Reservoir

Coastside CWD's water demand and its SFPUC delivery would slightly increase within the WSIP planning horizon of year 2030. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional deliveries and the resultant potential changes to the operation of SFPUC facilities and their affected environs are uncertain.⁹

Assuming a range of potential means to serve the additional delivery from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs were identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

In the No Purchase Request Alternative, Coastside CWD's water delivery is anticipated to slightly increase to its maximum allotment, but would be less than in the WSIP setting. Hydrologic effects to the Pilarcitos Creek watershed would be less than in the WSIP setting.

⁹ See "Analysis of SFPUC Pilarcitos/Coastside County Water District Operations", Daniel B. Steiner, March 8, 2007.

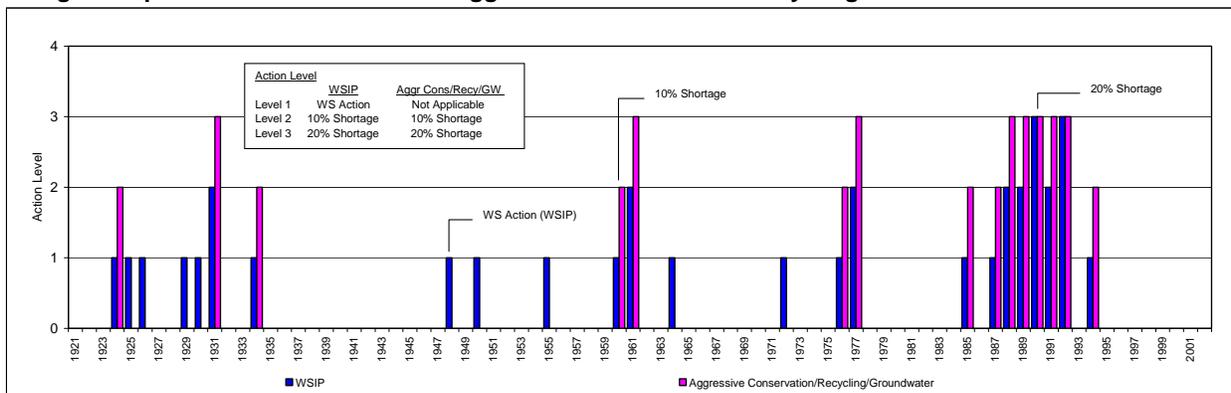
4. CEQA Alternative 3 – Aggressive Conservation/Recycling/Groundwater

CEQA Alternative 3 – Aggressive Conservation/Recycling/Groundwater Alternative would serve an increase in customer purchases from 265 mgd in 2005 to 300 mgd in 2030, met in large part through additional water conservation, water recycling, and groundwater programs beyond those already assumed in the 2030 demand projections. A total of 19 mgd of the demand is assumed to be met through regional recycled water, groundwater, and conservation projects within the regional service area, but outside of San Francisco. These projects are in addition to the 10 mgd of groundwater development, recycled water projects, and conservation in San Francisco (referred to herein as RRGWC) included in the WSIP and also incorporated into this alternative. The alternative would result in an average annual net demand on the regional system of 271 mgd compared to a net demand of 290 mgd in the WSIP setting, and compared to an average annual demand of 265 mgd for the base setting. The increased net water demand would be served through additional Tuolumne River diversions and increased use of local watershed supplies from restoration of Calaveras Reservoir. Compared to the WSIP setting, the alternative would not include supplemental supplies from implementation of the Westside Basin Groundwater Program, water transfers with the TID/MID, or water supply associated with restoration of Lower Crystal Springs Dam.¹⁰ All other WSIP facility improvement projects would be implemented.

4.1 Water Deliveries and Drought Response Actions

Compared to the WSIP setting, the regional system's resources are required to serve a net 271-mgd demand (300 mgd purchase request less 10 mgd of RRGWC and 19 mgd from projects within the region but not in San Francisco) instead of a net 290-mgd demand. However, the alternative does not provide relatively comparable supplemental water supplies for the lesser demand, and requires a more frequent implementation of rationing and severity of rationing from the SFPUC system during drought periods. The shortages that SFPUC customers would experience in supply from the SFPUC system in the future would be in a setting where the region would have already developed some portion of the 19 mgd included in this alternative as a system resource. Development of these projects might affect the ability of SFPUC customers to cope with projected shortages in SFPUC supplies. Table 1-1 illustrates the comparison of the drought response actions for the proposed program and the alternative. Figure 4.1-1 illustrates the occurrence of drought response actions for the simulated 82-year historical period (1921-2002).

**Figure 4.1-1
Drought Response Actions – WSIP and Aggressive Conservation/Recycling/Groundwater**



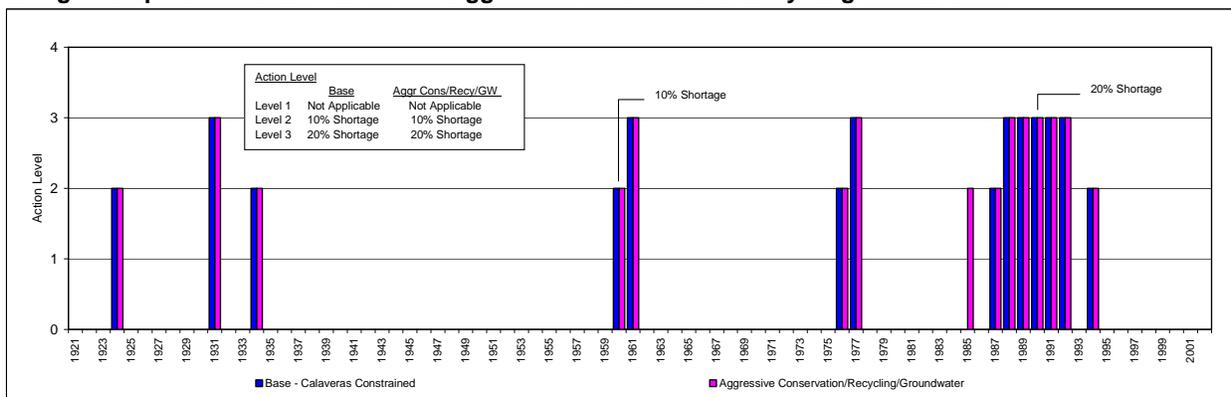
In Figure 4.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In the WSIP setting, the water supply action is the use of the Westside Groundwater Basin Program to supplement SFPUC water deliveries. Also occurring in the WSIP setting is the water transfer supplemental supply from MID/TID. In the alternative setting, no supplemental water supply action is available, and only water delivery shortage (rationing) measures are available. Action levels greater than “1” indicate the imposition of delivery shortages to SFPUC

¹⁰ The Lower Crystal Springs Dam Improvements (LCSDI) project is also included in this alternative; however, it was not included in the HH/LSM modeling.

customers. In both settings, the shortage measure is applied during level 2 (10 percent) and level 3 (20 percent), although they are applied to different levels of water demand. In the alternative, the system's net water demand is 271 mgd, and in the WSIP setting the net water demand is 290 mgd. SFPUC customers would experience more frequent periods of shortages, and the severity of shortages (percentage-wise) would increase.

The same form of information is shown in Figure 4.1-2 in comparing the alternative and "Base - Calaveras Constrained" (existing) settings. There is no level 1 action level in either the base or alternative setting. Without supplemental resources, both settings only have delivery shortage measures available to cope with drought. In the base setting, the shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). During this simulation period, rationing above 20 percent is not required in either setting; however, in the alternative setting, the frequency of water delivery shortages increases. The applied shortages (percentage-wise) occur to two different levels of net water demand.

**Figure 4.1-2
Drought Response Actions – Base and Aggressive Conservation/Recycling/Groundwater**



Not illustrated in Figure 4.1-2 but shown in Table 1-1 are the delivery shortages anticipated during the entire SFPUC Design Drought. During the Design Drought, the base setting does not have a viable operation without exceeding a 20-percent shortage level. The base setting exceeds the 20-percent shortage level (requires 25 percent rationing) during the last 18 months of the Design Drought. The alternative would viably provide deliveries without exceeding a 20-percent shortage level. However, the alternative would require 4 years of greater shortages (percentage-wise) than the WSIP setting during the Design Drought.

The difference in water deliveries between the proposed program and the alternative is shown chronologically for the 82-year simulation in Table 4.1-1. Less water would be delivered to the region by the SFPUC in all years, a result of serving a lesser net water demand (275 mgd instead of 290 mgd).

Comparing the alternative setting to the base setting, Table 4.1-2 illustrates the difference in water deliveries between the two settings. The increases in deliveries indicate the SFPUC system serving a larger net demand in the alternative setting (271 mgd) compared to the base setting (265 mgd). The one notable reduction in deliveries occurs during 1985 when the alternative setting requires rationing and the base setting does not.

Table 4.1-1

Water Year	Aggressive Conservation/Recycling/Groundwater minus WSP												WY Total	FY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
1921	-1,126	-346	-373	-370	-120	-155	-852	-868	-870	-905	-899	-873	-7,758	-8,423
1922	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1923	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1924	-902	-129	-149	-146	-120	-155	-852	-868	-870	-1,839	-1,816	-1,604	-9,450	-6,868
1925	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-1,794	-599	-625	-636	-10,754	-14,153
1926	-678	73	35	13	56	44	-633	-646	-634	-599	-625	-636	-4,229	-4,229
1927	-678	73	35	13	56	44	-633	-646	-634	-1,129	-1,123	-1,090	-5,712	-4,229
1928	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1929	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-599	-625	-636	-8,024	-9,508
1930	-678	73	35	13	56	44	-633	-646	-634	-599	-625	-636	-4,229	-4,229
1931	-678	73	35	13	56	44	-633	-646	-634	-1,518	-1,521	-1,409	-6,818	-4,229
1932	-1,375	-701	-656	-616	-593	-777	-1,331	-1,464	-1,502	-1,129	-1,123	-1,090	-12,358	-13,464
1933	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1934	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,839	-1,816	-1,604	-11,424	-9,508
1935	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-1,794	-1,129	-1,123	-1,090	-12,237	-14,153
1936	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1937	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1938	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
1939	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1940	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1941	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1942	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1943	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1944	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1945	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1946	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1947	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1948	-902	-129	-149	-146	-120	-155	-852	-868	-870	-599	-625	-636	-6,050	-6,868
1949	-678	73	35	13	56	44	-633	-646	-634	-1,129	-1,123	-1,090	-5,712	-4,229
1950	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-599	-625	-636	-8,024	-9,508
1951	-678	73	35	13	56	44	-633	-646	-634	-1,129	-1,123	-1,090	-5,712	-4,229
1952	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
1953	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1954	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1955	-902	-129	-149	-146	-120	-155	-852	-868	-870	-599	-625	-636	-6,050	-6,868
1956	-678	73	35	13	56	44	-633	-646	-634	-1,129	-1,123	-1,090	-5,712	-4,229
1957	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
1958	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1959	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1960	-902	-129	-149	-146	-120	-155	-852	-868	-870	-1,839	-1,816	-1,604	-9,450	-6,868
1961	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-1,794	-1,518	-1,521	-1,409	-13,343	-14,153
1962	-1,375	-701	-656	-616	-593	-777	-1,331	-1,464	-1,502	-1,129	-1,123	-1,090	-12,358	-13,464
1963	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1964	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-599	-625	-636	-8,024	-9,508
1965	-678	73	35	13	56	44	-633	-646	-634	-1,129	-1,123	-1,090	-5,712	-4,229
1966	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
1967	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1968	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1969	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1970	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1971	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1972	-902	-129	-149	-146	-120	-155	-852	-868	-870	-599	-625	-636	-6,050	-6,868
1973	-678	73	35	13	56	44	-633	-646	-634	-1,129	-1,123	-1,090	-5,712	-4,229
1974	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
1975	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1976	-902	-129	-149	-146	-120	-155	-852	-868	-870	-1,839	-1,816	-1,604	-9,450	-6,868
1977	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-1,794	-1,518	-1,521	-1,409	-13,343	-14,153
1978	-1,375	-701	-656	-616	-593	-777	-1,331	-1,464	-1,502	-1,129	-1,123	-1,090	-12,358	-13,464
1979	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1980	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
1981	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1982	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1983	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1984	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
1985	-902	-129	-149	-146	-120	-155	-852	-868	-870	-1,839	-1,816	-1,604	-9,450	-6,868
1986	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-634	-1,129	-1,123	-1,090	-11,077	-12,993
1987	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,839	-1,816	-1,604	-11,424	-9,508
1988	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-1,794	-1,518	-1,521	-1,409	-13,343	-14,153
1989	-1,375	-701	-656	-616	-593	-777	-1,331	-1,464	-1,502	-1,518	-1,521	-1,409	-13,464	-13,464
1990	-1,375	-701	-656	-616	-593	-777	-1,331	-1,464	-1,502	-394	-420	-432	-10,261	-13,464
1991	-473	49	16	-6	31	29	-438	-451	-430	-1,518	-1,521	-1,409	-6,121	-2,919
1992	-1,375	-701	-656	-616	-593	-777	-1,331	-1,464	-1,502	-394	-420	-432	-10,261	-13,464
1993	-473	49	16	-6	31	29	-438	-451	-430	-1,129	-1,123	-1,090	-5,015	-2,919
1994	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,839	-1,816	-1,604	-11,424	-9,508
1995	-1,467	-597	-445	-346	-424	-706	-1,448	-1,668	-1,794	-1,129	-1,123	-1,090	-12,237	-14,153
1996	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1997	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1998	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
1999	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
2000	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-1,129	-1,123	-1,090	-9,508	-9,508
2001	-1,126	-346	-373	-370	-323	-379	-1,069	-1,092	-1,087	-905	-899	-873	-8,842	-9,508
2002	-902	-129	-149	-146	-120	-155	-852	-868	-870	-905	-899	-873	-6,868	-6,868
Avg (21-02)	-1,018	-250	-255	-245	-217	-287	-967	-1,011	-1,008	-1,049	-1,047	-1,001	-8,356	-8,364

Table 4.1-2

Difference in Total System-wide Delivery (MG)															Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total		
1921	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1922	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1923	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1924	-92	482	312	229	317	454	-125	39	138	202	171	68	2,194	2,256		
1925	-64	400	265	191	268	372	-83	46	-1,022	240	196	67	875	814		
1926	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1927	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1928	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1929	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1930	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1931	-92	482	312	229	317	454	-125	39	138	184	151	63	2,152	2,256		
1932	-52	356	235	173	236	333	-71	36	109	240	196	67	1,856	1,753		
1933	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1934	-92	482	312	229	317	454	-125	39	138	202	171	68	2,194	2,256		
1935	-64	400	265	191	268	372	-83	46	-1,022	240	196	67	875	814		
1936	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1937	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1938	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1939	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1940	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1941	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1942	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1943	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1944	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1945	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1946	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1947	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1948	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1949	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1950	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1951	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1952	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1953	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1954	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1955	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1956	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1957	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1958	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1959	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1960	-92	482	312	229	317	454	-125	39	138	202	171	68	2,194	2,256		
1961	-64	400	265	191	268	372	-83	46	120	184	151	63	1,914	1,956		
1962	-52	356	235	173	236	333	-71	36	109	240	196	67	1,856	1,753		
1963	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1964	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1965	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1966	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1967	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1968	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1969	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1970	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1971	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1972	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1973	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1974	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1975	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1976	-92	482	312	229	317	454	-125	39	138	202	171	68	2,194	2,256		
1977	-64	400	265	191	268	372	-83	46	120	184	151	63	1,914	1,956		
1978	-52	356	235	173	236	333	-71	36	-2,001	240	196	67	-254	-358		
1979	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1980	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1981	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1982	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1983	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1984	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1985	-92	482	312	229	317	454	-125	39	138	-1,000	-996	-901	-1,144	2,256		
1986	-882	-187	-167	-130	-164	-297	-940	-983	138	240	196	67	-3,108	-6,508		
1987	-92	482	312	229	317	454	-125	39	138	202	171	68	2,194	2,256		
1988	-64	400	265	191	268	372	-83	46	120	184	151	63	1,914	1,956		
1989	-52	356	235	173	236	333	-71	36	109	184	151	63	1,753	1,753		
1990	-52	356	235	173	236	333	-71	36	109	184	151	63	1,753	1,753		
1991	-52	356	235	173	236	333	-71	36	109	184	151	63	1,753	1,753		
1992	-52	356	235	173	236	333	-71	36	109	184	151	63	1,753	1,753		
1993	-52	356	235	173	236	333	-71	36	-2,001	240	196	67	-254	-358		
1994	-92	482	312	229	317	454	-125	39	138	202	171	68	2,194	2,256		
1995	-64	400	265	191	268	372	-940	-983	-1,022	240	196	67	-1,010	-1,072		
1996	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1997	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1998	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
1999	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
2000	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
2001	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
2002	-92	482	312	229	317	454	-125	39	138	240	196	67	2,256	2,256		
Avg (21-02)	-96	456	295	216	299	427	-137	14	41	216	175	55	1,962	1,962		

4.2 Diversions from Tuolumne River

The metric for illustrating the SFPUC diversion from the Tuolumne River Basin (Tuolumne) is the flow through the San Joaquin Pipeline (SJPL). Inherent to this alternative setting is a net water demand slightly greater than the base setting, which is less than the demand served by the proposed program. Table 4.2-1 illustrates the difference in diversions to the SJPL between the proposed program and the alternative settings. In both settings, the conveyance capacity of the SJPL is increased compared to the base setting. During the summer, the SJPL would essentially operate at the same maximum rate in both the alternative and WSIP settings to minimize draw down of Bay Area reservoir storage. A few exceptions occur during the summer of drought periods when the alternative is serving a lesser net demand than in the WSIP setting. Overall, compared to the WSIP setting, the alternative setting would divert less water from the Tuolumne, primarily due to the lesser net water demand place on the system.

Table 4.2-2 illustrates the difference in diversions to the SJPL between the alternative and base settings. Evident in the operation is the increase in summer diversions associated with an increase in the conveyance capacity of the SJPL. As described above, with the increase in SJPL conveyance capacity, summer diversions would increase to retain storage in the Bay Area reservoirs. Because the demand of the alternative is approximately the same as the base setting, the increase in summer diversions to the SJPL result in reduced diversions during the late summer and fall. The differences in December diversions are largely the result of maintenance occurring in the alternative setting (lessening available conveyance capacity), which does not occur in the base setting. The increased diversion during the winter and spring result from the need to replenish Bay Area reservoir storage after the maintenance, and then top off Bay Area reservoir storage prior to summer. Overall, there would be an increase in average annual diversions to the SJPL in the alternative setting, which is predominantly associated with the increase in net water demand.

The average monthly diversion through the SJPL by year type for the 82-year simulation for the proposed program and the alternative settings and the difference between the two settings is illustrated in Table 4.2-3. Table 4.2-4 illustrates the same information for the alternative and base settings.

Table 4.2-1

Difference in Total SJPL (Acre-feet)		Aggressive Conservation/Recycling/Groundwater minus WSP												WY Total	FY Total
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			
1921	-2,854	-1,841	0	0	0	-5,708	0	-2,664	-2,578	0	0	-2,118	-17,763	-22,090	
1922	-5,233	-921	0	-1,902	0	0	-10,127	-2,664	-2,578	0	0	-2,118	-26,003	-25,543	
1923	-2,854	0	0	0	0	-2,949	-3,867	-2,664	-2,578	0	0	-2,118	-17,030	-17,490	
1924	-3,901	-921	952	-1,903	-1,719	0	0	0	0	0	0	-7,642	-15,134	-9,610	
1925	-7,897	0	0	0	-945	0	0	-3,996	-3,867	0	0	-2,118	-19,283	-24,347	
1926	-5,043	-2,854	0	-6,755	-6,875	-2,949	-4,880	-2,189	-2,118	0	0	-2,118	-35,781	-36,241	
1927	-5,233	-921	952	-1,902	0	-1,902	-5,524	-3,140	-3,038	0	0	-2,118	-22,826	-22,826	
1928	-2,854	-921	-523	-2,855	-2,578	-3,805	-5,524	-3,140	-3,038	0	0	-2,118	-27,356	-27,356	
1929	-5,233	-921	0	-3,805	-3,437	0	0	0	0	0	0	-1,197	-14,593	-15,514	
1930	-5,043	0	0	0	0	0	0	0	0	0	0	0	-5,043	-6,240	
1931	-3,140	-2,854	0	-6,755	-6,101	0	0	0	0	-2,522	-3,949	-10,726	-36,047	-18,850	
1932	-9,847	-4,005	7,944	-1,760	-8,034	-8,039	-3,821	-8,230	-7,964	0	0	-2,118	-45,874	-60,953	
1933	-1,903	-2,762	0	-2,854	-2,578	0	0	0	0	0	0	-1,197	-11,294	-12,215	
1934	-3,996	-1,013	-7,611	-6,659	-6,015	0	0	-1,237	-1,197	-1,237	-1,237	-7,642	-37,844	-28,925	
1935	-7,897	0	0	-1,047	-2,664	0	-10,404	-7,897	-7,642	0	0	-1,197	-38,748	-47,667	
1936	-7,897	-5,524	0	-3,806	-859	-6,755	-3,038	-3,996	-3,867	0	0	-1,197	-36,939	-36,939	
1937	-6,660	-2,762	952	-4,757	0	-2,663	-7,366	-3,996	-3,867	0	0	-2,118	-33,237	-32,316	
1938	-3,901	-921	1,142	-4,947	0	0	-9,206	-5,043	-4,880	0	0	-2,578	-30,334	-29,874	
1939	-2,854	0	2,854	-1,903	-1,719	0	0	-1,237	-1,197	0	0	-1,197	-7,253	-8,634	
1940	-5,043	0	0	0	-8,593	-9,704	-5,524	-3,996	-3,867	0	0	-1,197	-37,924	-37,924	
1941	-952	0	2,854	0	0	0	0	-2,854	-2,762	0	0	0	-3,714	-4,911	
1942	-3,805	-921	1,712	0	0	-2,854	-7,365	-2,854	-2,762	0	0	-1,197	-20,046	-18,849	
1943	-2,949	-1,841	0	0	0	-4,947	-4,880	-3,996	-3,867	0	0	-2,118	-24,598	-23,677	
1944	-952	0	1,903	-3,805	-3,437	-3,901	0	-3,140	-3,038	0	0	-1,197	-17,567	-18,488	
1945	-3,901	0	0	0	-2,578	0	0	-3,140	-3,038	0	0	-1,197	-13,854	-13,854	
1946	-7,897	-2,762	0	0	0	-3,901	0	-1,237	-1,197	0	0	-3,038	-20,032	-18,191	
1947	-8,562	-921	1,903	-4,757	-4,296	0	0	0	0	0	0	-2,118	-18,751	-19,671	
1948	-5,043	-2,854	0	-6,755	-5,156	0	0	0	0	0	0	-1,197	-21,005	-21,926	
1949	-5,043	-2,854	0	-2,855	-2,578	-952	-3,038	-3,140	-3,038	0	0	-2,118	-25,616	-24,695	
1950	-4,757	0	0	0	0	0	0	0	0	0	0	0	-4,757	-6,875	
1951	-3,140	-11,968	0	0	0	-7,801	-2,578	-3,996	-3,867	0	0	-2,118	-35,468	-33,350	
1952	-2,854	-921	0	0	0	0	-9,207	-5,043	-4,880	0	0	-2,118	-25,023	-25,023	
1953	-2,854	0	951	0	0	-5,803	0	-5,043	-4,880	0	0	-1,197	-18,826	-19,747	
1954	-2,854	0	2,855	-3,805	-1,718	-5,803	-1,197	-2,189	-2,118	0	0	-2,118	-18,947	-18,026	
1955	-3,901	0	0	0	0	0	0	0	0	0	0	0	-3,901	-6,019	
1956	-3,140	-1,013	0	0	0	-1,142	-3,867	-3,140	-3,038	0	0	-3,038	-18,378	-15,340	
1957	-4,756	-921	952	-1,903	-1,719	-2,949	0	-1,237	-1,197	0	0	-2,118	-15,848	-16,768	
1958	-7,897	-3,683	0	-3,805	0	0	-2,949	-2,854	0	0	0	-1,197	-22,385	-23,306	
1959	-2,854	0	2,855	-3,805	0	-1,047	0	-2,189	-2,118	0	0	-1,197	-10,355	-10,355	
1960	-5,043	0	0	0	0	0	0	0	0	0	0	-3,867	-8,910	-6,240	
1961	-6,945	-3,775	6,184	-571	-6,101	-1,047	0	-5,043	-4,880	-5,281	-5,281	-10,726	-43,466	-26,045	
1962	-11,084	-875	1,094	-5,566	-8,894	-8,039	-4,281	-9,181	-8,884	0	0	-1,197	-56,907	-76,998	
1963	-1,332	-5,524	0	-2,663	0	-4,947	-6,444	-2,854	-2,762	0	0	-1,197	-27,723	-27,723	
1964	-6,945	-1,841	0	-2,854	-2,578	0	0	0	0	0	0	-2,118	-16,336	-15,415	
1965	-5,043	0	0	-5,708	-5,156	0	-7,826	-3,806	-3,683	0	0	-1,197	-32,419	-33,340	
1966	-2,854	0	523	-3,805	-3,437	0	0	0	0	0	0	-2,578	-12,151	-10,770	
1967	-5,043	-5,616	-1,902	0	0	-3,805	-6,445	-2,855	-2,762	0	0	0	-28,428	-31,006	
1968	-3,806	-921	0	-952	-860	0	0	0	0	0	0	-3,038	-9,577	-6,539	
1969	-7,897	-3,683	0	0	0	0	-7,642	-3,996	-3,867	0	0	-2,118	-29,203	-30,123	
1970	-952	0	0	-1,903	-1,719	-5,803	0	-1,237	-1,197	0	0	-2,578	-15,389	-14,929	
1971	-4,757	0	0	0	0	0	0	0	0	0	0	-2,118	-6,875	-7,335	
1972	-5,043	-6,537	-2,854	-4,757	-4,296	0	0	0	0	0	0	0	-23,487	-25,605	
1973	-3,996	-3,775	0	0	0	0	-7,642	-3,140	-3,038	0	0	-2,578	-24,169	-21,591	
1974	-4,756	0	0	0	0	-2,854	-7,365	-5,043	-4,880	0	0	-2,118	-27,016	-27,476	
1975	0	0	0	0	-2,578	-2,854	-7,365	-3,996	-3,867	0	0	-2,118	-22,778	-22,778	
1976	0	0	0	-2,854	-2,578	0	0	0	0	0	0	-7,642	-13,074	-7,550	
1977	-7,897	-3,775	-2,854	1,427	-4,296	0	0	-5,043	-4,880	-4,424	1,760	-4,742	-34,724	-34,960	
1978	-3,663	-875	4,900	-8,420	-8,034	-9,847	-10,450	-5,185	-5,017	0	0	-2,578	-49,169	-53,997	
1979	-2,854	0	0	-3,805	0	-5,709	-1,197	-2,664	-2,578	0	0	-2,118	-20,925	-21,385	
1980	-7,897	0	0	-6,659	0	-7,611	-4,880	-3,996	-3,867	0	0	-2,118	-37,028	-37,028	
1981	-2,854	-921	0	-1,902	-1,718	-1,047	-1,197	-2,189	-2,118	0	0	-2,118	-16,064	-16,064	
1982	-6,660	-1,841	1,903	0	0	-2,663	0	-2,854	-2,762	0	0	-1,197	-16,074	-16,995	
1983	-2,949	0	0	0	0	0	-4,604	-1,902	-1,841	0	0	0	-11,296	-12,493	
1984	-5,043	-921	0	0	0	0	0	0	0	0	0	-2,578	-8,542	-9,964	
1985	-5,043	0	0	0	0	0	0	0	0	0	0	-4,880	-9,923	-7,621	
1986	-6,945	-3,775	0	-8,658	-3,437	-7,610	-11,968	-7,897	-7,642	0	0	-1,197	-59,129	-62,812	
1987	-1,902	0	952	-1,903	-1,719	0	0	0	0	0	-1,237	-7,642	-13,451	-5,769	
1988	-7,897	-3,775	0	-8,658	-6,875	0	0	-5,043	-4,880	-4,424	-5,281	-10,726	-57,559	-46,007	
1989	-6,041	-3,084	-1,284	-3,187	-2,878	-1,285	-2,440	-8,230	-7,964	-3,949	-4,424	-4,005	-48,771	-56,824	
1990	-3,187	0	0	-1,285	-2,105	-1,285	-1,243	-3,949	-4,281	-6,327	-4,138	-3,084	-30,884	-29,713	
1991	-1,285	-322	-761	618	558	-4,138	-3,360	-3,187	-3,084	-4,424	-2,141	-1,243	-22,768	-28,510	
1992	-1,285	-1,243	-1,284	-3,187	559	-8,039	-4,281	-9,181	-8,884	1,094	2,521	1,519	-31,691	-44,633	
1993	1,570	-322	-761	-1,285	-1,160	-1,285	-4,004	-4,139	-4,005	0	0	-1,197	-16,588	-10,257	
1994	-2,854	0	1,903	-2,855	-2,578	-1,047	0	-1,237	-1,197	0	0	-1,237	-7,642	-18,744	
1995	-7,897	0	0	-7,801	-5,328	0	-10,127	-6,659	-6,445	0	0	0	-3,867	-48,124	-53,136
1996	-4,756	0	0	0	0	0	-6,721	-3,996	-3,867	0	0	-2,578	-21,918	-23,207	
1997	-4,757	-2,762	0	0	0	-3,901	0	-3,140	-3,038	0	0	-2,118	-19,716	-20,176	
1998	-6,660	-4,603	-523	0	0	-951	-9,206	-3,901	-3,775	0	0	-3,867	-33,486	-31,737	
1999	-2,854	-921	1,903	-2,854	0	-5,709	-7,365	-5,043	-4,880	0	0	-2,578	-30,301	-31,590	
2000	-4,756	0	0	0	-2,578	-8,563	0	-3,140	-3,038	0	0	-1,197	-23,272	-24,653	
2001	-6,660	-2,762	0	-3,806	0	-5,708	-2,118	-2,664	-2,578	0	0	-2,118	-28,414	-27,493	
2002	-5,708	-2,762	1,142	-1,902	-1,718	0	0	-1,237	-1,197	0	0	-1,197	-14,579	-15,500	
Avg (21-02)	-4,532	-1,549	377	-2,230	-1,892	-2,333	-2,946	-2,925	-2,836	-384	-301	-2,552	-24,103	-24,167	

Table 4.2-2

Difference in Total SJPL (Acre-feet)				Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained											
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
1921	-1,902	-2,762	0	0	0	8,562	2,118	-475	-460	2,189	2,189	0	9,459	9,459	
1922	-5,708	-921	0	4,757	0	0	-2,762	2,379	2,302	2,189	2,189	-460	3,965	4,425	
1923	-2,854	-921	0	0	0	12,368	-1,749	-475	-460	2,189	2,189	0	10,287	9,827	
1924	-2,854	-921	0	-2,855	-2,578	5,803	2,118	2,189	2,118	2,189	2,189	-5,524	1,874	7,398	
1925	-5,708	-19,334	-15,222	5,803	16,327	15,317	2,118	-1,807	-1,749	2,189	2,189	-460	-337	-5,401	
1926	0	2,762	-7,088	-952	859	12,368	-2,762	0	0	2,189	2,189	0	9,565	9,105	
1927	-952	0	0	5,899	0	1,903	-5,524	-951	-920	2,189	2,189	2,762	6,595	3,833	
1928	0	-921	-1,902	2,854	2,578	3,805	-5,524	-951	-920	2,189	2,189	2,762	6,159	6,159	
1929	0	-921	0	952	860	10,560	2,118	2,189	2,118	2,189	2,189	921	23,175	25,016	
1930	-2,854	-19,334	-19,979	5,803	5,242	15,317	2,118	2,189	2,118	2,189	2,189	2,118	-2,884	-4,081	
1931	-951	2,762	-7,088	-952	3,437	5,803	2,118	2,189	2,118	-333	-1,760	-8,608	-1,265	15,932	
1932	-1,285	3,360	618	2,521	-1,160	8,420	-1,703	-333	-322	2,189	2,189	0	14,494	-585	
1933	0	-921	-7,088	4,757	4,297	10,560	2,118	2,189	2,118	2,189	2,189	921	23,329	22,408	
1934	-1,807	4,603	-2,855	952	4,297	10,560	2,118	952	921	952	952	-5,524	16,121	25,040	
1935	-5,708	-19,334	-19,979	15,412	12,202	10,560	-8,286	0	0	2,189	2,189	921	-9,834	-18,753	
1936	-952	-921	-7,088	8,562	0	8,562	-920	-1,807	-1,749	2,189	2,189	921	8,986	8,986	
1937	-2,854	-921	0	952	0	0	-5,524	1,047	1,013	2,189	2,189	0	-1,909	-988	
1938	0	-921	0	2,663	0	0	-1,841	0	0	2,189	2,189	2,302	6,581	4,279	
1939	-2,854	-921	1,902	1,902	1,718	10,560	2,118	952	921	2,189	2,189	921	21,597	22,978	
1940	-2,854	-19,334	-19,979	11,512	859	2,663	1,841	1,047	1,013	2,189	2,189	921	-17,933	-17,933	
1941	-952	-921	0	0	0	0	0	0	0	2,189	2,189	2,118	4,623	3,426	
1942	-1,902	-921	0	0	0	951	-1,841	0	0	2,189	2,189	921	1,586	2,783	
1943	0	1,841	-7,088	0	0	2,663	0	1,047	1,013	2,189	2,189	0	3,854	4,775	
1944	-952	-921	-952	952	5,328	11,418	2,118	-951	-920	2,189	2,189	921	20,417	19,496	
1945	-5,708	-19,334	-19,979	5,803	11,171	15,317	2,118	-951	-920	2,189	2,189	921	-7,184	-7,184	
1946	-952	-921	0	0	0	7,611	2,118	952	921	2,189	2,189	-920	13,187	15,028	
1947	-7,610	-921	3,805	0	0	10,560	2,118	2,189	2,118	2,189	2,189	0	16,637	15,717	
1948	-2,854	2,762	-7,088	-952	-859	5,803	2,118	2,189	2,118	2,189	2,189	921	8,536	7,615	
1949	-2,854	2,762	0	-2,855	-2,578	-5,709	-920	-951	-920	2,189	2,189	2,762	-6,885	-8,726	
1950	-952	-19,334	-19,979	18,171	16,413	10,560	2,118	2,189	2,118	2,189	2,189	2,118	17,800	18,444	
1951	-951	-7,365	0	0	0	-1,142	-460	-1,807	-1,749	2,189	2,189	2,762	-6,334	-6,978	
1952	-952	-921	0	0	0	0	1,841	0	0	2,189	2,189	0	4,346	7,108	
1953	-2,854	-921	0	0	0	9,514	2,118	-2,854	-2,762	2,189	2,189	921	7,540	6,619	
1954	-5,708	-921	0	4,757	5,328	9,514	921	0	0	2,189	2,189	0	18,269	19,190	
1955	-5,708	-19,334	-15,222	18,171	16,413	5,803	2,118	2,189	2,118	2,189	2,189	2,118	13,044	10,926	
1956	-951	4,603	-3,805	0	0	2,663	-1,749	1,903	1,842	2,189	2,189	-920	7,964	11,002	
1957	-2,854	-921	0	2,854	7,046	7,611	2,118	952	921	2,189	2,189	0	22,105	21,185	
1958	-2,854	-921	-2,331	0	0	0	0	0	0	2,189	2,189	921	-807	-1,728	
1959	-952	-921	0	4,757	0	14,270	2,118	0	0	2,189	2,189	921	24,571	24,571	
1960	-2,854	-19,334	-19,979	5,803	9,538	5,803	2,118	2,189	2,118	2,189	2,189	-1,749	-11,969	-9,299	
1961	-4,756	1,841	-2,331	4,757	4,297	4,756	2,118	-2,854	-2,762	-3,092	-3,092	3,360	2,242	7,695	
1962	3,472	-1,243	-2,236	-1,284	2,277	10,132	-2,163	-1,284	-1,242	2,189	2,189	3,683	14,490	3,605	
1963	3,901	-921	-2,331	0	0	1,712	-1,841	-952	-921	2,189	2,189	921	3,946	6,708	
1964	0	1,841	-952	6,659	6,015	5,803	2,118	2,189	2,118	2,189	2,189	0	30,169	31,090	
1965	-2,854	-19,334	-15,222	0	0	15,317	-3,683	-2,854	-2,762	2,189	2,189	3,683	-23,331	-27,014	
1966	-952	1,841	-1,379	4,757	4,297	10,560	2,118	2,189	2,118	2,189	2,189	-460	29,467	33,610	
1967	-2,854	0	-7,611	0	0	-951	-3,683	-2,855	-2,762	2,189	2,189	2,118	-14,220	-16,798	
1968	1,902	-921	-7,088	7,610	6,874	10,560	2,118	2,189	2,118	2,189	2,189	-920	28,820	31,858	
1969	-5,708	-921	1,902	0	0	0	0	1,047	1,013	2,189	2,189	0	1,711	791	
1970	-952	-19,334	-15,222	10,464	9,452	9,514	2,118	952	921	2,189	2,189	-460	1,831	2,291	
1971	-952	1,841	-951	0	0	10,560	2,118	2,189	2,118	2,189	2,189	0	21,301	20,841	
1972	-2,854	-921	-952	0	0	5,803	2,118	2,189	2,118	2,189	2,189	2,118	13,997	11,879	
1973	-1,807	1,841	-7,088	0	0	0	-921	-951	-920	2,189	2,189	2,302	-3,166	-3,350	
1974	-2,854	0	0	0	0	5,708	-1,841	0	0	2,189	2,189	2,762	8,153	7,693	
1975	-952	-19,334	-19,979	11,512	5,156	951	921	1,047	1,013	2,189	2,189	0	-15,287	-12,525	
1976	0	-921	-7,088	3,805	3,437	5,803	2,118	2,189	2,118	2,189	2,189	-5,524	10,315	15,839	
1977	-5,708	1,841	-952	952	860	5,803	2,118	-2,854	-2,762	-2,235	-2,235	-5,846	-11,018	-1,848	
1978	-1,285	3,360	-3,615	-1,285	-1,160	-1,285	-139	618	599	2,189	2,189	-460	-274	-14,508	
1979	-952	-921	-952	4,757	0	6,659	921	-475	-460	2,189	2,189	0	12,955	12,495	
1980	-952	-19,334	-15,222	8,562	0	951	0	1,047	1,013	2,189	2,189	0	-19,557	-19,557	
1981	-952	-921	-7,088	5,708	5,156	14,270	921	0	0	2,189	2,189	0	21,472	21,472	
1982	-5,708	1,841	-2,854	0	0	0	0	0	0	2,189	2,189	921	-1,422	-2,343	
1983	0	1,841	-2,663	0	0	0	-1,658	952	921	2,189	2,189	2,118	5,889	4,692	
1984	0	-921	0	0	0	5,803	2,118	2,189	2,118	2,189	2,189	-460	15,225	17,803	
1985	-2,854	-14,731	-15,222	5,803	9,538	10,560	2,118	2,189	2,118	2,189	2,189	-2,762	1,135	3,437	
1986	-4,756	1,841	-7,088	-2,855	0	0	-4,603	-2,854	-2,762	2,189	2,189	921	-17,778	-21,461	
1987	0	-921	0	1,902	1,718	10,560	2,118	2,189	2,118	2,189	952	-5,524	17,301	24,983	
1988	-5,708	1,841	-7,088	-2,855	1,718	5,803	2,118	-2,854	-2,762	619	1,664	-5,846	-13,350	-12,170	
1989	-1,285	3,360	618	-333	-300	9,275	-322	-6,041	-5,846	3,948	3,473	-5,846	701	-4,437	
1990	-1,285	-14,731	-15,222	10,227	8,293	9,275	875	-1,760	-2,163	1,570	1,570	-1,243	-4,594	-4,916	
1991	-1,285	3,360	-3,615	-4,139	1,418	12,986	-1,242	-6,041	-5,846	3,473	2,616	3,360	5,045	-2,507	
1992	3,472	-1,243	1,570	4,614	3,996	10,132	-2,163	-1,284	-1,242	1,094	3,473	3,360	25,779	27,301	
1993	3,472	-1,243	1,142	-1,285	-1,160	-1,285	5,202	-3,187	-3,084	2,189	2,189	921	3,871	6,499	
1994	-952	-921	-952	1,902	6,015	9,513	2,118	952	921	2,189	952	-2,762	18,975	23,895	
1995	-952	-19,334	-19,979	2,663	2,406	0	-921	-2,854	-2,762	2,189	2,189	1,013	-36,342	-41,354	
1996	-2,854	-921	-2,331	0	0	0	0	-1,807	-1,749	2,189	2,189	2,302	-2,982	-4,271	
1997	0	-1,841	0	0	0	7,611	2,118	-951	-920	2,189	2,189	0	10,395	12,697	
1998	-5,708	-2,762	-1,902	0	0	0	-1,841	0	0	2,189	2,189	1,013	-6,822	-7,835	
1999	-1,902	-921	3,805	5,708	0	3,805	-4,603	0	0	2,189	2,189	2,302	12,572	11,283	
2000	-2,854	-19,334	-19,979	15,317	6,874	4,947	2,118	-951	-920	2,189	2,189	3,683	-6,721	-8,102	
2001	-952	-921	-7,088	4,757	8,593	8,562	0	-475	-460	2,189	2,189	0	16,394	20,077	
2002	-2,854	-921	0	4,757	4,297	10,560	2,118	952	921	2,189	2,189	921	25,129	24,208	
Avg (21-02)	-1,909	-3,621	-5,044	2,941	2,644	6,191	227	-1	-6	2,022	2,000	187	5,631	5,620	

Table 4.2-3

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Aggressive Conservation/Recycling/Groundwater										WY Total	FY Total		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	22,256	14,748	8,830	8,557	6,020	8,872	15,346	22,446	21,722	29,778	29,778	26,918	215,270	212,379
Above Normal	22,315	12,816	8,655	13,317	7,817	13,272	18,969	24,626	23,832	29,778	29,778	27,040	232,214	230,981
Normal	21,450	13,732	9,169	14,089	10,835	18,733	26,265	26,933	26,064	29,778	29,778	26,918	253,743	251,826
Below Normal	22,681	14,476	11,954	18,731	16,210	23,750	27,885	28,082	27,176	29,285	29,207	25,930	275,369	275,036
Dry	22,202	18,335	15,040	16,791	14,517	24,938	28,397	27,506	26,590	28,018	27,691	21,860	271,885	277,955
All Years	22,189	14,793	10,719	14,339	11,103	17,927	23,374	25,929	25,087	29,332	29,252	25,752	249,796	249,718

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Aggressive Conservation/Recycling/Groundwater										WSIP	WY Total	FY Total	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	27,358	16,624	8,533	11,512	7,465	11,298	21,561	26,603	25,744	29,778	29,778	28,817	245,069	242,794
Above Normal	26,705	14,785	7,751	14,254	9,306	16,705	24,176	28,608	27,685	29,778	29,778	28,817	258,347	258,347
Normal	26,174	14,713	8,765	15,626	12,095	22,405	28,207	29,778	28,817	29,778	29,778	28,817	274,953	274,878
Below Normal	27,338	16,106	11,931	21,523	18,520	25,038	28,817	29,481	28,530	29,778	29,593	27,864	294,520	295,079
Dry	25,990	19,593	14,794	19,764	17,471	25,782	28,817	29,778	28,817	29,463	28,821	27,200	296,289	297,969
All Years	26,721	16,342	10,342	16,569	12,994	20,261	26,320	28,854	27,923	29,717	29,553	28,304	273,899	273,884

Difference in Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Aggressive Conservation/Recycling/Groundwater minus WSIP										WY Total	FY Total		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	-5,102	-1,876	297	-2,955	-1,445	-2,426	-6,215	-4,157	-4,022	0	0	-1,899	-29,799	-30,415
Above Normal	-4,390	-1,969	904	-937	-1,489	-3,433	-5,207	-3,982	-3,853	0	0	-1,777	-26,134	-27,367
Normal	-4,724	-981	404	-1,537	-1,259	-3,672	-1,942	-2,846	-2,753	0	0	-1,899	-21,209	-23,052
Below Normal	-4,656	-1,630	22	-2,793	-2,310	-1,287	-932	-1,399	-1,354	-493	-386	-1,934	-19,151	-20,044
Dry	-3,788	-1,257	247	-2,973	-2,954	-845	-420	-2,272	-2,227	-1,445	-1,130	-5,340	-24,404	-20,014
All Years	-4,532	-1,549	377	-2,230	-1,892	-2,333	-2,946	-2,925	-2,836	-384	-301	-2,552	-24,103	-24,167

Table 4.2-4

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Aggressive Conservation/Recycling/Groundwater										WY Total	FY Total		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	22,256	14,748	8,830	8,557	6,020	8,872	15,346	22,446	21,722	29,778	29,778	26,918	215,270	212,379
Above Normal	22,315	12,816	8,655	13,317	7,817	13,272	18,969	24,626	23,832	29,778	29,778	27,040	232,214	230,981
Normal	21,450	13,732	9,169	14,089	10,835	18,733	26,265	26,933	26,064	29,778	29,778	26,918	253,743	251,826
Below Normal	22,681	14,476	11,954	18,731	16,210	23,750	27,885	28,082	27,176	29,285	29,207	25,930	275,369	275,036
Dry	22,202	18,335	15,040	16,791	14,517	24,938	28,397	27,506	26,590	28,018	27,691	21,860	271,885	277,955
All Years	22,189	14,793	10,719	14,339	11,103	17,927	23,374	25,929	25,087	29,332	29,252	25,752	249,796	249,718

Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Base - Calaveras Constrained										WY Total	FY Total		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258	218,975
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776	230,776
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601	243,681
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263	264,595
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509	262,015
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165	244,098

Difference in Total SJPL (Acre-feet)														
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained										WY Total	FY Total		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	-2,004	-3,378	-4,953	529	5	1,439	-685	-624	-604	2,189	2,189	909	-4,987	-6,596
Above Normal	-1,861	-5,110	-5,549	4,217	1,660	3,993	-1,340	-53	-51	2,189	2,189	1,154	1,438	205
Normal	-1,918	-5,314	-5,221	4,159	3,972	8,101	314	-121	-118	2,189	2,189	909	9,142	8,145
Below Normal	-2,278	-3,504	-6,011	3,005	4,403	8,417	1,186	493	477	2,368	2,290	260	11,106	10,441
Dry	-1,463	-711	-3,393	2,711	3,131	9,002	1,698	274	236	1,142	1,112	-2,365	11,376	15,940
All Years	-1,909	-3,621	-5,044	2,941	2,644	6,191	227	-1	-6	2,022	2,000	187	5,631	5,620

4.3 Hetch Hetchy Reservoir and Releases

Compared to the WSIP setting, the alternative setting would draw less water from the Tuolumne due to the lesser net demand. This circumstance would lead to less draw from Hetch Hetchy Reservoir in all years. Figure 4.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 4.3-1 are the results for the WSIP, alternative (“Aggressive Conservation/Recycling/Groundwater”), and base (“Base – Calaveras Constrained”) setting. Supplementing the Figure 4.3-1 representation of Hetch Hetchy Reservoir storage are Table 4.3-1 Hetch Hetchy Reservoir Storage (Aggressive Conservation/Recycling/Groundwater), Table 4.3-2 Hetch Hetchy Reservoir Storage (WSIP), and Table 4.3-3 Difference in Hetch Hetchy Reservoir Storage (Aggressive Conservation/Recycling/Groundwater minus WSIP). Table 4.3-4 is provided to illustrate the difference in Hetch Hetchy Reservoir storage between the base and alternative settings.

Table 4.3-3 illustrates that, by the end of summer, storage in Hetch Hetchy Reservoir associated with the alternative setting would be equal to or greater than the storage in the WSIP setting, albeit typically below 3,000 acre-feet. In about 20 percent of the years, storage would be greater by 3,000 acre-feet or more. The relatively minor increases in storage are attributable to years when summer diversions are the same in both settings (SJPL operating at maximum capacity) but less water is being diverted in the fall due to the lesser water demand. The larger increases in storage are associated with drought periods during which the differences in underlying demand and water delivery shortages between the WSIP and alternative settings are greater.

**Figure 4.3-1
Hetch Hetchy Reservoir Storage and Stream Release**

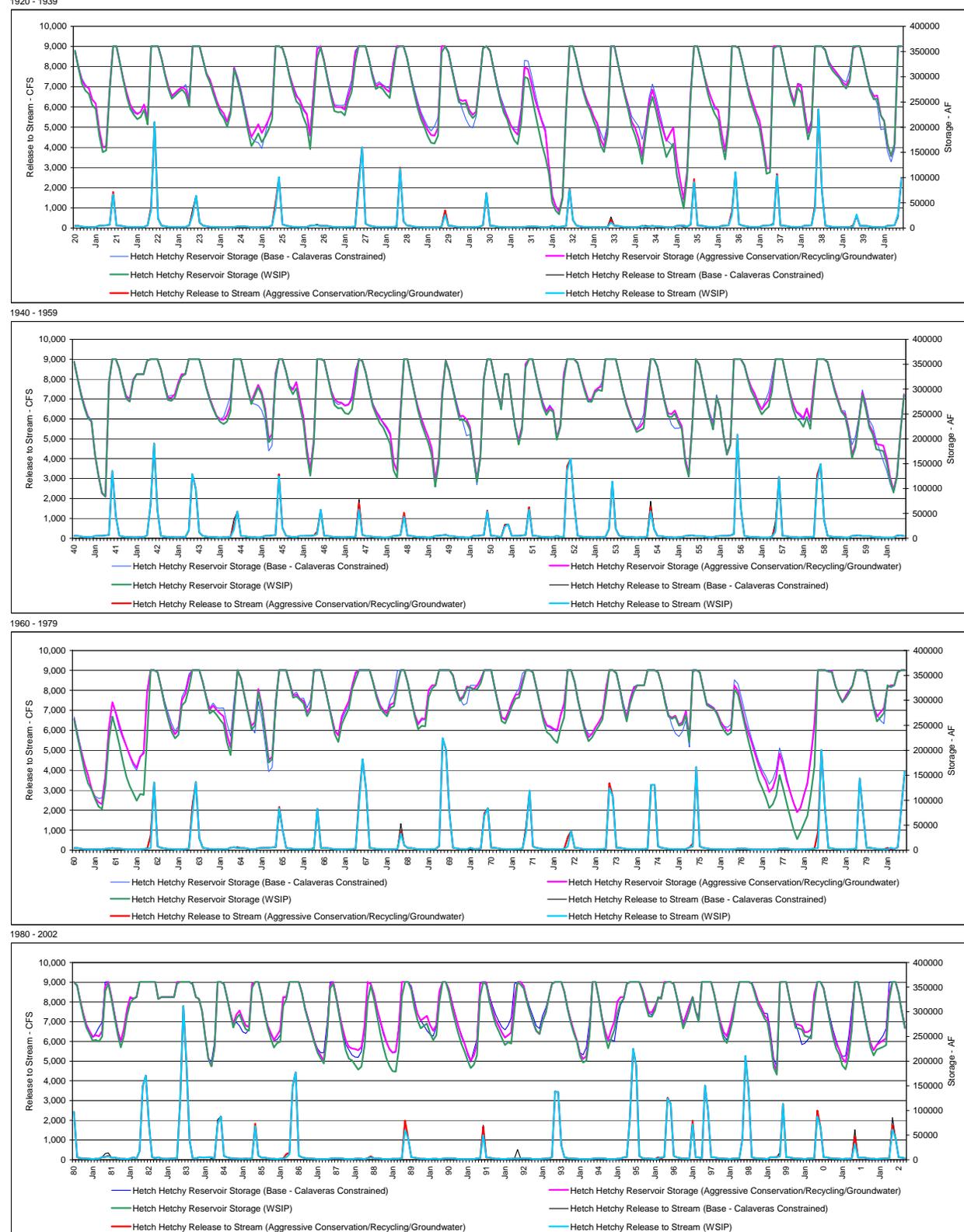


Table 4.3-1

Hetch Hetchy Reservoir Storage (Acre-feet)

Aggressive Conservation/Recycling/Groundwater

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	281,657	277,141	254,966	247,023	194,431	159,991	162,421	277,983	360,400	360,400	326,811	293,946
1922	267,077	243,918	232,993	225,959	230,427	245,002	215,316	360,400	360,400	360,400	336,082	305,431
1923	281,250	261,957	268,033	274,747	279,891	274,125	249,480	360,400	360,400	360,400	333,186	306,359
1924	294,113	272,399	250,916	235,842	227,319	210,751	232,489	316,966	295,221	267,276	232,011	203,785
1925	180,650	192,684	205,722	188,661	201,243	215,234	233,073	360,400	360,400	356,465	334,210	304,005
1926	281,704	261,900	253,814	236,607	226,700	183,134	268,004	354,623	360,400	333,232	297,804	265,973
1927	241,322	239,913	239,599	234,808	262,383	283,374	345,581	360,400	360,400	360,400	333,718	303,348
1928	280,505	286,079	281,961	274,888	269,612	323,975	360,400	360,400	360,400	337,096	302,689	271,561
1929	246,580	224,696	209,590	194,624	184,407	183,374	198,931	360,400	360,400	348,102	314,426	282,434
1930	255,732	252,162	253,492	233,989	224,561	231,039	292,402	356,465	360,400	350,768	316,726	283,424
1931	256,138	234,670	220,978	204,161	192,978	185,096	226,380	318,648	315,375	287,978	256,649	233,153
1932	211,056	190,774	122,917	63,462	43,287	32,708	61,263	231,849	360,400	360,400	333,089	302,036
1933	274,177	253,589	238,823	221,066	206,484	175,933	161,298	195,616	360,400	360,400	326,593	294,579
1934	266,153	240,549	211,282	198,047	177,252	142,202	195,747	249,490	274,481	249,470	218,678	195,056
1935	172,953	186,676	199,464	135,557	95,757	56,762	111,512	268,033	360,400	360,400	331,788	300,519
1936	276,179	257,315	240,966	233,390	188,216	151,962	209,136	360,400	360,400	356,465	327,853	295,307
1937	270,349	249,776	229,436	212,249	168,501	118,463	119,120	360,400	360,400	360,400	327,212	294,588
1938	268,792	249,312	285,620	280,856	229,949	188,446	211,201	360,400	360,400	360,400	352,029	327,292
1939	317,897	310,099	299,713	289,069	282,938	296,421	356,592	360,400	360,400	332,157	299,492	271,524
1940	261,447	262,483	223,464	211,605	164,370	142,152	165,319	360,400	360,400	354,451	320,313	287,507
1941	262,825	243,266	234,234	168,425	124,456	90,388	83,473	312,820	360,400	360,400	341,291	309,048
1942	284,527	279,668	318,892	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	308,159
1943	282,166	282,623	289,534	313,965	330,000	330,000	360,400	360,400	360,400	360,400	334,820	305,207
1944	282,212	263,416	246,128	239,216	238,155	246,731	266,806	360,400	360,400	360,400	329,290	298,642
1945	274,878	291,770	308,675	293,522	261,566	200,783	208,818	331,481	360,400	360,400	334,928	304,365
1946	298,672	313,863	278,431	244,500	180,036	136,015	197,378	360,400	360,400	357,267	325,581	296,273
1947	279,183	273,849	272,551	267,086	269,280	279,087	328,034	360,400	356,592	332,847	297,991	267,446
1948	254,417	241,532	232,643	223,936	211,067	152,415	135,190	258,087	360,400	360,400	325,774	292,259
1949	263,676	239,418	219,726	203,574	180,704	116,054	161,626	294,740	357,256	336,704	301,991	270,523
1950	245,263	246,232	239,497	223,137	168,546	118,643	166,212	322,737	360,400	359,600	323,849	289,929
1951	262,178	330,000	330,000	273,739	223,537	196,401	224,596	350,560	360,400	360,400	326,780	295,321
1952	269,737	253,969	264,895	256,420	200,982	226,689	329,861	360,400	360,400	360,400	351,651	324,328
1953	301,300	280,098	278,226	297,282	302,746	305,875	360,400	360,400	360,400	360,400	330,136	298,368
1954	272,115	251,105	231,363	218,572	224,052	233,542	300,539	360,400	360,400	343,956	308,827	277,600
1955	251,457	249,508	256,726	238,896	225,176	157,862	128,631	226,978	360,400	348,498	313,738	278,863
1956	247,956	222,953	283,831	261,759	206,930	168,244	188,452	360,400	360,400	360,400	347,791	322,328
1957	303,920	291,012	272,668	258,927	269,205	278,454	309,716	360,400	360,400	360,400	326,823	294,815
1958	271,074	254,673	249,653	241,567	261,085	237,578	309,381	360,400	360,400	360,400	353,900	325,107
1959	299,477	277,990	255,489	250,474	218,889	167,366	187,499	238,163	292,748	264,296	227,705	214,072
1960	189,902	187,746	186,590	162,192	122,437	96,645	127,341	217,247	289,010	262,767	227,562	197,208
1961	171,317	150,280	123,524	104,899	96,278	92,208	148,472	245,716	296,261	275,403	250,628	228,343
1962	208,375	189,601	174,783	165,360	187,849	194,125	316,933	360,400	360,400	356,465	326,379	293,328
1963	266,241	245,339	232,121	241,471	300,100	313,200	345,861	360,400	360,400	360,400	336,396	306,223
1964	281,809	289,398	280,709	273,515	267,970	230,748	205,464	283,682	360,400	343,750	309,409	278,014
1965	248,972	256,278	322,721	287,386	236,427	181,086	186,753	298,783	360,400	360,400	360,400	334,385
1966	309,450	311,813	302,491	298,750	275,440	286,706	360,400	360,400	360,400	331,450	297,972	267,899
1967	239,524	229,993	267,244	283,477	298,417	330,000	355,978	360,400	360,400	360,400	360,400	335,768
1968	309,096	289,459	280,489	273,774	291,597	294,654	336,860	360,400	360,400	334,325	299,837	270,490
1969	253,079	263,702	262,423	320,816	330,000	330,000	360,400	360,400	360,400	360,400	349,426	319,895
1970	302,364	308,727	327,503	326,065	322,564	330,000	341,873	360,400	360,400	360,400	326,016	293,338
1971	265,773	261,213	277,437	296,314	311,038	312,590	339,982	360,400	360,400	356,465	325,764	294,564
1972	265,998	250,065	247,565	242,573	240,490	270,702	292,166	360,400	360,400	336,426	299,001	267,965
1973	242,185	225,979	233,396	246,248	256,931	269,579	322,670	360,400	360,400	353,990	322,828	288,705
1974	265,128	300,833	323,837	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	297,304
1975	269,980	265,194	269,196	251,513	256,304	277,881	224,289	360,400	360,400	356,465	324,162	292,596
1976	288,453	284,585	275,546	257,236	246,936	238,637	242,987	329,818	319,261	299,186	257,477	235,216
1977	214,167	191,445	169,613	152,312	138,792	117,195	147,195	193,096	170,108	178,408	119,838	117,215
1978	94,943	76,140	85,023	110,460	134,887	189,873	254,103	360,400	360,400	360,400	357,869	358,984
1979	330,000	311,243	296,955	307,759	318,644	330,000	360,400	360,400	360,400	356,097	320,734	286,431
1980	267,738	275,890	284,548	326,065	330,000	330,000	356,592	360,400	360,400	360,400	352,729	322,530
1981	295,767	273,633	260,756	249,208	252,613	250,162	260,785	352,461	360,400	330,185	292,628	259,869
1982	240,552	266,428	305,285	330,000	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	360,400	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	299,035
1985	275,991	294,523	302,596	284,979	272,100	269,312	356,453	360,400	360,400	333,535	296,865	271,602
1986	257,224	243,248	252,070	263,604	330,000	330,000	360,400	360,400	360,400	360,400	337,490	305,794
1987	284,293	262,769	238,632	220,777	211,346	201,038	257,188	353,352	360,400	328,763	293,484	265,922
1988	242,023	228,860	225,605	224,502	222,304	228,397	271,258	360,400	356,592	335,159	305,655	282,737
1989	259,767	239,516	224,850	217,612	219,551	266,856	360,400	360,400	360,400	347,922	316,472	295,372
1990	282,246	286,967	291,747	273,665	261,796	272,890	341,833	360,400	360,400	345,488	317,587	294,174
1991	271,307	250,935	236,239	216,477	200,915	211,403	234,125	356,729	360,400	358,853	328,274	304,518
1992	283,554	271,315	257,759	247,558	252,610	258,049	328,854	360,400	360,400	351,568	322,244	298,979
1993	278,455	261,189	254,971	282,189	298,665	330,000	356,592	360,400	360,400	360,400	339,684	307,191
1994	282,765	260,670	241,502	214,685	204,545	209,885	258,742	360,400	360,400	328,106	289,741	262,176
1995	242,876	263,464	280,064	321,312	330,000	329,098	356,592	360,400	360,400	360,400	360,400	345,102
1996	321,724	299,723	298,941	311,930	326,446	330,000	360,400	360,400	360,400	356,465	329,269	298,386
1997	273,719	293,295	311,872	330,000	300,695	283,968	360,400					

Table 4.3-2

Hetch Hetchy Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	272,402	266,044	243,868	235,920	183,321	150,269	154,224	271,116	360,400	360,400	326,811	291,828
1922	259,728	235,648	224,723	215,782	220,244	234,819	205,133	360,400	360,400	360,400	336,082	302,853
1923	275,819	256,526	262,603	269,313	274,454	265,738	241,094	360,400	360,400	360,400	333,186	304,241
1924	288,096	265,462	244,930	227,949	217,703	201,135	226,615	314,032	292,290	264,348	229,088	193,225
1925	162,198	174,233	187,270	170,200	181,824	195,815	216,042	360,400	360,400	356,465	334,210	301,427
1926	274,085	251,427	243,883	219,916	203,496	156,406	245,154	336,819	358,277	331,111	295,686	261,739
1927	231,858	229,528	230,165	223,466	251,035	270,123	326,806	360,400	360,400	360,400	333,718	301,231
1928	275,534	280,188	275,546	265,616	257,757	308,315	356,993	360,400	360,400	337,096	302,689	269,444
1929	239,232	216,426	201,321	182,545	168,883	167,850	183,407	347,942	360,400	348,102	314,426	281,237
1930	249,493	245,923	247,253	227,747	218,315	224,793	286,156	356,465	360,400	350,768	316,726	283,424
1931	252,998	228,677	214,984	191,409	174,118	166,236	207,521	299,800	296,541	266,646	231,402	197,210
1932	165,286	141,000	108,382	51,375	34,654	27,412	58,311	229,715	360,400	360,400	333,089	299,918
1933	270,157	246,808	232,041	211,426	194,261	163,710	150,969	186,966	360,400	360,400	326,593	293,382
1934	260,961	234,344	202,242	182,930	159,810	127,492	183,946	236,459	260,268	234,045	202,043	170,799
1935	140,815	154,538	167,325	107,677	72,057	38,981	99,863	258,988	360,400	360,400	331,788	299,322
1936	267,086	242,699	226,345	214,884	170,029	136,212	195,836	360,400	360,400	356,465	327,853	294,110
1937	262,493	239,158	219,779	197,861	155,743	107,766	110,233	356,058	360,400	360,400	327,212	292,471
1938	262,775	242,374	277,970	268,254	217,341	175,883	200,130	360,400	360,400	360,400	352,029	324,714
1939	312,466	304,668	297,136	284,589	276,736	290,220	360,400	360,400	360,400	332,157	299,492	270,327
1940	255,209	256,245	222,760	213,012	165,616	143,200	166,203	360,400	360,400	354,451	320,313	286,310
1941	260,678	241,118	235,298	169,490	125,366	91,151	84,054	313,255	360,400	360,400	341,291	309,048
1942	280,721	274,942	315,878	330,000	330,000	330,000	356,592	360,400	360,400	360,400	339,529	306,962
1943	278,021	276,636	283,548	307,975	325,066	330,000	360,400	360,400	360,400	360,400	334,820	303,090
1944	279,144	260,348	244,962	234,244	229,744	234,419	254,494	360,400	360,400	360,400	329,290	297,445
1945	269,782	286,673	303,578	288,423	253,887	193,103	202,059	325,579	360,400	360,400	334,928	303,168
1946	289,579	302,009	266,576	232,638	168,168	125,876	188,823	360,400	360,400	357,267	325,581	293,235
1947	267,584	261,329	261,933	251,706	249,594	259,401	308,348	360,400	356,592	332,847	297,991	265,329
1948	247,258	231,519	222,630	207,163	189,129	136,187	121,486	246,616	360,400	360,400	325,774	291,062
1949	257,437	230,325	210,633	191,633	166,180	103,674	151,625	286,364	356,592	336,040	301,328	268,173
1950	237,728	238,697	233,450	217,724	163,129	114,105	162,436	319,562	360,400	359,600	323,849	289,929
1951	259,038	330,000	330,000	273,739	223,537	188,600	217,740	343,707	360,400	360,400	326,780	293,203
1952	264,766	248,078	259,003	253,471	198,031	223,738	317,703	360,400	360,400	360,400	351,651	322,211
1953	296,329	275,128	274,206	293,261	298,723	296,049	360,374	360,400	360,400	360,400	330,136	297,172
1954	268,064	247,055	230,167	213,569	217,328	221,015	286,815	360,400	360,400	343,956	308,827	274,943
1955	245,440	243,491	250,709	232,875	219,152	151,838	123,551	222,728	360,400	348,498	313,738	278,863
1956	244,816	218,801	283,964	261,892	207,063	168,550	188,550	360,400	360,400	360,400	347,791	319,290
1957	296,127	282,297	264,905	249,257	257,810	264,111	295,373	360,400	360,400	360,400	326,823	292,697
1958	261,061	240,978	235,957	224,058	243,566	220,059	291,862	360,400	360,400	360,400	353,900	323,910
1959	295,427	273,939	254,292	245,472	213,883	161,315	182,360	235,642	288,112	259,667	223,084	208,259
1960	179,051	176,894	175,738	151,333	116,394	92,543	124,226	215,694	287,458	261,217	226,015	191,797
1961	158,963	134,152	121,643	102,446	87,720	82,604	129,645	221,869	267,561	241,466	211,469	178,503
1962	147,481	127,832	114,109	99,056	112,573	110,810	229,337	360,400	360,400	356,465	326,739	292,131
1963	263,712	237,187	224,068	230,750	289,373	297,526	323,742	360,400	360,400	360,400	336,396	305,026
1964	273,668	279,416	270,727	260,673	252,543	215,321	190,335	275,763	360,400	343,750	309,409	275,896
1965	241,813	249,120	317,459	282,122	231,160	175,820	182,106	294,713	360,400	360,400	360,400	333,188
1966	305,400	307,762	300,989	293,442	268,461	279,726	360,400	360,400	360,400	331,450	297,972	265,321
1967	231,906	216,758	252,106	268,331	283,263	323,066	342,598	360,400	360,400	360,400	360,400	335,768
1968	305,290	284,733	275,763	268,094	285,055	288,111	330,318	360,400	360,400	334,325	299,837	267,451
1969	242,147	249,086	247,807	306,192	323,862	330,000	360,400	360,400	360,400	360,400	349,426	317,777
1970	299,296	305,659	324,435	326,065	320,846	322,797	334,670	360,400	360,400	360,400	326,016	290,760
1971	258,440	253,880	270,103	288,977	303,697	305,250	323,642	360,400	360,400	356,465	325,704	292,446
1972	258,839	236,370	231,016	221,257	214,866	245,077	266,541	360,400	360,400	336,426	299,001	267,965
1973	238,190	218,208	225,626	238,473	249,151	261,799	307,249	360,400	360,400	353,990	322,828	286,127
1974	257,794	293,500	316,503	330,000	330,000	330,000	360,400	360,400	360,400	356,465	331,550	295,187
1975	267,864	263,077	267,079	249,395	251,607	270,330	216,738	360,400	360,400	356,465	324,162	290,479
1976	286,336	282,468	273,429	252,264	239,384	231,084	235,434	322,270	311,719	281,653	249,955	220,061
1977	191,125	164,627	139,941	124,041	106,191	84,595	91,855	109,596	150,715	123,692	95,026	67,781
1978	41,897	22,219	36,001	52,988	69,331	114,471	168,252	360,400	360,400	360,400	357,869	356,406
1979	329,957	311,201	296,912	303,911	314,794	330,000	360,400	360,400	360,400	356,097	320,734	284,314
1980	257,725	265,877	274,536	330,000	326,446	330,000	356,592	360,400	360,400	360,400	352,729	320,413
1981	290,796	267,741	254,865	241,410	243,092	239,594	250,218	341,900	356,592	326,381	288,829	253,955
1982	227,982	252,018	292,777	317,906	326,446	330,000	360,400	360,400	360,400	360,400	360,400	360,400
1983	326,065	330,000	330,000	330,000	330,000	330,000	356,951	360,400	360,400	360,400	360,400	355,970
1984	330,000	326,192	301,515	251,330	205,725	189,676	227,004	360,400	360,400	356,465	328,962	296,457
1985	268,372	286,904	294,977	277,357	264,474	261,687	348,828	360,400	360,400	333,535	296,865	266,723
1986	245,402	227,652	236,474	239,341	311,791	326,065	360,400	360,400	360,400	360,400	337,490	304,597
1987	281,194	259,670	236,484	216,725	205,573	195,265	251,416	347,582	357,022	325,388	288,877	253,677
1988	221,889	204,952	201,696	191,923	182,833	188,925	231,786	323,285	352,727	326,875	292,101	258,469
1989	229,470	206,135	190,185	179,740	178,779	224,799	331,322	360,400	360,400	343,974	308,105	283,006
1990	266,700	271,420	276,200	256,827	242,842	252,652	320,352	360,400	360,400	360,400	337,162	301,130
1991	256,496	235,801	220,345	201,192	186,180	192,530	211,890	331,320	360,400	354,429	321,715	296,721
1992	274,476	260,994	246,154	232,759	238,361	235,761	302,285	360,400	355,022	347,290	320,492	298,748
1993	279,794	262,205	255,227	281,160	296,476	330,000	356,592	360,400	360,400	360,400	339,684	305,994
1994	278,714	256,620	239,355	209,682	196,961	201,254	250,111	360,400	360,400	328,106	288,504	253,299
1995	226,108	246,696	263,295	296,733	319,612	326,065	356,592	360,400	360,400	360,400	360,400	341,235
1996	313,102	291,101	290,319	303,304	330,000	326,065	357,776	360,400	360,400	356,465	329,269	295,808
1997	266,385	283,200	301,776	330,000	300,695	280,067	360,400	360,400	36			

Table 4.3-3

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

Aggressive Conservation/Recycling/Groundwater minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	9,255	11,097	11,098	11,103	11,110	9,722	8,197	6,867	0	0	0	2,118
1922	7,349	8,270	8,270	10,177	10,183	10,183	10,183	0	0	0	0	2,578
1923	5,431	5,431	5,430	5,434	5,437	5,437	8,387	0	0	0	0	2,118
1924	6,017	6,937	5,986	7,893	9,616	9,616	5,874	2,934	2,931	2,928	2,923	10,560
1925	18,452	18,451	18,452	18,461	19,419	19,419	17,031	0	0	0	0	2,578
1926	7,619	10,473	9,931	16,691	23,204	26,728	22,850	17,804	2,123	2,121	2,118	4,234
1927	9,464	10,385	9,434	11,342	11,348	13,251	18,775	0	0	0	0	2,117
1928	4,971	5,891	6,415	9,272	11,855	15,660	3,407	0	0	0	0	2,117
1929	7,348	8,270	8,269	12,079	15,524	15,524	15,524	12,458	0	0	0	1,197
1930	6,239	6,239	6,239	6,242	6,246	6,246	6,246	0	0	0	0	0
1931	3,140	5,993	5,994	12,752	18,860	18,860	18,859	18,848	18,834	21,332	25,247	35,943
1932	45,770	49,774	14,535	12,087	8,633	5,296	2,952	2,134	0	0	0	2,118
1933	4,020	6,781	6,782	9,640	12,223	12,223	10,329	8,650	0	0	0	1,197
1934	5,192	6,205	9,040	15,117	17,442	14,710	11,801	13,031	14,213	15,425	16,635	24,257
1935	32,138	32,138	32,139	27,880	23,700	17,781	11,649	9,045	0	0	0	1,197
1936	9,093	14,616	14,621	18,506	18,187	15,750	13,300	0	0	0	0	1,197
1937	7,856	10,618	9,657	14,388	12,758	10,697	8,887	4,342	0	0	0	2,117
1938	6,017	6,938	7,650	12,602	12,608	12,563	11,071	0	0	0	0	2,578
1939	5,431	5,431	2,577	4,480	6,202	6,201	-3,808	0	0	0	0	1,197
1940	6,238	6,238	704	-1,407	-1,246	-1,048	-884	0	0	0	0	1,197
1941	2,147	2,148	-1,064	-1,065	-910	-763	-581	-435	0	0	0	0
1942	3,806	4,726	3,014	0	0	0	0	0	0	0	0	1,197
1943	4,145	5,987	5,986	5,990	4,934	0	0	0	0	0	0	2,117
1944	3,068	3,068	1,166	4,972	8,411	12,312	12,312	0	0	0	0	1,197
1945	5,096	5,097	5,097	5,099	7,679	7,680	6,759	5,902	0	0	0	1,197
1946	9,093	11,854	11,855	11,862	11,868	10,139	8,555	0	0	0	0	3,038
1947	11,599	12,520	10,618	15,380	19,686	19,686	19,686	0	0	0	0	2,117
1948	7,159	10,013	10,013	16,773	21,938	16,228	13,704	11,471	0	0	0	1,197
1949	6,239	9,093	9,093	11,941	14,524	12,380	10,001	8,376	664	664	663	2,780
1950	7,535	7,535	6,047	5,413	5,417	4,538	3,776	3,175	0	0	0	0
1951	3,140	0	0	0	0	7,801	6,856	6,853	0	0	0	2,118
1952	4,971	5,891	5,892	2,949	2,951	2,951	12,158	0	0	0	0	2,117
1953	4,971	4,970	4,020	4,021	4,023	9,826	26	0	0	0	0	1,196
1954	4,051	4,050	1,196	5,003	6,724	12,527	13,724	0	0	0	0	2,117
1955	6,017	6,017	6,017	6,021	6,024	6,024	5,080	4,250	0	0	0	0
1956	3,140	4,152	-133	-133	-133	-116	-98	0	0	0	0	3,038
1957	7,793	8,715	7,763	9,670	11,395	14,343	14,343	0	0	0	0	2,118
1958	10,013	13,695	13,696	17,509	17,519	17,519	17,519	0	0	0	0	1,197
1959	4,050	4,051	1,197	5,002	6,051	5,109	2,521	4,636	4,629	4,621	4,621	5,813
1960	10,851	10,852	10,852	10,855	6,043	4,102	3,115	1,553	1,552	1,550	1,547	5,411
1961	12,354	16,128	1,881	2,453	8,558	9,604	18,827	23,847	28,700	33,937	39,159	49,840
1962	60,894	61,769	60,674	66,304	75,276	83,315	87,596	0	0	0	0	1,197
1963	2,529	8,052	8,053	10,721	10,727	15,674	22,119	0	0	0	0	1,197
1964	8,141	9,982	9,982	12,842	15,427	15,427	15,129	7,919	0	0	0	2,118
1965	7,159	7,158	5,262	5,264	5,267	5,266	4,647	4,070	0	0	0	1,197
1966	4,050	4,051	1,502	5,308	6,979	6,980	0	0	0	0	0	2,578
1967	7,618	13,235	15,138	15,146	15,154	6,934	13,380	0	0	0	0	0
1968	3,806	4,726	4,726	5,680	6,542	6,543	6,542	0	0	0	0	3,038
1969	10,932	14,616	14,616	14,624	6,138	0	0	0	0	0	0	2,118
1970	3,068	3,068	3,068	0	1,718	7,203	7,203	0	0	0	0	2,578
1971	7,333	7,333	7,334	7,337	7,341	7,340	7,340	0	0	0	0	2,118
1972	7,159	13,695	16,549	21,316	25,624	25,624	25,624	0	0	0	0	0
1973	3,995	7,771	7,770	7,775	7,780	7,780	15,421	0	0	0	0	2,578
1974	7,334	7,333	7,334	0	0	0	0	0	0	0	0	2,117
1975	2,116	2,117	2,117	2,118	4,697	7,551	7,551	0	0	0	0	2,117
1976	2,117	2,117	2,117	4,972	7,552	7,553	7,553	7,548	7,542	7,533	7,522	15,153
1977	23,042	26,818	29,672	28,271	32,601	32,600	32,600	37,599	42,381	46,716	44,812	49,434
1978	53,046	53,921	49,022	57,472	65,556	75,402	85,851	0	0	0	0	2,578
1979	43	42	43	3,848	3,850	0	0	0	0	0	0	2,117
1980	10,013	10,013	10,012	-3,935	3,554	0	0	0	0	0	0	2,117
1981	4,971	5,892	5,891	7,798	9,521	10,566	10,567	10,561	3,808	3,804	3,799	5,914
1982	12,570	14,410	12,508	12,094	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	3,449	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	2,578
1985	7,619	7,619	7,619	7,622	7,626	7,625	7,625	0	0	0	0	4,879
1986	11,822	15,596	15,596	24,263	18,209	3,935	0	0	0	0	0	1,197
1987	3,099	3,099	2,148	4,052	5,773	5,773	5,772	5,770	3,378	3,375	4,607	12,245
1988	20,134	23,908	23,909	32,579	39,472	39,472	39,472	37,115	3,865	8,284	13,554	24,268
1989	30,297	33,381	34,665	37,872	40,772	42,057	29,078	0	0	3,948	8,367	12,366
1990	15,546	15,547	16,838	18,954	20,238	21,481	0	0	0	6,326	10,457	13,534
1991	14,811	15,134	15,894	15,285	14,735	18,873	22,235	25,409	0	4,424	6,559	7,797
1992	9,078	10,321	11,605	14,799	14,249	22,288	26,569	0	5,378	4,278	1,752	23
1993	-1,339	-1,016	-256	1,029	2,189	0	0	0	0	0	0	1,197
1994	4,051	4,050	2,147	5,003	7,584	8,631	8,631	0	0	0	1,237	8,877
1995	16,768	16,768	16,769	24,579	10,388	3,033	0	0	0	0	0	3,867
1996	8,622	8,622	8,622	8,626	-3,554	3,935	2,624	0	0	0	0	2,578
1997	7,334	10,095	10,096	0	0	3,901	0	0	0	0	0	2,118
1998	8,776	13,380	13,903	13,911	13,919	0	0	0	0	0	0	3,867
1999	6,719	7,640	5,737	8,594	8,598	8,598	7,557	66	0	0	0	2,578
2000	7,334	7,333	7,333	7,338	9,920	18,482	18,482	0	0	0	0	1,197
2001	7,856	10,618	10,618	14,430	14,437	20,146	22,263	0	214	214	213	2,333
2002	8,038	10,799	9,658	11,566	13,291	13,292	13,292	0	0	0	0	1,197
Avg (21-02)	9,351	10,704	9,664	11,071	11,742	11,983	11,575	3,662	1,710	2,091	2,388	4,922

Table 4.3-4

Difference in Hetch Hetchy Reservoir Storage (Acre-feet)

Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	-2,466	296	297	296	296	261	219	184	0	0	-2,188	-2,188
1922	3,523	4,444	4,443	-311	-311	-312	-311	0	0	0	-2,188	-1,726
1923	1,129	2,050	2,049	2,050	2,052	-10,316	-10,316	0	0	0	-2,188	-2,188
1924	669	1,589	1,589	4,444	7,025	1,222	-1,507	-2,941	-5,056	-7,238	-9,413	-3,879
1925	1,832	21,165	36,388	30,606	14,300	-1,016	-888	0	0	0	-2,188	-1,726
1926	-1,725	-4,488	2,553	3,506	2,474	-9,894	-8,695	-5,777	0	-2,188	-4,374	-4,370
1927	-3,416	-3,416	-3,416	-9,316	-9,322	-11,225	-5,700	0	0	0	-2,188	-4,949
1928	-4,946	-4,026	-2,123	-4,978	-7,558	-6,025	0	0	0	-2,188	-4,373	-7,132
1929	-7,129	-6,208	-6,208	-7,163	-8,025	-18,586	-20,703	0	0	-2,188	-4,374	-5,291
1930	-2,434	16,900	36,878	31,096	25,872	10,556	8,438	0	0	-2,188	-4,373	-6,488
1931	-5,533	-8,296	-1,208	-257	-3,694	-9,497	-11,616	-13,797	-15,903	-15,551	-13,771	-5,147
1932	-3,859	-7,220	-3,025	-2,541	-1,889	-1,211	-750	-540	0	0	-2,188	-2,188
1933	-2,185	-1,265	5,823	1,069	-3,226	-13,786	-12,145	-10,171	0	0	-2,188	-3,107
1934	-1,298	-5,902	-10,710	-12,790	-24,274	-34,213	-8,997	-9,943	-10,853	-11,788	-12,719	-7,181
1935	-1,469	17,865	37,844	32,670	27,437	9,548	6,340	5,016	0	0	-2,188	-3,107
1936	-2,154	-1,234	5,854	-2,696	-2,697	-2,363	-1,995	0	0	0	-2,188	-3,107
1937	-252	669	669	-282	-249	-209	-174	0	0	0	-2,188	-2,187
1938	-2,186	-1,265	-1,265	-3,929	-3,931	-3,931	-3,446	0	0	0	-2,188	-4,488
1939	-1,632	-712	-2,614	-4,518	-6,238	-16,799	0	0	0	-2,188	-4,373	-5,291
1940	-2,434	16,900	28,243	14,637	12,980	10,894	9,201	0	0	-2,188	-4,374	-5,291
1941	-4,337	-3,416	-2,847	-2,847	-2,432	-2,038	-1,553	-1,160	0	0	-2,188	-4,304
1942	-2,399	-1,479	-1,479	0	0	0	0	0	0	0	-2,188	-3,107
1943	-3,106	-4,947	2,140	2,141	1,084	0	0	0	0	0	-2,188	-2,187
1944	-1,234	-313	638	-313	-5,641	-17,057	-19,175	0	0	0	-2,188	-3,107
1945	2,602	21,936	41,915	36,131	24,979	24,980	21,986	19,218	0	0	-2,188	-3,107
1946	-2,154	-1,234	-1,234	-1,234	-1,235	-1,085	-919	0	0	-2,188	-4,374	-3,449
1947	4,163	5,083	1,278	1,279	1,280	-9,281	-11,398	0	0	-2,188	-4,374	-4,370
1948	-1,513	-4,275	2,812	3,766	4,627	-1,177	-993	-836	0	0	-2,188	-3,107
1949	-252	-3,013	-3,013	-147	2,430	2,134	1,778	1,495	664	-1,524	-3,711	-6,470
1950	-5,515	13,819	33,318	14,528	13,470	11,294	9,353	7,850	0	-800	-2,988	-5,103
1951	-4,149	0	0	0	1,142	1,005	1,005	0	0	0	-2,188	-4,948
1952	-3,995	-3,074	-3,074	-1,539	-1,540	-1,540	-3,381	0	0	0	-2,188	-2,187
1953	669	1,589	1,589	1,590	1,590	-7,923	0	0	0	0	-2,188	-3,108
1954	2,602	3,523	3,523	-1,231	-6,560	-16,074	-16,994	0	0	-2,188	-4,370	-4,370
1955	1,340	20,674	35,896	17,746	1,344	-4,460	-3,767	-3,143	0	-2,188	-4,374	-6,488
1956	-5,533	-10,137	-4,318	-4,321	-4,323	-3,778	-3,183	0	0	0	-2,188	-1,266
1957	1,588	2,510	2,510	-344	-7,389	-15,001	-17,118	0	0	0	-2,188	-2,188
1958	669	1,589	3,920	3,923	3,925	3,925	3,925	0	0	0	-2,188	-3,107
1959	-2,155	-1,234	-1,234	-5,991	-5,994	-20,266	-17,561	-5,635	-5,629	-7,809	-9,984	-10,893
1960	-8,033	11,301	31,280	25,499	12,687	5,685	4,321	-34	-2,151	-4,336	-6,516	-4,760
1961	0	-1,842	1,410	-3,345	-7,646	-12,403	-5,298	-1,175	1,589	4,678	7,763	4,393
1962	918	2,161	4,397	5,684	3,411	-6,721	-4,557	0	0	0	-2,188	-5,869
1963	-9,767	-8,847	-6,515	-6,519	-6,523	-8,236	-6,395	0	0	0	-2,188	-3,107
1964	-3,106	-4,947	-3,996	-10,657	-16,677	-22,481	-22,481	-19,055	3,808	1,616	-574	-574
1965	2,281	21,614	24,783	24,793	24,806	24,005	20,476	17,588	0	0	0	-3,683
1966	-2,730	-4,571	-906	-5,663	-9,962	-14,070	3,808	0	0	-2,188	-4,373	-3,910
1967	-1,054	-1,053	6,558	6,561	0	3,683	0	0	0	0	-2,118	0
1968	-4,019	-3,099	3,988	-3,620	-10,496	-21,056	-23,174	0	0	-2,188	-4,374	-3,449
1969	2,260	3,182	1,279	1,279	0	0	0	0	0	0	-2,188	-2,188
1970	-1,234	18,100	33,322	-3,935	-7,436	0	-2,117	0	0	0	-2,188	-1,726
1971	-774	-2,615	-1,664	-1,665	-1,665	-12,226	-14,343	0	0	0	-2,188	-2,188
1972	669	1,589	2,540	2,542	2,543	-3,260	-5,377	0	0	-2,188	-4,373	-6,487
1973	-4,676	-6,517	570	570	571	571	1,491	0	0	-2,188	-4,374	-6,671
1974	-3,815	-3,815	-3,815	0	0	0	0	0	0	0	-2,188	-4,949
1975	-3,995	15,339	35,318	23,827	18,685	17,734	17,734	3,935	0	0	-2,188	-2,187
1976	-2,186	-1,264	5,823	2,021	-1,416	-7,218	-9,336	-11,519	-13,628	-15,799	-17,968	-12,423
1977	-6,707	-8,548	-7,597	-8,554	-9,420	-15,224	-17,341	-14,465	-11,678	-9,423	-7,169	-1,306
1978	-20	-3,380	235	1,519	2,682	3,966	4,104	0	0	0	-2,188	-1,416
1979	0	920	1,872	-2,884	-2,885	0	0	0	0	-2,188	-4,373	-4,371
1980	-3,417	15,917	31,139	-3,935	3,554	0	0	0	0	0	-2,188	-2,187
1981	-1,234	-313	6,774	1,070	-4,085	-18,355	-18,355	-7,939	0	-2,188	-4,374	-4,370
1982	1,341	-501	2,353	1,936	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	503	0	0	0	0	-2,118
1984	0	0	0	0	0	-9,736	-11,659	0	0	0	-2,188	-1,726
1985	1,129	15,860	31,081	25,292	15,766	5,207	3,090	0	0	-2,188	-4,374	-1,608
1986	3,150	1,308	8,396	11,255	1,757	0	0	0	0	0	-2,188	-3,107
1987	-3,106	-2,185	-2,185	-4,089	-5,810	-16,370	-18,488	-7,048	0	-2,188	-3,137	2,390
1988	8,097	6,255	13,343	16,204	14,495	8,692	6,574	2,048	0	-618	-2,283	3,568
1989	4,848	1,488	865	1,203	1,504	-7,771	0	0	0	-3,948	-7,416	-1,563
1990	-279	14,452	29,674	19,461	11,181	1,905	1,031	0	0	-1,570	-3,138	-1,892
1991	-607	-3,967	-353	3,788	2,370	-10,616	-9,373	-3,326	0	-1,547	-4,162	-7,519
1992	-10,989	-9,746	-11,316	-15,936	-19,941	-30,073	-27,909	0	0	-1,094	-4,565	-7,922
1993	-11,391	-10,148	-11,290	-10,012	-8,857	0	0	0	0	0	-2,188	-3,107
1994	-2,154	-1,234	-283	-2,185	-8,201	-17,715	-19,832	0	0	-2,188	-3,137	-372
1995	579	19,914	39,893	37,251	15,333	3,033	0	0	0	0	0	-1,013
1996	1,841	2,763	5,093	5,093	-3,554	3,935	2,624	0	0	0	-2,188	-4,488
1997	-4,486	-2,645	-2,645	0	0	-7,611	0	0	0	0	-2,188	-2,188
1998	3,523	6,285	8,188	8,192	8,197	0	0	0	0	0	-2,188	-3,199
1999	-1,295	-374	-4,180	-9,890	-9,894	-9,895	-8,694	0	0	0	-2,188	-4,488
2000	-1,632	17,702	37,680	22,386	15,524	10,577	8,460	0	0	-2,188	-4,373	-8,053
2001	-7,098	-6,177	911	-3,848	-12,441	-21,002	-21,003	0	0	-2,188	-4,374	-4,370
2002	-1,513	-593	-592	-5,350	-9,650	-20,209	-22,327	0	0	-2,188	-4,374	-5,291
Avg (21-02)	-1,602	1,990	6,778	3,416	557	-4,513	-3,795	-734	-718	-1,523	-3,386	-3,555

Through the fall and winter, storage in Hetch Hetchy Reservoir would be the same or higher. Hetch Hetchy Reservoir would fill by the end of May or June during approximately 89 percent of the years, which would negate any difference in storage from carrying into the next summer. Figure 4.3-2 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the WSIP setting. Also shown is the average difference in storage for the two settings during the 82-year simulation.

Table 4.3-4 illustrates the difference in Hetch Hetchy Reservoir storage between the alternative and base settings. Immediately after Hetch Hetchy Reservoir is filled (May or June, and then continuing through July), there would only be occasional differences in storage at the reservoir, typically a decrease of less than 10,000 acre-feet. This indicates that the same amount of water is being passed through the reservoir, regardless of the size of the conveyance capacity of the SJPL. Water not diverted to the SJPL would return to the Tuolumne River and flow to Don Pedro Reservoir. In the late summer and early fall, there would consistently be a slight difference (lower) in storage levels between the two settings as additional diversions to the SJPL would retain Bay Area reservoir storage. Some of this additional storage depletion would be ameliorated later in the fall and into winter as SJPL diversions are reduced due to lower Bay Area reservoir replenishment needs and less conveyance system maintenance. Storage becomes greater in November and December of the alternative setting due to the assumed system-wide maintenance that occurs in the alternative and does not occur in the base setting. Subsequent to December, the storage gain occurring in the alternative setting again becomes affected as replenishment of Bay Area reservoir storage resumes. In non-wetter years, there is a difference in storage between the alternative and base settings; the alternative setting results in a lower storage in the reservoir by the end of April. Figure 4.3-3 illustrates the difference in reservoir storage averaged by year type for the comparison of the alternative to the base setting. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 4.3-4 illustrates the average monthly storage in Hetch Hetchy Reservoir for the 82-year simulation, and the range in storage for each month for the variant and base settings.

The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the alternative would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream in excess of minimum release requirements. Figure 4.3-1 illustrates the stream release from O'Shaughnessy Dam for the WSIP, alternative, and base settings. Table 4.3-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative exhibits an incrementally greater stream release, predominantly during May or June, which reflects the months when releases to the stream above minimum release requirements are made in anticipation of the reservoir being filled. The exceptions to this circumstance during which incrementally larger reductions in releases to the stream occurs are considered anomalous within modeling, the results of only shifting releases from one month to the next. The increase in releases is the result of a less depleted reservoir, which is the result of lesser demands between the settings.

Table 4.3-6 illustrates the difference in stream release between the alternative and base settings. In this comparison, releases could be either greater or lesser than depicted for the base setting, and these differences would occur predominantly during May or June. Generally, Hetch Hetchy Reservoir storage would be slightly lower during non-wetter years, leading to a reduction in stream releases during non-wetter years if a release occurs. During wetter years, the releases are projected to increase. The differences, either increases or decreases are a result of the coincidence of the several parameters affecting the release of water from the reservoir, including system-wide water demands, conveyance capacity and maintenance assumptions, and the watershed's hydrology.

Table 4.3-5 illustrates the difference in stream release between the alternative and WSIP settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 4.3-7 illustrates the same information and the average monthly stream release for the alternative and WSIP setting, expressed in average monthly flow (cfs). Table 4.3-5 illustrates that the difference in monthly flow below O'Shaughnessy Dam could range up to an increase of approximately 51,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of

Figure 4.3-2

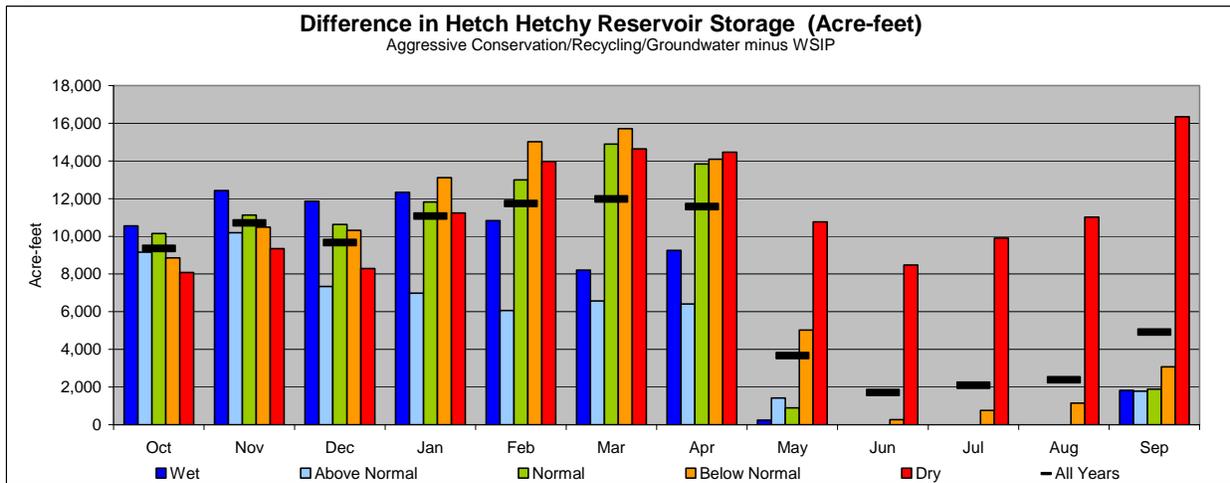


Figure 4.3-3

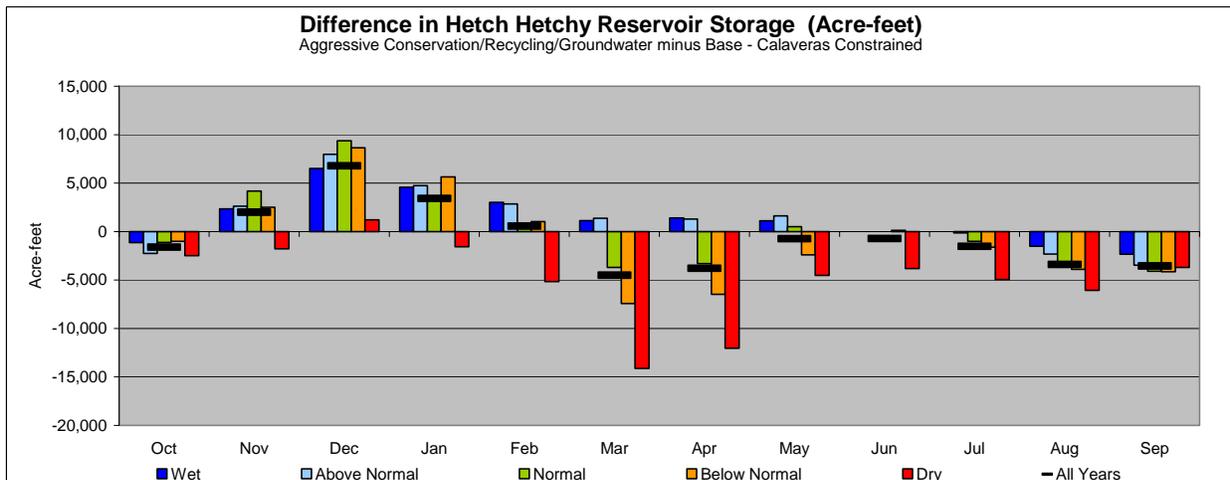


Figure 4.3-4

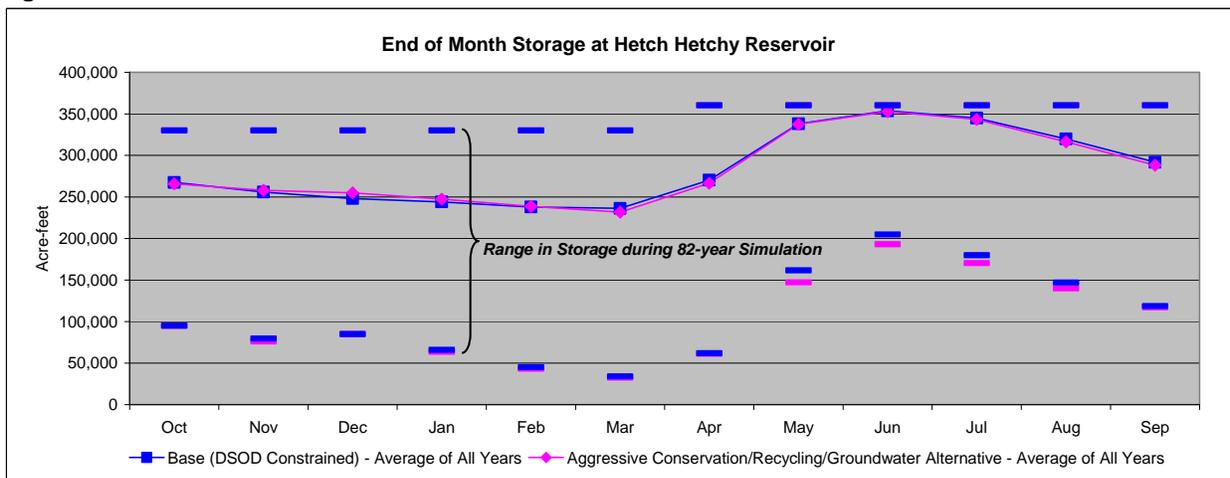


Table 4.3-5

Difference in Hetch Hetchy Release to Stream (Acre-feet)

Aggressive Conservation/Recycling/Groundwater minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	6,860	0	0	0	6,860
1922	0	0	0	0	0	0	0	8,866	0	0	0	0	8,866
1923	0	0	0	0	0	0	0	8,382	0	0	0	0	8,382
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	16,807	0	0	0	0	16,807
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	18,876	0	0	0	0	18,876
1928	0	0	0	0	0	0	0	3,618	0	0	0	0	3,618
1929	0	0	0	0	0	0	0	0	13,231	0	0	0	13,231
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	2,132	0	0	0	2,132
1933	0	0	0	0	0	0	0	0	7,593	0	0	0	7,593
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	9,034	0	0	0	9,034
1936	0	0	0	0	0	0	0	11,623	0	0	0	0	11,623
1937	0	0	0	0	0	0	0	3,000	4,603	0	0	0	7,603
1938	0	0	0	0	0	0	0	9,667	0	0	0	0	9,667
1939	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1940	0	0	0	0	0	0	0	-743	0	0	0	0	-743
1941	0	0	0	0	0	0	0	0	-435	0	0	0	-435
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	12,304	0	0	0	0	12,304
1945	0	0	0	0	0	0	0	0	5,897	0	0	0	5,897
1946	0	0	0	0	0	0	0	7,481	0	0	0	0	7,481
1947	0	0	0	0	0	0	0	19,678	0	0	0	0	19,678
1948	0	0	0	0	0	0	0	0	11,458	0	0	0	11,458
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	3,174	0	0	0	3,174
1951	0	3,140	0	0	0	0	0	0	7,281	0	0	0	10,421
1952	0	0	0	0	0	0	0	12,153	0	0	0	0	12,153
1953	0	0	0	0	0	0	0	26	0	0	0	0	26
1954	0	0	0	0	0	0	0	13,718	0	0	0	0	13,718
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	-86	0	0	0	0	-86
1957	0	0	0	0	0	0	0	14,338	0	0	0	0	14,338
1958	0	0	0	0	0	0	0	17,512	0	0	0	0	17,512
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	37,098	0	0	0	0	37,098
1963	0	0	0	0	0	0	0	22,238	0	0	0	0	22,238
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	4,066	0	0	0	4,066
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	14,176	0	0	0	0	14,176
1968	0	0	0	0	0	0	0	6,540	0	0	0	0	6,540
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	319	0	7,200	0	0	0	0	7,519
1971	0	0	0	0	0	0	0	7,337	0	0	0	0	7,337
1972	0	0	0	0	0	0	0	25,611	0	0	0	0	25,611
1973	0	0	0	0	0	0	0	15,414	0	0	0	0	15,414
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	7,424	0	0	0	0	7,424
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	50,691	0	0	0	0	50,691
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381
1981	0	0	0	0	0	0	0	0	1,888	0	0	0	1,888
1982	0	0	0	419	0	0	0	0	0	0	0	0	419
1983	0	0	0	0	0	0	0	3,662	0	0	0	0	3,662
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	8,123	0	0	0	0	8,123
1986	0	0	0	0	0	10,235	3,935	0	0	0	0	0	14,170
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1989	0	0	0	0	0	0	0	30,146	0	0	0	0	30,146
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	26,212	0	0	0	26,212
1992	0	0	0	0	0	0	0	167	0	0	0	0	167
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	3,554	-3,935	1,311	2,785	0	0	0	0	3,715
1997	0	0	0	10,100	0	0	0	0	0	0	0	0	10,100
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	5,877	698	0	0	0	6,575
2000	0	0	0	0	0	0	0	18,475	0	0	0	0	18,475
2001	0	0	0	0	0	0	0	22,251	0	0	0	0	22,251
2002	0	0	0	0	0	0	0	13,286	0	0	0	0	13,286
Avg (21-02)	0	38	0	176	0	81	110	5,752	1,311	0	0	0	7,469

Table 4.3-6

Difference in Hetch Hetchy Release to Stream (Acre-feet)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	0	0	0	184	0	0	0	184	
1922	0	0	0	0	0	0	0	-271	0	0	0	0	-271	
1923	0	0	0	0	0	0	0	-10,310	0	0	0	0	-10,310	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	-888	0	0	0	0	-888	
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913	
1927	0	0	0	0	0	0	0	-6,087	0	0	0	0	-6,087	
1928	0	0	0	0	0	0	0	0	0	0	0	0	0	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	-539	0	0	0	-539	
1933	0	0	0	0	0	0	0	0	-8,924	0	0	0	-8,924	
1934	0	0	0	0	0	0	-3,808	0	0	0	0	0	-3,808	
1935	0	0	0	0	0	3,935	0	0	5,010	0	0	0	8,945	
1936	0	0	0	0	0	0	0	-1,741	0	0	0	0	-1,741	
1937	0	0	0	0	0	0	0	-143	0	0	0	0	-143	
1938	0	0	0	0	0	0	0	-2,986	0	0	0	0	-2,986	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	0	0	0	7,719	0	0	0	0	7,719	
1941	0	0	0	0	0	0	0	0	-1,160	0	0	0	-1,160	
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	
1944	0	0	0	0	0	0	0	-19,165	0	0	0	0	-19,165	
1945	0	0	0	0	0	0	0	0	19,202	0	0	0	19,202	
1946	0	0	0	0	0	0	0	-804	0	0	0	0	-804	
1947	0	0	0	0	0	0	0	-11,394	0	0	0	0	-11,394	
1948	0	0	0	0	0	0	0	0	-835	0	0	0	-835	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	7,844	0	0	0	7,844	
1951	0	-4,149	0	0	0	0	0	0	1,068	0	0	0	-3,081	
1952	0	0	0	0	0	0	0	-3,380	0	0	0	0	-3,380	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	-16,987	0	0	0	0	-16,987	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	0	0	0	0	0	-2,789	0	0	0	0	-2,789	
1957	0	0	0	0	0	0	0	-17,111	0	0	0	0	-17,111	
1958	0	0	0	0	0	0	0	3,923	0	0	0	0	3,923	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	-4,556	0	0	0	0	-4,556	
1963	0	0	0	0	0	0	0	-6,825	0	0	0	0	-6,825	
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808	
1965	0	0	0	0	0	0	0	0	17,572	0	0	0	17,572	
1966	0	0	0	0	0	0	-3,808	4,045	0	0	0	0	237	
1967	0	0	0	0	0	0	0	3,920	0	0	0	0	3,920	
1968	0	0	0	0	0	0	0	-24,224	0	0	0	0	-24,224	
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	
1970	0	0	0	3,935	0	319	0	-2,117	0	0	0	0	2,137	
1971	0	0	0	0	0	0	0	-15,034	0	0	0	0	-15,034	
1972	0	0	0	0	0	0	0	-5,375	0	0	0	0	-5,375	
1973	0	0	0	0	0	0	0	1,490	0	0	0	0	1,490	
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	
1975	0	0	0	0	0	0	0	9,945	4,171	0	0	0	14,116	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	4,101	0	0	0	-310	3,791	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381	
1981	0	0	0	0	0	0	0	-10,407	-8,422	0	0	0	-18,829	
1982	0	0	0	419	0	0	0	0	0	0	0	0	419	
1983	0	0	0	0	0	0	0	531	0	0	0	0	531	
1984	0	0	0	0	0	3,935	0	-11,653	0	0	0	0	-7,718	
1985	0	0	0	0	0	0	0	3,288	0	0	0	0	3,288	
1986	0	0	0	0	0	1,757	0	0	0	0	0	0	1,757	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	-3,527	0	0	0	-3,527	
1992	0	0	0	0	0	0	0	-28,751	0	0	0	0	-28,751	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	3,554	-3,935	1,311	2,785	0	0	0	0	3,715	
1997	0	0	0	-2,646	0	0	0	0	0	0	0	0	-2,646	
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	
1999	0	0	0	0	0	0	0	-7,614	0	0	0	0	-7,614	
2000	0	0	0	0	0	0	0	8,456	0	0	0	0	8,456	
2001	0	0	0	0	0	0	0	-20,994	0	0	0	0	-20,994	
2002	0	0	0	0	0	0	0	-23,396	0	0	0	0	-23,396	
Avg (21-02)	0	-51	0	69	0	73	-77	-2,533	339	0	0	-4	-2,183	

Table 4.3-7

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												Aggressive Conservation/Recycling/Groundwater
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	181	85	94	148	2,522	4,552	2,034	184	89
Above Normal	55	92	88	66	93	90	133	1,260	3,119	379	125	89
Normal	54	54	50	55	74	74	98	1,414	1,921	167	122	86
Below Normal	55	55	46	43	51	63	88	692	751	113	111	73
Dry	53	53	44	40	44	50	60	160	159	86	86	65
All Years	54	61	56	76	70	75	105	1,204	2,097	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	167	89	84	144	2,412	4,548	2,034	184	89
Above Normal	55	89	88	66	89	94	131	1,186	3,095	379	125	89
Normal	54	54	50	55	74	74	98	1,260	1,906	167	122	86
Below Normal	55	55	46	43	51	63	88	565	706	113	111	73
Dry	53	53	44	40	44	50	56	157	139	86	86	65
All Years	54	61	56	73	70	73	103	1,110	2,075	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												Aggressive Conservation/Recycling/Groundwater minus WSIP
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	15	-4	10	4	110	4	0	0	0
Above Normal	0	3	0	0	4	-4	1	74	24	0	0	0
Normal	0	0	0	0	0	0	0	154	15	0	0	0
Below Normal	0	0	0	0	0	0	0	127	45	0	0	0
Dry	0	0	0	0	0	0	4	3	20	0	0	0
All Years	0	1	0	3	0	1	2	94	22	0	0	0

average monthly flow (cfs) is not always meaningful.¹¹ When comparing the alternative to the WSIP setting, a change in the volume of release from O’Shaughnessy Dam to the stream would likely result in the initiation of the release being delayed or initiated earlier by a matter of days. Typical spring-time releases, when initiated, amount to a release up to 3,000 cfs (approximately 6,000 acre-feet over the span of a day). Assuming that a change in release volume equates to a delay or an earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release between the alternative and WSIP would be up to an additional 8 days of release. Normally, the effect of this change in release would not affect the year’s peak stream release rate during a year. Table 4.3-8 illustrates the average monthly stream release for the alternative and base setting, and differences, expressed in average monthly flow (cfs). Table 4.3-6 illustrates that the difference in monthly flow below the dam between the alternative and base settings could range from an increase of approximately 18,000 acre-feet to a decrease of approximately 29,000 acre-feet. Using the same metric as described above to estimate the delay or addition in the number days of release to the stream, the alternative could lead to an effect ranging from an increase of 3 days of release to a decrease of up to 5 days, compared to the base setting.

Table 4.3-8

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												Aggressive Conservation/Recycling/Groundwater
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	181	85	94	148	2,522	4,552	2,034	184	89
Above Normal	55	92	88	66	93	90	133	1,260	3,119	379	125	89
Normal	54	54	50	55	74	74	98	1,414	1,921	167	122	86
Below Normal	55	55	46	43	51	63	88	692	751	113	111	73
Dry	53	53	44	40	44	50	60	160	159	86	86	65
All Years	54	61	56	76	70	75	105	1,204	2,097	548	125	81

Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												Base - Calaveras Constrained
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	55	51	51	180	89	93	148	2,518	4,534	2,034	184	90
Above Normal	55	96	88	66	89	86	131	1,273	3,092	379	125	89
Normal	54	54	50	51	74	74	98	1,479	1,913	167	122	86
Below Normal	55	55	46	43	51	63	91	758	768	113	111	73
Dry	53	53	44	40	44	50	64	224	168	86	86	65
All Years	54	62	56	75	70	73	107	1,245	2,091	548	125	81

Difference in Hetch Hetchy Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	2	-4	2	0	3	18	0	0	0
Above Normal	0	-4	0	0	4	4	1	-13	27	0	0	0
Normal	0	0	0	4	0	0	0	-65	8	0	0	0
Below Normal	0	0	0	0	0	0	-4	-67	-17	0	0	0
Dry	0	0	0	0	0	0	-4	-64	-9	0	0	0
All Years	0	-1	0	1	0	1	-1	-41	6	0	0	0

¹¹ See “Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir”, Memorandum by Daniel B. Steiner, December 31, 2006.

4.4 Lake Lloyd and Lake Eleanor

Compared to the operation of the WSIP, the operation of Lake Lloyd and Lake Eleanor are simulated to be only slightly different for the alternative. Figure 4.4-1 illustrates a chronological trace of the simulation of Lake Lloyd storage and stream releases. Shown in Figure 4.4-1 are the results for the WSIP, alternative, and base settings. The operation resulting from the alternative is essentially the same as for the WSIP setting, including during drought. The level of delivery between the alternative and base settings is close to the same (net demand of 271 mgd compared to 265-mgd demand) during the 1987-1992 drought, but there is a slightly greater draw from Hetch Hetchy Reservoir in the alternative setting compared to the base setting. The additional draw of water reduced the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir in the alternative setting, which, for satisfaction of MID/TID entitlements to inflow, was met with additional releases from Lake Lloyd, slightly more than in the base setting; thus, Lake Lloyd is slightly lower during this period in the alternative setting. Otherwise, the results for Lake Lloyd storage are essentially the same between the WSIP, base, and alternative settings.

Figure 4.4-2 illustrates the almost identical operation of Lake Eleanor for the alternative and WSIP settings. Also shown in Figure 4.4-2 is the operation for the base setting. Any difference that occurs in the Lake Eleanor operation would be caused by a small change in operation at Lake Lloyd that would affect the operation of the Cherry-Eleanor Tunnel between the two watersheds. Any difference that occurs in the simulations is more associated with modeling discretion than with any substantive difference in operation.

Supplementing the Figure 4.4-1 representation of Lake Lloyd stream releases is Table 4.4-1, illustrating releases for the alternative and WSIP settings, and the difference in releases between the two settings. Table 4.4-2 provides the same form of information for the alternative and base settings. With essentially no change in reservoir operations, stream releases would not be different.

4.5 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes in inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 4.5-1 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and Tuolumne River stream releases from La Grange Dam. Shown in Figure 4.5-1 are the results for the WSIP, alternative, and base settings.

Supplementing the Figure 4.5-1 representation of Don Pedro Reservoir storage are Table 4.5-1 Don Pedro Reservoir Storage (Aggressive Conservation/Recycling/Groundwater), Table 4.5-2 Don Pedro Reservoir Storage (WSIP), and Table 4.5-3 Difference in Don Pedro Reservoir Storage (Aggressive Conservation/Recycling/Groundwater minus WSIP). Table 4.5-4 is provided to illustrate the difference in Don Pedro Reservoir storage between the base and alternative settings.

Table 4.5-3 illustrates that, throughout many years, the storage in Don Pedro Reservoir associated with the alternative setting would differ from the storage in the WSIP setting, and this difference would almost always be more storage. Table 4.5-4 illustrates that the alternative setting results for Don Pedro Reservoir storage are close to the storage results depicted for the base setting, although typically lower than the base setting. Compared to the WSIP setting, the differences in storage indicate increases to the inflow of Don Pedro Reservoir that are due to lesser demands and SJPL diversions in the alternative setting. The increases in inflow typically occur during the winter through early summer. Compared to the base setting, the alternative would result in typically less inflow to Don Pedro Reservoir and the accumulation of less storage over multiple years.

**Figure 4.4-1
Lake Lloyd Storage and Stream Release**

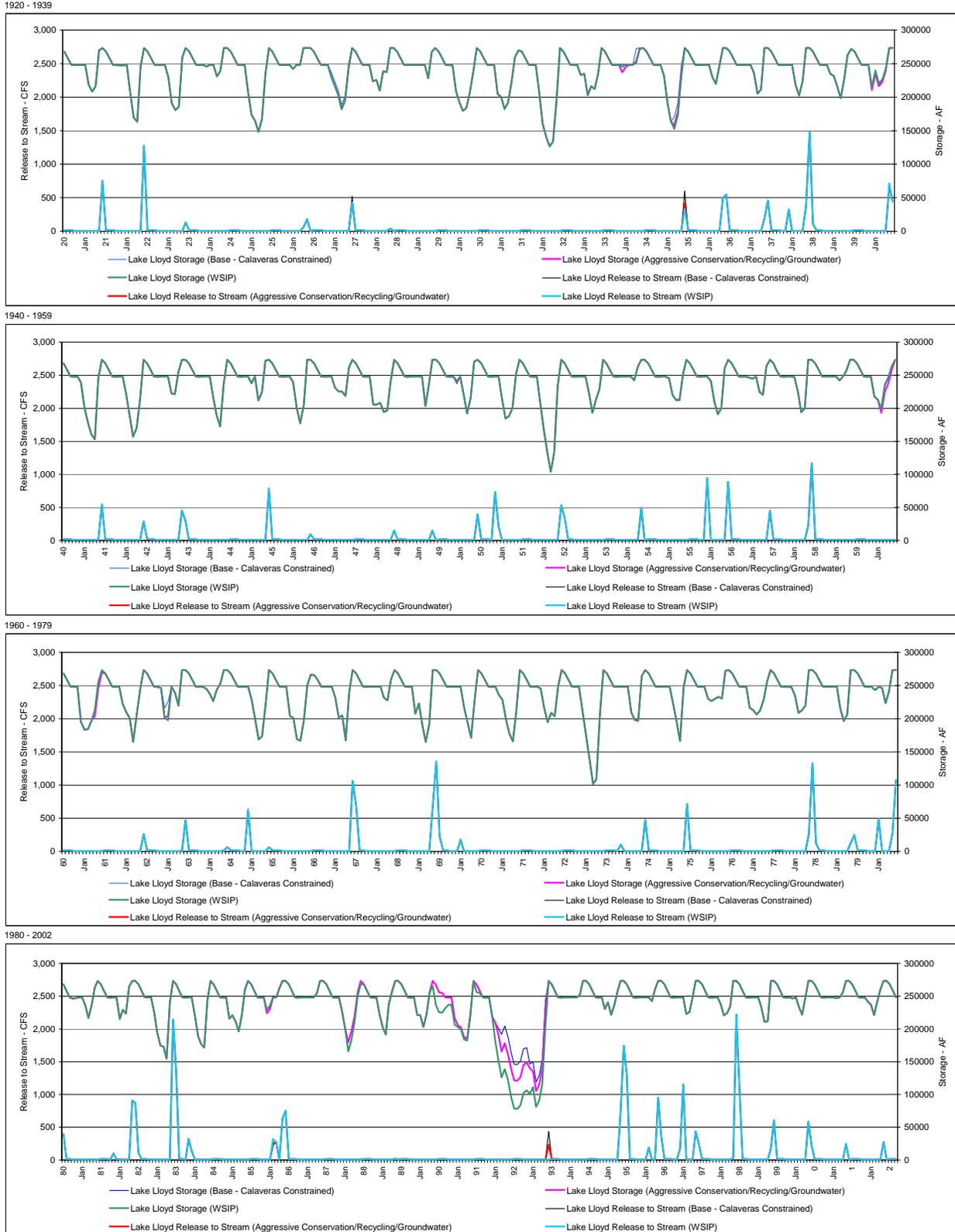


Figure 4.4-2
Lake Eleanor Storage and Stream Release

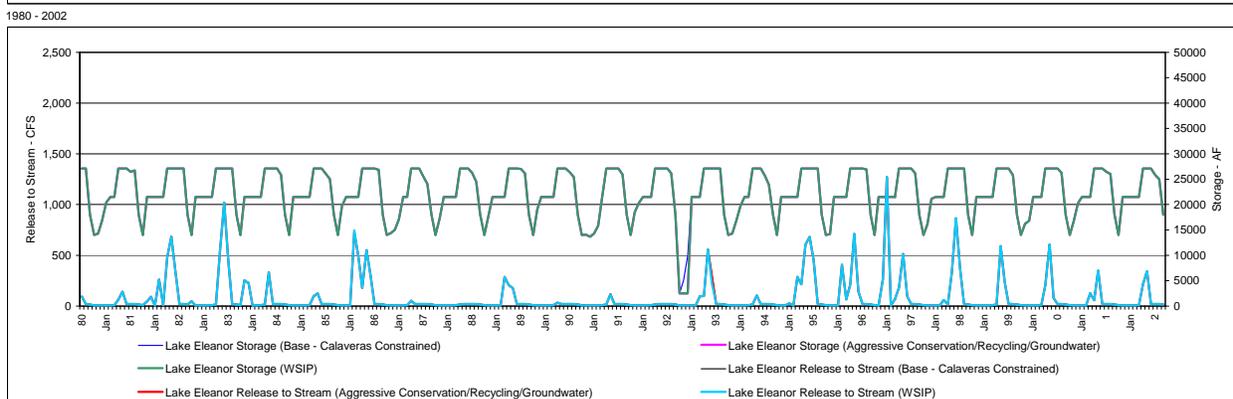
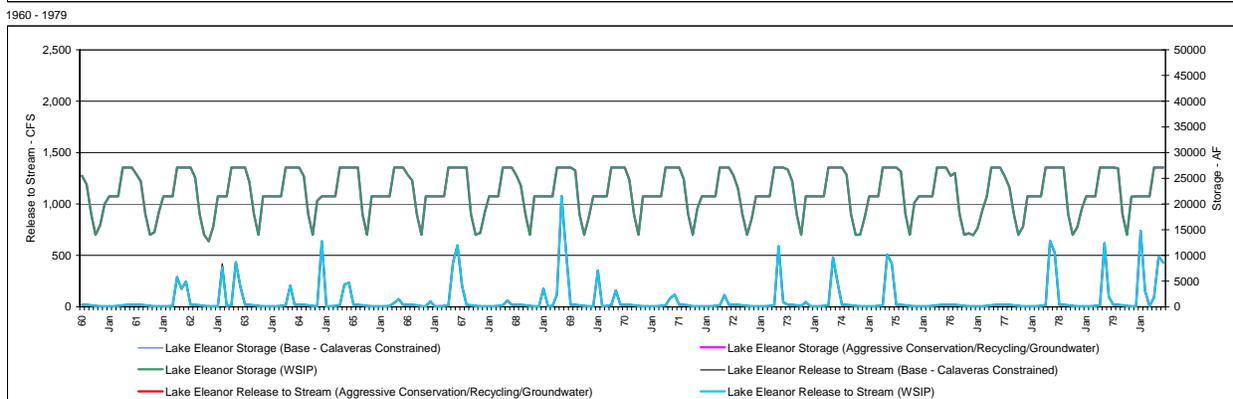
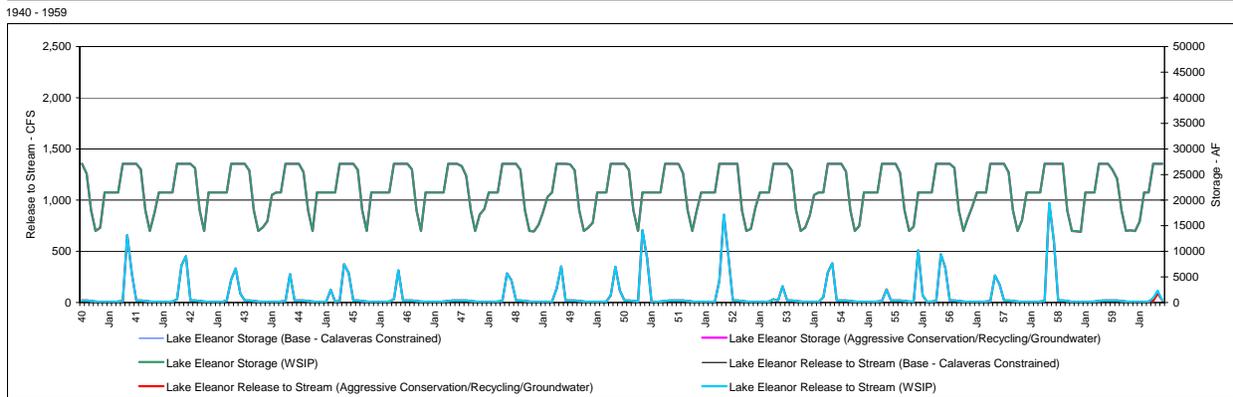
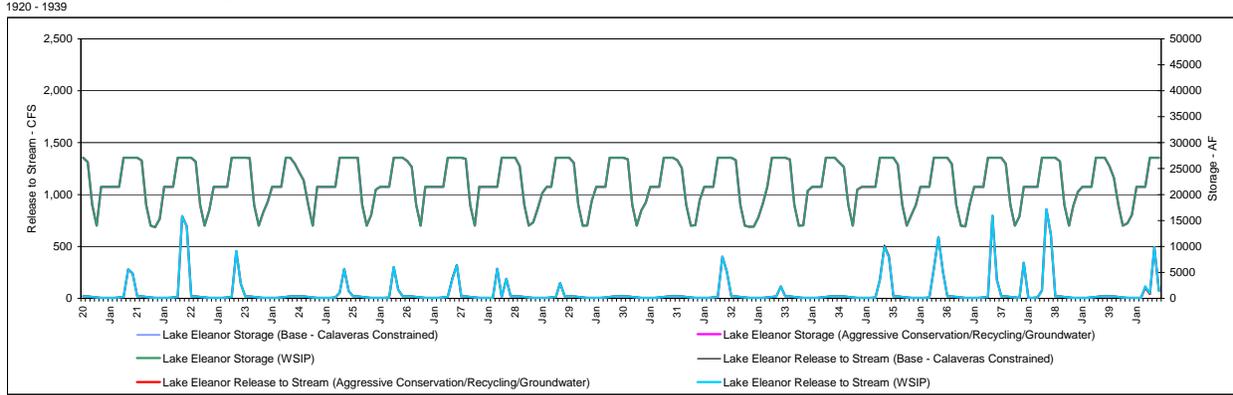


Table 4.4-1

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Aggressive Conservation/Recycling/Groundwater								WSIP			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	19	21	5	284	1,072	363	15	15
Above Normal	5	72	25	5	16	5	5	164	451	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	344	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Aggressive Conservation/Recycling/Groundwater								WSIP			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	25	21	5	284	1,058	363	15	15
Above Normal	5	72	25	5	16	5	5	167	446	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	11	8	6	121	340	83	15	15

Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Aggressive Conservation/Recycling/Groundwater minus WSIP								WSIP			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	-5	0	0	0	14	0	0	0
Above Normal	0	0	0	0	0	0	0	-3	5	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	-1	0	0	-1	4	0	0	0

Table 4.4-2

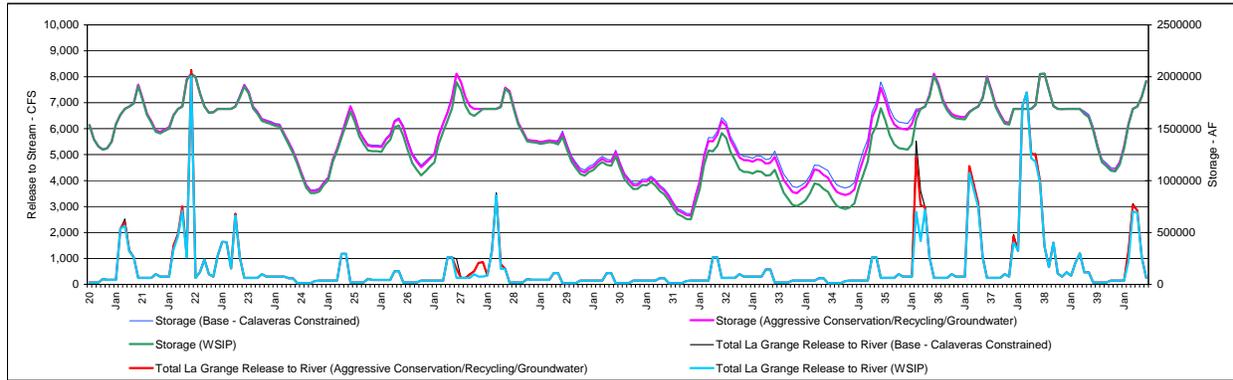
Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Aggressive Conservation/Recycling/Groundwater								Base - Calaveras Constrained			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	19	21	5	284	1,072	363	15	15
Above Normal	5	72	25	5	16	5	5	164	451	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	344	83	15	15

Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Aggressive Conservation/Recycling/Groundwater								Base - Calaveras Constrained			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	11	134	107	21	21	5	284	1,084	363	15	15
Above Normal	5	72	25	5	16	5	5	166	467	16	15	15
Normal	5	5	5	16	5	5	5	110	162	15	15	15
Below Normal	5	5	5	5	5	5	8	39	43	15	15	15
Dry	5	5	5	5	5	5	5	5	5	15	15	15
All Years	5	20	34	27	10	8	6	120	350	83	15	15

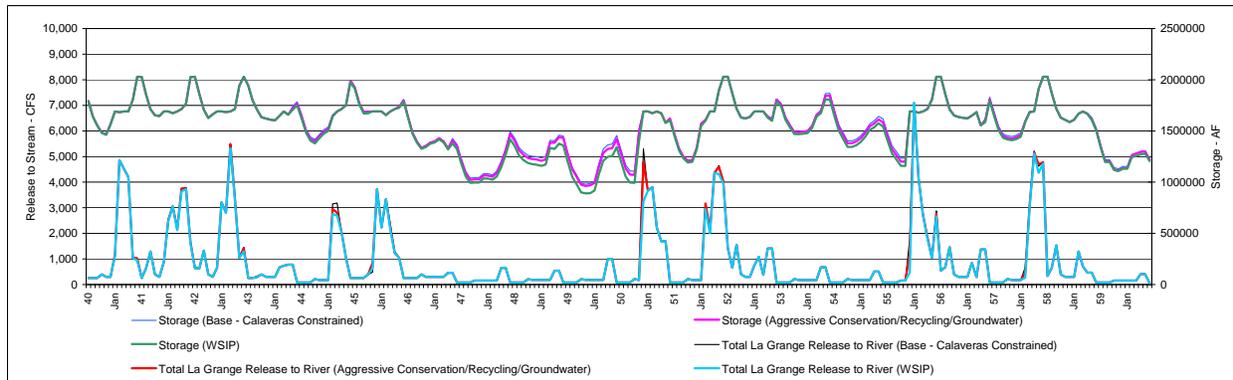
Difference in Lake Lloyd Release to Stream (CFS)												
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												
	Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained								Base - Calaveras Constrained			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	0	0	0	-2	0	0	0	-13	0	0	0
Above Normal	0	0	0	0	0	0	0	-2	-16	0	0	0
Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
All Years	0	0	0	0	0	0	0	0	-6	0	0	0

Figure 4.5-1
Don Pedro Reservoir Storage and Release below La Grange Dam

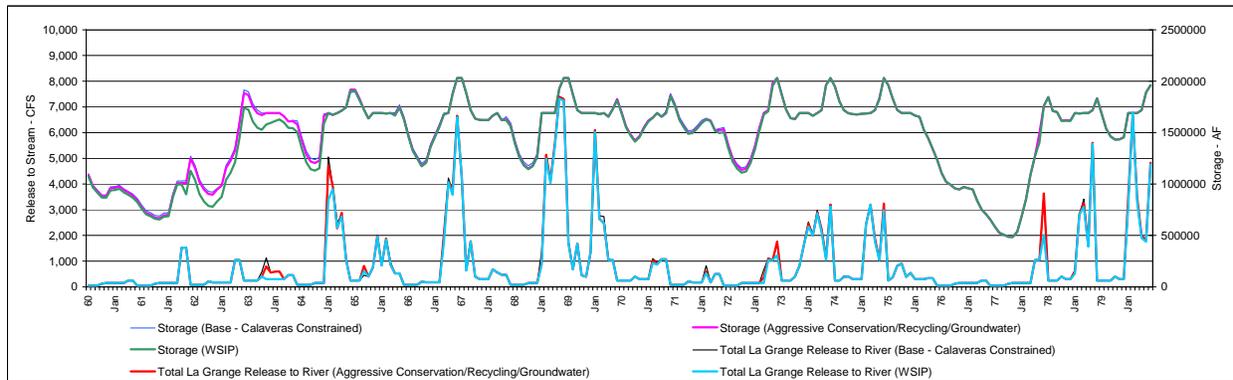
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

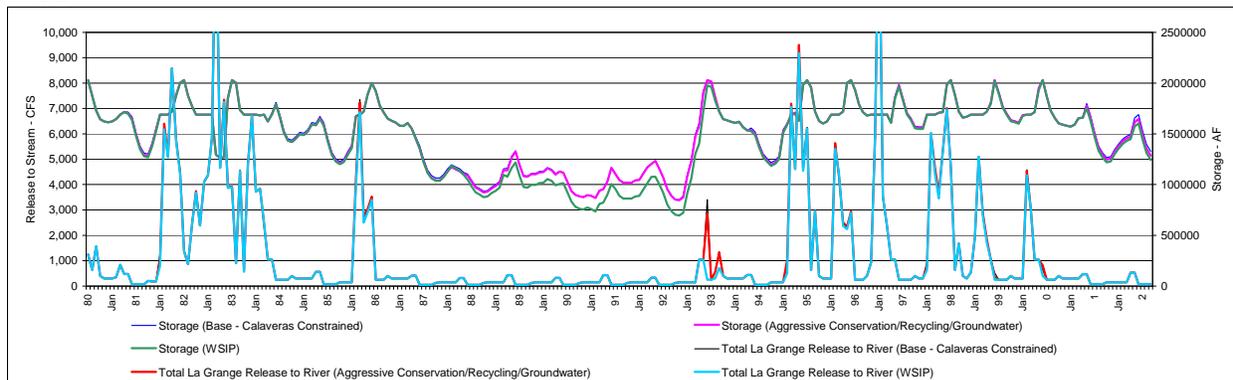


Table 4.5-1

Don Pedro Reservoir Storage (Acre-feet)

Water Year	Aggressive Conservation/Recycling/Groundwater											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,298,116	1,312,166	1,374,846	1,543,388	1,634,035	1,690,000	1,713,000	1,746,254	1,923,631	1,793,701	1,645,368	1,568,736
1922	1,482,736	1,467,921	1,492,215	1,512,383	1,632,510	1,690,000	1,713,000	1,977,583	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,810,382	1,919,290	1,851,257	1,708,541	1,656,913
1924	1,587,043	1,571,371	1,557,353	1,538,951	1,533,665	1,448,976	1,367,683	1,288,098	1,180,562	1,061,673	952,912	898,663
1925	900,800	914,901	978,692	1,020,965	1,197,284	1,304,132	1,436,394	1,579,581	1,711,757	1,613,406	1,472,784	1,400,658
1926	1,336,702	1,328,330	1,329,310	1,323,236	1,394,268	1,439,459	1,568,510	1,591,372	1,510,658	1,370,800	1,248,219	1,184,189
1927	1,128,809	1,168,421	1,214,934	1,254,511	1,432,431	1,547,144	1,656,276	1,797,538	2,030,000	1,949,971	1,803,700	1,718,303
1928	1,690,000	1,690,000	1,689,999	1,690,000	1,689,999	1,690,000	1,713,000	1,896,318	1,861,948	1,698,225	1,555,689	1,477,704
1929	1,394,089	1,385,750	1,382,857	1,369,653	1,378,508	1,386,911	1,380,458	1,367,370	1,452,154	1,329,380	1,215,921	1,151,885
1930	1,095,693	1,079,511	1,115,026	1,135,026	1,178,998	1,210,429	1,183,539	1,182,011	1,274,157	1,157,622	1,052,687	999,705
1931	954,967	957,283	994,721	992,911	1,024,441	991,131	937,530	903,486	847,390	773,344	713,343	693,684
1932	667,471	662,312	833,376	981,595	1,232,955	1,380,620	1,377,711	1,439,848	1,573,572	1,525,724	1,389,556	1,312,278
1933	1,223,014	1,197,553	1,195,256	1,180,752	1,205,411	1,197,270	1,163,529	1,169,883	1,228,006	1,117,747	1,006,684	947,278
1934	889,605	877,783	915,015	942,153	1,011,452	1,108,180	1,095,895	1,054,601	1,029,045	954,670	892,623	872,857
1935	861,888	875,447	914,968	1,074,311	1,204,982	1,332,638	1,607,409	1,702,119	1,891,791	1,775,734	1,630,166	1,542,565
1936	1,505,975	1,497,430	1,491,462	1,544,987	1,665,639	1,690,000	1,713,000	1,825,691	2,028,027	1,929,563	1,779,526	1,696,623
1937	1,643,274	1,621,943	1,615,418	1,609,353	1,662,992	1,690,000	1,713,000	1,800,733	2,003,587	1,868,857	1,722,668	1,637,903
1938	1,563,749	1,555,179	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,650,420	1,617,132	1,494,794	1,327,527	1,185,768	1,146,987
1940	1,104,744	1,097,470	1,172,009	1,327,526	1,547,043	1,690,000	1,713,000	1,807,916	1,958,797	1,793,074	1,642,834	1,554,212
1941	1,483,600	1,467,290	1,566,961	1,689,992	1,683,093	1,690,000	1,690,000	1,806,509	2,030,000	2,027,570	1,857,840	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,981	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,737	1,690,000	1,713,000	1,943,736	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,722,340	1,768,040	1,641,341	1,499,601	1,422,137
1945	1,397,468	1,445,485	1,491,921	1,518,219	1,647,456	1,690,000	1,713,000	1,754,594	1,992,326	1,929,188	1,774,942	1,687,016
1946	1,689,161	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,736,052	1,801,694	1,637,326	1,481,685	1,395,258
1947	1,336,035	1,352,466	1,385,793	1,398,015	1,428,806	1,398,318	1,330,455	1,410,592	1,351,548	1,210,805	1,085,321	1,021,999
1948	1,025,698	1,026,948	1,065,572	1,064,706	1,052,779	1,090,561	1,184,236	1,307,859	1,469,072	1,404,072	1,310,441	1,265,949
1949	1,236,620	1,226,101	1,220,864	1,209,352	1,221,438	1,388,660	1,383,592	1,439,810	1,432,171	1,269,567	1,126,164	1,051,097
1950	972,913	962,797	968,044	992,585	1,149,903	1,285,862	1,324,184	1,331,711	1,422,476	1,272,791	1,132,293	1,073,538
1951	1,070,744	1,488,456	1,689,994	1,689,971	1,673,951	1,690,000	1,674,893	1,582,480	1,623,173	1,469,675	1,329,803	1,250,402
1952	1,209,019	1,216,718	1,338,311	1,570,860	1,607,853	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,637,601	1,612,876	1,807,374	1,762,524	1,629,423	1,554,390
1954	1,488,563	1,487,754	1,491,397	1,498,203	1,547,172	1,656,733	1,694,547	1,842,655	1,844,804	1,684,589	1,458,474	1,459,916
1955	1,380,440	1,380,171	1,398,457	1,431,044	1,481,318	1,546,931	1,574,658	1,613,394	1,583,735	1,448,018	1,322,723	1,263,946
1956	1,200,937	1,199,546	1,689,999	1,689,942	1,678,244	1,690,000	1,713,000	1,807,969	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,601,605	1,810,011	1,662,709	1,522,759	1,449,042
1958	1,432,651	1,425,088	1,437,796	1,460,760	1,592,502	1,685,871	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,668,272	1,613,774	1,511,239	1,346,068	1,202,689	1,202,377
1960	1,124,461	1,113,034	1,136,262	1,135,952	1,260,578	1,279,681	1,294,114	1,299,490	1,220,270	1,089,550	980,720	931,421
1961	883,504	882,703	962,046	963,749	975,905	941,972	916,843	889,737	840,908	772,571	718,908	699,569
1962	673,602	668,506	696,242	700,189	887,290	1,008,394	1,008,522	1,009,300	1,247,365	1,156,129	1,018,813	945,723
1963	902,756	896,646	946,971	985,264	1,159,254	1,227,294	1,327,050	1,588,059	1,885,149	1,865,023	1,748,321	1,689,804
1964	1,670,166	1,690,000	1,690,000	1,689,998	1,689,999	1,660,043	1,607,767	1,611,163	1,580,208	1,424,930	1,289,630	1,218,501
1965	1,204,859	1,228,130	1,661,529	1,689,962	1,671,264	1,690,000	1,713,000	1,749,032	1,916,882	1,918,887	1,829,360	1,722,990
1966	1,638,033	1,690,000	1,689,998	1,689,996	1,685,637	1,690,000	1,673,183	1,750,711	1,633,424	1,469,368	1,325,726	1,255,121
1967	1,179,202	1,212,730	1,366,423	1,465,439	1,635,272	1,679,817	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,629,914	1,567,192	1,400,090	1,264,643	1,186,918
1969	1,150,489	1,179,797	1,269,280	1,689,993	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,951	1,679,633	1,690,000	1,655,509	1,733,462	1,826,128	1,696,059	1,558,979	1,480,821
1971	1,420,775	1,463,683	1,550,732	1,616,642	1,645,380	1,690,000	1,654,817	1,693,001	1,860,872	1,760,694	1,627,078	1,557,478
1972	1,495,246	1,503,790	1,547,387	1,597,860	1,631,406	1,614,352	1,520,432	1,523,646	1,532,873	1,375,031	1,243,566	1,176,831
1973	1,138,097	1,151,091	1,233,162	1,361,966	1,541,583	1,690,000	1,717,600	1,983,033	2,030,000	1,868,018	1,723,820	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,982	1,662,881	1,690,000	1,717,600	1,962,884	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,834,573	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,491,952	1,761,000	1,845,304	1,711,347	1,699,327
1979	1,617,427	1,620,500	1,619,556	1,689,997	1,684,439	1,690,000	1,690,000	1,717,600	1,834,877	1,684,867	1,540,837	1,464,234
1980	1,432,825	1,435,536	1,455,571	1,689,972	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,715,284	1,702,809	1,648,484	1,487,441	1,358,994	1,290,690
1982	1,281,797	1,388,704	1,539,448	1,689,993	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,972	1,681,440	1,690,000	1,622,221	1,691,612	1,791,967	1,663,838	1,517,244	1,433,830
1985	1,418,807	1,453,917	1,498,296	1,488,884	1,523,939	1,592,019	1,585,122	1,652,704	1,590,942	1,430,448	1,298,810	1,234,892
1986	1,207,890	1,229,077	1,306,220	1,371,232	1,671,168	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,678	1,709,305
1987	1,650,171	1,628,126	1,609,576	1,578,456	1,577,656	1,606,515	1,550,992	1,452,961	1,356,483	1,225,290	1,116,916	1,063,636
1988	1,040,909	1,040,005	1,076,189	1,130,008	1,							

Table 4.5-2

Don Pedro Reservoir Storage (Acre-feet)

WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	1,297,919	1,311,969	1,374,649	1,543,191	1,633,956	1,690,000	1,713,000	1,742,271	1,910,239	1,780,368	1,632,093	1,555,504
1922	1,469,532	1,454,724	1,479,018	1,499,182	1,627,229	1,690,000	1,713,000	1,967,374	2,030,000	1,998,136	1,838,254	1,715,718
1923	1,653,081	1,658,408	1,689,999	1,689,999	1,689,999	1,690,000	1,713,000	1,799,350	1,905,720	1,837,747	1,695,090	1,643,504
1924	1,573,662	1,557,997	1,543,979	1,525,572	1,520,285	1,435,601	1,350,582	1,268,108	1,160,641	1,041,842	933,176	878,997
1925	881,178	895,290	959,080	1,001,347	1,177,665	1,284,520	1,414,414	1,536,668	1,665,128	1,566,983	1,426,571	1,354,602
1926	1,290,743	1,282,398	1,282,833	1,276,745	1,347,403	1,393,186	1,513,528	1,529,318	1,431,062	1,291,567	1,169,352	1,105,586
1927	1,050,369	1,090,025	1,136,534	1,176,889	1,354,003	1,468,745	1,577,952	1,697,527	1,948,089	1,868,412	1,722,499	1,645,385
1928	1,624,109	1,655,435	1,689,902	1,690,000	1,689,998	1,690,000	1,705,499	1,882,298	1,844,942	1,681,291	1,538,831	1,460,902
1929	1,377,322	1,368,992	1,366,099	1,352,890	1,361,744	1,370,153	1,363,716	1,347,620	1,420,045	1,297,417	1,184,105	1,120,176
1930	1,064,049	1,047,885	1,083,398	1,103,389	1,147,360	1,178,802	1,151,942	1,144,262	1,236,535	1,120,169	1,015,406	962,553
1931	917,895	920,233	957,669	955,848	987,375	954,080	900,516	866,574	810,612	736,739	676,917	657,388
1932	631,250	626,111	769,876	913,848	1,153,707	1,290,028	1,281,046	1,334,403	1,458,411	1,411,082	1,275,442	1,198,554
1933	1,109,524	1,084,126	1,081,825	1,067,288	1,091,938	1,083,840	1,048,315	1,053,300	1,103,198	993,506	883,024	824,057
1934	766,654	754,904	779,126	811,010	879,460	973,506	960,998	918,785	892,442	818,720	757,328	738,038
1935	727,361	740,999	780,515	934,490	1,058,269	1,185,433	1,443,820	1,528,475	1,696,712	1,581,499	1,436,797	1,349,843
1936	1,313,654	1,305,218	1,299,245	1,352,785	1,588,986	1,690,000	1,713,000	1,808,423	2,006,955	1,908,581	1,768,637	1,675,801
1937	1,622,493	1,601,173	1,594,638	1,588,536	1,654,992	1,690,000	1,713,000	1,792,216	1,986,905	1,852,247	1,706,131	1,621,419
1938	1,547,298	1,538,738	1,689,998	1,689,992	1,689,987	1,690,000	1,690,000	1,730,000	2,025,000	2,030,000	1,870,754	1,718,957
1939	1,690,000	1,689,224	1,690,000	1,690,000	1,689,999	1,690,000	1,640,414	1,609,719	1,486,211	1,318,984	1,177,264	1,138,511
1940	1,096,286	1,089,016	1,153,019	1,306,880	1,540,470	1,690,000	1,713,000	1,807,953	1,954,973	1,789,267	1,639,044	1,550,434
1941	1,479,830	1,463,523	1,562,835	1,689,993	1,683,062	1,690,000	1,690,000	1,803,805	2,030,000	2,027,570	1,857,840	1,712,174
1942	1,653,602	1,645,974	1,689,999	1,689,982	1,673,445	1,690,000	1,713,000	1,765,000	2,027,000	2,030,000	1,860,016	1,707,840
1943	1,626,500	1,664,178	1,690,000	1,689,976	1,683,949	1,690,000	1,713,000	1,939,745	2,030,000	1,944,589	1,798,570	1,708,539
1944	1,635,547	1,622,064	1,610,321	1,603,274	1,647,456	1,690,000	1,658,867	1,706,915	1,749,631	1,623,011	1,481,354	1,403,951
1945	1,379,320	1,427,347	1,473,782	1,500,075	1,640,198	1,690,000	1,713,000	1,750,606	1,979,431	1,916,348	1,762,159	1,674,274
1946	1,676,444	1,690,000	1,689,996	1,689,984	1,655,146	1,690,000	1,713,000	1,726,277	1,790,756	1,626,434	1,470,843	1,384,452
1947	1,325,252	1,341,690	1,375,016	1,387,235	1,418,025	1,387,541	1,319,689	1,380,202	1,321,263	1,180,658	1,055,313	992,092
1948	995,855	997,122	1,035,745	1,034,871	1,022,941	1,055,025	1,146,212	1,267,720	1,417,634	1,352,869	1,259,478	1,215,157
1949	1,185,933	1,175,442	1,170,203	1,158,664	1,170,747	1,334,893	1,324,462	1,376,085	1,357,943	1,362,682	1,052,617	977,799
1950	899,772	889,700	891,735	917,336	1,074,649	1,209,756	1,247,393	1,254,524	1,342,391	1,193,077	1,052,942	994,455
1951	991,828	1,394,480	1,689,996	1,689,971	1,673,951	1,690,000	1,671,372	1,576,239	1,604,996	1,451,580	1,311,792	1,232,453
1952	1,191,106	1,198,816	1,320,408	1,550,006	1,599,510	1,690,000	1,690,000	1,895,000	2,030,000	2,030,000	1,869,932	1,719,140
1953	1,632,895	1,622,960	1,637,300	1,689,996	1,689,998	1,690,000	1,627,805	1,598,044	1,787,718	1,742,953	1,609,936	1,534,967
1954	1,469,181	1,468,382	1,472,024	1,478,824	1,527,793	1,637,361	1,675,192	1,807,461	1,807,613	1,647,557	1,501,608	1,423,171
1955	1,343,773	1,343,524	1,361,809	1,394,386	1,444,656	1,510,283	1,537,906	1,575,778	1,541,339	1,405,813	1,280,713	1,222,079
1956	1,159,157	1,157,788	1,690,000	1,689,941	1,678,244	1,690,000	1,713,000	1,804,932	2,030,000	2,030,000	1,859,576	1,712,725
1957	1,651,881	1,635,922	1,627,970	1,622,414	1,650,203	1,683,085	1,554,764	1,586,050	1,793,311	1,646,081	1,506,206	1,432,543
1958	1,416,187	1,408,633	1,421,341	1,444,300	1,585,917	1,683,239	1,690,000	1,910,000	2,030,000	2,030,000	1,868,297	1,719,418
1959	1,629,791	1,607,494	1,585,600	1,610,046	1,668,508	1,690,000	1,667,329	1,608,068	1,505,552	1,340,406	1,197,054	1,196,761
1960	1,118,856	1,107,432	1,130,660	1,130,349	1,243,727	1,256,367	1,271,555	1,279,420	1,205,492	1,074,839	966,076	916,828
1961	868,944	868,151	939,429	941,125	953,280	919,356	894,250	867,206	824,074	759,385	705,786	686,494
1962	660,555	655,467	683,202	687,146	687,245	995,355	995,496	899,706	1,129,280	1,038,578	901,808	829,134
1963	786,422	780,381	830,701	875,755	1,042,937	1,111,019	1,210,888	1,447,268	1,742,065	1,722,560	1,606,476	1,547,700
1964	1,529,068	1,578,634	1,594,299	1,612,405	1,628,891	1,598,956	1,546,441	1,542,798	1,504,176	1,349,242	1,214,296	1,143,418
1965	1,129,930	1,153,243	1,584,742	1,689,973	1,672,299	1,690,000	1,713,000	1,744,658	1,904,786	1,906,843	1,817,368	1,723,009
1966	1,638,052	1,690,000	1,689,998	1,689,996	1,685,990	1,690,000	1,666,206	1,743,752	1,626,487	1,462,463	1,318,853	1,248,271
1967	1,172,366	1,205,898	1,359,590	1,458,604	1,556,437	1,679,489	1,690,000	1,880,000	2,030,000	2,030,000	1,885,338	1,717,656
1968	1,636,802	1,624,597	1,622,733	1,622,937	1,666,603	1,690,000	1,620,006	1,623,382	1,560,682	1,393,610	1,258,193	1,180,490
1969	1,144,074	1,173,385	1,262,868	1,689,994	1,689,990	1,690,000	1,690,000	1,930,000	2,030,000	2,030,000	1,871,603	1,717,046
1970	1,690,000	1,690,000	1,689,999	1,689,952	1,679,633	1,690,000	1,655,509	1,725,036	1,816,534	1,686,506	1,549,469	1,471,343
1971	1,411,316	1,454,230	1,541,278	1,607,186	1,641,597	1,690,000	1,654,817	1,685,672	1,853,567	1,753,420	1,619,836	1,550,260
1972	1,488,043	1,496,591	1,540,187	1,590,658	1,628,525	1,611,472	1,517,554	1,495,198	1,504,521	1,364,809	1,215,475	1,148,834
1973	1,110,158	1,123,168	1,205,238	1,334,033	1,513,648	1,676,096	1,707,479	1,954,405	2,030,000	1,868,018	1,723,819	1,640,583
1974	1,631,540	1,690,000	1,689,998	1,689,983	1,662,882	1,690,000	1,717,600	1,963,536	2,030,000	1,947,300	1,804,413	1,717,372
1975	1,688,940	1,679,043	1,677,497	1,682,835	1,684,941	1,690,000	1,717,600	1,823,045	2,030,000	1,960,006	1,829,986	1,720,415
1976	1,690,000	1,690,000	1,690,000	1,664,706	1,652,292	1,526,598	1,445,307	1,341,473	1,236,083	1,107,685	1,022,829	992,425
1977	956,011	948,887	970,778	958,850	947,176	838,580	752,503	707,496	653,830	583,546	526,720	507,835
1978	487,414	485,146	537,432	682,534	851,424	1,090,274	1,269,016	1,401,086	1,761,000	1,845,304	1,711,347	1,699,327
1979	1,612,045	1,615,120	1,614,177	1,689,998	1,684,439	1,690,000	1,690,000	1,717,600	1,832,303	1,682,304	1,538,286	1,461,691
1980	1,430,288	1,433,000	1,453,035	1,689,976	1,689,987	1,690,000	1,717,600	1,890,400	1,960,200	2,030,000	1,874,603	1,727,346
1981	1,644,248	1,621,877	1,614,080	1,621,636	1,645,736	1,690,000	1,714,087	1,699,430	1,636,268	1,475,279	1,346,789	1,278,626
1982	1,269,759	1,376,672	1,527,416	1,689,995	1,689,988	1,690,000	1,717,600	1,876,400	2,002,900	2,030,000	1,874,041	1,772,100
1983	1,690,000	1,690,000	1,689,995	1,689,966	1,689,989	1,294,700	1,264,000	1,270,800	1,851,400	2,030,000	2,002,489	1,735,007
1984	1,690,000	1,690,000	1,689,992	1,689,971	1,681,440	1,690,000	1,622,221	1,691,612	1,791,967	1,663,838	1,517,244	1,433,830
1985	1,418,807	1,453,917	1,498,296	1,488,884	1,523,939	1,592,019	1,585,122	1,645,091	1,583,355	1,422,894	1,291,292	1,227,399
1986	1,200,412	1,221,603	1,293,188	1,358,196	1,670,079	1,690,000	1,717,600	1,888,300	2,001,400	1,921,921	1,777,677	1,709,305
1987	1,650,170	1,628,126	1,609,576	1,578,456	1,577,656	1,606,514	1,550,992	1,452,961	1,354,101	1,222,918	1,114,556	1,061,284
1988	1,038,561	1,037,658	1,073,842	1,127,662	1,183,519	1,160,536	1,					

Table 4.5-3

Difference in Don Pedro Reservoir Storage (Acre-feet)

Aggressive Conservation/Recycling/Groundwater minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	197	197	197	197	79	0	0	3,983	13,392	13,333	13,275	13,232
1922	13,204	13,197	13,197	13,201	5,281	0	0	10,209	0	0	0	0
1923	0	0	0	0	0	0	0	11,032	13,570	13,510	13,451	13,409
1924	13,381	13,374	13,374	13,379	13,380	13,375	17,101	19,990	19,921	19,831	19,736	19,666
1925	19,622	19,611	19,612	19,618	19,619	19,612	21,980	42,913	46,629	46,423	46,213	46,056
1926	45,959	45,932	46,477	46,491	46,865	46,273	54,982	62,054	79,596	79,233	78,867	78,603
1927	78,440	78,396	78,400	78,422	78,428	78,399	78,324	100,011	81,911	81,559	81,201	72,918
1928	65,891	34,565	97	0	0	0	7,501	14,020	17,006	16,934	16,858	16,802
1929	16,767	16,758	16,758	16,763	16,764	16,758	16,742	19,750	32,109	31,963	31,816	31,709
1930	31,644	31,626	31,628	31,637	31,638	31,627	31,597	37,749	37,622	37,453	37,281	37,152
1931	37,072	37,050	37,052	37,063	37,066	37,051	37,014	36,912	36,778	36,605	36,426	36,296
1932	36,221	36,201	63,500	67,747	79,248	90,592	96,665	105,445	115,161	114,642	114,114	113,724
1933	113,490	113,427	113,431	113,464	113,473	113,430	115,214	116,583	124,808	124,241	123,660	123,221
1934	122,951	122,879	135,889	131,143	131,992	134,674	134,897	135,816	136,603	135,950	135,295	134,819
1935	134,527	134,448	134,453	139,821	146,713	147,205	163,589	173,644	195,079	194,235	193,369	192,722
1936	192,321	192,212	192,212	192,202	176,653	0	0	17,268	21,072	20,982	20,889	20,822
1937	20,781	20,770	20,780	20,817	8,000	0	0	8,517	16,682	16,610	16,537	16,484
1938	16,451	16,441	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	10,006	7,413	8,583	8,543	8,504	8,476
1940	8,458	8,454	18,990	20,646	6,573	0	0	-37	3,824	3,807	3,790	3,778
1941	3,770	3,767	4,126	-1	31	0	0	2,704	0	0	0	0
1942	0	0	0	-1	0	0	0	0	0	0	0	0
1943	0	0	0	0	-212	0	0	3,991	0	0	0	0
1944	0	0	0	0	0	0	0	15,425	18,409	18,330	18,247	18,186
1945	18,148	18,138	18,139	18,144	7,258	0	0	3,988	12,895	12,840	12,783	12,742
1946	12,717	0	0	0	0	0	0	9,775	10,938	10,892	10,842	10,806
1947	10,783	10,776	10,777	10,780	10,781	10,777	10,766	30,390	30,285	30,147	30,008	29,907
1948	29,843	29,826	29,827	29,835	29,838	35,536	38,024	40,139	51,438	51,203	50,963	50,792
1949	50,687	50,659	50,661	50,688	50,691	53,767	59,130	63,725	74,228	73,885	73,547	73,298
1950	73,141	73,097	76,309	75,249	75,254	76,106	76,791	77,187	80,085	79,714	79,351	79,083
1951	78,916	93,976	-2	0	0	0	3,521	6,241	18,177	18,095	18,011	17,949
1952	17,913	17,902	17,903	20,854	8,343	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	9,796	14,832	19,656	19,571	19,487	19,423
1954	19,382	19,372	19,373	19,379	19,379	19,372	19,355	35,194	37,191	37,032	36,866	36,744
1955	36,667	36,647	36,648	36,658	36,662	36,648	36,752	37,616	42,396	42,205	42,010	41,867
1956	41,780	41,758	-1	1	0	0	0	3,037	0	0	0	0
1957	0	0	0	0	0	0	0	15,555	16,700	16,628	16,553	16,499
1958	16,464	16,455	16,455	16,460	6,585	2,632	0	0	0	0	0	0
1959	0	0	0	0	0	0	943	5,706	5,687	5,662	5,635	5,616
1960	5,605	5,602	5,602	5,603	16,851	23,314	22,559	20,070	14,778	14,711	14,644	14,593
1961	14,560	14,552	22,617	22,624	22,625	22,616	22,593	22,531	16,834	13,186	13,122	13,075
1962	13,047	13,039	13,040	13,043	13,045	13,039	13,026	109,594	118,085	117,551	117,005	116,589
1963	116,334	116,265	116,270	109,509	116,317	116,275	116,162	140,791	143,084	142,463	141,845	141,384
1964	141,098	111,366	95,701	77,593	61,108	61,087	61,326	68,365	76,032	75,688	75,334	75,083
1965	74,929	74,887	76,787	-11	-1,035	0	0	4,374	12,096	12,044	11,992	-19
1966	-19	0	0	0	-353	0	6,977	6,959	6,937	6,905	6,873	6,850
1967	6,836	6,832	6,833	6,835	6,835	328	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	6,532	6,510	6,480	6,450	6,428
1969	6,415	6,412	6,412	-1	0	0	0	0	0	0	0	0
1970	0	0	0	-1	0	0	0	8,426	9,594	9,553	9,510	9,478
1971	9,459	9,453	9,454	9,456	3,783	0	0	7,329	7,305	7,274	7,242	7,218
1972	7,203	7,199	7,200	7,202	2,881	2,880	2,878	28,448	28,352	28,222	28,091	27,997
1973	27,939	27,923	27,924	27,933	27,935	13,904	10,121	28,628	0	0	1	0
1974	0	0	0	-1	-1	0	0	-652	0	0	0	0
1975	0	0	0	0	0	0	0	11,528	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	90,866	0	0	0	0
1979	5,382	5,380	5,379	-1	0	0	0	0	2,574	2,563	2,551	2,543
1980	2,537	2,536	2,536	-4	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	1,197	3,379	12,216	12,162	12,105	12,064
1982	12,038	12,032	12,032	-2	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	1	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	7,613	7,587	7,554	7,518	7,493
1986	7,478	7,474	13,032	13,036	1,089	0	0	0	0	0	1	0
1987	1	0	0	0	0	1	0	0	2,382	2,372	2,360	2,352
1988	2,348	2,347	2,347	2,346	-11,313	-11,309	-5,721	4,008	42,739	47,533	47,307	47,139
1989	47,035	47,007	47,010	47,023	47,027	47,010	62,375	99,462	107,070	106,588	106,100	105,737
1990	105,514	105,454	105,460	105,490	105,497	105,458	105,357	122,049	104,030	103,551	103,050	116,483
1991	121,612	121,540	122,331	129,872	131,240	131,189	131,055	129,024	160,021	147,370	155,501	158,029
1992	157,685	157,593	157,599	157,647	157,660	157,601	126,689	153,327	152,800	152,097	151,364	150,828
1993	150,501	150,408	153,587	169,007	169,052	172,629	176,615	180,315	53,066	52,838	36,792	-59
1994	-59	-59	-59	-59	-59	-59	-59	9,791	10,952	10,902	10,851	10,815
1995	10,793	10,786	10,787	10,790	410	0	13,155	0	0	0	0	0
1996	0	0	0	0	-1	0	0	0	0	0	0	0
1997	0	0	0	-2	0	0	3,898	7,024	10,035	9,992	9,949	9,917
1998	9,897	9,892	9,892	-1	0	0	-1,840	0	0	0	0	0
1999	0	0	0	0	0	0	0	11,919	9,823	9,781	9,738	9,707
2000	9,688	9,682	9,682	9,685	0	0	0	21,587	0	1	1	0
2001	0	0	0	0	0	0	0	24,884	27,164	27,043	26,919	26,825
2002	26,770	26,756	26,757	26,765	26,767	26,756	26,731	41,167	42,223	42,035	41,841	41,697
Avg (21-02)	30,125	29,394	27,835	26,485	23,826	22,519	23,607	32,416	31,740	31,470	31,240	30,647

Table 4.5-4

Difference in Don Pedro Reservoir Storage (Acre-feet)				Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained								
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	510	1,151	-1,037	-1,033	-1,030
1922	-1,028	-1,027	-1,027	-1,027	-411	0	0	375	0	-2,184	-1,520	3
1923	3	2	0	0	0	0	0	-9,823	-9,330	-11,473	-11,423	-11,386
1924	-11,363	-11,357	-11,358	-11,361	-11,361	-11,357	-10,736	-11,460	-11,421	-11,370	-11,317	-11,275
1925	-11,251	-11,244	-11,244	-11,247	-11,249	-11,244	-13,478	-12,525	-10,737	-12,873	-12,815	-12,771
1926	-12,745	-12,738	-12,691	-12,694	-12,521	-12,516	-10,942	-13,824	-19,540	-19,451	-19,360	-19,295
1927	-19,255	-19,245	-12,646	-12,649	-12,651	-12,646	-12,634	-18,408	0	-2,184	-1,531	2
1928	0	0	0	0	0	0	0	950	1,866	1,858	1,850	1,843
1929	1,839	1,839	1,838	1,839	1,839	1,839	1,837	-21,018	-23,060	-22,954	-22,847	-22,771
1930	-22,723	-22,711	-22,712	-22,718	-22,720	-22,712	-22,690	-16,395	-18,452	-18,369	-18,286	-18,224
1931	-18,184	-18,174	-18,175	-18,180	-18,182	-18,175	-18,157	-18,106	-18,041	-17,954	-17,869	-17,805
1932	-17,765	-17,754	-22,568	-25,586	-25,081	-34,168	-32,893	-32,684	-32,789	-34,826	-34,668	-34,551
1933	-34,478	-34,458	-34,460	-34,470	-34,472	-34,460	-38,184	-42,235	-54,348	-56,287	-56,028	-55,835
1934	-55,714	-55,680	-37,016	-44,056	-39,740	-40,345	-49,021	-66,946	-67,243	-66,934	-66,614	-66,376
1935	-66,229	-66,189	-66,193	-76,426	-83,358	-63,371	-51,822	-51,432	-57,802	-59,733	-59,475	-59,279
1936	-59,159	-59,126	-59,128	-59,154	-24,351	0	0	-185	1,561	-629	-626	-625
1937	-623	-622	-622	-623	-243	0	0	-1,219	-2,226	-4,400	-4,380	-4,367
1938	-4,358	-4,355	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	-18,907	-19,810	-20,662	-20,568	-20,473	-20,405
1940	-20,363	-20,351	-9,084	-6,721	-2,850	0	0	6,138	5,107	5,085	5,063	5,046
1941	5,035	5,032	4,463	-1	83	0	0	-391	0	-2,183	-1,521	3
1942	3	3	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	-212	0	0	-1,045	0	-2,183	-2,174	4
1944	3	4	4	3	2	0	0	-18,192	-17,213	-19,323	-19,237	-19,172
1945	-19,132	-19,121	-19,122	-19,127	-7,652	0	0	3,703	23,780	21,495	21,400	21,332
1946	21,291	0	0	0	0	0	0	-1,867	-2,780	-2,768	-2,756	-2,746
1947	-2,741	-2,739	-2,739	-2,740	-2,740	-2,739	-2,737	-16,294	-18,351	-18,265	-18,182	-18,120
1948	-18,083	-18,073	-18,073	-18,079	-18,080	-18,073	-20,356	-22,645	-25,514	-27,581	-27,454	-27,359
1949	-27,303	-27,288	-27,288	-27,309	-27,311	-21,299	-20,001	-18,718	-16,906	-16,829	-16,753	-16,696
1950	-16,661	-16,652	-18,825	-15,539	-30,886	-39,257	-39,397	-39,984	-34,129	-35,358	-35,197	-35,079
1951	-35,006	-31,771	1	0	0	0	597	2,400	5,141	2,935	2,921	2,910
1952	2,905	2,903	2,903	1,367	547	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	-10,035	-7,160	-4,380	-6,544	-6,515	-6,494
1954	-6,481	-6,477	-6,477	-6,479	-6,480	-6,477	-6,471	-23,422	-23,345	-23,244	-23,140	-23,063
1955	-23,014	-23,001	-23,002	-23,009	-23,011	-23,003	-25,066	-27,927	-33,682	-33,531	-33,377	-33,262
1956	-33,194	-33,175	1	0	0	0	0	-5,078	0	0	0	0
1957	0	0	0	0	0	0	0	-18,040	-18,900	-21,002	-20,909	-20,839
1958	-20,796	-20,784	-20,785	-20,791	-8,317	-3,325	0	0	0	0	0	0
1959	0	0	0	0	0	0	-4,820	-16,709	-16,653	-16,577	-16,499	-16,445
1960	-16,411	-16,401	-16,402	-16,407	-8,607	-3,544	-5,554	-6,916	-10,444	-10,396	-10,347	-10,312
1961	-10,289	-10,282	-11,204	-11,207	-11,208	-11,205	-11,193	-12,423	-17,994	-21,477	-21,374	-21,298
1962	-21,249	-21,237	-21,238	-21,247	-21,247	-21,239	-21,218	-24,429	-23,104	-25,184	-25,068	-24,981
1963	-24,926	-24,912	-9,119	-3,476	-24,935	-24,926	-24,902	-30,271	-29,253	-31,310	-31,172	-31,073
1964	-19,834	0	0	0	0	0	-2,117	-7,705	-32,602	-32,455	-32,306	-32,195
1965	-32,129	-32,112	-20,059	3	2	0	0	5,722	26,004	23,709	21,421	-34
1966	-34	0	0	0	0	0	-19,987	-18,322	-20,376	-20,286	-20,193	-20,123
1967	-20,082	-20,071	-20,071	-20,077	-20,079	-9,529	0	0	0	0	-2,183	3
1968	4	4	4	3	2	0	0	-25,321	-27,350	-27,227	-27,100	-27,010
1969	-26,954	-26,939	-26,940	4	0	0	0	0	0	0	0	0
1970	0	0	0	-4	1,189	0	0	-3,065	-3,973	-6,139	-6,112	-6,092
1971	-6,079	-6,075	-6,076	-6,078	-2,432	0	0	-16,506	-18,566	-20,667	-20,578	-20,510
1972	-20,469	-20,457	-20,457	-20,463	-8,186	-8,184	-8,175	-15,709	-17,769	-17,689	-17,606	-17,547
1973	-17,511	-17,501	-17,502	-17,506	-17,509	0	0	2,439	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	-2,184	-2,174	3
1975	4	4	3	3	1	0	0	12,726	0	-2,184	-1,521	2
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	3,478	0	-2,183	-2,174	-2,476
1979	-2,935	-2,933	-2,934	0	1	0	0	0	460	458	455	454
1980	453	452	453	-4	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	-920	-11,312	-19,194	-19,109	-19,022	-18,956
1982	-18,916	-18,905	-18,906	3	0	0	0	0	0	0	-2,183	0
1983	0	0	0	0	0	0	0	0	0	0	-2,183	3
1984	0	0	0	1	0	0	-197	-14,020	-16,088	-18,202	-18,121	-18,060
1985	-18,023	-18,013	-18,014	-18,019	-18,020	-18,013	-17,996	-17,052	-19,109	-19,022	-18,935	-18,870
1986	-18,830	-18,820	-18,822	-16,908	-9,433	0	0	0	0	-2,183	-2,173	-2,167
1987	-2,162	-2,161	-2,162	-2,162	-2,162	-2,161	-2,159	-15,753	-24,843	-24,728	-24,617	-24,534
1988	-24,482	-24,468	-24,468	-24,477	-24,478	-24,469	-24,446	-17,016	-12,157	-12,101	-12,044	-12,003
1989	-11,977	-11,969	-11,970	-11,974	-11,975	-11,970	-19,405	-13,321	-7,439	-7,405	-7,370	-7,345
1990	-7,331	-7,326	-7,326	-7,328	-7,330	-7,327	-7,319	-4,513	-2,247	-2,237	-2,226	-2,209
1991	-2,304	-2,303	-2,303	-2,304	-2,304	-2,303	-2,301	-2,205	231	-1,690	-1,682	-1,677
1992	-1,673	-1,673	-1,673	-1,674	-1,673	-1,672	-2,156	-2,150	-2,143	-2,134	-2,124	-2,116
1993	-2,112	-2,110	-12,918	-12,922	-12,923	-20,562	-25,756	-22,509	0	-2,184	-1,520	3
1994	3	2	2	2	3	3	3	-20,744	-21,592	-21,495	-21,393	-21,321
1995	-21,276	-21,265	-21,266	-21,272	-12,416	0	3,952	0	0	0	-2,184	3
1996	4	3	4	4	-1	0	0	0	0	-2,183	-2,174	-2,167
1997	-2,163	0	0	0	0	0	-9,724	-8,750	-7,802	-9,952	-9,909	-9,877
1998	-9,857	-9,852	-9,853	2	0	0	-368	0	0	0	0	0
1999	0	0	0	0	0	0	0	-8,678	0	-2,183	-2,174	-2,167
2000	-2,162	-2,162	-2,162	-2,162	0	0	0	9,396	0	1	1	0
2001	0	0	0	0	0	0	0	-20,493	-19,967	-19,879	-19,787	-19,720
2002	-19,677	-19,666	-19,667	-19,672	-19,674	-19,668	-19,648	-42,838	-43,615	-43,421	-43,222	-43,074
Avg (21-02)	-11,073	-11,018	-9,623	-8,830	-8,010	-6,830	-7,652	-10,826	-10,852	-11,739	-11,778	-11,752

Figure 4.5-1 and Table 4.5-4 illustrate that, during drought sequences, reduction in inflow to Don Pedro Reservoir can accumulate from year to year. Compared to the base setting, the alternative would result in lower Don Pedro Reservoir storage during drought periods. Figure 4.5-2 illustrates the difference in reservoir storage averaged by year type in comparing the alternative to the WSIP settings. Also shown is the average difference in storage for the two settings during the 82-year simulation. Figure 4.5-3 illustrates the same information in comparing the alternative and base settings.

Figure 4.5-2

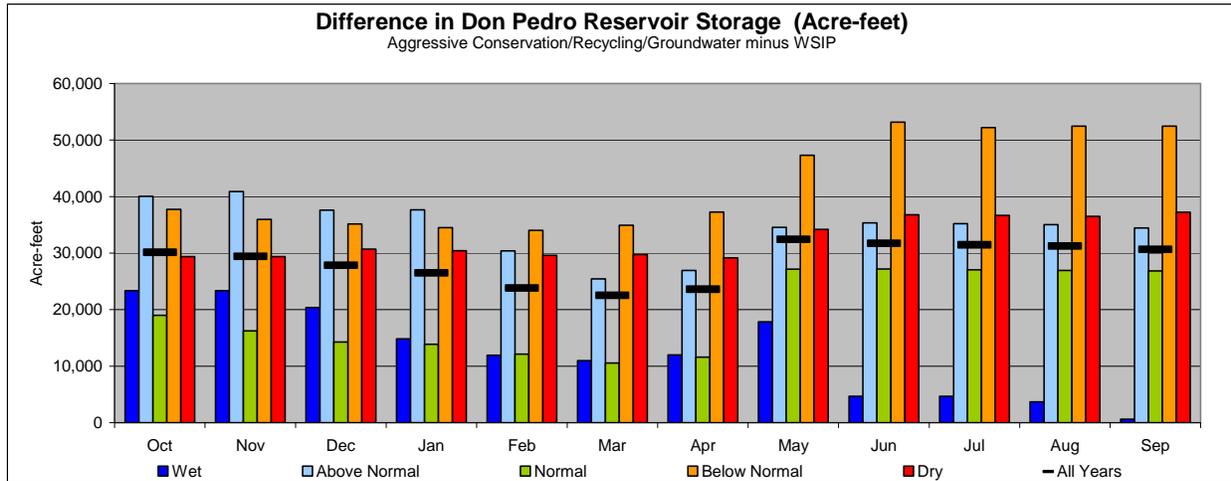


Figure 4.5-3

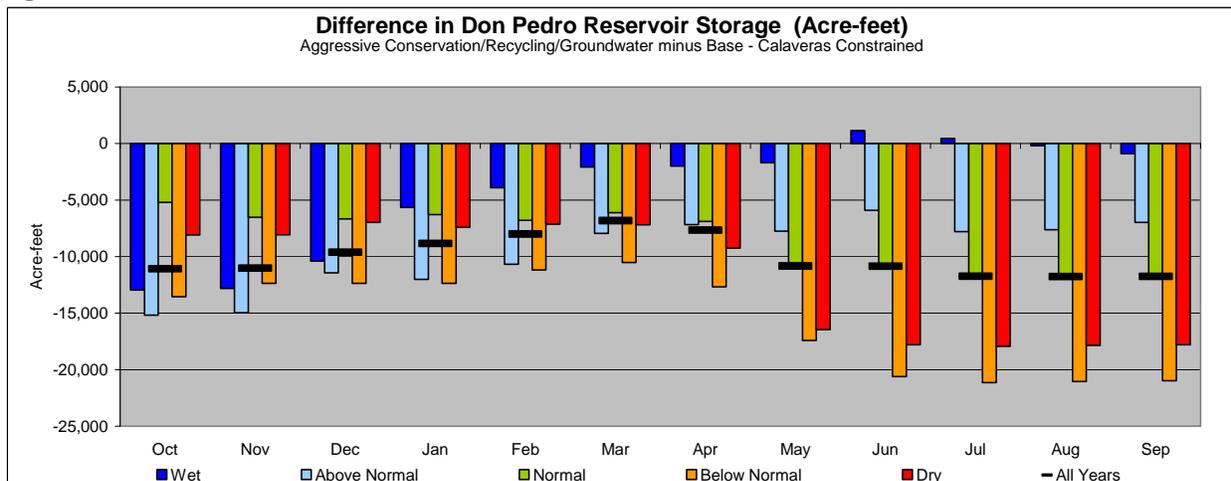


Figure 4.5-4 illustrates the average monthly storage in Don Pedro Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

The difference in storage in Don Pedro Reservoir attributed to the upstream effects of the alternative would manifest in differences in releases from La Grange Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. During periods when inflow differs and Don Pedro Reservoir is at maximum storage capacity within the flood control storage limitation, a change in inflow directly manifests as a change in release from La Grange Dam (a change of either more or less flow). Figure 4.5-1 illustrates the stream release from La Grange Dam for the WSIP, alternative, and base settings.

Figure 4.5-4

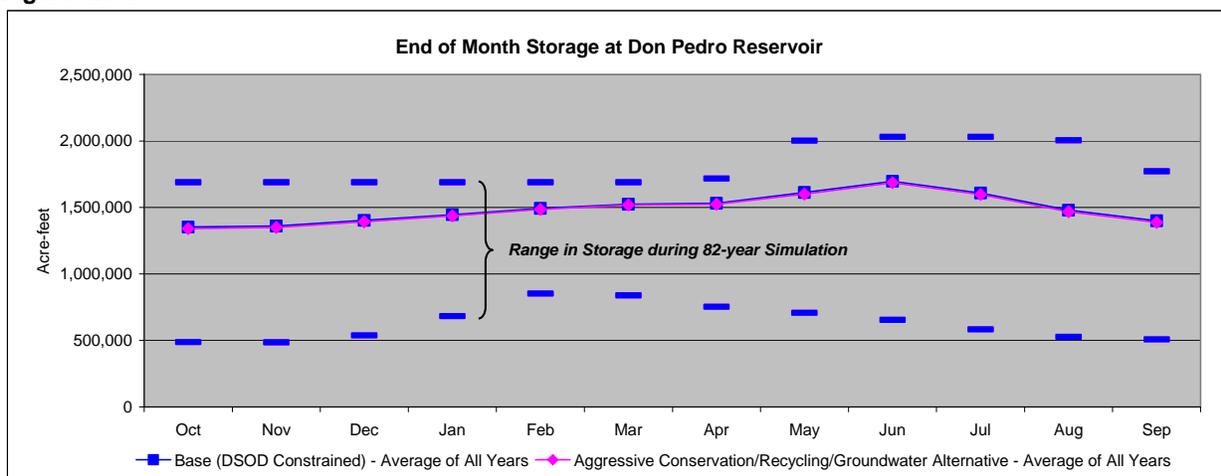


Table 4.5-5 illustrates the difference in stream releases between the alternative and WSIP settings. Compared to the WSIP setting, the alternative exhibits an incrementally larger stream release, predominantly during some months of the early-winter-through-June period, which reflects the months when releases to the stream above minimum release requirements are made due to flood control or in anticipation of the reservoir being filled. Table 4.5-6 illustrates the same information in comparing the alternative and WSIP settings, ranked in descending order of the San Joaquin River Index. Illustrated is the finding that differences in releases to the Tuolumne River from La Grange Dam would occur only when there are releases in excess of minimum FERC flow requirements. This circumstance typically occurs only in above normal and wet years, and predominantly during early winter through June. During other year types and during the summer and fall, releases would be maintained at minimum FERC flow requirements regardless of the setting. Compared to the WSIP setting, the large potential reduction in flow following an extended drought period is reduced with the alternative because the amount of water delivered by the SFPUC during these periods is less than that delivered in the WSIP setting, but is still more than that delivered in the base setting.

As described above concerning Don Pedro inflow and storage, compared to the base setting, the alternative setting would lead to an additional draw of storage due to SFPUC diversions that are greater than in the base setting. Although the reduction in storage would not greatly accumulate, greater replenishment of Don Pedro Reservoir storage is needed in about 38 percent of the years of the 82-year simulation. Occasionally, an increase in releases would occur, due to the shift in timing of SJPL diversions because of the increased conveyance capacity. The effect is an occasional additional release of water from Hetch Hetchy Reservoir in the winter, which then manifests as an additional release from Don Pedro Reservoir. Table 4.5-7 illustrates the difference in stream releases between the alternative and base settings, depicting the predominance of reductions to flow. Table 4.5-8 illustrates the same information ranked in descending order of the San Joaquin River Index.

Table 4.5-5 and Table 4.5-7 illustrate the difference in stream release between the alternative, WSIP, and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Table 4.5-9 illustrates the same information and the average monthly stream release for the alternative and WSIP settings, expressed in average monthly flow (cfs). Table 4.5-10 illustrates the same information in comparing the alternative and base settings. In comparing the alternative to the WSIP setting, the difference in monthly flow below La Grange Dam could range from an increase of approximately 155,000 acre-feet to a decrease of approximately 7,000 acre-feet. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful. Similar to the operation of releases below O'Shaughnessy Dam, a change in the volume of release from La Grange Dam to the stream would likely result in the initiation of the release being delayed or initiated earlier by a matter of days. Assuming that a change in release volume equates to a delay or acceleration of releasing 6,000 acre-feet per day, the difference in stream release from La Grange Dam between the alternative and WSIP would be an additional day of delay in releases

Table 4.5-5

Water Year	Aggressive Conservation/Recycling/Groundwater minus WSIP												WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	0	0	0	0	118	7,176	1,524	0	0	0	0	0	8,818
1922	0	0	0	0	7,921	5,280	10,127	2,619	12,770	0	0	0	38,717
1923	0	0	0	0	0	0	3,867	0	0	0	0	0	3,867
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	20,838	0	0	8,037	28,875
1928	6,889	31,299	34,469	97	0	0	10,272	0	0	0	0	0	83,026
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	116,747	85,831	5,488	0	0	0	0	0	208,066
1937	0	0	0	0	14,456	12,723	9,176	0	0	0	0	0	36,355
1938	0	0	14,588	0	0	45	10,699	16,107	4,880	0	0	0	46,319
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	22,505	15,298	4,746	0	0	0	0	0	42,549
1941	0	0	0	4,127	-187	-116	-181	0	5,028	0	0	0	8,671
1942	0	0	0	3,015	0	2,854	7,365	2,855	2,762	0	0	0	18,851
1943	0	0	0	0	1,270	9,670	4,879	0	7,851	0	0	0	23,670
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	10,887	7,257	921	0	0	0	0	0	19,065
1946	0	12,714	0	0	0	5,630	1,584	0	0	0	0	0	19,928
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	93,981	-2	0	0	0	0	0	0	0	0	93,979
1952	0	0	0	0	12,513	8,341	0	17,195	4,879	0	0	0	42,928
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	46,045	-1	0	1,125	3,849	0	6,071	0	0	0	57,089
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	9,876	3,950	2,631	20,461	2,854	0	0	0	39,772
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	29,662	15,670	18,132	16,489	0	0	0	0	0	0	0	79,953
1965	0	0	0	82,517	6,180	-1,035	8,445	0	0	0	11,992	0	108,099
1966	0	-19	2,026	0	2,121	-353	0	0	0	0	0	0	3,775
1967	0	0	0	0	0	18,532	327	16,228	2,762	0	0	0	37,849
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	6,413	8,491	6,138	7,641	3,996	3,866	0	0	0	36,545
1970	0	0	0	4,973	-1	319	0	0	0	0	0	0	5,291
1971	0	0	0	0	5,674	3,783	0	0	0	0	0	0	9,457
1972	0	0	0	0	4,321	0	0	0	0	0	0	0	4,321
1973	0	0	0	0	0	14,023	3,772	0	31,619	0	0	0	49,414
1974	0	0	0	7,338	-1	2,854	7,366	5,695	4,229	0	0	0	27,481
1975	0	0	0	0	0	0	7,366	0	15,377	0	0	0	22,743
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	95,731	0	0	0	95,731
1979	0	0	0	5,382	0	9,558	1,197	2,664	0	0	0	0	18,801
1980	0	0	0	23,152	-7,494	11,165	4,880	3,995	3,867	0	0	0	39,565
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	12,455	12,098	2,663	0	2,854	2,762	0	0	1,196	34,028
1983	2,949	0	0	0	0	0	1,154	5,351	1,841	0	0	0	11,295
1984	5,042	921	0	0	0	0	0	0	0	0	0	0	5,963
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	15,890	22,973	15,903	7,897	7,641	0	0	0	70,304
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	154,679	0	15,852	36,792	207,323
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	29,908	7,766	0	19,798	6,445	0	0	0	63,917
1996	0	0	0	0	12,184	-7,490	8,032	6,619	3,867	0	0	0	23,212
1997	0	0	0	10,101	-1	0	0	0	0	0	0	0	10,100
1998	0	0	0	9,895	-1	14,871	11,048	2,062	3,774	0	0	0	41,649
1999	0	0	0	0	0	5,708	8,407	0	7,600	0	0	0	21,715
2000	0	0	0	0	9,685	0	0	0	24,591	0	0	0	34,276
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	181	909	2,522	2,288	3,801	3,372	1,982	1,663	5,349	0	193	708	22,968

Table 4.5-6

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

Aggressive Conservation/Recycling/Groundwater minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	2,949	0	0	0	0	0	1,154	5,351	1,841	0	0	0	11,295
1969	0	0	0	6,413	8,491	6,138	7,641	3,996	3,866	0	0	0	36,545
1995	0	0	0	0	29,908	7,766	0	19,798	6,445	0	0	0	63,917
1938	0	0	14,588	0	0	45	10,699	16,107	4,880	0	0	0	46,319
1998	0	0	0	9,895	-1	14,871	11,048	2,062	3,774	0	0	0	41,649
1982	0	0	0	12,455	12,098	2,663	0	2,854	2,762	0	0	1,196	34,028
1967	0	0	0	0	0	18,532	327	16,228	2,762	0	0	0	37,849
1952	0	0	0	0	12,513	8,341	0	17,195	4,879	0	0	0	42,928
1958	0	0	0	0	9,876	3,950	2,631	20,461	2,854	0	0	0	39,772
1980	0	0	0	23,152	-7,494	11,165	4,880	3,995	3,867	0	0	0	39,565
1978	0	0	0	0	0	0	0	0	95,731	0	0	0	95,731
1922	0	0	0	0	7,921	5,280	10,127	2,619	12,770	0	0	0	38,717
1956	0	0	46,045	-1	0	1,125	3,849	0	6,071	0	0	0	57,089
1942	0	0	0	3,015	0	2,854	7,365	2,855	2,762	0	0	0	18,851
1941	0	0	0	4,127	-187	-116	-181	0	5,028	0	0	0	8,671
1986	0	0	0	0	15,890	22,973	15,903	7,897	7,641	0	0	0	70,304
1993	0	0	0	0	0	0	0	0	154,679	0	15,852	36,792	207,323
1997	0	0	0	10,101	-1	0	0	0	0	0	0	0	10,100
1996	0	0	0	0	12,184	-7,490	8,032	6,619	3,867	0	0	0	23,212
1943	0	0	0	0	1,270	9,670	4,879	0	7,851	0	0	0	23,670
1937	0	0	0	0	14,456	12,723	9,176	0	0	0	0	0	36,355
1974	0	0	0	7,338	-1	2,854	7,366	5,695	4,229	0	0	0	27,481
1975	0	0	0	0	0	0	7,366	0	15,377	0	0	0	22,743
1965	0	0	0	82,517	6,180	-1,035	8,445	0	0	0	0	11,992	108,099
1936	0	0	0	0	116,747	85,831	5,488	0	0	0	0	0	208,066
1984	5,042	921	0	0	0	0	0	0	0	0	0	0	5,963
1979	0	0	0	5,382	0	9,558	1,197	2,664	0	0	0	0	18,801
1945	0	0	0	0	10,887	7,257	921	0	0	0	0	0	19,065
1999	0	0	0	0	0	5,708	8,407	0	7,600	0	0	0	21,715
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	20,838	0	0	8,037	28,875
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	12,714	0	0	0	5,630	1,584	0	0	0	0	0	19,928
1973	0	0	0	0	0	14,023	3,772	0	31,619	0	0	0	49,414
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	9,685	0	0	0	24,591	0	0	0	34,276
1940	0	0	0	0	22,505	15,298	4,746	0	0	0	0	0	42,549
1923	0	0	0	0	0	0	3,867	0	0	0	0	0	3,867
1921	0	0	0	0	118	7,176	1,524	0	0	0	0	0	8,818
1970	0	0	0	4,973	-1	319	0	0	0	0	0	0	5,291
1951	0	0	93,981	-2	0	0	0	0	0	0	0	0	93,979
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	5,674	3,783	0	0	0	0	0	0	9,457
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	6,889	31,299	34,469	97	0	0	10,272	0	0	0	0	0	83,026
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-19	2,026	0	2,121	-353	0	0	0	0	0	0	3,775
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	29,662	15,670	18,132	16,489	0	0	0	0	0	0	0	79,953
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	4,321	0	0	0	0	0	0	0	4,321
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.5-7

Difference in Total La Grange Release to River (Acre-feet)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	-8,525	-2,076	0	0	0	0	0	-10,601	
1922	0	0	0	0	-616	-411	2,762	-3,065	-1,927	0	-655	-1,521	-5,433	
1923	0	0	3	0	0	0	1,750	0	0	0	0	0	1,753	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	
1927	0	0	0	0	0	0	0	0	-22,990	0	-644	-1,532	-25,166	
1928	3	0	0	0	0	-5,339	-501	0	0	0	0	0	-5,837	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-34,806	-33,244	553	0	0	0	0	0	-67,497	
1937	0	0	0	0	-413	-283	5,489	0	0	0	0	0	4,793	
1938	0	0	-4,356	0	0	0	1,356	-3,444	0	-2,189	0	0	-8,633	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	-3,067	-3,922	-538	0	0	0	0	0	-7,527	
1941	0	0	0	4,465	-502	-311	-485	0	-1,550	0	-655	-1,520	-558	
1942	0	0	2	-1,480	0	-951	1,841	0	0	-2,188	0	0	-2,776	
1943	0	0	0	0	1,270	-1,791	0	0	-2,056	0	0	-2,173	-4,750	
1944	0	0	0	0	2	1	0	0	0	0	0	0	3	
1945	0	0	0	0	-11,476	-22,968	876	0	0	0	0	0	-33,568	
1946	0	21,285	0	0	0	-7,762	-2,283	0	0	0	0	0	11,240	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	-31,771	0	0	0	0	0	0	0	0	0	-31,771	
1952	0	0	0	0	820	547	0	-3,380	0	-2,188	0	0	-4,201	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	-35,189	1	0	-3,209	1,155	0	-6,911	-2,188	0	0	-46,341	
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	
1958	0	0	0	0	-12,474	-4,991	-3,324	3,923	0	-2,188	0	0	-19,054	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	
1964	-11,189	-19,829	0	0	0	0	0	0	0	0	0	0	-31,018	
1965	0	0	0	-20,065	2	-14,515	7,212	0	0	0	0	21,421	-5,945	
1966	0	-34	-2,285	0	0	-6,452	0	0	0	0	0	0	-8,771	
1967	0	0	0	0	0	-3,028	-9,525	6,535	2,762	-2,188	0	-2,184	-7,628	
1968	0	0	0	0	2	1	0	0	0	0	0	0	3	
1969	0	0	0	-26,948	1,284	0	0	-1,047	-1,013	-2,188	0	0	-29,912	
1970	0	0	0	26,810	-7,146	-15,760	0	0	0	0	0	0	3,904	
1971	0	0	0	0	-3,647	-2,430	0	0	0	0	0	0	-6,077	
1972	0	0	0	0	-12,278	0	0	0	0	0	0	0	-12,278	
1973	0	0	0	0	0	-17,505	0	0	3,356	0	0	0	-14,149	
1974	0	0	0	-3,817	0	-5,708	1,842	1	0	0	0	-2,174	-9,856	
1975	0	0	0	0	2	1	-920	0	15,625	0	-655	-1,520	12,533	
1976	2	0	0	0	0	0	0	0	0	0	0	0	2	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	0	2,874	0	0	0	2,874	
1979	0	0	0	-2,934	0	-9,545	-921	475	0	0	0	0	-12,925	
1980	0	0	0	26,986	-7,495	2,603	0	-1,047	-1,013	-2,188	0	0	17,846	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	-18,492	1,939	0	0	0	0	-2,188	0	-3,101	-21,842	
1983	0	-1,841	2,664	0	0	0	1,154	-448	-921	-2,188	0	-2,183	-3,763	
1984	-2,113	921	0	0	0	3,935	0	0	0	0	0	0	2,743	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	110	-7,675	4,603	2,855	2,762	0	0	0	2,655	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	0	0	0	0	0	-33,283	0	-655	-1,521	-35,459	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	10,670	-113	0	6,801	2,762	-2,188	0	-2,183	15,749	
1996	0	0	0	0	8,656	-7,490	1,311	4,431	1,749	0	0	0	8,657	
1997	0	-2,162	0	-2,646	1	0	0	0	0	0	0	0	-4,807	
1998	0	0	0	-9,856	2	8,197	2,209	-368	0	-2,188	0	0	-2,004	
1999	0	0	0	0	0	-3,806	3,403	0	-8,664	0	0	0	-9,067	
2000	0	0	0	0	-2,163	0	0	0	10,301	0	0	0	8,138	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	-162	-20	-865	-341	-870	-2,103	207	149	-465	-320	-40	-2	-4,833	

Table 4.5-8

Difference in Total La Grange Release to River (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending SJR Index

Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	0	-1,841	2,664	0	0	0	1,154	-448	-921	-2,188	0	-2,183	-3,763
1969	0	0	0	-26,948	1,284	0	0	-1,047	-1,013	-2,188	0	0	-29,912
1995	0	0	0	0	10,670	-113	0	6,801	2,762	-2,188	0	-2,183	15,749
1938	0	0	-4,356	0	0	0	1,356	-3,444	0	-2,189	0	0	-8,633
1998	0	0	0	-9,856	2	8,197	2,209	-368	0	-2,188	0	0	-2,004
1982	0	0	0	-18,492	1,939	0	0	0	0	-2,188	0	-3,101	-21,842
1967	0	0	0	0	0	-3,028	-9,525	6,535	2,762	-2,188	0	-2,184	-7,628
1952	0	0	0	0	820	547	0	-3,380	0	-2,188	0	0	-4,201
1958	0	0	0	0	-12,474	-4,991	-3,324	3,923	0	-2,188	0	0	-19,054
1980	0	0	0	26,986	-7,495	2,603	0	-1,047	-1,013	-2,188	0	0	17,846
1978	0	0	0	0	0	0	0	0	2,874	0	0	0	2,874
1922	0	0	0	0	-616	-411	2,762	-3,065	-1,927	0	-655	-1,521	-5,433
1956	0	0	-35,189	1	0	-3,209	1,155	0	-6,911	-2,188	0	0	-46,341
1942	0	0	2	-1,480	0	-951	1,841	0	0	-2,188	0	0	-2,776
1941	0	0	0	4,465	-502	-311	-485	0	-1,550	0	-655	-1,520	-558
1986	0	0	0	0	110	-7,675	4,603	2,855	2,762	0	0	0	2,655
1993	0	0	0	0	0	0	0	0	-33,283	0	-655	-1,521	-35,459
1997	0	-2,162	0	-2,646	1	0	0	0	0	0	0	0	-4,807
1996	0	0	0	0	8,656	-7,490	1,311	4,431	1,749	0	0	0	8,657
1943	0	0	0	0	1,270	-1,791	0	0	-2,056	0	0	-2,173	-4,750
1937	0	0	0	0	-413	-283	5,489	0	0	0	0	0	4,793
1974	0	0	0	-3,817	0	-5,708	1,842	1	0	0	0	-2,174	-9,856
1975	0	0	0	0	2	1	-920	0	15,625	0	-655	-1,520	12,533
1965	0	0	0	-20,065	2	-14,515	7,212	0	0	0	0	21,421	-5,945
1936	0	0	0	0	-34,806	-33,244	553	0	0	0	0	0	-67,497
1984	-2,113	921	0	0	0	3,935	0	0	0	0	0	0	2,743
1979	0	0	0	-2,934	0	-9,545	-921	475	0	0	0	0	-12,925
1945	0	0	0	0	-11,476	-22,968	876	0	0	0	0	0	-33,568
1999	0	0	0	0	0	-3,806	3,403	0	-8,664	0	0	0	-9,067
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	-22,990	0	-644	-1,532	-25,166
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	21,285	0	0	0	-7,762	-2,283	0	0	0	0	0	11,240
1973	0	0	0	0	0	-17,505	0	0	3,356	0	0	0	-14,149
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	-2,163	0	0	0	10,301	0	0	0	8,138
1940	0	0	0	0	-3,067	-3,922	-538	0	0	0	0	0	-7,527
1923	0	0	3	0	0	0	1,750	0	0	0	0	0	1,753
1921	0	0	0	0	0	-8,525	-2,076	0	0	0	0	0	-10,601
1970	0	0	0	26,810	-7,146	-15,760	0	0	0	0	0	0	3,904
1951	0	0	-31,771	0	0	0	0	0	0	0	0	0	-31,771
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	-3,647	-2,430	0	0	0	0	0	0	-6,077
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	2	1	0	0	0	0	0	0	3
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	3	0	0	0	0	-5,339	-501	0	0	0	0	0	-5,837
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	-34	-2,285	0	0	-6,452	0	0	0	0	0	0	-8,771
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	2	1	0	0	0	0	0	0	3
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	-11,189	-19,829	0	0	0	0	0	0	0	0	0	0	-31,018
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	-12,278	0	0	0	0	0	0	0	-12,278
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	2	0	0	0	0	0	0	0	0	0	0	0	2
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.5-9

Total La Grange Release to River (Acre-feet) (Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,062	51,153	130,736	195,849	250,253	204,441	194,878	215,371	78,864	31,620	77,330	1,479,061
Above Normal	18,182	31,500	73,749	78,723	129,963	114,036	93,321	82,944	23,193	14,739	14,739	14,736	689,825
Below Normal	18,058	18,665	25,785	19,559	35,935	39,012	56,992	58,008	4,463	4,612	4,612	4,463	290,164
Dry	20,742	17,730	17,945	17,522	25,852	25,876	29,552	30,537	4,349	4,494	4,494	4,349	203,440
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,294	20,791	39,330	62,497	95,675	108,970	96,207	91,694	69,767	28,125	14,297	27,611	675,258

Total La Grange Release to River (Acre-feet) (Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,382	22,062	48,627	124,111	190,719	245,157	199,412	189,305	200,624	78,864	30,959	75,248	1,431,469
Above Normal	17,886	30,698	68,220	78,114	120,555	105,165	91,467	82,787	18,214	14,739	14,739	14,263	656,848
Below Normal	17,484	16,058	22,744	19,551	35,285	38,726	56,136	58,008	4,463	4,612	4,612	4,463	282,142
Dry	20,742	15,449	16,739	16,127	24,251	25,876	29,552	30,537	4,349	4,494	4,494	4,349	196,957
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,112	19,882	36,809	60,209	91,874	105,597	94,225	90,031	64,418	28,125	14,104	26,904	652,291

Difference in Total La Grange Release to River (Acre-feet) (Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	123	0	2,526	6,626	5,129	5,096	5,029	5,572	14,747	0	661	2,083	47,592
Above Normal	297	802	5,528	609	9,408	8,871	1,853	157	4,979	0	0	473	32,977
Below Normal	574	2,607	3,041	8	650	286	856	0	0	0	0	0	8,022
Dry	0	2,282	1,205	1,395	1,601	0	0	0	0	0	0	0	6,483
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	181	909	2,522	2,288	3,801	3,372	1,982	1,663	5,349	0	193	708	22,968

Table 4.5-10

Total La Grange Release to River (Acre-feet) (Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,062	51,153	130,736	195,849	250,253	204,441	194,878	215,371	78,864	31,620	77,330	1,479,061
Above Normal	18,182	31,500	73,749	78,723	129,963	114,036	93,321	82,944	23,193	14,739	14,739	14,736	689,825
Below Normal	18,058	18,665	25,785	19,559	35,935	39,012	56,992	58,008	4,463	4,612	4,612	4,463	290,164
Dry	20,742	17,730	17,945	17,522	25,852	25,876	29,552	30,537	4,349	4,494	4,494	4,349	203,440
Critical	14,534	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,250
All Years	20,294	20,791	39,330	62,497	95,675	108,970	96,207	91,694	69,767	28,125	14,297	27,611	675,258

Total La Grange Release to River (Acre-feet) (Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	26,505	22,228	52,690	132,897	195,713	251,883	203,746	194,388	216,210	79,958	31,729	77,274	1,485,222
Above Normal	18,307	30,194	75,617	77,318	133,414	121,042	93,276	82,916	24,252	14,739	14,777	14,826	700,678
Below Normal	18,058	18,668	25,976	19,559	36,239	40,197	57,034	58,008	4,463	4,612	4,612	4,463	291,887
Dry	21,603	19,256	17,945	17,522	26,796	25,876	29,552	30,537	4,349	4,494	4,494	4,349	206,770
Critical	14,533	11,590	12,560	11,644	10,518	11,644	20,489	21,172	2,975	3,074	3,074	2,975	126,249
All Years	20,456	20,812	40,195	62,838	96,544	111,073	96,000	91,545	70,232	28,445	14,337	27,614	680,091

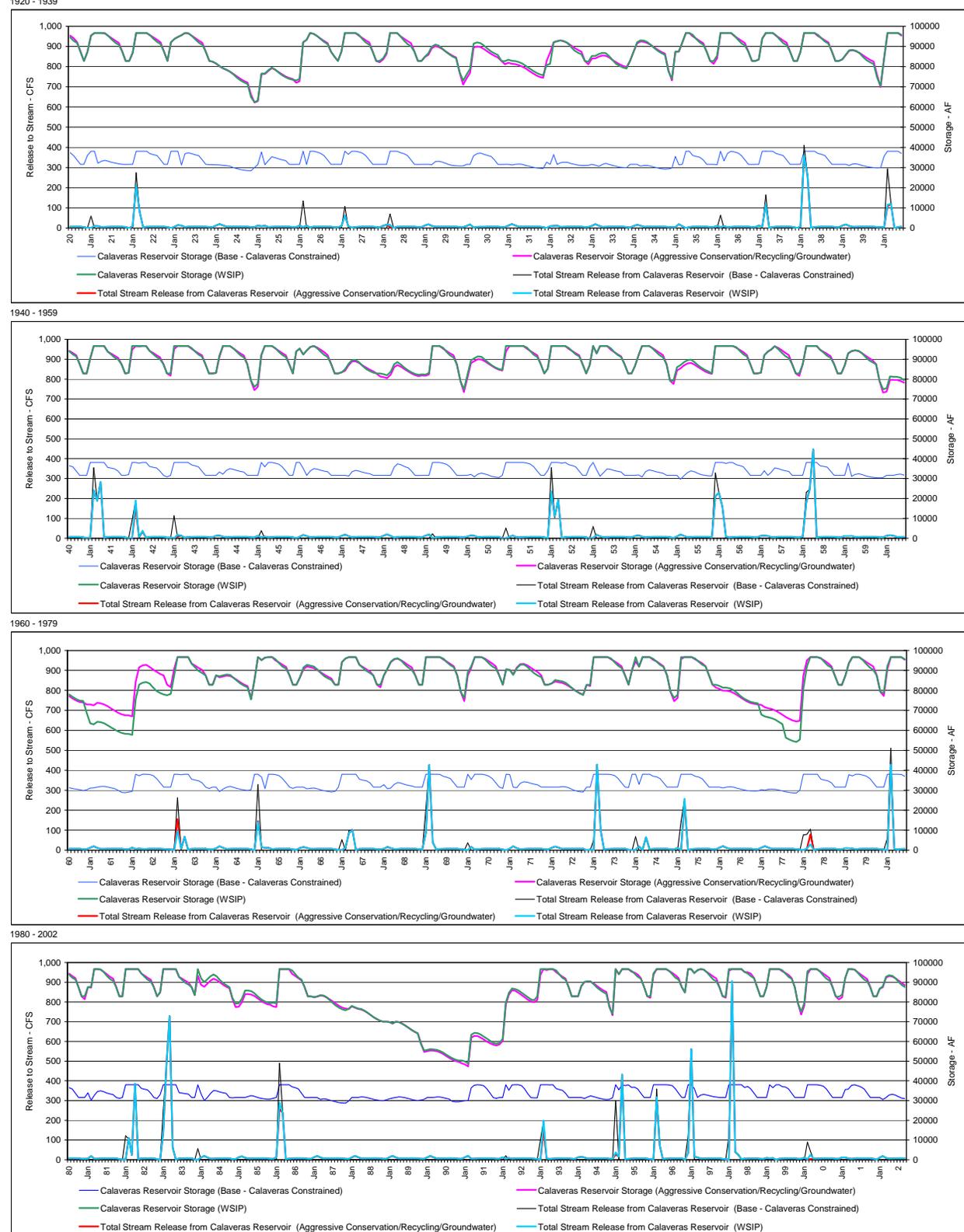
Difference in Total La Grange Release to River (Acre-feet) (Average within Year Type - Grouped by SJR Index Year Type)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	0	-167	-1,537	-2,161	136	-1,630	695	489	-839	-1,094	-109	56	-6,161
Above Normal	-124	1,306	-1,869	1,404	-3,450	-7,006	45	28	-1,059	0	-38	-90	-10,853
Below Normal	0	-3	-190	0	-304	-1,185	-42	0	0	0	0	0	-1,724
Dry	-861	-1,525	0	0	-944	0	0	0	0	0	0	0	-3,330
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
All Years	-162	-20	-865	-341	-870	-2,103	207	149	-465	-320	-40	-2	-4,833

or up to almost an added month of release. Normally, the effect of a change in release would not affect the year's peak stream release rate during a year. However, infrequently, the alternative's effect on stream releases could manifest as an elimination of all flow during a year or as the only provision of flow that occurs in excess of minimum FERC flow requirements. Compared to the base setting, the alternative's effect to stream flow ranges from a reduction in releases (a potential delay in release of 6 days) to an increase in releases (a potential additional 4 days of release).

4.6 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

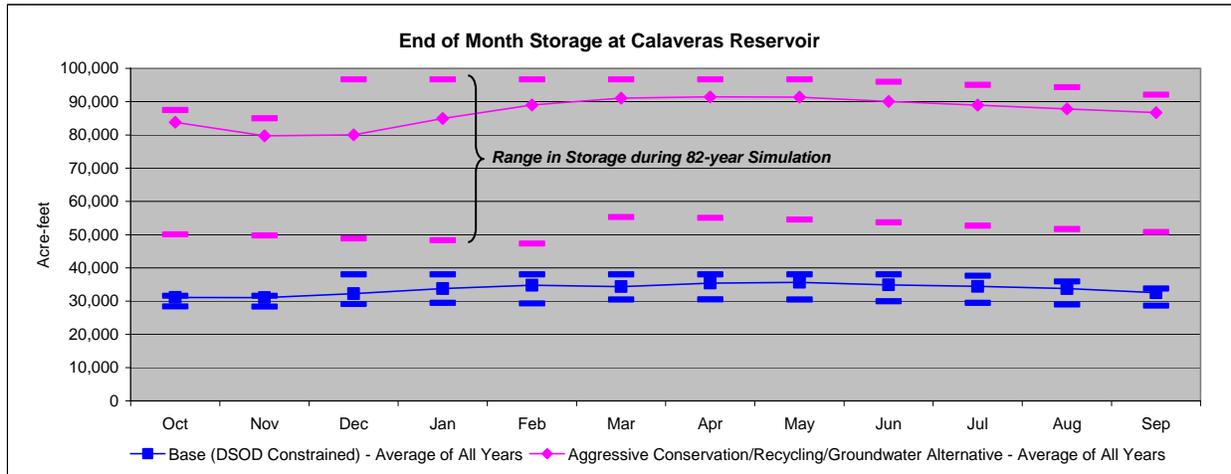
Compared to the WSIP setting, the operation of Calaveras Reservoir in the alternative setting is almost identical. Figure 4.6-1 illustrates a chronological trace of the simulation of Calaveras Reservoir storage and stream releases from Calaveras Dam. Shown in Figure 4.6-1 are the results for the WSIP, alternative, and base settings. Recognizing the different levels of system-wide deliveries served in each setting, the near identical operation of Calaveras Reservoir resulting from the two settings indicates that Calaveras Reservoir operations are mostly influenced by the principles that manage local watershed production. The differences in reservoir operation during the droughts of the 1960s and 1976-1977 are the result of modeling assumptions that balance reservoir storage among SFPUC reservoirs and the selection of the monthly SJPL conveyance rate. It is anticipated that the difference in Calaveras Reservoir operation in actual operations would be minimal, if any.

Figure 4.6-1
Calaveras Reservoir Storage and Stream Release



The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. Under both the alternative and WSIP settings, the full capacity of Calaveras Reservoir would be available, and a greater range in storage operation would occur. Figure 4.6-2 illustrates the average monthly storage in Calaveras Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 4.6-2



Compared to the WSIP setting, there would potentially be more or less release to Calaveras Creek below Calaveras Dam in the alternative setting. Both settings have fishery releases that are not included in the base setting. Calaveras Reservoir storage in the alternative setting is sometimes more and sometimes less than in the WSIP setting; however, in either direction, the difference is minor. Table 4.6-1 illustrates the difference in releases to Calaveras Creek between the alternative and WSIP settings (considered non-substantial). Supplementing the Figure 4.6-1 representation of Calaveras Dam stream releases and Table 4.6-1 is Table 4.6-2, illustrating releases for the alternative and WSIP settings, and the difference in releases between the two. Table 4.6-3 provides the same form of information for the alternative and base settings. The notable difference in releases between the alternative and base settings is the addition of the required flows to satisfy the 1997 MOU and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

There would be very little if any difference in Alameda Creek diversions to Calaveras Reservoir in the alternative setting compared to the WSIP setting. With essentially the same storage conditions between the two, there would be no difference in diversions from the Alameda Creek watershed. With no difference in the diversion at Alameda Creek Diversion Dam, flow spilling past the diversion dam would be the same in the alternative setting. Table 4.6-4 illustrates the difference in flow below the Alameda Creek Diversion Dam between the alternative and WSIP settings (considered non-substantial). Table 4.6-5 illustrates the difference in flow below Alameda Creek Diversion Dam between the alternative and base settings. In this comparison, the reduction in flow below the diversion dam is due to the additional diversions to Calaveras Reservoir resulting from the restoration of reservoir operating capacity. Table 4.6-6 and Table 4.6-7 illustrate the flow past the Alameda Creek Diversion Dam, comparing the alternative, WSIP, and base settings by year type and the average of all years.

Table 4.6-1

Water Year	Aggressive Conservation/Recycling/Groundwater minus WSIP												WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	-9	0	0	0	0	0	0	0	-9
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	-713	0	0	0	0	0	0	-713
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	-60	0	0	0	0	0	0	-60
1938	0	0	0	0	-136	0	0	0	0	0	0	0	-136
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	-487	0	0	0	0	0	0	0	-487
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	-1,920	0	-207	0	0	0	0	0	-2,127
1943	0	0	0	0	-294	0	0	0	0	0	0	0	-294
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-140	0	0	0	0	0	0	0	0	0	-140
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	3,290	0	0	0	0	0	0	0	3,290
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	288	0	0	0	0	0	0	0	0	288
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	-45	0	0	0	0	0	0	0	-45
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	-935	0	0	0	0	0	0	-935
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	2,982	0	0	0	0	0	0	2,982
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	-1,403	0	0	0	0	0	0	0	-1,403
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	-1,898	0	0	0	0	0	0	0	-1,898
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	-2,842	0	0	0	0	0	0	0	-2,842
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	-676	0	0	0	0	0	0	0	0	-676
1996	0	0	0	0	-750	0	0	0	0	0	0	0	-750
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	-871	0	0	0	0	0	0	0	-871
1999	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	-1,287	0	0	0	0	0	0	-1,287
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-2	-5	-90	0	-3	0	0	0	0	0	-99

Table 4.6-2

Total Stream Release from Calaveras Reservoir (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,057	5,041	14,741	10,007	5,072	255	387	417	425	415	38,494	
Above Normal	425	258	172	823	3,593	2,890	650	327	396	423	428	417	10,801	
Normal	429	275	195	548	725	512	264	370	408	428	430	417	5,001	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	386	1,552	4,148	2,921	1,321	350	403	426	428	417	13,049	

Total Stream Release from Calaveras Reservoir (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,065	5,083	15,133	10,007	5,085	255	387	417	425	415	38,494	
Above Normal	425	258	172	806	3,657	2,849	650	327	396	423	428	417	10,807	
Normal	429	275	195	548	725	556	264	370	408	428	430	417	5,046	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	387	1,557	4,238	2,921	1,323	350	403	426	428	417	13,148	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-9	-42	-392	0	-13	0	0	0	0	0	-456	
Above Normal	0	0	0	17	-64	41	0	0	0	0	0	0	-6	
Normal	0	0	0	0	0	-45	0	0	0	0	0	0	-45	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-2	-5	-90	0	-3	0	0	0	0	0	-99	

Table 4.6-3

Total Stream Release from Calaveras Reservoir (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	1,057	5,041	14,741	10,007	5,072	255	387	417	425	415	38,494	
Above Normal	425	258	172	823	3,593	2,890	650	327	396	423	428	417	10,801	
Normal	429	275	195	548	725	512	264	370	408	428	430	417	5,001	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	386	1,552	4,148	2,921	1,321	350	403	426	428	417	13,049	

Total Stream Release from Calaveras Reservoir (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	1,736	9,221	16,641	9,968	5,024	0	0	0	0	0	42,590	
Above Normal	0	0	184	2,731	5,911	3,096	459	0	0	0	0	0	12,382	
Normal	0	0	216	364	882	353	0	0	0	0	0	0	1,815	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	419	2,437	4,645	2,656	1,076	0	0	0	0	0	11,232	

Difference in Total Stream Release from Calaveras Reservoir (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	-680	-4,180	-1,899	39	48	255	387	417	425	415	-4,097	
Above Normal	425	258	-12	-1,908	-2,318	-206	190	327	396	423	428	417	-1,581	
Normal	429	275	-22	184	-157	159	264	370	408	428	430	417	3,186	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	-33	-884	-497	265	245	350	403	426	428	417	1,817	

Table 4.6-4

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet)													Aggressive Conservation/Recycling/Groundwater minus WSIP	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	
1922	0	0	0	0	0	0	0	0	0	0	0	0	0	
1923	0	0	0	0	0	0	0	0	0	0	0	0	0	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	
1927	0	0	0	0	0	0	0	0	0	0	0	0	0	
1928	0	0	0	0	0	0	0	0	0	0	0	0	0	
1929	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-1,272	0	0	0	0	0	0	0	-1,272	
1937	0	0	0	0	0	0	0	0	0	0	0	0	0	
1938	0	0	0	0	0	0	0	0	0	0	0	0	0	
1939	0	0	0	0	0	0	0	0	0	0	0	0	0	
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	
1941	0	0	0	0	0	0	0	0	0	0	0	0	0	
1942	0	0	0	1,922	0	0	0	0	0	0	0	0	1,922	
1943	0	0	0	457	-1,316	0	0	0	0	0	0	0	-859	
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	
1946	0	0	0	0	0	0	0	0	0	0	0	0	0	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	2,511	-2,746	-72	402	0	0	0	0	0	0	95	
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	
1973	0	0	0	-586	0	0	0	0	0	0	0	0	-586	
1974	0	0	0	2,096	0	1,320	0	0	0	0	0	0	3,416	
1975	0	0	0	0	-671	0	0	0	0	0	0	0	-671	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	
1983	0	0	0	0	0	0	0	922	0	0	0	0	922	
1984	0	0	3,332	0	0	0	0	0	0	0	0	0	3,332	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	1,034	0	752	0	0	0	0	0	0	1,786	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	215	0	0	0	0	0	0	0	0	215	
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	0	0	71	29	-41	30	0	11	0	0	0	0	101	

Table 4.6-5

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	-2,559	-1,353	0	0	0	0	0	0	0	-3,913
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	-2,856	-1,688	-1,004	0	0	0	0	0	0	0	-5,547
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	-3,210	0	0	0	0	0	0	0	-3,210
1927	0	0	0	0	0	0	373	0	0	0	0	0	373
1928	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-2,367	0	0	0	0	0	0	0	-2,367
1937	0	0	0	0	-3,964	0	0	0	0	0	0	0	-3,964
1938	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	-156	0	0	0	0	0	-156
1941	0	0	0	-1,197	0	0	0	0	0	0	0	0	-1,197
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	-1,316	0	0	0	0	0	0	0	-1,316
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	-4,471	0	0	0	0	0	0	0	-4,471
1946	0	0	-4,651	-1,522	0	0	0	0	0	0	0	0	-6,173
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	-5,524	0	0	0	0	0	0	-5,524
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	-2,793	-130	301	0	0	0	0	0	0	-2,622
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	-3,892	0	0	0	0	0	0	0	0	-3,892
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	-1,919	0	0	0	0	0	0	0	-1,919
1963	0	0	0	-2,219	0	0	0	0	0	0	0	0	-2,219
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	-1,921	0	0	0	3,250	0	0	0	0	0	1,329
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	-1,676	-1,872	0	0	0	0	0	0	0	-3,548
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	-4,247	0	-1,623	0	0	0	0	0	0	-5,870
1971	0	0	-613	0	0	0	0	0	0	0	0	0	-613
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	-4,926	0	0	0	0	0	0	0	0	-4,926
1974	0	0	-1,019	0	0	1,444	0	0	0	0	0	0	425
1975	0	0	0	0	-5,196	0	-156	0	0	0	0	0	-5,352
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	-4,152	-3,403	0	0	0	0	0	0	0	-7,556
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	-3,360	0	-101	0	0	0	0	0	0	-3,462
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	687	0	0	0	0	687
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	-3,578	0	0	0	0	0	0	0	-3,578
1993	0	0	0	0	0	651	0	0	0	0	0	0	651
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	-5,239	0	0	0	0	0	0	0	0	-5,239
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	-2,798	0	1,392	0	0	0	0	0	-1,406
2000	0	0	0	0	-4,567	0	0	0	0	0	0	0	-4,567
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	0	0	-135	-481	-502	-59	54	8	0	0	0	0	-1,115

Table 4.6-6

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,269	7,982	5,751	2,962	173	0	0	0	0	24,544	
Above Normal	7	23	843	2,575	3,896	3,237	969	0	0	0	0	0	11,551	
Normal	0	6	585	264	813	459	117	6	0	0	0	0	2,250	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	565	1,818	2,578	1,922	803	35	0	0	0	0	7,734	

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,172	7,982	5,751	2,962	116	0	0	0	0	24,389	
Above Normal	7	23	695	2,526	4,017	3,092	969	0	0	0	0	0	11,330	
Normal	0	6	377	264	893	459	117	6	0	0	0	0	2,122	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	494	1,789	2,618	1,892	803	24	0	0	0	0	7,633	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	97	0	0	0	58	0	0	0	0	155	
Above Normal	0	0	148	49	-121	146	0	0	0	0	0	0	222	
Normal	0	0	208	0	-80	0	0	0	0	0	0	0	129	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	71	29	-41	30	0	11	0	0	0	0	101	

Table 4.6-7

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,269	7,982	5,751	2,962	173	0	0	0	0	24,544	
Above Normal	7	23	843	2,575	3,896	3,237	969	0	0	0	0	0	11,551	
Normal	0	6	585	264	813	459	117	6	0	0	0	0	2,250	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	565	1,818	2,578	1,922	803	35	0	0	0	0	7,734	

Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	28	1,379	6,967	8,099	5,757	2,972	130	0	0	0	0	25,331	
Above Normal	7	23	1,184	3,672	5,292	3,096	692	0	0	0	0	0	13,968	
Normal	0	6	914	868	1,785	906	126	6	0	0	0	0	4,611	
Below Normal	0	0	18	45	106	191	2	0	0	0	0	0	361	
Dry	0	0	17	0	163	0	6	0	0	0	0	0	186	
All Years	1	12	700	2,299	3,079	1,982	750	27	0	0	0	0	8,849	

Difference in Flow Passing Alameda Creek Diversion Dam (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	-697	-117	-6	-10	43	0	0	0	0	-788	
Above Normal	0	0	-341	-1,097	-1,396	141	277	0	0	0	0	0	-2,416	
Normal	0	0	-329	-604	-972	-447	-10	0	0	0	0	0	-2,361	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-135	-481	-502	-59	54	8	0	0	0	0	-1,115	

Comparing the alternative and WSIP settings, differences in releases from Calaveras Dam to the stream, and differences to spills at Alameda Creek Diversion Dam, would result in differences in flow below the Alameda Creek and Calaveras Creek confluence. Table 4.6-8 illustrates the flow below the confluence for the alternative and WSIP settings. The modeled difference of these parameters has been described above as being non-substantial; thus, the combined effect of the differences at the confluence is considered non-substantial. Fishery releases for the 1997 MOU are assumed in both of the settings. Table 4.6-9 provides the same form of information for the alternative and base settings. The notable differences between the alternative and base settings (comparable to the difference between the WSIP and base settings) are the addition of required stream flows for the 1997 MOU and the reduction of wetter-year/wet season flows due to the restoration of Calaveras Reservoir storage.

Table 4.6-8

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Aggressive Conservation/Recycling/Groundwater	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,780	12,319	23,911	16,744	8,636	605	417	430	430	417	67,444	
Above Normal	437	327	1,259	3,996	8,266	6,689	1,929	430	417	430	430	417	25,026	
Normal	430	304	1,006	1,081	1,924	1,298	539	435	417	430	430	417	8,712	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,130	3,780	7,256	5,275	2,360	465	417	430	430	417	22,701	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,789	12,265	24,303	16,744	8,649	548	417	430	430	417	67,746	
Above Normal	437	327	1,111	3,929	8,451	6,502	1,929	430	417	430	430	417	24,810	
Normal	430	304	798	1,081	2,004	1,343	539	435	417	430	430	417	8,628	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,061	3,755	7,386	5,245	2,362	454	417	430	430	417	22,699	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Aggressive Conservation/Recycling/Groundwater minus WSIP	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-9	55	-392	0	-13	58	0	0	0	0	-301	
Above Normal	0	0	148	66	-185	187	0	0	0	0	0	0	215	
Normal	0	0	208	0	-80	-45	0	0	0	0	0	0	84	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	70	24	-130	30	-3	11	0	0	0	0	2	

Table 4.6-9

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Aggressive Conservation/Recycling/Groundwater	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	430	326	2,780	12,319	23,911	16,744	8,636	605	417	430	430	417	67,444	
Above Normal	437	327	1,259	3,996	8,266	6,689	1,929	430	417	430	430	417	25,026	
Normal	430	304	1,006	1,081	1,924	1,298	539	435	417	430	430	417	8,712	
Below Normal	430	298	324	858	1,217	1,007	419	430	417	430	430	417	6,677	
Dry	430	298	324	813	1,274	816	423	430	417	430	430	417	6,502	
All Years	431	310	1,130	3,780	7,256	5,275	2,360	465	417	430	430	417	22,701	

Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	1	80	3,460	17,197	25,928	16,711	8,598	307	30	12	4	2	72,329	
Above Normal	12	68	1,612	7,001	11,980	6,754	1,462	103	22	6	2	1	29,023	
Normal	1	29	1,356	1,501	3,053	1,586	284	65	9	2	0	0	7,886	
Below Normal	1	22	78	186	341	412	74	41	7	0	0	0	1,161	
Dry	1	6	43	35	230	69	49	23	1	0	0	0	457	
All Years	3	41	1,298	5,145	8,254	5,069	2,061	107	14	4	1	1	21,999	

Difference in Flow below Alameda/Calaveras Creek Confluence (Acre-feet)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	429	246	-680	-4,877	-2,016	33	38	298	387	417	425	415	-4,884	
Above Normal	425	258	-353	-3,006	-3,714	-65	467	327	396	423	428	417	-3,998	
Normal	429	275	-351	-420	-1,129	-288	255	370	408	428	430	417	825	
Below Normal	429	276	246	672	876	596	345	389	411	429	430	417	5,515	
Dry	429	292	281	778	1,044	747	374	407	416	430	430	417	6,045	
All Years	428	269	-168	-1,365	-998	206	299	358	403	426	428	417	702	

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the alternative and WSIP settings. This facility is assumed to recapture flows explicitly released from Calaveras Dam for the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir for the 1997 MOU. Flows below this diversion have been estimated and noted as the flow above the Alameda and San Antonio confluence. Table 4.6-10 illustrates the flow at this location for the alternative and WSIP settings. The flow changes at this location are consistent with the changes noted for below the confluence of Alameda and Calaveras Creeks. These flow changes are considered non-substantial. Table 4.6-11 provides the same form of information for the alternative and base settings. The flows identified at this location indicate flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated stream accretions between the Alameda and Calaveras Creek confluence and the Alameda and San Antonio Creek confluence, minus the water assumed to be recaptured (diverted) by the SFPUC from the creek.

Table 4.6-10

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Aggressive Conservation/Recycling/Groundwater					WY Total
									Jun	Jul	Aug	Sep		
Wet	6	154	3,172	13,666	25,436	17,847	9,286	556	76	33	15	9	70,256	
Above Normal	19	150	1,455	4,514	8,952	7,099	2,180	217	54	20	9	6	24,677	
Normal	7	64	1,131	913	1,757	1,224	469	134	28	9	4	3	5,742	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,196	3,883	7,369	5,362	2,407	208	38	14	7	4	20,586	

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)													
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	6	154	3,180	13,611	25,828	17,847	9,299	498	76	33	15	9	70,558
Above Normal	19	150	1,308	4,448	9,137	6,913	2,180	217	54	20	9	6	24,462
Normal	7	64	922	913	1,837	1,269	469	134	28	9	4	3	5,658
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853
All Years	9	89	1,127	3,859	7,499	5,332	2,409	197	38	14	7	4	20,583

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Aggressive Conservation/Recycling/Groundwater minus WSIP					WY Total
									Jun	Jul	Aug	Sep		
Wet	0	0	-9	55	-392	0	-13	58	0	0	0	0	-301	
Above Normal	0	0	148	66	-185	187	0	0	0	0	0	0	215	
Normal	0	0	208	0	-80	-45	0	0	0	0	0	0	84	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	70	24	-130	30	-3	11	0	0	0	0	2	

Table 4.6-11

Alameda Creek Flow abv San Antonio Confluence (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Aggressive Conservation/Recycling/Groundwater					WY Total
									Jun	Jul	Aug	Sep		
Wet	6	154	3,172	13,666	25,436	17,847	9,286	556	76	33	15	9	70,256	
Above Normal	19	150	1,455	4,514	8,952	7,099	2,180	217	54	20	9	6	24,677	
Normal	7	64	1,131	913	1,757	1,224	469	134	28	9	4	3	5,742	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,196	3,883	7,369	5,362	2,407	208	38	14	7	4	20,586	

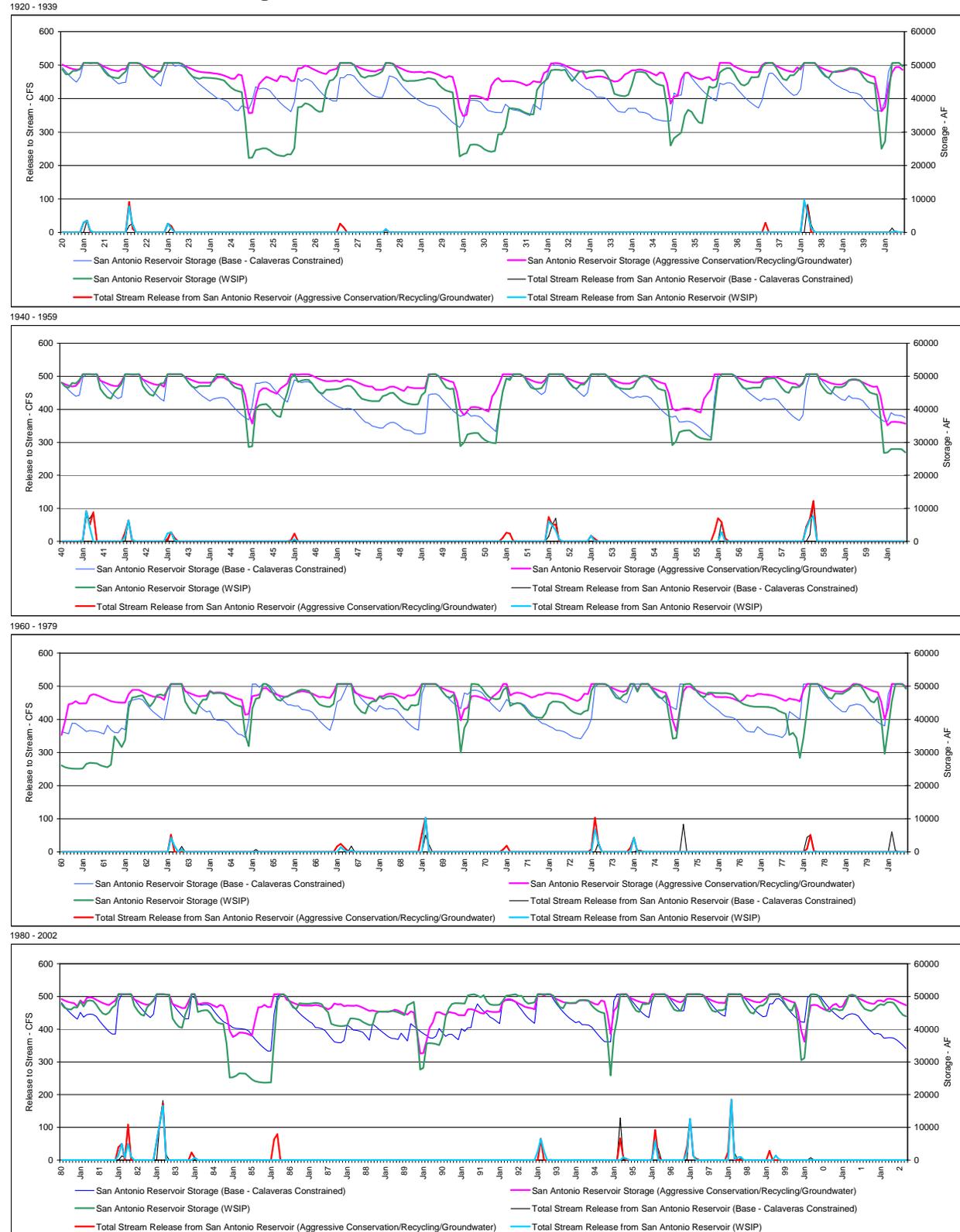
Alameda Creek Flow abv San Antonio Confluence (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Base - Calaveras Constrained				WY Total
										Jul	Aug	Sep		
Wet	6	154	3,968	18,668	27,692	17,977	9,358	513	76	33	15	9	78,470	
Above Normal	19	150	1,981	7,819	13,060	7,467	1,861	217	54	20	9	6	32,664	
Normal	7	64	1,676	1,881	3,611	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,733	9,022	5,616	2,356	199	38	14	7	4	24,656	

Difference in Alameda Creek Flow abv San Antonio Confluence (Acre-feet)														
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained					WY Total
									Jun	Jul	Aug	Sep		
Wet	0	0	-796	-5,002	-2,256	-131	-72	43	0	0	0	0	-8,214	
Above Normal	0	0	-525	-3,305	-4,108	-367	319	0	0	0	0	0	-7,987	
Normal	0	0	-545	-968	-1,854	-783	-10	0	0	0	0	0	-4,159	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-371	-1,850	-1,654	-254	50	8	0	0	0	0	-4,070	

Compared to the WSIP setting, the alternative’s San Antonio Reservoir operation would draw less from storage on annual basis, and particularly during cyclic maintenance. Figure 4.6-3 illustrates a chronological trace of the simulation of San Antonio Reservoir storage and stream releases from San Antonio Dam. Shown in Figure 4.6-3 are the results for the WSIP, alternative, and base settings. The difference in San Antonio Reservoir storage between the alternative and WSIP settings is mostly caused by the lesser demand of the alternative. Considering that Calaveras Reservoir storage is essentially the same between the settings, the difference in San Antonio Reservoir storage indicates the operational strategy to affect storage in San Antonio Reservoir more than storage in the other SFPUC Bay Area reservoirs. San Antonio Reservoir would retain more storage in the alternative setting compared to the WSIP setting.

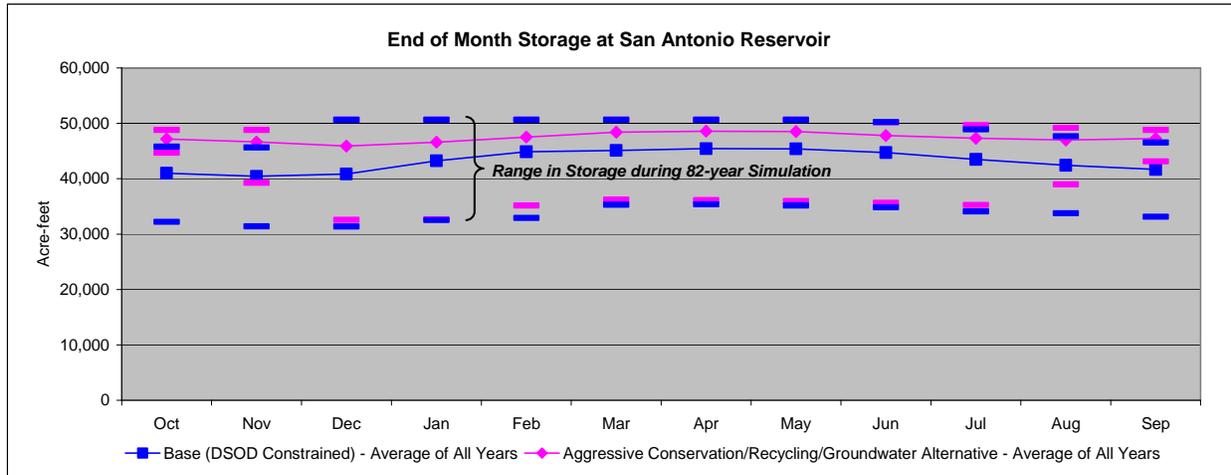
The difference in storage between the alternative and WSIP settings and the base setting is due to the restoration of the operational capacity of Calaveras Reservoir. In the base setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that retains relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. There is also a notable difference in storage operation between the alternative and WSIP settings and the base setting due to assumed maintenance. Assumed systematic maintenance of Hetch Hetchy conveyance facilities constrains diversions to the Bay Area from Hetch Hetchy every year, and particularly during every fifth year in the WSIP and alternative settings.

Figure 4.6-3
San Antonio Reservoir Storage and Stream Release



The reduction in diversion from Hetch Hetchy during these periods is accommodated in the system by the drawing of additional water from Bay Area reservoirs. The proportionate share of this operation is evident in the tracing of San Antonio Reservoir storage for the alternative and WSIP settings. Figure 4.6-4 illustrates the average monthly storage in San Antonio Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. Compared to the base setting, the alternative would draw less storage from San Antonio Reservoir, typically retaining a fuller reservoir.

Figure 4.6-4



Very little change in stream releases below San Antonio Reservoir is anticipated between the alternative and WSIP settings. Table 4.6-12 illustrates the modeled release to San Antonio Creek from San Antonio Reservoir for the two settings and the differences for the average release during a year type. With a fuller reservoir operation at times during the winter, as seen in Figure 4.6-4, a decrease in the ability to regulate reservoir inflow and avoid stream releases would be expected. Given the sometimes rigid constraints within the modeling assumptions, the model will overestimate the frequency and magnitude of stream releases from San Antonio Reservoir under any of the investigated settings. The flexibility that occurs in actual operations would likely avoid most of the releases represented by the model. The modeled stream releases from San Antonio Reservoir and the difference between releases for the alternative and base setting are shown in Table 4.6-13. The differences between the two settings reflect a general increase in modeled releases. This modeled circumstance reflects the different resulting storage operation between the two settings as seen in Figure 4.6-3. In most circumstances the alternative setting storage at San Antonio Reservoir would be higher than projected for the base setting during the same period. This circumstance could lead to an occasionally greater modeled release for the alternative setting, which is reflected in the results. As described above, the model will overestimate the frequency and magnitude of releases from San Antonio Reservoir, and the actual releases from San Antonio Reservoir in any setting and the difference between settings are expected to be minor.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Creek and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. Table 4.6-14 illustrates the flow below the confluence for the alternative and WSIP settings, and the differences in flow between the two. The difference in flow between the alternative and WSIP settings at this location are the net sum of the differences identified for flow reaching the location from Alameda Creek and San Antonio Creek. The difference in flow from upstream in Alameda Creek has previously been identified as non-substantial. Along with the conclusion that flow differences in San Antonio Creek are non-substantial, modeled differences below the confluence are also considered non-substantial.

Table 4.6-12

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	265	1,913	3,632	2,333	1,222	0	0	0	0	0	9,365	
Above Normal	0	0	84	479	1,530	475	0	0	0	0	0	0	2,568	
Normal	0	0	126	251	28	30	0	0	0	0	0	0	435	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	94	522	1,031	560	238	0	0	0	0	0	2,445	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	95	1,054	3,168	1,543	605	121	0	0	0	0	6,586	
Above Normal	0	0	0	540	1,045	277	67	44	0	0	0	0	1,974	
Normal	0	0	0	113	0	40	0	0	0	0	0	0	152	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	19	340	835	366	132	33	0	0	0	0	1,724	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	170	859	464	790	617	-121	0	0	0	0	2,778	
Above Normal	0	0	84	-60	485	198	-67	-44	0	0	0	0	594	
Normal	0	0	126	139	28	-10	0	0	0	0	0	0	283	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	75	182	196	193	106	-33	0	0	0	0	721	

Table 4.6-13

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	265	1,913	3,632	2,333	1,222	0	0	0	0	0	9,365	
Above Normal	0	0	84	479	1,530	475	0	0	0	0	0	0	2,568	
Normal	0	0	126	251	28	30	0	0	0	0	0	0	435	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	94	522	1,031	560	238	0	0	0	0	0	2,445	

Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	538	2,350	2,480	1,324	88	0	0	0	0	6,780	
Above Normal	0	0	0	0	881	883	12	58	0	0	0	0	1,835	
Normal	0	0	0	0	1	0	0	0	0	0	0	0	1	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	0	105	641	667	261	29	0	0	0	0	1,703	

Difference in Total Stream Release from San Antonio Reservoir (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	265	1,375	1,282	-147	-102	-88	0	0	0	0	2,585	
Above Normal	0	0	84	479	649	-408	-12	-58	0	0	0	0	733	
Normal	0	0	126	251	27	30	0	0	0	0	0	0	435	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	94	417	390	-108	-22	-29	0	0	0	0	741	

Table 4.6-14

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,437	15,579	29,068	20,180	10,507	556	76	33	15	9	79,621	
Above Normal	19	150	1,539	4,993	10,482	7,574	2,180	217	54	20	9	6	27,245	
Normal	7	64	1,257	1,165	1,785	1,254	469	134	28	9	4	3	6,178	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,290	4,405	8,400	5,922	2,645	208	38	14	7	4	23,030	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,276	14,666	28,996	19,390	9,903	619	76	33	15	9	77,144	
Above Normal	19	150	1,308	4,987	10,182	7,190	2,248	262	54	20	9	6	26,435	
Normal	7	64	922	1,026	1,837	1,308	469	134	28	9	4	3	5,810	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,145	4,199	8,334	5,698	2,541	229	38	14	7	4	22,307	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet) (Average within Year Type - Grouped by 5 Local Reservoir Runoff)													Aggressive Conservation/Recycling/Groundwater minus WSIP	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	161	913	72	790	604	-63	0	0	0	0	2,477	
Above Normal	0	0	231	6	300	385	-67	-44	0	0	0	0	810	
Normal	0	0	335	139	-52	-54	0	0	0	0	0	0	367	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	145	206	66	223	104	-22	0	0	0	0	723	

Table 4.6-15 illustrates the same information for the comparison between the alternative and base settings. Table 4.6-15 illustrates the larger differences in flow that would occur between the alternative and base settings. Those differences are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity and the fuller San Antonio Reservoir in the alternative setting (if the fuller reservoir has any effect on steam releases).

Table 4.6-15

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Aggressive Conservation/Recycling/Groundwater	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,437	15,579	29,068	20,180	10,507	556	76	33	15	9	79,621	
Above Normal	19	150	1,539	4,993	10,482	7,574	2,180	217	54	20	9	6	27,245	
Normal	7	64	1,257	1,165	1,785	1,254	469	134	28	9	4	3	6,178	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,290	4,405	8,400	5,922	2,645	208	38	14	7	4	23,030	

Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	6	154	3,968	19,206	30,042	20,458	10,681	601	76	33	15	9	85,250	
Above Normal	19	150	1,981	7,819	13,941	8,350	1,873	276	54	20	9	6	34,498	
Normal	7	64	1,676	1,881	3,612	2,007	479	134	28	9	4	3	9,902	
Below Normal	7	56	183	404	682	678	156	91	20	5	3	2	2,288	
Dry	6	19	87	98	337	145	96	48	9	3	2	2	853	
All Years	9	89	1,567	5,838	9,664	6,284	2,617	229	38	14	7	4	26,359	

Difference in Flow blw San Antonio and Alameda Creek Confluence (Acre-feet)													Aggressive Conservation/Recycling/Groundwater minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	-532	-3,627	-974	-278	-174	-45	0	0	0	0	-5,629	
Above Normal	0	0	-442	-2,825	-3,459	-776	307	-58	0	0	0	0	-7,253	
Normal	0	0	-419	-716	-1,827	-753	-10	0	0	0	0	0	-3,725	
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	
All Years	0	0	-277	-1,433	-1,263	-362	28	-21	0	0	0	0	-3,329	

4.7 Crystal Springs and San Andreas Reservoirs

There are differences in Crystal Springs Reservoir operations between the WSIP setting and the alternative and base settings. Figure 4.7-1 illustrates a chronological trace of the simulation of Crystal Springs Reservoir storage and stream releases from Crystal Springs Dam. Shown in Figure 4.7-1 are the results for the WSIP, alternative, and base settings. Fundamental to the difference in storage operations between the WSIP setting and the alternative and base settings is the restoration of reservoir operation capacity in the WSIP setting, which does not occur in the alternative or base settings.¹² The result is the operation of Crystal Springs Reservoir at a lower maximum storage in the alternative and base settings. A second difference in Crystal Springs Reservoir storage between the alternative and WSIP setting is caused by the interaction of the increased demand served by the system's resources (a net 271-mgd for the alternative and a net 290-mgd demand for the WSIP in many years), which tends to lessen the operation range of the reservoir in the alternative setting. Replenishment of Crystal Springs Reservoir storage (as well as other Bay Area reservoirs) would be accelerated with less system-wide demand to serve. The alternative setting would provide less carry-over storage at Crystal Springs Reservoir into periods of drought, thereby causing additional draw from other resources to serve the same delivery. The magnitude of the draw of storage from Crystal Springs Reservoir depends partially on the discretionary assumptions of the model that proportion the use of storage among the Bay Area system reservoirs. In actual operations, some of the differences in result may not occur as system operators and prevailing hydraulic and hydrologic conditions may direct the operational effect of the different demand to an alternative apportionment of effect among the reservoirs. However, operation strategy prefers the retention of storage in the Peninsula Reservoirs, similar to the strategy used by the model. Figure 4.7-2 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and WSIP settings.

¹² The Lower Crystal Springs Dam Improvements (LCSDI) project is included in this alternative, but was not modeled. With the LCSDI project included in the alternative the hydrologic effects at Crystal Springs Reservoir would be comparable to the WSIP setting.

**Figure 4.7-1
Crystal Springs Reservoir Storage and Release**

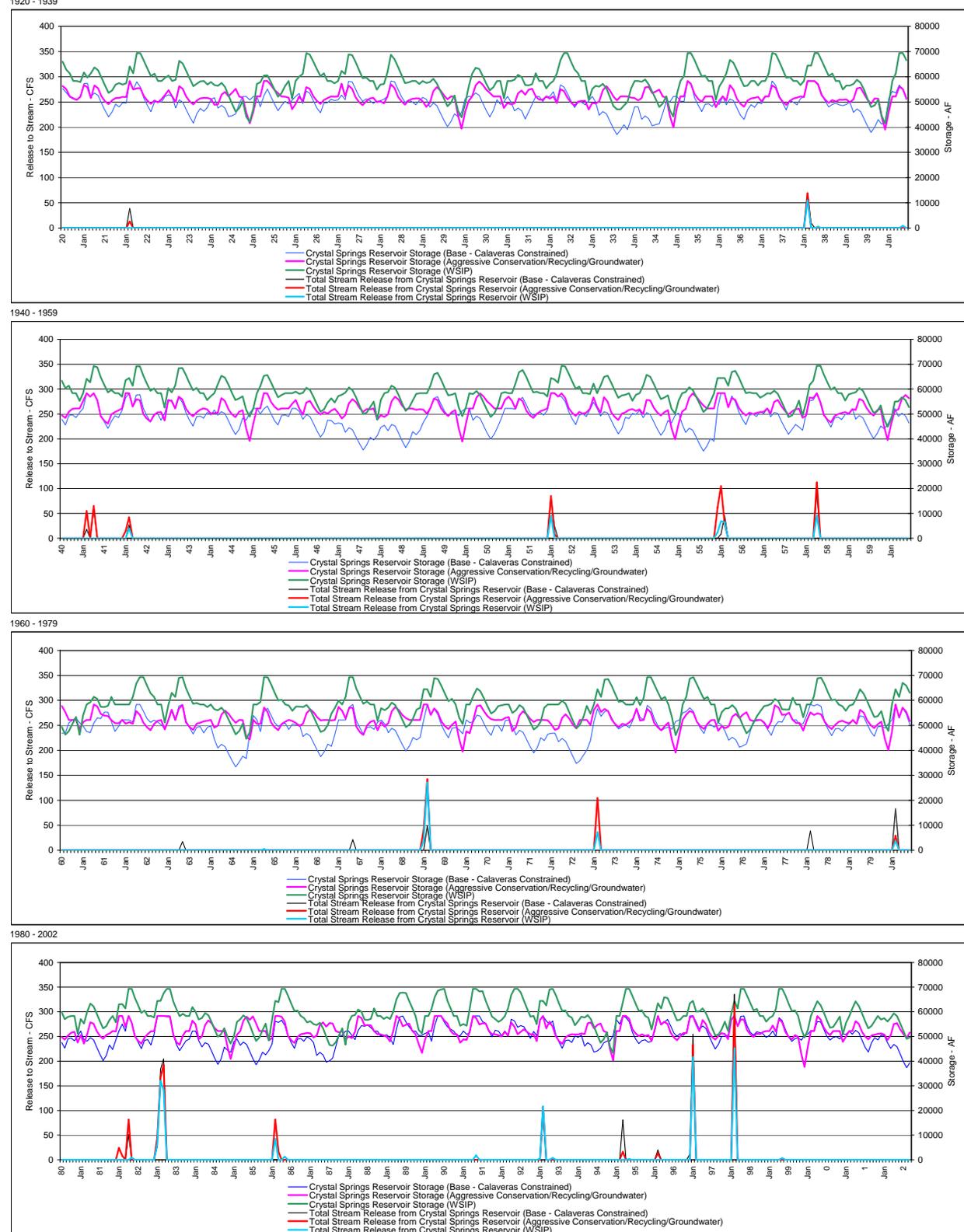


Figure 4.7-2

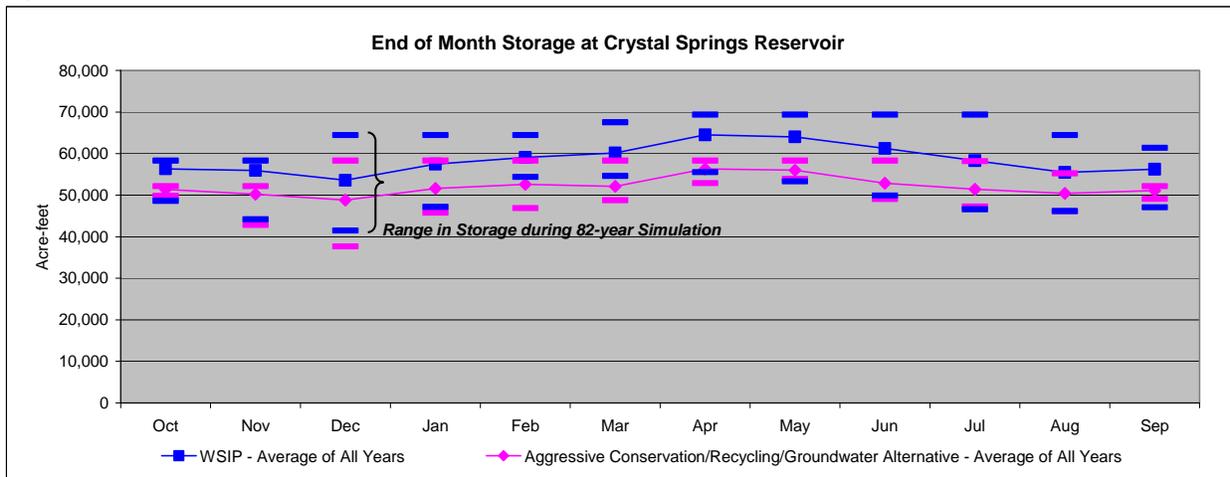


Figure 4.7-3 illustrates the average monthly storage in Crystal Springs Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings. The alternative setting would result in reservoir storage operating at a slightly higher average storage during some months, and the range of operating storage would typically be smaller in the alternative setting.

Figure 4.7-3

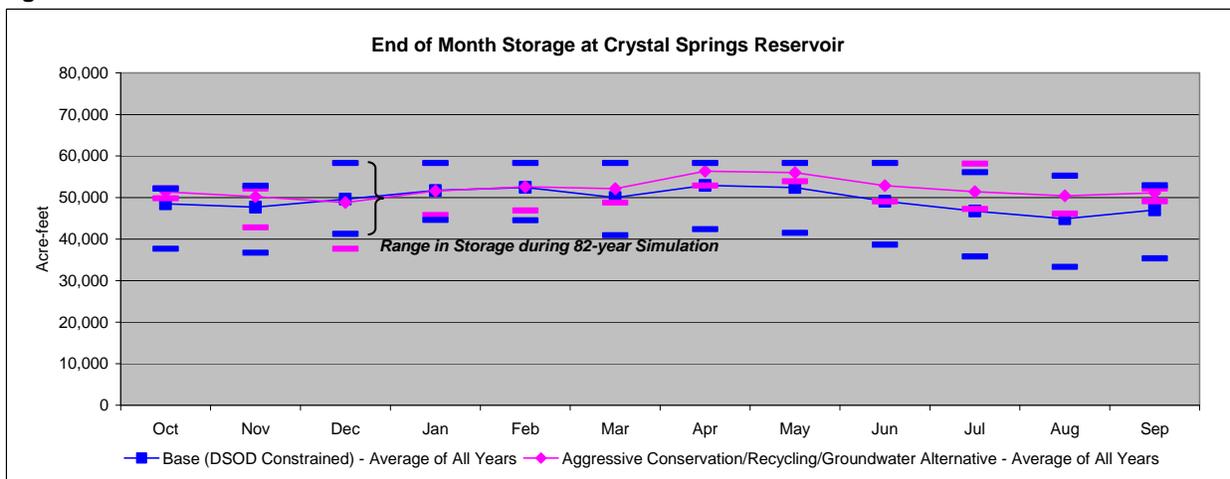


Table 4.7-1 illustrates the modeled alternative and WSIP stream releases from Crystal Springs Reservoir and the differences between the two settings. Modeling results indicate that an increase in the occasional release could occur. The potential difference is attributed to a narrower operating range of reservoir storage in the alternative setting. This narrower range in storage would lead to a greater potential for stream releases. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting, with the effect of essentially no difference between the alternative and WSIP settings. Similarly, Table 4.7-2 illustrates the stream releases for the alternative and base settings, and the difference in modeled flows between the two settings. A lesser draw down in Crystal Springs Reservoir storage associated with the alternative setting would lead to a decreased potential to regulate reservoir inflow, which would lead to additional risk in needing to make stream releases. However, as described above, actual system operations would attempt to minimize releases under any setting; thus, the difference in releases between the alternative and base setting would be minimal, if any.

Table 4.7-1

Total Stream Release from Crystal Springs Reservoir (Acre-feet)																
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	237	2,106	3,643	862	963	0	0	0	0	0	0	7,812		
Above Normal	0	0	0	0	437	0	0	0	0	0	0	0	0	437		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	46	411	802	168	188	0	0	0	0	0	0	1,615		
Total Stream Release from Crystal Springs Reservoir (Acre-feet)																
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	47	1,296	2,512	542	170	54	0	0	0	0	0	4,623		
Above Normal	0	0	0	8	354	0	8	42	0	0	0	0	0	412		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	33	0	0	0	0	0	33		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	9	254	564	106	35	26	0	0	0	0	0	994		
Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)																
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	190	809	1,131	320	793	-54	0	0	0	0	0	3,189		
Above Normal	0	0	0	-8	83	0	-8	-42	0	0	0	0	0	25		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	-33	0	0	0	0	0	-33		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	37	156	238	62	153	-26	0	0	0	0	0	621		

Table 4.7-2

Total Stream Release from Crystal Springs Reservoir (Acre-feet)																
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	237	2,106	3,643	862	963	0	0	0	0	0	0	7,812		
Above Normal	0	0	0	0	437	0	0	0	0	0	0	0	0	437		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	46	411	802	168	188	0	0	0	0	0	0	1,615		
Total Stream Release from Crystal Springs Reservoir (Acre-feet)																
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	44	1,433	2,889	1,134	756	81	0	0	0	0	0	6,336		
Above Normal	0	0	0	0	608	0	0	63	0	0	0	0	0	671		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	9	280	690	221	147	29	0	0	0	0	0	1,375		
Difference in Total Stream Release from Crystal Springs Reservoir (Acre-feet)																
(Average within Year Type - Grouped by 5 Local Reservoir Runoff)																
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total			
Wet	0	0	193	673	755	-272	207	-81	0	0	0	0	0	1,476		
Above Normal	0	0	0	0	-171	0	0	-63	0	0	0	0	0	-234		
Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
All Years	0	0	38	131	112	-53	40	-29	0	0	0	0	0	239		

Reservoir storage at San Andreas Reservoir would follow a systematic filling and lowering each year; however, there would be slight differences in draw down between the alternative and WSIP settings, primarily because of the coincidental effects of different system-wide maintenance and differing water demands within each setting. Figure 4.7-4 illustrates a chronological trace of the simulation of San Andreas Reservoir storage and stream releases from San Andreas Dam. Shown in Figure 4.7-4 are the results for the WSIP, alternative, and base settings. There are no projected stream releases from San Andreas Reservoir in any setting. Compared to the base setting, Figure 4.7-4 illustrates the difference in storage operation every fifth year for the WSIP and alternative settings. These operations are the result of Hetch Hetchy conveyance maintenance, which is assumed to occur systematically in the alternative and WSIP settings. The maintenance constrains the amount of Hetch Hetchy water supplied to serve water demands in the Bay Area. As discussed previously, during these winter periods, the Bay Area reservoir system accommodates the reduction in imported supply by serving the Bay Area water deliveries with the local watersheds' runoff and storage. At San Andreas Reservoir, the serving of water demand affects the reservoir when additional required water production at Harry Tracy WTP associated with WSIP or the alternative exceeds the ability to maintain San Andreas Reservoir storage with pumping from Crystal Springs Reservoir. In the modeling, the conveyance capacity from Crystal Springs Reservoir is assumed to be same among all of the settings. The additional water demand of the WSIP and alternative require additional production from Harry Tracy WTP to be drawn from San Andreas Reservoir.

Figure 4.7-4
San Andreas Reservoir Storage and Stream Release

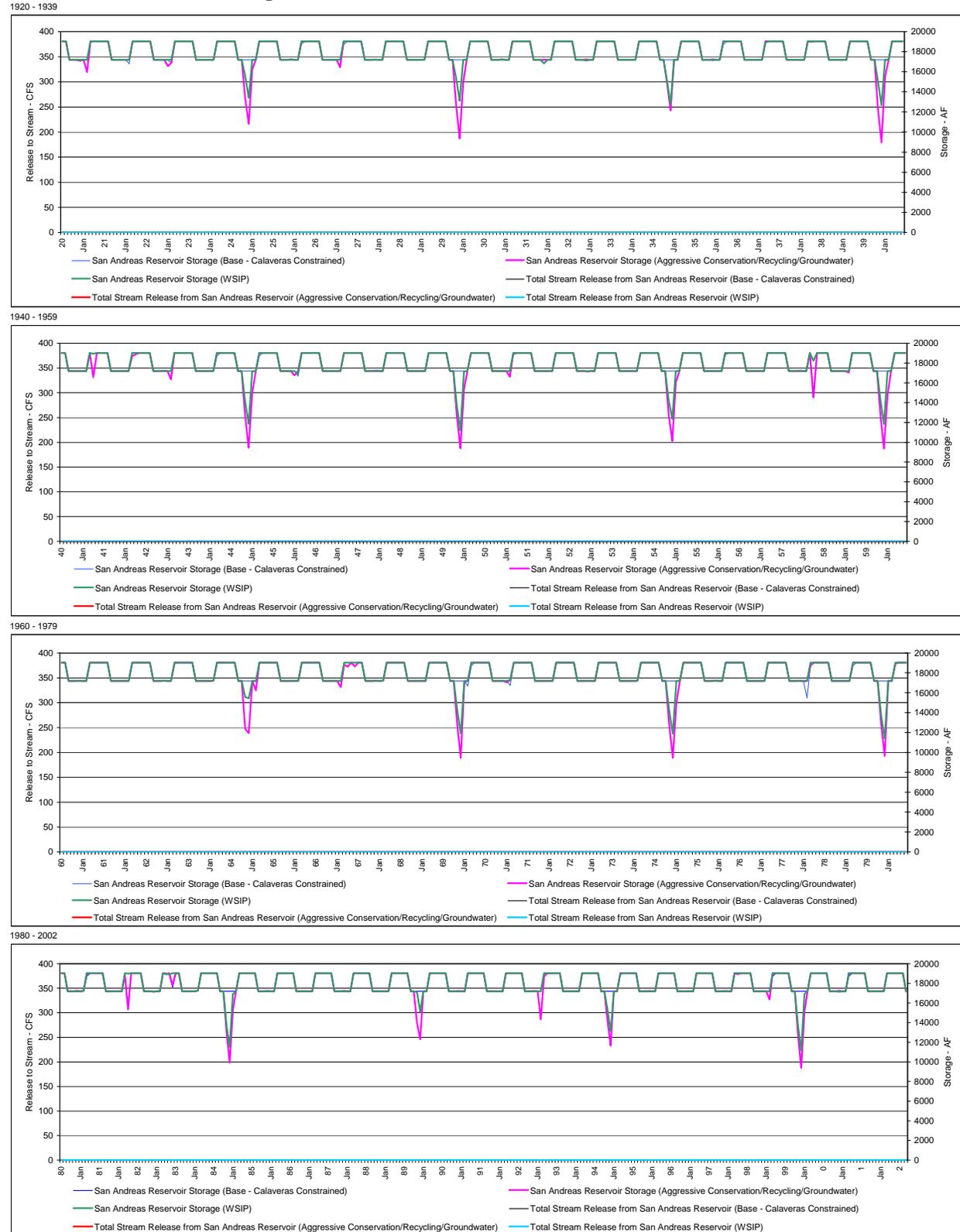
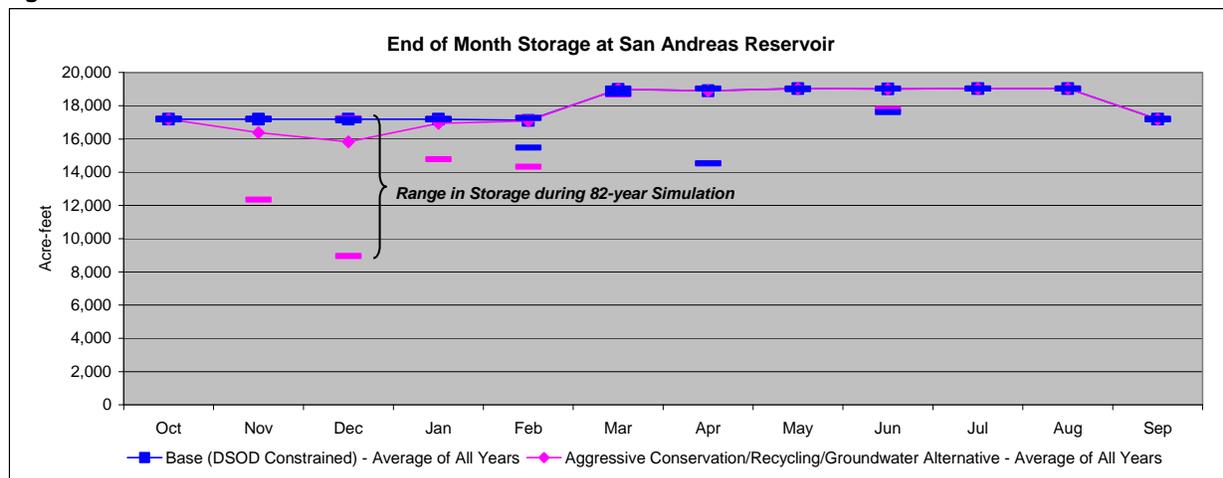


Figure 4.7-5 illustrates the average monthly storage in San Andreas Reservoir for the 82-year simulation, and the range in storage for each month for the alternative and base settings.

Figure 4.7-5



4.8 Pilarcitos Reservoir

Coastside CWD's water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. With the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated at about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. In the alternative, Coastside CWD's contribution to the 19 mgd of conservation, recycling, and groundwater is very small; therefore, Coastside CWD's purchase request in the alternative setting is assumed essentially equal to the WSIP setting. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request and the resultant potential changes to the operation of SFPUC facilities and their affected environs are uncertain.¹³

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs are identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

In the alternative setting, the hydrologic effects to the Pilarcitos Creek watershed would essentially be the same as those identified for the WSIP setting.

¹³ See "Analysis of SFPUC Pilarcitos / Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

4.9 Additional Considerations Regarding the Aggressive Conservation Alternative

The hydrologic effects of Alternative 3, Aggressive Conservation, are described above. The additional observations noted during the formulation and analysis of the alternative are discussed below.

As configured, the alternative serves a total SFPUC purchase request of 300 mgd, and 29 mgd of the purchase request is met with conservation, recycled water, and groundwater programs. The amount of purchase request served by the regional system is a net 271 mgd compared to the net 290 mgd served in the WSIP setting.

The alternative does not implement the Westside Basin Groundwater Program, water transfers from MID/TID, or the restoration of Crystal Springs Reservoir operational capacity, which foregoes 30 mgd of yield during the SFPUC design drought.¹⁴ The foregone yield during the design drought is partially offset in effect to customer deliveries by the 19 mgd of additional conservation provided by the customers that reduces the net delivery demand from the regional system. The net remaining difference between the reduction in yield and lesser regional system demand is accommodated by the imposing of greater shortages (rationing) to deliveries during the design drought. Although the 20-percent maximum rationing objective was achieved in the alternative setting, 4 years of 10 percent greater rationing was required during the 8½-year design drought period (e.g., imposing 10 percent rationing when in the WSIP setting no rationing was required, or imposing 20 percent rationing when in the WSIP setting 10 percent rationing was required). The water delivery protocols that provided a viable operation through the design drought, although resulting in a lesser LOS than the objectives of the WSIP, manifest in additional rationing in other drought periods in the alternative setting.

Without the MID/TID water transfer, the amount of water served from the Tuolumne River during the design drought is about the same as between the alternative and base settings, and is constrained by the size and configuration of SFPUC facilities and the amount of water available to the SFPUC during the period after the rights and entitlements of MID/TID are satisfied. However, during non-drought years when the availability of water to the SFPUC from the Tuolumne River is practicably not constrained, diversions greater than the base setting would occur to serve a portion of the increase in purchase request. The purchase request increases by 35 mgd while the customers' conservation, recycled water, and groundwater programs only offset 29 mgd of regional system demand, thus leaving 6 mgd to be served by other SFPUC resources. Commensurate with the difference, Tuolumne River diversions increase by approximately 5 mgd annually during the 82-year simulation period.¹⁵

To prevent an increase in diversions from the Tuolumne River in the context of the alternative (with the assumed level of conservation, recycled water, and groundwater programs), the SFPUC would be required to further erode the LOS for the 300 mgd of purchase request, reduce the purchase request, or implement additional sources of supply that do not rely on the Tuolumne River.

LOS Reliability Option

As described above, the alternative as configured does not achieve the water supply reliability LOS of the WSIP, requiring greater levels of shortage during drought than the WSIP. Although the maximum severity of shortage for any year of shortage (20 percent) is achieved, a greater level of shortage is required in 4 years during the design drought. The protocols to provide a viable operation during the design drought result in shortages being applied during other drought periods of the 82-year simulation. During the entire simulation period, there would still be an additional average 5 mgd of diversion from the Tuolumne River annually, due to the 271-mgd demand of the typical net regional system, which is greater than the current 265-mgd demand.

¹⁴ The Lower Crystal Springs Dam Improvements (LCSDI) project is included in the alternative, but was not modeled. With the LCSDI project included in the alternative the hydrologic effects at Crystal Springs Reservoir would be comparable to the WSIP setting. The restoration of operational capacity at Crystal Springs Reservoir results in an additional 1 mgd of system firm yield during the Design Drought.

¹⁵ The difference between the 6-mgd increase in purchase request and the 5 mgd of additional Tuolumne River diversion is due to delivery shortages occurring during the 82-year simulation period, which reduces the average amount of water delivered during the simulation period.

If the metric for attempting to prevent increases in Tuolumne River diversions was based on the long-term average annual diversion from the basin, a comparable diversion could occur by further eroding the LOS water supply reliability objective. Assuming delivery shortage (rationing) of up to 25 percent in any year, and applying that shortage at the first hint of drought, a long-term average annual diversion from the basin could result that essentially equals the level of diversions currently occurring. As in the configured alternative, there would continue to be greater diversions from the Tuolumne River during non-drought years; however, during drought, there would be less diversion than occurs in the alternative setting. The delivery shortages during the Design Drought would manifest as 7½ years of 25-percent shortage during the 8½-year period. Approximately 18 percent of the years (15 years) during the 82-year simulation would be subject to the 25-percent shortage.

Alternatively, the SFPUC could attempt to maintain no more than the current diversion from the Tuolumne River basin by reducing the LOS for the level of purchase request. This option would be similar to the No Purchase Increase Alternative described previously in Section 3. There would be a nexus between the amount of additional conservation, recycled water, and groundwater developed and the accepted increase in purchase request. The LOS for level of purchase request, reliability, and firm yield would all be less than the WSIP objectives.

Additional Water Supply Option

If LOS objectives are to be met with the alternative (with its assumed level of conservation, recycled water, and groundwater), with no objective of additional diversion of water from the Tuolumne River, the SFPUC must develop additional water supply resources that do not rely on Tuolumne River water. The nature of the additional supply could be similar to that described in Section 5, Desalination in San Francisco. The development of sufficient supply from supplemental resource(s) would be required to provide additional drought and non-drought supply to meet WSIP LOS objectives while not increasing diversions from the Tuolumne River. As described later in Section 5, the development of supplemental resources separate from the Tuolumne River would not eliminate the potential for year-to-year diversions to change from the base setting. System-wide changes to the regional system, such as a planned maintenance program for the Hetch Hetchy conveyance system, would inherently change the pattern of diversions from the Tuolumne River, which would manifest in year-to-year and seasonal differences between current and future diversions.

5. CEQA Alternative 4 – Lower Tuolumne River Diversion

CEQA Alternative 4 – Lower Tuolumne River Diversion Alternative would, similar to the proposed WSIP, rely primarily on Tuolumne River water to serve the increased system-wide demand. However, instead of the entire SFPUC Tuolumne River diversion originating from Hetch Hetchy Reservoir, the alternative would divert most of the increase in demand at facilities located on the lower Tuolumne River upstream of the confluence with the San Joaquin River. The alternative would provide supplemental releases to the lower Tuolumne River in excess of those currently required below La Grange Dam for FERC requirements. Supplemental releases above those currently required would also be provided to the Tuolumne River below O’Shaughnessy Dam coincident with the lower Tuolumne River diversion. The purpose of this alternative is to accommodate the increase in system-wide demand with the diversion of Tuolumne River water, while at the same time increasing flow conditions in the middle Tuolumne River (Hetch Hetchy Reservoir to Don Pedro Reservoir) and in the lower Tuolumne River below La Grange Dam.

The alternative would implement almost all of the proposed facilities for the proposed WSIP. The exception to the WSIP configuration and proposed facilities would be the specific improvements to the SJPL. Improvements and repairs would be made to the SJPL to ensure that conveyance would continue at the existing 290-mgd capacity. A new SFPUC diversion facility located in the Tuolumne River near its confluence with the San Joaquin River would be sized to recover up to 55 mgd of releases provided by the SFPUC. From the diversion point, the recovered water would be pumped to a new water treatment plant near the Tesla Portal where it would be filtered and disinfected prior to blending with Hetch Hetchy water in the Coastal Tunnel. Numerous new permits and institutional arrangements would be necessary to facilitate the diversion of water by the SFPUC from the lower Tuolumne River, including an arrangement with MID/TID to release SFPUC water into the river.¹⁶

During non-drought years, the SFPUC would serve the increase of 35 mgd in purchase requests through a combination of conservation, water recycling, and groundwater supply programs, increased diversions from the Tuolumne River, and greater utilization of the Bay Area watershed supplies associated with the restoration of operational storage capacity, primarily at Calaveras Reservoir.¹⁷ The SFPUC would implement conservation, water recycling, and groundwater supply programs in the SFPUC retail service area to achieve the equivalent of 10 mgd of supply every year in all years. These programs would be in addition to demand management and conservation measures already accounted for in the 2030 purchase request for the retail service area.

In most years, the SFPUC could serve the projected 2030 water purchases of 300 mgd with its existing sources of water supply; however, these sources alone have not allowed for full water deliveries during past droughts, and would continue to be insufficient during future droughts as purchase requests increase. In this alternative, the SFPUC would serve the 2030 need for increased system firm yield with a combination of conservation, water recycling, and groundwater programs in the SFPUC retail service area, water transfers from the Turlock Irrigation District (TID) and Modesto Irrigation District (MID), a groundwater conjunctive-use program incorporating the Westside Basin Groundwater Program, and restoration of reservoir operating capacity at Crystal Springs and Calaveras Reservoirs. As with the WSIP, system-wide rationing would be limited to no more than 20 percent in any year.

The following described results for this alternative are derived from studies performed by the SFPUC during the investigation of Water Supply Option 3. Subsequent to those studies, several refinements to assumptions for water demands, facility configuration, and operations have changed for the proposed future SFPUC regional system, which would have slightly altered the studies incorporated into Water Supply Option 3. These changes are non-substantive in terms of conclusions derived concerning the alternative; however, due to this circumstance, a comparison of the explicit modeling results for this alternative with results for the WSIP setting or base setting requires caution, and qualitative descriptions are provided.

¹⁶ This setting is additionally described in *Water System Improvement Program (WSIP) Water Supply Option 3*, prepared by San Francisco Public Utilities Commission and Parsons, June 2006.

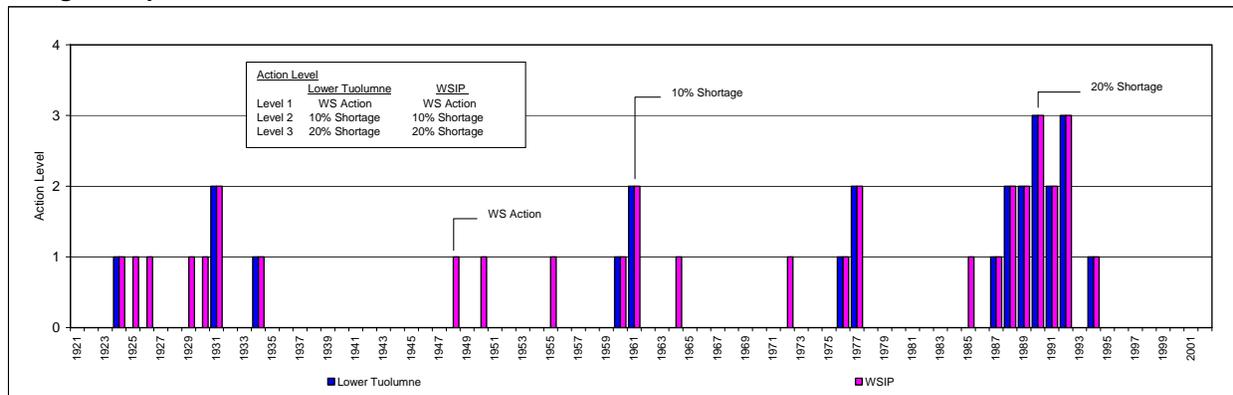
¹⁷ The Lower Crystal Springs Dam Improvements project would be included in this alternative.

5.1 Water Deliveries and Drought Response Actions

In both the alternative and the WSIP settings, an average annual 300 mgd system-wide purchase request is served. Both settings include implementation of 10 mgd of conservation, water recycling, and groundwater supply programs in the SFPUC retail service area, with a net regional system demand of 290 mgd. Table 5.1-1 compares the drought response actions for the proposed program and the alternative settings. Figure 5.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002).

In Figure 5.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In both the WSIP and alternative settings, the action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. The water transfer from MID/TID is also occurring during these periods. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers.

**Figure 5.1-1
Drought Response Actions – Lower Tuolumne River Diversion and WSIP**

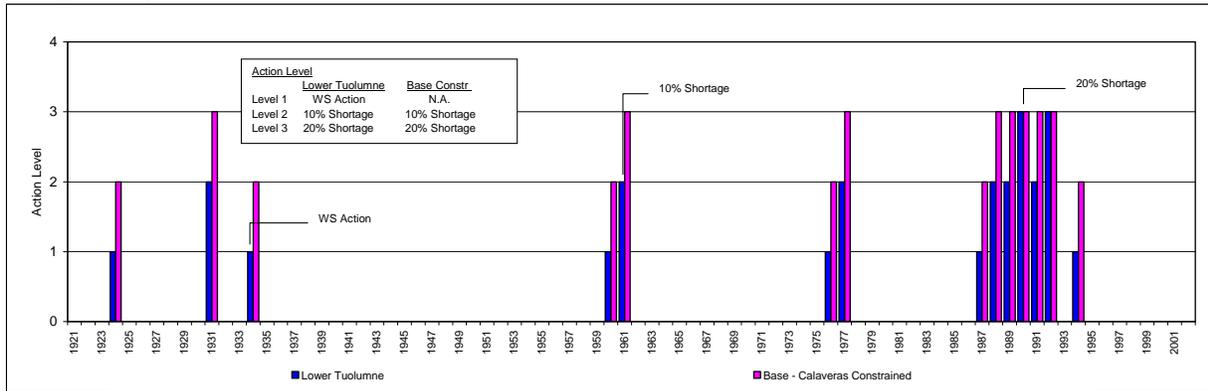


The need for water delivery shortages, in frequency and severity, would be the same for the alternative and WSIP settings, including during the design drought. Shortages would be no greater than 20 percent in any year. Although the WSIP setting indicates a greater frequency of use of the level 1 action (Westside Basin Groundwater Program), the indicated difference is partially a result of modeling discretion that was applied in the more recent WSIP studies and not consistently applied in the earlier Water Supply Option 3 studies. The modeling discretion concerned the explicit system storage level, at which the action is triggered. As described later concerning Bay Area reservoir storage, less depletion of local reservoir storage would be anticipated in the alternative setting because of the increased seasonal availability of conveyance from the Hetch Hetchy system. This would lead to a lesser need to trigger the supplemental groundwater program to retain local Bay Area reservoir storage. The increase in frequency of triggering the action associated with the WSIP is likely overstated.

The same form of information is shown in Figure 5.1-2 in comparing the alternative setting to the base setting. In modeling parlance, there is no level 1 action level in the base setting. Without supplemental resources, the existing system only has the delivery shortage measure available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the alternative and base settings for these action levels. As evident in the illustration, the imposition of rationing occurs more frequent and to a greater extent in the base setting (level 2 and level 3 actions).

Figure 5.1-2 illustrates that, when comparing the base setting to the alternative setting, the supplemental resource (Westside Basin Groundwater Program) is triggered at times of drought, during periods when no supplemental resource is currently available to the system. The use of the supplemental resource during these times results in the elimination or reduction (or at least a non-increase in the severity) of delivery shortage.

**Figure 5.1-2
Drought Response Actions – Base and Lower Tuolumne River Diversion**



Not illustrated in Figure 5.1-1 or Figure 5.1-2 are the delivery shortages anticipated during the entire SFPUC Design Drought. Shortages during the Design Drought with the WSIP and alternative are maintained within the objective to limit the severity of shortage to no more than 20 percent. With the existing system (Calaveras and Crystal Springs Reservoirs constrained), the 20-percent limitation (cap) objective cannot be achieved during the last 18 months of the Design Drought, and a 25 percent shortage is applied.

5.2 Diversions from Tuolumne River

For the WSIP and base settings, the metric for illustrating the SFPUC diversion from the Tuolumne River Basin is the flow through the San Joaquin Pipeline (SJPL) originating at Moccasin Reservoir. In this alternative setting, additional water is diverted from the basin at the new diversion site, which is located in the lower Tuolumne River above its confluence with the San Joaquin River.

Table 5.2-1 illustrates the diversions and difference in diversions to the SJPL (from Moccasin Reservoir) for the proposed program and WSIP settings, averaged by month, by year type. Evident is the decrease in annual diversions associated with the alternative setting. Although the same system-wide level of deliveries occurs for the two settings, the specific locations of the SFPUC's Tuolumne River diversions differ. The difference in SJPL diversions between the WSIP setting and alternative setting is also illustrated in Figure 5.2-1, and the difference in average monthly diversion through the SJPL is shown, by year type, for the 82-year simulation period.

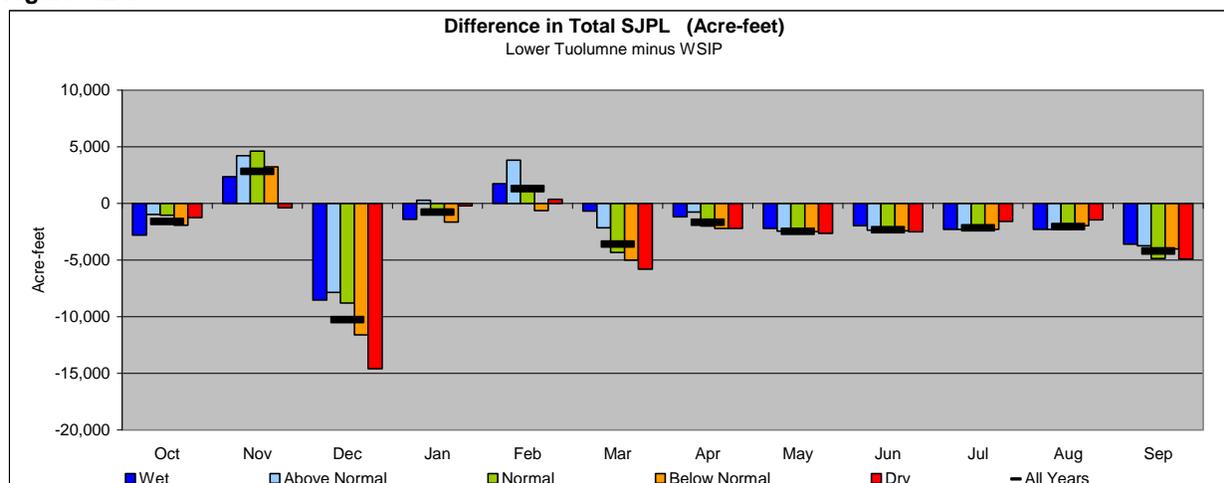
Table 5.2-1

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)															
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	24,616	18,989	0	10,109	9,130	10,394	20,427	24,497	23,880	27,589	27,589	25,318	222,537	220,982	
Above Normal	25,407	18,684	0	14,539	13,132	14,551	23,341	26,246	25,399	27,589	27,589	25,183	241,660	241,064	
Normal	24,795	19,276	0	14,628	13,212	18,017	26,411	27,351	26,469	27,589	27,589	24,052	249,388	249,331	
Below Normal	25,295	19,226	0	19,923	17,994	19,979	26,699	27,085	26,212	27,589	27,589	23,937	261,528	262,013	
Dry	24,676	19,219	0	19,682	17,777	19,979	26,699	27,232	26,411	27,589	27,470	22,384	259,117	260,732	
All Years	24,967	19,076	0	15,811	14,281	16,600	24,723	26,487	25,677	27,589	27,566	24,184	246,962	246,939	

Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)															
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	27,417	16,624	8,533	11,512	7,401	11,072	21,613	26,698	25,836	29,873	29,873	28,909	245,359	242,680	
Above Normal	26,381	14,460	7,852	14,254	9,306	16,705	24,111	28,687	27,761	29,873	29,873	28,909	258,169	258,169	
Normal	25,830	14,656	8,776	15,448	12,041	22,339	28,403	29,873	28,909	29,873	29,873	28,909	274,929	274,849	
Below Normal	27,220	15,998	11,595	21,574	18,621	24,976	28,909	29,571	28,617	29,873	29,548	27,945	294,447	295,146	
Dry	25,931	19,593	14,583	19,883	17,417	25,782	28,909	29,873	28,909	29,165	28,904	27,281	296,229	298,165	
All Years	26,562	16,241	10,254	16,568	12,982	20,191	26,392	28,945	28,011	29,735	29,617	28,391	273,887	273,872	

Difference in Total SJPL (Acre-feet)															
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)															
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	FY Total	
Wet	-2,801	2,365	-8,533	-1,403	1,729	-678	-1,185	-2,200	-1,957	-2,284	-2,284	-3,591	-22,822	-21,698	
Above Normal	-974	4,224	-7,852	285	3,826	-2,154	-769	-2,441	-2,362	-2,284	-2,284	-3,726	-16,509	-17,105	
Normal	-1,035	4,621	-8,776	-820	1,171	-4,322	-1,991	-2,522	-2,440	-2,284	-2,284	-4,857	-25,541	-25,518	
Below Normal	-1,926	3,228	-11,595	-1,651	-627	-4,997	-2,210	-2,485	-2,405	-2,284	-1,959	-4,008	-32,919	-33,133	
Dry	-1,255	-374	-14,583	-202	360	-5,803	-2,210	-2,641	-2,498	-1,576	-1,434	-4,897	-37,112	-37,433	
All Years	-1,594	2,835	-10,254	-756	1,299	-3,591	-1,669	-2,458	-2,333	-2,146	-2,051	-4,207	-26,925	-26,932	

Figure 5.2-1



The lesser diversions from the Moccasin Reservoir source for the alternative setting during March through August is due to the assumed lesser conveyance capacity of the SJPL associated with the alternative setting. In the WSIP setting, conveyance is increased to 313 mgd, while in the alternative setting the capacity is not improved above the currently used 290-mgd capacity. The December reduction in conveyance is due to the annual maintenance associated with each setting. In the alternative setting, conveyance from the Moccasin Reservoir source is not available during December.

In the alternative setting, water would also be diverted by the SFPUC at a location in the lower Tuolumne River. The protocol for using the downstream diversion initiates with the local system calling for water from Hetch Hetchy. During March through August, the need is usually for all flow that can be provided because that period's system-wide delivery is greater than local watershed production. There is also an operational goal of the system to replenish and retain Bay Area reservoir storage, which calls for water from the Hetch Hetchy system. The 345-mgd capacity of the Coastal Tunnel physically limits the amount of water that could be conveyed from Hetch Hetchy, and determines the sizing of lower river diversion (345 mgd minus the 290-mgd capacity of the SJPL). During this season, the "first" 55 mgd is assigned to the lower Tuolumne River diversion. However, depending on the resultant SJPL residual, it may be slightly changed to provide an operation of the SJPL at one of its pre-set capacity rates. The SJPL is limited to operate at one of the set points, a minimum of 70 mgd (exceptions occur), zero during the maintenance period during December, or 210 mgd during November through March. During September through February, the lower Tuolumne River diversion fills in the call for Hetch Hetchy water that is greater than the available SJPL capacity (e.g., 290 mgd in October; 210 mgd in November, January, and February). During December, the SJPL capacity is zero, and the lower Tuolumne River diversion provides up to 55 mgd as needed. The lower Tuolumne River diversion is operated at assumed set points, 10, 20, 30, 40, 45, and 55 mgd.

Table 5.2-2 illustrates the modeled operation of the lower Tuolumne River diversion for the 82-year simulation period. The protocol generally produces a result that would develop releases and diversions during July and August; often but sporadic operation during March through June; more sporadic operation during November, January, and February; and a rare operation during October and September. Because of the SJPL outage during December, full operation of the diversion typically occurs. The "additional" flows occur below Hetch Hetchy Reservoir and La Grange. They do not reach beyond the Tuolumne River as they are recaptured at the lower Tuolumne River diversion. Table 5.2-3 illustrates the same diversion information in terms of monthly average volumes by year type.

The flow of the conveyance at the Coastal Tunnel fully describes the entire Tuolumne River diversion for the alternative. Figure 5.2-2 illustrates the average monthly diversion from the Tuolumne River Basin for the alternative and WSIP settings, and Table 5.2-4 illustrates the average monthly diversions for each setting and the differences between the two for each year type.

Table 5.2-2

Lower Tuolumne River Diversion (MGD)

Water Year	Lower Tuolumne											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	55	0	0	50	55	55	55	55	55	0
1922	0	30	55	0	0	0	0	0	0	55	55	0
1923	0	0	55	0	0	50	55	55	55	55	55	0
1924	0	20	55	20	20	55	55	55	55	45	45	45
1925	45	0	45	0	0	45	45	45	55	55	55	0
1926	0	0	55	30	30	30	55	0	0	55	55	0
1927	0	0	55	0	0	0	0	55	55	55	55	0
1928	0	30	55	0	0	0	0	0	0	55	55	0
1929	0	0	55	0	0	55	55	55	55	55	55	0
1930	0	20	55	0	0	55	55	55	55	55	55	0
1931	0	20	55	20	20	55	55	55	55	45	45	0
1932	0	0	45	0	0	45	45	0	0	55	55	0
1933	0	20	55	20	20	55	55	55	55	55	55	55
1934	55	0	55	0	0	55	55	55	55	45	45	0
1935	0	20	45	0	0	45	45	45	45	55	55	0
1936	0	30	55	30	30	30	55	55	55	55	55	0
1937	0	20	55	20	20	0	55	0	0	55	55	0
1938	0	0	55	0	0	0	0	0	0	55	55	0
1939	0	0	55	0	0	55	55	55	55	55	55	0
1940	0	20	55	0	0	0	0	0	0	55	55	0
1941	0	20	55	0	0	0	0	0	0	55	55	0
1942	0	0	55	0	0	0	0	0	0	55	55	0
1943	0	20	55	0	0	0	55	0	0	55	55	0
1944	0	0	55	0	0	55	55	55	55	55	55	0
1945	0	20	55	20	20	20	55	0	0	55	55	0
1946	0	0	55	0	0	55	55	55	55	55	55	0
1947	0	0	55	0	0	55	55	55	55	55	55	0
1948	0	0	55	20	20	55	55	55	55	55	55	0
1949	0	20	55	20	20	30	55	0	0	55	55	0
1950	0	20	55	0	0	55	55	55	55	55	55	0
1951	0	0	55	0	0	30	55	0	0	55	55	0
1952	0	0	55	0	0	0	0	0	0	55	55	0
1953	0	20	55	0	0	50	55	55	55	55	55	0
1954	0	30	55	20	20	55	55	55	55	55	55	0
1955	0	20	55	0	0	55	55	55	55	55	55	0
1956	0	20	55	0	0	0	55	0	0	55	55	0
1957	0	0	55	0	0	55	55	55	55	55	55	0
1958	0	0	55	0	0	0	0	0	0	55	55	0
1959	0	0	55	0	0	50	55	55	55	55	55	0
1960	0	20	55	20	20	55	55	55	55	45	45	0
1961	0	10	45	20	20	45	45	45	45	45	45	0
1962	0	10	45	10	10	0	45	0	0	55	55	0
1963	0	30	55	0	0	20	0	0	0	55	55	0
1964	0	20	55	0	0	55	55	55	55	55	55	0
1965	0	20	55	0	0	50	0	0	0	55	55	0
1966	0	0	55	0	0	55	55	55	55	55	55	0
1967	0	0	55	0	0	0	0	0	0	55	55	0
1968	0	0	55	0	0	55	55	55	55	55	55	0
1969	0	30	55	0	0	0	0	0	0	55	55	0
1970	0	0	55	0	0	20	55	0	0	55	55	0
1971	0	0	55	0	0	55	55	55	55	55	55	0
1972	0	0	55	0	0	55	55	55	55	55	55	0
1973	0	0	55	0	0	0	55	0	0	55	55	0
1974	0	0	55	0	0	0	0	0	0	55	55	0
1975	0	0	55	0	0	0	0	0	0	55	55	0
1976	0	0	55	0	0	55	55	55	55	45	45	0
1977	0	10	45	10	10	45	45	45	45	45	45	0
1978	0	20	45	0	0	0	0	0	0	55	55	0
1979	0	30	55	0	0	50	55	55	55	55	55	0
1980	0	20	55	0	0	0	55	0	0	55	55	0
1981	0	20	55	0	0	55	55	55	55	55	55	0
1982	0	0	55	0	0	0	0	0	0	55	55	0
1983	0	0	55	0	0	0	0	0	0	55	55	55
1984	55	0	55	0	0	55	55	55	55	55	55	0
1985	0	0	55	0	0	55	55	55	55	55	55	0
1986	0	0	55	20	20	0	0	0	0	55	55	0
1987	0	0	55	20	20	55	55	55	55	45	45	0
1988	0	0	45	10	10	45	45	45	45	55	45	0
1989	0	0	45	10	10	45	45	45	45	55	45	0
1990	0	40	45	40	40	45	45	45	45	0	0	0
1991	0	0	45	0	0	45	45	0	0	55	45	0
1992	0	0	45	10	10	10	45	0	0	0	0	0
1993	0	0	45	0	0	0	0	0	0	55	55	0
1994	0	0	55	20	20	55	55	55	55	55	45	0
1995	0	20	45	0	0	0	0	0	0	55	55	0
1996	0	20	55	0	0	0	55	0	0	55	55	0
1997	0	0	55	0	0	50	55	55	55	55	55	0
1998	0	20	55	0	0	0	0	0	0	55	55	0
1999	0	0	55	0	0	0	0	0	0	55	55	0
2000	0	0	55	0	0	0	55	0	0	55	55	0
2001	0	20	55	20	20	50	55	55	55	55	55	0
2002	0	20	55	0	0	55	55	55	55	55	55	0
Avg (21-02)	2	10	53	5	5	31	38	29	29	53	52	2

Table 5.2-3

Lower Tuolumne River Diversion (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Lower Tuolumne WY Total
Wet	0	863	5,054	119	107	595	950	327	317	5,232	5,232	317	19,111
Above Normal	308	1,137	5,120	280	253	1,371	2,275	1,175	1,137	5,232	5,232	0	23,520
Normal	268	1,036	5,113	297	269	3,211	4,632	3,211	3,165	5,232	5,232	0	31,665
Below Normal	0	758	5,120	784	708	4,812	4,956	4,253	4,170	5,176	5,064	298	36,099
Dry	327	691	4,935	1,011	913	4,697	4,776	4,667	4,575	4,162	4,043	259	35,055
All Years	180	898	5,070	499	451	2,941	3,520	2,726	2,672	5,012	4,965	174	29,108

Figure 5.2-2

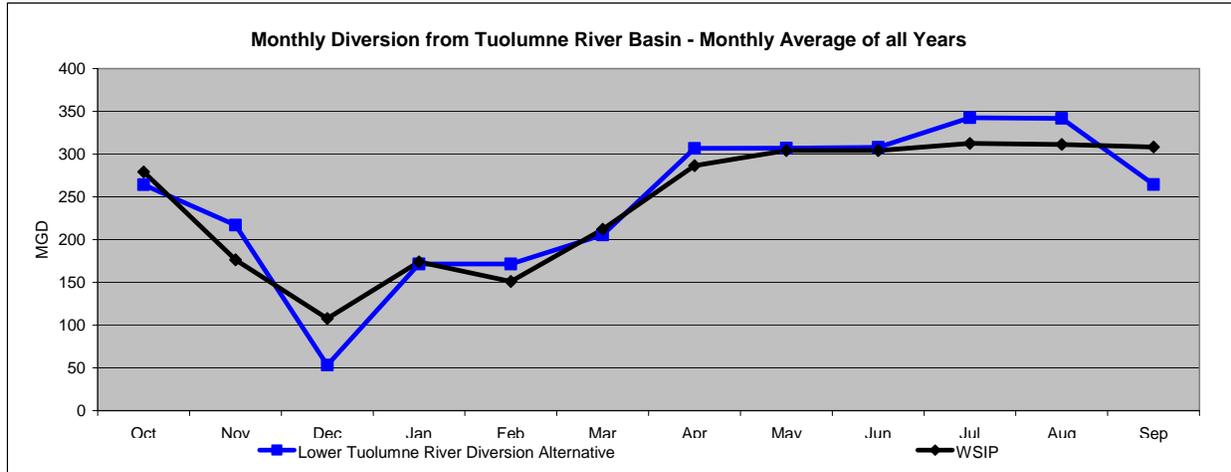


Table 5.2-4

Total Diversion from Tuolumne River Basin													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Lower Tuolumne WY Total
Wet	24,616	19,852	5,054	10,227	9,237	10,988	21,377	24,824	24,196	32,822	32,822	25,635	241,651
Above Normal	25,715	19,821	5,121	14,819	13,385	15,921	25,616	27,421	26,537	32,822	32,822	25,183	265,183
Normal	25,062	20,312	5,114	14,924	13,480	21,227	31,044	30,562	29,634	32,822	32,822	24,052	281,056
Below Normal	25,295	19,984	5,121	20,706	18,702	24,791	31,655	31,339	30,382	32,766	32,654	24,235	297,630
Dry	25,003	19,909	4,935	20,692	18,690	24,676	31,475	31,900	30,986	31,752	31,514	22,643	294,175
All Years	25,147	19,974	5,070	16,310	14,732	19,541	28,243	29,214	28,350	32,601	32,532	24,358	276,072

Total Diversion from Tuolumne River Basin													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WSIP WY Total
Wet	27,417	16,624	8,532	11,511	7,401	11,071	21,613	26,697	25,836	29,873	29,873	28,909	245,358
Above Normal	26,381	14,460	7,852	14,254	9,306	16,705	24,111	28,686	27,761	29,873	29,873	28,909	258,168
Normal	25,829	14,656	8,776	15,448	12,041	22,339	28,403	29,873	28,909	29,873	29,873	28,909	274,928
Below Normal	27,220	15,998	11,595	21,573	18,621	24,976	28,909	29,570	28,617	29,873	29,548	27,945	294,446
Dry	25,930	19,593	14,583	19,883	17,417	25,782	28,909	29,873	28,909	29,165	28,903	27,281	296,228
All Years	26,561	16,241	10,254	16,568	12,982	20,191	26,392	28,944	28,011	29,735	29,616	28,391	273,886

Difference in Total Diversion from Tuolumne River Basin													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Lower Tuolumne minus WSIP WY Total
Wet	-2,801	3,228	-3,478	-1,284	1,837	-83	-236	-1,873	-1,640	2,949	2,949	-3,274	-3,706
Above Normal	-666	5,362	-2,731	565	4,079	-783	1,506	-1,265	-1,224	2,949	2,949	-3,726	7,015
Normal	-767	5,656	-3,663	-523	1,439	-1,112	2,641	690	725	2,949	2,949	-4,857	6,129
Below Normal	-1,925	3,986	-6,475	-867	81	-185	2,746	1,768	1,766	2,893	3,106	-3,710	3,184
Dry	-928	316	-9,647	809	1,273	-1,106	2,566	2,028	2,077	2,587	2,610	-4,638	-2,053
All Years	-1,414	3,733	-5,184	-258	1,750	-650	1,851	269	339	2,867	2,916	-4,033	2,186

The average total diversion from the Tuolumne River Basin is essentially the same for the alternative and the WSIP settings, with some variation between the two settings by year type.

The differences between the alternative's diversions from the Tuolumne River Basin and the base setting diversions are similarly illustrated. Table 5.2-5 illustrates the diversions and difference in diversions to the SJPL (from Moccasin Reservoir) for the alternative and base settings, averaged by month, by year type. This information is also illustrated in Figure 5.2-3 in terms of monthly average diversions for the simulation period. The average annual diversions associated with the alternative setting are about the same as for the base setting. The difference in diversions during December results from different facility maintenance assumptions for the two settings. The alternative incorporates a maintenance program that constrains conveyance through the SJPL during December. Following this maintenance period, larger diversions occur to replenish Bay Area reservoirs and to partially serve the additional demand associated with the alternative.

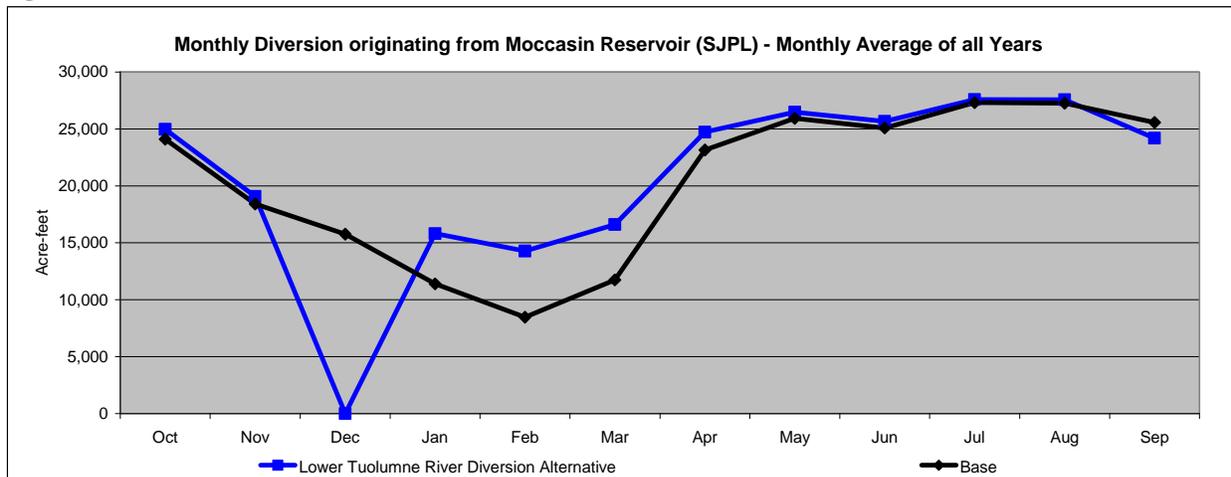
Table 5.2-5

Total SJPL (Acre-feet)													Lower Tuolumne		
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul					
Wet	24,616	18,989	0	10,109	9,130	10,394	20,427	24,497	23,880	27,589	27,589	25,318	222,537		
Above Normal	25,407	18,684	0	14,539	13,132	14,551	23,341	26,246	25,399	27,589	27,589	25,183	241,660		
Normal	24,795	19,276	0	14,628	13,212	18,017	26,411	27,351	26,469	27,589	27,589	24,052	249,388		
Below Normal	25,295	19,226	0	19,923	17,994	19,979	26,699	27,085	26,212	27,589	27,589	23,937	261,528		
Dry	24,676	19,219	0	19,682	17,777	19,979	26,699	27,232	26,411	27,589	27,470	22,384	259,117		
All Years	24,967	19,076	0	15,811	14,281	16,600	24,723	26,487	25,677	27,589	27,566	24,184	246,962		

Total SJPL (Acre-feet)													Base - Calaveras Constrained		
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul					
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258		
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776		
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601		
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263		
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509		
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165		

Difference in Total SJPL (Acre-feet)													Lower Tuolumne minus Base - Calaveras Constrained		
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Aug	Sep	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul					
Wet	357	863	-13,783	2,081	3,115	2,961	4,396	1,427	1,554	0	0	-691	2,280		
Above Normal	1,231	758	-14,204	5,440	6,975	5,272	3,033	1,567	1,516	0	0	-704	10,884		
Normal	1,427	230	-14,390	4,698	6,348	7,385	460	297	288	0	0	-1,956	4,787		
Below Normal	336	1,245	-17,964	4,197	6,187	4,645	0	-504	-487	672	672	-1,733	-2,735		
Dry	1,011	173	-18,433	5,602	6,391	4,043	0	0	58	714	892	-1,841	-1,392		
All Years	870	662	-15,763	4,414	5,822	4,864	1,576	557	584	278	313	-1,381	2,797		

Figure 5.2-3



In the alternative setting, additional SFPUC diversions occur at a location on the lower Tuolumne River. The flow of the conveyance at the Coastal Tunnel fully describes the entire Tuolumne River Basin diversion for the alternative. Figure 5.2-4 illustrates the average monthly diversion from the Tuolumne River Basin for the alternative and base settings, and Table 5.2-6 illustrates the average monthly diversions for each setting and the differences between the two for each year type. As illustrated in the discussion above, regarding the differences in basin diversions between the alternative and WSIP settings, the alternative essentially diverts the same amount of water from the basin as does the WSIP, with both settings diverting more than the base setting. The alternative diverts essentially the additional demand for the increase in purchase request and delivery reliability from the lower Tuolumne River.

Figure 5.2-4

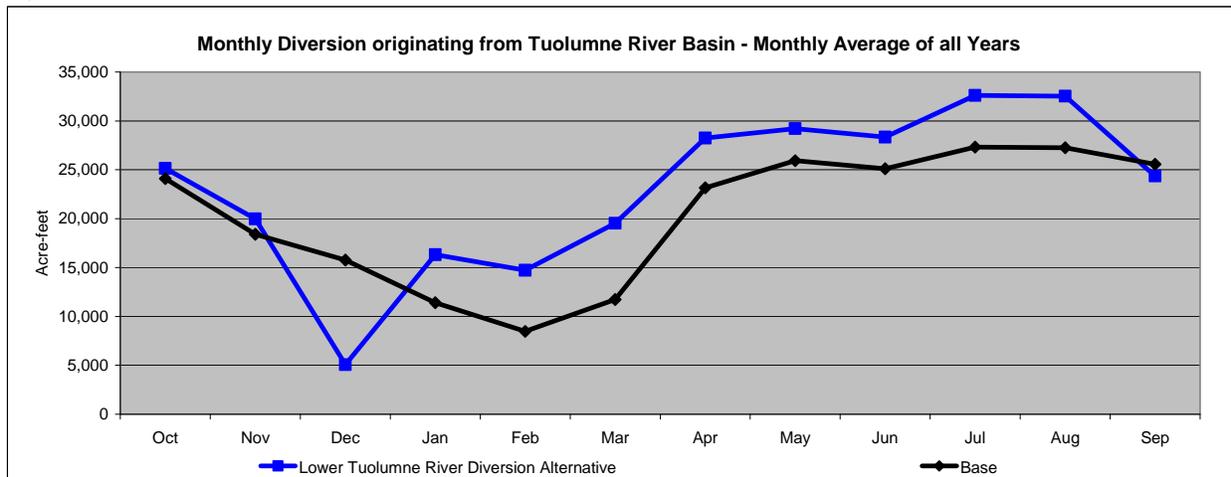


Table 5.2-6

Total Diversion from Tuolumne River Basin (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Lower Tuolumne	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	24,616	19,852	5,054	10,227	9,237	10,988	21,377	24,824	24,196	32,822	32,822	25,635	241,651	
Above Normal	25,715	19,821	5,121	14,819	13,385	15,921	25,616	27,421	26,537	32,822	32,822	25,183	265,183	
Normal	25,062	20,312	5,114	14,924	13,480	21,227	31,044	30,562	29,634	32,822	32,822	24,052	281,056	
Below Normal	25,295	19,984	5,121	20,706	18,702	24,791	31,655	31,339	30,382	32,766	32,654	24,235	297,630	
Dry	25,003	19,909	4,935	20,692	18,690	24,676	31,475	31,900	30,986	31,752	31,514	22,643	294,175	
All Years	25,147	19,974	5,070	16,310	14,732	19,541	28,243	29,214	28,350	32,601	32,532	24,358	276,072	

Total Diversion from Tuolumne River Basin (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	24,260	18,126	13,783	8,027	6,015	7,432	16,031	23,070	22,326	27,589	27,589	26,009	220,258	
Above Normal	24,176	17,926	14,203	9,099	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,777	
Normal	23,368	19,046	14,389	9,930	6,864	10,631	25,951	27,054	26,182	27,589	27,589	26,009	244,603	
Below Normal	24,959	17,980	17,964	15,725	11,808	15,334	26,699	27,589	26,699	26,918	26,918	25,670	264,264	
Dry	23,665	19,046	18,433	14,080	11,386	15,935	26,699	27,233	26,354	26,876	26,579	24,225	260,511	
All Years	24,097	18,413	15,762	11,398	8,459	11,737	23,147	25,930	25,094	27,311	27,253	25,565	244,166	

Difference in Total Diversion from Tuolumne River Basin (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Lower Tuolumne minus Base - Calaveras Constrained	WY Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Wet	357	1,726	-8,729	2,200	3,222	3,556	5,346	1,754	1,870	5,232	5,232	-374	21,393	
Above Normal	1,539	1,895	-9,083	5,719	7,228	6,643	5,307	2,742	2,654	5,232	5,232	-704	34,406	
Normal	1,695	1,266	-9,276	4,995	6,617	10,596	5,092	3,508	3,453	5,232	5,232	-1,956	36,453	
Below Normal	336	2,004	-12,843	4,981	6,895	9,458	4,955	3,749	3,683	5,848	5,736	-1,435	33,366	
Dry	1,338	863	-13,497	6,612	7,304	8,741	4,776	4,668	4,632	4,876	4,935	-1,582	33,664	
All Years	1,050	1,561	-10,692	4,912	6,273	7,805	5,096	3,283	3,256	5,290	5,279	-1,207	31,906	

5.3 Hetch Hetchy Reservoir and Releases

Both the WSIP and alternative settings have the same underlying system-wide net demand for water (290 mgd), and would result in essentially the same draw of water from the Tuolumne River Basin. In the alternative setting, the need from the Bay Area system would be met from both diversion through the SJPL and the diversion in the lower Tuolumne River, and either diversion would still originate from water released from Hetch Hetchy Reservoir. Figure 5.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 5.3-1 are the results for the WSIP, base-Calaveras constrained (“Base – Calaveras Constrained”) and alternative (“Lower Tuolumne”) settings. Over the simulation period, the average annual release (Canyon Tunnel and stream release combined) from Hetch Hetchy Reservoir is about the same between the alternative and WSIP settings; however, the seasonal timing of the release is slightly different, predominantly due to the greater summer conveyance to the Bay Area system in the alternative setting and to the difference in conveyance maintenance. Table 5.3-1 illustrates the total releases from Hetch Hetchy Reservoir for the alternative and WSIP settings, and the difference between the two settings.

Storage in Hetch Hetchy Reservoir associated with the alternative setting could be either greater or less than anticipated for the WSIP setting, as seen in Figure 5.3-1. Figure 5.3-2 illustrates the average monthly storage for the alternative and WSIP settings.

Figure 5.3-1
Hetch Hetchy Reservoir Storage and Stream Release

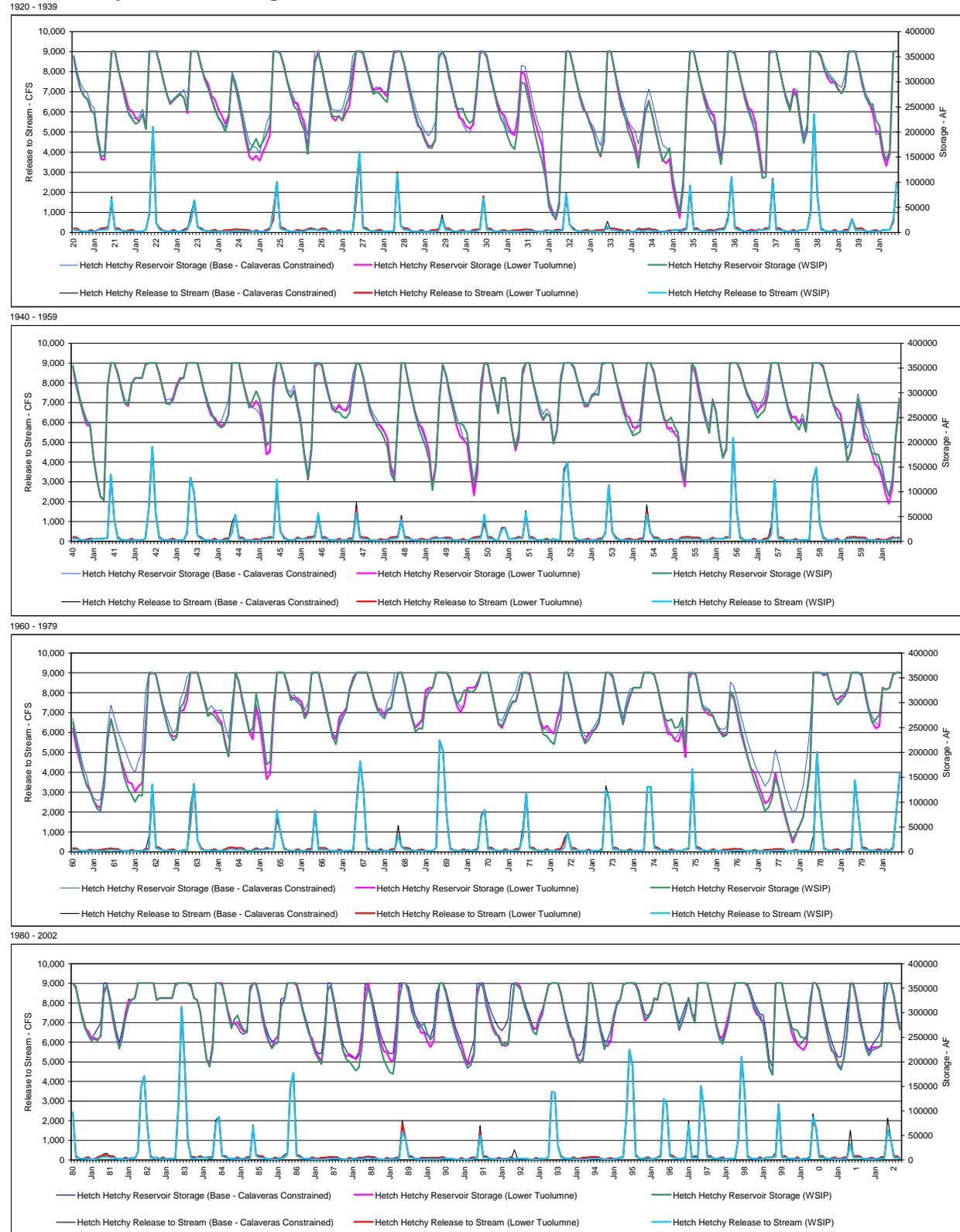


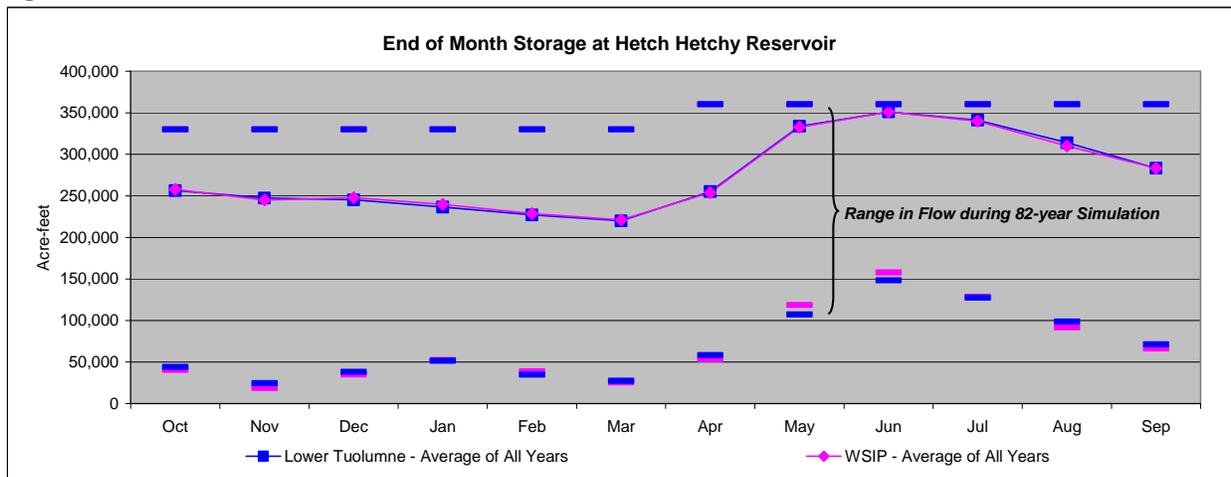
Table 5.3-1

Total Release from Hetch Hetchy Reservoir (Acre-feet) (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Lower Tuolumne		WY Total
											Aug	Sep	
Wet	33,218	26,119	25,210	40,453	43,830	55,651	60,211	228,218	348,593	205,316	53,494	33,884	1,154,195
Above Normal	31,242	33,931	28,655	42,991	50,695	57,330	69,597	146,607	260,579	92,958	42,475	32,404	889,463
Normal	30,483	25,452	16,252	26,201	36,275	44,461	57,114	155,057	190,067	59,335	42,302	31,080	714,079
Below Normal	30,626	25,143	10,580	25,415	27,763	47,572	57,090	110,977	106,190	43,420	41,439	30,484	556,700
Dry	30,237	24,975	11,022	25,587	26,895	36,196	44,609	58,402	54,259	39,003	38,766	28,408	418,360
All Years	31,156	27,182	18,375	32,180	37,144	48,345	57,861	139,582	191,729	87,523	43,653	31,257	745,987

Total Release from Hetch Hetchy Reservoir (Acre-feet) (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	36,134	23,063	28,547	42,219	40,887	53,752	59,883	228,164	349,966	205,070	51,221	37,019	1,155,924
Above Normal	32,330	27,836	29,984	43,071	48,601	56,030	67,921	150,556	263,777	92,821	39,526	36,129	888,582
Normal	31,245	19,796	20,124	28,153	34,961	44,608	54,332	154,996	192,895	58,107	39,353	35,936	714,503
Below Normal	32,551	21,157	16,963	26,236	27,508	47,790	53,197	108,239	105,608	41,174	38,334	34,194	552,951
Dry	31,164	24,658	20,465	24,733	25,437	37,148	41,269	57,450	53,095	36,417	36,155	33,046	421,037
All Years	32,679	23,331	23,223	32,926	35,542	47,964	55,448	139,625	192,864	86,237	40,869	35,262	745,969

Difference in Total Release from Hetch Hetchy Reservoir (Acre-feet) (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	WSIP Sep	WY Total
Wet	-2,916	3,055	-3,337	-1,766	2,943	1,899	328	54	-1,373	246	2,273	-3,135	-1,729
Above Normal	-1,088	6,094	-1,329	-79	2,094	1,300	1,676	-3,949	-3,198	137	2,949	-3,725	881
Normal	-762	5,656	-3,872	-1,952	1,315	-147	2,782	61	-2,827	1,228	2,949	-4,856	-424
Below Normal	-1,925	3,986	-6,383	-822	255	-218	3,894	2,738	581	2,247	3,106	-3,709	3,749
Dry	-927	316	-9,443	854	1,458	-952	3,340	952	1,164	2,587	2,610	-4,638	-2,678
All Years	-1,523	3,851	-4,848	-746	1,602	381	2,413	-43	-1,135	1,286	2,784	-4,006	17

Figure 5.3-2



Hetch Hetchy Reservoir storage is drawn slightly more during summer in the alternative, as the combined release from Hetch Hetchy for the SJPL diversion (maximum 290 mgd) and the lower Tuolumne River diversion (maximum 55 mgd) are slightly greater than the combined releases for the SJPL diversion in the WSIP setting (maximum 313 mgd).

Similar to the WSIP setting comparison to the base setting, the comparison of the alternative setting's depiction of Hetch Hetchy Reservoir storage to the base setting storage would be a general reduction in storage for the alternative setting. The greater system-wide water demand of the alternative would draw additional water from Hetch Hetchy Reservoir. Figure 5.3-3 illustrates the average monthly storage for the alternative and base settings.

The difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the alternative or WSIP settings compared to the base setting would manifest in differences in releases from O'Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the WSIP would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. In the case of the alternative, supplemental releases are explicitly made from Hetch Hetchy Reservoir to the stream to serve the diversion from the lower Tuolumne River. Figure 5.3-4 illustrates the difference in average monthly stream release from O'Shaughnessy Dam for the alternative and WSP settings by year type.

Figure 5.3-3

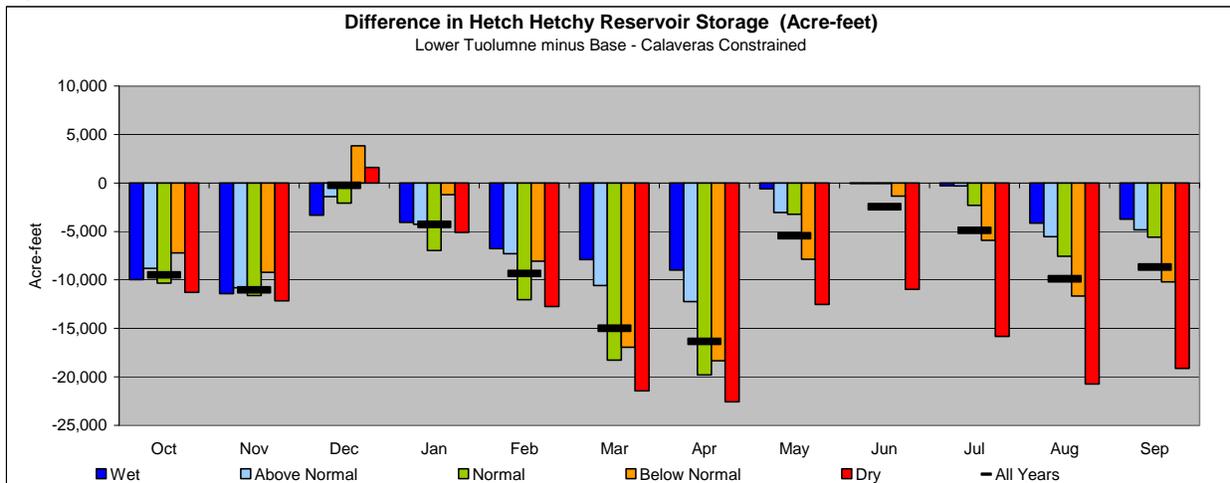


Figure 5.3-4

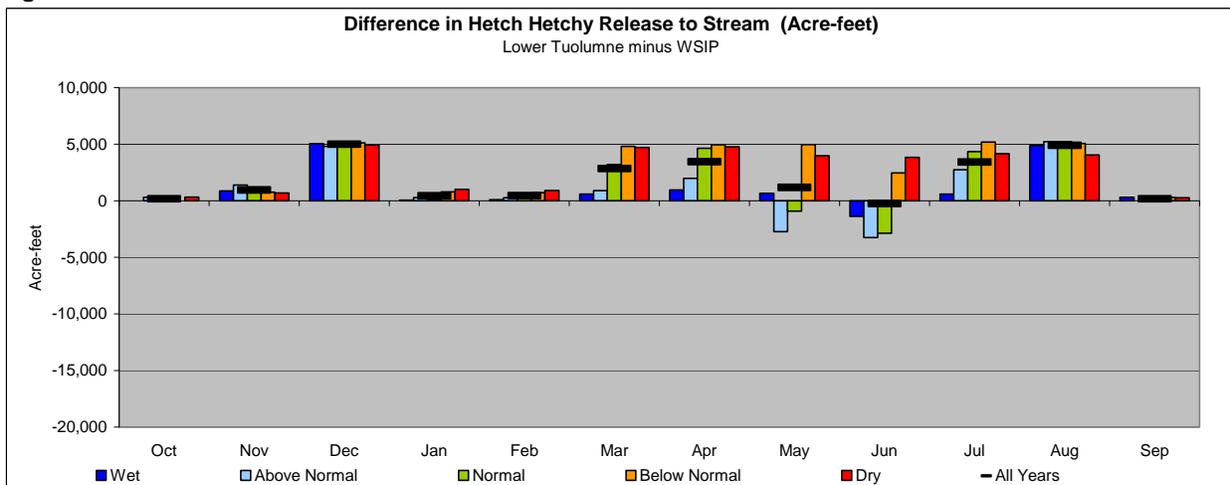


Figure 5.3-4 mirrors the results that were previously described regarding the lower Tuolumne River diversion. When the lower Tuolumne River diversion occurs, a corresponding release to the middle Tuolumne River from O’Shaughnessy Dam is made. A 5,000-acre-foot release is roughly equivalent to the 55-mgd diversion from the lower river.

Figure 5.3-5 compares stream releases from O’Shaughnessy Dam for the alternative and base settings. The change in release below O’Shaughnessy Dam in comparison to the base setting mostly mirrors the differences for the WSIP comparison. The exception occurs during the spring. The alternative draws additional water from Hetch Hetchy Reservoir to serve the greater system-wide demand, subsequently requiring greater replenishment of the reservoir, which typically results in a lesser stream release, predominantly during May or June, reflecting the months when releases to the stream above minimum release requirements are made in anticipation of filling the reservoir.

Supplementing Figure 5.3-4 (alternative comparison to WSIP) and Figure 5.3-5 (alternative comparison to base) are Table 5.3-2 and Table 5.3-3, which illustrate the difference in stream release from O’Shaughnessy Dam for the alternative compared to the WSIP and base settings, respectively.

Figure 5.3-5

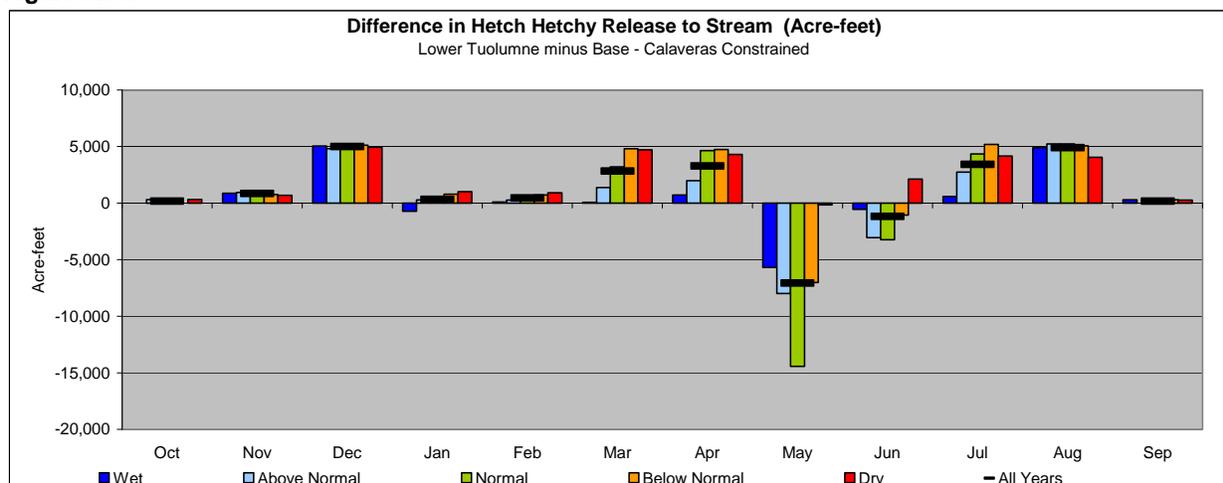


Table 5.3-2 and Table 5.3-3 illustrate the difference in stream release between the alternative setting and the WSIP and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Although there are “enhanced” flows below O’Shaughnessy, the lower Tuolumne River diversion setting creates the same type of storage depletions at Hetch Hetchy Reservoir as the WSIP setting. These depletions affect the spills past O’Shaughnessy during replenishment, delaying the occurrence of releases in excess of minimum requirements. Figure 5.3-6 illustrates a sampling of the difference in stream releases below O’Shaughnessy Dam for the WSIP, alternative, and base settings. Illustrated are the additional flows during the year and the potential effect to releases during the reservoir’s replenishment.

The difference in monthly flow below O’Shaughnessy Dam indicates a potential change in releases between the alternative and WSIP settings, ranging to a decrease of approximately 24,000 acre-feet. Considering the manner in which releases are determined and made to the stream,¹⁸ quantifying the effect of these changes in terms of average monthly flow (cfs) is not always meaningful. Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from O’Shaughnessy Dam between the alternative and WSIP settings could be a delay in releases above minimum requirements by up to 4 days. Compared to the base setting, the delay could be up to 8 days. Normally, the effect of a delay in release would not affect the year’s peak stream release rate during a year.

5.4 Lake Lloyd and Lake Eleanor

Compared to the operation in the WSIP setting, the operation of Lake Lloyd and Lake Eleanor are simulated to be essentially the same as in the alternative setting. Also, the operation resulting for the alternative and WSIP settings are essentially the same as in the base setting, because the Lake Lloyd and Lake Eleanor operation predominantly occur for the satisfaction of power generation needs and MID/TID entitlements to inflow. The lone exception in the simulation occurs during the prolonged drought of 1987-1992. During this drought period, there is a slightly different draw from Hetch Hetchy Reservoir in the different settings, which affects the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir; for satisfaction of MID/TID entitlements to inflow, this affects the amount of releases from Lake Lloyd. However, the effect is small and rarely occurs. A different storage level would result in Lake Lloyd manifesting as a change to releases to the stream above minimum requirements during a subsequent period of reservoir replenishment.

¹⁸ See “Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir”, Memorandum by Daniel B. Steiner, December 31, 2006.

Table 5.3-2

Difference in Hetch Hetchy Release to Stream (Acre-feet)

Lower Tuolumne minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	5,232	0	0	4,757	5,064	5,233	-12,743	5,232	5,232	0	18,007
1922	0	2,762	5,232	0	0	0	0	779	0	0	5,232	0	14,005
1923	0	0	5,232	0	0	4,757	5,064	-5,229	0	0	5,232	0	15,056
1924	0	1,841	5,232	1,903	1,719	5,232	5,064	5,232	5,064	4,281	4,281	4,143	43,992
1925	4,281	0	4,281	0	0	4,281	4,143	-18,152	0	5,233	5,232	0	9,299
1926	0	0	5,232	2,854	2,578	2,854	5,064	0	0	5,232	5,232	0	29,046
1927	0	0	5,232	0	0	0	0	-23,846	0	3,311	5,232	0	-10,071
1928	0	2,762	5,232	0	0	0	0	3,849	0	5,232	5,232	0	22,307
1929	0	0	5,232	0	0	5,232	5,064	5,232	-1,793	5,232	5,232	0	29,431
1930	0	1,841	5,232	0	0	5,232	5,064	1,297	4,171	5,232	5,232	0	33,301
1931	0	1,841	5,232	1,903	1,719	5,232	5,064	5,232	5,064	4,281	4,281	0	39,849
1932	0	0	4,281	0	0	4,281	4,143	0	-3,334	0	5,232	0	14,603
1933	0	1,841	5,232	1,903	1,719	5,232	5,064	5,232	-5,933	5,615	5,232	5,064	36,201
1934	5,232	0	5,232	0	0	5,233	5,064	5,232	5,064	4,281	4,281	0	39,619
1935	0	1,841	4,281	0	0	346	4,143	4,281	-12,062	5,232	5,232	0	13,294
1936	0	2,762	5,232	2,854	2,578	2,854	5,064	375	0	5,233	5,232	0	32,184
1937	0	1,841	5,232	1,903	1,719	0	5,064	1,447	4,231	5,232	5,232	0	31,901
1938	0	0	5,232	0	0	0	0	2,941	0	0	5,232	0	13,405
1939	0	0	5,232	0	0	5,232	5,064	0	5,064	5,232	5,232	0	31,056
1940	0	1,841	5,232	0	0	0	0	-6,989	0	5,232	5,232	0	10,548
1941	0	1,841	5,232	0	0	0	0	0	-528	0	5,232	0	11,777
1942	0	0	5,232	0	0	0	0	-2	0	0	5,232	0	10,462
1943	0	1,841	5,232	0	0	0	40	0	0	0	5,232	0	12,345
1944	0	0	5,232	0	0	5,232	5,064	343	0	5,232	5,232	0	26,335
1945	0	1,841	5,232	1,903	1,719	1,903	5,064	0	-17,970	0	5,232	0	4,924
1946	0	0	5,233	0	0	5,233	5,064	2,479	-9,131	5,232	5,232	0	19,342
1947	0	0	5,232	0	0	5,232	5,064	12,508	5,064	5,232	5,232	0	43,564
1948	0	0	5,232	1,903	1,719	5,233	5,064	5,233	-611	5,232	5,232	0	34,237
1949	0	1,841	5,232	1,903	1,719	2,854	5,064	0	0	5,232	5,232	0	29,077
1950	0	1,841	5,232	0	0	5,233	5,064	5,233	-23,956	5,232	5,232	0	9,111
1951	0	4,180	0	0	0	2,854	5,064	0	-8,732	5,448	5,232	0	14,046
1952	0	0	5,232	0	0	0	0	3,618	0	0	5,232	0	14,082
1953	0	1,841	5,232	0	0	4,757	5,064	-3,214	0	0	5,232	0	18,912
1954	0	2,762	5,232	1,903	1,719	5,232	5,064	10,174	0	5,232	5,232	0	42,550
1955	0	1,841	5,232	0	0	5,233	5,064	5,233	5,064	5,232	5,232	0	38,131
1956	0	1,841	5,233	0	0	0	5,064	-2,536	-1,056	0	5,232	0	13,778
1957	0	0	5,232	0	0	5,232	5,064	11,737	0	5,232	5,232	0	37,729
1958	0	0	5,232	0	0	0	0	2,477	0	0	5,232	0	12,941
1959	0	0	5,232	0	0	4,757	5,064	5,233	5,064	5,232	5,232	0	35,814
1960	0	1,841	5,232	1,903	1,719	5,232	5,064	1,297	5,064	4,281	4,281	0	35,914
1961	0	921	4,281	1,903	1,719	4,281	4,143	4,281	4,143	4,281	4,281	0	34,234
1962	0	921	4,281	951	859	0	4,143	3,935	-4,173	5,233	5,232	0	21,382
1963	0	2,762	5,232	0	0	1,903	0	-19,448	0	0	5,232	0	-4,319
1964	0	1,841	5,232	0	0	5,232	5,064	5,233	5,064	5,232	5,232	0	38,130
1965	0	1,841	5,233	0	0	4,757	0	0	-20,970	0	5,232	0	-3,907
1966	0	0	5,232	0	0	5,232	5,064	0	5,064	5,232	5,232	0	31,056
1967	0	0	5,232	0	0	0	0	5,857	0	0	5,232	0	16,321
1968	0	0	5,232	0	0	5,232	5,064	-509	0	5,232	5,232	0	25,483
1969	0	2,762	5,232	0	0	0	40	0	0	0	5,232	0	13,266
1970	0	0	5,232	-3,935	0	1,903	5,064	3,341	0	5,232	5,232	0	22,069
1971	0	0	5,232	0	0	5,232	5,064	-4,322	0	1,297	5,232	0	17,735
1972	0	0	5,232	0	0	5,232	5,064	18,809	0	5,232	5,232	0	44,801
1973	0	0	5,232	0	0	0	5,064	-5,448	0	5,232	5,232	0	15,312
1974	0	0	5,232	0	0	0	0	0	0	5,233	5,232	0	15,697
1975	0	0	5,232	0	0	0	0	-2,359	-12,613	5,233	5,232	0	725
1976	0	0	5,232	0	0	5,232	5,064	5,232	5,064	4,281	4,281	0	34,386
1977	0	921	4,281	951	859	4,281	4,143	4,281	4,143	4,281	4,281	0	32,422
1978	0	1,841	4,281	0	0	0	0	0	0	0	5,232	0	11,354
1979	0	2,762	5,232	0	0	4,757	5,064	0	0	5,232	5,232	0	28,279
1980	0	1,841	5,232	0	0	0	5,064	-2	0	0	5,232	0	17,367
1981	0	1,841	5,232	0	0	5,232	5,064	5,233	5,064	5,232	5,232	0	38,130
1982	0	0	5,232	0	0	0	40	0	0	0	5,232	0	10,504
1983	0	0	5,232	0	0	0	0	-1,919	0	0	0	5,064	8,377
1984	5,232	0	5,233	0	0	1,297	5,064	1,795	0	1,297	5,232	0	25,150
1985	0	0	5,232	0	0	5,232	5,064	-5,033	2,684	5,232	5,232	0	23,643
1986	0	0	5,232	1,903	1,719	0	40	0	0	4,176	5,232	0	18,302
1987	0	0	5,232	1,903	1,719	5,232	5,064	5,232	5,064	4,281	4,281	0	38,008
1988	0	0	4,281	951	859	4,281	4,143	4,281	4,143	5,232	4,281	0	32,452
1989	0	0	4,281	951	859	4,281	4,143	24,654	0	5,232	4,281	0	48,682
1990	0	3,683	4,281	3,805	3,437	4,281	4,143	4,281	5,064	0	0	0	32,975
1991	0	0	4,281	0	0	4,281	4,143	0	11,085	5,232	4,281	0	33,303
1992	0	0	4,281	951	859	951	4,143	0	0	0	0	0	11,185
1993	0	0	4,281	0	0	0	0	-2	0	0	5,232	0	9,511
1994	0	0	5,232	1,903	1,719	5,232	5,064	5,232	5,064	5,232	4,281	0	38,959
1995	0	1,841	4,281	0	0	0	0	-2	0	0	5,011	0	11,131
1996	0	1,841	5,232	0	0	0	5,064	-1,262	0	5,233	5,232	0	21,340
1997	0	0	5,232	-1,158	0	4,757	5,064	0	0	5,232	5,232	0	24,359
1998	0	1,841	5,232	0	0	0	0	0	0	0	5,232	0	12,305
1999	0	0	5,232	0	0	0	0	420	127	5,232	5,232	0	16,243
2000	0	0	5,232	0	0	0	5,064	-12,589	0	5,232	5,232	0	8,171
2001	0	1,841	5,232	1,903	1,719	4,757	5,064	-2,213	5,064	5,232	5,232	0	33,831
2002	0	1,841	5,232	0	0	5,232	5,064	-1,481	0	5,232	5,232	0	26,352
Avg (21-02)	180	949	5,006	437	451	2,845	3,460	-1,189	-242	3,419	4,899	174	22,766

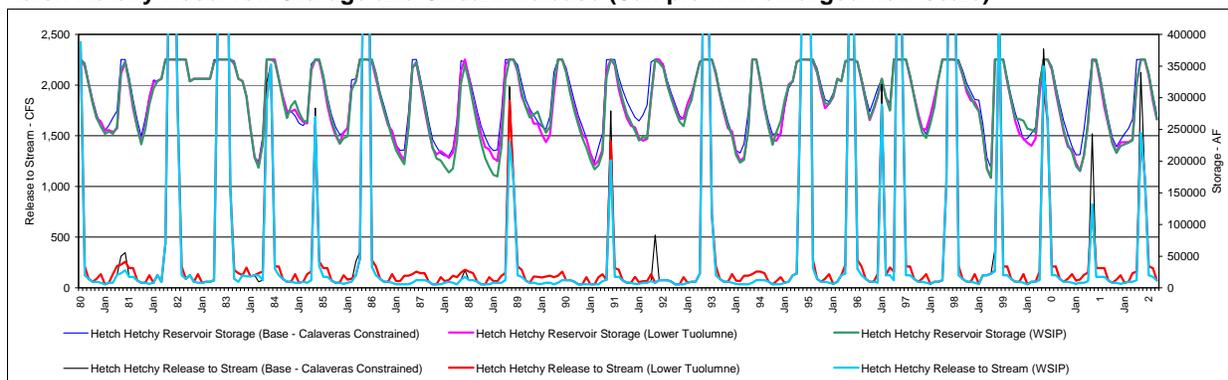
Table 5.3-3

Difference in Hetch Hetchy Release to Stream (Acre-feet)

Lower Tuolumne minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	5,232	0	0	4,757	5,064	5,233	-19,537	5,232	5,232	0	11,213
1922	0	2,762	5,232	0	0	0	0	-8,106	0	0	5,232	0	5,120
1923	0	0	5,232	0	0	4,757	5,064	-22,266	0	0	5,232	0	-1,981
1924	0	1,841	5,232	1,903	1,719	5,232	5,064	5,232	5,064	4,281	4,281	4,143	43,992
1925	4,281	0	4,281	0	0	4,281	4,143	-36,385	0	5,233	5,232	0	-8,934
1926	0	0	5,232	2,854	2,578	2,854	5,064	-2,913	0	5,232	5,232	0	26,133
1927	0	0	5,232	0	0	0	0	-48,034	0	3,311	5,232	0	-34,259
1928	0	2,762	5,232	0	0	0	0	0	0	5,232	5,232	0	18,458
1929	0	0	5,232	0	0	5,232	5,064	5,232	-15,016	5,232	5,232	0	16,208
1930	0	1,841	5,232	0	0	5,232	5,064	1,297	4,171	5,232	5,232	0	33,301
1931	0	1,841	5,232	1,903	1,719	5,232	5,064	5,232	5,064	4,281	4,281	0	39,849
1932	0	0	4,281	0	0	4,281	4,143	0	-5,970	0	5,232	0	11,967
1933	0	1,841	5,232	1,903	1,719	5,232	5,064	5,232	-20,883	5,615	5,232	5,064	21,251
1934	5,232	0	5,232	0	0	5,233	1,256	5,232	5,064	4,281	4,281	0	35,811
1935	0	1,841	4,281	0	0	4,281	4,143	4,281	-15,936	5,232	5,232	0	13,355
1936	0	2,762	5,232	2,854	2,578	2,854	5,064	-13,135	0	5,233	5,232	0	18,674
1937	0	1,841	5,232	1,903	1,719	0	5,064	-1,696	0	5,232	5,232	0	24,527
1938	0	0	5,232	0	0	0	0	-8,398	0	0	5,232	0	2,066
1939	0	0	5,232	0	0	5,232	1,256	4,045	5,064	5,232	5,232	0	31,293
1940	0	1,841	5,232	0	0	0	0	1,359	0	5,232	5,232	0	18,896
1941	0	1,841	5,232	0	0	0	0	0	-1,725	0	5,232	0	10,580
1942	0	0	5,232	0	0	0	0	-2	0	0	5,232	0	10,462
1943	0	1,841	5,232	0	0	0	40	0	0	0	5,232	0	12,345
1944	0	0	5,232	0	0	5,232	5,064	-30,360	0	5,232	5,232	0	-4,368
1945	0	1,841	5,232	1,903	1,719	1,903	5,064	0	-4,809	0	5,232	0	18,085
1946	0	0	5,233	0	0	5,233	5,064	-5,157	-9,131	5,232	5,232	0	11,706
1947	0	0	5,232	0	0	5,232	5,064	-18,938	5,064	5,232	5,232	0	12,118
1948	0	0	5,232	1,903	1,719	5,233	5,064	5,233	-12,666	5,232	5,232	0	22,182
1949	0	1,841	5,232	1,903	1,719	2,854	5,064	0	0	5,232	5,232	0	29,077
1950	0	1,841	5,232	0	0	5,233	5,064	5,233	-18,846	5,232	5,232	0	14,221
1951	0	-3,486	0	0	0	2,854	5,064	0	-14,945	5,448	5,232	0	167
1952	0	0	5,232	0	0	0	0	-12,532	0	0	5,232	0	-2,068
1953	0	1,841	5,232	0	0	4,757	5,064	-3,536	0	0	5,232	0	18,590
1954	0	2,762	5,232	1,903	1,719	5,232	5,064	-20,810	0	5,232	5,232	0	11,566
1955	0	1,841	5,232	0	0	5,233	5,064	5,233	5,064	5,232	5,232	0	38,131
1956	0	1,841	5,233	0	0	0	5,064	-5,342	-1,056	0	5,232	0	10,972
1957	0	0	5,232	0	0	5,232	5,064	-19,991	0	5,232	5,232	0	6,001
1958	0	0	5,232	0	0	0	0	-10,061	0	0	5,232	0	403
1959	0	0	5,232	0	0	4,757	5,064	5,233	5,064	5,232	5,232	0	35,814
1960	0	1,841	5,232	1,903	1,719	5,232	5,064	1,297	5,064	4,281	4,281	0	35,914
1961	0	921	4,281	1,903	1,719	4,281	4,143	4,281	4,143	4,281	4,281	0	34,234
1962	0	921	4,281	951	859	0	4,143	-37,719	-4,173	5,233	5,232	0	-20,272
1963	0	2,762	5,232	0	0	1,903	0	-47,716	0	0	5,232	0	-32,587
1964	0	1,841	5,232	0	0	5,232	5,064	5,233	1,256	5,232	5,232	0	34,322
1965	0	1,841	5,233	0	0	4,757	0	0	-7,756	0	5,232	0	9,307
1966	0	0	5,232	0	0	5,232	1,256	4,045	5,064	5,232	5,232	0	31,293
1967	0	0	5,232	0	0	0	0	-2,866	0	0	5,232	0	7,598
1968	0	0	5,232	0	0	5,232	5,064	-31,457	0	5,232	5,232	0	-5,465
1969	0	2,762	5,232	0	0	0	40	0	0	0	5,232	0	13,266
1970	0	0	5,232	0	0	1,903	5,064	-5,022	0	5,232	5,232	0	17,641
1971	0	0	5,232	0	0	5,232	5,064	-27,958	0	1,297	5,232	0	-5,901
1972	0	0	5,232	0	0	5,232	5,064	-10,648	0	5,232	5,232	0	15,344
1973	0	0	5,232	0	0	0	5,064	-19,842	0	5,232	5,232	0	918
1974	0	0	5,232	0	0	0	0	0	0	5,233	5,232	0	15,697
1975	0	0	5,232	0	0	0	0	0	-8,442	5,233	5,232	0	7,255
1976	0	0	5,232	0	0	5,232	5,064	5,232	5,064	4,281	4,281	0	34,386
1977	0	921	4,281	951	859	4,281	4,143	4,281	4,143	4,281	4,281	0	32,422
1978	0	1,841	4,281	0	0	0	0	-46,590	0	0	5,232	-310	-35,546
1979	0	2,762	5,232	0	0	4,757	5,064	0	0	5,232	5,232	0	28,279
1980	0	1,841	5,232	0	0	0	5,064	-2	0	0	5,232	0	17,367
1981	0	1,841	5,232	0	0	5,232	5,064	-5,174	-5,246	5,232	5,232	0	17,413
1982	0	0	5,232	0	0	0	40	0	0	0	5,232	0	10,504
1983	0	0	5,232	0	0	0	0	-5,050	0	0	0	5,064	5,246
1984	5,232	0	5,233	0	0	5,232	5,064	-9,950	0	1,297	5,232	0	17,340
1985	0	0	5,232	0	0	5,232	5,064	-10,268	2,684	5,232	5,232	0	18,408
1986	0	0	5,232	1,903	1,719	-8,478	-3,895	0	0	4,176	5,232	0	5,889
1987	0	0	5,232	1,903	1,719	5,232	5,064	5,232	5,064	4,281	4,281	0	38,008
1988	0	0	4,281	951	859	4,281	4,143	4,281	335	5,232	4,281	0	28,644
1989	0	0	4,281	951	859	4,281	4,143	-8,700	0	5,232	4,281	0	15,328
1990	0	3,683	4,281	3,805	3,437	4,281	4,143	4,281	5,064	0	0	0	32,975
1991	0	0	4,281	0	0	4,281	4,143	0	-17,889	5,232	4,281	0	4,329
1992	0	0	4,281	951	859	951	4,143	-28,918	0	0	0	0	-17,733
1993	0	0	4,281	0	0	0	0	-2	0	0	5,232	0	9,511
1994	0	0	5,232	1,903	1,719	5,232	5,064	5,232	5,064	5,232	4,281	0	38,959
1995	0	1,841	4,281	0	0	0	0	-2	0	0	5,011	0	11,131
1996	0	1,841	5,232	0	0	0	5,064	-1,262	0	5,233	5,232	0	21,340
1997	0	0	5,232	-13,234	0	4,757	5,064	0	0	5,232	5,232	0	12,283
1998	0	1,841	5,232	0	0	0	0	0	0	0	5,232	0	12,305
1999	0	0	5,232	0	0	0	0	-13,071	0	5,232	5,232	0	2,625
2000	0	0	5,232	0	0	0	5,064	-22,887	0	5,232	5,232	0	-2,127
2001	0	1,841	5,232	1,903	1,719	4,757	5,064	-44,880	5,064	5,232	5,232	0	-8,836
2002	0	1,841	5,232	0	0	5,232	5,064	-37,929	0	5,232	5,232	0	-10,096
Avg (21-02)	180	856	5,006	338	451	2,838	3,273	-7,059	-1,176	3,419	4,899	170	13,193

**Figure 5.3-6
Hetch Hetchy Reservoir Storage and Stream Release (Sample with enlarged flow scale)**



5.5 Flow below Tuolumne River and Cherry River Confluence

The flow that occurs below the confluence of the Tuolumne River and Cherry River is considered important to recreational activity (white water rafting) during May through September. To estimate the effect of Hetch Hetchy operations on the occurrence of flow at this location, HH/LSM monthly volumetric flow results were post-processed to reflect the daily and hourly shaping potential currently exercised by Hetch Hetchy operators to satisfy water and power objectives while accommodating the desires of recreational interests.¹⁹ Compared to the WSIP setting, the alternative setting would typically result in greater flow at the location, particularly during July and August when the lower Tuolumne River diversion is occurring and coincidentally triggering a supplemental release to the middle Tuolumne River from O’Shaughnessy Dam. The supplemental release associated with a 55-mgd lower Tuolumne River diversion is approximately 85 cfs.

The same result essentially occurs in the comparison of the alternative setting to the base setting. However, in that comparison, the combined effect of the supplemental lower Tuolumne River diversion releases and the reduction to releases above minimum release requirements caused by system-wide demand increase replenishment typically leads to a reduction in flow at the location during May and June (the same underlying effect attributed to the WSIP setting). However, there would only be a rare occurrence when the shaped flow of the alternative would cross the threshold of being less than 1,000 cfs, as compared to greater than 1,000 cfs in the base setting. While in both the alternative and base settings there are occasional dry and critical years, there could be instances when the shaped flow would be less than 1,000 cfs; however, results indicate that it would be rare for the alternative setting to increase that frequency.

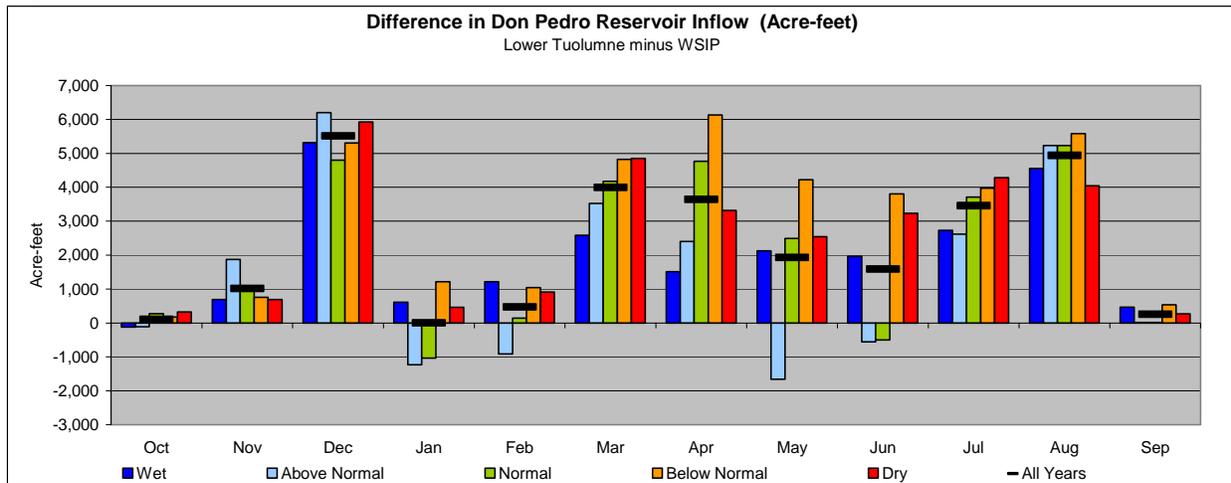
5.6 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes to inflow to and releases from the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities, described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. In the alternative setting, the supplemental releases made from Hetch Hetchy Reservoir for the lower Tuolumne River diversion also affect inflow to Don Pedro Reservoir. The lower Tuolumne River diversion also affects releases from Don Pedro Reservoir.

Figure 5.6-1 illustrates the difference in inflow to Don Pedro Reservoir between the alternative and WSIP settings, averaged by month for each year type. The results are consistent with the intent of the alternative’s operation, which shifts the effect of the increase in Tuolumne River diversion from upstream of Don Pedro Reservoir. Instead of reducing inflow to Don Pedro by diverting the additional flow to the SJPL from upstream, the otherwise diverted flow is released to the middle Tuolumne River and flows into Don Pedro Reservoir.

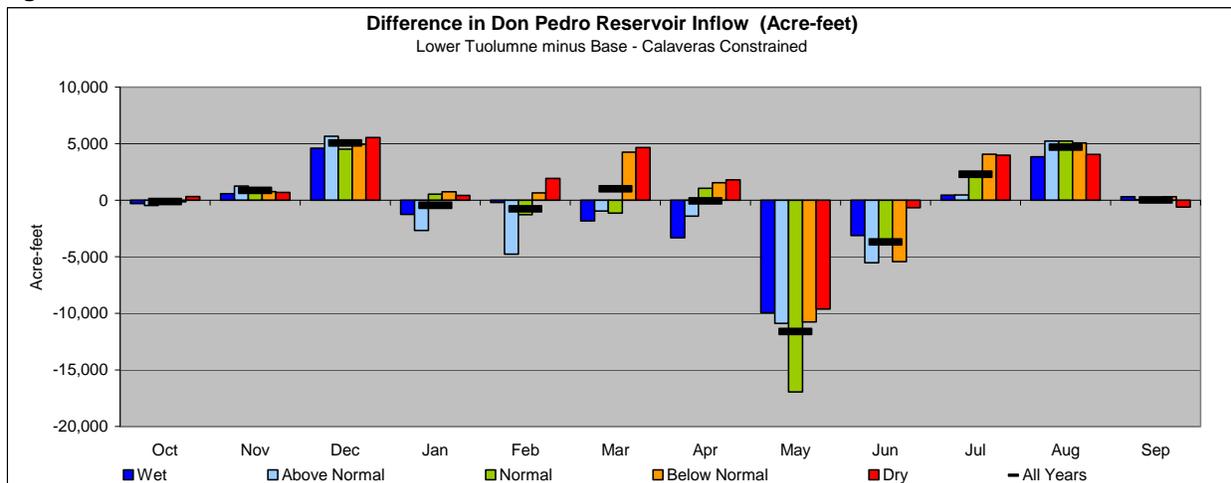
¹⁹ See “HH/LSM Assumptions and Results – Proposed WSIP”, Memorandum by Daniel B. Steiner, March 18, 2007.

Figure 5.6-1



The comparison of inflow to Don Pedro Reservoir between the alternative and base settings is illustrated in Figure 5.6-2. The illustration shows that all of the effects to inflow to Don Pedro Reservoir attributable to additional diversions from the Tuolumne River Basin are not eliminated with the lower Tuolumne River diversion. Shifts in the timing of inflow to Don Pedro Reservoir would occur due to changes in the seasonal operation of the entire SFPUC system, including a different maintenance program. Also, in this configuration of the alternative, there occurs an increase (albeit, a relatively small one) in upstream diversions to the Bay Area system.

Figure 5.6-2

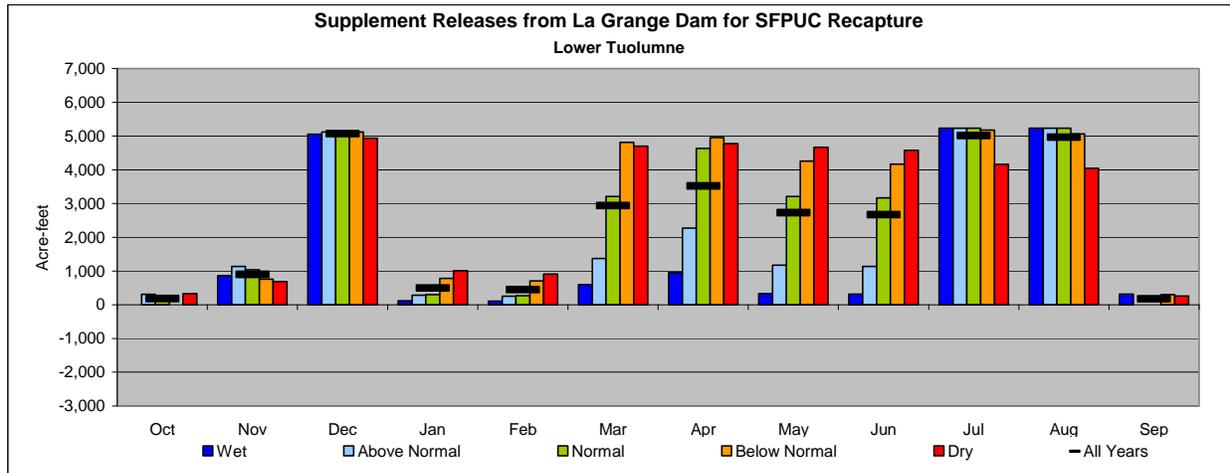


Generally coincident with the changes to inflow to Don Pedro Reservoir would be changes to releases from La Grange Dam to the lower Tuolumne River. The alternative setting assumes that the SFPUC diversion at the lower Tuolumne River location would recapture releases from La Grange Dam that are explicitly made for the diversion. These releases would be in addition to releases made for compliance to the FERC release requirements. Described previously (in Table 5.2-3) are the modeled diversions at the lower Tuolumne River diversion location. Table 5.6-1 illustrates the same information, expressed as average monthly flow rates by year type, that would supplement La Grange Dam releases to serve the SFPUC diversions. The supplemental flows are also illustrated in Figure 5.6-3.

Table 5.6-1

Supplemental Release at La Grange Dam for SFPUC Recapture - CFS (Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)												Lower Tuolumne	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Wet	0	15	82	2	2	10	16	5	5	85	85	5	
Above Normal	5	19	83	5	5	22	38	19	19	85	85	0	
Normal	4	17	83	5	5	52	78	52	53	85	85	0	
Below Normal	0	13	83	13	13	78	83	69	70	84	82	5	
Dry	5	12	80	16	16	76	80	76	77	68	66	4	
All Years	3	15	82	8	8	48	59	44	45	82	81	3	

Figure 5.6-3



Compared to the WSIP setting, the inflow to Don Pedro Reservoir associated with the alternative setting is greater by about the amount of the diminishment of inflow that occurred between the WSIP setting and the base setting. Essentially, the same inflow to Don Pedro Reservoir occurs for either the alternative or the base setting. In the alternative setting, the inflow to Don Pedro Reservoir explicitly made by the SFPUC for the lower Tuolumne River diversion is assumed to pass through Don Pedro Reservoir as a supplemental release at La Grange Dam. Therefore, although the inflow to Don Pedro Reservoir associated with the alternative is essentially the same as for the base setting, an additional release from Don Pedro Reservoir (and La Grange Dam to the lower Tuolumne River) occurs, which depletes Don Pedro Reservoir storage by the amount of the supplemental release. This additional depletion of storage due to the supplemental release to the lower Tuolumne River is about the same as the depletion of storage associated with the WSIP. The depletion of inflow associated with the WSIP setting was caused by the diversion of additional water from upstream. The end result is that Don Pedro Reservoir storage is depleted by about the same amount in either the WSIP or alternative setting as compared to the base setting.

Although the alternative would increase the flow below La Grange Dam in many months, in many years, the resultant depletion of storage in Don Pedro Reservoir attributed to the alternative would subsequently manifest in reductions in releases from La Grange Dam to the stream in other months. The additional depletion of reservoir storage manifests as a reduction in subsequent releases below La Grange Dam in order to replenish reservoir storage. The differences in releases to the Tuolumne River from La Grange Dam would occur only when there would otherwise be releases in excess of minimum FERC flow requirements. With the net effect of changes in Don Pedro Reservoir inflow and releases resulting in a storage operation essentially the same as the WSIP setting, the alternative setting would result in the same magnitude of flow reductions during reservoir replenishment. Most notable would be the flow difference in a year, such as 1993, that follows the extensive drought of 1987-1992. Similar to the WSIP setting, the accumulated effect of the additional releases below La Grange Dam during this period could deplete the reservoir to an extent that the entire volume of flow that would have occurred in excess of FERC requirements in the base setting would have been eliminated during 1993, to replenish Don Pedro Reservoir. In other years, the depletion of storage associated with the alternative would delay the day that excess flow above FERC requirements would be released. Normally, the effect of the delay in release would not affect the year's peak stream release rate during a year. However, infrequently, and as described for the period following the 1987-1992 drought, the alternative's affect on stream releases

could manifest as an elimination of all flows during a year that would otherwise occur in excess of minimum FERC flow requirements. Such a large and lengthy reduction in flow would not be common, and would result only because of the multi-year droughts.

5.7 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

The analytical studies used to evaluate the alternative focused on depicting an alternative method of managing the SFPUC diversion of water from the Tuolumne River basin, i.e., the supplementing of flows in the middle and lower Tuolumne River and diverting of the increase in SFPUC demand from a location in the lower Tuolumne River. Those studies were used in support of developing Water Supply Option 3. Subsequent to those studies, refinements to the depiction of the Bay Area system and its operation have occurred that limit the direct use of HH/LSM results for illustrative purposes. The following qualitative descriptions of the comparison between the alternative, WSIP, and base settings have been developed from the review of HH/LSM results and engineering judgment. Overall, in the alternative setting, the Bay Area system would perform very much the same as in the WSIP setting.

Compared to the base setting, Calaveras Reservoir operations would substantively change in the alternative setting. With the restoration of Calaveras Reservoir operating capacity, the reservoir would be operated to a larger storage capacity. The operation of Calaveras Reservoir would be very similar to the operation described for the WSIP setting.

There would be two categorical changes in the regime of releases to Calaveras Creek below Calaveras Dam between the alternative and base settings. In the alternative setting, there would be the addition of the flows representing the flow objectives associated with the 1997 MOU, and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

Compared to the base setting, diversions from Alameda Creek to Calaveras Reservoir would increase in the alternative setting. With the current constraints on Calaveras Reservoir storage, diversions to Calaveras Creek are rejected. With the restoration of operational storage in the reservoir, the opportunity to divert water into the reservoir would increase.

Commensurate with changes in diversions from Alameda Creek to Calaveras Reservoir would be changes to the flow below the Alameda Creek Diversion Dam. Opposite in effect compared to diversions to Calaveras Reservoir, flow passing Alameda Creek Diversion Dam would decrease in the alternative setting. With operational capacity restored at Calaveras Reservoir, there would be more opportunity (and need) to divert Alameda Creek flows, thus reducing flow passing the dam.

Flow below the confluence of Alameda Creek and Calaveras Creek is affected by releases from Calaveras Dam to the stream, flow passing Alameda Creek Diversion Dam, and unregulated flow below Alameda Creek Diversion Dam and Calaveras Dam. As for the WSIP setting comparison, the notable differences between the alternative and the base settings are the addition of stream flows representing the 1997 MOU and the reduction of wetter-year/wet season flows due to the restoration of Calaveras Reservoir storage.

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the alternative setting. This facility is assumed to recapture flows explicitly released from Calaveras Dam in the representation of the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir. The flows at this location would be essentially the same as those described for the WSIP setting. The flows identified at this location indicate flow below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated unregulated stream accretions between the Alameda-Calaveras Creek confluence and the Alameda-San Antonio Creek confluence, minus the water assumed to be recaptured (diverted) by the SFPUC from the creek.

The difference in San Antonio Reservoir storage between the alternative and base settings is the result of several factors, and is predominantly due to the restoration of the operational capacity of Calaveras

Reservoir, the use of SJPL flow for maintenance of Sunol Valley WTP production, and the maintenance of Hetch Hetchy conveyance. In the base setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that draws relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. The result is that the alternative setting would retain more storage in San Antonio Reservoir than in the base setting. There would very little change in stream releases below San Antonio Reservoir between the alternative, WSIP, and base settings, as the operational goal is to minimize releases to the stream. Flexibility within the balancing of storage among the Bay Area reservoirs would continue to facilitate this goal.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Reservoir and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. The differences in flow at this location between the alternative and base settings are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity in the alternative setting, and would be essentially the same as described for the differences between the WSIP and base settings.

5.8 Crystal Springs and San Andreas Reservoirs

Fundamental to the difference in storage operations at Crystal Springs Reservoir between the alternative setting and the base settings is the restoration of reservoir operation capacity in the alternative setting, which does not occur in the base setting. The result is the operation of Crystal Springs Reservoir at a higher maximum storage in the alternative setting. The operation of Crystal Springs Reservoir would be similar to the operation described for the WSIP setting.

Compared to the base setting, the alternative setting would generally result in a shifting of the maximum storage level and the range of reservoir operation to a greater volume (elevation), and the lower end of the monthly operating range would normally be greater in storage than in the base setting.

A difference in stream release below Crystal Springs Reservoir would be infrequent, and could be either an increase or decrease in the release. The potential difference is attributed to whether the alternative's operation would result in more or less available operational storage capacity at an instant compared to another setting. In actual operations, it is anticipated that system operators would manage the reservoir system such that stream releases would be minimal under any setting, with the effect of essentially no difference between the alternative, WSIP, and base settings.

Overall, Crystal Springs Reservoir, San Antonio Reservoir, and Calaveras Reservoir would tend to retain more storage during a year in the alternative setting as compared to the WSIP setting, and that result is even more dramatic when compared to the base setting. The alternative setting includes greater diversion capacity during the year from the Tuolumne River Basin, which is particularly used during the summer through the lower Tuolumne River diversion. The additional diversion capacity during the summer reduces the need to draw from Bay Area system storage, retaining greater storage in the Bay Area system during the summer and fall. The availability and use of the lower Tuolumne River diversion during December, when otherwise there would be no conveyance from Hetch Hetchy due to maintenance, also retains storage in the Bay Area system.

San Andreas Reservoir operations would generally be the same between the alternative, WSIP, and base settings. Reservoir storage would follow a systematic filling and lowering each year to manage runoff. However, different from the base and WSIP settings, the alternative setting would not typically result in an additional draw down of storage from San Andreas Reservoir during Hetch Hetchy conveyance maintenance periods. With the lower Tuolumne River diversion available during the period of conveyance maintenance, sufficient supplies and conveyance among the Bay Area system and the Tuolumne River system would negate the need to increase production at Harry Tracy WTP to compensate for the absence of Tuolumne River supply. The need to draw storage from San Andreas Reservoir to serve the demand at Harry Tracy WTP would be eliminated.

5.9 Pilarcitos Reservoir

Coastside CWD's water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. With the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated at about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request and the resultant potential changes to the operation of SFPUC facilities and their affected environs are uncertain.²⁰

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs are identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

The alternative setting would result in the same potential effects in the Pilarcitos Creek watershed as in the WSIP setting.

²⁰ See "Analysis of SFPUC Pilarcitos / Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

6. CEQA Alternative 5 – Oceanside Seawater Desalination Plant

CEQA Alternative 5 – Oceanside Seawater Desalination Plant Alternative (Desalination in San Francisco) would incorporate the production of 25 mgd of potable water from a desalination facility located near the Oceanside Water Pollution Control Plant in San Francisco. The 25 mgd of reverse osmosis production would be provided year-round in all years and served to the retail customers in the City and County of San Francisco.

The alternative would implement almost all of the proposed facilities for the proposed WSIP. The exception to the WSIP configuration and proposed facilities would be the specific improvements to the SJPL. Improvements and repairs would be made to the SJPL to ensure that conveyance would continue at the existing 290-mgd capacity. A SFPUC desalination plant and its appurtenant facilities would be constructed.²¹

During non-drought years, the SFPUC would serve the increase of 35 mgd in purchase requests through the supply derived from the desalination plant and a combination of conservation, water recycling, and groundwater supply programs, and greater utilization of the Bay Area watershed supplies associated with the restoration of operational storage capacity, primarily at Calaveras Reservoir.²² The SFPUC would implement conservation, water recycling, and groundwater supply programs in the SFPUC retail service area to achieve the equivalent of 10 mgd of supply every year. These programs would be in addition to demand management and conservation measures already accounted for in the 2030 purchase request for the retail service area.

In most years, the SFPUC could serve the projected 2030 water purchases of 300 mgd with its existing sources of water supply; however, these sources alone have not allowed for full water deliveries during past droughts, and would continue to be insufficient during future droughts as purchase requests increase. In this alternative, the SFPUC would serve the 2030 need for increased system firm yield with a combination of conservation, water recycling, and groundwater programs in the SFPUC retail service area, water production from the desalination plant, a groundwater conjunctive-use program incorporating the Westside Basin Groundwater Program, and restoration of reservoir operating capacity at Crystal Springs and Calaveras Reservoirs. As with the WSIP, system-wide rationing would be limited to no more than 20 percent in any year. The water transfer program with MID/TID would not occur.

The following described results for this alternative are derived from studies performed by the SFPUC during the investigation of Water Supply Option 3. Subsequent to those studies, several refinements to assumptions for water demands, facility configuration, and operations have changed for the proposed future SFPUC regional system, which would have slightly altered the studies incorporated into Water Supply Option 3. Due to this circumstance, a comparison of the explicit modeling results for this alternative with results for the WSIP setting or base setting requires caution, and additional qualitative descriptions are provided.

6.1 Water Deliveries and Drought Response Actions

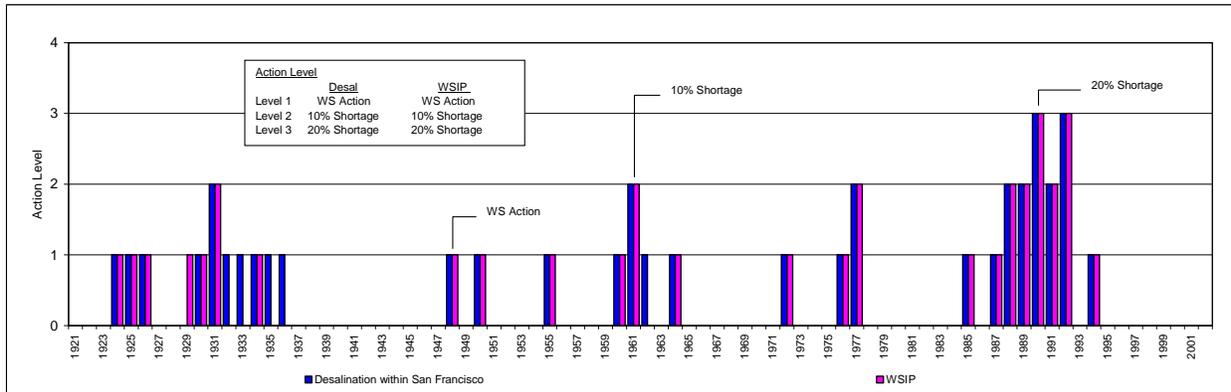
In both the alternative and WSIP settings, an average annual 300-mgd system-wide purchase request is served. With implementation of 10 mgd of conservation, water recycling, and groundwater supply programs in the SFPUC retail service area, the net regional system demand would be 290 mgd. Figure 6.1-1 illustrates the drought response actions for the simulated 82-year historical period (1921-2002).

In Figure 6.1-1, years with bars showing a “1” or greater level of action indicate periods when a supplemental water supply action is initiated. In both the WSIP and alternative settings, the action is the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. Action levels greater than “1” indicate the imposition of delivery shortages (rationing) to SFPUC customers.

²¹ This setting is additionally described in *Water System Improvement Program (WSIP) Water Supply Option 3*, prepared by San Francisco Public Utilities Commission and Parsons, June 2006.

²² The Lower Crystal Springs Dam Improvements project would be included in this alternative.

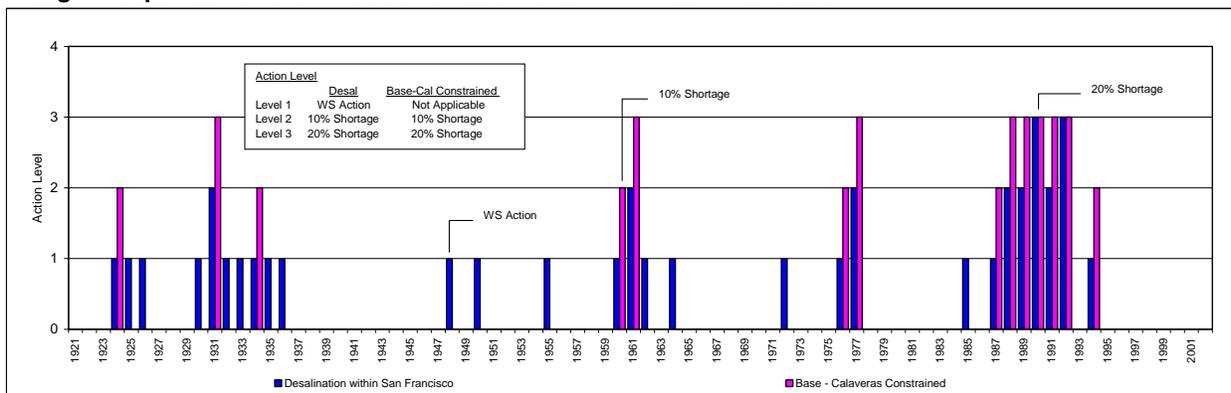
**Figure 6.1-1
Drought Response Actions – Desalination within San Francisco and WSIP**



The need for water delivery shortages, in frequency and severity, would be the same for the two settings, including during the design drought. Shortages would be no greater than 20 percent in any year. Although the WSIP and alternative settings indicate a different frequency of use of the level 1 action (Westside Basin Groundwater Program), the differences are partially a result of modeling assumptions that were applied in the more recent WSIP studies, which were not consistent with assumptions applied in the earlier Water Supply Option 3 studies. The modeling assumptions concern the explicit system storage level at which use of the action is triggered. As described later concerning Bay Area reservoir storage, less depletion of local reservoir storage would be anticipated in the alternative setting due to the availability of water supply production in the Bay Area system. This circumstance would lead to generally greater retention of Bay Area system storage due to the absence of conveyance constraints that limit the amount of Hetch Hetchy water that can be used seasonally to serve system-wide demand in the WSIP setting. The difference in frequency of triggering the action between the two settings is non-substantive.

The same form of information is shown in Figure 6.1-2 for the comparison of the alternative setting to the base setting. In modeling parlance, there is no level 1 action level in the base setting. Without supplemental resources, the existing system only has the delivery shortage measure available to cope with drought. This shortage measure is imposed during level 2 (10 percent) and level 3 (20 percent). These percentages of shortage are applied to both the alternative and the base settings for these action levels. As evident in the illustration, the imposition of rationing occurs more frequent and to a greater severity in the base setting (level 2 and level 3 actions). Figure 6.1-2 illustrates that, when comparing the base setting to the alternative setting, the supplemental resource (Westside Basin Groundwater Program) is triggered at times of drought, during periods when there currently is no supplemental resource available to the system. The utilization of the supplemental resource during these times results in the elimination or reduction, or at least a non-increase in the severity, of delivery shortage.

**Figure 6.1-2
Drought Response Actions – Base and Desalination within San Francisco**



Not illustrated in Figure 6.1-1 or Figure 6.1-2 are the delivery shortages anticipated during the entire SFPUC Design Drought. Shortages during the Design Drought with the WSIP and alternative are maintained within the objective to limit the severity of shortage to no more than 20 percent. With the existing system (Calaveras and Crystal Springs Reservoirs constrained), the 20-percent limitation (cap) objective cannot be achieved during the last 18 months of the Design Drought, and a 25 percent shortage is applied.

6.2 Diversions from Tuolumne River

For the alternative, WSIP, and base settings, the metric for illustrating the SFPUC diversion from the Tuolumne River Basin is the flow through the San Joaquin Pipeline (SJPL). Table 6.2-1 illustrates the diversions and difference in diversions to the SJPL for the proposed program and alternative settings, averaged by month, by year type. Evident is the decrease in annual diversions associated with the alternative setting. Although the same system-wide level of deliveries occurs for the two settings, the production of water supply by the desalination plant in San Francisco diminishes the use of the Tuolumne River water to serve the additional purchase request. The difference in SJPL diversions between the WSIP setting and the alternative setting is also illustrated in Figure 6.2-1. Illustrated is the difference in average monthly diversion through the SJPL by year type for the 82-year simulation period.

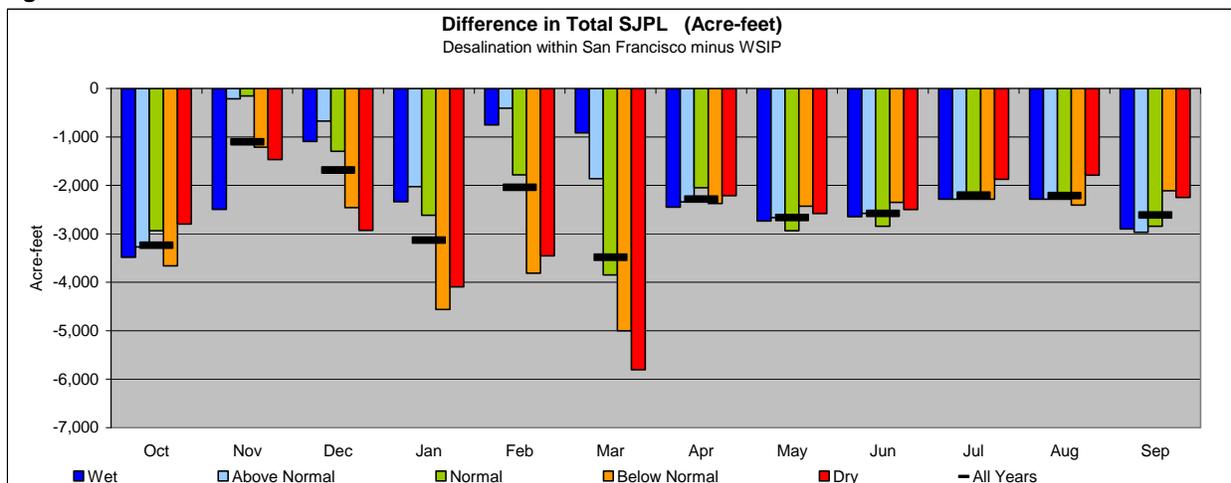
Table 6.2-1

Total SJPL (Acre-feet)													Desalination within San Francisco		WY Total
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Jul	Aug	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	23,932	14,127	7,438	9,175	6,649	10,156	19,161	23,962	23,189	27,589	27,589	26,009	218,976		
Above Normal	23,112	14,243	7,180	12,228	8,896	14,841	21,771	26,022	25,183	27,589	27,589	25,941	234,596		
Normal	22,892	14,501	7,480	12,832	10,258	18,492	26,354	26,935	26,066	27,589	27,589	26,066	247,053		
Below Normal	23,560	14,785	9,138	17,013	14,810	19,979	26,537	27,141	26,266	27,589	27,141	25,833	259,792		
Dry	23,130	18,126	11,654	15,787	13,964	19,979	26,699	27,292	26,411	27,292	27,113	25,030	262,476		
All Years	23,326	15,140	8,568	13,436	10,938	16,707	24,106	26,278	25,430	27,531	27,403	25,778	244,642		

Total SJPL (Acre-feet)													WSIP		WY Total
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Jul	Aug	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	27,417	16,624	8,533	11,512	7,401	11,072	21,613	26,698	25,836	29,873	29,873	28,909	245,359		
Above Normal	26,381	14,460	7,852	14,254	9,306	16,705	24,111	28,687	27,761	29,873	29,873	28,909	258,169		
Normal	25,830	14,656	8,776	15,448	12,041	22,339	28,403	29,873	28,909	29,873	29,873	28,909	274,929		
Below Normal	27,220	15,998	11,595	21,574	18,621	24,976	28,909	29,571	28,617	29,873	29,548	27,945	294,447		
Dry	25,931	19,593	14,583	19,883	17,417	25,782	28,909	29,873	28,909	29,165	28,904	27,281	296,229		
All Years	26,562	16,241	10,254	16,568	12,982	20,191	26,392	28,945	28,011	29,735	29,617	28,391	273,887		

Difference in Total SJPL (Acre-feet)													Desalination within San Francisco minus WSIP		WY Total
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													Jul	Aug	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total		
Wet	-3,485	-2,497	-1,094	-2,337	-752	-916	-2,451	-2,736	-2,647	-2,284	-2,284	-2,901	-26,383		
Above Normal	-3,268	-217	-672	-2,026	-410	-1,863	-2,340	-2,664	-2,578	-2,284	-2,284	-2,968	-23,574		
Normal	-2,938	-155	-1,296	-2,616	-1,783	-3,847	-2,049	-2,938	-2,843	-2,284	-2,284	-2,843	-27,876		
Below Normal	-3,660	-1,213	-2,457	-4,561	-3,811	-4,997	-2,372	-2,429	-2,351	-2,284	-2,407	-2,112	-34,655		
Dry	-2,801	-1,467	-2,929	-4,097	-3,453	-5,803	-2,210	-2,581	-2,498	-1,874	-1,790	-2,250	-33,753		
All Years	-3,236	-1,100	-1,686	-3,131	-2,044	-3,484	-2,286	-2,667	-2,580	-2,204	-2,213	-2,613	-29,245		

Figure 6.2-1



The lesser diversions for the alternative setting during March through August are due to the assumed lesser conveyance capacity of the SJPL associated with the alternative setting. In the WSIP setting, conveyance is increased to 313 mgd, while in the alternative setting the capacity is not improved above the currently used 290-mgd capacity. Differences during the fall, winter, and spring result from the lesser replenishment needed for Bay Area system storage from the Tuolumne River under the alternative setting. Also, less of the increase in demand is served from the Tuolumne River during this period.

The differences between the alternative's diversions from the Tuolumne River and the base setting diversions are similarly illustrated in Table 6.2-2 and in Figure 6.2-2. The average annual diversions associated with the alternative setting are about the same as those occurring for the base setting. However, there would be year-to-year differences and seasonal shifts in diversions. The seasonal shift in diversions between the two settings is due to different facility maintenance assumptions for the two settings. The alternative incorporates a maintenance program that constrains conveyance through the SJPL during November and December. Following this maintenance period, larger diversions occur to replenish Bay Area reservoirs. There would also be differences in management of storage due to the restoration of Calaveras Reservoir operational capacity and the occurrence of the desalination supply within the Bay Area system. All of these system-wide differences would result in the use of the SJPL. While the overall average annual diversion through the SJPL in the alternative setting remained within 500 acre-feet of the base setting diversion, modeling results indicated that the difference in annual diversions could be as much as 35,000 acre-feet more or less than the base setting diversions in any particular year.

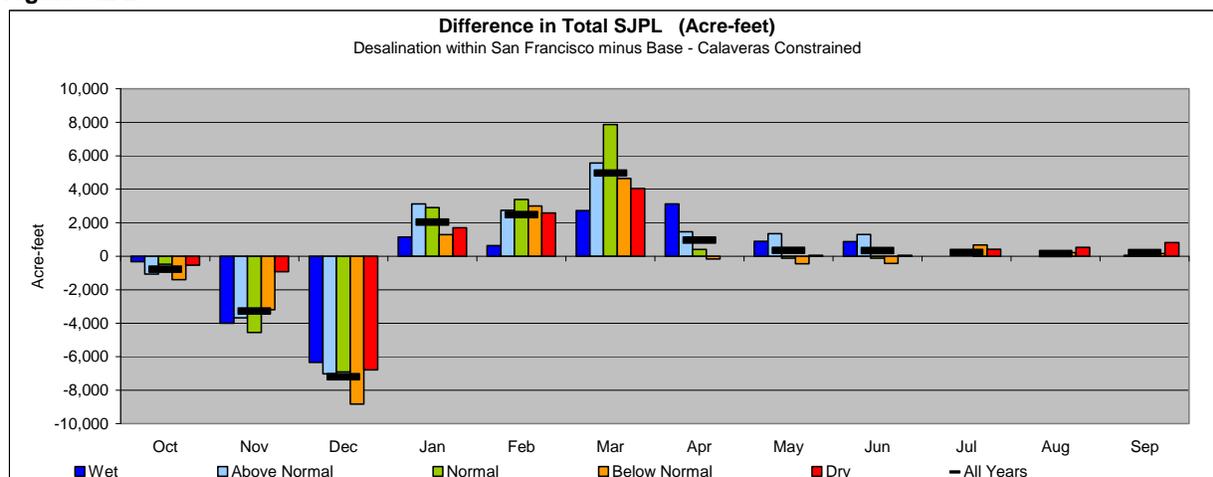
Table 6.2-2

Total SJPL (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Desalination within San Francisco												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	23,932	14,127	7,438	9,175	6,649	10,156	19,161	23,962	23,189	27,589	27,589	26,009	218,976
Above Normal	23,112	14,243	7,180	12,228	8,896	14,841	21,771	26,022	25,183	27,589	27,589	25,941	234,596
Normal	22,892	14,501	7,480	12,832	10,258	18,492	26,354	26,935	26,066	27,589	27,589	26,066	247,053
Below Normal	23,560	14,785	9,138	17,013	14,810	19,979	26,537	27,141	26,266	27,589	27,141	25,833	259,792
Dry	23,130	18,126	11,654	15,787	13,964	19,979	26,699	27,292	26,411	27,292	27,113	25,030	262,476
All Years	23,326	15,140	8,568	13,436	10,938	16,707	24,106	26,278	25,430	27,531	27,403	25,778	244,642

Total SJPL (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Base - Calaveras Constrained												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	24,260	18,126	13,783	8,028	6,015	7,433	16,031	23,070	22,326	27,589	27,589	26,009	220,258
Above Normal	24,176	17,926	14,204	9,100	6,157	9,279	20,309	24,679	23,883	27,589	27,589	25,887	230,776
Normal	23,368	19,046	14,390	9,930	6,864	10,632	25,951	27,054	26,181	27,589	27,589	26,009	244,601
Below Normal	24,959	17,980	17,964	15,726	11,808	15,334	26,699	27,589	26,699	26,917	26,917	25,670	264,263
Dry	23,665	19,046	18,433	14,080	11,386	15,936	26,699	27,232	26,354	26,876	26,578	24,225	260,509
All Years	24,097	18,413	15,763	11,398	8,459	11,737	23,147	25,930	25,093	27,311	27,253	25,565	244,165

Difference in Total SJPL (Acre-feet)													
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)													
	Desalination within San Francisco minus Base - Calaveras Constrained												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
Wet	-327	-3,999	-6,345	1,147	634	2,723	3,130	892	863	0	0	0	-1,282
Above Normal	-1,063	-3,683	-7,024	3,128	2,740	5,563	1,462	1,343	1,300	0	0	54	3,820
Normal	-476	-4,546	-6,910	2,902	3,394	7,861	403	-119	-115	0	0	58	2,452
Below Normal	-1,399	-3,195	-8,826	1,287	3,003	4,645	-162	-448	-433	672	224	162	-4,471
Dry	-535	-921	-6,779	1,707	2,578	4,043	0	60	58	416	535	806	1,967
All Years	-772	-3,273	-7,195	2,038	2,479	4,970	959	348	337	220	151	213	477

Figure 6.2-2



6.3 Hetch Hetchy Reservoir and Releases

Both the WSIP and alternative settings have the same underlying system-wide net demand for water (290 mgd); however, the alternative supplements the SFPUC water supply with production from the desalination plant instead of from the Tuolumne River. The increase in system-wide demand is essentially served with a Bay Area water resource, which results in about the same residual demand for the Hetch Hetchy system. Figure 6.3-1 illustrates a chronological trace of the simulation of Hetch Hetchy Reservoir storage and stream releases. Shown in Figure 6.3-1 are the results for the WSIP, base-Calaveras constrained (“Base – Calaveras Constrained”), and alternative (“Desalination within San Francisco”) settings.

Storage in Hetch Hetchy Reservoir associated with the alternative setting would be either equal to (when full) or greater than anticipated for the WSIP setting, as seen in Figure 6.3-1. With a lesser demand (compared to the WSIP setting) served from the Tuolumne River in the alternative setting, more storage would be retained in Hetch Hetchy Reservoir. Figure 6.3-2 illustrates the average monthly storage and range of reservoir storage for the alternative and WSIP settings.

With about the same diversion from the Tuolumne River, Hetch Hetchy Reservoir storage in the alternative setting would be similar to the storage depicted for the base setting. Figure 6.3-3 illustrates the average monthly storage and range of storage for the alternative and base settings. Hetch Hetchy Reservoir storage is typically greater by the end of December in the alternative setting due to the effect of constrained conveyance for maintenance during November and December. The increase in storage is often diminished by early spring as additional Bay Area reservoir replenishment subsequent to the maintenance draws additional water from the Hetch Hetchy system. By the end of April, during about 60 percent of the years, the reservoir would be slightly fuller.

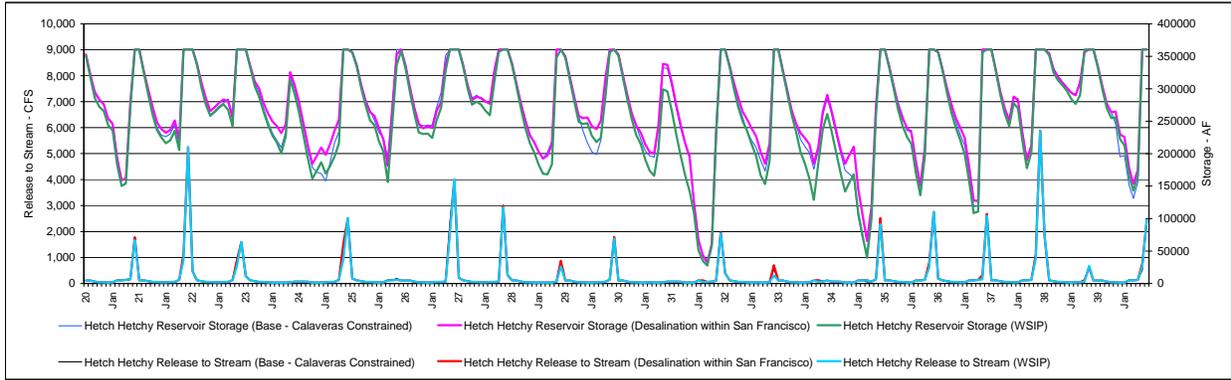
A difference in storage in Hetch Hetchy Reservoir attributed to the diversion effects of the alternative or WSIP settings compared to the base setting would manifest in differences in releases from O’Shaughnessy Dam to the stream. A different amount of available reservoir space in the winter and spring due to the alternative would lead to a different ability to regulate inflow, thus potentially changing the amount of water released to the stream that is above minimum release requirements. Figure 6.3-1 chronologically illustrates the average monthly stream release from O’Shaughnessy Dam for the alternative, WSIP, and base settings. The average monthly releases and difference in releases to the stream from O’Shaughnessy Dam for the alternative and WSIP settings are illustrated in Table 6.3-1 and Figure 6.3-4. The same form of information for the alternative setting and base setting is illustrated in Table 6.3-2 and Figure 6.3-5.

Compared to the WSIP setting, the alternative setting would typically result in an increase in stream releases during years and months when releases in excess of minimum requirements occur. As the reservoir would typically be fuller entering the reservoir filling season, there would be less ability to regulate inflow without releases in excess of minimum requirements.

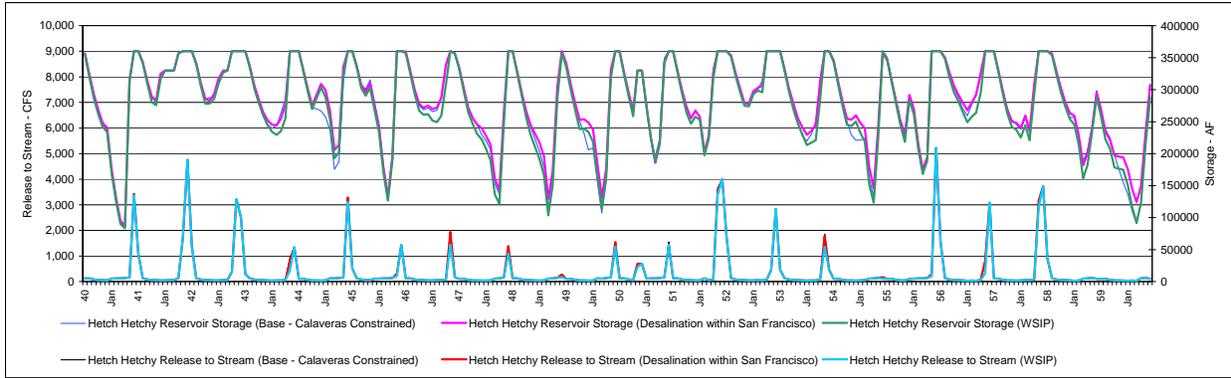
Compared to the base setting, the alternative setting would result in alternating effects, ranging in effect from increases to decreases, and in some circumstances no change in releases. As described previously, essentially no change is anticipated in the long-term average diversion from the Hetch Hetchy system to serve the increased system-wide demand; however, year to year, there could be different amounts of diversions as compared to the base setting. These changes in diversions from year to year would lead to a change in storage from year to year in comparison to the base setting, and thus changes to releases at times. Over the 82-year simulation period, modeling results indicate that about a third of the time there would be no change to releases, about a third of the time there would be increases in releases, and about a third of the time there would be decreases in releases.

Table 6.3-1 and Table 6.3-4 illustrate the difference in stream release between the alternative setting and the WSIP and base settings, expressed in terms of a monthly volume (acre-feet) of flow. Considering the manner in which releases are determined and made to the stream, quantifying the effect of these

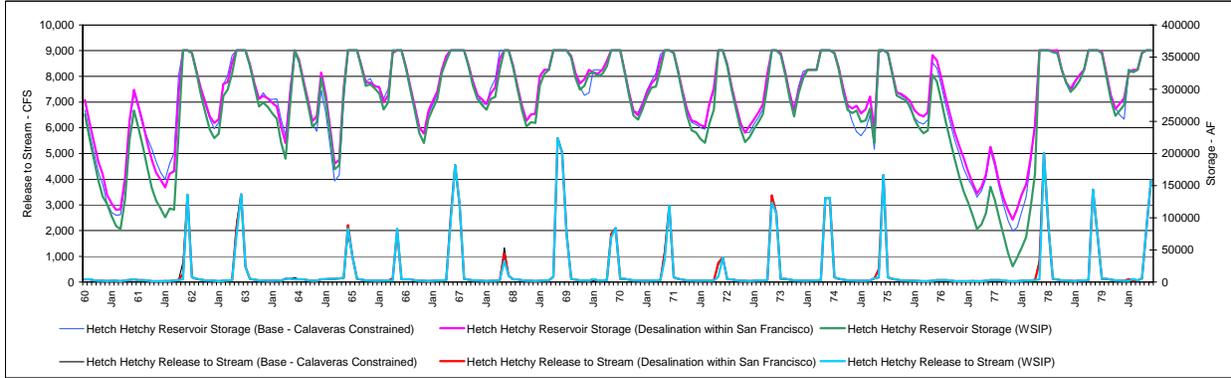
Figure 6.3-1
Hetch Hetchy Reservoir Storage and Stream Release
 1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

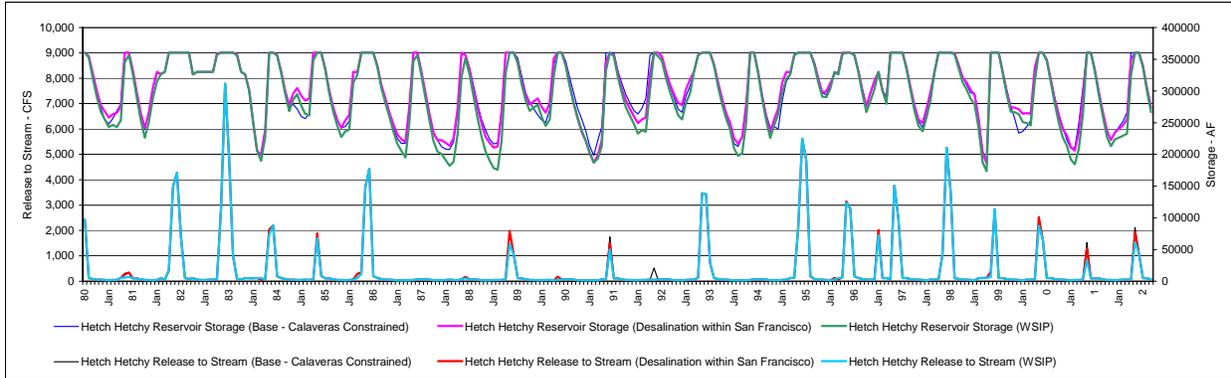


Figure 6.3-2

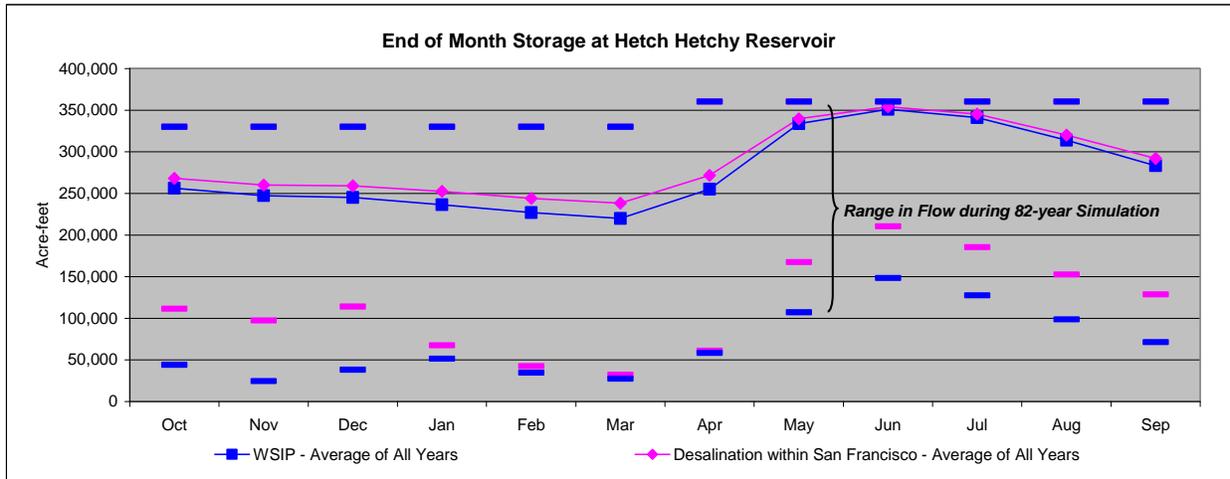


Figure 6.3-3

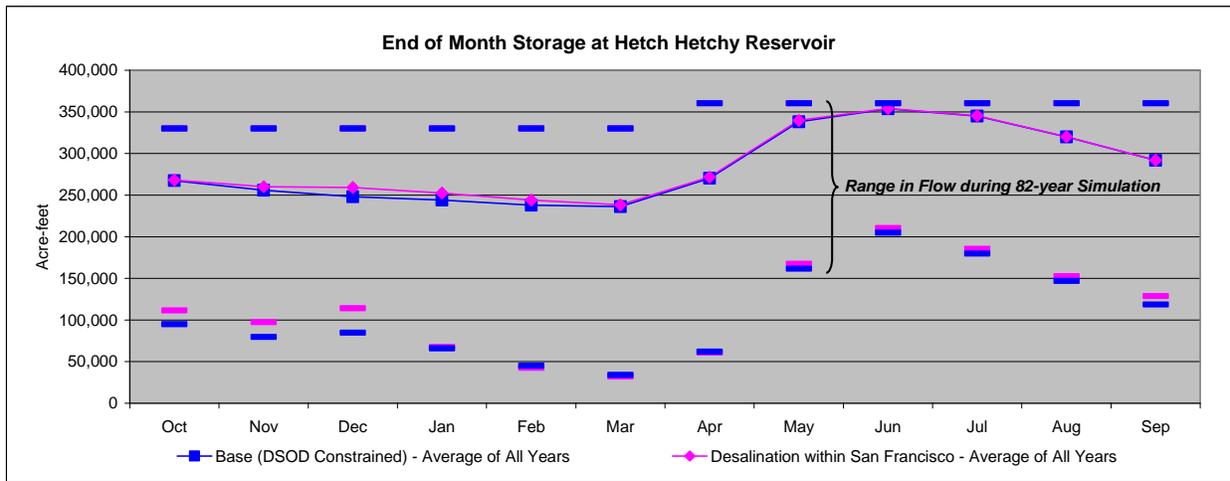


Table 6.3-1

Hetch Hetchy Release to Stream (Acre-feet)													Desalination within San Francisco	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	3,378	3,031	3,124	11,348	4,695	5,804	8,790	154,062	271,048	125,059	11,310	5,335	606,984	
Above Normal	3,400	5,733	5,435	4,033	5,354	5,309	7,885	79,178	185,748	23,302	7,686	5,316	338,378	
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	89,574	114,843	10,299	7,513	5,123	254,838	
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,436	45,611	46,267	6,927	6,818	4,345	134,208	
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,816	11,419	9,991	5,285	5,285	3,861	56,846	
All Years	3,351	3,703	3,449	4,728	3,904	4,535	6,356	75,638	125,346	33,709	7,711	4,797	277,227	

Hetch Hetchy Release to Stream (Acre-feet)													WSIP	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	3,378	3,031	3,124	10,290	4,917	5,165	8,544	148,523	270,615	125,059	11,310	5,316	599,271	
Above Normal	3,400	5,282	5,435	4,033	4,936	5,772	7,808	73,003	184,183	23,302	7,686	5,316	330,156	
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	77,459	113,463	10,299	7,513	5,123	241,343	
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,212	34,660	42,164	6,927	6,818	4,345	118,930	
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,340	9,651	8,283	5,285	5,285	3,861	52,893	
All Years	3,351	3,609	3,449	4,522	3,861	4,506	6,153	68,297	123,484	33,709	7,711	4,793	267,446	

Difference in Hetch Hetchy Release to Stream (Acre-feet)													Desalination within San Francisco minus WSIP	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	1,058	-222	640	246	5,539	433	0	0	19	7,714	
Above Normal	0	451	0	0	418	-463	77	6,175	1,564	0	0	0	8,222	
Normal	0	0	0	0	0	0	0	12,116	1,380	0	0	0	13,496	
Below Normal	0	0	0	0	0	0	224	10,951	4,103	0	0	0	15,278	
Dry	0	0	0	0	0	0	476	1,769	1,709	0	0	0	3,953	
All Years	0	93	0	207	43	29	203	7,340	1,862	0	0	4	9,782	

Figure 6.3-4

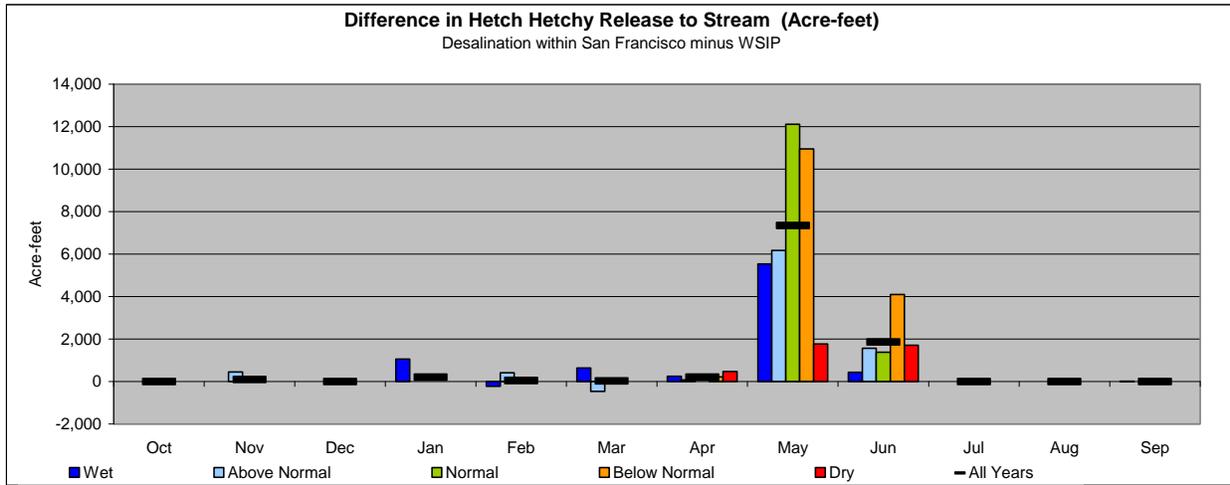


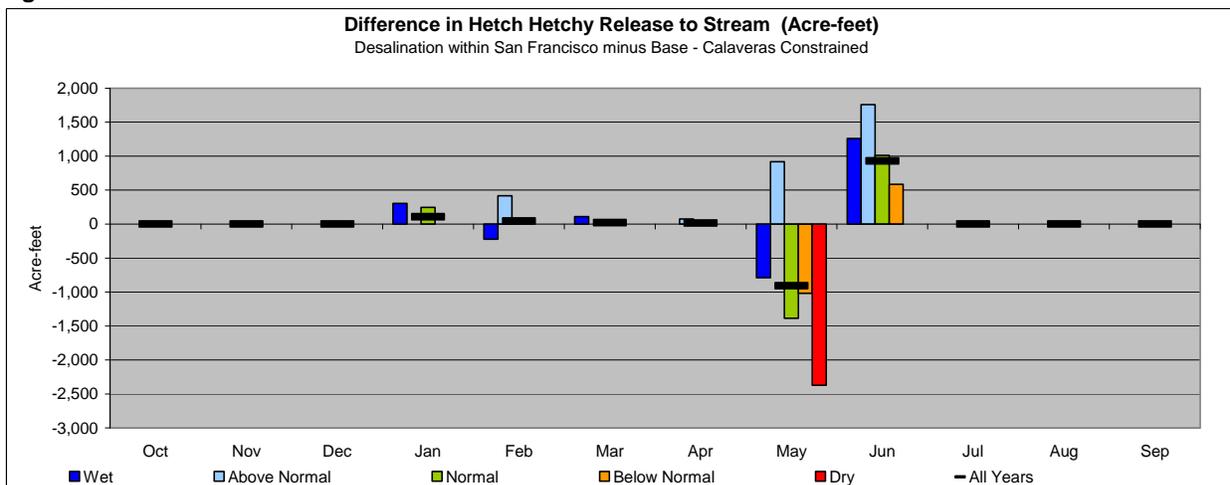
Table 6.3-2

Hetch Hetchy Release to Stream (Acre-feet)													Desalination within San Francisco	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	3,378	3,031	3,124	11,348	4,695	5,804	8,790	154,062	271,048	125,059	11,310	5,335	606,984	
Above Normal	3,400	5,733	5,435	4,033	5,354	5,309	7,885	79,178	185,748	23,302	7,686	5,316	338,378	
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	89,574	114,843	10,299	7,513	5,123	254,838	
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,436	45,611	46,267	6,927	6,818	4,345	134,208	
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,816	11,419	9,991	5,285	5,285	3,861	56,846	
All Years	3,351	3,703	3,449	4,728	3,904	4,535	6,356	75,638	125,346	33,709	7,711	4,797	277,227	

Hetch Hetchy Release to Stream (Acre-feet)													Base - Calaveras Constrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	3,378	3,031	3,124	11,045	4,917	5,695	8,790	154,853	269,789	125,059	11,310	5,335	606,325	
Above Normal	3,400	5,733	5,435	4,033	4,936	5,309	7,808	78,261	183,990	23,302	7,686	5,316	335,208	
Normal	3,343	3,235	3,051	3,109	4,128	4,557	5,817	90,958	113,833	10,299	7,513	5,123	254,966	
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,436	46,628	45,681	6,927	6,818	4,345	134,639	
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,816	13,790	9,991	5,285	5,285	3,861	59,217	
All Years	3,351	3,703	3,449	4,621	3,861	4,514	6,340	76,545	124,417	33,709	7,711	4,797	277,018	

Difference in Hetch Hetchy Release to Stream (Acre-feet)													Desalination within San Francisco minus Base - Calaveras Constrained	
(Average within Year Type - Grouped by Unimpaired Runoff at LaGrange)														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
Wet	0	0	0	304	-222	110	0	-791	1,259	0	0	0	660	
Above Normal	0	0	0	0	418	0	77	917	1,758	0	0	0	3,170	
Normal	0	0	0	246	0	0	0	-1,384	1,011	0	0	0	-128	
Below Normal	0	0	0	0	0	0	0	-1,017	586	0	0	0	-431	
Dry	0	0	0	0	0	0	0	-2,371	0	0	0	0	-2,371	
All Years	0	0	0	107	43	21	16	-908	929	0	0	0	209	

Figure 6.3-5



changes in terms of monthly flow (acre-feet or cfs) is not always meaningful.²³ Assuming that a change in release volume equates to a delay or earlier initiation of releasing 6,000 acre-feet per day, the difference in stream release from O'Shaughnessy Dam between the alternative and WSIP settings could be additional days of releases in excess of minimum requirements by up to 7 days. Compared to the base setting, a range of up to 4 days of additional releases to a delay of up to 5 days of releases could occur. Normally, the effect of a delay or earlier start in release would not affect the year's peak stream release rate during a year. Table 6.3-3 and Table 6.3-4 illustrate the modeled monthly volumetric changes in stream release between the alternative and WSIP settings and the alternative and base settings, respectively.

6.4 Lake Lloyd and Lake Eleanor

Compared to the operation in the WSIP setting, the operation of Lake Lloyd and Lake Eleanor in the alternative setting is simulated to be essentially the same. Also, the operation resulting for the alternative and WSIP settings are essentially the same as in the base setting. These outcomes are the result of Lake Lloyd and Lake Eleanor operations predominantly occurring for the satisfaction of power generation needs and MID/TID entitlements to inflow. The lone exception in the simulation occurs during the prolonged drought of 1987-1992. During this drought period, there is a slightly different draw from Hetch Hetchy Reservoir in the WSIP setting as compared to the alternative and base settings, affecting the amount of water released from Hetch Hetchy Reservoir to Don Pedro Reservoir, which, for satisfaction of MID/TID entitlements to inflow, affects the amount of releases from Lake Lloyd. The effect is small and would rarely occur. The effect of a different storage level occurring in Lake Lloyd would manifest as a change to releases to the stream above minimum requirements during a subsequent period of reservoir replenishment. There would be no difference in the operation of the reservoirs between the alternative and base settings.

6.5 Flow below Tuolumne River and Cherry River Confluence

With little difference between the performance of the alternative setting and the base setting, the flow below the Tuolumne River and Cherry River confluence is anticipated to be the same in both settings. While both the alternative and base settings, during some dry and critical years, there could be instances when the shaped flow would be less than 1,000 cfs; however, results indicate that the alternative setting would rarely change that frequency. There would be slightly more flow at this location in the alternative setting as compared to the WSIP setting.

6.6 Don Pedro Reservoir and La Grange Releases

A change in Don Pedro Reservoir operation is caused by changes to inflow to the reservoir. The changes in inflow to the reservoir are the result of net changes within the operation of the upstream SFPUC facilities, described previously, and other changes in SFPUC operations associated with diversions to the Holm, Kirkwood, and Moccasin Powerhouses. Figure 6.6-1 illustrates the difference in inflow to Don Pedro Reservoir between the alternative and WSIP settings, averaged by month for each year type. The results illustrate how serving the increase in system-wide demand with the water supply from the desalination plant located in the Bay Area system would reduce the amount of diversion from the Hetch Hetchy system compared to the WSIP setting, thus resulting in more inflow to Don Pedro Reservoir. The comparison of inflow to Don Pedro Reservoir between the alternative and base settings is illustrated in Figure 6.6-2. The illustration shows the small effect to inflow to Don Pedro Reservoir attributable to the alternative. Shifts in the timing of inflow to Don Pedro Reservoir would occur due to changes in the seasonal operation of the entire SFPUC system, including a different maintenance program. While the overall average annual inflow to Don Pedro Reservoir in the alternative setting remained within 500 acre-feet of the base setting diversion, modeling results indicated that the difference in annual inflow could be as much as 30,000 acre-feet more or less than the base setting diversions in any particular year.

²³ See "Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir", Memorandum by Daniel B. Steiner, December 31, 2006.

Table 6.3-3

Difference in Hetch Hetchy Release to Stream (Acre-feet)

Desalination within San Francisco minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	6,285	0	0	0	6,285
1922	0	0	0	0	0	0	0	14,428	0	0	0	0	14,428
1923	0	0	0	0	0	0	0	13,146	0	0	0	0	13,146
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	36,643	0	0	0	0	36,643
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	11,320	0	0	0	0	11,320
1928	0	0	0	0	0	0	0	3,849	0	0	0	0	3,849
1929	0	0	0	0	0	0	0	0	13,223	0	0	0	13,223
1930	0	0	0	0	0	0	0	0	4,007	0	0	0	4,007
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	3,554	0	0	0	1,885	0	0	0	5,439
1933	0	0	0	0	0	0	0	0	23,521	0	0	0	23,521
1934	0	0	0	0	0	0	3,808	0	0	0	0	0	3,808
1935	0	0	0	0	0	0	0	0	14,075	0	0	0	14,075
1936	0	0	0	0	0	0	0	10,680	0	0	0	0	10,680
1937	0	0	0	0	0	0	0	9,591	4,231	0	0	0	13,822
1938	0	0	0	0	0	0	0	9,324	0	0	0	0	9,324
1939	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1940	0	0	0	0	0	0	0	7,327	0	0	0	0	7,327
1941	0	0	0	0	0	0	0	0	2,676	0	0	0	2,676
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	21,582	0	0	0	0	21,582
1945	0	0	0	0	0	0	0	0	10,018	0	0	0	10,018
1946	0	0	0	0	0	0	0	4,532	0	0	0	0	4,532
1947	0	0	0	0	0	0	0	30,499	0	0	0	0	30,499
1948	0	0	0	0	0	0	0	0	17,542	0	0	0	17,542
1949	0	0	0	0	0	0	0	0	6,209	0	0	0	6,209
1950	0	0	0	0	0	0	0	0	11,568	0	0	0	11,568
1951	0	7,666	0	0	0	0	0	0	-2,188	0	0	0	5,478
1952	0	0	0	0	0	0	0	9,278	0	0	0	0	9,278
1953	0	0	0	0	0	0	0	322	0	0	0	0	322
1954	0	0	0	0	0	0	0	26,531	0	0	0	0	26,531
1955	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1956	0	0	0	0	0	0	0	5,047	0	0	0	0	5,047
1957	0	0	0	0	0	0	0	30,123	0	0	0	0	30,123
1958	0	0	0	0	0	0	0	14,919	0	0	0	0	14,919
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	13,399	0	0	0	0	13,399
1963	0	0	0	0	0	0	0	17,085	0	0	0	0	17,085
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	6,934	0	0	0	6,934
1966	0	0	0	0	0	0	3,808	-4,045	0	0	0	0	-237
1967	0	0	0	0	0	0	0	7,742	0	0	0	0	7,742
1968	0	0	0	0	0	0	0	17,143	0	0	0	0	17,143
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	8,363	0	0	0	0	8,363
1971	0	0	0	0	0	0	0	14,663	0	0	0	0	14,663
1972	0	0	0	0	0	0	0	33,266	0	0	0	0	33,266
1973	0	0	0	0	0	0	0	17,125	0	0	0	0	17,125
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	18,345	0	0	0	0	18,345
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	40,360	0	0	0	310	40,670
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381
1981	0	0	0	0	0	0	0	7,368	10,310	0	0	0	17,678
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	1,957	0	0	0	0	1,957
1984	0	0	0	0	0	-3,935	0	11,745	0	0	0	0	7,810
1985	0	0	0	0	0	0	0	12,715	0	0	0	0	12,715
1986	0	0	0	0	0	10,235	3,935	0	0	0	0	0	14,170
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1989	0	0	0	0	0	0	0	33,354	0	0	0	0	33,354
1990	0	0	0	0	0	0	0	7,831	0	0	0	0	7,831
1991	0	0	0	0	0	0	0	0	14,664	0	0	0	14,664
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	3,554	-3,935	1,311	2,785	0	0	0	0	3,715
1997	0	0	0	12,998	0	0	0	0	0	0	0	0	12,998
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	11,255	127	0	0	0	11,382
2000	0	0	0	0	0	0	0	20,792	0	0	0	0	20,792
2001	0	0	0	0	0	0	0	28,670	0	0	0	0	28,670
2002	0	0	0	0	0	0	0	24,892	0	0	0	0	24,892
Avg (21-02)	0	93	0	207	43	29	203	7,340	1,862	0	0	4	9,782

Table 6.3-4

Difference in Hetch Hetchy Release to Stream (Acre-feet)

Desalination within San Francisco minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-509	0	0	0	-509
1922	0	0	0	0	0	0	0	5,543	0	0	0	0	5,543
1923	0	0	0	0	0	0	0	-3,891	0	0	0	0	-3,891
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	18,410	0	0	0	0	18,410
1926	0	0	0	0	0	0	0	-2,913	0	0	0	0	-2,913
1927	0	0	0	0	0	0	0	-12,868	0	0	0	0	-12,868
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	4,007	0	0	0	4,007
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	3,554	0	0	0	-751	0	0	0	2,803
1933	0	0	0	0	0	0	0	0	8,571	0	0	0	8,571
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	3,935	0	0	10,201	0	0	0	14,136
1936	0	0	0	0	0	0	0	-2,830	0	0	0	0	-2,830
1937	0	0	0	0	0	0	0	6,448	0	0	0	0	6,448
1938	0	0	0	0	0	0	0	-2,015	0	0	0	0	-2,015
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	15,675	0	0	0	0	15,675
1941	0	0	0	0	0	0	0	0	1,479	0	0	0	1,479
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	-9,121	0	0	0	0	-9,121
1945	0	0	0	0	0	0	0	0	23,179	0	0	0	23,179
1946	0	0	0	0	0	0	0	-3,104	0	0	0	0	-3,104
1947	0	0	0	0	0	0	0	-947	0	0	0	0	-947
1948	0	0	0	0	0	0	0	0	5,487	0	0	0	5,487
1949	0	0	0	0	0	0	0	0	6,209	0	0	0	6,209
1950	0	0	0	0	0	0	0	0	16,678	0	0	0	16,678
1951	0	0	0	0	0	0	0	0	-8,401	0	0	0	-8,401
1952	0	0	0	0	0	0	0	-6,872	0	0	0	0	-6,872
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	-4,453	0	0	0	0	-4,453
1955	0	0	0	0	0	0	0	0	3,808	0	0	0	3,808
1956	0	0	0	0	0	0	0	2,241	0	0	0	0	2,241
1957	0	0	0	0	0	0	0	-1,605	0	0	0	0	-1,605
1958	0	0	0	0	0	0	0	2,381	0	0	0	0	2,381
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	-28,255	0	0	0	0	-28,255
1963	0	0	0	0	0	0	0	-11,183	0	0	0	0	-11,183
1964	0	0	0	0	0	0	0	0	-3,808	0	0	0	-3,808
1965	0	0	0	0	0	0	0	0	20,148	0	0	0	20,148
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	-981	0	0	0	0	-981
1968	0	0	0	0	0	0	0	-13,805	0	0	0	0	-13,805
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	3,935	0	0	0	0	0	0	0	0	3,935
1971	0	0	0	0	0	0	0	-8,973	0	0	0	0	-8,973
1972	0	0	0	0	0	0	0	3,809	0	0	0	0	3,809
1973	0	0	0	0	0	0	0	2,731	0	0	0	0	2,731
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	20,704	4,171	0	0	0	24,875
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-6,230	0	0	0	0	-6,230
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	3,935	-3,554	0	0	0	0	0	0	0	381
1981	0	0	0	0	0	0	0	-3,039	0	0	0	0	-3,039
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	-1,174	0	0	0	0	-1,174
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	7,480	0	0	0	0	7,480
1986	0	0	0	0	0	1,757	0	0	0	0	0	0	1,757
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	7,831	0	0	0	0	7,831
1991	0	0	0	0	0	0	0	0	-14,310	0	0	0	-14,310
1992	0	0	0	0	0	0	0	-28,918	0	0	0	0	-28,918
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	3,554	-3,935	1,311	2,785	0	0	0	0	3,715
1997	0	0	0	922	0	0	0	0	0	0	0	0	922
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	-2,236	0	0	0	0	-2,236
2000	0	0	0	0	0	0	0	10,494	0	0	0	0	10,494
2001	0	0	0	0	0	0	0	-13,997	0	0	0	0	-13,997
2002	0	0	0	0	0	0	0	-11,556	0	0	0	0	-11,556
Avg (21-02)	0	0	0	107	43	21	16	-908	929	0	0	0	209

Figure 6.6-1

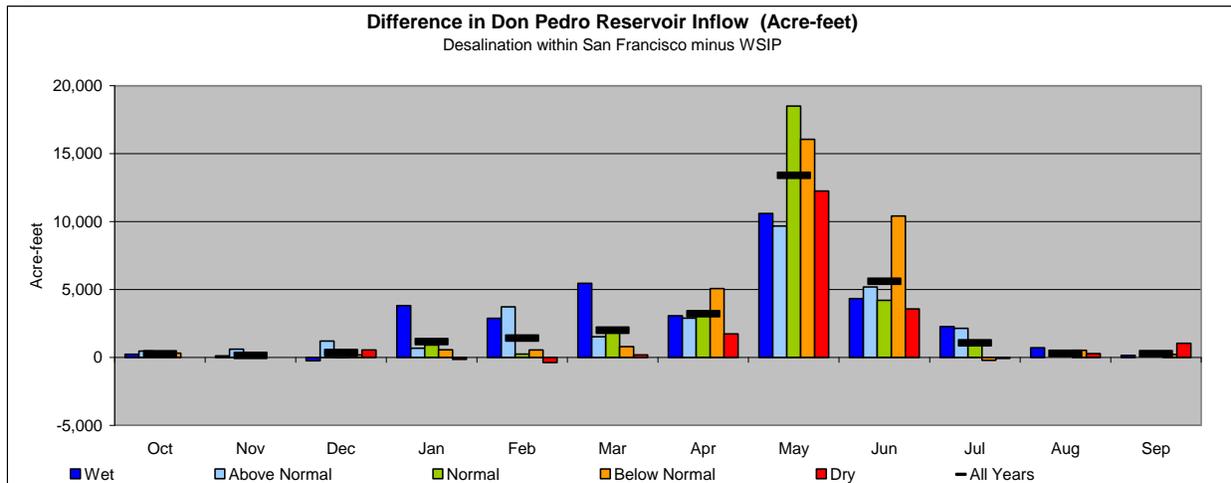
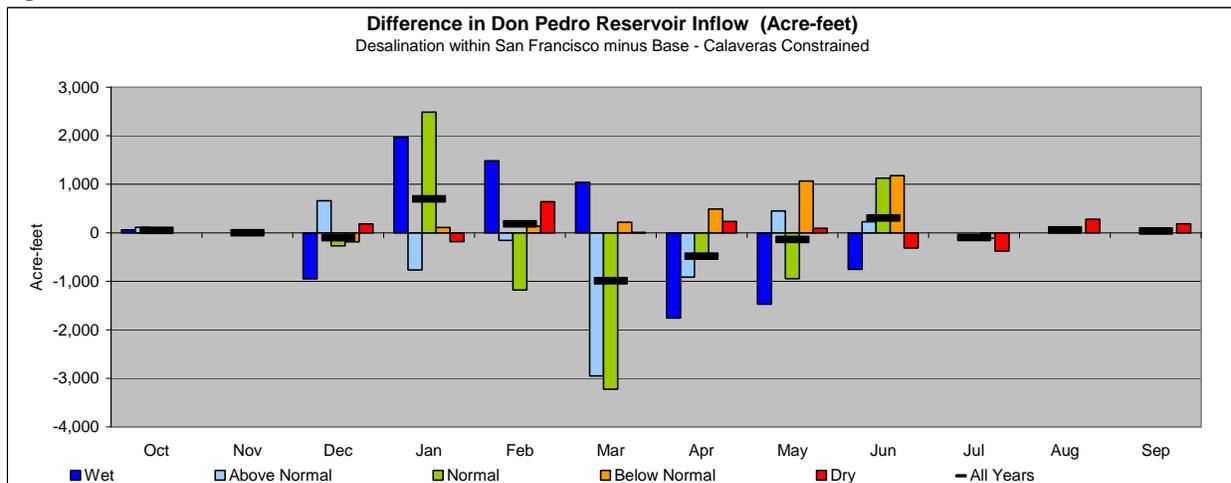


Figure 6.6-2

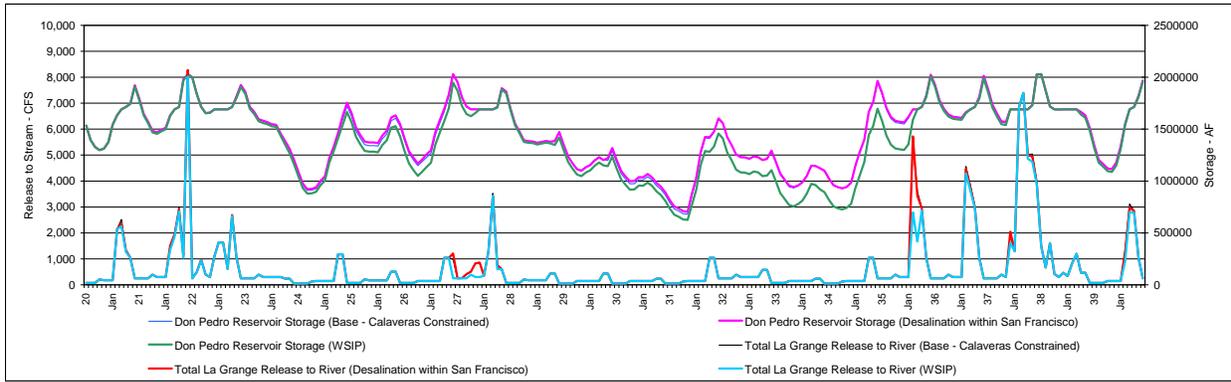


Essentially the same inflow to Don Pedro Reservoir occurs for the alternative and base settings. Figure 6.6-3 illustrates a chronological trace of the simulation of Don Pedro Reservoir storage and stream releases. Shown in Figure 6.6-3 are the results for the WSIP, base, and alternative settings. The alternative setting operation of Don Pedro Reservoir is essentially the same between the alternative and base settings. The lesser inflow to Don Pedro Reservoir associated with the WSIP setting would tend to deplete more storage from Don Pedro Reservoir than either the base or alternative settings, particularly during periods of sustained drought.

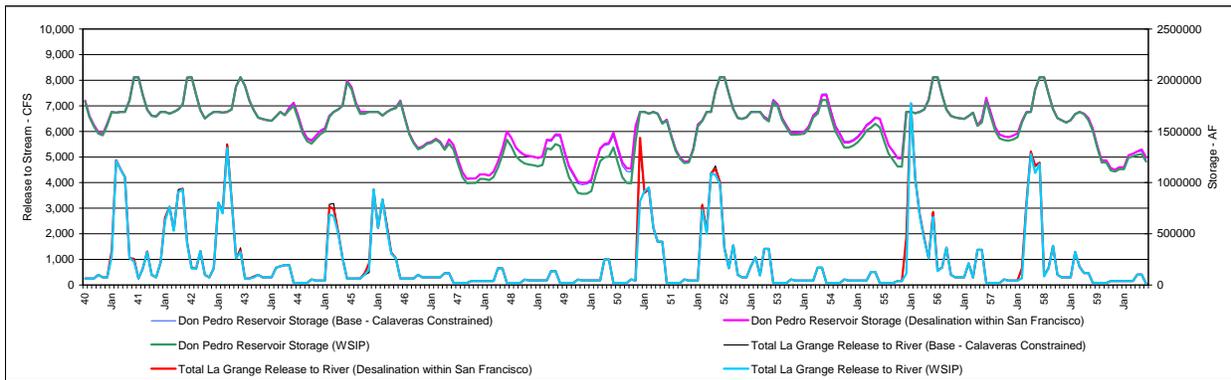
The additional depletion of reservoir storage in the WSIP setting manifests as a reduction in subsequent releases below La Grange Dam in order to replenish reservoir storage. The differences in release to the Tuolumne River from La Grange Dam would occur only when there would otherwise be releases in excess of minimum FERC flow requirements. In the alternative setting, the storage operation of Don Pedro Reservoir is essentially the same as the base setting, resulting in little difference in releases below La Grange Dam. As described previously, slight changes in inflow would occur between the alternative and base settings due to changes in the overall system-wide operation of the SFPUC system. The changes in inflow during periods when Don Pedro Reservoir would be passing inflow to maintain flood control space in the reservoir would manifest as a change in the amount of flow passed to the river. The overall average annual release to the Tuolumne River associated with the alternative is essentially the same as the water released in the base setting; however, there would be month-to-month and year-to-year differences.

Figure 6.6-3

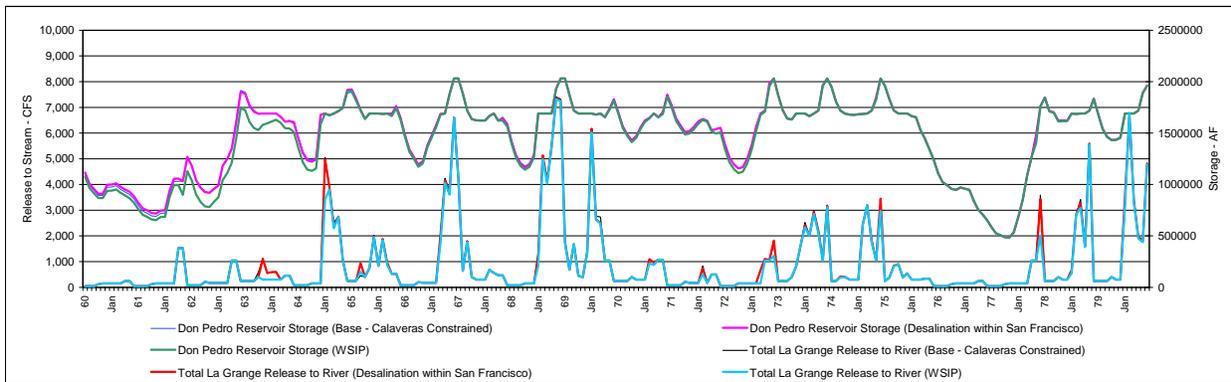
1920 - 1939



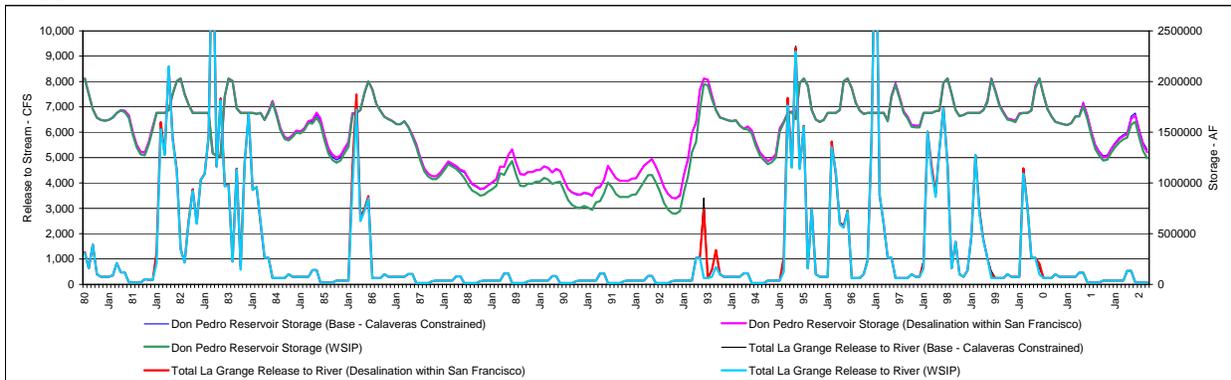
1940 - 1959



1960 - 1979



1980 - 2002



6.7 Calaveras and San Antonio Reservoirs, Alameda Creek and Downstream

The analytical studies used to evaluate this alternative focused on depicting an alternative method of serving the increase in system-wide demand through means other than the Tuolumne River. Those studies were used in support of developing Water Supply Option 3. Subsequent to those studies, refinements to the depiction of the Bay Area system and its operation have occurred that limit the direct use of HH/LSM results for illustrative purposes. The following qualitative descriptions of the comparison between the alternative, WSIP, and base settings have been developed from the review of HH/LSM results and engineering judgment. Overall, in the alternative setting, the Bay Area system would perform very much the same as the system performs in the WSIP setting; however, the occurrence of the alternative's supplemental water supply within the Bay Area system would provide an improved ability to retain storage in the Bay Area reservoirs. This would occur due to the absence of the effect of conveyance constraints in the Hetch Hetchy system during summer and the conveyance maintenance period. The need for water from the Hetch Hetchy system that would at times occur when conveyance could not fully deliver would be satisfied from production at the desalination plant, leaving the Bay Area reservoirs less depleted within a year.

Compared to the base setting, Calaveras Reservoir operations would substantively change in the alternative setting. With the restoration of Calaveras Reservoir operating capacity, the reservoir would be operated to a larger storage capacity. The operation of Calaveras Reservoir would be very similar to the operation described for the WSIP setting.

There would be two categorical changes in the regime of releases to Calaveras Creek below Calaveras Dam between the alternative and base settings. In the alternative setting, there would be the addition of the flows representing the flow objectives associated with the 1997 MOU, and the reduction of stream releases during wetter-year/wetter-season flows due to the restoration of Calaveras Reservoir operational capacity.

Compared to the base setting, diversions from Alameda Creek to Calaveras Reservoir would increase in the alternative setting. With the current constraints on Calaveras Reservoir storage, diversions to Calaveras Creek are rejected. With the restoration of operational storage in the reservoir, the opportunity to divert water into the reservoir would increase.

Commensurate with changes in diversions from Alameda Creek to Calaveras Reservoir would be changes to the flow below the Alameda Creek Diversion Dam. Opposite in effect compared to diversions to Calaveras Reservoir, flow passing Alameda Creek Diversion Dam would decrease in the alternative setting. With operational capacity restored at Calaveras Reservoir, there would be more opportunity (and need) to divert Alameda Creek flows, and thus reduce flow passing the dam.

Flow below the confluence of Alameda Creek and Calaveras Creek is affected by releases from Calaveras Dam to the stream, flow passing Alameda Creek Diversion Dam, and unregulated flow below Alameda Creek Diversion Dam and Calaveras Dam. As with the WSIP setting comparison, the notable differences between the alternative and base settings are the addition of stream flows representing the 1997 MOU and the reduction of wetter-year/wet season flows due to the restoration of Calaveras Reservoir storage.

A flow recapture facility in Alameda Creek below Calaveras Reservoir is incorporated in the alternative setting. This facility is assumed to recapture flows explicitly released from Calaveras Dam in the representation of the 1997 MOU. The effect of the recapture is a reduction in the flow that occurs below the confluence of Alameda and Calaveras Creeks, but only to the extent that releases were explicitly made from Calaveras Reservoir. The flows at this location would be essentially the same as those described for the WSIP setting. The flows identified at this location indicate flow occurring below the confluence of Alameda and Calaveras Creeks (described above), with the addition of estimated unregulated stream accretions between the Alameda-Calaveras Creek confluence and the Alameda-San Antonio Creek confluence, minus the water assumed to be recaptured (diverted) by the SFPUC from the creek.

The difference in San Antonio Reservoir storage between the alternative and base settings is the result of several factors, and is predominantly due to the restoration of the operational capacity of Calaveras Reservoir, the use of SJPL flow for maintenance of Sunol Valley WTP production, and the maintenance of Hetch Hetchy conveyance. In the base setting, the limited operating storage capacity at Calaveras Reservoir leads to a different operation at San Antonio Reservoir, one that draws relatively more stored water for system demands when the draw from Calaveras Reservoir is constrained due to limited storage. The result is that the alternative setting would retain more storage in San Antonio Reservoir than in the base setting. There would very little change in stream releases below San Antonio Reservoir between the alternative, WSIP, and base settings, as the operational goal is to minimize releases to the stream. Flexibility within the balancing of storage among the Bay Area reservoirs would continue to facilitate this goal.

Flow below the confluence of Alameda and San Antonio Creeks is influenced by releases from San Antonio Reservoir and flow arriving at the location from Alameda Creek, which includes upstream impairment by SFPUC operations and facilities. The differences in flow at this location between the alternative and base settings are particularly due to the effects of the restoration of Calaveras Reservoir operating capacity in the alternative setting, and would be essentially the same as described for the differences between the WSIP and base settings.

6.8 Crystal Springs and San Andreas Reservoirs

Fundamental to the difference in storage operations at Crystal Springs Reservoir between the alternative setting and the base settings is the restoration of reservoir operation capacity in the alternative setting, which does not occur in the base setting. The result is the operation of Crystal Springs Reservoir at a higher maximum storage in the alternative setting. The operation of Crystal Springs Reservoir would be similar to the operation described for the WSIP setting.

Compared to the base setting, the alternative setting would generally result in a shifting of the maximum storage level and the range of reservoir operation to a greater volume (elevation), with the lower end of the monthly operating range normally greater in storage than in the base setting.

A difference in stream release below Crystal Springs Reservoir would be infrequent, and could be either an increase or decrease in the release. The potential difference is attributed to whether the alternative's operation would result in more or less available operational storage capacity at an instant compared to another setting. In actual operations, it is anticipated that system operators would manage the reservoir system whereby stream releases would be minimal under any setting, with the effect of essentially no difference between the alternative, WSIP, and base settings.

Overall, Crystal Springs Reservoir, San Antonio Reservoir, and Calaveras Reservoir would tend to retain more storage during a year in the alternative setting as compared to the WSIP setting, and that result is even more dramatic when compared to the base setting. The alternative setting includes water supply production from a desalination plant located within the Bay Area system. The additional supply during the summer reduces the need to draw from Bay Area system storage, retaining greater storage in the Bay Area system during the summer and fall. The availability and use of the supplemental supply during December, when otherwise there would be no conveyance from Hetch Hetchy due to maintenance, also retains storage in the Bay Area system.

San Andreas Reservoir operations would generally be the same between the alternative, WSIP, and base settings. Reservoir storage would follow a systematic filling and lowering each year to manage runoff. However, in contrast to the base and WSIP settings, the alternative setting would not typically result in an additional draw down of storage from San Andreas Reservoir during Hetch Hetchy conveyance maintenance periods. With the desalination supply available during the period of conveyance maintenance, sufficient supplies and conveyance among the Bay Area system would negate the need to increase production at Harry Tracy WTP to compensate for the absence of Tuolumne River supply. The need to draw storage from San Andreas Reservoir to serve the demand at Harry Tracy WTP would be eliminated.

6.9 Pilarcitos Reservoir

Coastside CWD's water demand and its SFPUC purchase request are projected to increase within the WSIP planning horizon of year 2030. With the context of the 2030 purchase request of 300 mgd, Coastside CWD's portion has been estimated at about 3 mgd. This projected purchase request is approximately 1 mgd greater than its current purchase request. Recognizing the current physical constraints to deliveries from the SFPUC to Coastside CWD and the ongoing planning activities in the watershed, the precise means of serving Coastside CWD's additional purchase request and the resultant potential changes to the operation of SFPUC facilities and their affected environs are uncertain.²⁴

Assuming a range of potential means to serve the additional purchase request from Coastside CWD, the following potential hydrologic effects to SFPUC facilities and their affected environs have been identified:

- Due to limited yield from Pilarcitos Reservoir, additional diversions would be required from Crystal Springs Reservoir.
- If deliveries to Coastside CWD from Pilarcitos Reservoir increase during the winter season, these deliveries could potentially reduce storage in Pilarcitos Reservoir, thereby potentially reducing diversions to the San Mateo Creek watershed. Although the increased delivery would increase releases to Pilarcitos Creek from Pilarcitos Dam for a period of time, the increase would subsequently lead to a reduction in spills past Stone Dam.
- Additional wintertime deliveries could also potentially impair the ability to provide carry-over storage into the summer season from Pilarcitos Reservoir, and subsequently lead to an acceleration of the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.
- An increase in summertime deliveries from Pilarcitos Creek could also accelerate the beginning of the season when releases to Pilarcitos Creek from Pilarcitos Reservoir consist only of the passage of reservoir inflow.

The alternative setting would result in the same potential effects to the Pilarcitos Creek watershed as in the WSIP setting.

²⁴ See "Analysis of SFPUC Pilarcitos / Coastside County Water District Operations", Memorandum by Daniel B. Steiner, March 8, 2007.

APPENDIX H2-6

Memorandum

Subject: HH/LSM Assumptions and Results – Proposed WSIP in Future Cumulative Setting
From: Daniel B. Steiner
Date: December 6, 2006

1. Introduction

This memorandum summarizes the assumptions for and interprets the Hetch Hetchy Local Simulation Model (HH/LSM) results for the simulation of the Water System Improvement Program (“WSIP” or the “proposed program”) in the “cumulative” setting. Because additional activities may occur separate from the WSIP, this analysis evaluates the future hydrologic effects that could occur as a result of such activities in combination with the WSIP. Two potential activities specific to the Tuolumne River Basin have been identified for the cumulative analysis: 1) the U.S. Fish & Wildlife Service (USFWS) “discretionary flows” below Hetch Hetchy; and 2) the Turlock Irrigation District (TID) river diversion project. The USFWS activity is explicitly modeled by HH/LSM, and is the topic of this paper; the TID project will be evaluated with post-processing of the HH/LSM results. The TID project would affect only the balance of river releases below La Grange Dam and Turlock Canal diversions, and would not affect the upstream operation of San Francisco facilities. A separate analysis of that cumulative action is being performed, the results of which are not included in this paper.

The San Francisco Public Utilities Commission (SFPUC) proposes to adopt and implement a WSIP to increase the reliability of the regional water system. The WSIP implements the service goals and system performance objectives established by the SFPUC for the Regional Water System in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2030. The WSIP level of service objectives for water supply are to: 1) fully meet customer purchase requests in non-drought years through the planning year 2030, estimated at 300 million gallons per day (mgd) average annual delivery; and 2) provide drought-year delivery with a maximum system-wide delivery reduction (rationing) of 20 percent in any one year of a drought. These objectives correspond to a required system firm yield of 256 mgd in 2030.

The WSIP’s effect on hydrology is described in a separate memorandum.¹ That memorandum discusses the components of the WSIP, the various modeling assumptions and performance and hydrologic results for the WSIP compared to the modeled existing setting (2005) with Calaveras Reservoir constrained by California Division of Safety of Dams (DSOD) restrictions, and the pre-2002 setting (with a Calaveras Reservoir operation prior to DSOD restrictions). The hydrology of the proposed program is primarily compared to the baseline condition of the Program Environmental Impact Report, i.e., the simulated current (2005) operation of the Regional Water System, assuming that the operation of Calaveras and Crystal Springs Reservoirs is constrained by DSOD restrictions. Primary hydrologic parameters such as projected water deliveries, reservoir storage, and stream flows are compared, and additional parameters that assist in identifying causes of hydrologic changes are also described as needed. The key hydrologic factors that lead to environmental impact assessment are also illustrated.

This analysis is based on both the projection of the WSIP operation in the year 2030 and the current operation of the Regional Water System.

2. USFWS Discretionary Flows

The USFWS has the discretion to require the release of additional water from Hetch Hetchy Reservoir. These releases amount to 15,000, 6,500, and 4,400 acre-feet during year types A, B, and C, respectively, as the year types are classified by the amount of precipitation and runoff at Hetch Hetchy Reservoir. Table 2-1 presents the criteria that determine the year type classification and the required basic releases

¹ See “HH/LSM Assumptions and Results – Proposed WSIP,” Memorandum by Daniel B. Steiner, March 18, 2007.

to the Tuolumne River below O'Shaughnessy Dam. In addition to the basic release, during year types A and B, an additional release of 64 cubic feet per second (cfs) below Hetch Hetchy Reservoir can be required whenever Canyon Tunnel flow exceeds 920 cfs.

**Table 2-1
Average Daily Required Fishery Release Schedule Below O'Shaughnessy Dam**

Month	Year Type A		Year Type B		Year Type C
	Release (cfs)	Criteria ^{a, b}	Release (cfs)	Criteria ^{a, b}	Release (cfs)
January	50	8.80"	40	6.10"	35
February	60	14.00"	50	9.50"	35
March	60	18.60"	50	14.20"	35
April	75	23.00"	65	18.00"	35
May	100	26.60"	80	19.50"	50
June	125	28.45"	110	21.25"	75
July	125	575,000 acre-feet	110	390,000 acre-feet	75
August	125	640,000 acre-feet	110	400,000 acre-feet	75
September 1-14	100		80		75
September 15-30	80		65		50
October	60		50		35
November	60		50		35
December	50		40		35

^a Precipitation indicator in inches is cumulative, measured at Hetch Hetchy Reservoir, starting October 1.
^b Runoff indicator in acre-feet is the calculated inflow into Hetch Hetchy Reservoir commencing on the previous October 1.

Table 2-2 illustrates the assumed monthly basic release schedule and the discretionary release schedule used for the cumulative scenario. The analysis of the WSIP does not include the assumption of the discretionary release requirement. The implementation of the additional 64-cfs release as a condition of Canyon Tunnel diversions is applied dynamically within the HH/LSM.

**Table 2-2
Modeled Monthly Minimum Release Below O'Shaughnessy Dam – Acre-feet**

Month	Type A			Type B			Type C		
	F&W	Discre-	Total	F&W	Discre-	Total	F&W	Discre-	Total
	Release	tionary	Release	Release	tionary	Release	Release	tionary	Release
October	3,689	0	3,689	3,074	0	3,074	2,152	0	2,152
November	3,570	0	3,570	2,975	0	2,975	2,083	0	2,083
December	3,074	0	3,074	2,460	0	2,460	2,152	0	2,152
January	3,074	0	3,074	2,460	0	2,460	2,152	0	2,152
February	3,362	0	3,362	2,802	0	2,802	1,961	0	1,961
March	3,689	0	3,689	3,074	0	3,074	2,152	0	2,152
April	4,463	0	4,463	3,868	0	3,868	2,083	0	2,083
May	6,149	0	6,149	4,919	0	4,919	3,074	0	3,074
June	7,438	0	7,438	6,545	0	6,545	4,463	0	4,463
July	7,686	6,000	13,686	6,764	2,600	9,364	4,612	1,800	6,412
August	7,686	6,000	13,686	6,764	2,500	9,264	4,612	1,800	6,412
September	5,316	3,000	8,316	4,284	1,400	5,684	3,669	800	4,469
Total	59,196	15,000	74,196	49,989	6,500	56,489	35,165	4,400	39,565

^a If July first-of-month storage at Hetch Hetchy Reservoir is less than 210,000 acre-feet program will not make the discretionary release.

3. Results

3.1 Comparison to WSIP

For the area upstream of Don Pedro Reservoir operations, the cumulative setting replicates the WSIP setting, except for the discretionary releases. The additional discretionary releases below Hetch Hetchy Reservoir would at times occur at the expense of diversions to Canyon Tunnel, and at other times from storage of Hetch Hetchy Reservoir and the subsequent reduction of release to the river that would otherwise be above required minimum releases.

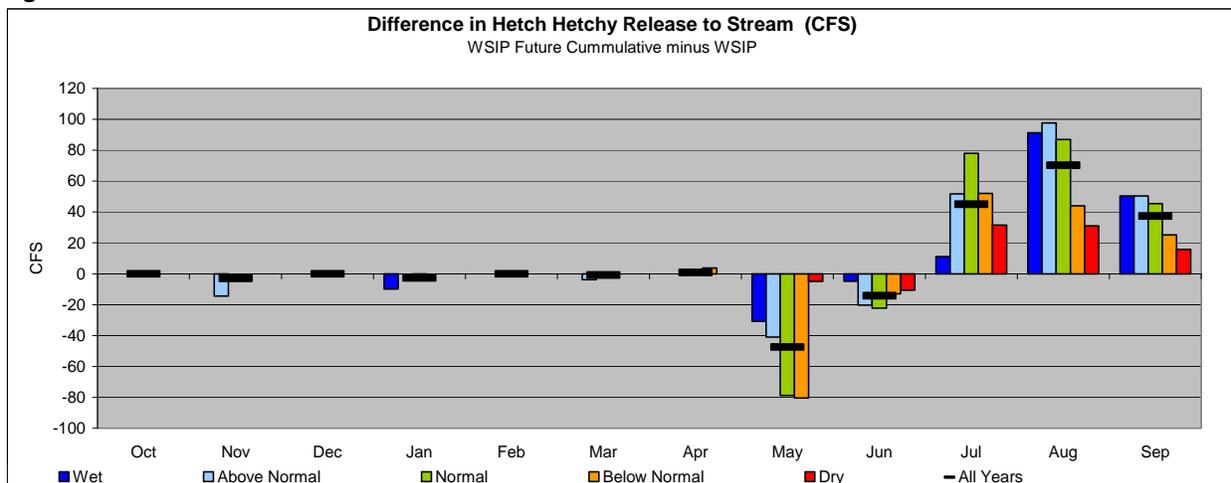
Table 3.1-1 illustrates the simulated releases below O’Shaughnessy Dam for the cumulative setting, depicted in average monthly flow (in cfs) in chronological sequence for the 1921-through-2002 modeling period. The values illustrate both periods of controlled releases for minimum release requirements and periods of excess release above minimum requirements (spills).

Table 3.1-2 illustrates the differences between releases anticipated with the WSIP and the cumulative settings. The values are illustrated in average monthly flow (in cfs), with positive values representing an increase in flow associated with the cumulative setting. The same data are shown in Table 3.1-3, arranged by descending order of wetness in the basin (La Grange unimpaired flow). Although the release requirement is based on a separate wetness index, the results show flow increases during the summer (July through September), with relatively larger increases during wetter years. During the wetter years, there sometimes appears to be no increase in flows during certain summer months (e.g., July). This is due to releases above minimum requirements (spills) in both settings, and the change in minimum release requirement has no effect on the release.

Table 3.1-2 illustrates that the additional summer releases would result in subsequent reductions in releases in some years, typically during May. This is consistent with the effect of additional demand from Hetch Hetchy Reservoir. Additional reservoir demand would lead to an additional draw on storage, which would require subsequent replenishment. The replenishment would occur through the additional capture of inflow, typically during May, when otherwise the inflow would spill to the river.

Table 3.1-4 illustrates the rank-ordered differences in monthly flow volumes (acre-feet). The reductions in springtime flow, due to replenishment, can accumulate to about 18,000 acre-feet (May 1989), but are typically less. As described for the effects of WSIP, this monthly reduction in flow would typically manifest as a delay of the day in which substantial dam releases are made to the stream.² In this extreme example, the delay could amount to about 6 days. Subsequent to this delay, releases would return to the level that would occur without the effect of the discretionary flows. Figure 3.1-1 illustrates the difference in flow between the WSIP and cumulative scenario by year type. The values represent the average flow change for all of the years within each year type classification. The graphic illustrates the increase in flow that would occur during summer due to the discretionary flows, and also the general decrease in flow that would occur during reservoir replenishment (decrease in spills) during spring.

Figure 3.1-1



² See “Estimated Effect of WSIP on Daily Releases below Hetch Hetchy Reservoir,” Memorandum by Daniel B. Steiner, December 2006.

Table 3.1-1

Hetch Hetchy Release to Stream (CFS)

WSIP Future Cumulative

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	50	50	40	50	125	124	139	164	1,607	223	223	140
1922	60	60	50	50	61	60	139	766	5,247	469	223	140
1923	60	60	50	50	61	60	129	490	1,600	275	223	140
1924	60	60	50	35	35	35	35	50	75	104	104	75
1925	35	35	35	50	61	60	139	836	2,519	287	223	140
1926	60	60	50	40	50	124	129	144	110	152	151	96
1927	50	50	40	50	61	60	75	1,754	4,010	287	223	140
1928	60	60	50	50	61	60	75	2,716	329	223	151	96
1929	50	50	40	40	35	35	35	80	483	152	151	96
1930	50	50	40	35	50	50	65	80	1,800	152	151	96
1931	50	50	40	35	50	35	35	50	75	104	104	75
1932	35	35	35	114	61	60	75	100	1,920	396	223	140
1933	60	60	50	35	50	35	35	50	184	152	151	96
1934	50	50	40	40	50	114	65	80	110	104	104	75
1935	35	35	35	114	125	60	75	164	2,273	223	223	140
1936	60	60	50	40	114	124	139	539	2,759	287	223	140
1937	60	60	50	50	125	124	139	164	2,533	223	223	140
1938	60	60	50	50	125	124	139	871	5,883	1,832	223	140
1939	60	60	50	40	50	50	65	680	110	152	151	96
1940	50	50	40	40	125	124	139	608	2,442	223	223	140
1941	60	60	50	114	125	124	139	164	3,305	1,102	223	140
1942	60	60	50	50	61	60	139	1,715	4,762	1,400	223	140
1943	60	60	50	50	61	60	391	3,215	2,503	296	223	140
1944	60	60	50	40	50	50	65	267	1,338	152	151	96
1945	50	50	40	50	125	124	139	164	3,070	519	223	140
1946	60	60	114	114	125	124	139	164	1,373	223	223	140
1947	60	60	50	50	61	60	75	1,203	174	152	151	96
1948	50	50	40	40	50	114	129	164	1,053	223	223	140
1949	60	60	50	40	50	114	129	144	174	152	151	96
1950	50	50	40	40	125	114	139	164	1,298	223	223	140
1951	60	320	699	114	125	124	139	164	1,444	223	223	140
1952	60	60	50	50	125	60	75	3,302	4,001	1,728	223	140
1953	60	60	50	50	61	50	65	304	2,836	478	223	140
1954	60	60	50	40	50	50	75	1,211	467	152	151	96
1955	50	50	40	50	61	114	129	144	110	152	151	96
1956	50	50	104	114	125	124	139	171	5,215	1,540	223	140
1957	60	60	50	35	35	35	65	176	3,081	223	151	96
1958	50	50	40	50	61	60	75	2,772	3,728	902	223	140
1959	60	60	50	35	35	114	129	144	110	152	151	96
1960	50	50	40	35	35	35	129	144	110	152	151	96
1961	50	50	40	50	50	35	65	80	110	104	104	75
1962	35	35	35	40	35	60	75	100	3,297	287	223	140
1963	60	60	50	35	50	60	75	1,598	3,417	595	223	140
1964	60	60	50	50	61	50	129	144	117	152	151	96
1965	50	50	104	114	125	124	139	164	2,020	1,001	223	140
1966	60	60	50	50	61	60	129	2,009	110	152	151	96
1967	50	50	40	50	61	60	75	2,265	4,549	3,012	223	140
1968	60	60	50	40	50	50	65	745	249	152	151	96
1969	50	50	40	50	61	60	213	5,603	5,043	1,885	223	140
1970	60	60	50	50	61	60	75	1,779	2,099	223	223	140
1971	60	60	50	50	61	60	75	745	2,977	223	223	140
1972	60	60	50	50	61	50	65	144	913	152	151	96
1973	50	50	40	50	61	60	75	2,998	2,679	223	223	140
1974	60	60	50	50	61	60	75	3,270	3,272	287	223	140
1975	60	60	50	50	50	60	139	164	4,097	287	223	140
1976	60	60	50	50	35	35	35	50	75	104	104	75
1977	35	35	35	35	35	35	35	50	75	75	75	62
1978	35	35	35	50	61	60	75	100	5,018	2,162	223	140
1979	60	60	50	40	61	60	75	3,594	1,804	223	223	140
1980	60	60	50	50	125	60	139	2,168	3,964	2,422	223	140
1981	60	60	50	35	50	50	129	144	174	152	151	96
1982	50	50	40	50	125	60	439	3,723	4,271	1,764	223	140
1983	124	60	50	50	61	60	75	2,881	7,789	4,923	1,000	140
1984	60	124	114	114	125	124	75	1,838	2,200	223	223	140
1985	60	60	50	50	61	50	75	1,607	214	152	151	96
1986	50	50	40	50	61	124	287	3,722	4,433	287	223	140
1987	60	60	50	35	35	35	35	50	75	104	104	75
1988	35	35	35	50	61	50	35	80	110	104	104	75
1989	35	35	35	50	50	50	75	1,144	1,057	223	151	96
1990	50	50	40	40	50	50	35	50	75	104	104	75
1991	35	35	35	35	35	35	65	80	1,172	152	151	96
1992	50	50	40	40	50	50	65	50	75	104	104	75
1993	35	35	35	50	61	60	139	3,467	3,430	717	223	140
1994	60	60	50	40	35	35	35	50	75	104	104	75
1995	35	35	35	50	61	124	139	2,135	5,620	4,783	287	140
1996	60	60	50	40	61	124	139	3,100	2,842	287	223	140
1997	60	60	50	1,652	125	124	75	3,767	2,469	223	223	140
1998	60	60	50	40	61	60	75	1,044	5,259	3,543	223	140
1999	60	60	50	40	125	124	139	164	2,710	223	223	140
2000	60	60	50	35	61	60	75	2,046	1,642	223	223	140
2001	60	60	50	40	50	50	65	573	110	152	151	96
2002	50	50	40	50	61	60	75	1,422	1,091	223	151	96
Avg (21-02)	54	58	56	71	70	73	104	1,063	2,061	593	196	118

Figure 3.1-2

Difference in Hetch Hetchy Release to Stream (CFS)

WSIP Future Cumulative minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	0	-66	98	98	50
1922	0	0	0	0	0	0	0	-132	0	0	98	50
1923	0	0	0	0	0	0	0	-173	0	0	98	50
1924	0	0	0	0	0	0	0	0	0	29	29	13
1925	0	0	0	0	0	0	0	-102	0	98	98	50
1926	0	0	0	0	0	0	0	0	0	42	41	24
1927	0	0	0	0	0	0	0	-166	0	66	98	50
1928	0	0	0	0	0	0	0	-221	0	98	41	24
1929	0	0	0	0	0	0	0	0	-171	42	41	24
1930	0	0	0	0	0	0	0	-64	70	42	41	24
1931	0	0	0	0	0	0	0	0	0	29	29	13
1932	0	0	0	0	0	0	0	0	-12	0	98	50
1933	0	0	0	0	0	0	0	0	-121	42	41	24
1934	0	0	0	0	0	0	0	0	0	29	29	13
1935	0	0	0	0	0	0	0	0	-10	98	98	50
1936	0	0	0	0	0	-64	0	-78	0	98	98	50
1937	0	0	0	0	0	0	0	0	-78	98	98	50
1938	0	0	0	0	0	0	0	-100	0	0	98	50
1939	0	0	0	0	0	0	0	0	0	42	41	24
1940	0	0	0	0	0	0	0	-43	0	98	98	50
1941	0	0	0	0	0	0	0	0	-77	0	98	50
1942	0	0	0	0	0	0	0	0	0	0	98	50
1943	0	0	0	0	0	0	0	0	0	0	98	50
1944	0	0	0	0	0	0	0	-159	0	42	41	24
1945	0	0	0	0	0	0	0	0	-48	0	98	50
1946	0	0	0	0	0	0	0	-45	-57	98	98	50
1947	0	0	0	0	0	0	0	-238	0	42	41	24
1948	0	0	0	0	0	0	0	0	-42	98	98	50
1949	0	0	0	0	0	0	0	0	0	42	41	24
1950	0	0	0	0	0	0	0	0	-56	98	98	50
1951	0	-245	0	0	0	0	0	0	0	98	98	50
1952	0	0	0	0	0	0	0	-85	0	0	98	50
1953	0	0	0	0	0	0	0	-151	0	0	98	50
1954	0	0	0	0	0	0	0	-142	0	42	41	24
1955	0	0	0	0	0	0	0	0	0	42	41	24
1956	0	0	0	0	0	0	0	-34	0	0	98	50
1957	0	0	0	0	0	0	0	-142	0	98	41	24
1958	0	0	0	0	0	0	0	-142	0	0	98	50
1959	0	0	0	0	0	0	0	0	0	42	41	24
1960	0	0	0	0	0	0	0	0	0	42	41	24
1961	0	0	0	0	0	0	0	0	0	29	29	13
1962	0	0	0	0	0	0	0	0	-99	98	98	50
1963	0	0	0	0	0	0	0	-240	0	0	98	50
1964	0	0	0	0	0	0	0	0	7	42	41	24
1965	0	0	0	0	0	0	0	0	-76	0	98	50
1966	0	0	0	0	0	0	64	-66	0	42	41	24
1967	0	0	0	0	0	0	0	-131	0	0	98	50
1968	0	0	0	0	0	0	0	-78	0	42	41	24
1969	0	0	0	0	0	0	0	0	0	0	98	50
1970	0	0	0	-64	0	0	0	48	0	98	98	50
1971	0	0	0	0	0	0	0	-126	0	34	98	50
1972	0	0	0	0	0	0	0	-65	-47	42	41	24
1973	0	0	0	0	0	0	0	-98	0	98	98	50
1974	0	0	0	0	0	0	0	0	0	98	98	50
1975	0	0	0	0	0	0	0	-38	-70	98	98	50
1976	0	0	0	0	0	0	0	0	0	29	29	13
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	98	50
1979	0	0	0	0	0	0	0	0	0	98	98	50
1980	0	0	0	0	0	0	0	0	0	0	98	50
1981	0	0	0	0	0	0	0	0	0	42	41	24
1982	0	0	0	0	0	0	0	0	0	0	98	50
1983	0	0	0	0	0	0	0	0	0	0	0	50
1984	0	0	0	0	0	0	0	1	0	34	98	50
1985	0	0	0	0	0	0	0	-81	0	42	41	24
1986	0	0	0	0	0	0	0	0	0	80	98	50
1987	0	0	0	0	0	0	0	0	0	29	29	13
1988	0	0	0	0	0	0	0	0	0	29	29	13
1989	0	0	0	0	0	0	0	-299	0	98	41	24
1990	0	0	0	0	0	0	0	0	0	29	29	13
1991	0	0	0	0	0	0	0	0	-87	42	41	24
1992	0	0	0	0	0	0	0	0	0	29	29	13
1993	0	0	0	0	0	0	0	0	0	0	98	50
1994	0	0	0	0	0	0	0	0	0	29	29	13
1995	0	0	0	0	0	0	0	0	0	0	94	50
1996	0	0	0	0	0	0	0	0	0	98	98	50
1997	0	0	0	0	0	0	0	0	0	98	98	50
1998	0	0	0	-157	0	0	0	0	0	0	98	50
1999	0	0	0	0	0	0	0	0	-128	98	98	50
2000	0	0	0	0	0	0	0	-142	0	98	98	50
2001	0	0	0	0	0	0	0	-253	0	42	41	24
2002	0	0	0	0	0	0	0	-109	0	98	41	24
Avg (21-02)	0	-3	0	-3	0	-1	1	-47	-14	45	70	37

Figure 3.1-3

Difference in Hetch Hetchy Release to Stream (CFS)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

WSIP Future Cumulative minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1983	0	0	0	0	0	0	0	0	0	0	0	50
1995	0	0	0	0	0	0	0	0	0	0	94	50
1969	0	0	0	0	0	0	0	0	0	0	98	50
1982	0	0	0	0	0	0	0	0	0	0	98	50
1938	0	0	0	0	0	0	0	-100	0	0	98	50
1998	0	0	0	0	0	0	0	0	0	0	98	50
1997	0	0	0	-157	0	0	0	0	0	98	98	50
1956	0	0	0	0	0	0	0	-34	0	0	98	50
1967	0	0	0	0	0	0	0	-131	0	0	98	50
1980	0	0	0	0	0	0	0	0	0	0	98	50
1986	0	0	0	0	0	0	0	0	0	80	98	50
1952	0	0	0	0	0	0	0	-85	0	0	98	50
1978	0	0	0	0	0	0	0	0	0	0	98	50
1965	0	0	0	0	0	0	0	0	-76	0	98	50
1958	0	0	0	0	0	0	0	-142	0	0	98	50
1993	0	0	0	0	0	0	0	0	0	0	98	50
1941	0	0	0	0	0	0	0	0	-77	0	98	50
1951	0	-245	0	0	0	0	0	0	0	98	98	50
1922	0	0	0	0	0	0	0	-132	0	0	98	50
1984	0	0	0	0	0	0	0	1	0	34	98	50
1943	0	0	0	0	0	0	0	0	0	0	98	50
1942	0	0	0	0	0	0	0	0	0	0	98	50
1996	0	0	0	0	0	0	0	0	0	98	98	50
1974	0	0	0	0	0	0	0	0	0	98	98	50
1940	0	0	0	0	0	0	0	-43	0	98	98	50
1936	0	0	0	0	0	0	0	-78	0	98	98	50
1932	0	0	0	0	0	0	0	0	-12	0	98	50
1935	0	0	0	0	0	-64	0	0	-10	98	98	50
1999	0	0	0	0	0	0	0	0	-128	98	98	50
1945	0	0	0	0	0	0	0	0	-48	0	98	50
1927	0	0	0	0	0	0	0	-166	0	66	98	50
1963	0	0	0	0	0	0	0	-240	0	0	98	50
1975	0	0	0	0	0	0	0	-38	-70	98	98	50
1973	0	0	0	0	0	0	0	-98	0	98	98	50
1921	0	0	0	0	0	0	0	0	-66	98	98	50
1937	0	0	0	0	0	0	0	0	-78	98	98	50
1970	0	0	0	-64	0	0	0	48	0	98	98	50
2000	0	0	0	0	0	0	0	-142	0	98	98	50
1925	0	0	0	0	0	0	0	-102	0	98	98	50
1979	0	0	0	0	0	0	0	0	0	98	98	50
1946	0	0	0	0	0	0	0	-45	-57	98	98	50
1923	0	0	0	0	0	0	0	-173	0	0	98	50
1962	0	0	0	0	0	0	0	0	-99	98	98	50
1971	0	0	0	0	0	0	0	-126	0	34	98	50
1950	0	0	0	0	0	0	0	0	-56	98	98	50
1953	0	0	0	0	0	0	0	-151	0	0	98	50
1928	0	0	0	0	0	0	0	-221	0	98	41	24
1954	0	0	0	0	0	0	0	-142	0	42	41	24
2002	0	0	0	0	0	0	0	-109	0	98	41	24
1957	0	0	0	0	0	0	0	-142	0	98	41	24
1948	0	0	0	0	0	0	0	0	-42	98	98	50
1989	0	0	0	0	0	0	0	-299	0	98	41	24
1966	0	0	0	0	0	0	64	-66	0	42	41	24
1944	0	0	0	0	0	0	0	-159	0	42	41	24
1949	0	0	0	0	0	0	0	0	0	42	41	24
1985	0	0	0	0	0	0	0	-81	0	42	41	24
1972	0	0	0	0	0	0	0	-65	-47	42	41	24
1930	0	0	0	0	0	0	0	-64	70	42	41	24
1964	0	0	0	0	0	0	0	0	7	42	41	24
1955	0	0	0	0	0	0	0	0	0	42	41	24
1926	0	0	0	0	0	0	0	0	0	42	41	24
1933	0	0	0	0	0	0	0	0	-121	42	41	24
1991	0	0	0	0	0	0	0	0	-87	42	41	24
2001	0	0	0	0	0	0	0	-253	0	42	41	24
1947	0	0	0	0	0	0	0	-238	0	42	41	24
1960	0	0	0	0	0	0	0	0	0	42	41	24
1981	0	0	0	0	0	0	0	0	0	42	41	24
1968	0	0	0	0	0	0	0	-78	0	42	41	24
1959	0	0	0	0	0	0	0	0	0	42	41	24
1939	0	0	0	0	0	0	0	0	0	42	41	24
1929	0	0	0	0	0	0	0	0	-171	42	41	24
1990	0	0	0	0	0	0	0	0	0	29	29	13
1992	0	0	0	0	0	0	0	0	0	29	29	13
1994	0	0	0	0	0	0	0	0	0	29	29	13
1988	0	0	0	0	0	0	0	0	0	29	29	13
1934	0	0	0	0	0	0	0	0	0	29	29	13
1961	0	0	0	0	0	0	0	0	0	29	29	13
1976	0	0	0	0	0	0	0	0	0	29	29	13
1987	0	0	0	0	0	0	0	0	0	29	29	13
1931	0	0	0	0	0	0	0	0	0	29	29	13
1924	0	0	0	0	0	0	0	0	0	29	29	13
1977	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.1-4

Difference in Hetch Hetchy Release to Stream (Acre-feet)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

WSIP Future Cummulative minus WSIP

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1983	0	0	0	0	0	0	0	0	0	0	0	3,000	3,000
1995	0	0	0	0	0	0	0	0	0	0	5,778	3,000	8,778
1969	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1982	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1938	0	0	0	0	0	0	0	-6,147	0	0	6,000	3,000	2,853
1998	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1997	0	0	0	-9,665	0	0	0	0	0	6,000	6,000	3,000	5,335
1956	0	0	0	0	0	0	0	-2,094	0	0	6,000	3,000	6,906
1967	0	0	0	0	0	0	0	-8,027	0	0	6,000	3,000	973
1980	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1986	0	0	0	0	0	0	0	0	0	4,943	6,000	3,000	13,943
1952	0	0	0	0	0	0	0	-5,253	0	0	6,000	3,000	3,747
1978	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1965	0	0	0	0	0	0	0	0	-4,529	0	6,000	3,000	4,471
1958	0	0	0	0	0	0	0	-8,708	0	0	6,000	3,000	292
1993	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1941	0	0	0	0	0	0	0	0	-4,592	0	6,000	3,000	4,408
1951	0	-14,599	0	0	0	0	0	0	0	6,000	6,000	3,000	401
1922	0	0	0	0	0	0	0	-8,120	0	0	6,000	3,000	880
1984	0	0	0	0	0	0	0	92	0	2,065	6,000	3,000	11,157
1943	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1942	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1996	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1974	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1940	0	0	0	0	0	0	0	-2,671	0	6,000	6,000	3,000	12,329
1936	0	0	0	0	0	0	0	-4,773	0	6,000	6,000	3,000	10,227
1932	0	0	0	0	0	0	0	0	-731	0	6,000	3,000	8,269
1935	0	0	0	0	0	-3,935	0	0	-576	6,000	6,000	3,000	10,489
1999	0	0	0	0	0	0	0	0	-7,605	6,000	6,000	3,000	7,395
1945	0	0	0	0	0	0	0	0	-2,844	0	6,000	3,000	6,156
1927	0	0	0	0	0	0	0	-10,236	0	4,078	6,000	3,000	2,842
1963	0	0	0	0	0	0	0	-14,740	0	0	6,000	3,000	-5,740
1975	0	0	0	0	0	0	0	-2,359	-4,171	6,000	6,000	3,000	8,470
1973	0	0	0	0	0	0	0	-6,024	0	6,000	6,000	3,000	8,976
1921	0	0	0	0	0	0	0	0	-3,923	6,000	6,000	3,000	11,077
1937	0	0	0	0	0	0	0	0	-4,662	6,000	6,000	3,000	10,338
1970	0	0	0	-3,935	0	0	0	2,982	0	6,000	6,000	3,000	14,047
2000	0	0	0	0	0	0	0	-8,719	0	6,000	6,000	3,000	6,281
1925	0	0	0	0	0	0	0	-6,241	0	6,000	6,000	3,000	8,759
1979	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1946	0	0	0	0	0	0	0	-2,754	-3,366	6,000	6,000	3,000	8,880
1923	0	0	0	0	0	0	0	-10,652	0	0	6,000	3,000	-1,652
1962	0	0	0	0	0	0	0	0	-5,886	6,000	6,000	3,000	9,114
1971	0	0	0	0	0	0	0	-7,732	0	2,065	6,000	3,000	3,333
1950	0	0	0	0	0	0	0	0	-3,328	6,000	6,000	3,000	11,672
1953	0	0	0	0	0	0	0	-9,279	0	0	6,000	3,000	-279
1928	0	0	0	0	0	0	0	-13,563	0	6,000	2,500	1,400	-3,663
1954	0	0	0	0	0	0	0	-8,718	0	2,600	2,500	1,400	-2,218
2002	0	0	0	0	0	0	0	-6,728	0	6,000	2,500	1,400	3,172
1957	0	0	0	0	0	0	0	-8,719	0	6,000	2,500	1,400	1,181
1948	0	0	0	0	0	0	0	0	-2,528	6,000	6,000	3,000	12,472
1989	0	0	0	0	0	0	0	-18,389	0	6,000	2,500	1,400	-8,489
1966	0	0	0	0	0	0	3,808	-4,045	0	2,600	2,500	1,400	6,263
1944	0	0	0	0	0	0	0	-9,763	0	2,600	2,500	1,400	-3,263
1949	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1985	0	0	0	0	0	0	0	-5,001	0	2,600	2,500	1,400	1,499
1972	0	0	0	0	0	0	0	-3,975	-2,778	2,600	2,500	1,400	-253
1930	0	0	0	0	0	0	0	-3,935	4,171	2,600	2,500	1,400	6,736
1964	0	0	0	0	0	0	0	0	438	2,600	2,500	1,400	6,938
1955	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1926	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1933	0	0	0	0	0	0	0	0	-7,174	2,600	2,500	1,400	-674
1991	0	0	0	0	0	0	0	0	-5,156	2,600	2,500	1,400	1,344
2001	0	0	0	0	0	0	0	-15,562	0	2,600	2,500	1,400	-9,062
1947	0	0	0	0	0	0	0	-14,613	0	2,600	2,500	1,400	-8,113
1960	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1981	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1968	0	0	0	0	0	0	0	-4,814	0	2,600	2,500	1,400	1,686
1959	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1939	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1929	0	0	0	0	0	0	0	0	-10,149	2,600	2,500	1,400	-3,649
1990	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1992	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1994	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1988	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1934	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1961	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1976	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1987	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1931	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1924	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1977	0	0	0	0	0	0	0	0	0	0	0	0	0

Results also indicate that an average annual increase in releases of approximately 5,000 acre-feet would occur below Hetch Hetchy Reservoir. The implementation of the discretionary releases would not cause a change to the water deliveries of the SFPUC or diversions in the San Joaquin Pipeline (SJPL). However, the additional release from the dam to the stream would result in less diversion to the Canyon Tunnel that would otherwise be released back to the Tuolumne River below Kirkwood Powerhouse. The reduction in these releases would generally occur between December and July during years when spill is anticipated from Hetch Hetchy Reservoir.

Hetch Hetchy Reservoir storage would be affected by the discretionary flows. Subsequent to the reservoir being filled in late spring, any additional demand from the reservoir would cause additional drawdown. Figure 3.1-2 is a chronological illustration of storage during the 1921-through-2002 modeling period. Annually, the additional summertime release would cause additional depletion of storage. However, this storage depletion would be followed by replenishment, due to reductions in diversions to Canyon Tunnel and reductions in following-period spills to the river.

Figure 3.1-3 presents the same information, by illustrating the anticipated change in storage of Hetch Hetchy Reservoir with the cumulative setting compared to the WSIP setting. The data are presented by year type, represented as the average of the storage of all years within a year type. As shown, storage is cumulatively depleted, beginning in summer, with storage normally replenished by the end of spring.

No additional notable hydrologic effects are apparent within the Hetch Hetchy system in the comparison of the WSIP and cumulative settings. The Cherry-Eleanor system would experience a near identical operation, with a rare exception during extended drought when a difference in reservoir storage balancing between Hetch Hetchy Reservoir and Lake Lloyd may occur due to Don Pedro Water Bank Account operations. This difference would be essentially unnoticeable within the discretion of existing operations.

The net effect of release operations from Hetch Hetchy Reservoir (Canyon Tunnel and stream releases) manifests as a change in inflow to Don Pedro Reservoir. Figure 3.1-4 illustrates this anticipated change between the WSIP and cumulative settings. The data are presented by year type averages. In terms of average annual inflow to Don Pedro Reservoir, there is no change; however, the distribution of inflow changes. With the slight changes in inflow to Don Pedro Reservoir, a slight increase in the summer, a corresponding increase in storage would occur at the end of the water year (September) during years when Don Pedro Reservoir storage is below the fall-time flood control storage limit. In some years, the storage in Don Pedro Reservoir would be slightly lower in the spring when inflow is reduced by discretionary release operation. Figure 3.1-5 illustrates the simulated difference between the WSIP and cumulative settings, shown by the average storage of all years within a year type. These changes in storage are negligible, and in part only a result of modeling assumptions that make constant the Districts' (Modesto Irrigation District and TID) allocation of water to their customers. If storage were anticipated to be greater, conceptually, the Districts could allocate additional water for delivery, and storage would be unaffected.

Minor changes to releases to the Tuolumne River from La Grange Dam could occur from the single factor of the discretionary releases from Hetch Hetchy Reservoir. Table 3.1-5 illustrates the chronological differences in release between the WSIP and cumulative scenario. The values are presented in terms of monthly volume of flow (acre-feet). The potential changes occur sporadically, and would generally occur as an increase in spill (release above minimum requirements) in some months during the fall and early winter (as greater storage in Don Pedro Reservoir causes earlier and greater spills for flood control) and as a decrease in some winter and early spring releases (when the reduction in inflow to Don Pedro is coincident with spills at La Grange Dam). The average annual flow past La Grange Dam would remain the same. The same information, concerning the difference in flow between the settings, is illustrated in Figure 3.1-6 in terms of average monthly flows by year type.

**Figure 3.1-2
Hetch Hetchy Reservoir Storage**

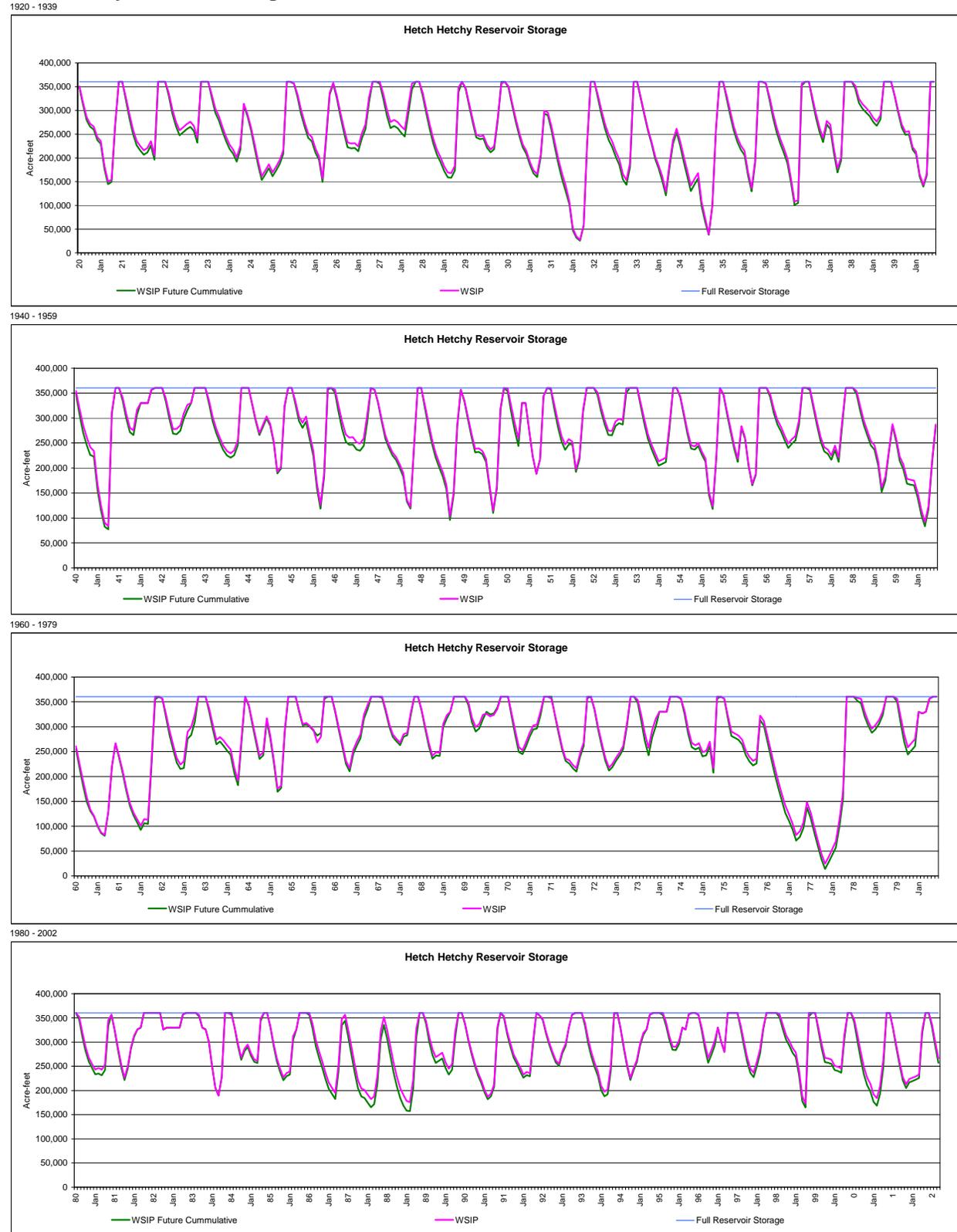


Figure 3.1-3

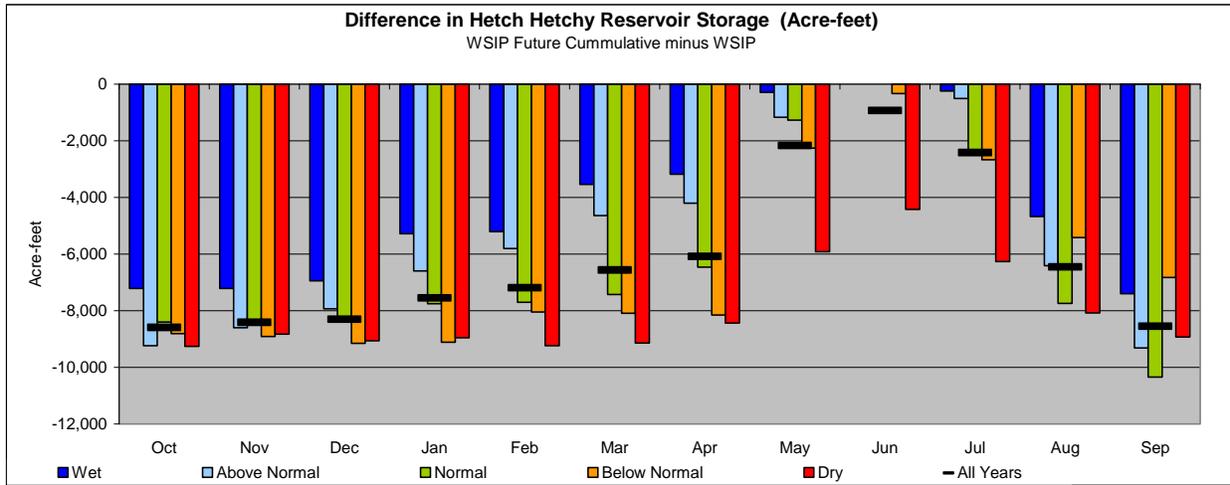


Figure 3.1-4

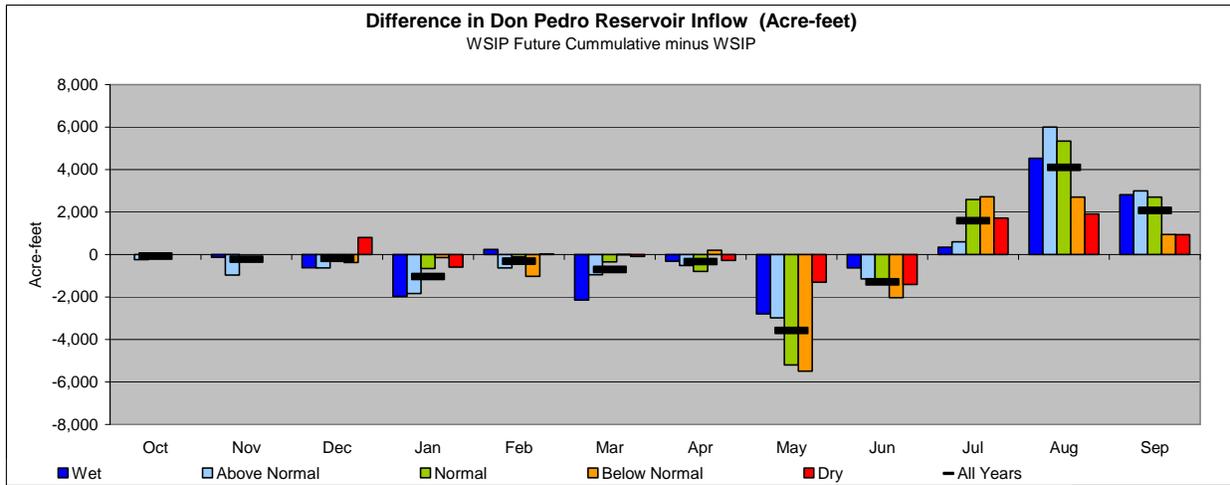


Figure 3.1-5

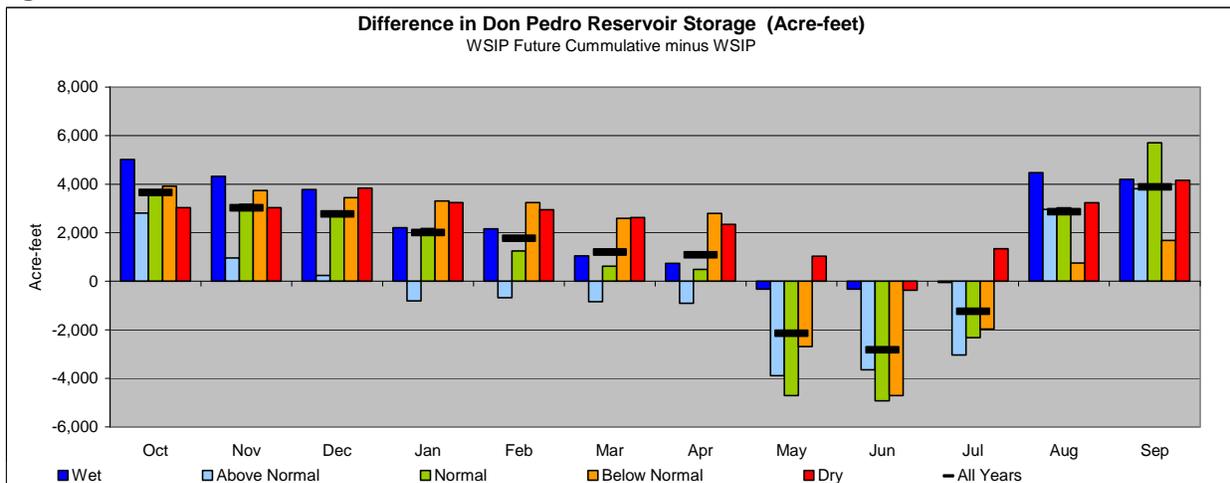
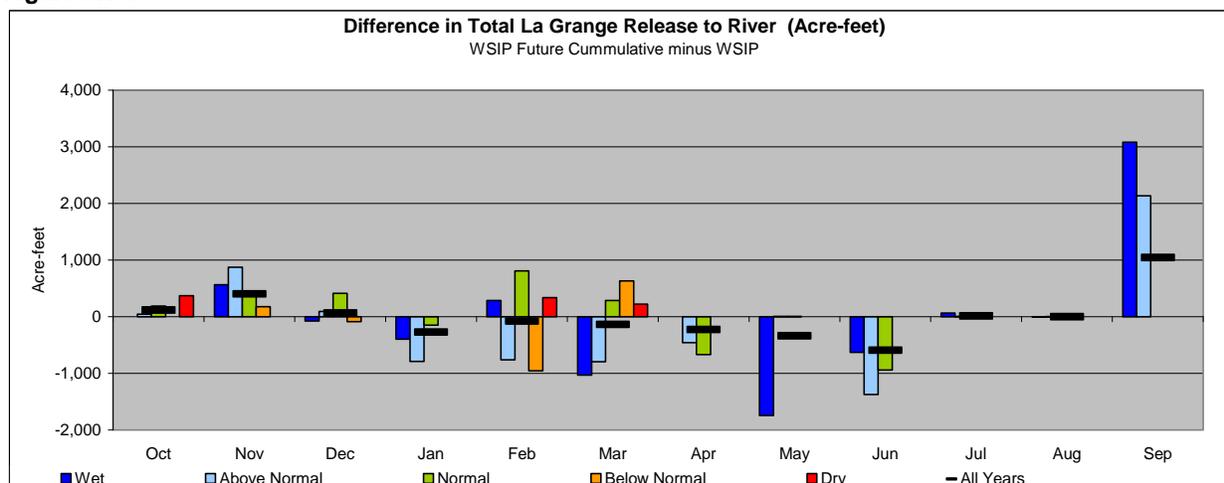


Table 3.1-5

Difference in Total La Grange Release to River (Acre-feet)										WSIP Future Cumulative minus WSIP			
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	3,865	1,807	-763	0	0	0	0	0	4,909
1922	0	0	0	0	2,773	1,849	0	0	-9,072	0	29	6,053	1,632
1923	0	0	2,978	0	0	0	92	0	0	0	0	0	3,070
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	4,078	0	0	0	0	0	0	0	0	0	4,078
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	-2,912	-2,172	-914	0	0	0	0	0	-5,998
1937	0	0	0	0	1,016	387	-1,713	0	0	0	0	0	-310
1938	0	0	2,262	0	0	-1,027	-1,197	-6,926	92	95	0	5,988	-713
1939	2,982	0	0	0	0	0	0	0	0	0	0	0	2,982
1940	0	0	0	0	-1,482	-1,401	-1,744	0	0	0	0	0	-4,627
1941	0	0	0	8,203	-1,982	-1,293	-1,937	0	-6,116	0	28	6,053	2,956
1942	0	0	2,978	-9,731	1	0	0	0	0	95	0	5,987	-670
1943	0	0	2,978	0	0	-10,655	92	0	187	0	0	6,082	-1,316
1944	0	0	0	0	1,787	1,192	0	0	0	0	0	0	2,979
1945	0	0	0	0	-3,256	-2,171	-364	0	0	0	0	0	-5,791
1946	0	6,021	-465	0	0	-1,541	-1,177	0	0	0	0	0	2,838
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	-7,353	0	0	0	0	0	0	0	0	0	-7,353
1952	0	0	0	0	4,060	2,707	1	-5,157	92	96	0	5,987	7,786
1953	0	0	0	2,978	-1	0	0	0	0	0	0	0	2,977
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	-3,483	0	0	-413	-365	0	-2,198	95	0	5,987	-377
1957	0	0	0	0	1,788	0	0	0	0	0	0	0	1,788
1958	0	0	0	0	289	116	77	-8,708	0	95	0	5,987	-2,144
1959	0	0	0	0	1,787	1,192	0	0	0	0	0	0	2,979
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	-3,528	0	0	-492	0	0	0	0	-4,913	-8,933
1966	0	2,996	-1,453	0	-18,453	9,527	0	0	0	0	0	0	-7,383
1967	0	0	0	0	0	8,416	5,605	-8,021	0	95	0	2,089	8,184
1968	0	0	0	0	1,791	1,194	0	0	0	0	0	0	2,985
1969	0	0	0	1,905	0	-6,118	92	95	93	95	0	5,987	2,149
1970	2,982	0	0	-12,745	2	1	0	0	0	0	0	0	-9,760
1971	0	0	0	0	7,287	4,858	0	0	0	0	0	0	12,145
1972	0	0	0	0	-1,354	0	0	0	0	0	0	0	-1,354
1973	0	0	0	0	0	0	0	0	-6,549	0	0	0	-6,549
1974	0	14,870	-1	-14,702	1	1	0	0	187	0	0	6,081	6,437
1975	1,921	0	0	0	636	424	0	0	-8,606	0	29	6,053	457
1976	2,983	0	0	0	0	0	0	0	0	0	0	0	2,983
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	-8,298	0	0	0	-8,298
1979	0	0	0	7,366	0	-910	-7,120	95	0	0	0	0	-569
1980	0	0	0	254	0	-1,903	92	96	92	96	0	5,987	4,714
1981	0	0	0	0	1,787	1,192	0	0	0	0	0	0	2,979
1982	0	0	0	-4,596	-2,974	-1,713	0	0	0	95	0	187	-9,001
1983	0	0	0	0	0	0	0	0	0	95	0	95	190
1984	-1,152	0	0	0	0	0	0	0	0	0	0	0	-1,152
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	4,398	-6,121	0	95	92	0	0	0	-1,536
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	-43	5,886	5,843
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	-1,162	-4,794	0	0	0	95	0	4,021	-1,840
1996	0	0	0	2,819	-6,681	1	92	95	92	0	0	0	-3,582
1997	0	9,037	0	-9,665	1	0	0	0	0	0	0	0	-627
1998	0	0	0	9,311	-1	-5,637	-3,813	634	0	95	0	5,987	6,576
1999	0	0	2,979	0	0	1,903	-3,000	0	0	0	0	0	1,882
2000	0	0	0	0	793	0	0	0	-8,507	0	0	0	-7,714
2001	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg (21-02)	118	402	67	-270	-76	-135	-225	-338	-590	14	1	1,044	11

Figure 3.1-6



The changes in flow past La Grange Dam as a comparison between the WSIP and cumulative (with only the discretionary flow action) settings is relatively minor, and occur as a coincidence of change in inflow and flood control operations at Don Pedro Reservoir. The effect of larger or lesser releases at La Grange (shown by the volumes in Table 3.1-5) would manifest similarly to the effect described for WSIP changes. The change in volume would likely lead to a delay or earlier initiation of the day that releases are made in excess of minimum flow requirements. Most of changes illustrated would likely be managed with reservoir storage, and would lead to no change in river release.

The effect of the TID river diversion project on La Grange releases will be evaluated by layering on the absolute results for the La Grange releases to illustrate the combined cumulative effect of both the WSIP and the discretionary release actions.

With no change to the operation of the SJPL identified under the cumulative scenario, the local system operation would be identical to the WSIP. No changes in hydrologic effects would occur in the local system between the WSIP and cumulative settings.

3.2 Comparison to Base

The preceding discussion identifies the hydrologic parameters that, under the cumulative setting, differ from the WSIP setting. When comparing to the base setting, hydrologic effects associated with the cumulative setting would be consistent (identical) to those effects identified for the WSIP, except for the topic areas (parameters) described above. The following discussion presents those parameters compared to the base setting.

Table 3.1-1 illustrates the simulated releases below O’Shaughnessy Dam for the cumulative setting, depicted in average monthly flow (in cfs) in chronological sequence for the 1921-through-2002 modeling period. The values illustrate both periods of controlled releases for minimum release requirements and periods of releases above minimum requirements (spills).

Table 3.2-1 illustrates the differences between releases anticipated for the cumulative and base settings. The values are illustrated in average monthly flow (in cfs), with positive values representing an increase in flow associated with the cumulative setting. The same data are shown in Table 3.2-2, arranged by descending order of wetness in the basin (La Grange unimpaired flow). Although the release requirement is based on a separate wetness index, the results show flow increases during the summer (July through September), with relatively larger increases during wetter years. During the wetter years, there are instances in which no flow increases appear during certain summer months (e.g., July). This is due to releases above minimum requirements (spills) occurring in both settings, and the change in minimum release requirement has no effect on the release.

Table 3.2-1

Difference in Hetch Hetchy Release to Stream (CFS)

WSIP Future Cumulative minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1921	0	0	0	0	0	0	0	0	-180	98	98	50
1922	0	0	0	0	0	0	0	-277	0	0	98	50
1923	0	0	0	0	0	0	0	-450	0	0	98	50
1924	0	0	0	0	0	0	0	0	0	29	29	13
1925	0	0	0	0	0	0	0	-398	0	98	98	50
1926	0	0	0	0	0	0	0	-47	0	42	41	24
1927	0	0	0	0	0	0	0	-560	0	66	98	50
1928	0	0	0	0	0	0	0	-283	0	98	41	24
1929	0	0	0	0	0	0	0	0	-393	42	41	24
1930	0	0	0	0	0	0	0	-64	70	42	41	24
1931	0	0	0	0	0	0	0	0	0	29	29	13
1932	0	0	0	0	0	0	0	0	-57	0	98	50
1933	0	0	0	0	0	0	0	0	-372	42	41	24
1934	0	0	0	0	0	0	-64	0	0	29	29	13
1935	0	0	0	0	0	0	0	0	-75	98	98	50
1936	0	0	0	0	0	0	0	-297	0	98	98	50
1937	0	0	0	0	0	0	0	-51	-149	98	98	50
1938	0	0	0	0	0	0	0	-284	0	0	98	50
1939	0	0	0	0	0	0	-64	66	0	42	41	24
1940	0	0	0	0	0	0	0	92	0	98	98	50
1941	0	0	0	0	0	0	0	0	-97	0	98	50
1942	0	0	0	0	0	0	0	0	0	0	98	50
1943	0	0	0	0	0	0	0	0	0	0	98	50
1944	0	0	0	0	0	0	0	-658	0	42	41	24
1945	0	0	0	0	0	0	0	0	173	0	98	50
1946	0	0	0	0	0	0	0	-169	-57	98	98	50
1947	0	0	0	0	0	0	0	-749	0	42	41	24
1948	0	0	0	0	0	0	0	0	-245	98	98	50
1949	0	0	0	0	0	0	0	0	0	42	41	24
1950	0	0	0	0	0	0	0	0	30	98	98	50
1951	0	-374	0	0	0	0	0	0	-104	98	98	50
1952	0	0	0	0	0	0	0	-348	0	0	98	50
1953	0	0	0	0	0	0	0	-156	0	0	98	50
1954	0	0	0	0	0	0	0	-646	0	42	41	24
1955	0	0	0	0	0	0	0	0	0	42	41	24
1956	0	0	0	0	0	0	0	-80	0	0	98	50
1957	0	0	0	0	0	0	0	-658	0	98	41	24
1958	0	0	0	0	0	0	0	-346	0	0	98	50
1959	0	0	0	0	0	0	0	0	0	42	41	24
1960	0	0	0	0	0	0	0	0	0	42	41	24
1961	0	0	0	0	0	0	0	0	0	29	29	13
1962	0	0	0	0	0	0	0	-677	-99	98	98	50
1963	0	0	0	0	0	0	0	-699	0	0	98	50
1964	0	0	0	0	0	0	0	0	-57	42	41	24
1965	0	0	0	0	0	0	0	0	146	0	98	50
1966	0	0	0	0	0	0	0	0	0	42	41	24
1967	0	0	0	0	0	0	0	-272	0	0	98	50
1968	0	0	0	0	0	0	0	-582	0	42	41	24
1969	0	0	0	0	0	0	0	0	0	0	98	50
1970	0	0	0	0	0	0	0	-88	0	98	98	50
1971	0	0	0	0	0	0	0	-510	0	34	98	50
1972	0	0	0	0	0	0	0	-544	-47	42	41	24
1973	0	0	0	0	0	0	0	-332	0	98	98	50
1974	0	0	0	0	0	0	0	0	0	98	98	50
1975	0	0	0	0	0	0	0	0	0	98	98	50
1976	0	0	0	0	0	0	0	0	0	29	29	13
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-758	0	0	98	45
1979	0	0	0	0	0	0	0	0	0	98	98	50
1980	0	0	0	0	0	0	0	0	0	0	98	50
1981	0	0	0	0	0	0	0	-169	-173	42	41	24
1982	0	0	0	0	0	0	0	0	0	0	98	50
1983	0	0	0	0	0	0	0	-51	0	0	0	50
1984	0	0	0	0	0	64	0	-190	0	34	98	50
1985	0	0	0	0	0	0	0	-166	0	42	41	24
1986	0	0	0	0	0	-138	-66	0	0	80	98	50
1987	0	0	0	0	0	0	0	0	0	29	29	13
1988	0	0	0	0	0	0	0	0	-64	29	29	13
1989	0	0	0	0	0	0	0	-842	0	98	41	24
1990	0	0	0	0	0	0	0	0	0	29	29	13
1991	0	0	0	0	0	0	0	0	-574	42	41	24
1992	0	0	0	0	0	0	0	-470	0	29	29	13
1993	0	0	0	0	0	0	0	0	0	0	98	50
1994	0	0	0	0	0	0	0	0	0	29	29	13
1995	0	0	0	0	0	0	0	0	0	0	94	50
1996	0	0	0	0	0	0	0	0	0	98	98	50
1997	0	0	0	-354	0	0	0	0	0	98	98	50
1998	0	0	0	0	0	0	0	0	0	0	98	50
1999	0	0	0	0	0	0	0	-219	-130	98	98	50
2000	0	0	0	0	0	0	0	-309	0	98	98	50
2001	0	0	0	0	0	0	0	-947	0	42	41	24
2002	0	0	0	0	0	0	0	-702	0	98	41	24
Avg (21-02)	0	-5	0	-4	0	-1	-2	-182	-30	45	70	37

Table 3.2-2

Difference in Hetch Hetchy Release to Stream (CFS)

Matrix Data for Water Year 1921-2002 Rank Ordered by Descending Unimpaired Runoff at LaGrange

WSIP Future Cumulative minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1983	0	0	0	0	0	0	0	-51	0	0	0	50
1995	0	0	0	0	0	0	0	0	0	0	94	50
1969	0	0	0	0	0	0	0	0	0	0	98	50
1982	0	0	0	0	0	0	0	0	0	0	98	50
1938	0	0	0	0	0	0	0	-284	0	0	98	50
1998	0	0	0	0	0	0	0	0	0	0	98	50
1997	0	0	0	-354	0	0	0	0	0	98	98	50
1956	0	0	0	0	0	0	0	-80	0	0	98	50
1967	0	0	0	0	0	0	0	-272	0	0	98	50
1980	0	0	0	0	0	0	0	0	0	0	98	50
1986	0	0	0	0	0	-138	-66	0	0	80	98	50
1952	0	0	0	0	0	0	0	-348	0	0	98	50
1978	0	0	0	0	0	0	0	-758	0	0	98	45
1965	0	0	0	0	0	0	0	0	146	0	98	50
1958	0	0	0	0	0	0	0	-346	0	0	98	50
1993	0	0	0	0	0	0	0	0	0	0	98	50
1941	0	0	0	0	0	0	0	0	-97	0	98	50
1951	0	-374	0	0	0	0	0	0	-104	98	98	50
1922	0	0	0	0	0	0	0	-277	0	0	98	50
1984	0	0	0	0	0	64	0	-190	0	34	98	50
1943	0	0	0	0	0	0	0	0	0	0	98	50
1942	0	0	0	0	0	0	0	0	0	0	98	50
1996	0	0	0	0	0	0	0	0	0	98	98	50
1974	0	0	0	0	0	0	0	0	0	98	98	50
1940	0	0	0	0	0	0	0	92	0	98	98	50
1936	0	0	0	0	0	0	0	-297	0	98	98	50
1932	0	0	0	0	0	0	0	0	-57	0	98	50
1935	0	0	0	0	0	0	0	0	-75	98	98	50
1999	0	0	0	0	0	0	0	-219	-130	98	98	50
1945	0	0	0	0	0	0	0	0	173	0	98	50
1927	0	0	0	0	0	0	0	-560	0	66	98	50
1963	0	0	0	0	0	0	0	-699	0	0	98	50
1975	0	0	0	0	0	0	0	0	0	98	98	50
1973	0	0	0	0	0	0	0	-332	0	98	98	50
1921	0	0	0	0	0	0	0	0	-180	98	98	50
1937	0	0	0	0	0	0	0	-51	-149	98	98	50
1970	0	0	0	0	0	0	0	-88	0	98	98	50
2000	0	0	0	0	0	0	0	-309	0	98	98	50
1925	0	0	0	0	0	0	0	-398	0	98	98	50
1979	0	0	0	0	0	0	0	0	0	98	98	50
1946	0	0	0	0	0	0	0	-169	-57	98	98	50
1923	0	0	0	0	0	0	0	-450	0	0	98	50
1962	0	0	0	0	0	0	0	-677	-99	98	98	50
1971	0	0	0	0	0	0	0	-510	0	34	98	50
1950	0	0	0	0	0	0	0	0	30	98	98	50
1953	0	0	0	0	0	0	0	-156	0	0	98	50
1928	0	0	0	0	0	0	0	-283	0	98	41	24
1954	0	0	0	0	0	0	0	-646	0	42	41	24
2002	0	0	0	0	0	0	0	-702	0	98	41	24
1957	0	0	0	0	0	0	0	-658	0	98	41	24
1948	0	0	0	0	0	0	0	0	-245	98	98	50
1989	0	0	0	0	0	0	0	-842	0	98	41	24
1966	0	0	0	0	0	0	0	0	0	42	41	24
1944	0	0	0	0	0	0	0	-658	0	42	41	24
1949	0	0	0	0	0	0	0	0	0	42	41	24
1985	0	0	0	0	0	0	0	-166	0	42	41	24
1972	0	0	0	0	0	0	0	-544	-47	42	41	24
1930	0	0	0	0	0	0	0	-64	70	42	41	24
1964	0	0	0	0	0	0	0	0	-57	42	41	24
1955	0	0	0	0	0	0	0	0	0	42	41	24
1926	0	0	0	0	0	0	0	-47	0	42	41	24
1933	0	0	0	0	0	0	0	0	-372	42	41	24
1991	0	0	0	0	0	0	0	0	-574	42	41	24
2001	0	0	0	0	0	0	0	-947	0	42	41	24
1947	0	0	0	0	0	0	0	-749	0	42	41	24
1960	0	0	0	0	0	0	0	0	0	42	41	24
1981	0	0	0	0	0	0	0	-169	-173	42	41	24
1968	0	0	0	0	0	0	0	-582	0	42	41	24
1959	0	0	0	0	0	0	0	0	0	42	41	24
1939	0	0	0	0	0	0	-64	66	0	42	41	24
1929	0	0	0	0	0	0	0	0	-393	42	41	24
1990	0	0	0	0	0	0	0	0	0	29	29	13
1992	0	0	0	0	0	0	0	-470	0	29	29	13
1994	0	0	0	0	0	0	0	0	0	29	29	13
1988	0	0	0	0	0	0	0	0	-64	29	29	13
1934	0	0	0	0	0	0	-64	0	0	29	29	13
1961	0	0	0	0	0	0	0	0	0	29	29	13
1976	0	0	0	0	0	0	0	0	0	29	29	13
1987	0	0	0	0	0	0	0	0	0	29	29	13
1931	0	0	0	0	0	0	0	0	0	29	29	13
1924	0	0	0	0	0	0	0	0	0	29	29	13
1977	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.2-1 shows that additional summer releases along with additional diversions due to the WSIP would result in subsequent reductions in releases in some years, typically during May. This is consistent with the effect of additional demand from Hetch Hetchy Reservoir. Additional reservoir demand would lead to a draw on storage, which then would require subsequent replenishment. The replenishment would occur primarily through the additional capture of inflow, typically during May, when otherwise the inflow would have spilled to the river.

Table 3.2-3 illustrates the rank-ordered differences in monthly flow volumes (acre-feet). The reductions in springtime flow, due to replenishment, can accumulate to about 58,000 acre-feet (May 2001), but typically would be less. This monthly reduction in flow would typically manifest as a delay of the day in which substantial dam releases are made to the stream.

Figure 3.2-1 illustrates the difference in flow between the cumulative base settings by year type. The values represent the average flow change for all of the years within each year type classification. The graphic illustrates the increase in flow that occurs during the summer due to the discretionary flows, as well as the general decrease in flow that would occur during reservoir replenishment (decrease in spills) in the spring due to the cumulative effect of the WSIP and discretionary flows.

Hetch Hetchy Reservoir storage would be affected by the WSIP and discretionary flows. Subsequent to the reservoir being filled in late spring, additional demand from the reservoir would cause additional drawdown in comparison to the base setting. Figure 3.2-2 illustrates a chronological depiction of Hetch Hetchy Reservoir storage during the 1921-through-2002 modeling period. Annually, the additional summertime release and increased diversions would cause depletion of storage in comparison to the base setting. Typically, however, this depletion of storage would be subsequently replenished by inflow and reductions in following-period spills to the river. The additional depletion can accumulate over a sequence of drought years when no spills occur from Hetch Hetchy Reservoir. Figure 3.2-3 presents the same information in summarizing the anticipated change in storage of Hetch Hetchy Reservoir between the cumulative and base settings. The data are presented by year type, represented as the average of the monthly storage of all years within a year type. As shown, storage is depleted beginning in summer, and is normally replenished by the end of spring.

The net effect of release operations from Hetch Hetchy Reservoir (Canyon Tunnel and stream releases) manifests as a change in inflow to Don Pedro Reservoir. Figure 3.2-4 illustrates the anticipated difference between the cumulative and base settings. The data are presented by year type averages.

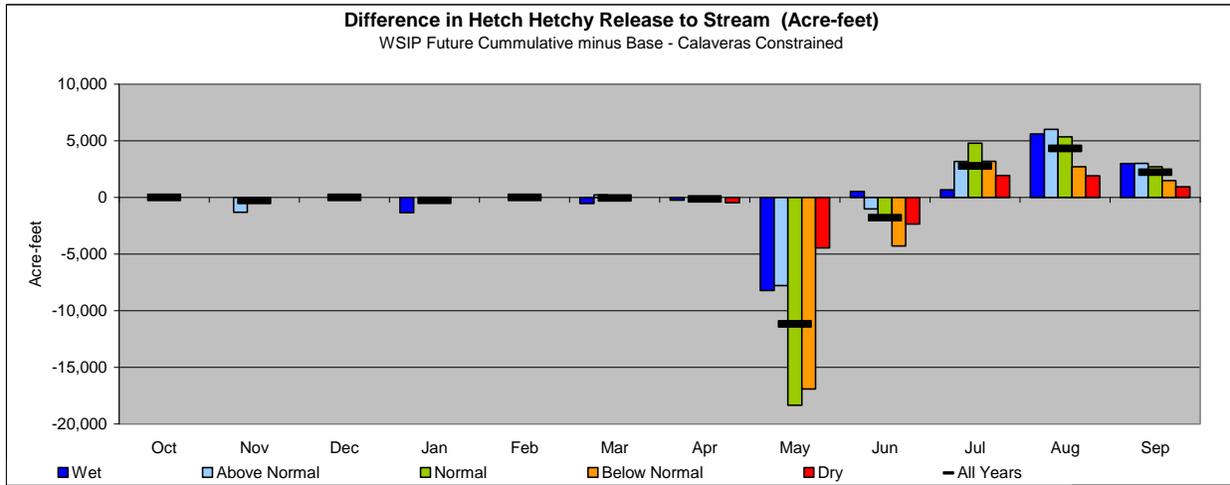
Table 3.2-3

Difference in Hetch Hetchy Release to Stream (Acre-feet)

WSIP Future Cumulative minus Base - Calaveras Constrained

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
1921	0	0	0	0	0	0	0	0	-10,717	6,000	6,000	3,000	4,283
1922	0	0	0	0	0	0	0	-17,005	0	0	6,000	3,000	-8,005
1923	0	0	0	0	0	0	0	-27,689	0	0	6,000	3,000	-18,689
1924	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1925	0	0	0	0	0	0	0	-24,474	0	6,000	6,000	3,000	-9,474
1926	0	0	0	0	0	0	0	-2,913	0	2,600	2,500	1,400	3,587
1927	0	0	0	0	0	0	0	-34,424	0	4,078	6,000	3,000	-21,346
1928	0	0	0	0	0	0	0	-17,412	0	6,000	2,500	1,400	-7,512
1929	0	0	0	0	0	0	0	0	-23,372	2,600	2,500	1,400	-16,872
1930	0	0	0	0	0	0	0	-3,935	4,171	2,600	2,500	1,400	6,736
1931	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1932	0	0	0	0	0	0	0	0	-3,367	0	6,000	3,000	5,633
1933	0	0	0	0	0	0	0	0	-22,124	2,600	2,500	1,400	-15,624
1934	0	0	0	0	0	0	-3,808	0	0	1,800	1,800	800	592
1935	0	0	0	0	0	0	0	0	-4,450	6,000	6,000	3,000	10,550
1936	0	0	0	0	0	0	0	-18,283	0	6,000	6,000	3,000	-3,283
1937	0	0	0	0	0	0	0	-3,143	-8,893	6,000	6,000	3,000	2,964
1938	0	0	0	0	0	0	0	-17,486	0	0	6,000	3,000	-8,486
1939	0	0	0	0	0	0	-3,808	4,045	0	2,600	2,500	1,400	6,737
1940	0	0	0	0	0	0	0	5,677	0	6,000	6,000	3,000	20,677
1941	0	0	0	0	0	0	0	0	-5,789	0	6,000	3,000	3,211
1942	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1943	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1944	0	0	0	0	0	0	0	-40,466	0	2,600	2,500	1,400	-33,966
1945	0	0	0	0	0	0	0	0	10,317	0	6,000	3,000	19,317
1946	0	0	0	0	0	0	0	-10,390	-3,366	6,000	6,000	3,000	1,244
1947	0	0	0	0	0	0	0	-46,059	0	2,600	2,500	1,400	-39,559
1948	0	0	0	0	0	0	0	0	-14,583	6,000	6,000	3,000	417
1949	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1950	0	0	0	0	0	0	0	0	1,782	6,000	6,000	3,000	16,782
1951	0	-22,265	0	0	0	0	0	0	-6,213	6,000	6,000	3,000	-13,478
1952	0	0	0	0	0	0	0	-21,403	0	0	6,000	3,000	-12,403
1953	0	0	0	0	0	0	0	-9,601	0	0	6,000	3,000	-601
1954	0	0	0	0	0	0	0	-39,702	0	2,600	2,500	1,400	-33,202
1955	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1956	0	0	0	0	0	0	0	-4,900	0	0	6,000	3,000	4,100
1957	0	0	0	0	0	0	0	-40,447	0	6,000	2,500	1,400	-30,547
1958	0	0	0	0	0	0	0	-21,246	0	0	6,000	3,000	-12,246
1959	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1960	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1961	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1962	0	0	0	0	0	0	0	-41,654	-5,886	6,000	6,000	3,000	-32,540
1963	0	0	0	0	0	0	0	-43,008	0	0	6,000	3,000	-34,008
1964	0	0	0	0	0	0	0	0	-3,370	2,600	2,500	1,400	3,130
1965	0	0	0	0	0	0	0	0	8,685	0	6,000	3,000	17,685
1966	0	0	0	0	0	0	0	0	0	2,600	2,500	1,400	6,500
1967	0	0	0	0	0	0	0	-16,750	0	0	6,000	3,000	-7,750
1968	0	0	0	0	0	0	0	-35,762	0	2,600	2,500	1,400	-29,262
1969	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1970	0	0	0	0	0	0	0	-5,381	0	6,000	6,000	3,000	9,619
1971	0	0	0	0	0	0	0	-31,368	0	2,065	6,000	3,000	-20,303
1972	0	0	0	0	0	0	0	-33,432	-2,778	2,600	2,500	1,400	-29,710
1973	0	0	0	0	0	0	0	-20,418	0	6,000	6,000	3,000	-5,418
1974	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1975	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1976	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	-46,590	0	0	6,000	2,690	-37,900
1979	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1980	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1981	0	0	0	0	0	0	0	-10,407	-10,310	2,600	2,500	1,400	-14,217
1982	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1983	0	0	0	0	0	0	0	-3,131	0	0	0	3,000	-131
1984	0	0	0	0	0	3,935	0	-11,653	0	2,065	6,000	3,000	3,347
1985	0	0	0	0	0	0	0	-10,236	0	2,600	2,500	1,400	-3,736
1986	0	0	0	0	0	-8,478	-3,935	0	0	4,943	6,000	3,000	1,530
1987	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1988	0	0	0	0	0	0	0	0	-3,808	1,800	1,800	800	592
1989	0	0	0	0	0	0	0	-51,743	0	6,000	2,500	1,400	-41,843
1990	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1991	0	0	0	0	0	0	0	0	-34,130	2,600	2,500	1,400	-27,630
1992	0	0	0	0	0	0	0	-28,918	0	1,800	1,800	800	-24,518
1993	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1994	0	0	0	0	0	0	0	0	0	1,800	1,800	800	4,400
1995	0	0	0	0	0	0	0	0	0	0	5,778	3,000	8,778
1996	0	0	0	0	0	0	0	0	0	6,000	6,000	3,000	15,000
1997	0	0	0	-21,741	0	0	0	0	0	6,000	6,000	3,000	-6,741
1998	0	0	0	0	0	0	0	0	0	0	6,000	3,000	9,000
1999	0	0	0	0	0	0	0	-13,491	-7,732	6,000	6,000	3,000	-6,223
2000	0	0	0	0	0	0	0	-19,017	0	6,000	6,000	3,000	-4,017
2001	0	0	0	0	0	0	0	-58,229	0	2,600	2,500	1,400	-51,729
2002	0	0	0	0	0	0	0	-43,176	0	6,000	2,500	1,400	-33,276
Avg (21-02)	0	-272	0	-265	0	-55	-141	-11,166	-1,780	2,770	4,314	2,223	-4,371

Figure 3.2-1



**Figure 3.2-2
Hetch Hetchy Reservoir Storage**

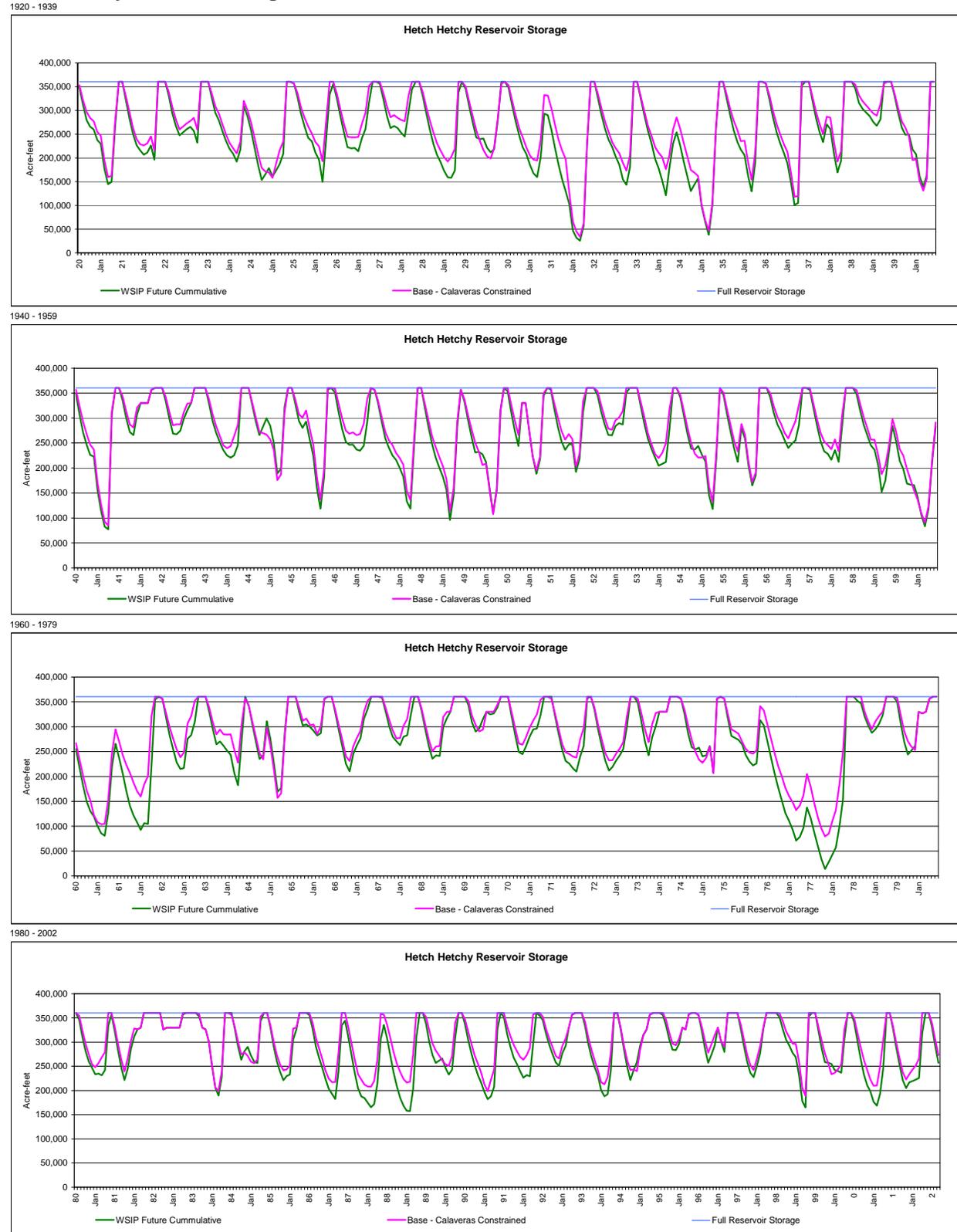


Figure 3.2-3

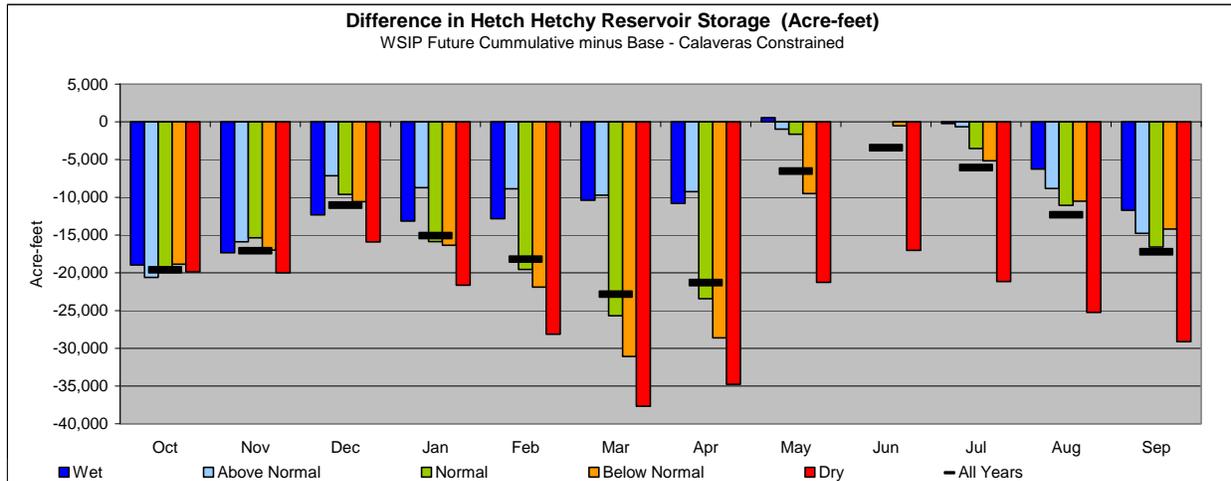
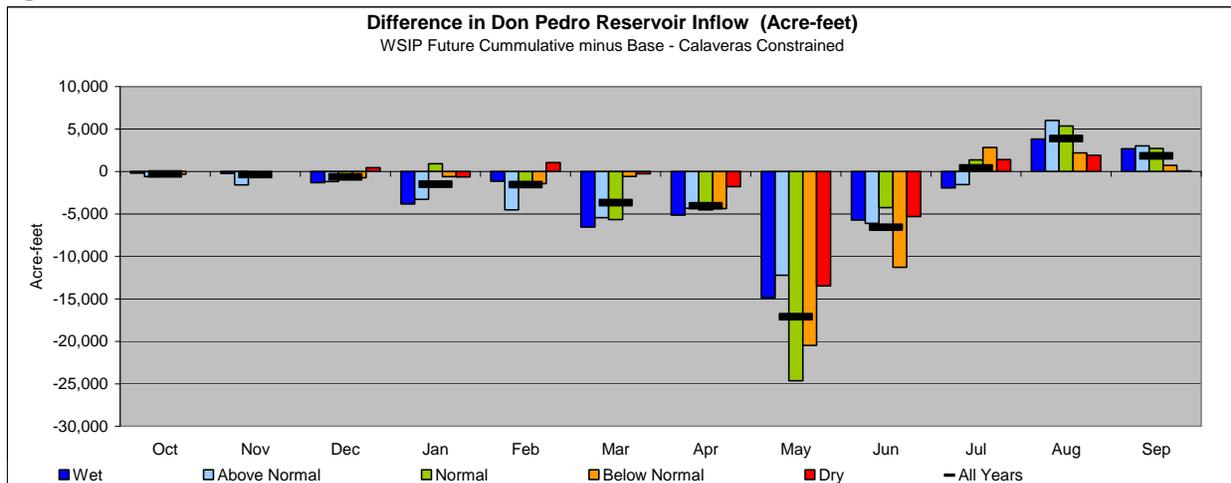


Figure 3.2-4



The average annual inflow to Don Pedro Reservoir would be reduced by about 30,000 acre-feet due to the WSIP, and this quantity would not change with the cumulative activity. Figure 3.2-5 shows simulated Don Pedro Reservoir storage chronologically for the modeling period. Figure 3.2-5 primarily compares the base and cumulative settings. The WSIP-alone setting is also illustrated in Figure 3.2-5, and is mostly included under the cumulative setting. As described above, there is very little change in storage operation between the WSIP and cumulative settings. The effects of the cumulative setting to Don Pedro Reservoir storage are essentially the same as those identified for the WSIP setting.

Changes in releases to the Tuolumne River from La Grange Dam would occur due to the WSIP and the single factor of the discretionary releases. These changes would be primarily caused by the WSIP, altered slightly (sometimes decreased, sometimes increased) by the effect of the discretionary flows at Hetch Hetchy Reservoir. Figure 3.2-6 illustrates the relative comparison of the base, cumulative, and WSIP-alone settings. Again, there is not much difference between the effects of the WSIP-alone setting and the cumulative setting when compared to the base setting. Table 3.2-4 shows the chronological differences in release between the base and cumulative settings, in terms of monthly volume of flow (acre-feet).

Figure 3.2-5
Don Pedro Reservoir Storage

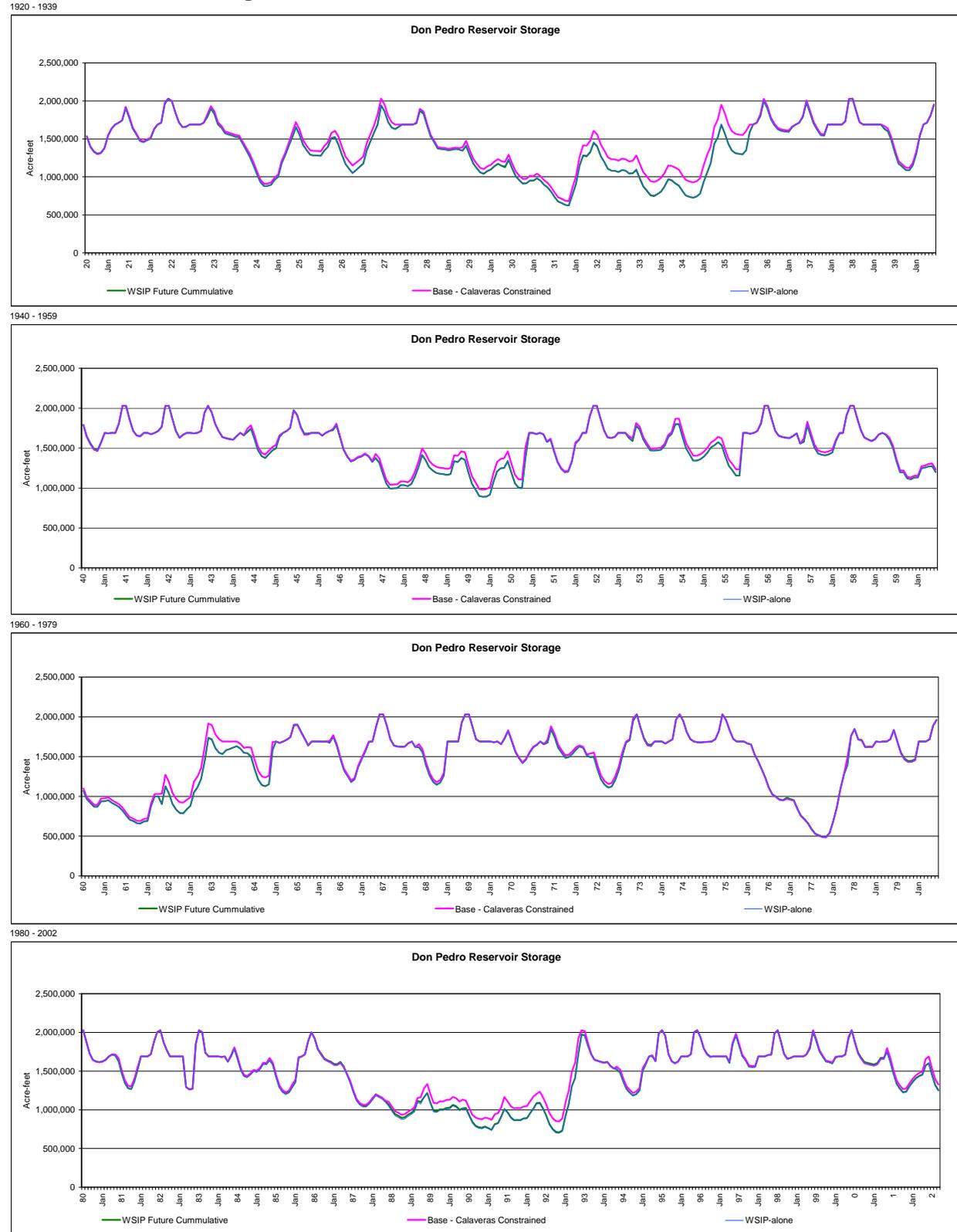
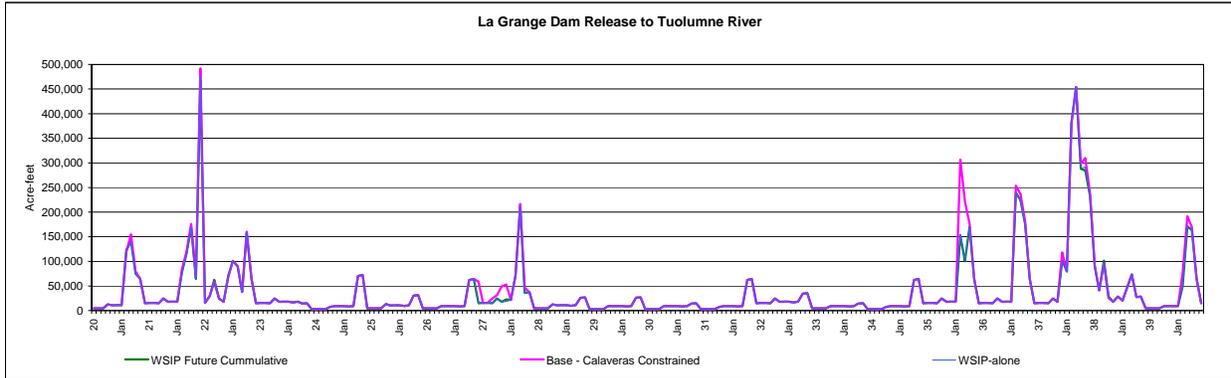
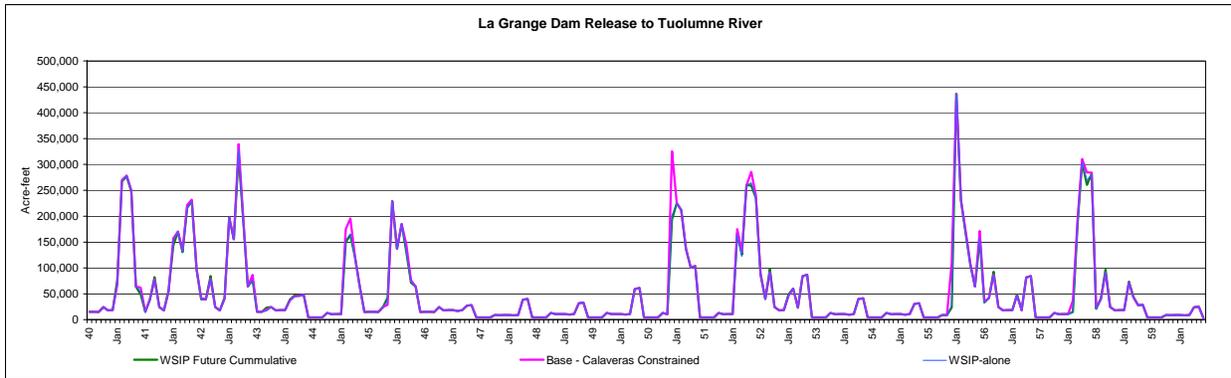


Figure 3.2-6
Release to the Tuolumne River from La Grange Dam

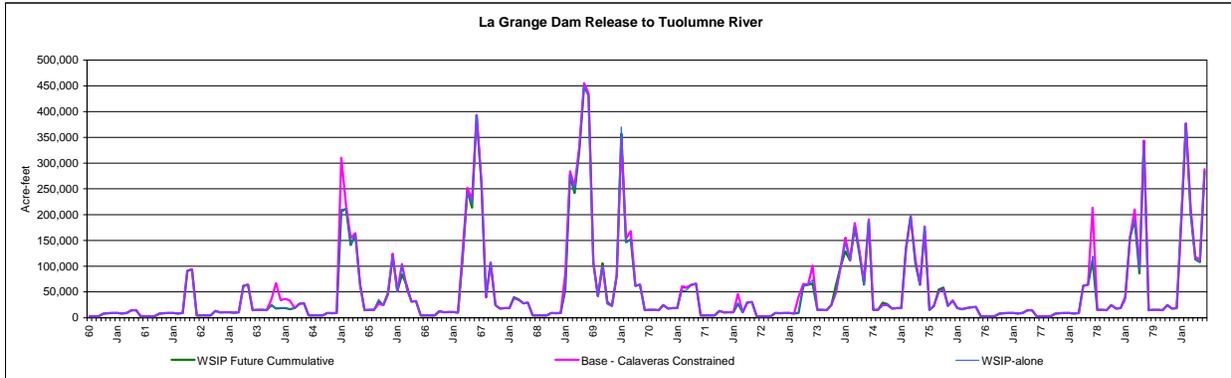
1920 - 1939



1940 - 1959



1960 - 1979



1980 - 2002

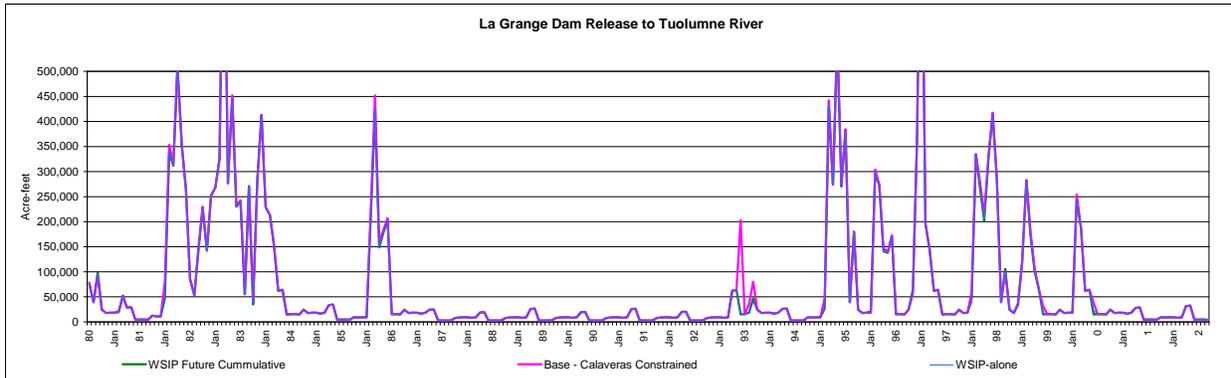


Table 3.2-4

Difference in Total La Grange Release to River (Acre-feet)													WSIP Future Cumulative minus Base - Calaveras Constrained	
Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total	
1921	0	0	0	0	3,747	-13,917	-4,481	0	0	0	0	0	-14,651	
1922	0	0	0	0	-6,014	-4,009	-7,365	-5,684	-23,668	0	-655	4,466	-42,929	
1923	0	0	2,981	0	0	0	-2,117	0	0	0	0	0	864	
1924	0	0	0	0	0	0	0	0	0	0	0	0	0	
1925	0	0	0	0	0	0	0	0	0	0	0	0	0	
1926	0	0	0	0	0	0	0	0	0	0	0	0	0	
1927	0	0	0	0	0	0	0	0	0	0	0	0	0	
1928	-6,886	-31,299	-30,186	0	0	-5,339	-10,773	0	-43,828	0	-644	-9,569	-54,041	
1929	0	0	0	0	0	0	0	0	0	0	0	0	-84,483	
1930	0	0	0	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	0	0	0	
1933	0	0	0	0	0	0	0	0	0	0	0	0	0	
1934	0	0	0	0	0	0	0	0	0	0	0	0	0	
1935	0	0	0	0	0	0	0	0	0	0	0	0	0	
1936	0	0	0	0	-154,326	-121,162	-5,971	0	0	0	0	0	-281,459	
1937	0	0	0	0	-13,999	-12,693	-5,279	0	0	0	0	0	-31,971	
1938	0	0	-16,576	0	0	-1,027	-10,341	-25,069	-4,880	-2,189	0	5,988	-54,094	
1939	2,982	0	0	0	0	0	0	0	0	0	0	0	2,982	
1940	0	0	0	0	-27,455	-20,894	-6,132	0	0	0	0	0	-54,481	
1941	0	0	0	8,336	-2,500	-1,614	-2,438	0	-13,324	0	-655	4,467	-7,728	
1942	0	0	2,980	-13,492	1	-3,805	-5,524	-2,855	-2,762	-2,188	0	5,987	-21,658	
1943	0	0	2,978	0	0	-20,460	-4,879	0	-9,907	0	0	3,814	-28,454	
1944	0	0	0	0	1,789	1,193	0	0	0	0	0	0	2,982	
1945	0	0	0	0	-25,334	-32,206	-523	0	0	0	0	0	-58,063	
1946	0	14,152	-465	0	0	-14,763	-4,998	0	0	0	0	0	-6,074	
1947	0	0	0	0	0	0	0	0	0	0	0	0	0	
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	
1949	0	0	0	0	0	0	0	0	0	0	0	0	0	
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	
1951	0	0	-131,631	2	0	0	0	0	0	0	0	0	-131,629	
1952	0	0	0	0	-8,223	-5,481	1	-26,445	-4,880	-2,188	0	5,987	-41,229	
1953	0	0	0	2,978	-1	0	0	0	0	0	0	0	2,977	
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	
1956	0	0	-86,461	2	0	-4,767	-3,172	0	-15,485	-2,188	0	5,987	-106,084	
1957	0	0	0	0	1,788	0	0	0	0	0	0	0	1,788	
1958	0	0	0	0	-22,392	-8,958	-5,966	-24,196	-2,854	-2,188	0	5,987	-60,567	
1959	0	0	0	0	1,787	1,192	0	0	0	0	0	0	2,979	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	
1964	-11,189	-49,491	-15,670	-18,132	-16,489	0	0	0	0	0	0	0	-110,971	
1965	0	0	0	-103,767	-6,178	-13,480	-2,230	0	0	0	0	3,997	-121,658	
1966	0	2,982	-5,810	0	-20,602	3,433	0	0	0	0	0	0	-19,997	
1967	0	0	0	0	0	-13,321	-4,366	-16,187	0	-2,188	0	-190	-36,252	
1968	0	0	0	0	1,793	1,195	0	0	0	0	0	0	2,988	
1969	0	0	0	-31,821	-7,207	-12,633	-7,641	-5,043	-4,879	-2,188	0	5,987	-65,425	
1970	2,982	0	0	8,905	-7,144	-16,078	0	0	0	0	0	0	-11,335	
1971	0	0	0	0	-1,639	-1,092	0	0	0	0	0	0	-2,731	
1972	0	0	0	0	-18,865	0	0	0	0	0	0	0	-18,865	
1973	0	0	0	0	0	-31,528	-3,772	0	-34,750	0	0	0	-70,050	
1974	0	14,870	-1	-26,139	2	-8,561	-5,524	-5,694	-4,229	0	0	3,813	-31,463	
1975	1,921	0	0	0	638	425	-8,286	0	-8,731	0	-655	4,467	-10,221	
1976	2,985	0	0	0	0	0	0	0	0	0	0	0	2,985	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	0	-102,498	0	0	0	-102,498	
1979	0	0	0	627	0	-20,891	-9,330	-2,189	0	0	0	0	-31,783	
1980	0	0	0	4,953	-1	-10,465	-4,880	-5,042	-4,880	-2,188	0	5,987	-16,516	
1981	0	0	0	0	1,787	1,192	0	0	0	0	0	0	2,979	
1982	0	0	0	-32,442	-16,653	-2,663	0	-2,854	-2,762	-2,188	0	-4,297	-63,859	
1983	-2,949	-1,841	2,664	0	0	0	0	-5,799	-2,762	-2,188	0	-2,183	-15,058	
1984	-7,162	0	0	0	0	3,935	0	0	0	0	0	0	-3,227	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	-11,928	-34,577	-11,300	-5,042	-4,879	0	0	0	-67,726	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	0	0	0	0	0	-187,962	0	-16,926	-33,299	-238,187	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	-20,168	-12,896	0	-12,997	-3,683	-2,188	0	1,743	-50,189	
1996	0	0	0	2,819	-10,301	1	-6,721	-2,188	-2,118	0	0	0	-18,508	
1997	0	6,781	0	-21,743	3	0	0	0	0	0	0	0	-14,959	
1998	0	0	0	-10,808	2	-12,498	-12,652	-1,796	-3,774	-2,188	0	5,987	-37,727	
1999	0	0	2,979	0	0	-9,514	-6,074	0	-16,264	0	0	0	-28,873	
2000	0	0	0	0	-10,698	0	0	0	-23,262	0	0	0	-33,960	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	
Avg (21-02)	-211	-535	-3,320	-2,801	-4,814	-5,594	-1,985	-1,818	-6,451	-320	-238	306	-27,782	

The effects of La Grange releases to the Tuolumne River between the cumulative and base settings are essentially the same as between the WSIP and base settings. The effect of lesser or greater releases at La Grange (shown by the volumes in Table 3.2-4) would manifest similarly to the effect described for WSIP changes. The change in volume would likely lead to a delay in, or earlier initiation of the day in which, releases are made above minimum flow requirements.

With no change to the operation of the SJPL identified under the cumulative setting, the local system would have an operation identical to the WSIP setting. In addition, when compared to the base setting, the hydrological effects would be the same as those identified for the WSIP setting.

APPENDIX H3

Temperature Modeling Report

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1. Model Description

In addition to the Hetch Hetchy/Local Simulation Model (HH/LSM) analysis, a second model, VR_Temp, was used to assess the effects of the WSIP on water temperature in the Tuolumne River below La Grange Dam. As described in Chapter 5 of the PEIR, the WSIP would result in reduced flows at this location, which could elevate water temperatures and cause adverse effects on coldwater fisheries in the Tuolumne River. This modeling was not needed at other locations in the Tuolumne River system or in the Alameda Creek and Peninsula watershed systems because the predicted changes in flow would not occur at times when thermal conditions would be at issue.

VR_Temp was developed by Beth Neilson at Utah State University and Dr. Steve Chapra at Tufts University for application to the Virgin River in Utah. VR_Temp is a one-dimensional, surface heat balance and kinematic flow routing model developed based on the derivations found in Chapra (1997). The model is able to estimate maximum daily water temperatures and was constructed to allow different input time steps for meteorological data as well as point and distributed inflow sources. The model allows a single stream or river segment to be divided into computational cells or elements; stream networks are not modeled and tributaries are treated as a time-series input. VR_Temp was adapted for use on the Tuolumne River by Merritt-Smith Consultants.

Data requirements for the VR_Temp include time-series inputs for meteorological and hydrologic data, water temperature data for all inflows, and a description of the river channel geometry. The meteorological requirements are solar radiation, air temperature, relative humidity, and wind speed. Hydrologic data requirements include headwater flow (e.g., upstream inflow), tributary and distributed inflows, and diversions. Each inflow to the modeled river reach requires a corresponding water temperature. In addition, data regarding the geometry of the river is necessary, including lengths, elevations, and river-bottom widths.

2. Analysis Methodology

Application to the Lower Tuolumne River

The objective of simulating flow and temperature in the Tuolumne River was to compare water temperature at discrete points in the river under different management scenarios. A number of possible methods were considered, including empirical/statistical relationships, analytical approaches using a spreadsheet, a simple flow and temperature model, or a comprehensive basin-scale production model. The limitations of empirical models and spreadsheet models precluded their application. Further, for this fairly straightforward analysis, a large complex model was not desired (e.g., such models require considerable time to implement and populate with data). The VR_Temp model includes a flow model and the transport of heat, providing time series of daily temperatures—information readily used by biologists and similar scientists in assessing potential impacts of temperature change in aquatic systems.

The necessary data were gathered or estimated from available sources (Table 1) in order to implement the VR_Temp model on the Tuolumne River from La Grange Dam (river mile [RM] 52.5) to the confluence with the San Joaquin River (RM 0.0) (Figure 1). Dry Creek was the only major tributary modeled, entering the river at approximately RM 16.7.

**TABLE 1
DATA SETS NECESSARY FOR MODEL COMPLETION**

Data Type	Units	Reason Necessary	Availability
Bottom width	m	Reach characteristics	Estimated using USGS topographic maps (TopoQuad)
Slope	km/km	Reach characteristics	Estimated using USGS topographic maps (TopoQuad)
Segment length	km	Reach characteristics	Estimated using USGS topographic maps (TopoQuad)
La Grange outflow	cms	Headwater boundary condition	USGS 11289650
La Grange outflow temperature	°C	Headwater boundary condition	wy9604TIDMID.xls
Dry Creek flow	cms	Inflow	USGS 11289950
Dry Creek water temperature	°C	Inflow	No data
Flow in Tuolumne River at Modesto	cms	Calibration	USGS 11290000
Water temperature in Tuolumne River at Modesto	Calibration	Calibration	USGS 11290000
Air temperature	°C	Meteorological conditions	CIMIS – Modesto
Wind speed	m/s	Meteorological conditions	CIMIS – Modesto
Relative humidity	%	Meteorological conditions	CIMIS – Modesto
Solar radiation	W/m ²	Meteorological conditions	CIMIS – Modesto

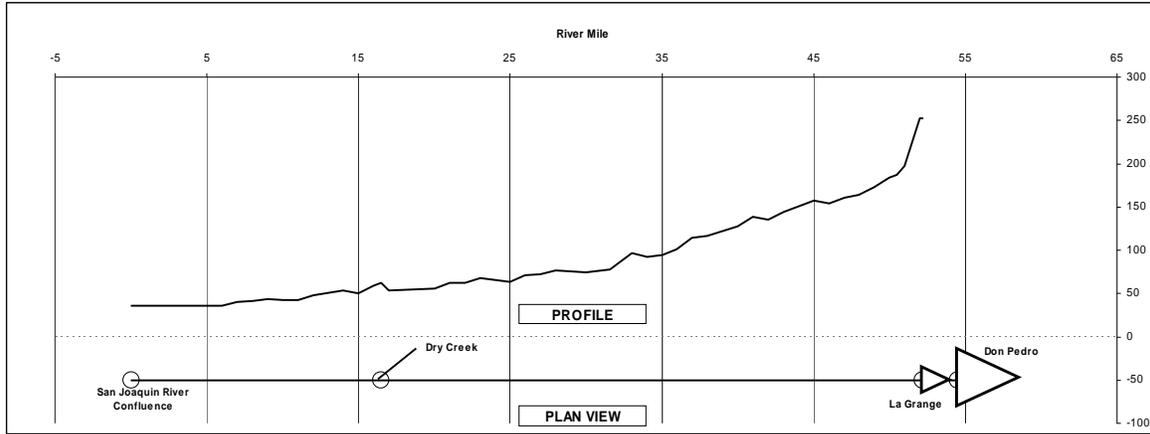
Unit Abbreviations:

m – meters
s – seconds
km – kilometer

cms – cubic meters per second
°C – degrees Celsius
W – watt

Other Abbreviations:

USGS – U.S. Geological Survey
CDEC – California Data Exchange Center
CIMIS – California Irrigation Management Information System



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Figure 1
Profile and Plan View Schematic of the Tuolumne River
from La Grange Dam to the San Joaquin River

Model Calibration

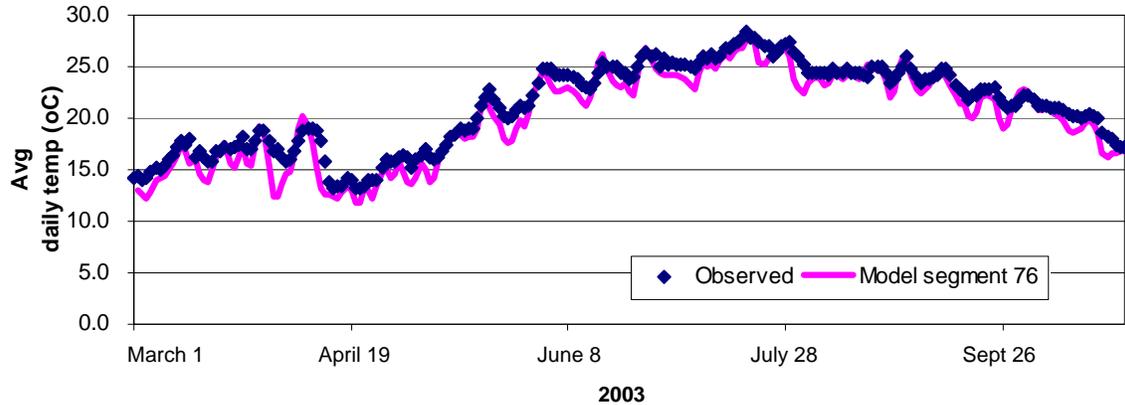
The model was calibrated for the period from March–October using data from 2003. This year was picked because, of the years for which data were available, 2003 provided the best variety in conditions (e.g., wet and dry periods). The model was run for eight months to focus on the period of the year when water temperatures were considered potentially important. Calibration results are shown in Figure 2, which shows that simulated temperatures are in good agreement with observations. Model performance was formally quantified using BIAS, MAE, and RMSE, as defined below, for maximum daily temperature, minimum daily temperature, and average daily temperature. Summary model performance statistics are presented in Table 2.

$$BIAS = \frac{1}{n} \sum_{i=1}^n (Temp_{modeled} - Temp_{measured})$$

$$MAE = \frac{1}{n} \sum_{i=1}^n |Temp_{modeled} - Temp_{measured}|$$

$$RMSE = \left(\frac{1}{n} \sum_{i=1}^n [Temp_{modeled} - Temp_{measured}]^2 \right)^{0.5}$$

Where n is the number of paired data points (observed and simulated).



NOTE: The modeled data are from the final calibration run.

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Figure 2
Modeled Versus Observed Temperature
in the Tuolumne River at Modesto

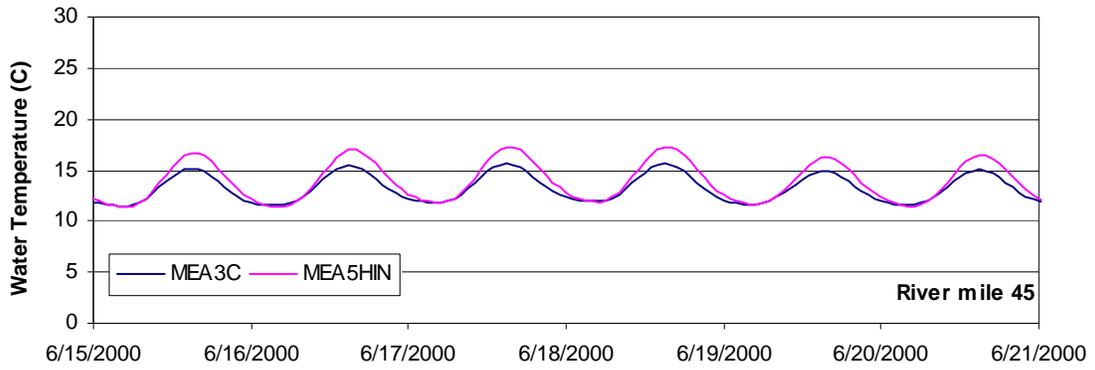
TABLE 2
SUMMARY OF STATISTICS FOR MODEL CALIBRATION
(degrees Celsius)

	BIAS	MAE	RMSE
Maximum Daily Temperature	-0.13	0.84	1.26
Mean Daily Temperature	-0.99	1.08	1.71
Minimum Daily Temperature	-1.85	1.87	4.28

Model Application

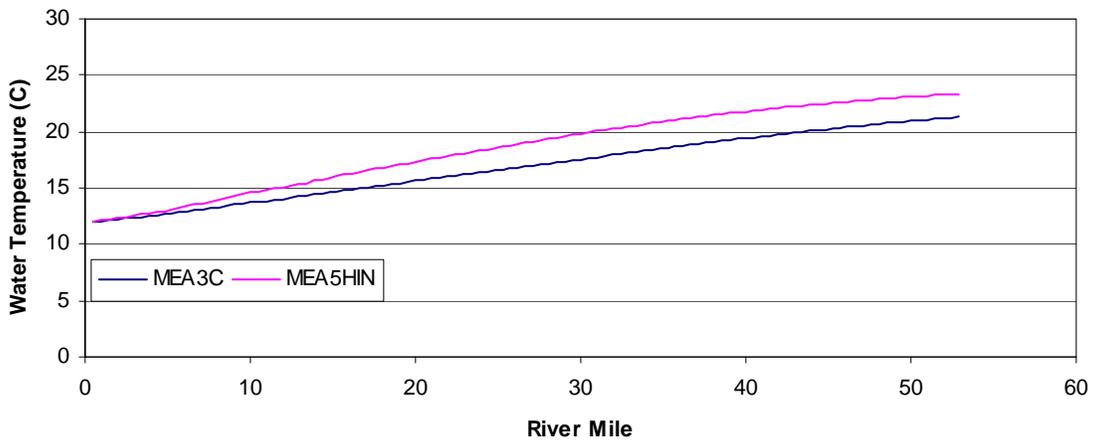
Application of the flow and temperature model was based on comparative analysis. Specifically, a baseline conditions scenario (e.g., existing conditions, MEA3C¹) was compared to a proposed scenario (e.g., the WSIP, MEA5HIN). Evaluation of simulated baseline results with simulated scenario results presumes that model uncertainty is approximately equal in both cases, and a direct comparison yields differences in “performance,” which in this case is identified as a temperature difference. Figure 3 shows an example of such a comparison as a time series of water temperature at RM 45 in the Tuolumne River for mid-June, when the flow at La Grange Dam was 3,000 cfs for MEA3C and 250 cfs for MEA5HIN. A longitudinal profile of temperatures (daily average temperature from La Grange to the San Joaquin River) for the same period is shown in Figure 4.

¹ Temperature modeling was based on HH/LSM data output from model run MEA3C as the existing conditions, which is an earlier version of model run MEA3CHR, which was used as the existing conditions for the hydrologic analysis described in Appendix H1. The differences between the two versions are minor and would result in no substantive changes in the temperature modeling.



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Figure 3
Time Series of Simulated Water Temperature for MEA3C and MEA5HIN at RM 45 in the Tuolumne River



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Figure 4
Longitudinal Profile of Simulated Water Temperature for MEA3C and MEA5HIN for the Tuolumne River

3. Temperature Modeling Results

Two reaches of the Tuolumne River were examined: below Hetch Hetchy Dam and the reach from La Grange Dam to the San Joaquin River. Although the VR_Temp model was only applied to the river below La Grange, approaches for both reaches are outlined herein.

Tuolumne River Below Hetch Hetchy Reservoir

Although several months of the year are identified as having notable flow reductions in this reach, the vast majority of flow reductions occur during the time of year when thermal conditions are not at issue (Table 3). To further explore potential impacts, individual months from the complete record were examined. The criteria for selecting potential months of concern included:

- May through October flow (period when thermal loading in the foothills and mid-Sierra may be of concern), and
- Reductions in flow on the order of 50 percent or more, and
- Final base flows under 200 cfs.

**TABLE 3
HETCH HETCHY RELEASE FLOW
(acre-feet)**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Existing Condition, MEA3C (2005)												
All Years	3,351	3,703	3,449	4,621	3,861	4,514	6,340	76,567	124,417	33,709	7,711	4,797
Wet	3,378	3,031	3,124	11,045	4,917	5,695	8,790	154,853	269,789	125,059	11,310	5,335
Above Normal	3,400	5,733	5,435	4,033	4,936	5,309	7,808	78,363	183,990	23,302	7,686	5,316
Normal	3,343	3,235	3,051	3,109	4,128	4,557	5,817	90,958	113,833	10,299	7,513	5,123
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,436	46,628	45,681	6,927	6,818	4,345
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,816	13,790	9,991	5,285	5,285	3,861
Future with Proposed Program, MEA5HIN (2030)												
All Years	3,351	3,609	3,449	4,522	3,861	4,506	6,153	68,297	123,484	33,709	7,711	4,793
Wet	3,378	3,031	3,124	10,290	4,917	5,165	8,544	148,523	270,615	125,059	11,310	5,316
Above Normal	3,400	5,282	5,435	4,033	4,936	5,772	7,808	73,003	184,183	23,302	7,686	5,316
Normal	3,343	3,235	3,051	3,355	4,128	4,557	5,817	77,459	113,463	10,299	7,513	5,123
Below Normal	3,363	3,255	2,821	2,622	2,851	3,891	5,212	34,660	42,164	6,927	6,818	4,345
Dry	3,266	3,161	2,729	2,460	2,469	3,105	3,340	9,651	8,283	5,285	5,285	3,861
% Change												
All Years	0	-3	0	-2	0	0	-3	-11	-1	0	0	0
Wet	0	0	0	-7	0	-9	-3	-4	0	0	0	0
Above Normal	0	-8	0	0	0	9	0	-7	0	0	0	0
Normal	0	0	0	8	0	0	0	-15	0	0	0	0
Below Normal	0	0	0	0	0	0	-4	-26	-8	0	0	0
Dry	0	0	0	0	0	0	-12	-30	-17	0	0	0

Based on these screening criteria, five dates were identified when thermal conditions may be of concern (Table 4).

TABLE 4
CURRENT AND PROPOSED MONTHLY AVERAGE FLOWS FOR CONDITIONS WHERE WATER
TEMPERATURES MAY BE ADVERSELY AFFECTED: TUOLUMNE RIVER BELOW HETCH HETCHY
(cubic feet per second)

Date	MEA3C	MEA5HIN	Difference
May 1962	777	100	-677
May 1978	857	100	-757
May 1981	413	144	-169
May 1992	530	50	-470
May 1999	383	164	-219

Although water temperatures may be elevated in May, this month is the predominate snowmelt runoff month. Typically elevated temperatures would be short-lived (i.e., a “hot” spell), and snowmelt runoff from adjacent lands may ameliorate stream conditions. These five occurrences represent approximately one-half of 1 percent of the simulation period (five months out of 984 months). Other, less stringent screening criteria were examined (e.g., final base flows under 400 cfs versus 200 cfs), but, by and large, temperature conditions were limited to May. Overall, the impact is expected to be less than significant.

Tuolumne River Below La Grange Dam

La Grange Dam on the Tuolumne River is located at approximately RM 52.5. Releases from this point flow generally westward to the confluence with the San Joaquin River and subsequently to the Delta.

In downstream Tuolumne River reaches (and San Joaquin River reaches as well), meteorological conditions dominate thermal processes. Table 5 illustrates flow conditions for the existing and proposed conditions, as well as the percent change between the two regimes. For the vast majority of conditions, flow decreases occur during months when temperature conditions are not at issue (e.g., winter, summer); occur during high-flow conditions (i.e., when meteorological conditions would not affect temperature due to high flow); or are small deviations from the baseline. However, in a few instances (e.g., June in a normal year), flow reductions may affect the thermal regime of the Tuolumne River downstream of La Grange Dam. This impact could be further evaluated by inspecting existing daily temperature and flow data to determine if flow differences similar to the difference between existing and proposed conditions (shown for June in a normal year) results in a meaningful temperature impact. The reservoir generally attains isothermal conditions each winter, from year to year, and thermal carryover effects do not occur.

TABLE 5
MONTHLY FLOWS ATTRIBUTABLE TO EXISTING CONDITIONS (TOP), PROPOSED PROGRAM
(MIDDLE), AND PERCENT CHANGE (BOTTOM) – TUOLUMNE RIVER BELOW LA GRANGE DAM
(cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Existing Condition, MEA3C (2005)												
All Years	20,456	20,812	40,677	62,838	96,370	111,086	96,005	91,545	70,251	28,445	14,337	27,614
Wet	27,559	22,492	61,154	158,619	200,916	267,649	216,636	243,574	241,822	110,617	35,503	94,716
Above Normal	19,703	31,993	68,013	75,452	147,873	155,200	131,049	81,465	88,529	16,277	18,922	27,774
Normal	18,888	17,236	37,139	51,177	91,185	95,734	79,283	80,277	16,527	9,992	9,992	9,670
Below Normal	17,763	17,993	21,100	16,941	23,829	17,911	33,630	34,751	4,025	4,160	4,160	4,025
Dry	18,583	13,822	15,496	14,083	19,361	22,004	21,134	21,838	3,347	3,459	3,459	3,347
Future with Proposed Program, MEA5HIN (2030)												
All Years	20,126	19,875	36,808	60,307	91,806	105,614	94,241	90,065	64,371	28,111	14,098	26,876
Wet	27,375	22,236	54,957	146,788	194,832	260,382	212,727	237,163	222,346	109,047	34,448	92,117
Above Normal	19,349	31,993	58,377	74,566	136,291	143,159	127,988	80,494	81,026	16,143	18,763	26,665
Normal	18,457	15,788	34,998	52,109	88,443	88,129	77,404	80,134	13,842	9,992	9,992	9,670
Below Normal	17,105	15,081	19,922	15,874	21,703	17,553	33,630	34,751	4,025	4,160	4,160	4,025
Dry	18,584	13,822	15,496	14,083	19,361	22,004	21,134	21,838	3,347	3,459	3,459	3,347
% Change												
All Years	-2	-4	-10	-4	-5	-5	-2	-2	-8	-1	-2	-3
Wet	-1	-1	-10	-7	-3	-3	-2	-3	-8	-1	-3	-3
Above Normal	-2	0	-14	-1	-8	-8	-2	-1	-8	-1	-1	-4
Normal	-2	-8	-6	2	-3	-8	-2	0	-16	0	0	0
Below Normal	-4	-16	-6	-6	-9	-2	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0

To further explore potential impacts, individual months from the complete record were examined. The criteria for selecting potential months of concern included:

- Months of April through October flow (period when thermal loading in the Central Valley may be of concern), and
- Reductions in flow on the order of 50 percent or more, and
- Final base flows under 400 cfs.

Four months were identified using these criteria, or approximately one-half of 1 percent of all months in the simulation period. Based on these screening criteria, three dates were identified when thermal conditions may be of concern (Table 6). Less strict criteria resulted in additional days being identified as potentially of concern. Although an occasional August or September date would be indicated during this sensitivity testing, the most prominent month was clearly June.

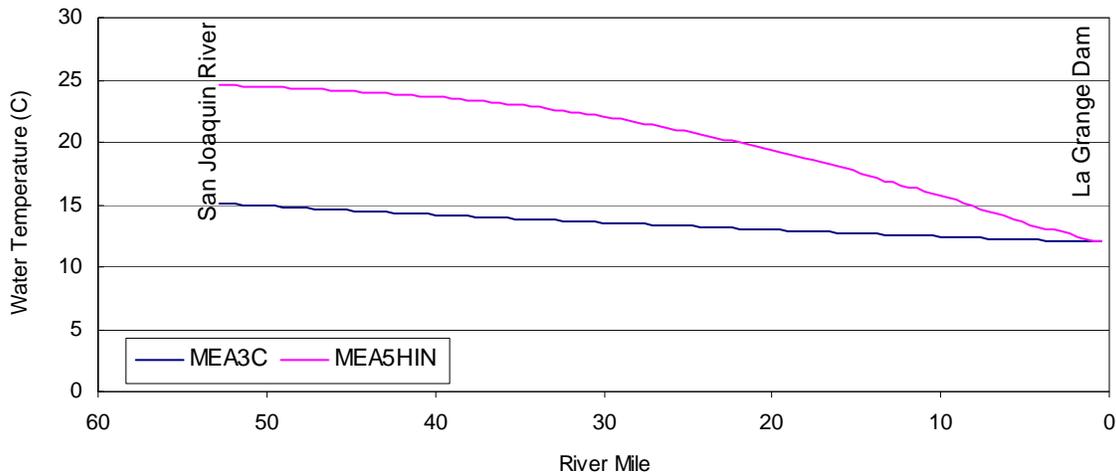
These flow reductions were assessed using the VR_Temp model. The model uses time series of flow and water temperature at La Grange Dam and associated time series of meteorological conditions to simulate

TABLE 6
CURRENT AND PROPOSED MONTHLY AVERAGE FLOWS FOR CONDITIONS WHERE WATER TEMPERATURES MAY BE ADVERSELY AFFECTED: TUOLUMNE RIVER BELOW LA GRANGE (cubic feet per second)

Date	MEA3C	MEA5HIN	Difference
June 1927	1,424	250	-1,174
June 1993	2,996	250	-2,746
June 1999	523	250	-773

water temperature at 0.5-mile increments. Output is in the form of time series at each simulation point, or longitudinal profiles of temperatures along the river length; both types of output are included in the following analysis.

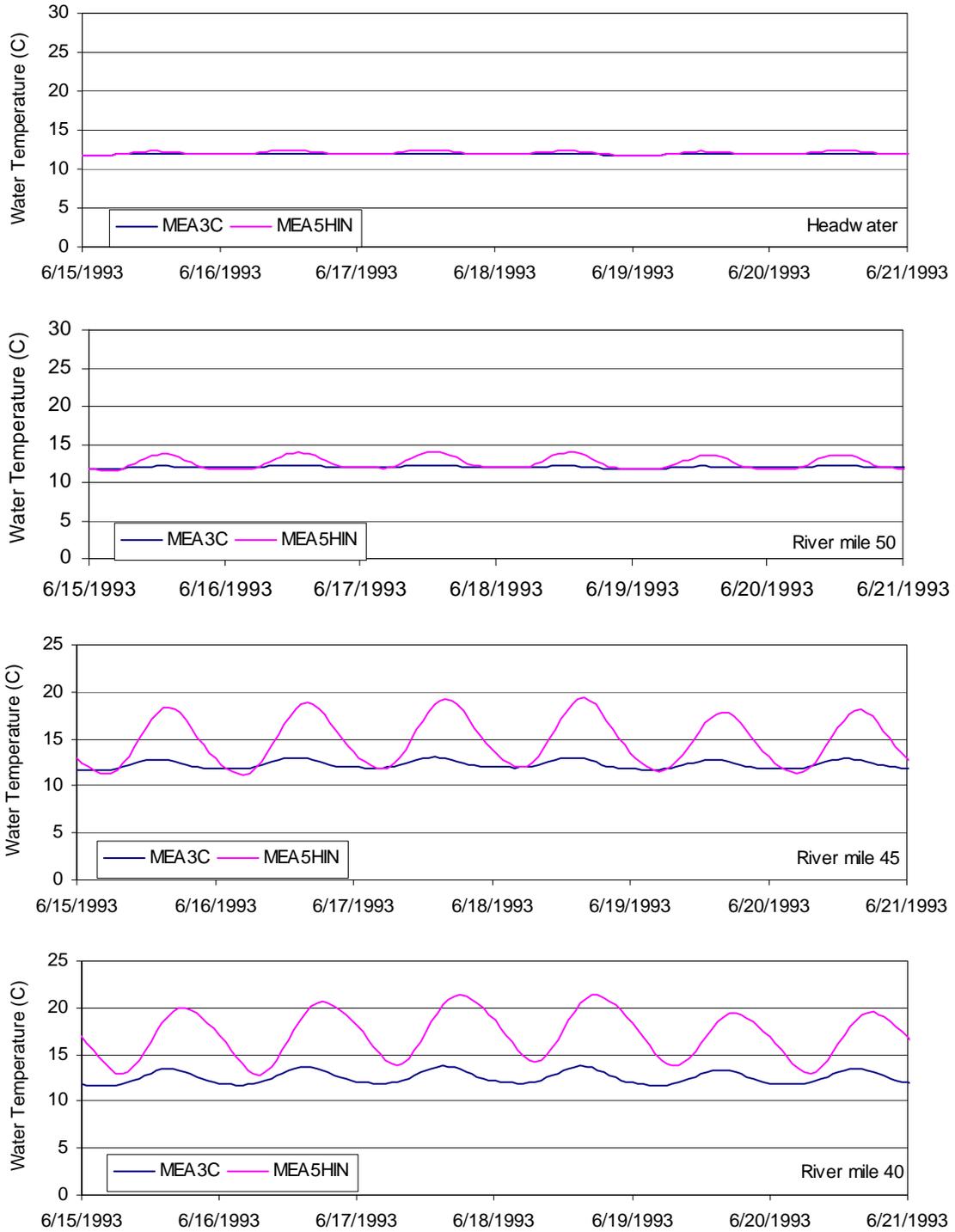
Simulation of June 1993 and June 1999 are shown to bracket the range of conditions that may occur—June 1993 being the extreme event, with over a 90 percent reduction in flow (Figures 5 through 8), and June 1999 representing a more modest event, with an approximate 50 percent reduction in flow (Figures 8 through 10).



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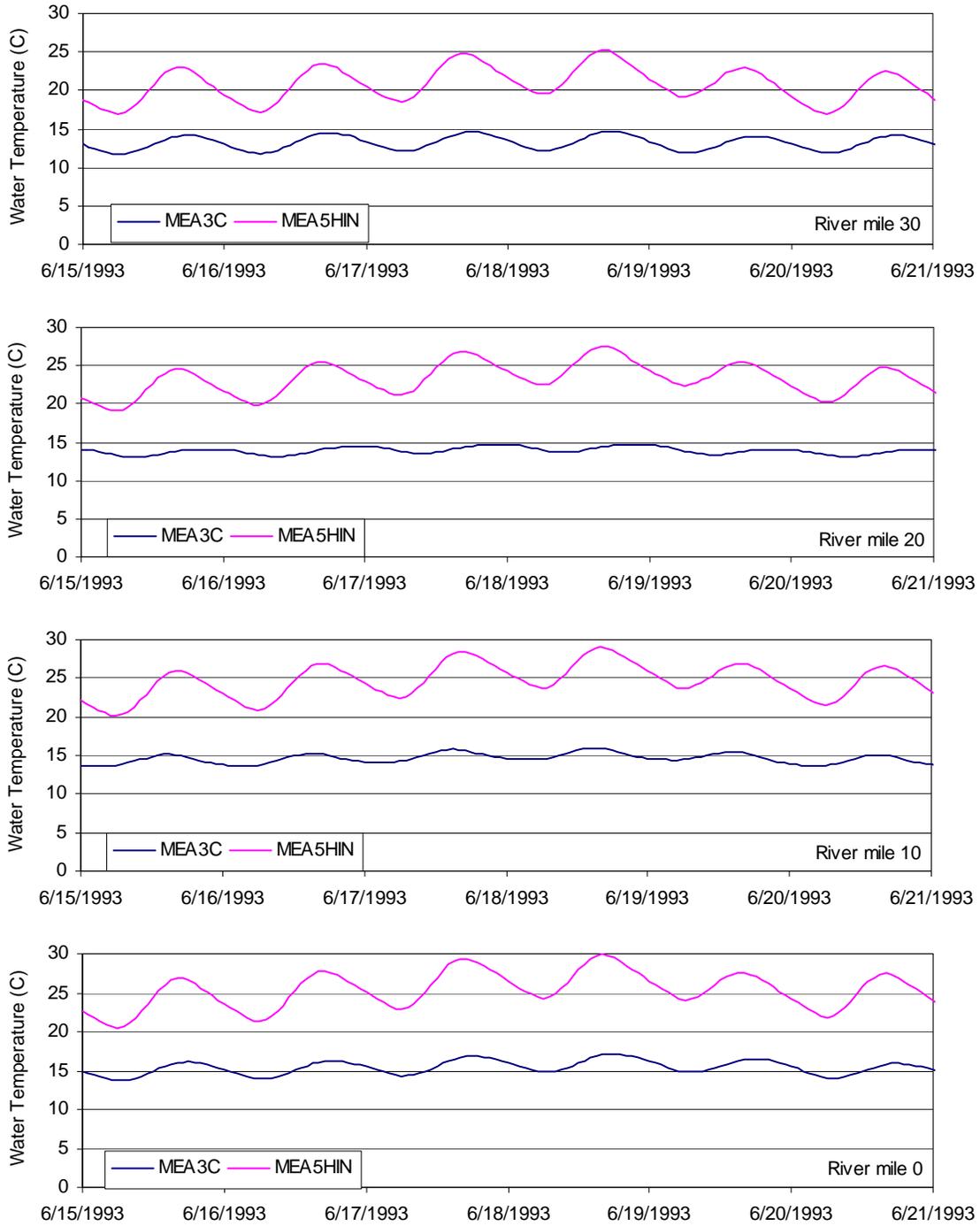
Figure 5
 Longitudinal Profile of Simulated Mean Daily Water Temperature from La Grange Dam to the San Joaquin River for MEA3C and MEA5HIN: June 15, 1927

For the large flow reduction in June 1993, water temperatures increase dramatically in the Tuolumne River below La Grange Dam. Releases from La Grange are largely below equilibrium temperature—the temperature at which water is in approximate equilibrium with meteorological conditions—because they originate from deep within Don Pedro Reservoir. Water temperatures rise steadily towards an equilibrium temperature of approximately 26 degrees Celsius (°C) (Figure 5), but at a



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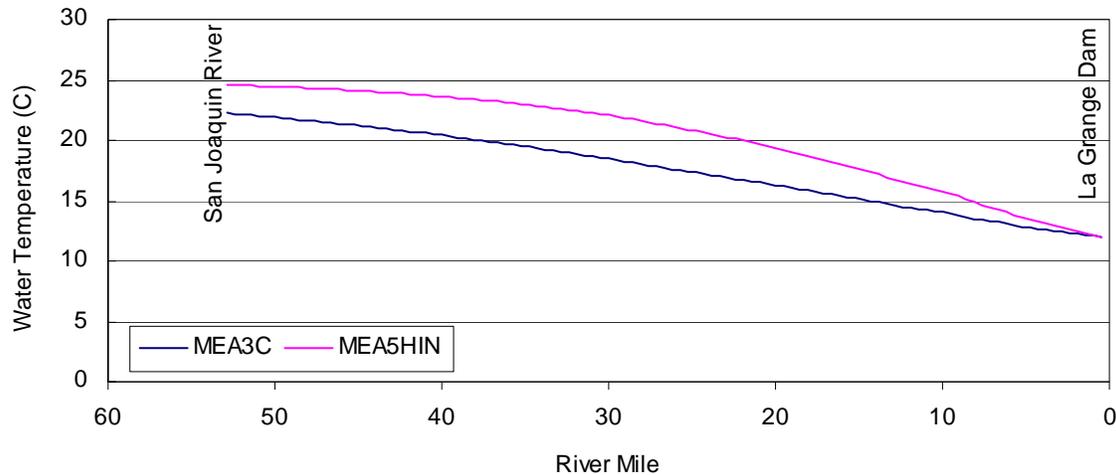
Figure 6
 Time Series of Simulated Mean Daily Water Temperature for MEA3C and MEA5HIN for (top to bottom) La Grange Dam, RM 50, RM 45, RM 40: June 15–21, 1993



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Figure 7

Time Series of Simulated Mean Daily Water Temperature for MEA3C and MEA5HIN for (top to bottom) RM 30, RM 20, RM 10, RM 0 (confluence with San Joaquin River): June 15–21, 1993



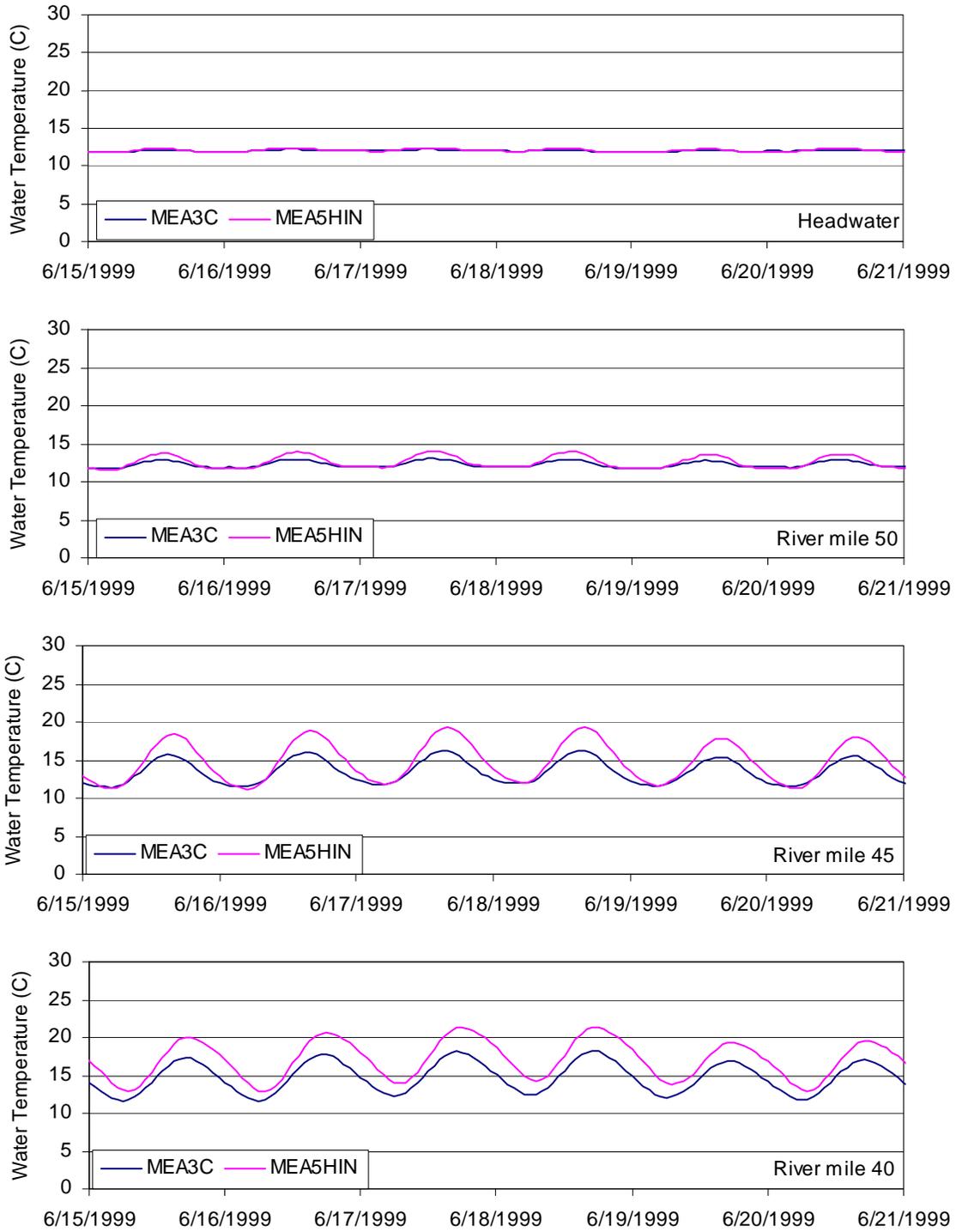
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Figure 8
Longitudinal Profile of Simulated Mean Daily Water Temperature from La Grange Dam to the San Joaquin River for MEA3C and MEA5HIN: June 15, 1999

much faster rate for the proposed conditions due to lower flows, which translate to longer transit times and shallower flow depths/volumes. The result is that daily mean temperatures are approximately 10 °C warmer under the proposed conditions by the time waters reach the San Joaquin River. Simulated time series for discrete locations along the river are presented in Figures 6 and 7. These data indicate the diurnal pattern of the river in response to the meteorological conditions, and clearly represent the changes in daily maximum and minimum temperatures under the two flow regimes. The larger flow, associated with current conditions, has a larger thermal mass and heats and cools much slower than the proposed flow. Thus, the proposed flow experiences not only a higher daily average temperature (Figure 5) than under the current condition, but also a larger diurnal range. The diurnal range at RM 40 is approximately 2 °C for current conditions and approximately 7 °C for proposed conditions, with maximum temperatures approaching 30 °C at the river's mouth.

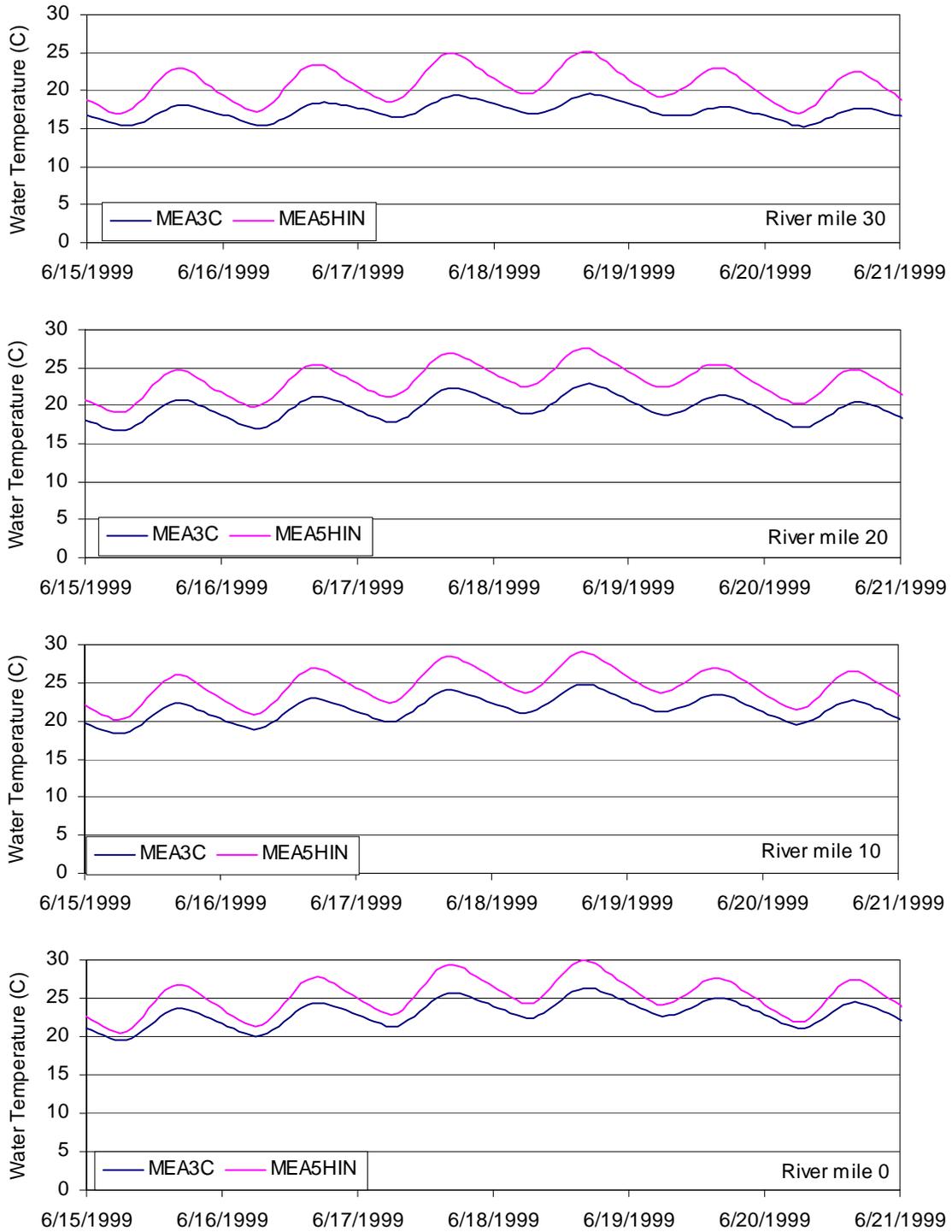
Conditions in June 1999 are not as disparate as in June 1993. Comparison of Figures 5 and 8 indicate that in 1999 the difference in daily average water temperatures at the San Joaquin River confluence are on the order of 2 °C as flows under both the current and future conditions rapidly approach equilibrium temperature. The diurnal range is similar at most locations between the two flow conditions, with the proposed lower-flow condition warmer overall than the current condition.

Overall, proposed operations may cause considerable deviation from the current condition in June, and an impact may occur.



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Figure 9
 Time Series of Simulated Mean Daily Water Temperature for MEA3C and MEA5HIN
 for (top to bottom) La Grange Dam, RM 50, RM 45, RM 40: June 15–21, 1999



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Figure 10
 Time Series of Simulated Mean Daily Water Temperature for MEA3C and MEA5HIN for
 (top to bottom) RM 30, RM 20, RM 10, RM 0 (confluence with San Joaquin River):
 June 15–21, 1999

References

Chapra, S.E., *Surface Water Quality Modeling*, McGraw-Hill, New York, 1997.