California State Water Resources Control Board

Final Environmental Impact Report
Volume II - Edited Version of 2011 2nd RDEIR

Consideration of Modifications to the
U.S. Bureau of Reclamation's Water Right Permits 11308 and 11310
(Applications 11331 and 11332)
to Protect Public Trust Values and
Downstream Water Rights on the Santa Ynez River
below Bradbury Dam (Cachuma Reservoir)

State Clearinghouse # 1999051051

Prepared for:
State Water Resources Control Board
Division of Water Rights
1001 "I" Street
Sacramento, California 95814

December 2011

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LIST OF ACRONYMS

1994 MOU	(1994) Memorandum of Understanding for Cooperation in Research and Fish Maintenance
af	acre-feet
afy	acre-feet per year
ACHP	Advisory Council on Historic Preservation
ANA	Above Narrows Account
BNA	Below Narrows Account
cfs	cubic feet per second
CRHR	California Register of Historic Resources
CCIC	Central Coast Information Center
CCRB	Cachuma Conservation Release Board
CCWA	Central Coast Water Authority
CEQA	California Environmental Quality Act
COMB	Cachuma Operations and Maintenance Board
County FCD	Santa Barbara County Flood Control District
County Parks	Santa Barbara County Parks Department
CSPA	California Sportfishing Protection Alliance
CVWD	Carpinteria Valley Water District
DFG	California Department of Fish and Game
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
Southern ESU	Southern California Steelhead Evolutionary Significant Unit
GWD	Goleta Water District
HCI	Hydrologic Consultants, Inc.
mg/l	Milligram(s) per liter
MODFLOW	Three Dimensional Finite Difference Flow Model
MOA	Memorandum of Agreement
MWD	Montecito Water District
NHPA	National Historic Preservation Act
NMFS	U.S. National Marine Fisheries Service
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PM_{10}	particulate matter less than 10 micrometers in diameter
Reclamation	U.S. Bureau of Reclamation
Recreation Area	Cachuma Lake Recreation Area
Regional Board	Regional Water Quality Control Board, Central Coast Region
ROG	reactive organic gases
SBCWA	Santa Barbara County Water Agency
SHPO	California State Office of Historic Preservation
SO_2	sulfur dioxide
SUTRA	Two-Dimensional Finite Element Solute Transport Model
SWP	State Water Project
SWRCB	State Water Resources Control Board
SYRHM	Santa Ynez River Hydrologic Model

LIST OF ACRONYMS (continued)

SYRTAC	Santa Ynez River Technical Advisory Committee
SYRWCD	Santa Ynez River Water Conservation District
SYRWCD, ID #1	Santa Ynez River Water Conservation District – Improvement District #1
TDS	Total dissolved solids
UCSB	University of California, Santa Barbara
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAFB	Vandenberg Air Force Base
WR	Water Rights [SWRCB – Water Rights Division]
WWTP	Wastewater treatment plant

EXECUTIVE SUMMARY

ES-1 PROPOSED PROJECT

The proposed project analyzed in this 2nd Revised Draft Environmental Impact Report (Revised Draft EIR) consists of potential modifications to the U.S. Bureau of Reclamation's (Reclamation) water right permits for the Cachuma Project in order to provide appropriate protection of downstream water rights and public trust resources on the Santa Ynez River.

The proposed project analyzed consists of potential modifications to Reclamation's existing water rights permits to provide appropriate protection of downstream water rights and public trust resources on the Santa Ynez River. The proposed project, as listed in the Notice of Preparation (NOP) issued by the State Water Resources Control Board (SWRCB), is:

> *Development of revised release requirements and other conditions, if any, in the Reclamation water rights permits (Applications 11331 and 11332) for the Cachuma Project. These release requirements will take into consideration the National Marine Fisheries Service's Biological Opinion and the draft Lower Santa Ynez River Fish Management Plan and other reports called for by Order WR 94-5. The revised release requirements are to provide appropriate public trust and downstream water rights protection. Protection of prior rights includes maintenance of percolation of water from the stream channel as such percolation would occur from unregulated flow, in order that the operation of the project shall not reduce natural recharge of groundwater from the Santa Ynez River below Bradbury Dam.*

Under section 15378 of the *California Environmental Quality Act (CEQA) Guidelines*, a "project" is defined as "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment." A project includes activities directly undertaken by any public agency such as public works construction, as well as activities involving the issuance or modification of a permit for use by other agencies. Modification of the release requirements and other conditions of Reclamation's water rights could affect the physical environment on the Santa Ynez River, and as such represents a project.

ES-2 PROJECT OBJECTIVES

The *State CEQA Guidelines* (Sec. 15124(b)) indicate that the EIR, as part of the project description, should contain "a statement of objectives sought by the proposed project. A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding considerations, if necessary. The statement of objectives should include the underlying purpose of the project."

The objectives for the project are:

- Protecting public trust resources, including but not limited to steelhead, red-legged frog, tidewater goby, and wetlands, in the Santa Ynez River downstream of Bradbury Dam, to the extent feasible and in the public interest, taking into consideration: (1) the water supply impacts of measures designed to protect public trust resources, and (2) the extent to which any water supply impacts can be minimized through the implementation of water conservation measures;

- Protecting senior water right holders from injury due to changes in water quality resulting from operation of the Cachuma Project, including water quality effects in the Lompoc Plains groundwater basin that impair any senior water right holder's ability to beneficially use water under prior rights; and

- Protecting senior water right holders from injury due to a reduction in the quantity of water available to serve prior rights.

ES-3 BACKGROUND

The Cachuma Project includes Bradbury Dam, which impounds water on the Santa Ynez River in northern Santa Barbara County, forming Cachuma Lake. The Cachuma Project provides water to the Cachuma Project Member Units for irrigation, domestic, municipal, and industrial uses. The Member Units consist of the City of Santa Barbara, Goleta Water District (GWD), Montecito Water District (MWD), Carpinteria Valley Water District (CVWD), and the Santa Ynez River Water Conservation District – Improvement District #1 (SYRWCD, ID#1).

Reclamation owns all project facilities and operates Bradbury Dam. The Member Units have assumed responsibility for operation and maintenance of the Cachuma Project facilities, other than Bradbury Dam. The Member Units formed the Cachuma Operation and Maintenance Board (COMB) to carry out these responsibilities.

In 1958, the SWRCB's predecessor, the State Water Rights Board, issued Permits 11308 and 11310 to Reclamation. The permits authorize Reclamation to divert and store water from the Santa Ynez River using Cachuma Project facilities. A condition of the permits requires Reclamation to release enough water to satisfy downstream users with senior rights to surface water and to maintain percolation of water from the stream channel in order that operation of the Cachuma Project does not reduce natural recharge of groundwater from the Santa Ynez River. The State Water Rights Board reserved jurisdiction to determine the amount, timing, and rate of releases necessary to satisfy downstream rights. Through a series of subsequent water right orders, the State Water Resources Control Board (SWRCB) modified the release requirements imposed on Reclamation and extended its reservation of jurisdiction.

In 1987, the California Sportfishing Protection Alliance (CSPA) filed a complaint with the SWRCB, which alleged that Cachuma Project operations had impacted steelhead trout in violation of the constitutional prohibition against the misuse of water. CSPA's complaint has not been resolved.

In December 1994, the SWRCB issued Order WR 94-5. The order continued the reservation of jurisdiction over Reclamation's permits until long-term permit conditions were set to protect downstream water right holders and set a deadline of December 1, 2000, to commence a hearing on this issue. Order WR 94-5 required Reclamation to conduct various studies and collect certain data for use by the SWRCB in the hearing. In addition, Order WR 94-5 required Reclamation to prepare any additional environmental documentation that the Chief of the Division of Water Rights determined was necessary to comply with the CEQA in connection with the SWRCB's consideration of modifications to Reclamation's permits. With direction from SWRCB staff, Reclamation prepared an environmental impact report (EIR) to comply with the order.

The SWRCB issued a NOP to prepare an EIR on May 19, 1999, to interested local, state, and federal agencies, as well as to environmental groups, landowners, and other parties with interests in the Santa Ynez River Watershed. The SWRCB received comment letters from a number of interested parties. In 2000, the SWRCB provided Reclamation with refinements to the alternatives described in the original NOP. This resulted in the development of seven variations of the original four alternatives to reflect the Biological Opinion issued by NMFS.

In November 2001, the SWRCB staff provided additional clarification to Reclamation concerning the December 2000 set of alternatives. SWRCB staff clarified that the baseline operations alternative should reflect any changes in Cachuma Project operations that had occurred since NMFS issued the Biological Opinion.

On August 8, 2003, the SWRCB issued a Draft EIR for public review and comment. In comments on the 2003 Draft EIR, California Trout (CalTrout) argued that the Draft EIR should be revised to include consideration of a different project alternative designed to protect fishery resources in the Santa Ynez River. The new alternative was described as Alternative 3A2 in a 1995 Environmental Impact Report/Environmental Impact Statement prepared by Reclamation and Cachuma Project water supply contractors in connection with the renewal of the water supply contract for the Cachuma Project. In response to CalTrout's comments, the SWRCB has developed two new alternatives, Alternatives 5B and 5C, which are modified versions of Alternative 3A2. The SWRCB has revised the August 2003 Draft EIR to analyze those alternatives.

The Revised Draft EIR included sections on background information and alternatives analyzed in the 2003 Draft EIR to establish a context for the analysis of Alternatives 5B and 5C, but focused on the analysis of the new alternatives. In addition, the Revised Draft EIR was updated to reflect a number of changes, including the surcharging of Cachuma Lake to 2.47 feet, that have occurred since the 2003 Draft EIR was prepared. Finally, the Revised Draft EIR made some changes and corrections in response to comments on the 2003 Draft EIR. The Revised Draft EIR did not contain, however, a complete response to comments.

ES-4 ALTERNATIVES CONSIDERED

The following six alternatives, representing baseline conditions, yet-unconsidered modified CalTrout alternatives, and previously considered alternatives included for comparison, were analyzed as part of the Revised Draft EIR:

2. Baseline Operations under Orders WR 89-18 and 94-5 and the Biological Opinion (interim release requirements only) – environmental baseline conditions.

3B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with a 1.8-foot surcharge.

3C. Existing operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge.

4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and the discharge of SWP water to the river near Lompoc in exchange for water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.

5B. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry, and critical water year types, assuming Reclamation achieves a 1.8-foot surcharge.

5C. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry, and critical water year types, assuming Reclamation achieves a 3.0-foot surcharge.

On July 31, 2007, the SWRCB released the Revised Draft EIR for a 60-day public review July 31 to September 28, 2007.

A summary of the alternatives is provided in **Table ES-1, Summary of Alternatives Addressed in the EIR**.

Table ES-1
Summary of Alternatives Addressed in the Revised Draft EIR

Alternative	Key Elements
2. Baseline condition operations - operations incorporating current Biological Opinion requirements, including interim rearing target flows.	Includes Order WR 89-18 releases with revised ramping schedule, releases for interim rearing target flows, emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity feed and pump releases, and surcharging at 0.75′. This alternative also includes certain non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
3B. Operations incorporating Biological Opinion requirements, including long-term rearing target flows. Surcharging at 1.8′.	This alternative represents the new operations to be implemented as required by the Biological Opinion assuming Reclamation achieves a 3.0′ surcharge, except that all releases for rearing and passage will be provided from a combination of 1.8′ surcharging and water supply. Includes emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity and pumped releases, and Order WR 89-18 releases with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
3C. Operations incorporating Biological Opinion and Settlement Agreement requirements, including long-term rearing target flows. Surcharging at 3.0′.	This alternative represents the new operations to be implemented as required by the Biological Opinion and Settlement Agreement assuming Reclamation achieves a 3.0′ surcharge. Releases for rearing and passage will be provided from a 3.0′ surcharge. Includes emergency winter storm operations, SWP mixing and associated water release restrictions, Hilton Creek gravity feed and pumped releases, and Order WR 89-18 including conjunctive use for fish flows releases and with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
4B. Operations incorporating Biological Opinion requirements, with additional actions to address water quality in the Lompoc Basin.	Includes fish releases under Alternative 3C, as well Discharge of SWP water to the river near Lompoc for recharge in exchange for Below Narrows Account water.
5B Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the long-term Biological Opinion operations during below-normal, dry and critical water year types. Surcharging at 1.8′.	This alternative represents the operations to be implemented as required by the Biological Opinion assuming Reclamation achieves a 3.0′ surcharge, except that all releases for rearing and passage will be provided from a combination of 1.8′ surcharging and water supply. During wet and above-normal water year types, releases for fish will occur under the operations as proposed in CalTrout Alternative 3A2. Includes emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity and pumped releases, and Order WR 89-18 releases with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.

Alternative	Key Elements
5C. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the long-term Biological Opinion operations during below-normal, dry and critical water year types. Surcharging at 3.0′.	This alternative represents the operations to be implemented as required by the Biological Opinion assuming Reclamation achieves a 3.0′ surcharge. All releases for rearing and passage will be provided from a 3.0′ surcharge. During wet and above-normal water year types, releases for fish will occur under the operations as proposed in CalTrout Alternative 3A2. Includes emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity feed and pumped releases, and Order WR 89-18 releases with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.

In accordance with the *State CEQA Guidelines* Section 16126.6 (e)(1) the Draft EIR provides analysis of a "No Project" alternative. The purpose of describing and analyzing a no project alternative is to allow decision makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project. The no project alternative analysis is not the baseline for determining whether the proposed project's environmental impacts may be significant, unless it is identical to the existing environmental setting analysis which does establish that baseline.

The 2003 Draft EIR considered Alternative 2, which represented the environmental baselines conditions at the time, as the No Project Alternative. The 2003 Draft EIR compared Alternative 2, then-existing conditions, to Alternative 1, historic conditions, in order to evaluate the changes that had taken place since Reclamation began to implement interim target flows pursuant to the Biological Opinion; Alternative 1 did not represent existing or baseline conditions.

As provided for by the *State CEQA Guidelines* Section 15126.6(e)(1), the "No Project" alternative can analyze the existing conditions as they exist at the time that the environmental impact report is prepared, as well as what could be reasonably expected to occur in the foreseeable future if the permit applications were not approved, based on current plans and consistent with available infrastructure and services. As such, the Revised Draft EIR considered Alternative 3C, which reflect existing operations under the Biological Opinion, as the No Project Alternative. However, the Revised Draft EIR still considers Alternative 2 as the baseline conditions.

ES-5 SUMMARY OF IMPACTS

The potential impacts of Alternatives 3B, 3C, 4B, 5B, and 5C were evaluated using Alternative 2 as the environmental baseline. Alternative 2 represents the conditions that existed beginning in September 2000, when Reclamation began to implement interim release requirements under the Biological Opinion. Since that time, Reclamation has increased the surcharge of Cachuma Lake from 0.75 to 2.47 feet and has begun to implement long-term release requirements under the Biological Opinion. Accordingly, Alternative 2 no longer represents existing conditions. Nonetheless, Alternative 2 remains an appropriate baseline for purposes of evaluating the potential impacts of the alternatives. Normally, the environmental conditions that exist at the time a lead agency issues a notice of preparation of an EIR constitute baseline conditions for purposes of the impacts analysis, even if conditions change during the environmental review process. (Cal. Code Regs, tit. 14, Section 15125, subd. (a)).~~)~~

Moreover, the use of Alternative 2 as the baseline, as opposed to using current conditions as the baseline, provides a conservative estimate of the potential environmental impacts of the alternatives. Alternative 2 assumes a 0.75-foot surcharge. Accordingly, comparing the other alternatives, which assume either a 1.8- or 3.0-foot surcharge, to Alternative 2 results in the full disclosure of the potential environmental impacts of surcharging Cachuma Lake above 0.75-feet, even though some of those impacts already have occurred. By contrast, if current conditions, including a 2.47-foot surcharge, were used as the baseline, only the incremental impacts associated with increasing the surcharge from 2.47 feet to 3.0 feet would be disclosed.

Similarly, using Alternative 2 as the baseline results in a modest over-estimate of water supply related impacts. This is because the amount of water available from the Cachuma Project during a drought would be slightly less under current conditions than it would have been under Alternative 2, notwithstanding the recent 2.47-foot surcharge, due to implementation of the long-term release requirements under the Biological Opinion (**Appendix F**, Technical Memorandum No. 5,Table 22.) This reduction in the amount of water that would be available during a drought would not be included in the analysis if current conditions were used as the baseline for purposes of calculating water supply reductions under the various alternatives. Conversely, if Alternative 2 is used as the baseline, the incremental reduction in supply that would occur under current conditions is included in the analysis.

Table ES-2 presents the impacts of the proposed alternatives (3B, 3C, 4B, 5B, and 5C) compared to environmental baseline conditions and operations (i.e., Alternative 2). Key findings are listed below:

- Alternatives 3B, 5B and 5C would result in potential shortages in supply during dry years that could require new sources of water, which could result in significant and unavoidable (Class I) impacts attributable to increased groundwater pumping, temporary water transfers, and desalination
- All of the alternatives, except Alternative 2 would have temporary significant unavoidable impacts (Class I) until such time that replacement trees become established and self-sustaining, which is estimated to take about 10 years. After this time, the loss of oaks is considered significant, but mitigable (Class II) impacts to oak trees.
- All of the alternatives would have potential significant, but mitigable (Class II) impacts to cultural resources.
- All of the alternatives would result in beneficial (Class IV) impacts to groundwater conditions; steelhead movement, migration and habitat; and riparian vegetation along the Santa Ynez River. In addition, Alternative 4B would have beneficial impacts related to surface water quality (TDS) in the Santa Ynez River.

Table ES-2
Summary of Impacts of Different Alternatives

Impact	Alt 3B	Alt 3C	Alt 4B	Alt 5B	Alt 5C
Significant, unmitigable (Class I)					
Water supply	X			X	X
Riparian and Lakeshore Vegetation					
Oak trees (short-term/temporary)	X	X	X	X	X
Significant, but mitigable (Class II)					
Riparian and Lakeshore Vegetation					
Oak trees (long-term)	X	X	X	X	X
Cultural Resources	X	X	X	X	X
Adverse, but not significant (Class III)					
Water supply		X	X		
Surface water hydrology	X	X	X	X	X
Surface water quality	X	X	X	X	X
Riparian and Lakeshore Vegetation					
Substantially remove or convert existing upland vegetation types (excluding oak woodlands)	X	X	X	X	X
Frequency and amount of low flows (2-5 cfs)	X	X	X	X	X
Sensitive Aquatic and Terrestrial Wildlife					
Surcharge would result in the loss of upland wildlife habitat	X	X	X	X	X
Reduce the frequency of spills, and affect riparian	X	X	X	X	X
Substantially affect the survival of sensitive wildlife species	X	X	X	X	X
Impact to southwestern willow flycatcher	X	X	X	X	X
Recreation	X	X	X	X	X
Beneficial (Class IV)					
Above the Narrows Aquifer	X	X	X	X	X
Surface water quality			X		
Lompoc Groundwater Basin	X	X	X	X	X
Riparian and Lakeshore Vegetation					
Effects of uncontrolled downstream flows	X	X	X	X	X
Southern California Steelhead and Other Fishes	X	X	X	X	X
Sensitive Aquatic and Terrestrial Wildlife	X	X	X	X	X

ES-6 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

The environmentally superior alternatives would be Alternative 3C and Alternative 4B as they have the fewest significant impacts. These alternatives would not result in any significant and unavoidable impacts (Class I) to water supply but would result in temporary significant and unavoidable (Class I) impacts to oak trees. Impacts related to the loss of oak trees would become significant but mitigable (Class II) once the replacement of oaks trees through planting is considered sustainable Alternatives 3C and 4B would also result in significant impacts to cultural resources that could be mitigated to less than significant (Class II). Both Alternatives 3C and 4B would result in some level of beneficial impacts to groundwater storage, riparian vegetation and steelhead passage and habitat. Alternative 4B would also result in improved surface water quality for total dissolved solids (TDS) in the Santa Ynez River. Although Alternative 4B would have slightly more beneficial impacts, it would require the import of SWP water, which would require an agreement between the City of Lompoc and ~~also have impacts related to~~ the construction of a pipeline and outlet works to discharge SWP water into the Santa Ynez River. Further, the City of Lompoc has expressed concern regarding potential impacts to water quality if SWP water was introduced into the Lompoc Groundwater Basin which could result in less than significant impacts (Class III) to water quality.

Alternatives 3B, 5B, and 5C would result in significant and unavoidable (Class I) impacts to water supply related that could not be mitigated as well as significant impacts (Class I and Class II) to oak trees and, therefore, would not be the environmentally superior alternative.

Alternatives 3C and 4B meet the objectives as set forth for the proposed project including:

- Protecting public trust resources, including but not limited to steelhead, red-legged frog, tidewater goby, and wetlands, in the Santa Ynez River downstream of Bradbury Dam, to the extent feasible and in the public interest, taking into consideration: (1) the water supply impacts of measures designed to protect public trust resources, and (2) the extent to which any water supply impacts can be minimized through the implementation of water conservation measures.

- Protecting senior water right holders from injury due to changes in water quality resulting from operation of the Cachuma Project, including water quality effects in the Lompoc Plains groundwater basin that impair any senior water right holder's ability to beneficially use water under prior rights; and

- Protecting senior water right holders from injury due to a reduction in the quantity of water available to serve prior rights.

As Alternative 3C is the No Project Alternative, Alternative 4B would be the environmentally superior alternative as the State CEQA Guidelines[1] requires that another alternative other than the No Project be identified among the other alternatives if the No Project is environmentally superior. However, ~~it~~ Alternative 4B would require additional measures beyond those that can be considered at this time and may ~~also~~ have additional impacts related to the construction of a pipeline and outlet works to discharge SWP water into the Santa Ynez River.

For Alternative 4B to be implemented, the City of Lompoc would need to implement an agreement for delivery of State Water Project (SWP) water which could serve to harden the demand for SWP water at a time when the state is looking to diversify regional water portfolios to improve water supply reliability. The residents of the City of Lompoc ~~have~~ rejected the use of SWP water in 1991 as part of countywide elections in Santa Barbara County ~~held in 14 Santa Barbara County cities, communities and water districts~~ on a state water ballot measure, which asked whether voters in each city or district would approve issuance of revenue bonds to finance local facilities needed to treat and distribute SWP water once the state completed construction of the Coastal Branch Phase II project. Voters in 11 cities and districts approved the bond measures; the City of Lompoc denied the measure.

~~Further, the Biological Opinion issued by the National Marine Fisheries Service (NMFS) for the Cachuma project expresses concern that salmonids may incorrectly imprint on SWP water. The Biological Opinion included a reasonable and prudent measure (number 6) to avoid mixing Central Coast Water Authority Water (CCWA) (SWP water) in the Santa Ynez River downstream of Bradbury Dam when Steel head smolts could be imprinted.[2]~~

~~make it difficult may~~~~Therefore,~~These considerations neither add significant new information nor affect the analyses contained in the 2011 2nd RDEIR, but support a conclusion that Alternative 4B is not ~~considered a~~ feasible ~~alternative~~ and should not be considered.

1 California Code of Regulations, Title 14, Division 6, Chapter 3, *California Environmental Quality Act Guidelines*, Section 15126.6(e)(2).

~~2 National Marine Fisheries Service, Southwest Region Biological Opinion – U.S. Bureau of Reclamation operation and maintenance of the Cachuma Project on the Santa Ynez in Santa Barbara County, California, p. 68.~~

1.0 INTRODUCTION

This document is a 2nd Revised Draft Environmental Impact Report (2nd Revised Draft EIR) for the Consideration of Modifications to the U.S. Bureau of Reclamation's (Reclamation) Water Rights Permits 11308 and 11310 (Applications 11331 and 11332) to Protect Public Trust Values and downstream Water Rights on the Santa Ynez River below Bradbury Dam (Cachuma Reservoir) (hereafter referred to as the "proposed project").

This 2nd Revised Draft EIR incorporates comments received on both the Draft Environmental Impact Report (Draft EIR) released in 2003 and Revised Draft Environmental Impact Report (Revised Draft EIR) released in 2007. The 2nd Revised Draft EIR has been prepared in accordance with the California Environmental Quality Act (CEQA) (Public Resources Code Sections 21000 et seq.), and its implementing guidelines (Title 14, California Code Regulations, Sections 15000 et seq., [*State CEQA Guidelines*]) as amended.

As provided for in the *State CEQA Guidelines* (Section 15088.5), the State Water Resources control Board (SWRCB) is recirculating the EIR for the proposed project as a result of significant new information is added to the EIR after public notice is given of the availability of the Draft EIR for public review. As provided for under the *State CEQA Guidelines*,

> *Significant new information" requiring recirculation include, for example, a disclosure showing that:*
>
> *(1) A new significant environmental impact would result from the project or from a new mitigation measure proposed to be implemented;*
>
> *(2) A substantial increase in the severity of an environmental impact would result unless mitigation measures are adopted that reduce the impact to a level of insignificance;*
>
> *(3) A feasible project alternative or mitigation measure considerably different from others previously analyzed would clearly lessen the environmental impacts of the project, but the project's proponents decline to adopt it; or*
>
> *(4) The draft EIR was so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded.*

For purposes of this 2nd Revised Draft EIR, the SWRCB has recirculated this EIR as a result of potential new significant impacts associated with water supply (item 1 above).

1.1 PROCESS

As defined by Section 15050 of the *State CEQA Guidelines*, the SWRCB is serving as Lead Agency, and is responsible for preparing the EIR for this project. As such, the SWRCB is responsible for ensuring that the EIR satisfies the procedural and informational requirements of CEQA and for the consideration and certification of the adequacy of the EIR prior to making any decision regarding the project.

1.2 CONTENTS OF THE EIR

As discussed above, the primary intent of this 2nd Revised Draft EIR is to address comments pertaining to the analysis contained within the Draft EIR and Revised Draft EIR. Pursuant to Section 15088 of the *State CEQA Guidelines*, the SWRCB, as the Lead Agency for this project, has reviewed and addressed all comments received on the Draft EIR and Revised Draft EIR prepared for the proposed project that were submitted during the required public review period for the Draft EIR and Revised Draft EIR.

Volume II, July 2007 Revised Draft EIR, as originally circulated.

Volume III, August 2003 Draft EIR, as originally circulated.

This 2nd Revised Draft EIR maintains the same fundamental outline and numbering as the original August 2003 Draft EIR and July 2007 Revised Draft EIR.

1.3 PROPOSED PROJECT

The proposed project analyzed consists of potential modifications to Reclamation's existing water rights permits to provide appropriate protection of downstream water rights and public trust resources on the Santa Ynez River. The proposed project, as listed in the Notice of Preparation (NOP) issued by the SWRCB, is:

> *Development of revised release requirements and other conditions, if any, in the Reclamation water rights permits (Applications 11331 and 11332) for the Cachuma Project. These release requirements will take into consideration the National Marine Fisheries Service's Biological Opinion and the draft Lower Santa Ynez River Fish Management Plan and other reports called for by Order WR 94-5. The revised release requirements are to provide appropriate public trust and downstream water rights protection. Protection of prior rights includes maintenance of percolation of water from the stream channel as such percolation would occur from unregulated flow, in order that the operation of the project shall not reduce natural recharge of groundwater from the Santa Ynez River below Bradbury Dam.*

Under section 15378 of the CEQA Guidelines, a "project" is defined as "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment." A project includes activities directly undertaken by any public agency such as public works construction, as well as activities involving the issuance or modification of a permit for use by other agencies. Modification of the release requirements and other conditions of Reclamation's water rights could affect the physical environment on the Santa Ynez River, and as such represents a project.

1.4 FACTUAL AND PROCEDURAL BACKGROUND INFORMATION

Bradbury Dam impounds water on the Santa Ynez River in northern Santa Barbara County, forming Cachuma Lake (**Figure 1-1**). Bradbury Dam and Cachuma Lake are part of the Cachuma Project. The Secretary of the Interior authorized construction of the Cachuma Project pursuant to section 9(a) of the Reclamation Project Act of 1939. The United States Department of the Interior, Bureau of Reclamation (Reclamation) began construction of the Cachuma Project in 1950 and completed construction in 1956.

The Cachuma Project provides water to the Cachuma Project Member Units for irrigation, domestic, municipal, and industrial uses. The Member Units consist of the City of Santa Barbara, GWD, MWD, CVWD, and the SYRWCD, ID #1. Water is delivered to the South Coast Member Units through the Tecolote Tunnel beneath the Santa Ynez Mountains (**Figure 1-2**). Initial deliveries using the Tecolote Tunnel began in 1955.

Reclamation owns all Cachuma Project facilities and operates Bradbury Dam. In 1956, the Member Units assumed responsibility for operation and maintenance of Cachuma Project facilities other than Bradbury Dam. The Member Units formed the COMB to carry out these responsibilities.

In 1958, the SWRCB's predecessor, the State Water Rights Board, adopted Decision 886 and issued Permits 11308 and 11310 to Reclamation. The permits authorize Reclamation to divert and store water from the Santa Ynez River using Cachuma Project facilities. Permit 11308 authorizes the direct diversion of 100 cubic feet per second (cfs) and the diversion to storage of 275,000 acre-feet per year (afy) for purposes of domestic use, salinity control, incidental recreational use, and irrigation. Permit 11310 authorizes the direct diversion of 50 cfs and the diversion to storage of 275,000 afy for purposes of municipal, industrial, and incidental recreational uses. The total maximum amount of water that may be diverted to storage under both permits is 275,000 afy. Under both permits, the authorized season of direct diversion is year-round and the authorized season of diversion to storage is from October 1 to about June 30 of the following year.

A condition of the permits requires Reclamation to release enough water to satisfy downstream users with senior rights to surface water and to maintain percolation of water from the stream channel as such percolation would occur from unregulated flow, in order that the operation of the project does not reduce natural recharge of groundwater from the Santa Ynez River. Decision 886 required Reclamation to make all releases of water past Bradbury Dam in such a manner as to maintain a live stream at all times as far below the dam as possible, consistent with the purposes of the Cachuma Project and the requirements of downstream users. The river downstream of Bradbury Dam is shown on **Figure 1-3**.

Decision 886 required Reclamation to conduct various investigations and studies to determine the amount, timing, and rate of the releases necessary to satisfy downstream users in compliance with the decision. The SWRCB reserved jurisdiction for 15 years or for such further time prior to issuance of licenses as the SWRCB might determine upon notice and hearing to be necessary to determine the amount, timing, and rate of releases necessary to satisfy downstream rights.

The SWRCB extended its reservation of jurisdiction through a series of subsequent water rights orders. In 1973, Order WR 73-37 modified the original permits for a 15-year trial period. Under a modified operation or new release schedule, Reclamation was allowed to store inflow to Cachuma Lake regardless of whether there was a live stream, and dewatered storage in the downstream alluvial basins between the dam and the Narrows (east of Lompoc) was ~~maintained~~allowed to remain, with the intent of enhancing ground-water recharge from the tributary streams downstream of Cachuma Lake and spills from Bradbury Dam. Instead of the "live stream" requirement, Order WR 73-37 established two accounts – the Above Narrows Account (ANA) and the Below Narrows Account (BNA) – to provide for the replenishment of the groundwater basins above and below the Lompoc Narrows. Order WR 73-37 required water to be credited to and released from the accounts in accordance with a detailed formula set forth in the order. Order WR 73-37 also required Reclamation to monitor the impacts of the release schedule on riparian vegetation.

In September 1989, the SWRCB adopted Order WR 89-18, ~~slightly~~ modifying the release schedule and extending continuing jurisdiction until 1994. The SWRCB also extended the riparian vegetation monitoring requirement for a minimum of five years. Finally, the SWRCB addressed a complaint filed by the CSPA in 1987, which alleged that Cachuma Project operations had severely impacted steelhead trout in violation of the constitutional prohibition against the misuse of water. The SWRCB directed SWRCB staff to hold a hearing on CSPA's complaint as soon as possible.

In 1990, the SWRCB held and then recessed a consolidated hearing on all outstanding issues in the Santa Ynez River watershed, including the SWRCB's reservation of jurisdiction over Reclamation's permits and CSPA's complaint. The SWRCB recessed the hearing in order to allow the parties to resolve technical issues outside the hearing process. Subsequently, the SWRCB informed the parties that a cumulative environmental impact report needed to be prepared and other information needed to be developed before the SWRCB could take action on the matters pending before it.

The SWRCB scheduled hearings again in 1994, but Reclamation requested that the SWRCB postpone the hearings in order to collect additional well data, implement a riparian vegetation study required by the SWRCB, and collect data on fish in the river pursuant to a 1994 Memorandum of Understanding (1994 MOU) between Reclamation, the DFG; the U.S. Fish and Wildlife Service (USFWS), the Cachuma Conservation Release Board (CCRB) (composed of the City of Santa Barbara, GWD, MWD, and CVWD), SYRWCD, ID #1, the Santa Ynez River Water Conservation District (SYRWCD), Santa Barbara County Water Agency (SBCWA), and the City of Lompoc.

In December 1994, the SWRCB issued Order WR 94-5. The order continued the reservation of jurisdiction over Reclamation's permits until long-term permit conditions were set to protect downstream water right holders. The order established a deadline of December 1, 2000 to commence a hearing on this issue. The order also required Reclamation to make releases for the benefit of fish in accordance with the 1994 MOU.

Order WR 94-5 required Reclamation to conduct various studies and collect certain data for use by the SWRCB in the hearing. Not later than February 1, 2000, the order required Reclamation to submit, among other things: (1) reports and data resulting from the 1994 MOU, (2) a report on the riparian vegetation monitoring program, (3) information developed and conclusions reached during ongoing negotiations between the Member Units and the City of Lompoc, and (4) a report on the impacts of the Cachuma Project on downstream diverters. In addition, Order WR 94-5 required Reclamation to prepare any additional environmental documentation that the Chief of the Division of Water Rights determined was necessary to comply with CEQA in connection with the SWRCB's consideration of modifications to Reclamation's permits. The Division Chief was to have made this determination by March 1, 2000, and Reclamation was to have submitted a draft of any required documentation to the SWRCB by July 31, 2000. This EIR has been prepared to comply with the order. This EIR analyzes the environmental impacts of various operational alternatives designed to protect downstream water rights and public trust resources.

Independent of the release requirements under Orders WR 89-18 and WR 94-5, Reclamation has recently modified its operations to allow for additional releases for purposes of protecting and enhancing habitat for the steelhead present in the Santa Ynez River below Bradbury Dam. On August 18, 1997, the NMFS listed the Southern ESU as an endangered species under the federal ESA. The steelhead population in the Santa Ynez River below Bradbury Dam is part of this ESU. The new releases were developed in compliance with the requirements of the federal ESA. In 2000, Reclamation completed an endangered species consultation with NMFS under Section 7 of the ESA regarding the effects of the Cachuma Project on the steelhead. NMFS issued a Biological Opinion in September 2000, which contains mandatory terms and conditions that Reclamation must observe to protect the species, including new water releases from the dam. These releases supplement the releases under Orders WR 89-18 and WR 94-5.

1.5 PUBLIC SCOPING AND PRIOR ENVIRONMENTAL REVIEWS

The SWRCB issued an NOP for the EIR on May 19, 1999, to interested local, state, and federal agencies, as well as to environmental groups, landowners, and other parties with interests in the Santa Ynez River Watershed. The SWRCB received comment letters from the following parties:

- U.S. Fish and Wildlife Service
- California Department of Water Resources
- City of Lompoc
- Cachuma Conservation Release Board
- Santa Ynez River Water Conservation District
- Environmental Defense Center
- California Sportfishing Protection Alliance
- Linda Sehgal

In letters dated May 17, 2000, and December 20, 2000, the SWRCB provided Reclamation with refinements to the alternatives described in the original NOP. This resulted in the development of seven variations of the original four alternatives to reflect the Biological Opinion issued by NMFS.

In November 2001, the SWRCB staff provided additional clarification to Reclamation concerning the December 2000 set of alternatives. SWRCB staff clarified that the baseline operations alternative should reflect any changes in Cachuma Project operations that had occurred since NMFS issued the Biological Opinion.

On August 8, 2003, the SWRCB issued a Draft EIR for public review and comment. Comments were due by October 7, 2003. The SWRCB received comments on the August 2003 Draft EIR from the following parties:

- Santa Barbara County Public Works Department - Flood Control Water Agency
- City of Lompoc
- Arve Sjovold
- County of Santa Barbara
- Cachuma Conservation Release Board

- Marc Guonin
- Cynthia Lara
- Valerie Weiss
- California Trout, Inc.
- Paul Willis
- Mike Homes
- Santa Ynez River Water Conservation District, Improvement District No. 1
- City of Solvang
- California Department of Fish and Game
- National Marine Fisheries Service
- Santa Ynez River Water Conservation District
- U.S. Bureau of Reclamation
- Elizabeth Mason
- Santa Barbara Urban Creeks Council
- Majorie Lakin Erickson
- Conception Coast Project

In comments on the 2003 Draft EIR, California Trout (CalTrout) argued that the Draft EIR should be revised to include consideration of a different project alternative designed to protect fishery resources in the Santa Ynez River. The new alternative was described as Alternative 3A2 in a 1995 Environmental Impact Report/Environmental Impact Statement (EIR/EIS) prepared by Reclamation and Cachuma Project water supply contractors in connection with the renewal of the water supply contract for the Cachuma Project. In response to CalTrout's comments, the SWRCB has developed two new alternatives, Alternatives 5B and 5C, which are modified versions of Alternative 3A2. The July 2007 Revised Draft EIR analyzed those alternatives.

The Revised Draft EIR included sections on background information and alternatives analyzed in the 2003 Draft EIR to establish a context for the analysis of Alternatives 5B and 5C, but focused on the analysis of the new alternatives. In addition, the Revised Draft EIR was updated to reflect a number of changes, including the surcharging of Cachuma Lake to 2.47 feet, that have occurred since the 2003 Draft

EIR was prepared. Finally, the Revised Draft EIR made some changes and corrections in response to comments on the 2003 Draft EIR. The Revised Draft EIR did not contain, however, a complete response to comments.

1.5.1 Project Alternatives Considered in August 2003 Draft EIR

As discussed above, the project analyzed in the Revised Draft EIR consisted of potential modifications to Reclamation's existing water rights permits to provide appropriate protection of downstream water rights and public trust resources on the Santa Ynez River downstream of Bradbury Dam. Reclamation releases water to satisfy downstream water rights in accordance with requirements imposed by SWRCB Orders WR 73-37 and WR 89-18. SWRCB Order WR 94-5 required Reclamation to release water for the benefit of fishery resources in accordance with a 1994 Memorandum of Understanding (1994 MOU) between Reclamation and other parties, including the California Department of Fish and Game (DFG).

Independent of the release requirements under the water rights permits for the Cachuma Project; Reclamation modified its operations to allow for additional releases for purposes of protecting and enhancing habitat for the steelhead present in the river below Bradbury Dam. On August 18, 1997, the U.S. National Marine Fisheries Service (NMFS) listed the Southern California Steelhead Evolutionarily Significant Unit (ESU or Southern ESU) as an endangered species under the federal Endangered Species Act (ESA). In 2000, Reclamation completed an endangered species consultation with NMFS under Section 7 of the ESA regarding the effects of the Cachuma Project on the steelhead. NMFS issued a Biological Opinion in September 2000, which contains mandatory terms and conditions that Reclamation must observe to protect the species, including new water releases from the dam.

The operating plan that Reclamation proposed as part of the Section 7 consultation, and the plan that NMFS evaluated in the Biological Opinion, included the surcharging of Cachuma Lake to provide additional water for fish releases. *Surcharging* is a term used to describe the overflow amount left after a reservoir has been filled to capacity. Through manipulating spillways and other means of controlling dam overflow, surcharge levels can be raised or lowered depending on factors like reservoir capacity and water demand. For this project, the surcharge is used to describe the operations at Bradbury Dam in which the water level of Lake Cachuma is allowed to rise above the elevation of the top of the spillway gates (750.0 feet) in order to store more water. Flashboards have been installed on the spillway to allow surcharging up to 753.0 feet. Once the amount of water is surcharged above the 750.0-foot level, that amount of water can be carried to a lower level when the reservoir is drawn down. The Biological Opinion assumed that Reclamation would complete the ~~spill~~spillway gate modifications to allow surcharging at 1.8 feet during calendar year 2002, and 3.0 feet during calendar year 2005. These changes have been made.

The Biological Opinion requires Reclamation to implement a number of flow-related measures. These measures include meeting interim and long-term target flows in order to improve steelhead-rearing habitat. Until a 3.0-foot surcharge is implemented, Reclamation must meet the interim target flows. Reclamation initiated the interim target flows in September 2000, and initiated long-term flows with a 2.47-foot surcharge in May 2005. Upon implementation of either a 1.8-foot or a 3.0-foot surcharge, the Biological Opinion also requires releases to facilitate fish passage. In addition to releases for fish rearing and passage, the Biological Opinion requires Reclamation to implement several other flow-related measures and a number of physical habitat improvements, including the removal of a number of fish passage barriers on tributaries to the Santa Ynez River below Bradbury Dam.

The SWRCB developed a Draft EIR for the project, which was circulated in August 2003. The Draft EIR analyzed the following alternatives, all of which incorporate the requirements of the Biological Opinion:

1. Operations under the Original WR Order 89-18.
2. Baseline Operations under Orders WR 89-18, WR 94-5 and the Biological Opinion (interim release requirements only) – environmental baseline conditions.

3A. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with current 0.75-foot surcharge.

3B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with a 1.8-foot surcharge.

3C. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge.

4A. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and provision of State Water Project (SWP) water directly to the City of Lompoc in exchange for water available for groundwater recharge in the Below Narrow Account established by Order WR 73-37, as amended by Order WR 89-18.

4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and the discharge of SWP water to the river near Lompoc in exchange for water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.

The 2003 Draft EIR compared Alternative 2 (then-existing conditions) to Alternative 1 (historic conditions) in order to evaluate the changes that had taken place since Reclamation began to implement interim target flows pursuant to the Biological Opinion. Alternative 1, however, did not represent existing or baseline conditions; therefore, the discussion of Alternative 1 was not been incorporated into the Revised Draft EIR. In addition, since August 2003, Reclamation has constructed the ~~spill~~spillway gates modifications, allowing a surcharge of 1.8 and then 3.0 feet to be implemented. Accordingly, Alternative 3A, which was based on the assumption that Reclamation would be allowing a 0.75-foot surcharge, has been made irrelevant. Finally, the SWRCB no longer considers Alternative 4A, to be feasible because Alternative 4A required the cooperation of the City of Lompoc, and the City opposed the alternative. The remaining Alternatives 3B, 3C, and 4B were comprehensively evaluated in the August 2003 Draft EIR, but were also analyzed in the July 2007 Revised Draft EIR to provide the reviewer with an adequate comparison of all project alternatives still being considered by the SWRCB.

1.5.2 Project Alternatives to Be Considered in the Revised Draft EIR

As stated earlier, CalTrout submitted comments on the August 2003 Draft EIR. Among other things, CalTrout stated that the SWRCB should analyze an alternative based on Alternative 3A2 from the 1995 Cachuma Project Contract Renewal EIR/EIS (Reclamation and CPA, 1995). In general, Alternative 3A2 would require Reclamation to release more water from Bradbury Dam to protect fishery resources than Reclamation would be required to release pursuant to the Biological Opinion. The SWRCB evaluated CalTrout's comments and determined that new alternatives should be developed and analyzed in a Revised Draft EIR to be recirculated to allow the public and agencies a meaningful opportunity to comment on these new alternatives. The Revised Draft EIR analyzes the environmental impacts of these new operational alternatives designed to protect public trust resources.

The SWRCB formulated two new alternatives since the circulation of the August 2003 Draft EIR: Alternatives 5B and 5C. These alternatives were based on Alternative 3A2 from the 1995 Cachuma Project Contract Renewal EIR/EIS. Under Alternatives 5B and 5C, the Cachuma Project would be operated pursuant to the proposed CalTrout Alternative 3A2 during wet and above-normal water years, and pursuant to the operations dictated by the Biological Opinion during below-normal, dry, and critical water years. Alternatives 5B and 5C would provide higher flows for fishery resources than Alternatives 3B, 3C, and 4B during wet and above-normal years when more water is available. By switching to the long-term flow requirements in the Biological Opinion during below-normal, dry, and critical years, Alternatives 5B and 5C would have less of an impact on the water supply available to the Member Units from the Cachuma Project than Alternative 3A2.

Under Alternatives 5B and 5C, flow requirements to protect fishery resources would be the same, but the two alternatives assume that Reclamation would implement different surcharge levels at Cachuma Lake. Like Alternative 3B, Alternative 5B assumes a 1.8-foot surcharge. Like Alternative 3C, Alternative 5C assumes a 3.0-foot surcharge. Thus, the following six alternatives, representing baseline conditions, yet-unconsidered modified CalTrout alternatives, and previously considered alternatives included for comparison, were analyzed as part of the Revised Draft EIR:

2. Baseline Operations under Orders WR 89-18 and 94-5 and the Biological Opinion (interim release requirements only) – environmental baseline conditions.

3B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with a 1.8-foot surcharge.

3C. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge.

4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and the discharge of SWP water to the river near Lompoc in exchange for water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.

5B. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry and critical water year types, assuming Reclamation achieves a 1.8-foot surcharge.

5C. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry, and critical water year types, assuming Reclamation achieves a 3.0-foot surcharge.

On July 31, 2007, the SWRCB released the Revised Draft EIR for a 60-day public review July 31 to September 28, 2007. The SWRCB received comments on the July 2007 Revised Draft EIR from the following parties:

- Cachuma Conservation Release Board
- U.S. Bureau of Reclamation
- Santa Ynez River Water Conservation District
- Santa Ynez River Water Conservation District, Improvement District No. 1
- Carpinteria Valley Water District
- City of Lompoc
- City of Solvang
- County of Santa Barbara
- Montecito Water District
- Environmental Defense Center – CalTrout
- California Department of Fish and Game
- National Marine Fisheries Service
- Pacific Institute
- Peter B. Movle

- Endangered Habitat League
- Nancy Crawford-Hall and San Lucas Ranch
- John Williams
- Edwin T. Zapel
- Native American Heritage Commission
- Alisal Properties

1.6 REGULATORY FRAMEWORK

In California, water use and supplies are controlled and managed under an intricate system of common law principles, constitutional provisions, state and federal statutes, court decisions, and contracts or agreements. All of these components constitute the institutional framework for the protection of public interests and their balance with private claims in California's water allocation and management.

1.6.1 Constitutional, Statutory and Common Law Framework for Water Uses

The people of California own all the water in the state. Water rights provide the right to reasonable and beneficial use of the water, not ownership of the water. Public interests are thus involved at every level of water management in California.

Principle of Reasonable and Beneficial Use. California's Constitution (Article X, Section 2) requires that all uses of the state's water be both reasonable and beneficial. It places a significant limitation on water rights by prohibiting the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water. However, the interpretation of what is wasteful can vary significantly depending on the circumstances and may depend on opinions of the SWRCB or, ultimately, the courts.

Public Trust Doctrine Values and Trustees. Rights to use water are subject to state government's obligation under the Public Trust Doctrine as trustee of certain resources for Californians. The Public Trust Doctrine is a legal doctrine that imposes responsibilities on state agencies to protect trust resources associated with California's waterways, such as navigation, fisheries, recreation, ecological preservation, and related beneficial uses. In *National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419, the California Supreme Court concluded that the public trust is an affirmation of the duty of the state to protect the people's common heritage of streams, lakes, marshlands, and tidelands—surrendering such protection only in rare cases when the abandonment of that right is consistent with the purposes of the trust. Thus, California agencies have fiduciary obligations to the public when they make decisions affecting trust assets.

In *National Audubon*, the court addressed the relationship between the Public Trust Doctrine and California's water rights system, and integrated them. The court reached three major conclusions:

1. The state retains continuing supervisory control over its navigable waters and the lands beneath them. This prevents any party from acquiring a vested right to appropriate water in a manner harmful to the uses protected by the public trust. The State Water Resources Control Board may reconsider past water allocation decisions in light of current knowledge and current needs.

2. As a practical matter, it will be necessary for the state to grant usufructuary licenses to allow appropriation of water for uses outside the stream, even though this taking may unavoidably harm the trust uses of the source stream.

3. The state has an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible.

Thus, while the state may, as a matter of practical necessity, have to approve appropriations that will cause harm to trust uses, it "must at all times bear in mind its duty as trustee to consider the effect of such taking on the public trust, (cite omitted) and to preserve, so far as consistent with the public interest, the uses protected by the trust."

Surface Water Rights. California's system for surface water rights recognizes both riparian rights and appropriative rights.

- **Riparian.** A riparian right is the right to divert, but not seasonally store, a portion of the natural flow for use based on the ownership of property adjacent to a natural watercourse. Water claimed through a riparian right must be used on the riparian parcel. Such a right is generally attached to the riparian parcel of land except where a riparian right has been preserved for non-contiguous parcels when land is subdivided. Generally, riparian rights are not lost through non-use. All riparian water users have the same priority; senior and junior riparian water rights do not exist. During times of water shortage, all riparian water users must adjust their water use to allow equal sharing of the available water supply.

- **Appropriative.** Under the prior appropriation doctrine, a person may acquire a right to divert, store, and use water regardless of whether the land on which it is used is adjacent to a stream or within its watershed. The rule of priority between appropriators is "first in time is first in right." A senior appropriative water rights holder may not change an established use of the water to the detriment of a junior, including a junior's reliance on a senior's return flow. Since 1914, obtaining a permit from the SWRCB has been the exclusive means of acquiring an appropriative water right, with priority based on the date an application is filed. The SWRCB may include terms and conditions in a permit designed to ensure that the water sought to be appropriated will be developed, conserved, and used in the public interest, taking into consideration the relative benefit to be derived from all beneficial uses of the water concerned, including the preservation and enhancement of fish and wildlife. (Wat. Code, Sections 1253, 1257, 1257.5, 1258.) Permit and license provisions do not apply to pre-1914 appropriative rights (those initiated before the Water Commission Act took effect in 1914), but pre-1914 rights are still subject to the public trust doctrine and the prohibition against unreasonable use. Appropriative rights may be sold or transferred.

Groundwater Use and Management. The use of groundwater is governed by a water right system that is similar to the system that governs surface water use. Overlying rights, analogous to riparian rights, authorize landowners to extract groundwater for use on overlying land within the basin or watershed, as long as that groundwater is put to a reasonable and beneficial use. Appropriative rights may be acquired by applying water to beneficial use on non-overlying land. The SWRCB's permitting authority extends to subterranean streams flowing through known and definite channels, but does not extend to percolating groundwater.

Water Transfers. Every year, hundreds of water transfers take place between water users within water districts. These districts have their own rules for the initial allocation of water to their users. Water transfers between water districts within the same water basin are becoming more common. Local rules allow districts to transfer water through groundwater banking agreements or other joint water development projects. In many cases, local rules provide members the right of first refusal to obtain the water before the water is transferred to outside parties. If the transfer of water under a water right permit or license entails a change in point of diversion, place of use, or purpose of use, SWRCB approval is required.

1.6.2 Environmental Laws for Protecting Resources

Several laws outline the state and federal obligations to protect and restore fish and wildlife. These include:

- **Federal Endangered Species Act.** Under the federal ESA, an endangered species is one that is in danger of extinction in all or a significant part of its range, and a threatened species is one that is likely to become endangered in the near future. The ESA is designed to preserve endangered and threatened species by protecting individuals of the species and their habitat and by implementing measures that promote their recovery. The ESA sets forth a procedure for listing species as threatened or endangered. Final listing decisions are made by USFWS or NMFS. Under section 7 of the ESA (16 U.S.C. § 1536), federal agencies must consult with USFWS or NMFS, as appropriate, to ensure that federal agency actions will not jeopardize the continued existence of any threatened or endangered species, or destroy or adversely modify critical habitat. After consultation, USFWS or NMFS issues a biological opinion, which includes USFWS's or NMFS's opinion on whether the federal agency action in question is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. A "jeopardy" opinion must include reasonable and prudent alternatives, if any, necessary to minimize the incidental take of listed species.

- **California Endangered Species Act.** The California ESA is similar to the federal ESA. Listing decisions are made by the California Fish and Game Commission. All state lead agencies are required to consult with the Department of Fish and Game about projects that impact state listed species.

- **Local General Plans and Specific Plans.** Local (city and county) general plans and specific plans provide methods to manage and protect fish and wildlife. The Conservation element of a plan provides direction and objectives for the conservation, development and use of natural resources. The Open-Space element of a plan guides the comprehensive, long-range preservation and conservation of open space lands including water bodies.

- **Releases of Water for Fish.** Fish and Game Code Section 5937 provides protection to fisheries by requiring that the owner of any dam allow sufficient water at all times to pass through the dam to keep in good condition any fisheries that may be planted or exist below the dam.

2.0 OVERVIEW OF THE CACHUMA PROJECT

2.1 CACHUMA PROJECT FACILITIES

2.1.1 Bradbury Dam and Cachuma Lake

Bradbury Dam is located on the Santa Ynez River approximately 25 miles northwest of Santa Barbara (**Figure 1-1, Santa Ynez River Watershed**). It is an earth-filled structure with a structural height of 279 feet and a hydraulic height of 190 feet. The crest of the dam is at elevation 766 feet. The spillway crest is at elevation 720 feet. Four 30-foot by 50-foot radial gates, with a concrete lined chute and stilling basin, control the spillway. The gate opening is 30 vertical feet. When closed, the top of the gates is at elevation 753 feet with a flashboard for a 3.0-foot surcharge. Surcharge is a term used to describe the amount of water stored above the elevation 750 feet in the reservoir. When the gates are raised, water passes under them in a controlled manner, depending upon the height of the gate. There is an outlet at the base of the dam with a capacity of 2~~1~~50 cfs.

Cachuma Lake has a surface area of 3,043 acres at elevation 750.0 feet (**Figure 2-2**). Siltation has reduced the original 204,874 acre-foot capacity of Cachuma Lake. In 1989, Reclamation estimated capacity to be 190,409 acre-feet (af). A bathymetric survey conducted in 2008~~0~~ indicated that the reservoir capacity has been further reduced to ~~188,030~~186,636 af at elevation 750.0 feet (MNS, 2008~~0~~). The minimum operating pool for Cachuma Lake can be as low as 12,000 af, but pumps are required for diversions to Tecolote Tunnel when lake storage is about 30,000 af.

2.1.2 Conveyance and Local Storage Facilities

Water from Cachuma Lake is conveyed to the South Coast Member Units through the Tecolote Tunnel intake tower (**Figure 1-2, Cachuma Project Facilities and Member Units**). The lowest portal on the intake tower is at elevation 650 feet. Tecolote Tunnel extends 6.4 miles through the Santa Ynez Mountains from Cachuma Lake to the headworks of the South Coast Conduit. The tunnel has a diameter of 7 feet and a capacity of 100 cfs.

The South Coast Conduit is a high-pressure concrete pipeline that extends from the Tecolote Tunnel outlet to the Carpinteria area, a distance of over 24 miles, and includes four regulating reservoirs described below. This pipeline distributes raw water to GWD, the City of Santa Barbara, MWD, and CVWD.

There are four regulating reservoirs along the South Coast Conduit: (1) Glen Annie Dam Reservoir (500 af), located on the West Fork of Glen Annie Canyon Creek below the outlet of Tecolote Tunnel in the

GWD; (2) Lauro Reservoir (640 af), located on Diablo Creek outside the City of Santa Barbara; (3) Ortega Reservoir (60 af), located within the MWD; and (4) Carpinteria Reservoir (40 af), located within the CVWD.

Water was originally delivered to SYRWCD, ID #1 through the Bradbury Dam outlet works into the Solvang/Santa Ynez Conduit, a pipeline that terminated in Solvang. This pipeline has been converted to a delivery pipeline to convey SWP water from the Central Coast Water Authority's (CCWA) Santa Ynez Pump Station to Cachuma Lake. Water is now delivered to SYRWCD, ID #1 primarily through an exchange agreement with the other South Coast Member Units in which SYRWCD, ID #1 receives SWP water directly in exchange for its Cachuma entitlement in the reservoir. If necessary, SYRWCD, ID #1 also can receive water directly through the CCWA pipeline, which is connected to Bradbury Dam, in the event SWP water deliveries cannot be made.

2.1.3 Facility Operations and Maintenance

Reclamation operates Bradbury Dam, including the outlet works and spillway gates, and COMB operates and maintains the other project facilities. COMB is responsible for diversion of water to the South Coast through the Tecolote Tunnel, and operation and maintenance of flow control valves, meters and instrumentation at control stations and turnouts along the South Coast Conduit and at regulating reservoirs. COMB coordinates closely with staff of the Member Units to ensure that water supply meets daily demands. COMB staff read meters and account for Cachuma Project water deliveries on a monthly basis, and perform repairs and preventative maintenance on Cachuma Project facilities and equipment. COMB safeguards Cachuma Project lands and rights-of-way on the South Coast. COMB issues monthly Cachuma Project water production and use reports, operations reports, and financial and investment reports which track operation and maintenance expenditures.

2.1.4 Cachuma Lake Recreation Area

The Cachuma Lake Recreation Area (Recreation Area) encompasses approximately 9,250 acres, including Cachuma Lake and the surrounding rugged hillsides and oak woodland-covered shores (**Figure 2-2**). The Recreation Area is currently managed by the Santa Barbara County Parks Department (County Parks), which expired in 2003, and the County is on an extended agreement that expires in 2011.Reclamation will develop a new management contract with a local managing partner using the RMP for guidance on future land, resource, and recreation management.

Most of the recreational facilities at the lake are located in a 375-acre County Park on the south side of Cachuma Lake at the Tequepis Peninsula (County Park). Facilities include day-use facilities, large group camping facilities, campsites and temporary cabins, Live Oak Camp and Camp Whittier, a general store, a scenic overlook for Bradbury Dam, a marina and launch ramp, bait and tackle shop, amphitheater, trailer storage yard, recreational vehicle (RV) campsites, Nature Center, County Park Ranger Station, family center, swimming pools, snack shop, and maintenance and infrastructure facilities. The north side of Cachuma Lake consists of open space that is leased for grazing and permitted equestrian use. It is not open for general public access.

Cachuma Lake is known for its natural, scenic qualities. It is also one of Southern California's favorite bass and trout fishing lakes. The California Department of Health Services allows no body contact sports such as swimming or water skiing due to water quality restrictions.

2.2 PROJECT OPERATION

2.2.1 Use of Project Water

Under the Reclamation Act of 1939, and Permits 11308 and 11310, water appropriated using Cachuma Project facilities may be used for municipal, industrial, domestic, irrigation, salinity control, and incidental recreation purposes. Reclamation completed construction of Bradbury Dam in 1956 and Cachuma Lake first filled and spilled in 1958. Initial water deliveries occurred in 1955, drawing from the Tecolote Tunnel infiltration only. The Cachuma Project provides about 65 percent of the total water supplies for the Member Units who provide water to an estimated 207,000 people along the South Coast and in the Santa Ynez Valley (within SYRWCD, ID #1 service area). Approximately 38,000 acres of croplands are irrigated by water from the Cachuma Project. Approximately 30 percent of total deliveries are used for purposes of irrigation, and 70 percent are used for municipal and industrial purposes.

2.2.2 Project Yield and Deliveries

The initial planning studies that supported the original Cachuma Project contract indicated that the project could deliver a safe yield of 32,000 afy. Safe yield is usually defined as the amount of water a project can be expected to deliver over a sustained hydrologic period – a period that preferably is long enough to contain wet periods as well as droughts. Since the 1950s, the original estimate of safe yield has been reduced several times based on: (1) use of a longer hydrologic period that incorporates a key drought period, 1946-51; and (2) loss of reservoir storage due to ongoing sedimentation.

The most recent estimate of the Project's operational yield, 25,908 afy, was developed for the Contract Renewal EIR/EIS (Reclamation and CPA, 1995). Operational yield is usually defined as that amount of water supply that can be delivered in all years with acceptable shortages or deficiency levels in critically dry years.

Under the original Cachuma Project water supply Master Contract between Reclamation and the Member Units, the Member Units were entitled to 32,000 afy, based on the initial estimate of the Project's safe yield (see above). However, with the exception of deliveries in 1976, the Member Units have requested annual deliveries that are lower than the original entitlement in order to avoid shortages in dry years.

Under the current Master Contract, Reclamation delivers an annual amount to the Member Units that does not exceed the "Available Supply." The latter represents the maximum amount of project water that is available after Reclamation has met all requirements for water for other purposes under current and future state and federal laws, permits, orders, and requirements. Hence, Available Supply does not include water released pursuant to SWRCB Orders WR 89-18 and WR 94-5 for downstream groundwater replenishment, or water released to meet the requirements of the Biological Opinion of NMFS for the endangered southern steelhead.

The Project's estimated operational yield, 25,908 afy was based on hydrologic model simulations using the SBCWA's Santa Ynez River Hydrologic Model (SYRHM). The hydrologic period of analysis for the model simulations included the water years 1918 through 1992. Key assumptions in the modeling included a Cachuma Lake capacity of 190,409 af, a minimum pool of 12,000 af, and a maximum allowable shortage of 20 percent in any single year with shortages beginning when the lake storage reaches 100,000 af. The Member Units consider the 20 percent deficiency criterion to be an acceptable level of shortage. A higher operational yield for Cachuma Lake can be attained, but it would increase the risk of a shortage greater than 20 percent in any single year.

However, an operational yield of 25,714 afy has been maintained by Member Units based on the new estimate of reservoir capacity completed in 2000 (MNS, 2000); since 1993, this is the maximum Cachuma Project ~~delivery~~allocation. In essence, this delivery limit constitutes an estimate of operational yield developed by the Member Units.

Cachuma Project annual deliveries to the Member Units for the years 2002-2008 are summarized in **Table 2-1**, Cachuma Project Entitlements, Percent of Total Member Unit Water Supply, and Recent Cachuma Project Usage by Member Units. The City of Santa Barbara and GWD receive the largest quantity of water from the project. The importance of the Cachuma Project for each Member Unit is shown in **Table 2-1**, which shows the percentage of the Member Unit's total supply provided by the Cachuma Project. This percentage varies from 35 percent for MWD to 53 percent for the GWD.

Historical annual water deliveries from the Cachuma Project since its construction are shown on **Table 2-2** and **Chart 2-1, Historical Cachuma Project Deliveries (Lake and Tunnel** (**Appendix B**). Deliveries range from about 8,850 af in the fourth year of operation, to over 35,980 af in 1972. The amount of water delivered to the Member Units varies from year to year, depending on winter runoff. For example, in the 1990 drought, the Project Water deliveries from the Cachuma Project were reduced to 19,337 af. In 1993, the water deliveries from the project were about 26,597 af because the reservoir filled in the winter. Peak monthly deliveries occur in July and August. Historical deliveries to the individual Member Units is shown on **Chart 2-2, Historical Annual Usage of Cachuma Project Water by Member Units** (**Appendix B**).

Cachuma Project deliveries include infiltration into Tecolote Tunnel. Infiltration varies with precipitation, and, prior to the recent drought, was determined to average about 3,000 afy (**Table 2-2, Cachuma Project: Historical Operations Data**). Reclamation and the Member Units reevaluated the average infiltration rate since the 1988-91 drought, and lowered the estimate to about 2,000 afy.

2.2.3 The Above Narrows Account and the Below Narrows Account

The groundwater basins downstream of Bradbury Dam have been divided into the Above Narrows Alluvial Groundwater Basin, and the Below Narrows Groundwater Basin. The former extends along the Santa Ynez River from Bradbury Dam to the Narrows, located east of Lompoc Valley (**Figure 1-3, Lower Santa Ynez River Below Bradbury Dam**). It consists of coarse-grained unconsolidated sand and gravel river channel and younger alluvium deposits, with a length of 35 miles and a variable width of 0.2 to 1.5 miles. The depth ranges from 150 feet at the Narrows to about 50 feet near the dam. It is underlain with non-water bearing shales. The Above Narrows Alluvial Groundwater Basin is divided into three subareas based on geographic characteristics: Santa Ynez Subarea (Bradbury Dam to Alisal Road in Solvang, 11 river miles); Buellton Subarea (Alisal Road to 3 miles west of Buellton, 7.4 river miles), and Santa Rita Subarea (west of Buellton to the Narrows).

The Below Narrows Basin consists of the Lompoc Plain Groundwater Basin underlying the center of the Lompoc Valley. Flows in the river percolate through channel alluvium into the underlying basin. Most of the percolation occurs in the Lompoc Plain Forebay, which consists of the eastern 4 miles of the river beginning at the Robinson Road Bridge.

Table 2-1
Cachuma Project Entitlements, Percent of Total Member Unit Water Supply, and Recent Cachuma Project Usage by Member Units

Member Unit	Percentage of Project Yield (%)	Annual Deliveries Based on Operational Yield of 25,714 afy	Percent of Total Member Unit Water Supply from Cachuma[1]	Cachuma Project Usage (afy) During Water Year [2]						
				2002	2003	2004	2005	2006[5]	2007[5]	2008[5]
Carpinteria Water District [3]	10.94	2,813	38	3,511	2,632	2,788	2,939	2,755	2,872	2,699
Montecito Water District [3]	10.31	2,651	35	2,646	1,721	2,820	2,298	3,456	2,425	346
City of Santa Barbara [3]	32.19	8,277	45	7,525	5,918	7,119	8,229	5,848	10,584	6,882
Goleta Water District [3]	36.25	9,321	53	10,118	8,545	11,308	10,404	11,706	11,393	10,464
SYRWCD, ID #1 [4,6]	10.31	2,652	44	2,102	3,189	2,472	2,382	2,947	2,447	1,873
Total	100.00	25,714	NA	25,902	22,005	26,507	26,252	26,712	29,721	22,264

1 *Based on the Member Units' testimony at the SWRCB hearings in October 2003.*
2 *Based on data received from COMB, January 04, 2007.*
3 *Includes SWP water exchanged with SYRWCD, ID #1.*
4 *Includes diversion to Cachuma Park and SYRWCD, ID #1 exchange.*
5 *Taken from Summary of Water Use Report, COMB, Water Years ending 9/30: 2006, 2007, 2008.*
6 *ID No. 1 is receiving its Cachuma Project entitlement through an exchange with South Coast Project Member Units.*

Table 2-2
Cachuma Project: Historical Operations Data (af)

	Inflow						Releases										
Water Year	Computed	% of Average	End of WY Storage	Gross Evaporation	Precip. on Lake	SWP Inflow	Direct Diversion	Tecolote Tunnel	SYRWCD ID#1	Downstream	Fish	Spills	Total	Tunnel Infiltration	Member Unit Deliveries	Project Water Deliveries	Water Rights Releases
1953	17,942	20%	9,188	1,319	106	0	0	0	0	7,541	0	0	7,541	0	0	0	7,541
1954	18,955	26%	21,779	2,327	598	0	0	0	0	4,636	0	0	4,635	0	0	0	4,635
1955	4,941	7%	19,584	2,540	936	0	0	0	0	3,922	0	0	3,922	9,621	9,621	9,621	3,922
1956	24,330	33%	36,629	4,200	1,482	0	0	2,118	0	2,449	0	0	4,567	6,734	8,852	8,852	2,449
1957	6,150	8%	30,154	4,642	1,162	0	0	5,470	0	3,674	0	0	9,144	5,388	10,858	10,858	3,674
1958	219,129	296%	196,889	11,210	4,459	0	0	4,850	0	5,050	0	35,748	45,648	5,005	9,855	9,855	5,050
1959	15,068	20%	187,178	14,624	3,629	0	0	8,432	0	2,296	0	3,056	13,784	4,732	13,164	13,164	4,284
1960	2,643	4%	163,149	13,613	2,669	0	169	11,410	300	3,849	0	0	15,728	3,626	15,505	15,505	4,149
1961	795	1%	134,493	12,015	2,382	0	662	17,309	239	1,608	0	0	19,818	4,242	22,452	22,452	1,608
1962	100,134	135%	190,475	12,446	4,963	0	402	11,921	890	1,633	0	21,822	36,668	3,739	16,952	16,952	1,633
1963	4,270	6%	171,736	12,157	3,788	0	510	10,595	694	2,843	0	0	14,642	3,259	15,058	15,058	2,843
1964	2,439	3%	141,506	11,786	2,378	0	447	17,352	1,504	3,958	0	0	23,261	3,357	22,660	22,660	3,958
1965	12,314	17%	122,308	10,204	3,043	0	182	14,909	1,837	7,423	0	0	24,351	3,271	20,199	20,199	7,423
1966	79,292	107%	168,926	12,524	3,707	0	345	17,522	2,129	3,862	0	0	23,858	3,137	23,133	23,133	3,862
1967	208,961	282%	191,622	12,683	5,774	0	246	14,155	2,575	8,557	0	153,823	179,356	3,219	20,195	20,195	8,557
1968	10,404	14%	160,871	13,524	2,414	0	357	18,199	3,669	7,820	0	0	30,045	3,222	25,447	25,447	7,820
1969	525,370	709%	190,181	12,305	9,727	0	240	15,031	2,597	3,199	0	472,411	493,478	3,582	21,450	21,450	3,199
1970	28,740	39%	176,407	13,525	1,793	0	335	21,448	4,115	4,888	0	0	30,786	3,065	28,963	28,963	4,888
1971	31,045	42%	161,345	12,308	3,497	0	357	22,800	3,115	11,028	0	0	37,300	3,335	29,607	29,607	11,028
1972	8,754	12%	121,314	11,452	2,231	0	167	28,158	4,469	6,769	0	0	39,563	3,185	35,979	35,979	6,769
1973	125,804	170%	185,591	12,056	5,948	0	129	18,456	3,552	3,982	0	29,300	55,419	2,842	24,979	24,979	3,982
1974	33,670	45%	182,039	12,677	4,112	0	138	17,805	3,469	1,590	0	5,655	28,657	2,878	24,290	24,290	1,009
1975	50,544	68%	184,467	11,866	5,867	0	128	20,854	3,057	1,275	0	16,804	42,118	3,072	27,111	27,111	576
1976	5,310	7%	145,187	11,804	3,189	0	148	26,020	4,655	5,152	0	0	35,975	2,750	33,573	33,573	4,643
1977	1,520	2%	112,077	10,775	2,601	0	98	18,740	4,583	3,035	0	0	26,456	2,191	25,612	25,612	2,795
1978	329,219	444%	193,424	13,535	9,573	0	114	20,701	3,011	790	0	219,295	243,911	3,161	26,987	26,987	56
1979	61,692	83%	183,949	13,917	5,250	0	147	20,102	4,029	1,837	0	36,385	62,500	4,295	28,573	28,573	895
1980	153,543	207%	187,382	13,353	6,003	0	139	22,057	2,483	1,166	0	116,915	142,760	3,346	28,025	28,025	311
1981	22,066	30%	168,871	13,811	4,019	0	178	20,856	5,007	4,743	0	0	30,784	3,157	29,198	29,198	4,175
1982	26,848	36%	159,528	11,479	3,868	0	187	20,956	2,963	4,474	0	0	28,580	2,964	27,070	27,070	3,963
1983	428,601	578%	196,347	12,630	10,995	0	183	22,616	1,532	4,142	0	361,675	390,148	3,061	27,392	27,392	3,447
1984	39,074	53%	171,599	14,534	3,354	0	193	25,601	5,054	4,577	0	17,217	52,642	3,360	34,208	34,208	3,162
1985	5,057	7%	135,748	12,275	2,816	0	142	22,781	2,664	5,862	0	0	31,449	2,894	28,481	28,481	5,392
1986	76,571	103%	171,873	12,782	4,831	0	108	21,690	2,686	8,010	0	0	32,494	2,287	26,771	26,771	7,391
1987	2,374	3%	128,352	12,147	1,996	0	150	27,209	3,812	4,573	0	0	35,744	1,848	33,019	33,019	3,887
1988	8,732	12%	99,150	10,293	4,092	0	102	23,917	2,803	4,911	0	0	31,733	1,794	28,616	28,616	4,856

Water Year	Inflow: Computed	Inflow: % of Average	End of WY Storage	Gross Evaporation	Precip. on Lake	SWP Inflow	Releases: Direct Diversion	Releases: Tecolote Tunnel	Releases: SYRWCD ID#1	Releases: Downstream	Releases: Fish	Releases: Spills	Releases: Total	Tunnel Infiltration	Member Unit Deliveries	Project Water Deliveries	Water Rights Releases
1989	4,044	5%	66,098	8,366	1,459	0	86	20,632	2,802	6,670	0	0	30,190	1,878	25,398	25,398	6,670
1990	2,627	4%	34,188	6,019	909	0	66	16,384	863	4,792	0	0	22,105	2,031	19,344	19,344	4,792
1991	53,566	72%	60,995	6,373	2,057	0	43	15,762	1,656	4,983	0	0	22,444	1,876	19,337	19,337	4,983
1992	135,828	183%	157,066	11,239	4,022	0	52	18,170	891	13,427	0	0	32,540	1,899	21,012	21,012	13,099
1993	333,387	450%	177,479	13,428	8,875	0	79	22,582	2,042	1,591	1,429	280,698	308,421	1,894	26,597	26,597	1,518
1994	16,729	23%	151,046	12,561	4,144	0	73	22,821	1,819	9,537	494	0	34,744	1,937	26,650	26,650	9,192
1995	365,092	493%	134,855	10,321	10,063	0	64	23,887	109	1,823	740	354,402	381,025	2,028	26,088	26,088	1,547
1996	33,243	45%	120,503	11,627	2,653	0	76	24,721	2,109	9,703	2,012	0	38,621	2,040	28,946	28,946	9,313
1997	56,552	76%	124,771	11,861	2,911	148	83	26,785	1,785	13,205	1,623	0	43,481	2,034	30,687	30,539	12,791
1998	475,175	641%	185,500	11,350	12,071	1,354	60	24,473	0	3,956	1,976	386,055	416,520	2,057	26,590	25,236	1,684
1999	21,562	29%	168,772	12,341	4,077	323	70	26,397	0	883	2,999	0	30,349	2,091	28,558	28,235	0
2000	51,895	70%	170,840	12,435	4,972	2,156	79	30,365	0	5,972	2,037	6,067	44,520	2,413	32,857	30,701	4,423
2001	152,773	206%	173,479	11,995	7,712	818	78	26,089	0	3,502	2,157	112,313	144,139	2,404	28,571	27,753	1,795
2002	5,508	7%	129,370	11,004	2,040	4,627	90	30,976	0	11,961	2,253	0	45,280	2,405	33,471	28,844	11,466
2003	18,822	25%	115,449	9,402	3,707	6,816	99	28,781	0	2,292	2,691	0	33,863	1,714	30,594	23,778	2,000
2004	5,750	8%	71,378	8,829	1,782	5,924	83	32,269	0	14,217	2,134	0	48,703	2,229	34,580	28,656	14,193
2005	401,752	542%	179,994	11,763	8,365	3,137	62	26,796	0	2,894	3,045	260,078	292,875	2,600	29,458	26,321	1,813
2006	100,~~496~~595	136%	180,203	12,354	6,075	1,014	66	24,119	0	0	~~8,079~~7,057	63,84~~9~~62,828	95,092	2,196	26,281	25,367	
2007	~~4,264~~4,357	6%	132,392	11,940	1,716	5,204	83	32,797	0	9,327	~~4,930~~4,931	0	47,137	1,958	34,838	29,634	9,327
2008	~~109,471~~109,551	148%	173,280	13,448	4,712	4,701	79	32,591	0	2,274	~~6,668~~6,689	~~23,014~~22,994	64,626	2,291	34,961	30,260	2,274
2009	~~12,025~~13,216	16%	142,479	12,220	3,114	2,602	82	27,634	0	0	8,688	0	36,404	1,794	29,510	26,908	
Maximum	525,400	709%	196,889	14,624	12,071	6,816	662	32,797	5,054	23,794	8,688	468,150	493,480	9,621	35,979	35,979	23,794
Minimum	1,910	3%	9,188	1,319	108	323	43	2,117	109	883	494	1,405	3,921	1,714	8,851	8,851	56
Average	89,251	120%	141,254	11,086	4,135	3,223	165	20,928	2,571	5,756	3,187	139,979	79,761	3,007	25,481	24,778	5,369

Source: Bureau of Reclamation, Cachuma project, Historical Operation Data, Table 4. August 2010.

Notes:

1. *The percent of average is based on the historical average annual runoff of 74,100 af estimated for the Santa Ynez River at the gauging station near the town of Santa Ynez. This average is based on 22 years of record during the period October 1929 through September 1952, excluding the ~~no record~~no record for water year 1932.*
2. *Computed inflow is the algebraic sum of the change in storage, releases, spills, and evaporation minus precipitation on the reservoir surface and SWP inflow.*
3. *In water year 1971, the inflow included approximately 5,700 af, which reached Cachuma Lake after being released from storage in Gibraltar Reservoir. The remaining inflow (25,300 af) was about 34 percent of the historical average.*
4. *In water years 1971 and 1972, 5,580 af and 1,358 af, respectively, were released through the Tecolote Tunnel for delivery to the City of Santa Barbara, which had been temporarily stored in Lake Cachuma.*
5. *Releases indicated include leakage from around spillway gates and through river outlet works valves.*
6. *In water year 1995, the water spilled down the river was due to large winter storms and a reservoir restriction, which resulted from a safety of dams concern.*
7. *The Member Unit Deliveries is the algebraic sum of the releases to the SYRWCD, ID #1, Direct Diversion, and the Tecolote Tunnel plus infiltration into the tunnel.*
8. *Based on the new capacity table prepared in August 1955, the storage was reduced by 1,610 af on August 1, 1955. In March 1989, a sediment survey was completed resulting in capacity reduction of 14,465 af at 750 feet elevation. A revised capacity table went into effect on June 1, 1990, reducing the storage by 7,322 af. N~~A new~~ capacity tables went into effect on July 1, 2001, which resulted in reducing the storage by 2,379 af and December 1, 2008, which indicates a reduction in storage of 1,110 af.~~.~~*
9. *Data for water years 1958–2001 were taken directly from the Annual Progress Reports submitted to the SWRCB. Data for water years 1953–1957 were taken from Daily Operations Reports.*
10. *Releases to Tecolote Tunnel in water years 1998–2002 include SWP water conveyed through the reservoir and tunnel.*
11. *Project Water Deliveries equals the Member Unit Deliveries minus the SWP water conveyed through the reservoir and tunnel.*
12. *For water years 1953–1966, Water Rights Releases were reported as "water released for downstream rights" in the Annual Progress Reports, not including outlet spill releases.*
13. *For water years 1967–1973, Water Rights Releases were reported as "downstream releases from Bradbury Dam outlets for live-stream purposes" in the Annual Progress Reports, not including outlet spill releases.*
14. *For water years 1974–2002, Water Rights Releases were taken directly from the monthly downstream users reports.*
15. *Note that from 1998 through 2009 (present), SYRWCD, ID #1 receives its Cachuma Project entitlement through an exchange with South Coast Project members.*
16. *Since 2006, leakage has not been estimated in the reservoir hydrologic budget.*

As provided in Order WR 73-37 and Order WR 89-18, the inflow to Cachuma Lake is credited to the Above Narrows Account (ANA) to the extent there is no visible flow (live stream) at designated locations in the river from Bradbury Dam to Floradale Avenue in the Lompoc Valley. Water credited to the ANA remains stored in Cachuma Lake until it is released at the request of SYRWCD or lost by spill. The SYRWCD may request releases from the ANA once dewatered storage in the Above Narrows Alluvial Groundwater Basin exceeds 10,000 af. The monthly balance in the ANA may not exceed the total dewatered storage within the Above Narrows Alluvial Groundwater Basin. The ANA is not subject to evaporative losses in the lake, but is deemed the first water spilled to the extent that the dewatered storage is reduced by such spills.

The Below Narrows Account (BNA) is based on the difference between the actual percolation below the Narrows and the estimated percolation that would have occurred if river flows were not impounded by Cachuma Lake. Reclamation calculates monthly "constructive" flows and percolation, and estimates the difference using two percolation curves adopted in Order WR 89-18. The two curves reflect different flow-percolation relationships based on groundwater levels in the Lompoc Plain. Reclamation has been using the upper curve until such time sufficient well data have been collected to determine which curve should be used to determine the differences in percolation with and without the Cachuma Project. In general, use of the upper curve provides a higher rate of credit accrual in the BNA. Pursuant to a December 17, 2002, settlement agreement, CCRB, SYRWCD, SYRWCD, ID #1, and the City of Lompoc have agreed that the upper curve should continue to be used for purposes of establishing BNA credits, but under certain conditions, a portion of the credits should be set aside for the Member Units' use during dry conditions.

Dewatered storage capacity in the groundwater basin allows for additional percolation of rainfall and tributary runoff below Bradbury Dam. Water releases to recharge downstream groundwater basins are made in average and dry years, based on the amount of dewatered storage in the Above Narrows Alluvial Groundwater Basin and the extent of percolation from tributary flows in the Below Narrows Basin. In very wet years, downstream basins are full and do not require recharge to satisfy downstream water rights. In dry years, releases are typically made in the summer and early fall to recharge the upper reaches of the Above Narrows Alluvial Groundwater Basin (Santa Ynez Subarea). In normal and some dry years, combined releases to satisfy the Above Narrows Alluvial Basin and the Below Narrows Basin are made in the summer and fall. Typically, these releases are made when the river is dry with an initial rate of ~~135 to~~about 150 cfs for a period of 10 to 15 days until the water reaches the Lompoc Basin Forebay. At that time, the releases are reduced ~~to 50 to 70 cfs~~ for several weeks to months, to rates such as 50 to 70 cfs, depending upon percolation rates.

Releases from Bradbury Dam from water year 1953 to 2009 are shown in **Table 2-2**. Annual releases from the ANA and the BNA are shown in **Table 2-3, Historical Releases from the ANA and BNA,** by calendar year and on **Chart 2-3, Historical Annual ANA and BNA WR 89-18 Releases** (**Appendix B**). Monthly releases under Order WR 89-18 are shown on **Chart 2-4, Historical Monthly WR 89-18 Water Rights and Fish Releases** (**Appendix B**). For the period from 1989 to 2009, the average annual release was 5,305 af. The average annual releases during the period from 1973 to 1988 were substantially less than the releases since 1989, particularly for the BNA.

Table 2-3
Historical Releases from the ANA and BNA

Calendar Year	ANA	Releases (afy) BNA	Total
Releases under Order WR 73-37			
1974	1,353	0	1,353
1975	1,134	0	1,134
1976	4,237	0	4,237
1977	2,299	0	2,299
1978	62	0	62
1979	1,200	0	1,200
1980	0	0	0
1981	4,175	0	4,175
1982	6,655	755	7,410
1983	0	0	0
1984	3,162	0	3,162
1985	5,686	0	5,686
1986	5,317	1,780	7,097
1987	3,887	0	3,887
1988	5,050	1,283	6,333
Releases under Order WR 89-19			
1989	5,192	0	5,192
1990	4,792	0	4,792
1991	7,745	3,638	11,383
1992	4,930	3,287	8,217
1993	0	0	0
1994	6,727	4,012	10,739
1995	0	0	0
1996	7,319	3,459	10,778
1997	9,572	3,438	13,010
1998	0	0	0
1999	0	0	0
2000	4,360	1,858	6,218
2001	0	0	0
2002	9,054	4,412	13,466
2003	0	0	0
2004	11,494	4,512	16,006
2005	0	0	0
2006	0	0	0
2007	6,703	4,897	11,600
2008	0	0	0
2009	0	0	0

2.2.4 Conveyance and Releases of SWP Water

Deliveries and Allocations

Beginning in 1997, water from the State Water Project (SWP) has been delivered to SYRWCD, ID #1 and the South Coast Member Units. For the latter, SWP water is delivered to Cachuma Lake through the outlet works in Bradbury Dam. The SWP water mixes with water in Cachuma Lake, and an equivalent amount is removed from the lake through the Tecolote Tunnel, representing delivery of SWP water to the South Coast. Under an agreement with Reclamation, SWP water can be stored in Cachuma Lake for up to 30 days; thereafter, a storage charge is imposed. SYRWCD, ID #1 receives its SWP entitlement by direct delivery from the CCWA pipeline. In addition, SYRWCD, ID #1 receives SWP water directly under an exchange agreement with South Coast Member Units, although this water is not included in SYRWCD, ID #1's SWP entitlement.

SWP contract entitlements for the Member Units are listed below:

- Carpinteria Valley Water District – 2,000 acre-ft/yr;
- Montecito Water District – 3,000 acre-ft/yr;
- City of Santa Barbara – 3,000 acre-ft/yr;
- Goleta Water District – 4,500 acre-ft/yr (Goleta Water District has an additional 2,500 af drought buffer); and
- SYRWCD, ID #1 – Under the Water Supply Agreement, the District is entitled to 2,000 acre-ft/yr, of which 500 acre-feet per year plus 200 af of drought buffer water is delivered. The remaining 1,500 af is contractually obligated to the City of Solvang through a separate agreement.

In addition to these annual entitlements, each Member Unit has contracted with CCWA for a portion of the CCWA 3,908-afy Drought Buffer that CCWA purchased to firm up the reliability of the SWP entitlements to Santa Barbara County contractors. During years when availability of SWP water exceeds project participants' demand, the Member Units can store drought buffer water in a groundwater basin or reduce their groundwater pumping and take drought buffer water instead. Stored drought buffer water can be used in dry years to augment SWP water deliveries.

The overall availability of SWP water varies with hydrologic cycles in Northern California and contractor demands throughout the state. During wet years, the SWP is able to deliver sufficient amounts to meet all or most contractor requests. During dry years, the SWP experiences shortages and contractors only receive a portion of the requested deliveries. The long-term annual average delivery of SWP water to the Santa Barbara County SWP contractors is estimated to be 77 percent of total entitlement, not including the drought buffer.[1] Actual deliveries of SWP since 1998 have ranged from 15 to 100 percent, with an average of 67 percent in the last 13-year period.

DWR issues the State Water Project Delivery Reliability Report every two years, with the Final 2009 now available. Based on information from the Final DWR Reliability Report, the average reliability of future SWP Table A deliveries through 2029 is projected to be 63 percent.[2] This percentage of allocations is based on computer modeling of the state's watersheds, with past hydrology adjusted for factors that affect reliability. The projected average reliability is a decrease from the provided average in the 2007 Final State Water Project Delivery Reliability Report of 66 to 69 percent for the scenarios through 2027.[3]

Deliveries of SWP water to the Member Units for the period since 1998 are shown in **Table 2-4, Recent (1998 to 2009) State Water Project Deliveries for Cachuma Project Member Units**.

SWP water is delivered to Cachuma Lake at the dam outlet works, which is also used for releasing water to the river. No SWP water can be delivered to the lake when water is being released from the dam. However, SWP water can be mixed with water being released from the dam and simultaneously discharged to the river due to configuration of the outlet works; however, no release occurs April through June if flow is continuous in the river. The SWP pipeline can deliver up to 22 cfs through the outlet works. A Warren Act Agreement between Reclamation and CCWA provides for the conveyance of SWP water through the Cachuma Project and includes the following key terms:

- SWP water may be commingled with Cachuma water, but must not exceed 50% of the total rate of releases to the river at any time,
- Commingled water must not enter the stilling basin with a temperature over 18 degrees Celsius,
- SWP water may not be delivered to the reservoir during spill events, and
- Mixing of SWP with Cachuma to reduce address water quality concerns.

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1 This estimate is based on a simulation of the SWP during the period 1922-1994, using the Department of Water Resources model DWRSIM version 9.06T, provided to Stetson Engineers for this EIR. The model utilizes the historic hydrology of the Sacramento-San Joaquin Delta to predict annual delivery in the SWP as a percentage of total entitlements. Based on the simulation model, annual deliveries are reduced to 20 – 30 percent of full entitlement during severe drought periods. Results of the simulation model are shown on **Chart 2-5** in **Appendix B**.

2 California Department of Water Resources, Bay-Delta Office, Final - *The State Water Project Delivery Reliability Report 2009*, (August 2010), Tables 6.20 and 6.21, 46.

3 California Department of Water Resources, Bay-Delta Office, Final *The State Water Project Delivery Reliability Report 2007*, draft document (August 2008), Table 6.13, 51.

Table 2-4
Recent (1998 to 2009) State Water Project Deliveries for Cachuma Project Member Units

Member Unit[4]	Water Year (af) [1,5,6]											
	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Carpinteria Valley Water District[2]	419	383	289	345	311	1,093	1,163	729	436	479	621	306
Montecito Water District[2]	113	111	602	346	902	2,140	1,874	1,297	648	2,713	3,677	1,207
City of Santa Barbara[2]	0	0	0	0	1,118	1,733	1,594	1,255	648	567	631	427
Goleta Water District[2]	2,939	2,161	2,998	1,989	3,192	3,842	2,689	2,516	964	2,991	1,693	1,367
SYRWCD, ID #1[3]	973	1,366	621	564	303	773	378	628	704	597	196	241
TOTAL	**4,444**	**4,021**	**4,510**	**3,244**	**5,826**	**9,581**	**7,698**	**6,425**	**3,400**	**7,347**	**6,818**	**3,548**

Source: Communications with William Brennan, Executive Director, Central Coast Water Association, August 2010.

1 *Water year represents October through September.*

2 *Some or all of this water was delivered to SYRWCD ID #1 and exchanged for Cachuma Project water, which was delivered to the South Coast as if it were SWP water.*

3 *WY 1998 deliveries include 50 afy of drought buffer water. WY 1999 deliveries include 200 afy plus 841 afy of DWR Turnback Pool water. WY 2000 deliveries include 200 afy of drought buffer water.*

4 *SYRWCD ID #1 total are Table A only; all other participants include Table A and Exchange water.*

5 *The numbers in this table also include SWP water that ID No. 1 provides to the City of Solvang under a separate agreement.*

6 *This table does not include turnback water.*

Areas of Significant Uncertainty for SWP Delivery Reliability

There are three significant factors contributing to uncertainty in the delivery reliability of the SWP: possible effects from climate change and sea level rise, the vulnerability of Delta levees to failure, and greater operation restrictions imposed by the USFWS and NMFS in response to decreasing populations of endangered fish species.[4] Each of these uncertainties is discussed below.

Climate Change and Sea Level Rise

Climate change is identified in the Final 2009 update of the California Water Plan (Bulletin 160-09)[5] as one of the key considerations in planning for the state's water management. California's reservoirs and water delivery systems were developed based on historical hydrology and, under climate change; the past may no longer be a good guide for the future.

Rising air temperatures are expected to continue to reduce snowpack, especially in low-elevation watersheds where more precipitation may fall as rain rather than snow. Reduced snowpack is expected to lead to higher winter runoff and lower spring runoff. This could increase flooding during the winter and reduce river flows in the spring and summer, which may require water managers to evaluate the tradeoffs between flood protection and water supply. Future sea level rise estimates range from 4 to 16 inches by mid-century and 7 to 55 inches by the end of the century. Higher sea levels could threaten the existing levee system in the Sacramento-San Joaquin Delta. Salinity intrusion into the Delta could also require increased releases of freshwater from upstream reservoirs to maintain compliance with water quality standards.

For the SWP, these climate changes have the potential to simultaneously affect the availability of source water, the ability to convey water, and users' demands for water. This may exacerbate the existing mismatch in California between where and when precipitation occurs and where and when people use water.

Vulnerability of Delta Levees to Failure

Delta levees provide constant protection from flooding because most lands in the Delta are below sea level. Most Delta levees, however, do not meet modern engineering standards and are highly susceptible to failure. Levees are subject to failure at times of high flood flows, but also at any time of the year due to

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4 California Department of Water Resources, Bay-Delta Office, Final - *The State Water Project Delivery Reliability Report 2009*, (August 2010), 17 to 23.

5 California Department of Water Resources, *California Water Plan Update 2009*, July 2010.

seepage or the piping of water through the levee, slippage or sloughing of levee material, or sudden failure due to an earthquake.

A breach of one or more levees and island flooding may affect Delta water quality and water operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, a significant amount of saline water may be drawn into the interior Delta from Suisun and San Pablo bays. At the time of island flooding, exports may be drastically reduced or ceased to evaluate the salinity distribution in the Delta and to avoid drawing higher-saline water toward the pumps. The introduced salinity then could become dispersed and degrade Delta water quality for a prolonged period because of complex relationships between Delta inflows, tidal mixing, and the time taken to repair the breaches.

A large earthquake in the Delta causing significant levee failures and island flooding could lead to multiyear disruptions in water supply and significant water quality degradation. A worst-case scenario for water supply effects would be a moderate or large earthquake causing extensive levee failure in the late summer or fall of a dry year.

National Marine Fisheries Service and Fish and Wildlife Service Biological Opinions

Over the past five years and in response to declining fish populations, the rules defined by the federal biological opinions issued under the Endangered Species Act for the operation of the SWP and Central Valley Project (CVP) in the Delta have become more and more restrictive. In December 2008, the USFWS issued a new biological opinion for delta smelt. In June 2009, the National Marine Fisheries Service (NMFS) issued a new biological opinion covering winter-run and spring-run Chinook salmon, steelhead, green sturgeon, and killer whales. The biological opinions imposed additional operational requirements that restrict the amount of water supply that can be exported from the Delta.

2.2.5 Modified Storm Operations

In 1998, Reclamation initiated a modified storm operations program for the Cachuma Project to reduce the ~~frequency and~~ magnitude of flood flows along the lower Santa Ynez River, particularly in the Lompoc Valley. Reclamation implements the program at its sole discretion on an as-needed basis during wet winters, but Reclamation consults with the Member Units, ~~and~~ the Santa Barbara County Flood Control District~~, the Member Units~~ and downstream interests, as appropriate. The program consists of the following elements:

- **Precautionary Releases.** Reclamation will make releases from the conservation storage in the lake prior to the onset of a flood (i.e., flow events that are likely to result in uncontrolled spills) in order to create surcharge space for passing flood flows. By releasing water from the dam in a controlled manner, which does not cause flooding, Reclamation may attenuate (along with pre-release and/or gateholding) the peaks of large flows that ~~avoid spills, which are uncontrolled and~~ may cause flooding. Precautionary releases only evacuate a volume of storage that is equal to, or less than, 50 percent of remaining runoff estimated to be in the watershed. Precautionary releases are made 24 to 36 hours in advance of a runoff event and typically will result in a 5- to 6-foot lowering of the lake.

- **Pre-releases.** These releases match the inflows at the beginning of a flood event, designed to pass the early part of a flood while maintaining as much of the surcharge space in the reservoir as possible. Reclamation establishes a maximum allowable release level prior to initiating the releases that takes into account downstream flows and flooding hazards.

- **Gateholding.** Under this method, Reclamation opens the spillway gates in response to a rise in the reservoir as flood flows fill the lake. This action releases water downstream while maintaining a minimum freeboard on the gates in order to prevent overtopping of the gates and the dam crest.

2.3 MEMORANDUM OF UNDERSTANDING FOR FISH STUDIES

In June 1994, various parties with interests along the Santa Ynez River executed the Memorandum of Understanding for Cooperation in Research and Fish Maintenance (1994 MOU or MOU). Signatories to the 1994 MOU include Reclamation, DFG, USFWS, CCRB, SYRWCD, ID #1, SYRWCD, SBCWA, and the City of Lompoc. The MOU established a Fish Reserve Account of 2,000 afy to provide water for fish studies, habitat, critical life stages, or passage of downstream fish. Fish studies commenced in 1994 under the MOU.

Reclamation has historically managed the maximum water level of Cachuma Lake at 750 feet. However, beginning in 1998, Reclamation surcharged the reservoir 0.75 foot when the reservoir spilled, providing an additional 2,300 af of water. Water stored above 750 feet due to the 0.75-foot surcharge was credited to the Fish Reserve Account. The reservoir has spilled 22~~0~~ times since Bradbury Dam was completed. The most recent spills occurred in 1998, 2000, 2001, 2005, 2006, ~~and~~ 2008 and 2011. A summary of historic spills is provided in **Table 2-2**. When the reservoir level did not exceed 750 feet in a given year, 2,000 af from the minimum pool (dead storage) was dedicated to the Fish Reserve Account. (Note: The Fish Reserve Account has been superseded by the requirements of the Biological Opinion, discussed in **Section 2.4**, below.)

The 1994 MOU established two committees, the Consensus Committee to address policy issues and the Santa Ynez River Technical Advisory Committee (SYRTAC) to provide technical input to the Consensus Committee regarding the biological studies and analyses. The SYRTAC directs the studies performed under the 1994 MOU and directed the timing and amount of releases from the Fish Reserve Account each year. The committee is composed of various biologists and resource agency personnel. In addition to the signatories to the 1994 MOU, the following agencies and organizations are participants in the SYRTAC: NMFS; U.S. Forest Service; Natural Resources Conservation Service; California Trout; Santa Barbara Urban Creeks Council; Central Coast Regional Water Quality Control Board; CCWA; Santa Barbara

County Fish and Game Commission; and the California Coastal Commission. The SYRTAC provides data and recommendations to a Consensus Committee that, in turn, reviews the SYRTAC's work and provides necessary direction. A full-time fish biologist is funded under the 1994 MOU to conduct field investigations and compile data. Annual releases from the Fish Reserve Account during the period 1993 through 2000 ranged from 494 to 2,999 afy, as shown in **Table 2-2**. Monthly releases from the Fish Reserve Account are shown on **Chart 2-4** (**Appendix B**).

The fisheries studies in the lower Santa Ynez River began in earnest in 1994. Major components of the studies included: (1) flow recommendations for maintenance of the fish in the lower river, (2) evaluation of steelhead habitat restoration on the tributaries below Bradbury Dam, (3) establishment of mainstem spawning and rearing habitat, and (4) assessment of how to optimize the productive capacity of the fishery in the mainstem river and the tributaries within the context of natural hydrological patterns and available water supplies. The SYRTAC remained active until the Adaptive Management Committee (AMC) was established by the Biological Opinion and Fish Management Plan (FMP) in 2000. The AMC effectively replaced the SYRTAC.

The 1994 MOU also established a Fish Reserve Account of 2000 ac-ft/year to be used as determined by the SYRTAC for fish maintenance in the lower river. This was a voluntary amount of water agreed to by the Cachuma Member Units and was provided from Cachuma Project water supply. WR Order 94-5 made that provision of 2000 af mandatory. The MOU was renewed in 1995 and stayed in effect until 2001, when a new MOU was signed to implement the flow and non-flow management actions of the Cachuma Project Biological Opinion and Lower Santa Ynez FMP.

A new MOU was executed in 2001 by essentially the same group of public agencies to implement the steelhead management actions specified in the FMP and the Biological Opinion. This was a shift from the studies in the 1994 and 1995 MOUs to implementation of habitat improvements, removal or modification of numerous fish passage barriers on the tributaries, and fish releases to meet target rearing flows and supplementary migration passage flows as specified in the Biological Opinion and FMP. The Fish Reserve Account was effectively superseded. Instead, "surcharging" the reservoir in spill years provides about 9200 af of water, which is wholly dedicated to the downstream fishery, with 3200 af reserved for passage supplementation, 500 af reserved for adaptive management actions, and the balance to meet target rearing flows, which flow rates were established under various hydrological conditions. The target flows must be met regardless, so when the surcharge water is depleted, target flows are provided from project yield.

Through these MOUs, a consensus-based, long-term FMP was developed that provides protection for steelhead/rainbow trout downstream of Bradbury Dam through a combination of water releases from

Bradbury Dam through the Hilton Creek watering system, and the removal or modification of numerous fish passage barriers to steelhead on tributaries to the mainstem Santa Ynez River. By implementing these actions, the parties to the MOU have created additional habitat for steelhead within the Santa Ynez River watershed and increased the number of fish.

2.4 BIOLOGICAL OPINION

2.4.1 Background Information

In August 1997, NMFS designated the anadromous form of southern steelhead (*Oncorhynchus mykiss)* inhabiting the Southern Evolutionarily Significant Unit (ESU), which includes the lower Santa Ynez River below Bradbury Dam, as an endangered species under the federal ESA.

In April 1999, Reclamation requested a formal endangered species consultation with NMFS regarding ongoing operations of the Cachuma Project under the provisions of Section 7 of the ESA. The request for consultation included a Biological Assessment (revised in June 2000) (Appendix C to the 2003 Draft EIR), based on a Draft Fish Management Plan prepared by the SYRTAC on behalf of Reclamation which proposed various modifications to operations and conservation measures to protect the southern steelhead. The modifications to project operations and conservation measures were developed in consultation with Reclamation and designed to improve the availability and quality of habitat for *O. mykiss* in the lower river~~, while the conservation measures were designed to contribute to the recovery of the population in the Southern ESU~~. The Biological Assessment formed the basis for the Fish Management Plan (2000) discussed in **Section 2.5**, below.

The consultation was completed in September 2000, when the NMFS issued a Biological Opinion. (**Appendix D**) In the Biological Opinion, NMFS evaluated the effect of the ongoing operation and maintenance of the Cachuma Project, including the changes in operations and conservation measures proposed by Reclamation for the benefit of the *O. mykiss* population on the lower Santa Ynez River. NMFS also assessed impacts on critical habitat for the *O. mykiss*, which was designated on the lower river on February 16, 2000. NMFS concluded that the operation of the Cachuma Project as proposed would not jeopardize the continued existence of *O. mykiss* in the Southern ESU and was not likely to destroy or adversely modify critical habitat. The Biological Opinion contains mandatory terms and conditions, including operational changes that are required to implement 15 specific "reasonable and prudent measures" necessary to minimize take of the *O. mykiss*. Reclamation is currently implementing these measures.

In essence, the Biological Opinion requires implementation of most of the operational changes and conservation measures described in the Biological Assessment, along with additional operational, reporting and monitoring requirements for *O. mykiss*.

The Biological Opinion for the Cachuma Project ~~as well as~~and the Fish Management Plan underwent environmental review in compliance with both CEQA and NEPA, which was completed in 2004.[6]

~~The~~ Reclamation prepared a Final EIS/EIR for the "Lower Santa Ynez River Fish Management Plan (Plan) and Cachuma Project Biological Opinion ~~(Opinion)~~ for Southern Steelhead Trout. The actions evaluated include various flow and non-flow measures to be implemented by Reclamation and the Cachuma Project Member Units to protect and enhance habitat for the endangered southern steelhead trout along the Santa Ynez River downstream of Bradbury Dam. Reclamation issued a Record of Decision on November 18, 2004.~~A summary of the operational and conservation measures described in the Biological Assessment and the additional operational changes required by NMFS in the Biological Opinion is provided below.~~

In 2005, NMFS revisited critical habitat designations and confirmed the critical habitat for *O. mykiss* extending upstream from the lagoon within Vandenberg Airforce Base to Bradbury dam, including the main tributaries (50 CFR Part 226). The policy of using of Evolutionarily Significant Units was superseded by the alternative approach to determining "species" according to the Distinct Population Segment (DPS) policy in 2006 (50 CFR Parts 223 and 224). This policy recognizes that within discrete *O. mykiss* populations, resident and anadromous life forms remain "markedly different" from other populations as a consequence of physical, physiological, ecological and behavioral factors. Using this criteria, all naturally spawned steelhead originated in freshwater habitat below impassible barriers and which exhibit an anadromous life history are considered part of the DPS. Individuals originating in freshwater above impassible barriers that exhibit an anadromous life history are also considered part of the DPS when they are within waters below the barriers.

In June of 2009, the Santa Ynez River Adaptive Management Committee (~~SYRTAC~~ AMC) completed the "Summary and Analysis of Annual Fishery Monitoring in the Lower Santa Ynez River 1993-2004" ~~(June 2009)~~. This document updates the data from the 2000 Fish Management Plan, and summarizes the status of actions related to the Biological Opinion.

6 Cachuma Operation and Maintenance Board and U.S. Bureau of Reclamation, Final Program and Project Specific Environmental Impact Report/Environmental Impact Statement for Lower Santa Ynez River Fish Management Plan and Cachuma Project Biological Opinion, February, 2004.

In May 2010, Reclamation released the Compliance Report for the Biological Opinion for the Operation and Maintenance of the Cachuma Project on the Santa Ynez River in Santa Barbara County, CA 2003-2009. This summarizes all actions accomplished to date relative to the 15 Reasonable and Prudent Measures and Terms and Conditions of the Biological Opinion. Discussion of these actions and a summary of compliance status are found in **Section 2.4.6**.

2.4.1.1 Summary of Reasonable and Prudent Measures Status of Compliance

The Biological Opinion lists 15 Reasonable and Prudent Measures (RPM) and associated Terms and Conditions. **Table 2-4A, Summary of Reasonable and Prudent Measures/Terms and Conditions Described in the Cachuma Project Biological Opinion and Status of Compliance**, summarizes the implementation and compliance status for each measure and term and condition. Details related to specific RPM follow (**Subsections 2.4.2 – 2.4.5**)

Table 2-4A
Summary of Reasonable and Prudent Measures/Terms and Conditions Described in the Cachuma Project Biological Opinion and Status of Compliance

Biological Opinion Reference	Summary of RPM and T&C	Status
RPM 1 T&C 1[1]	Maintain and monitor residual pool depth in Alisal and Refugio reaches during spill years and the first year after spill years if steelhead are present until the 3 foot surcharge is achieved (done) and the 11 passage barrier fixes are completed	Three-foot surcharge achieved in 2005. Residual pool depths maintained in spill years and year after spill years as required with two brief exceptions that were reported to NMFS.
RPM 2 T&C 2[1]	Maintain flow in Hilton Creek at flows ≥ 2 cfs unless (1) the AMC decides otherwise and NMFS approves or (2) the transect data indicate that habitat space does not decrease significantly at flows less than 2 cfs	Implemented in 2000; minimum flows greater than 2 cfs maintained in Hilton Creek
RPM 2	Hilton Creek habitat monitoring:	Implemented in 2000-2002.
T&C 2[2]	Reclamation shall implement the Hilton Creek Habitat Monitoring study plan described on page 3-60 of the Revised Project Proposal (U.S. Bureau of Reclamation 2000) and report the results to NMFS in each year the study is conducted	Monitoring report for study conducted from 2000 to 2002 submitted to NMFS in 2003 (Reclamation 2003)
RPM 3	Develop and implement a plan for supplemental releases for fish mitigation	Proposed revisions set to NMFS and authorized in 2005.
T&C 3[1]	Reclamation shall design a strategy within six months of the issuance of this opinion to further refine the supplemental flow releases for steelhead migration. Such a strategy shall include shifting migration supplementation releases away from dry years when releases may not be helpful to the steelhead population in the Santa Ynez and review of storm flow decay curves (mean, median, etc.) and other methodologies for providing increased migration availability.	Program implemented in 2006 once Lake Cachuma was surcharged
RPM 4 T&C 4[1]	Reconsult with NMFS if planned passage improvements will not be completed in 2005.	Two Biological Opinion tributary passage projects and one non-Biological Opinion project completed by 2005. As ~~all projects were not~~not all projects were completed by 2005, request for reconsultation submitted to NMFS in December 2005.
RPM 5 T&C 5[1]	Do not mix CCWA water into the SYR during December through June unless flow is discontinuous in the mainstem.	Implemented in 2001 and ongoing as required.

Biological Opinion Reference	Summary of RPM and T&C	Status
RPM 6 T&C 6[1]	During the next three years of water rights releases, monitor steelhead downstream of Bradbury to confirm that they are not encouraged to move downstream.	Implemented in 2004 and 2007. Third water rights release pending.
RPM 7 T&C 7[1-2]	Monitor mainstem and Hilton Creek stage and wetted width during first year of ramping. T&C 7[1]: WR 89-18 ramp down wetted width and depth monitoring. T&C 7[2]: Report results in the year they are collected	Implemented in 2000. Deemed complete by NMFS in 2005.
RPM 8 T&C 8[1-19]	Reclamation shall avoid and minimize turbidity, sedimentation, loss of riparian vegetation, and steelhead relocation during implementation of tributary passage fixes, the El Jaro Creek demonstration project, and future Reclamation enhancement measures. Reclamation shall obtain NMFS's approval of final project designs. Nineteen T&Cs specify project implementation best management practices (BMP) and monitoring	Implemented for all projects.
RPM 9 T&C 9[1-3]	Avoid and minimize steelhead harm and death during predator relocation and predator removal. Three T&Cs specify rescue implementation: T&C 9[1]: Hilton Creek Fish Rescue Plan T&C 9[2]: Electrofishing Policy T&C 9[3]: BMPs for Predator Removal	Ready to implement since 2000.
RPM 10 T&C 10[1]	All decisions that affect steelhead made by the AMC must be approved by NMFS before they are implemented	Implemented in 2001.
RPM 11 T&C 11[1]	Monitoring of project impacts on steelhead Monitoring of Cachuma Project shall occur as described above and as described in the revised project description (Reclamation 2000) under the direction of a qualified biologist. Reclamation shall provide NMFS with yearly reports (unless otherwise noted) that include the data taken each year and preliminary data analysis	(1) Monitoring report for 2000 to 2002 submitted to NMFS 2003; (2) Synthesis Report for 1993-2004 submitted to NMFS 2009; (3) Annual report for 2008 with trend analysis for 2005-2008 submitted to NMFS February 2010; (4) Annual report for 2009 (in draft)

Biological Opinion Reference	Summary of RPM and T&C	Status
RPM 11	Monitoring of project impacts on steelhead	Implemented annually since 2000.
T&C 11[2]	Monitoring involving take of endangered steelhead such as migrant trapping, snorkel and bank observations, tagging, and tissue sampling, shall be conducted as described in the revised project description and the following take minimization and avoidance measures shall apply.	
RPM 11	Monitoring of project impacts on steelhead	Completed and submitted to NMFS in June 2009
T&C 11[3]	Develop a plan to monitor changes to the bed and banks of the SYR within one year of the issuance of this opinion.	
RPM 11	Monitoring of project impacts on steelhead	Implemented 2000-2001; new method implemented in 2004.
T&C 11[4]	Target flow compliance monitoring at Highway 154 bridge	
RPM 11	Monitoring of project impacts on steelhead	Three-foot surcharge achieved in January 2005. There were no spills during 2003 and 2004, therefore residual pool depth maintenance and monitoring was not required. The interim period is complete.
T&C 11[5]	If conditions occur during the interim period that require pool surface areas to be maintained in the Alisal and Refugio reaches, Reclamation shall monitor these pools on a weekly basis and adjust flows as necessary to maintain residual pool depth.	
RPM 11	Monitoring of project impacts on steelhead	Implemented in 2001, reports posted on Reclamation's website.
T&C 11[6]	NMFS shall receive quarterly reports detailing water releases for fish and the achievement of the flow targets (and pool surface areas) during the interim period (until the 3.0-foot surcharge is achieved) and for the first three years of long-term operations. In later years, these reports may occur on a yearly basis.	
RPM 11	Monitoring of project impacts on steelhead	Monitoring program has been implemented since 2000 with minor changes to program elements.
T&C 11[7]	Reclamation shall provide plans for changes in monitoring locations and methodologies and obtain approval from NMFS prior to implementation	
RPM 11	Monitoring of project impacts on steelhead	Implemented in 2001, and ongoing as needed.
T&C 11[8]	Reclamation shall identify to NMFS the personnel designated to conduct the monitoring activities described in this opinion prior to each monitoring season and confirm their experience through resumes or other evidence of their accomplishments	

Biological Opinion Reference	Summary of RPM and T&C	Status
RPM 12 T&C 12[1-3]	Reclamation shall relocate steelhead in danger of becoming stranded should releases fall due to mechanical or human error. T&C 12[1]: Notify NMFS & relocate steelhead T&C 12[2]: Use Hilton Creek Fish Rescue Plan methods T&C 12[3]:Emergency procedures under 50 CFR 402.05	Ready to implement since 2000 pending need.
RPM 13 T&C 13[1-2]	Temporary road crossing maintenance and vehicle use during seismic retrofit T&C 13[1]: Implement Steelhead Protection Measures T&C 13[2]: Limit crossing to six or fewer vehicle round-trips	Implemented in 2000.
RPM 14 T&C 14[1]	If upgrading the Hilton Creek water supply line to increase capacity requires shutting down the supply of water to steelhead in Hilton Creek and/or the Santa Ynez, Reclamation shall reinitiate consultation on the Cachuma Project.	HCWS upgrade completed in 2005 without shutting down the water supply to Hilton Creek.
RPM 15 T&C 15[1]	Reclamation shall work with NMFS to design and implement a strategy to further verify the analysis of migration supplementation and mainstem rearing targets within six months of the issuance of this opinion	(1) Passage supplementation recommendations from the AMC approved by NMFS in 2005; led to the formation of the Real-Time Decision Group. (2) Rearing study-confirmation of rearing constrained by access issues in Highway 154 Reach. (3) Passage confirmed during 2006 supplementation and monitoring.

2.4.2 OPERATIONAL CHANGES

In order for the *O. mykiss* population to remain viable, adults must have opportunities to migrate upstream to spawn, typically between December and April when seasonal rainfall is sufficient to breach the sandbar at the mouth of the river and provide upstream connectivity. Additionally, smolts need sufficient flow and connectivity to migrate downstream to the ocean, typically between February and May. The amount of time it takes for adults to migrate upstream to spawn in the Santa Ynez River is not known; however, the available information indicates a range of between 8 and 31 miles per day, depending on flow rates (Groot and Margolis 1991, Dettman and Kelly 1986).

Target flows designed to meet minimum *O. mykiss* migration passage opportunities were based on the Adult Steelhead Passage Flow Analysis for the Santa Ynez River (SYRTAC 1999), which analyzed the historical flow conditions in relation to the Cachuma Operations, using the channel configurations existing at that time. By comparing the flow rates both with, and simulated without Cachuma Operations for the same period of record (1942-1993), this analysis found that, historically, *O. mykiss* had greater passage opportunities than are present under the current operating regime.

The flow conditions between 1942 and 1993 were analyzed to determine flow rates at four locations downstream of Bradbury dam (River Park in Lompoc, Cargasacchi Ranch, Alisal Bridge near Buellton, and the upper Refugio Area near Solvang). The assumed passage criteria was based on Thompson (1972) which identified a depth of greater than 0.6 foot over 25 percent of the wetted channel width, with at least 10 percent contiguous, and velocities of less than 8 feet per second. Due to the observed conditions found in Southern California, these adult steelhead passage criteria were modified to recognize that fish often are able to migrate when there is less than 25 percent of contiguous stream channel width and wetted widths of less than 10 feet. Therefore, channel widths of 8 feet of contiguous channel and relative widths of 10 percent and 25 percent of wetted channel were used for the modeling (SYRTAC 1999).

Target rearing flows and fish passage supplementation criteria were developed to address the conditions identified and meet the minimum requirements of the Biological Opinion, based on a series of studies initiated cooperatively between SYRTAC, Reclamation, and NMFS and outlined in the BA and subsequent supplemental studies.

2.4.2.1 Reservoir Surcharging

The operating plan that Reclamation proposed and NMFS evaluated in the Biological Opinion included the surcharging of Cachuma Lake to provide additional water for fish releases. The Biological Opinion assumed that Reclamation would complete the spillgate modifications to allow surcharging at 1.8 feet during the calendar year 2002, and 3.0 feet during the calendar year 2005. If Reclamation did not meet the deadline for the 3.0-foot surcharge, the Biological Opinion required that Reclamation re-initiate consultation with NMFS under Section 7 of the ESA. (There was no requirement for Reclamation to re-initiate consultation with NMFS if the 1.8-foot surcharge was not implemented.) Reclamation did not implement a 3.0-foot surcharge in 2005 due to potential impacts to recreational facilities at the lake. Instead, Reclamation implemented a 2.47-foot surcharge pursuant to a Memorandum of Understanding (MOU) between CCRB, SYRWCD, ID #1, and the County of Santa Barbara. In 2009, the MOU expired and Reclamation is now able to implement a 3.0-foot surcharge.

The amounts of water stored during surcharge years for 1.8-foot and 3.0-foot surcharges are shown in **Table 2-5, Allocation of Surcharged Water**. **Table 2-5** also shows the amount of surcharge water dedicated to long-term and interim rearing target flows, the Fish Passage Account, and the Adaptive Management Account under Reclamation's proposed operating plan. These flows and accounts are discussed in greater detail below. When the reservoir spills, the accounts shown in **Table 2-5** are deemed to spill and the accounts will receive a new allocation based on the amount of surcharge. Otherwise, unused water from each account is carried over to the next year. Releases for interim and long-term rearing target flows required by the Biological Opinion are derived from a combination of surcharge, the Cachuma Project yield, and meeting target flow conditions with water rights releases.

2.4.2.2 Ramping Water Rights Releases

In the Biological Assessment, NMFS authorized ~~Reclamation also proposed to implement~~ a ramping schedule for the ramp-down of releases made to satisfy downstream water rights. ~~to prevent stranding of steelhead in the mainstem.~~ These ramping rates, which are a refinement of rates recommended by the SYRTAC and used since 1994, are detailed in **Table 2-6, Ramp Down Schedule for Releases Made to Satisfy Downstream Water Rights**. They have been used since 2000.

Table 2-5
Allocation of Surcharged Water

Surcharge Level (feet)	Account and Use	Surcharge Allocation (af)	Total Amount in Surcharge Years
1.8	Interim rearing target flow releases	3,000	5,500
	Fish passage supplementation	2,500	
3.0	Long-term rearing target flow releases	5,500	9,200
	Fish passage supplementation	3,200	
	Adaptive Management Account (for rearing or passage flows)	500	

Note: The Target flows required by the Biological Opinion are met from a combination of surcharge, Cachuma Project yield, and conjunctive use of water rights releases.

Table 2-6
Ramp Down Schedule for Releases Made to Satisfy Downstream Water Rights

Release Rate (cfs)	Maximum Ramp Down Increment (cfs)	Minimum Ramp Down Interval (hours)
> 90	25	4
90 – 30	10	4
30 – 10	5	4
10 – 5	2.5	4
5 – 3.5	1.5	4
3.5 – 2.5	1	4

In addition to the ramping schedule for water rights releases, additional fish passage supplementation criteria were developed in 2004 by the SYRTAC Adaptive Management Committee (AMC), Reclamation and NMFS; the criteria were formally approved by NMFS in 2007. The purpose of the fish passage supplementation program is to take advantage of rainfall events by supplementing the receding limb of the hydrograph to increase the number of days passage is possible between the ocean and Bradbury Dam. The supplementation rate and ramping down process are guided by the Real-Time Decision Making Group, and attempt to mimic a decay function that maximizes passage opportunities.

2.4.2.3 Mainstem Rearing Releases

The Biological Opinion requires Reclamation to meet interim and long-term target flows at two locations on the mainstem. The objective of the flows is to improve summer rearing habitat conditions for *O. mykiss* in the upper mainstem below Bradbury Dam to the Highway 154 bridge, as well as in lower Hilton Creek. The target flows are produced by a combination of natural runoff and releases from Cachuma Lake. Continuous flows are being provided in all but the driest years to Highway 154 (a distance of 2.9 miles). In years with spills exceeding 20,000 af and the year following such a spill year, flow is maintained between the dam and Alisal Road (a distance of 10.5 miles).

Reclamation, in cooperation with the SYRWCD, has operated water rights releases to meet fish water release targets in the Highway 154 reach since 1994, as well as during years when target flows are being met down to Alisal Road, and proposes to continue this operation in the future. That is, when releases are being made for water rights, the water from this source will be used to continue to meet the mainstem target flows as well as the habitat flow requirement in Hilton Creek. Currently, water rights releases as well as fish target flow releases are made from the outlet works and the Hilton Creek watering system (described below) that is designed to deliver water to three release points: two along Hilton Creek and one in the stilling basin (**Figure 2-3**). The design capacity of this system is 10 cfs. Releases made to satisfy downstream water rights are made using the dam outlet works, with up to 10 cfs released through the Hilton Creek watering system at the same time.

Water rights releases typically occur between June and November. The additional flow during summer months does not augment spring flows to assist smolts in moving downstream. Because long-term target releases are made as necessary, the accounting of the amount of water released from Highway 154 bridge and Hilton Creek to meet target flows sometimes exceeds the amount allocated for fish in a given year.

Under Reclamation's operating plan, the long-term target flows for each year depend on the amount of water stored in Cachuma Lake and the extent to which Cachuma Lake spills. When Cachuma Lake spills at least 20,000 af, the long-term target flow at the Highway 154 Bridge is 10 cfs. When Cachuma Lake spills less than 20,000 af, or does not spill at all, but storage is at least 120,000 af, the target flow at the Highway 154 Bridge is 5 cfs. When storage drops below 120,000 af, the target flow at the Highway 154 Bridge is 2.5 cfs. When storage drops below 30,000 af, no long-term target flow exists. Instead, Reclamation anticipates that 30 af per month would be available to provide refreshing flows to the Stilling Basin and Long Pool below Bradbury Dam. In addition, Reclamation must reinitiate consultation with NMFS to determine what actions, if any, will be taken for *O. mykiss* in the mainstem under these conditions. Long-term target flows at the Alisal Road Bridge are 1.5 cfs in years when Cachuma Lake spills at least 20,000 af and *O. mykiss* are present in the Alisal reach of the Santa Ynez River and in the water year following any such year.

Long-term target flows are summarized in **Table 2-7, Long-Term Mainstream Rearing Target Flows**. According to the Biological Assessment, this action will result in year-round flows with good quality *O. mykiss* rearing habitat in the upper mainstem to the Highway 154 bridge and Hilton Creek. The SYRTAC (2000) estimates that flows at Highway 154 would meet or exceed 2.5 cfs about 98 percent of the time, and that flows at Alisal Road would meet or exceed 1.5 cfs about 75 percent of the time.

Until a 3.0-foot surcharge was implemented, the Biological Opinion provided for interim rearing target flows, as summarized in **Table 2-8, Interim Mainstream Rearing Target Flows**. The framework and sites for the target flows are the same as for the long-term target flows (**Table 2-7**). However, the target flow amounts are less, Reclamation began implementing the long-term target flows with a surcharge of 2.47 feet in 2005.

The target baseflow releases were indexed to the hydrologic cycle via storage levels in Lake Cachuma and vary in response to yearly changes in precipitation and runoff (water year type) within the watershed. Populations of *O. mykiss* respond to the variable hydrologic conditions with a boom-bust cycle, with abundance increasing during and following wet years when migration, spawning, and rearing habitat expands and contracting during dry years. The Biological Opinion recognizes this yearly variability, and baseflow targets are designed to take advantage of the "boom" years by extending flow following spill events as well as maintaining suitable aquatic habitat by target flows of 2.5-5.0 cfs, which have been maintained yearly since 2000 in compliance with the Biological Opinion at Highway 154. These flows support suitable oversummering habitat conditions in the Highway 154 reach and provide ancillary benefits of improved habitat conditions extending downstream to pool habitats within the Refugio and Alisal reaches (SYRTAC 2009).

Table 2-7
Long-Term Mainstem Rearing Target Flows

Lake Storage Conditions (af)	Reservoir Spill	Long Term Target Flow (cfs)	Long Term Target Site
> 120,000	Spill > 20,000	10	Highway 154
> 120,000	Spill > 20,000	1.5*	Alisal Road
> 120,000	No spill or < 20,000 spill	5	Highway 154
< 120,000	No spill	2.5	Highway 154
< 30,000	No spill	Periodic release; < or = 30 af/month	Stilling Basin & Long Pool
> 30,000	No spill or < 20,000 spill	1.5*	Alisal Road**

** Only if steelhead are present in the Alisal Reach.*
*** This target will be met in the year immediately following a > 20,000 af spill year.*

Table 2-8
Interim Mainstem Rearing Target Flows

Lake Storage Conditions (af)	Reservoir Spill	Interim Target Flow (cfs)	Target Site
> 120,000	Spill > 20,000	5	Highway 154
> 120,000	Spill > 20,000	None	Alisal Road
> 120,000	No spill, or < 20,000	2.5	Highway 154
< 120,000	No spill	1.5	Highway 154
< 30,000	No spill	Periodic release; < or = 30 af/month	Stilling Basin & Long Pool
> 30,000	No spill, or < 20,000	None	Alisal Road

2.4.2.4 Fish Passage Flows

The Biological Opinion also requires Reclamation to maintain a Fish Passage Account for purposes of providing flows in order to increase the number of days that migration would be possible in the mainstem of the river for steelhead to reach tributaries near Bradbury Dam. The water will be released in the period January through May to extend the receding limb of naturally occurring storm hydrographs once the sandbar at the mouth of the river has been naturally breached. Storms are defined as flows of 25 cfs or greater at the Solvang U.S. Geological Survey (USGS) gauge location. Releases would be made after a storm has ended and flows have receded to 150 cfs at Solvang. In the event that storms do not produce

150 cfs at Solvang, but flows exceed 25 cfs, then releases would be made to reach 150 cfs. The combination of natural flows and the Fish Passage Account releases will provide an average of 14 days or more of passable flows to facilitate steelhead migration to the mainstem and tributaries above Alisal Road.

As with ~~interim and~~ long-term target flows, under Reclamation's operating plan implementation of the Fish Passage Account was contingent upon implementation of either a 1.8-foot or 3.0-foot surcharge, which was achieved in 2005. In addition, whether water is credited to the account depends on whether the reservoir surcharges. The Fish Passage Account has been allocated 3,200 af in years when the reservoir surcharges to 3 feet. Though the reservoir surcharged to 2.47 feet in 2005 and 2006, the full 3,200 af was allocated to the Fish Passage Account. Water is released to facilitate passage beginning in the year following a surcharge year, and in subsequent years until the account is depleted. The account is not subject to evaporation or seepage losses, and can be carried over to subsequent years. However, the account is reset when the reservoir surcharges.

2.4.2.5 Adaptive Management Account

Reclamation proposed to create an Adaptive Management Account to provide additional releases for future habitat needs that may be identified under an adaptive management program. Under Reclamation's operating plan, once a 3.0-foot surcharge has been implemented, Reclamation will allocate 500 af to the account in years when the reservoir surcharges at 3 feet. Though the reservoir was surcharged at 2.47 feet in 2005 and 2006, the full 500 af was allocated to the Adaptive Management Account. The account is not subject to evaporation or seepage losses, and can be carried over to subsequent years. The account is used at the discretion of an Adaptive Management Committee (AMC) to benefit *O. mykiss* and its habitat as determined by the committee, which is composed of Reclamation, NMFS, DFG, USFWS, CCRB, SYRWCD, ID #1, SYRWCD, and Lompoc.

2.4.3 Habitat Improvements

2.4.3.1 Tributary Passage Impediment Removal Measures

According to the Biological Opinion, there are many natural and man-made passage impediments on tributaries below Bradbury Dam, particularly under low to moderate flow conditions. The impediments include culverts, road crossings, and boulder cascades. Removal of these impediments would increase access to suitable spawning and rearing habitats, thereby expanding the total available habitat for *O. mykiss* on the lower river. The Biological Assessment identified the highest priority tributaries as being Salsipuedes, El Jaro, Hilton, and Quiota creeks because they have perennial flow in their upper reaches and can support spawning and rearing.

The Biological Opinion listed 11 passage impediments along tributaries that Reclamation proposed to remove on Hilton Creek (one on federal land and one under Highway 154) and on the following tributaries: Salsipuedes Creek (Highway 1 bridge), Quiota Creek (six road crossings), El Jaro Creek (one road crossing), and Nojoqui Creek (one road crossing). The Biological Opinion required Reclamation to reinitiate consultation if the projects were not completed by 2005, which Reclamation did in December of 2005. The Biological Opinion also required Reclamation to minimize turbidity, sedimentation, loss of riparian vegetation and steelhead relocation during implementation of tributary passage fixes. **Appendix G** provides a status report for all habitat enhancement projects (Table 22 in **Appendix G**) as well as "before" and "after" photographs of several completed restoration projects (Figures 10-13 in **Appendix G**)

Hilton Creek Passage Projects

The Hilton Creek Cascade Chute Project was completed in December 2005. By installing six cast-in-place control structures to produce step pools, reduce the jump heights, and create rearing habitat, water velocities were reduced and resting places created, providing *O. mykiss* access to all 2,980 feet of suitable habitat. The intermittent flow conditions and elevated temperatures found prior to implementation of these improvements restricted successful reproduction, with few smolts moving downstream. Since these improvements were completed, between 400-900 young-of-the-year *O. mykiss* have been observed in yearly spring snorkel surveys (SYRTAC 2009).

The final upstream passage barrier is a culvert under Highway 154. Caltrans completed preliminary engineering drawings in 2000 for modifications to the culvert to achieve fish passage with the intent of implementing and funding the project within its agency. There were concerns by Caltrans that the gradient of the culvert too steep to meet California Department of Fish and Game (CDFG) fish passage criteria. In 2007, the design drawings were sent to CDFG for review, comment and approval. The project has been dropped from further consideration by Caltrans.

Reclamation has not considered constructing the project due to potential legal challenges from an adjacent landowner and design constraints related to the culvert gradient being too steep for fish passage.

Salsipuedes Creek Highway 1 Fish Passage Project

Salsipuedes Creek Watershed provides substantial spawning and rearing habitat for *O. mykiss* and is one of the largest tributaries of the Santa Ynez River at 62 square miles as well as one of the closest to the ocean. Observations indicate that flow from the Salsipuedes alone is sufficient to breach the sandbar at the mouth of the lagoon. A concrete and rock grade control apron located on the downstream side of the Highway 1 Bridge created a significant passage barrier at low flows, and a moderate passage barrier for adults moving upstream under higher flows. Creation of three step pools and a 30-foot concrete sidewall in 2002 has successfully restored passage to 12.5 miles of suitable habitat for juveniles and adults. (SYRTAC 2009).

Salsipuedes Creek Jalama Road Bridge Fish Passage Project

Also located on Salsipuedes Creek, the concrete low-flow passage barrier located approximately 70 feet downstream of Jalama Road Bridge and approximately 0.5 mile upstream of the Highway 1 project was restored in 2003. The concrete grade control structure across a bedrock channel created a 4-foot drop and leap barrier for both adult and juvenile *O. mykiss*. The fish ladder is comprised of four weirs and three plunge pools separated by a 0.9-foot drop, which satisfies adult *O. mykiss* passage criteria and is within the leaping ability estimated for larger juveniles as well. Each weir contains a 90 degree V-notch to provide passage at lower flows. Visual observations have documented both young-of-the-year and juvenile *O. mykiss* rearing in each of the step pools since 2004. Thus in addition to facilitating additional passage opportunities, the project had a secondary benefit of creating new oversummering habitat (SYRTAC 2009).

El Jaro Creek Demonstration Projects

El Jaro Creek is another tributary to Salsipuedes Creek and is primarily privately owned. Opportunities for addressing erosion and sedimentation issues and development of a management strategy relied on outreach, education and participation of private stakeholders. A series of demonstration projects have been implemented to demonstrate technically feasible and cost-effective sediment management solutions for reducing sedimentation in the tributary. To date, there have been three projects completed and complimented by two public workshops focusing on Best Management Practices, which were attended by 18 interested stakeholders.

1) An undersized culvert was removed and replaced with a properly sized culvert. The surrounding area was stabilized to reduce erosion and headcutting in the upslope gully.

2) Immediately downstream of the culvert project, a large scour hole had developed at a bend in the channel. This scour hole was filled with large boulders to reduce and limit storm related erosion.

3) Downstream of the scour hole, a floodplain enhancement project was implemented to reduce siltation, stabilize the banks and increase native riparian vegetation. A hard toe of 4 to 5 ton boulders was constructed at the base of the unstable slope, with the rocks placed so they were consistent with bankful elevation. Using native soils from the slump, the bank was backfilled and planted with willows.

El Jaro Creek Rancho San Julian Fishway

San Julian Ranch Fishway was designed and is operated to support upstream and downstream migration over a 7-foot-high migration barrier during both moderate to high flow conditions, as well as during extended low flow conditions. Two fishway configurations were incorporated into the 62-foot-long concrete structure, including entrance and exit, weir plates, wing baffles, trash rack, and an auxiliary water system. The structure was installed beneath the existing San Julian Ranch access bridge on the left bank of the stream channel (looking upstream). Completed in March 2009, the fishway has resulted in increased numbers of O. mykiss upstream of the structure.

El Jaro Creek Cross Creek Ranch Fish Improvement

Cross Creek Ranch fish passage improvement involved restoring 250 feet of channel bank and installing a series of five rock weirs within the active channel to allow fish passage over a low flow crossing of El Jaro Creek. Riprap, pipe, and wire revetments and gabion baskets were also removed. *O. mykiss* now spawn and oversummer within the project area.

Quiota Creek Fish Passage Projects

Quiota Creek, located approximately 8.4 miles downstream of Bradbury dam, drains a 7.6-square-mile tributary to the Santa Ynez River. The creek meanders along and under Refugio Road, resulting in nine at-grade concrete instream crossing barriers within 3 miles. These concrete crossings are in poor condition, and limit access to the spawning and rearing habitat located in the upper reach of the creek. Snorkel survey observations document a resident population of *O. mykiss* distributed in the perennial middle and upper reaches, where water temperatures are among the coolest observed, under a well-established riparian canopy. Repairing all nine crossings will restore over 2 miles of access and additional high quality habitat.

The crossings are numbered starting where the creek meets the mainstem of the Santa Ynez River and ascending upstream. Implementation of these passage improvements has been delayed due to a series of conflicts with regulatory agencies and Santa Barbara County. In 2008, the Cachuma ~~Conservation~~ Operation and ~~Release~~ Maintenance Board completed the removal of Crossing #6 and replaced it with a 48-foot bottomless arched culvert and associated channel and bank restoration using grant funding. Designs are in progress for replacing the other crossing and passage barriers (SYRTAC 2009)

Since not all of the projects listed in the Biological Opinion were completed by 2005, Reclamation has reinitiated consultation under Section 7 of the Endangered Species Act.

Nojoqui Creek Highway 101 Passage Impediment Repair Project

In June 2003, a feasibility analysis was completed to determine the potential biological benefit for enhancing fish passage in Nojoqui Creek as well as an evaluation of measures to enhance fish passage through the Highway 101 culvert (ENTRIX 2003). Analysis of the passage impediment at Nojoqui Creek, completed in 2003, found that implementation of the project was not warranted due to the lack of significant biological benefit and the high cost associated with enhancing passage.

Cachuma Project Biology Staff (CPBS) have continued to monitor habitat and fish usage in Nojoqui Creek. Monitoring through 2009 has confirmed that there is no oversummering habitat upstream of the bridge during the summer period due to the creek channel routinely going dry. Early annual surveys indicated only limited amounts of water were available in the system during summer and fall. This was apparent on several occasions when planned surveys could not be performed due to the stream being dry. Furthermore, CPBS observations from 2000-2004 have documented that the perennial section of Nojoqui Creek appears to be decreasing in length. As a result, annual surveys were discontinued, although the CPBS continued periodic surveys of the habitat and fish usage in the creek.

A reconnaissance-level spawning survey conducted by the CPBS in January 2004 did not document any steelhead/rainbow trout or evidence of spawning. In May 2005, CPBS conducted a snorkel survey from the second Highway 101 Bridge to the fourth Highway 101 Bridge along Nojoqui Creek in order to assess the presence of any steelhead/rainbow trout. This section appeared to represent the best available habitat quality along the creek yet no steelhead/rainbow trout were observed. CPBS has also observed sections of creek upstream of the Highway 101 culvert with little to no flow in the summers of 2005-2009 (CPBS 2005-2009). During a site visit by National Marine Fisheries Service (NMFS) and California Department of Fish and Game (CDFG) to the Highway 101 culvert and the reaches above the culvert on Nojoqui Creek in November 2006, the conditions were evaluated and they conclude that there was limited biological benefit of the habitat upstream of this passage barrier.

Nojoqui Creek was initially designated as critical habitat for steelhead in the Lower Santa Ynez River, but this designation has been removed in NMFS' most recent assessment suggesting that NMFS agrees that suitable habitat is not present in Nojoqui Creek.

2.4.3.2 Additional Measures on Hilton Creek

Construction of the Hilton Creek Watering System was completed in 2000, providing year-round flow of cool, well-oxygenated water withdrawn from Lake Cachuma and delivered by a pipeline with three separate release outlets, two located on Hilton Creek and the third outlet into the Stilling Basin located below the dam. The Biological Opinion required that Reclamation augment flows via a supplemental watering system, providing year-round flows with a minimum flow of 2 cfs. When Reclamation reduces supplemental flows in Hilton Creek, it must comply with the following ramping schedule for Hilton Creek: (1) releases from 10 to 5 cfs will be reduced at no greater than 1 cfs every 4 hours; and (2) releases below 5 cfs will be reduced at no greater than 0.5 cfs every 4 hours.

2.4.3.3 Fish Rescue Program

The Biological Opinion (as well as the BA Proposed Action) requires Reclamation to capture and relocate stranded *O. mykiss* that are vulnerable to exposure to elevated water temperatures, desiccation, or predation. Fish rescue operations would occur on an as-needed basis under the direction of the Adaptive Management Committee. The most likely relocation site for fish stranded in Hilton Creek, should the flow levels drop below sustainable levels include the Long Pool below the dam, portions of the mainstem between Bradbury Dam down to the Highway 154 bridge and the Long Pool, and certain downstream tributaries. Hydrologic analysis indicates that a fish rescue operation could be necessary in approximately 2 percent of all water years. Fish rescue operations must be conducted with the approval and requisite permits from DFG and NMFS, and are the expected adaptive management response to unfavorable hydrologic conditions in Hilton Creek, other tributaries or within the mainstem. As the abundance of *O. mykiss* increases in response to flow augmentation and habitat improvements, there may be a greater need to rescue fish. Although it is expected that all fish operations would follow the basic procedures outlined in the Hilton Creek Fish Rescue/Management Plan (2000), ongoing consultation and planning is needed to ensure prompt response to strandings. Reclamation successfully captured and relocated stranded *O. mykiss* in Hilton Creek in 1995 and 1998.

2.4.4 Additional Measures to Minimize Incidental Take

In addition to the operational modifications and conservation measures described above, the Biological Opinion requires Reclamation to implement a number of other reasonable and prudent measures necessary to minimize the incidental take of *O. mykiss*, three of which are operational in nature and described below.

2.4.4.1 Maintain Residual Pool Depth

The Biological Opinion requires that until the 3.0-foot surcharge is achieved and the 11 passage impediments along the mainstem and tributaries are completed, Reclamation must maintain pools in the Alisal and Refugio reaches in spill years and the first year after spill years, if *O. mykiss* are present. This action will be accomplished by maintaining residual pool depth using releases from Cachuma Lake. Residual pool depth is the difference between the elevation of the deepest point in the pool and the elevation of the lowest point of the crest (outlet depth) that forms the hydraulic control in the pool.

2.4.4.2 Alternative Passage Flow Releases

The Biological Opinion required Reclamation to design a strategy within six months of the issuance of the Biological Opinion to further refine the releases for *O. mykiss* migration. Such a strategy was to include shifting releases from dry years when releases may not be helpful to the *O. mykiss* population in the Santa Ynez River and review of storm flow decay curves (mean, median, etc.) and other methodologies for providing increased migration opportunity. To meet this requirement of the Biological Opinion, Reclamation has studied alternative passage flow criteria. The study was designed to address measures outlined in the Biological Opinion to: (1) modify the Fish Passage Supplementation Program during dry years, (2) better define the adaptive management program for upstream and downstream migration, and (3) outline a method to verify the effectiveness of the migration supplementation. The results of the study are presented in a memorandum entitled "Cachuma Project Fish Passage Supplementation Program: supplementation criteria, real-time decision making, and adaptive management" (Adaptive Management Committee, 2004). NMFS approved the Fish Passage Supplementation Program on October 11, 2005 (letter from NMFS, October 11, 2005).

Fish passage supplementation is triggered by two criteria: (1) flows in the Santa Ynez River at Solvang must be greater than or equal to 25 cfs, which indicates that continuous passage for adults from the ocean is possible provided the sandbar is breached; and (2) cumulative flow in Salsipuedes Creek has been equal to or greater than 1,000 af since December. The USGS stream gauge at Salsipuedes, perennial flow conditions and proximity to the ocean of this major south-side tributary provides insight into hydrologic conditions just prior to the onset of the migration season and provides an indicator of subsequent summer/fall low flow condition potential. This trigger is designed to prevent supplementation during the majority of "dry" water years.

Flow supplementation is designed to enhance the storm hydrograph at the Solvang gauge, using a decay function developed based on the hydrograph recession at the Los Laureles gauge, located above the Cachuma reservoir. The Solvang gauge recedes faster than that at Los Laureles, which takes approximately 14 days to go from 150 cfs to 25 cfs. Fourteen days is considered to be a reasonable minimum estimate of passage time for migrating fish. (AMC, 2004).

Flow supplementation was implemented in winter/spring 2006. The storms of February 28, 2006, and March 29, 2006, were both supplemented, resulting in 19 additional passage days in February and five additional passage days in March. Implementation of the Fish Passage Supplementation Program directed by the Real-Time Decision Making Group in coordination with Reclamation appears to achieve the desired passage augmentation goals identified in the Biological Opinion.

2.4.4.3 Restrictions on State Water Project Water Releases

The Biological Assessment described restrictions on the delivery of SWP water to the reservoir. SWP water will not exceed 50 percent of the amount of water released from Bradbury Dam at any given time. In addition, SWP water will not enter the stilling basin with a temperature over 18 degrees Celsius. Finally, the Biological Opinion requires that releases of SWP water to the mainstem in conjunction with water rights and fish enhancement releases shall not occur during the migration period of December through June, unless flow in the mainstem is discontinuous. This requirement has been met since 2001.

2.4.5 Conservation Recommendations

Section 7(a)(1) of the ESA (16 U.S.C. Section 1536 (a)) requires federal agencies to carry out programs for the conservation of threatened and endangered species. To that end, NMFS has developed three conservation recommendations to avoid adverse effects to Santa Ynez River *O. mykiss* and aid in their recovery. These actions are voluntary on the part of Reclamation. Specifically, NMFS recommends the following discretionary measures:

1. Investigation of alternative methods to provide downstream water right holders with water from the Cachuma project. This action could reduce the detrimental impacts sometimes associated with water right releases.

   As of 2010, no alternative methods for providing downstream water right releases have been analyzed and proposed.

2. Study methods to make Bradbury dam passable to steelhead. There is a large amount of steelhead habitat available upstream of the dam, which, if made accessible, could speed the recovery of the species.

   As of 2010, no studies have been conducted to identify and evaluate methods for making Bradbury dam passable for *O. mykiss.* Several upper basin studies have been conducted to evaluate historical extent of *O. mykiss* populations and their abundance, evaluate habitat quality and identify passage barriers (AMC 2004b, Cachuma Conservation Release Board 2008, Stoecker 2004). The genetic relationship between *O. mykiss* found in the mainstem, tributaries and upstream of the dams (including hatchery stocking information) has also been examined (Garza and Clemento 2007, Cachuma Conservation Release Board 2007).

3. Design a study to investigate the role of periodic flood flows on the geomorphology of the channel downstream of Bradbury dam. NMFS believes that these high flows play an important role in creating and maintaining steelhead habitat.

   As of 2010, a study investigating the role of periodic floods on channel geomorphology has not been completed.

2.5 FISH MANAGEMENT PLAN AND SUMMARY REPORTS

2.5.1 Lower Santa Ynez River Fish Management Plan (2000)

The ultimate goal of the SYRTAC was to develop appropriate flow requirements and resource management recommendations necessary to balance water supply needs and fisheries needs in the lower river. In 1994, the first long-term study plan was developed, which was the foundational work for the Lower Santa Ynez River FMP. It laid out a program of work to document and better understanding the life history and habitat conditions required by steelhead in order to develop restoration goals, management objectives, and a long-term management plan for the steelhead inhabiting the Santa Ynez River and its tributaries.

The SYRTAC prepared a draft Fish Management Plan based on data collected between 1993 and 1996 and issued it for public comment in April 1999. Public meetings to accept comments were conducted in Santa Barbara and Santa Ynez. The SYRTAC issued a final Fish Management Plan in October 2000. It incorporated the requirements of the Biological Opinion for the Cachuma Project issued by NMFS in September 2000 (see **Section 2.4**), as well as provided a road map for future studies and mitigation actions. The Fish Management Plan identifies specific reaches of the mainstem and tributaries for habitat protection and improvement. The Plan assigns highest priority to lower Hilton Creek, which is located on Reclamation property, and the mainstem of the river between Bradbury Dam and Highway 154 (**Figure 1-3**). Habitat conditions in these areas are relatively good, and water releases have the highest potential to benefit aquatic habitat. The Plan also assigns a high priority to enhancing habitats on the following tributaries, which have favorable flows and habitat conditions for aquatic resources: Quiota, El Jaro, and Salsipuedes creeks (**Figure 1-3**). The management actions focus on steelhead trout. However, all actions have been designed to either have no adverse impact on other native aquatic species along the river, or to result in incidental beneficial effects to these species, which include the tidewater goby, three-spine stickleback, prickly sculpin, Pacific lamprey, arroyo chub, southwestern pond turtle, and red-legged frog.

The management actions identified in the 2000 plan were designed to benefit *O. mykiss* and other aquatic species directly and indirectly by: (1) creating new habitat and improving existing habitat in the lower river and tributaries; (2) improving access to spawning and rearing habitats in the lower river and tributaries; and (3) increasing public awareness and support for beneficial actions on private lands. The plan is based on an adaptive management strategy that calls for long-term monitoring to observe trends in habitat conditions and *O.mykiss* populations. The performance of each management action has been monitored, and modified to improve its effectiveness and respond to annual variations in hydrologic and water supply conditions. In June 2009, the SYRTAC released the Summary and Analysis of Annual Fishery Monitoring in the Lower Santa Ynez River 1993-2004. This updated report provides analysis of 12 years of data collection related to hydrology, water quality, habitat, fishery populations and habitat enhancement actions. There were no major modifications or additional management actions added to those identified in the 2000 report. Key areas of interest with management implications that were examined in light of the 12-year monitoring database included:

- Factors affecting the quality and availability of *O. mykiss* spawning and rearing habitat:
- The role of tributary spawning and rearing habitat for *O. mykiss;*
- Summer-fall habitat fragmentation in the mainstem river and in the tributaries;
- Relationship between wet and dry year hydrology, migration and spawning by anadromous *O. mykiss*;
- The dynamic nature of the mainstem and tributary channels, especially during periods of high flow;
- The role of impediment and barriers to migrations; and
- Predation by warm-water fishes.

Information on conditions between 2005 and 2010 will be summarized in the annual report that will be released in 2011.

As part of the adaptive management strategy, a team of agency and water district representatives were organized as the Adaptive Management Committee to advise and review all management and monitoring activities. The Real-Time Decision Making Group was developed in 2005 as a response to the need to coordinate fish passage supplementation releases with Reclamation.

Monitoring activities outlined by the Fish Management Plan (2000) and documented in the SYRTAC 2009 Report focused on continued baseline monitoring of habitat conditions and populations dynamics in order to track any abundance increases related to management actions; special studies and investigations to answer specific questions, testable hypothesis and/or linkages between monitoring elements, associated management actions, and program guidance; and investigations designed to inform adaptive management decisions and provide guidance on future modifications and refinements to management actions and project operations, as implemented through 2004.

Additional data on trapping results, snorkel survey results, and habitat assessments from 2005 to 2010 are provided in **Appendix G**. Trapping efforts continued in Salsipuedes and Hilton creeks, and in the lower mainstem of the Santa Ynez River. The number of anadromous *O. mykiss* adults captured from 2005 – 2010 peaked with 16 in 2008. The genetic origin of the anadromous *O. mykiss* extends from rivers in Monterey County (two individuals) and included three individuals from San Luis Obispo County, although the majority of individuals were from the Salsipuedes (five individuals), Hilton (four individuals) and Quiota Creek tributaries of the Santa Ynez River (Table 10, **Appendix G)**. Anadromous *O. mykiss* adults were captured in seven out of 11 years. Both upstream and downstream migration has been documented in Hilton and Salsipuedes creeks since 2005. Summaries of trapping results are found in **Appendix G**.

Snorkel survey data from 2005-2010 indicates consistent presence of *O. mykiss* in the Refugio and Alisal reaches of the lower Santa Ynez River, as well as in the main tributaries including Hilton, Quiota, Salsipuedes and El Jaro creeks. The abundance of *O. mykiss* observed is highest in Hilton Creek, associated with the consistent availability of water (**Appendix G**).

Habitat quality assessment was quantified in 1999 and 2001 and qualitatively assessed thereafter (SYRTAC 2009). Since 2000, wet years and supplemental flows, along with passage restoration projects, have resulted in the extension of *O. mykiss* distribution within the mainstem and tributaries. The recovery of riparian vegetation associated with the interim target flow releases has increased cover and stabilized banks in some reaches downstream of the Highway 154 bridge, although the majority of the mainstem still has poorly developed riparian cover.

A summary map illustrating habitat quality and passage impediments/barriers is found in **Appendix G**. A summary of Fish Management Plan actions is provided in **Table 2-9, Summary of Fish Management Plan Actions**.

Table 2-9
Summary of Fish Management Plan Actions

Actions by Reclamation and Member Units
Conjunctive use[1] of releases made to satisfy downstream water rights and mainstem rearing releases
Fish passage supplementation
Adaptive management account
Hilton Creek habitat enhancement and fish passage project
Fish rescue program
Public education and outreach
Investigate passage around Bradbury Dam
Actions that Require Cooperation of Other Agencies and Private Landowners
Tributary enhancement measures
Tributary passage impediment removal
Mainstem habitat enhancement and protection
Genetic protection of Southern Steelhead populations
Access for adult steelhead to the upper watershed
Downstream passage for outmigrating juveniles from the upper watershed

1 *"Conjunctive use" is defined in the Settlement Agreement in* ***Appendix H***.

2.6 DRAFT STEELHEAD RECOVERY PLAN

In July 2009, National Marine Fisheries Service released the Draft Southern California Steelhead Recovery Plan (Recovery Plan). This plan outlines the recovery process necessary to accomplish the recovery of southern steelhead (*O. mykiss)* and its removal from the federal list of Endangered and Threatened Wildlife in the Southern California Distinct Population Segment (DPS) (formerly Evolutionarily Significant Unit). The Santa Ynez River is one of the four major rivers (along with the Santa Maria, Ventura, and Santa Clara rivers) included in the Monte Arido Highlands Biogeographic Population Group and is considered to be a Core 1 population. Core 1 populations are those identified as a high priority for recovery actions.

The Draft Recovery Plan identifies the following objectives for recovering southern steelhead (*O. mykiss*):

1. Prevent *O. mykiss* extinction by protecting existing populations and their habitats.

2. Maintain current distribution of *O. mykiss* and restore distribution to previously occupied areas that are essential for recovery.

3. Increase abundance of *O. mykiss* to viable population levels, including the expression of all life-history forms and strategies.

4. Conserved existing genetic diversity and provide opportunities for interchange of genetic material between and within metapopulations.

5. Maintain and restore suitable habitat conditions and characteristics for all life-history stages so that viable populations can be sustained.

6. Conduct research and monitoring necessary to refine and demonstrate attainment of recovery criteria.

In order to be considered viable, the Draft Recovery Plan indicates that the run size needs to be sufficient to result in an extinction risk of less than 5 percent within 100 years (estimated at 4,150 spawners/year) for the whole DPS (Boughton et al 2007); that run size must be met during years of poor ocean conditions; and that the anadromous fraction of the population should equal 100 percent of mean annual run size proposed. The Recovery Plan recognizes that spawner density is unknown at present and further research is needed. For the Monte Arido Highlands Biogeographic Population Group, all four Monte Arido Highlands populations must meet the above recovery criteria for viability in order to achieve the Draft Recovery Plan objectives as currently proposed. Additional factors that contribute to meeting the recovery criteria include viable populations inhabiting watersheds with drought refugia, viable populations separated from each other by at least 68 km or as widely dispersed as possible, and viable populations that express all three life-history stages (fluvial-anadromous, lagoon-anadromous, freshwater resident)

The Draft Recovery Plan lists the following critical recovery actions for the Santa Ynez River:

> *Implement operating criteria to ensure the pattern and magnitude of water releases from Bradbury, Gibraltar and Juncal dams comport with the natural or pre-dam pattern and magnitude of streamflow. Physically modify Bradbury, Gibraltar and Juncal dams to allow unimpeded volitional migration of steelhead to upstream spawning and rearing habitats. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats.*

This recommendation is consistent with the conservation recommendations included in the Biological Opinion stated in 2000, as described in **Section 2.4.5**.

Critical habitat for the Santa Ynez River was designated in September 2, 2005, (50 Federal Register 52488) and includes approximately 48 miles of the river and its tributaries downstream of Bradbury Dam. The river reaches upstream of Bradbury, Gibraltar, and Juncal dams are not included as critical habitat, however, populations of *O. mykiss* that exist upstream of introduced barriers are largely or entirely descended from relic *O. mykiss* populations ascending the watersheds historically (Boughton et al 2006). Garzo and Clemento (2007) examined the genetic relationships of 1,581 tissue samples from *O. mykiss* collected in traps in the Santa Ynez River below Bradbury Dam. They found that the Santa Ynez River maintains a spatially differentiated population similar to the patterns observed in most coastal steelhead populations and that both native and hatchery fish appear to have migrated downstream of Bradbury dam. Additionally, by examining other tissue samples originally studied by Nielsen (1998), they found that the native fish found upstream of the dam appear to be descended from anadromous *O. mykiss* historically, despite extensive stocking with hatchery fish over the years (Cachuma Conservation Release Board 2007). Hatchery fish do not appear to have significantly interbred into the wild strain, potentially due to different life cycle patterns.

Genetic studies indicate that life history forms (anadromous and freshwater) can be sympatric and each result in progeny that exhibits the other life history strategy (Zimmerman and Reeves 2000, McPhee et al 2007). Studies indicate that even today *O.mykiss* leave freshwater lakes and migrate to upstream tributaries (Bloom 2005). Therefore, the Draft Recovery Plan emphasizes restoring access to the approximately 40 river miles upstream of the barriers in the Santa Ynez River in order to promote ecological traits such as capacity to migrate long distances and withstand warmer temperatures. These adaptations are thought to be critical to promoting the ability to withstand the hot, dry climate, and potentially adjust to climate shifts associated with warming trends projected for the future.

Additionally, the Draft Recovery Plan outlines Threats Abatement Criteria, which consist of a matrix ranking potential threats such as passage barriers, urban development, wildfires, roads and groundwater extraction, which are tied to listing factors and priority for recovery actions. The threat source ranking for the Santa Ynez River identifies six very high threats such as dams and water surface diversions, groundwater extraction, agricultural development, recreational facilities, non-native species, and wildfires. The single high-level threat identified was flood control.

Urban development, levees and channelization, mining and quarrying, roads, urban effluents, agricultural effluents, and other passage barriers are identified as medium threats (NMFS 2009).

From this threat abatement assessment, the DPS recovery action matrix for the Santa Ynez River lists a total of 33 action categories that are ranked based on the level of threat (1-prevent extinction, 2-prevent significant decline, 3-all other actions for full recovery) combined with the five listing factors (a. Present or threatened destruction, modification or curtailment of habitat or range; b. Over-utilization for commercial, recreational, scientific or educational purposes; c. Disease and predation; d. inadequacy of existing regulatory mechanisms; and e. other natural or human made factors affecting continued existence) (NMFS 2009).

The recovery actions cluster in the following categories:

1A Physically modify Bradbury Gibraltar and Juncal dams to allow unimpeded volitional migration of steelhead to upstream spawning and rearing habitats.

1B Nine actions related to research and monitoring needed in order to recover steelhead, which includes implementing operational criteria to ensure the pattern and magnitude of water release to comport with natural or pre-dam patterns and magnitude of streamflow.

2A One action to develop and implement a plan to remove or physically modify all fish passage barriers identified in the Santa Ynez River watershed to allow unimpeded volitional migration of steelhead to upstream spawning and rearing habitats as identified in the Steelhead Migrations Assessment and Recovery Opportunities for the Santa Ynez River (2003) and the Santa Ynez River Fish Management Plan (2000.).

2B Twenty-one actions related to restoring watershed level function by relocating development, restoring riparian habitat and function and integrating local planning and permitting documents with fish recovery.

The above summary reflects the current recommendations of the Draft Recovery Plan. The final Recovery Plan is expected to be released within the next year.

2.7 SETTLEMENT AGREEMENT

In 2002, the Cachuma Project Settlement Agreement (Agreement) was approved by the Cachuma Conservation Release Board (CCRB)~~Member Units~~, the Santa Ynez River Water Conservation District (SYRWCD), Santa Ynez River Water Conservation District Improvement District No. 1 (ID No.1), and the City of Lompoc (the Parties). The Agreement is endorsed by Reclamation and supported by other entities (e.g., Cities of Solvang and Buelton). The Agreement is considered "global" in that it resolves outstanding issues between the parties, including water quantity, water quality, flood control and existing (at the time) litigation. Notably, it provides support for the Fish Management Plan and Biological Opinion, including the 3-foot surcharge. The Agreement resolves between the parties both water rights issues and fisheries issues. A copy of the Settlement Agreement is provided as **Appendix H**.

The basic provisions of the Agreement include:

1. **Support of WR 89-18.** The Parties agree that releases pursuant to WR 89-18 *as* modified by the Agreement will protect downstream water right holders and will not adversely affect water quality otherwise available downstream, and further agree to support WR 89-18 and the modifications in the Agreement as the appropriate mechanism for administering downstream water rights releases;

2. **Protection of Public_Trust Resources.** The Parties agree to mutually support the Terms and Conditions of the National Marine Fisheries Service (NMFS) Biological Opinion and the Fish Management Plan as the preferred operational program for the Cachuma Project in order to address public trust resource issues;

3. **Conjunctive Operation of WR 89-18 and Fish Water Releases.** The Parties agree that downstream water rights releases will be scheduled in accordance with existing provisions of WR 89-18 (Condition 5) assuring that such releases in the future are similar to the historical practices, such that

these releases operate conjunctively with the fish water releases required to meet target flows described in the NMFS Biological Opinion;

4. **Deliveries during Releases.** The Parties agree that deliveries of SWP water characterized by low concentrations of total dissolved solids (TDS) will be scheduled in accordance with existing provisions of the Warren Act contract such that deliveries of this low-TDS water will be maximized during periods of WR 89-18 water rights releases, consistent with limitations in the NMFS Biological Opinion. The objective of such co-mingling operations is to lower the TDS of water rights releases for the lower Santa Ynez River downstream of Bradbury Dam;

5. **~~Conjunctive~~ Operation of the Below Narrows Account and the Lompoc Groundwater Basin.** In order to resolve a dispute about the switch from "Curve A" to "Curve B" for determining BNA credits as provided in Condition 5 of Order WR 89-18, the Parties agree to operate the BNA Account conjunctively with the Lompoc groundwater basin. This involves remaining on "Curve A" so that more water is available in the Below Narrows area in all years, although some BNA water is made available to the Cachuma Member Units during shortage years;

6. **Livestream Determination and Other Monitoring Activity.** In order to accommodate changed circumstances (SWP deliveries to the Reservoir and releases of water for fish) and to provide for more comprehensive water quality sampling along the River downstream of Bradbury Dam, the Parties agree Conditions 5 and 6 of Order WR 89-18 require modification;

7. **Protest to Change in Place and Purpose of Use Withdrawn.** Lompoc will withdraw its protest to the Cachuma Project Change in Place and Purpose of Use in connection with Phase I of the Order WR 94-5 hearing;

8. **Modified Winter Storm Operations.** The Parties agree to Reclamation's adoption and continued use of "Modified Winter Storm Operations" as described in technical memoranda cited in the Agreement in order to help protect life and property along the Santa Ynez River downstream of Bradbury Dam; and

9. **Re-Opener.** The Parties agree to review and evaluate various provisions of the Agreement after 10 years of operation, and if there is substantial evidence that objectives are not being met, then the Agreement may be revised by mutual consent of the parties, with the concurrence of Reclamation and SWRCB when applicable. If agreement cannot be reached, then any party may request that the State Board review the matter in the manner provided by law.

3.0 PROPOSED PROJECT (ALTERNATIVES)

3.1 PROPOSED PROJECT

3.1.1 Description of the Proposed Project

Project Characteristics

As described in greater detail in **Section 1.0**, the project analyzed in this EIR consists of potential modifications to Reclamation's existing water rights permits (11308 and 11310; Applications 11331 and 11332) to provide appropriate protection of downstream water rights and public trust resources on the Santa Ynez River downstream of Bradbury Dam.

As stated in the Notice of Preparation (NOP), development of revised release requirements and other conditions, if any, in the Reclamation water rights permits (Applications 11331 and 11332) for the Cachuma Project will take into consideration the NMFS's Biological Opinion and the draft Lower Santa Ynez River Fish Management Plan and other reports called for by Order WR 94-5. The revised release requirements are to provide appropriate public trust and downstream water rights protection. Protection of prior rights includes maintenance of percolation of water from the stream channel; as such percolation would occur from unregulated flow, in order that the operation of the project shall not reduce natural recharge of groundwater from the Santa Ynez River below Bradbury Dam.

The hearing process has established an understanding of the scope of the project, as detailed in the Cachuma Hearing Notice issued by the SWRCB on September 25, 2000, and revised on August 13, 2003. The notices state that the SWRCB will be determining "if modifications in permit terms and conditions for Permits 11308 and 11310 of the U.S. Bureau of Reclamation are necessary to protect public trust resources and water right holders on the Santa Ynez River below Bradbury Dam."

Currently, Reclamation releases water to satisfy downstream water rights in accordance with requirements imposed by SWRCB Orders WR 73-37 and WR 89-18, as described in **subsection 2.2.3**, above, and the requirements of the Biological Opinion. The proposed project entails a potential modification of existing release requirements under these Orders.

SWRCB Order WR 94-5 required Reclamation to release water for the benefit of fishery resources in accordance with the 1994 MOU between Reclamation and various parties that is described in **subsection 2.3**, above. Independent of the release requirements under Order WR 94-5, Reclamation has recently modified its operations to allow for additional releases for purposes of protecting and enhancing habitat for the endangered southern steelhead along the river below Bradbury Dam in accordance with the

Biological Opinion issued by NMFS (discussed in **subsection 2.4**, above), and the Lower Santa Ynez River Fish Management Plan (discussed in **subsection 2.5**, above). The proposed project entails potential modification of the releases required under Order WR 94-5, and potential imposition of other requirements, taking into consideration the requirements of the Biological Opinion and Fish Management Plan, and the instream flow requirements advocated by CalTrout (discussed in **subsection 3.2.2**, below).

Project Objectives

The *State CEQA Guidelines* (Sec. 15124(b)) indicate that the EIR, as part of the project description, should contain "a statement of objectives sought by the proposed project. A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding considerations, if necessary. The statement of objectives should include the underlying purpose of the project."

The objectives for the project are:

- Protecting public trust resources, including but not limited to steelhead, red-legged frog, tidewater goby, and wetlands, in the Santa Ynez River downstream of Bradbury Dam, to the extent feasible and in the public interest, taking into consideration: (1) the water supply impacts of measures designed to protect public trust resources, and (2) the extent to which any water supply impacts can be minimized through the implementation of water conservation measures;

- Protecting senior water right holders from injury due to changes in water quality resulting from operation of the Cachuma Project, including water quality effects in the Lompoc Plains groundwater basin that impair any senior water right holder's ability to beneficially use water under prior rights; and

- Protecting senior water right holders from injury due to a reduction in the quantity of water available to serve prior rights.

3.1.2 Downstream Water Rights

Downstream water rights consist of appropriative and riparian rights to divert from the Santa Ynez River surface or subterranean stream, and groundwater diversion from groundwater basins that under natural conditions would be recharged by the river.

Known water right holders are listed ~~below~~in **Table 3-1a, Existing and Claimed Water Rights and Diversions Along the Santa Ynez River**

Table 3-1a
Existing and Claimed Water Rights and Diversions along the Santa Ynez River

Location	Application ID	Permit ID	License ID	Water Right Type	Status	Holder Name	Date	Face Amount	County	Source
Bradbury Dam to Alisal Bridge (Solvang)	S015195_01	_	_	Statement of Diversion and Use	Claimed	John V. Crawford	11/19/1999	1000 acre-ft/yr	Santa Barbara	Santa Ynez River
	S020791_01	_	_	Statement of Diversion and Use	Claimed	Palmer Gavit Jackson Trust	04/19/2011	778 acre-ft/yr	Santa Barbara	Santa Ynez River
	S020793_01	_	_	Statement of Diversion and Use	Claimed	Palmer Gavit Jackson Trust	04/19/2011	778 acre-ft/yr	Santa Barbara	Santa Ynez River
	A004007	1831	1261	Appropriative	Licensed	Anne V. Crawford-Hall	2/10/1933	1,219.90 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A012601	7436	10415	Appropriative	Licensed	Santa Ynez River Water Conservation District, ID No. 1	7/21/1948	515 acre-ft/yr	Santa Barbara	Santa Ynez River
	A011331	11308	_	Appropriative	Permitted	U.S. Bureau of Reclamation	3/19/1958	347,397.80 acre-ft/yr	Santa Barbara	Santa Ynez River
	A011332	11310	_	Appropriative	Permitted	U.S. Bureau of Reclamation	3/19/1958	311,198.90 acre-ft/yr	Santa Barbara	Santa Ynez River
	A022423_02	15878	_	Appropriative	Permitted	City of Solvang	03/15/1966	3600 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A024578_01	17733	_	Appropriative	Permitted	Santa Ynez River Water Conservation District, ID No. 1	03/22/1974	2220 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A024579_01	17734	_	Appropriative	Permitted	Santa Ynez River Water Conservation District, ID No. 1	02/28/2001	3400 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	S008667			Statement of Diversion and Use	Inactive	Patricia Lee Myers	04/22/2009	0 acre-ft/yr	Santa Barbara	Santa Ynez River
Alisal Bridge to 101 Bridge (Buellton)	S020792_01	_	_	Statement of Diversion and Use	Claimed	Palmer Gavit Jackson Trust U/A 2/25/88	04/19/2011	778 acre-ft/yr	Santa Barbara	Santa Ynez River
	S020794_01	_	_	Statement of Diversion and Use	Claimed	Palmer Gavit Jackson Trust U/A 2/25/88	04/19/2011	778 acre-ft/yr	Santa Barbara	Santa Ynez River
101 Bridge to Pacific Ocean	S015121_01	_	_	Statement of Diversion and Use	Claimed	Mary Jane M. Edalatpour	11/02/1999	76 acre-ft/yr	Santa Barbara	Santa Ynez River
	S015229_01	_	_	Statement of Diversion and Use	Claimed	Alan H. Mercer	06/07/2000	50 acre-ft/yr	Santa Barbara	Santa Ynez River
	S016616_1	_	_	Statement of Diversion and Use	Claimed	Georgia S. Gammie Weister Trust	06/07/2010	1 acre-ft/yr	Santa Barbara	Santa Ynez River
	S016934_1	_	_	Statement of Diversion and Use	Claimed	Mary Jane M. Edalatpour	06/08/2010	3 acre-ft/yr	Santa Barbara	Santa Ynez River
	S016935_1	_	_	Statement of Diversion and Use	Claimed	Mary Jane M. Edalatpour	06/08/2010	118 acre-ft/yr	Santa Barbara	Santa Ynez River
	S016948_1	_	_	Statement of Diversion and Use	Claimed	Allison Gammie Hill, et. Al.	06/15/2010	1 acre-ft/yr	Santa Barbara	Santa Ynez River
	S016951_1	_	_	Statement of Diversion and Use	Claimed	John S. Hill	06/15/2010	8.6 acre-ft/yr	Santa Barbara	Santa Ynez River
	S017091_1	_	_	Statement of Diversion and Use	Claimed	Miller Merritt Trust	07/01/2010	11 acre-ft/yr	Santa Barbara	Santa Ynez River
	S017100	_	_	Statement of Diversion and Use	Claimed	Miller Merritt Trust	7/1/2010	7.5 acre-ft/yr	Santa Barbara	Santa Ynez River
	S017124_1	_	_	Statement of Diversion and Use	Claimed	Miller Merritt Trust	07/01/2010	162 acre-ft/yr	Santa Barbara	Santa Ynez River
	S017145_1	_	_	Statement of Diversion and Use	Claimed	Bruce A. Steele	07/01/2010	59 acre-ft/yr	Santa Barbara	Santa Ynez River
	S017151_1	_	_	Statement of Diversion and Use	Claimed	Bruce A. Steele	07/01/2010	0 acre-ft/yr	Santa Barbara	Santa Ynez River
	S020795_01	_	_	Statement of Diversion and Use	Claimed	Palmer Gavit Jackson Trust	04/19/2011	701 acre-ft/yr	Santa Barbara	Santa Ynez River
	A002394A	1276	001313A	Appropriative	Licensed	N Edalatpour	06/17/1921	53 acre-ft/yr	Santa Barbara	Santa Ynez River
	A002394B	1276	001313B	Appropriative	Licensed	Gene Shaw	1/23/1969	50 acre-ft/yr	Santa Barbara	Santa Ynez River
	A003927A	_	000932A	Appropriative	Licensed	Michael P. O"Brien	05/03/2002	146 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A003927B	_	000932B	Appropriative	Licensed	John M. Sundheim	05/03/2002	36 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A003927C		000932C	Appropriative	Licensed	Daniel H. Gainey Truct	05/03/2002	36 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A022423_01	15878	_	Appropriative	Permitted	City of Solvang	03/15/1966	3600 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A022516_01	15879	_	Appropriative	Permitted	City of Buellton	07/01/1966	1385 acre-ft/yr	Santa Barbara	Santa Ynez River Underflow
	A023960_01	17447	_	Appropriative	Permitted	Santa Ynez River Water Conservation District	01/06/1972	40000 acre-ft/yr	Santa Barbara	Santa Ynez River
Additional Statement not in eWRIMS										
	_	_	_	_	Claimed	Gildred Trust	_	27.12 acre-ft/yr	Santa Barbara	Santa Ynez River Alluvial Basin
	_	_	_	_	Claimed	Petersen Family Properties,	_	10.9 acre-ft/yr	Santa Barbara	Santa Ynez River Alluvial Basin
	_	_	_	_	Claimed	Petersen Family Properties	_	0.01 acre-ft/yr	Santa Barbara	Santa Ynez River Alluvial Basin
	_	_	_	_	Claimed	Petersen Family Properties	_	0.80 acre-ft/yr	Santa Barbara	Santa Ynez River Alluvial Basin
	_	_	_	_	Claimed	Petersen Family Properties	_	10.80 acre-ft/yr	Santa Barbara	Santa Ynez River Alluvial Basin
	S0004237	_	_	_	Claimed	Pitts	_	2.12 cfs from Mar 1 to Oct 31	Santa Barbara	Santa Ynez River Alluvial Basin
	_	_	_	_	Claimed	Slavik Trust	_	14.0 acre-ft/yr	Santa Barbara	Santa Ynez River Alluvial Basin

Source: SWRCB, eWRMIS data base, October, 2011.
Note: information on this table is also provided in body of the ER text.

Appropriative Diverters – Above Narrows

The following have licenses and permits:

- **City of Solvang, Permit 15878 (Application 22423)**. Maximum diversion of 5 cfs for municipal and industrial purposes from Santa Ynez River underflow. The City has two wells located in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin. Production from 1997-1999 ranged from 879 to 1,053 afy, at a maximum diversion rate of 1.8 cfs. The permit expired in 1990 and the City filed a petition for a time extension with the SWRCB, which was denied; the City has filed a petition for reconsideration, and the SWRCB's~~s denied the extension in 2010 and the City has requested reconsideration. The's~~ action is still pending.

- **City of Buellton, Permit 15879 (Application 22516)**. Maximum diversion of 3.1 cfs for municipal and industrial purposes with an annual diversion limit of 1,385 afy. The City has three wells in the Santa Ynez River. Buellton petitioned the SWRCB to modify its place of use and add a new well to the permit. Action on the petition is being consolidated with Buellton's request for a license for its maximum annual use in 1996 of 2.7 cfs, with an annual diversion limit of 557 afy.

- **SYRWCD, ID #1, Permit 17733 (Application 24578)**. Maximum diversion of 4 cfs, from Santa Ynez River underflow, with an annual diversion limit of 2,220 af. Water diversion facilities include wells that are located in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.

- **SYRWCD, ID #1, Permit 17734 (Application 24579)**. Maximum diversion of 6 cfs, from Santa Ynez River underflow, with an annual diversion limit of 3,400 af. Water diversion facilities include wells located in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.

- **SYRWCD, ID #1, License 10415 (A12601)**. Maximum diversion of 1.73 cfs, from Santa Ynez River underflow, with an annual diversion limit of 515 af. Water is diverted from an infiltration gallery in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.

- **Edalatour, License 1313A (Application 2394A)**. Maximum diversion of 0.52 cfs with an annual diversion limit of 53 afy. Water is diverted from the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Mercer et al (Shaw), License 1313B (Application 2394B)**. Maximum diversion of 0.30 cfs with an annual diversion limit of 50-afy limit. Water is diverted from the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **O'Brien, et al. (Sundheim, Gainey), Licenses 932A, 932B and 932C (Applications 3927A, 3927B and 2927C)**. Total diversion of 0.81 cfs, split as follows. License 932A allows diversion of 0.51 cfs with a diversion limit of 146 afy. License 932B allows diversion of 0.11 cfs with a diversion limit of 36 afy. License 932C allows diversion of 0.19 cfs with a diversion limit of 36 afy. Water is diverted from the Santa Rita East Subarea of the Santa Ynez River Alluvial Basin.

- ~~**CWright and Torres, License 790 (Application 4034)**. Maximum diversion of 0.62 cfs. Diversion is from Santa Rita West Subarea of the Santa Ynez River Alluvial Basin.~~

- **~~C~~rawford-Hall ~~and San Lucas Ranch~~, License 1261 (Application 4007)**. Maximum diversion of 2.5 cfs from the Santa Ynez River. Water is diverted from the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.

Appropriative Diverters – Below Narrows

The following have permits:

- **SYRWCD, Permit 17447 (Application 23960)**. Maximum diversion of 100 cfs (40,000-afy limit) from the Santa Ynez River for groundwater storage. Diversion works consisting of sand dikes in the stream course were destroyed by high runoff in 1983 and have not been replaced. SYRWCD has petitioned to change its project, and petitioned for a time extension. SWRCB action on the petitions is being held in abeyance based on SYRWCD's proposal, as CEQA lead agency, to complete environmental documentation for the petitions after the SWRCB certifies the final EIR for the Cachuma Project. Water is diverted from the Eastern Plain Subarea of the ~~Santa Ynez River Alluvial~~Lompoc Basin.

Riparian Diverters – Above Narrows

The following have provided statements of diversion and use:

- **Crawford, Statement S015195**. Claims the right to divert 1.37 cfs for irrigation and stockwatering, with a maximum annual use of 1000 af. The season of diversion is from May 1 to October 31 for irrigation and January 1 to December 31 for stockwatering. Diversion is from Santa Ynez River Subarea of the Santa Ynez River Alluvial Basin.

- **Edalatpour, Statement S015121.** Claims a right to divert 76 acre-ft/yr for domestic and irrigation use year-round from the Santa Ynez River.

- **Edalatpour, Statement S016934.** Claims a right to divert 3 acre-ft/yr for domestic use year-round. Water is diverted from a well in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Edalatpour, Statement S016935.** Claims a right to divert 118 acre-ft/yr for irrigation year-round. Water is diverted from a well in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Hill, et al, Statement S016948.** Claims a right to divert 1.0 acre-ft/yr for domestic and livestock watering purposes year-round. Water is diverted from a well 0.25 mile south of the Santa Ynez River in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Hill, Statement S016951.** Claims a right to divert 8.6 acre-ft/yr for domestic and irrigation purposes year-round. Water is diverted from a well 0.25 mile south of the Santa Ynez River in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Mercer, Statement S015229**. Claims the right to divert 0.65 cfs for domestic and irrigation purposes, with a maximum annual diversion of 50 af. The season of diversion for irrigation is May 1 to October 31. The season for domestic uses is year-round. Diversion is from Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Merrit Trust, Statement S017091.** Claims a right to divert 11 acre-ft/yr for domestic, livestock watering, and irrigation purposes year-round. Diverted from a well 0.1 mile from the Santa Ynez River in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Merrit Trust, Statement S017100.** Claims a right to divert 7.5 acre-ft/yr for domestic and livestock watering purposes year-round. The water is diverted from a well located 0.1 mile from the Santa Ynez River in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Merrit Trust, Statement S017124.** Claims a right to divert 162 acre-ft/yr to irrigation April through November. Water is diverted from a well 0.1 mile from the Santa Ynez River in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

- **Myers, Statement S008667**. Claims the right to divert 0.117 cfs for irrigation from May 1 to September 30. Diversion is from the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin. (Inactive).

- **Palmer-Gavit Jackson Trust S020791, S020792 S020793 and S020792**. Claims a right to divert 778 acre-ft/yr for domestic and irrigation use from the Santa Ynez River.

- **Pitts, Statement S004237**. Claims the right to divert 2.12 cfs from March 1 to October 31. Diversion is from Santa Rita East Subarea of the Santa Ynez River Alluvial Basin.

- **Steele, Statement S017145.** Claims a right to divert 59 acre-ft/yr for year-round irrigation. Water is diverted from a well in the Solvang Subarea of the Santa Ynez River Alluvial Basin.

- **Steele, Statement S017151.** Claims a right to divert 0.52 acre-ft/yr for domestic and livestock watering purposes year-round. Water is diverted from a well adjacent to the Santa Ynez River in the Solvang Subarea of the Santa Ynez River Alluvial Basin.

- **Weister Trust, Statement S016616.** Claims a right to divert 1 acre-ft/yr for livestock watering. The season of diversion is year-round. Water is diverted from a well located 0.25 mile south of Santa Ynez River in the Buellton Subarea of the Santa Ynez River Alluvial Basin.

The following statements have been received by the SWRCB but not yet entered into the electronic Water Rights Information Management System (e-WRIMS):

- **Gildred Trust.** Claims a right to divert 27.12 acre-ft/yr for domestic and pasture irrigation year-round. The water is diverted from a well in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.

- **Palmer Gavit Jackson Trust.** Claims a right to divert 1,020 acre-ft/yr for irrigation use on riparian land. The water is diverted from five wells located in the Solvang and/or Santa Ynez Subareas of the Santa Ynez River Alluvial Basin. The Trust has filed another Statement of Diversion (April 14, 2011) for the five wells for the years 2000 through 2010.

- **Petersen Family Properties.** Claims a right to divert 10.9 acre-ft/yr for sand and gravel washing year-round. Water is diverted from a well in the Solvang Subarea of the Santa Ynez River Alluvial Basin.

- **Petersen Family Properties.** Claims a right to divert 0.01 acre-ft/yr for irrigation year-round. Water is diverted from a well in the Solvang Subarea of the Santa Ynez River Alluvial Basin.

- **Petersen Family Properties.** Claims a right to divert 0.80 acre-ft/yr for domestic use year-round. Water is diverted from a well in the Solvang Subarea of the Santa Ynez River Alluvial Basin.

- **Petersen Family Properties.** Claims a right to divert 10.80 acre-ft/yr for water truck fill and dust control year-round. Water is diverted from a well in the Solvang Subarea of the Santa Ynez River Alluvial Basin.

- **Slavik Trust.** Claims a right to divert 14.0 acre-ft/yr for domestic, livestock watering, and irrigation year-round. The water is diverted from a well in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.

Riparian Diverters - Below Narrows

- No riparian diverters exist below the Narrows with Statements of Water Diversion and Use on file with the SWRCB.

Groundwater Pumpers

The following pump groundwater:

- City of Lompoc, Vandenberg Village Community Services District, Mission Hills Community Services District, and private landowners pump from the Lompoc Basin, which includes the Lompoc Uplands and Lompoc Terrace (both hydrologically connected to the river) and the Lompoc Plain, which receives direct recharge from the river.

- Groundwater also is pumped from upland basins along the Santa Ynez River that are not hydrologically connected to the river. Private landowners, small mutual water companies, SYRWCD, ID #1, City of Buellton, and the City of Solvang pump from the Santa Ynez Upland Basin, Buellton Upland Basin, and Santa Rita Upland Basin for municipal, industrial and irrigation uses within the SYRWCD. Extractions from these upland basins are not considered downstream water rights for the purposes of this EIR.

3.1.3 Public Trust Resources

As discussed in **subsection 1.4.1**, rights to use water are subject to the Public Trust Doctrine. Public trust resources for this project include the following resources that occur at Cachuma Lake and/or along the Santa Ynez River downstream of Bradbury Dam:

- Endangered southern steelhead trout occur along the lower river;

- Other native fish, amphibians, reptiles, birds, and mammals occur along the river and at the lake;

- Threatened or endangered wildlife occur at the lake (bald eagle), along the lower river (California red-legged frog, southern willow flycatcher, and others), and at the mouth of the river (snowy plover, least tern, brown pelican);
- Riparian vegetation exists along the lower river; and
- Recreational activities occur in and around the lake and river.

3.2 ALTERNATIVES

3.2.1 Development of Alternatives

The SWRCB issued a NOP May 1999 with four alternatives:

1. Operations based on Order WR 73-37, as amended by Order WR 89-18.
2. Operations based on Order WR 73-37, as amended by WR 89-18 plus any conditions contained in the Biological Opinion issued by NMFS.
3. Operations based on Order WR 73-37, as amended by Order WR 89-18 plus any conditions contained in the Biological Opinion and any additional measures contained in the 1999 draft Lower Santa Ynez River Fish Management Plan.
4. Operations based on Order WR 73-37, as amended by Order WR 89-19 plus any conditions contained in the Biological Opinion, any additional measures contained in the 1999 draft Lower Santa Ynez River Fish Management Plan, plus the exchange of imported SWP water for all or part of the water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.

In December 2000, the SWRCB revised the original set of alternatives to be addressed in the EIR. SWRCB staff defined seven variations of the original alternatives in the NOP. The new alternatives incorporated the requirements of the Biological Opinion.

In November 2001, SWRCB staff provided additional clarification to Reclamation concerning the December 2000 set of alternatives. SWRCB staff clarified that the baseline operations alternative should reflect any changes in Cachuma Project operations that had occurred or other fish enhancement activities that had taken place since NMFS issued the Biological Opinion.

The SWRCB developed a Draft EIR for the project that was circulated in August 2003. The Draft EIR analyzed the following alternatives, all of which incorporate the requirements of the Biological Opinion:

1. Operations under the Original WR Order 89-18.
2. Baseline Operations under Orders WR 89-18, WR 94-5 and the Biological Opinion (interim release requirements only) – environmental baseline conditions.

3A. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage would be provided with current 0.75-foot surcharge.

3B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage would be provided with a 1.8-foot surcharge.

3C. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge.

4A. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and provision of State Water Project (SWP) water directly to the City of Lompoc in exchange for water available for groundwater recharge in the Below Narrow Account established by Order WR 73-37, as amended by Order WR 89-18.

4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and the discharge of SWP water to the river near Lompoc in exchange for water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.

In accordance with the *State CEQA Guidelines* Section 16126.6 (e)(1) the Draft EIR provides analysis of a "No Project" alternative. The purpose of describing and analyzing a no project alternative is to allow decision makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project. The no project alternative analysis is not the baseline for determining whether the proposed project's environmental impacts may be significant, unless it is identical to the existing environmental setting analysis, which does establish that baseline.

The 2003 Draft EIR considered Alternative 2, which represented the environmental baselines conditions at the time, as the No Project Alternative. The 2003 Draft EIR compared Alternative 2, then-existing conditions, to Alternative 1, historic conditions, in order to evaluate the changes that had taken place since Reclamation began to implement interim target flows pursuant to the Biological Opinion; Alternative 1 did not represent existing or baseline conditions.

Since August 2003, Reclamation has constructed spillgate modifications allowing a surcharge of 1.8 and then 3.0 feet to be implemented. As a result, Alternative 2 no longer reflects existing conditions. However, as explained below, it is still appropriate to use Alternative 2 as the baseline for purposes of evaluating the potential environmental impacts of the remaining alternatives. The surcharge also renders Alternative 3A obsolete because that alternative was based on the assumption that Reclamation would be allowing a 0.75-foot surcharge. Finally, the SWRCB no longer considers Alternative 4A, which required the cooperation of the City of Lompoc, to be feasible, as a result of that City's choice not to pursue the proposed arrangement.

The SWRCB formulated two new alternatives since the circulation of the August 2003 Draft EIR: Alternatives 5B and 5C. These alternatives are derived from Alternative 3A2 from the 1995 Cachuma Project Contract Renewal EIR/EIS (Reclamation and CPA, 1995). Under Alternative 3A2, which is described in detail in **subsection 3.2.2**., Reclamation would be required to maintain certain flows in the Santa Ynez River at specified locations in order to benefit fishery resources. Under Alternatives 5B and 5C, the Cachuma Project would be operated pursuant to Alternative 3A2 during wet and above-normal water years, and pursuant to the operations dictated by the Biological Opinion during below-normal, dry and critical water years. Alternatives 5B and 5C would provide higher flows for fishery resources than Alternatives 3B, 3C, and 4B during wet and above-normal years when more water is available. By switching to the long-term flow requirements in the Biological Opinion during below-normal, dry and critical years, Alternatives 5B and 5C would have less of an impact on the water supply available from the Cachuma Project than Alternative 3A2.

Under Alternatives 5B and 5C, flow requirements to protect fishery resources would be the same, but the two alternatives assume that Reclamation would implement different surcharge levels at Cachuma Lake. Like Alternative 3B, Alternative 5B assumes a 1.8-foot surcharge. Like Alternative 3C, Alternative 5C assumes a 3.0-foot surcharge. In summary, the alternatives included in the August 2007 Revised Draft EIR are listed below and described in the following subsections:

2. Baseline Condition Operations under Orders WR 89-18 and WR 94-5 and the Biological Opinion interim flow requirements.

3B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage would be provided with a 1.8-foot surcharge.

3C. Existing operations under the Biological Opinion and Settlement Agreement assuming Reclamation achieves a 3.0-foot surcharge.

4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and the discharge of SWP water to the river near Lompoc in exchange for water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.

5B. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry and critical water year types, assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with a 1.8-foot surcharge.

5C. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry and critical water year types, assuming Reclamation achieves a 3.0-foot surcharge.

As provided for by the *State CEQA Guidelines* Section 15126.6(e)(1), the "No Project" alternative can analyze the existing conditions as they exist at the time that the environmental impact report is prepared, as well as what could be reasonably expected to occur in the foreseeable future if the permit applications were not approved, based on current plans and consistent with available infrastructure and services. As such, the Revised Draft EIR considered Alternative 3C, which reflects existing operations under the Biological Opinion and Settlement Agreement, as the No Project Alternative. However, the Revised Draft EIR still considers Alternative 2 as the baseline conditions.

A summary of the alternatives is provided in **Table 3-1b, Summary of Alternatives Addressed in the EIR,** and **Table 3-2, Key Elements of the Alternatives**.

Table 3-1b
Summary of Alternatives Addressed in the EIR

Alternative	Key Elements
2. Baseline condition operations - operations incorporating current Biological Opinion requirements, including interim rearing target flows.	Includes Order WR 89-18 releases with revised ramping schedule, releases for interim rearing target flows, emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity feed and pump releases, and surcharging at 0.75'. This alternative also includes certain non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
3B. Operations incorporating Biological Opinion requirements, including long-term rearing target flows. Surcharging at 1.8'.	This alternative represents the new operations to be implemented as required by the Biological Opinion assuming Reclamation achieves a 3.0' surcharge, except that all releases for rearing and passage will be provided from a combination of 1.8' surcharging and water supply. Includes emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity and pumped releases, and Order WR 89-18 releases with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
3C. Operations incorporating Biological Opinion and Settlement Agreement requirements, including long-term rearing target flows. Surcharging at 3.0'.	This alternative represents the new operations to be implemented as required by the Biological Opinion and Settlement Agreement assuming Reclamation achieves a 3.0' surcharge. Releases for rearing and passage will be provided from a 3.0' surcharge. Includes emergency winter storm operations, SWP mixing and associated water release restrictions, Hilton Creek gravity feed and pumped releases, and Order WR 89-18 including conjuctive use for fish flows releases and with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
4B. Operations incorporating Biological Opinion requirements, with additional actions to address water quality in the Lompoc Basin.	Includes fish releases under Alternative 3C, as well Discharge of SWP water to the river near Lompoc for recharge in exchange for Below Narrows Account water.

Alternative	Key Elements
5B Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the long-term Biological Opinion operations during below-normal, dry and critical water year types. Surcharging at 1.8′.	This alternative represents the operations to be implemented as required by the Biological Opinion assuming Reclamation achieves a 3.0′ surcharge, except that all releases for rearing and passage will be provided from a combination of 1.8′ surcharging and water supply. During wet and above-normal water year types, releases for fish will occur under the operations as proposed in CalTrout Alternative 3A2. Includes emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity and pumped releases, and Order WR 89-18 releases with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.
5C. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the long-term Biological Opinion operations during below-normal, dry and critical water year types. Surcharging at 3.0′.	This alternative represents the operations to be implemented as required by the Biological Opinion assuming Reclamation achieves a 3.0′ surcharge. All releases for rearing and passage will be provided from a 3.0′ surcharge. During wet and above-normal water year types, releases for fish will occur under the operations as proposed in CalTrout Alternative 3A2. Includes emergency winter storm operations, SWP water release restrictions, Hilton Creek gravity feed and pumped releases, and Order WR 89-18 releases with revised ramping schedule. This alternative also includes non-flow fish conservation measures required by the Biological Opinion, affecting the mainstem and tributaries.

Table 3-2
Key Elements of the Alternatives

Key Elements	Alternatives					
	2	3B	3C	4B	5B	5C
Releases for downstream water rights pursuant to Order WR 89-18 releases	X	X	X[1]	X	X	X
Emergency winter storm operations	X	X	X	X	X	X
Revised Order WR 89-18 ramping schedule	X	X	X	X	X	X
SWP water seasonal restrictions on releases, and limits on mixing percentage	X	X	X	X	X	X
Surcharge to 0.75 foot	X					
Surcharge to 1.8 feet		X			X	
Surcharge to 3 feet			X	X		X
Releases for interim rearing target flows per the Biological Opinion	X					
Releases for long-term operations for fish per the Biological Opinion		X	X	X		
Fish Releases using a combination of the long-term fish releases under the Biological Opinion and the 3A2 Operating Criteria					X	X
Other habitat enhancement actions under Biological Opinion, primarily consisting of tributary projects	X	X	X	X	X	X
Delivery of SWP water to Lompoc Forebay in exchange for BNA water				X		

As modified by the Settlement Agreement for 3C.

3.2.2 Description of Alternatives

3.2.2.1 Alternative 2 – Baseline Condition Operations

Under this alternative, the release requirements for the protection of downstream water rights specified in Order WR 89-18 would remain unchanged. Independent of the water right permit requirements, Reclamation would implement the interim requirements of the Biological Opinion issued by NMFS. These requirements include interim rearing target flows with no releases for fish passage. This alternative also includes other steelhead conservation actions described in the Biological Opinion (and Fish Management Plan) such as the Hilton Creek and other tributary passage improvement projects. It includes the 0.75-foot surcharging, conveyance of SWP water through the Cachuma Project facilities, and the emergency winter storm operations. Under this alternative, releases for interim rearing target flows pursuant to the Biological Opinion are made without the benefit of the additional storage capacity created by a 1.8 or 3.0-foot surcharge. Releases for fish would also be met through conjunctive use with water rights releases. The average annual amount to meet the Biological Opinion interim release requirements is estimated to be 2,500 af, not including tributary inflows below Cachuma Lake and spills from Cachuma Lake. The breakdown of releases that meet the rearing target flows is as follows:

	Afy
Project Releases	1,400
Water Right Releases	700
Leakage from the Dam	400
Total	2,500

The leakage quantities represent the historical rate of leakage from the spillway gates. To the extent the spillway gates are repaired to minimize the leakage, an additional amount would be released for the purpose of fish habitat maintenance. But the total amount of water needed from Cachuma Lake for the interim Biological Opinion habitat target flows would still be about 2,500 afy on average, according to the Santa Ynez River Hydrology Model (SYRHM, see **subsection 4.2.2.1**). This is an estimate based on the model period 1918-1993 (76 years). The 0.75-foot surcharge produces about 2,300 af in a spill year.

The potential impacts of Alternatives 3B, 3C, 4B, 5B and 5C were evaluated using Alternative 2 as the environmental baseline. Alternative 2 represents the conditions that existed beginning in September 2000, when Reclamation began to implement interim release requirements under the Biological Opinion. Since that time, Reclamation has increased the surcharge of Cachuma Lake from 0.75 to 3.0 feet, and has begun to implement long-term release requirements under the Biological Opinion. Accordingly, Alternative 2 no longer represents existing conditions. Nonetheless, Alternative 2 remains an appropriate baseline for purposes of evaluating the potential impacts of the alternatives. Normally, the environmental conditions that exist at the time a lead agency issues a notice of preparation of an EIR constitute baseline conditions for purposes of the impacts analysis, even if conditions change during the environmental review process. (Cal. Code Regs, tit. 14, Section 15125, subd. (a).)

Moreover, the use of Alternative 2 as the baseline, as opposed to using current conditions as the baseline, will result in a conservative estimate of the potential environmental impacts of the alternatives. Alternative 2 assumes a 0.75-foot surcharge. Accordingly, comparing the other alternatives, which assume either a 1.8- or 3.0-foot surcharge, to Alternative 2 results in the full disclosure of the potential environmental impacts of surcharging Cachuma Lake above 0.75 foot, even though some of those impacts already have occurred. By contrast, if current conditions, including a 3.0-foot surcharge, were used as the baseline, the impacts associated with increasing the surcharge from 0.75 foot to 3.0 feet would not be disclosed.

Similarly, using Alternative 2 as the baseline results in a modest over-estimate of water supply related impacts. This is because the amount of water available from the Cachuma Project during a drought would be slightly less under current conditions than it would have been under Alternative 2, notwithstanding the recent 3.0-foot surcharge, due to implementation of the long-term release requirements under the Biological Opinion (**Appendix F**, Technical Memorandum No. 5, Table 22.) This reduction in the amount of water that would be available during a drought would not be included in the analysis if current conditions were used as the baseline for purposes of calculating water supply reductions under the various alternatives. Conversely, if Alternative 2 is used as the baseline, the incremental reduction in supply that would occur under existing conditions is included in the analysis.

3.2.2.2 Alternative 3B - Operations under the Biological Opinion with 1.8-foot Surcharge

This alternative incorporates the water rights release requirements under Order WR 89-18, releases to meet long-term rearing and passage target flows under the Biological Opinion, and other steelhead conservation actions described in the Biological Opinion (and Fish Management Plan) such as the Hilton Creek and other tributary passage improvement projects. It also includes conveyance of SWP water through the Cachuma Project facilities and the emergency winter storm operations. This alternative assumes that Reclamation will modify the spill gates for a 1.8-foot surcharge. Under this alternative, long-term rearing and passage releases for fish pursuant to the Biological Opinion would be met with the 1.8-foot surcharge and project yield rather than from a 3.0-foot surcharge. Releases for fish would also be met through conjunctive use with water rights releases. The average annual amount to meet the Biological Opinion long-term release requirements is estimated to be 3,905 af, not including tributary inflows below

Cachuma Lake and spills from Cachuma Lake. The breakdown of releases that meet the long-term rearing target flows is as follows:

	Afy
Project Releases	2,185
Water Right Releases	1,220
Leakage from the Dam	500
Total	3,905

The leakage quantities represent the historical rate of leakage from the spillway gates. To the extent the spillway gates are repaired to minimize the leakage, then an additional amount would be released for the purpose of fish habitat maintenance. But the total amount of water needed from Cachuma Lake for the final BO habitat target flows would still be about 3,900 afy on average, according to the SYRHM. The 1.8-foot surcharge produces about 5,500 af in a spill year.

Long-term releases for fish under the Biological Opinion also include releases for passage and adaptive management. The Fish Passage Account is allocated 3,200 af in years when the reservoir surcharges to 3.0 feet (or 1.8 feet for Alternative 3B). In addition, an Adaptive Management Account is created of 500 af. Water is released to facilitate passage beginning in the year following a surcharge year, and in subsequent years until the account has been depleted. The account is not subject to evaporation or seepage losses, and can be carried over to subsequent years. However, the account is reset when the reservoir surcharges.

Comparing this alternative to Alternative 2 (baseline conditions) will show how greater releases for fish purposes (rearing and passage) under this alternative may affect downstream environmental conditions. Comparing this alternative to Alternative 2 will also show the water supply related impacts of these releases coupled with implementation of a 1.8-foot surcharge, and the impacts of a 1.8-foot surcharge on resources at the lake.

3.2.2.3 Alternative 3C - Operations under the Biological Opinion with 3.0-foot Surcharge

This alternative includes all the elements of Alternative 3B except that this alternative assumes that Reclamation will modify the spill gates for a 3.0-foot surcharge. Under this alternative, long-term rearing and passage releases for fish pursuant to the Biological Opinion would be met with the 3.0-foot surcharge. Additionally, Alternative 3C incorporates the Settlement Agreement (see **subsection 2.7** for discussion).

Comparing this alternative to Alternative 2 (baseline conditions) will show how greater releases for fish purposes (rearing and passage) under this alternative may affect downstream environmental conditions. Comparing this alternative to Alternative 2 will also show the water supply related impacts of these releases coupled with implementation of a 3.0-foot surcharge, and the impacts of a 3.0-foot surcharge on resources at the lake.

Section 15126.6, subdivision (e) of the *State CEQA Guidelines* requires that an EIR analyze the No Project Alternative to allow decision makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project. When the proposed project represents a modification of an ongoing operation, the No Project Alternative is the continuation of the existing operation into the future. The "no project" analysis should include a discussion of what would be reasonably expected to occur in the foreseeable future if the project were not approved.

Reclamation already has begun implementation of the long-term release requirements under the Biological Opinion. In addition, Reclamation has implemented a full 3.0-foot surcharge. Accordingly, Alternative 3C should be considered the No Project Alternative because it reflects how the Cachuma Project is likely to be operated if Reclamation's permits are unchanged.

~~For purposes of the~~In this 2nd Revised Draft EIR, Alternative 3C ~~has been revised to incorporate~~ includes ~~the~~ provisions of the 2002 Settlement Agreement reached between the ~~Member Units~~CCRB, SYRWCD, ID No. 1, and the City of Lompoc. The Settlement Agreement has a number of provisions that reflect the BO, including the water releases required for fish management. In addition, the Settlement Agreement provides for:

1. Continuation of WR 89-18 to provide for accumulation of downstream water rights water in reservoir and its release to protect downstream water rights.

2. Conjunctive (conjoining) use of water rights water with fish water releases.

3. ~~Conjunctive~~ U~~u~~se of water rights (BNA Account) water with Lompoc groundwater basin, including:

   - Account accumulates water in all years for water rights releases.

   - Account provides limited amounts of water to Cachuma Member Units for use in dry years.

   The foregoing provides for maximum use of available water resources and does not waste any water.

4. Mixing lower salt content water from State Water Project in water rights releases to lower the total dissolved solids in water moving downstream.

5. Pre-releases, releases during storm, and holding back water in reservoir temporarily ("gate-holding") to manage the timing of and reduce peak flows ("flood control").

6. Support for the Fish Management Plan (FMP) required by SWRCB and Biological Opinion (BO) required by NOAA Fisheries.

7. Technical changes related to monitoring water quantity and quality downstream of Cachuma Reservoir and the place and purpose of use of Cachuma water supply.

3.2.2.4 Alternative 4B- Operations under the Biological Opinion with a 3.0-foot Surcharge and the Exchange of SWP Water for BNA Water

The objective of this alternative is to improve water quality in the Lompoc Plain for the City of Lompoc and other groundwater pumpers in response to claims by the City of Lompoc that operations of the Cachuma Project have degraded water quality in the Lompoc Basin. There are two specific methods contained in this alternative, as described below. This alternative includes water release requirements under Order WR 89-18 (as modified below), releases for steelhead to meet long-term rearing and passage target flows under the Biological Opinion, and other steelhead conservation actions described in the Biological Opinion (and Fish Management Plan). It also includes 3.0-foot surcharging, conveyance of SWP water through the Cachuma Project facilities, and emergency winter storm operations.

This alternative as described below involves the exchange of water available for recharge to the Lompoc Plain in the BNA for an equal amount of SWP water delivered to the Lompoc Valley via the existing CCWA pipeline.

The average annual BNA delivery from Cachuma Lake was 1,683 af (1989-2005). Annual deliveries have varied greatly (0 to 4,512 af) depending upon groundwater and runoff conditions. Requests for deliveries of BNA water to recharge the Lompoc Basin are not made every year. The total dissolved solids (TDS) of water released from Cachuma Lake reaching the Narrows for recharge ranges from 800 to 1,300 milligrams per liter (mg/l). The TDS of raw groundwater extracted from the Lompoc Basin by the City ranges from 1,000 to 2,000 mg/l. The TDS of water treated by the City is about 900 mg/l. The TDS of SWP water is typically 150 to 400 mg/l.

This alternative provides a physical solution to address water quality issues in the Lompoc Plain using a nearby source of high quality water. Its implementation would require cooperation by all involved agencies, completion of project-specific environmental review and permitting, secure funding, and operational agreements.

This alternative would involve the conveyance of SWP water to the Lompoc Valley. SWP water would be discharged directly to the Lompoc Forebay for recharge purposes in exchange for BNA releases from Bradbury Dam. A 20-inch diameter pipeline would be connected to the CCWA pipeline at an existing blowoff valve along McLaughlin Road near its terminus at the Santa Ynez River (**Figure 3-1**). The pipeline would be buried in or within existing agricultural roads. It would convey up to 20 cfs and 3,500 af over a four-month period in the summer and fall when BNA releases traditionally occur. The water would be discharged at four locations on the western banks of the river (**Figure 3-1**) and allowed to flow across the broad riverbed and percolate into the groundwater basin identical to the recharge by BNA flows. The average annual BNA delivery for the period 1989-2005 was 1,683, with a maximum delivery of 4,512 af in 1994.

The SWP water would commingle with groundwater, which would be pumped by the City of Lompoc and by private pumpers. Over time, this EIR anticipates that higher quality recharge water will improve the TDS of the basin, and thereby reduce treatment requirements by the City and other pumpers.

Capital facilities required for the project include the pipeline noted above, as well as the following: (1) a new flow control valve at the CCWA pipeline with de-chloramination equipment; (2) 10,000 feet of 20-inch diameter plastic pipe; and (3) four outlet valves along the river. Temporary construction and permanent easements would need to be acquired along the pipeline route. Construction would require about three months to complete.

In order to implement the project, the SWRCB would need to amend Reclamation's permits to allow a new method of fulfilling the recharge requirements for the Below Narrows Basin (i.e., Lompoc Basin). In addition, the agreements noted above would be required, including agreements on a secure delivery of SWP water for recharge even when SWP deliveries are curtailed due to shortages.

Under this alternative, varying amounts of SWP water would be delivered to the forebay area for recharge based on the average annual credits in the BNA. If this alternative ~~is~~were implemented, potential recharge requests in certain years that may exceed the capacity of the pipeline, or potential changes in the average annual delivery if the BNA accrues at a higher rate in the future compared to the past would have to be addressed.

As discussed in **subsection 2.2.4**, the availability of SWP water varies from year to year depending upon runoff in northern California and demands on the statewide system. The average annual delivery of SWP water to the Member Units is estimated to be 77 percent of the full entitlements, but can be reduced to 20 - 30 percent during drought years. Under Alternative 4B, the agreement among the parties must account for this variability in deliveries. It can be addressed in two ways. One, the deliveries to the forebay area would be guaranteed its full amount of SWP water over a fixed period of time, and any shortages in the SWP water deliveries would be taken by the Member Units. Two, deliveries to the Lompoc forebay would take shortages in the SWP water deliveries in the same proportions as the Member Units. To fulfill requests for recharge under the BNA that are not met by the SWP water deliveries, the Member Units would request releases from Cachuma Lake. Finally, in the event of an outage in the SWP system, recharge to the Lompoc Basin under Order WR 89-18 would be fulfilled in the traditional manner by releases from Cachuma Lake.

The City of Lompoc, through its legal representative, has notified the SWRCB in a letter regarding the EIR dated June 18, 1999, that the City does not consider this alternative to be feasible because the residents of the City have twice rejected SWP water as a new water supply.

3.2.2.5 Alternatives 5B and 5C

As stated in the Executive Summary, Alternatives 5B and 5C are similar to Alternatives 3B and 3C. Alternatives 5B and 5C differ from Alternatives 3B and 3C in their incorporation of the release criteria under the proposed CalTrout Alternative 3A2 during wet and above-normal year types. The origin of the CalTrout Alternative 3A2 is the Cachuma Contract Renewal EIS/EIR (Reclamation and CPA, 1995). In the 2003 SWRCB hearing concerning potential modifications to Reclamation's permits for the Cachuma project, CalTrout advocated institution of the Alternative 3A2 flows based on the conclusion from the Cachuma Contract Renewal EIS/EIR that this alternative would have the greatest benefit to steelhead below the dam. (CalTrout Exhibit 90.) The 1995 EIS/EIR describes Alternative 3A2 as follows (pg. 6.1-11):

Alternative 3A2 involves operation of Cachuma Lake with releases to maintain the following minimum streamflows at selected locations downstream of the dam in order to improve steelhead habitat and general aquatic and riparian habitat conditions.

- 48 cfs 15 February to 14 April, then
- 20 cfs to 1 June, then
- 25 cfs for one week, then
- Ramp releases to 10 cfs by 30 June, then
- Hold at 10 cfs to 1 October, then
- 5 cfs for the rest of the year.

Under this alternative, the above flows are to be maintained at both San Lucas and Alisal bridges. These flows would be created by both natural streamflow and releases from the dam.

The Alternative 3A2 operating criteria for fish water releases would have significant water supply impacts to the Project Member Units, according to studies performed for the 1995 Cachuma Contract EIS/EIR and the 2003 SWRCB hearings. Variations of Alternative 3A2 have been suggested to reduce the water supply impacts to the Member Units. In the 2003 SWRCB hearings, CalTrout proposed a variation called “3A2 Adjusted for Dry Years.”

The new Alternatives 5B and 5C are based on a variation of CalTrout Alternative 3A2 Adjusted for Dry Years. These alternatives would operate under two different sets of hydrologic conditions for releases of water from Cachuma Lake for fish. In wet or above-normal years, the criteria for fish water releases would be based on the proposed CalTrout Alternative 3A2, which would entail the increased stream flows outlined in that alternative. In below-normal, dry, or critical years, the criteria for fish water releases would be under the long-term Biological Opinion. The idea is to attempt to reduce impacts to water supplies by switching to the long-term Biological Opinion operating criteria in years of below-normal, dry, and critical runoff conditions.

For purposes of modeling the potential impacts of Alternatives 5B and 5C, five hydrologic year types were developed based on inflows to Cachuma Lake for the period 1918-1993 (76 years) (**Appendix F**, Technical Memorandum No. 5, pp. 7-9.) The five water-year types were based on roughly twenty-percentile grouping of ranked data. The top 40 percent annual inflow into Cachuma Lake is greater than 33,707 af. Accordingly, once the cumulative annual inflow into Cachuma Lake exceeded 33,707 af, then the runoff conditions were considered to be wet or above normal, and the proposed CalTrout Alternative 3A2 flows shown above became the operating criteria for fish water releases. At the beginning of a water year, it is not known what type of water year it will be, so Alternative 3A2 flows were triggered when the cumulative Cachuma inflow (from October 1) of 33,307 af was reached. It is important to note that this cumulative inflow can be reached at varying times over the water year, and as such operations were governed by the Biological Opinion until the cumulative inflow (from October 1) reached 33,707 af.

Under Alternatives 5B and 5C, flow requirements to protect fishery resources would be the same, but the two alternatives assume that Reclamation would implement different surcharge levels at Cachuma Lake. Like Alternative 3B, Alternative 5B assumes a 1.8-foot surcharge. Like Alternative 3C, Alternative 5C assumes a 3.0-foot surcharge. Comparing Alternatives 5B and 5C to Alternative 2, (baseline operations) will show how greater releases for fish purposes under these alternatives may affect downstream environmental conditions. Comparing these alternatives to Alternative 2 will also show the water supply related impacts of these releases coupled with implementation of a 1.8-foot or a 3.0-foot surcharge, respectively.

4.0 ENVIRONMENTAL ANALYSIS OF ALTERNATIVES (FLOW-RELATED ACTIONS)

4.1 OVERVIEW OF IMPACT ASSESSMENT

The flow-related actions associated with the project alternatives are addressed in this section. These actions include: (1) releasing water from Bradbury Dam to enhance downstream steelhead rearing and passage, as well as aquatic habitat for other species, (2) releasing water ~~rights~~ and other actions under the Settlement Agreement, and (3~~2~~) providing additional storage to support the releases for fish. Additional storage may be provided by reservoir surcharging or dedication of existing storage. Impacts associated with non-flow related measures along tributaries downstream of Bradbury Dam are addressed in a programmatic manner in **Section 5.0**.

4.1.1 Environmental Baseline for the purposes of analyzing flow-related measures

State CEQA Guidelines Section 15125, subdivision (a) states: "An EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, from both a local and regional perspective. This environmental setting will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant."

The primary environmental conditions in the vicinity of the project are: (1) the aquatic and recreational environments at Lake Cachuma; and (2) the aquatic and riparian habitats, surface water, and groundwater conditions along the lower Santa Ynez River from Bradbury Dam to the ocean. These conditions have been influenced by the past and ongoing operations of the Cachuma Project, which directly affect fluctuations of the reservoir and the amount and timing of flows below the dam. Cachuma Project operations have varied over the past 45 years due to modifications in the release requirements designed to protect downstream water rights, and due to recent changes in releases to protect the endangered southern steelhead. As a result, the environmental setting or baseline has been very dynamic.

The current downstream water release program to protect downstream water rights was implemented in 1989 pursuant to a SWRCB Order WR 89-18. In 1993, Reclamation initiated downstream reservoir releases to study and maintain steelhead downstream of the dam in accordance with a 1994 MOU with various interested parties. Order WR 94-5, adopted by the SWRCB in 1994, required Reclamation to continue to make releases in accordance with a 1994 MOU with various interested parties. In 2000, NMFS issued a Biological Opinion to Reclamation that established additional release criteria for steelhead. The Biological Opinion has both interim and long-term phases for implementation, and the criteria are based, in part, on available water supply and surcharging Lake Cachuma.

The NOP for this EIR was issued in May 1999, prior to the completion of the Biological Opinion and implementation of some of the Biological Opinion requirements, such as downstream releases for steelhead rearing. Hence, use of the environmental conditions in 1999 in the EIR impact assessment would not be an accurate representation of current environmental conditions. Thus, the SWRCB has determined that the environmental setting at the time of the NOP should not be used as the baseline physical conditions for impact assessment. As noted above, Section 15125, subdivision (a) of the *State CEQA Guidelines* allows the lead agency discretion in selecting the appropriate baseline for impact assessment purposes.

In this case, the appropriate baseline conditions are Cachuma Project operations under Alternative 2. Alternative 2 represents the conditions that existed in September 2000, when the NOP was issued and Reclamation began to implement interim release requirements under the Biological Opinion.

4.1.2 Impact assessment and Alternatives Comparison

State CEQA Guidelines Section 15126.6, subdivision (a) states that:

> *An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives.*

The purpose of this EIR is to assist the SWRCB in determining if modifications to Reclamation's water rights permits are required to better protect downstream water rights and public trust resources. The SWRCB has not selected a particular modified operational scheme as a proposed project, opting instead to examine several alternatives that address downstream water rights and public trust needs differently.

The impacts of Alternatives 3B, 3C, 4B, 5B and 5C are assessed using Alternative 2 (Baseline Operations) as the environmental baseline. This comparison will indicate if there are any incidental environmental impacts associated with the new releases for fish under the alternatives. Also, the EIR compares the alternatives to one another, to determine which alternatives have the most incidental environmental impacts.

4.1.3 Impact Thresholds

Environmental impacts of the alternatives are classified in the categories shown below. An impact was determined to be significant using guidance from: (1) Public Resources Code section 21083, (2) the definitions of "significance" in *State CEQA Guidelines* sections 15064, 15064.5 and 15065, and (3) the thresholds used in the updated CEQA Guidelines Environmental Checklist.

- Class I Impacts. Unavoidable significant impacts. For these impacts, the SWRCB must issue a "Statement of Overriding Considerations" under Section 15093 of the *State CEQA Guidelines* if the project is approved.
- Class II Impacts. Significant environmental impacts that can be mitigated. The SWRCB must make "findings" under Section 15091(a) of the *State CEQA Guidelines* if the project is approved.
- Class III Impacts. Other environmental impacts that are potentially adverse but not significant. Mitigation measures are recommended to minimize adverse impacts.
- Class IV Effects. Beneficial Effects.

Feasible mitigation measures are also identified in this section to avoid or reduce significant impacts.

4.1.4 Impact Assessment for Non-flow Related Habitat Enhancements

Adverse environmental impacts incidental to various non-flow related habitat enhancements that are mandated in the Biological Opinion and included in the Fish Management Plan are addressed in this EIR at the programmatic level. These actions include extension of Hilton Creek, removal of fish passage barriers on Hilton Creek and key tributaries, additional measures on Hilton Creek, and a fish rescue program (among others). They will be implemented as individual projects by Reclamation or COMB. Although these projects will be implemented in a phased manner, they represent parts of a comprehensive plan to improve conditions for steelhead and other aquatic species. Some of the projects will require project level environmental review under CEQA or NEPA. Others may be exempt from environmental review. The impacts of non-flow habitat enhancements are assessed in a programmatic manner in this EIR for the following reasons:

- Most of the projects have only been developed at a conceptual level, and there is insufficient information for a project-level impact analysis;
- For those projects with sufficient detail, such as the Hilton Creek passage impediment project, it is appropriate for Reclamation and COMB to serve as lead agencies for conducting the impact assessment because they are the agencies funding and sponsoring the projects; and

- Reclamation and COMB prepared a joint EIR/EIS for implementation of the Biological Opinion and Fish Management Plan non-flow related habitat enhancements for those projects where there is sufficient information.

4.1.5 Issue Areas Not Subject to Analysis

The EIR alternatives will not result in any impacts to the following resources or issue areas: visual resources, agriculture, noise, public services, traffic and circulation, public safety, hazardous materials, energy, geologic hazards, land use, air quality, and population and housing. Hence, these topics are not addressed further in the EIR.

4.2 SURFACE WATER HYDROLOGY

4.2.1 Existing Conditions

The Santa Ynez River watershed encompasses about 900 square miles and is located in the central part of Santa Barbara County (**Figure 1-1**). The south side of the basin is formed by the Santa Ynez Mountains. These mountains, ranging in elevation from 2,000 to 4,000 feet, separate the Santa Ynez River basin from the South Coast of the County. The Purisima Hills and the San Rafael Mountains, which range in elevation from 4,000 to 6,000 feet, form the north side of the basin.

The Santa Ynez River Basin has a Mediterranean climate with hot, dry summers and cool, wet winters. Almost all precipitation occurs between November and April, although large variations in annual quantities occur within the basin. Annual rainfall ranges from about 14 inches near the ocean to about 30 inches at Juncal Dam with higher rates in the headwater areas due to orographic effects. Average monthly rainfall data and annual rainfall from Gibraltar Dam, located upstream of Cachuma Lake, are presented on **Charts 4-1, Average Monthly Rainfall Near Lake Cachuma,** and **4-2, Historic Annual Rainfall Near Lake Cachuma**, respectively (**Appendix B**).

The Santa Ynez River flows westerly about 90 miles to the Pacific Ocean, passing through Jameson Lake, Gibraltar Reservoir, and Cachuma Lake. Immediately above Cachuma Lake, the river passes through a narrow valley between the San Rafael and Santa Ynez mountains. Below Bradbury Dam, the river passes between the Santa Ynez Mountains and the southern edge of the Santa Ynez Upland, and through the broad part of the valley near Buellton (**Figure 1-3**). West of Buellton, the river flows through a narrow meandering stretch, then flows through the Narrows and emerges onto the broad, flat Lompoc Plain. The Santa Ynez River flows across the Lompoc Plain for about 13 miles and empties into the ocean at Surf.

The flow of the river has been intermittent, both in the past and under current Cachuma Project operations. Winter flows were largely uncontrolled prior to the construction of Bradbury Dam with virtually no flow in the summer months. Since operations of Bradbury Dam began in 1953, the winter flows have been moderated by reservoir operations and previously nonexistent summer flows have been replaced with releases for downstream water rights. Median monthly streamflow at the Narrows prior to, and after, construction of Bradbury Dam is shown on **Chart 4-5, Historical Median Daily Streamflow at the Narrows**. These data demonstrate the reduction in winter flows due to Cachuma Lake. Mean monthly discharge (af) and flow (cfs) at USGS stream gauge stations at Santa Ynez, Solvang, and the Narrows from 1956 to 1999 are presented in **Table 4-0, Historical Streamflow Below Lake Cachuma**.

Table 4-0
Historical Streamflow Below Lake Cachuma

STREAMFLOW FOR SANTA YNEZ RIVER BELOW LAKE CACHUMA												
USGS Gauging Station # 11126000												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Monthly Flow 1956-1976 (af/month)	174	113	513	8,958	11,693	8,208	5,665	1,964	582	399		
Mean Monthly Flow 1956-1976 (cfs)	2.8	1.9	8.3	145.7	210.5	133.5	95.2	31.9	9.8	6.5	5.1	4.3
Median Daily Flow 1956-1976 (cfs)	0.0	0.0	0.0	0.3	5.3	7.6	10.0	6.5	4.7	2.4	0.9	0.0
STREAMFLOW FOR SANTA YNEZ RIVER AT SOLVANG												
USGS Gauging Station # 11128500												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Monthly Flow 1956-1999 (af/month)	418	274	1,236	13,582	29,828	25,634	10,021	3,702	924	437		
Mean Monthly Flow 1956-1999 (cfs)	6.8	4.6	20.1	220.9	537.1	416.9	168.4	60.2	15.5	7.1	7.1	6.5
Median Daily Flow 1956-1999 (cfs)	0.0	0.0	2.3	6.0	15.0	16.0	7.0	0.4	0.0	0.0	0.0	0.0
STREAMFLOW FOR SANTA YNEZ RIVER AT NARROWS NEAR LOMPOC												
USGS Gauging Station # 11133000												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Monthly Flow 1956-1999 (af/month)	250	395	1,803	15,208	32,582	29,155	11,734	4,531	1,224	337		
Mean Monthly Flow 1956-1999 (cfs)	4.1	6.6	29.3	247.3	586.7	474.2	197.2	73.7	20.6	5.5	3.3	3.3
Median Daily Flow 1956-1999 (cfs)	0.0	0.0	1.5	13.0	27.0	59.0	26.0	5.2	1.4	0.5	0.0	0.0

Juncal, Gibraltar and Bradbury dams regulate flow in the upper portion of the watershed. Juncal and Gibraltar dams are located above Bradbury Dam (Cachuma Lake), and regulate 14 and 216 square miles, respectively. Cachuma Lake regulates about 417 square miles, or less than half of the Santa Ynez River Basin. The average annual runoff of the Santa Ynez River at Bradbury Dam is about 71,400 afa (1953-1992). The average annual runoff for the Santa Ynez River at the Narrows is about 66,500 afa for the same period. The Narrows flow includes the effects of Cachuma Lake winter spills averaging about 34,800 afa and summer river releases of about 7,000 afa. Data available from the Bureau of Reclamation for the period 2000 to July 2010 shows that the average annual runoff of the Santa Ynez River at Bradbury Dam (reported as inflows in to Cachuma Lake) is about 73,600 afa and at the Narrows is about 90,100 afa, including the effects of Cachuma Lake winter spills which average approximately 18,600[1] afa and average summer river releases of approximately 13,000 afa for the same period (2000 to July 2010).[2]

4.2.1.1 Lake Storage and Elevation

The amount of water in Cachuma Lake varies depending upon runoff, downstream releases, and diversions to the Member Units. Annual storage at the end of summer in Cachuma Lake is shown on **Chart 4-3, Historical Annual End of Summer Lake Storage**. Periods of low storage reflect droughts since 1953. The most pronounced decrease in storage occurred in 1990 during the third year of the most recent drought. Lake elevations vary similar to lake storage. The maximum lake elevation was 750 feet until 1993, when Reclamation implemented a 0.75-foot surcharge to support releases under the 1994 MOU (see **Section 2.3**); the level on January 1, 2011 was 742.96 feet.[3] Lake levels vary during the year due to runoff, diversions, releases, and evaporation. According Reclamations Daily Operation logs, the following lake levels and surcharging above the 750.0-foot elevation have occurred since 2000:

- From April 17, 2000 to June 12~~0~~, 2001, the lake exceeded 750.0. During this period, the daily maximum lake level was 750.83 (April 24, 2000).
- From March 5, 2001 to June 21, 2001, the lake exceeded 750.0. ~~From April 27, 2005 to May 12, the lake exceeded 752/47 (the 2.47-foot surcharge height).~~ During this period, the daily maximum lake level was ~~751.34~~752.17 (~~April 21~~March 5, 2001).
- From January 10, 2005 (except for a few specific days) to August 5, 2005, the lake exceeded 750.0. From April 27, 2005 to May 12, the lake exceeded 752.47 (the 2.47-foot surcharge height).

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1 Only two winter spills occurred during the period 2000 to 2010. In 2005, 194,360 af were released while 10,665 af were released in 2008.

2 http://www.usbr.gov/mp/cvo/reports.html

3 U.S. Bureau of Reclamation, Cachuma Project, Cailfornia, Lake Cachuma Daily Operations, Monthly Reports, http://www.usbr.gov/mp/cvo/reports.html.

- From March 22, 2006 through August 11, 2006, the lake exceeded 750.0 feet with a maximum of 753.~~08~~ 15 on May 22~~1~~, 2006. From April 24 to June 22, 2006, the lake exceeded the 2.47-foot surcharge.

- From January 30, 2008 to June 27, 2008, the lake exceeded 750.0 feet with a maximum of 752.7 feet (April 10. 2008). ~~Between February and May 2008, lake elevations did exceed 752.0 feet (with a maximum of 752.7 [a 2.7 foot surcharge on April 10]).~~ From March 23, 2008 to April 25, 2008, the lake exceeded the 2.47-foot surcharge.

The peak lake level is typically reached in April or May when the winter runoff has ended and before significant diversions and downstream releases occur. Median monthly lake levels are shown on **Chart 4-4, Historical Median Monthly Lake Elevations,** for two periods: 1952–2000 and 1989–2000. The latter period represents operations under Order WR 89-18, which continue today. Higher lake levels are present under Order WR 89-18 because of more frequent wet years in the period 1993-2000.

4.2.1.2 Existing Surface Diversions

Surface water diversions from the Santa Ynez River Basin are made primarily from Juncal, Gibraltar, and Bradbury dams. These facilities divert water from the river for agricultural, municipal and industrial uses in the Santa Ynez Valley (Cachuma Project only) and on the South Coast of Santa Barbara County.

Juncal Dam (Jameson Lake)

MWD owns and operates Juncal Dam, which was completed in 1930. Juncal Dam forms Jameson Lake. The original storage capacity of Jameson Lake (7,228 af) has been reduced to about 5,000 af due to siltation. Diversions of water stored in Jameson Lake are made to Montecito on the South Coast through the 2-mile long Doulton Tunnel. Flows from Alder and Fox creeks are sporadically diverted by flume into Jameson Lake when turbidity conditions permit. The tunnel intake location also allows for minor diversions of downstream tributary inflow from Fox Creek. Average diversions from Jameson Lake to Montecito are about 1,750 afa. Tunnel infiltration, while not Santa Ynez River water supply, is also delivered to MWD at a rate of about 400 to 500 afa.

Gibraltar Dam and Reservoir

The City of Santa Barbara constructed Gibraltar Dam in 1920. Gibraltar Reservoir's original capacity of 14,500 afa had been reduced due to siltation to about 7,600 af by 1947. The City subsequently raised the dam 23 feet in 1948 to increase the capacity to 14,777 af. However, due to continuing siltation, Gibraltar Reservoir capacity has been reduced once again to about ~~8,600~~5,251 af. Diversions from Gibraltar are made to the City of Santa Barbara through the 3.7-mile-long Mission Tunnel. Gibraltar Reservoir is not operated on a safe yield basis. Carryover storage is not sufficient to protect against drought years. Annual diversions to the City have ranged from over 9,000 af in very wet years to nearly zero in extreme drought years. Alternative sources must be relied upon in these years. Mission Tunnel infiltration, averaging about 1,000 afa, is also delivered to the City.

In August 1928, the owners of 38 parcels of land located adjacent to the Santa Ynez River downstream of Gibraltar Dam brought suit against MWD and the City of Santa Barbara over the construction of Gibraltar Dam and Juncal Dam and resultant reduction in natural flow. The case resulted in the California Supreme Court decision Gin S. Chow v. City of Santa Barbara (1933) 217 Cal. 673 [22 P.2d 5]. As a result of the Gin S. Chow case, the City of Santa Barbara is required to release up to 616 afa of Gibraltar Reservoir inflow during the summer and fall months.

Bradbury Dam (Cachuma Lake)

Bradbury Dam and Cachuma Lake are described in detail in **Sections 1.2, 2.1** and **2.2**. In summary, Reclamation completed construction of Bradbury Dam in 1953. The 204,874 af original capacity of Cachuma Lake has been reduced due to siltation. A survey conducted in 2008~~0~~ indicates that the reservoir capacity has been reduced to ~~188,035~~186,636 af at elevation 750.0 feet (MNS, 2008~~0~~). Diversions from Cachuma Lake are made to the four Member Units on the South Coast, and SYRWCD, ID #1 in the Santa Ynez Valley. The South Coast Member Units are served through the 6.4-mile-long Tecolote Tunnel that extends from the lake to near Glen Anne Reservoir in Goleta.

Historic annual Cachuma Project deliveries to the South Coast Member Units and SYRWCD, ID #1 are provided in **Table 2-2**. The operational yield of Cachuma Lake used in this and previous studies is 25,714 ac-ft/yr. The operational yield includes infiltration into Tecolote Tunnel. Infiltration varies with precipitation. Reclamation and the Member Units estimate average infiltration to be about 2,000 afa.

Project deliveries can exceed operational yield if there is sufficient storage in the lake, and Reclamation has met all requirements for downstream releases. Diversions from the lake to the South Coast Member Units and SYRWCD, ID #1 exceeded 30,000 afa in 1972, 1976, 1984, 1987, and 2000 (**Table 2-2**). As a result of these relatively high diversions in the early years of the 1988-91 droughts, only 17,000 af could be delivered in calendar years 1990 and 1991.

Upper Santa Ynez River Operations Agreement

In 1986, the City of Santa Barbara and downstream interests entered into negotiations to determine if the City's need for stabilized yield from Gibraltar Reservoir and downstream interests' respective needs could be realized through an agreement that included the use of Cachuma Lake to replace the diminishing capacity of Gibraltar Reservoir. The result was the Upper Santa Ynez River Operations Agreement (Operations Agreement or Agreement), which was signed in 1989.

The Agreement sets the amount of diversion from Gibraltar to the City at an amount that would be available under a "Base Operation" with Gibraltar Reservoir assumed to have a fixed storage of 8,567 af with no further reduction in capacity due to subsequent siltation. The "Base Operation" allows for diversions up to 4,189 afa of ordinary flow plus flood flows, if available. Ordinary flows are defined by the Agreement to be daily Gibraltar Reservoir inflows of less than 800 cfs. Flood or freshet flows are flows in excess of this amount.

Under the Agreement, the City's entitlements from Gibraltar Reservoir can be delivered to the City from either Gibraltar or Cachuma Lake. "Base Operation" entitlements that cannot be physically delivered from Gibraltar itself can be supplied to the City through Tecolote Tunnel. Conversely, diversions in excess of "Base Operations" entitlements can be made to the City through Mission Tunnel but must be mitigated by correspondingly reducing Cachuma contract water deliveries to the City through Tecolote Tunnel.

4.2.1.3 River Discharge and Flood Hazard Conditions

The majority of the Santa Ynez River Watershed is undeveloped and consists mostly of brushlands, rangelands, and agricultural fields. Several major tributaries downstream of Bradbury Dam contribute significant flows to the river including Santa Agueda, Alamo Pintado, Zaca, Alisal, Salsipuedes, and Miguelito creeks. Regulation of flood flows comes primarily from Juncal, Gibraltar, and Bradbury dams on the river, and, to a lesser extent, Alisal Dam on Alisal Creek.

Historical Flood Flows

There are five stream gages on the river between Bradbury Dam and the Pacific Ocean. The one with the longest period of record (since 1907) is located near Lompoc at the Narrows. The greatest discharges of record at this gage are 120,000 cfs and 80,000 cfs in 1907 and 1969, respectively. There have been several major flood events along the Santa Ynez River over the past 100 years. Major floods occurred in the years 1907, 1914, 1938, 1969, and 1978. Reported peak discharges for these storms ranged from 45,000 to 120,000 cfs. These floods caused significant damage to the Lompoc Valley. The most devastating flood occurred in January and February 1969. ~~Although the 1969 flood was reportedly lower in magnitude than the 1907 flood, it caused more damage because the county was relatively undeveloped in 1907.~~In 1996, the Bureau of Reclamation revised the peak flood estimate of 1907 and 1969 to 55,000 and 88,000, respectively.[4]

[4] U.S. Bureau of Reclamation. Ostensaa, Dean A., Levish, Daniel R., and O'Connell, Daniel R. H. Paleoflood Study for Bradbury Dam, Cachuma Project, California, Seismotectonic Report 96-3. Seismotectonic and Geophysics Section, Technical Service Center, Bureau of Reclamation, Denver, Colorado. 1996.

In Santa Barbara County, the 1969 storms damaged residential, commercial, agricultural, and public property; highways, railroads, and bridges; utilities; and irrigation and flood control facilities. In addition to the major flood events, several minor floods with peak discharges ranging from 15,000 to 45,000 cfs have occurred since the 1930s, including in 1983, 1995, 1998, and 2001, and have caused minor damage to portions of the Lompoc Valley.

River channel capacities vary greatly along the river below the dam. With the exception of the 1969 floods, river channel capacities have been adequate to pass historic flood flows without damage to urban areas such as Solvang, Buellton, and Lompoc. However, past flood events have caused flooding and erosion to undeveloped and agricultural lands at various locations along the river. Previous floods have also damaged or destroyed numerous bridges including the Refugio Road, Alisal, Robinson (Highway 246), Floradale, 13th Street, and Southern Pacific Railroad bridges.

Flooding in the Lompoc Valley

Flooding of agricultural lands west of the Lompoc Regional Wastewater Treatment Plant has been an ongoing concern of Santa Barbara County Flood Control District (County FCD). Riparian growth in the Santa Ynez River channel west of Lompoc has been enhanced by continuous discharge of effluent from the treatment plant. The dense riparian vegetation in the river channel creates a flood hazard by reducing the conveyance capacity. In addition, it reduces water velocities, which in turn increase sediment deposits, further decreasing capacity. Finally, trees in the riverbed can become uprooted during flood events and block the channel under bridges, thereby causing additional flooding upstream or serious damage to the bridges.

To reduce flooding hazards, the County FCD has periodically cleared vegetation from the channel from above Floradale Bridge to 13th Street Bridge thereby increasing channel capacity (**Figure 4-3, Boundaries of the Lompoc Plain Basin and Key Wells**). In January 1992, the County FCD cleared portions of the river along this reach with a tracked mower under emergency conditions due to the threat of imminent flooding. A 25- to 100-foot-wide swath of vegetation was cleared at that time. In December 1992/January 1993, the County FCD cleared a 100-foot-wide swath of vegetation in the center of the riverbed along the entire reach under emergency conditions. In December 1997/January 1998, the County FCD mowed about 16 acres to maintain the 100-foot-wide corridor in the riverbed that was created in 1992/1993.

After the 100-foot-wide channel clearing in December 1992/January 1993, the County FCD estimated that 18,300 cfs was conveyed during the March 1993 flood flows with only minor flooding of adjacent agricultural lands. In January and March 1995, flows in excess of 20,000 cfs passed through the reach with only minor flooding. Flows of about 20,000 cfs were observed in the project reach without flooding during February 1998 (after the December 1997/January 1998 mowing) and in March 2001.

The County FCD has concluded that the 100-foot-wide mowing creates about 20,000 cfs channel capacity in the reach, providing a reasonable level of protection for the adjacent agricultural lands.

In early 2001, the County FCD proposed a long-term routine maintenance program to maintain the 100-foot-wide swath in the reach. The County FCD proposes to continue the mowing of the 100-foot-wide swath on an as-needed basis, estimated to be every three to five years. The County FCD estimates that the capacity of the reach without channel clearing will be reduced to 5,000 cfs due to the accumulation of dense, obstructive vegetation in the channel invert over time.

Modified Storm Operations

As described in **Section 2.2.5**, in 1998~~3~~, Reclamation implemented Modified Storm Operations to reduce the ~~frequency and~~ magnitude of flood flows along the lower Santa Ynez River, particularly in the Lompoc Valley. The program is implemented on an as-needed basis during wet winters primarily by making releases prior to the onset of a flood in order to create space for passing flood flows. These precautionary releases are made 24 to 36 hours in advance of inflows and typically will result in a 5- to 6-foot lowering of the lake. Reclamation also may make releases that match inflows at the beginning of a flood event, designed to pass the early part of a flood, as well as gateholding which holds back the increase in inflows. These actions effectively reduce the peak downstream flows compared to prior operations. According to the County FCD, the Modified Storm Operations reduced the risk of flooding in the Lompoc Valley in 1998 and 2001.

4.2.1.4 Updates After 2003

As described below, some changes in surface water hydrology have occurred since 2003. For the reasons explained in **Section 3.2.2**, however, the baseline conditions that existed in ~~August~~ September of 2000~~3~~ are used to analyze the project alternatives.

Pursuant to the signing of an MOU entitled “Memorandum of Understanding Regarding the Surcharge of Cachuma Lake and the Protection of Recreational Resources at the Lake” in February of 2004, the County, CCRB, and ID #1 implemented a phased surcharging at Cachuma Lake. ~~The first action undertaken was the raising of the reservoir surcharge level from the previous elevation of 750.75 feet to an interim elevation of 751.8 feet.~~ Following a spill event in January 2005, Stetson Engineers conducted a survey of the vulnerability of the lake’s recreation facilities, revealing that the facilities identified earlier as being at risk of inundation were actually located at elevations higher than had been previously thought. In April of 2005, the aforementioned MOU was amended to provide for an increase in surcharge elevation to 752.47 feet, thereby allowing for the undertaking of emergency protective measures for facilities deemed to need them.[5]

In 2008, a bathymetric survey (MNS, 2008) was completed that updated information from prior surveys (2000). The 2008 survey was completed after the Zaca fire of July 2007 that burned over 240,207 acres primarily in extremely steep and rugged areas of the Los Padres National Forest and the Santa Ynez River Recreation Area.[6] The 2008 survey indicated that at full lake elevation (750 feet), the total change in capacity was reduced from 188,030 af to 186,636 af, or a reduction of 0.7 percent.

In 2009, the MOU expired and Reclamation is now able to implement a 3.0-foot surcharge. Originally~~Due to the fact that the surcharge is maintained exclusively for releases for fish in the Santa Ynez River, operational yield has not changed from the levels associated with the historic high water mark at 750 feet. However~~, the 3.0 surcharge would increase reservoir capacity by 9,200 af. However, ~~–~~the 3.0-foot surcharge will increase the reservoir capacity by only ~~9,200~~8,942 ~~-~~af, due to sedimentation from the Zaca fire as noted above, to a total capacity of ~~198,200~~195,578 af.

4.2.2 Potential Impacts of the Alternatives

In the following section, the impacts of the various project alternatives on surface water hydrology are addressed. The resulting changes in lake storage and river flows under each alternative may not, in and of themselves, represent adverse or beneficial effects. The favorable or unfavorable aspects of these hydrologic changes are primarily based on their effects on groundwater quantity and quality along the river, aquatic and riparian habitats along the river, and recreation at Cachuma Lake. The only hydrological effect that can be interpreted as adverse or beneficial would be the change in flood hazard downstream of the dam.

4.2.2.1 Overview of Hydrologic Modeling for the EIR

Use of the Model for Comparing Alternatives

The hydrologic characteristics and impacts of the various alternatives were evaluated using the SYRHM, developed by SBCWA. The SYRHM was first developed in 1979 and has since been used by water

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5 Following the completion of the proposed emergency protective measures in May of 2006, the County, CCRB, and ID No. 1 approved an "Interim Agreement Regarding the Surcharge of Cachuma Lake," which allowed a 3.0 surcharge for one year after Lake Cachuma spilled in April of 2006; this agreement expired in February 2009.

6 California Department of Forestry and Fire Protection, Zaca Fire Information, September 4, 2007, http://bof.fire.ca.gov/incidents/incidents_details_info?incident_id=190.

agencies to evaluate various management alternatives in the basin. The model was used in Reclamation's 1995 EIR/EIS for the Cachuma Contract Renewal. Over the last two decades, the SYRHM has been expanded and modified in consultation with the Santa Ynez River Hydrology Committee, composed of technical hydrology experts from Reclamation, the Member Units, the County Water Agency, the City of Lompoc, and SYRWCD. The model is written in Microsoft Quick Basic code and is publicly available from SBCWA. Stetson Engineers performed the hydrologic modeling for the EIR under the direction of Reclamation's EIR consultant. A detailed description of the modeling and the results of the hydrological simulations are provided in technical memoranda by Stetson (2001a, 2006a (2006a is included in **Appendix F**)). The documentation of the SYRHM has been made available to the SWRCB (Stetson and SBCWA 2004).

A schematic of SYRHM is shown in **Figure 4-1, Overview of Santa Ynez River Hydrology Model**. This schematic depicts the primary physical features and hydrologic data input items necessary to properly simulate monthly and annual alternative operations of the Cachuma Project. Physical features simulated in SYRHM include Juncal Dam (Jameson Lake) and Doulton Tunnel; Gibraltar Dam and Mission Tunnel; Bradbury Dam (Cachuma Lake) and Tecolote Tunnel; the Santa Ynez River; the Above Narrows Account riparian ground water sub-basins for Santa Ynez, Buellton, and Santa Rita East and West; and percolation to the Lompoc Plain below Narrows.

Hydrologic data utilized in SYRHM includes precipitation in the Santa Ynez Basin above and below Bradbury Dam; Santa Ynez River streamflow; tributary inflow from streams below Bradbury Dam; infiltration to Doulton, Mission, and Tecolote tunnels; evaporation from Jameson, Gibraltar, and Cachuma Lake; in the lower Santa Ynez River Basin, municipal, industrial, agricultural, riparian and phreatophyte consumptive uses; river bank inflow; river bank depletion; precipitation percolation factors; and percolation to the Lompoc Plain from Santa Ynez River water.

The model uses historic records of rainfall, runoff, evaporation, and tunnel infiltration for the period 1918 through 1993. Reservoir releases, diversions, streamflow percolation, groundwater pumping, and depletions are based on monthly time steps. The model includes Gibraltar operations under the Operations Agreement, and Cachuma operations under Order WR 89-18. In addition, the model has been expanded to include releases for fisheries and SWP water deliveries through the Bradbury Dam outlet works. The major hydrologic outputs from the SYRHM for the EIR include lake storage and elevation; alluvial groundwater levels and storage; and streamflow below the dam.

The Santa Ynez River between Bradbury Dam and Lompoc Narrows is divided into four reaches in the model: (1) Bradbury Dam-Solvang, (2) Solvang-Buellton Bend, (3) Buellton Bend-Salsipuedes Creek, and (4) Salsipuedes Creek-Narrows Gage. Recently, the SBCWA expanded the SYRHM to incorporate a detailed version of the Bradbury-Solvang reach, in which the reach is divided into 12 segments between tributaries. This allows for a direct modeling of tributary flow contributions in the Bradbury Dam-Solvang reach of the SYRHM. This version of the model is referred to as SYRHM 498, which was used for the analyses supporting NMFS' Biological Opinion, as well as for this EIR.

The operational elements for the various EIR alternatives that were included in the modeling are listed in **Table 4-1, Operational Elements Used to Model Alternatives**.

Emergency winter storm operations and ramping of outlet releases have not been included in the SYRHM due to its limitation – i.e., use of monthly time steps. Winter storm operations and ramping of outlet releases would occur within days.

Table 4-1
Operational Elements Used to Model Alternatives

Operational Elements	Alternatives					
	2	3B	3C	4B	5B	5C
Releases for downstream water rights pursuant to Order WR 89-18	X	X	X	X	X	X
SWP water seasonal restrictions on releases, and limits on mixing percentage	X	X	X	X	X	X
Surcharge to 0.75'	X					
Surcharge to 1.8'		X			X	
Surcharge to 3'			X	X		X
Fish releases for interim rearing target flows per Biological Opinion	X					
Long-term fish releases under Biological Opinion for rearing and passage; Adaptive Management Account for fish releases		X	X	X		
Fish Releases using a combination of the long-term fish releases under the Biological Opinion and the 3A2 Operating Criteria					X	X
Delivery of SWP water to Lompoc Forebay in exchange for BNA water				X		

Note: As modified by the Settlement Agreement for 3C.

Releases from Cachuma Lake for steelhead rearing and passage have been modeled for three sets of operating criteria. The first set of operating criteria involves releases for steelhead rearing to meet interim target flows until dedicated reservoir storage is available, as required in the Biological Opinion and presented in **Table 2-8**. This set of operating criteria was used in Alternative 2, baseline operations. The second set of operating criteria involves releases for steelhead rearing using long-term target flows. Reservoir surcharge or dedication of existing reservoir storage for fishery purposes would provide the water to meet the long-term target flows. These criteria were used in modeling Alternatives 3B, 3C, and 4B and are summarized in **Table 2-7**. The operating criteria used in modeling Alternatives 5B and 5C involves a hybrid of what is termed the “3A2” operating criteria and the long-term Biological Opinion flows. These criteria are summarized in **Table 2-7** and **Section 3.2.2**.

One element that is common to all of the operating criteria is the conjunctive operation of releases for purposes of satisfying downstream water rights with fish releases. This dual-purpose use would extend the period of time each year when instream flows improve fisheries habitat for over-summering and juvenile rearing within the mainstem.

Key modeling assumptions associated with the delivery of SWP water to the Member Units include the following (Stetson Engineers, 2001a):

- A maximum delivery rate of 22 cfs is assumed which provides a potential monthly delivery of 1,220 to 1,310 af.
- SWP water deliveries are subject to statewide and Delta shortages based on estimates of shortages from the California Department of Water Resources’ hydrologic model DWRSIM v.9.06T. Shortages were applied annually, as predicted by the DWR model.
- SWP water imported into Cachuma Lake is exported out through Tecolote Tunnel in the same month.
- SWP deliveries are not made in months when Cachuma Lake is spilling. Although SWP deliveries can be made up in other months, spill conditions usually indicate a wet period in which additional SWP deliveries probably would not be needed. Therefore, it was assumed that SWP deliveries would not be made during spills and would not be made up in subsequent months.
- The proportion of the SWP water as a part of a Cachuma release for purposes of satisfying downstream water rights is limited to 50 percent of the total release to provide protection to steelhead.
- Reclamation must avoid mixing SWP water in the Santa Ynez River downstream of Bradbury Dam when steelhead smolts could be subject to imprint; hence, SWP deliveries were curtailed during releases for steelhead passage.

It should be emphasized that all of the results presented in this EIR are the result of analyzing simulated operations using SYRHM. Simulated operations should not be confused with experienced or real-time operations. All modeling of project alternatives used the historic hydrologic conditions from the period of record 1918 to 1993, which includes a wide range of rainfall conditions. For example, there were four significant dry periods in this period of record, as well as several very wet years. By using the historic period of record for the basis of the modeling, the hydrologic impacts of each alternative can be predicted with greater certainty. Review of current precipitation data for Lompoc and Gilbraltar Dam[7] shows that

[7] Lompoc station: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5064; Gibraltar 2 http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3402

average annual rainfall for the project area from 1993 to 2010 is within the range of precipitation of the model historic period (14 to 30 inches).

All simulation models have a certain amount of inherent error in predicting absolute results due to inherent errors in the mathematically derived representations of actual operations and the historic input data. Calibrations were performed by the SBCWA in developing SYRHM to match simulated operations with historic operations to minimize the amount of model error. Stetson Engineers performed all of the calibrations when modifying the model for use in the EIR (Stetson, 2001a).

The SYRHM operations have some limitations because the model uses monthly time steps. Other limitations of the SYRHM are related to real-time management decisions. For example, releases under Order WR 89-18, project delivery reductions in times of shortages, and SWP deliveries could vary based on real-time management decisions.

SYRHM is not able to reproduce historic operations exactly. Instead, the SYRHM recreates operations using historic climatic and hydrologic data within acceptable limits of error. It is important to note that the analysis of alternatives for the EIR is comparative in nature. Hence, all model simulations contain the same degree of error, and as such, the use of the model for comparative purposes is valid.

Peer Review of Modeling Approach and Results

The Santa Ynez River Water Quality Technical Advisory Committee (SYRWQTAC) was formed several years ago to develop suitable modeling tools to address ongoing hydrology, groundwater, and salinity issues along the lower river. The SYRWQTAC is composed of technical experts representing Reclamation, ~~COMB~~Department of Fish and Game, U.S. Fish and Wildlife Service, CCRB, ID No.1, SBCWA, SYRWCD, ~~City of Santa Barbara, and~~ City of Lompoc, and interested environmental agencies. The technical consultant for the SYRTAC is Stetson Engineers. The SYRWQTAC had meetings periodically to provide guidance on the development of modeling tools. It has provided oversight on recent updates to the SYRHM, as well as the addition of a salinity component to the model (see **Section 4.5**).

The SYRWQTAC conducted a technical review of the various modeling efforts by Stetson Engineers for the EIR to provide comments on key assumptions, modeling protocols, methods of interpreting results, and reliability of the results. The SYRWQTAC met with Reclamation and the EIR project manager on three occasions (April 20, May 11, May 30, 2001) to provide comments on four of the technical memoranda prepared by Stetson Engineers for the EIR, as listed below (provided in Appendix E of the August 2003 Draft EIR):

- Technical Memorandum No. 1. Impacts of EIR Alternatives using the Santa Ynez River Hydrology Model (Stetson Engineers, 2001a),
- Technical Memorandum No. 2. Impacts of EIR Alternatives on steelhead (Stetson Engineers, 2001b),
- Technical Memorandum No. 3. Hydrologic Analysis of Surface Water Salinity (Stetson Engineers, 2001c), and
- Technical Memorandum No. 4. Cachuma Water Rights EIR Alternatives – Results of USGS and HCI Lompoc Groundwater Flow and Transport Models (Stetson Engineers, 2001d),

In general, the SYRWQTAC concluded that the modeling analyses performed by Stetson Engineers for the EIR were appropriate and reasonable for the purposes of comparing alternatives at an EIR level. A summary of key technical issues raised by the SYRWQTAC on the use of the SYRHM to evaluate surface water and groundwater salinity issues is provided in **Section 4.5.2.1**.

SYRWQTAC did not review the recent hydrologic analyses in 2005 and 2006 that Stetson performed for the additional EIR alternatives (Alternatives 5B and 5C). Three additional technical memoranda prepared by Stetson Engineers for this revised EIR, are provided in **Appendix F** as listed below:

- Technical Memorandum No. 5. Hydrologic Impact Analysis of Possible Cachuma Operations Alternatives (Stetson Engineers, 2006a),
- Technical Memorandum No. 6. Santa Ynez River Flow Analysis for Impact Assessment on Steelhead (Stetson Engineers, 2006b), and
- Technical Memorandum No. 7. Hydrologic Impacts of Alternatives 5B and 5C on Salinity (Stetson Engineers, 2006c).

4.2.2.2 Changes in Lake Hydrology

The storage in Cachuma Lake is shown on **Chart 4-6, Simulated Cachuma Reservoir Storage for Various EIR Alternatives Using SYRHM0498,** in Appendix B for the various alternatives for the 76-year simulation period. The patterns of lake storage are identical for all alternatives.

Discussion of Data and Analyses

The discussion of data and analyses is found in **Section 4.2.2.1**.

Comparison of Alternatives

The median monthly storage for the alternatives is presented in **Table 4-2, Median Monthly (Simulation, 1918-1993) for Different Alternatives Storage in Cachuma Lake**. Alternative 5B exhibits lower storage than under the baseline operations (Alternative 2) throughout the year due to additional releases for fish. Median monthly storage under Alternatives 3C and 4B are greater than under the baseline operations (Alternative 2) throughout the year due to increasing total reservoir storage by 9,200 af as a result of a 3.0-foot surcharge. Depending upon the month, Alternatives 3B and 5C exhibit both higher and lower median storage levels throughout the year than under baseline operations (Alternative 2). This is due to a combination of both increased fish releases and increased reservoir surcharge during spills.

Table 4-2
Median Monthly Storage (Simulation, 1918-1993) for Different Alternatives in Cachuma Lake

Month	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
November	130,484	132,602	136,080	135,135	126,831	130,324
February	152,394	150,918	154,607	154,660	149,466	152,943
April	165,533	165,018	167,877	169,135	162,685	166,287
July	146,851	149,528	153,067	154,840	144,258	147,788

Median monthly lake elevations for the various alternatives are shown on **Chart 4-7, Median Monthly Cachuma Lake Elevations (Simulation 1918–93),** in **Appendix B**. The modeling results indicate the highest monthly elevations are exhibited by Alternatives 3C (Biological Opinion plus 3.0-foot surcharge) and 4B (SWP delivery to Lompoc Plain). These alternatives have higher lake levels than under Alternative 2 baseline operations because they involve the 3.0-foot surcharge. Median monthly lake levels would be lower under Alternative 5B than under the baseline operations (Alternative 2) because greater releases for fish would not be fully offset by a surcharge to 1.8 feet. The median monthly lake elevation for Alternatives 3B and 5C are slightly higher to about the same as under the baseline operations (Alternative 2) because the greater releases for fish are offset by a 1.8-foot surcharge and a 3.0-foot surcharge, respectively. A comparison of median annual winter and fall lake elevations amongst the alternatives shows the same pattern; this comparison is also provided in **Table 4-3, Median Lake Level (Water Elevation in feet)**.

The frequency of surcharging to specific lake elevations under the various alternatives is summarized in **Table 4-4, Frequency of Surcharging**. The frequency of reaching a lake level above 750.0 feet under the baseline operations (Alternative 2) is 26 of the 76 years of the simulation period; Alternatives 3B and 5B reach a lake level above 750.0 feet with the same frequency as under the baseline operations. Alternatives 3C, 4B and 5C reach a lake level above 750.0 feet in 27 of the 76 years of the simulation period.

Table 4-3
Median Lake Level (Water Elevation in feet)

Period	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
Annual	733.7	733.3	734.6	735.2	732.5	733.7
Feb	737.2	736.7	738.1	738.1	736.1	737.4
Aug	732.2	733.6	735.0	735.2	731.4	733.0

Table 4-4
Frequency of Surcharging

Lake Elevation Reached due to Surcharging	Number of Years Surcharging Occurred During 76-year Period					
	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4 B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
750 – 750.9	26	26	27	27	26	27
751 – 751.9	--	25	26	26	26	26
752 – 752.9	--	--	26	26	--	26
= or >753	--	--	25	24	--	23

The percentage of time (months) that Cachuma Lake would reach maximum levels is presented in **Table 4-5, Percentage of Time at Different Elevations that Lake Elevations are Met or Exceeded,** based on the simulation modeling (76 years). These results indicate that under the baseline operations (Alternative 2), the maximum lake level (750.75 feet) is achieved 11 percent of the time. The alternatives involving additional surcharging would cause more frequent inundation of the baseline shoreline (750.75 feet). For example, lake levels for Alternatives 3B and 5B (with 1.8-foot surcharge) would reach or exceed

750.75 feet about 14 and 13 percent of the time, respectively. Under Alternatives 3C, 4B, and 5C (with 3.0-foot surcharge to 753.00 feet), lake levels would reach or exceed 750.75 feet 16 percent of the time.

Table 4-5
Percentage of Time at Different Elevations that Lake Elevations are Met or Exceeded

Lake Elevation	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
750.75	11%	14%	16%	16%	13%	16%
751	--	11%	14%	14%	11%	13%
752	--	--	11%	11%	--	11%
753	--	--	9%	8%	--	8%

The median period of inundation at higher lake elevations for the alternatives is presented in **Table 4-6, Duration of Inundation**. The results of the modeling simulation indicate that median number of consecutive months at the maximum lake elevation is the same for all alternatives – about four months. The alternatives involving surcharging above 750.75 feet (Alternatives 3B, 3C, 4B, 5B, and 5C) would cause slightly more prolonged inundation of the baseline shoreline (750.75 feet). For example, under Alternatives 3C, 4B, and 5C, the median duration of flooding above 750.75 feet would be 5 months compared to Alternative 2 when the median duration above 750.0 feet would be 4 months.

Table 4-6
Duration of Inundation

Lake Elevation	MEDIAN NUMBER OF CONSECUTIVE MONTHS AT OR ABOVE LAKE ELEVATION					
	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
750	4	5	5	5	5	5
751	--	4	5	5	4	5
752	--	--	4	4	--	4
753	--	--	3	3	--	3

4.2.2.3 Changes in River Hydrology

A summary of the key downstream hydrologic characteristics of the various alternatives is presented in **Table 4-7, Key Hydrologic Characteristics**. **Table 4-7** indicates that more low flow releases (fish releases) would result in fewer spills or high flow releases under the project alternatives.

Discussion of Data and Analyses

Modifications to the accounting method for the ANA and BNA described in the Settlement Agreement have been implemented over about the past 20 years, including the use of the livestream checkpoint at San Lucas Creek rather than San Lucas Bridge for determining ANA account balance and the use of Reclamation Curve A only for making determinations of the BNA account balance in Cachuma Lake and resulting releases.

The account balance for the ANA, and more so the BNA, has increasingly grown under the operational format set forth in the Settlement Agreement.[8] ~~due to surface flows in the river~~ **Charts 4-30, Account Balance and Dewatered Storage Above the Narrows on the Santa Ynez River, 1973–2010**, and **4-31, Balance and Dewatered Storage Below the Narrows on the Santa Ynez River, 1973–2010**~~,~~ show the plots of Dewatered Storage versus for the ANA and BNA, respectively, as reported by Reclamation from 1973 through May 2010 (see **Appendix I**). Dewatered storage has ~~not~~ dropped below the 10,000-af threshold ~~for~~during several years since 1991. Except for periods of extreme drought (1986–1991) and very wet winters (1997-1998), dewatered storage generally remains between 12,000 and 15,000 ac-ft. ~~In addition, the Settlement Agreement Accumulated Drought Water Credit amount (a maximum of 3,200 acre-ft/year for the combined member units) and baseflow additions (25 acre-ft/month without stream flow) provide additional limited water supplies through surface water releases for downstream users during drought periods.~~

[8] It is important to differentiate between the account balance and credits accrued under ANA. The ANA account balance (carryover) intended to be larger because of the conjunctive operation of the ANA with the BNA since 1989 (Order WR 89-18). The releases have been more targeted to convey the BNA water to the Lompoc area while recharging the Above Narrows Groundwater Basin. There have been no increases in the ANA credits as a result of the amendments to Order WR 73-37 in 1989. However, the amendments under Order WR 89-18 reduced the amount of loss from the BNA in spill years and provided some additional BNA credits associated with the percolation capacity in the Lompoc Forebay. **Chart 4-31** shows that there is a noticeable break between the pre- and post-1989 conditions for the BNA.

Table 4-7
Key Hydrologic Characteristics

Parameter	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B "3A2"/BO and 1.8′ surcharge	Alt 5C "3A2"/BO and with 3′ surcharge
Average spill amount/leakage (afy)	36,693	35,784	35,415	35,288	34,916	34,537
Average Order WR 89-18 releases (afy)	6,023	5,682	5,737	3,940	5,473	5,529
Average fish releases (afy)	1,362	2,701	2,715	2,801	3,999	4,026
Total discharges from the dam (afy)	44,078	44,167	43,867	42,029	44,388	44,092
No. of spill months	82	79	78	74	75	74
No. of spill water years	26	25	25	24	23	23
No. of spill water years >20,000 af	16	15	15	15	15	15

Comparison of Alternatives

For all alternatives, releases for fish downstream of the dam would be greater than for the baseline operations (Alternative 2). Under the baseline operations (Alternative 2), releases from the dam averaged 1,362 afy. The average annual releases for fish would increase to 2,701 acre-ft/year; 2,715 acre-ft/year; and 2,801 afy under Alternatives 3B, 3C, and 4B respectively, which operate under the long-term BO operations. The average annual releases for fish would increase to 3,999 acre-ft/year and 4,026 acre-ft/year under Alternatives 5B and 5C, respectively, which operate under the hybrid operations for releases for fish (BO and 3A2 operations). Releases for fish under Alternatives 5B and 5C would be greater than Alternatives 3B, 3C, and 4B because the alternatives must meet higher flows in a wet or above-normal water year. It should be noted that releases for fish from Cachuma Lake also occur as dual-purpose releases with water rights releases as well as leakage from the dam. To the extent the spillway gates are repaired to minimize the leakage, an additional amount would be released for the purpose of fish habitat maintenance. The number of spills per month (frequency) and average annual spill amount under the baseline conditions (Alternative 2) are slightly greater than the rest of the alternatives. The number of spill months over a 76-year period would range from 74 to 79 months for Alternatives 3B, 3C, 4B, 5B, and 5C compared to 82 months under the baseline operations (**Table 4-7**). The average annual spill amount would be reduced 2, 3, and 4 percent from the baseline conditions under Alternatives 3B, 3C, and 4B, respectively. The average annual spill amount would also be reduced 5 and 6 percent from the baseline conditions under Alternatives 5B and 5C, respectively.

Table 4-7 shows that the releases for purposes of satisfying downstream water rights under Alternatives 3B, 3C, 4B, 5B, and 5C would be less than under the baseline operations (Alternative 2) because the additional releases for fish reduces the need for releases to replenish groundwater basins, which reduces the credits in the ANA. Most of the reduction in ANA credits due to fish releases occurs in the uppermost portion of the Above Narrows Aquifer (i.e., Santa Ynez Subarea) as described in **Section 4.4.2**.

Releases for water rights under Alternative 4B would also be less than under the baseline operations because releases from the BNA would not be made from the dam. Instead, SWP water would be delivered for artificial groundwater recharge to the Lompoc Forebay pursuant to an exchange agreement. The combined average annual releases for water rights and fish are 7,385 afy under the baseline operations (Alternative 2) and 8,383; 8,452; 6,741; 9,472; and 9,555 afy under Alternatives 3B, 3C, 4B, 5B, and 5C, respectively (**Table 4-7**).

Updates After 2003

As a comparison, based on data available from Reclamation, under current operations (which is similar to Alternative 3C), the average annual fish release[9] between April 2005 and July 2010 (prior to April 2005, USBR does not indicate Hilton Creek as a discharge point on monthly reports) and 2010 has been approximately 3,600 acre-ft/yr.[10] The releases documented by Bureau of Reclamation for 2005 through 2010, a very short hydrologic period, average 3,600 acre-ft/yr which is higher than the modeled result likely due to the short hydrologic period skewed by a very wet year in 2005.

Reclamation data indicates that between 2000 and 2010, two spills occurred in 2005 (in January and February) and 2008 in the winter, or 4 months of 33 months. Summer spills, were not reported during that period. However, data over a longer period is required to assess the long-term effect of current operations.

For comparison under current operations (which is similar to Alternative 3C), the combined average annual releases for water rights and fish between April 2005 and July 2010 was approximately 13,900 af[11]. The modeled (long-term hydrologic period~~,~~ - 76 years) value as opposed to the reported value (short term

[9] According to Mr. Darrin Williams of Reclamation, fish releases can be calculated by taking the values in the Hilton Creek column of the Monthly Reservoir operations report when no other release are shown, i.e., in from outlet or spillway.

[10] See http://www.usbr.gov/mp/cvo/reports.html. On the published reservoir operations monthly reports, fish releases are releases from the Hilton Creek discharge point when no other releases are being made, i.e., from the outlet or spillway.

[11] The combined water rights releases and fish releases were determined by summing the Hilton Creek column values and the outlet column values of Reclamation's monthly reservoir operations reports. Outlet values were not included in the sum when there were values recorded in the spillway column.

hydrologic period~~,~~ - about 6 years) under Alternative 3C is 8,452 acre-ft (5,737 acre-ft/yr for average Order WR 89-18 releases and 2,715 acre-ft/yr 2,715 = 8,452 acre-ft/yr). The modeled value is lower than the reported values ~~since the 2005 through 2010 represents a very short hydrologic sampling and the value is likely skewed by a very wet year in 2005~~.

Actual operations under the interim and long-term BO operations are compared with Alternatives 2 and 3C, respectively in **Table 4-7b, Comparison of Actual and Simulated BO Operations**. Interim BO operations were in place for the period 2001-2004 (4 years) and are compared with Alternative 2, which was simulated for the period 1918-1993 (76 years). Long-term BO operations have been in place for the period 2005-2010 (6 years) and are compared with Alternative 3C which was simulated for the period 1918-1993 (76 years).

Table 4-7b shows that the 2001-2004 period was relatively drier and the 2005-2010 period was relatively wetter compared to the 1918-1993 period. Correspondingly, actual spills were less in the 2001-2004 period and more in the 2005-2010 period compared with simulated spills. Similarly, actual water rights releases were more in the 2001-2004 period and less in the 2005-2010 period compared with simulated water releases. Actual fish releases under both interim and long-term BO operations have been higher than simulated fish releases, which is discussed in further detail in **Section 4.3, Water Supply Conditions**.

Overall it should be noted that this comparison between actual and simulated operations is for informational purposes only. It is not valid to draw conclusions by comparing averages over different hydrologic periods. To date, interim and long-term BO operations have occurred only over short periods, which skew the averages. Data over a longer period are required to assess the long-term effect of current operation.

The frequencies of the different sizes of releases from the dam under all alternatives are shown in **Table 4-8, Percentage of Time that Spills and Downstream Releases are at or above the Indicated Flow From Lake Cachuma Due to Spills and Downstream Releases**. The releases from the dam that are at or above 2 cfs, 5 cfs, or 10 cfs reflect the three different operating criteria for releases for fish including interim BO operations (Alternative 2), long-term BO operations (Alternatives 3B, 3C, and 4B), and the hybrid operations of long-term BO and "3A2" operations (Alternatives 5B and 5C). Under all operations, releases from the dam are 2 cfs or greater 99 percent of the time. The flow regime created below the dam due to spills and downstream releases are similar for Alternatives 3B, 3C, 4B, 5B, and 5C, as shown in **Table 4-8**. All of these alternatives result in more frequent downstream low flows (i.e., 2 – 10 cfs) than under the baseline operations (Alternative 2) due to greater releases for fish under these alternatives. Alternatives 5B and 5C also result in more frequent flows from 10-20 cfs (**Table 4-8**) than under the baseline operations (Alternative 2) and Alternatives 3B, 3C, and 4B.

Table 4-7b
Comparison of Actual and Simulated BO Operations

Parameter	Simulated Alt 2 1918-1993 (76 years)	Actual Interim BO Operations 2001-2004 (4 years)	Simulated Alt 3C 1918-1993 (76 years)	Actual Long-term BO Operations 2005-2010 (6 years)
Average spills (afy)	36,293	28,078	34,915	57,599
Average 89-18 releases (afy)	6,023	7,364	5,737	3,430
Average fish releases (afy)	1,762	2,310	3m215	6,264
Total non-spill discharges from the dam (afy)	7,785	9,673	8,952	9,694
Total discharges from the dam (afy)	44,078	37,752	43,867	67,293
No. of spill months	82 (9%)	3 (6%)	78 (9%)	3 (50%)
No. of spillwater years	26 (34%)	1 (25%)	25 (33%)	3 (50%)
No. of spill water years >20,000 ac-ft	16 (21%)	1 (25%)	15 (20%)	3 (50%)

Note: Leakage from spillway gates has been subtracted from the spills and added to the fish water releases in this table. Leakage was simulated at 400 afy and 500 afy for Alt 2 and 3C, respectively.

Table 4-8
Percentage of Time that Spills and Downstream Releases are at or above the Indicated Flow From Lake Cachuma Due to Spills and Downstream Releases (Simulation, 1918-1993)

cfs	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
2	99	99	99	99	99	99
5	42	67	68	68	68	69
10	30	36	36	34	45	45
20	26	27	27	24	31	31
50	13	12	12	8	12	12

The additional releases for fish under Alternatives 3B, 3C, 4B, 5B, and 5C result in more frequent low-flows (2-5 cfs) downstream of the dam compared to the baseline operations (Alternative 2), as shown in **Table 4-9, Percentage of Time that Downstream Flows are at or above the Indicated Flow**. For example, under the operations in Alternatives 3B and 5B, flows at Highway 154 are 5 cfs or greater 77 or 76 percent of the time, respectively. In contrast, flows of 5 cfs or more under the baseline operations occurred only 48 percent of the time. The increase in frequency of downstream low-flows over the baseline operations becomes smaller with distance from the dam, such that there is very little difference in the frequency of low-flows near Salsipuedes Creek (**Table 4-9**).

There is very little difference in the frequency of higher flows downstream of the dam because flows over 20 cfs are primarily due to natural runoff, not releases for fish, as shown in **Table 4-9**.

Downstream of Alisal Road, low-flows under Alternative 4B would be less frequent and would have less volume than other alternatives because BNA releases to the river would not be made from the dam under Alternative 4B. BNA releases from the dam involve high release rates (e.g., 75-100 cfs) to reach the Lompoc Plain.

Table 4-9
Percentage of Time that Downstream Flows are at or above the Indicated Flow
(Simulation, 1981–1993)

cfs	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion and 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
Below Hilton Creek						
2	99	99	99	99	99	99
5	47	74	75	75	74	75
10	33	39	39	37	48	48
20	26	28	28	24	32	32
50	13	12	12	8	12	12
Highway 154						
2	82	99	99	99	99	99
5	48	77	78	78	76	77
10	34	39	39	37	49	49
20	27	28	28	25	33	33
50	12	12	12	8	11	11
Alisal Road						
2	53	69	69	69	70	71
5	43	49	49	47	56	56
10	34	36	36	34	48	48
20	23	25	25	18	28	28
50	12	12	12	10	11	12

cfs	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion and 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
Near Buellton						
2	51	57	57	56	61	61
5	41	44	44	42	52	52
10	32	34	34	29	38	38
20	24	26	26	18	28	28
50	12	12	12	12	12	12
Above Salsipuedes Creek						
2	39	42	43	36	48	48
5	35	37	37	29	40	40
10	30	32	32	25	35	35
20	25	26	26	19	29	29
50	12	13	13	12	12	12
Narrows						
2	45	48	48	40	52	53
5	38	41	41	33	44	44
10	33	35	35	27	38	38
20	28	29	29	21	31	31
50	14	14	14	14	14	14

Charts 4-8a, Median Monthly Streamflow Below Lake Cachuma, and **4-8b, Median Monthly Streamflow Below Lake Cachuma** in **Appendix B** show that median monthly flows under the project alternatives (Alternatives 3B, 3C, 4B, 5B, and 5C) are predominantly greater than under the baseline operations (Alternative 2). The overall higher median monthly flows under the project alternatives are attributed to higher releases for fish. An exception would occur in August at the dam and Highway 154 when median monthly flows under Alternative 4B would decrease relative to baseline operations and the other project alternatives. The lower flows would occur under Alternative 4B because no BNA releases to the river from the dam would occur at that time. In addition, **Charts 4-8a** and **4-8b** show that Alternatives 5B and 5C have a higher median flow in May and June compared to other Alternatives due to the switch to 3A2 operating criteria in wet or above-normal hydrologic year type.

4.2.2.4 Impacts on Existing Flood Hazards

4.2.2.5 Threshold of Significance

An impact is considered significant if an increase downstream flows could increase the instream riparian vegetation that could in turn reduce channel capacity and cause flooding hazards. Specifically, additional flows for fish could increase the density, vigor, and extent of riparian vegetation in the river channel over time due to greater moisture availability, particularly during the early summer when water is generally at lower quantities in the river channel under baseline conditions (Alternative 2). The availability of water throughout the year in the channel will extend the growing season for phreatophytes and reduce the period of drought stress.

4.2.2.6 Discussion of Data and Analyses

The extent to which the expected increase in riparian vegetation along the river would reduce channel capacity and create potential flooding hazards cannot be predicted with any available analytic tools. Vegetative changes reduce channel capacity by increasing channel roughness due to more vegetation in the channel, and/or a greater percentage of woody obstructive vegetation. At the same time, the vegetative changes predicted in conjunction with Alternatives 3B, 3C, 4B, 5B, and 5C would also result in slope stabilization, which would help to prevent bank erosion. Flood hazards are created if the reduction in channel capacity deflects flows that cause bank erosion, or higher water levels are created that exceed the banks. The extent of flooding and bank erosion is dependent on site-specific channel conditions, which are highly variable along the lower river.

Historically, the County FCD has not needed to conduct channel maintenance along the lower Santa Ynez River outside of the western Lompoc Valley because the upstream river channel historically has had sufficient capacity. Most of the river between the dam and Lompoc Valley does not contain bank protection or development adjacent to the river, with the exception of scattered land development in Solvang, Santa Ynez, and Buellton. Hence, minor flooding may occur without adverse consequences. However, public infrastructure along the river is vulnerable to flood damage, such as bridges at Refugio Road, Alisal Road, and Highway 101 and numerous pipeline crossings. Private and public water wells near the river are vulnerable to flood damage. For example, the 1995 and 1998 floods destroyed several SYRWCD, ID #1 production wells near Santa Ynez.

It should also be noted that the reduction in the frequency of spills under the project alternatives would reduce the frequency of uncontrolled downstream flows, which could cause flooding. The reduction in spill frequency, however, may also increase flooding hazards along the lower river. Flood flows during spills generally cause scouring that can remove riparian vegetation, and thereby increase channel capacity. In essence, flood flows reestablish channel capacity that is slowly reduced by vegetative growth between flood flows. As such, the project alternatives could slightly increase flooding hazard along the lower river over time by reducing the number of times flood flows would mechanically clear riparian vegetation (due to scouring flows) and restore channel capacity.

4.2.2.7 Comparison of Alternatives

As described in **Section 4.2.2.3**, Alternatives 3B, 3C, 4B, 5B, and 5C would alter downstream hydrology compared to the baseline operations (Alternative 2).

- The spill frequency and average annual spill amount under the project alternatives would be slightly less than under baseline operations.
- The releases for steelhead rearing and passage flows downstream of the dam under the project alternatives would be greater than under baseline operations (Alternative 2) because they would involve higher rearing target flows and the baseline operations do not include passage flows. Due to an increase in fish releases, low flows downstream of Cachuma Lake would occur for a slightly longer duration and over a larger portion of the river than under the baseline operations. For example, under the baseline operations, flows at Highway 154 are 5 cfs or greater 48 percent of the time. In contrast, flows of 5 cfs or more under the other project alternatives occur 76 to 78 percent of the time.
- The frequency and amount of low-flows downstream of the dam (to Alisal Road) under the project alternatives are similar to one another and greater than under baseline operations. However, moderate flows (50-100 cfs) would occur less frequently under Alternative 4B than under baseline operations because BNA releases to the river are not being made from the dam.
- There is very little difference between alternatives in the frequency of high flows (>50 cfs) downstream of the dam because such flows are primarily due to natural runoff, not releases for water rights or fish.

Alternatives 3B, 3C, 4B, 5B, and 5C would increase downstream flows (primarily from the dam to Alisal Road) that could reduce channel capacity and cause flooding hazards as explained above. These effects are likely to be most pronounced in the reach between the dam and Alisal Road where rearing flows for steelhead would be continuous except in drought years. The increase in riparian vegetation probably would not be measurable below Buellton where flows would not be maintained for fish. As such, impacts to riparian vegetation would be less than significant (Class III).

Alternatives 3B, 3C, 4B, 5B, and 5C are not expected to significantly increase the potential for flooding hazards along the lower Santa Ynez River as the result of an increase in in-stream woody riparian vegetation and a minor reduction in spill frequency. The effect is expected to occur between the dam and Buellton in portions of the channel that already have limited channel capacity or vulnerable banks, and where existing riparian vegetation will respond to more frequent low flows by increasing growth. The potential increase in flood hazard is considered a less than significant impact (Class III) due to the fact that, although reduced spills associated with the project alternatives may result in a reduction in scouring that can restore channel capacity, this impact would be offset by a reduction in uncontrolled spills, which can cause flooding. As such, impacts for potential flooding hazards would be less than significant (Class III).

4.2.3 Mitigation Measures

No mitigation is considered because no significant adverse hydrologic impacts would occur due to the project alternatives.

4.3 WATER SUPPLY CONDITIONS

4.3.1 Existing Conditions

An overview of the Cachuma Project Member Units and their water supply and demand conditions is provided below. Current water supply (2009/2010) and future water supply and demand estimates were provided by the Member Units and are described below. **Tables 4-10** through **4-14** tabulate water supply and demand for each member unit. It should be noted that future projections made for individual Member Units vary in time. Current year water use is 2009 for CVWD while MWD, City of Santa Barbara, GWD, and SYRWCD #1 use the year 2010. Future projections for CVWD, MWD, and GWD are for the year 2020. The City of Santa Barbara has projections to the year 2050, while SYRWCD #1 has projections to the year 2025. In addition, the calculation of water reliability from the SWP is based on the Final 2009 State Water Project Reliability Report,[1] which is slightly different as provided by each member unit.

4.3.1.1 Carpinteria Valley Water District

The Carpinteria Valley Water District (CVWD) encompasses about ~~8,912~~11,280 acres with a mixture of land uses including agriculture (3,400 acres, or 3~~4~~0 percent), residential (1,160 acres, or ~~13 ~~10 percent), ~~and~~ industrial/commercial/institutional (700 acres, or ~~14 ~~6 percent), ~~and ~~open space (5,230 acres, or ~~33 ~~46 percent~~) ~~) and undesignated (790 acres, or 7 percent)~~land uses~~. Domestic water service is provided to a population of about ~~17,900~~15,694 and approximately ~~3,240~~3,400 acres of irrigated crops, ranging from lemons and avocados to nursery products. CVWD maintains ~~3,936~~4,283 connections.

It has three sources of water: Cachuma Project, groundwater pumping, and SWP water. As shown in **Table 4-10, Water Supply and Demand Carpinteria Valley Water District**, Cachuma Project water (3,100 afy) represents about ~~49 ~~65.4 percent of CVWD's supplies. Groundwater is extracted from the Carpinteria Basin, which according to CVWD has a total perennial yield of about 5,000 af. CVWD pumps about ~~1,800~~1,150 afy~~a~~ (24.3 percent) on average from this basin. Approximately ~~50 ~~48 percent of the water deliveries are for agricultural customers. It is anticipated that in a future normal[2] year CVWD will extract 1,500 acre-ft/yr from the groundwater basin (see **Table 4-10**).

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[1] California Department of Water Resources, Bay-Delta Office, Final - *The State Water Project Delivery Reliability Report 2009*, August 2010).

[2] *Normal* (USGS definition) - A central value (such as arithmetic average or median) of annual quantities for a 30-year period ending with an even 10-year, thus 1921-50,~~;~~ 1931-60, and so forth. This definition accords with that recommended by the Subcommittee on Hydrology of the Federal Inter-Agency Committee on Water Resources: http://water.usgs.gov/wsc/glossary.html#N. For cases of surface water, the median value over a period of a hydrologic record of at least 30 years could be considered the normal value.

Table 4-10
Water Supply and Demand - Carpinteria Valley Water District

	Normal Year (afa)	Critical Drought Year[1] (afa)	Comment
Supplies			
Cachuma Project	2,813	1,445	Fixed percentage of Cachuma Project yield. Cachuma represents 49% of total supply. Critical Drought Year I is based on simulation of Alternative 5B.
State Water Project	1,386	132	SWP entitlement is 2,000 afy plus 200 afy of CCWA drought buffer; this analysis assumes 63% average annual delivery and 6% during droughts.[2]
Local groundwater	1,500	3,500	Share of local groundwater basin.
Total	**5,699**	**5,077**	
Demand			
Current (2009)	4,12~~0~~0		Approximately ~~50~~48% for agricultural use.
Planned future (2020)	4,600		

Source: 2009/2010, 2020/2030 and 2050 from Cachuma Member Units as provided by CCRB and ID #1; CVWD (CVWD 2009: Initial Study/Negative Declaration for Determination and Disposition of State Water Project Allotment Surplus: C. Hamilton, General Manager, 2010: Urban Water Management Plan, 2005, 2007).
Notes:
1 *State of California (State of California 2008: The State Water Project Delivery Reliability Report 2007, p. 44 Tables 6.4 and 6.5).*
2 *63 percent of Table A allotment (2,000 acre-ft) plus CCWA drought buffer (10 percent or 200 acre-ft) = 1,386 acre-ft. 6 percent of 2,200 acre-ft during a single drought period = 132 acre-ft.*

4.3.1.2 Montecito Water District

The Montecito Water District (MWD) encompasses an area of approximately 9,888 acres of which about 70 percent is residential, while the remainder is a mixture of commercial/recreation (1 percent), open space (18 percent), and agriculture (11 percent). MWD delivers approximately 67 percent its water to residential customers. MWD delivers the remainder for purposes of agricultural or recreational purposes (i.e., golf courses and parks).

MWD obtains water from the following sources: Cachuma Project, Jameson Reservoir/Doulton Tunnel (located along the Santa Ynez River above Cachuma Lake), diversions on Fox and Alder Creeks (tributaries to the Santa Ynez River), SWP water, and groundwater (see **Table 4-11, Water Supply and Demand Montecito Water District**). MWD pumps from the Montecito Basin, which according to MWD has a perennial yield of about 1,650 afa. MWD estimates its long-term share of the groundwater basins' perennial yield is 200 afy in a Normal Year and 400 afa in a Critical Drought Year. MWD does not provide water to all properties in its service area. Many properties are served by private wells or stream diversions, or one of nine private water companies.

Table 4-11
Water Supply and Demand Montecito Water District

	Normal Year (afa)	Critical Drought Year[2] (afa)	Comment
Supplies			
Cachuma Project	2,651	1,362	Normal Year based on percentage of Cachuma Project yield. Critical Drought Year is based on simulation of Alternative 5B.
Jameson Lake, Fox and Alder creeks	2,000	800	Normal Year based on annual diversion entitlement. Critical Drought Year based on Bachman "Optimization Plan" and the Jameson lake operating storage curve.
Doulton Tunnel	375	160	Represents tunnel infiltration; Critical Drought Year based on 75-year supply history.
State Water Project	2,079	198	SWP Table A amount is 3,000 afy plus 300 afy of CCWA drought buffer; assumes 63% average annual delivery of Table A amount and 6% delivery during droughts.3
Local groundwater	200	400	District's portion of Montecito Groundwater Basin's safe yield of 1,650 afa. Maximum pumping is 400 afa.
Total[1]	**7,305**	**2,920**	
Demand			
Current (2010)	6,680		Customer demand is 5,800 acre-feet +10% unaccounted and the annual 300 af transfer to City of Santa Barbara
Planned future (2020)[2]	6,500		2030 demand is for a 20% reduction in current demand based on historical peak FY 2007/08 ac-ft customer usage with an additional 500 units for full buildout condition.

Source: 2009/2010, 2020/2030 and 2050 from Cachuma Member Units as provided by CCRB and ID #1.).
Notes:
[1] *Does not include available State Water Dry year purchase programs/transfers and purchase of excess supplies from local water agencies.*
[2] *Lower customer demand in 2030 based on increasing reduction in customer usage since 2007/08. District is expecting to see a further reduction in current customer demand by 2020.*
[3] *63 percent of Table A allotment (3,000 acre-ft) plus CCWA drought buffer (10 percent or 300 acre-ft) = 2,079 acre-ft. 6 percent of 3,300 acre-ft during a single drought period = 198 acre-ft*

4.3.1.3 City of Santa Barbara

The City of Santa Barbara encompasses approximately 12,000 acres of which about 90 percent is developed. The developed area is comprised of residential (43 percent), commercial/industrial/ institutional (26 percent), vacant land (24 percent), and transportation corridors (7 percent). Almost all deliveries are for municipal and industrial uses in the City; agricultural demands are approximately 70-100 afa.

In 2009-2010, t~~T~~he City ~~obtains~~ received water from the following sources: Cachuma Project, Gibraltar Reservoir, ~~/~~Mission Tunnel~~/Devil's Canyon Creek~~ (located in the Santa Ynez River watershed above Cachuma Lake), ~~water transferred from Juncal Reservoir by agreement with MWD,~~ rec~~laim~~ycled water, SWP water, ~~desalination,~~ and groundwater (see **Table 4-12, Water Supply and Demand City of Santa Barbara**). The City has not received water from it desalination plant and does not expect to in the near future. The City's water supplies from these sources for the 2009-2010 water year are:[3]

- Lake Cachuma – the City's share of the Cachuma Project normal annual deliveries is 8,277 af; actual use for 2009-2010 was 6,803 af. The unused portion has been carried over to the current year;
- Gibraltar Reservoir – Deliveries were 3,331 af;
- Mission Tunnel – Groundwater that seeps into the tunnel provided 1,288 af;
- Groundwater – Four of nine production wells are currently available for production. Four additional wells feeding Ortega Groundwater Treatment Plant (OGTP) are being considered for rehabilitation in conjunction with the upgrade of the OGTP. The City used 1,273 af of groundwater.
- SWP water – The City has a 3,000 af entitlement, plus 300 af drought buffer. The Coastal Branch and Santa Ynez Extension of the SWP are in place to deliver the City's SWP water into Lake Cachuma, subject to availability of water supplies. The City used 777 af of SWP Water in 2010;
- Recycled water – The City's recycled water system provides recycled water to parks, schools, golf courses, other large landscaped areas, and some public restrooms. The system provides approximately 5 percent of the total water demand. Demand from recycled water customers was 660 af in 2010, not including process water at El Estero Wastewater Treatment Plant.

The City estimates the total safe yield of the Santa Barbara Groundwater Basin (includes Unit #1, Unit #3, and the Foothill Storage Unit) is 1,850 afa. The City estimates its long-term share of the groundwater basin's perennial yield is 1,300 afy in a Normal Year and 3,500 afy in a Critical Drought Year.

4.3.1.4 Goleta Water District

The Goleta Water District (GWD) encompasses an area of approximately 32,000 acres of which about 4,000 acres (12 percent) are agricultural, 5,760 acres (18 percent) are residential, 640 acres (2 percent) are commercial, and 21,600 acres (68 percent) are open space. GWD serves the University of California, Santa Barbara, the Santa Barbara Airport, schools, recreational facilities, and the City of Goleta.

GWD obtains water from the following sources: Cachuma Project, SWP water, groundwater and reclamation of treated wastewater (reclaimed water) (**Table 4-13, Water Supply and Demand Goleta**

[3] City of Santa Barbara, Public Works Department, Water Resources Division, Water Supply Management Report, 2010 Water Year, December 2010, Table 1.

Water District). GWD obtains 9,322 afy in a Normal Year from the Cachuma Project. GWD also has 3,800 afy of SWP entitlement, plus 450 afy of CCWA's drought buffer. Pumping capacity and GWD's SAFE ordinance currently limit delivery of SWP water. GWD can presently use 4,500 afy of the CCWA facility capacity, which restricts the amount of SWP water available to GWD at this time. In 1995, Goleta began making deliveries from a new reclaimed water project developed in cooperation with the Goleta Sanitary District, a separate public agency. The recycled water project has a capacity of approximately 1,500 afy and GWD currently delivers about 1,000 afy in a Normal Year to the University of California, Santa Barbara, several golf courses, and other users who were previously using potable water. GWD extracts approximately 2,350 afy in a Normal Year of groundwater from the Goleta Basin. GWD estimates the safe yield of the basin is 3,410 af.

A groundwater management consideration for GWD is compliance with the District's SAFE Ordinance that sets 1972 groundwater levels in the Central subbasin as the baseline for determining a drought buffer.[4] SAFE is an operational plan for GWD that augments the storage quantified in the Wright Judgment.[5] SAFE requires a certain amount of water to be stored by GWD when groundwater elevations are below 1972 levels. The combination of the Wright Judgment's groundwater storage component and GWD's SAFE Ordinance has established a large storage bank in the Central subbasin for droughts and other potential shortages of supply.[6] GWD's use of groundwater in storage is controlled by both the SAFE Ordinance and the Wright Judgment. The Wright Judgment only requires that there is stored water available that was accumulated by either injection in wells or by deliveries of other supplies in lieu of pumping under GWD's water rights. Certain specified effects of increased GWD pumping on other pumpers would also need to be mitigated. [7] The SAFE Ordinance is more restrictive, limiting pumping of stored water in some circumstances.

The effectiveness of drought protection in the basin can be estimated using either the expected decline in groundwater elevations when the stored water is pumped during a drought or using the annual volume withdrawn during a drought.

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4 Bachman, Steve, Ph.D., Final Groundwater Management Plan, Goleta Groundwater Basin, prepared for Goleta Water District and La Cumbre Mutual Water Company, May 2011.

5 In 1973 a group of landowners filed suit for the adjudication of water rights in the Goleta North-Central Groundwater Basin; the decision was finalized in 1989 (Martha H. Wright et al v. Goleta Water District et al, 1989, amended Judgment, Superior Court of Santa Barbara County Case No. SM57969).

6 Bachman, Steve, Ph.D., Final Groundwater Management Plan, Goleta Groundwater Basin, prepared for Goleta Water District and La Cumbre Mutual Water Company, May 2011, p. 5-14.

7 Superior Court of the State of California for County of Santa Barbara, Martha H. Wright et al v. Goleta water District, Case No. SM57969, amended judgment, filed November 17, 1989.

During the 1986–1991 drought, there was about an 8-foot-–per-–year decline in groundwater elevations in the Index Wells when GWD pumped ~~about~~approximately 2,500 afa of groundwater above its current water right.[8] Because the Modified Operations zone (between 1972 and 1989 groundwater elevations) encompasses a range of 59 feet of groundwater elevation for the Index Wells, stored water could be pumped for 7.4 years if groundwater elevations dropped 8 feet per year. Pumping more or less than the 2,500 afa of extra groundwater above current water rights would shorten or lengthen that time. Now that SWP water is available, that water could extend the effectiveness of drought protection by providing a supplemental supply to groundwater. In addition, water conservation, either through voluntary or mandated actions, could substantially prolong the effectiveness of the Drought Buffer. An extended drought might require pumping groundwater to below historical elevations. In addition, it is also likely that production yields for individual wells will decrease as groundwater elevations decrease. This relationship was detected during the drought of 1986–1991, when production capacity from GWD's wells dropped by a third over a period of five years as groundwater elevations dropped to their historical low. If pumping below the historical low groundwater elevations is contemplated in the future, increased monitoring would be necessary to detect potential problems in the basin.

The GWD Water Supply Management Plan questions whether GWD should manage its groundwater pumping such that groundwater elevations generally remain well above or only slightly above 1972 levels (except during a drought).~~?~~[9] The WSMP model used the SAFE rules that groundwater can be pumped anytime groundwater elevations are above 1972 levels. Maintaining elevations well above 1972 levels would enhance the existing Drought Buffer and drought protection for customers. In addition, the District's Annual Storage Commitment to the Drought Buffer is currently 2,378 acre-feet per year, which means that the District will be required to not pump wells and inject a small amount of water from another source to meet the requirements of SAFE, if groundwater elevations were to drop below the 1972 levels (except during a drought). At the same time, maintaining a buffer above the 1972 levels means that more costly SWP water would be used in lieu of groundwater to serve customers.

The GWD Water Supply Management Plan recommends that the groundwater SWP water hybrid management strategy be used by GWD to manage its various water sources.[10] This hybrid strategy is described below in priority order:

1. Cachuma water sources are used first until their entitlement is exhausted for the year, in the following order: Carry-over Water, spill Water, and Cachuma Entitlement.

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[8] Bachman, Steve, Ph.D., Final Groundwater Management Plan, Goleta Groundwater Basin, prepared for Goleta Water District and La Cumbre Mutual Water Company, May 2011, pp. 5-14 through 5-16.

[9] Bachman, Steve, Ph.D., Goleta Water District, Water Supply Management Plan, April 2011, p. 17.

[10] Bachman, Steve, Ph.D., Goleta Water District, Water Supply Management Plan, April 2011, p. 20.

2. However, if there is a local drought such that Cachuma deliveries are reduced below 100 percent in any month, then groundwater is pumped at its capacity as a supplement to Cachuma water. This extends the availability of Cachuma water later into the water year and allows longer pumping of the limited capacity groundwater wells.

3. Any CCWA banked water is then used. CCWA considers that the first SWP water used is banked water, so this accounting is done automatically as SWP water is used.

4. Determine the average spring groundwater elevations from the Index Wells. Use the following logic sequence:

   a. If groundwater elevations are higher than -26.2 ft. msl (1972 groundwater elevation), pump groundwater at its capacity of 300 acre-feet per month. Then supplement SWP water as needed to fully meet demand.

   b. If groundwater elevations are lower than -84.6 ft. msl (historical low elevation), use SWP water to meet demand.

   c. If groundwater elevations are between -26.2 ft. and -84.6 ft. msl, use the following logic sequence:

      i. If Cachuma deliveries are at 100 percent, use SWP water to meet demand.

      ii. If Cachuma deliveries have been reduced, use groundwater first at its capacity, supplemented by SWP water to meet demand.

Table 4-12
Water Supply and Demand City of Santa Barbara

	Normal Year (afa)	Critical Drought Year1 (afa)	Comment
Supplies[2]			
Cachuma Project	8,277	4,251	Fixed percentage of Cachuma Project yield. Cachuma Drought Year is based on simulation of Alternative 5B from the SYRHM.
Gibraltar Reservoir and Devils Canyon	3,612	0	
Mission Tunnel	1,125	500	Infiltration; tunnel from Gibraltar Reservoir.
Juncal Reservoir	300	300	Water from Montecito Water District per prior agreement.
State Water Project	2,079	198	SWP Table A: 3,000 afy plus 300 afy of CCWA drought buffer. Deliver estimates based on DWR 2008 State Water Project Reliability Report, Table B.7; Normal Year reduced to 63% of Table A.[3]
Local groundwater	1,300	3,500	Normal Year is City's portion of the Santa Barbara Groundwater Basin's safe yield of about 1,850 afa; Critical Drought Year based on increased pumping to offset reduced surface water due to drought.
Recycled Water	800	800	Current connected demand.
SWP Deliveries of Non-project Water	0	396	
Desalination	0	0	Reserved for emergency use only. Currently in storage mode. Assumed capacity = 3,125 afa.
Total	**17,493**	**9,945**	No safety margin included in supply total; 13% shortage in Critical Drought Year compared to Normal Year.
Demand			
Current (2010)	14,000	12,600	
Planned future (2050 per Plan Santa Barbara – Extended Range Forecast)	16,028	14,425	

Source: 2009/2010, 2020/2030 and 2050 from Cachuma Member Units as provided by CCRB and ID #1. City of Santa Barbara (2010 Preliminary values for Plan Santa Barbara [General Plan Update] DEIR; and Bill Ferguson, City Water Resources Supervisor, 2010).

Notes:

[1] *Based on 5th year of 5-year critical drought period as evaluated for Plan Santa Barbara DEIR process. (1951 for Santa Ynez River watershed. 1992 for State Water Project watershed).*

[2] *Above numbers do not include any safety margin to protect against unforeseen change in supply or demand.*

[3] *63 percent of Table A allotment (3,000 acre-ft) plus CCWA drought buffer (10 percent or 300 acre-ft) = 2,079 acre-ft. 6 percent of 3,300 acre-ft during a single drought period = 198 acre-ft.*

Table 4-13
Water Supply and Demand Goleta Water District

	Normal Year (afa)	Critical Drought Year (afa)	Comment
Supplies			
Cachuma Project	9,321	4,788	Cachuma Water year. Fixed percentage of Normal Cachuma Project yield; Cachuma represents about 57% of Normal Year total supply. Critical Drought Year based on simulation of Alternative 5B from the SYRHM.
State Water Project	3,800[3]	474[2]	SWP entitlement is 7,450[1] afy plus 450[1] afy of CCWA drought buffer. Delivery is 63% of entitlement and 6% delivery during droughts[.2].
Local groundwater	2,350	3,600	District's portion of the Goleta Basin. Basin yield estimated at 3,410 afa. Assumes Airport, San Antojio, San Marcos, El Camino and University wells operate at 75% efficiency based on 2008 well use.
Recycled Water project	1,000	1,060	Based on highest historical use. Recycled water supply only meets recycled water demand.
Total	**16,471**	**9,922**	
Demand			
Current (2010)	14,070		Past 10 year potable water average production of 13,060 af and 1,000 af recycled water production.
Proposed future (2020)	15,890		Includes approximately 1,250 afy of Recycled Water Average of recycled water use to create Table a-18 of the December 2005 UWMP.

Source: Water Supply Assessment. City of Goleta Proposed Amended General Plan/Coastal Land Use Plan. May 22, 2008.
Notes:
1 *63% of the Table A allotment (7,450 acre-ft) plus CCWA drought buffer (450 acre-ft) = 4,977 acre-ft. This exceeds the capacity of delivery of 4,500 acre-ft."*
2 *6% of Table A plus (7,450 acre-ft) plus drought buffer 450 acre-ft) = 474 acre-ft*
3 *Table 4.3 – Water Supply Assessment. 2008, reports: SAFE directs that: "Due to the controversy concerning the physical ability of the State Water Project to deliver its full contractual commitments, the District shall plan for the delivery of 3,800 acre feet of water as the amount of firm average long-term yield."*

4.3.1.5 Santa Ynez River Water Conservation District, Improvement District #1

The SYRWCD, ID #1 encompasses an area of approximately 10,850 acres of which about 5,000 acres are residential, 150 acres are commercial, 400 acres are institutional, 2,600 acres are agricultural, and 2,700 acres are grazed or undeveloped. Approximately, 50 to 60 percent of water deliveries are for agricultural customers; the remainder is for residential uses. SYRWCD, ID #1 is a primary supplier of municipal and industrial water for the City of Solvang.

SYRWCD, ID #1 obtains water from the following sources: Cachuma Project, SWP water, groundwater from the Santa Ynez Upland, and underflow from the Santa Ynez River Riparian basins (see **Table 4-14, Water Supply and Demand Santa Ynez River Water Conservation District ID #1**). The latter supplies are developed in two well fields in the river (4 cfs and 6 cfs fields) and a gallery in the riverbed, which is currently inactive. SYRWCD, ID #1 has an entitlement for SWP of 2,000 afa, which includes an entitlement of 1,500 afy for the City of Solvang. Cachuma Project water represents an important source of SYRWCD, ID #1's total water supply.

SYRWCD, ID #1 currently participates in a water exchange program with other Cachuma Project Member Units. Under the program, South Coast Member Units purchase SWP water, which is then delivered directly to SYRWCD, ID #1 from the CCWA pipeline near Santa Ynez. The South Coast Member Units then take an equivalent amount of water from the Cachuma Project in exchange. This program allows the Member Units to avoid the cost of pumping SWP water to Cachuma Lake and then conveying the water downstream to SYRWCD, ID #1.

Water deliveries for 1989 to 2000 by the Member Units to their customers are shown in **Table 4-15, Annual Water Deliveries by the Member Units to Their Customers (1989 to 2000)**.

Table 4-14
Water Supply and Demand
Santa Ynez River Water Conservation District, ID #1

	Total (afa)	Critical Drought Year (afa)	Comment
Supplies			
Cachuma Project	2,651	1,362	Fixed percentage of Cachuma Project. Cachuma represents approximately 38% of total supply. SWP Drought and institutional constraints on deliveries will affect the ability for the South Coast Member Units (SCMUs) to exchange SWP water from Cachuma Project water. With 13% deliveries of SWP water to the SCMUs, ID No. 1's Cachuma Project water Exchange Agreement deliveries would need to be supplemented. Critical Drought Year is based on simulation of Alternative ~~3C~~ 5B from the SYRHM ~~with reserves set aside~~.
Santa Ynez Uplands Groundwater Basin	1,622	2,570	Production for Normal Year is based on average of the last 5 years (2005–2009) and all wells producing at a reduced rate due to lower water levels. Drought supply is based upon average annual production during the 1987–1991 drought adjusted reduced production from all wells. Includes Solvang upland well production based on its Water Master plan.
Gallery Well	0	0	Currently inactive due to proximity of the river under the surface water treatment rule. Maximum licensed diversion is 515 afa.
Santa Ynez River Underflow	1,582	2,215	Production from the 6.0 cfs permitted well field with two wells damaged – one permanently and a second under the surface water treatment rule, and based on 5-year average. The 4.0 cfs permitted well field limited production in 2009 only. Includes City of Solvang permitted river well production based on its Water Master Plan.
State Water Project	1,386	132	SWP Table A amount is 2,000 afy plus 200 afy of CCWA drought buffer. District's Table A amount is 500 afy plus 200 afy of drought buffer. The remaining 1,500 afy is allocated to the City of Solvang under a water supply contract. Due to the long-term institutional constraints related to the ESA matters in the Delta, ID No. 1 plans for OMR restrictions to 63% delivery of its 2,200 afy allocation in normal years, and 6% during drought conditions.1
Total	**7,241**	**6,279**	
Demand			
Current (2009)	6,826		Includes for the City of Solvang
Planned future (2025)	8,273		Includes 1,500 afy for Solvang

Source: 2009/2010, 2020/2030 and 2050 from Cachuma Member Units as provided by CCRB and ID #1 ID No. 1 (Chris Dahlstorm, ID No. 1 General Manager, 2010).

[1] *63% of Table A allotment (2,000 acre-ft) plus CCWA drought buffer (10% or 200 acre-ft) = 1,386 acre-ft. 6% of 2,200 acre-ft during a single drought period = 132 acre-ft.*

Table 4-15
Annual Water Deliveries by the Member Units to Their Customers
(1989 to ~~2000~~2010)

Year	Carpinteria[1]	Montecito[4]	City of Santa Barbara[2]	Goleta[3, 4]	SYRWCD ID #1[4]
1989–90	~~6,398~~6,522	5,106	16,637	13,994	~~7,902~~6,864
1990–91	4,79~~6~~8	3,580	9,427	9,593	6,34~~6~~3
1991–92	4,028	3,093	9,518	9,076	~~6,050~~5,320
1992–93	4,354~~30~~	3,900	11,073	12,172	~~6,343~~6,048
1993–94	4,508~~331~~	3,750	11,438	12,671	~~6,236~~5,592
1994–95	4,416~~70~~	4,044	12,337	11,531	~~6,138~~5,377
1995–96	4,40~~1~~3	5,383	13,636	12,312	~~6,812~~6,111
1996–97	4,689~~8~~	4,202	14,230	14,667	~~6,506~~6,277
1997–98	3,880	4,306	12,818	11,758	~~5,110~~4,290
1998–99	4,443	4,812	14,291	13,700	~~6,163~~5,310
1999–00	4,673~~2~~	5,337	15,291	~~No data~~14,232	~~6,681~~5,303
2000-01	3,497	5,773	13,792	14,414	NA
2001-02	3,774	NA	13,344	13,244	NA
2002-03	3,774	NA	12,879	14,909	NA
2003-04	3,298	NA	12,223	13,871	NA
2004-05	3,710~~,~~	NA	13,073	15,318	NA
2005-06	2,719	5,250	12,528	12,509	4,740
2006-07	2,933	NA	12,860	NA	NA
2007-08	2,833	NA	14,106	NA	NA
2008-09	2,836	NA	14,432	NA	NA
2009-10	3,158	4,653	13,576	12,023	4,635
Average	3,964~~4,201~~	4,514~~3,959~~	13,024~~11,725~~	~~11,043~~12,889	~~5,859~~5,555

Source:

1 *Capinteria Valley Water District, Public Review Drat – 2010 Urban Water Management Plan Update, June 2011, Table 4-5.*

2 *City of Santa Barbara, Urban Water Management Plan 2010 Update, adopted June 14, 2011, Table 2.*

3 *Goleta Water District, Final Urban Water Management Plan, December 20. 2005, corrected December 20, 2007, Table 16*

4 *Central Coast Water Authority, 2010 Urban Water Management Plan, June 2011, Tables 3-1 and 3-2.*

Current water demand by MUs are listed in **Tables 4-10** through **4-14**. CVWD's current water deliveries (4,120 afy) are less than ~~to~~ those in earlier years (4,610 afy for the period 1989 to 2000), as shown in **Table 4-15**; however, they are similar to the deliveries for the period from 2000 to 2010 (4,204 afy). MWD, City of Santa Barbara, GWD, and SYRWCD, and ID#1 current water deliveries have increased by approximately 68 percent, 19 percent, 27 percent, and 17 percent, respectively, from the historic average annual water deliveries for the period 1989 to 2000 as shown in **Table 4-15**.

Deliveries from the Cachuma Project to the Member Units are discussed in greater detail in **Section 2.2.2**. Cachuma Project annual deliveries to the Member Units through 2008 are summarized in **Table 2-1**. They have ranged from ~~24,641~~ 22,005 af in 2003 to~~to~~ 29,427 af in 2007. ~~The City of Santa Barbara and GWD receive the largest quantity of water from the project, receiving about 11,000 and 12,000 af in 1999-2000, respectively.~~ The percentage of each Member Unit's total supply provided by the Cachuma Project in 2008 ~~based on current supply and demand values~~ was:

- Carpinteria Valley Water District: 2,699 af~~-~~ (~~–49~~12%)
- Montecito Water District: 346 af (~~–39~~2%)
- City of Santa Barbara: 6,882 af (~~–49~~31%)
- Goleta Water District: 10,464 af (~~–57~~47%)
- SYRWCD, ID #1: 1,873 af (~~–38~~8%)

Historical annual water deliveries from the Cachuma Project since its construction are shown on **Chart 2-1**, **Historical Cachuma Project Deliveries (Lake and Tunnel)**, in **Appendix B**. They range from about 8,900 af in the fourth year of operation, to over 35,800 af in 1972. The amount of water delivered to the Member Units varies from year to year, depending on various factors, including winter runoff.

4.3.1.6 Post-2003 Conditions

Current and projected water supply and water demand information was provided by the member units and is tabulated in **Tables 4-10, 4-11, 4-12, 4-13**, and **4-14**.

4.3.2 Potential Impacts of Alternatives

The current and projected water supply and water demand information has been used, where relevant, to revise subsequent tables within this section.

4.3.2.1 SYRHM Modeling

The Cachuma Project water supply impacts of the alternatives are summarized in **Table 4-16** based on the results of SYRHM simulations over the period of 1918-1993. The model estimates project deliveries each month after the release requirements under Order WR 89-18 and the various criteria for releases for fish have been met. The principal value of models is to compare alternatives, not to forecast actual drought supplies with complete accuracy.

A constant demand of 25,714 afy from Lake Cachuma was applied in the model, which represents the average annual project operational yield identified by the Member Units that would meet their water supply needs. Using this target project yield, the maximum shortage in project yield would not exceed 20 percent based on the droughts observed in the modeling period, before releases for fish were made from the Cachuma Project and before the reservoir sedimentation-area-capacity survey of 2000. Under their water supply contract with Reclamation, the Member Units may request and receive higher project deliveries if Reclamation determines that available supply exists. However, deliveries in excess of 25,714 afy could result in greater shortages in dry years.

It should be noted that the Member Units work together during severe droughts to manage water supplies. In doing so, their supplies are not combined or shared.

4.3.2.2 Average Annual Project Yield

Discussion of Data and Analyses

All data and analyses are discussed in **subsections 4.3.1** and **4.3.2.1.**

Comparison of Alternatives

The average annual yield under Alternatives 3B, 5B, and 5C would be less than under the baseline operations (Alternative 2) by the following amounts: 129 afy (0.5 percent) under Alternative 3B; 260 afy (1 percent) under Alternative 5B; and 127 afy (0.5 percent) under Alternative 5C (**Table 4-16, Impacts on Cachuma Project Deliveries to Member Units**). The reductions under these alternatives would be minor, approximately 1 percent or less than the total average annual yield. Alternatives 3C and 4B would increase the average annual project yield compared to the baseline operations by a slight amount (7 and 54 afy—both less than 0.5 percent, respectively), resulting in a beneficial effect on water supply conditions for the Member Units.

Another approach to evaluating water supply impacts is presented below in which the reduction in water supply during drought years is evaluated. Reductions during dry years provide a more meaningful assessment of water supply impacts because development of water supply reliability is based on anticipated shortages during drought years.

4.3.2.3 Frequency of Years with Shortages in Project Deliveries

Discussion of Data and Analyses

All data and analyses are discussed in **subsections 4.3.1** and **4.3.2.1.**

Comparison of Alternatives

Compared to the baseline operations, Alternatives 3B, 5B, and 5C involve greater releases for fishery resources that are not fully offset by the additional surcharging during spill events. As a consequence, the frequency of years with shortages of 10 percent or more is greater than the baseline under Alternatives 3B, 5B, and 5C. Cachuma Lake is the primary local water source for South Coast communities, and an increase in years with shortages will require greater reliance on alternative sources of supply (primarily imported state water) which is less desirable due to lower reliability and higher costs.

Alternatives 3C and 4B would involve greater releases for fish than under the baseline operations, but the associated reduction in water supply is offset by a 3.0-foot surcharge. Hence, the frequency of shortages in project yield under Alternatives 3C and 4B would be the same as under the baseline conditions because surcharging would produce more storage in the reservoir.

Table 4-16
Impacts on Cachuma Project Deliveries to Member Units (1918 to 1993)

Water Supply Parameter	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
Average Annual Deliveries and Years of Shortages						
Average annual delivery (includes 2,000 afy from Tecolote Tunnel)	25,115	24,986	25,122	25,169	24,855	24,988
Reduction compared to baseline operations (Alt. 2)	-	-129	7	54	-260	-127
Number of years with 10% or more shortage	6	7	6	6	8	7
Number of years with 10% or more shortages – difference from Alternative 2	-	1	0	0	2	1
Critical Drought Year (based on 1951 drought year, compared to target yield of 25,714 af)						
Shortage in critical drought year (af)	9,808	11,262	9,895	9,351	12,506	11,406
Reduction compared to baseline operations (Alt. 2)	-	-1,454	87	457	-2,698	-1598
% shortage in Cachuma deliveries in critical drought year	38%	44%	38%	36%	49%	44%
% shortage in Cachuma deliveries in critical drought year – difference from Alt. 2	-	6%	>1%	-2%	10%	6%
Critical 3-year Drought Period (based on 1949-51 drought, compared to target yield of 25,714 af)						
Shortage in critical drought years (af)	20,134	23,373	19,925	17,467	26,659	23,806
Reduction compared to baseline operations (Alt. 2)	-	-3,239	209	2,667	-6,525	-3,672
% shortage in Cachuma deliveries in critical drought period	26%	30%	26%	23%	35%	31%
% shortage in Cachuma deliveries in critical drought period – difference from Alternative 2	---	4%	>1%	-3%	8%	5%

4.3.2.4 Deliveries during Drought Periods

Discussion of Data and Analyses

All data and analyses are discussed in **Sections 4.3.1** and **4.3.2.1.**

Comparison of Alternatives

Using the worst drought year on record (1951) for purposes of analysis, project yield under baseline operations (Alternative 2) would be 15,906 af, which represents a 38 percent shortage relative to the desired project yield of 25,714. Under 1951 drought conditions (**Table 4-16**), the shortages under Alternatives 3B, 5B, and 5C would be greater than under the baseline operations (Alternative 2) because these alternatives involve greater releases for fish and the additional reservoir surcharge is not large enough to compensate. The shortages beyond those of the baseline would be ~~129~~ 1,454 af (or ~~.51~~approximately 6 percent) under Alternative 3B; ~~-260~~2,698 af (or ~~1.03~~ approximately 10 percent) under Alternative 5B; and ~~127~~ 1,598 af (or ~~.51~~ approximately 6 percent) under Alternative 5C (**Table 4-16**). For Alternatives 3C and 4B, the annual deliveries would be approximately the same (albeit slightly more) at ~~7~~ 87 af (approximately 0.~~0~~3 percent) af and- ~~54~~ 457 af (approximately ~~.21~~2 percent), respectively.

The pattern of shortages amongst the alternatives using the worst three-year drought period on record (1949-51; **Table 4-16**) as compared to the baseline (Alt. 2) is similar, with 3,239 af (or 4 percent) under Alternative 3B; 6,525 af (or 8 percent) under Alternative 5B; and 3,672 af (or 5 percent) under Alternative 5C. The three-year period used in the analysis - from May 1, 1949 to May 1, 1951 - was the period with the most critical shortages of any 36-month period simulated by the model. In contrast, under 1951 and 1949-51 conditions, the shortages under Alternatives 3C (-209 af or less than 1 percent) and 4B (-2,667 af or 3 percent) would be about the same or slightly less than under baseline operations despite the higher releases for steelhead because of the additional storage created by a 3.0-foot surcharge.

4.3.2.5 Comparison of Member Units Demand and Supply from All Sources

Threshold of Significance

An alternative may result in a significant environmental impact if under that alternative the Member Units' water demand exceeds their water supply from all sources (see **Table 4-17, Member Units' Supply and Demand in Critical Drought Year [1951],** lines 6 and 9) by an appreciable amount.

Table 4-17
Member Units' Supply and Demand in Critical Drought Year (1951) (afy)

	Alt 2 (Baseline Conditions under WR 89-18 and WR 94-5)	Alt 3B (1.8′ surcharge)	Alt 3C (Existing Operations under Biological Opinion and Settlement Agreement with 3.0′ surcharge)	Alt 4B (Operation under Biological Opinion with 3.0′ surcharge and SWP Discharge to Lompoc Forebay)	Alt 5B "3A2"/BO and 1.8′ surcharge	Alt 5 "3A2"/BO and 3′ surcharge
1. Cachuma Project yield in a critical drought year (SYRHM simulation, Appendix F, Technical Memorandum No. 5)	15,906	14,452	15,819	16,363	13,208	14,308
2. Total supply from sources other than the Cachuma Project (**Table 4-18**)	20,935	20,935	20,935	20,935	20,935	20,935
3. Total supply (**Line 1 + Line 2**)	36,841	35,387	36,754	37,298	34,143	35,243
4. Year 2010 demand (**Table 4-19**)	45,676	45,676	45,676	45,676	45,676	45,676
5. Surplus or shortage (**Line 3 – Line 4**)	*-8,835*	*-10,289*	*-8,922*	*-8,378*	*-11,533*	*-10,433*
6. Difference from Baseline (Alt. 2)	-	1,454 16%	87 1%	-457 -5%	2,698 31%	1,598 18%
7. Year 2020/2030 demand (**Table 4-19**)	49,763	49,763	49,763	49,763	49,763	49,763
8. Shortage (**Line 3 – Line 7**)	*-12,922*	*-14,376*	*-13,009*	*-12,465*	*-15,620*	*-14,520*
9. Difference from Baseline (Alt. 2)	-	1,454 11%	87 0.7%	-457 -4%	2,698 21%	1,598 12%

Table 4-17 compares the Member Units' water demand to their water supply from all sources, including the Cachuma Project and the SWP, in the critical drought year (1951) under the project alternatives. Line 6 and line 9 of the table show the amount and percent difference between water supply shortages under the Alternative 2 baseline and shortages under the other alternatives.

Discussion of Data and Analyses

The 20,935 af figure for total supply from sources other than the Cachuma Project used in **Table 4-17** is derived from **Table 4-18, Member Units' Supply from Sources Other than Cachuma Project in Critical Drought Year**. The analysis depicted in **Table 4-18** is based on data provided by the Member Units as of 2009. The analysis also assumes that the Member Units would receive a SWP delivery of 1,530 af based on reduced delivery of Table A (SWP Allocation Schedule) and CCWA drought buffer (see **Tables 4-10** through **4-14**). This is a conservative assumption in light of the fact that the results of SYRHM and DWRSIM modeling show that SWP deliveries in 1951 would have been 12,029 af (Technical Memorandum No. 1, Table 15B). SWP deliveries during a critical drought year in the Santa Ynez River Watershed will not necessarily drop below average because precipitation in Northern California may vary from precipitation in the Central Coast region. The demand figures in **Table 4-17** are derived from **Table 4-19, Member Units Demand**, which summarizes the current Member Units' demand in 2009/2010 and their projected future demand.

The shortages in Member Unit water supplies would vary considerably among Member Units. **Tables 4-20** through **4-24** compare the supply and demand of the individual Member Units in a critical drought year such as 1951 under Alternative 5B. The source of the data presented in **Tables 4-20** through **4-24** is **Appendix F**, Technical Memorandum No. 5 and the 2009 SWP Reliability Report, **Tables 4-10** through **4-14**. For Cachuma Project water supply in the critical drought year, Alternative 5B was chosen because the water supply impacts are most severe under this alternative. For purposes of this analysis, each Member Unit's share of the 13,208 af of water available from the Cachuma Project in a critical drought year was calculated by reducing each Member Unit's share pro rata in accordance with the amount of Cachuma Project supply claimed by each Member Unit in **Tables 4-10** through **4-14**. The total supply from other sources for the Member Units includes increased groundwater pumping which would not be sustainable on a long term basis and reduced delivery of State Project water (Table A (SWP Allocation Schedule) and CCWA drought buffer).

Table 4-20 indicates that CVWD would have a surplus of 977 af. However, in a critical drought year all other Member Units would experience a water shortage. **Table 4-21** indicates that under current demand levels, MWD would experience a shortage of 3,760 af. Table **4-22** indicates that under current demand levels, the City of Santa Barbara would experience a shortage of 2,655 af. **Table 4-23** indicates that under current demand levels, GWD would experience a shortage of 4,148 af. **Table 4-24** indicates that under current demand levels, SYRWCD, ID #1 would experience a shortage of 547 af. An overall net shortage in meeting current demand is indicated in **Table 4-17** for all Alternatives. **Table 4-17** also indicates that there would be a net shortage for all alternatives under future year demand levels ranging from -12,465 af under Alternative 4B to -15,620 af under Alternative 5B.

Table 4-18
Member Units' Supply from Sources Other than Cachuma Project in Critical Drought Year (1951)

	Member Unit	afy
Carpinteria Valley Water District		
1.	Local groundwater supply	3,500
Montecito Water District		
2.	Jameson Lake and Alder Creek diversions	800
3.	Doulton Tunnel infiltration and Fox Creek diversion	160
4.	Local groundwater supply	400
5.	MWD subtotal (**Lines 2 + 3 + 4**)	1,360
City of Santa Barbara		
6.	Gibraltar Reservoir	0
7.	Mission Tunnel infiltration and Devil's Canyon diversion	500
8.	Juncal Reservoir	300
9.	Local groundwater supply	3,500
10.	Recycled water	800
11.	Desalinization	0
12.	City of Santa Barbara subtotal (**Lines 6 + 7 + 8 + 9 + 10 + 11**)	5,100
Goleta Water District		
13.	Local groundwater supply	3,600
14.	Recycled water	1,060
15.	GWD subtotal (**Lines 13 + 14**)	4,660
SYRWCD, ID #1		
16.	Local groundwater supply	2,570
17.	Santa Ynez River diversion	2,215
18.	SYRWCD, ID #1 subtotal (**Lines 16 + 17**)	4,785
19.	State Water Project delivery (assume reduced delivery of Table A (SWP Allocation Schedule) + buffer)	1,530
Total		
20.	**Total supply from sources other than the Cachuma Project (Lines 1 + 5 + 12 + 15 + 18 + 19)**	**20,935**

[1] *Includes SWP delivery to Solvang under a water supply contract with SYRWCD, ID# 1 and SWP deliveries of non-Project water to the City of Santa Barbara.*

Table 4-19
Member Units Demand

Member Unit	Year 2000 Demand (af)	Year 2009/2010 Demand (af)	Year 2020/2030 Demand (af)	Year 2050 (af)
CVWD	4,300[1]	4,100[3]	4,600	NA
MWD	6,073	6,680[4]	6,500[4]	NA
City of Santa Barbara	14,342	14,000[5]	14,500[5]	16,028[5]
GWD	14,000	14,070[6]	15,890[6]	NA
SYRWCD, ID #1[2]	7,292	6,826[7]	8,273[7]	NA
Total	**46,007**	**45,676**	**49,763**	**NA**

Source: 2009/2010, 2020/2030 and 2050 from Cachuma Member Units as provided by CCRB and ID #1.
Notes:

1 *Represents year 2001*

2 *Includes 1,500 afy of SWP allocated to City of Solvang under a water supply contract.*

3 *Current (2009) demand based on year 2009. 2010 demand based on UWMP (2005 and 2007).*

4 *Current (2009) demand based on year 2010. 2030 demand based on projected demand with increased rates and water conservation.*

5 *Current (2009) demand based on City of Santa Barbara preliminary values from Plan Santa Barbara (General Plan Update) 2010. 2020 demand extrapolated from 2050 projected demand. 2050 demand based on Plan Santa Barbara extended forecast.*

6 *Current (2009) demand based on year 2010. 2020 demand based on GWD 2005 UWMP.*

7 *Current (2009) demand based on year 2010. 2020/2030 demand based on project future water use.*

Table 4-20
CVWD Supply and Demand in Critical Drought Year (1951) Under Alternative 5B

Supply and Demand	Critical Drought Year afy
1. Local groundwater supply (Table 4-10)	3,500
2. State Water Project supply including CCWA drought buffer (Table 4-10)	132
3. Cachuma Project supply	1,445
4. Total supply	**5,077**
5. Year 2009 Demand (Table 4-10)	4,100
6. Surplus (Line 4 –Line 5)	977
7. Year 2020 Demand (Table 4-10)	4,600
8. Surplus (Line 5 – Line 8)	477

Table 4-21
MWD Supply and Demand in Critical Drought Year (1951) Under Alternative 5B

	Supply and Demand	Critical Drought Year afy
1.	Jameson Lake and Alder Creek diversions (Tab. 4-11)	800
2.	Doulton Tunnel infiltration and Fox Creek diversion (Tab. 4-11)	160
3.	Local groundwater supply (Table 4-11)	400
4.	State Water Project supply including CCWA drought buffer (Table 4-11)	198
5.	Cachuma Project supply	1,362
6.	**Total supply**	**2,920**
7.	Year 2010 demand (Table 4-11)	6,680
8.	**Shortage (Line 7 – Line 8)**	**-3,760**
9.	Year 2030 demand (Table 4-11)	6,500
11.	**Shortage (Line 7 – Line 10)**	**-3,580**

Table 4-22
City of Santa Barbara Supply and Demand in Critical Drought Year (1951) Under Alternative 5B

	Supply and Demand	Critical Drought Year afy
1.	Gibraltar Reservoir (Table 4-12)	0
2.	Mission Tunnel infiltration (Table 4-12)	500
3.	Juncal Reservoir (Table 4-12)	300
4.	Santa Barbara local groundwater supply (Table 4-12)	3,500
5.	State Water Project supply including drought buffer (Table 4-12)	594
6.	Cachuma Project supply in critical drought year	4,251
7.	Recycled water (Table 4-12)	800
8.	Desalinization (Table 4-12)	0
9.	**Total supply**	**9,945**
10.	Year 2010 demand (Table 4-12)	12,600
11.	**Shortage (Line 10 – Line 11)**	**-2,655**
12.	Year 2020 demand (Table 4-12)	14,425
13.	**Shortage (Line 10 – Line 13)**	**-4,480**

Table 4-23
GWD Supply and Demand in Critical Drought Year (1951) Under Alternative 5B

	Supply and Demand	afy
1.	GWD local groundwater supply (Table 4-13)	3,600
2.	GWD recycled water (Table 4-13)	1,060
3.	State Water Project supply including drought buffer (Table 4-13)	474
4.	Cachuma Project supply in critical drought year Table 4-13)	4,788
5.	**Total supply**	**9,922**
6.	Year 2010 demand (Table 4-13)	14,070
7.	**Shortage (Line 6 –Line 7)**	**-4,148**
8.	Year 2020 demand (Table 4-13)	15,890
9.	**Shortage (Line 6 –Line 9)**	**-5,968**

Table 4-24
SYRWCD, ID #1 Supply And Demand In Critical Drought Year (1951)
Under Alternative 5B

	Supply and Demand	afy
1.	Local groundwater supply (Table 4-14)	2,570
2.	Santa Ynez River diversion (Table 4-14)	2,215
3.	State Water Project supply including drought buffer (Table 4-14)	132
4.	Cachuma Project supply in critical drought year	1,362
5.	**Total supply**	**6,279**
6.	Year 2009 demand (Table 4-14)	6,826
7.	**Shortage (Line 6 – Line 7)**	**-547**
8.	Year 2025 demand (Table 4-14)	8,273
9.	**Shortage (Line 6 – Line 9)**	**-1,994**

Table 4-25a, **Member Units' Supply and Demand During Critical Three-Year Drought Period**, shows the Member Units' supply and demand during the critical three-year drought period (1949-1951) for all project alternatives. **Table 4-25b**, **Member Units' Supply From Sources Other Than Cachuma Project During Critical Three-Year Drought Period**, indicates the types and quantities assumed for water supplies other than the Cachuma Project. Local groundwater is based on the critical drought year supply with a 0.8 reduction factor, except for SYRWCD, ID #1 river wells, which are based on simulated water

levels (dewatered storage). State Water Project imported supply is based on average 32 percent[11] delivery (Table A [SWP Allocation Schedule] and CCWA drought buffers). Under all of the alternatives, including baseline conditions (Alternative 2), the current water supply would not meet water demand during a three-year drought period. The projected increase in demand would further exceed supply for future demand estimates for all alternatives. Under the baseline conditions (based on year 2009/10 demand levels), ~~supply~~ demand would exceed ~~demand~~ supply by 10,295 af. In 2020, demand would exceed supply by 22,556 af, taking into account the CCWA drought buffer and about 31,500 af of ground water pumping for three-year drought period.

11 The 2009 SWP Reliability Report tables indicate that the critical three year drought deliveries were for the years 1990 (43%), 1991, (27%) and 1992 (26%). The average delivery for this three-year drought was 32%.

Table 4-25a
Member Units' Supply and Demand During Critical Three-Year Drought Period (1949–1951) (afy)

		Alt 2 (Baseline Conditions under WR 89-18 and WR 94-5)	Alt 3B (1.8′ surcharge)	Alt 3C (Existing Operations under Biological Opinion and Settlement Agreement with 3.0′ surcharge)	Alt 4B (Operation under Biological Opinion with 3.0′ surcharge and SWP Discharge to Lompoc Forebay)	Alt 5B "3A2"/BO and 1.8′ surcharge	Alt 5 "3A2"/BO and 3′ surcharge
1.	Cachuma Project yield in a critical drought year (SYRHM simulation, Appendix F, Technical Memorandum No.5)	57,008	53,769	57,217	59,675	50,483	53,336
2.	Total supply from sources other than the Cachuma Project (**Table 4-25b**)	~~69,725~~63,767	~~69,725~~63,767	~~69,725~~63,767	~~69,725~~63,767	~~69,725~~63,767	~~69,725~~63,767
3.	Total supply (**line 1 + line 2**)	~~126,733~~120,775	~~123,494~~117,536	~~126,942~~120,984	~~129,400~~123,442	~~120,208~~114,250	~~123,061~~117,103
4.	Year 2009/2010 demand (**Table 4-19 * 3**)	137,028	137,028	137,028	137,028	137,028	137,028
5.	*Surplus or shortage (**line 3 – line 4**)*	*~~-10,295~~10,295*	*-~~-13,534~~19,492*	*-~~-10,086~~16,044*	*~~-7,628~~-13,586*	*~~-16,820~~-22,778*	*~~-13,967~~-19,925*
6.	Difference from Baseline (Alt.2)	-	~~3,239~~9,197 ~~31~~89%	~~-209~~5,749 ~~-2%~~56%	~~-2,667~~3291 ~~-26%~~32%	~~6,525~~12,483 ~~63%~~121%	~~3,672~~9,680 ~~36%~~94%
7.	Year 2020/2030 demand (**Table 4-19 * 3**)	149,289	149,289	149,289	149,289	149,289	149,289
8.	*Shortage (**line 3 – line 7**)*	*~~-22,556~~-28,214*	*~~-25,795~~-31,753*	*~~-22,347~~-28,305*	*~~-19,889~~-25,847*	*~~-29,081~~-35,039*	*~~-26,228~~-32,186*
9.	Difference from Baseline (Alt.2)	-	3,239 ~~14%~~11%	-209 ~~-0.9%~~-1%	-2,667 ~~-12%~~-9%	6,525 ~~29%~~23%	3,672 ~~16%~~13%

Table 4-25b
Member Units' Supply[1] From Sources Other Than Cachuma Project During Critical Three-Year Drought Period (1949–1951)

Member Unit	Afy
Carpinteria Valley Water District	
1. Local groundwater	~~8,400~~2,442
Montecito Water District	
2. Jameson Lake and Alder Creek diversions	2,194
3. Doulton Tunnel infiltration and Fox Creek diversion	432
4. Local groundwater	960
5. MWD subtotal	3,586
City of Santa Barbara	
6. Gibraltar Reservoir	4,055
7. Mission Tunnel infiltration and Devil's Canyon diversion	1,577
8. Local groundwater	8,400
9. Recycled water	2,400
10. Desalination	0
11. City of Santa Barbara subtotal	16,432
Goleta Water District	
12. Local groundwater supply	8,640
13. Reclaimed water	3,180
14. GWD subtotal	11,820
SYRWCD, ID #1	
15. Local groundwater supply	5,088
16. Santa Ynez River diversion	6,255
17. SYRWCB, ID #1 subtotal	11,343
18. State Water Project delivery[2]	18,144
Total	
19. Total supply from sources other than Cachuma Project in critical three-year drought period (lines 1 + 5 + 11 + 14 + 17 + 18)	**~~69,725~~63,767**

Notes:

[1] Information provided Member Units on via Cachuma Conservation Release Board, see correspondence from Kate Rees, General Manager, CCRB to Joe Gibson, Impact Sciences, dated March 4, 2010.

[2] The number is the sum of individual agency SWP allocation and drought buffer x 32 percent reliability (2009 SWP Reliability Report Average and dry year SWP Table A delivery from the Delta [Table B.2] - six year drought ~~critical years 1990~~ 1987 through 1991) x three years.

Comparison of Alternatives

Critical Drought Year

Table 4-17 indicates that under Alternative 2 in a critical drought year under the baseline conditions the Member Units' 2009/2010 demand would exceed total supply by 8,835 af (line 5). If the Member Units' demand increases as projected, they will experience a shortage of 12,922 af (line 8) by future demand estimates for the baseline.

For Alternative 3B, in a critical drought year the Member Units' 2009/2010 demand would exceed total supply by 10,289 af (line 5); this would exceed the baseline (Alternative 2) by 1,454 af or 16 percent. If the Member Units' demand increases as projected, they will experience a shortage of 14,376 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 1,454 af or 11 percent.

For Alternative 3C, in a critical drought year, the Member Units' 2009/2010 demand would exceed total supply by 8,922 af (line 5); this would exceed the baseline (Alternative 2) by 87 af or 1 percent. If the Member Units' demand increases as projected, they will experience a shortage of 13,009 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 87 af or 0.7 percent.

For Alternative 4B, in a critical drought year the Member Units' 2009/2010 demand would exceed total supply by 8,378 af (line 5); this would be less than the baseline (Alternative 2) by -457 af or -5 percent. If the Member Units' demand increases as projected, they will experience a shortage of 12,465 af (line 8) by future demand estimates for the baseline; this would be less than the baseline (Alternative 2) by -457 af or -4 percent.

For Alternative 5B, in a critical drought year the Member Units' 2009/2010 demand would exceed total supply by 11,533 af (line 5); this would exceed the baseline (Alternative 2) 2,698 af or 31 percent. If the Member Units' demand increases as projected, they will experience a shortage of 15,620 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 2,698 af or 21 percent.

For Alternative 5C, in a critical drought year the Member Units' 2009/2010 demand would exceed total supply by 10,433 af (line 5); this would exceed the baseline (Alternative 2) by 1,598 af or 18 percent. If the Member Units' demand increases as projected, they will experience a shortage of 14,520 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 1,598 af or 12 percent.

An appreciable (10 percent or greater) water supply shortage in a critical drought year from the baseline, as shown for Alternatives 3B, 5B and 5C, could result in a significant and unavoidable impact (Class I), depending on the manner in which the Member Units make up for the shortage. The same pattern of demand exceeding supply would be present for the future demand estimates (e.g., 2020/2030) for project alternatives 3B, 5B, and 5C. These impacts would also be potentially significant and unavoidable (Class I).

In contrast, total supply under Alternatives 3C and 4B in a critical drought year for 2010 and for future demand (**Table 4-17** line 5) estimates would be approximately the same for Alternative 3C or slightly greater for Alternative 4B) than total supply under the baseline conditions resulting in a less than significant impact (Class III).

Critical Three-Year Drought Period

Table 4-25a indicates that under Alternative 2 in a critical three-year drought period under the baseline conditions the Member Units' 2009/2010 demand would exceed total supply by 10,295 afy (line 5). If the Member Units' demand increases as projected, they will experience a shortage of ~~22,556~~ 28,514 af (line 8) by future demand estimates for the baseline.

For Alternative 3B, in a critical three-year drought period the Member Units' 2009/2010 demand would exceed total supply by ~~13,534~~19,492 af (line 5); this would exceed the baseline (Alternative 2) by ~~3,239~~9,197 af or ~~31~~ 89 percent. If the Member Units' demand increases as projected, they will experience a shortage of ~~25,795~~31,753 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 3,239 af or ~~14~~ 11 percent.

For Alternative 3C, in a critical three-year drought period the Member Units' 2009/2010 demand would exceed total supply by ~~10,086~~16,044 af (line 5); this would less than the baseline (Alternative 2) by -~~209~~ 5,749 af or ~~-2~~56 percent. If the Member Units' demand increases as projected, they will experience a shortage of ~~22347~~ 28,305 af (line 8) by future demand estimates for the baseline; this would be less than the baseline (Alternative 2) by -209 af or ~~-2~~1 percent.

For Alternative 4B, in a critical three-year drought period the Member Units' 2009/2010 demand would exceed total supply by ~~7628~~ 13,586 af (line 5); this would be less than the baseline (Alternative 2) by -~~2,667~~3,291 af or ~~-26~~ 32 percent. If the Member Units' demand increases as projected, they will experience a shortage of ~~19889~~ 25,847 af (line 8) by future demand estimates for the baseline; this would be less than the baseline (Alternative 2) by -2,667 af or ~~-12~~9 percent.

For Alternative 5B, in a critical three-year drought period the Member Units' 2009/2010 demand would exceed total supply by ~~16,820~~22,778 af (line 5); this would exceed the baseline (Alternative 2) ~~6,525~~12,483 af or ~~63~~ 121 percent. If the Member Units' demand increases as projected, they will experience a shortage of ~~29081~~ 35,039 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 6,525 af or ~~29~~ 23 percent.

For Alternative 5C, in a critical three-year drought period the Member Units' 2009/2010 demand would exceed total supply by ~~13,967~~19,925 af (line 5); this would exceed the baseline (Alternative 2) by ~~3,672~~9,630 af or ~~36~~ 94 percent. If the Member Units' demand increases as projected, they will experience a shortage of ~~26,228~~32,186 af (line 8) by future demand estimates for the baseline; this would exceed the baseline (Alternative 2) by 3,672 af or ~~16~~ 13 percent.

Impact Determination

An appreciable (10 percent or greater) water supply shortage in a critical drought year from the baseline, as shown in **Table 4-17** for Alternatives 3B (11 percent), 5B (21 percent) and 5C (12 percent), could result in a significant and unavoidable impact (Class I~~)~~ (- greater than 10 percent), depending on the manner in which the Member Units make up for the shortage. The same pattern of demand exceeding supply would be present for the future demand estimates (~~e.g.,~~see **Table 4-17** line 9)~~ 2020/2030~~) for project alternatives 3B (11 percent), 5B (21 percent), and 5C (12 percent). These impacts would also be potentially significant and unavoidable (Class I).

In contrast, total supply under Alternatives 3C and 4B in a critical drought year for 2010 and for future demand (**Table 4-17** line 5) estimates would be approximately the same for Alternative 3C (~~0.9~~1 percent) or greater for Alternative 4B (~~12~~ 5 percent) than total supply under the baseline conditions resulting in a less than significant impact (Class III). For 2020/2030, Alternatives 3C and 4B would have differences from the baseline (Alternative 2) of 0.7 percent and 4 percent (see **Table 4-17** line 9), respectively, which would be considered less than significant.

Water Supply Impacts Due to Meeting Alisal Bridge Flow Target

Releases for meeting target flows have been larger than expected based on modeling results from the Santa Ynez River Hydrology Model (SYRHM), primarily due to releases required to meet target flow at the Alisal Bridge in spill years and the year following a spill. The SRYHM predicted that~~,~~ most of the time~~,~~ releases for meeting target flows at the Highway 154 Bridge (3.2 miles downstream) would also meet the target flow requirement at the Alisal Bridge (10.5 miles downstream). The target flow requirement at the Alisal Bridge has been in effect from 2005 through 2009. In only two of the five years (2005 and 2006), were target flows at the Highway 154 Bridge sufficient to also meet the target flow at the Alisal Bridge. In 2007, 2008 and 2009, substantially more water had to be released during the summer in order to meet the target flow at Alisal Bridge.

Factors contributing to the relatively large amount of fish water released for target baseflows in years 2007, 2008 and 2009 include the following abnormalities:

- Year 2007 had the lowest precipitation total on record as measured at Lake Cachuma~~,~~ - 7.41 inches;
- Year 2008 was a marginal spill year greater than 20,000 af (about 23,000 af of spill); and
- Year 2009 was unusually hot and dry.

Years 2007 and 2009 had the lowest and third lowest runoff totals in a year following a spill greater than 20,000 af, respectively, compared to years used in the SYRHM.

Besides the hydrologic abnormalities mentioned above, several other factors have contributed to greater impacts to Cachuma Project water supply than originally anticipated as a consequence of meeting higher target flow. These include:

- Year round baseflow releases have increased riparian vegetation growth in the Santa Ynez River channel, which, in turn, has increased consumptive use by the riparian vegetation, resulting in a further increase in water releases to meet the target flows downstream.
- Originally, inflow from the tributaries between Bradbury Dam and the Highway 154 Bridge were combined with releases from the dam to meet target flows at the Highway 154 Bridge. Private property restrictions in the Highway 154 Reach have limited the ability to measure these tributary inflows, so they have not been accounted for in meeting the target flows at the Highway 154 Bridge.
- Under actual operations, releases were made to provide flows of 3 to 5 cfs at the Alisal Bridge in spill years and in the year following a spill. Whereas, the SYRHM is based on meeting the required 1.5 cfs target flow at the Alisal Bridge as specified in the BO.

4.3.2.6 Indirect Environmental Impacts of Water Supply Shortages

Threshold of Significance

An indirect environmental impact due to water supply shortages is considered significant for an alternative if the Member Units' make up for the shortage using a new source of water supply. Any potential indirect environmental impacts that may result from the acquisition of new sources of water supply to meet the Member Units' future demand would be attributable to future growth in the Member Units' service areas, and would not be attributable to impacts to the Member Units' Cachuma Project supply under the alternatives. Conversely, if the Member Units can meet current demand in a critical drought year or drought period using existing sources of supply or by implementing drought contingency measures, no indirect environmental impacts would occur.

Discussion of Data and Analyses

The Member Units could increase their annual delivery from the Cachuma Project to make up for the Cachuma supply shortages under Alternatives 3B, 5B, and 5C. Doing so, however, would mean exceeding the target annual Cachuma Project yield of 25,714 af, which would increase the risk of greater shortages during subsequent dry years. Another possible solution would be to implement drought contingency measures, such as fallowing agricultural land on a temporary basis.

Comparison of Alternatives

The water supply values for a single critical drought year (lines 6 and 9 in **Table 4-17)** show the difference between supply and demand for the alternatives and the baseline (Alternative 2) considering current and projected future demand. **Table 4-25a** (Lines 6 and 9) show the percent difference between shortages under the baseline (Alternative 2) and shortages under the other alternatives for critical three-year drought periods. According to the Member Units' current water supply and demand estimates, the normal and drought year water supplies from sources other than Cachuma Project would vary for each Member Unit.

The potential impact to the Member Units' water supply under Alternatives 3B, 5B, and 5C, in both the critical drought year (as shown in **Table 4-17**) and in a critical three-year drought period (as shown in **Table 4-25a**), could result in indirect environmental impacts as compared to the baseline condition, depending on the manner in which the Member Units make up for the shortage. Therefore, Alternatives 3B, 5B, and 5C would result in a significant and unavoidable impact (Class I); for Alternatives 3C and 4B, there would be a less than significant impact (Class III) compared to the baseline.

4.3.2.7 Indirect Environmental Impacts from Groundwater Pumping, Temporary Transfer, or Desalination

Threshold of Significance

An indirect environmental impact could occur for an alternative if the alternative would force in: (1) significant groundwater pumping, (2) temporary transfers, or (3) desalination.

Discussion of Data and Analyses

Increased Groundwater Pumping

One potential new source of supply is increased groundwater pumping. A temporary increase in pumping in the Above Narrows Alluvial Aquifer is unlikely to have environmental impacts. Some groundwater aquifers are adjudicated, so additional pumping may be prohibited. As of 2009, GWD had banked over 43,000 af of water in the Goleta Groundwater Basin.[12] Accordingly, GWD likely could increase its groundwater pumping to the extent necessary to make up for a water supply shortage during a drought without overdrafting the Goleta Groundwater Basin or causing saltwater intrusion.

Increased groundwater pumping during droughts could have a detrimental effect on groundwater quality by increasing the flux of water from poorer water quality areas in the absence of fresh water recharge. In addition, depending on how long overdraft conditions persist, wells may go dry or operate with reduced yields and increased pumping lifts.

Additional groundwater pumping elsewhere along the coast, however, could cause an increase in saltwater intrusion. An increase in the total concentration of soluble salts in groundwater could reduce agricultural crop yield. It may require expensive treatments, such as reverse osmosis, if the water is used for municipal and industrial purposes. In addition, an increase in the concentration of soluble salts could contribute to the increased production of halogenated (organochlorinated) compounds such as trihalomethanes, which may be carcinogenic.

Temporary Water Transfer

Another potential new source of supply is a temporary transfer from another SWP contractor. The capacity of the SWP delivery pipeline to the Member Units is 43 af/day, for a total of about 16,000 afy. The analysis of water supply impacts for the alternatives, in a critical drought year~~ or three-year drought period~~, assumes that the Member Units would receive ~~2,845~~1,530 afy, leaving about ~~13,000~~14,500 af of extra CCWA pipeline capacity available for use in the event of a transfer from an outside agency. Delivery of SWP water to the Member Units could be achieved by delivery to Bradbury Dam and mixing with Cachuma Lake water.~~, or by delivery directly to SYRWCD, ID #1 pursuant to an exchange agreement with the other Member Units~~.

Potential transferors include other contractors that receive water from SWP Coastal Branch facilities, such as agencies in San Luis Obispo County. If the transfer were from another SWP contractor south of the San Francisco Bay/Sacramento-San Joaquin River Delta (Bay-Delta), the environmental impacts would be minimal, as the water would only need to be transferred from San Luis Reservoir through SWP facilities to the Member Units. Should the transfer initiate north of the Bay-Delta, some environmental impacts to the Bay-Delta could occur due to pumping extra water through the Department of Water Resources (DWR) Harvey Banks pumping plant. In similar past transfer scenarios that have conveyed water

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12 Steven Bachman, PhD, Groundwater Management Plan, Goleta Groundwater Basin, Final (May 11, 2010) at p. 4-7.

through the Bay-Delta, DWR has mitigated these effects through the use of water surcharges. These surcharges range from 20 percent to 50 percent of the transferred water, depending on year type and current hydrologic conditions. The water surcharges augment Bay-Delta outflow and serve to combat water quality problems that can occur in the central and south Bay-Delta as pumping is increased to move the transferred water.

Desalination

A third potential new source of supply is desalination. The City of Santa Barbara owns a reverse osmosis desalination plant, which is adjacent to the El Estero Wastewater Treatment Plant. The City constructed a reverse osmosis seawater desalination facility (shown below) as an emergency water supply during the drought of 1990. The facility has since been incorporated into the City's long-term supply plan as a way of reducing shortages due to depleted surface supplies during drought. A portion of the reverse osmosis filtration capacity was subsequently sold, leaving a current capacity of 3,125 af.[13]

This plant was constructed in 1991 to 1992 by the City of Santa Barbara, Goleta Water District, and Montecito Water District (Goleta and Montecito no longer participants in the desalination plant) as an emergency water supply in response to the severe drought lasting from 1986 to 1991. The plant is currently decommissioned due to ample quantities of less expensive supplies and there are no plans in the near future to reactivate it; the desalination facility can, however, be brought into operation within 6 to 12 months if needed during drought or water shortage conditions.

Relatively high variable costs for desalination make this supply the last to be utilized during periods of shortage.[14] The facility is normally in long-term storage mode and is expected to be recommissioned when the demand (less a maximum acceptable shortage of 10 percent) cannot be met using all of the other available supplies. As an alternative operating mode, desalted water could be produced during non-drought periods for exchange with other water purveyors throughout the state via the State Water Project.

A recent detailed engineering analysis of the facility by Carollo Engineers determined it could be rehabilitated with more up-to-date technology and reactivated for $20.2 million. The result would be a facility with a 2.8 MGD capacity.[15]

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13 City of Santa Barbara, Public Works Department, Water Supply, http://www.santabarbaraca.gov/Resident/Water/Supply/WaterSupplySources.htm#Desal, accessed September 29, 2011.

14 City of Santa Barbara, Public Works Department, Water Supply, http://www.santabarbaraca.gov/Resident/Water/Supply/WaterSupplySources.htm#Desal, accessed September 29, 2011.

15 Carollo Engineers, "Desalination Rehabilitation Study", prepared for City of Santa Barbara, March 2009. p. ES-9.

~~Just over half of the prefiltration capacity and reverse osmosis treatment modules were sold, leaving sufficient capacity to meet the City's anticipated need for approximately 3,000 ac-ft/year of production in future droughts.~~

~~According to the USGS,[16] the cost of desalinated water is approximately $1,000 per acre-foot.~~The 2009 study for Santa Barbara determined the operations and maintenance (O&M) cost of a rehabilitated facility, excluding past and rehabilitation capital cost, would ~~be~~lead to a cost of $1,470 per acre-foot of water produced.[17] Even with potentially low energy cost assumptions, the total marginal cost of water from this facility could be well above $2,000 per acre-foot of water if the facility is brought back into operation, based on O&M costs and existing capital costs. The O&M cost alone for a rehabilitated and modernized facility in Santa Barbara is projected to be $1,470 per acre-foot of water produced as is evidenced by past capital costs for the Santa Barbara facility.[18] However, the costs for desalination will likely decrease as new less expensive technology becomes available.

The City recognizes the role of the desalination as a vital back-up supply for a potential prolonged drought and unforeseen interruptions of water supply.[19] However, reactivation of the facility would result in significant costs. In 2004, after three years of drought, the City was beginning the reactivation process.

While the plant may be available in the long-term, City staff projects no need for desalinated water within at least the next 5 years.[20] In the current Long-Term Water Supply Plan, any utilization of the plant would be deferred until at least the sixth year of a drought, and is considered the lowest priority of potential supplies.[21]

No major barriers have been identified that would prevent reactivation. The City has approval of all major permits required to operate the facility, although permit requirements would be subject to review

~~16 http://ga.water.usgs.gov/edu/drinkseawater.html~~

17 Carollo Engineers, 2009.

18 Fryer, James, Environmental Scientist, "An Investigation of the Marginal Cost of Seawater Desalination in California", sponsored by Residents for Responsible Desalination, March 18, 2010.

19 City of Santa Barbara, Long-term Water Supply Plan 2011, June 14, 2011, p. 20.

20 City of Santa Barbara, Public Works Department, Water Resources Division, Water Supply Management Report, 2010 Water Year, December 2010.

21 City of Santa Barbara, Long-term Water Supply Plan 2011, June 14, 2011, p. 22 and 23.

by various regulatory agencies.[22] Further, should the need arise, reactivation is estimated to require about 16 months from the time of approval of any permits.[23]

The desalination process may adversely affect water quality. The desalination process generates significant levels of liquid wastes, including disinfectants (chlorine and biocides), de-fouling agents, and brine effluent. Solid wastes or toxic metals also may be generated in lesser quantities. Liquid or solid waste may be discharged directly into the ocean, combined with sewage treatment plant wastewater or with power plant cooling water before being discharged into the ocean, or dried and disposed of in landfills. Typically, brine effluent is carried offshore through an outfall pipe and discharged directly into the ocean or estuary from the end of the pipe or through a diffuser that accelerates the diffusion and mixing process. The Charles Meyer facility was designed to discharge directly to the ocean. Any potential water quality impacts of the discharge are mitigable to less than significant levels through compliance with a national pollutant discharge elimination system (NPDES) permit issued by the Regional Water Quality Control Board, Central Coast Region (Regional Board). The NPDES permit will ensure that the beneficial uses of receiving waters are protected.

The desalination process also requires additional power generation, which has environmental consequences. A 3,000-afy seawater desalination plant would require roughly two megawatts of generating capacity continuously. If the electricity were produced from existing thermal power plants, it could result in impacts to air quality from air emissions and water quality impacts from the cooling system. Much of the electricity used in California is generated through use of fossil fuels. These power plants, operating on natural gas or coal, produce nitrogen oxides (NOx), particulate matter, reactive organic gases (ROGs), and in some cases, sulfur dioxide (SO_2). Coal-fired generation is almost all out-of-state, with the energy brought to California through the high voltage transmission system. Coal-fired power plants produce more air pollutant emissions than gas-fired plants, including sulfur, particulates, and carbon dioxide. Assuming that new load from the desalination facility is only met through an efficient natural gas-fired power plant using the best available emissions reduction technology, a 3,000 afy facility using two megawatts of electricity would result in 1,053 pounds of NOx, 93 pounds of SO_2, 693 pounds of particulate matter less than 10 micrometers in diameter (PM_{10}), 693 pounds of ROG, 2,000 pounds of carbon monoxide, and 2,000 tons of carbon per year. This assumes that the desalination facility operates continuously. These impacts could be mitigated in part if the desalination plant has been designed so that it can be shut down during peak power demand periods, thereby taking advantage of unused power capacity in off-peak times.

[22] City of Santa Barbara, Long-term Water Supply Plan 2011, June 14, 2011, p. 11.

[23] City of Santa Barbara, Long-term Water Supply Plan 2011, June 14, 2011, p. 12.

Comparison of Alternatives

The indirect environmental impacts that could result under Alternatives 3B, 5B and 5C if the Member Units increase groundwater pumping, obtain a temporary transfer from another SWP contractor, or desalinate seawater are potentially significant. These potentially significant impacts might be mitigable to less than significant levels if the Member Units were to develop and implement a drought contingency and/or conservation plans to cover the water supply shortage; conservation plans to achieve a reduction of 20 percent by 2020 are required as part of the 2009 Comprehensive Water Legislation (SB7X) and must be demonstrated in an agencies 2010 Urban Water Management Plan (UWMP) updates due by June 30, 2011. In addition, the potential impacts to water quality associated with desalination are mitigable to less than significant levels through compliance with an NPDES permit issued by the Regional Water Quality Board.

However, the feasibility of fully mitigating for all of the potential indirect environmental impacts is uncertain. During the 2003 evidentiary hearing before the SWRCB, expert witnesses for CalTrout testified that the Member Units could conserve an additional 5,000 to 7,000 af by replacing inefficient toilets and washing machines and improving landscape irrigation efficiency. The Member Units presented rebuttal testimony, however, that disputed the testimony of CalTrout's witnesses. In addition, if a drought were to occur in the near future, it might not be possible to fully offset water supply shortages by implementing the conservation measures identified by CalTrout. Accordingly, this EIR assumes that the impacts to the Member Units' water supply under Alternatives 3B, 5B, and 5C could result in significant and unmitigable indirect environmental impacts (Class I).

4.3.3 Mitigation Measures

Section 210 of the Reclamation Reform Act of 1982 (43 U.S.C.A. 390jj) requires water districts with repayment or water supply contracts to develop and maintain water conservation plans containing water conservation measures and time schedules for meeting conservation objectives. By 1993, all of the Member Units had conservation plans in place. Additionally, CVWD, MWD, the City of Santa Barbara, and GWD also are required to prepare and adopt UWMP update by June 30, 2011 in accordance with the Urban Water Management Planning Act. (Wat. Code, Sections 10610–10657.) Among other things, the plans must describe the water demand management or conservation measures that are being implemented or are scheduled for implementation in order to meet the requirements of the 2009 Comprehensive Water Legislation (SB7X). (Wat. Code, Section 10631.) In addition, the plans must contain an urban water supply contingency analysis. The 2010 UWMP updates must include, among other things, actions to be undertaken in response to a water supply shortage, including up to a 20 percent reduction in per capita water demand by 2020, and mandatory prohibitions against specific water use practices during shortages, including but not limited to prohibiting the use of potable water for street cleaning. (Wat. Code, Section 10632.)

CVWD, MWD, the City of Santa Barbara, and GWD submitted urban water management plans to DWR in 2005. Although it is not required to prepare an urban water management plan, SYRWCD, ID #1 also submitted a plan to DWR in 2005. The Member Units have implemented a number of conservation measures or Best Management Practices, including but not limited to water use audits, metering agricultural and non-agricultural accounts, lining ditches and canals, implementation of tiered pricing structures, public education, and water recycling. Water rates are some of the highest in the state and constitute a strong incentive to conserve water.

The Central Coast Water Authority (CCWA) is one of two State Water Contractors in Santa Barbara County and is responsible for among others providing SWP water to the member units. The CCWA has adopted contingency planning for drought periods. Other mechanisms that CCWA can use to fill project participant delivery requests during shortages in SWP supplies are:

- Acquiring water from the State "Turnback Pool," which is an internal SWP mechanism that pools unused SWP supplies early in the year for purchase by other SWP contractors at a set price. In addition, CCWA has established its own Turnback Pool Program whereby CCWA project participants can buy and sell excess entitlement among themselves before submitting it for sale in the state turnback pool program. The turnback pool mechanism is only for one-year sales of water.

- Acquiring water from the State Water Bank during those years the bank is implemented by the state to market water that it purchases on the open market (i.e., non-SWP water). The bank was first implemented in 1991 as the State Drought Water Bank and has since been utilized during certain dry years when additional water is needed by SWP contractors. The water bank also is only for one-year sales of water.

- Term water purchases and sales of SWP entitlement by CCWA project participants in accordance with the CCWA Water Transfer Procedures adopted in March 1996. The procedures typically cover multi-year temporary and permanent sales of SWP entitlement.[24]

In summary, despite the fact that the Member Units already have implemented a number of conservation measures, it may be possible to implement additional drought contingency measures identified as part of the Member Units’ urban water supply contingency analysis in order to make up for a temporary water supply shortage in a critical drought year or period under Alternatives 3B, 5B, and 5C. Therefore, as a mitigation measure, any drought contingency measures identified in the Member Units’ urban water management plans shall be implemented to the extent necessary to make up for a shortage in water supply in a critical drought year.

24 http://www.ccwa.com/history/index.html

4.4 ABOVE NARROWS ALLUVIAL AQUIFER

4.4.1 Existing Conditions

4.4.1.1 Above Narrows Aquifer (Santa Ynez River Riparian Basin)

Overview

The Above Narrows Alluvial Groundwater Basin consists of the Santa Ynez River alluvium from Bradbury Dam to the Narrows (**Figures 4-2a** and **4-2b, Groundwater Basins Below Lake Cachuma**). Groundwater storage and groundwater levels in the Above Narrows Alluvial Groundwater Basin ~~fluctuate~~ change in response to streamflow and groundwater pumping. ~~These factors, in addition to the fact that the Above Narrows Alluvial Groundwater Basin is thin and narrow, cause wide fluctuations in groundwater levels.~~

Groundwater storage and groundwater levels generally increase during winter and spring, and other wet periods, when flow in the Santa Ynez River recharges the underlying alluvial aquifer. The Above Narrows Aquifer Alluvial Groundwater Basin is usually ~~becomes full shortly~~recharged after the onset of "wet" conditions~~ and then it no longer accepts additional water~~. Surface water will pass through the basin with very little percolation under high streamflows and/or when the basin is ~~full~~recharged.

Groundwater storage and groundwater levels decrease in the Above Narrows Alluvial Groundwater Basin during summer, fall and dry periods due to pumping, phreatophytes, groundwater discharge back into the Santa Ynez River as base flow, and underflow through the alluvium downstream toward the Lompoc Basin. While typically t~~T~~he longer the dry period, the greater the decline in groundwater storage and groundwater levels, there are surface and subsurface contributions from tributaries, as well as return flows, which tend to keep the upper reaches of the alluvial basin watered. Although the dam is blocking the natural flow (including subflow) of the Santa Ynez River to replenish the upper reaches of the Above Narrows Groundwater Basin, historically water rights releases have kept the upper basin replenished.~~. The upper reaches of the Above Narrows Alluvial Groundwater Basin drain first, analogous to a long pipe raised at one end. If a dry period persists, the upper reaches of the Above Narrows Aquifer may drain completely even though the lower reaches may remain full.~~

Pumping for agricultural, domestic, and municipal uses decreases the amount of water in storage. In wet years, the basin acts as a reservoir. Pumping increases unused storage capacity, or dewatered storage, in the basin, which results in capture of more stream flow. However, pumping decreases groundwater storage and levels during dry periods, particularly in the upper-most reaches where natural drainage already reduces the amount of water in storage. In addition, pumping causes local declines in groundwater storage and water levels that would not necessarily occur under undisturbed conditions.

As discussed in **Section 2.2.3**, prior SWRCB orders established the Above Narrows Account (ANA) for purposes of maintaining groundwater levels in the Above Narrows Alluvial Groundwater Basin. Reclamation stores water credited to the ANA in Lake Cachuma until SYRWCD requests it. SYRWCD may request a release once dewatered storage in the basin exceeds 10,000 af.

The ~~fluctuation~~ change in the dewatered storage of the basin since 1972 is shown on **Chart 4-9, Annual Dewatered Storage in the Above Narrows Alluvial Basin,** in **Appendix B**. These data show that ~~SYRWCD has maintained~~ dewatered storage has been maintained between approximately 10,000 and 13,000 af through the releases from the ANA. Dewatered storage was substantially reduced in 1991 when the most recent drought suddenly ended with high precipitation and runoff. Since that time (through 2009), ~~SYRWCD has maintained~~ dewatered storage has been maintained within a narrow range.

Groundwater quality in the Above Narrows Aquifer also ~~fluctuates~~ changes to some extent with seasonal and climatic trends. During wet periods, the basin absorbs high quality surface water flows, blending with water already present in the alluvium. In addition, groundwater is flushed through the basin, displacing poorer quality water with higher quality water. This effect becomes magnified the longer the wet period. Conversely, during dry periods, the basin will absorb poorer quality flows from tributary streams to the Santa Ynez River and possibly relatively poorer quality underflow from water-bearing rocks that underlie and surround the basin.

Groundwater pumping also affects groundwater quality. Pumping tends to remove total dissolved solids from the basin; however, this beneficial effect is likely offset by the return flows of water used for municipal, agricultural, and other uses. In addition, pumping decreases groundwater levels, thereby potentially increasing the migration of relatively poorer quality underflow from shale and other water-bearing rocks that underlie and surround the basin. Losses through phreatophytes also contribute to the concentration of total dissolved solids in the basin.

Basin Boundaries, Storage, and Safe Yield

The Above Narrows Alluvial Groundwater Basin is formed by a narrow strip of alluvium associated with the Santa Ynez River. The basin is approximately 36 miles long. It has been subdivided into the Santa Ynez Subarea (2,500 acres); the Buellton Subarea (4,400 acres); and the Santa Rita Subarea (5,200 acres), as shown in **Figures 4-2a** and **4-2b**.

The total storage capacity of the alluvial deposits is 105,000 af. Of this total, the Santa Ynez Subarea contributes 21,000 af, the Buellton Subarea contributes 27,000 af, and the Santa Rita Subarea contributes 56,500 af (Stetson, 1992).

Groundwater levels in the Above Narrows Alluvial Groundwater Basin ~~fluctuate~~ change in response to groundwater pumping, runoff from tributaries below Cachuma Reservoir, and spills and releases from Bradbury Dam. Under average water supply conditions, net losses from the basin do not exceed recharge; however, Reclamation monitoring wells showed that storage did decline during the recent drought (1986-1991), indicating that losses are greater than recharge under dry conditions (Stetson, 1992).

The perennial yield of the Above Narrows Alluvial Groundwater Basin is unlike that of other basins because recharge to the basin is largely determined by how full the basin is and the flow of the Santa Ynez River. There is a relatively unlimited amount of water available to wells if there is an unlimited amount of water available from the river. Water is released from the Cachuma Project ANA to recharge the basin as long as there is water in the account, and the dewatered storage of the basin exceeds 10,000 af. If the ANA is exhausted, and there is no flow in the river, then the supply of water from the basin is limited to what is in storage and subsurface inflow from upstream subareas and surrounding basins. Pumping of over 13,000 afa has been sustained from the basin as described below.

Historic, Current, and Future Projected Pumping (Private and Public)

The majority of groundwater pumped from the Above Narrows Alluvial Groundwater Basin is used for agriculture. Purveyors that pump groundwater from the basin include the SYRWCD, ID #1, and the cities of Solvang and Buellton. Historical groundwater production data from the Above Narrows Alluvial Groundwater Basin are relatively limited. From 1935 to 1944, pumping increased from under 4,000 afa to over 8,000 afa. Peak pumping occurred in 1990-91 and was estimated to be about 13,000 afa. Future pumping is expected to be 18,400 afa by 2035 (Stetson, 1992). A summary of historic pumping from the basin is provided in **Table 4-26, Summary of Pumping in the Above Narrows Groundwater Basin**.

Table 4-26
Summary of Pumping in the Above Narrows Groundwater Basin*

	Average Annual Pumping, 1942–1993 (afa)			
	Santa Ynez Subarea	Buellton Subarea	Santa Rita Subarea	Total
Agricultural	1,600	3,300	4,300	9,200
Municipal	300	800	0	1,100
Total	1,900	4,100	4,300	10,300

** Source: Stetson Engineers.*

The SYRWCD, ID #1, and the cities of Solvang and Buellton have entitlements to SWP water. Delivery of SWP water to the Santa Ynez Valley began in 1997. The imported water is expected to reduce pumping from the Above Narrows Alluvial Groundwater Basin for municipal and industrial purposes.

Groundwater Management Efforts and Programs

The SYRWCD is a local agency formed in 1939 for the primary purpose of protecting water rights on the Santa Ynez River. This agency is also known as the "parent district" to distinguish it from SYRWCD, ID #1._SYRWCD covers approximately 180,000 acres in the Santa Ynez River basin and includes the service areas of seven water purveyors. Several mutual water companies and a large number of private users also pump water for irrigation and domestic purposes within the SYRWCD (Stetson, 1992).

~~In 1992, Stetson Engineers prepared a report outlining various water resource management alternatives for the SYRWCD. The report recommended that a groundwater management plan be developed. State law allows local agencies to establish a groundwater management authority that can collect revenues, via a tax on pumping, to provide supplemental water supplies. Currently, committees have been formed to develop groundwater management plans for the Buellton Uplands and Santa Ynez Uplands areas.~~In cooperation with water purveyors in the District, SYRWCD prepared a report outlining various water resources management alternatives (Stetson, 1992). Groundwater management efforts were initiated by SYRWCD and local purveyors in the Lompoc Basin in 1985. Through cooperative funding efforts with the USGS, the Basin water resources were evaluated, a comprehensive monitoring program was prepared and implemented, and a groundwater model was developed (Bright et al.; 1992, 1997).

The Groundwater Management Act of 1992 (AB 3030) (Water Code Part 2.75, Section 10753) established a process to provide local agencies greater management authority over their groundwater resources. Most recently, the State required the development of groundwater elevation monitoring programs as established through the 2009 Comprehensive Water Legislation (SBX7-6).The City of Lompoc originally initiated an AB 3030 plan in 1999 and continued to move forward with a Plan in the Spring of 2011. Working with the City of Buellton, SYRWCD completed an AB 3030 Plan for the Buellton Uplands Basin in 1995; a similar effort for the Santa Ynez Basin was terminated because most of the basin is outside of the District.

4.4.1.2 Santa Ynez Uplands Basin

The Santa Ynez Uplands Basin is a large groundwater basin that does not receive direct recharge from the Santa Ynez River (minor recharge occurs from return flows that originate from the river valley); therefore, the operation of the Cachuma Project does not impact groundwater storage, levels, and quality in this basin.

4.4.2 Potential Impacts of the Alternatives

4.4.2.1 Simulation Modeling

The Santa Ynez River Hydrologic Model (SYRHM) was used to model groundwater storage and elevations in the Above Narrows Alluvial Groundwater Basin. A general description of the model is provided in **Section 4.2.2.1**. A detailed description of the model, as well as the model results pertaining to the basin is provided in Stetson Engineers (2000, 2001a, 2006a). In the model, the Above Narrows Alluvial Groundwater Basin is divided into four subareas between the dam and the Narrows: (1) Bradbury Dam-Solvang; (2) Solvang-Buellton Bend; (3) Buellton Bend-Salsipuedes Creek; and (4) Salsipuedes Creek-Narrows Gage. The upper segment is further subdivided into 12 smaller segments between tributaries.

Separate surface and groundwater budgets were established in the simulation model for each segment. Monthly groundwater accounting was performed for 912 months over the simulation period (1918-1993) for the following groundwater parameters: river percolation, underflow, bank infiltration, depletions by riparian vegetation, agricultural consumptive use, and municipal and industrial consumptive use. Surface water parameters included surface inflow from the mainstem, tributary inflow, and accretions from precipitation and percolation. The model estimates percolation using a function relating stream width to flow levels, and a maximum percolation rate that decreases as the groundwater basin fills. The maximum percolation rate is based on historic seepage rates, stream width, length of segment, highest percolation rates observed and known groundwater storage in the river alluvium.

Bank infiltration represents groundwater contributions from less permeable, fractured, underlying shale and other deposits. In general, bank infiltration increases when storage in the basin declines and adjacent aquifers are sufficiently full. In times of drought when adjacent aquifers are likely to be dewatered, bank infiltration will decrease. When riparian groundwater storage is sufficiently high such as during a period of high runoff, bank flows become modeled as an outflow to adjacent formations.

Flow from tributaries in the model is based on historic streamflow measurements and represents unimpaired natural flows that occur between Bradbury Dam and the Narrows. In dry years, the Santa Ynez River would be dry except for Cachuma releases so that flows in the river decrease as they move downstream. In wet years, runoff from the tributaries accumulates in the river, so that flows increase as they move downstream.

4.4.2.2 Basin Storage and Groundwater Levels

Threshold of Significance

An impact is considered significant if the mean and median monthly dewatered storage for the Above Narrows Alluvial Groundwater Basin over the simulation period is greater for the alternatives than for the baseline operations condition (Alternative 2). The mean and median monthly dewatered storage for the Above Narrows Alluvial Groundwater Basin (in its entirety and by subarea) is presented in **Table 4-27**. An updated (to 2009) plot of ANA dewatered storage is provided as **Chart 4-30.**

Discussion of Data and Analyses

Chart 4-10, Total Dewatered Storage for Above Narrows Aquifer, in **Appendix B** shows the changes in total dewatered storage in the entire Above Narrows Alluvial Groundwater Basin, based on the SYRHM. ~~In general, this~~These charts also shows~~s~~ that there is no significant difference in the year-to-year variation in dewatered storage in the aquifer, except during droughts. However, the chart shows less total dewatered storage during low flow periods of most years for all project alternatives compared to the baseline conditions due to increased releases for fish. More water is released from the dam compared to the baseline conditions in the alternatives during the summer and fall to support steelhead rearing to Highway 154, and in some years, to Alisal Road in Solvang. As a result of these new releases, there is more percolation into the Above Narrows Alluvial Groundwater Basin during the low flow period of the year compared to the baseline operations (Alternative 2). **Chart 4-10** also shows that the Above Narrows Alluvial Groundwater Basin recovers to the same levels with the recharge of winter runoff under all alternatives.

It should also be noted that SYRWCD ~~actively~~ manages water releases in order to users along the River and on the Lompoc Plain to fulfill senior water rights~~the dewatered storage in the Above Narrows Alluvial Groundwater Basin through the ANA releases from Cachuma Lake~~. Except for Alternative 3C, n~~N~~o significant difference in management of the ANA releases is expected to occur under the project alternatives compared to the baseline operations. In addition, use of the upper percolation curve, subject to ~~new checkpoint at San Lucas Creek in determining the ANA account balance, development of~~ Accumulated Drought Water Credits, conjunctive use of water rights releases (spill years excluded) with fish water, 65-day average annual water rights releases ~~minus any reductions for spills (a maximum of 3,200 acre-ft/year for the combined member units),~~ and releases of 25 acre-ft/month during no-flow periods, ~~(simulated baseflow)~~ as described in the Settlement Agreement, will result in some additional ANA and BNA releases ~~for~~ to downstream ~~users~~areas, which will also benefit the fish and project water supply. **Charts 4-30** and **4-31** (**Appendix B**) show the plots of Dewatered Storage versus for the ANA and

BNA, respectively, as reported by the USBR from 1973 through May 2010. Based on hydrologic data from ~~1999~~ 2003 through 2010, ADWC would have accrued to the MUs in ~~5~~ 3 out of ~~12~~ 8 years (2005, 2006 and 2008). ~~Based on the historical hydrology (1913–1993), MUs would have accrued baseflow allowances for 48 months (2 acre-ft/month x 48 months = 1,200 acre-ft) during that period.~~

Comparison of Alternatives

The modeling results indicate that dewatered storage for the entire basin under the baseline operations (Alternative 2) is higher than the rest of the alternatives. For example, the median monthly dewatered storage over the entire basin under the baseline operations is estimated to be 10,517 af, compared to a range of 10,099 af to 9,840 af for the other alternatives (**Table 4-27**). The reduction in dewatered storage is due to the additional downstream releases for steelhead under the alternatives. With additional releases for fish from the Cachuma Project, additional percolation occurs primarily in the Santa Ynez Subarea, the portion of the river affected by releases for fish.

Median monthly dewatered storage for each subbasin under Alternatives 3B, 3C, 4B, 5B, and 5C would be less than under the baseline operations (with the one exception being the Santa Rita subarea for Alternative 4B) because the project alternatives would involve additional downstream releases to support steelhead. The results of the modeling of groundwater elevations (see **Table 4-28**) are essentially the same as for groundwater storage; that is, groundwater elevations remain unchanged or slightly higher for all alternatives as compared to the baseline condition (Alternative 2). Hence, the proposed alternatives would have a beneficial effect (Class IV) on the alluvial basin storage and groundwater elevation. Based on the dewatered storage data, it is likely that groundwater levels under current operations may be slightly lower than model predicted values.

4.4.3 Mitigation Measures

No adverse impacts on the Above Narrows Alluvial Groundwater Basin alluvial storage or groundwater elevations were identified for Alternatives 3B, 3C, 4B, 5B, and 5C. Hence, there is no need for mitigation.

Table 4-27
Monthly Dewatered Storage in the Above Narrows Alluvial Groundwater Basin

	af for each Alternative based on Simulation (1918-1993)					
	2	**3B**	**3C**	**4B**	**5B**	**5C**
Total Storage for the Entire Basin						
Mean	10,769	10,310	10,281	10,240	10,146	10,131
Median	10,517	10,099	10,081	10,031	9,852	9,840
% Difference Relative to Alt 2		*-4%*	*-4%*	*-5%*	*-6%*	*-6%*
Minimum	2,324	2,315	2,315	2,311	2,315	2,315
Santa Ynez Subarea						
Mean	1,926	1,722	1,704	1,647	1,684	1,683
Median	1,769	1,606	1,584	1,510	1,553	1,547
% Difference Relative to Alt 2		*-9%*	*-10*	*-15%*	*-12%*	*-13%*
Minimum	0	0	0	0	0	0
Buellton Subarea						
Mean	5,634	5,482	5,471	5,438	5,435	5,432
Median	5,570	5,449	5,442	5,382	5,363	5,360
% Difference Relative to Alt 2		*-2%*	*-2%*	*-3%*	*-4%*	*-4%*
Minimum	2,166	2,167	2,153	2,144	2,168	2,169
Santa Rita Subarea						
Mean	3,244	3,105	3,105	3,155	3,027	3,016
Median	3,080	2,981	2,978	3,105	2,870	2,867
% Difference Relative to Alt 2		*-3%*	*-3%*	*1%*	*-7%*	*-7%*
Minimum	0	0	0	0	0	0

Table 4-28
Monthly Water Elevation in the Above Narrows Alluvial Groundwater Basin

	Elevation in Feet for each Alternative based on Simulation (1918–1993)					
	2	**3B**	**3C**	**4B**	**5B**	**5C**
Santa Ynez Subarea						
Mean	459	460	460	460	460	460
Median	460	460	460	460	460	460
% Difference Relative to Alt 2		*0%*	*0%*	*0%*	*0%*	*0%*
Minimum	442	444	445	446	444	444
Buellton Subarea						
Mean	304	304	304	304	304	304
Median	304	304	304	304	304	304
% Difference Relative to Alt 2		*0%*	*0%*	*0%*	*0%*	*0%*
Minimum	295	295	295	295	295	295
Santa Rita Subarea						
Mean	176	176	176	176	176	176
Median	176	176	176	176	176	176
% Difference Relative to Alt 2		*0%*	*0%*	*0%*	*0%*	*0%*
Minimum	163	165	165	165	165	165

4.5 SURFACE WATER QUALITY

The primary water quality issue associated with the SWRCB's consideration of Cachuma Project operations is the concentration of total dissolved solids (TDS) in the Lompoc Plain groundwater basin. Flows in the Santa Ynez River that reach the Lompoc Narrows are a significant source of recharge for the Lompoc Plain groundwater basin, and as such, influence the TDS values in the basin. This basin is the primary water supply for the City of Lompoc. The groundwater in the basin has TDS consisting of various naturally occurring mineral salts (often called "salinity" in certain reports, as a term for minerals in general). TDS values have increased over time in the Lompoc Plain groundwater basin. The TDS concentration of the groundwater in the central and western plains has increased from less than 1,000 milligrams per liter (mg/l) in the 1940s to greater than 2,000 mg/l in the 1960s (Bright et al., 1997). In the past eight years, TDS levels appear to have decreased.

To assess the potential impact of the project alternatives on TDS in the Lompoc Plain groundwater basin, water quality in the entire watershed must be evaluated. Stetson Engineers (2000, 2001c) conducted several technical studies for the EIR to assess the salinity conditions in Cachuma Lake and in the river downstream of the lake to determine if changes in operations could affect the TDS levels in river water that recharges the Lompoc Plain groundwater basin. The studies involved the use of the SYRHM to predict TDS concentrations and salt loading (i.e., quantities of salt) for the project alternatives using the historic hydrologic record. A summary of the modeling studies is provided in this section for the lake and river salinity conditions. Salinity issues associated with the Lompoc Plain groundwater basin are addressed in **Section 4.6**.

4.5.1 Existing Conditions

4.5.1.1 Cachuma Lake

During the past 50+ years, the DWR, City of Santa Barbara, and City of Lompoc have collected a large set of data on the total dissolved solids (TDS) of Cachuma Lake. This data through 1993 is displayed on **Chart 4-11, Lake Cachuma Total Dissolved Solids,** in **Appendix B**. A monthly average was calculated using this data, except for the data collected by the City of Lompoc, which appears to be unusually high and possibly unreliable, compared to other water quality measurements for this watershed. The average annual range of TDS is 547 to 625 mg/l, as shown in **Table 4-29**. The average seasonal variation in TDS during the year is about 78 mg/l.

Table 4-29
Historical Cachuma Lake Total Dissolved Solids (TDS)

Parameter	Concentration (mg/l)
Average annual minimum	547
Average annual maximum	625
Average variation within a year	78

The typical seasonal pattern of TDS is low TDS value in the winter due to fresh inflows, followed by an increase in TDS of up to 100 mg/l over the summer and fall due to evaporation. TDS can increase more than 100 mg/l during years with low inflow or high TDS inflow in average and dry years. In wet years with high inflow, TDS in the reservoir will decrease to 475 to 550 mg/l as there is a large increase in storage consisting of higher quality runoff. Substantial decreases in TDS occurred in the following wet years: 1962, 1967, 1969, 1973, 1978, 1983, 1986, 1993, and 1998 (**Chart 4-11, Cachuma Lake Historic Total Dissolved Solids**). In the years following a wet year, TDS values increase 30 to 200 mg/l. The largest increase in TDS occurred during the 1986 to 1991 drought. In 1986 (a wet year), the TDS was about 550 mg/l. By the end of 1990, reservoir TDS had increased to 750 mg/l.

Cachuma Lake follows a typical pattern of stratification during the spring and summer, with vertical mixing in the late fall and winter. Water temperatures at depths of 30 to 50 feet decrease 5 to 20 degrees Celsius during the spring and summer as the lake stratifies. Vertical mixing is prevented by the temperature stratification. As surface water temperatures decrease in the fall, vertical mixing occurs and the lake turns over.

Over the course of a year, TDS does not vary substantially with depth in the lake and does not appear to be greatly affected by temperature stratification (Stetson Engineers, 2001c). TDS measurements were taken monthly from 1984 to 1999 at different intakes (and therefore, different depths) on Tecolote Tunnel during the year (SYRTAC, 1997). The average difference in TDS amongst the different depths was only four percent. Substantial differences in TDS at different depths only occur after large storms when low TDS water enters the reservoir and is mostly located near the surface. For example, in the large storms of February 1995, the surface TDS was 472 mg/l, while the TDS at 40 feet was 519 mg/l. TDS was monitored at different depths during the February 1992 storms. Immediately after the storm, surface TDS was 482 mg/l and TDS at 40 feet was 576 mg/l. Within one month the TDS at all depths was 530-550 mg/l (Stetson Engineers, 2001c). Based on these observations, it appears that there is complete mixing of TDS in Cachuma Lake. Horizontal mixing of TDS is also very complete, based on a comparison of TDS at Tecolote Tunnel to TDS at the dam site 3.7 miles away (Stetson Engineers, 2001c).

4.5.1.2 Santa Ynez River

Stetson Engineers (2000, 2001c) compiled over 9,000 separate measurements of TDS from 50 locations in the Santa Ynez River watershed. The TDS database for the reservoir, as described above, is very good. The data along the river is generally good, and includes TDS measurements from various locations along the mainstem and along tributaries downstream of the dam since 1951. An inventory of these data is provided in Stetson Engineers (2000). The largest data gaps in TDS data for the river and tributaries are as follows: (1) TDS data at high streamflows are scarce; (2) there are few data prior to 1953; and (3) continuous flow data have not been collected. Eighty-eight percent of the available water quality data was collected for flows of 75 cfs or less.

Stetson Engineers (2001e) summarized TDS values for the river at the Narrows over the period 1942 to 1993 using 138 instantaneous measurements of TDS and flows. These data indicated an inverse relationship between TDS and flows. In the winter months when there is runoff, TDS values in the Santa Ynez River are generally around 500 mg/l. Santa Ynez River TDS values increase to about 1,000 mg/l in the summer and fall when flows are minimal. Flows that exceed 100 cfs typically have TDS concentrations of about 400 mg/l, while flows that are less than 10 cfs range from 1,000 to 1,300 mg/l. The median TDS value at the Narrows is 1,070 mg/l (Stetson Engineers, 2000e). By comparison, TDS values in Salsipuedes Creek, one of the largest tributary streams downstream of the dam, typically range from 700 to 1,000 mg/l. The inverse relationship between flow and TDS at the Narrows is shown on **Chart 4-12, TDS-Flow Relationship at the Narrows**.

4.5.2 Potential Impacts of the Alternatives

4.5.2.1 Development and Calibration of the Salinity Model

Stetson Engineers (2000) added a salinity component to the SYRHM (see **subsection 4.2.2.1**) to simulate TDS levels in the lake and along the river using historic hydrologic conditions from 1942-1993. **Figure 4-1** in **Appendix A** shows the flow components of the SYRHM used to predict lake levels, river flows, and alluvial groundwater storage. Stetson Engineers created input files for the model at five key locations along the river to estimate loading of dissolved solids into the system. Salt loading (i.e., the mass of salt conveyed) was based on observed flow and salt relationships at key calibration locations along the river where empirical data were available. These key locations were Santa Cruz Creek, Salsipuedes Creek, and the mainstem of the river at Los Laureles Canyon, Solvang and the Narrows, as shown in **Table 4-30, Key Salinity Calibration Locations**.

Table 4-30
Key Salinity Calibration Locations

	Location	Number Of Measurements: TDS	Number Of Measurements: Electrical conductivity w/o TDS	Period of Record Available	Sources
1.	Santa Ynez River below Los Laureles Canyon	64	21	1951-54, 73, 80-89, 91-98	USGS
2.	Santa Cruz Creek	65	1	1980, 92-98	USGS
5.	Santa Ynez River near Solvang	223	121	1951-58, 91-98	USGS, DWR, Lompoc
6.	Salsipuedes Creek near Lompoc	241	2	1971, 77-78	USGS
7.	Santa Ynez River at Narrows near Lompoc	235	8	1962-64, 66-70, 72-88, 91-98	USGS, Lompoc

Stetson Engineers (2000) identified a good correlation between flow and salt loading. An example of the flow-salt loading relationship at Solvang is shown on **Chart 4-13, Example of Salt Loading-Flow Data at Solvang,** in **Appendix B**.

The initial results of the salinity modeling showed that when using the flow and salt loading relationships based on available data, the TDS would be consistently overestimated in Cachuma Lake by up to 150 mg/l. Stetson Engineers (2000) attributed this error to difficulty in modeling of salinity of storm events using the very limited TDS data for high flow events in the watershed. Hence, Stetson Engineers adjusted the salinity of high flows to match the observed TDS in the reservoir to improve the model performance. This was achieved by reducing all dissolved solid inflows (inflow quantity was unchanged) by 15 percent when the average monthly combined inflow into Cachuma Lake was greater than 75 cfs. After this high flow adjustment, the simulated TDS matches the observed TDS quite well with a standard deviation of 50 mg/l or 9 percent (Stetson Engineers, 2001a).

In developing and calibrating the salinity model, Stetson Engineers (2000) examined data collected by the City of Lompoc that showed an increase in TDS from the dam to the Narrows when Reclamation releases water pursuant to Order WR 89-18 and no tributary flow exists. For example, TDS concentrations in the river during Order WR 89-18 releases in 1991-96 are shown on **Chart 4-14, TDS Measurements During WR 89-18 Releases** (**Appendix B**). These data show that TDS concentrations during Order WR 89-18 releases increase from about 750 mg/l at the dam to about 1,000 mg/l at the Narrows. The TDS data from the City of Lompoc in **Chart 4-14** show a sharp increase in TDS about 5 miles upstream of the Narrows, in the Santa Rita Subarea of the Above Narrows Alluvial Groundwater Basin. The channel thalweg is very near or below the groundwater elevation in this subarea, in contrast to the upstream Buellton and Santa

Ynez subareas where groundwater is about 10 feet below the channel thalweg. The river alluvium is very coarse and there is a high degree of continuity between the river and groundwater.

Stetson Engineers (2000, 2001c) calls this phenomenon "channel loading," or "Alisal to Narrows Salinity Increase (ANSI)." The source and mechanism for the increase in TDS concentrations in river water as it passes downstream may be the result of any combination of the following:

- Remobilization of evaporated salts stored on the riverbed. Salts accumulate on the riverbed during periods of low flow, and can be re-solubilized upon contact with water.
- Upwelling of alluvial groundwater with higher salt concentrations.
- Phreatophyte transpiration, which would increase salt concentrations in the surface-groundwater system.
- River surface water evaporation.
- Surface-groundwater interface mixing in which alluvial groundwater with high TDS near the surface mixes with surface water.
- Dissolution of geologic formations in the river channel.

Possible sources of salts include percolation from the Santa Ynez River; weathering of geologic material; percolation from the Buellton and Solvang wastewater treatment plant effluent, which is discharged to percolation ponds on the river; inflow from septic systems; irrigation return flows; and lateral sub-flows from tributaries.

The TDS measurements on **Chart 4-14** are based on the City of Lompoc's TDS measurements in Cachuma Lake and along the river, which are about 100 mg/l higher than data from other sources, as documented by Stetson Engineers (2000). However, the trend of increasing concentration from the dam to the Narrows appears valid. Reservoir releases result in higher flows near the dam than at the Narrows, which affects TDS concentrations. Based on limited salinity data collected by the USGS, Stetson Engineers (2000) estimated the actual salt loading between the dam and the Narrows during the Order WR 89-18 releases. Performing a water and salt balance calculation using the 13 available samples during water rights releases, Stetson Engineers estimated the average flux of the ANSI to be about 25 tons/day. In addition, the amount of flux of the ANSI is proportional to the flow as shown in **Chart 4-15, Relationship between Salt Loading and Flows at the Narrows** (**Appendix B**). **Chart 4-15** also shows the flow-ANSI relationships used to calculate the amount of salt input due to the ANSI occurrence in the Buellton, East Santa Rita, and West Santa Rita subareas as used in the SYRHM.

Stetson Engineers verified the accuracy of the SYRHM simulation of TDS at the Narrows, using historical Cachuma Lake operations and downstream water use data for the period 1942-1993 (52 years). Because continuous recording of TDS at the Narrows does not exist for the period 1942-1993, the historical monthly salt outflows at the Narrows had to be independently estimated in order to verify the monthly output from the SYRHM. Using actual TDS measurements at the Narrows (**Table 4-30**), Stetson Engineers developed a relationship between measured daily flow at the Narrows and the flow-salt loading. Stetson Engineers used this relationship, in conjunction with measured daily flows at the Narrows, to estimate flow-salt loading data for the 52-year period, both with and without Cachuma releases (Stetson Engineers, 2001). This method of calculating salt flux is referred to as the "estimated" historical salt flux at the Narrows, which is based on daily flows and estimated flow-salt loading relationship at the Narrows. Stetson Engineers compared the measured and estimated salt loading values for those dates when both values existed, and found that the match between the measured and estimated salt loading for the Narrows was very good. This estimated salt flux based on measured data at the Narrows produced a continuous historic monthly data set, which could then be compared with the model output from the SYRHM.

The method of calculating salt flux by the SYRHM is referred to as the "simulated" salt flux at the Narrows, which is based on the monthly time step of the model and the routing of salts from Cachuma to the Lompoc Narrows based on simulation. Stetson Engineers (2001c) found that the match between the simulated and estimated monthly salt loading at the Lompoc Narrows was very good. In addition, the TDS-flow relationships, as simulated by the SYRHM, were reasonable when compared with the estimated average monthly and measured instantaneous TDS at the Lompoc Narrows (**Chart 4-12**). The pattern of SYRHM simulation results compared with measured data is very similar for both surface flows (quantity) and salinity (quality) in that the simulation matches measured values better at high flows. Overall, the high correlation observed in the calibrations indicated that the salinity model is a reasonable tool for assessing impacts of operations on downstream surface water salinity, and most importantly, for comparing effects on salinity of the various alternatives.

The salinity model includes the delivery of SWP water to Cachuma Lake. A summary of the assumed SWP deliveries for each EIR alternative is shown in **Table 4-31, SWP Water Deliveries Used in the Modeling**. Key SWP water delivery assumptions used in the salinity model simulations are discussed below.[1]

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1 Deliveries now and since 1993 are similar to those used in the modeling.

Table 4-31
SWP Water Deliveries Used in the Modeling

Alternative	afy				
	Exchange with SYRWCD, ID #1 (a)	BNA Exchange for Alt 4B only (b)	SWP Delivered to Cachuma Lake (c)	SWP Released in the Outlet Works (d)	Total SWP Imports (a)+(b)+(c)+(d)
2	2,497	0	5,489	1,789	10,135
3B	2,482	0	5,844	1,841	10,167
3C	2,497	0	5,836	1,866	10,199
4B	2,501	1,770	4,853	1,245	10,369
5B	2,470	0	5,251	2,317	10,038
5C	2,484	0	5,246	2,337	10,068

Total SWP contract entitlements for the Member Units are 17,000 afy. The Member Units purchase additional water from the 3,908 afy Drought Buffer to bank for use during dry years (see **Section 2.2.4**). The actual quantity of SWP water delivery varies based on runoff in the San Francisco-San Joaquin Bay Delta, and averages 77 percent of the contract amount (see **Section 2.2.6**). The salinity model assumes that the average delivery rate is 74 percent. The model also assumes that South Coast average annual SWP delivery is 13,750 afy, which was then adjusted (see **Table 4-31**) to reflect the 74 percent average delivery rate. Key assumptions are listed below, which restrict SWP water deliveries to Cachuma Lake and SWP water releases into the Santa Ynez River. The 13,750 afy does not include Goleta Water District's 1994 purchase of 2,500 af of additional contract water from other SWP contractors because the pipeline capacity and other factors limit delivery to 4,500 afy of Goleta's 7,000 afy SWP entitlement at this time. The model assumes that SWP water would continue to be delivered directly to SYRWCD, ID #1 as part of its current exchange program with other Member Units.

Key assumptions about the delivery of SWP water in the salinity model include:

- Maximum delivery rate to the reservoir is 22 cfs, which provides a monthly delivery capacity of about 1,300 af, and an annual delivery of 15,930 af.
- SWP water cannot be delivered to the reservoir when it is spilling.
- SWP water delivered to the reservoir is exported out Tecolote Tunnel in the same month; hence, SWP water is not stored in Cachuma Lake.
- SWP water may be commingled with Cachuma Project releases, but SWP water must not exceed 50 percent of the total releases to the river at any time. Also, no SWP water may be mixed into

downstream releases during the months of December through June unless flow is discontinuous in the mainstem.

- No SWP water can be delivered to the reservoir when water is being released from Bradbury Dam for fish passage releases.
- SWP water that cannot be delivered due to restrictions in the outlet works is allowed up to one year to be re-scheduled, subject to SWP pipeline delivery capacity and outlet restrictions in the following 12 months.

To model the effect of SWP water deliveries on TDS values downstream of Bradbury Dam, estimated or actual SWP TDS values were input into the model. Actual data were used for the period 1968 to 1993, based on TDS in the California Aqueduct near Kettleman City. The TDS from 1942 to 1967 (prior to the construction of the SWP) was estimated using monthly average values of historic measured data and average annual TDS values based on regression analysis with shortages in the Delta (Stetson Engineers, 2000, 2001c). Average TDS in SWP water is 289 mg/l, with a range of 104 to 567 mg/l.

Under the baseline operations and for all other alternatives, the model assumed SWP water was delivered consistent with the assumptions set forth above. Under Alternative 4B, BNA water would be provided by discharging SWP water to the river near Lompoc for recharge. For the simulation modeling of Alternative 4B, it was assumed that SWP water would be directly recharged at Lompoc Narrows. SWP water was not used for recharge at the Narrows in the months of December through June per a restriction in the Biological Opinion to avoid "imprinting" steelhead with Delta water. In addition, SWP water was not used for recharge when flow at the Narrows was greater than 0.5 cfs. If flow at the Narrows was greater than 0.5 cfs into summer and fall, which would occur in very wet years, then it was assumed that SWP imports for recharge would not occur. Also, as indicated in **Table 4-31**, the total amount of SWP water delivery to the South Coast would be reduced slightly (less than 1 percent) under Alternatives 5B and 5C compared to the baseline conditions (Alternative 2). This is due to the restrictions limiting SWP water mixing in the dam outlet works and the increased use of the outlet works for making additional releases for fish under Alternatives 5B and 5C.

As described in **Section 4.2.2.1**, the Santa Ynez River Water Quality Technical Advisory Committee (SYRWQTAC) conducted a technical peer review of the simulation modeling performed by Stetson Engineers for the EIR, including the surface water quality calibration. The current methodology employed in determining surface water salinity in the Santa Ynez River as described above is the best available method to compare the surface water salinity impacts of the EIR alternatives. The intended use of the SYRHM is to compare EIR alternatives. The simulated salinity data generated from the SYRHM are not meant to be predictive. The model is simply an analytical tool for statistical and comparative purposes. Because the model is used for comparative analyses, some of the inherent inaccuracies in the model are expected to offset one another when comparing the results of one scenario with another. All simulation models have a limitation in predicting absolute results due to inherent errors in the mathematically derived representations of real time operations and complex natural systems.

4.5.2.2 Impacts on Reservoir TDS

Threshold of Significance

An impact is considered significant if under the alternative considered, the TDS levels in Cachuma Lake would be elevated substantially as compared to the baseline condition (Alternative 2).

Discussion of Data and Analyses

The predicted TDS levels in Cachuma Lake for the model simulation period are presented in **Chart 4-16, Predicted Lake Cachuma TDS (Simulations),** in **Appendix B**. TDS levels fluctuate in the model, as under historic conditions, due to variation in annual inflows and storage. The predicted TDS levels in the reservoir shown on **Chart 4-16** may be low because the salinity model included maximum reasonable deliveries of SWP water, a scenario that will not occur for many years. In reality, reservoir TDS levels will be proportional to the amount of SWP water delivered over time to Cachuma Lake and will become more evident during times of low reservoir storage.

Under all alternatives, SWP water is commingled with releases from the dam. By releasing a portion of SWP water from the outlet works (prior to it entering the reservoir), the full water quality benefits in the lake due to commingling SWP and reservoir water would not occur. However, SWP water that does not enter the reservoir is released to the river where it can reduce TDS concentrations and salt loading in downstream surface water and groundwater basins.

Comparison of Alternatives

The simulated lake TDS under Alternatives 3B, 3C, 5B, and 5C would be about 0-5 mg/l higher than under the baseline operations (Alternative 2) as shown in **Chart 4-16**. The amount of SWP water delivered to the reservoir under the baseline operations and Alternatives 3B, 3C, 5B, and 5C would be about the same. Under Alternative 4B, water would be delivered to the Lompoc Forebay. TDS levels in Cachuma Lake under Alternative 4B would be about 5-10 mg/l higher than under the baseline operations (Alternative 2) due to higher lake levels than the other alternatives (**Table 4-31**) and less SWP water that would be delivered to the reservoir under Alternative 4B (**Table 4-31**). Instead, SWP water would be delivered directly to the Lompoc Basin.

As shown on **Chart 4-16**, the amount of surcharging would not appreciably affect the TDS levels in the reservoir. In other words, the TDS levels under Alternatives 3B, 3C, 5B, and 5C would be essentially the same (Stetson, 2001c, 2006c). The additional surcharging under Alternatives 3B, 3C, 4B, 5B, and 5C would capture high inflows during the winter, which typically have low TDS concentrations. As such, there may be a temporary reduction in TDS in the lake after surcharging. However, the salinity modeling indicates that this improvement in TDS levels is mostly offset by the effects of evaporation on a larger lake surface during the subsequent summer months.

The median of the simulated TDS values shown on **Chart 4-16** under the baseline operations (Alternative 2) is 566 mg/l. The median TDS for Alternatives 3B and 3C is 567 mg/l. The median TDS for Alternatives 5B and 5C is 570 mg/l. The median TDS for Alternative 4B is 572 mg/l. A 1 to 10 mg/l increase is small and would not affect the beneficial uses of Cachuma Lake. This potential increase is also smaller than model simulation and field measurement accuracies of +/-5%. This impact analysis is also based on SWP deliveries that are considerably less than the Member Units' full contractual entitlements. (See **Table 4-31** and accompanying text.) Since SWP water has a lower TDS than Santa Ynez River flows, modeling reduced SWP deliveries (as compared to the full contract quantities) results in a conservative analysis.

The potential increase in TDS in Cachuma Lake under Alternatives 3B, 3C, 4B, 5B, and 5C as compared to the baseline conditions (Alternative 2) is considered an adverse, but not significant impact (Class III).

4.5.2.3 Impacts on River TDS

Threshold of Significance

An impact is considered significant if under the alternative considered, the TDS levels in the Santa Ynez River below Bradbury Dam would be elevated substantially as compared to the baseline condition (Alternative 2).

Discussion of Data and Analyses

The TDS of releases for purposes of satisfying downstream water rights at Bradbury Dam and at the Narrows are shown on **Charts 4-17, TDS Concentrations in Water Rights Releases Below the Dam (Simulation),** and **4-18, TDS Concentrations in Water Rights Releases at the Narrows (Simulations)**, respectively. Because the salinity modeling showed no difference in TDS concentrations between Alternatives 3B and 3C and between Alternatives 5B and 5C, these charts only show a single line for "Alternative 3" and "Alternative 5."

The median TDS concentration in water rights releases below the dam under all alternatives is estimated to be about 450 mg/l, which is a combination of low salinity SWP water (about 250 mg/l) and higher salinity reservoir water (about 600 mg/l). Under recent historic operations prior to the importation of SWP water, the median TDS level in water rights releases is estimated to be about 625 mg/l.

The predicted TDS of releases from the BNA that reach the Narrows is shown on **Chart 4-18**. The median TDS concentration of these releases under the baseline operations (Alternative 2) is about 800 mg/l, compared to 450 mg/l in the same releases at the dam. Salt concentrations increase in these low flows as they pass along the river due to the salt loading factors noted above.

The predicted mean monthly TDS of flows at the Narrows is shown on **Chart 4-19, Monthly Mean Flow-Weighted TDS at the Narrows (Simulation)**. These flows represent all water passing through the Narrows during the year, including winter runoff from the mainstem and tributaries, as well as BNA water rights releases. The months of July, August, September, and October are indicative mostly of the TDS of the BNA water rights releases because the quantity of summertime runoff is very small or nonexistent. During the rest of the year, flows are dominated by either runoff or spills from Cachuma Lake.

The effects shown on **Charts 4-17** to **4-19** represent the TDS levels likely to occur when the SWP water is commingled at 50 percent in all water rights releases. Because the full contractual deliveries have not yet occurred, the lowest TDS levels have not yet occurred. The quality of water in downstream water rights releases will be proportional to the amount of SWP water delivered to the reservoir and commingled with water rights releases. Projected future decreases in the availability of SWP water may result in a slight increase in TDS concentrations in the Santa Ynez River. This is due to a lesser proportion of lower TDS SWP water mixing with Cachuma Lake water. **Charts 4-32a, Specific Conductance of Santa Ynez River Surface Water near Solvang,** and **4-32b, Specific Conductance of Surface Water at Narrows**, (provided in **Appendix B**) plot surface water quality monitoring results obtained by USGS for the last 14 years for the USGS surface water station near Solvang and 22 years for the USGS surface water station at the Narrows. The trendlines added to the plots indicate that under current release operations specific conductance of surface water of the Santa Ynez River near Solvang has increased very slightly since 1994 while Santa Ynez River surface water at the narrows at the Narrows has also increased very slightly at the same time.

Continuous electrical conductivity (EC) for salinity was measured during water rights releases in 2000, 2004, and 2007. In 2000, very little SWP water was mixed in with the releases but SWP water was mixed continuously during the 2004 and 2007 releases. These years have specific conductance data available as well as water quality samples. **Figures 22** through **24** from the "Water Quality in the Santa Ynez River –

2007 Water Rights Releases" (Stetson, 2008) show salinity data at the USGS Long Pool, Solvang and Lompoc Narrows gages. The effect of SWP water is clearly noticeable at the Long Pool gage when SWP water was mixed in with water rights releases for about five days in 2000. During this short period of SWP mixing, salinity dropped to the 2004 and 2007 levels. Overall, the 2004 and 2007 water rights releases were approximately 100 to 130mg/L lower in total dissolved solids concentration tha~~t~~n the year 2000 water rights releases at the Long Pool gage. The reduction in salinity due to SWP water mixing would result in a reduction of approximately 1,700 to 2,400 tons of salt loading in the lower Santa Ynez River ~~for~~based on the 11,600 af of water rights releases in 2007.

Other locations downstream of Bradbury Dam also show improvements in water quality from the 2004 and 2007 water rights releases compared to year 2000. **Figures 23** and **24** show the 2004 and 2007 water rights releases were approximately 100 to 150 mg/L lower in total dissolved solids concentration than the year 2000 water rights releases at both the Solvang and the Lompoc Narrows. **Figure 24** shows that the 2007 water rights releases have the lowest salinity at the Lompoc Narrows compared to the releases in 2000 and 2004.

~~The report entitled "Water Quality in the Santa Ynez River – 2007 Water Rights releases," issued by~~ Stetson (~~Engineers in~~ 2008)~~,~~ observed that downstream salinity is not only a function of the percentage of mixing of SWP water but is also a function of the total volume of mixed water available for downstream recharge.

Releases for steelhead rearing, as required under the Biological Opinion, will primarily be made through the Hilton Creek supplemental watering system (maximum capacity of 10 cfs) in order to conjunctively use this water to support both Hilton Creek habitat and mainstem habitat. As a consequence, the rearing releases to maintain target flows at Highway 154 or Alisal Road will not typically contain SWP water. The TDS of these releases will reflect the current salinity levels in the reservoir (about 600 mg/l). However, the higher target flows under Alternatives 5B and 5C would require at times releases greater than 10 cfs and might contain up to 50% SWP water and a lower salinity. Hence, there may be occasions when releases for fish have a lower TDS than reservoir water.

TDS concentrations in spills from the reservoir under all alternatives would not include mixing with SWP water. In addition, the TDS concentrations in spill water are likely to be dominated by the inflows from upstream, which during large storms have a low TDS. ~~Under the recent operational changes, seasonal salinity patterns do not appear to be changing. USGS water quality data for specific conductance of Santa Ynez River water at Solvang (USGS Station 11128500 for years 1996-2010) and at the Narrows (USGS Station 11133000 for years 1978-2010) indicate that specific conductance (directly related to TDS) in Santa Ynez River water has exhibited the same general seasonal trends during the sampling period noted above~~

~~for each surface water station (see **Charts 4-32a** and **4-32b,** in **Appendix B**) as was observed in the modeling data.~~

Comparison of Alternatives

Impacts of Alternatives 3B, 3C, 5B and 5C

The salinity modeling results showed no significant difference in TDS concentrations in water rights releases at the dam and at the Narrows between Alternatives 3B, 3C, 5B, and 5C (**Charts 4-17, TDS Concentrations in Water Rights Releases Below the Dam [Simulation]** and **4–18, TDS Concentrations in Water Rights Releases at the Narrows [Simulations]**). **Chart 4-19, Monthly Mean Flow-Weighted TDS at the Narrows (Simulation),** shows that the average flow-weighted TDS at the Lompoc Narrows for Alternatives 3B, 3C, 5B, and 5C are also very similar. In addition, the TDS levels in the water rights releases under Alternatives 3B, 3C, 5B, and 5C would be similar to those under the baseline operations (Alternative 2), and therefore impacts would be less than significant (Class III).

The varying quantities of SWP water delivered from year to year would not cause any difference in the TDS levels between these alternatives. For example, the median TDS of releases for steelhead rearing would be about 560 mg/l for the baseline operations, and 556 to 561 mg/l for Alternatives 3B, 3C, 5B, and 5C (Stetson, 2006c). **Chart 4-19** also shows that the TDS for Alternatives 5B and 5C is about 5-10 mg/l less than the baseline conditions (Alternative 2) during the summer months July through September which is due to the increase of SWP water released directly into the Santa Ynez River under Alternatives 5B and 5C (**Table 4-31**). (Note: due to the removal of Alternative 1, which had no SWP mixing in water rights releases, **Chart 4-20, Frequency of TDS Levels in Annual Flows at the Narrows [Simulation],** has been removed.)

Impacts of Alternative 4B

Under Alternative 4B, BNA releases would not be made from the dam. Instead, SWP water would be delivered to the Lompoc Valley from a pipeline and discharged to the river for purposes of groundwater recharge. The only water rights releases from the dam would be ANA releases. Both the overall quantity of water rights releases from the dam (**Table 4-7**) and SWP imports (**Table 4-31**) under Alternative 4B would decrease compared to the baseline operations (Alternative 2). The TDS of releases from the dam would be similar to the TDS in the reservoir under Alternative 4B. Based on the modeling, the predicted median annual TDS of fish releases is 581 mg/l under baseline operations compared to 590 mg/l under Alternative 4B. This potential slight increase in TDS is considered an adverse, but not significant impact (Class III).

Chart 4-18 shows that the median TDS of the SWP water during the recharge operations under Alternative 4B would be significantly less than the TDS of water rights releases at the Lompoc Narrows under the baseline conditions (Alternative 2). The median TDS of water rights releases under Alternative 4B would be about 240 mg/l compared to 770 mg/l under Alternative 2 (**Chart 4-18, Appendix B**). The predicted TDS concentration at the Narrows under Alternative 4B is shown on **Chart 4-19**. The TDS at the Narrows, except during the winter months, would be higher under Alternative 4B immediately upstream of the recharge ponds than it is under the baseline operations. This increase in TDS under Alternative 4B would also impact salinity in the alluvial groundwater basin immediately upstream of the Lompoc Narrows, which is the Santa Rita sub-~~unit~~unit, which would also be less than significant (Class III).

The TDS of SWP water discharged to the river in the Lompoc Forebay under Alternative 4B would be very low, and reflect the quality of the water derived from the Delta. The water would commingle with native flows in the groundwater basin, and the resultant TDS values would be lower than the TDS under the baseline operations during times when SWP water is being discharged to the Lompoc Forebay (Technical Memorandum No. 4, p. 19.). The recharge of the Lompoc Plain Groundwater Basin using higher quality water under Alternative 4B would have a beneficial effect (Class IV) at that location because it would improve surface water quality in the Lompoc Forebay during the discharge period. The beneficial effect would be offset, however, by higher TDS levels upstream of the Lompoc Forebay.

4.5.3 Mitigation Measures

If Alternative 4B is implemented, there would be an adverse impact associated with increasing river TDS from the dam to the Lompoc Forebay. To mitigate the adverse impact, water should be released from the dam in sufficient quantity to offset negative impacts to water quality.

4.6 LOMPOC GROUNDWATER BASIN CONDITIONS

4.6.1 Existing Conditions

The following description of the Lompoc Plain groundwater basin is primarily based on USGS studies (Bright et al., 1992, 1997).

4.6.1.1 Geology and Lithography

The Lompoc hydrologic unit consists of the Lompoc Plain, Lompoc Uplands, and Lompoc Terrace (**Figure 4-3**), which together are referred to as the Lompoc Groundwater Basin. The basin is bordered on the north by the Purisima Hills, on the east by the Santa Rita Hills, on the south by the foothills of the Santa Ynez Mountains, and on the west by the Pacific Ocean. The basin is drained by the Santa Ynez River which exhibits perennial flow downstream of the Lompoc Wastewater Treatment Plant due to continual effluent discharges, irrigation return flow, and groundwater discharge. Several intermittent tributaries enter the Lompoc Plain on the north and south.

There are two lithologic units in the basin: (1) impermeable consolidated rock that underlies the groundwater basin, and (2) unconsolidated deposits that compose the aquifer. The unconsolidated deposits include Careaga Sand of Pliocene age, Paso Robles Formation of the Pliocene to Pleistocene age, Orcutt Sand of Pleistocene age, terrace deposits of the Pleistocene age, Holocene alluvium, and river channel deposits. In the Lompoc Plain, the Holocene alluvial deposits range in thickness up to 200 feet.

The unconformity separating the Holocene deposits from the Pliocene and Pleistocene formations serves as a natural boundary for dividing the aquifer into two principal aquifers: the upper and lower aquifers. The upper aquifer consists of the river channel deposits and upper and lower members of the Holocene alluvium. It is limited to the Lompoc Plain area (**Figure 4-3**) and contains three zones: shallow, middle, and main (**Figure 4-4**). The shallow zone of the upper aquifer is primarily composed of river channel deposits and shallow deposits of the upper member of the alluvium. The average thickness of the shallow zone is about 50 feet. The shallow alluvial deposits in the western and central plains contain low-permeability fine sand, silt, and clay layers that confine the underlying deposits. The shallow alluvial deposits under the eastern and southern plains contain fine to medium sand with only occasional discontinuous clay layers. In these areas, deposits underlying the shallow zone are unconfined.

The middle zone of the upper aquifer contains moderately permeable sand and gravel lenses intergraded with fine sand, silt and clay deposits with low hydraulic conductivity. The sand and gravel lenses range from 5 to 40 feet in thickness and yield small to moderate quantities of water to domestic wells. The interbedded fine sand, silt, and clay deposits in this zone confine or partially confine the sand and gravel lenses in the central and western plains.

The main zone of the upper aquifer is composed of the lower member of the Holocene alluvium, which consists of medium to coarse sand and gravel with very high hydraulic conductivity. These deposits yield large quantities of water to agricultural and municipal wells, and are the primary source of water supply in the valley. The base of the sand and gravel overlie the unconsolidated deposits of the lower aquifer. Throughout most of the Lompoc Plain, the main zone is separated from the middle zone by lenses of silt and clay that conflict or partially confine the sand and gravel deposits in the main zone. The silt and clay layers are absent or discontinuous in the eastern plain.

The lower aquifer consists of highly permeable terrace deposits and Orcutt Sands; the Paso Robles Formation; and Careaga Sands. It is present beneath the Lompoc Upland, the Lompoc Terrace, and the eastern two-thirds of the Lompoc Plain. The lower aquifer is the primary water supply in the Lompoc Upland and Terrace. It is not used as a water source in the Lompoc Plain. Groundwater in the lower aquifer beneath the Lompoc Plain is confined.

4.6.1.2 Recharge

The primary sources of recharge to the Lompoc Basin include: (1) seepage from the Santa Ynez River and streams entering from the northern and southern portions of the valley; (2) underflow in river channel deposits; (3) infiltration of rainfall; (4) infiltration of excess irrigation water; and (5) infiltration from wastewater effluent. Estimates of average annual recharge by various investigators generally range from 20,000 to 30,000 afa (Upson and Thomasson, 1951; Evenson, 1966; Miller, 1976; Ahlorth and others, 1977).

Recharge from the Santa Ynez River occurs primarily from the Narrows to H Street Bridge (called the Lompoc Forebay). The average annual recharge from the river along this reach has been estimated to be about 2,000 to 4,000 afa. Recharge from the river downstream of H Street Bridge is estimated to be about 2,000 afa, which is primarily treated effluent. Average annual recharge from underflow in the river channel is about 1,500 af. The average annual releases from the Below Narrows Account since 1989 have been about 1,500 afa. Irrigation return flows account for about 7,000 afa of recharge.

4.6.1.3 Discharge

The principal losses from the Lompoc Basin include: (1) agricultural and municipal pumping; (2) transpiration of phreatophytes along the river; (3) underflow from the upper aquifer to offshore deposits; and (4) seepage to the Santa Ynez River in the coastal area. Estimates of average annual losses from the

Lompoc Basin range from 25,000 to 33,000 afa (Upson and Thomasson, 1951; Evenson, 1966; Miller, 1976; Ahlorth and others, 1977). Phreatophyte losses account for about 3,000 afa of total losses.

Most of the groundwater pumping from the Lompoc Basin historically has been for irrigation. Agricultural wells are located throughout the Lompoc Plain. Municipal pumping by the City of Lompoc, and VAFB and/or the federal penitentiary[1] has increased significantly since the late 1950s. However, total pumping from the Lompoc Basin has remained relatively constant in the past twenty years at about 25,000 to 30,000 afa (**Chart 4-21, Reported and Estimated Total Annual Pumping from the Lompoc Basin**). Irrigation uses account for about 60-70 percent of the total pumping. Pumping by the City of Lompoc increased dramatically in the late 1980s, then dropped off during the drought as groundwater levels decreased. Since the drought, annual pumping has been about 5,000 afa (**Chart 4-22, Annual Pumping Reported by the City of Lompoc**).

4.6.1.4 Occurrence and Movement of Groundwater in the Upper Aquifer

In the 1940s, groundwater movement in the upper aquifer was from the Santa Ynez River (the principal source of recharge in the eastern plain) towards the west. However, due to increased municipal pumping in the center of the Lompoc Plain, a water level depression of up to 30 feet has been created around the City of Lompoc's municipal wells in the eastern plain. This depression has reversed the direction of groundwater movement in the northeastern plain, which is depicted in **Figure 4-3**.

Long-term water level hydrographs in the eastern and western plains indicate that the hydraulic head in the main zone can fluctuate more than 10 feet per year, and that the water level in the main zone declined about 20 feet in the eastern and western zones between the 1940s and the 1990s. Water level fluctuations in the shallow, middle, and main zones of the upper aquifer in the eastern plain are similar because groundwater moves freely between all zones in this area. In contrast, water level fluctuations in the shallow and main zones of the central and western plains are not similar due to discontinuity between the zones, particularly thick deposits of silt and clay in the shallow zone that retard movement of groundwater between the shallow and middle zones.

Historical water level data from various private and City of Lompoc wells are presented on **Chart 4-23, Historical Water Levels in the Lompoc Plain**. The data are quite variable, and show great fluctuation from year to year.

Substantial changes in water levels do not always correspond to climatic events, such as droughts and wet years.

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1 VAFB's wells have been transferred to and now are used by the federal prison.

4.6.1.5 Groundwater Quality in the Upper Aquifer

TDS concentrations in the shallow zone of the eastern plain, which is uncultivated, from the 1930s are similar to those measured in 1988 – about 1,000 mg/l. In contrast, the TDS concentrations in the shallow zone beneath irrigated areas of the central and western plain were about 5,000 mg/l in 1988 compared to 3,000 mg/l in the 1940s. In 1988, the TDS levels of the shallow zone in irrigated areas of the central and western plains were more than twice the levels in the middle and main zones. This difference is due to agricultural return flows, dissolution of salts in the unsaturated zone, and silt and clay deposits in the shallow zone that retard the downward movement of poor-quality groundwater to the middle zone. In 1988, average TDS levels in the middle zone ranged from 1,000 to 3,000 mg/l.

TDS in the main zone beneath the eastern plain has increased from about 1,000 mg/l in the early 1960s to about 1,500 mg/l today. A cone of depression created by municipal pumping in the main zone of the eastern plain (see above) has apparently induced the migration of water containing high TDS from the middle zone of the northeastern plain towards the City of Lompoc's wells. The extent to which the increase in TDS in the eastern plain is also due to the quality of recharge in the Santa Ynez River, which may be affected by the Cachuma Project, is unknown at this time.

TDS levels in the main zone were typically less than 1,100 mg/l prior to the 1940s. In the areas adjacent to the Santa Ynez River, TDS in the main zone has not changed significantly since that time. However, in the central and western plains, the TDS levels have increased from 1,000 mg/l in the 1940s to greater than 2,000 mg/l in the 1960s. These concentrations increased because increased irrigation and municipal pumping in the eastern plain during the 1950s intercepted a large percentage of the recharge from the Santa Ynez River. Consequently, leakage of water with high TDS from the shallow and middle zones in the northeastern plain became a significant source of recharge to the main zone in the western two-thirds of the entire Lompoc Plain. TDS levels in the main zone have remained relatively constant since the 1960s primarily because pumping has also remained constant.

In the western plain, the main zone lies above, and in direct contact with, the lower aquifer and consolidated rock. Historical water quality data indicate that as groundwater moves westward in the main zone from the central plain, TDS levels decrease due to upward leakage of better quality water from the lower aquifer. However, if the lower aquifer is absent, the main zone is in contact with the consolidated rock and TDS levels in the main zone increase dramatically because these rocks are marine in origin and the zone contains poor quality water. ~~TDS levels in the main zone have historically been highest in the western plain, generally exceeding 3,000 mg/l. Seawater is the primary source of high TDS in this area.~~

Potential causes for the overall increase in TDS in portions of the Lompoc Plain since the 1940s are listed below in no particular order:

- Intensive pumping by the City of Lompoc in the 1950s and 1960s.
- Leaching of high TDS water from shallow and middle zones.
- Percolating irrigation water that conveys salts into the groundwater.
- Evapotranspiration from irrigated crops.
- Land leveling that releases minerals for leaching.
- Migration of high salinity water from underlying consolidated rocks.
- Leaching of salts from estuarine clay lenses.
- Leaking abandoned oil and gas wells.
- Decrease in the quality of recharge water in the Santa Ynez River due to the Cachuma Project.
- Effects of drought on quality of recharge water.

4.6.1.6 Recent Trends in Groundwater Quality

Historical TDS concentrations in the City of Lompoc's municipal wells are shown on **Chart 4-24, Historical TDS in Lompoc City Wells (City Data),** in **Appendix B**. The TDS levels vary among the wells, with the lowest TDS observed in wells nearest to the river. TDS concentrations increased about 150 mg/l between the 1960s (1,110 – 1,400 mg/l) and 1992 (1,300 – 1,500 mg/l) when the 1986-1991 drought ended. After 1992, TDS levels decreased significantly, and now appear to be stabilized at about 1,000 mg/l in wells near the river, and 1,500 mg/l in wells at greater distances from the river. The reasons for the recent improvement in water quality in the City of Lompoc's wells have not been investigated. Possible explanations include the beneficial impacts of a series of very high runoff years, changes in Cachuma Project operational criteria established by the SWRCB, and a substantial increase in the frequency and amount of BNA releases compared to pre-drought years.

Historical TDS levels in other wells in the Lompoc Plain are shown on **Chart 4-25, Historical TDS in Lompoc Plain Wells (USGS Data)**. Wells with the highest TDS concentrations are located in the western plain. Most of the wells show a decrease in TDS in the early 1990s. **Chart 4-33, Well 7N/35W-26F5 Total Dissolved Solids; Charts 4-34a, Measured Salinity Data for Well 7N/34W-34A4,** and **4-34-b**, **Measured Salinity Data for Well 7N/34W-29N6,** and **Chart 4-35, Measured Salinity Data for Well 7N/34W-27P5,** provide TDS plots for wells 7N/35W – 26F5 (Lompoc Western Plain), 7N/34W – 34A4 and 29N6 (Lompoc

Central Plain), and 7N/34W – 27P5 (Lompoc Eastern Plain). The plots indicate a continuing decreasing trend in TDS across the Lompoc Plain from the 1986–1991 period shown on **Chart 4-24**.

4.6.2 Modeling Performed for the EIR

4.6.2.1 Overview of the Modeling Approach

Stetson Engineers evaluated the effect of the project alternatives on water quality in the Lompoc Plain groundwater basin using two groundwater models developed for this basin – one developed by the USGS and the other developed by Hydrologic Consultants, Inc. (HCI). The modeling analysis was used to estimate the TDS concentration of groundwater in one of the four aquifers in the Lompoc Plain, called the Main Zone of the Upper Aquifer. It is the primary source of water for irrigation and municipal wells in the Lompoc Plain.

The model simulations utilize Santa Ynez River flow and TDS data from the SYRHM, described in **Sections 4.2** and **4.5**, and local precipitation and recharge for the historical period 1942 to 1988. That period was selected primarily because it roughly matches the calibration period for the USGS models (January 1941 to December 1988) and HCI models (October 1941 to September 1994).

The models predict TDS levels in the groundwater over time, based on the various model elements such as the amount and quality of runoff in the river, pumping (amount, depth, and location), irrigation return flows, leakage from bedrock, wastewater percolation, and infiltration from adjacent upland basins. Because both models used the same hydrologic period, the primary variables that affect groundwater TDS are the amount, timing, and TDS of recharge from the river. These variables depend on the quality of natural runoff and Cachuma Project operations, including frequency of spills, and the quality of water rights releases and spills.

4.6.2.2 Peer Review

Both groundwater models are used in this EIR because they were available, technically sound, and exhibit different approaches to modeling flow and solute transport. The SYRWQTAC is evaluating both models to determine which model or combination of models will provide the best tool for ongoing studies on water quality issues in the Santa Ynez River. Stetson Engineers is the technical consultant for the SYRWQTAC. At this time, Stetson Engineers does not consider one model to be more accurate than the other model – they are both valid simulation models with unique strengths and weaknesses.

The SYRWQTAC conducted a technical review of the groundwater modeling for the EIR of key assumptions, modeling protocols, methods of interpreting results, and reliability of the results.

A summary of key technical issues raised by SYRWQTAC on the use of the two groundwater models are listed below, along with an assessment how such issues may or may not affect the accuracy and reliability of the EIR conclusions.

Stetson Engineers (2001 d) employed various measures to ensure that the input data representing flow and TDS at the Narrows was similar for both the HCI and the USGS models in order that the results of the simulations may be compared. The simulations were not expected to predict, with a high degree of accuracy, the TDS and water levels in the future. Rather, they were intended to allow a relative comparison between alternatives. The differences between EIR alternatives are best evaluated using the results of one model rather than comparing the results of two models. It is difficult to compare the results of the models to one another without detailed knowledge of the hydrogeology of the basin and the spatial and temporal quality of available data.

The capability of these models to predict ground water quality conditions in the future is limited by: (1) the conversion of monthly SYRHM output into the biannual and annual stress periods of the USGS and HCI transport models; and (2) the use of constant 1988 pumping, which may not represent present or future pumping amounts or pumping distribution by aquifer and sub-region. In addition, the models do not account for water and land use changes that may affect the distribution and quality of water recharging the aquifers in the future.

From the limited evaluation of the models that could be conducted within the scope of the Stetson (2001d) study, it appears that the TDS models accurately predict future TDS concentrations within a range of 100 to 300 mg/l. The accuracy of the predictions is dependent on location, magnitude of changes in input data, hydrologic conditions, length of simulation period, and other factors.

4.6.2.3 USGS Groundwater Model

The USGS model is described in Bright, et al. (1997). It uses a three-dimensional finite-difference code, MODFLOW, to simulated flow in the three hydrologic units in the Lompoc Basin of which the Lompoc Plain is a part (**Figure 4-3**). The solute transport model employs a two-dimensional finite-element code, SUTRA, the USGS modified for its study to handle time steps of varying length. The MODFLOW grid uses a uniform spacing of 1/4 mile and includes four layers representing the entire Lompoc Basin. Layer 3 of the USGS flow model corresponds to the Main Zone aquifer of the Lompoc Plain. The two-dimensional SUTRA solute transport model represents one layer only, the Main Zone in the Lompoc Plain. It utilizes a uniform-density finite-element mesh that is rectangular in order to match the geometry of the MODFLOW grid; however, each half-mile wide flow model cell of the MODFLOW grid is assigned nine SUTRA transport model nodes. A total of 905 nodes were used to represent the Main Zone. The two-dimensional USGS SUTRA solute transport model represents one layer only, the Main Zone in the Lompoc Plain. It utilizes a uniform-density finite-element mesh that is rectangular in order to match the geometry of the MODFLOW grid; however, each half-mile wide flow model cell of the MODFLOW grid is assigned nine SUTRA transport model nodes, as shown in **Figure 4-4**.

The USGS calibrated its model for the period 1941-88 with two stress periods per year of a varying duration, the length of which is related to the number of consecutive days in a particular year that were classified by Bright et al. (1997) as wet, and the number classified as dry. Since historical TDS data at the Narrows are limited, the USGS used the data available in the early 1990's to make assumptions for the historical calibration. USGS assumed a fixed value for wet and dry periods of 800 mg/l and 1,300 mg/l, respectively, for inflows at the Narrows.

4.6.2.4 HCI Groundwater Model

Lompoc developed several flow and transport models for the HCI model. Of those, only the Lompoc Basin Flow Model and Lompoc Plain Flow and Transport Models are used in this EIR. The numerical codes used are FLOW3D and TRANS3D. The HCI Lompoc Basin Flow Model uses a finite element grid and includes four layers representing the Shallow, Middle, Main, and Lower aquifers, similar to the USGS model. There are a total of 689 nodes in the HCI basin flow model. This model uses monthly stress periods and is, therefore, directly compatible with the output of the SYRHM that is used to provide Santa Ynez River flow and TDS input at the Narrows.

Compared to the USGS model, the HCI Lompoc Plain Flow Model covers a smaller area, uses a finer grid, and consists of a total of 3,936 nodes. It has seven layers -- four Shallow, two Middle, and one Main, but none for Lower Aquifer. The Lompoc Plain Transport Model has the same structure as the Lompoc Plain Flow Model; however, it operates on an annual, rather than monthly, stress period.

One of the key features of the TRANS3D code used for the HCI Lompoc Plain Transport Model is that, unlike the SUTRA code used for the USGS transport model, it dynamically accounts for changes in aquifer TDS. As groundwater is pumped from any well, the model applies the computed ground-water salinity for the current month and aquifer location to that water. Whatever portion of the water applied to the land surface that percolates through the soil will carry its salt load with it. This agricultural return flow interacts with the soil system, and the salt content of the water may either increase or decrease, depending on whether salt moves from the soil into the water or precipitates from the water into the soil. The effects will be carried through the shallow and middle zones before reaching the main zone of the aquifer.

Another key difference between the USGS and HCI models is that the initial TDS assumed for the HCI historical calibration was a uniform 1,200 mg/l for the entire Main Zone. The USGS used a spatially varying TDS for its initial conditions based on historic data. Finally, the USGS transport model was calibrated to selected TDS data considered reliable from wells known to produce from the Main Zone Aquifer, whereas the HCI model was calibrated to ten-year average TDS values for general regions of the Lompoc Plain using a method defined as "spatial averaging."

4.6.2.5 Key Assumptions

The models were used to simulate hydrologic conditions for the period 1942 to 1988 with the following exceptions: (1) groundwater pumping and return flow from agriculture were held constant at 1988 levels; (2) initial water levels and TDS were reset to those simulated at the end of 1988; (3) the SYRHM generated streamflow and TDS of the Santa Ynez River at the Lompoc Narrows for each EIR alternative for the 1942-1988 period; and (4) pumping from the City of Lompoc wells was reduced by 1,770 afa in Alternative 4A, because this amount would be delivered directly to the City in an SWP water exchange. The purpose of using constant pumping was to better represent current pumping (which is similar to 1988 conditions), and to facilitate comparison between EIR alternatives without a variable factor such as pumping.

There are some changes in pumping rates and distribution that have reportedly occurred since 1988 that are not represented in the models. These changes include: (1) a switch from Main Zone production to that of shallower aquifers for irrigation wells in the Western Plain, and (2) some municipal pumpers outside the Lompoc Plain have begun to use SWP water which is likely to have reduced their pumping and slightly improved the quality of discharge from the Lompoc Wastewater Treatment Plant (WWTP). There are insufficient data to modify the models to accommodate these conditions. The omission of these new conditions in the models does not invalidate the results of the simulations, which are comparative in nature only.

4.6.2.6 Influence of Santa Ynez River Flows and TDS at the Narrows

The groundwater models are greatly influenced by the timing, amount, and TDS of Santa Ynez River flows at the Narrows where the Lompoc Plain is recharged from river flows. Inflows to the Narrows under each alternative vary based on the operation of the reservoir, particularly the frequency and duration of spills, the amount of BNA water releases, and the amount of SWP water commingled with water rights and fish releases.

The simulated flows at the Narrows for the alternatives over the simulation period are shown on **Chart 4-26, Annual Average Flow of Santa Ynez River at the Narrows (Simulation),** in **Appendix B**. Annual flows are very similar for all alternatives, except Alternative 4B, which often shows higher annual flows.

The simulated mean monthly flows at the Narrows are shown on **Chart 4-27, Simulated Mean Streamflow at the Lompoc Narrows**. The differences between alternatives are most apparent during summer months. Flows under Alternatives 3B, 3C, 5B, and 5C are almost identical throughout the year. In contrast, flows in the summer under Alternative 4B would be very different compared to the other alternatives. Under Alternative 4B, SWP water would be recharged directly at or below the Narrows, increasing the flow below the point of discharge significantly in dry months.

The simulated average annual TDS of river flows at the Narrows is shown on **Chart 4-28, Average Annual Flow Weighted TDS at the Narrows (Simulation)**. The monthly average TDS of flows simulated at the Narrows for each EIR alternative is shown on **Chart 4-19**. These data show the inverse relationship between flow and TDS. Higher flows below the point of SWP water discharge under Alternative 4B would result in lower TDS levels. The TDS for Alternatives 3B, 3C, 5B, and 5C are almost identical to one another because all of these alternatives entail releases from the BNA in the same manner, and with the same commingling of SWP water.

4.6.3 Potential Impacts of the Alternatives

4.6.3.1 Results of Simulation Modeling

Threshold of Significance

An impact is considered significant if the TDS level would be significantly increased above the baseline condition (TDS levels from 1952 through 1982).

The results of the groundwater modeling using the USGS and HCI models are summarized in this section. Stetson (2001d, 2006c) contains more detailed simulation modeling results. The alternatives were evaluated for impacts to groundwater levels and TDS in the Main Zone aquifer of the Lompoc Basin using the two simulation models. Modeling results are presented using predicted water level and TDS conditions at two well locations within each of the three main sub-areas within the Lompoc Basin. The following results are presented for each alternative: (1) average TDS at each location over the period 1952 through 1982; and (2) time series graphs of TDS and water levels representing the results for the entire simulated period.

The results of the USGS and HCI models were different in terms of absolute values for water levels and TDS values. However, the models showed the same relative differences amongst alternatives. As such, the reliability of the modeling analyses for comparative purposes is considered very high.

The average TDS for the Main Zone aquifer in the Lompoc Basin for each sub-area at selected locations and the flow-weighted average for the five City of Lompoc active wells are shown in **Table 4-32, Simulated Average TDS for Selected Wells in the Main Zone**. These results illustrate the magnitude of the average simulated TDS between and within sub areas, as well as between alternatives and between models. The values shown in **Table 4-32** suggest a high level of precision because they are reported to four significant places. As noted earlier, actual TDS concentrations may vary from the models' predictions by 100 to 300 mg/l, depending upon many factors. Hence, the values in **Table 4-32** should be used cautiously, and are best used when rounded to the nearest 100 mg/l. Differences less than 100 mg/l should only be relied upon when other clear trends support these differences.

Table 4-32 shows that, according to the HCI model, the overall magnitude of the average TDS under all the alternatives ranges from about 2,000 to 2,300 mg/l in the western plain, would be a relatively uniform 1,800 mg/l in the central plain, ranges from over 800 to 1,700 mg/l in the eastern plain, and ranges from about 900 to 1,000 mg/l for the City of Lompoc wells. The range of TDS is approximately 1,500 mg/l basin wide. The differences in results within each sub-area are about 900 mg/l in the eastern plain, 300 mg/l in the western plain, and no significant difference within the central plain.

According to the USGS model, the overall magnitude of the average TDS ranges from about 2,200 to 2,900 mg/l in the western plain, 1,900 to 2,200 mg/l in the central plain, 900 to 1,800 mg/l in the Eastern Plain, and would be about 1,100 mg/l for the City of Lompoc wells. The range of TDS is approximately 2,000 mg/l basin wide. The differences in results within each subarea are about 700 mg/l in the Western Plain, about 300 mg/l within the central plain, and 800 mg/l in the eastern plain.

Table 4-32 shows that, except very near the Narrows, the USGS model simulates higher overall TDS in the Main Zone than the HCI model by about 100 mg/l to 600 mg/l. The greatest difference between the models occurs in the western plain where the difference in TDS ranges from about 200 to 600 mg/l. This may be because of the difference in the boundary conditions at the base of the models. The USGS model includes a head dependent boundary between the consolidated rocks, a source of high TDS waters, and the Main Aquifer in the Western Plain, whereas the HCI model represents that contact as a no flow boundary.

Table 4-32
Simulated Average TDS for Selected Wells in the Main Zone (mg/l 1952-82)

Well	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Recharge to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
HCI MODEL RESULTS						
Western Plain						
Well 26F1,3, 4, 5	2,330	2,329	2,330	2,332	2,333	2,333
Well 25D1, 3	2,018	2,016	2,016	2,018	2,017	2,017
Central Plain						
Well 31A1	1,784	1,784	1,782	1,803	1,798	1,798
Well 29N6	1,784	1,784	1,786	1,794	1,800	1,798
Eastern Plain						
Well 28M2	1,728	1,726	1,723	1,731	1,715	1,712
Well 34B1	1,009	1,006	1,002	842	986	987
City Wells						
City Wells –Avg.	1,012	1,011	1,008	854	989	991
USGS MODEL RESULTS						
Western Plain						
Well 26F1,3, 4, 5	2,885	2,844	2,850	2,906	2,831	2,830
Well 25D1, 3	2,273	2,231	2,235	2,284	2,210	2,209
Central Plain						
Well 31A1	2,180	2,176	2,176	2,176	2,172	2,171
Well 29N6	1,937	1,935	1,935	1,928	1,934	1,934
Eastern Plain						
Well 28M2	1,770	1,758	1,758	1,752	1,753	1,754
Well 34B1	973	974	974	931	971	970
City Wells						
City Wells –Avg.	1,108	1,109	1,107	1,085	1,105	1,104

In the central and western plains, the USGS model also simulates a greater range of TDS and higher average concentrations than the HCI model by about 100 to 300 mg/l. This difference may also be attributed to the lower boundary conditions as well as the difference between the USGS and HCI conceptual models. In the USGS model, the primary source of salts introduced to the Main Zone is poor quality water from the lower aquifer and consolidated rocks. In the HCI model, dissolution of salts by percolating recharge from rainfall and irrigation return flows in the unsaturated zone is the primary source of salts. (Note: **Table 4-33** has been deleted due to the removal of Alternative 1.)

Table 4-33

Has been deleted due to the removal of Alternative 1.

4.6.3.2 Effects of Alternatives 3B, 3C, 5B, and 5C

The modeling results indicate that TDS levels in the groundwater of the Lompoc Basin under Alternatives 3B, 3C, 5B, and 5C would improve slightly (see **Table 4-34, Change in Average TDS for Selected Wells in the Main Zone Alternatives 3, 4, and 5**), particularly in the western and eastern portions of the basin. The differences are very small relative to the total TDS levels in these wells (800 to 2,500 mg/l). The reduced TDS levels are likely due to a combination of higher and longer surface flows in the summer due to increased releases for fish. In addition, Alternatives 5B and 5C have an increase of SWP water mixed in the outlet works and the direct release of SWP water into the Santa Ynez River during wet and above-normal years when the outlet works must be used to meet higher target flows for fish. The HCI model results indicate very small differences between alternatives that are less than one percent, probably due to their modeling approach and use of annual stress periods.

None of the alternatives exhibit conspicuous basin-wide trends. The predicted water quality improvements based on the USGS model is generally larger in magnitude compared to the HCI model, except in the extreme eastern portion of the basin. The HCI model shows a greater sensitivity to the flows and water quality of the surface water at the Narrows in the eastern plain, while the USGS model is more sensitive in the western plain.

Table 4-34
Change in Average TDS for Selected Wells in the Main Zone
Alternatives 3, 4, and 5 (mg/l, 1952-82)

Well	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Recharge to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8′ surcharge	Alt 5C: "3A2"/BO and 3′ surcharge
HCI MODEL RESULTS					
Western Plain					
Well 26F1, 3, 4, 5	<1	<1	2	3	3
Well 25D1, 3	-2	-2	<1	-1	-1
Central Plain					
Well 31A1	<1	-2	20	14	14
Well 29N6	<1	1	10	16	15
Eastern Plain					
Well 28M2	-2	-5	3	-13	-16
Well 34B1	-3	-7	-167	-23	-22
City Wells					
City Wells –Avg.	-1	-5	-158	-23	-21
USGS MODEL RESULTS					
Western Plain					
Well 26F1, 3, 4, 5	-41	-35	21	-54	-55
Well 25D1, 3	-43	-38	10	-64	-65
Central Plain					
Well 31A1	-4	-4	-4	-8	-9
Well 29N6	-1	-1	-8	-3	-3
Eastern Plain					
Well 28M2	-12	-12	-18	-17	-16
Well 34B1	2	2	-42	-2	-3
City Wells					
City Wells –Avg.	1	-1	-24	-3	-4

The difference in TDS between alternatives at a single well location (**Table 4-34**) is less than the inherent accuracy of either model. However, the aggregate results in **Table 4-34** are sufficient to exhibit a trend of improved groundwater quality in comparison to the baseline operations (Alternative 2). The groundwater modeling results indicate that Alternatives 3B, 3C, 5B, and 5C would potentially decrease TDS levels in the Lompoc Plain over time. As such, they would result in a beneficial effect on water quality in the Lompoc Plain, and in the quality of the drinking water for the City of Lompoc (Class IV).

As stated in the previous section, projected decreases in the availability of SWP water may result in increases of TDS in surface recharge water in the Lompoc forebay producing a slight increase in the TDS concentrations of groundwater. Increased pumping to meet the greater demand and decreased supply in future scenarios will also likely result in an increase in TDS concentrations in groundwater during drought periods.

4.6.3.3 Effects of Alternative 4B

Alternative 4B includes direct recharge of high quality SWP water in the basin. Alternative 4B would reduce TDS levels in portions of the Main Zone in the Lompoc Basin, and as such, would result in a beneficial effect on groundwater quality in the Lompoc Basin (Class IV).

Under the HCI model, the greatest improvement in groundwater quality occurs very near the Lompoc Narrows under Alternative 4B. In that case, recharging of low TDS SWP water would result in a significant improvement near the City wells, including Well 34B1, possibly due to high vertical permeability, which allows localized deep percolation of high quality SWP discharge.

In the USGS modeling results, Alternative 4B shows a marked improvement in water quality in the eastern and central plains due to direct recharge of high quality SWP waters at low flows. The magnitude of the improvement in the extreme eastern plain is far less than that simulated by the HCI model, possibly for reasons discussed above regarding vertical permeability and the greater TDS of river sub-flow in the USGS model. The cause of the relative decrease in quality in the western plain for this alternative is unknown.

4.6.3.4 Effects on Groundwater Levels – All Alternatives

The results of both models indicate no significant changes in groundwater levels in the Lompoc Basin under Alternatives 3B, 3C, 4B, 5B, and 5C. Detailed time series graphs of water elevation changes due to pumping and recharge over the modeling period are provided in Stetson (2001d, 2006c).

4.6.4 Mitigation Measures

No mitigation measures are necessary because no significant impacts were identified due to the proposed alternatives.

4.7 SOUTHERN CALIFORNIA STEELHEAD AND OTHER FISHES

4.7.1 Existing Conditions

The following information about southern steelhead (*O. mykiss)* and other fish is based on the studies by SYRTAC on behalf of Reclamation and the Member Units under provisions of the 1994 MOU (SYRTAC, 1994, 1996, 1997, 1998, 2000a, 2000b, 2009).

4.7.1.1 Species Accounts

Twenty-six species of fish inhabit the Santa Ynez River watershed (**Table 4-35, Native and Introduced Fish in Cachuma Lake and Santa Ynez River**), including 11 native species. All native species reported in the 1940's are still present (ENTRIX 1995, SYRTAC 2009). Steelhead/rainbow trout (*O. mykiss)*, prickly sculpin, partially armored threespine stickleback, and Pacific lamprey are native to the Santa Ynez River and seven additional native species are found only in the lagoon (tidewater goby, Pacific herring, topsmelt, shiner perch, starry flounder, staghorn sculpin, and striped mullet). Fifteen fish species have been introduced to the watershed including the native arroyo chub, and non-native large- and small-mouth bass, sunfishes, and catfish, among others (**Table 4-35**). Two federally listed endangered fish species are found in the Santa Ynez River watershed and one California species of concern:

- Southern California Evolutionary Significant Unit of steelhead trout *(Oncorhynchus mykiss)* – Federally-listed endangered species
- Tidewater goby *(Eucyclogobius newberryi)* – Federally-listed endangered species
- Arroyo chub *(Gila orcutti)* – California species of concern

The Santa Ynez River downstream of Bradbury Dam and its tributaries are designated as critical habitat for the endangered *O. mykiss.* The Santa Ynez River lagoon is not designated as critical habitat for either *O. mykiss* or the tidewater goby, as it is located within Vandenberg Air Force Base and is therefore exempt.

Table 4-35
Native and Introduced Fish in Cachuma Lake and the Santa Ynez River

Common Name	Scientific Name	Status	Location
Rainbow/steelhead trout	*Oncorhynchus mykiss*	N1	RATCL
Threespine stickleback	*Gasterosteus aculeatus*	N	RATCL
Prickly sculpin	*Cottus asper*	N	RATCL
Pacific lamprey	*Lampetra tridentata*	N	R
Arroyo chub	*Gila orcutti*	I2	RATCL
Fathead minnow	*Pimephales promelas*	I	RTL
Mosquitofish	*Gambusia affinis*	I	RATCL
Smallmouth bass	*Micropterus dolomieui*	I	RACL
Largemouth bass	*Micropterus salmoides*	I	RATC
Bluegill	*Lepomis macrochirus*	I	RAC
Green sunfish	*Lepomis cyanellus*	I	RATCL
Redear sunfish	*Lepomis microlophus*	I	RC
Black crappie	*Pomoxis nigromaculatus*	I	RC
White crappie	*Pomoxis annularis*	I	C
Channel catfish	*Ictalurus punctatus*	I	RACL
Black bullhead	*Ameiurus melas*	I	RATCL
Threadfin shad	*Dorosoma petenense*	I	C
Goldfish	*Carassius auratus*	I	RAC
Carp	*Cyprinus carpio*	I	RAC
Tidewater goby	*Eucyclogobius newberryi*	N1*	L
Pacific herring	*Clupea harengus*	N	L
Topsmelt	*Atherinops affinis*	N	L
Shiner perch	*Cymatogaster aggregata*	N	L
Staghorn sculpin	*Leptocottus armatus*	N	L
Starry flounder	*Platichthys stallatus*	N	L
Striped mullet	*Mugil cephalus*	N	L
Brown trout	*Salmo trutta*	I	-3
Brook trout	*Salvelinus fontinalis*	I	-3
Walleye	*Stizostedion vitreum*	I	-3

[1] *Endangered species under the ESA; *the tidewater goby has been proposed to be de-listed although no action has yet been taken.*
[2] *California species of special concern.*
[3] *Introduction of these species was unsuccessful according to DFG Region 5 data.*
R = Santa Ynez River below Bradbury Dam; T = Tributary Streams; C = Cachuma Lake;
A = Santa Ynez River above Cachuma Lake; L = Santa Ynez River lagoon; N = Native species; I = Introduced species

Steelhead/Rainbow Trout (*Oncorhynchus mykiss)*

Coastal rainbow trout (resident *Oncorhynchus mykiss*) are native to the Santa Ynez River and exhibit three distinctive life history strategies (NMFS 2009). Resident *O. mykiss* live their entire lives in freshwater. Fluvial anadromous *O. mykiss* are born in freshwater, emigrate to the ocean to rear to maturity, and then return to freshwater to spawn. Lagoon anadromous *O. mykiss* consist primarily of juveniles who oversummer in the estuary of their natal creek, growing quickly and emigrating to the ocean at a larger size than those fish that rear in freshwater habitats (Bond 2008). It is common to find populations exhibiting all life history strategies within the same river system. Individuals exhibiting one life history strategy can produce offspring that exhibit the other strategy. Individual *O. mykiss* exhibiting rainbow trout and steelhead (fluvial anadromous) life histories are indistinguishable except when juveniles smolt (typically during February through May) or when adults migrate upstream from the ocean and exhibit the characteristic grey steelhead coloration. In August 1977, the NMFS listed anadromous steelhead (*O. mykiss*) as an endangered species under the federal ESA.

In the Santa Ynez River system, adult *O. mykiss* migrate from the ocean to spawn mainly December through April. Upstream migration requires sufficient streamflow to breach the sandbar at the river mouth and to allow passage in the river. In dry years, passage can be impeded by low flows at critical locations (e.g., riffles). *Oncorhynchus mykiss* typically migrate upstream when streamflow rises during a storm event. The eggs are laid in a nest (redd) in gravel. Fish prefer gravels that are free of fine sediment to promote water circulation around the incubating eggs. After spawning, adults may return to the ocean (about 30% of adults). *Oncorhynchus mykiss* may spend one to several years in freshwater before emigrating to the ocean, during which time the steelhead/anadromous life history form are indistinguishable from the resident life history form in both appearance and in habitat use. Typically, however, southern California *O. mykiss* migrate to the ocean when they are one or two years old (5-10 inches long). The juvenile outmigration period is typically February through May, but the timing of migration is dependent upon streamflows. Juveniles undergo physiological changes that adapt them to a life in saltwater, and become “smolts.” Unlike most salmonids, *O. mykiss* may emigrate back to the ocean as “kelts” and return to spawn in later years. Resident *O. mykiss* may reach maturity and spawn in their second year of life (based on size class observation SYRTAC 2009), although the time of first spawning is generally in their third or fourth year

The life history forms of *O. mykiss* (steelhead and rainbow trout) juveniles are indistinguishable, both in appearance and in habitat use. Young-of-the-year often utilize riffle and run habitat during the growing season and move to deeper, slower water during the high flow months. Larger fish (yearlings or older) use heads of pools for feeding. Pools provide over-summer refugia for trout in small streams during low flow conditions. Another strategy is to rear in a lagoon.

DFG has used a daily average temperature of 20°C (68°F) in central and southern California to evaluate the suitability of stream temperatures for resident *O. mykiss*. This level represents a water temperature below which reasonable growth of resident *O. mykiss* may be expected. However, elevated water temperatures are consistently observed throughout southern California and studies indicate that *O. mykiss* can survive short-term temperature peaks as high as 28°C (Carpanzo 1996, Matthews and Berg 1997, Myrick and Cech 2000a, Myrick and Cech 2000b, Myrick and Cech 2005). Spina (2007) determined that juvenile *O. mykiss* were able to forage and remain active with an elevated body temperature. These observations support the hypothesis that *O. mykiss* in southern California have a higher thermal tolerance than salmonids in cooler regions (Marine and Cech 2004). Lethal temperature limits are based on laboratory and field observations, but current practice uses maximum daily temperature greater than 24°C as an indicator of high stress (Myrick and Cech 2000a).

Historically, runs of *O. mykiss* are estimated to have ranged from between 10,000 and 20,000 adult spawners prior to installation of all the dams on the Santa Ynez River (CDFG 1940, 1944, 1945, ENTRIX 2004). Population fluctuations related to the extended drought in the mid-1940s and habitat loss to Gibraltar and Juncal dams resulted in CDFG actively supporting these populations with fish from the Filmore Hatchery and relocation of rescued fish to the Santa Cruz Creek drainage when conditions in the lower Santa Ynez River were too stressful. Despite the addition of thousands of hatchery fish over the years throughout the watershed, Garza and Clemento (2008) found that the genetic composition of over 1,581 tissue samples collected in the Santa Ynez were genetically differentiated and relatively stable. Their results were based on a more comprehensive analysis than that previously done, and found that although there has been some introgression of hatchery genes (primarily in the Juncal Creek drainage), the *O. mykiss* throughout the Santa Ynez are primarily native, wild fish and show similar differentiations to populations of *O. mykiss* found throughout the southern California region. The progress report (Garza and Clemento 2010) further analyzed relatedness by examining individual assignments to determine the most probable origin of the fish. This supported the previous observation that there is a strong population structure within the Santa Ynez River, with Hilton Creek and Salsipuedes Creek remaining genetically distinct. Importantly, these data indicate that hatchery and native fish periodically are able to migrate downstream over Bradbury Dam, presumably during high flows. Several of the samples assigned to *O. mykiss* populations found above the dam at Santa Cruz Creek, which suggests that downstream fish are historically descended from native wild fish from upstream, or were able to migrate downstream. The strains of hatchery trout from Filmore Hatchery are highly distinct from the Santa Ynez population; and, although stocking has been significant, it appears that the hatchery fish are sufficiently different in physiology and life history that they do not successfully reproduce with naturally spawning native fish (Garza and Clemento 2008).

Further, the analysis of genetic origin from 16 adult anadromous *O. mykiss* sampled in 2008 found that four of these fish assigned to Hilton Creek, five to Salsipuedes Creek, and one captured in the mainstem that was assigned to Quito Creek. None of these fish had any evidence of hatchery ancestry. The genetic origin matched the location where the fish was captured for the Hilton Creek and Salsipuedes Creek individuals, indicating that these adults were returning to their natal creeks to spawn. The other six individuals appear to be migrants from other systems, including San Antonio River and Tasajarra Creek in Monterey County (over 220 miles upcoast) and Lopez Canyon Creek and Arroyo Grande Creek in San Luis Obispo County (approximately 31 miles upcoast) (Garza and Clemento 2010). These relationships are illustrated in **Figure 6** in **Appendix G**.

Tidewater Goby

The tidewater goby is a small estuarine fish, rarely exceeding 2 inches in length, which inhabits lagoons and the tidally influenced region of rivers from San Diego County to Del Norte County, California. They are typically found in the upper ends of lagoons in brackish water, usually in salinities of less than 10 ppt, but have been found in water ranging from 0 to 40 ppt (Swift et al., 1989). Tidewater gobies are bottom dwellers and are typically found at depths of less than 3 feet. Instream, they inhabit low-velocity habitats out of the main current. Tidewater gobies may spawn at anytime of the year, but spawning typically peaks in late April through early May. Spawning takes place in burrows dug 4-8 inches deep in coarse sand. Spawning takes place at fairly low to moderate salinities (5-10 parts-per-thousand [ppt]). After hatching, the larval tidewater goby become planktonic (suspended in the water column) and are associated with aquatic plants in near-shore habitat. Juvenile tidewater goby are benthic dwellers, similar to adults. Tidewater gobies remain common in the Santa Ynez River lagoon, and both young-of-the-year and adults have been collected (DFG 1988, SYRTAC 1994, SYRTAC 2009).

Arroyo Chub

The arroyo chub was introduced into the Santa Ynez River drainage during the early 1930's. Arroyo chub are native to the Los Angeles, San Gabriel, San Luis Rey, Santa Margarita, and Santa Ana River systems, as well as San Juan Creek. The arroyo chub is a relatively small, chunky minnow, typically less than 5 inches in length. Arroyo chub prefer slow-moving sections of rivers with a sand or mud substrate, or standing waters in reservoirs. Although the arroyo chub seems to prefer very low water velocities, they are apparently adapted to surviving periodic high winter flows. They are adapted to survive in widely fluctuating water temperatures and oxygen levels. Arroyo chub were observed in a pool in the Santa Ynez River that had a predawn dissolved oxygen minimum level of approximately 1.6 ppm (SYRTAC 1994). In 1993, SYRTAC (1997) found arroyo chub along the river below the dam in abundant numbers in shallow pools. However, they were not observed in pools inhabited by large predators (bass and sunfish), and they were relatively scarce in riffle and run habitats. Arroyo chub are found throughout the Santa Ynez River Watershed.

Threespine Stickleback

Freshwater populations of threespine stickleback live in shallow, low-velocity habitats, often in association with aquatic plants. Spawning can occur from March through October. Threespine stickleback build nests in beds of aquatic plants with sand substrates. The diet of threespine stickleback consists of small organisms living on plants and the stream bottom. Stickleback generally live one year or less, but some individuals may survive for two to three years. Threespine stickleback inhabit the Santa Ynez River above and below Cachuma Lake and are found in the Salsipuedes/El Jaro Creek system.

Prickly Sculpin

Prickly sculpin can live in an extremely wide range of habitats. Prickly sculpin are known to live in freshwater and saltwater, in streams that are small, clear and cold, in rivers that are large, warm and turbid, and in lakes of all sizes, rich in nutrients or infertile. They can tolerate water temperatures up to at least 82°F. Prickly sculpin inhabit Cachuma Lake, the Santa Ynez River below the lake, and the lower reaches of Hilton and Salsipuedes Creeks.

Pacific Lamprey

Pacific lamprey are anadromous, spending four to seven years in freshwater and one to two years in the ocean. Spawning lamprey, like steelhead, are dependent on winter storms providing sufficient streamflow to open the mouth of the lagoon to the ocean, and to provide adequate streamflow to allow for upstream migration. Pacific lamprey spawning migration begins in February and lasts through early May. They build nests in gravel and rock substrates in areas of low velocity. The freshwater residency of the young is spent typically as bottom dwellers. Pacific lamprey inhabit the Santa Ynez River below Cachuma Lake and may inhabit the tributaries, although none have been observed in the tributaries.

Pacific Herring

Pacific herring are a small schooling marine fish that enter estuaries and bays to spawn. Pacific herring spawn from late October through March. After spawning has been completed, adult Pacific herring return to their ocean feeding grounds. After hatching, young herring usually remain through the spring and summer in the estuary or bay in which they were spawned before migrating to the ocean in the fall. Herring produced in the Santa Ynez River lagoon would likely remain until the following winter when high streamflow reopened the sandbar.

Topsmelt, Shiner Perch, Staghorn Sculpin, and Starry Flounder

Topsmelt, shiner perch, staghorn sculpin, and Starry flounder are common marine fish that also occur in estuaries and lower reaches of coastal streams. These species, particularly topsmelt and perch, exhibit a tolerance to a wide range of salinities. These species occur periodically in the Santa Ynez River lagoon.

Introduced Species

Fifteen introduced species have populations in the watershed (**Table 4-35**). All of the introduced species occur in Cachuma Lake and along the Santa Ynez River above and below the lake, except for the white crappie and threadfin shad, which only occur in the lake. Most of these introduced species are game species or baitfish that were originally planted in Cachuma Lake but have since spread. Many of the game fish can prey on *O. mykiss* and other native species. Most notable among these predators are large- and small-mouth bass, green sunfish, and black bullhead (a type of catfish).

4.7.1.2 Fish Communities

Cachuma Lake

Cachuma Lake was managed primarily as a rainbow trout fishery until 1957 when largemouth bass, a warm water species, were introduced into the lake. Since 1957, Cachuma Lake has been stocked with a variety of warm water fish and hatchery rainbow trout. At least 15 species have been identified in the lake including: rainbow trout, prickly sculpin, large- and small-mouth bass, bluegill, redear sunfish, green sunfish, white crappie, black crappie, channel catfish, black bullhead, threadfin shad, goldfish, carp and mosquitofish. Cachuma Lake is a popular destination for fishermen in the area. Key game fish include large- and small-mouth bass, bluegill, green and redear sunfish, and black and white crappie.

Rainbow trout are maintained in Cachuma Lake primarily through stocking. DFG annually stocked between 45,000 and 60,000 catchable size rainbow trout into the lake in the early 1990s. Since at least 1997, the allotment for Cachuma Lake has been 48,000 rainbow trout. The mainstem Santa Ynez River upstream of Cachuma Lake has been planted on a yearly basis with between 9,000 and 12,000 trout. Stocking was discontinued in 2010 pending the completion of the newly required Pre-Stocking Evaluation Protocol (CDFG 2010).

Mainstem Below Bradbury Dam

SYRTAC studies conducted from 1993 to 2010 have documented *O. mykiss* in the mainstem Santa Ynez River downstream of Cachuma Lake. These studies have occurred during dry, wet, and average periods. *O. mykiss* are consistently found in the mainstem below Bradbury Dam, primarily in the first three miles downstream of the dam, (SYRTAC 1997, 2000a) but their distribution continues to extend farther downstream during years with wet hydrologic conditions and contracts to the upstream tributaries and areas near Bradbury dam during dry years (SYRTAC 2009). The river below Bradbury Dam has been divided into reaches that comply with the flow release requirements of the Biological Opinion. These reaches are summarized in **Table 4-36, Mainstream Study Reaches Below Bradbury Dam**.

Table 4-36
Mainstem Study Reaches Below Bradbury Dam
(Revised based on Table 5-3 (SYRTAC 2009)

Reach Name	Landmarks		Reach Length (miles)	Miles below Bradbury Dam
Highway 154	0.0-3.2	Bradbury Dam to Highway 154 Bridge, Spilling Basin, Long Pool, confluence with Hilton Creek, to the BOR boundary, Pool habitats near or under Highway 154 Bridge with access via Caltrans easement	0.5	3.2
Refugio	3.2-7.8	Highway 154 bridge to Refugio Rd. bridge, Meadowlark Crossing/Upper Gainey, parts of reach have intermittent summer flow; upper 1.75 miles of this reach is not accessible due to access limitations	4.6	7.8
Alisal	7.8-10.5	Refugio bridge to Alisal bridge	2.7	10.5
Sanford/Weister	19.0-19.3	Approximately 1/2 mile upstream of Sanford Property	0.3	19.3
Cadwell	22.1-22.7	Also known as Santa Rosa Park	0.6	22.7
Cargasacchi	26.1-26.7	Near Sweeney Road Crossing, surveyed only in 1997	0.6	26.7
To Lompoc	26.7-37.5	From Cargasacchi to the Highway 1 bridge in Lompoc	10.8	36.5
Below Lompoc	37.5-45.8	From Highway 1 bridge in Lompoc to lagoon	9.3	45.8

The fragmentation of study reaches is due to limited access on private lands located between publically accessible areas.

Distribution of *O. mykiss* varies seasonally, but use of refugia pools primarily in the Highway 154, Refugio and Alisal reaches increases during wet years. Following the addition of flow into Hilton Creek since 2000, young-of-the-year and juvenile *O. mykiss* were observed downstream as far as the Alisal reach, which suggests that the high reproduction rates observed in Hilton Creek are contributing to expanding the distribution of *O. mykiss* into available habitats. Greater numbers of adult *O. mykiss* were seen in the Refugio and Alisal reaches during years when Lake Cachuma spilled (1995, 1998, 2001, 2005, 2006, 2008) than in other years. Spill years are typically wet years, thus more water is available throughout the entire watershed.

Spawning activity has been observed in the mainstream downstream of Bradbury Dam and tributaries from December through May, although the majority of redds were observed between March and May. In addition to documenting number of redds, the location and habitat conditions relevant to spawning success were also noted. It appears that spawning is triggered by high-flow events and the relative abundance of resident *O. mykiss* to anadromous *O. mykiss* redds was associated with passage conditions. During dry years when the ocean sandbar did not breach, it was assumed that all spawners were resident *O. mykiss*. Observations by Cachuma Conservation Release Board (CCRB) and Santa Ynez River Water Conservation District Improvement District No. 1 (ID No. 1) (collectively referred to as the Cachuma Project Water Agencies or CPWA) biologists indicate that it is difficult to differentiate between smaller resident and anadromous redds; however, those larger than 3 feet are more likely to be created by larger resident or anadromous *O. mykiss*, as the range of length (2.2-9.8 feet) and width (1.4 to 3.9 feet) were comparable for both life-history forms. Redds were more frequently observed in the tributaries than in the mainstem, although redd surveys are opportunistic and have not systematically been conducted. (SYRTAC 2009).

Pacific lamprey, also an anadromous species, has been observed in the mainstem. Other native residents of the lower Santa Ynez River include threespine stickleback and prickly sculpin. Several introduced fishes are found in the mainstem including: arroyo chub, fathead minnow, mosquitofish, large- and small-mouth bass, bluegill, green and redear sunfish, black crappie, channel catfish, black bullhead, goldfish, and carp. The majority of the non-native fish are concentrated in pool habitat that exists throughout the summer in the first 10 miles downstream of Bradbury Dam

Water quality in the mainstem of the Santa Ynez River follows a seasonal pattern that primarily reflects flow levels. Extensive monitoring indicates that water temperatures increase and dissolved oxygen levels decrease with distance downstream of the Highway 154 reach. During summer, water temperatures are greater than 20°C on average, and maximum temperatures exceed 24°C regularly (SYRTAC 2009). Even though data indicate that *O. mykiss* in southern California are regularly exposed to elevated average and maximum temperatures, these spikes in stressful temperatures reduce habitat quality and can decrease foraging ability.

Patterns of dissolved oxygen are similarly variable on several temporal scales: daily and seasonal. Monitoring focused on levels during the warmer months from June through October and is measured at five to seven locations within the mainstem. The general trends are consistent, showing daily peaks between 1500 and 1800 hours and lows occurring between 0500 and 0900 hours (SYRTAC 2009). Concentrations of dissolved oxygen above 6 mg/L are considered suitable for *O. mykiss*, and below 6 mg/L to 3 mg/L are considered to be highly stressful (Deas and Orlob 1999).

Associated with high summer water temperatures and low dissolved oxygen levels, filamentous algal growth patterns during summer months compounds the water quality impacts to habitat quality. In slow-moving reaches and pools where flow velocity is not sufficient to remove the algae, the abundance of algae is thought to potentially adversely impact *O. mykiss*.

The fact that *O. mykiss* are routinely observed inhabiting pools and marginally suitable habitat suggests that their tolerance to highly variable environmental conditions is still not well documented and understood. A detailed summary of all fishery observations is included in **Appendix G**.

Tributaries Below Bradbury Dam

Oncorhynchus mykiss have been observed during the SYRTAC studies in all of the major south-side tributaries, although use of Nojoqui Creek has been minimal. Results of snorkel surveys and migrant trapping in the tributaries indicates that *O. mykiss* have successfully reproduced and reared in Hilton, Salsipuedes, El Jaro, Quiota and San Miguelito creeks (SYRTAC 2009). Population dynamics and life-history forms expressed varied among years, depending on hydrologic conditions and whether the lagoon sandbar was breached to provide access. All life stages of *O. mykiss* were observed more frequently in tributaries with more suitable habitat. Abundance of all life stages in Hilton Creek appears to be associated with higher abundance observed downstream in the mainstem.

Chart 4-29, Occurrence of Steelhead/Rainbow Trout in Tributaries, (in **Appendix B**) shows locations of habitat improvements depicts the locations where *O. mykiss* have been observed between 1995 and 1999 in the tributaries of the lower watershed according to the SYRTAC studies. The basis for the following summaries is Entrix (2001a) and SYRTAC (2009). Detailed summaries of fishery observations are found in **Appendix G**.

- **Hilton Creek.** *Oncorhynchus mykiss* and prickly sculpin inhabit a portion of Hilton Creek. No introduced warm water species, such as bass, bullhead or sunfish, have been found in Hilton Creek. Adult *O. mykiss* passage to upper Hilton Creek was impeded at a cascade and bedrock chute (located about 1,380 feet upstream from the confluence with the Santa Ynez River), which was improved in 2000 but remains completely blocked at a culvert under the Highway 154 crossing (about 4,200 feet upstream from the confluence). Spawning has been observed downstream from the culvert to the confluence with the Santa Ynez River. A CDFG fisheries biologist observed adult *O. mykiss* in the pool immediately below the Highway 154 culvert (M. Cardenas, pers. com. 2000). A COMB fish biologist also observed adult *O. mykiss* immediately below the Highway 154 culvert in 2000 (S. Engblom, pers. comm., 2001).

  Adult *O. mykiss* have been documented migrating into Hilton Creek in all years that SYRTAC observations have been made (SYRTAC 1997, 1998, 2000b, 2009), but numbers were low in years with low winter runoff until the Hilton Creek Water System (HCWS) was completed in 2000. Actual spawning with production of young-of-the-year was documented in 1995, 1997, and 1998 and yearly since 2000, producing between 400 and 900 young-of-the-year annually. Adults migrating into Hilton Creek are often large and could be anadromous *O. mykiss* from the ocean (particularly in wet years), resident *O. mykiss* that spilled over from Cachuma Lake, or fish that are resident in the river, its tributaries or the lagoon.

Young *O. mykiss* remain in fresh water for a year or more. Hilton Creek formerly went dry during the summer, (SYRTAC 1997, 1998, 2000a). Fish were either stranded or had to enter the mainstem, where the likelihood of predation by bass and catfish increases. Fish rescue operations were conducted in 1995 and 1998 to move young-of-the-year from the drying stream to better habitat. During the 1995 fish rescue, over 220 young-of-the-year and 5 adults were rescued and relocated. In June 1998, 831 young-of-the-year and three adults were captured in 1,200 linear feet of stream (SYRTAC 2000b). Since the spring of 2000, a supplemental watering system has provided consistent, cool water from Cachuma Lake to support several hundred young-of-the-year.

Water temperature in Hilton Creek prior to the implementation of the supplemental flows was highly variable. Since operations for the HCWS began in 2000, flow typically ranges between 1 and 5 cfs and water temperature remains under 20°C into the reach downstream of the water system release points. Water temperature increases downstream as it mixes with mainstream flow.

- **Quiota Creek**. DFG conducted visual surveys from 1993 to 1998 and SYRTAC biologists conducted roadside surveys from 1993 to 2000, which show that Quiota Creek, especially in the upper reach, supports *O. mykiss*. Over 100 young-of-the-year were observed in August 1994, and another 100 young-of-the-year and 20 to 30 juvenile/adults were observed in a tributary to Quiota Creek in August 1994 (SYRTAC 1997). A visual survey in February 1995 documented spawning activity, redds and two adults (one 16-inch female and 6-to 8-inch male) approximately 2 miles upstream of the confluence with the Santa Ynez River (SYRTAC 1997). Observations from nine road crossings in late 1998 documented approximately 100 young-of-the-year from about 1.5 to 3 miles upstream of the confluence. Both adult and juvenile *O. mykiss* are consistently observed in Quiota Creek (SYRTAC 2009).

  Water temperatures average between 10° and 20°C, which is considered optimal for *O. mykiss*.

- **Alisal Creek.** Prior to 1995, a concrete drop structure and apron blocked migration into Alisal Creek. High flows in early 1995 washed away this structure, and *O. mykiss* were subsequently trapped in the lower creek. Trapping in lower Alisal Creek in January 1995 captured two adult *O. mykiss* migrating upstream into the creek. Fish surveys were conducted in February 1995, when access to private property was available for migrant trapping and an electrofishing survey (SYRTAC 1997). Twenty resident *O. mykiss* juveniles and adults were found in Alisal Creek upstream of Alisal Reservoir (SYRTAC 1997). Bass and sunfish inhabit the reservoir. Many other *O. mykiss* of various size classes were common to abundant within the upper portions of Alisal Creek (S. Engblom, pers. com. 2000).

- **Nojoqui Creek**. Electro-fishing and snorkel surveys in May 1994 found arroyo chub and threespine stickleback abundant in Nojoqui Creek, with small populations of green sunfish and large-mouth bass in a few pools. However, no *O. mykiss* were observed or captured. Two adults were captured migrating upstream in March 1998 and another adult observed in a pool, but no *O. mykiss* were captured in 1995 or 1997. Unlike the other creeks in the lower basin, Nojoqui may not have a remnant population within its watershed. Land use activities coupled with the recent drought effectively dried Nojoqui Creek for several years during the late 1980's and early 1990's.

Average daily temperatures in Nojoqui Creek during summer months exceeded 20°C and maximum temperatures frequently exceeded 24°C. These temperatures are considered extremely stressful for *O. mykiss* over extended periods of time.

- **Salsipuedes-El Jaro Creeks.** Arroyo chub, fathead minnow, and threespine stickleback are common throughout the Salsipuedes-El Jaro Creek system. In addition, warm water species, such as green sunfish, large-mouth bass, and bullhead, have been observed in lower Salsipuedes Creek. *O. mykiss* of all size classes also have been found in the Salsipuedes-El Jaro Creek system. During summer months when water temperatures are warm, typically they are found in pools and deep runs. In March 1987, USFWS collected two adult females and two adult males during an electro-fishing survey (Harper and Kaufman 1988). In 1994, an electro-fishing survey in May and August found young-of-the-year and juvenile *O. mykiss* around the confluence of Salsipuedes and El Jaro, and one adult was found in Salsipuedes upstream of the confluence (SYRTAC 1997). In 1997, an average rainfall year, snorkel surveys in lower Salsipuedes found young-of-the-year (33), juveniles (172), and small adults (16), while surveys in upper Salsipuedes and El Jaro found young-of-the-year (56 in upper Salsipuedes, 45 in El Jaro) as well as juveniles and adults (10 in upper Salsipuedes, 62 in El Jaro) (SYRTAC 1998). Also in 1997, a trap installed in lower Salsipuedes Creek captured 34 upstream migrants. In 1998, only one upstream migrant was captured, and 40 migrants were captured in 1999.

  Spawning has been documented in both streams (SYRTAC 1997, 2000b). In 1997, surveys found most redds just above the confluence (within a 1/2 mile) in El Jaro (18 redds) and upper Salsipuedes (11 redds), with 14 redds located on lower Salsipuedes Creek. Three redds were observed in upper Salsipuedes Creek in 1998, while 64 redds were observed in 1999 (48 lower, 16 upper). No redds were observed in El Jaro Creek during surveys conducted in 1998 and 1999. Snorkel surveys of upper and lower Salsipuedes and El Jaro Creek continue to document both juvenile and adult *O. mykiss* throughout the available habitat (SYRTAC 2009).

  Water temperatures in upper Salsipuedes Creek are moderated by the intact riparian corridor and were typically 2–4°C cooler than corresponding temperatures in lower Salsipuedes and El Jaro reaches. Despite average daily temperatures over 20°C with peaks exceeding 24°C, refugia pools consistently supported *O. mykiss* in the lower reaches during the summer. Inflow from El Jaro Creek into lower Salsipuedes Creek contributes to higher daily and maximum water temperatures. Average daily temperatures exceeding 20°C for extended periods over the summer and fall, and occasionally exceeding 27°C, suggest that this reach sustains potentially lethal temperatures and is less suitable for supporting *O. mykiss* for much of the year.

- **San Miguelito Creek**. A concrete culvert, drop structures and other barriers, including a bridge with a long concrete apron that is raised 4 feet above the downcut channel, completely block passage from the Santa Ynez River to San Miguelito Creek. Resident *O. mykiss* spawn and rear in the upper creek. In 1996 surveys, young-of-the-year resident *O. mykiss* and adults were relatively abundant near San Miguelito Park (about 3 miles upstream of Lompoc) (SYRTAC 1997). Spawning surveys began in 1997 and found 49 redds. In 1998, one redd was observed, while 35 redds were observed in 1999. Due to the numerous passage limitations, this creek is not part of regular snorkel surveys.

  Water temperatures in this drainage provide suitable habitat for *O. mykiss.*

- **Lagoon**. The physical characteristics of the Santa Ynez lagoon are varied and complex, resulting in habitat for a number of fish species. Lagoons are considered important habitat elements for *O. mykiss* and potentially provide critical rearing habitat for juveniles and smolts. Typically, a salinity gradient in the lagoon exists, with salinity is higher near the ocean, and a freshwater lens near the inflow of the Santa Ynez River indicating tidal prism influences. Water depth increases when the sandbar closes, creating vertical gradients of water temperature, dissolved oxygen and salinity. Average daily and maximum temperatures in the lagoon during the summer were consistently lower (10–21°C bottom, 9–24°C surface) than those observed further upstream along the mainstem, reflecting the influence of the marine layer. Dissolved oxygen levels varied, and when stratification was present, the surface layer remained over 5 mg/L, while the bottom layer ranged from 1 to 4 mg/L. Turbidity and pH levels were variable, but remained within the range considered to be suitable for *O. mykiss.*

  Both ocean and brackish water species have been observed in the lagoon, including the tidewater goby, Pacific herring, topsmelt, shiner perch, staghorn sculpin, starry flounder, and striped mullet. The following freshwater species have also been found in the lagoon, although concentrated near the upper end: threespine stickleback, prickly sculpin, arroyo chub, fathead minnow, mosquitofish, small-mouth bass, green sunfish, channel catfish and black bullhead.

In August of 1993, SYRTAC conducted a beach seining survey in the lagoon (1997). SYRTAC caught ten species of fish, including small-mouth bass, arroyo chub, mosquitofish, stickleback, tidewater goby, starry flounder, Pacific herring, topsmelt, shiner perch, and staghorn sculpin. SYRTAC conducted a second set of lagoon fishery surveys in 1999 (SYRTAC 2000b). During the 1999 surveys, SYRTAC captured 14 species of fish, including 7 species not found during the 1993 survey. Species observed in the 1999 survey include steelhead, fathead minnow, channel catfish, green sunfish, bullhead, prickly sculpin, arroyo chub, stickleback, starry flounder, Pacific herring, topsmelt, shiner perch, staghorn sculpin, and striped mullet. SYRTAC captured a single steelhead during the 1999 survey at the mid-lagoon sampling location.

In 1993, tidewater gobies were collected throughout the lagoon, in salinities ranging from 6.5 to 16.0 ppt (SYRTAC, 1997). Tidewater goby abundance was considerably higher in the upper half of the lagoon where the numbers of gobies per seine haul exceeded 100. The salinities in this portion of the lagoon ranged from approximately 8.0 to 13.5 ppt. Tidewater goby abundance in the lower half of the lagoon was considerably lower, ranging from one to 24 per seine haul. Corresponding salinities in the lower half of the lagoon were approximately 14.0 to 16.0 ppt. During the August survey, most of the gobies observed were adult (i.e., approximately 1.5 inches in length). Observations in July 1994 indicated successful reproduction by tidewater gobies, as evidenced by the presence of large numbers of young-of-the-year. Freshwater fish (small-mouth bass, arroyo chub and mosquitofish) were found in a narrow (approximately 0.5 meter thick) freshwater lens located in the upstream end of the lagoon. Overall, the lagoon appeared to be extremely productive.

4.7.1.3 Status of Fish Habitat

Habitat mapping provides essential information on the quantity, quality and spatial distribution of habitat necessary to support all life stages and life-history forms of O. *mykiss.* Mapping also provides information critical to assessing enhancement opportunities to improve degraded habitat or reconnect access to suitable habitats. Documenting habitat restoration effectiveness as outlined in the Biological Opinion is also accomplished by repeated habitat mapping that illustrates before and after conditions. Stream channel configuration changes occurring following spill events and wet years provides information critical to understanding the relationship between the current hydrologic regime and the geomorphologic response of the river. Surveys of all available mainstsem habitat were fragmented due to access limitations.

SYRTAC and others have assessed habitat conditions in the lower Santa Ynez River and its tributaries where landowners granted access (ENTRIX 1995a, SYRTAC 1997, 1998, 2000, 2009). Habitat types (e.g. pool, run, riffle) and other habitat variables were documented including water quality, substrate, cover, instream vegetation, and riparian canopy. Habitat quality was ranked as Good, Fair, or Poor based on the matrix of flow, water temperature, habitat structures, dissolved oxygen levels, presence/absence of *O. mykiss*, gradient, and potential refugia (unsurveyed private areas) (SYRTAC 2009). See **Table 4-36A, Stream River Miles and Percentages of Potential *O. mykiss* Habitat Quality Assessment**. The condition and distribution of fish habitat below Bradbury Dam, evaluated prior to implementation of the Biological Opinion, is presented below, based on Entrix (2001) and updated based on surveys conducted following implementation of several restoration actions (SYRTAC 2009).

SYRTAC 2009 also reported on initial results of the Aquatic macroinvertebrate Reconnaissance Survey based on implementing the standard CDFG Benthic Macroinvertebrate Index sampling protocol (Harrington 1999) in three locations within the mainstem at Highway 154 reach, Refugio Reach, and Alisal Reach, as well as at one location in Hilton Creek in 2002. Benthic macroinvertebrates (BMI) serve as a biological indicator of aquatic habitat conditions and provide important prey for *O. mykiss*. Numerous factors influence the characteristics of a macroinvertebrate community, such water quality and quantity, and habitat variables such as substrate, canopy cover, flow, temperature and dissolved oxygen. A commonly used index of BMI is the ratio of *Ephemeroptera* (mayfly), *Plecoptera* (stonefly) and *Tricoptera* (caddisfly) taxa present, which is referred to at the EPT Ratio. Each of these orders contains species that have varying degrees of tolerance and sensitivity to environmental stress. Results indicate that a highly variable macroinvertebrate community occupies the majority of habitat in the mainstem, and that these species are relatively less sensitive and more tolerant of disturbance than those found within Hilton Creek. Although both the mainstem and Hilton Creek were characterized as moderately disturbed systems, the BMI community assemblage in Hilton Creek reflected the better function of that tributary as compared to the mainstem.

Table 4-36A
Stream River Miles and Percentages of Potential *O. mykiss* Habitat Quality Assessment

Stream-River	Good (mi)	Fair (mi)	Poor (mi)	Potential (mi)	Not-Classed (mi)	Total (mi)	Good (%)	Fair (%)	Poor (%)	Potential (%)	Not-Classed (%)
Hilton Creek	2.24	0	0	2.76	0	5.00	45%	0%	0%	55%	0%
Quiota Creek	1.91	0.66	3.38	0	1.78	7.73	25%	9%	44%	0%	23%
Alisal Creek	0	1.92	1.74	3.86	0	7.52	0%	26%	23%	51%	0%
Nojoqui Creek	0	0	7.88	0	1.87	9.75	0%	0%	71%	0%	29%
El Jaro Creek	0	10.44	0	2.10	0	12.54	0%	83%	0%	17%	0%
Salsipuedes Creek	1.59	4.19	0	1.06	0	6.84	23%	61%	0%	15%	0%
San Miguelito Creek	0	5.68	0	0	2.92	8.60	0%	66%	0%	0%	34%
Lower Santa Ynez River	3.12	0	7.48	0	38.95	49.54	6%	0%	15%	0%	79%
Mainstem and Tributary total:	**8.9**	**22.9**	**20.5**	**9.8**	**45.5**	**107.5**	**8%**	**21%**	**19%**	**9%**	**42%**

Riparian vegetation cover in many of the tributaries is intact and provides shade, cover, and bank stabilization. Riparian vegetation cover has increased downstream of the Highway 154 reach as a result of the supplemental releases since 2001.

Riffle and run habitats characterize the lower mainstem river and tributaries, but refugia pools exist even under low-flow conditions, where they provide the only available habitat for juvenile and adult *O. mykiss* and other fish species. High water temperatures and low dissolved oxygen levels limit the suitability of these pools for *O. mykiss,* although some thermal stratification has been observed.

Summary of Fish Habitat (1993-2004)

Habitat characterized as Good for various life-history stages of *O. mykiss* is located primarily within the Highway 154 reach and Hilton, Quiota, and Salsipuedes creeks. Fair habitat is found in Quiota, Alisal, El Jaro, Salsipuedes, and San Miguelito creeks. Poor habitat was also documented in Quiota, Alisal, and Nojoqui creeks, and the mainstem. A summary of stream miles and percent of potential *O. mykiss* habitat quality is found in **Table 4-36A**.

- **Spawning Habitat**. As discussed in **Section 4.7.1.2**, spawning habitat providing suitable gravel exists in the mainstem immediately downstream of Bradbury Dam, near Refugio Road, and downstream of Alisal Bridge. Good spawning habitat for *O. mykiss* is located in Hilton Creek and mid-to-upper Quiota Creek. Spawning habitat in Salsipuedes and El Jaro creeks is moderate due to the presence of fine sediments and sand in the stream. *O. mykiss* consistently spawn in these tributaries. Good habitat occurs above passage impediments in San Miguelito and Alisal creeks. Spawning substrate quality in the mainstem Lompoc reach downstream to the lagoon was poor due to the transition from gravel to sand-bedded channel.

- **Rearing Habitat**. Potentially good quality *O. mykiss* rearing habitat is present in the mainstem between Bradbury Dam and the Highway 154 (**Figure 4-6**). In general, the Refugio and Alisal reaches of the mainstem have poor rearing habitat conditions, although refuge pools in these reaches are valuable. Rearing habitat is unavailable downstream of the Alisal Reach in the mainstem, although the lagoon could provide some moderate-quality rearing habitat. Mainstem habitat for *O. mykiss* is typically not found below the Alisal Bridge except in the portion of the river where flow is maintained by the releases from the Lompoc wastewater treatment plant. In addition to mainstem habitat, a number of the south-side tributary streams provide over-summering habitat for *O. mykiss*. High quality *O. mykiss* rearing habitat is located in Quiota Creek, upper Salsipuedes Creek, and, with flow enhancement, in lower Hilton Creek. Fair quality habitat exists in El Jaro and lower Salsipuedes creeks, and above impassible barriers in Alisal and San Miguelito creeks. While Nojoqui Creek appears to have some good habitat elements, the lack of fish suggests otherwise. Lower Quiota, lower Nojoqui, and lower Alisal creeks have poor habitat and often little or no flow to support over-summering fish.

Habitat Description of Study Reaches along the Mainstem

Oncorhynchus mykiss habitat along the 48 miles of river downstream of Bradbury Dam was divided into six different reaches (see **Table 4-36**), then characterized by the SYRTAC (1997, 1998, 2000, 2009). A summary of *O. mykiss* habitat conditions is presented below based on Entrix (2001) and updated based on SYRTAC (2009).

- **Highway 154 Reach**. The Highway 154 Reach extends from the dam to Highway 154 Bridge, a distance of about 2.9 miles. It has a more confined channel than reaches further downstream, as well as better riparian cover in general and perennial flow. This reach is dominated by pool habitat. Most of the pools are less than three feet deep. Several large and deep perennial pools are present on Reclamation property, including the Stilling Basin and the Long Pool. Substrates consist primarily of cobble near Bradbury Dam with increasing proportions of sand and gravel downstream. High-flow events in 1995 and 1998 moved additional gravels into the system from Hilton Creek and other tributaries.

  The Highway 154 Reach has moderate canopy coverage, which is better than canopy cover in reaches further downstream. Instream aquatic vegetation, mainly algae, forms in the Highway 154 Reach, typically in pools. During the early part of the summer this reach appears to have less algal growth than more downstream reaches. However, by the late summer, algae becomes abundant. Temperature monitoring and modeling results by Entrix (2001) and monitoring by SYRTAC (2009) indicate that this reach of the mainstem Santa Ynez River is the only portion of the mainstem river where water temperatures remain consistently within the tolerance limits of *O. mykiss*. Several localized areas of upwelling cool water were noted in the Long Pool, which may help account for these cool water temperatures and which may also provide temperature refugia for fish when water temperatures reach stressful levels.

  This reach is considered to have good habitat conditions overall.

- **Refugio Reach**. Flows in the 5-mile long Refugio Reach often become intermittent or non- existent during the summer. The habitat composition is composed of almost equal extent of pools and runs, with smaller reaches of glides, and riffles during spring and early summer flows. The substrate is a mix of small cobble, gravel, and fine sediment. Spawning-sized gravels are extremely limited within the wetted channel between Refugio Road and Bradbury Dam. Instream cover is moderate near pools. Riparian vegetation is not well developed, and canopy coverage is low. This reach has the most extensive growths of algae in the summer compared with the other mainstem reaches (Entrix, 2001).

  Suitable temperatures in this reach could likely not be maintained on a reliable basis during most years even at flows of up to 20 cfs. In relatively cool, wet years, it may be possible to maintain suitable temperatures in some or all of this reach. Upwelling of cool groundwater, which occurs in a few habitat units, can provide a thermal refuge for fish in the summer.

- **Alisal Reach**. The Alisal Reach extends about 2.6 miles from the Refugio Road Bridge to the Alisal Road Bridge in Solvang (approximately 10.5 miles downstream from Bradbury Dam). Quiota and Alisal creeks join the mainstem Santa Ynez River in this reach. Surface flows generally disappear during the summer and fall months except in very wet years. The habitat composition of this reach is

35 percent riffles, 29 percent runs, 27 percent glides, and only 9 percent pools. The substrate is small cobble, gravel, and fine sediments. Riparian vegetation is not well developed, and canopy coverage is poor. Floating mats of algae can be extensive in the summer. The Alisal Reach is the downstream extent to which *O. mykiss* have been observed on a regular basis in the mainstem. Temperatures suitable for *O. mykiss* cannot be maintained in this portion of the river on a reliable basis even with flow releases of up to 20 cfs.

- **Avenue of the Flags Reach**. The habitat along the Avenue of the Flags Reach has a lot of run habitat with some pools. The substrate is mostly sand and gravel. This reach is essentially devoid of canopy cover. Water temperatures at Buellton are potentially adverse or lethal for *O. mykiss* (Entrix 2001, SYRTAC 2009).

- **Buellton to Lompoc**. The mainstem between Buellton and Lompoc (about 36.5 miles downstream from Bradbury dam to the Robinson Bridge in Lompoc) extends approximately 23.9 miles. Near the confluence with Salsipuedes Creek, the channel is broad and braided, with little shading. Runs are the dominant habitat type, with some riffles and a few pools. Substrate is mainly sand and small gravel. Canopy cover and instream cover are minimal. Coverage from algal mats is lower compared to the Refugio and Alisal reaches.

- **Below Lompoc**. Pools, formed by beaver ponds, and extensive distances of runs dominate habitat two miles below the Lompoc Wastewater Treatment Facility. Downstream of Bailey Avenue in Lompoc, progressively greater concentrations of riparian vegetation occur, including extensive growths of willows, both along the sides and within the river channel. The growth of willows and other vegetation in this area is supported by freshwater (treated effluent) releases to the channel from the Lompoc Wastewater Treatment Facility. Substrate in the area is typically sand and fine silt.

Habitat Description of Study Reaches in Major Tributaries

The SYRTAC studies have focused on the tributaries on the south side of the mainstem because these tributaries have perennial flow in their upper reaches. *O. mykiss* have been observed during the SYRTAC (2000a, 2009) studies in all of the major south-side tributaries. The habitat, where accessible, has been surveyed in these streams and these observations are presented below. More up-to-date information on habitat details can be found in SYRTAC 2009, and a summary table is provided in **Appendix G**.

- **Hilton Creek**. Hilton Creek flows are now consistent year round with the influx from Hilton Creek Watering System. The lower reach of Hilton Creek is high gradient and well confined. Riparian vegetation and the walls of the incised channel shade the streambed. A rocky cascade and bedrock chute, located about 1,380 feet upstream from the confluence with the river, has been reconfigured to facilitate the passage of migrating *O. mykiss*. A culvert forms a migration barrier approximately 4,200 feet upstream.

  Channel width averages about 9 feet, and maximum pool depth averages 3 feet. Most pools have suitable spawning habitat at their tails. The lower creek, up to the chute pool, is primarily riffle/cascades, with some runs, and pools. Above the chute pool to the Reclamation property boundary (1,553 feet total), the habitat also consists primarily of riffle/cascades, with more runs, than pools. The reach just above the bedrock chute (about 300 feet) is consecutive run/riffle habitat with recovering canopy cover. Above this reach to the Highway 154 culvert (about 2,400 feet total), habitat conditions are good to excellent. Pool habitat is greater than those in lower Hilton and old growth sycamore dominate the vegetation providing dense canopy cover. Streamflows persist longer in this re ach than farther downstream.

Water temperatures of natural flows are generally suitable for rearing through the entire year. With the addition of water from the supplemental watering system in 2000, suitable rearing temperatures are now maintained all summer.

- **Quiota Creek**. Studies on this tributary have been limited due to lack of access on private property. Oaks and willows generally are abundant, although riparian vegetation is lacking in many places. Silt is the predominant substrate, especially in pools. Summer flow in the lower section is intermittent in average and dry years. Grazing practices have decreased the amount of streamside vegetation in this area. Refugio Road crosses Quiota Creek nine times. The numerous road crossings of Refugio Road impede upstream passage at low and high flows. All nine crossings are shallow-water "Arizona" style crossings with concrete beds. Several sites have a 2- to 3-foot drop downstream of the concrete apron. Crossing #6 has been replaced with a bottomless arch culvert and designs for restoration of the other crossings are in preparation.

  Good canopy conditions provide shading along portions of the stream. Pool habitats have good depth and complexity of instream cover. Numerous undercut banks exist (particularly in pools) providing excellent rearing habitat. In contrast to several other tributaries, substrate is composed of larger size gravel, cobbles, and boulders. In the lower reach, lack of good shading suggests that water temperature may not be suitable in the summer. Cattle fecal material was also observed in and around the stream in this area that may contribute to nutrient loading.

- **Alisal Creek**. Riparian and instream habitat is similar to that of upper Quiota Creek. The lower creek runs through a golf course. A dam and small reservoir (Alisal Reservoir) are located about 3.6 miles upstream from the confluence and block passage for *O. mykiss* to upstream areas. Conditions below the reservoir appear fair, with good riparian vegetation and canopy cover. Alisal Creek flows for approximately two miles above the Alisal Reservoir. The habitat above the reservoir is very good with excellent riparian vegetation and canopy, and has perennial flow. No temperature monitoring has been conducted, but observations suggest good temperature conditions in upper Alisal Creek (Entrix, 2001).

- **Nojoqui Creek**. The lower reach of Nojoqui Creek from the confluence with the mainstem Santa Ynez River to 1/2 to 3/4 miles upstream had degraded conditions with no canopy, little vegetation, eroded banks, and little or no flow during summer. Further upstream, however, conditions appear good for spawning and rearing, although flow is fragmented and intermittent within this section, particularly during average and dry years. The stream had dense riparian vegetation and canopy cover, good instream cover from boulders, roots, and undercut banks. No significant passage impediments currently exist. Summer water temperatures may occasionally be unsuitable for *O. mykiss*; although, in general, water temperatures appear to be favorable (Entrix, 2001).

- **Salsipuedes Creek And El Jaro Creek**. The Salsipuedes-El Jaro creek system is the largest tributary drainage in the lower basin. This system is the second tributary that returning anadromous *O. mykiss* encounter after entering the Santa Ynez River from the ocean, and the first into which they can migrate. Bridges and road crossings may block access to habitat within Salsipuedes and El Jaro creeks under low-flow conditions. Two passage improvement projects have been implemented, providing additional passage, along with suitable rearing habitat under the Highway 1 bridge and Jalama Road bridge.

The habitat along lower Salsipuedes Creek is comprised primarily of shallow runs, with some deep runs, step runs, pools, and riffles. After the first quarter mile, the flood plain widens, and there is minimal riparian vegetation and canopy. Several small pools with undercut banks and other features provide important summer habitat for *O. mykiss*. Riparian vegetation was scoured from the main channel in the winters of 1995 and 1998. Following the heavy winter flows of 1998, lower Salsipuedes Creek habitat was mostly runs and slightly fewer pools (73% runs, 15% glides, 7% riffles, and 4% pools) (SYRTAC 2000b). Silty conditions were generally found throughout lower Salsipuedes Creek although riffles were dominated by small cobbles.

In 1994, seven habitat units were identified and measured in upper Salsipuedes Creek, directly upstream of the confluence of El Jaro Creek. The habitat units surveyed included pools, riffles, and runs, covering a distance of approximately 500 feet, beyond which access issues limited the extent of the survey. Excellent cover and shading, and suitable spawning gravels were observed in all riffle and pool tail areas. A 1996 survey found that habitat was comprised mainly of runs (44% by length), followed by step runs (27%), pools (20%), and riffles (9%). Canopy coverage was relatively high compared to lower Salsipuedes and El Jaro creeks. Instream cover was 38 to 40 percent for all habitat types. Substrate composition was also similar across habitat types, with gravels dominant, and, in pools and runs, fine sediments subdominant.

The banks and channel in El Jaro Creek are very similar to lower Salsipuedes. The 1994 survey near the confluence with Salsipuedes Creek documented large pools, good riparian cover with overhanging vegetation, good instream cover in the form of vegetation and boulders, and generally excellent *O. mykiss* habitat. Further upstream there were areas of marginal habitat with abundant fine sediment, slow flow, and medium canopy. Other sections had high gradient riffles, very rocky substrate, and appeared to provide quality trout habitat. Although some reaches upstream of the ford had excellent spawning and rearing habitat, no *O. mykiss* were observed in the stream for 2 miles. A greater incidence of destabilized banks and fine sediments were observed in the upstream portion of El Jaro Creek.

El Jaro Creek was surveyed again in 1996. The survey (4,490 feet total) found primarily runs (61% by length), with lower proportions of pools (17%), step runs (13%), riffles (6%), and deep runs (3%). Canopy cover averaged 26 percent in pools, 28 percent in riffles, 23 percent in deep runs, and only 5 percent in runs. Instream cover was greatest in pools. Fine sediments dominated substrate in pools and deep runs; gravels dominated riffles and runs. Following the heavy winter flows of 1998, a survey in July 1998 (4,548 feet total) found more riffles and fewer pools (66% runs, 19% riffles, 12% glides, and 3% pools) (SYRTAC 2000b). The large storms of 1995 and 1998 have altered this reach by filling in some pool habitat and scouring riparian vegetation.

Water temperatures in upper Salsipuedes Creek are suitable for *O. mykiss* year-round, and slightly cooler than in El Jaro Creek or in lower Salsipuedes Creek. Mean daily temperatures in El Jaro and lower Salsipuedes creeks in the summer are often unfavorable for steelhead. Snorkel surveys from 1993 to 2010 have consistently documented *O. mykiss* throughout these reaches.

- **Santa Ynez River Lagoon**. The lagoon typically forms as flows decline after the winter runoff period when the mouth of the river is filled with sand deposited by both the river and by the strong longitudinal drift of sand from north to south along the shoreline. High winter river flows are capable of opening an outlet. Low summer flows are typically insufficient to keep the outlet open, although inflow from the Lompoc treatment facility and wave action can breach this barrier.

  The lagoon is about 13,000 feet long, with an average width of about 300 feet. Near the beach, it is substantially wider than at the upstream end. The average water depth is about 4 feet, and the water surface elevation with the mouth closed is about 5 feet MSL. The lagoon supports the growth of emergent aquatic vegetation along the margins, but the majority of the lagoon is open water. Substrate in the lagoon typically consists of sand and silt.

  The lagoon represents a unique habitat characterized by saltwater/freshwater mixing. Water quality within the lagoon, particularly salinity, has a major influence on the distribution of fish and macroinvertebrates inhabiting this area of the system. Vertical gradients in water temperature, dissolved oxygen, and salinity were observed within deeper areas of the lagoon during periods when the lagoon mouth was closed. Vertical stratification in water quality parameters varied substantially between locations and survey periods. Dissolved oxygen concentrations decreases quickly with depth.

  Average daily and maximum daily water temperatures within the lagoon during the summer were usually lower than water temperatures measured elsewhere on the mainstem of the river. Salinity is at ocean levels at the mouth of the lagoon, decreasing to freshwater levels at the upstream end. Salinity level varied at each site between months, reflecting seasonal variation in the balance between freshwater inflow and tidal influence.

4.7.1.4 Inventory of Mainstem Passage Barriers and Impediments

The ability of adult and juvenile *O. mykiss* to migrate up and downstream is considered critical to the long-term viability of the population (NMFS 2009). Natural and anthropogenic barriers have been inventoried by Stoecker (2004) and as part of the fishery-monitoring program (SYRTAC 2009). Fish passage criteria has been developed by CDFG, and barriers are classified by CPWA biologists (SYRTAC 2009) according to the degree of severity as complete barriers such as Bradbury dam, complete-natural barriers such as Nojoqui Falls, partial barriers under certain hydrologic conditions, such as low-flow crossings, partial-natural barriers that prevent passage over natural features during certain hydrologic conditions, and temporal barriers such as the sandbar at the mouth of the lagoon,

CPWA biologists are currently mapping, characterizing, and monitoring the locations of identified barriers along the mainstem and tributaries. Due to limited access to private property along the mainstem, these inventories are potentially incomplete. Stoecker (2004) identified two partial barriers (sandbar at the mouth of the Santa Ynez River and an earthen culvert crossing located approximately 3.5 miles above the confluence of Salsipuedes Creek), and three barriers of unknown severity which were inaccessible from public right of way (channelization/gravel operation/road crossing located approximately 1.25 miles downstream of Solvang, earthen culvert crossing 1.5 miles downstream of the Highway 154 bridge and a utility crossing located 0.5 mile upstream of the Highway 154 bridge). SYRTAC surveys focused on the tributaries, finding three barriers on Hilton Creek, eleven barriers on Quiota Creek, two barriers on Alisal Creek, four barriers on Nojoqui Creek, four barriers on Salsipuedes Creek, three barriers on El Jaro Creek, and three barriers on San Miguelito Creek. The majority of these barriers were identified in the Biological Opinion and restoration actions have been implemented or are in progress (See **Section 2.4.3, Habitat Improvements**). Bradbury dam is currently a complete barrier to upstream passage.

In addition to anthropogenic barriers and natural geomorphologic features, dams constructed by introduced American Beavers (*Castor canadensis*) may also negatively impact passage opportunities, especially under low-flow conditions, by altering channel velocity, changing local erosion and deposition patterns, altering riparian vegetation and large woody debris cover. Beaver activity is highest in areas with perennial flows and deep pools. Beavers have been observed in the Highway 154 reach, as well as downstream to the Cargasacchi reach. Beavers have also been observed in Salsipuedes and El Jaro tributaries. Over 100 dams were observed in fall 2009 between Bradbury dam and the ocean. The effect of beaver dams on passage opportunities and distribution of *O. mykiss* is not known.

4.7.1.5 Threats to Oncorhynchus mykiss

Water Quality

Water quality limitations, especially elevated summer temperatures, depressed dissolved oxygen and increased eutrophication in the mainstem have been identified as limiting factors affecting habitat suitability. Most sections of the mainstem downstream of the Highway 154 bridge become thermally stressful with associated low dissolved oxygen levels for much of the summer and fall. Water temperature and dissolved oxygen levels are consistently more favorable in the upper reaches of most tributaries.

The Central Coast Regional Water Quality Control Board 303 (d) list (2006) identifies several water quality concerns which will ultimately result in the development of Total Maximum Daily loads (TMDL) for the mainstem Santa Ynez River. Some of these factors also impact water quality for *O. mykiss* and other fish species. This list includes stream segments that do not meet water quality objectives necessary to protect beneficial uses. Beneficial uses include both municipal, industrial, and agricultural uses, as well as warm and cold freshwater habitat.

The reach below the City of Lompoc into the lagoon has several water quality problems identified by the 303 (d) list including nitrate as nitrate (NO_3), salinity/total dissolved solids (TDS)/chlorides, and sedimentation/siltation. The reach of the Santa Ynez River upstream from Lompoc to Cachuma Lake is similarly listed, although nitrate as nitrate is omitted.

Predation

Predation mortality of all size classes of *O. mykiss* has been identified as a significant factor affecting population abundance and survival in numerous rivers (Poe et al 1991, Beamsesderfer 2000). Identified predators include largemouth and smallmouth bass, channel catfish, sunfish, crappie, and other piscivorous fishes. CPWA biologists observed bullfrogs preying on juvenile *O. mykiss* and crayfish may incidentally prey on eggs or young-of-the-year *O. mykiss*. Bullfrog numbers have increased since 2000, as flows have been more consistent and longer reaches of the mainstem remain wetted.

Predation by largemouth bass is common enough to warrant documentation by CPWA biologists during snorkel surveys. Introduced into Lake Cachuma, largemouth bass have successfully colonized and maintained a population throughout the lower Santa Ynez River. Juvenile largemouth bass have also been observed in Hilton and lower Salsipuedes creeks; although, none have been observed in Hilton Creek since initiation of the HCWS in 2000 (SYRTAC 2009). Co-occurrence of largemouth bass and *O. mykiss* has been documented at several sites within the mainstem. Although each species appears to utilize different areas of the pools, predation pressure is thought to increase as pools shrink during the summer months.

The increased abundance and distribution of these piscivorous fishes and their impacts on *O. mykiss* warrants further study and active management to reduce the impacts of predaceous fishes may be necessary.

Poaching

Despite California Fish and Game Commission regulations prohibiting recreational angling in the lower Santa Ynez River, which is enforced by both CDFG and NMFS, incidental observations of illegal angling have been made during fishery monitoring surveys. Locations of illegal angling have been reported to the authorities, and a total of eleven sites have been documented where fishing gear and/or poachers are observed regularly. Signs have been installed at many of these locations informing the public of angling restrictions, but poaching remains a potential threat to the recovery of a viable population of *O. mykiss.*

4.7.2 Potential Impacts of the Alternatives

Between 2000 and 2010, the long-term rearing target flows required by the Biological Opinion have been met to the Highway 154 bridge. The installation of flashboards to achieve a 3.0-foot surcharge were installed in 2005, and surcharge occurred in 2005 and 2006. Spills also occurred in 2005, 2006, and 2008, providing additional flows downstream to the Alisal reach in 2006, 2007, 2008, and 2009. These additional flows have resulted in increased abundance of *O. mykiss* in the lower Santa Ynez River and its tributaries, increased riparian vegetation quantity and quality, as well as spawning and rearing habitat along the mainstem. Restoration projects implemented in the main tributaries have increased passage opportunities for adults to access upstream spawning and rearing habitat, contributing to the increased numbers of young-of-the year and juveniles observed.

The scoring analysis that follows was based on previous data available, and does not reflect the on-the-ground improvements implemented since 2006. Consistent with the requirements of CEQA, the analysis compares the benefits and impacts of each alternative relative to baseline conditions, and does not include an evaluation of the proposed alternatives compared to pre-dam conditions. Prior to the installation of the dams, approximately 90 river miles were available to support the various life history and life-cycle phases of *O. mykiss*. As each dam was built, incremental loss of significant upper watershed habitat occurred, along with associated anthropogenic impacts downstream. The installation of Bradbury dam resulted in the conditions observed currently. Given the elements of the proposed alternatives, the analysis focuses on impacts at Cachuma Lake and downstream of Bradbury dam(See **Table 4-36B, Summary of Scores**).

The scoring method attempts to quantify relative habitat suitability and impacts associated with the project alternatives by examining each life-cycle phase independently. This provides a limited opportunity to evaluate the synergistic relationships between flows having different rates, decay times and timing sequences, each of which plays an important role in providing suitable passage, spawning and rearing opportunities for all the species of concern. However, by examining the potential impacts for each species under each proposed alternative, three important factors were determined:

1. None of the proposed alternatives resulted in significant impacts to any of the fish species;
2. None of the proposed alternatives are significantly better or worse than the others when compared to the baseline condition (Alternative 2); and,
3. Each alternative provides benefits when compared to the baseline condition (Alternative 2).

Table 4-36B
Summary of Scores

Fish	Alt 2	Alt 3B	Alt 3C	Alt 4B	Alt 5B	Alt 5C
Largemouth bass spawning Cachuma Lake	4.3	4.3	4.3	4.4	4.2	4.2
Sunfish spawning in Cachuma Lake	3.8	3.7	3.7	3.8	3.7	3.7
Bass and sunfish fry rearing in Cachuma Lake						
based on reservoir drawdown	3.4	3.4	3.4	3.5	3.3	3.3
Overall score for bass and sunfish	3.8	3.8	3.8	3.9	3.7	3.7
O. mykiss adult migration Alisal Road Bridge	2.7	3.5	3.5	3.5	3.5	3.5
O. mykiss spawning at Highway 154 Bridge	2.6	3.1	3.1	3.1	3.3	3.3
O. mykiss fry rearing at Highway 154 bridge	2.9	3.6	3.7	3.7	4	4.1
O. mykiss juvenile rearing Highway 154 bridge	2.6	3.4	3.5	3.5	3.4	3.4
Resident Fish rearing at Highway 154 bridge	2.6	3.4	3.5	3.5	3.4	3.4
Overall score for *O. mykiss*	2.7	3.4	3.5	3.5	3.5	3.5

4.7.2.1 Comparison of Alternatives

Given that the lake has surcharged and spilled on several occasions, it is possible to describe actual impacts associated with the alternatives, especially 3C and 5C.

Alternative 2 (Baseline Condition): This condition effectively changed in 2000 with the implementation of the rearing flows, passage supplementation flows and Adaptive Management account flows required by the Biological Opinion.

Alternative 3B Operations under the Biological Opinion with a 1.8-foot surcharge directing fish releases:

- With installation of the flashboards in 2005 to achieve the 3.0-foot surcharge level, there have been no significant impacts to fish passage, spawning, fry rearing or juvenile rearing observed.

Alternative 3C Operations under the Biological Opinion with a 3.0-foot surcharge:

- Operations have basically complied with the required target rearing flows to the Highway 154 bridge since 2000, and following the surcharge of Cachuma Lake in 2005 and 2006, have complied with the supplemental flows to the Alisal reach required by the Biological Opinion. This has resulted in increased abundance of *O. mykiss* and improved riparian vegetation conditions. These conditions have also favored increased abundance of warm-water predators such as largemouth bass and bullfrogs throughout the same reaches. This alternative reflects the operational standard established by the Settlement Agreement. Target rearing flows are being maintained as required by the Biological Opinion (see **Section 2.4.2**).

Alternative 4B Operations under the Biological Opinion with a 3.0-foot surcharge and discharge of SWP water to the river near Lompoc:

- No significant impacts were associated with this alternative, other than those associated with temporary habitat removal and localized impacts to fish during construction of the four proposed outlets near Lompoc.

Alternative 5B Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below normal, dry, and critical water year types, assuming a 1.8-foot surcharge:

- As the surcharge level has been implemented to 3.0 feet, the impacts associated with this alternative refer more to timing and amount of releases. The analysis below indicates that there were no significant negative impacts to fish associated with this alternative.

Alternative 5C Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below normal, dry, and critical water year types, assuming a 3.0-foot surcharge:

- As the surcharge level has been implemented to 3.0 feet, the impacts associated with this alternative refer more to timing and amount of releases. The analysis below indicates that there have been no significant negative impacts to fish associated with this alternative. Under this alternative, in wet and above-normal years, 20 cfs would be required at the Highway 154 and Alisal Road bridges from April 15 to June 1. Flows would gradually decrease to 10 cfs by the end of June and would be held until October 1.

The timing of water releases as well as the amount released are ultimately the factors associated with each of the alternatives that could potentially impact fish. The requirements of the Biological Opinion represent the consensus of minimal flows needed in order to support the continued survival of *O. mykiss* in the Santa Ynez River. Further analysis of optimal timing and amount of flows needed in order to fully recover the population is outside the scope of this proposed project.

4.7.2.2 Information from the 2007 Draft EIR

The impacts of the various alternatives on the fishes in Cachuma Lake and along the lower Santa Ynez River are assessed below based on technical analyses and modeling performed by ENTRIX (2002 and 2006) for this EIR. Hydrologic data were provided by Stetson Engineers (2001a, 2001b, 2006a, 2006b).

Method of Analysis and Scoring

To provide an objective basis for comparing flow-related impacts among alternatives, a scoring system was developed to compare the effects of the different flow regimes on fish habitat in the lower Santa Ynez

River and in Cachuma Lake using modeled flow. A scoring system to allow for comparison of the alternatives was set up on a relative scale of 0 to 5, with a score of 0 indicating little or no habitat value and a score of 5 indicating the higher habitat value. A score of 5 was not established to determine the best potential habitat conditions, but rather to reflect habitat conditions within the range of potential changes in operations of the Cachuma Project. A separate scoring system was set up for each species and lifestage that could potentially be affected by the proposed alternatives. If it was determined that no effect was anticipated, such as for species in the lagoon, a qualitative comparison of the alternatives was provided. The scoring system discussed above only provides a basis of comparison for the alternatives and does not predict the actual amount or quality of habitat expected under the various alternatives. In addition, the scores do not necessarily present a complete analysis of benefits of the alternatives. However, this analysis does include a class of impacts for beneficial effects of alternatives (Class IV) compared to baseline operations. Although CEQA does not require the discussion of positive environmental effects, such an analysis was included in the 2003 Draft EIR and 2007 Revised Draft EIR and for consistency will be included here.

The primary methods by which the alternatives may affect fish resources are through changes in streamflow or lake storage, therefore, a score value was assigned to each monthly flow or water surface elevation. The mean daily flows or water surface elevations were computed by the SYRHM for each month of water years 1918 through 1993 for each alternative. The score was based only on the months when the species/lifestage being evaluated would be expected to be present in the river or reservoir. The frequency of each score value was calculated for the period of record for each alternative. Scores were then averaged over the 76 years where streamflow and water surface elevations were simulated to achieve an average score for each alternative for the species/lifestage group. These scores formed the basis for habitat analyses for fish inhabiting the mainstem of the Santa Ynez River (steelhead and residents) and fish inhabiting the reservoir.

The SYRHM runs were conducted to reflect operations pursuant to the alternatives; however, some assumptions were made in the process. For example, the method/time/duration for releasing the Adaptive Management Account water is not specifically stipulated within either the Biological Opinion or the Fish Management Plan and has, in these documents, been left to the Adaptive Management Committee. Thus, for the purpose of the hydrological analysis, it was assumed that during years other than critical drought years the 500 af in the Adaptive Management Account was released to benefit fish passage in accordance with the guidelines governing the Fish Passage Account. (In essence, the Fish Passage Account was allocated 3,700 af instead of the 3,200 af included in the Biological Opinion and Fish Management Plan.)

Alternatives 5B and 5C operate under a different flow regime than Alternatives 3B, 3C and 4B. Alternatives 5B and 5C are described in **Section 3.2**. Under Alternatives 5B and 5C, "3A2 operations" would not become the operating criteria for fish water releases until cumulative annual inflow into Cachuma Lake exceeds 33,707 af (wet and above-normal water years). If cumulative annual inflow does not reach this criterion, then operations would proceed under the Biological Opinion, with surcharges of 1.8 feet or 3.0 feet (Alternatives 3B and 3C, respectively).

4.7.2.3 Cachuma Lake – Resident *O. mykiss*

Resident *O. mykiss* present in Cachuma Lake require stream habitat to spawn and complete their life cycle and therefore require access to tributaries to Cachuma Lake. Water level reductions due to modified releases may affect the ability of these fish to migrate from Cachuma Lake into tributaries providing spawning habitat. Changes in water surface elevation are not likely to affect fry, juvenile, or adult life stages for resident *O. mykiss*. Fish spawned from lake resident *O. mykiss* typically spend two years in streams and two years in the lake before maturing. Thus, fry and smaller juveniles will likely remain in stream habitat where they will be unaffected by reservoir operations. Juveniles and adults, which inhabit the lake, are mobile enough to be generally unaffected by changes in lake levels.

Resident *O. mykiss* migration into streams could potentially be affected by a phenomenon called stream perching. Stream perching may result from wave action eroding the bank at the mouth of a stream, as the reservoir water elevation recedes during the summer. Over time, a steep drop off or a high gradient chute may form resulting in a partial or complete barrier to fish migration into spawning tributaries. Stream perching is more likely to occur along relatively high gradient shorelines.

Depth soundings have been taken from the mouths of Cachuma and Santa Cruz creeks (ENTRIX, 1995), two large tributaries to Cachuma Lake. The soundings were taken to a depth of approximately 20 feet (reservoir surface elevations between 746 to 726 feet) to determine the potential for the stream mouths to become perched. The results indicate that the gradient in both canyons between the depths measured was relatively moderate, and no distinct changes in elevation were located. These results indicate that the potential for stream perching is minimal. Hence, resident *O. mykiss* inhabiting Cachuma Lake would not have difficulty ascending into tributaries under the varying lake levels of all alternatives.

4.7.2.4 Cachuma Lake – Game Fish

Many different fishes inhabit Cachuma Lake including resident *O. mykiss*, three-spine stickleback, prickly sculpin, arroyo chub, mosquito fish, bass, sunfish, catfish, threadfin shad, goldfish, and carp. The alternative operations would affect the timing and amount of water released from the reservoir and, as such, would affect lake elevations and the near shore habitat of resident fishes. Depending upon the alternative chosen, the changes in project operations may result in a net gain or loss in aquatic habitat for different life stages. The early life history stages (egg and fry) of fish are most vulnerable to effects from fluctuations in water surface elevation.

ENTRIX's analysis of lake level fluctuation on game fish focused on two representative fish types: bass and sunfishes. A rapid drop in water surface elevation could result in nests becoming dewatered, resulting in the mortality of eggs. Fry spend their first few months rearing in shallow water in and around aquatic plants and submerged objects where they find food and shelter from predators. Largemouth bass were chosen for evaluation because they are highly sought-after by sportsmen, and because their spawning requirements are similar to smallmouth bass, which also reside in Cachuma Lake. Bluegill, redear sunfish, white crappie and black crappie are abundant in the lake (DFG Region 5 files; CDWR, 1990), and these sunfishes form an important component of the sport-fishery, as well as serving as a forage base for largemouth bass. There is considerable overlap in the spawning requirements of the sunfishes. Therefore, the important characteristics of these species were combined into a single criterion that was used to assess the effects of reservoir operations on their spawning success.

Members of the family Centrarchidae, which includes largemouth and smallmouth bass and the "sunfishes," (e.g., white and black crappie, bluegill, green sunfish, redear sunfish) often complete their early life stages in water less than 10 feet deep. Nests are generally built in shallow water, and a rapid drop in the water surface elevation could result in the nests becoming dewatered, resulting in the mortality of eggs. Fry spend their first few months rearing in shallow water in and around aquatic plants and submerged objects where they find food and shelter from predators. A rapid decrease in water surface elevation during the rearing season may result in a loss in near shore cover through dewatering, and an increase in the rate of mortality through predation. Therefore, bass and sunfish generally benefit from relatively stable water surface elevations during their spawning season and fry rearing season. A decrease in the amount of habitat during the fry-growing season may increase the fry's vulnerability to predation. However, concentrating fry in a smaller area may benefit the juvenile and adult life stages of larger fish such as largemouth bass and black crappie, which feed on young fish, but this effect cannot be quantified. Older centrarchids, juveniles and adults, are relatively unaffected by changes in water level, therefore, the evaluation of the potential impacts to centrarchids concentrates on spawning and fry survival.

To assess the effects of different lake levels under the alternatives, ENTRIX conducted an analysis (2002 and 2006), which entailed estimating the amount of critical shallow water habitat for selected lake fishes under different lake levels. ENTRIX then used a scoring system to rate the amount of habitat available under the different alternatives due to different lake level fluctuations. ENTRIX examined the effects of varying lake levels amongst the alternatives for the following habitats: (1) bass spawning; (2) sunfish spawning; and (3) bass/sunfish fry rearing. A description of scoring criteria for each species and life stage is provided below. The change in lake levels under the various alternatives is described in **Section 4.2.2**.

The median monthly lake elevation for Alternatives 3B and 5B is about the same as under baseline operations (Alternative 2) because the greater releases for fish under Alternatives 3B and 5B are offset by a 1.8-foot surcharge. Operations under Alternatives 3C, 4B, and 5C would exhibit higher lake levels compared to baseline conditions due to surcharging at 3.0 feet.

The seasonal pattern of fluctuation would be similar among the six alternatives. Compared to baseline conditions, the shoreline would be shifted from 750.75 feet to a higher shoreline at 751.8 feet under Alternatives 3B and 5B or 753 feet under Alternatives 3C, 4B, and 5C where the pattern of seasonal and annual fluctuation generally repeats.

Largemouth Bass Spawning Habitat

Site-specific data on largemouth bass spawning requirements from Cachuma Lake were not available from the DFG Region 5 files (ENTRIX 1995). However, their spawning requirements have been well documented in other settings. Spawning occurs in the spring (typically April and May) when water temperature warms to approximately 57 to 61°F (Emig, 1966; Moyle, 1976). Largemouth bass build nests in relatively shallow water over a variety of substrates, including gravel, sand, roots and aquatic vegetation. Nests are often built near rocks, submerged logs, or other structures providing protection to the nest. Largemouth bass reportedly spawn at depths ranging between 0.5 and 24.5 feet (Stuber et al., 1982c). However, the average depth at which bass spawn is typically at the shallower end of this range. Largemouth bass nests were reported at depths of 0.5 to 2.5 feet, 3.9 to 5.9 feet, and 0.5 to 6.5 feet with an average of approximately two feet, in three studies reported in Carlander (1977) and between 3.3 and 6.5 feet (Moyle, 1976). Stuber et al. (1982c) report that nests are found, on average, between 1.0 and 3.0 feet. Nests were more likely to be located at a depth of 2.5 feet than at 1.5 feet in a California reservoir (Carlander, 1977). Largemouth bass in Millerton Lake, California, spawned at an average depth of 3.9 feet, with a range of 2.0 to 8.2 feet (Mitchell, 1982). On the basis of these data, largemouth bass spawning habitat was defined as the lake area ranging in depth from 0.5 to 8.2 feet.

Incubation (to hatching) of largemouth bass eggs is largely influenced by water temperature, and ranges from approximately 13 days at 50°F to 1.5 days at 86°F (data cited by Carlander 1977). The expected temperature range in Cachuma Lake during the April and May spawning season is approximately 59 to 68°F, which would equate to an incubation period of approximately three to seven days. The newly hatched largemouth bass spend five to eight days in the nest before they are able to rise up off the bottom and feed, and remain around the nest for an additional four to five days. Using the rates of nest construction and embryo and larval development provided by Carlander (1977), at the expected water temperatures in Cachuma Lake during April and May, larval largemouth bass would be expected to leave the nest 13 to 21 days after the onset of nest construction.

Reservoir operations, specifically changes in water surface elevation, have the potential to adversely effect spawning success. Stuber et al. (1982c) report that shallow (<4.5 foot deep) nests can be vulnerable to destruction by wave action. Decreasing water surface levels may decrease nest production through dewatering (i.e. loss of habitat), nest desertion, and disrupted spawning. Rapidly increasing water surface elevations have also been reported to negatively affect largemouth bass spawning. Potential mechanisms for declining reproductive success with increasing water surface elevations are decreasing water temperatures and nest desertion by the male, which guards the nest. Abandonment by the male, it is hypothesized, can lead to increased predation (Edwards et al. 1983). For these reasons, stable water surface elevations during spawning are optimal (Stuber et al., 1982c).

In Millerton Lake, Mitchell (1982) found that an increase in the water surface elevation of approximately 13 feet resulted in a decrease in water temperature around the nests, which were then abandoned by the adult bass. Mitchell (1982) reported that a water surface elevation increase of about 27 feet per month (10.6-inch increase/day) was the upper limit for tolerance for bass in Millerton Lake. However, Millerton Lake receives runoff from snow pack through the San Joaquin River, and the in-flowing water would be expected to be colder than in-flowing water from the Santa Ynez River, which originates primarily from rainfall. Therefore, a greater increase in water surface elevation may be required to disrupt spawning by largemouth bass in Cachuma Lake, compared to conditions found in Millerton Lake. According to Stuber et al. (1982c) an increase in water surface elevation of 33 feet can reduce the suitability of spawning habitat by 30 percent.

ENTRIX assessed the potential for alternatives to affect largemouth bass spawning habitat by analyzing the amount of spawning habitat (i.e., areas between 0.5 and 8.2 feet deep) affected by water surface elevation changes during the months of April and May for each water year for the period of record for each alternative. Using SYRHM simulations, ENTRIX compared water surface elevations at the end of each month to those at the start to determine the extent to which reservoir operations under each alternative affect the habitat available at the start of the month. ENTRIX developed a scoring system to assess potential impacts of both reservoir drawdowns and reservoir increases during the spawning period (April and May), as shown below. A high score suggests that largemouth bass have a high likelihood of reproducing successfully under the reservoir operations for the particular alternative. A score of 0 indicates a lower likelihood that spawning would be successful. These scoring criteria are designed to allow a comparison of the potential affects of the different alternatives and do not constitute an assessment of all variables that determine success of redds. For instance, direct predation, amount of shelter, specific timing of water surface elevation change to redd development, and other potential variables are difficult to quantify and are not directly assessed in this scoring analysis.

Largemouth Bass Spawning Habitat Score Criteria

Score	Criteria Monthly Water Surface Elevation Decrease	 Monthly Water Surface Elevation Increase
5	<0.5 feet	≤ 13.0 feet
4	which decreases the available spawning depth[*] by > 0 but ≤ 20% (≥ 0.5 ft to < 2.0 ft)	which decreases the available spawning depth[1] by > 0 but ≤ 20% (≥ 13 ft to < 21 ft)
3	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 2.0 ft to < 3.6 ft)	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 21 ft to < 29 ft)
2	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 3.6 ft to < 5.1 ft)	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 29 ft to < 37 ft)
1	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 5.1 ft to < 6.7 ft)	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 37 ft to < 45 ft)
0	which decreases the available spawning depth by > 80% (≥ 6.7 ft)	which decreases the available spawning depth by > 80% (≥ 45 ft)

[1] *"Available spawning depth" is defined as the spawning habitat (area located between the depths of 0.5 and 8.2 feet) available at the start of the month for potential nest building.*

Sunfish Spawning Habitat

Site-specific data on sunfish spawning requirements from Cachuma Lake were not available from the DFG Region 5 files (ENTRIX 1995). Information on the spawning requirements of sunfishes have been synthesized by Calhoun (1966), Moyle (1976) and Carlander (1977). Although the specific requirements vary by species, sunfishes (bluegill, redear sunfish, white crappie and black crappie) spawn during the spring and summer months in fairly shallow water over substrates of gravel, sand, mud, roots or aquatic vegetation. Nests are typically built near rocks or aquatic vegetation that provide protection. The onset of spawning is largely controlled by water temperature, with black crappie spawning at the lowest temperatures (approximately 57.0 to 62.5°F), and redear sunfish spawning at the highest temperatures (approximately 71.5 to 75.0°F). On the basis of water temperature recorded in Cachuma Lake between 1980 and 1994 (Reclamation, 1987 and Reclamation, unpubl. data) the sunfish spawning season is expected to begin in late March (for black crappie), and extend into June, and possibly July (for redear sunfish).

ENTRIX based the scoring system for sunfish spawning habitat on that described for largemouth bass, except that ENTRIX designated spawning habitat as areas at depths between 0.5 and six feet deep and determined the maximum inundation depth based on sunfish spawning temperature ranges, which vary during the spawning period. Sunfishes typically spawn at depths less than six feet, but have been reported spawning at depths up to 20 feet. The depths at which the sunfishes spawn appear to be flexible within a specific range, and have been reported to vary depending upon local conditions. The normal range of depths at which black crappie spawn are given as three to eight feet (Calhoun, 1966) and less than three feet (Moyle, 1976). Bluegill spawning depths have been reported between two and six feet (Calhoun, 1966) and between 0.5 and four feet (Carlander, 1977). Redear sunfish have been reported to spawn at greater depths than bluegill and black crappie (with the preferred range between six and ten feet). On the basis of these data, sunfish spawning habitat was defined as the area ranging in depth from 0.5 to 6 feet. This range of depths was used to assess the potential affects of the alternatives on the more vulnerable species (i.e., shallow spawners).

Temperatures within Cachuma Lake vary over the course of the sunfish spawning period (March through July). Spawning for each of the sunfish species begins when water temperatures become suitable for each species and the effects of inundation will vary depending on water year type and species. In the early part of the spawning season, the minimum depth at which unsuitable spawning temperatures for crappie (cooler temperatures spawner) are found is about 40 feet (SYRTAC 1997, 1998, 2000b). Later in the season, unsuitable temperatures for redear sunfish spawning occur at about 30 feet. This information was used as the foundation for the development of the sunfish scoring for months in which water surface elevation increased. An increase in water surface elevation of 30 feet was considered to provide unsuitable conditions for nest development and production. It is unknown what levels of water surface elevation increase result in no effect on sunfish nests therefore, scores were equated with increases in water surface elevation based on 16.7 percent intervals; the result of dividing the depth range evenly into six sub-categories.

ENTRIX assessed the potential for each alternative to affect sunfish spawning habitat by analyzing the amount of spawning habitat affected by water surface elevation changes during the months of March through July for each water year for the simulation period. Specific scoring criteria are shown below.

Sunfish Spawning Habitat Score Criteria

Score	Criteria Monthly Water Surface Elevation Decrease	Monthly Water Surface Elevation Increase
5	<0.5 feet	< 5 ft
4	which decreases the available spawning depth[1] by > 0 but ≤ 20% (≥ 0.5 ft to < 1.6 ft)	which decreases the available spawning depth[1] by > 0 but ≤ 20% (≥ 5 ft to < 10 ft)
3	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 1.6 ft to < 2.7 ft)	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 10 ft to < 15 ft)
2	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 2.7 ft to < 3.8 ft)	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 15 ft to < 20 ft)
1	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 3.8 ft to < 4.9 ft)	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 20 ft to < 25 ft)
0	which decreases the available spawning depth by > 80% (≥ 4.9 ft)	which decreases the available spawning depth by > 80% (≥ 25 ft)

[1] *"Available spawning depth" is defined as the spawning habitat (area located between the depths of 0.5 and 8.2 feet) available at the start of the month for potential nest building.*

Bass and Sunfish Fry Rearing Habitat

Site-specific data on largemouth bass and sunfish fry habitat requirements from Cachuma Lake were not available from the DFG Region 5 files (ENTRIX, 1995). Largemouth bass and sunfish fry ("fry") inhabit nearshore habitat with abundant cover (e.g., aquatic plants and woody debris that provide shelter from predatory fish) (Stuber et al., 1982 a, b, & c; Moyle, 1976; Nack et al., 1993). Centrarchid fry abundance was found to be higher in protected coves compared to open shoreline in the main body of a lake (Meals and Miranda, 1991; Nack et al., 1993). Nack et al. (1993) also reported that "many" centrarchid fry were collected in water less than 6.5 feet deep, but they did not provide an average depth or a range of depths preferred. Rising water surface elevations during the fry-rearing season increases available habitat by flooding terrestrial vegetation, which provides shelter for the young fish.

The range of depths utilized during the rearing season were not presented in the literature reviewed. For the purposes of this analysis, ENTRIX defined fry rearing habitat as the area less than 10 feet deep. This depth was assumed to supply the necessary range of feeding and hiding habitat for largemouth bass and sunfish fry. Centrarchid spawning usually begins in March, and significant numbers of fry would be expected to be present by May. Therefore, May 1 was designated as the beginning of the rearing season.

Decreasing water surface elevation during the fry growing season (May through August), reduces the amount of available cover, which increases the fry's vulnerability to predation. Cover observed in the reservoir during a May 1994 survey at a water surface elevation of approximately 746 feet (ENTRIX, 1995) consisted of submerged woody debris, rocky points, and submerged and emergent vegetation, which should provide suitable habitat for all life stages of centrarchids. The loss of cover is associated with aquatic plants and submerged objects becoming exposed as the water surface level decreases. A drawdown of greater than three feet was considered sub-optimal by Stuber et al. (1982c) because it would increase predation due to lower amounts of cover. If, however, water surface elevations decline at a slow rate, new growth can occur to continue to provide fry shelter.

ENTRIX developed a scoring system to rate monthly reservoir drawdown, as shown below. ENTRIX equated a drawdown of three feet or less with the middle of the scoring range, given the monthly time step which provides some time for growth of aquatic plants in response to declining water surface elevation. ENTRIX divided the remaining scores evenly such that a score of "5" represented little monthly drawdown (a foot or less) and a score of one represented a more severe rate of drawdown. A score of "0" represents a drawdown of greater than 5 feet based upon the even distribution of scores and poorer habitat conditions. Some fry habitat will always be available unless the reservoir goes dry; therefore, a "0" score does not mean that there is no habitat.

Bass and Sunfish Fry Rearing Habitat Score Criteria

Score	Criteria
5	monthly water surface elevation decrease ≥ 0 and ≤ 1 ft
4	monthly water surface elevation decrease > 1 and ≤ 2 ft
3	monthly water surface elevation decrease > 2 and ≤ 3 ft
2	monthly water surface elevation decrease > 3 and ≤ 4 ft
1	monthly water surface elevation decrease > 4 and ≤ 5ft
0	monthly water surface elevation decrease > 5 ft

ENTRIX conducted a second analysis to assess the amount of rearing habitat (area < 10 feet deep) available to fry under the different alternatives. ENTRIX calculated rearing habitat area using a regression (MNS Engineers, 2000) derived from lake surface area (in acres) and water surface elevation (in feet) data.

The available fry rearing habitat area is the difference between the surface area at the elevation in question and the surface area at ten feet below the area in question. ENTRIX calculated the amount of fry rearing habitat for each month in which fry rearing is anticipated to occur in Cachuma Lake for the 76-

year period of record. The median rearing habitat area is presented for each month and alternative. Monthly water surface elevation drawdown was calculated for each month (May through August) during the fry-rearing season and the drawdown scored.

Evaluation of Alternatives

Largemouth Bass Spawning Habitat

Scoring of bass spawning habitat in Cachuma Lake is essentially the same under all six alternatives in both April and May (**Table 4-37, Scores for Largemouth Bass Spawning in Cachuma Lake**). Lake levels in April and May are similar for all alternatives (within 2 feet of each other), as shown on **Chart 4-7** in **Appendix B**. This small difference in lake levels is not sufficient to cause a significant difference in the amount of nearshore spawning habitat among the alternatives.

Table 4-37
Scores for Largemouth Bass Spawning in Cachuma Lake

April Frequency of Scores							
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	41	33	1	1	0	0	4.5
3B	37	36	2	1	0	0	4.4
3C	37	36	2	1	0	0	4.4
4B	37	36	2	1	0	0	4.4
5B	36	37	2	1	0	0	4.4
5C	36	37	2	1	0	0	4.4
May Frequency of Scores							
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	23	43	9	1	0	0	4.2
3B	23	43	9	1	0	0	4.2
3C	23	43	9	1	0	0	4.2
4B	23	45	7	1	0	0	4.2
5B	22	44	9	1	0	0	4.1
5C	22	44	9	1	0	0	4.1

Alternatives 3B, 3C, and 4B would have four fewer years with high spawning scores in April than under baseline operations (Alternative 2). This effect is caused by a greater drawdown of the lake due to releases for downstream fish. However, this impact is offset by the increased number of years with spawning scores of 4. In May, the number of years with high spawning scores would be the same under current operations and Alternatives 3B, 3C, and 4B. In addition, the number of years with spawning scores of 4 would be the same under Alternatives 3B and 3C and greater under Alternative 4B than under baseline conditions.

Alternatives 5B and 5C have one less year with spawning scores of 5 in both April and May than Alternatives 3B, 3C, and 4B. Alternatives 5B and 5C have one more year of spawning scores of 4 in both April and May, compared to Alternatives 3B and 3C.

In summary, Alternatives 3B, 3C, 4B, 5B and 5C all have overall negligible net effects on bass spawning habitat when compared to the "Baseline Operations" alternative. The alternatives either have the same average spawning score as baseline operations or are within one-tenth of a point. Accordingly, the effect of the alternatives on bass spawning habitat would not be significant.

Sunfish Spawning Habitat

The results of the simulation for sunfish spawning habitat indicate that there is little to no difference in spawning habitat between the six alternatives due to varying lake levels (**Table 4-38, Scores for Sunfish Spawning in Cachuma Lake**). The average scores for each alternative are either the same or within two-tenths of a point during the spawning period of March through June. In July when more spawning habitat is lost due to increasing water withdrawals, scores of 2 and 3 are the most common for all alternatives. Alternatives 5B and 5C have slightly more years with scores of 2 in June and July than the other alternatives. The effect over the course of the spawning season means that fish that typically spawn in warmer temperatures (and thus later in the season), such as redear sunfish, are more likely to be affected than species that spawn earlier in the year, such as black crappie. While the results show a general decrease in the stability of spawning habitat over the course of the spring and early summer for all alternatives, the potential impacts of Alternatives 3B, 3C, 4B, 5B and 5C are not significant relative to the baseline operations alternative.

Table 4-38
Scores for Sunfish Spawning in Cachuma Lake

			March				
			Frequency of Scores				
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	53	18	2	0	1	2	4.5
3B	47	23	2	1	1	2	4.4
3C	47	23	2	1	1	2	4.4
4B	46	22	4	1	1	2	4.4
5B	47	22	3	1	1	2	4.4
5C	47	22	3	1	1	2	4.4
			April				
			Frequency of Scores				
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	37	35	2	0	0	2	4.4
3B	33	37	4	0	0	2	4.3
3C	33	37	4	0	0	2	4.3
4B	33	37	4	0	0	2	4.3
5B	32	37	5	0	0	2	4.3
5C	32	37	5	0	0	2	4.3
			May				
			Frequency of Scores				
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	23	38	7	7	1	0	4.0
3B	23	36	9	7	1	0	4.0
3C	23	38	7	7	1	0	4.0
4B	23	36	10	6	1	0	4.0
5B	22	33	13	7	1	0	3.9
5C	22	34	12	7	1	0	3.9

June Frequency of Scores							
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	7	35	24	7	3	0	3.5
3B	7	32	28	5	4	0	3.4
3C	7	32	29	4	4	0	3.4
4B	7	28	37	3	1	0	3.5
5B	7	25	32	9	3	0	3.3
5C	7	25	33	8	3	0	3.3
July Frequency of Scores							
Alternatives		**← better**			**worse →**		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	1	9	33	25	8	0	2.6
3B	1	9	36	22	8	0	2.6
3C	1	9	35	23	8	0	2.6
4B	0	9	47	15	5	0	2.8
5B	1	5	36	27	7	0	2.6
5C	1	5	38	26	6	0	2.6

Bass and Sunfish Fry Rearing Habitat

Overall, from the beginning of the fry-rearing season to the end, monthly reservoir drawdowns increase, which suggests a potential decrease in the amount of cover available for rearing fry. The results of the bass and sunfish fry rearing scoring analysis, however, indicate no significant difference in the amount of habitat amongst the alternatives relative to baseline operations.

The results of the bass and sunfish fry rearing scoring analysis indicate no significant difference in the amount of habitat amongst the alternatives (**Table 4-39, Scores for Bass and Sunfish Fry Rearing in Cachuma Lake Based on Reservoir Drawdown**).

Table 4-40, Median Available Bass and Sunfish Fry Rearing Habitat in Cachuma Lake, compares the estimated fry rearing habitat area available during the different portions of the rearing season for the different alternatives. The results demonstrate that as water surface elevation declines through the fry rearing season fry rearing habitat declines under all alternatives. Alternative 5B starts and ends the season with slightly less habitat area than Alternatives 2, 3B, 3C, and 4B. Alternative 5C begins the season with slightly more habitat area than Alternatives 2 and 3B and slightly less than Alternatives 3C and 4B.

Alternative 5C ends the season with slightly more habitat area than the baseline and slightly less habitat area than Alternatives 3B, 3C, and 4B.

Based on these analyses, Alternatives 3B, 3C 4B, 5B, and 5C would not adversely affect bass and sunfish rearing habitat, even with lake surcharging. Alternative 5B would provide slightly less favorable habitat conditions and slightly less habitat area than baseline operations and Alternatives 3B, 3C, and 4B. Alternative 5C would provide slightly better conditions and more habitat area than the baseline alternative, but still less than Alternatives 3B, 3C, and 4B. However, these small physical changes would not result in a significant difference in the fry population and therefore would have no significant effect on bass and sunfish rearing habitat.

Table 4-39
Scores for Bass and Sunfish Fry Rearing in Cachuma Lake Based on Reservoir Drawdown

May Frequency of Scores							
Alternatives		← better			worse →		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	31	35	8	1	1	0	4.2
3B	30	36	7	2	1	0	4.2
3C	30	36	6	3	1	0	4.2
4B	29	39	5	2	1	0	4.2
5B	28	38	8	1	1	0	4.2
5C	27	39	7	2	1	0	4.2
June Frequency of Scores							
Alternatives		← better			worse →		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	11	42	15	5	3	0	3.7
3B	11	42	16	4	3	0	3.7
3C	11	42	16	4	3	0	3.7
4B	11	45	18	1	1	0	3.8
5B	10	39	18	7	2	0	3.6
5C	10	39	19	6	2	0	3.6

July Frequency of Scores							
Alternatives		← better			worse →		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	2	24	21	25	4	0	2.9
3B	2	27	19	24	4	0	3.0
3C	2	27	19	24	4	0	3.0
4B	2	29	33	10	2	0	3.3
5B	2	15	30	27	2	0	2.8
5C	2	17	29	26	2	0	2.9
August Frequency of Scores							
Alternatives		← better			worse →		
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	1	17	30	20	8	0	2.8
3B	1	21	26	20	7	1	2.8
3C	1	21	27	19	7	1	2.8
4B	0	22	27	21	6	0	2.9
5B	1	19	29	19	7	1	2.8
5C	1	19	31	17	7	1	2.8

Table 4-40
Median Available Bass and Sunfish Fry Rearing Habitat in Cachuma Lake

	Median Monthly Habitat Area (Acres) for Alternatives					
	2	**3B**	**3C**	**4B**	**5B**	**5C**
Start of Season (April)	316	315	320	322	311	317
May	310	309	315	315	305	311
June	299	300	306	307	295	301
July	286	290	295	298	282	287
End of Season (August)	276	281	286	287	274	279
Median*	293	293	299	300	289	294
Range*	147–361	146–368	147–375	148–375	145–368	146–375

4.7.2.5 Impacts on Southern California *O. mykiss* along the River

Threshold of Significance

In order to complete their lifecycle, anadromous *O. mykiss* must gain access to the Santa Ynez River watershed and migrate into the mainstem. Spawning can occur at locations within the mainstem or in tributaries downstream of Bradbury Dam. Perennial rearing habitat in the mainstem, tributaries, and/or lagoon must be available for young-of-the-year to successfully grow to become juveniles and sufficient flows must be available to allow for juvenile outmigration. For resident *O. mykiss*, passage into the system is not an issue, but flows to allow movement within the system and to provide spawning and rearing habitat are. An impact is considered significant if the flows would prevent free movement within the system and limit the extent of spawning and rearing habitat when compared to the baseline (Alternative 2).

The effect of different downstream flow regimes under the various alternatives is described below based on ENTRIX (2002 and 2006). The analysis in this section focuses on mainstem habitat for *O. mykiss*, as the Cachuma Project has the potential to affect mainstem habitat and not tributary habitat, with the exception of a portion of Hilton Creek where reservoir releases are used to supplement streamflow.

Discussion of Method of Analysis and Scoring

Streamflow

The primary method by which the alternatives may affect fish resources is through changes in streamflow. Therefore, to provide an objective basis for comparing and evaluating flow-related impacts to fish habitat under different alternatives, a habitat scoring system was developed. The habitat scoring system assigns higher scores to flows that are likely to provide more habitat and lower scores to flows that are likely to provide less habitat. The habitat scores are derived from the average monthly flows calculated using simulated mean daily flows for each alternative. Monthly time steps provide adequate resolution for rearing and spawning habitat conditions in the river and lake and therefore were used for these analyses.

A separate habitat scoring system was set up for each lifestage that potentially could be affected by the proposed alternatives. The score was based only on the months when the lifestage being evaluated would be expected to be present in the river. The flow levels used in the scoring system were based on the habitat and passage analyses conducted for the SYRTAC (1999a and b) and on the flow levels that NMFS determined would result in no jeopardy to steelhead (NMFS, 2000). The frequency of each score value was calculated for the 76-year period of record for each alternative. Scores were then averaged. The scoring criteria are shown in **Table 4-41, Scoring Criteria For *O. mykiss* Habitat**. These scores only form a basis for comparison of the alternatives and do not provide an absolute prediction of the amount and quality of habitat expected under the alternatives.

Table 4-41
Scoring Criteria For *O. mykiss* Habitat

			Scores					
			← better			worse →		
Life Stage	Flow Location	Months Considered	(5)	(4)	(3)	(2)	(1)	(0)
Passage	Alisal Road	January–April	> 14 days*	11 to 14 days	7 to 10 days	4 to 6 days	1 to 3 days	0 days
Spawning	Highway 154	February–May	> 30 cfs	> 15 to ≤ 30 cfs	> 10 to ≤ 15 cfs	> 5 to ≤ 10 cfs	> 2.5 to ≤ 5 cfs	≤ 2.5 cfs
Fry Rearing	Highway 154	April–August	≥ 10 cfs	≥ 5 to < 10 cfs	≥ 2.5 to < 5 cfs	≥ 1.5 to < 2.5 cfs	> 0 to < 1.5 cfs	0 cfs
Juvenile Rearing	Highway 154	January–December	≥ 10 cfs	≥ 5 to < 10 cfs	≥ 2.5 to < 5 cfs	≥ 1.5 to < 2.5 cfs	> 0 to < 1.5 cfs	0 cfs

* *A 'passage day' is defined as a flow of ≥ 25 cfs at the Alisal Road Bridge.*

Fish Migration

Adult *O. mykiss* primarily migrate upstream in the Santa Ynez River from December through April (SYRTAC 1997, 2000a and b). To allow *O. mykiss* to migrate within the mainstem and into the tributaries, passage flows must be available within the system and for anadromous *O. mykiss*, the sandbar at the mouth of the lagoon must be open. A passage analysis was conducted to determine the amount of flow needed to provide passage at critical riffles in the lower mainstem of the Santa Ynez River (SYRTAC, 1999b). The result of these analyses indicate that a flow of 25 cfs at the Alisal Road Bridge is sufficient to provide passage between Bradbury Dam and the lagoon 92 percent of the time (SYRTAC, 2000a). Therefore, a passage day is defined as a day with a flow of greater than or equal to 25 cfs at the USGS gage at the Alisal Road Bridge. For suitable access to mainstem and tributary spawning habitat, there must be sufficient number of days with flow at the Alisal Road Bridge greater than or equal to 25 cfs.

Travel times for salmonids are not well defined in the literature. NMFS cites several studies of salmonid travel times which range from 8 to 31 miles per day (Groot and Margolis 1991, cited in NMFS 2000) to 1.85 to 18.4 miles per day (average of 4.6 miles per day) for anadromous *O. mykiss* in the Carmel River (Dettman and Kelly 1986, cited in NMFS 2000). NMFS also considered an analysis of recession curves derived from the Los Laureles gage (located above Cachuma Lake), which demonstrated that the recession from 150 cfs to baseflow took 14 days. Based on these studies, NMFS considered 14 days of passage in a particular storm event to provide the minimum adequate passage opportunities (NMFS, 2000). A score of 5 was equated with years in which the number of passage days exceeded this threshold (**Table 4-41**). A score of 0 was equated to years that provide no passage opportunity. The remaining scores were assigned passage days by dividing the remaining passage days evenly amongst the scores. This reflects that, given the uncertainty and variability in *O. mykiss* travel times, passage opportunities to portions of the mainstem may be provided even with smaller numbers of passage days.

In order to compare the passage opportunities between the alternatives, the total number of passage days provided under each alternative was estimated using daily data from the SYRHM. This is because fish passage events in the Santa Ynez River system can occur on a scale of hours to days. Therefore, in order to assess and compare anadromous *O. mykiss* passage opportunities between alternatives, the SYRHM was adapted to estimate daily flow. The model was run for a 52-year sub-set of the original data set (1942-1993) because these were the years in which daily information used to adapt the model was available. A similar caution must be applied to daily passage data as to the monthly habitat data; the model provides a basis for alternative comparison, but may not accurately predict the actual number of passage days that would result under each alternative.

Spawning and Rearing Habitat

Spawning and rearing habitat in the lower Santa Ynez River is primarily restricted to the upper portion of the river where suitable habitat structure exists. As the river channel widens, sand replaces gravel as the primary substrate and riffles become less well defined. The Highway 154 Reach was selected as the index location for spawning and rearing habitat because it contains the best quality habitat available in the mainstem (SYRTAC 2000a). Much of this reach is located on private property and no additional data collection efforts have been undertaken except in the short reach near the dam. In this reach, few observations of spawning pairs have been made. *O. mykiss* appear to rely primarily on the tributaries to the Santa Ynez River (i.e., Hilton Creek and Salsipuedes Creek) for spawning and rearing.

To provide spawning habitat in the mainstem, there must be sufficient flow to provide habitat during the spawning season, which is typically between February and April in the Santa Ynez River (SYRTAC, 2000a). The period analyzed to assess spawning starts at the onset of the peak spawning season (February) through the end of the peak fry emergence period (May). A study conducted by the SYRTAC (1999a) assessed the relationship of stream flow at Highway 154 to habitat area, average depth, and average velocity in the Highway 154, Refugio, and the Alisal reaches. The relationship in the study demonstrated that large increases in the top width of habitat units occur at lower flows (<15 cfs) and lower rates of increase are found at higher flows (>30 cfs). The changes were most dramatic below 5 cfs and in riffle and run habitats where spawning frequently occurs. For riffles, changes ranged from 1.8 feet at 30 cfs (2.4 percent change) to 1.1 feet at 50 cfs (1.3 percent change), compared to 8.7 feet at 5 cfs (15.1 percent change) and 2.9 feet at 10 cfs (4.4 percent change). Similarly, changes in runs ranged from 10.3 feet at 5 cfs (17.6 percent) and 0.4 feet at 50 cfs (0.5 percent change). The SYRTAC biological team observed that spawning can occur in the mainstem at low flows (>2.5 cfs). While there is little habitat area available, compared to higher flows, there is sufficient flow in some locations to enable spawning to occur. The flow criteria used for the spawning habitat were developed to reflect the relationship between top width and flow in riffles and runs in the Highway 154 Reach and based on observations in the mainstem as outlined in **Table 4-41**.

O. mykiss need areas to seek refuge from warm summer water temperatures (NMFS 2005). Oversummering rearing habitat is an important limiting factor for *O. mykiss* populations in California and in the Santa Ynez River (ENTRIX 1995, SYRTAC 2009). Rearing habitat must persist throughout the period when young O. mykiss are in freshwater.

The scoring system developed for fry and juvenile rearing in April through August was based on the habitat analysis in SYRTAC (1999a) and rearing target flow levels established in the Biological Opinion. The minimum, long-term rearing target flow level established by the Biological Opinion is 2.5 cfs. This flow was equated with a score of "3," which falls in the middle of the scoring range. Conditions without flow were scored "0." A score of "5" was given to flows greater than 10 cfs because this is the maximum rearing flow required in the Biological Opinion for habitat maintenance. In addition, the top-width versus flow relationships developed during the habitat analysis show that the rate of increase in habitat (i.e., top-width) typically declines above 10 cfs (SYRTAC, 1999a). These rearing criteria were used for both fry and juvenile rearing although, the period of time to which the criteria are applied varied between the two lifestages. Juveniles rear throughout the entire year and therefore the analysis was conducted for all 12 months. Fry rear in the Santa Ynez system from April through approximately August and therefore the fry analyses were conducted using only these months.

Both the fry and juvenile analyses were conducted by scoring the month in each year with the lowest flow. This corresponds to the 'low-flow' period that represents a critical point for these lifestages. The 'low-flow' score recognizes that lower flows can lead to concentration of fry, juveniles, and adults into smaller habitat spaces which can decrease habitat suitability and survival. This scoring system also highlights the importance of no-flow conditions when habitat units become discontinuous and poorer water quality conditions (i.e., high temperatures, low dissolved oxygen) can result. To further assess the effects of higher flow requirements at Alisal Road Bridge, a qualitative discussion is provided for potential impacts or benefits for Alternatives 5B and 5C.

Results and Comparison of Alternatives

Fish Migration

The scoring of anadromous *O. mykiss* passage opportunities among the alternatives was divided into two categories as shown in **Table 4-42, Scores for Adult *O. mykiss* Migration at the Alisal Road Bridge**. The number of years that would meet the passage criteria resulting in a score of "5" (i.e., >14 days of passage flows at Alisal) under baseline operations would be 21 of the 52 years (**Table 4-42**). Baseline operations do not include releases to facilitate passage. In contrast, Alternatives 3B, 3C, 4B, 5B, and 5C would substantially increase the frequency of years with passage for anadromous *O. mykiss* due to releases to supplement passage (**Table 4-42**). Hence, these alternatives would result in a beneficial effect (Class IV) on anadromous *O. mykiss* passage compared to baseline operations.

Table 4-42
Scores for Adult *O. mykiss* Migration at the Alisal Road Bridge

	Frequency of Scores						
		← better			worse →		
Alternatives	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**	**(0)**	**(AVG)**
2	21	4	2	5	5	15	2.7
3B	31	6	0	2	1	12	3.5
3C	31	6	0	2	1	12	3.5
4B	31	4	2	2	2	11	3.5
5B	33	2	1	3	2	11	3.5
5C	33	2	1	3	2	11	3.5

The score analysis shows that Alternatives 5B and 5C provided another two years with scores of "5," reduced years with scores of "4" and "3," and slightly increased years with scores of "2" and "1," compared to Alternatives 3B, 3C, and 4B. Alternatives 5B and 5C provide slightly fewer years (35 years) with greater than 11 passage days than Alternatives 3B and 3C (37 years). This is due to the fact that under Alternatives 3B and 3C there were more years with a small spill (<20,000 af) than under Alternatives 5B and 5C. However, in wet years in which there were no spills, Alternatives 5B and 5C had more passage days than Alternatives 3B and 3C. Overall, all of the alternatives provide the same average score for steelhead adult migration at the Alisal Road Bridge.

Overall, Alternatives 5B and 5C provide a beneficial effect (Class IV) when compared to Alternative 2. When compared with Alternatives 3B and 3C, passage opportunities are very similar among the alternatives. Alternatives 5B and 5C provide a biologically significant number of additional days of passage flows in four years (1962, 1966, 1991, and 1992) compared to Alternatives 3B, 3C, and 4B. In three years (1946, 1974, and 1986), Alternatives 5B and 5C provide a biologically significant reduction in the number of days of passage flows compared to Alternatives 3B and 3C (Stetson, 2006b).

Spawning Habitat

Under baseline operations (Alternative 2), spawning flows with scores of "5" are provided in 23 years of the 52-year simulation period (**Table 4-43, Scores for *O. mykiss* Spawning at the Highway 154 Bridge**). The spawning habitat scores show that in a number of years, regardless of Cachuma Project operations, enough runoff occurs to provide for spawning habitat between the dam and Highway 154. These are typically years with large amounts of rainfall in which Cachuma Lake likely spills. Without the long-term operations proposed in the Biological Opinion and Fish Management Plan, there are also a substantial number of years in which there is little flow (less than 5 cfs), on average, in the mainstem at the Highway 154 Bridge during the February through May spawning/incubation season (scores of 0 and 1).

Table 4-43
Scores for *O. mykiss* Spawning at the Highway 154 Bridge

	Frequency of Scores						
		← better			worse →		
Alternatives	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**	**(0)**	**(AVG)**
2	23	5	5	11	22	10	2.6
3B	23	7	17	18	9	2	3.1
3C	23	7	17	18	9	2	3.1
4B	23	4	16	23	10	0	3.1
5B	26	8	16	13	11	2	3.3
5C	26	8	16	13	11	2	3.3

The frequency of years with scores of "5" for spawning (30 cfs or more) under Alternatives 3B, 3C, and 4B would be the same as under baseline operations. However, these alternatives would increase the number of years with scores between 4 and 2 (with the exception of Alternative 4B which has one less year with a score of "4") for spawning (i.e., years with intermediate flows). In addition, these alternatives would have fewer years in which flows are less than 5 cfs (scores of "0" and "1"). Alternatives 5B and 5C would have slightly more years with scores of "5" and "4" than the other alternatives, which is attributed to the higher flow requirements of Alternatives 5B and 5C from February through April. Under Alternatives 5B and 5C, the number of years with intermediate flows (i.e., years with spawning scores of "2" or "3") also would increase. Based on the above, Alternatives 3B, 3C, 4B, 5B, and 5C would result in a beneficial effect (Class IV) on *O. mykiss* spawning compared to baseline operations.

Rearing Habitat

Alternatives 3B, 3C, 4B, 5B, and 5C all show beneficial effects (Class IV) on *O. mykiss* fry rearing along the mainstem of the river compared to baseline operations. The frequency and quality of fry rearing habitat flows under Alternatives 3B, 3C and 4B would significantly improve fry rearing conditions compared to baseline operations (Alternative 2), as shown in **Table 4-44, Scores for *O. mykiss* Fry Rearing at the Highway 154 Bridge**. The higher releases for rearing under these alternatives would result in 50 or more years of rearing habitat with a score of “4” or greater during the 76-year simulation period compared to 17 years under baseline operations. Compared to the other alternatives, Alternatives 5B and 5C would result in the most years (29 years), with a rearing score of “5” being provided for *O. mykiss* fry. Years with scores of “3” or greater would be provided in 75 of the 76 years simulation period for both Alternatives 5B and 5C. In addition to effects from changed flow release patterns, rearing habitat suitability in the reach between Bradbury dam and the Highway 154 bridge is also effected by channel maintenance activities and land use practices.

Table 4-44
Scores for *O. mykiss* Fry Rearing at the Highway 154 Bridge

	Frequency of Scores						
	← better			worse →			
Alternatives	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**	**(0)**	**(AVG)**
2	1	16	38	21	0	1	2.9
3B	0	52	23	0	0	1	3.6
3C	0	54	21	0	0	1	3.7
4B	0	53	22	0	0	1	3.7
5B	29	23	23	0	0	1	4.0
5C	29	26	20	0	0	1	4.1

The results of the analysis of juvenile rearing habitat for the various alternatives (see **Table 4-45, Scores for *O. mykiss* Juvenile Rearing at the Highway 154 Bridge**) follow the same pattern and support the same conclusions as for fry rearing habitat. As with fry rearing, all of the alternatives would have a beneficial effect (Class IV) compared to baseline conditions. Alternatives 3B, 3C, 4B, 5B and 5C all provide substantially more years with scores of “4” than are provided under baseline conditions. In addition, all of these alternatives provide substantially higher average scores compared to baseline conditions.

Table 4-45
Scores for *O. mykiss* Juvenile Rearing at the Highway 154 Bridge

	Frequency of Scores						
		← better			worse →		
Alternatives	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**	**(0)**	**(AVG)**
2	0	15	39	20	0	2	2.6
3B	0	39	35	0	0	2	3.4
3C	0	41	33	0	0	2	3.5
4B	0	41	33	0	0	2	3.5
5B	1	35	38	0	0	2	3.4
5C	1	37	36	0	0	2	3.4

Alternatives 5B and 5C provide one more year with a score of "5" than all of the other alternatives, but slightly lower average scores than Alternatives 3C and 4B.

As indicated by the scoring system described above, the additional flows provided by Alternatives 5B and 5C generally result in beneficial effects on *O. mykiss* habitat. However, this relationship is not always proportional given other complicating factors such as habitat structure, predation, water temperatures, and dissolved oxygen. The following discussion provides a qualitative frame of reference.

Under Alternatives 5B and 5C in wet and above-normal years, 20 cfs would be required at the Highway 154 and Alisal Road bridges from April 15 to June 1. Flows would gradually decrease to 10 cfs by the end of June and would be held until October 1.

The Highway 154 Reach extends 3.2 miles from the dam to Highway 154 Bridge. It has a more confined channel than reaches further downstream and better riparian cover in general. The reach is dominated by pool habitat, with perennial pools present in portions of the reach. Overall, the Highway 154 Reach provides more complex habitat components and structure than what is observed in many reaches downstream.

The Refugio Reach is located between the Highway 154 Reach and Refugio Road bridge and consists mostly of pools and runs. Much of the 4.6 miles of this reach are not accessible for monitoring due to private property constraints. In the summer, flows often become intermittent. Riparian vegetation has increased since 2000 and canopy coverage is increasing as well. Algae growth is the most extensive in this reach, compared with other mainstem reaches. Frequently there is a dry gap in the middle of the reach (approximately 1 mile long) that remains dry even while conducting target flows to the Alisal bridge.

The Alisal Reach extends from the Refugio Road Bridge down to the Alisal Road Bridge (approximately 2.7 miles). This reach is a mix of pool and run habitat with marginal water quality, depending on flow rates. Riparian vegetation is not well developed and canopy cover is poor. Floating mats of algae can be extensive in the summer.

Studies indicate that predatory fish may limit the ability of *O. mykiss* to use pools in the Refugio, Alisal and Highway 154 reaches. Because stream flow is low or absent at times, all fish are forced into these pool habitats. These pools provide good habitat for largemouth bass, as they tend to prefer habitat with little flow variation and warm water temperatures. Bullfrogs also prosper in areas that are wetted year round. Studies show that numbers of young *O. mykiss* decline rapidly in habitats occupied by largemouth bass (Engblom, unpubl. data). *O. mykiss* tend to be more productive in areas where predators are absent, or few in number (i.e., Hilton and Salsipuedes creeks).

Water temperature may also be a limiting factor for *O. mykiss* in the mainstem of the Santa Ynez River. Water temperature tends to increase longitudinally in distance from Bradbury Dam when groundwater influences are not present (SYRTAC 1997). The Highway 154 Reach is about the limit of where releases from Bradbury Dam can provide water temperatures in the preferred range for *O. mykiss*. Even with larger releases of water, such as the WR 89-18 releases, water temperature tends to remain high due to thermal heating as distance increases from the Bradbury Dam (SYRTAC 1997). For example, before the 1996 WR 89-18 release, water temperatures were 18.6 to 19.6°C at 7.8 miles from Bradbury Dam (Alisal Reach). After the release, water temperatures were 17.0 to 25.1°C (SYRTAC 1997). At 9.5 miles from Bradbury Dam, water temperatures were 19.4 to 22.5°C before the release and 17.0 to 27.1°C after the release at the bottom of a pool (SYRTAC 1997). Cool water refuges, caused by groundwater upwelling, have been found in several pools in the Refugio and Alisal reaches, creating cool pockets of water in these reaches. These thermal refuges play an important role during periods of warm temperatures for *O. mykiss* rearing.

In summary, Alternatives 3B-C, 4B, and 5B-C show a beneficial effect over baseline conditions, with Alternatives 5B and 5C showing the most benefits to rearing. Given the habitat complexity and favorable habitat conditions for rearing *O. mykiss* observed in the Highway 154 Reach, additional flow would provide the greatest biological benefit in this reach. The Alisal Reach lacks habitat complexity and favorable rearing conditions for *O. mykiss*. Accordingly, additional flow would not necessarily provide favorable rearing conditions in the Alisal reach.

4.7.2.6 Impacts on Resident Fish along the River

Threshold of Significance

This section evaluates the impacts of the different alternatives on habitat for resident fish (e.g., arroyo chub, largemouth bass, prickly sculpin, catfish) in the mainstem, again using a scoring system. An impact is considered significant if, when using the habitat scoring system evaluating the river flows, a score is less than the baseline condition (Alternative 2).

Discussion of Data and Analyses

As indicated previously, the scoring system is intended to compare the alternatives and does not necessarily provide an accurate measure of habitat quantity or quality. Prior to the construction of Bradbury Dam, summer and fall flows were absent downstream of the dam site. The low-flow period is an important factor in fish population size. Therefore, flows during this time of the year were used to compare the alternatives. The scores in this system range from zero to five, with "0" representing poorer habitat conditions and "5" representing better habitat. The Highway 154 Bridge was selected as the index location for comparing the effects of reservoir releases on mainstem rearing habitat because the river downstream of Highway 154 becomes discontinuous in most years, and as such, habitat downstream of the Highway 154 is often not directly related to mainstem flow.

Scores were equated with flow ranges based on the flow habitat study conducted by the SYRTAC in conjunction with DFG (SYRTAC 1999a). Several habitat types (e.g. pool run, glide, and riffle) were selected for the study. Although top width is not a complete description of habitat, it does provide an index of the amount of available habitat (Swift, 1976; Annear and Condor, 1983; Nelson, 1984). The top width versus flow curves developed in the SYRTAC study were used to assign rankings for habitat. Habitat scores between 0 and 5 were assigned.

In assigning habitat scores, the shape of the wetted perimeter versus flow curve was used as well as the total amount of habitat. At flows below 5 cfs, an increase in flow results in a large increase in top width. At flows from 5 cfs to 10 cfs, moderate increases in top width occur. At flows above 10 cfs, for most habitat types, increases in flow result in slightly wider top width, but the rate of increase is much slower than at lower flows (SYRTAC, 1999a). Therefore, under low-flow conditions, much of the habitat benefits of higher flows is reached by 10 cfs. A score of "5" was assigned to years when flow in the summer would be 10 cfs or more at Highway 154. A score of "0" was assigned to years in which there was no flow during at least one month of the year. Scores associated with intermediate flows are shown below.

Score	Flow Criteria for Highway 154 Bridge
5	≥10 cfs
4	≥5 to <10 cfs
3	≥2.5 to <5 cfs
2	≥1.5 to <2.5 cfs
1	>0 to <1.5 cfs
0	0 cfs

The score for the month in each water year with the lowest average flow for rearing is reported in **Table 4-46, Scores for Resident Fish Rearing at the Highway 154 Bridge**.

Comparison of Alternatives

The quantity and quality of rearing habitat under the project alternatives (Alternatives 3B, 3C, 4B, 5B and 5C) would be significantly greater than under baseline operations (**Table 4-46**) because these alternatives would involve higher rearing target flows, including target flows at Alisal Bridge. Alternatives 3B, 3C and 4B provide significantly more years with scores of "4"and less years with scores of "2" compared to baseline conditions. Alternatives 5B and 5C follow a similar pattern to Alternatives 3B, 3C, and 4B. Alternatives 5B and 5C provide one year when flows are greater than or equal to 10 cfs. There are slightly fewer years with scores of "4," but more years with a score of "3" (intermediate flows) provided by Alternatives 5B and 5C, compared with Alternatives 3B, 3C, and 4B. The additional flow provided under Alternatives 5B and 5C would likely provide slightly more pool depth within the Alisal Reach, which should improve conditions for the other fish inhabiting these pools because it would increase habitat space for these warm water fish in spill years and the year following a spill year. Hence, these alternatives

Table 4-46
Scores for Resident Fish Rearing at the Highway 154 Bridge

	Frequency of Scores						
	← better			worse →			
Alternatives	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**	**(0)**	**(AVG)**
2	0	15	39	30	0	2	2.6
3B	0	39	35	0	0	2	3.4
3C	0	41	33	0	0	2	3.5
4B	0	41	33	0	0	2	3.5
5B	1	35	38	0	0	2	3.4
5C	1	37	36	0	0	2	3.4

would result in a beneficial effect (Class IV) on resident fish rearing along the mainstem of the river compared to baseline operations.

Santa Ynez River Lagoon

The water release operations under the six alternatives are focused on providing benefits in the reaches just below the dam. The releases for passage flows and some emergency winter storm operational releases made predominately during February through May would reach the estuary when the sandbar is open.

Emergency winter operations include precautionary drawdown of Cachuma Lake, releases of initial storm run-off, and temporary surcharging. These operations are implemented under specific guidelines which require the reservoir to have spilled at least once already that year before implementation. The same volume of stormwater passes through the lagoon with or without the emergency winter operations. Qualitative analysis of these operations suggest that a slight (hours) modification of the peak storm flow will produce slightly lower peak inflows into the lagoon for a slightly prolonged period of time. An analysis of historic flow and precipitation records indicate that emergency winter operations would occur in about 30 percent of years (in 14 of the 47 post-Cachuma years studied) (Reclamation, 1999). River flows under emergency winter operations are well within the range of natural storm events to which lagoon species are adapted and are not substantially modified from baseline conditions. Thus, the emergency winter operations are anticipated to have, at most, slight changes in water quality (decrease in salinity or increase in dissolved oxygen). The same may be true of the passage releases, but they would likely be of lower magnitude than the releases for emergency storm operations, but of longer duration.

Alternatives 3B, 3C, 4B, 5B and 5C are anticipated to have a slight beneficial effect on lagoon residents due to increases in flow to the lagoon during emergency winter operations and passage releases, which would likely slightly increase dissolved oxygen levels and reduce the salinity in the upper portion of the lagoon. The increase in flow under Alternatives 3B, 3C, 4B, 5B and 5C, relative to Alternative 2, may have a beneficial effect on steelhead and other marine species that enter the lagoon to spawn (such as Pacific herring). Higher flows also allow for a breach to be maintained.

4.7.3 Mitigation Measures

No mitigation is required because the project alternatives would not result in any significant adverse impacts to fish in Cachuma Lake or along the lower Santa Ynez River, including the endangered southern California steelhead *O. mykiss.*

4.8 RIPARIAN AND LAKESHORE VEGETATION

4.8.1 Existing Conditions

4.8.1.1 Vegetation Along the Margins of Cachuma Lake

A variety of native vegetation types occurs around Cachuma Lake, as summarized below and shown on **Figure 4-7, Vegetation Surrounding Lake Cachuma**.

Grasslands are common on the flats and slopes northwest of Cachuma Lake and are dominated by introduced species such as wild oats *(Avena fatua),* soft chess *(Bromus mollis),* and Italian ryegrass *(Lolium perenne).* Native spring flowering herbs are also present, including *Amsinckia* sp. and *Layia platyglossa.*

Coast live oak (*Quercus agrifolia*) woodlands occur throughout the vicinity of Cachuma Lake, primarily on protected north-facing slopes and ravines. These woodlands often include a dense understory of poison oak *(Toxicodendron diversilobum),* toyon *(Heteromeles arbutifolia),* sagebrush *(Artemisia californica),* redberry *(Rhamnus crocea),* blackberry *(Rubus ursinus),* and elderberry *(Sambucus mexicana).* Valley oak *(Q. lobata)* and blue *(Q. douglasii)* oak trees are present in smaller numbers.

Chaparral is common on dry, rocky slopes and is dominated by big pod ceanothus *(Ceanothus megacarpus),* spiny redberry *(Rhamnus crocea),* chamise *(Adenostoma fasciculatum),* sage *(Salvia* sp.*),* and scrub oak *(Quercus berberidifolia).*

Scrub vegetation occurs along the north shore of Cachuma Lake on steep south-facing slopes. Scrub vegetation within the study area is classified as Venturan coastal sage scrub dominated by *Artemisia californica* and various sage species *(Salvia* spp.*).*

Freshwater marsh areas occur in scattered locations around the margins of Cachuma Lake where there is shallow water. Dense stands of emergent wetland plants are present dominated by cattail *(Typha* spp.), bulrush *(Scirpus* spp.), sedges *(Carex* spp.), curly dock *(Rumex* sp.*),* smartweed *(Polygonum* sp.*),* speedwell *(Veronica* sp.*),* and duckweed *(Lemna minor).* Marsh areas are often bordered by stands of mulefat *(Baccharis salicifolia)* and willow *(Salix lasiolepsis, S. laevigata, S. lasiandra).*

Riparian vegetation is located in scattered narrow bands around the lake, along Cachuma and Santa Cruz creeks, and along several other smaller intermittent streams that empty into the lake. This vegetation is dominated by mulefat, willow, coyote brush (*Baccharis pilularus*), poison oak, box elder *(Acer negundo),* hoary nettle *(Urtica holosericea),* and bristly ox tongue *(Picris echioides).* Tamarisk (*Tamarix* spp.) scrub occurs in scattered areas around the lake on sandy or gravelly braided washes.

4.8.1.2 Santa Ynez River

Vegetation Types

Vegetation types along the Santa Ynez River are described below based on the 1995 Contract Renewal EIR/EIS and updated information from Jones & Stokes (2000).

Riparian Types:

- **Open Water/Live Stream (Wet Low Flow Channel)** - seasonal live streams, and ephemeral or semi-permanent pond and pools. Herbaceous vegetation may or may not be present.

- **River Wash (Dry Low Flow Channel)** - areas of the river channel which are usually devoid of vegetation due to the time of year (dry season). Includes sand, gravel, or boulder substrate.

- **Barren River Terrace** - arid terraces within the river channel that are naturally devoid of vegetation. Fluvial gravel deposits with exposed soils dominate this portion of the river.

- **Disturbed River Wash/Terrace** - areas of the river channel that have been subject to disturbance such as mining, flood control activities, or ORV use; may or may not be devoid of vegetation. Dominant plant species include willow (*Salix* spp.), mulefat (*Baccharis salicifolia*), coyote brush (*Baccharis pilularis*), sweetclover (*Melilotus indicus*), tree tobacco (*Nicotiana glauca*), mustard (*Hirschfeldia incana*), California chicory (*Rafinesquia californica)*, cheeseweed (*Malva parviflora)*, Italian thistle (*Carduus pycnocephalus)*, cocklebur (*Xanthium strumarium)*, pineapple weed (*Chamomilla suaveolens)*, and grasses such as *Bromus diandrus, B. rubens*, and *Hordeum leporinum*.

- **Freshwater Marsh** - freshwater or brackish emergent, persistent vegetation with or without open water at the lowest elevations in the channel. Dominant plant species include cattails (*Typha* spp.), sedges and bulrushes (*Carex* spp., *Cyperus* sp., *Scirpus* spp.), dock (*Rumex* sp.), smartweed (*Polygonum* sp.), speedwell (*Veronica* sp.), plantain (*Plantago* sp.) and duckweed (*Lemna minor*).

- **River Terrace Scrub/Herbland** - the portion of the stream channel that is dominated by fluvial gravel deposits with a near absence of perennial species. The herbaceous element of this type ranges from nearly non-existent to near complete ground cover during late summer. Coyote brush, scalebroom *(Lepidospartum squamatum),* mustard, sweet fennel *(Foeniculum vulgare),* and non-native grasses occur in scattered small patches on high terraces.

- **Willow/Mulefat Scrub** - occurs generally along the low flow channel banks. Dominant plant species include arroyo, red and yellow willow (*Salix lasiolepsis*, *S. laevigata, S. lasiandra*), mulefat, coyote brush, poison oak (*Toxicodendrum diversilobum*), blackberry (*Rubus ursinus*), elderberry (*Sambucus mexicana*), box elder (*Acer negundo*), hoary nettle (*Urtica holosericea*), bristly ox-tongue (*Picris echioides*).

- **Riparian Woodland/Forest** - occurs along the edges and banks of the river. Vegetation is dominated by arroyo willow and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and Fremont cottonwood (*Populus fremontii*). These species are intermixed with mature willow-forest species including sandbar and yellow willow.

- **Oak Riparian Forest** - coast live oak *(Quercus agrifolia)* dominates this type that occurs primarily on protected north-facing ravines within the river channel. Associated species include toyon *(Heteromeles arbutifolia)* and elderberry *(Sambucus mexicana).*

Estuarine Types:

- **Saltwater Marsh -** low-growing perennial herbs in tidally influenced area dominated by pickleweed *(Salicornia* sp.*),* marsh jaumea *(Jaumea carnosa),* saltgrass *(Disticlis spicata)* and frankenia *(Frankenia salina)* occur at the Santa Ynez River lagoon.

Upland Types:

- **Grassland –** occurs adjacent to the river channel on arid hillsides; also a component of oak woodlands. Dominant non-native species include *Avena fatua* and *Bromus* spp. Dominant native species include *Amsinckia* sp. and *Layia platyglossa.*

- **Oak Woodland/Forest -** includes all woodlands and forests occurring outside of the river floodplain. Coast live oak is dominant. Blue and valley oak species also occur.

- **Chaparral –** occurs on dry, rocky slopes. Dominant species are big pod ceanothus *(Ceanothus megacarpus),* spiny redberry *(Rhamnus crocea),* chamise *(Adenostoma fasciculatum),* sage *(Salvia* sp.*),* and scrub oak *(Quercus berberidifolia).*

- **Coastal Sage Scrub –** occurs on dry, rocky slopes. Dominant species include California sagebrush *(Artemisia californica*), laurel sumac (*Malosma laurina*), coast prickly pear (*Opuntia littoralis*), and sage *(Salvia* sp.*).*

Riparian Vegetation Conditions Within Each Reach

The 1995 Contract Renewal EIR/EIS divided the river from the dam to the ocean into nine study reaches and described riparian vegetation conditions, as shown on **Figures 4-8a, Vegetation along the Santa Ynez River,** and **4-8b, Vegetation along the Santa Ynez River**. The dominant vegetation types, relative density ranking, relative disturbance ranking, and adjacent land uses for each reach are summarized on each figure.

The densest reaches below the dam are located from Highway 101 at Buellton to Highway 246 (18 miles) and from the Lompoc Wastewater Treatment Plant to the ocean (9 miles). In the former area, the vegetation is attributable to favorable groundwater conditions, a lack of recent scouring, and only minor human disturbance. Riparian growth in the Lompoc Valley is probably enhanced by the low river gradient that limits scouring effects, extensive agricultural run-off, and the discharges from the Lompoc Wastewater Treatment Plant.

The least dense reach is from the dam to San Lucas Bridge where there is very low soil moisture and a predominance of coarse substrate. This area includes the Santa Ynez subarea of the Above Narrows Alluvial Groundwater Basin. The basin is prone to dewatering during extended droughts.

The density and pattern of vegetation along the river are a result of many factors, including the time since the last major flood, extent of human disturbance, and seasonal and long-term riparian groundwater levels which have been influenced by the target flow releases for fish since 2001. A study was conducted as part of the 1995 Contract Renewal EIR on vegetation dynamics along the river since 1969. In 1969, a flood destroyed much of the riparian vegetation along the river, creating a new successional process that has not been curtailed and re-initiated by another flood since 1969. The results of the study indicated that there has been a steady and dramatic increase in both scrub and woody riparian vegetation since 1969 except for:

1. localized die-outs of willows, sycamores, and cottonwoods during the 1987–1990 drought; and
2. localized removal of vegetation due to flood flows during 1983, 1995, 1998, and 2001.

Despite these occasional natural disturbances, the pattern of riparian vegetation along the river (i.e., the relative distribution and position of various vegetation types) has remained relatively constant since 1969, suggesting that a predictable pattern of riparian plant growth is occurring based on the physical and hydrologic conditions since 1969. At this time, the overall extent of riparian vegetation from the dam to the ocean is the highest since 1969. In addition, the current density of vegetation is also the highest since the earliest air photo records in 1928.

The trend for increased riparian vegetation along the banks of the Santa Ynez River has continued with the additional release flows for protection of *Oncorhynchus mykiss*. The amount of riparian vegetation along the riverbanks in 2010 has not been quantified, but there is a considerable increase in the streamside vegetation since the original 2003 Draft EIR was prepared.

Santa Ynez River Riparian Vegetation Monitoring Program

In Order WR 73-37, the SWRCB required Reclamation to develop and implement a riparian vegetation-monitoring program to determine the effect of releases on riparian vegetation downstream of the dam. The SWRCB imposed this requirement in response to concerns expressed by the California Department of Fish and Game. SWRCB Order WR 94-5 required Reclamation to submit a report on the riparian vegetation-monitoring program by February 1, 2000. Initially, Reclamation prepared a vegetation study based on a series of historic aerial photographs (Holland 1988). Reclamation and the Member Units completed a more comprehensive study in 2000 (Jones & Stokes, 2000) and submitted it to the SWRCB.

The objectives of the Jones & Stokes (2000) study were to: (1) identify key factors that affect the establishment and growth of riparian vegetation along the river; and (2) determine how hydrologic changes associated with water rights operations since 1973 have affected the extent and condition of riparian vegetation. The study first involved a review of riparian vegetation using time series aerial photographs from 1938 to 1996. Based on the review, Jones and Stokes identified vegetation changes, and if possible, the underlying causes of the changes, particularly any changes possibly related to Cachuma Project operations. Jones and Stokes conducted field surveys in 1996 to further investigate the vegetative changes and underlying causes.

Based on the review of aerial photographs from 1938 to 1996, Jones & Stokes (2000) observed various vegetative changes along the river which were due to major flood events that caused scouring and channel widening; conversion of floodplain to agriculture; and channel clearing for instream aggregate mining. The only vegetative change observed on the aerial photographs that Jones and Stokes could attribute to operations of the Cachuma Project was a reduction in riparian vegetation in the downstream construction zone of Bradbury Dam, and on a floodplain area about one mile downstream of the dam.

To further investigate the various vegetative changes, Jones and Stokes established 17 transects along the river for more detailed data collection. Both natural and human-induced factors have affected the vegetation along the river since the construction of Cachuma Lake. Primary natural factors include droughts, floods, and plant succession. Primary human-induced factors include land use conversion, sediment trapping and peak flow attenuation by Cachuma Lake, releases from Cachuma Lake for purposes of satisfying downstream water rights, and managed groundwater levels in the riparian aquifer.

The overriding natural cause of vegetation change since the dam was constructed was the extensive removal of vegetation during the January 1969 flood. Other smaller, but important flood events occurred in 1978, 1983, 1993, 1995, 1998, and 2001 which caused vegetation removal at specific locations. Following the 1969 flood (as well as others), gradual recolonization by native plants occurred, resulting in a natural successional process. Most of the areas scoured in the 1969 flood have recovered, although there are a few notable areas that remain barren. Natural floods have also caused channel incision along portions of the river, particularly between the dam and Refugio Road. The lowering of the channel reduces soil moisture in the adjacent floodplain, causing a conversion from riparian woodland to more xeric shrub communities.

Land use conversions have occurred along the entire river, resulting in the removal of riparian vegetation from floodplains for agriculture, land development, and recreation. In-stream aggregate mining near Buellton has limited riparian vegetation during active operations. However, upon abandonment of the mined areas, wetland vegetation often becomes established quickly because the channel has been lowered and a greater percentage of fine sediments are left behind. Wastewater discharges at Solvang, Buellton, and Lompoc have caused localized increases in riparian vegetation over the years. While it is evident from visual surveys along the Santa Ynez River that woody riparian vegetation has increased in the intervening years since the 2000 Jones & Stokes survey was completed, no formal quantification of the riparian vegetation has subsequently been undertaken to substantiate this increase in vegetation.

Jones & Stokes (2000) identified the following project-related factors that have affected the riparian vegetation downstream of Bradbury Dam:

- Reduced Sediments. The Cachuma Project has reduced sediment load below the dam, causing channel incision and armoring between the dam and Refugio Road. Observations in the field suggest that the river system is now in a new equilibrium with current sediment loading from tributaries, and that further channel degradation is not likely. Localized channel downcutting due to the interruption of sediment load may reduce future flooding of higher riparian terraces. These areas may gradually convert to more xeric plant communities over time, as the rate of riparian recruitment decreases.

- Reduction in Peak Flows. The project has reduced peak winter flows and the frequency of small to moderate high flow events, causing lower flows in the spring, as well as more rapid flow recession in the spring. The decrease in peak flows can limit the extent, duration, and frequency of flows that inundate the low floodplain. Consequently, the zone of potential riparian recruitment may be reduced to the banks of the low flow channel and active channel bed. This effect would be most pronounced in the reach immediately below the dam, upstream of major tributaries.

- Effect on Channel Migration. Channel migration, which is important to riparian colonization, is also affected by changes in the extent, duration, and frequency of flows. Channel migration since the project has been constructed may be more gradual with the attenuated peak flows and their more limited area of effect.

- Effect of ANA and BNA Releases. Typically, Reclamation releases water from the ANA and BNA in the summer after the seed germination and plant establishment period. Hence, these releases do not affect riparian recruitment. However, the releases support riparian growth along the low flow channel that would not otherwise be present. Releases for groundwater replenishment and fish have little effect on the geomorphic processes that determine the channel width and alignment due to their low velocities.

- Effect of Managed Groundwater Levels. Jones & Stokes (2000) assessed the effects of groundwater levels in the Above Narrows Alluvial Groundwater Basin on riparian vegetation. Jones and Stokes examined historic water levels of 26 wells along the river to correlate trends in groundwater levels since 1973 with observations on historic patterns of riparian vegetation. With few exceptions, the annual and seasonal patterns of groundwater levels could not be linked to specific operational changes of the Cachuma Project. Most of the persistent changes in groundwater levels have been very small (less than 3 feet) and were not clearly caused by changes in releases for water rights. Jones & Stokes (2000) observed that, even in dry years, groundwater levels in the basin remained less than 10 feet below the channel thalweg along most of the river, and remained at relatively constant depths below the ground surface on the banks of the river. The groundwater has been maintained at depths suitable to support mature phreatophytic plants (such as willows and cottonwoods), in combination with winter flows. Jones & Stokes (2000) concluded that the operations of the Cachuma Project since 1973 have not altered groundwater conditions in a manner that adversely affects riparian vegetation.

Jones & Stokes (2000) conducted a survey of the riparian vegetation along the river in November 1996 to qualitatively assess its condition. They concluded that riparian vegetation along the river downstream of the dam is in good condition, with multiple age-classes of vegetation, a diversity of both woody and herbaceous native plants, and complex canopy structure at most sites. In general, the riparian forest along the river is well developed for an intermittent stream. Native vegetation occupies major portions of the river channel and floodplain. In some undisturbed areas, there were stands of riparian vegetation up to 2,000 feet wide. Bare riverwash areas in the channel between the dam and Buellton occur on the low floodplain and in the active channel. This condition is due to periodic flood events that displace vegetation of all age classes along the coarse unconsolidated substrate.

Jones and Stokes observed recent recruitment at most sites surveyed, as evidenced by the presence of seedlings, saplings, and stand of young plants. Non-native invasive plants, such as tamarisk and giant reed, occurred in very small numbers. Indications of drought stress at the time of the survey (which occurred in the driest time of the year, prior to winter rains) were generally absent. Jones and Stokes did not note any evidence of the 1988–91 drought, such as dead stands of trees, in contrast to the presence of such evidence along most California river systems. Most trees and shrubs exhibited good vigor and full canopy during the surveys.

Jones and Stokes observed frequent secondary high flow channels and bend cutoffs throughout the floodplain. These dry riverwash areas were generally devoid of vegetation due to low substrate moisture. Evidence of recent channel incision is common between the dam and Refugio Road, and along a portion of the river between Santa Rosa Creek and the Narrow where the river channel shifted during a flood event. Field evidence of channel incision includes high steep banks devoid of vegetation, channel headcutting at tributary mouths, and high floodplains that appear to be recently abandoned due to the presence of older riparian woodland and younger upland shrubs.

Jones & Stokes (2000) concluded the following:

- The quality of the riparian vegetation along the river is good, with multiple age-classes, a diversity of woody and herbaceous native plants, and complex canopy structure. Recent recruitment was evident at most locations, although limited to a narrow band along the low flow channel between the dam and Buellton.

- The primary influences on the condition and distribution of riparian vegetation on the river are past natural flood events and land use conversions.

- It does not appear that the reduction in spring flows and more rapid spring flow recession due to Cachuma Project operations have limited recruitment needed to replace natural population losses along the river. Mature riparian vegetation is healthy and vigorous, and recruitment is observed throughout the river. In addition, because flood flows are episodic and woody riparian species are relatively long lived, it is not necessary to annually inundate the flow floodplain and recruit new growth to maintain a self-sustaining woodland.

- The effect of the project on depth of groundwater does not appear to have had any direct impact on the distribution or vigor of riparian vegetation.

Jones and Stokes did not detect a measurable effect on the extent and condition of riparian vegetation due to the change in project operations from the live stream operations (1953-73) to the managed release program under Order WR 89-18.

4.8.1.3 Sensitive Plant Species

This section addresses the occurrence of sensitive plant species at Cachuma Lake and along the river below Bradbury Dam. Sensitive species consist of state and federally listed, proposed, and candidate plants; state "species of special concern" identified by CDFG; and species considered rare and endangered by the California Native Plant Society (Skinner and Pavlik, 1998).

- **Beach Layia (Layia carnosa) (CE, FE)**. Beach layia is a state- and federally-listed endangered species. It occurs in coastal foredunes at a few widely separated locations in northern and central California. Beach layia is a low-growing, glandular, succulent annual that flowers from May through July. It has not been seen in Santa Barbara County since 1929, when it was collected at the Santa Ynez river mouth. This species is presumed extirpated from the project area.

- **Beach Spectaclepod (Dithyrea maritima) (CT)**. Beach spectaclepod is a state-listed threatened species. It is a prostrate perennial herb that occurs on relatively undisturbed coastal foredunes from Morro Bay to Los Angeles County and on San Miguel Island and occurs in the back slopes of foredunes at Surf.

- **La Graciosa Thistle (Cirsium loncholepis) (CT, FE)**. La Graciosa thistle is a state-listed threatened and federally listed endangered species. It is an annual to short-lived perennial herb that occurs in brackish and freshwater wetlands, mostly near the coast, in northern Santa Barbara and southern San Luis Obispo counties. It was reported to have been found in the vicinity of Surf, and 2 miles east of the rivermouth, but it has not been found in recent years, despite repeated surveys, and is now presumed extirpated from these areas.

- **Surf Thistle (Cirsium rhothophilum) (ST)**. Surf thistle is a state-listed threatened species. It is a perennial herb that occurs on relatively undisturbed coastal foredunes in San Luis Obispo and Santa Barbara counties, including on the dunes near Surf.

- **Crisp Monardella (Monardella crispa) (CNPS-1B)**. The California Native Plant Society considers Crisp monardella to be rare and endangered. It is a perennial herb that occurs in open sandy areas on coastal dunes, including both fore- and backdune areas. Although it has reportedly been found in the dunes near Surf, these reports appear likely to have been of M. frutescens.

- **San Luis Obispo Monardella (Monardella frutescens) (CNPS-1B)**. The California Native Plant Society also considers San Luis Obispo Monardella to be rare and endangered. This species is a perennial herb that flowers from May through September and occurs in dune scrub on stabilized back-dunes along the coastline of northern Santa Barbara and southern San Luis Obispo Counties. This species is abundant on San Antonio Terrace. It also occurs on the dunes north and south of the Santa Ynez river mouth.

Potential impacts to these species are discussed in **subsection 4.8.2.5**.

4.8.2 Potential Impacts of the Alternatives

4.8.2.1 Impacts to Lakeshore Vegetation

Threshold of Significance

An impact to lakeshore vegetation is considered significant when surcharge inundation of the Alternatives would substantially remove or convert existing vegetation types over large areas compared to the baseline (Alternative 2).

Discussion of Data and Analyses

The maximum lake level under baseline operations (Alternative 2) is 750.75 feet. Maximum lake levels would increase 1.8 feet under Alternatives 3B and 5B, and 3.0 feet under Alternatives 3C, 4B and 5C due to surcharging the reservoir, relative to the 750.75 feet elevation. Surcharging to 3.0 feet occurred in 2005 and 2006.

The effect of surcharging on lake levels is discussed in **subsection 4.2.2.2**. Surcharging is expected to occur, on average, about once every three years (**Table 4-4**). The frequency of achieving the maximum lake level is about 11 percent of the time for all alternatives (**Table 4-5**). The median number of consecutive months at the maximum lake level is about four months (**Table 4-6**) under all alternatives. The area affected by increased lake levels is dependent upon the slope of the shore. Using topographic and bathymetric maps, an estimate was developed of the total area inundated by surcharging at 1.8 feet (Alternatives 3B and 5B) and 3.0 feet (Alternatives 3C, 4B and 5C). The results are shown in **Table 4-47**, **Inundation Acreage and Width Due to Surcharging**. They indicate that the total acreages affected by the 1.8-foot and 3.0-foot surcharging are 42 and 91 acres, respectively. The average widths of effect are 15 and 25 feet, respectively.

Table 4-47
Inundation Acreage and Width Due to Surcharging

Maximum Lake Elevation (feet)	Area (acres)	Increase in Area (acres)	Average Width of Inundation Zone	Maximum Width of Inundation Zone (feet)
750.75 (baseline operations – Alt. 2)	3,056	--	--	--
751.8 (1.8' surcharge, Alts. 3B & 5B)	3,098	42	15	218
753.0 (3' surcharge, Alts. 3C, 4B & 5C)	3,147	91	25	363

Increased maximum lake levels over baseline conditions (750.75 feet) would alter the vegetation along the margins of the lake above the water level. The periodic inundation during surcharge years is likely to destroy upland vegetation types over time. The effect could require up to 10 years to occur. For example, inundation of upland vegetation for one month or less may not be sufficient to kill woody plants. However, prolonged inundation over one year, or repeated inundation over many years, may have a severe effect.

Upland vegetation above the current lake levels would be converted to one of several other habitat types, depending upon the slope and substrate of the shoreline: (1) bare shoreline would develop on steep slopes that were once vegetated with chaparral or coastal sage scrub; (2) annual grassland with a small percentage of wetland herbs would develop on moderate slopes that were vegetated with grassland or oak woodlands; and (3) emergent wetland would develop on very flat slopes that contained annual grassland because the depth of water would be shallow during surcharging.

Comparison of Alternatives

To estimate the effect of higher lake levels on shoreline vegetation, boat surveys were conducted in 2005 and 2007 to identify and map vegetation types in the inundation zone associated with the 1.8 and 3.0-foot surcharging. The results are presented in **Table 4-48, Lakeshore Vegetation Affected by Surcharging**, and indicate the most common upland vegetation types that would be affected are chaparral and oak woodland. The destruction of upland vegetation types (excluding oak woodlands) listed in **Table 4-48**, under Alternatives 3B, 3C, 4B, 5B and 5C (compared to baseline operations) is considered an adverse, but not significant impact (Class III) because of the small acreage involved compared to the total acreage of these common vegetation types in the area. Impacts of surcharging on oak woodlands are addressed below in **subsection 4.8.2.2**.

Table 4-48
Lakeshore Vegetation Affected by Surcharging

Vegetation	% of Lake Margin Vegetation	Acres Affected by Periodic Flooding above 750.75 feet	
		1.8 Inundation Zone	3.0 Inundation Zone
Chaparral	39.5	16.6	35.9
Oak woodland	26.5	11.1	24.1
Freshwater marsh	25.3	10.6	23.0
Coastal sage scrub	2.7	1.1	2.5
Grassland	2.4	1.0	2.2
Barren slopes	1.8	0.76	1.6
County Park (turf, bare slope)	1.8	0.76	1.6
TOTAL		41.9	90.9

Chaparral vegetation comprises the largest percentage of lake margin vegetation (39.5 percent **Table 4-48**). Although chaparral is not considered a sensitive plant community, it does have habitat value for a variety of species. The Cachuma Lake Recreation Area, managed by Santa Barbara County, encompasses approximately 9,250 acres. Of the 9,250 acres, Cachuma Lake covers over 3,000 acres and chaparral vegetation covers nearly 1200 acres. At the 3-foot surcharge level 35.9 acres of chaparral habitat would be lost over a period of time. These 35.9 acres of lost habitat is 3 percent of the total chaparral vegetation contained within the Cachuma Lake Recreation Area. Because of the small percent of total acreage lost, this is considered an adverse, but not significant impact.

Freshwater marsh areas around the margins of the lake are expected to persist under higher maximum lake levels. Wetlands are located in shallow water areas around the lake where there are flat or very low gradient slopes under water. Raising the lake level at these locations would essentially shift the wetlands upslope. Hence, surcharging the reservoir under Alternatives 3B, 3C, 4B, 5B, and 5C would have a neutral effect on wetlands along the lake margins.

4.8.2.2 Impacts to Lakeshore Oak Trees

Threshold of Significance

An impact to lakeshore oak trees is considered significant when surcharge inundation of the Alternatives would substantially affect the survival of oak trees around the lake compared to the baseline (Alternative 2).

Discussion of Data and Analyses

The 2007 Revised Draft EIR identified the impacts to oak trees as a significant, unmitigable impact (Class I). The 2007 Revised Draft EIR did not describe impacts associated with loss of the chaparral and oak woodland communities. Chaparral communities are not afforded any special protection, either within Santa Barbara County or on a state level, despite their obvious importance in supporting a suite of plants and wildlife that are an integral part of the Lake Cachuma ecosystem. Of the 3,147 acres of lakeshore margin that were impacted by the surcharge, chaparral comprises 39.5 percent and is the plant community most impacted.

Oak woodlands are recognized as a significant plant community by both Santa Barbara County and the state. Of the 3,147 acres of lakeshore margin impacted by the surcharge, approximately 24.1 percent supported oak woodlands. The complexity of restoring lost oak woodland functions—including the interactions of soil, understory species and the oaks, as well as intricate weave of invertebrate and animal species that rely on these woodlands for nesting, roosting, foraging and other life-cycle needs—has resulted in efforts by Santa Barbara County and the state to require analysis of these impacts, in addition to the loss of individual oak trees. This analysis was not included in the 2007 Revised Draft EIR, and sufficient data is not available to provide a detailed analysis in this document. Given those limitations, and acknowledgement that the Cachuma Project is on federal lands rather than directly under the jurisdiction of the county or state, a reasonable default has been to acknowledge that the loss of approximately 755 acres of oak woodlands along the lake margin should be compensated for by developing an integrated Oak Woodland Restoration Plan that, at minimum, achieves the identified ratio of 2:1 replacement of each individual oak lost after 20 years.

Surcharge to 3.0 feet was implemented in 2005, therefore, impacts associated with 1.8-foot surcharge proposed under Alternatives 3B and 5B, and 3.0 feet under Alternatives 3C, 4B, and 5C have occurred. Based on the anticipated loss of as many as 452 oaks associated with 3.0-foot surcharge, the 2007 Revised Draft EIR identified impacts to oaks as a significant, unmitigable impact (Class I), until such time that replacement trees become established and self-sustaining, which is estimated to take about 10 years. After this time, the loss of oaks under Alternatives 3B, 3C, 4B, 5B, and 5C is considered significant, but mitigable (Class II). The 2007 Revised Draft EIR estimated that surcharge to 753 feet elevation (3.0 feet surcharge) would occur approximately every three years; however, surcharge to 753 feet took place immediately following installation of the flashboards in 2005 and again in 2006. A follow-up shoreline survey of oaks was done in 2007 to assess the actual oak tree loss associated with these surcharge events.

A total of 612 oaks were found dead, with an additional 263 deemed at risk. This is more than the estimated 452 oaks that were identified as potential losses in the 2007 Revised Draft EIR and upon which the mitigation-planting plan was based. As of 2010, a total of 1,881 oaks (1,714 coast live oaks and 167 valley oaks) have been planted. The survival rate is 94 percent for the coast live oaks and 90 percent for the valley oaks. Planting an additional 374 oaks is planned for 2011, bringing the total of oaks planted to 2,256 trees.

According to the 2007 Revised Draft EIR, required survival rate after 20 years is a 2:1 for all oaks that have been lost, both as a result of the surcharge impacts as well as replacing planted mitigation oaks that failed. Of the 1,881 oaks planted thus far, a total of 122 have died. This represents a current survival ratio of 2.4:1 (based on a loss of 734 trees to date). The initial intention was to plant replacement trees at a 5:1 ratio, providing a buffer for losses to occur over the 20-year monitoring time frame. To achieve that planting ratio, based on the documented loss of 612 oaks on the shoreline and 122 mitigation oaks that died, a total of 3,670 oaks would have to be planted. If subsequent surveys find that additional oaks identified as at risk have also declined, this number could increase.

Maintenance and watering of the mitigation oaks is anticipated to continue until 2013, approximately eight years into the required monitoring cycle. Once regular watering is discontinued, loss of additional oaks can be anticipated. Because of the time lag between loss of mature oaks and growth of replacement planting, the level of significance for this impact remains at Class I, until such time as the replacement planting ratio of self-sustaining oaks is achieved.

As shown in **Table 4-48**, surcharging to 1.8 and 3.0 feet -has affected oak woodlands that occur along the margins of the lake. To determine more precisely the magnitude of the impacts of surcharging under Alternatives 3B, 3C, 4B, 5B and 5C, field surveys were conducted to inventory the number of trees in the inundation zone (**Figure 4-9, Oak Trees Along the Margins of Lake Cachuma**). Surveys were conducted from both the shore and from a boat in June and August 2005 and again in August 2007. Coast live oaks with a diameter at breast height of 6 inches or greater and valley oaks with a diameter at breast height of 4 inches or greater were inventoried, in accordance with the County of Santa Barbara standards. Field estimations were supplemented by a review of detailed topographic maps depicting large trees in the County Park (1 inch equals 100 feet in scale). A topographic map at scale 1 inch equals 400 feet was used along the margins of the lake.

The number and species of oak trees in the two new inundation zones (1.8 and 3.0 feet) above the current maximum lake level were inventoried. The number of trees in a 3-foot-wide zone above the new maximum lake levels were also inventoried. Trees were characterized as dead, root crown submerged (RCS), and at risk (above the high water level but threatened by exposure to flooding or bank failure). This zone represents an area subject to wave action during winter storm or windy days, as well as possible storm surcharging which occurs during very high inflows to a lake that is already filled. Based on the increased numbers of oaks impacted, the Oak Restoration Management Plan was extended to plant additional oaks through 2011 to meet the ratio requirements (Fournier 2010).

Cachuma Lake exhibits a clearly visible high-water line below which oak trees are mostly absent. The few oaks that are rooted below the former high water mark at 750.75 feet elevation are in poor condition due to root flooding, as well as damage from wave action that has caused the trees to become unstable or topple. Oak trees located at or within several feet of the current high-water line often have exposed roots. Many are also located on eroding, undercut banks that have been affected by wave action and storm surcharging. These field observations confirm that oak trees within the new maximum lake level will eventually perish due to a combination of root flooding and physical disturbance from wave action. The field observations also suggested that a portion of the trees in the wave action zone (that is, three feet above the new maximum water elevation) would be destroyed due to root flooding and/or wave action. The loss of trees in the direct inundation zone was expected to occur over many years, possibly 10 or 15 years, and the loss of 612 oaks between 2005 and 2007 related to two surcharge events was higher than anticipated. The loss of trees in the wave action zone is also expected to occur over a longer period of time, possibly 20 or more years based on field observations of trees in the former wave action zone created over 40 years ago. A summary of the total number of oak trees lost due to the surcharge following the 2004-05 rainy season to 752.28 feet, which is greater than the 1.8-foot surcharge of Alternatives 3B and 5B, reaching almost to the 3.0-foot surcharge of Alternatives 3C, 4B, and 5C is provided in **Table 4-49**, **Revised Summary of Oak Tree Conditions Affected in Inundation Zones, 2005 and 2007**,

Table 4-49
Revised Summary of Oak Tree Conditions Affected in Inundation Zones
2005 and 2007

	RCS*	At Risk	Dead	Total Oaks Impacted
Survey 1 (June 1 2005)	558	74	0	632
Survey 2 (August 10, 2005)	40	546	245	831
Survey 3 (August 27, 2007)	NA	263	612	889

**RCS = root crown submerged*

Comparison of Alternatives

The loss of oak trees under Alternatives 3B, 3C, 4B, 5B and 5C along the margins of Cachuma Lake is considered a significant, unmitigable impact (Class I) until such time that replacement trees become well established and self-sustaining, estimated to be about 10 years. After this time, the loss of oak trees under

Alternatives 3B, 3C, 4B, 5B and 5C along the margins of Cachuma Lake is considered a significant, but mitigable impact (Class II). An oak tree restoration program, described below in section 4.8.3, has been designed and is being implemented to compensate for the loss of trees at the lake. Depending upon additional loss of oak trees due to surcharging and the rate of growth of new trees, the lag time between tree loss and establishment of self-sustaining trees may be very small.

4.8.2.3 Impacts to Riparian Vegetation along the River

Threshold of Significance

An impact to riparian vegetation along the Santa Ynez River is considered significant when the effects of the Alternatives would substantially remove or reduce existing riparian vegetation stands through spill releases compared to the baseline (Alternative 2).

Discussion of Data and Analyses

As described in **subsection 4.2.2.3**, Alternatives 3B, 3C, 4B, 5B, and 5C would alter downstream hydrology in the following manner compared to baseline operations (Alternative 2):

- The spill frequency and average annual spill amount under the project alternatives would be slightly less than under baseline operations.
- The releases for steelhead flows downstream of the dam under Alternatives 3B, 3C, 4B, 5B, and 5C would be greater than under baseline operations (Alternative 2) because they would involve passage flows and higher rearing target flows.
- Releases for purposes of satisfying downstream water rights under Alternatives 3B, 3C, 4B, 5B and 5C would be slightly less than under baseline operations because the additional releases for fish under these alternatives would reduce the need for releases to replenish groundwater basins.
- The frequency and amount of low-flows (2-5 cfs) downstream of the dam (to Alisal Road) are similar among project alternatives 3B, 3C, 4B, 5B and 5C, and more than under baseline operations.

Comparison of Alternatives

- Alternatives 3B, 3C, 4B, 5B, and 5C would slightly reduce (2-5 percent) the frequency of spills compared to baseline operations. (See **Table 4-7**.) Uncontrolled downstream flows facilitate riparian recruitment on floodplains and may be necessary for the long-term health of the riparian vegetation. The reduction in spill frequency is considered a potentially adverse, but less than significant impact (Class III) on riparian vegetation.
- Under Alternatives 3B, 3C, 4B, 5B and 5C, the frequency and amount of low flows (2-5 cfs) would increase, primarily from the dam to Alisal Road, compared to baseline conditions. The additional flows are expected to increase the instream riparian vegetation. This effect is considered beneficial (Class IV) to wetland and riparian vegetation.

4.8.2.4 Impacts to Riparian Vegetation from the Delivery of SWP Water under Alternative 4B

Alternative 4B would involve the construction of four outlets on the east bank of the Santa Ynez River to discharge SWP water for recharge into the riverbed. The outlets would consist of steel pipes extending to the base of the riverbank. A concrete or rip-rap spillway or apron would be constructed under each outlet to prevent bank erosion. About 200 square feet of riparian vegetation would be permanently displaced at each location. Vegetation that would be removed consists of mulefat and willow scrub, and possibly several mature willow or cottonwood trees, depending upon the final locations of the outlets. No mature oak trees or wetlands would be removed. The permanent removal of riparian vegetation from the four discharge outlets is considered a potentially significant, but mitigable impact (Class II). The impact can be mitigated by avoiding mature woodland habitat and by restoring any riparian scrub disturbed during construction.

4.8.2.5 Impacts to Sensitive Plant Species

Threshold of Significance

An impact to sensitive plant species is considered significant when spill releases of the Alternatives would substantially remove or jeopardize the survival of these species compared to the baseline (Alternative 2).

Discussion of Data and Analyses

The potential for four state- or federally listed sensitive plant species and two CNPS rare plant species to occur within the project area is discussed in **subsection 4.8.1.3, Sensitive Plant Species**

None of the six sensitive plant species listed in **subsection 4.8.1.3** occur around the margins of Cachuma Lake or in the Santa Ynez River channel between the dam and the ocean. Hence, changes in lake elevation and flow regime downstream of the dam would not affect these species and no significant impacts would occur. Because these sensitive species would avoid impact, each Alternative would produce the same result of no significant impact.

4.8.3 Mitigation Measures

As described in **subsection 4.8.2.2**, surcharging to 753 feet in 2005 resulted in a loss of 245 oak trees with an additional 586 identified as being in jeopardy, which constitutes a significant impact, at least in the near-term. A survey conducted in 2007 found that a total of 612 mature oaks along or below the high water mark were dead (Fournier 2007). An additional 263 oak trees were observed to be in jeopardy of loss due to exposure to flooding. Reclamation began efforts to mitigate the loss of mature oak trees by implementing an oak tree replacement program, starting in 2005.

The objective of Reclamation's oak tree replacement program is to replace coast live and valley oak trees lost due to periodic surcharging in a phased manner linked to the incremental loss of oak trees over time. The program utilizes opportunities for establishing new oak woodlands and enhancing existing ones within the Cachuma Recreation Area, which includes all federal lands around the lake and the County Park on federal lands. As Reclamation prefers to have full control to maintain and protect new oak tree habitat, the acquisition of land or easements from private landowners for the purposes of oak tree restoration outside the Recreation Area has been deemed infeasible.

The oak tree replacement program being implemented has been modified from the one described in the August 2003 Draft EIR (CCRB 2006b). This mitigation plan is based on the agreement between COMB and Santa Barbara County as outlined in the 2004 Lower Santa Ynez River Fish Management Plan and Cachuma Project Biological Opinion for Southern Steelhead Trout EIR/EIS. Because the mitigation is designed to achieve compliance with federal standards, it is slightly different from mitigation required by Santa Barbara County. The Modified Oak Tree Restoration program (2005) is designed to achieve a 2:1 replacement ratio after 20 years for all trees that might be affected as a result of surcharging Cachuma Lake by 3 feet. This program is being accomplished by maintaining and monitoring the planted trees over a 20 year period in order to ensure that the trees are self-sustaining and reproducing. As is stated above, a projected possible loss of up to 452 coast live oak and valley oak trees is being mitigated in a phased program. An initial planting ratio is 5:1, or 2260 trees, based on the projected loss of 452 trees, but the final number will be adjusted as necessary based on observed mortality. As of 2007, a total of 612 oaks have died, with an additional 263 oaks identified as being at risk. This brings the baseline for replacement to approximately 900 oaks, rather than the 452 initially proposed. The phased approach entails planting 375 oak trees per year for the first five years resulting in outplanting a total of 1,881 trees by 2010. In order to achieve at least the minimum planting of 2:1, the planting in year six (2011) will expand from 375 to the actual number of trees needed to ensure full mitigation. For the next ten years, the loss of trees along the shoreline will be monitored. Replacement trees that do not survive will be replaced on an annual basis. By planting oaks at a ratio of 5:1, a sufficient number of oaks should be growing in 20 years to more than meet the required 2:1 ratio, despite attrition over time.

At year 10, the number of oak trees around the perimeter of the lake that do not appear healthy and are expected to perish in the future, will be counted and replaced (using the appropriate replacement ratio), and the monitoring of tree loss along the shoreline will be terminated. For years 10-20, all planted trees will be maintained and monitored. At year 20, a final count will be performed to determine if a sufficient number of self-sustaining trees are present to offset the observed tree loss at a 2:1 ratio.

In addition to the change in the mitigation program, there has been a change to the locations where the replacement oak trees have been planted to date. However, the new areas for Year 1 through Year 2 plantings were still within the Cachuma Recreation Area. The initial Planting Plan identified in the August 2003 Draft EIR identified a project scope within the public boundaries of the County's Cachuma Lake Park. Restoration sites outside the park were also explored for future plantings. However, the Cachuma Member Units and the County were concerned that newly planted oak trees would be at a substantially greater risk of damage by the recreating public if the trees were installed within the Park. Therefore, after extensive discussions with the County Parks personnel, it was agreed that as many oak trees as possible should be planted in a less recreated area of the Cachuma Recreation Area to ensure maximum survival of the young oak trees. This resulted in project relocation for Year 1 and Year 2 plantings to the wild-land setting along Storke Flats, approximately two miles south of the Cachuma Park entrance, off of Highway 154. **Figure 4-19, Storke Flats - Cachuma Project Oak Tree Restoration Program**, and **Figure 4-20, Bradbury Dam - Cachuma Project Oak Tree Restoration Program,** depict the locations of replacement oak plantings for Year 1 (2005) and Year 2 (2006) , and Year 3 (2007) through Year 5 (2009), respectively**.**

From September 2004 through June 2006, approximately 1,500 acorns and thousands of native understory seeds were collected, planted in containers, and placed in a nursery for a year in preparation for the first year's planting in 2005. In December 2005, the first year's fieldwork began at the Storke Flats location. 375 suitable planting sites were identified just below and along the existing oak tree canopy of the mature woodlands bordering the upper slopes of Storke Flats along Highway 154. The planting efforts were conducted in accordance with the techniques detailed in the Modified Oak Tree Restoration Program approved by CCRB and Santa Barbara County in 2005. The oak trees were planted in cages to protect the roots and shoots. Prior to augering the 18-inch-diameter holes, the planting area was cleared of weeds for a radius of six feet around each planting hole. Planting took place when natural rainfall provided suitable moisture levels for installation. Following planting, the trees were tagged, stem diameter and height measured, health and vigor noted and mulch and fencing installed. The success rate for the first year was 98.6 percent, which is far above survival rates normally assumed to be about 70 percent. The second year's (2006) planting locations were located within the Storke Flats pasture area once again, bordering the lakeshore and lower elevations of the existing oak woodland on the furthest southeast side of the pasture. An additional 380 oaks were planted, of which 333 trees survive to date.

Planting sites for Years 3 to 5 (2007-2009) were located at several locations adjacent to Bradbury Dam in order to prevent over planting in the Storke Flats area. In Year 3, a total of 200 oaks were planted on the north side of Bradbury dam, on the uppermost south-facing slope area bordering the existing oak woodland. An additional 126 coast live oaks were planted along the north-facing slope, in a large fill area where stockpiled topsoil from the north side of the spillway was placed following the seismic retrofit in 2006. Because this site was not suitable to support valley oaks, a total of 30 valley oaks were planted in the south-facing meadow located on the north side of the dam.

Planting in Year 4 (2008) and 5 (2009) focused on restoring and replacing oak woodland cleared during the construction and retrofit activities associated with the surcharge elevation. During Year 4, a total of 350 coast live oak and 35 valley oaks in an area spreading from the base of the slope to the base of the dam. During Year 5 (2009), 350 coast live oaks and 35 valley oaks were planted to expand the restoration along the base of Bradbury Dam. A summary of planting and survival data is included in **Table 4-49A**, **Summary of Oak Mitigation Planting Year 1 (2005) through Year 5 (2009)**, and **Table 4-49B**, **Size of Replacement Oak Planting Year 1 (2005) through Year 5 (2010).**

Table 4-49A
Summary of Oak Mitigation Planting Year 1 (2005) through Year 5 (2009)

	Year 1	Year 2	Year 3	Year 4	Year 5
Coast Live Oaks (*Quercus agrifolia*)					
Under 3 feet	80	45	46	91	130
Between 3-6 feet	196	248	258	226	206
Greater than 6 feet	32	7	12	19	12
Total Number Planted	345	343	326	350	350
Total Number Dead (06/2010)	37	43	10	14	2
Total Survivors (06/2010)	**308**	**300**	**316**	**336**	**348**
Percent Survivorship	89.3%	87.5%	96.9%	96.0%	99.4%
Valley Oaks (*Quercus lobata*)					
Under 3 feet	10	16	12	5	19
Between 3-6 feet	15	10	9	23	11
Greater than 6 feet	2	7	4	3	5
Total Number Planted	30	37	30	35	35
Total Number Dead (02/2010)	3	4	5	4	0
Total Survivors (02/2010)	**27**	**33**	**25**	**31**	**35**
Percent Survivorship	90.0%	89.2%	83.3%	88.6%	100%

Source: Fournier 2010. Cachuma Lake Oak Tree Restoration Program: Annual Progress Report Planting year 1 through Year 5 (June 25, 2010)

Replacement oak tree planting growth and survival has been good at all sites. As of Year 5 (2009), a total of 1,881 oaks have been planted, with an overall survival rate of 92 percent. Over 80 percent of all trees have shown evidence of growth and establishment. Some of the trees are well over 6 feet tall and producing acorns. Tree loss has occurred due to predation by gophers and bark beetles. All trees are irrigated as needed (approximately 10 gallons per application) using a water truck. Irrigation schedule varies depending on natural rainfall and monitoring of soil moisture.

Table 4-49B
Size of Replacement Oak Planting Year 1 (2005) through Year 5 (2010)

	Year 1	Year 2	Year 3	Year 4	Year 5	Total Planted
Coast Live Oak (*Quercus agrifolia*)						
One gallon sapling	145	55	65	75	95	435
Growing Solutions Trees (4-inch, 6-inch, 5 gallon)	44	125	175	0	0	344
5 gallon sapling trees (trees 2.5-foot – 4-foot in 5 gallon container for approx. 6 months)	110	150	56	215	200	731
5 gallon trees (trees > 4-foot in 5 gal container over 6 months)	46	13	30	60	55	204
Valley Oak (*Quercus lobata*)						
One gallon sapling	10	5	15	20	11	61
Growing Solutions Trees (4-inch, 6-inch, 5 gallon)	10	22	10	0	0	42
5 gallon sapling trees	0	0	0	7	12	19
5 gallon trees	10	10	5	8	12	45
TOTAL Planted Years 1-5	**375**	**380**	**356**	**385**	**385**	**1881**

Source: Fournier 2010. Cachuma Lake Oak Tree Restoration Program: Annual Progress Report Planting year 1 through Year 5 (June 25, 2010)

Attention has been maintained in planting site location to retain and promote diversification of habitat by planting oak associated understory species along with the oak trees (see **Table 4-49C**, **Summary of Understory Planting Years 1 through 5.** Species composition has varied according to the planting site and were placed in hand-dug holes without cages or irrigation system: however, plants were watered at a rate of approximately 1-3 gallons/application as needed. A total of 660 one-gallon and five-gallon shrubs provided by Growing Solutions were planted between 2005 and 2010.

As noted above in **subsection 4.8.2.2**, the loss of oak trees under both surcharging scenarios (1.8 and 3.0 feet) is considered significant until such time that the replacement trees have become well established and self-sustaining, which is estimated to be about 10 years. By 2011, a total of at least 2250 oak trees will have been installed. The current survival rate of 1,759 (94 percent) for the 1,871 oaks planted between 2005 and 2009 suggests that the goal of having at least 1,224 viable trees after 20 years is within reach. At such time, the impact would be considered mitigated to a less than significant level as the new trees would then grow and reproduce without artificial support. The proposed oak tree replacement program described above is designed to minimize the loss of trees during the interim growing period to the extent practical.

Table 4-49C
Summary of Understory Planting Years 1 through 5

Species/size	Year 1	Year 2	Year 3	Year 4	Year 5	Total Planted
GRASSES						
Blue-eyed grass – 1 gallon (*Sisrynchium bellum*)	45	40				85
HERBACEAOUS ANNUALS AND PERRENIALS						
Hummingbird sage – 1 gallon (*Salvia spathacea*)	25	18	25			68
Hummingbird sage – 5 gallon (*Salvia spathacea*)	35					35
Sticky monkey flower- 1 gallon *(Mimulus aurantiacus)*	75	35				110
Sticky monkey flower- 5 gallon *(Mimulus aurantiacus)*	75					75
SHRUBS						
Mountain mahogany - 1 gallon (*Cercocarpus betuloides*)	60		22			82
Mountain mahogany - 5 gallon (*Cercocarpus betuloides*)		35				35
Coffeeberry – 1 gallon (*Rhamnus californica)*		35	50	20	15	120
Toyon – 1 gallon (*Heteromeles arbutifolia)*			5			5
Toyon – 5 gallon (*Heteromeles arbutifolia)*	45					45
Total Understory Plantings	**360**	**163**	**102**	**20**	**15**	**660**

Source by: Fournier 2010. Cachuma Lake Oak Tree Restoration Program

Depending upon the rate of loss of oak trees due to surcharging and the rate of growth of new trees, the lag time between tree loss and establishment of self-sustaining trees may be very small. Eventually, the loss of trees would be mitigated to a less than significant level.

RP-1 To mitigate for the loss of oak trees under Alternatives 3B, 3C, 4B, 5B and 5C, Reclamation shall implement the long-term oak tree restoration program at the Cachuma

Lake Project areas as described in this section. Oak trees shall be replaced at a ratio that ensures a 2:1 replacement ratio 20 years after the first surcharge event. The exact number of trees to be replaced shall be based on actual tree loss over time. The restoration program shall be designed to create new oak woodlands, as well as to enhance existing oak woodlands in the park, without creating conflicts with ongoing and future recreational uses. Reclamation has begun to implement the program in phases. Reclamation shall monitor the loss of trees annually in the 10 years following the first surcharge event, and replace lost trees on an annual basis.

RP-2 In the event that Alternative 4B is pursued, the facilities associated with Alternative 4B shall be designed and constructed to ensure avoidance of significant riparian vegetation. Any riparian vegetation displaced by construction activities and the new facilities on the riverbank shall be replaced onsite at a 2:1 ratio.

4.9 SENSITIVE AQUATIC AND TERRESTRIAL WILDLIFE

4.9.1 Existing Conditions

Riparian habitat along the lower Santa Ynez River supports a great diversity of aquatic and terrestrial wildlife species. Streams and pools provide habitat for aquatic and semi-aquatic species such as Pacific chorus frog, western toad, Pacific treefrog, and the introduced bullfrog. Common reptiles include the ensatina, western fence lizard, common kingsnake, gopher snake, and common garter snake. Small mammals use the riparian vegetation for cover, movement corridors, and foraging. In addition to these common species, various sensitive aquatic and wildlife species occur along the lower Santa Ynez River from the dam to the ocean, and at Cachuma Lake. Sensitive species include those listed as threatened or endangered under the California Endangered Species Act or the federal Endangered Species Act, or designated as a "species of special concern" by the California Department of Fish and Game (CDFG). A review of the occurrence of sensitive species at the lake and along the river is presented below.

4.9.1.1 Amphibians and Reptiles

Arroyo Toad

The arroyo toad (*Bufo [Anaxyrus] californicus*) is a federally listed endangered species. It occurred historically in coastal drainages from the upper Salinas River to Rio Santo Domingo in Baja California Norte. Arroyo toads are typically found in upper streams where they breed in pools generally less than one foot deep with minimal current and a gently sloping shoreline, and where bordering vegetation is absent or set back from the margins of the pool. Adults use nearby sandy terraces for burrowing and may forage in live oak flats along the river floodplain.

Within the Santa Ynez watershed, the arroyo toad is reported to occur between Mono Creek and Middle Santa Ynez Campground on the Santa Ynez River and on Mono and Indian creeks. The Santa Ynez River Technical Advisory Committee (SYRTAC) biologist found one arroyo toad in the upper basin above Cachuma Lake during 2000 surveys. The species is not known to occur in any of the tributaries flowing into Cachuma Lake, and it is not known to occur below Bradbury Dam, although pools that meet breeding requirements exist there. Potentially suitable habitat for the arroyo toad occurs at scattered locations along the lower river, primarily between Bradbury Dam and Alisal Road. The U.S. Fish and Wildfire Service (USFWS) designated critical habitat for this species in 2001, which does not include the lower Santa Ynez River.

California Red-Legged Frog

The California red-legged frog (*Rana draytonii*) is a federally listed threatened species. It occurred historically in coastal mountains from Marin County south to northern Baja California, and along the floor and foothills of the Central Valley from about Shasta County south to Kern County. California red-legged frogs are confined strictly to aquatic habitats, such as creeks, streams, and ponds, and occur primarily in areas having pools two to three feet deep with dense emergent or shoreline vegetation. Although they may move between breeding pools and foraging areas, they rarely leave the dense cover of the riparian corridor. California red-legged frogs breed from November to March when eggs are attached to emergent vegetation. Eggs hatch within six to fourteen days, and metamorphosis generally occurs between July and September. Red-legged frogs are omnivorous and will eat other animals including other amphibians and small mammals. Major predators include introduced fish, bullfrogs, and native garter snakes.

Red-legged frogs are not likely to occur in Cachuma Lake due to the presence of predatory fish. However, they are likely to be present in tributaries to the lake. Much of the Santa Ynez River above Alisal Road becomes dry by early summer, and is, therefore, unlikely to support California red-legged frogs due to the lack of permanent water. However, portions of the river downstream from Buellton support large areas of habitat for the California red-legged frog, and pools in this area probably contain permanent water due to agricultural and urban runoff and discharges from wastewater treatment plants. The presence of bullfrogs, largemouth bass, and green sunfish may limit the potential for red-legged frogs. Frogs were not located along the lower Santa Ynez River during the 1994 surveys for the Contract Renewal EIR/EIS, perhaps due to the presence of predatory fish and bullfrogs throughout the lower river. In 1996, the SYRTAC biologist found an individual in the mainstem of the Santa Ynez River, northwest of the Santa Rosa Hills. Recent sightings and potentially suitable habitat areas on the lower river are shown on **Figure 4-13, Locations of Red-legged Frogs on the Lower Santa Ynez River**. The California Natural Diversity Database includes a 2007 record of this species approximately two miles west of Solvang along the south side of the Santa Ynez River.

Red-legged frogs occur on tributaries to the Santa Ynez River (**Figure 4-13**). The SYRTAC biologist observed frogs in Nojoqui Creek near the fifth bridge crossing from the confluence in 1995, and 1996. In 2000, the SYRTAC biologist recorded individuals at the confluence of Salsipuedes and El Jaro Creeks, as well as in El Jaro Creek, a quarter-mile from the confluence. A frog was also recorded in San Miguelito Creek, approximately one mile north of Miguelito Park. Other tributaries that may support the red-legged frog include El Jaro Creek, Alisal Creek, Quito Creek, Alamo Pintado Creek along Figueroa Mountain Road, Calabazal and San Lucas creeks, Hilton Creek, and Santa Agueda Creek. USFWS designated critical habitat for this species in 2001, which does not include the lower Santa Ynez River or any lower tributaries.

California Tiger Salamander

On January 19, 2000, the USFWS issued an emergency listing of the populations of California tiger salamander (*Ambystoma californiense*) in Santa Barbara County as an endangered species. The species in the County represents a Distinct Vertebrate Population Segment of the tiger salamander that occurs throughout the state. Less than 20 breeding sites are present in the County, many of which are currently threatened due to conversion of rangeland to vineyards. The populations in Santa Barbara County are restricted to the Santa Maria, Los Alamos, and Santa Rita valleys.

No populations are known to occur adjacent to the Santa Ynez River, or in stock ponds in proximity to the river. Cachuma Lake itself does not offer suitable habitat for the species.

Southwestern Pond Turtle

The southwestern pond turtle (*Actinemys marmorata pallida*) is a state species of special concern that occurs from roughly Monterey Bay south through the Coast Ranges to northern Baja California Norte. Southwestern pond turtles live primarily in freshwater rivers, streams, lakes, ponds, vernal pools, and seasonal wetlands, but also seem to have some tolerance for slightly brackish conditions. They may live in intermittent streams where permanent pools exist. The species requires slowly moving water and appropriate basking sites such as logs, banks, or other suitable areas above water level. In the relatively mild climate of central and southern California, pond turtles may spend extended periods on land away from water. Hatchlings are particularly vulnerable, and require shallow water (less than 30 cm) and abundant emergent vegetation. Bullfrogs and largemouth bass are predators of hatchling turtles. Turtles eat primarily small to moderately sized invertebrates, especially insects and crayfish, but turtles also may consume vegetation, small fish, and carrion. Turtles mate between May and September and lay eggs from May through August.

Habitat for the southwestern pond turtle occurs throughout the Santa Ynez River watershed. Turtles were observed at many locations along the river during the 1994 field surveys for the Contract Renewal EIR/EIS. Turtles reside in large pools at the end of Paradise Road between Gibraltar Reservoir and Cachuma Lake. Although the SYRTAC biologist has observed turtles along the lower river between Bradbury Dam and Buellton, the most suitable habitat occurs downstream from Buellton, where deep pools and dense vegetation exist at several locations along the river. Turtles were observed in Long Pool below Bradbury Dam, between Refugio and Alisal Road near Solvang, and at several locations west of

Buellton. Suitable turtle habitat exists below the Floradale Bridge west of Lompoc, and turtles were observed in Salsipuedes Creek southeast of Lompoc.

Two-Striped Garter Snake

The two-striped garter snake (*Thamnophis hammondii*) is a State Species of Special Concern. It occurs from Monterey County south through the coast range to northern Baja California. It is a highly aquatic species that is typically found near slowly moving creeks and streams, ponds, and coastal lagoons where water is permanent and tadpoles, frogs, and small fish are present as a prey base. These snakes are often found in areas of barren soil or short grass near the aquatic sites, and individuals may use large boulders for basking. Females give birth from mid to late summer and by October individuals may move to adjacent upland areas where they apparently hibernate in rodent burrows or under logs or boulders.

The two-striped garter snake is reported to occur in the upper Santa Ynez River above Gibraltar Reservoir and elsewhere in the watershed. It is unlikely that the species occurs along the lake, but it is highly likely to be found on some of the tributaries flowing into the Lake. During 1994 surveys for the Cachuma Contract Renewal EIR/EIS, a small two-striped garter snake was observed just downstream from Bradbury Dam attempting to eat a relatively large stickleback. During surveys in August 2000, the SYRTAC biologist observed several two-striped garter snakes in Salsipuedes Creek approximately 1.5 miles upstream of the confluence with the Santa Ynez River mainstem. Also in year 2000, the SYRTAC biologist documented this species on Nojoqui Creek, near the bridge crossing about 1.5 miles upstream of the mainstem confluence and another in the mainstem, near the confluence. Suitable habitat for the species occurs elsewhere downstream and is especially abundant in the area around Buellton. The occurrence of this species on Nojoqui Creek, approximately two miles south of Buellton, was also confirmed by Caltrans in 2008. Lack of permanent water upstream from Buellton may preclude the two-striped garter snake in this portion of the mainstem.

4.9.1.2 Sensitive Bird Species

Southwestern Willow Flycatcher

The southwestern willow flycatcher (*Empidonax traillii extimus*) is a state- and federally-listed endangered species. It is a small bird that occurs in riparian habitats along rivers and streams where there are dense growths of willows, coyote brush, tamarisk, and Russian olive. The southwestern willow flycatcher is one of five subspecies of the willow flycatcher currently recognized. The breeding range of the southwestern willow flycatcher includes southern California, southern Nevada, southern Utah, Arizona, New Mexico, and western Texas.

The southwestern willow flycatcher nests in thickets of trees and shrubs approximately 10-25 feet or more in height, with dense foliage from approximately 0 - 15 feet aboveground, and often a high canopy cover percentage. Nest site vegetation is usually structurally homogeneous. Flycatchers may, however, breed at sites with openings in the canopy where a dense growth of herbaceous plants occurs, sites with height heterogeneity in the canopy, or sites at the edge of the riparian canopy. Nesting willow flycatchers virtually always nest near surface water or saturated soil. At some nest sites, surface water may be present early in the breeding season but only damp soil is present by late June or early July. Habitat patches from 1 to 3 acres can support one or two nesting pairs. The nest is constructed in a fork or on a horizontal branch, approximately 3-15 feet above ground in a medium-sized bush or small tree, with dense vegetation above and around the nest. The southwestern willow flycatcher builds nests and lays eggs in late May and early June and fledges young in early to mid-July. The southwestern willow flycatcher is an insectivore. It forages within and above dense riparian vegetation, taking insects on the wing or gleaning them from foliage. It also forages in areas adjacent to nest sites, which may be more open. The southwestern willow flycatcher most likely winters in Mexico, Central America, and perhaps northern South America.

The southwestern willow flycatcher breeds along the lower Santa Ynez River, which represents its northern geographic limit. On the Santa Ynez River, willow flycatchers tend to breed in willow-dominated habitat, usually with a dense understory that may include native and exotic species. Most of the river from Bradbury Dam downstream to below Solvang (i.e., to about 1.3 miles downstream of Alisal Road) contains poor habitat for the flycatcher due to the lack of well-developed and continuous riparian woodland. The most suitable habitat on the lower river begins about 1.3 miles downstream from Alisal Road, and consists of scattered reaches with well-developed riparian woodland, as shown on **Figure 4-14, Locations of the Willow Flycatcher and Suitable Habitat the Lower Santa Ynez River**.

The UCSB Museum of Systematics and Ecology has performed annual surveys over portions of the river downstream of Buellton in 1994, 1996, 1997, and 2000. The numbers of flycatchers observed during these surveys ranged from 33–39 in 1996 to 26–28 in 1997. The results of these surveys suggest that the Santa Ynez River is a significant area in the overall status of flycatcher.

Surveys were conducted from May to July 2000 to determine the distribution of the southwestern willow flycatcher from Cachuma Lake to the ocean. There are two known breeding populations along the lower Santa Ynez River. The largest occurs about three miles south of the Avenue of the Flags Bridge in the City of Buellton, extending to Santa Rosa Creek. That population consists of 15-20 breeding pairs. The second population occurs downstream of Floradale Bridge, primarily near the 13th Street Bridge and Vandenberg Air Force Base (VAFB) waterfowl ponds near the river. The number of flycatchers recorded during the 2000 surveys was 27-30, with the largest population near Buellton (approximately 15-17 birds).

Locations of breeding birds based on recent surveys are listed below and shown on **Figure 4-15, Habitat for Riparian Breeding Birds on the Lower Santa Ynez River**:

- Ballard site (approximately 0.6 mile upstream of US 101), 2000 and in the past.
- Buellton site (approximately 0.7-1.3 miles downstream of US 101), 1986-2000.
- Yvonne site (approximately 3.4 miles downstream of US 101), 1996-2000.
- Santa Rosa site (upstream from the confluence with Santa Rosa Creek, approximately 5-6.5 miles downstream of US 101), 1994-2000
- Salsipuedes site (approximately 2.3 miles upstream from Route 246), 1996.
- Northwest of Lompoc (approximately 2.3 miles downstream from Highway 1), 1991-1993.
- VAFB, south of the military residence, (approximately 3.4 miles downstream from Highway 1), 1991-1993.
- VAFB, just downstream of Renwick Avenue, 1991-1999.
- VAFB, Waterfowl Management Ponds, 1996-2000.
- VAFB, southeast edge of Santa Ynez River mouth, 1992-1994.

Water is a crucial element of southwestern willow flycatcher habitat on the Santa Ynez River, as elsewhere. Typically, the flycatchers choose sites in dense riparian vegetation next to the river channel, as with some territories at the Buellton site, the Yvonne site, and the uppermost portion of the Santa Rosa site. Flycatchers breeding on the river often choose sites with standing water or moist surface soils away from the main channel. Thus split channels and low-lying areas at the base of the riparian zone, but away from the main channel, can provide good habitat. An example of this habitat is located approximately 0.5 mile downstream of the confluence of the Santa Ynez River and Santa Rosa Creek, where shallow pools and moist soil lie at the base of the south bank. Depressions in the riparian zone that are away from the main channel can also remain moist throughout the breeding season, and such areas may support willow flycatcher territories, as in the case of the area on VAFB, just west of the 13th Street Bridge. Areas with standing water near willow woodland, as occurs at the Miguelito Wetland just south of the river channel and 1.3 miles east of the Pacific Ocean, can provide good breeding habitat for flycatchers. Willow flycatchers on the Santa Ynez River often choose sites near beaver dams, as at the Buellton site and the Ballard site in 2000. Effluent from the Lompoc wastewater treatment facility provides excellent conditions for breeding southwestern willow flycatchers along the river west of Lompoc. The year-round discharge supports lush willow growth in the river channel.

Least Bell's Vireo

The least Bell's vireo (*Vireo bellii pusillus)* is a state- and federally-listed endangered species. Bell's vireos use a variety of riparian habitat types with dense understory growth. It breeds in the upper Santa Ynez River (above Gibraltar Reservoir) and lower Mono Creek. Nesting occurred along the lower Santa Ynez River up until the 1940s. Suitable habitat is present along much of the lower river, particularly between Buellton and the Narrows. A breeding population is not present along the lower river, although there have been many recent sightings of transients and possible breeding individuals. No Bell's vireos were recorded on the lower Santa Ynez River in the spring or summer 2000.

Suitable habitat for the vireo occurs from Alisal Road to Highway 101. Further downstream, good quality riparian habitat begins again at Gardner Ranch. For about 0.7 of a mile downstream from Gardner Ranch extensive riparian habitat exists where other vireo species, thrushes, warblers, and finches were noted during the 2000 surveys. Some very good riparian habitat also exists in the upper and lower portions between Highway 101 and the Sanford Winery (approximately 1 mile upstream from Santa Rosa Creek). The riparian zone broadens on the west, or north, side of the river about 4.2 miles downstream of Highway 101, where a Bell's vireo was detected on July 10, 1996. Furthermore, there are good riparian areas, notably on the north bank, below Sweeney Road between Salsipuedes Creek and Route 246. Bell's vireos were present here in the summers of both 1996 and 1997, and nesting evidence was found in 1997 (Museum of Systematics and Ecology, UCSB).

Good habitat exists from Salsipuedes Creek downstream to the Highway 246 Bridge. In 1997, a vireo was present approximately two miles upstream of Route 246. In July 1998, a singing vireo was also in this area, while another was near the 2-mile mark (Museum of Systematics and Ecology, UCSB). Also just above the mouth of Salsipuedes Creek, a broad riparian terrace on the northeast side of the river, could support the Bell's vireo. Further downstream, between the Lompoc Sewage Plant and Union Sugar Avenue is more Bell's vireo habitat, just below and downstream from the Floradale Bridge, and again just upstream of Union Sugar Avenue. Finally, from Union Sugar Avenue to 13th Street (VAFB) is the last stretch of potential Bell's vireo habitat, with mature willow-dominated riparian habitat extensive along the south bank the entire length of this reach.

Belding's Savannah Sparrow

The Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) is a state-listed endangered species that resides in pickleweed saltmarsh habitat. Resident populations occur in Goleta Slough and Carpinteria Marsh, as well as at the mouth of the Santa Ynez River. Foraging adult and juvenile birds use mudflats and sandbars when tidal movement exposes them. In the mid-1990s, the number of adult Belding's savannah sparrows found at the Santa Ynez River estuary within the VAFB was 150-200.

Western Yellow-billed Cuckoo

The yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a state-listed endangered species. Although the cuckoo probably once nested commonly in Santa Barbara County, there are no definite breeding records for any period. In the county, the yellow-billed cuckoo is considered a "casual transient," and there were only twelve records for this species anywhere in the county between 1963 and 1993 (Lehman 1994). A transient was detected in July 2000 along the Santa Ynez River, about two miles upstream of Highway 246. Suitable habitat occurs along this portion of the river. The portion of the river above the mouth of Salsipuedes Creek contains a broad riparian terrace on the northeastern side of the river that has potential to support the cuckoo.

In addition, the reach approximately 2.5 - 3 miles downstream of Highway 101 provides some marginal habitat for the yellow-billed cuckoo. A loose canopy of mature cottonwoods and a dense understory characterize vegetation in this area. However, the overall rarity of this species makes it unlikely that it will occur as a breeder in the near future.

California Brown Pelican

The California brown pelican (*Pelecanus occidentalis californicus*) is a state- and federally-listed endangered species. It is a large, fish-eating bird that occurs in the nearshore waters along California. Brown pelicans nest in Baja California, and on Anacapa Island. Brown pelicans are regularly seen offshore in the Santa Barbara Channel, and may occasionally be found at the mouth of the Santa Ynez River.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a state-listed endangered species but has been delisted under the federal Endangered Species Act. It inhabits coastal bays, estuaries, and deep-water lakes. One or more pair of bald eagles breed regularly at Cachuma Lake. Eagles primarily eat catfish and other types of fish, and coots. In winter, Cachuma Lake hosts relatively large numbers of bald eagles. During the past 15 years, counts have ranged from two to 18 birds. The number of wintering birds appears to have increased substantially over the past 30 years. Bald eagles may winter rarely at the mouth of the Santa Ynez River.

American Peregrine Falcon

The American peregrine falcon (*Falco peregrinus anatum*) is a state-listed endangered species. Peregrine falcons nest on cliff ledges or potholes usually near water. During the nesting season, peregrines may forage up to 10 or more miles from the nest, especially over water. Peregrines nest in the Santa Ynez Mountains. Cachuma Lake is within the foraging range of this species. In winter, resident peregrine falcons are augmented by migrants from the north, which may be found foraging anywhere in the project area, most particularly at the mouth of the Santa Ynez River. There have been no recent occurrences of this species reported within the project area.

Western Snowy Plover

The western snowy plover (*Charadrius alexandrinus nivosus*) is a federally listed threatened species. It is a small shorebird that nests in depressions in the sand above the drift zone. This species is a fairly common winter visitor at the mouth of the Santa Ynez River, and a spring breeder. Plovers nest in the dunes within a one-half mile on either side of the river mouth. USFWS has designated critical habitat for this species at the mouth of the river.

California Least Tern

The California least tern (*Sternula antillarum browni*) is a state- and federally-listed endangered species. This species nests in the upper beach habitat at the mouths of the Santa Maria and Santa Ynez rivers, and at several locations on VAFB. Nesting at the mouth of the Santa Ynez River is infrequent and involves only a small number of birds.

4.9.1.3 Riparian Breeding Bird Habitat

A diverse number of bird species utilize riparian habitat along the Santa Ynez River. Common species include black phoebe, house finch, song sparrow, scrub jay, plain titmouse, yellow warbler, red-tailed hawk, giant horned owl, common yellowthroat, turkey vulture, house sparrow, cliff swallow, California quail, California towhee, spotted towhee, Anna's hummingbird, mourning dove, acorn woodpecker, and bush tit. The portion of the river with well-developed riparian woodland suitable for riparian-dependent species primarily occurs from one mile downstream of Alisal Road to VAFB. Specific areas where high numbers of riparian breeders were located during the 2000 surveys are shown on **Figure 4-15** in **Appendix A**. Typical breeding birds encountered include the warbling vireo, Swainson's thrush, yellow warbler, Wilson's warbler, and yellow-breasted chat.

Many water-associated birds also occur along the lower river. During the 2000 surveys, non-breeding green herons were present throughout the lower Santa Ynez River downstream of Bradbury Dam. Great blue herons are also widespread along the river. One of the few nesting locations for the great blue herons in Santa Barbara County occurs just west of Bradbury Dam. Another possible nesting site is located approximately 10 miles upstream of Highway 246. Other members of the heron family found along the river during the 2000 surveys include the great egret, the snowy egret, and the black-crowned night heron. All of these species summer in the county, including along the Santa Ynez River. Individual snowy egrets were recorded during the spring-summer of 2000 at Refugio Road and just upstream of the

Highway 246 Bridge. Individual great egrets were recorded between Avenue of the Flags and Highway 101. Black-crowned night herons were recorded near Union Sugar Avenue, Avenue of the Flags and at the Buellton site.

The spotted sandpiper is a rare breeder on the lower river. It may have nested in 1993 below Bradbury Dam and near Buellton. The killdeer is a common breeding shorebird on the lower Santa Ynez River. In 2000, it was noted in larger numbers one mile upstream of Refugio Road, along the eastern and northern fringes of Lompoc, and a mile upstream of Union Sugar Avenue. Some of the lower parts of the river are good for wintering and migrating shorebirds. The area downstream of the 13th Street Bridge on VAFB appears to be suitable for greater yellowlegs and dowitchers. The most favorable location for migrating and wintering species is the river mouth, especially in the fall and when large expanses of mud are exposed. Mallards are widespread along the lower river. Other waterfowl that occur in low numbers include American wigeon, common mergansers, and cinnamon teal.

4.9.2 Potential Impacts of the Alternatives

4.9.2.1 Lake Impacts

Threshold of Significance

An impact to lake resources, including vegetation, is considered significant when surcharge inundation under the Alternatives would substantially affect the survival of sensitive wildlife species, or remove or convert existing vegetation types over large areas as compared to the baseline (Alternative 2).

Discussion of Data and Analyses

As described in **subsection 4.8.2.1**, increased maximum lake levels over baseline conditions due to surcharging under Alternatives 3B, 3C, 4B, 5B and 5C would alter the vegetation that currently exists along the margins of the lake above the water level. The periodic inundation during surcharge years is likely to destroy upland vegetation types over time. The effect could take up to 10 years to occur. The total area around the margins of the lake that would be affected would be 42 acres under Alternatives 3B and 5B (1.8-foot surcharge), and 91 acres under Alternatives 3C, 4B and 5C (3.0-foot surcharge) (**Table 4-48**).

The most common upland vegetation types that would be affected are chaparral and oak woodland. The removal of a narrow band of upland vegetation along the perimeter of the lake would reduce cover and food sources for common wildlife. Wildlife using these habitats would be displaced to adjacent similar habitats. No sensitive wildlife species occur in these habitats. The loss of trees along the lakeshore is expected to occur over many years, possibly 10 to 15 or more years. It is estimated that over time, up to

251 oak trees would be lost due to surcharging 1.8 feet and 452 oak trees would be lost due to surcharging 3.0 feet. A total of 612 oaks were found dead, with an additional 263 deemed at risk, during a 2007 shoreline survey of oaks. See **subsection 4.8.2.2 Impacts to Lakeshore Oak Trees** for detailed discussion on oak tree loss.

Comparison of Alternatives

The destruction of upland wildlife habitat (including the loss of oak woodlands) under Alternatives 3B, 3C, 4B, 5B and 5C is considered an adverse, but not significant impact (Class III) because: (1) a small acreage is involved compared to the total acreage of these common habitat types in the area which is sufficient to support large wildlife populations; (2) the loss of a narrow band of habitat (15 to 25 feet) around the lake margin would not substantially degrade wildlife cover and foraging opportunities at the lake because a similar margin of upland habitats will remain after surcharging; (3) the impact would occur slowly over time, allowing wildlife populations to adjust to the change; and (4) no sensitive wildlife species would be affected. This impact to wildlife habitat is distinguished from the loss of oak trees themselves (described in **subsection 4.8.2.2**), which is considered significant and not fully mitigable until the replacement trees are well established. After replacement oak trees become established and self-sustaining, estimated to be about 10 years, the loss of oaks under Alternatives 3B, 3C, 4B, 5B, and 5C are considered significant, but mitigable (Class II). The impact to wildlife associated with the oak trees around the perimeter of the lake is considered less than significant because the removal of a narrow band of trees, often scattered at distances of 100 or more feet from one another, would not appreciably affect the wildlife cover and food resources in the oak tree habitat around the lake, which is extensive.

Chaparral vegetation comprises the largest percentage of lake margin vegetation (39.5 percent, **Table 4-48**). Although chaparral is not considered a sensitive plant community, it does have habitat value for a variety of species. At the 3.0-foot surcharge level 35.9 acres of chaparral habitat would be lost over a period of time. The 35.9 acres of lost habitat is 3 percent of the approximately 1200 acres of chaparral vegetation contained within the Cachuma Lake Recreation Area. Because of the small percent of total acreage lost, this is considered an adverse, but not significant impact.

Freshwater marsh areas around the margins of the lake are expected to persist if maximum lake levels increase due to surcharging. Wetlands are located in shallow water areas around the lake where there are flat or very low gradient slopes under water. Raising the lake level at these locations would essentially shift the wetlands upslope. Hence, surcharging the reservoir under Alternatives 3B, 3C, 4B, 5B, and 5C would have a neutral effect on wetlands and their resident wildlife populations along the lake margins.

Impacts to Bald Eagles

Currently there is at least one pair of bald eagles that breed at Cachuma Lake and from 2 to 18 birds have been observed to winter at the lake. The gradual loss of oak trees around the lake margin due to inundation will eventually decrease the number of trees available as roost sites for bald eagles. This loss is expected to occur over a 10 to 15-year period. During this period many of the trees would still be accessible for roost sites. Trees above the inundation zone would remain available for roost sites for resting or foraging. The oak tree replacement program is expected to achieve a replacement ration of 2:1 at the end of 20 years. With the loss of oaks occurring at a gradual rate and the implementation of the tree replacement program, the impact to bald eagles or other raptors from loss of roosting sites is not expected to be significant.

Impacts to Southwestern Pond Turtle

Southwestern pond turtles have been observed in Cachuma Lake and may use upland areas around the lake to breed. Depending on latitude, the peak nesting season is from late May through early July but can extend from late April through August (Holland 1994). Female pond turtles move to upland locations to nest. Nests are typically located along stream or pond margins; however, they may be located over 100 meters and up to 400 meters from water on hillsides (Holland 1991). If suitable nesting sites are not available, females have been observed to travel up to 1.2 miles along a waterway to lay their eggs (Rathbun et al. 1992). Terrestrial nest locations (6) inspected by Rathbun et al. (1992) were all found in open, grassy areas with a southern exposure, probably to ensure that substrate temperatures will be high enough to incubate the eggs.

Incubation period varies with latitude but is typically 80 to 126 days (Goodman 1997a; Holland 1994). Complete failure of nests is not uncommon in some years or locations (Holland 1994). Goodman (1997) observed an 80 percent hatchling success rate for 15 eggs in three nests; Holland (1994) reports an overall average of 70 percent. In the northern portions of their range, hatchlings remain in the nest through the winter, although in southern California, most emerge in the early fall (Holland 1994).

Western pond turtles frequently bask on logs or other objects out of the water when water temperatures are low and/or air temperatures are greater than water temperatures. Habitat quality seems to vary with the availability of aerial and aquatic basking sites (Holland 1991); western pond turtles often reach higher densities where many aerial and aquatic basking sites are available. Hatchlings require shallow water habitat with relatively dense submergent or short emergent vegetation in which to forage.

Surcharge of the lake has the potential to inundate some possible nest locations. Surcharge will occur during the rainy season, usually November to April. Since nesting typically occurs from late May to July and nest sites are chosen to keep the eggs dry and at a suitable temperature for hatching, little or no direct impact to nests or hatchlings is expected. Availability and location of nesting sites may change after surcharge, depending on terrain adjacent to the lake at the new surcharge level.

Conversely, inundation of vegetation around the margin of the lake may provide an increased number of logs and vegetation for basking sites and submerged or emergent vegetation that will provide cover from predators for hatchlings. Impacts to southwestern pond turtles from surcharge of the lake are not expected to be significant.

4.9.2.2 River Impacts

Threshold of Significance

An impact to river resources is considered significant when flows under the Alternatives would substantially affect the survival of sensitive wildlife species compared to the baseline (Alternative 2).

Discussion of Data and Analyses

The releases for steelhead rearing and passage flows downstream of the dam under Alternatives 3B, 3C, 4B, 5B and 5C would be greater than under baseline operations (Alternative 2). The frequency and amount of low-flows downstream of the dam (to Alisal Road) would be greater under all the alternatives, and they would be greater downstream to the Narrows under Alternatives 5B and 5C.

The additional flows downstream of Bradbury Dam under Alternatives 3B, 3C, 4B, 5B, and 5C could increase the vigor and extent of wetland and riparian vegetation along the river, and indirectly benefit the associated aquatic and terrestrial wildlife, including sensitive species. This is considered a beneficial effect (Class IV) to these resources.

Comparison of Alternatives

Alternatives 3B, 3C, 4B, 5B, and 5C would slightly reduce the frequency of spills compared to baseline operations. As described in **Section 4.8.2.3**, the reduction in uncontrolled downstream flows could adversely affect riparian plant recruitment and the long-term health of the riparian vegetation. Riparian-dependent wildlife could be indirectly affected if there is a decrease in the extent or condition of riparian vegetation over time. This impact is considered a potentially adverse, but less than significant impact (Class III). It is not considered significant because the reduction in spill frequency is very small, and there is no evidence that the riparian recruitment along the river is limited by the frequency of flood disturbance.

Alternatives 3B, 3C, 4B, 5B and 5C are anticipated to have a slight beneficial effect on the Santa Ynez River lagoon due to increases in flow to the lagoon during emergency winter operations and passage releases, which would likely slightly increase dissolved oxygen and reduce the salinity in the upper portion of the lagoon, an area that supports sensitive species such as the California brown pelican, California least tern, western snowy plover, and Belding savannah sparrow.

4.9.2.3 Impacts to Southwestern Willow Flycatcher Nesting

Threshold of Significance

An impact to southwestern willow flycatcher is considered significant when flows under the Alternatives would substantially affect the breeding behavior and survival of this sensitive species compared to the baseline (Alternative 2).

Discussion of Data and Analyses

The endangered willow flycatcher breeds in two locations along the river. The largest population occurs about three miles south of the Avenue of the Flags Bridge in the City of Buellton, extending to Santa Rosa Creek. That population consists of 15-20 breeding pairs. The second population occurs downstream of Floradale Bridge, primarily near the 13th Street Bridge and VAFB waterfowl ponds near the river.

Releases from the ANA and BNA to recharge downstream groundwater basins have the potential to adversely affect southwestern willow flycatcher nesting. As described in **Section 2.2.3**, in very wet years, downstream basins are full and do not require recharge to satisfy downstream water rights. In dry years, Reclamation typically makes releases in the spring to recharge the upper reaches of the Above Narrows Alluvial Groundwater Basin. In normal and some dry years, Reclamation makes combined releases to satisfy the Above Narrows Alluvial Groundwater Basin and the Below Narrows Groundwater Basin in the summer and fall. Reclamation makes these releases when the river is dry with an initial rate of 135 to 150 cfs for a period of 10 to 15 days until the water reaches the Lompoc Basin Forebay. At that time, Reclamation reduces the releases to 50 to 70 cfs for several weeks to months, depending upon percolation rates.

Flows from the releases pass through the breeding habitat for the southwestern willow flycatcher, from Buellton to near the Narrows. These flows may occur during the breeding period when nests have eggs or fledglings – late-May to early July. These flows may impinge upon vegetation where nests are built, potentially disturbing the nests due to physical movement of the stems holding the nests. Nests are typically constructed in the fork of a branch or on a horizontal branch, about 3.2 to 15 feet above the ground (USFWS, Fed. Reg. July 23, 1993).

Mark Holmgrem, a biologist with the UC Santa Barbara Vertebrate Museum, observed releases impinge upon vegetation with a flycatcher nest in July 1997 (Holmgrem, 1998, 2001). He observed water flowing under the nest and the tips of the branches holding the nest being inundated by a rise in river flows. His observations suggest that certain flows from releases from the ANA or BNA could potentially disturb nests by toppling the stem supporting the nest, or otherwise rendering its location undesirable due to the new presence of surface water near the nest that may discourage use by the birds.

Stetson (2001e) conducted a hydraulic analysis of the expected rise in water surface elevation in southwestern willow flycatcher habitat downstream of Buellton. Stetson measured twenty cross sections of the river from ground surveys and then developed a stage discharge relationship. Stetson compared the stage-discharge curve to one developed by USGS upstream at Alisal Bridge for validation. The predicted rise in water surface elevation for varying flows at the nesting locations are as follows:

Flow	Predicted Rise
0–50 cfs:	9–13 inch rise
50–100 cfs:	13–19 inch rise
100–150 cfs:	17–24 inch rise

Stetson (2001e) observed multiple braided channels in the areas occupied by the southwestern willow flycatcher, which is a very wide portion of the river (500 to 1000 feet wide). Hence, substantial increases in flows result in very small water surface changes, as shown above. Stetson's results indicate that flows due to releases from the ANA or BNA in this portion of the river (usually 50 to 100 cfs at the peak flow) would not inundate southwestern willow flycatcher nests.

Beaver dams are present in this reach, creating large ponds in the middle of the river. These obstructions could potentially exacerbate the effect of releases on nests by temporarily creating a surcharge behind a dam when elevated flows are ramping up. Once the flows breach the dam, the water surface elevation behind the dam would decrease. However, the temporary surcharge could cause a greater disturbance to nests that are in the path of the new flows.

Comparison of Alternatives

The frequency and magnitude of this impact cannot be predicted because of the presence of many complex variables, including the difficulty in predicting where flows will occur during water rights releases, and whether they will be concentrated in one channel or spread among many braided channels. The location and height of nests also cannot be predicted, and will vary from year to year. Finally, the effects of beaver dams are highly unpredictable. The physical disturbance of a nest due to higher flows does not necessarily result in nest abandonment or lessened reproduction success.

In light of these factors, it is not possible to accurately assess the magnitude of the impact of ongoing and future water rights releases under baseline operations (Alternative 2) and Alternatives 3B, 3C, 4B, 5B, and 5C. However, if such impacts were significant, it is likely that the flycatcher population between Buellton and the Narrows would not have exhibited the steady increase in numbers over recent years during which time ANA and BNA releases have occurred regularly. Furthermore, the releases provide additional water to support aquatic insects and provide more riparian growth – both beneficial effects to the population. Hence, impacts of releases on southwestern willow flycatcher nesting are considered neutral and less than significant (Class III) in consideration of all factors and available evidence.

4.9.2.4 Impacts to Wildlife from the Delivery of SWP Water under Alternative 4B

Threshold of Significance

An impact to sensitive wildlife species is considered significant when flows under the Alternatives would substantially affect the survival of these sensitive species compared to the baseline (Alternative 2).

Discussion of Data and Analyses

Alternative 4B would involve the construction of four outlets on the east bank of the Santa Ynez River to discharge SWP water for recharge into the riverbed. The outlets would consist of steel pipes extending to the base of the riverbank. A concrete or riprap spillway or apron would be constructed under each outlet to prevent bank erosion. Riparian vegetation would be permanently displaced at each location, encompassing about 200 square feet apiece. Vegetation that would be removed consists of mulefat and willow scrub. The permanent removal of riparian vegetation from the four discharge outlets is not likely to significantly affect riparian-dependent wildlife described above because only a small amount of habitat would be removed (less than 1,000 square feet). However, it is possible that sensitive breeding birds (such as the flycatcher) could occur in proximity to the discharge locations during breeding season. This impact is considered significant, but mitigable (Class II) by avoiding construction within 200 feet of the river during the breeding season (April 15 through July 15).

4.9.3 Mitigation Measures

WL-1 In the event that Alternative 4B is pursued, facilities shall be constructed to avoid disturbance to sensitive riparian breeding birds in the vicinity, particularly the southwestern willow flycatcher. The following work shall be scheduled to avoid the breeding season (April 15 through July 15): trenching work within 200 feet of the river, and construction of discharge outlets on the riverbank.

4.10 RECREATION

4.10.1 Existing Conditions

4.10.1.1 Cachuma Recreation Area

The Cachuma Lake Recreation Area (Recreation Area) is federally owned land designated for recreational uses. It includes Cachuma Lake and the surrounding hillsides (**Figure 2-2**). The surface area of Cachuma Lake is about 3,100 acres at full level, of which 2,950 acres are available for boating and fishing. Approximately 6,448 acres of land surrounding the lake are within the Recreation Area; however, only 375 acres are developed for public recreational use as a County Park (**Figure 4-16, Recreational Facilities at Lake Cachuma**). The Recreation Area provides a variety of year-round recreation activities, attracting visitors from throughout the southern California region.

Contract with County of Santa Barbara

After Reclamation constructed Bradbury Dam, the County of Santa Barbara (County) agreed to manage recreation at the federally owned reservoir. Santa Barbara County Parks Department manages the Plan Area pursuant to a contract between Reclamation and Santa Barbara County (County). Reclamation and the County executed a 50-year contract titled *Agreement to Administer Recreation Area* (Contract No. 14-06-200-600) in January 1953, which has subsequently been extended to 2011. Reclamation will develop a new management contract with a local managing partner using the Resource Management Plan (RMP) for guidance on future land, resource, and recreation management.

The contract required the County to develop, maintain, and administer recreation according to a recreation plan, prepared by the County, and approved by the National Park Service (Park Service) and Reclamation. The original plan specified a 375-acre County Park on the south side of the lake. The contract allowed modifications to the recreation plan by either Reclamation or the County provided both parties agreed and the Park Service approved the modification. The contract prohibited the County from adding any additional service or facility to the Recreation Area that was not included in the plan. Funding for operations, maintenance and administrative costs at the Recreation Area were the responsibility of the County. Under the contract, the County was responsible for controlling and regulating all licenses and leases regarding recreation services and facilities, and for uses such as grazing and cultivation. The County is authorized to make and enforce rules at the Recreation Area to prevent pollution; protect visitor health and safety, law and order, and plants and wildlife; and to protect and conserve the scenic, scientific, aesthetic, historic, and archeological resources of the area. Rules and regulations made and enforced by the County at the Recreation Area must be consistent with local, state, and federal rules and regulations.

The contract requires the County to create a reserve fund from a portion of the net income derived from Recreation Area operations when the park is operating at a profit. Reserve fund money was used by the County to develop and maintain the recreation area. Reclamation and the County would agree annually upon the amount of money set aside in the reserve fund.

A Memorandum of Understanding[1] (which expired in February 2009) was executed between CCRB, SYRWCD, ID #1, and the County of Santa Barbara to give County Parks Department 5 years to replace or move critical health and safety and revenue generating facilities so they would not be impacted by surcharging the reservoir by 3 feet. These included the Water Treatment Plant, the sewage lift stations, and the boat launch ramp. The only one of those actually affected by surcharging was the boat launch ramp.

Recreational Facilities and Uses

Cachuma Lake is widely known for its natural, scenic qualities. Its location in a mostly undeveloped valley among wooded mountains attracts visitors that seek a quiet, outdoor experience. The lake has a Nature Center that promotes the natural history of the lake area and region. Visitors can enjoy a quiet setting while fishing, boating, or wildlife watching. No swimming or water skiing is allowed, and lake speed limits prohibit wakes in all bays and coves, and speeds in excess of 10 miles per hour unless no other boats would be inconvenienced by the wake.

Most of the Recreational Area facilities, such as campgrounds and boat ramps, are concentrated in the County Park, a 375-acre site on a peninsula located on the south side of the lake (**Figure 4-16**). The north side of the lake is primarily undeveloped recreational area bordered by private property consisting of ranches and grazing lands. Highway 154 parallels the south shore and provides access to the Recreation Area facilities. There are no other public access points to the Recreation Area.

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1 The CCRB, SYRWCD, ID #1, and the County of Santa Barbara signed an MOU in February 2004 with a term of 5 years to allow time for the County to construct a new boat launch ramp and a new water treatment plant (WTP); the MOU was amended in April 2005 allowing a 2.47 feet surcharge based on Stetson's lake elevation survey under 3.0 feet surcharge elevation. The basic purpose of the MOU was to give County Parks Dept 5 years to replace or move critical health and safety and revenue generating facilities so they would not be impacted by surcharging the reservoir by 3 feet. These included the WTP, the sewage lift stations and the boat launch ramp. The only one of those actually affected by surcharging was the boat launch ramp. The MOU expired in February 2009.

Public facilities located in the County Park include the following: campsites, general store, marina and launch ramp, fish cleaning stations, private docks, bait and tackle shop, snack shop, horse campsites, rustic amphitheater, trailer storage yard, transient mobile home park, nature center, County Park Ranger Station, and a family fun center with arcade, swimming pools, and snack shop. A brief summary of the recreational opportunities and facilities at the County Park, and in the Recreation Area in general, is provided below.

Camping

The main campground is located along the south shore in the County Park (**Figure 2-2**). Campsites for tents and RV's are available year-round on a first-come, first-serve basis. There are 500 campsites, which include 90 sites with electrical, water and sewer hookups, 38 sites with electrical and water hookups, and 4 sites with corrals for horses. The campsites with corrals have access to equestrian trails located outside the recreation area. All campsites include picnic tables and barbecue pits, and are located near showers, rest rooms, and water. In addition, the park offers reservable Yurt and "Cabin Style Trailers" for rental. Other facilities available to day users and campers include laundromat, gas station, telephones, RV dump station, children's play area, swimming pools, and during summer, bicycle rentals. The County Park provides accessible facilities and paths for handicapped visitors.

A second campground in the Recreation Area, Live Oak Campground, is located east of Cachuma Lake along the oak-lined banks of the Santa Ynez River (**Figure 2-2**). Live Oak campground is accessible only by an access road, and is used by large groups of equestrians and other groups for camping. The campground has outdoor showers, a covered eating area, barbecue pits, electricity, and a corral and facilities for horses. Ranch Road horse trail begins at Live Oak Campground and leads to a loop trail on the north side of the lake.

Boating

Boats for fishing and sightseeing are allowed on the lake all year. Power boating is permitted, however water contact activities associated with boating (i.e., water skiing) are not allowed. Boats are available for rent at the marina, including aluminum skiffs with and without engines and covered aluminum patio deck boats with engines. The marina also has private boat mooring facilities for long and short-term rentals. Log booms and buoy lines restrict public access to some areas of the lake (**Figure 2-2**). Restricted areas include the shallow end of Santa Cruz Bay, the Narrows near the mouth of the river, Cachuma Bay, and water surrounding the dam and Tecolote water pipeline intake facilities. Access to the dam and water intake facility is restricted to ensure boater safety and to comply with health code regulations.

Sailboats are allowed on Cachuma Lake and are given the right-of-way. The University of California Santa Barbara (UCSB) rowing team has a small facility located at Cachuma Lake.

Fishing

Cachuma Lake provides a large and diverse recreational fishery, supporting smallmouth and largemouth bass, rainbow trout, bullhead, channel catfish, bluegill, redear sunfish, green sunfish, white crappie, and black crappie. Cachuma Lake is one of southern California's finest bass fishing lakes because bass flourish in the lake's rocky "dropoffs" (places where the elevation changes abruptly), shallow areas, and weed beds. Bass tournaments are held frequently during spring. Bigger fish are caught in the winter months of January through March; however, more fish are caught in the summer months.

Trout fishing is also very popular at Cachuma Lake. Trout are caught trolling and bait fishing. Trout do not spawn at Cachuma Lake since water temperatures are too warm. The Park Department currently stocks Cachuma Lake with approximately 4,000 pounds of trout once every two weeks from September through April. The two to five pound trout are trucked from a hatchery in Idaho. On alternating weeks during this period, the DFG stocks the lake with trout from the Fillmore State Fish Hatchery. DFG matches the number of trout stocked by the Park Department. The Park Department pays for Idaho trout with recreation area fees. License fees fund the DFG stocking program.

Bass fishing locations are concentrated at the eastern end of the lake surrounding Arrowhead Island, and at drop-offs located throughout the lake. Trout fishing locations are located at the headwaters of coves and on points. Catfish fishing locations are located at the shallow end of coves. Crappie fishing locations are concentrated at the east end of the lake surrounding Arrowhead Island, and at Jack Rabbit Flats. Bluegill and redear sunfish fishing locations are scattered at shallow locations throughout the lake.

Naturalist Programs

The Recreation Area has a well-developed naturalist program. The Interpretive Nature Center features displays of the area's plants, wildlife, history, geology, and Native American artifacts. The Center schedules nature walks, fireside theater, wildlife lake cruises, astronomy programs, and summer movies.

Wildlife Watching

Visitors can see a wide variety of animals and birds in the Recreation Area such as deer, bear, wild pigs and over 275 species of resident and migratory birds. Wildlife cruises are conducted year round from the marina to different locations along the north shore of the lake. Bald eagles reside year-round at Cachuma

Lake and can be seen on two-hour "Eagle Cruises," led by a park naturalist from November through February on the north shore.

Hiking and Equestrian Trails

Several hiking trails are located within the County Park and portions of the Recreation Area. The Oak Canyon Loop Trail begins and ends at the Nature Center, circling the RV park area near Harvey's Cove. Horses and mountain bikes are prohibited on these trails. Sweetwater Trail begins at the parking lot at Harvey's Cove and continues west along the lake. Mohawk Trail begins near the swimming pool and continues east through the Recreation Area. Ranch Road horse trail begins at Live Oak Campground and leads to a loop trail on the north side of the lake. In addition to the two equestrian trails at the Live Oak Campground, there are two other equestrian trails in the Recreation Area, both of which extend from the County Park area to the Santa Ynez Mountains to the south.

Visitor Use Patterns

Most of the Recreation Area visitors reside in southern California. The majority of annual visitors camp overnight. Although day use is a small portion of overall visitation, day use areas can be crowded on summer weekends. More than half of the visitors travel to the Recreation Area for fishing and boating. Camping is the second most popular attraction. Over 40 percent of annual visitation occurs during the summer months of June, July and August. The peak attendance month is August. Attendance is lighter in the spring and fall months and drops to about five percent of annual visitation during the winter months. Attendance varies from year to year. The lowest attendance was observed during the recent drought years (1998-1991), particularly in 1990-91 when the lake level was at its lowest (661 feet). Recreation that does not directly depend on water, such as hiking and camping, were also affected during the drought. When the lake level dropped approximately 89 feet below full level, some of the trails were far from the water and hiking was not as attractive.

Recreation Management

The Santa Barbara County Park Department (Park Department) manages the County Park (**Figure 4-16**) as a financially independent park. Fees collected from visitors pay for facility operation and maintenance, employee salaries, and managing concessions and special services in the park. Fees are collected upon entering for activities and services such as day use, camping, boat launching and equestrian camping. The Park Department saves some revenues in a reserve fund to pay for capital improvement and to pay for operating costs during unprofitable years during times when the park operates at a profit.

A number of private concessions operate in the recreation area, including Cachuma Store, Cachuma Boats, Cachuma Bikes, Yurt and "Cabin Style Trailer" Rentals, and Cachuma Snacks. The owners of the concessions fund their own operations and maintenance and pay the Park Department a percentage of their gross income from all sales and receipts.

The Cachuma Lake Foundation is a non-profit organization designed to raise money for educational programs, natural history oriented displays, events and the Cachuma Lake Docents Organization at Cachuma Lake. The Cachuma Lake Docents Organization prepares and staffs many of the Cachuma Lake Foundation programs and displays.

4.10.1.2 Recreation in the Santa Ynez River Watershed

Forest Service Lands

Lower Santa Ynez Recreation Area

The Lower Santa Ynez Recreation Area is located along the Santa Ynez River upstream of Lake Cachuma between Fremont Campground on Paradise Road and Gibraltar Reservoir (**Figure 4-17, Recreation along the River Downstream of Bradbury Dam**). It includes campgrounds, trail camps, day use areas and several trails. The campgrounds (Fremont, Paradise, Los Prietos, Upper Oso and Sage Hill Group Campground) are located along Paradise Road, which generally parallels the river. The trail camps (Nineteen Oaks, Hidden Potrero and Middle Camuesa) are located along Santa Cruz Trail and Camuesa Road. The day use or picnic areas are located at White Rock, Lower Oso, Falls and Live Oak. Hikers, backpackers, mountain bikers and equestrians can access several trails in the Lower Santa Ynez Recreation Area for day use or for access to backcountry and wilderness campgrounds. Off-road vehicles are prohibited in the Lower Santa Ynez Recreation Area and on all trails. The Santa Ynez River in the Los Padres National Forest is open year round for swimming and fishing for trout, bluegill, green sunfish and catfish. During the late winter and spring, the DFG stocks the river above Lake Cachuma from Fremont Campground as far up river as allowed by water levels and access.

Upper Santa Ynez Recreation Area

The Upper Santa Ynez Recreation Area is located just east of the Gibraltar Reservoir (**Figure 4-17**). This area is more remote and harder to access than the Lower Santa Ynez Recreation area. The Upper Santa Ynez Recreation Area offers campgrounds (Juncal, Middle Santa Ynez, P-Bar Flat and Mono), day use areas, several trails and hot springs. Hikers, backpackers, mountain bikers and equestrians can access several trails for day use and extended trips, including Mono-Alamar, Indian Creek, Agua-Caliente, Cold Springs, Blue Canyon, and Jameson Reservoir and Alder Creek trails. Mono-Alamar and Blue Canyon

Trail offer overnight camping and access to the Dick Smith Wilderness. Mountain bikes are not permitted in the Dick Smith Wilderness. Off-highway vehicle (OHV) riders can use Camuesa and Buckhorn Roads.

Downstream Areas

Recreation on or along the Santa Ynez River between Bradbury Dam and the ocean is limited because most of the land adjacent to the river is privately owned and access is restricted. Persons wanting to recreate along the river need access permission from private landowners or face potential trespassing violations. Despite trespassing laws, people occasionally fish along the river without permission from landowners. Illegal fishing also occurs on tributaries such as Salsipuedes Creek and Alisal Creek.

Fishing is restricted along the Santa Ynez River from the dam to the ocean due to the presence of the endangered southern steelhead. The California Fish and Game Commission (CFGC) regulations prohibit fishing from the dam to the ocean during the steelhead spawning migration period (November through May) and allows catch and release with barbless hooks during the rest of the year.

The Park Department maintains Ocean Beach Park, which has a parking lot, picnic tables, barbecues, restrooms, a drinking fountain, and telephone. Park visitors must remain in the confines of the park, which is surrounded by VAFB property and patrolled heavily.

Other recreational areas along the Santa Ynez River downstream of Bradbury Dam include:

- River Park and Riverbed Park – two City of Lompoc Parks located along the riverbanks between Highway 246 and McLaughlin Road. The former includes day use, RV camping, and tent camping. Riverbend Park is primarily used for baseball
- Alisal Golf Course – located in Solvang, the course abuts the river near Alisal Road
- Santa Rosa County Park – a small day use park located near the river between Buellton and Lompoc

4.10.1.3 Baseline

Reclamation has begun implementing a 3.0-foot surcharge, as described in **subsection 4.2.1**. For the reasons described in **subsection 3.2.2**, however, Alternative 2, which includes a 0.75-foot surcharge, will be used as the baseline for purposes of evaluating the impacts of the other alternatives on recreation.

4.10.2 Potential Impacts of the Alternatives

4.10.2.1 Lake Impacts

Threshold of Significance

An impact is considered significant if the alternative would cause substantial changes in shoreline configuration, increase the visibility or frequency of exposure of barren slopes, cause substantial changes in vegetation, or cause inundation or damage of recreational facilities that would disrupt recreational activities within the park.

Discussion of Data and Analysis

Effect on Shoreline Conditions

The maximum lake elevation under historic operations was 750 feet. In 1993, Reclamation increased the maximum lake elevation to 750.75 feet to store water for releases for fish. This maximum lake level is reflected under baseline operations (Alternative 2). Maximum lake levels would increase 1.8 feet under Alternatives 3B and 5B and 3.0 feet under Alternatives 3C, 4B, and 5C due to surcharging the reservoir.

Surcharging is a term used to describe the amount left after a reservoir has been filled to capacity. Through manipulating spillways and outlet works, surcharge levels can be raised or lowered depending on reservoir capacity. The effect of surcharging on lake levels is discussed in **subsection 4.2.2.2**. As simulation modeling using historic data shows that surcharging would occur in 26 out of the 76 years modeled, it can be assumed that surcharging under each alternative (751.8 feet under Alternatives 3B and 5B; and 753.0 feet under Alternatives 3C, 4B and 5C) would occur, on average, about every three years (**Table 4-4**). Of the total time that the lake was surcharged during the period modeled for the simulation (at 750.75 feet under baseline conditions), the maximum lake level (750.75 feet) was achieved about 11 percent of the time (**Table 4-5**).

As discussed in **subsection 4.8.2.1**, increased maximum lake levels over baseline conditions would adversely affect native vegetation along the margins of the lake. The periodic inundation during surcharge years is likely to destroy upland vegetation types over time. The most common upland vegetation types that would be affected are chaparral and oak woodland, including oak trees. Freshwater marsh areas around the margins of the lake are expected to persist under higher maximum lake levels. Wetlands are located in shallow water areas around the lake where there are flat or very low gradient slopes under water. Raising the lake level at these locations would effectively shift the wetlands upslope.

The loss of upland vegetation along the lakeshore is not expected to have an impact on recreational uses and experiences at Cachuma Lake. In essence, the shoreline would shift upslope. Increased lake levels would not cause any perceptible change in shoreline configuration, or increase the visibility or frequency of exposure of the barren slopes below the maximum water level. Lake level fluctuations would remain essentially the same as under baseline operations.

Comparison of Alternatives

Due to additional surcharging under Alternatives 3B, 3C, 4B, 5B and 5C, inundation of the shoreline would occur more frequently. Accordingly, lake levels under Alternatives 3B and 5B (with a 1.8-foot surcharge) would reach or exceed 750.75 feet about 13 or 14 percent of the time. Alternatives 3C, 4B and 5C (with a 3.0-foot surcharge) would reach or exceed 750.75 feet about 16 percent of the time. Thus implementation of Alternatives 3B, 3C, 4B, 5B and 5C would result in a 3 percent to 5 percent increase in the amount of time that surcharging occurs at Cachuma Lake. The median number of consecutive months at or above 750.75 feet elevation ranges from four to five months (**Table 4-6**) under all alternatives. The area affected by increased lake levels is dependent upon the slope of the shore. Using topographic and bathymetric maps, an estimate was developed of the total area inundated by surcharging at 1.8 feet (Alternatives 3B and 5B) and 3.0 feet (Alternatives 3C, 4B and 5C). The results are shown in **Table 4-47**. They indicate that the total acreages that would be affected by the 1.8-foot and 3.0-foot surcharging compared to baseline conditions are 42 and 91 acres, respectively. The average widths of inundation would be 15 and 25 feet, respectively.

The higher maximum lake levels under Alternatives 3B, 3C, 4B, 5B and 5C would not have an adverse impact on game fish, as described in **Section 4.7.2.2**.

Discussion of Data and Analysis

Effect on County Park

In May of 2006, the County, CCRB, and SYRWCD, ID #1 approved the "Interim Agreement Regarding the Surcharge of Cachuma Lake," which allowed a temporary 3.0-foot surcharge after Cachuma Lake spilled in April of 2006.

The decision to implement the 3.0-foot surcharge was preceded by a topographic site study conducted at the County Park by Stetson Engineers in January 2005. The study provided evidence that the elevations previously used by the County in its assessment of the potential effect on park facilities such as the water treatment plant, water intake work and other park facilities (Flowers & Associates [2001]) were incorrect, and that these facilities were actually situated at higher elevations. Consequently, the County's assertion that the water treatment plant and water intake work would be inundated with a surcharge over 751.8 feet was an error. The study was conducted at a lake elevation of 753.18 feet in January of 2005, and it showed that there would be no inundation of those facilities at present locations and elevations. The study also negated the claim that other park facilities would be negatively impacted, such as the water treatment plant intake and electrical facilities, the sewage lift stations near Teepee Island and Mohawk, and access to the Marina and concessions.

With this new information, the County acknowledged that there would be no inundation of facilities at elevation 753.0 feet.[2] However, park personnel were still concerned about use of the existing boat launch ramp and potential impacts to the water treatment plant from wave run-up. In April 2005, SYRWCD, ID #1 and CCRB constructed a gabion basket barrier around the water treatment plant at an elevation of 756 feet to protect the plant from the effect of potential wave run-up. Protective measures and modifications to the water treatment plant's backwash system were also completed in April 2005 (CCRB 2006c) and have operated effectively since that time. As a result, no impacts to the water treatment plant from wave run-up or inundation have occurred during surcharge periods, and no concerns regarding the impact of wave run-up on the facility have been raised since the gabion basket barrier was constructed.

The gabion basket barrier is a temporary measure until a new water treatment plant is built and the existing plant is decommissioned. The target date for the new plant to begin construction is 2011 with a 2013 completion date. After the new plant is constructed and operational, the existing plant will be removed. The planned water treatment plant would be located and designed to accommodate the surcharged lake water level.[3] Though initially described as a temporary emergency protective measure, the gabion basket barrier's ability to protect the water treatment plant from potential wave run-up has proven sufficient to preclude any need for other measures to protect the facility until the planned new water treatment facility is operational. In order to ensure the continued viability of the gabion basket barrier, regular small-scale maintenance (i.e., monitoring of the integrity of the barrier and conducting repairs if necessary) similar in scale to that already performed on the water treatment plant will be required to maintain the barrier's effectiveness.

Preliminary engineering designs have been completed, and the County has secured partial funding of close to $1 million from Reclamation and through federal legislation. Unrelated to the effects of surcharging the reservoir, Reclamation has submitted a request for $12 million in federal funding for other park facilities including wastewater treatment facilities.

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2 Due to upgrades of County Park facilities, **Figure 4-18**, Recreational Facilities Affected by Surcharging, in the 2003 Draft EIR is no longer accurate. Therefore, this figure has been removed from this Final EIR.

3 Juan Beltranean, Project manager, County of Santa Barbara Parks Department, communication with ISI, August 4, 2010.

Pursuant to the January 2005 study, it was determined that the boat launch ramp could be operated without negative effects from a 2.47-foot surcharge. In order to ensure safe operation of the boat ramp, the County Parks Department upgraded the existing boat launch ramp to allow it to be operated at 753.0 feet. The boat ramp upgrade commenced in September 2007 and was completed in June 2008.[4]

Comparison of Alternatives

There would be no impact to the water treatment plant or the boat launch ramp under Alternatives 3B and 5B, which entail a 1.8-foot surcharge. The potential disruption of recreational uses at the County Park due to surcharging under Alternatives 3C, 4B, and 5C has been determined to be less than significant (Class III). Pursuant to the installation of a gabion basket barrier to protect the water treatment plant from wave run-up, there would be no impact to the water treatment plant under Alternatives 3C, 4B, and 5C.

Lake levels under Alternatives 3B and 5B (with a 1.8-foot surcharge) would reach or exceed 750.75 feet and would result in impacts less than those for Alternatives 3C, 4B, and 5C. As such, any impact would be less than under those alternatives and would be less than significant (Class III).

4.10.2.2 Impacts to Recreation along the River

Threshold of Significance

An impact is considered significant if the alternative would cause changes along the river that would cause inundation or damage of recreational facilities, or changes that would disrupt recreational activities within the river.

Discussion of Data and Analysis

Recreation opportunities and facilities upstream of Cachuma Lake are not expected to be affected by changes in operations under any of the alternatives.

Most of the river downstream of Cachuma Lake is private property with limited access. No public recreational facilities are located within the river channel. Several public parks are located adjacent to the river, including Riverbend and River Park in Lompoc Valley, Santa Rosa Park, and Ocean Park at the mouth of the river. Alisal Golf Course, a private facility, is located on the river near Solvang.

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4 Juan Beltranean, Project manager, County of Santa Barbara Parks Department, communication with ISI, August 4, 2010.

Comparison of Alternatives

Changes in operations under Alternatives 3B, 3C, 4B, 5B, and 5C that would affect flows in the river and the extent and condition of riparian vegetation would only have an indirect effect on downstream recreational uses. Impacts would be less than significant (Class III).

Alternatives 3B, 3C, 4B, 5B, and 5C are anticipated to increase flows to the Santa Ynez River lagoon during emergency winter operations and passage releases. This increase in flow would have a slightly beneficial effect on anadromous fish and sensitive aquatic and terrestrial wildlife, but would not affect recreation at Ocean Beach Park.

4.10.2.3 Impacts to Recreation from the Delivery of SWP Water under Alternative 4B

Threshold of Significance

An impact is considered significant if construction of the pipeline would cause damage to recreational facilities or would disrupt recreational activities within the park.

Discussion of Data and Analysis

Construction of the pipelines and outlets associated with Alternatives 4B along the Santa Ynez River will occur in proximity to River Park and Riverbend Park. These construction activities would be brief and highly localized, and as such, would not disrupt recreational activities. The discharge of water from the outlets on the riverbanks under Option B to recharge the river is likely to increase recreational interests, especially by children, as the discharge would typically occur in the late summer. No adverse impact is anticipated, and impacts would be less than significant (Class III)

4.10.3 Mitigation Measures

No mitigation required.

4.11 CULTURAL RESOURCES

4.11.1 Regulatory Requirements

Consideration of cultural resources is required under federal and state statutes, regulations, and guidelines, including Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C.A. Section 470f), Executive Order 11593, and CEQA. The procedures for complying with Section 106 of the NHPA are outlined in title 36, part 800 of the Code of Federal Regulations. Federal agencies must comply with Section 106, which requires federal agencies to take into account the effects of their undertakings on historic properties and affords the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. The effects of a project on properties of traditional religious and cultural importance to Native Americans must be considered in accordance with section 101(d)(6) of the NHPA (16 U.S.C.A. Section 470a(d)(6)) and the American Indian Religious Freedom Act (42 U.S.C.A. Section 1996). In addition to these responsibilities, federal agencies must consider Native American religious and cultural concerns in accordance with the Native American Graves Protection and Repatriation Act (25 U.S.C.A. Sections 3001-3013; 28 U.S.C.A. Section 1170) and Executive Order 13007 concerning Indian Sacred Sites.

Under CEQA, historical resources are considered a part of the environment. (Pub. Resources Code, Sections 21060.5, 21084. 1.) A "historical resource" includes, but is not limited to, any object, building, structure, site, area, place, record, or manuscript which is historically or archeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California." (Pub. Resources Code, Sections 21084.1, 5020.1, subd. (j).)

In 1992, the Public Resources Code was amended as it affects historical resources. The amendments included creation of the California Register of Historic Resources (California Register). (Pub. Resources Code, Section 5024. 1.) The State Historical Resources Commission (SHRC) administers the California Register and adopted implementing regulations effective January 1, 1998. (Cal. Code Regs., tit. 14, Section 4850 et seq.) The California Register is a listing for resources that should be protected from substantial adverse effect. The California Register includes historical resources that are listed automatically by virtue of their appearance on, or eligibility for, certain other lists of important resources. The California Register incorporates historical resources that have been nominated by application and listed after public hearing. Also included are historical resources listed as a result of the SHRC's evaluation in accordance with specific criteria and procedures.

CEQA requires consideration of potential impacts to resources that are listed or qualify for listing, on the California Register as well as resources that are significant but may not qualify for listing.

4.11.2 Regional Setting

4.11.2.1 Ethnography

The Cachuma Project area lies within the historic territory of the Native American Indian group known as the Chumash. The Chumash occupied the region from San Luis Obispo County to Malibu Canyon on the coast, and inland as far as the western edge of the San Joaquin Valley, and the four northern Channel Islands (Grant, 1978). The Chumash are sub-divided into factions based on six distinct dialects: Barbareño, Ventureño, Purisimeño, Ynezeño, Obispeño, and Island.

Cachuma Lake falls within the historic territory of the Ynezeño, whose name is derived from the mission with local jurisdiction, Santa Ines. The Ynezeño are less documented than the coastal Chumash, both in historical references and by archaeological research. It is known that their material culture was quite similar to the coastal Chumash, but their economy placed more emphasis on hunting and gathering then the maritime-oriented economy of the coastal tribes.

The Chumash were very advanced in their culture, social organization, religious beliefs, and art and material object production (Morrato, 1984). Class differentiation, inherited chieftainship, and intervillage alliances were all components of Chumash society. The development of a highly effective maritime subsistence pattern enabled Chumash villages of nearly 1,000 individuals to cluster in areas along the coast. These were the most populous aboriginal settlements west of the Mississippi River (Morrato, 1984). Coastal Chumash subsisted on fish, shellfish, sea mammals, and waterfowl. Permanent inland settlements subsisted on a variety of resources including acorns, seed plants, rabbits, and deer. The smaller inland villages were often economically allied with the larger coastal villages.

At the time of European settlement in the Santa Barbara Channel area, which began with the construction of the Santa Barbara Presidio in 1762, there were approximately 25 Ynezeño villages, eight of which were in the middle and upper Santa Ynez River Valley (Rudolph, 1990). The villages were tied together by marriage and each village contained from 40 to 280 people (West and Slaymaker, 1987). Early European explorers, Spanish missionaries, the early ethnographer John P. Harrington, and modern anthropologists have described these villages. Marriage patterns, baptismal records, and genealogies are documented for many of the villages. Although the Chumash society was decimated by epidemic diseases and missionization during the early historic period, today more than 500 living Chumash descendants trace their ancestry from the historic villages of the Santa Ynez River Valley (Reclamation and CPA, 1995).

4.11.2.2 Prehistory

Archaeological data support the hypothesis that prehistoric occupation of the California coast dates to over 10,000 years before the present (B.P.). Such data include the recent dating of human bones from Santa Rosa Island at 13,000 years old. This early Paleo-Indian occupation is not well understood, due to a paucity of archaeological data. The archaeological record does indicate that sedentary populations occupied the coastal regions of California more than 8,000 years ago. Several chronological frameworks have been developed for the Chumash region including Rogers (1929), Wallace (1955), Harrison (1964), Warren (1968), and King (1990). King postulates three major periods -- Early, Middle and Late. Based on artifact typologies from a great number of sites, he was able to discern numerous style changes within each of the major periods. The Early Period (8000 to 3350 B.P.) is characterized by a primarily seed processing subsistence economy. The Middle Period (3350 to 800 B.P.) is marked by a shift in the economic/subsistence focus from plant gathering and the use of hard seeds to a more generalized hunting-maritime-gathering adaptation with an increased focus on acorns. The full development of the Chumash culture, one of the most socially and economically complex hunting and gathering groups in North America, occurred during the Late Period (800 to 150 B.P.).

Large Chumash villages typically contained sweathouses, storehouses, numerous homes, ceremonial areas, and extensive middens of residential debris at the time of Spanish contact (1542). Villages were located near important resources in coastal, estuarine, and riparian habitats. Cemeteries typically were located near the villages; elaborate burial practices included the interment of grave goods such as beads, quartz crystals, red and yellow pigments, delicate soapstone bowls, sandstone mortars, and carved charmstones.

In comparison to Santa Barbara's coastal plain, the Santa Ynez Valley was sparsely populated throughout prehistory. The interior Chumash subsisted on a wide variety of floral and faunal resources. Storable staples included acorns, pinyon nuts, and seeds from numerous grasses and forbs. The interior Chumash consumed deer, quail, rabbit, and freshwater fish, as well as marine fish, shellfish, and sea mammals acquired through exchange or trips to the coast.

Ethnohistoric records indicate that the interior Chumash established summer and winter villages, individual sweat bath sites, short-term camps for gathering and processing acorns and pinyon nuts, isolated hearths and millingstone sites for roasting yucca and pounding and boiling islay bulbs, and caches for food and water in caves and rock shelters.

4.11.2.3 History

Early Exploration Period (1542-1782)

The historic era in Santa Barbara County began with an exploratory voyage led by Juan Rodriguez Cabrillo in 1542–1543. The next European explorers to pass through the Santa Barbara Channel were Sebastian Rodriguez Cermeno in 1595, followed by Sebastian Vizcaino in 1602. Over one hundred and fifty years passed before the next major European expedition reached Santa Barbara County. In 1769, Gaspar de Portola and Fray Crespi departed the newly established San Diego settlement and marched northward toward Monterey with the objective of securing the port and establishing five missions along the route. They passed through present-day Santa Barbara County that same year. The 1769 Portola Expedition and the later De Anza Expedition of 1775 were preludes to systematic Spanish colonization of Alta California. These early maritime and overland expeditions brought the Spanish in contact with the natives of the Santa Barbara region, but it was not until the late 1700s that the Spanish penetrated the interior.

Spanish Mission Period History (1782-1820)

Along the Santa Barbara Channel, the Spanish Mission Period commenced with the foundation of the Santa Barbara Presidio in A.D. 1782; four years later the Santa Barbara Mission was founded. In 1798, an exploring expedition was sent to the Santa Ynez Valley to find a location for a new mission. Fourteen villages were mentioned within 12 leagues of a spot called Alajulapu, meaning rincon or corner. This spot, where Mission Santa Inez was established, is next to the present-day town of Solvang. Father Estevan Tapis recorded the names of the valley's villages, their location in relation to Alajulapu, and the number of residence structures at each village. Tapis' estimated four persons per structure. Two of these villages have been correlated with known archaeological sites in the vicinity of Cachuma Lake.

The village of *Teqepsh* (*Tequepis, Teqeps* - Chumash for "seed beater") was located on the west bank of Tequepis Creek near its confluence with the Santa Ynez River. This was the first village encountered on the expedition. This village site (CA-SBa-477) is now inundated by Cachuma Lake. Early explorers also noted the village of *Elijman* (CA-SBa-485) located on a terrace on the west side of the Santa Ynez River.

The Santa Ynez River was originally called the Santa Rosa River of *Calaguasa* after the large village of *Calaguasa (Calahuasa)* once located just downstream of *Teqepsh.* The name Cachuma probably derives from the village of *Aquitsumu* mentioned by Tapis as being seven leagues from the mission site. The plat of College Rancho, surveyed in 1858, preserves the name *Aquachuma* or *Aguachuma* as the name for Cachuma Creek, and the plat for Rancho Tequeps spelling for the creek's name is *Guchuma.* Site CA-SBa-809 is the probable archaeological remnant of this village located along Cachuma Creek.

Fathers Jose Antonio Calzada and Jose Romualdo Gutierez established Mission Santa Inez on September 17, 1804. A cadre of neophytes from nearby missions was installed at Santa Inez to provide skilled labor and train subsequently proselytized natives. The first baptisms included children and 15 men. Among these were the headmen of the villages *Calahuasa, Soctonocmu,* and *Ahuama.*

Missions Santa Barbara and La Purisima had been proselytizing the Santa Ynez Valley for some time prior to the founding of the Mission Santa Inez. With its establishment, the jurisdiction of the Mission Santa Barbara commenced upstream of the village of *Teqepsh.*

Rancho San Marcos, located at the eastern end of the project area, was established in 1804 to serve the Mission Santa Barbara. Its lands extended along the Santa Ynez River from Tequepis Canyon upstream to about the Fremont campground, then northward for about eight miles. Under the supervision of an alcalde, neophytes raised livestock and crops for the growing mission population. The original adobe building consisted of living quarters and a chapel. Modified over the years, the San Marcos Adobe now is in ruins. The ruins and remaining associated features (CA-SBa-109/H) are on the National Register of Historic Places (NRHP or National Register). The Chumash knew the adobe and the adjacent area as *Mistwaghewag* or *Mistaxiwax.* It is not known whether the village predated the founding of Rancho San Marcos.

Rancho and Anglo- Mexican Period History (1821-1880)

With the successful revolt of Mexico against Spain in 1821, all mission lands passed from Spanish to Mexican ownership. Anxious to remove any sources of former Spanish power, the Mexican government in 1834 secularized the missions and began to sell or grant their former grazing lands. Cachuma Lake falls within the historic territory of two large Mexican land grants, Tequepis and Rancho San Marcos. Governor Pio Pico granted Tequepis to Antonio Maria Villa in 1845. William Pierce acquired it from Villa's heirs in 1868. Rancho San Marcos, as described earlier, was originally part of the Santa Barbara Mission lands. Nicholas and Richard Den purchased the 35,500-acre rancho from Governor Pio Pico in 1846. As on other large, self-sufficient ranches in Santa Barbara County, cattle grazing and grain production were the principal economic mainstays on Tequepis and Rancho San Marcos.

After the Mexican-American War in 1848, California was ceded to the United States, becoming a state in 1850. Numerous easterners, mid-westerners, and Europeans immigrated to California, lured first by gold, and later by farming opportunities. Large land grants and cattle and sheep raising continued as the California way of life, until the great drought of 1862-64 killed most of the cattle, forcing large landholders into bankruptcy. At this point, the balance tipped from Mexican land ownership to

American, as foreclosed land began to be subdivided into smaller farm-sized parcels and sold to outsiders.

In 1855, the Christian natives residing at Mission Santa Inez were forced to take up residence at the site of the present Santa Ynez Indian Reservation. By this time, the Chumash population had been decimated by infectious diseases and had experienced massive social disruption due to European contact and missionization.

Americanization Period History (1890-1960)

As more and more Americans emigrated to California to buy farm land, towns sprang up, roads and wharves were developed to take crops to market, and a stage coach system grew up to connect passengers and mail throughout the state. Chinese laborers cut the Santa Ynez turnpike road over San Marcos Pass. Passengers traveling from Los Angeles to San Luis Obispo had to pay a toll. Stages stopped at Cold Springs to change the driver and horses and allow the passengers to get food and water. The present Cold Springs Tavern is a survivor of those early stagecoach days. Additionally, the stage stopped at Chalk Rock, now inundated by Cachuma Lake, and Ballard's adobe (County Landmark No. 20), four miles below Los Olivos.

Between 1874 and 1910, the towns of Lompoc, Santa Ynez, Los Olivos, Ballard, and Solvang were established. Settlers were attracted to the Santa Ynez Valley by good weather, water, and rich soil capable of producing wheat, barley and a wide variety of fruit trees. Point Sal and Lompoc wharves shipped the produce of these towns to markets up and down the coast. By 1887, the Pacific Coast Railway stop in Los Olivos provided Santa Ynez River Valley farmers an alternative way to get agricultural goods to market.

From mission times until the 20th Century, Santa Barbara relied on the De la Guerra wells for domestic water supplies. Even with supplemental sources, the water supply was inadequate for the growing population. As early as 1888, the Santa Ynez River was recognized as a potential major source of water for Santa Barbara. The Mission Tunnel was drilled in 1902 to carry water, by gravity, from the Santa Ynez River to Santa Barbara. Planning for the Cachuma Dam (now Bradbury Dam) was started in 1941, construction commenced in 1949 and the dam was completed in 1953. The reservoir filled with enough water to go over the spillway on April 12, 1958. The Recreation Area is federally owned land designated for recreational uses. It includes Cachuma Lake and approximately 6,448 acres of surrounding land.

4.11.3 Site Specific Setting

4.11.3.1 Cachuma Lake

There are at least 18 documented archaeological surveys or excavations within the area surrounding Cachuma Lake on file at the Central Coast Information Center (CCIC) housed at the University California, Santa Barbara (UCSB). The two most pertinent archaeological investigations for purposes of this EIR are Reclamation's 1986-87 survey for the proposed enlargement of Bradbury Dam (West and Slaymaker, 1987), and a 2001 survey by Reclamation for the EIR (West and Welch, 2001). The 2001 survey included a field examination of 12 archaeological sites recorded between the elevations of 734 to 760 feet. Lake elevation during the 1986-1987 survey was 730 to 740 feet. The lake level ranged from 741.3 to 746 feet during the 2001 survey.

Archaeological Resources

Maki conducted a record search at the CCIC for the proposed surcharge project in February 2001 (Maki, 2001). Forty-six archaeological sites are recorded within the Recreation Area. Forty-one of the sites are Native American in origin, three have historic and prehistoric and/or protohistoric materials, and two are historic. The status of the 46 archaeological sites in relation to surcharging of Cachuma Lake is as follows. Two archaeological sites were destroyed during construction of Bradbury Dam. There are 13 archaeological sites that have been inundated by Cachuma Lake and, thus, are located below the proposed surcharge zone. Twenty-five sites are located at and above elevations of 760 feet and, therefore, above the 1.8- and 3.0-foot surcharge impact zone. Three sites (CA-SBa-481, -2685H, and -2728H) were not relocated during the 1997 or 2001 surveys. It appears these sites are destroyed and would not be affected by the proposed surcharging (West and Welch, 2001).

The three remaining sites, CA-SBa-891, -2101, and -2105, are located along the current margins of the lake (750.75 feet maximum level) and extend above and below the lake level. As such, portions of the sites have been eroded over the past 50 years since the lake was established.

CA-SBa-891/2105

West and Slaymaker originally recorded CA-SBa-891/2105 as two separate sites in 1987 and described them as follows: CA-SBa-891 consists of a sparse scatter of milling tools with chert flakes and cores, basin metates, a unifacial slab metate, manos, and a possible mortar consisting of chert flakes, chert bifaces, cores, and a unifacial mano and a possible mano. West and Slaymaker noted severe wave erosion at both sites (West and Slaymaker, 1987).

The results of the 2001 field examination suggest that the gap between CA-SBa-891 and CA-SBa-2105 is the result of siltation and not an actual break in cultural deposits. Therefore, West and Welch (2001) concluded that the two archaeological sites are one large site. The 2001 field examination identified 20+ handstones, mostly bifacial, two pitted, and at least six large basin metates scattered along the wave cut portions of CA-SBa-891/2105. Other items noted included two pestles, several unifacial cobble tools, hammerstones, flakes, cores, and a single projectile point. CA-SBa-891/2105's artifact assemblage is consistent with sites that date to middle Holocene or earlier (Early Period/early Middle Period/Milling Stone Horizon) (West and Welch, 2001).

CA-SBa-2101

West and Slaymaker recorded CA-SBa-2101 in 1987 and described the site as a large linear midden with artifacts. Surface observations in 1987 indicated the site was at least 150 meters in length along western Santa Cruz Bay and 25 meters wide. Artifacts observed included: metates; unifacial, bifacial, and quadrifacial manos; pestles; chert cores and flakes; large quantities of fire-cracked rock; and marine shell with asphaltum (West and Slaymaker, 1987). The site was described as severely wave cut with a depth of at least 40-cm. It is probable that CA-SBa-2101 and CA-SBa-481 are the same site. The 2001 field investigation found that a large part of CA- SBa-2101 has apparently been eroded by reservoir fluctuations and the only intact part of the site is above the wave-cut bank.

Historical Resources

Rancho San Marcos Adobe

The Rancho San Marcos Adobe (CA-SBa-109/H) is listed on the NRHP. This historic site consists of the remains of the original mayordomo adobe built on the San Marcos Rancho in 1804, parts of one to three kilns and a remnant of the old Stagecoach Road. A number of buildings on the San Marcos Old Ranch Headquarters were evaluated as significant under CEQA for the Rancho San Marcos Golf Course project in 1990 (Rudolph, 1990). Prehistoric resources have also been associated with this site. The 3-foot surcharge would not impact the Rancho San Marcos' historic structures or prehistoric site area, as this site is located at an elevation above 760 feet.

Rancho San Fernando Rey

To the west of the Rancho San Marcos buildings on the shore of Cachuma Lake is the Rancho San Fernando Rey, which includes a large stable, adobe house, and numerous ranch hands' houses built by Dwight Murphy in 1938. The Rancho San Fernando Rey buildings have not been evaluated for historical significance. However, the rancho is not within the Recreation Area and the USGS 7.5' Cachuma Lake

Quadrangle indicates that the rancho's structures are all above the 760 feet elevation contour line and therefore would not be impacted by the 3.0-foot surcharge.

Bradbury Dam

The surcharge requires that small flashboards be placed on top of the Bradbury Dam gate. The dam is over 50 years of age but has no special engineering features or nationally significant criteria that would make it eligible for listing on the NRHP (West and Welch, 2001). Therefore, any minor modifications to Bradbury Dam would not constitute a significant impact on cultural resources.

Ethnographic Resources

Ethnographic resources in the Recreation Area include: (1) archaeological sites, especially large village sites and burial locations that provide a sense of continuity with the past and demand stewardship, particularly with respect to reburying ancestral remains; and (2) native plant species that are collected by contemporary Native Americans for basket-making, constructing sweatlodges and medicinal purposes. Ethnographic plant resources include tule, juncas, willow, and other species. There are no known gathering areas of plants used by contemporary Native Americans within the project area.

4.11.3.2 SWP Water Delivery Pipeline Routes in the Lompoc Valley

Ethnohistory

The Chumash living in the Lompoc and VAFB area have been grouped with the Purisimeño Chumash who occupied the coastline, adjacent interior and offshore islands from Point Conception to the Santa Maria River area. Their material culture, social organization, traditions and rituals, and cosmology are described in Blackburn (1975), Johnson (1988), Hudson et al. (1977), and Hudson and Underhay (1978). The era of Chumash contact with Europeans began with initial Spanish exploration in 1542 (Landberg, 1965). In 1769, the Portolá expedition passed through the Lompoc area traveling overland from San Diego to Monterey, and again on their return voyage in 1770. Juan Bautista de Anza and 240 companions camped in the area on their 1775-76 trip from Mexico to San Francisco. The Mission of San Luis Obispo was founded in 1772, the first Spanish establishment in Chumash territory (King, 1984), followed with Mission la Purisima Conception in 1788, in the present-day City of Lompoc, and Mission Santa Ynez in 1804. By 1803, La Purisima had removed most of the Chumash from the surrounding area; the neophyte population of La Purisima in 1804 is recorded as 1,520 (Dart, 1954). But in 1806, an epidemic of measles killed over 200 Chumash at La Purisima alone. In 1812, an earthquake severely damaged the Lompoc Mission, and the Fathers of Purisima decided to rebuild in a new location across the Santa Ynez River to the north. Although the mission buildings at the present-day location of La Purisima were completed by

1818, the resident neophytes continued to decline in numbers, from 888 in 1819 to 372 in 1831 (Dart, 1954). By the time of secularization in 1834, missionization and disease had severely impacted the Chumash and their culture (Greenwood, 1978).

History

During the Spanish Mission period, the proposed project area was within the lands controlled by La Purisima Mission, which in the years after secularization of the missions gradually fell into ruin. The mission lands were part of the Lompoc Rancho, granted to Domingo and Joaquin Carrillo in 1837; and in 1844 the Carrillo brothers also obtained by purchase the Mission Vieja Rancho-the original location of La Purisima Mission in present-day downtown Lompoc. The Carrillos then controlled approximately 42,000 acres consisting of the Lompoc Valley and the mesa and hills to the north and south. The land was used for cattle grazing and overseen by a majordomo and vaqueros. The following twenty years saw the Gold Rush related rise and decline of the cattle industry in California. The More brothers purchased the Lompoc Rancho around 1860. The Hollisters, Thomas Dibblee, and J.W. Cooper purchased it in 1863 for the purpose of establishing a sheep empire. After a disastrous first year due to drought, the enterprise was immensely successful, and these men purchased other neighboring ranchos with their profits (Dart, 1954).

In 1874, motivated by the desire to form a temperance colony in the Lompoc Valley, a group of businessmen from Santa Barbara, Santa Cruz and San Francisco formed the Lompoc Valley Land Company, purchasing the Lompoc and Mission Vieja Ranchos for $500,000. The eleven thousand acres that was initially put on the market was sold within three days (Dart, 1954), and the town quickly sprouted houses and agricultural fields in its rich soil. In 1879, the Company sold all of its remaining unsold lands back to the original owners, but the town of Lompoc, which was incorporated in 1888, continued to grow. In the ensuing years, agriculture, and the diatomaceous earth and defense industries, have been the primary economic mainstays of the community. Development of the project area began in the 1960's with the expansion of VAFB and the establishment of the communities of Vandenberg Village and Mission Hills (Spanne, 1992).

Site Records Search

In January 2001, Gerber conducted a site records review for the SWP water delivery pipeline routes; and examined base maps and reports at the CCIC. The results of the search indicate that 37 cultural resource surveys or other studies have been recorded within a 1.0-mile radius of the pipeline corridor (Gerber, 2001). Only a small portion of the pipeline routes appears to have been previously surveyed. The previously surveyed area consists of about 80 linear feet along both sides of McLaughlin Road immediately east of the Santa Ynez River (Levulet et al., 1998). Additional portions of the project area may have been surveyed for the Mission Hills Interceptor and Pumping Station Project, but the actual surveyed area is not clear from the available maps (Spanne, 1978).

Three additional sites, CA-SBa-221, -1751, and -2705, are located within a 0.25-mile radius of the pipeline routes. The three sites are all located on the alluvial plain or terraces of the Santa Ynez River and do not appear to be located immediately adjacent to the pipeline routes.

Pedestrian Survey

Gerber conducted a pedestrian survey of the unpaved portions of the pipeline routes in February 2001 (Gerber, 2001). The surveyed area consisted of an approximately 100-foot corridor along roads and through agricultural fields. Gerber examined thoroughly the ground surface for prehistoric artifacts or any other culturally derived materials indicating the presence of a prehistoric or historic archaeological site. The overall visibility was fair and considered sufficient for an adequate assessment of the presence or absence of cultural materials on the surface. No cultural material greater than 50 years of age was observed during the survey of the unpaved portions of the pipeline corridor.

4.11.4 Potential Impacts of the Alternatives

4.11.4.1 Impact Thresholds

"A project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." (Pub. Resources Code, Section 21084.1.) In evaluating historical resources, several criteria are considered. A resource shall generally be considered "historically significant" if the resource is listed or the lead agency determines that the resource meets the criteria for listing on the California Register of Historical Resources (CRHR) (Pub. Resources Code, Section 21084.1; Cal. Code Regs., tit. 14 Section 15064.5, subd. (a)(3)). The criteria used for determining the eligibility of a resource for the CRHR are similar to those developed by the National Park Service for the National Register of Historic Places (NRHP).

To be eligible for listing in the NRHP, historic properties must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of the following NRHP criteria:

- Association with events that have made significant contributions to the broad patterns of the history of the United States;
- Association with the lives of people significant in United States history;

- Embodiment of the distinctive characteristics of a type, period, or method of construction; representation of the work of a master; possession of high artistic value; or representation of a significant and distinguishable entity whose components may lack individual distinction; or
- Has yielded, or is likely to yield, information important in prehistory or history.

The criteria of eligibility for the CRHR were reworded to better reflect California history. The criteria include the following:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
- Is associated with the lives of persons important in our past;
- Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
- Has yielded, or may be likely to yield, information important in prehistory or history.

(Cal. Code Regs., tit. 14, Section 15064.5, subd. (a)(3)(A-D).) As with the process of evaluating historical resources for National Register eligibility, California Register evaluations include the consideration of seven aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. The evaluation of integrity must be judged with reference to the particular criterion or criteria under which a resource may be eligible for the California Register.

Under CEQA, impacts on some historical resources besides those listed or eligible for listing on the CRHR must also be considered. "The fact that a resource is not listed in, or determined to be eligible for listing in the [CRHR], not included in a local register of historical resources (pursuant to section 5020.1(k) of the Public Resources Code), or identified in an historical resources survey (meeting the criteria in section 5024.1(g) of the Public Resources Code) does not preclude a lead agency from determining that the resource may be an historical resource as defined in Public Resources Code sections 5020.1(j) or 5024.1." (Cal. Code Regs., tit. 14, Section 15064.5, subd. (a)(4))

An archeological resource constitutes a significant historical resource if it meets the definition of an "historical resource" described above. In addition, an archaeological resource may meet the definition of a "unique archeological resource" under Public Resources Code section 21083.2.

Discussion of Data and Analyses

The evaluation of impacts to cultural resources along the margins of Cachuma Lake is based on an assessment of the project area entitled "Data Recovery Excavation at Two Prehistoric Archaeological Sites on Cachuma Reservoir, Santa Barbara County, California" (Bever et. al., 2004) completed in October of

2004. This assessment builds upon archaeological surveys conducted by Reclamation in 1986–1987 and 2001 (West and Slaymaker, 1987; West and Welch, 2001), and supplemented by archaeological site records and additional survey reports on file at the Central Coastal Information Center (CCIC) (Maki, 2001).

Cachuma Lake

Pacific Legacy, Inc. prepared the aforementioned report, as a contractor to Reclamation, in order to satisfy the terms laid out in the 2002 Memorandum of Agreement (MOA) between Reclamation and State Historic Preservation Officer (SHPO) (CCRB 2006d). The report presents the results of excavation, analysis, and interpretation of two prehistoric archaeological sites, CA-SBa-891/2105 and CA-SBa-2101, located along the lake margins that would be subject to increased erosion under both the 1.8 and 3.0-foot surcharge schemes.

The sites may be subjected to erosion by wave action and inundation for periods longer than have occurred under previous reservoir operations. Findings of the report also indicate that both sites are to be considered historic properties eligible for listing in the National Register of Historic Places. Because of this determination, and the potential effects of the proposed project, the project is considered an "undertaking" subject to Section 106 of the National Historic Preservation Act (NHPA).

Reclamation has conducted a parallel assessment of the effects of surcharging on cultural resources along the lake margin pursuant to Section 106. As part of the Section 106 process, consultants for Reclamation have conducted several identification-level cultural resources surveys. Reclamation has also consulted with the Santa Ynez Band of Mission Indians.

West and Welch (2001) evaluated CA-SBa-891/2105 as follows: "In summary, while portions of the cultural deposit within the draw down zone have been destroyed or have been more or less permanently inundated, undisturbed deposits still remain above the inundation zone. Because of the high likelihood that large areas of undisturbed cultural deposits still remain at SBa-891/2105, the site appears to have significant research potential in clarifying the region's prehistory and thus we conclude that it is eligible to the National Register under criterion D."

West and Welch (2001) conclude their evaluation of CA-SBa-2101 as follows: "While much of this site has been destroyed it appears that some cultural deposit remains and that the site still contains, albeit incomplete, information that would be useful for interpreting the area's prehistory and would be eligible under criterion D. The site may provide chronological data that may be useful in reconstructing settlement patterns. The presence of marine shell indicates connections with the coast. Several test pits may help to clarify the significance of this site."

During 2001, Reclamation completed a Determination of Effect for the surcharge (West and Welch, 2001) after consultations with the California State Office of Historic Preservation (SHPO). Modification of flashboards on the spillway gates would increase maximum lake level from 750.75 feet to 751.8 feet under Alternatives 3B and 5B, and to 753.0 feet under Alternatives 3C, 4B, and 5C. Reclamation determined the Area of Potential Effect to be the zone of changed reservoir elevation, plus the rise that may occur during exceptionally high flows such as occurred in 1969 for cultural resource purposes. This includes the rise to 753 feet for normal operations plus an additional approximated 7 feet that may occur during peaks in runoff during exceptional high flow events. While most adverse affects will occur within the 750-753 zone, infrequent short-term inundations and wave actions could possibly occur up to the 760-foot elevation level. It is expected that these short-term events will be less than 24 hours in length and occur infrequently.

The type of impacts prehistoric sites within project area would be subjected to include erosion by wave action, and inundation for periods longer than have occurred under the current reservoir operations. Inundation effects to sites will vary with landforms, contours, water depth, rock type, soil type, length of fetch for wave generation, currents, sediment load, debris, and temporal factors. Erosion of the sites could destroy their integrity and the elements of the sites that constitute their historic significance. The disturbance of the sites is considered a significant, but mitigable impact. For purposes of this EIR, a significant but mitigable impact is defined as a Class II impact (see **Section 4.1.3**). Impacts could be reduced to less than significant by the application of Mitigation Measures CR-1 and CR-2.

In addition, there is a potential that buried cultural resources, prehistoric and/or historic, could be exposed or eroded by the proposed surcharging scenarios, which is considered a significant, but mitigable impact (Class II). These impacts could be reduced to less than significant levels by the application of Mitigation Measures CR-2 and CR-3.

SWP Water Delivery Pipeline Route

The SWP pipeline routes occur in an area with a high density of archeological sites. Hence, unknown archeological resources could be encountered during trenching for the pipeline in the unpaved areas of the route (Alternatives 4B), particularly between Highway 246 along the margin of River Park and across the cultivated fields north to McLaughlin Road. This impact is considered significant but mitigable (Class II). Any impacts can be mitigated by implementing the procedures in Mitigation Measure CR-4.

Comparison of Alternatives

The potential changes in operation of the Cachuma Project could result in the following types of impacts to cultural resources:

- Potential impacts to prehistoric archeological sites along the margins of Cachuma Lake due to increased lake levels due to surcharging at 1.8 or 3.0 feet under Alternatives 3B, 3C, 4B, 5B and 5C.
- Potential impacts to prehistoric archeological sites due to the installation of a pipeline and associated facilities in order to deliver SWP water to the Lompoc Valley under Alternative 4B.

Under baseline operations (Alternative 2) and Alternatives 3B, 3C, 4B, 5B and 5C, Reclamation and the Member Units will implement many non-flow related habitat enhancements in the watershed to improve conditions for steelhead and other aquatic species. Several of the management actions could cause physical disturbances, which in turn could affect prehistoric archeological resources. These actions include the construction of the Hilton Creek channel extension, and the tributary enhancement measures that involve erosion control and range management projects in upland areas. Other management actions would not result in physical disturbances to the environment, or would only occur in active stream or river channels where intact archeological resources are absent. Reclamation and the Member Units will conduct the appropriate cultural resources studies for each individual project as it is proposed for implementation. Therefore, all alternatives would result in a Class II, significant but mitigable, impact.

4.11.5 Mitigation Measures

4.11.5.1 Cachuma Lake Sites

Federal regulations provide a mechanism by which Reclamation can conclude the Section 106 process by the use of a Memorandum of Agreement (MOA). After consultations with the SHPO regarding the Determination of Effect, Reclamation and the SHPO entered into an MOA titled *Memorandum of Agreement Between the Bureau of Reclamation and the California State Historic Preservation Officer Regarding the Additional Surcharge to Cachuma Reservoir Santa Barbara County, California*, West 2002. The Santa Ynez Band of Mission Indians was consulted as a concurring party; however, they chose not sign the MOA. Execution of this agreement and implementation of the terms evidences that the appropriate agencies have afforded the ACHP a reasonable opportunity to comment on the management and treatment of the historic properties affected by the surcharge and that the effects of the surcharge on such properties have been taken into account in compliance with Section 106 of the NHPA. The MOA defines the agency roles and responsibilities, and specifies how and when mitigation will occur.

Section 15126.4, subdivision (b) of the CEQA Guidelines prescribes the treatment of historical resources, including historical resources of an archaeological nature. The Guidelines provide that public agencies should avoid impacts to historical resources of an archaeological nature when feasible. (Cal. Code Regs., tit. 14, Section 15126.4, subd. (b)(3).) Where a project will impact significant sites and avoidance is difficult or impractical, mitigation of impacts may be achieved through data recovery. (*Id*., Section 15126.4, subd. (3)(C).)

According to West and Welch (2001), past attempts to protect archeological sites in the draw down zone of reservoirs have been expensive and ineffective (Carrell et al., 1976; West and Welch, 2001). Storms or seismic events can destroy even the most well maintained protective structure such as an earthen berm, riprap, sheet piling or even gunite caps, leading to irreparable flooding damage to the cultural resource that was to be protected. Generally, it is Reclamation's policy to preserve and protect historic properties. However, since long-term protection within the surcharge impact zone is realistically unfeasible, Reclamation has determined that data recovery is the preferred alternative for mitigating project impacts to a less than significant level.

The most likely significance criterion for a prehistoric archeological resource is the potential to yield important information. Archeological sites that are important for their data alone can usually be mitigated through data recovery (excavation). The information potential represented by subsurface deposits of artifacts and ecofacts may be realized through the extraction of data through excavations and the analysis of artifacts and provenience information.

Pursuant to the conditions of the MOA, a treatment plan titled *Treatment Plan for Prehistoric Archeological Sites Sba-891/2105 and Sba-2101/481, Cachuma Reservoir (Bradbury Dam), Santa Barbara County, California* (West, 2002) was finalized to provide for data recovery at the two prehistoric sites that will be adversely affected by the surcharge. According to West and Welch (2001), one of the goals of the MOA is to recover data that will clarify the region's prehistory. Primary issues that need to be addressed include chronology, settlement patterns and the relationship of the area's archeology to geomorphic features.

Guidelines for excavation of archeological sites (Department of Parks and Recreation, 1991) stipulate that archeological excavations should be conducted in reference to explicitly stated research designs. Previous research in the locality has identified regionally important research questions, test implications and data requirements for archeological research within Santa Barbara County.

The mitigation measures listed below will reduce the impacts under Alternatives 3B, 3C, 4B, 5B and 5C to a less than significant level.

Data recovery, as outlined in the MOA, took place throughout 2003, well before Reclamation began to implement a phased surcharge. The data is presented in "Data Recovery Excavation at Two Prehistoric Archaeological Sites on Cachuma Reservoir, Santa Barbara County, California" (Bever et al., 2004).

CR-1 Data recovery excavation shall be conducted of a representative sample of the features and artifacts contained within those portions of CA-SBa-891/2105 and CA-SBa-2101, which will be impacted by surcharging. The excavations shall be conducted in accordance with the *Treatment Plan for Prehistoric Archeological Sites Sba-891/2105 and Sba-2101/481, Cachuma Reservoir (Bradbury Dam), Santa Barbara County, California,* prepared by West (2002). All cultural materials collected shall be curated at a qualified institution that has proper facilities and staffing for insuring research access to the collections. Reports of the scientifically consequential information that is recovered from the site shall be deposited with the California Historical Resources Regional Information Center.

CR-2 Reclamation shall implement the Memorandum of Agreement, titled *Memorandum of Agreement Between the Bureau of Reclamation and the California State Historic Preservation Officer Regarding the Additional Surcharge to Cachuma Reservoir Santa Barbara County, California* prepared by West in 2002 and developed in consultation with the Santa Ynez Band of Mission Indians and the State Historic Preservation Officer.

CR-3 If any currently unknown archaeological resources or archeological materials are identified within the project area, activities shall cease within 100 feet of the discovery and a professional archeologist shall evaluate the find, and recommend appropriate mitigation measures in accordance with the applicable federal and state guidelines. Project-related activities shall not resume within 100 feet of the find until all approved mitigation measures have been completed to the satisfaction of the appropriate federal and state agencies.

4.11.5.2 SWP Water Delivery Pipeline Route

CR-4 If any currently unknown archeological resources or archeological materials are identified within the project area, activities shall cease within 100 feet of the discovery and a professional archeologist shall evaluate the find, and recommend appropriate mitigation measures in accordance with the applicable federal and state guidelines. Project-related activities shall not resume within 100 feet of the find until all approved mitigation measures have been completed to the satisfaction of the appropriate federal and state agencies.

4.12 CLIMATE CHANGE

4.12.1 Regulatory Requirements

Substantial work on the effect of climate change on future water supplies has been completed by the California Department of Water Resources (DWR) and other entities. DWR has issued a number of technical studies and memoranda that discuss potential impacts on water supply, and how increased water-use efficiency can reduce annual urban and agricultural demand. DWR has indicated in its studies that accelerating efficiency efforts could result in a cumulative reduction of greenhouse gas (GHG) emissions. Substantial comments were made on the Revised Draft EIR that related to conservation measures.

GHG emissions are being considered as a relatively new issue in environmental documents because of their impact to climate change. Currently, there are no standard, widely used methodologies or significance criteria to address climate change impacts from GHG emissions. At the state level, air districts have generally provided guidance on analysis methodologies and significance criteria for criteria pollutant and toxic air contaminant impacts, but they have not yet established guidelines for GHG emissions and their impacts.

4.12.2 Environmental Setting

Climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The state has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year.

These climate-driven changes affect resources critical to the health and prosperity of California. For example, forest wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later. The state's water supply, already stressed under current demands and expected population growth, will shrink under even the most conservative climate change scenario. Almost half a million Californians, many without the means to adjust to expected impacts, will be at risk from sea level rise along bay and coastal areas.

With the growing recognition that climate change is already underway and science that suggests additional impacts are inevitable despite mitigation efforts, adaptation planning is rapidly becoming an important policy focus in the United States and internationally. Historically, California state agencies and private entities have adjusted their practices to account for climate impacts. For example, reservoirs and levees have been built to protect against common winter and springtime floods and periods of summer drought. In agriculture, improvements in irrigation efficiency have been made to better ensure water reliability and supply.

4.12.2.1 Climate Change Forecasts

The state's 2009 Climate Change Impacts Assessment (the 2009 Scenarios Project) provides the scientific basis from which statewide climate impacts were synthesized for this adaptation strategy.[1] The 2009 Scenarios Project examined future projections for changes in average temperatures, precipitation patterns, sea-level rise, and extreme events, as well as resulting impacts on particularly climate-sensitive sectors. For the 2009 Scenarios Project, a set of six global climate models were run using two emissions scenarios (A1 and B1). These emissions scenarios are part of a family of common scenarios used by the Intergovernmental Panel on Climate Change (IPCC) in its 2007 assessment. It is important to note that these two scenarios do not bracket the entire range of possible future emissions and resulting climatic changes, as even higher emissions or lower emissions futures are possible. Moreover, it is impossible to say with scientific confidence which of the two scenarios is more likely.

Generally, research indicates that California should expect overall hotter and drier conditions with a continued reduction in winter snow (with concurrent increases in winter rains), as well as increased average temperatures, and accelerating sea-level rise. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. The impacts assessment indicates that extreme weather events, such as heat waves, wildfires, droughts, and floods, are likely to be some of the earliest climate impacts experienced.

Temperature Projections

Climate change temperature projections generated for the 2009 Scenarios Project suggest the following:[2]

- Average temperature increase is expected to be more pronounced in the summer than in the winter season.
- Inland areas are likely to experience more pronounced warming than coastal regions.
- Heat waves are expected to increase in frequency, with individual heat waves also showing a tendency toward becoming longer and extending over a larger area, thus more likely to encompass multiple population centers in California at the same time.

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1 California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 17.

2 Ibid, 18.

- As GHGs remain in the atmosphere for decades, temperature changes over the next 30 to 40 years are already largely determined by past emissions. By 2050, temperatures are projected to increase by an additional 1.8 to 5.4°F; similar for both the A2 and B1 scenarios (an increase one to three times as large as that which occurred over the entire 20th century).
- After the middle of the century, temperature projections clearly diverge for the A2 and B1 scenarios (as a result of emissions choices made in the early part of the 21st century), with A2 projections leading to significantly greater warming. By 2100, the models project temperature increases between 3.6 to 9°F.

Precipitation Projections

Current climate change projections suggest that California will continue to enjoy a Mediterranean climate with the typical seasonal pattern of relatively cool and wet winters and hot, dry summers. While precipitation levels are expected to change over the 21st century, models differ in determining where and how much rain and snowfall patterns will change under different emissions scenarios.[3] While the precipitation results vary more than the temperature projections, precipitation models run by the Scripps Institution of Oceanography suggest a small to significant (12-35 percent) overall decrease in precipitation levels by mid-century. In addition, higher temperatures increase evaporation and make for a generally drier climate, as higher temperatures hasten snowmelt and increase evaporation and make for a generally drier climate. Moreover, the 2009 Scenarios Project concludes that more precipitation will fall as rain rather than as snow, with important implications for water management in the state. California communities have largely depended on runoff from yearly-established snowpack to provide the water supplies during the warmer, drier months of late spring, summer, and early autumn. With rainfall and meltwater running off earlier in the year, the state will face increasing challenges of storing the water for the dry season while protecting Californians downstream from floodwaters during the wet season.

Sea-Level Rise Projections

Over the 20th century, sea level has risen by about seven inches along the California coast.[4] Replacing previous projections of relatively modest increases of sea-level rise for the 21st century, the 2009 Scenarios Project built on scientific findings that became available in the last two years to produce estimates of up to 55 inches (1.4 meters) of sea-level rise under the A2 emissions scenario by the end of this century. This projection accounts for the global growth of dams and reservoirs and how they can affect surface runoff into the oceans, but it does not account for the possibility of substantial ice melting from Greenland or the West Antarctic Ice Sheet, which would drive sea levels along the California coast even higher. Projections

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3 California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 19.

4 Ibid, 20.

of sea level rise under the B1 scenario are still several times the rate of historical sea-level rise, and would barely differ under a stringent "policy scenario" in which global emissions would be drastically reduced. This suggests that, while mitigation will be important to minimize many climatic and ecological impacts, adaptation is the only way to deal with the impacts of sea-level rise that is anticipated under either emissions scenario during the 21st century. In short, even on a lower emissions trajectory and without the addition of meltwater from the major continental ice sheets, sea levels in the 21st century can be expected to be much higher than sea levels in the 20th century.

Projection of Extreme Events

Changes in average temperature, precipitation, and sea level are significant, especially under the higher emissions (A2) scenario.[5] Yet gradual changes in average conditions are not all for which California must prepare. In the next few decades, it is likely that the state will face a growing number of climate-change-related extreme events such as heat waves, wildfires, droughts, and floods. Because communities, infrastructure, and other assets are at risk, such events can cause significant damages and are already responsible for a large fraction of near-term climate-related impacts every year.

One recent study, conducted as part of the 2009 Scenarios Project, synthesized existing research to characterize the direct impacts of extreme events across different sectors of California's economy, including public health, energy, agriculture, and natural ecosystems. It also analyzed how impacts from extreme events "spill over" from one sector into other sectors and produce new projections of the future frequency and intensity of extreme events for all counties in California.

Consistent with other studies, researchers found that significant increases in the frequency and magnitude of both maximum and minimum temperature extremes are possible in many areas across the state. For example, in many regions of California, the study projected at least a tenfold increase in the frequency of extreme temperatures currently estimated to occur once every 100 years, even under the moderate B1 emissions scenario. Under the A2 emissions scenario, these 100-year temperature extremes are projected to occur close to annually in most regions. Projections of precipitation extremes vary by model and downscaling method used, and expected changes tend to vary across the state. In general, however, it appears longer dry spells will become more common over the 21st century, interspersed with the occasional intense rainfall event.

The July 2006 heat wave and the December 1998 freezing spell represent rather memorable extreme events in recent California history. Researchers in the 2009 Scenarios Project asked how the frequency of

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5 California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 21.

similar events may change with climate warming. Not surprisingly, they found that heat waves similar in length and intensity to those experienced in 2006 may become more frequent all across the state in the 21st century, with some simulations using the higher emissions scenario suggesting that such events could become annual occurrences by the end of this century.

In contrast, freezing spells such as that in 1998 are projected to become less frequent across the state even in locations where they are currently a yearly event. Over large portions of the state, freezing events may occur once every ten years or less by the end of the 21st century.

According to the 2009 Scenarios Project, the frequency of large coastal storms and heavy precipitation events do not appear to change significantly over the 21st century. However, even if storm intensity or frequency were not to change, storms will impact the California coast more severely due to higher average sea levels that can result in higher storm surges, more extensive inland flooding, and increased erosion along the state's coastline. Future research should improve our understanding of these extreme precipitation events and their potential impacts on coastal erosion and floods.

Abrupt Climate Changes

Most climate projections developed to date, including those used in this report, produce gradual if sometimes substantial changes for a given climate variable. In the past, rapid climate changes have been observed and scientists are increasingly concerned about additional abrupt changes that could push natural systems past thresholds beyond which they could not recover. Such events have been recorded in paleoclimatological records but current global climate models cannot predict when they may occur again. Such abrupt changes have been shown to occur over very short periods of time (a few years to decades) and thus represent the most challenging situations to which society and ecosystems would need to adapt.

Short of being able to predict such abrupt changes, scientists are focusing their attention on aspects of the climate and Earth system called "tipping elements" that can rapidly bring about abrupt changes. Tipping elements involve thresholds where increases in temperature cause a chain reaction of mutually reinforcing physical processes in the Earth's dynamic cycles. The most dangerous of these include the following:

- A reduction in Arctic sea ice, which allows the (darker) polar oceans to absorb more sunlight, thereby increasing regional warming, accelerating sea ice melting even further, and enhancing Arctic warming over neighboring (currently frozen) land areas.
- The release of methane (a potent GHG), which is currently trapped in frozen ground (permafrost) in the Arctic tundra, will increase with regional warming and melting of the ground, leading to further and more rapid warming and resulting in increased permafrost melting.

- Continued warming in the Amazon could cause significant rainfall loss and large scale dying of forest vegetation, which will further release CO_2.
- The accelerated melting of Greenland and West Antarctic Ice Sheets observed in recent times, together with regional warming over land and in the oceans, involves mechanisms that can reinforce the loss of ice and increase the rate of global sea-level rise.

The temperature increases that could trigger these chain reaction events are still the subject of research, but estimates range from 1 to 3°F of additional warming for widespread, rapid (10 years) Arctic sea ice melt; 2 to 4°F for irreversible melting of the Greenland Ice Sheet (over the next 300 years or more); 5 to 9°F for the irreversible melting of the West Antarctic Ice Sheet (also over 300 or more years), and 5 to 7°F for Amazon forest die-back. Should these thresholds be crossed in the coming decades, the Earth's sea level would be on an irreversible course destined to rise 7–12 meters (as much as 23–40 feet) over the course of several centuries—a rate not seen in human history.

Another tipping element that could have a significant effect on California's long-term climate variability is the potential intensification of the El Niño Southern Oscillation (ENSO) cycles over the Pacific Ocean. ENSO is one key factor in California's wet year and drought year cycles, and intensification would mean stormier wet years and even drier (or extended periods of) drought years. It would also mean more severe coastal storms during the winter months and hence more erosion and coastal flooding. Current research indicates that a tipping point of 6 to 11°F could trigger this intensification of ENSO cycles.1

4.12.3.2 Impact Assessment

The following sections focus on the climate change impacts:

- Biodiversity and Habitat
- Oceans and Coastal Resources
- Water Supply

Biodiversity and Habitat

The IPCC's Fourth Assessment Report found that global climate warming is "unequivocal" and largely attributable to human activities. Despite the certainty that climate change is currently underway and having an impact on natural resources, there are still many unanswered questions about how these climate effects will play out at local, state, and regional scales and how ecosystems will respond to those changes.

Although there is still uncertainty on regional variations in climate change impact, it is likely the nation's fish and wildlife species and their habitats will experience many of the following impacts:[6]

- Temperatures and precipitation changes will vary regionally but will lead to changes in the water cycle that will impact both aquatic and terrestrial species.
- Extreme events such as floods, heat waves, droughts, and severe storms are expected to increase resulting in increased wildfires, pests, diseases, and invasive species that will alter habitat for many species.
- Sea level rise will result in significant losses to coastal wetlands and estuary habitats. Some regions will see large shifts in their coastline due to increased sedimentation and/or coastal erosion. Ocean acidification will impact marine life, particularly coral reef ecosystems.
- With increasing temperatures, flora and fauna will migrate northward and/or to higher elevations to escape warming conditions. For some species, the inability or lack of opportunity to migrate to a more suitable climate may lead to extinction or extirpation.
- Temperature increases will alter seasons and result in earlier spring and later fall. This will result in migration pattern shifts of birds and migratory insects that may cause misalignment of food availability.
- Reduced snowpack and increased temperatures in streams, rivers, and lakes will contribute to decreased populations of freshwater and anadromous fish such as salmon and trout and altered flooding regimes that will affect spawning and rearing habitat for many aquatic species.

Individual species and habitats will have very different responses to climate change. Many species and habitats will be negatively affected by climate change and will require a special set of actions in order to ensure their survival. Some species may benefit from a changing climate and could expand their range or increase in abundance; requiring a separate set of actions. In addition, the movement of species will create new communities of species for which there will be no previous examples and will require new management regimes. Wildlife management plans will need to reflect these changes and will likely need to be updated on a more frequent basis.

Climate change is a large and growing threat to wildlife and natural systems, but it will also exacerbate many existing threats. Efforts to address climate change should not diminish the immediate need to combat threats that are independent of climate change, such as habitat loss, invasive species spread, pollution, and wildlife diseases. Our goal should be to sustain ecosystems and viable wildlife populations regardless of the threat.

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6 Association of Fish and Wildlife Agencies, Voluntary Guidance for Sates to Incorporate Climate Change into Wildlife Action Plans & Other Management Plans, September 2009. 7.

Increased Temperature

Every species has a temperature range in which it thrives and can survive.[7] Brief exposures to extreme temperature events or repeated occurrences of temperatures outside of the range will stress plants and animals, and will exacerbate environmental pressures exerted by competitors, predators, pests and invasive species, habitat change, varying food and water supplies, diseases, and anthropogenic stressors such as contaminants and habitat fragmentation. As average temperatures rise, plant and animal species will increasingly be confronted by thermal stress, which will force terrestrial plant and animal species to either adapt to these changing conditions and/or shift their geographical range to conditions that are more favorable. Shifts in geographical range depend upon availability and accessibility of appropriate habitat, as well as the necessary behavioral and life history characteristics that promote rapid dispersal and establishment of new populations. If species are unable to adapt in situ or shift their ranges, local populations may be extirpated and species may face extinction.

Species that cannot adapt in their existing communities may, over time, shift in their ranges if appropriate habitat is available, accessible, and if their behavioral characteristics allow. If they are unable to shift their ranges, they face the threat of local extirpation, if not extinction. The amount of future warming expected in California may likely exceed the tolerance of endemic species (i.e., those that are native to a specific location and that occur only there) given their limited distribution and microclimate.

Species that have the capacity to shift their ranges will require movement corridors that are not blocked by natural landscape features or human development. Planning to maintain natural corridors in anticipation of predicted climate changes should be factored into future local and regional habitat conservation planning efforts.

Invasive Species

Disturbance events or extreme weather events thought to increase due to climate change generally benefit invasive species given their tolerance to a wide range of environmental conditions.[8] Invasive species often have greater flexibility and can survive under variable and extreme conditions, such as flood events or drought. Invasive species also tend to produce large numbers of seeds or young and are capable of long-distance dispersal; they also have the ability to outcompete native species (especially plants that require no pollination or seed development).

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7 California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 47-48.

8 Ibid, 48-49.

Invasive species threaten the diversity or abundance of native species through competition for resources, predation, parasitism, interbreeding with native populations, transmitting diseases, or causing physical or chemical changes to the invaded habitat. Through their impacts on natural ecosystems, agricultural and other developed lands, water delivery and flood protection systems, invasive species may also negatively affect human health and/or the economy. Examples of direct impact to human activities include the clogging of navigable waterways and water delivery systems, weakening flood control structures, damaging crops, introducing diseases to animals that are raised or harvested commercially, and diminishing sport fish populations.

Changes to Community Composition and Interactions

Warming has already impacted the seasonal timing of biological events in California, including flowering times, leaf emergence, fall bird migration, and insect emergence.[9] In addition, interactions between climate change, habitat fragmentation, and agricultural practices may have critical impacts on pollination services for crops and wild plants. A change in composition can disrupt biological interactions and impact ecosystem dynamics by displacing existing biological interactions and replacing it with another.

Expected range shifts in response to precipitation and temperature changes may differ, and responses to novel climates are difficult to predict.

Ecosystem Services

Biodiversity in natural ecosystems and working landscapes supports a wide range of ecosystem services that sustain human well-being and the economy of California.[10] Ecosystem services are simply defined as the benefits people obtain from ecosystems. These include carbon sequestration, forage production, timber production, water storage and filtration, crop pollination, soil fertility, fish and game habitat, tourism, recreation and aesthetic values.

Warming, changes in precipitation, and increases in extreme events (drought, storms, heat waves, etc.) are expected to alter many ecosystem services, due to impacts on biodiversity and on the structure and functioning of ecosystems. Changes in the geographic distribution of individual species and major habitats will alter the distribution of ecosystem services across the state. Reduced snowpack, changes in water flows, expansion of reservoirs, and warmer water temperatures will impact freshwater ecosystems, with likely negative effects on many native species. Conflicts between human water uses and management of game and non-game fish populations are expected to increase under future climates.

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9 California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 49.

10 Ibid, 49-50.

Precipitation Changes and Extreme Events

Changes in Streamflow

Current projections for California suggest that precipitation and temperature events will be more extreme.[11] For example, more frequent and intense heat waves can impact heat-sensitive species, reducing fitness and increasing mortality. With more precipitation falling as rain (less snowpack), river flows during the winter and spring seasons will be greater, while reduced snowfall in the winter will result in reduced snowmelt and subsequently lower streamflows during summer months.

One of the first species groups impacted by streamflow change will be fish. Fish reproduction is affected by streamflows in several ways. Increases in winter runoff and earlier spring peak flows are likely to lead to increases in the number of flooding events during these seasons. Early spring, high-runoff periods or flooding may occur during egg incubation periods for many fish species, thus impacting reproduction. High streamflow could additionally shift streambed gravel, and heighten the risk of damage to incubating eggs; while the emergence of juveniles can be displaced, thus undermining the reproductive success of species.

As a result of a decrease in snowpack and earlier snowmelt, streamflows are expected to be lower during the summer months and extending into the fall. In addition, reduced stream water depth and higher air temperatures will increase stream water temperatures to levels that are potentially unhealthy for coldwater fish. Salmonids are temperature-sensitive and rely on precipitation and snowmelt. The projected changes in inland water temperatures with changing seasonal flows is projected to place additional stress on these species, contributing to the need for increased resources for monitoring and restoration efforts. It is common for adult fish migrating to spawning grounds to encounter obstacles that require high-flow conditions in order to pass. If climate change results in reduced streamflows, this could impede or halt their progress. A delay in the arrival to spawning grounds may decrease reproductive success and increase fish mortality. Repeated low streamflows during spawning migration periods may naturally select against large adult body sizes.

The projected changes in temperature and precipitation patterns will also affect the distribution and longevity of available surface water. Changes in the composition and structure of riparian communities may result from changes in precipitation and flow and could contribute to increased management conflicts as the needs of humans and wildlife compete for limited resources. Changes in temperature and

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[11] California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 50-51.

precipitation associated with climate change may lead to less stored water and will have a direct effect on the survival of aquatic species and the preservation of wetland habitats.

Other factors impacting aquatic species may be exacerbated by changes in precipitation, including the timing and amount of river and stream diversions, temperature changes, and pollution or sediment load. Alterations in timing and magnitude of high- or low-water events could impact riparian vegetation and the species that depend on it.

Floods and Droughts

Aside from the impacts of high-runoff events and flooding on stream habitats and fish populations, periodic floods have always been a part of the formation of landscapes and ecosystem processes.[12] Species and ecosystems in riparian habitats are largely adapted to such events. The projected increase in drought conditions will further impact stream and terrestrial habitat quality as well as the adaptive capacity of ecosystems to continue to provide their goods and services.

Reduced rainfall and snowmelt will lead to less water infiltrating the soil, stressing plants and animals. This reduced infiltration rate will also diminish groundwater recharge. Lowered levels of groundwater, combined in coastal areas with saltwater intrusion, will exacerbate dry conditions and further stress species and habitats. Together, all these changes in water availability can cause landscape transformations as conditions select for species that require less water.

Fish and Wildlife Challenges

Species' abundance and distribution are dynamic due to a variety of factors, including climate. As climate changes, the U.S. Fish and Wildlife Service has indicated that an abundance and distribution of fish and wildlife will also change.[13] However, it can be difficult to estimate with precision which species will be affected by environmental change, and exactly how they will be affected.

Using a landscape conservation approach to strategically connect the most important blocks of wildlife and aquatic habitat will be important to allow wildlife to adapt to climate change. This highlights the need for collaborative and partnership efforts with landowners, state and local governments, tribes, federal agencies, and conservation organizations.

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[12] California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 51-52.

[13] US Fish and Wildlife Service, Climate Change in the Pacific Region, http://www.fws.gov/pacific/Climatechange/challenges.html.

Fish and wildlife managers will need to take a variety of actions to address the many climate-related threats to species and ecosystems. For example, Fish and Wildlife Service manages America's National Wildlife Refuge System, and changing climate will force change in the stewardship of these lands. Some challenges posed by a changing climate might include:

- Changing patterns of rain and snowfall;
- Changing access to water;
- Altered hydrology in rivers and wetlands;
- Increased frequency of extreme weather events;
- Changing abundance and distribution of fish, wildlife, and plant species.

More broadly, conservation and fish and wildlife management challenges include:

Continued refinement of regional climate models. Regional climate change models can lack the spatial resolution needed to produce ecologically useful data. Finer-scale models are needed to provide information that reflects complex topography so that better hydrological and habitat information is available. Regional climate models also need to be combined with other predictive models on species distribution related to climate change (climate envelope modeling), other biological responses to climate change, and human-caused disturbances.

Predicting potential changes in species distributions and community structure based on current best estimates of climate change. The use of climate sensitivity analyses for species and climate-envelope models to predict future habitats for fish and wildlife is fundamental to conservation planning for climate change. It is important to note that these models often do not include ecological interactions and so require experimental testing to become dependable predictive tools.

Establishing an array of climate-change monitoring sites that reflect climate change events in habitats. An array of climate change monitoring sites that can be used to evaluate the regional climate models at ecologically important sites would allow early detection of climate change and help establish baseline biological data for populations, species, and habitats.

Establishing experimental areas that will test the potential to support fish and wildlife in new locations. As climate change begins to affect habitats, it may become necessary to evaluate ecological interactions at new locations and among the new mix of species, as indicated by climate-envelope predictions. At its simplest, this may involve assisted migration of individuals from one geographic location to another. More likely, it will involve much more complex, ecologically based actions that may better be characterized as *transition ecology*. The degree to which this can be successfully accomplished will depend on the level of understanding of species biology and nature of ecological and community interactions.

Evaluating the current and future need for captive propagation and seed storage to preserve species. As climate change moves to more extreme states, there may be a need to consider maintaining species that no longer have native habitat in the wild. These species may include currently listed endangered and threatened species but may also include many unlisted species that will eventually become endangered by climate change. Climate envelope modeling can help identify the species that may eventually need captive propagation and/or seed storage assistance.

Evaluating the need for future reserves or refuges. Climate change may mean a changing role for landowners who manage lands for fish and wildlife conservation. Species may change as climate change alters habitats. These land managers will face the challenge of maintaining existing species and/or transitioning to new species compositions.

Ocean and Coastal Resources

Increased Temperature and Extreme Events

Air temperatures are expected to rise in coastal California at a slower pace than inland areas due to the cooling influence of the Pacific Ocean.[14] Ocean water temperatures will rise as air temperatures rise, causing changes in marine and coastal species behavior and distribution. Species within California's coastal and ocean environments are adapted for life within a particular range of temperatures. Temperatures above or below optimal range can affect the metabolism, growth, and reproduction of stressed aquatic species. As such, temperature is one of the primary environmental factors that determine the geographic range of a species. One direct impact of changing water temperatures is a change in coastal water quality because warmer water holds less oxygen.

Warming can also affect the ocean food web in indirect ways. El Niño patterns or Santa Ana winter wind intensity could significantly alter the nutrient cycling that underpins the marine food web and current species assemblages. Santa Ana winds coincide with cool sea surface temperatures, upwelling, and a spike in biological activity. These winds are projected to decline in intensity, but it is not known how marine nutrient availability and food webs will change.

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[14] California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 68.

Precipitation Changes and Extreme Events

A general pattern of a drying climate over the 21st century could result in rainstorms that are fewer in number, but greater in intensity, and less coastal fog.[15] Changes to the timing and intensity of freshwater input from rainstorms could impact marine and near-shore species. Changing precipitation patterns will potentially increase the occurrences of flooding in coastal drainages.

Less frequent but more intense rainfall patterns could have serious consequences on water quality. With an increase in frequency and intensity of wildfires, increased runoff and flooding will remain a considerable risk and may also result in higher levels of pollution and sediment runoff. If the intensity of such extreme events increases, both human populations and natural habitats will be exposed to increased stresses and have less time to recover between occurrences.

Sea-Level Rise

Wetland Loss and Habitat Degradation

Potential impacts to wetlands due to sea-level rise include changes to estuarine mixing, water quality, and carbon cycling; changes to upland habitats and sediment loads into downstream wetlands; and changes to wetland biological habitat, diversity, and changes in biological distribution which will potentially impact foraging opportunities and rearing habitats for key ocean species.[16]

Saltwater Intrusion

Sea-level rise and changes in the intensity of storm events could impact low-lying coastal areas and result in the loss or inundation of coastal wetlands and dune habitat resulting in salt water intrusion and loss of fresh water resources for fish and wildlife. Sea-level rise will also adversely affect coastal water supplies through saltwater intrusion into coastal aquifers, potentially increasing the need for other water sources (such as desalination) to address coastal water shortages and impact groundwater resources tapped for irrigation.[17]

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15 California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 69.

16 Ibid, 72.

17 Ibid, 73.

Water Supplies

Nearly 75 percent of California's available water supply originates in the northern third of the state (north of Sacramento), mainly from water stored in the Sierra Nevada snowpack.[18] At the same time, 80 percent of the demand occurs in the southern two-thirds of the state. California has been able to bridge the geographic distance between water supply and demand by building one of the most complex water storage and transport systems in the world to convey large quantities of water throughout the state.

The state's water supply system already faces challenges to provide water for California's growing population. Climate change is expected to exacerbate these challenges through increased temperatures and possible changes in precipitation patterns.

California water planners are concerned about climate change and its potential effects on the state's water resources. There are many potential ways in which climate change can affect the water resources including changes to precipitation as well as increases in extreme wet and dry conditions, decreased snowpack, variability in annual runoff, sea level rises, and ecosystem challenges. The California Department of Water Resources (DWR) is currently addressing the issues of global climate change and the impacts under the public draft of the *California Water Plan Update 2009* released in January 2009. This draft plan looks at emerging effects of climate change on the state's water resources and builds upon the management strategies laid out in the *California Water Plan Update 2005*.

The DWR also released a technical memorandum report called *Progress on Incorporating Climate Change into Management of California's Water Resources* in July 2006. The technical memorandum looked at potential effects in regions in California close to Cachuma Lake, thereby providing an idea of what the potential effects on lake levels would be. In addition, the Climate Action Team (CAT) released a biennial report in April 2009 that used updated, comprehensive scientific research to outline environmental and economic climate impacts. The CAT report synthesized 37 research papers written by world-class scientists from prominent universities and research institutions.

Increased Temperature and Extreme Events

Increasing average temperatures may have several impacts on water supply and demand, affecting California's farms, municipalities, and ecosystems.

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[18] California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 79-82.

First, increasing winter and early spring temperatures will cause earlier melting of the Sierra Nevada snowpack—the most important seasonal surface reservoir of water in California.[19] Historically, this snowpack has released about 15 million acre-feet slowly over the warming spring and summer months (one acre-foot provides the annual water needs of one to two families). California's water storage and conveyance infrastructure gathers this melting snow in the spring and delivers it for use during the drier summer and fall months. This same infrastructure is also used for flood control in the winter and early spring by keeping lower reservoir levels. With earlier snowmelt and heavy winter/spring rains possibly coinciding, difficult tradeoffs may need to be made between water storage and flood protection. Increased underground storage of surface waters and increased groundwater withdrawal may potentially be used to ensure that future water supplies meet growing demands.

In addition, climate change may make preservation and restoration of habitat more difficult. The ecological requirements of cold-water fishes provide an example. Climate change may warm rivers and streams, with less water available for ecosystem flow and temperature needs in spring and summer. In many low- and middle-elevation streams today, summer temperatures often approach the upper tolerance limits for salmon and trout; higher air and water temperatures will exacerbate this problem. Thus, climate change might require dedication of more water, especially cold water stored behind reservoirs, to simply maintain existing fish habitat. Higher water temperatures also can accelerate biological and chemical processes that increase growth of algae and microorganisms, thereby creating an additional demand for oxygen in the water.

Higher temperatures increase evapotranspiration rates from plants, soils, and open water surfaces. In a study conducted for the 2008 California climate impacts assessment, net evaporation from reservoirs was projected to increase by 37 percent in a warmer-drier climate, but only by 15 percent in a warmer-only scenario, reducing available supplies accordingly. While higher temperatures increase the water demand and use by plants, soil moisture decreases and reservoirs and/or groundwater reserves are reduced. Non-irrigated agriculture and landscaped areas, as well as natural systems, will suffer moisture deficits if natural water supplies are limited. Elsewhere, irrigation will need to be increased if crop losses are to be avoided. During extreme heat events, livestock will require more water for drinking and cooling.

Finally, higher average temperatures extending over longer periods of the year will lengthen the growing season, thereby increasing the amount of water needed for non-irrigated plant growth, environmental water needs, and for the irrigation of crops and landscaped areas. A recent study on water demand in California estimated agricultural and urban water demands under both a warmer-only and a warmer-

[19] California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 82-83.

drier climate change scenarios.[20] Using these scenarios, the study found that agricultural water use would decrease by nearly 15 percent (4,070 thousand acre-feet [taf]/year) between 2020 and 2050 as urban demand increases and overall supply decreases by 7 percent. Even assuming the implementation of water conservation and water-efficiency measures to partially compensate for the expected reduction in supply, urban water demand is expected to increase by more than 10 percent (1,606 taf/year) between 2020 and 2050. The study also concluded that the agricultural sector is more vulnerable to water shortages than the urban sector; thus, water supplies to agriculture may be 20 percent below demand targets under the warmer-only climate scenario and 23 percent below demand under the warmer-drier scenario.

Precipitation Changes and Extreme Events

Climate change can potentially alter California's historical precipitation patterns.[21] While the state is expected to retain its Mediterranean pattern of dry summers and wet winters, along with significant year-to-year variability in total precipitation, some projections of the future involve worrisome changes for the state's water supplies. Scientists project a future marginally to considerably drier by mid-century. In addition to the warming trend and the snowline moving higher, scientists expect that a growing proportion of winter precipitation to fall as rain instead of as snow, significantly reducing snow accumulation on April 1.

The expected reduction in the Sierra snowpack is particularly troublesome for California water supplies, as it essentially functions as California's largest surface water reservoir. The state's agriculture, industrial and municipal users, and a wide variety of ecosystem functions, depend heavily on the stored water being released in the early dry months of the year.

Extreme Rainfall and Flooding

California's current water systems are designed and operated to strike a balance between water storage for the dry months and flood protection during the winter and spring, when heavy rainstorms, runoff, and snowmelt can cause downstream flooding.[22] While some climate models predict an overall drying of California's climate, at the same time there are also continued risks from intense rainfall events that can generate more frequent and/or more extensive runoff and flooding. Additionally, periodic larger than historical floods are expected to occur, especially in the southern parts of the Sierra Nevada, where a transition from snow to more rainfall will occur.

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[20] California Natural Resources Agency, California Water Plan Update 2009, Vol. 4, Reference Guide, 2009 California Climate Adaptation Strategy (2009), 83.

[21] Ibid, 84.

[22] Ibid, 85.

Flood peaks can increase erosion rates that results in greater sediment loads and turbidity while runoff from streets and farms can increase concentrations of pollutants. Changes in temperature and precipitation could alter existing fresh water systems and an overall reduced availability of water for fish and wildlife. An increase in floods may amplify movement of pollutants and contaminants into previously pristine areas. Temperature and precipitation changes will affect a variety of aquatic species and may result in loss and degradation of sensitive aquatic ecosystems and potentially increase invasive species challenges. In addition, these changes will affect groundwater recharge and overdrafting as well as hydropower and hatchery project operations, fish passage issues, and water diversion projects. Changes in composition and structure from precipitation and flow changes for riparian communities and conflicts over allocation of surface water could result in increased management conflicts between people and wildlife and will require communication and collaboration among managers.

Project Implications Resulting from Climate Change

Based on the finding in the CAT report, the DWR report, and the technical memorandum, there are four potential climate change effects that could affect the environment and water levels at Cachuma Lake:

- Changes in precipitation and runoff,
- Increased future demand for drinking water and agricultural needs,
- Possible effects to the aquatic ecosystem and endangered species, and
- Increased risk of wildfires.

There are direct correlations between decreased snowpack and global climate change laid out in the DWR technical memorandum. However, since the water in Cachuma Lake is not the result of snowpack this effect will not be an issue at Cachuma Lake.

Changes in Precipitation and Runoff

The DWR technical memorandum looked at statewide annual average precipitation from 1890 to 2002. According to this analysis, Cachuma Lake has experienced decreasing precipitation in recent years. It is difficult to predict what the future changes in precipitation at Cachuma Lake would be. However, the data trend suggests that there might be a decrease in precipitation and, therefore, a decrease in water levels due to global climate change.

Future Water Demand

A group of researchers at the University of California (UC), Davis, as outlined in the CAT report, investigated the effect of potential climate-induced reductions in water supply to the agricultural sector. One of their findings is that the lack of water could result in reductions in irrigated crop area contributing to the loss of agricultural lands in the Central Valley. Under the particular climate change scenario investigated, the researchers also found that changes in yields (mostly negative) and changes in water availability could result in gross revenue losses of up to three billion dollars by year 2050.

The DWR technical memorandum states that the domestic water use typically increases with increasing temperature. The water at Cachuma Lake is used for drinking water purposes. Global climate might cause an increase in drinking water demand, thereby possibly affecting the water demand and related levels at Cachuma Lake.

The 2009 State Water Project Delivery Reliability Report indicates that average deliveries amounts may decrease from 66 percent/69 percent to 60 percent (a reduction of 6 percent to 9 percent) statewide.[23] This decrease in deliveries is primarily due to the effect of the biological opinions requirements in reducing the amount of Delta water available for export by the SWP. Santa Barbara County delivery estimates are anticipated to be at 63 percent for 2029; a decrease of previous estimates of 67 percent.

The availability of water at the source depends on the amount of rain and snow and water use in the source areas. For the SWP, the size of the April 1 snowpack in the Feather River watershed and the storage in Lake Oroville are key components of the annual estimation of the SWP's delivery capabilities from April through September. The inherent yearly variable location, timing, amount, and form of precipitation in California introduce some uncertainty to the availability of future SWP source water and hence future SWP deliveries.

Climate change is another factor in source-water uncertainty. Current literature suggests that global warming is likely to significantly affect the hydrologic cycle, changing California's precipitation pattern and amount from that shown by the historical record. In fact, there is evidence that some changes have already occurred, such as Sierra snowmelt starting earlier, more runoff shifting from the spring to the winter, and an increase in winter flooding frequency. These changes would place more stress on the reliability of existing flood management and water supply systems, such as the SWP.

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23 Department of Water Resources, The State Water Project Delivery Reliability Report 2009, August 2010, p. 48.

Water demand in the delivery service area is affected by such factors as the magnitude and types of water demands, the extent of water conservation measures, local weather patterns, and water costs. Supply from a water system may be sufficiently reliable at a low level of demand but become less reliable as the demand increases. In other cases, the reliability of a water supply system to meet a higher demand may be maintained at its past level because new facilities have been added or the operation of the system has been changed. In general, the higher and the more time-concentrated the water demands, the more need for storage and conveyance capacity to achieve the same delivery reliability. For example, if the demand occurs only three months in the summer, a water system with a sufficient annual supply but insufficient water storage may not be able to reliably meet the demand. If, however, the same total amount of demand is distributed over the year, the same system could more easily meet the demand because the need for water storage is reduced.

Demand levels for the SWP water users in this report are derived from historical data and information from the SWP contractors. Annual demand on the SWP is nearing the maximum contract amount (referred to as the "Maximum SWP Table A amount"). Each SWP contract contains a SWP Table A, which states the maximum annual delivery amount from the SWP over the period of the contract. These annual amounts usually increase over time. Most contractors' SWP Table A amounts reached a maximum in 1990. The total of all contractors' maximum SWP Table A amounts is 4,173 maf per year. SWP Table A is used to define each contractor's portion of the available water supply that DWR will allocate and deliver to that contractor. The SWP Table A amounts in any particular contract are not guarantees of annual delivery amounts but are used to allocate individual contractors' portion of the total delivery amount available.

For Santa Barbara County, the historic Table A delivery amounts has averaged 63 percent with a maximum of 95 percent (1938) and a minimum of 6 percent (1977).[24] The Maximum annual SWP Table A delivery amount for Santa Barbara County is 45,486 ac-ft.[25] Historical Table A deliveries for Santa Barbara County are shown below.

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24 Department of Water Resources, The State Water Project Delivery Reliability Report 2009, August 2010, Excel Table for 2029, Delivery estimates by contractor – Santa Barbara County Flood Control & Water Conversation District (FC & WCD), http://baydeltaoffice.water.ca.gov/swpreliability/.

25 Department of Water Resources, The State Water Project Delivery Reliability Report 2009, August 2010, p. 48.

Table A

Year	Delivery Amount	Percent
2008	11,311	25%
2007	24,760	54%
2006	19,255	42%
2005	22,981	51%
2004	29,566	65%
2003	24,312	53%
2002	24,166	53%
2001	14,285	31%
2001	22,741	50%
1999	20,137	44%
Average	**21,351**	**47%**

Based on the maximum and average Table A deliveries, and the forecast future reliability, SWP deliveries under the Santa Barbara contract would be:

	Maximum	Average	Forecast
Percent	100%	47%	63%
Amount	45,486 ac-ft	21,370 ac-ft	28,645 ac-ft

As shown in **Section 4.3**, the SWP demand for the Member Units is as shown below.

Member Unit	Normal Year (afy)	Critical Drought Year (afy)
CVWD (**Table 4-10)**	1,386	132
MWD (**Table 4-11**)	2,079	198
City Santa Barbara (**Table 4-12**)	2,079	594
GWD (**Table 4-13**)	3,800	474
SYRWCD ID#1 (**Table 4-14**)	1,386	132
Total	**10,730**	**1,530**

For the critical three-year drought period, the demand for SWP would be 18,144 af-ft.

Under the forecast provided in the 2009 State Water Project Delivery Reliability Report as shown above for Santa Barbara County, adequate water could be delivered to meet normal, critical dry year and critical three-year drought period demands.

Aquatic Ecosystem Changes

The DWR technical memorandum revealed that increased air temperatures as the result of climate change will likely cause increases in water temperatures at California's lakes and waterways. Increased water temperatures might affect the aquatic ecosystem, especially for aquatic species that are sensitive to changes in water temperature. Increases in water temperature might also cause a decrease in dissolved oxygen demand concentrations, which would likely increase production of algae and some aquatic weeds.

Increased Risk of Wildfires

Scientists at the UC Merced and Pardee RAND Graduate School, as outlined in the CAT report, performed a novel analysis of wildfire risk in California. They estimated that wildfire risk due to impacts of climate change would increase throughout the end of the century.

The influence of global climate change on future environmental condition of Cachuma Lake cannot be predicted with any accuracy. The potential effects listed above may occur, but it is not possible at this time to estimate when they might occur or to what extent. It is therefore not possible to assess whether any changes in future environmental conditions would influence the implementation of the proposed project. To address this uncertainty, the local managing partner will update the Fish Management Plan and Biological Opinion to periodically manage the potential effects of climate change if and when they occur.

4.13 RELATIONSHIP TO OTHER PLANS

Other plans and programs relevant to this project include the adopted general and various resource management plans of the Permittee and other non-Permittees. Plans considered in the preparation of this EIR are listed and discussed.

4.13.1 Federal Plans

4.13.1.1 Bureau of Reclamation

Cachuma Lake Resource Management Plan

Cachuma Lake Resource Management Plan (RMP) involves alternatives for future use of the project area for recreation and resource protection and management. The RMP provides for:

(1) ensuring safe storage and timely delivery of high-quality water to users while enhancing natural resources and recreational opportunities;

(2) protecting natural resources while educating the public about the value of good stewardship;

(3) recreational opportunities to meet the demands of a growing, diverse population;

(4) ensuring recreational diversity and the quality of the experience; and

(5) the updated management considerations for establishing a new management agreement with the managing partner.

This RMP will have a planning horizon of 20 years. The Cachuma Lake Recreation Area (Plan Area) (**Figure 4-21, Overview of Cachuma Lake Recreation Area**) encompasses approximately 9,250 acres, including Cachuma Lake (3,043 acres at full level) and the surrounding shores and rugged hillsides.

The Notice of Intent to develop an EIS was published in the Federal Register in March 2002. The Draft EIS was made available for public review during July and August 2008. A public open house was held in August 2008. The Final EIS was released on May 19, 2010. The 30-day wait period started on May 28, 2010. Reclamation is in the process of finalizing a Record of Decision (ROD) for the RMP.

Purpose of the RPM

The purpose of the RMP is to provide a program and set of policy guidelines necessary to encourage orderly use, development, and management of the reservoir and the surrounding lands. The plan will identify outdoor recreational opportunities, enhanced by Cachuma Lake and its shoreline, compatible with the surrounding scenic, environmental, and cultural resources. In addition, the RMP proposes uses that will be compatible with operation of the reservoir for water delivery.

The RMP includes recommendations for various resource management actions and facility improvement projects. These are specific actions that may be implemented at Cachuma Lake Plan Area to meet the RMP goals. These management actions and projects are defined at a conceptual or programmatic level in the RMP. More detailed descriptions of the actions and project will be developed during the planning horizon of the RMP. The responsibility for funding, designing, and implementing (or constructing) the management actions and improvement projects will be specified in an agreement with the local managing partner.

Roles of Reclamation and Local Managing Partner

Santa Barbara County Parks Department manages the Plan Area pursuant to a contract between Reclamation and Santa Barbara County (County). The 50-year contract expired in 2003 and will be extended through the completion of the RMP process. Reclamation will develop a new management contract with a local managing partner using the RMP for guidance on future land, resource, and recreation management.

The local managing partner will have overall responsibility for managing public access, recreation, infrastructure and public services, and natural resources in the Plan Area, excluding Bradbury Dam and Tecolote Tunnel Intake. The RMP will provide the overall resource and recreation management direction and framework for the Plan Area. It will be a guidance document for the local managing partner for its day-to-day operations and long-range planning.

Reclamation will have overall responsibility for ensuring that all actions in the Plan Area by Reclamation and its local managing partner are consistent with the RMP. The local managing partner must ensure that its actions in managing the Plan Area and associated land, recreation facilities, and infrastructure, are consistent with the RMP.

The agreement with a local managing partner will require that the local managing partner to use the RMP as the primary land use, natural resource, and recreation management guidance document to be followed during the management of the Plan Area.

The RMP will be implemented through two types of management approaches: (1) specification of allowable land uses, and (2) recommendations for specific management actions and improvement projects.

In 2004, the County of Santa Barbara, the Santa Barbara County Water Agency, the Cachuma Conservation Release Board, and Santa Ynez River Water Conservation District Improvement District No. 1 entered into a memorandum of understanding (MOU)[1] to provide for a phased surcharge increase over a five-year period. The phased surcharge allowed the County to protect certain Plan Area facilities to avoid effects from wave run-up or inundation as a result of the 3-foot maximum surcharge level. In 2005, the Cachuma Member Units constructed a gabion basket barrier wall around the water treatment facility as a temporary protection measure, and in 2007, County Parks completed construction of a new boat ramp. The water treatment facility will ultimately be reconstructed at a higher elevation. Other facilities that are not compatible with being submerged for extended periods have either been moved or provisions have been made to protect them.

RMP Alternatives

The RMP alternatives were designed to address the issues, opportunities, and constraints at the Plan Area. A broad range of management actions was developed to address alternatives that would represent the varied interests pertaining to the Plan Area. The No Action Alternative and two action alternatives are as follows:

- No Action (Alternative 1) – This alternative manages land and activities with the continuation of current management practice.
- Enhanced Recreation (Alternative 2) – This alternative balances natural resource protection and recreation opportunities.
- Expanded Recreation (Alternative 3) – This alternative emphasizes expanded recreation opportunities.

The Cachuma Lake RMP includes resource management alternatives for the reservoir and adjacent Reclamation lands as appropriate for recreation and natural resource management opportunities and water quality. All recreational uses and improvements at the lake must be consistent with the original purpose of the Cachuma Project. They must not interfere with reservoir operations, which are focused on providing a reliable annual yield of high-quality water primarily for agricultural and municipal use. Recreational uses and improvements must also not interfere with protection of endangered species, particularly Southern California steelhead.

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1 *Memorandum of Understanding (MOU) Regarding the Surcharge of Cachuma Lake and the Protection of Recreational Resources at the Lake* (February 2004; amended April 2005).

For planning purposes and consideration of any future new facilities addressed in the RMP, the maximum 3-foot surcharge with an additional safety buffer for wave run-up of 7 feet was assumed (lake level 760 feet). Any potential recreational facilities proposed in this RMP must be therefore be located above the surcharge zone (760-foot lake level elevation) or be compatible with being submerged for extended periods.

The RMP will provide management guidance through a set of allowable uses. Specifying the allowable uses creates both restrictions and opportunities for recreation and natural resource management. Using this geographically based land use and recreation plan, the local managing partner will conduct its day-to-day operations and long-range planning within a comprehensive and predictable planning framework.

Reclamation will encourage ongoing coordination with the COMB and Cachuma Project Member Units regarding RMP management actions and recreation projects. Reclamation will create a Coordinating Committee composed of representatives of Reclamation, the local managing partner, COMB, and one Member Unit (representing all Member Units).

All RMP alternatives include the following infrastructure, facility, and operational improvements at the County Park and Live Oak Camp. County Park refers to the 375-acre south shore area on Tequepis Peninsula with most of the major facilities such as campsites, marina and boat ramp, amphitheater, RV campsites, swimming pools, and ranger station. Live Oak Camp is a 40-acre facility approximately 5 miles east of the County Park that has camping (including for large groups), cabin rentals, and special events. It also is used as a temporary base of operations for emergency fire protection services or for other emergency personnel.

The following are features meant to improve the infrastructure, facilities, and operational elements of the County Park and Live Oak Camp as they relate to the anticipated surcharge levels:

- Provide public services that are reliable and sufficient to meet current and future demand.
  - Operate, maintain, and upgrade or replace the wastewater collection system and treatment plant serving the County Park, as necessary, to meet demand and applicable state health requirements, and operate under all lake levels meeting health requirements.
  - Provide a potable water supply for the County Park and Live Oak Camp that will operate under all lake levels, meet drinking water and fire demands, and meet all applicable state health requirements.

- Provide facilities for water-based recreation under all lake levels (including surcharge events up to a maximum lake elevation of 753 feet with a safety buffer for wave run-p to 760 feet) to ensure uninterrupted recreational uses to the public.
  - Modify marina shops, docks, and walkways to accommodate future surcharging.
- Ensure full access to the County Park and its recreational facilities during surcharge events (up to a maximum lake elevation of 753 feet with a safety buffer for wave run-up to 760 feet) to maintain uninterrupted recreational uses at the lake.
  - Modify County Park facilities as necessary to accommodate future surcharging such as the marina overflow parking lot, Mohawk Road, Harvey's Cove picnic area, Harvey's Cove path, Barona Shores Trail, Teepee Island footbridge, Sweetwater Trail, Boat Works Shop yard, UCSB Crew Building and Ramp, and Mohawk Overflow Area and Road.

Under all RMP alternatives, federal and state regulations will be adhered to for natural and cultural resources protection, wetland and riparian habitat, and endangered or sensitive species at the lake. Riparian areas will be protected where not affected by annual lake level fluctuations.

Under all RMP alternatives, the fish-stocking program for Cachuma Lake will comply with the requirements of the NMFS Recovery Plan Outline for Southern California Coast Steelhead DPS (NMFS 2007) and the subsequent Recovery Plan.

4.13.1.2 National Marine Fisheries Service

The Draft Southern Steelhead Recovery Plan (NMFS 2009) is discussed in **Section 2.6**.

4.13.1.3 U.S. Fish and Wildlife Service

The Santa Ynez River downstream of Lake Cachuma is identified as critical habitat for several federally listed species under Endangered Species Act.

The Recovery Plan for the Tidewater Goby (*Eucyclogobius newberryi)* is not directly applicable as the gobies are found only in the Santa Ynez Lagoon, which is located within Vandenberg Air Force Base.[2]

Additional plans for the arroyo toad (*Bufo californicus,* formerly *B. microscaphus californicus*),[3] western snowy plover (*Charadrius alexandrinus nivosus)* (USFWS 2007) and California least tern (*Sternula antillarum browni*)[4] also not applicable as these species are not found within the project boundaries.

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2 US Fish and Wildlife Service. 2005. *Recovery Plan for the Tidewater Goby (*Eucyclogobius newberryi*)*. Portland, Oregon.

3 Ibid, 1999. *Recovery Plan for the Arroyo Southwestern Toad*. Portland, Oregon.

4 Ibid, 1985. *Revised California Least Tern Recovery Plan*. Portland, Oregon

The Recovery Plan for the California red-legged frog[5] (*Rana draytonii*) identifies habitat loss and degradation, degraded water quality, use of pesticides, and introduced predators as some of the synergistic factors leading to the decline of this once widespread species. The impacts of habitat loss associated with tributaries lost as a result of impoundments behind Bradbury, Gibraltar, and Juncal dams were identified in the recovery plan as critical problems, along with impacts from agricultural practices, livestock grazing and predation by introduced species. The California red-legged frog Santa Ynez River population is in the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit and is identified as a core area (#24) for focused recovery efforts. Specific recovery actions identified in the plan relevant to the Cachuma Project include, but are not limited to, manage flows to decrease impacts of water diversions, control non-native predators, and preserve buffers from agriculture in the lower reaches of the Santa Ynez River. Development of a management and protection plan is identified as a high-priority task.

The least Bell's vireo (*Vireo bellii pusillus)* was listed as endangered in 1986 and the Draft Recovery Plan was released for review in 1998, but was never finalized.[6] The most recently published five-year review was released in 2007. A total of 11 vireo territories were documented in the Sana Ynez River. This is considered a downward trend in the population. The two main threats to least Bell's vireo identified in the listing were loss of habitat and habitat degradation caused by exotic plant infestations, and nest parasitism by brown-headed cowbirds. Over 90 percent of all least Bell's vireos found in Santa Barbara County have been located in the Santa Ynez River. The Santa Ynez River population was identified as being at risk of extinction. Restoring riparian habitat and reducing parasitism are considered to be the primary recovery actions.

The Final Recovery Plan for the southwestern willow flycatcher[7] (*Empidonax traillii extimus*) was completed in 2002 and critical habitat along a 20-mile segment of the Santa Ynez River within the 100-year floodplain was designated in 2005, identifying the Santa Ynez River as one of 15 management units. The Santa Ynez River is the northern limit of breeding for this species and they are concentrated in dense patches of intact complexes of mixed riparian vegetation located near slow-moving stream reaches. The most significant factors in the decline of this federally and state-listed endangered species are habitat loss, habitat fragmentation, and modification of riparian breeding habitat.

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5 Ibid, 2002. *Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*)*. Portland, Oregon.

6 US Fish and Wildlife Service. 1998. *Draft Recovery Plan for the least Bell's vireo* (*Vireo bellii pusillus).* Portland, Oregon.

7 Ibid, 2002. *Final Recovery Southwestern Willow Flycatcher* (*Empidonax traillii extimus*). Albuquerque, New Mexico.

4.13.1.4 U.S. Forest Service

The Los Padres National Forest Land Management Plan[8] provides guidelines for conservation of riparian habitats identified as necessary to support the recovery of California red-legged frogs. These include watershed analysis of the Santa Ynez River and recommends non-native species removal, streambank stabilization and revegetation, restrictions on recreational activities, education programs and continued monitoring of the populations.

4.13.2 State Plans

4.13.2.1 California Department of Fish and Game

The several of the species listed by the State of California and known to occur or potentially occurring within the project area are also federally protected. These species include least Bell's vireo, southwestern willow flycatcher, and California least tern. CDFG consults with and participates in development of federal plans the help protect those species.

In addition to the species covered at the federal level, western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), California brown pelican (*Pelecanus occidentalis californicus*), bald eagle (*Haliaeetus leucocephalus*), and American peregrine falcon (*Falco peregrinus anatum*) are stated-listed endangered species with the potential to occur within the project area. The California Endangered Species Act (CESA) prohibits the take or possession of these species without authorization from the California Department of Fish and Game (CDFG).

The California red-legged frog is listed as a species of special concern by the State of California. Sport fishing regulations for take or possession of red-legged frogs is prohibited without an approved scientific collection permit.

4.13.2.2 California Department of Water Resources

2009 California Water Plan

The California Water Plan is the state's strategic plan for managing and developing water resources statewide. Since its first California Water Plan, published in Bulletin No. 3 in 1957, the Department of Water Resources (DWR) has prepared eight water plan updates, known as the Bulletin 160 series. The California Water Plan provides a framework for water managers, legislators, and the public to consider

8 Ibid, 2005. *Land Management Plan Part 2 Los Padres National Forest Strategy*. Pacific Southwest Region. R5-MB-078.

options and make decisions regarding California's water future. California Water Code requires that the Water Plan be updated every five years; the 2009 update (Bulletin 160-09) is the latest plan.

The 2009 Water Plan provides information on the various hydrologic regions across the state. Included as part of the 2009 Water Plan is a discussion on the Central Coast Hydrologic Region.[9] This region is divided into two parts, northern and southern, with the Santa Barbara County area located in the southern area.

The 2009 Water Plan notes that water supplies for the southern planning area include groundwater, surface water, imported State Water Project (SWP) water, and recycled water. In addition to local groundwater basins, the 2009 Water Plan notes that the Cachuma Project provides surface water storage and supplies for agricultural and municipal uses downstream of Bradbury Dam, and to the municipal users along the Santa Barbara coast.

Further, the 2009 Water Plan notes that surface water supplies are an important part of the regional water supply, and the Lake Cachuma and Gibraltar Reservoir provide the majority of the south coast's water supply annually.

The water balance summary presented in the 2009 Water Plan notes that the distribution of the dedicated water supply to various uses can change significantly based on wetness or dryness of the water year. For the Central Coast region, agricultural water uses are the largest component of the total. The 2009 Water Plan notes that there is very little dedicated water required for instream flows within the region, and surface streams generally have smaller intermittent flows than other regions.

The 2009 Water Plan notes that for the eight-year period from 1998 to 2003, the annual change in the region's surface water and groundwater storage can be estimated as part of the balance between supplies and uses. In wetter years, water will usually be added to storage, but during drier years, storage volumes may be reduced. Of the total water supply to the region, more than half is used by native vegetation, or evaporates to the atmosphere, provides some of the water agricultural crops and managed wetlands, or flows to the Pacific Ocean. The remaining portion, referred to as consumptive use of applied water, is distributed among urban and agricultural uses and for diversions to managed wetlands.

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9 Department of Water Resources, California Water Plan. Update 2009, Volume 3, Regional Reports, Central Coast, Integrated Water Management, Bulletin 160-09.

The 2009 Water Plan notes that the modification of existing operations may provide for a limited increase of surface supplies and water storage. The 2009 Water Plan identifies Reclamation's proposed surcharging of Bradbury Dam and Lake Cachuma up to three feet as a potential for additional water supply to enhance downstream fish habitat.

The 2009 Water Plan provides future scenarios for managing future water conditions.[10] These include:

- **Scenario 1 – Current Trends**. This scenario assumes recent trends will continue into the future.
- **Scenario 2 – Slow & Strategic Growth.** Assumes that private, public, and governmental institutions form alliances for more efficient planning and development that is less resources intensive than current conditions.
- **Scenario 3 – Expansive Growth**. Assumes future conditions are more resource intensive than existing conditions.

For the Central Coast hydrologic region, change in total demand for each scenario is based on historical averages for the eight-year periods from 1998 to 2003 and future averages for 2043 to 2050. As shown in the 2009 Water Plan, the Expansive Growth scenario shows an increase in average water demand, the Current Trends shows no change, and the Slow & Strategic Growth shows a reduction in water demand.

For urban demand, the 2009 Water Plan shows that, without climate change, the Current Trends and the Expansive Growth show a substantial increase in water demand, while the Slow & Strategic Growth shows a modest increase when compared to the historical average. When considering climate change, all three scenarios increase in urban demand with a slightly higher range than under the historical climate.

Changes in agricultural water demand are generally reduced due to decreases in irrigated acreage and increases in background water conservation. Without climate change, Slow & Strategic Growth shows the largest reduction, followed by Expansive Growth and Current Trends. When climate change is considered, all scenarios show either an increase or smaller reduction in water demands.

State Water Project Delivery Reliability Report

The SWP is primarily a water storage and delivery system intended to help close the gap in California between when and where precipitation primarily falls and when and where most water demands occur. Water from the SWP is a critical component of water supply for the 29 state water contractors, who may also receive water from other sources. While each of the water supply contracts defines the maximum amount of water to be delivered annually, the amount of water actually delivered may be less due to such

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[10] Department of Water Resources, California Water Plan. Update 2009, Volume 3, Regional Reports, Central Coast, Integrated Water Management, Bulletin 160-09, 37-39.

factors as variable precipitation and runoff, physical and institutional limits on storage and conveyance, and contractors' variable water demands. For communities receiving SWP water, the reliability of SWP water deliveries is a key factor for local planners and government officials estimating their own water supply reliability.

The report on SWP delivery reliability is intended to help local agencies, cities, and counties that use SWP water while planning integrated water resources management to develop adequate and affordable water supplies for their communities. These activities are usually conducted in the course of preparing a water management plan such as the Urban Water Management Plans required by Water Code Section 10610. The information can be used by local agencies in preparing or amending their water management plans and identifying the new facilities or programs that may be necessary to meet future water demands. Local agencies and governments will also find in the report useful information for conducting analyses mandated by laws requiring water retailers to demonstrate whether their water supplies are sufficient for certain proposed subdivisions and development projects subject to the California Environmental Quality Act.

With the *2007 SWP Delivery Reliability Report*, DWR updated its estimate of current (2007) and future (2027) SWP delivery reliability and has expanded the conditions under which reliability is quantified.[11] The additional conditions are changes in hydrology due to potential climate change and restrictions on SWP and CVP pumping in accordance with the interim operation rules imposed by the December 2007 federal court order.

DWR issues the State Water Project Delivery Reliability Report every two years, with the Final 2009 version released August 2010.[12] This updated report accounts for impacts to water delivery reliability associated with climate change and recent federal litigation. Based on information from the draft DWR Reliability Report, the average reliability of future SWP Table A deliveries through 2029 is projected to be 60 percent.[13] This percentage of allocations is based on computer modeling of the state's watersheds' past hydrology adjusted for factors that affect reliability.

"Water delivery reliability" is defined as the annual amount of water that can be expected to be delivered with a certain frequency. SWP delivery reliability is calculated using computer simulations based on 82 years of historical data.

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11 Department of Water Resources, *The State Water Project Delivery Reliability Report 2007*, August 2008.

12 Department of Water Resources, Bay-Delta Office, Final *The State Water Project Delivery Reliability Report 2009*, (August 2010)

13 Ibid, Tables 6.20 and 6.21, 53.

The amount of the SWP water supply delivered to the state water contractors in a given year depends on the demand for the supply, amount of rainfall, snowpack, runoff, water in storage, pumping capacity from the Delta, and legal constraints on SWP operation. Expressed in more general terms, water delivery reliability depends on three general factors: the availability of water at the source, the ability to convey water from the source to the desired point of delivery, and the magnitude of demand for the water.

The availability of water at the source depends on the amount of rain and snow and water use in the source areas. For the SWP, the size of the April 1 snowpack in the Feather River watershed and the storage in Lake Oroville are key components of the annual estimation of the SWP's delivery capabilities from April through September.

The inherent yearly variable location, timing, amount, and form of precipitation in California introduce some uncertainty to the availability of future SWP source water and hence future SWP deliveries. Simulating an 82-year sequence based on historical weather patterns restricts the analytical approach to no more extreme droughts or severe storms than have historically occurred. However, the 82-year sequence of weather patterns does produce a wide range of hydrologic events with which to evaluate the ability of the SWP to deliver water.

Climate change is another factor in source-water uncertainty. Current literature suggests that global warming is likely to significantly affect the hydrologic cycle, changing California's precipitation pattern and amount from that shown by the historical record. In fact, there is evidence that some changes have already occurred, such as Sierra snowmelt starting earlier, more runoff shifting from the spring to the winter, and an increase in winter flooding frequency. These changes would place more stress on the reliability of existing flood management and water supply systems, such as the SWP.

The ability to convey source water to the desired point of delivery depends on the availability of facilities to capture and convey water and any institutional limitations placed upon the facilities. Uncertainty in SWP deliveries may be, in part, due to uncertainty in the ability to convey water. For the SWP, this uncertainty centers on the Delta. In general, SWP operations are closely regulated by Delta water quality standards established by the State Water Resources Control Board (SWRCB) in Water Rights Decision 1641. In addition, SWP and Central Valley Project (CVP) operations are further constrained by requirements in the USFWS and NMFS Biological Opinions. The requirements in both Biological Opinions are based on physical and biological phenomena that do not lend themselves to simulations using a monthly time step. Much scientific and modeling judgment has been employed to represent the implementation of the Biological Opinions. The modeled representation of the requirements is the best possible, given the current scientific understanding of environmental factors enumerated in the Biological

Opinions and the limited historical data for some of these factors. Turbidity, water temperature, and the presence of fish are examples of environmental factors that must be approximated in the model.

Another potential uncertainty for SWP water conveyance through the Delta is the risk of interruptions in SWP diversions from the Delta due to levee failures. SWP source water enters the Delta through the Sacramento River and is conveyed to Banks Pumping Plant via Delta channels lined with fragile levees. If a levee fails, depending on the location and the size of the adjacent island, the flow of water from nearby channels onto the affected island can draw saline water from Suisun and San Pablo bays into the central Delta. In such an incident, SWP pumping at Banks Pumping Plant may have to be curtailed or stopped for a period to prevent drawing saline water into the south Delta. Additional releases from Lake Oroville may also be necessary to flush the Delta of the saline water. As discussed in **Section 4.0**, the likelihood of levee failures in the future is expected to increase.

4.13.2.3 State Water Resources Control Board

Watershed Management Initiative

The SWRCB and Regional Water Quality Control Boards (RWQCBs) developed the Watershed Management Initiative to meet the goal of providing water resource protection, enhancement, and restoration, while balancing economic and environmental impacts. Potential water quality issues include impacts from agriculture, total maximum daily loads (TMDLs), urban runoff, point source regulatory programs, basin planning, monitoring, and cleanup. Three targeted watersheds are located in Santa Barbara County, and the corresponding state agency concerns are (Central Coast RWQCB, 2002):

- Santa Maria River – Priority concerns include nitrate contamination of groundwater, sedimentation build up in Twitchell Reservoir, and habitat loss.
- Santa Ynez River – Priority concerns include effects of water rights decisions, erosion, sedimentation, flood control, and habitat loss (especially for steelhead); water quality impacts from urban development are another concern.
- South Coast – Priority concerns include creek and near shore water quality and beach closures.

4.13.3 Local Plans

4.13.3.1 Integrated Regional Water Management Plan

The Integrated Regional Water Management Plan (IRWMP)[14] is the Santa Barbara Countywide integrated planning document prepared for the State Water Resource Control Board's Integrated

14 *Santa Barbara Countywide Integrated Regional Water Management Plan*, May 2007.

Regional Water Management (IRWM) Grant Program. The intent of the locally generated planning document is to promote and practice integrated regional water management to ensure sustainable water uses, reliable water supplies, better water quality, environmental stewardship, efficient urban development, protection of agriculture, and a strong economy.

The IRWMP is intended to increase the level of coordination among all the agencies and districts responsible for water resources planning, nongovernmental organizations, and interested members of the public to facilitate the optimal management of water resources within the county over the next 20 years. The IRWMP also provides the foundation for grant applications needed to augment limited local financial resources.

The planning framework established by the IRWMP will be modified as needed to respond to changing conditions, including regulatory requirements, and will increase flexibility and efficiency by integrating multiple aspects of water resources management, such as water quality, local and imported water supplies, watershed protection, wastewater treatment and recycling, and protection of local ecosystems.

The Santa Barbara Countywide IRWMP implements these planning efforts by developing an appropriate mix of resource management strategies and projects based on water management objectives and priorities that are specific to Santa Barbara County.

The IRWMP was been prepared by a broadly based group, referred to as the "Cooperating Partners." The Cooperating Partners consist of 29 water districts, sanitary districts, community service districts, water conservation districts, private water companies, cities (large, medium, and small), Santa Barbara County, and joint powers agencies.

The IRWMP will allow regional needs to be met in a manner that is consistent with state of California planning efforts, including the California DWR Bulletin 160 (California Water Plan Update), the State Water Resources Control Board (SWRCB) Strategic Plan, Watershed Management Initiative, basin planning process, and the Central Coast Regional Water Quality Control Board's (RWQCB) draft "Vision, Goals, and Objectives."

Plan Area and Service Providers

The IRWMP encompasses all of Santa Barbara County and identifies demand and supplies for the region. The water providers, service areas and sources of water for these within and served the project area are shown below.

Providers	Service Area and Water Source[15]
Carpinteria Valley Water District	**Service Area:** City of Carpinteria and unincorporated areas of the Carpinteria Valley **Source:** Carpinteria Valley Groundwater Basin, Cachuma Project, and State Water Project
City of Buellton	**Service Area**: City of Buellton **Source**: Buellton Uplands and Santa Ynez Riparian groundwater basins and State Water Project
City of Lompoc	**Service Area:** City of Lompoc **Source**: Lompoc Groundwater Basin
City of Solvang	**Service Area**: City of Solvang and adjacent unincorporated areas **Source**: Santa Ynez Uplands Groundwater Basin, Santa Ynez River Riparian Basin, State Water Project (acquired through contract with Santa Ynez River Water Conservation District Improvement District No. 1)
Goleta Water District	**Service Area:** West of the Santa Barbara city limits to El Capitan State Beach **Source**: Goleta North/Central Groundwater Basin, Cachuma Project, and State Water Project. The Goleta Water District also treats and distributes reclaimed water to various golf courses, UCSB, and other sites for irrigation and agricultural purposes.
Montecito Water District	**Service Area**: Montecito and Summerland **Source**: Montecito Groundwater Basin, the Cachuma Project, State Water Project, Jameson Lake, Fox and Alder creeks, and Doulton Tunnel
SYRWCD ID No. 1	**Service Area**: Santa Ynez, Chumash Indians' Santa Ynez Reservation, Los Olivos, and Ballard; also supplies domestic water to the City of Solvang **Source:** Cachuma Project, State Water Project, Santa Ynez Upland and Santa Ynez River Riparian Basins

Water Use

Agricultural water use accounts for approximately 75 percent of all water demand in the county. Most agricultural water supplies are obtained from private groundwater wells, although some water purveyors provide agricultural water as well. The estimated agricultural demand for the project area as noted in the IRWMP is as follows:

Source	Demand[16] (ac-ft/yr)
Carpinteria Valley Water District	1,840
Goleta Water District	2,537
Montecito Water District	550
SYRWCD ID No.1	2,404
Private wells – Santa Ynez Valley	59,980
Total	**67,311**

In recent years, improvements in agricultural technology have allowed increases in crop yield and intensification of agricultural development on an acre-by-acre basis. In some cases, water demand per

15 *Santa Barbara Countywide Integrated Regional Water Management Plan*, May 2007. Table 4-1.

16 *Santa Barbara Countywide Integrated Regional Water Management Plan*, May 2007. Table 2-5.

acre has increased to allow for double and triple cropping and for higher water-using (and income-producing) crops, such as strawberries, to be grown. Irrigation technologies have also improved, reducing the amount of water used by some crops. These improvements include drip irrigation, seedling propagation in controlled greenhouse environments, laser leveling of fields, and use of tailwater recovery systems in furrow-irrigated fields.

Urban water use accounts for approximately 25 percent of all water demand in Santa Barbara County. Supplies provided by each water purveyor in the project area are shown in the following table.

Source	Demand[17] (ac-ft/yr)	Per capita[18] (gal/per/day)
Carpinteria Valley Water District	2,122	**102**
City of Buellton	806	**281**
City of Lompoc	5,212	**104**
City of Santa Barbara	12,960	**121**
City of Solvang	1,277	**227**
Goleta Water District	11,781	108
Montecito Water District	5,655	345
SYRWCD ID No.1	2,405	273
Total	**42,218**	

Variances in water usage are due in part to the amount of industry and subregional climate, as well as variation in lot sizes and soil types.

By 2040, the Santa Barbara County population is expected to increase by almost 52 percent over 2000 levels (from about 399,000 to 606,000).[19] Total water demand for this same 40-year period is projected to increase by only 9 percent, from 314,000 ac-ft/yr to 345,000 ac-ft/yr. Agricultural water demand, which accounts for about 75 percent of total demand, is expected to remain nearly the same. At present, with careful and strategic planning, water supplies are sufficient to meet demand countywide during normal water years, but water purveyors will need to develop an additional 10,800 ac-ft/yr by 2030; this number is projected to increase to 12,400 ac-ft/yr by 2040, or they will have to rely on mining groundwater in certain areas in order to meet future demand.

17 Ibid, Table 2-6.

18 Ibid, Table 2-7.

19 *Santa Barbara Countywide Integrated Regional Water Management Plan*, May 2007. 2-38.

Only one of the five Designated Analysis Units (DAU) in Santa Barbara County (as defined by State of California DWR), DAU 75 South Coast, has a water supply that meets the current demand in normal rainfall years. The other basins have existing shortfalls in water supply that will increase in the future:[20]

- DAU 71 Santa Maria—The current 4,200 ac-ft/yr water supply shortfall will increase to 7,700 ac-ft/yr by 2040, although water conservation efforts are expected to continue.
- DAU 73 San Antonio—The current 3,900 ac-ft/yr shortfall will decrease slightly to 3,800 ac-ft/yr by 2040, primarily due to limited population growth and increased conservation.
- DAU 74 Santa Ynez—Although this DAU has a slight overall current water supply deficit of only 300 ac-ft/yr, the water supply shortfall is expected to reach 1,600 ac-ft/yr by 2040.
- DAU 75 South Coast—The DAU as a whole has sufficient water supplies through the year 2040 on a normal year basis. However, periodic severe droughts reduce supplies by as much as 25 percent, requiring water purveyors to reserve available water supply during normal years for later drought use to partially offset shortages.
- DAU 76 Cuyama Valley—This DAU is already experiencing a water supply shortfall of about 7,900 ac-ft/yr of its total average water demand of 20,700 ac-ft/yr. This water shortfall is expected to decline slightly to about 6,600 ac-ft/yr in 2040; however, significant new water supplies will be required to balance average annual water supply and demand.

Water Supplies

Groundwater basins are the major source of water in the county, supplying about 77 percent of Santa Barbara County's domestic, commercial, industrial, and agricultural water.[21] In the South County, water purveyors use groundwater as a secondary source of potable water. However, the North County is largely supported by groundwater and/or shallow, riparian basin water, both of which are recharged by surface flows.

Surface water refers to water resources that flow or are stored in surface channels (streams and rivers or lakes and reservoirs).[22] Surface water reservoirs are an important part of the regional water supply so the loss of storage capacity is of significant concern. Gibraltar Reservoir is the source of about one-third of the City of Santa Barbara's water supply. The unincorporated community of Montecito receives 45 percent of its water supply from Jameson Lake, and Fox and Alder creeks via the Doulton Tunnel. On an average annual basis, Lake Cachuma provides approximately 65 percent of the South Coast's water supply.

20 Ibid, 2-39.

21 *Santa Barbara Countywide Integrated Regional Water Management Plan*, May 2007. 4-16 and 4-17.

22 Ibid, 4-17.

Agencies in the County contract with the SWP for an amount of water to which each Santa Barbara County participant in the SWP has a contractual right, referred to as Table A Amount.[23] The primary factors affecting the amount of Table A deliveries are the availability of SWP supplies and the SWP Contractors' demands for this water. Climatic conditions and other factors can significantly alter the availability of SWP water in any year; a topic of growing concern for water planners and managers is global warming and the potential impacts it could have on California's future water supplies, including SWP supplies. The amount of water DWR determines is available and allocates for delivery in a given year is based on that year's hydrologic conditions, the amount of water in storage in the SWP system, current regulatory and operational constraints, and Contractors' requests for SWP supplies. Even in years when additional Table A supplies are available, the amount of water DWR allocates is limited to Contractors' requests.

SWP water has helped reduce the use of groundwater in all major basins, except the Cuyama Basin, which does not have a water purveyor that receives SWP water. It also has improved water quality in areas that directly receive SWP water and has increased the overall water supply in Santa Barbara County.

Water Conservation

Water conservation addresses the "demand side" of water management, and thereby constitutes an important part of stretching the county's water supplies.[24] Through water conservation programs implemented at the regional and water purveyor level, additional water supplies become available for use within the county, reducing pressures on other water resources. Water conservation activities occur countywide through the Regional Water Efficiency Program (RWEP), in which water purveyors work cooperatively to implement conservation in the areas of residential, commercial, agricultural, and landscape programs. Additionally, regional education and public information programs help change behavior to decrease water use. Regional programs have been in place since 1990 and are staffed and funded by a multiagency team of conservation staff from the Santa Barbara County Water Agency and local water purveyors. Water savings through conservation programs are calculated on an annual basis by those agencies who are members of the California Urban Water Conservation Council. Council Signatories, who have committed to best management practices for water conservation by signing the Council Memorandum of Understanding, plus the conservation activities of nonmembers in the County, have resulted in the conservation of 86,660 acre-feet during the period from 1991 to 2006. Not all water purveyors report their savings and, therefore, savings may be significantly higher.

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23 Ibid.

24 *Santa Barbara Countywide Integrated Regional Water Management Plan*, May 2007. 4-17.

Conjunctive Use

Santa Barbara's water purveyors practice the conjunctive use of surface and groundwater supplies when excess water is available to recharge groundwater basins for later withdrawal when supplies are short.[25] Some purveyors use State Water Project water, when available, and rely on groundwater to supplement when demand is higher. Purveyors may also purchase a "drought buffer" of additional SWP water or bank water in a groundwater basin. Similarly, some purveyors may manage, possibly in accordance with an AB 3030 Groundwater Management Plan, the groundwater pumped and stored in groundwater basins in order to optimize the basin's overall long-term working yield. The City of Santa Barbara maintains a water well system capable of extracting up to 4,500 ac-ft/yr. Most of this potential supply is kept in reserve in case of drought, since a majority of its water supply is from surface water sources outside of the watershed area. During normal years, the City's groundwater basins are allowed to recharge, with groundwater extraction generally reserved for periods of drought or other supply shortages. Pumping occurs in Storage Unit No. 1 (downtown area) and the Foothill Basin (outer State Street area). The City of Santa Barbara conducts conjunctive use water supply management activities by injecting and storing surface water in the basins.

4.13.3.2 Local Plans

State law requires that all cities and counties adopt a comprehensive, long-term general plan that outlines physical development of the county or city. The general plan must cover a local jurisdiction's entire planning area so that it can adequately address the broad range of issues associated with the city or county's development.

Ultimately, the general plan expresses the community's development goals and embodies public policy relative to the distribution of future public and private land uses. The general plan may be adopted as a single document or as a group of documents relating to subjects or geographic segments of the planning area.

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25 ~~Ibid.,~~Ibid, 4-19.

County of Santa Barbara

General Plan - Conservation Element

The Conservation Element[26] of the Santa Barbara County General Plan includes policies that address the conservation, development, and use of natural resources including water, forests, soils, rivers, and mineral deposits in Santa Barbara County. It also includes the Groundwater Resources Section (updated in 1994), which presents goals, policies, actions, and development standards intended to improve groundwater supply.

Water Resources

State Planning Law (Government Code Section 65302 (d)) requires that the section referring to water resources in the Conservation Element be prepared "in coordination with any county-wide water agency and with all district and city water agencies which have developed, served, controlled or conserved water for any purpose for the county or city for which the plan is prepared."

The Conservation Element's discussion of water resources provides an overview of water quality, including surface water and groundwater supplies.

Surface Water Supplies[27] - The surface water supplies developed by the reservoirs on the Santa Ynez River generally are of satisfactory mineral quality, containing somewhat in excess of 500 milligrams per liter of total dissolved solids. Some taste and odor problems result from polysulfides contained in the influent seepage into Tecolote Tunnel, but means of alleviating this problem are being investigated. Otherwise, conventional treatment is sufficient to produce acceptable water for domestic purposes. Such treatment is provided by Goleta County Water District and the City of Santa Barbara, and is under consideration by the Montecito, Summerland, and Carpinteria County Water Districts. No significant present degradation of surface water supplies due to waste discharges occurs, and the regulatory powers of the Regional Board are adequate to prevent such degradation from point source discharges.

Groundwater Supplies[28] - The principal concern with quality of groundwaters is their mineral content. Part of the mineral content of the groundwaters occurs naturally. Surface runoff, which eventually contributes to the recharge of groundwater, dissolves minerals from the soil and rock with which it comes in contact and thereby acquires some mineral content. Some additional mineralization may occur

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26 Santa Barbara County, *Comprehensive General Plan,* Conservation Element, Adopted 1979, republished May 2009.

27 Ibid, 22.

28 Santa Barbara County, *Comprehensive General Plan, Conservation Element*, Adopted 1979, republished May 2009. 22-23.

by solution of minerals, both from the aquifer materials and from the materials lying between the surface of the ground and the water table, after the surface waters have percolated. Some increase in mineralization also occurs from point sources of waste discharge (municipal wastewaters, industrial wastes, etc.). To the extent that the mineral content of these wastes is greater than that of the underlying groundwater, the groundwater salinity will be increased. For example, municipal wastewaters typically contain total dissolved solids concentrations that exceed those of the source water by 300 milligrams per liter or more. Therefore, pumpage of groundwater for municipal purposes, and subsequent return of the effluent to the groundwater basin, results in some increase in salinity of the underlying groundwater.

The Conservation Element also notes that developments in areas tributary to major surface water supplies or overlying or tributary to groundwater should be compatible with the protection of these water resources. Accordingly, lands in the County were categorized with respect to their relationship to such water sources:[29]

- Category 1: Stream Channels Recharging Groundwater
- Category 2: Areas Tributary to Present Major Surface Water Supplies
- Category 3: Areas Tributary to Proposed Future Major Surface Water Supplies
- Category 4: Areas Overlying Unconfined Groundwater
- Category 5: Areas Tributary to Groundwater
- Category 6: Areas Not Tributary to Water Resources

Category 2, encompassing the areas tributary to present surface water supplies, consists only of the headwaters area of the Santa Ynez River above Bradbury Dam. Category 2 also includes Gibraltar, Jameson, and Cachuma reservoirs along with several small reservoirs located north of Goleta and Santa Barbara on the coastal side of the Santa Ynez Mountains.

In this category, activities should not be permitted that would significantly degrade the quality of the surface water supplies or increase silt production. Accordingly, the amount of development should be limited, and controls should be imposed on development to prevent deleterious effects. Light recreational activities should cause few problems, provided that sanitary pollution from such usage is prevented and erosion is not increased. Intensive recreational usage could be somewhat more of a problem because of the potentially greater sanitary pollution load resulting from more people using the area.

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29 Ibid, 24-25.

In the case of agricultural use and intensive recreation, the salinity of return flows, the possible presence of nutrients (nitrates and phosphates) (which could stimulate algal growth in reservoirs), and the erosion potential must be evaluated. Irrigated lands also contribute such trace constituents as pesticides, but this is not a major problem in the County. Waste loads resulting from excessive numbers of livestock tributary to surface water supplies likewise should be considered. For example, construction of a feedlot above Cachuma Reservoir obviously could create problems. The effects of agricultural uses are a question of degree. Some agriculture above surface water supplies can be tolerated, but if the amount of agricultural development becomes excessive, the problems may become too severe to be tolerated.

In urban areas, sanitary and industrial wastes and surface runoff are the principal sources of pollution. Land grading in connection with development may increase erosion and silt production. Obviously, the greater the total amount of urban development, the greater the potential for problems.

The question of usage of lands tributary to surface water supplies primarily involves the extent of development which should be permitted. It would be difficult to place a specific upper limit on the amount of development which might be acceptable. However, most of the lands in the County that are tributary to surface water supplies have limited development potential due to other factors.

Santa Barbara County’s water resources consist of groundwater and surface water supplies. The groundwater basins are the major source of water in the County, providing over 85 percent of the total applied water Countywide. Regardless of future decisions on supplemental water, groundwater will remain the major water source. In general, the available supply of groundwater is termed the “safe yield” of the basin.

The County’s surface water supplies consist of Cachuma, Gibraltar, and Jameson reservoirs along the Santa Ynez River.

The Groundwater Resources Section of the Conservation Element provides the following goals and policies that apply to the proposed project:

Goal 1:	To ensure adequate quality and quantity of groundwater for present and future County residents, and to eliminate prolonged overdraft of any groundwater basins.
Policy 1.1:	The County shall encourage and assist all of the County's water purveyors and other groundwater users in the conservation and management, on a perennial yield basis, of all groundwater resources.

Goal 3: To coordinate County land use planning decisions and water resources planning and supply availability.

Policy 3.1: The County shall support the efforts of the local water purveyors to adopt and implement groundwater management plans pursuant to the Groundwater Management Act and other applicable law.

Policy 3.2: The County shall conduct its land use planning and permitting activities in a manner which promotes and encourages the cooperative management of groundwater resources by local agencies and other affected parties, consistent with the Groundwater Management Act and other applicable law.

Policy 3.3: The County shall use groundwater management plans, as accepted by the Board of Supervisors, in its land use planning and permitting decisions and other relevant activities.

The proposed project provides for groundwater and water quality management.

Ecological Resources

The Conservation Element notes that the Santa Ynez River, by virtue of its length, passes through a variety of plant communities and geologic formations. Because of differing topographic features and soil characteristics, it also supports several different ecological communities along its course, such as freshwater marshes, large reservoirs, and riparian communities. Many of the County's plants and animals are most abundant in, or are almost limited to, the Santa Ynez River area. The Conservation Element makes the following recommendation relative to future development of the Santa Ynez River:[30]

> *The completion of the Cachuma Dam in 1952 illustrated the delicate nature of the Santa Ynez River. At the same time that the dam created a lake habitat, it eliminated a large Steelhead run. To preclude further environmental problems, future development of the Santa Ynez River should be halted, and further depletion of river water should not be tolerated. Far too many ecological communities would suffer with any further diminution in the flow of the river. For similar reasons, no noxious or polluting materials should be permitted to be added to the drainage where the river flows through urban areas.*

The Conservation Element notes that Cachuma Lake, the largest inland body of water in the County, attracts numerous migratory birds and acts as home for a wide variety of plants and animals. A rookery of great blue herons can be found in the dead valley oak (*Quercus lobata*) at the eastern end of the lake. It

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30 Santa Barbara County, *Comprehensive General Plan,* Conservation Element, Adopted 1979, republished May 2009. 143-144.

also is possible to observe such uncommon predatory birds as sharp-shinned hawks, Cooper's hawks, red-shouldered hawks, ospreys, and the endangered southern bald eagle at this same section of the lake, and makes the following recommendation relative to Lake Cachuma:[31]

> *The eastern end of the lake, at present undisturbed, should continue to receive total protection. Traffic into this portion of the lake would reduce the attractiveness of this habitat to the large birds of prey which now frequent the area. It also would be desirable to maintain the Park Department's present policy of preventing use of the northern shore.*

The proposed project provides for mitigation to protect ecological resources.

Oak Trees

The Conservation Element includes a subsection for the protection of oak trees in inland rural areas of the County.[32] This component of the Conservation Element includes goals and polices for protecting oak trees:

Goal: Santa Barbara County shall promote the conservation and regeneration of oak woodlands in the County over the long term, and, where feasible, shall work to increase the native oak population and extent of woodland acreage. The highest priority for conservation, protection and regeneration shall be for valley oak trees, valley oak woodlands and valley oak savanna.

Policy: Native oak trees, native oak woodlands and native oak savannas shall be protected to the maximum extent feasible in the County's rural and/or agricultural lands. Regeneration of oak trees shall be encouraged. Because of the limited range and increasing scarcity of valley oak trees, valley oak woodlands and valley oak savanna, special priority shall be given to their protection and regeneration.

The proposed project provides for oak tree mitigation.

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31 Ibid, 145.

32 Ibid., Oak Tree Protection In The Inland Rural Areas of Santa Barbara County, Supplement to the Mapped Areas Communities Section, Adopted 2003, republished May 2009.

Other Agencies

Cachuma Conservation Release Board

The Cachuma Conservation Release Board (CCRB) is a joint powers agency formed in January 1973 between the Carpinteria Valley Water District, Goleta Water District, the City of Santa Barbara, ~~and~~ Montecito Water District, and the Summerland Water District. CCRB's current members include Goleta ~~w~~Water District, the City of Santa Barbara, and Montecito Water District. The Board was established to jointly represent the respective parties in protecting the Cachuma water rights interests of the four South Coast entities and maximizing the amounts of water that they can obtain from the Cachuma Project or other sources that may be available to them. The Cachuma Conservation Release Board, partnering with the Santa Ynez River Water Conservation District Improvement District No. 1, conducts the long-term steelhead fishery program in the Lower Santa Ynez River in accordance with an MOU with the U.S. Bureau of Reclamation (Reclamation) and other parties.

Cachuma Operation and Maintenance Board

The Cachuma Operation and Maintenance Board is a joint-powers agency that includes the five Cachuma Project Member Units. Although Reclamation owns Bradbury Dam, the Tecolote Tunnel, and the South Coast Conduit, and its four regulating reservoirs, the Board has operated and maintained the Cachuma Project facilities, other than Bradbury Dam, since 1957, when it was formed to take over these responsibilities from Reclamation.

Central Coast Water Authority

The Central Coast Water Authority was formed in 1991 to construct, manage, and operate Santa Barbara County's 42-mile portion of the SWP and a regional water treatment plant. It later secured agreements with the State of California DWR to operate and maintain an additional 101-mile portion of pipeline and associated facilities in Santa Barbara and San Luis Obispo counties. It is presently composed of eight public agencies: the Cities of Buellton, Guadalupe, Santa Barbara, and Santa Maria, plus the Carpinteria Valley Water District, Goleta Water District, Montecito Water District, and Santa Ynez River Water Conservation District Improvement District No. 1.

Santa Barbara County Water Agency

The Santa Barbara County Water Agency manages a number of regional programs, which include (1) implementation and partial funding of operational programs such as the cloud seeding program, (2) implementation of the Regional Water Efficiency Program, (3) development of countywide hydrologic data and development of hydrologic models, and (4) development of a program to identify and implement solutions to creek and ocean water pollution on the South Coast of Santa Barbara County. Included in these programs are the compilation and publication of an annual report on groundwater conditions, sediment management studies, technical support to other public agencies, and public information.

Major water projects involving the Water Agency include the State Water Project (Coastal Branch Extension), Cachuma Project, and the Twitchell Project. The Water Agency administers development of the IRWMP supported by a number of local governments. The County Board of Supervisors adopted an MOU with 28 local agencies in September 2006.

Santa Ynez River Water Conservation District

The Santa Ynez River Water Conservation District was formed in 1939 to protect the water rights and supplies of its constituents in the Santa Ynez River watershed with respect to diversions by South Coast agencies. It also manages releases of water from Bradbury Dam to replenish the Santa Ynez River Riparian Basin and the Lompoc Groundwater Basin and provides groundwater management planning and related activities on the uplands adjacent to the river throughout the watershed.

4.13.3.3 Urban Water Management Plans

In 1983, the California Legislature enacted the Urban Water Management Planning (UWMP) Act (Division 6, Part 2.6 of the Water Code Section 10610–10656). The UWMP Act states that every urban water supplier that provides water to 3,000 or more customers, or that provides over 3,000 acre-feet of water annually, should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The UWMP Act describes the contents of the UWMP as well as how urban water suppliers should adopt and implement the plans. It was the intention of the Legislature, in enacting the UWMP Act, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied.

The California Water Code (Sections 10610–10656) requires water suppliers to prepare an UWMP to promote water conservation and efficient water use. Objectives of this UWMP include the following:

- Accomplishes water supply planning over a 20-year period in 5-year increments
- Identifies and quantifies adequate water supplies, including recycled water, for existing and future demands, in normal, dry, and multiple dry years
- Identifies actions to prepare for and implement during a catastrophic interruption of water supplies

- Implements conservation and efficient use of urban water supplies.

The next cycle of plans (2010), is due July 1, 2011.

Among other things, the plans must describe the water demand management or conservation measures that are being implemented or are scheduled for implementation in order to meet the requirements of the 2009 Comprehensive Water Legislation (SB7X). (Wat. Code, Section 10631). In addition, the plans must contain an urban water supply contingency analysis. The 2010 UWMP updates must include, among other things, actions to be undertaken in response to a water supply shortage, including up to a 20 percent reduction in per capita water demand by 2020, and mandatory prohibitions against specific water use practices during shortages, including but not limited to prohibiting the use of potable water for street cleaning. (Wat. Code, Section 10632.)

Each of the following water providers have WSAs and are currently in the process of completing their 2010 updates. These updates will reflect changes in water supply conditions associated with the Cachuma Project.

Information and data from the existing UWMPs, and where available more recent data as provided by the districts, was used in preparing this EIR.

Carpinteria Valley Water District

The Carpinteria Valley Water District has prepared the Urban Water Management Plan 2005 Update.[33] The UWMP 2005 Update is a public statement of the goals, objectives, and strategies needed to maintain a reliable water supply for the District's service area. It is important to understand that this UWMP be viewed as a long-term, general planning document, rather than as policy for supply and demand management. The UWMP was adopted by the Board of Directors on July 25, 2007.

Goleta Water District

The Goleta Water District has prepared the Urban Water Management Plan 2005 Update.[34] The UWMP 2005 Update is a public statement of the goals, objectives, and strategies needed to maintain a reliable water supply for the District's service area. It is important to understand that this UWMP be viewed as a long-term, general planning document, rather than as policy for supply and demand management. The UWMP was adopted by the Board of Directors on December 20, 2005.

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33 Carpinteria Valley Water District. *Final Report – Urban Water Management Plan 2005 Update*. July 2007.

34 Goleta Water District, *Final Urban Water Management Plan – Goleta Water District*, December 20, 2005.

Montecito Water District

The Montecito has prepared the Urban Water Management Plan 2005 Update.[35] The UWMP 2005 Update is a public statement of the goals, objectives, and strategies needed to maintain a reliable water supply for the District's service area. It is important to understand that this UWMP be viewed as a long-term, general planning document, rather than as policy for supply and demand management. The UWMP was adopted by the Board of Directors on December 20, 2005.

City of Santa Barbara

The City of Santa Barbara has prepared the Urban Water Management Plan 2005 Update.[36] The UWMP 2005 Update is a public statement of the goals, objectives, and strategies needed to maintain a reliable water supply for the District's service area. It is important to understand that this UWMP be viewed as a long-term, general planning document, rather than as policy for supply and demand management. The UWMP was adopted by the Board of Directors on December 20, 2005.

Santa Ynez River Water Conservation District – Improvement District No. 1

The Santa Ynez River Water Conservation District – Improvement District No. 1 (SYRWCD ID No. 1) has prepared the Urban Water Management Plan 2000 Update.[37] The UWMP 2000 Update is a public statement of the goals, objectives, and strategies needed to maintain a reliable water supply for the District's service area. It is important to understand that this UWMP be viewed as a long-term, general planning document, rather than as policy for supply and demand management. The UWMP was adopted by the Board of Directors on October 16, 2001.

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[35] Montecito Water District, *Final Urban Water Management Plan Update – 2005*, October 2005.

[36] City of Santa Barbara, *Urban Water Management Plan*, December 2005.

[37] Santa Ynez River Water Conservation District – Improvement District No. 1, *Urban Water Management Plan 2000*, October 16, 2001.

4.14 OTHER CEQA COSIDERATIONS

4.14.1 Significant Unavoidable Impacts

According to *State CEQA Guidelines*, an EIR must disclose the significant unavoidable impacts that will result from a project.[1] The following significant impacts would occur as a result of the proposed alternatives:

Section 4.3, Water Supply Conditions

- Under current demand would exceed supply by an appreciable amount (greater than 10 percent) over baseline conditions (Alternative 2~~B~~) for Alternative 3B by 10,289 acre-feet (af) (16 percent over baseline), for Alternative 5B by 11,533 af (31 percent over baseline), and Alternative 5C by 10,433 af (18 percent over baseline), respectively, for a single critical drought year (see **Table 4-17** line 5). For the critical three-year drought period, ~~forecast~~ current demand would exceed supply by an appreciable amount (greater than 10 percent) over baseline conditions (Alternative 2~~B~~) for Alternative 3B by 13,534 af (31 percent over baseline), for Alternative 5B by 16,820 af (63 percent over baseline), and Alternative 5C by 13,967 af (36 percent over baseline), respectively, for a single critical drought year (see **Table 4-25a** line 5). The same pattern of demand exceeding supply would be present for the future demand estimates (e.g., 2020/2030) for project alternatives 3B, 5B, and 5C.

  The potential impact to the Member Units' water supply under Alternatives 3B, 5B, and 5C, in both the critical drought year and in a critical drought period, could result in indirect environmental impacts as compared to the baseline condition, depending on the manner in which the Member Units make up for the shortage. Indirect environmental impacts could result under Alternatives 3B, 5B and 5C if the Member Units increase groundwater pumping, obtain a temporary transfer from another SWP contractor, or desalinate seawater. Accordingly, the impacts to the Member Units' water supply under Alternatives 3B, 5B, and 5C could result in significant and unmitigable indirect environmental impacts (Class I).

- The loss of oak trees under Alternatives 3B, 3C, 4B, 5B and 5C along the margins of Cachuma Lake is considered a significant, unmitigable impact (Class I) until such time that replacement trees become well established and self-sustaining, estimated to be about 10 years. Maintenance and watering of the mitigation oaks is anticipated to continue until 2013, approximately eight years into the required monitoring cycle. Once regular watering is discontinued, loss of additional oaks can be anticipated. Because of the time lag between loss of mature oaks and growth of replacement planting, the level of significance for this impact remains at Class I, until such time as the replacement-planting ratio of self-sustaining oaks is achieved. After this time, the loss of oak trees under Alternatives 3B, 3C, 4B, 5B and 5C along the margins of Cachuma Lake is considered a significant, but mitigable impact (Class II).

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[1] California Code of Regulations, Title 14, Division 6, Chapter 3, *California Environmental Quality Act Guidelines*, Section 15126.6

4.14.2 Significant Irreversible Changes

The environmental effects of the project alternatives are discussed in **Section 4.0** of this 2nd Revised Draft EIR. Surcharging under the project alternatives would result in an irreversible environmental change at Cachuma Lake permanently changing the lakeshore and associated vegetation.

4.14.3 Growth Inducing Impacts

CEQA requires that an EIR discuss the ways in which the proposed project could foster economic or population growth or the construction of additional housing, either directly or indirectly, in the surrounding environment. The EIR must address the potential for a project to remove an obstacle to growth as well as discuss characteristics of the project, which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.[2]

A project is growth inducing if it is reasonably foreseeable that it will encourage construction of additional development. This encouragement may occur directly or indirectly by, for example, providing infrastructure that removes an obstacle to growth (such as a new road into an undeveloped area or a wastewater treatment plant with excess capacity).

Under the project alternatives, Cachuma Lake would be surcharged by up to three additional feet. This would increase project yield during years when the reservoir surcharges. However, as illustrated in the water supply analysis, the increase in project yield would be offset by increased fish release requirements and, therefore, the project alternatives would not be growth inducing.

2 California Code of Regulations, Title 14, Division 6, Chapter 3, *California Environmental Quality Act Guidelines*, Section 15126.6(d).

5.0 ENVIRONMENTAL ANALYSIS OF NON-FLOW HABITAT ENHANCEMENTS ON TRIBUTARIES

Non-flow habitat enhancements on tributaries will be implemented in the same manner under all of the alternatives being considered by the SWRCB. These management actions were included in the Biological Opinion issued by the NMFS, as well as the Fish Management Plan prepared by Reclamation and COMB. Reclamation is required to implement these actions in accordance with the Biological Opinion.

The impacts of the various non-flow habitat enhancements described in detail in **subsection 2.4.3** are evaluated below in a programmatic manner. One of the reasons why this level of review is appropriate is because Reclamation and COMB prepared a joint EIR/EIS for implementation of those measures for which sufficient information was available. Unlike flow-related actions, for which the SWRCB is the appropriate lead agency, it is appropriate for COMB to serve as CEQA lead agency and conduct a project-level environmental review of any non-flow habitat enhancement measures that COMB is funding and implementing.

5.1 TRIBUTARY PASSAGE IMPEDIMENT REMOVAL MEASURES

There are many natural and man-made passage impediments on tributaries below Bradbury Dam, particularly under low to moderate flow conditions. The impediments include culverts, road crossings, and boulder cascades. Removal of these impediments would increase access to suitable spawning and rearing habitats, thereby expanding the total available habitat for *O. mykiss* on the lower river. The highest priority tributaries are Salsipuedes, El Jaro, Hilton, and Quiota creeks because they have perennial flow in their upper reaches and can support spawning and rearing. The Biological Opinion required that Reclamation remove at least 11 passage impediments on Hilton Creek (one on federal land and one under Highway 154), Salsipuedes Creek (Highway 1 Bridge), Quiota Creek (six road crossings), El Jaro Creek (one road crossing), and Nojoqui Creek (one road crossing). Many impediments have been removed and passage restored; however, all initially identified projects were not completed by 2005 as required by the Biological Opinion. Therefore, Reclamation has reinitiated consultation with NMFS. Several additional impediments identified following the issuance of the Biological Opinion have been repaired as well. Details on these projects are provided in **subsection 2.4.3.1** and **2.4.3.2**.

Passage through culverts can be improved by placing boulder weirs downstream of the culvert to raise water levels in the culvert; modifying the culvert to reduce flow velocities; and replacing pipe culverts with box or arched culverts. “Arizona” road crossings can be modified to allow fish passage by constructing jump pools at the downstream end, notching the road for a low flow channel, or constructing a bridge. Vertical concrete structures at existing bridges can be modified by notching them to reduce their height, and the streambed below the structure can be modified to create a plunge pool. Potential programmatic level environmental impacts associated with passage impediment removal measures are summarized in **Table 5-1**.

Table 5-1
Summary of Programmatic Level Impacts Associated with Tributary Passage Removal Projects

Action	Type of Adverse Environmental Impacts (if any)	Programmatic Mitigation Measures to be Implemented	Impact Classification
Remove passage impediments	Relocation of steelhead or rainbow trout from affected creek prior to construction.	Conduct relocation in accordance with Biological Opinion requirements for handling fish and with NMFS and CDFG approval.	Class II temporary impact
	Temporary dewatering of creek during construction, removing aquatic habitat, and organisms.	Remove and relocate organisms prior to dewatering.	Class III temporary and reversible impact
	Temporary displacement of endangered red-legged frog and other sensitive aquatic species such as western pond turtle, if present, during construction.	Conduct daily pre-construction surveys; remove frogs under authorization from U.S. Fish and Wildlife Service.	Class II temporary impact
	Temporary increase in erosion and sedimentation due to work in or near the creek.	Limit extent of disturbance. Utilize BMPs to reduce on-site erosion and off-site sedimentation; may require permits from RWQCB.	Class II temporary impact
	Temporary and permanent disturbance to riparian scrub and woodland vegetation if present at work area.	Minimize extent of disturbance; restore temporarily disturbed riparian vegetation; replace riparian vegetation permanently removed.	Class II temporary impact

5.2 ADDITIONAL MEASURES ON HILTON CREEK

The Biological Opinion required Reclamation to enhance spawning and rearing habitat on lower Hilton Creek on federal lands by augmenting flows via a supplemental watering system which has been functional since 2000. In addition, the Biological Opinion assumed that Reclamation would re-align and extend the lower portions of the creek 1,500 feet to provide additional habitat. The additional channel project has not yet been realized; however, the Hilton Creek Cascade Chute Project was completed in 2006, removing a passage barrier and providing access to all 2,980 feet of suitable habitat downstream to the main river. The programmatic level impacts associated with these actions are summarized below in **Table 5-2**. The magnitude and extent of the individual impacts depended upon the final design, location, and implementation of each project, as well as the specific mitigation measures incorporated into the projects. Reclamation and COMB evaluated the project-specific impacts of each project and developed site-specific mitigation measures through their EIR/EIS.

5.3 FISH RESCUE PROGRAM

The supplemental watering system will provide flow to Hilton Creek in most years. However, it may not be possible to provide summer and fall flows when the lake level drops to below 660 feet. If flows are curtailed due to extremely low lake levels, or due to mechanical failure of the system, the Biological Opinion requires Reclamation to capture and relocate stranded *O. mykiss*. Fish rescue operations would occur on an as-needed basis. The details of the current Fish Rescue Program are found in **Section 2.4.3.3**. The most likely relocation site is the Long Pool below the dam, portions of the mainstem between Bradbury Dam and the Long Pool, and certain downstream tributaries. Fish rescue operations would be conducted with the approval and requisite permits from DFG and NMFS. No adverse environmental impacts are expected from the fish rescue operations, which involve deployment of nets and handling of fish by qualified biologists, working in the stream.

Table 5-2
Summary of Programmatic Level Impacts Associated With Hilton Creek Projects

Action	Type of Adverse Environmental Impacts (if any)	Programmatic Mitigation Measures to be Implemented	Impact Classification
Install flexible intake and floating pump in Lake Cachuma	None. No construction required. Pipe will be attached to existing intake in the dam. Pump will be placed on float.	Not applicable.	Not applicable
	Relocation of steelhead from lower Hilton Creek prior to work.	Conduct relocation in accordance with Biological Opinion requirements for handling fish and with NMFS and CFDG approval.	Class II temporary impact
	Temporary dewatering of Hilton Creek during construction, removing aquatic habitat and organisms.	Remove and relocate organisms prior to dewatering.	Class III temporary and reversible impact
	Temporary displacement of endangered red-legged frog, if present on Hilton Creek, during construction.	Conduct daily pre-construction surveys; remove frogs under authorization from U.S. Fish and Wildlife Service.	Class II temporary impact; not expected to occur
	Temporary and permanent disturbance to riparian scrub and woodland along new creek alignment.	Minimize extent of disturbance; restore temporarily disturbed riparian vegetation; replace riparian vegetation permanently removed.	Class II temporary impact
Re-align and extend lower channel of Hilton Creek.	Temporary increase in erosion and sedimentation due to work in or near the creek.	Limit extent of disturbance. Utilize Best Management Practices to reduce on-site erosion and off-site sedimentation.	Class II temporary impact

6.0 COMPARISON OF ALTERNATIVES

The California Environmental Quality Act (CEQA) requires that an environmental impact report (EIR) describe a range of reasonable alternatives to the project, or to the location of the project that could feasibly avoid or lessen any significant environmental impacts while substantially attaining the basic objectives of the project. An EIR should also evaluate the comparative merits of the alternatives. This section sets forth the proposed project alternatives and evaluates them, as required by CEQA.

Key provisions of the *State CEQA Guidelines*[1] pertaining to the alternatives analysis are summarized below:

- The discussion of alternatives shall focus on alternatives to the project or its location that are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly.
- The No Project alternative shall be evaluated along with its impact. The No Project analysis shall discuss the existing conditions at the time the notice of preparation is published. Additionally, the analysis shall discuss what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services.
- The range of alternatives required in an EIR is governed by a "rule of reason"; therefore, the EIR must evaluate only those alternatives necessary to permit a reasoned choice. The alternatives shall be limited to ones that would avoid or substantially lessen any of the significant effects of the project.
- For alternative locations, only locations that would avoid or substantially lessen any of the significant effects of the project need be considered for inclusion in the EIR.
- An EIR need not consider an alternative whose effects cannot be reasonably ascertained and whose implementation is remote and speculative.

The range of feasible alternatives is selected and discussed in a manner to foster meaningful public participation and informed decision making. Among the factors that may be taken into account when addressing the feasibility of alternatives are environmental impacts, site suitability, economic viability, availability of infrastructure, general plan consistency, regulatory limitations, jurisdictional boundaries, and whether the applicant could reasonably acquire, control, or otherwise have access to the alternative site.[2]

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1 California Code of Regulations, Title 14, Division 6, Chapter 3, *California Environmental Quality Act Guidelines*, Section 15126.6.

2 Ibid, Section 15126.6(f)(1).

6.1 FLOW-RELATED ACTIONS ALONG THE SANTA YNEZ RIVER

As noted in **Section 4.1**, the SWRCB has not selected a particular alternative as a proposed project at this time. During the pending hearing being held pursuant to Order WR 94-5, the SWRCB will consider testimony concerning the alternatives analyzed in this EIR and any other evidence entered into the administrative record.

The impacts of the various alternatives were evaluated in **Section 4.0** using Alternative 2 as the environmental baseline~~ (No Project)~~. A comparison of these impacts among the alternatives is provided below.

6.1.2 Impacts of the Proposed Alternatives

A summary of the number of different types of impacts under each alternative is presented in **Table 6-1, Summary of Impacts of Different Alternatives**. Impacts of the proposed alternatives relative to baseline operations (Alternative 2) are summarized in **Table 6-2, Comparison of Impacts of the Proposed Alternatives**.

Based on **Tables 6-1** and **6-2**, the following environmental consequences would occur:

- Alternatives 3B, 5B, and 5C would result in potential shortages in supply during dry years that could require new sources of water, which could result in **significant and unavoidable (Class I)** impacts attributable to increased groundwater pumping, temporary water transfers, and desalination.
- All of the alternatives, except Alternative 2 would have temporary significant unavoidable impacts (**Class I**) until such time that replacement trees become established and self-sustaining, which is estimated to take about 10 years. After this time, the loss of oaks is considered **significant, but mitigable (Class II)** impacts to oak trees.
- All of the alternatives would have potential significant, but mitigable (Class II) impacts to cultural resources.
- All of the alternatives would result in **beneficial (Class IV)** impacts to groundwater conditions; steelhead movement, migration and habitat; and riparian vegetation along the Santa Ynez River. In addition, Alternative 4B would have beneficial impacts related to surface water quality (TDS) <u>on the area below the Lompoc Forebay </u>in the Santa Ynez River.

6.2 NON-FLOW RELATED ACTIONS ON TRIBUTARIES

Impacts of the non-flow related management actions on tributaries downstream of Bradbury Dam are described in **Section 5**. These impacts would occur in the same manner under current operations and under Alternatives 3B, 3C, 4B, 5B, and 5C. Hence, impacts due to these actions would not differ among alternatives.

6.3 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

The environmentally superior alternatives would be Alternative 3C and Alternative 4B as they have the fewest significant impacts. These alternatives would not result in any significant and unavoidable impacts (Class I) to water supply but would result in temporary significant and unavoidable (Class I) impacts to oak trees. Impacts related to the loss of oak trees would become significant but mitigable (Class II) once the replacement of oaks trees through planting is considered sustainable Alternatives 3C and 4B would also result in significant impacts to cultural resources that could be mitigated to less than significant (Class II). Both Alternatives 3C and 4B would result in some level of beneficial impacts to groundwater storage, riparian vegetation and steelhead passage and habitat. Alternative 4B would also result in improved surface water quality for total dissolved solids (TDS) in the Santa Ynez River.

Although Alternative 4B would have slightly more beneficial impacts, it would require the import of SWP water, which would require an agreement between the City and DWR, could have impacts related to steelhead, and would require the construction of a pipeline and outlet works to discharge SWP water into the Santa Ynez River.

Alternatives 3B, 5B, and 5C would result in significant and unavoidable (Class I) impacts to water supply related that could not be mitigated as well as significant impacts (Class I and Class II) to oak trees and, therefore, would not be the environmentally superior alternative.

Alternatives 3C and 4B meet the objectives as set forth for the proposed project including:

- Protecting public trust resources, including but not limited to steelhead, red-legged frog, tidewater goby, and wetlands, in the Santa Ynez River downstream of Bradbury Dam, to the extent feasible and in the public interest, taking into consideration: (1) the water supply impacts of measures designed to protect public trust resources, and (2) the extent to which any water supply impacts can be minimized through the implementation of water conservation measures;

- Protecting senior water right holders from injury due to changes in water quality resulting from operation of the Cachuma Project, including water quality effects in the Lompoc Plains groundwater basin that impair any senior water right holder's ability to beneficially use water under prior rights; and

- Protecting senior water right holders from injury due to a reduction in the quantity of water available to serve prior rights.

As Alternative 3C is the No Project Alternative, Alternative 4B would be the environmentally superior alternative as the *State CEQA Guidelines*[3] requires that another alternative other than the No Project be

[3] California Code of Regulations, Title 14, Division 6, Chapter 3, *California Environmental Quality Act Guidelines*, Section 15126.6(e)(2).

identified among the other alternatives if the No Project is environmentally superior. However, Alternative 4B would require additional measures beyond those that can be considered at this time and could have additional potentially significant (either Class I or II) impacts related to the construction of a pipeline and outlet works to discharge SWP water into the Santa Ynez River.

For Alternative 4B to be ~~a viable alternative~~implemented, the City of Lompoc would need to implement an agreement for delivery State Water Project (SWP) water which ~~w~~could serve to harden the demand for SWP water at a time when the state is looking to diversify regional water portfolios to improve water supply reliability. The residents of the City rejected the use of SWP water in 1991 as part of Countywide elections in Santa Barbara County on a State water ballot measure which asked whether voters in each City or district would approve issuance of revenue bonds to finance local facilities needed to treat and distribute SWP water once the state completed construction of the Coastal Branch Phase II project. Voters in 11 cities and districts approved the bond measures; the City of Lompoc denied the measure.

In addition, the CCWA has expressed concern that ~~the~~ connection of a new pipeline to deliver SWP water from the Santa Ynez River area ~~blew~~ below Bradbury Dam to their existing pipeline in the vicinity of the Rucker Road could reduce water pressure to a degree that they would be unable to meet their downstream contractual requirements. CCWA participant contracts require it to provide up to 28 cfs of water supply to downstream participants located downstream of the dam during certain operation periods outlined in Alternative 4B. Based on the analysis conducted by CCWA, there is no additional capacity in the existing pipeline above its current level of operation, and if a turnout and pipeline were added and operated as suggested in Alternative 4B, CCWA may not be able to deliver SWP water at the rates required.

These considerations neither add significant new information nor affect the analyses contained in the 2011 2nd RDEIR, but support a conclusion that Alternative 4B is not feasible and should not be considered.

Table 6-1
Summary of Impacts of Different Alternatives

Impact	Alt 3B	Alt 3C	Alt 4B	Alt 5B	Alt 5C
Significant, unmitigable (Class I)					
Water supply	X			X	X
Riparian and Lakeshore Vegetation					
Oak trees (short-term/temporary)	X	X	X	X	X
Significant, but mitigable (Class II)					
Riparian and Lakeshore Vegetation					
Oak trees (long-term)	X	X	X	X	X
Cultural Resources	X	X	X	X	X
Adverse, but not significant (Class III)					
Water supply		X	X		
Surface water hydrology	X	X	X	X	X
Surface water quality	X	X	X	X	X
Riparian and Lakeshore Vegetation					
Substantially remove or convert existing upland vegetation types (excluding oak woodlands)	X	X	X	X	X
Frequency and amount of low flows (2-5 cfs)	X	X	X	X	X
Sensitive Aquatic and Terrestrial Wildlife					
Surcharge would result in the loss of upland wildlife habitat	X	X	X	X	X
Reduce the frequency of spills, and affect riparian	X	X	X	X	X
Substantially affect the survival of sensitive wildlife species	X	X	X	X	X
Impact to southwestern willow flycatcher	X	X	X	X	X
Recreation	X	X	X	X	X
Beneficial (Class IV)					
Above the Narrows Aquifer	X	X	X	X	X
Surface water quality (below the Lompoc Forebay)			X		
Lompoc Groundwater Basin	X	X	X	X	X
Riparian and Lakeshore Vegetation					
Effects of uncontrolled downstream flows	X	X	X	X	X
Southern California Steelhead and Other Fishes	X	X	X	X	X
Sensitive Aquatic and Terrestrial Wildlife	X	X	X	X	X

Table 6-2
Comparison of Impacts of the Proposed Alternatives

Impact	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay	Alt 5B Biological Opinion/ CalTrout 3A2 with 1.8′ surcharge	Alt 5C Biological Opinion/ CalTrout 3A2 with 3′ surcharge
Surface Water Hydrology					
Changes in downstream flows (primarily from the dam to Alisal Road) that could reduce channel capacity and cause flooding hazards.	Class III	Class III	Class III	Class III	Class III
Significantly increase the potential for flooding hazards along the lower Santa Ynez River	Class III	Class III	Class III	Class III	Class III
Water Supply					
Member Units' water demand exceeds their water supply from all sources by an appreciable amount (greater than 10 percent) for either the single critical drought year (**Table 4-17**) or the critical three-year drought period (**Table 4-25a**).	Class I	Class III	Class III	Class I	Class I
Above Narrows Alluvial Aquifer					
The mean and median monthly dewatered storage for the Above Narrows Alluvial Groundwater Basin over the simulation period is greater for the alternatives than for the baseline operations condition.	Class IV	Class IV	Class IV	Class IV	Class IV
Surface Water Quality					
TDS levels in Cachuma Lake and downstream (upstream of Lompoc Narrows) would be elevated substantially as compared to the baseline condition.	Class III	Class III	Class III	Class III	Class III
TDS levels in the Santa Ynez River below Bradbury Dam would be elevated substantially as compared to the baseline condition.	Class III	Class III	Class IV	Class III	Class III

Impact	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay	Alt 5B Biological Opinion/ CalTrout 3A2 with 1.8′ surcharge	Alt 5C Biological Opinion/ CalTrout 3A2 with 3′ surcharge
Lompoc Groundwater Basin Conditions					
TDS level would be significantly de~~in~~creased above the baseline condition (TDS levels from 1952 through 1982). TDS would be lowered in the portions of the Lompoc Basin below the Lompoc Forebay with the introduction of State Water Project water.	Class ~~IV~~III	Class ~~IV~~III	Class IV	Class ~~IV~~III	Class ~~IV~~III
Southern California Steelhead and Other Fishes					
Substantially increase the frequency of years with passage for anadromous *O. mykiss* due to releases to supplement passage as compared to the baseline.	Class IV	Class IV	Class IV	Class IV	Class IV
Result in spawning habitat scores that show enough runoff occurs to provide for spawning habitat between the dam and Highway 154 as compared to the baseline.	Class IV	Class IV	Class IV	Class IV	Class IV
The frequency and quality of rearing habitat flows would significantly change rearing conditions compared to baseline operations	Class IV	Class IV	Class IV	Class IV	Class IV
Riparian and Lakeshore Vegetation					
Substantially remove or convert existing upland vegetation types (excluding oak woodlands) as compared to the baseline.	Class III	Class III	Class III	Class III	Class III
Surcharge inundation would substantially affect the survival of oak trees around the lake compared to the baseline.	Class I – short-term Class II – long-term	Class I – short-term Class II – long-term	Class I – short-term Class II – long-term	Class I – short-term Class II – long-term	Class I – short-term Class II – long-term
Effects of uncontrolled downstream flows would substantially remove or reduce existing riparian vegetation stands along the Santa Ynez River through spill releases as compared to the baseline.	Class IV	Class IV	Class IV	Class IV	Class IV
The frequency and amount of low flows (2-5 cfs) would substantially affect existing riparian vegetation stands along the Santa Ynez River as compared to the baseline.	Class III	Class III	Class III	Class III	Class III

Impact	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay	Alt 5B Biological Opinion/ CalTrout 3A2 with 1.8′ surcharge	Alt 5C Biological Opinion/ CalTrout 3A2 with 3′ surcharge
Sensitive Aquatic and Terrestrial Wildlife					
Surcharge would result in the loss of upland wildlife habitat (including the loss of oak woodlands) compared to the baseline.	Class III	Class III	Class III	Class III	Class III
Alter the vigor and extent of wetland and riparian vegetation along the river, and impact associated aquatic and terrestrial wildlife, including sensitive species compared to the baseline.	Class IV	Class IV	Class IV	Class IV	Class IV
Reduce the frequency of spills, and affect riparian plant recruitment and the long-term health of vegetation compared to the baseline.	Class III	Class III	Class III	Class III	Class III
Impact to river resources would substantially affect the survival of sensitive wildlife species compared to the baseline.	Class III	Class III	Class II	Class III	Class III
Impact to southwestern willow flycatcher would substantially affect the breeding behavior and survival of this sensitive species compared to the baseline.	Class III	Class III	Class III	Class III	Class III
Recreation					
Cause substantial changes in shoreline configuration, increase the visibility or frequency of exposure of barren slopes, cause substantial changes in vegetation, or cause inundation or damage of recreational facilities that would disrupt recreational activities within the park.	Class III	Class III	Class III	Class III	Class III
Cause changes along the river that would cause inundation or damage of recreational facilities, or changes that would disrupt recreational activities within the river.	Class III	Class III	Class III	Class III	Class III
Construction of the pipeline would cause damage to recreational facilities or would disrupt recreational activities within the park.	NA	NA	Class III	NA	NA

Impact	Alt 3B Biological Opinion with 1.8′ surcharge	Alt 3C Biological Opinion with 3′ surcharge	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay	Alt 5B Biological Opinion/ CalTrout 3A2 with 1.8′ surcharge	Alt 5C Biological Opinion/ CalTrout 3A2 with 3′ surcharge
Cultural Resources					
Cause a substantial adverse change in the significance of an historical resource as compared to the baseline.	Class II	Class II	Class II	Class II	Class II

7.0 CUMULATIVE IMPACTS

Under *State CEQA Guidelines* section 15130, an EIR must discuss cumulative impacts of a project when the project's incremental effect is "cumulatively considerable." "Cumulatively considerable" means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. (*State CEQA Guidelines* section 15065.) Section 15355 of the *State CEQA Guidelines* defines cumulative impacts as two or more individual effects, that when considered together, are either considerable or compound other environmental impacts.

INCREASED RISK OF FLOODING AND OTHER IMPACTS TO DOWNSTREAM WATER USERS

Some or all of the proposed alternatives could increase the risk of flooding below Bradbury Dam and adversely affect other downstream water users and natural oak trees, ~~a recreational facility (the boat launch ramp),~~ riparian habitat and associated aquatic and terrestrial wildlife, surface water and groundwater quality, and cultural resources. These resources are located at Cachuma Lake and along the Santa Ynez River between Bradbury Dam and the ocean.

All of the users listed ~~o~~in **Table 3-1a, Existing and Claimed Water Rights and Diversions along the Santa Ynez River**, have been accounted for in the modeling based on historical pumping records and estimates, as the modeling uses historical diversions rather than any maximum amounts listed.[1] The historical pumping from the Santa Ynez River alluvium was collected and calculated by the Santa Ynez River Hydrology Committee in the 1980s and 1990s (see documentation for the Santa Ynez River Hydrology Model [SYRHM][2]). The municipal diversions in the SYRHM— are based on historical diversions by Solvang, SYRWCD ID No. 1, and Buellton.

Existing diver~~ters~~ sions and ongoing activities and potential future projects ~~or ongoing activities~~ that could affect the same resources or involve similar impacts are listed below:

- Appropriative diverters along the lower river include the City of Solvang, City of Buellton, SYRWCD, ID #1~~ and SYRWCD~~, SYRWCD and other water users (see Section 3.1.2). Diversions are accomplished by production wells in the river alluvium. In addition, many private landowners divert from the Above Narrows Alluvial Groundwater Basin for municipal and industrial and irrigation uses within

1 All applications, permits and licensed listed have been accounted for except for the Santa Ynez River Water Conservation District (SYRWCD) Permit 17447 (the Lompoc recharge project). This permit was not included as it has not been developed and does not include any historical pumping.

2 Santa Ynez River Hydrology see documentation for the Santa Ynez River Hydrology Model Manual, April 15, 1993.

the SYRWCD. As the population in the Santa Ynez and Lompoc Valleys expands in the future, pumping from the alluvial groundwater basin may increase.

- Since Alternative 4B bypasses the BNA flows around select stream reaches, the extent and vigor of riparian vegetation and wildlife in these stream reaches could be affected. The potential impacts to riparian vegetation under Alternative 4B are speculative, however, and potentially offset by beneficial effects to riparian vegetation. (In addition, as more diversions occur from the Above Narrows Alluvial Groundwater Basin, the amount of water released from the ANA may increase because there will be an increase in dewatered storage in the groundwater basin.) Therefore, Alternative 4B will not have a significant cumulative impact to riparian vegetation or riparian-~~dependant~~dependent wildlife.

- The City of Lompoc, Vandenberg Village Community Services District, Mission Hills Community Services District, and private landowners pump from the Lompoc Basin, which includes the Lompoc Uplands and Lompoc Terrace (both hydrologically connected to the river) and the Lompoc Plain, which receives direct recharge from the river. At the present time, pumping levels appear to be static. None of the alternatives result in increased groundwater pumping in the Lompoc Basin, and therefore, do not contribute to a cumulative impact to the groundwater basin.

- In the past 5 to 8 years, there has been a substantial increase in the acreage of vineyards in Northern Santa Barbara County, particularly in the Los Alamos Valley. As a result, hundreds of native oak trees were legally removed as part of agricultural development. The County has initiated several efforts to control the loss of oak trees, and recently proposed a permit program for oak tree removal on agricultural lands. The loss of oak trees at Cachuma Lake under Alternatives 3B, 3C, 4B, 5B, and 5C would contribute to this past and ongoing significant impact to native trees. The contribution of these alternatives to loss of oak trees in Santa Barbara County can be mitigated by implementing Mitigation Measure RP-1 identified in **Subsection 4.8.3**. The loss of oak trees due to Cachuma Lake surcharging will be fully mitigated once replacement trees have become established (approximately ten years). The cumulative impact of these alternatives to the ongoing loss of oak trees in Santa Barbara County is less than significant because it would be short term.

- The simultaneous removal of two or more tributary passage impediments to facilitate fish passage under Alternatives 3B, 3C, 4B 5B and 5C could cause cumulative construction-related impacts (e.g., disturbances to aquatic and riparian habitats) but these impacts would be temporary and less than significant.

INCREASED AIR QUALITY IMPACTS

In addition, should additional water supplies warrant the re-activation of the City of Santa Barbara's desalination plant (see discussion in **Subsection 4.3.2.7**). The plant is currently decommissioned due to ample quantities of less expensive supplies and there are no plans in the near future to reactivate it; the desalination facility can, however, be brought into operation within 6 to 12 months if needed during drought or water shortage conditions. Just over half of the prefiltration capacity and reverse osmosis treatment modules were sold, leaving sufficient capacity to meet the City's anticipated need for approximately 3,000 acre-feet per year (afy) of production in future droughts.

As discussed in **Subsection 4.3.2.7**, the desalination process requires additional power generation, which has environmental consequences. A 3,000-afy seawater desalination plant would require roughly two megawatts of generating capacity continuously. If the electricity were produced from existing thermal power plants, it could result in impacts to air quality from air emissions and water quality impacts from the cooling system, which could be considered cumulative impacts. Power plants produce nitrogen oxides (NOx), particulate matter, reactive organic gases (ROGs), and in some cases, sulfur dioxide (SO_2). Coal-fired generation is almost all out-of-state, with the energy brought to California through the high voltage transmission system. Assuming that new load from the desalination facility is only met through an efficient natural gas-fired power plant using the best available emissions reduction technology, a 3,000 afy facility using two megawatts of electricity would result in 1,053 pounds of NOx, 93 pounds of SO_2, 693 pounds of particulate matter less than 10 micrometers in diameter (PM_{10}), 693 pounds of ROG, 2,000 pounds of carbon monoxide, and 2,000 tons of carbon per year. This assumes that the desalination facility operates continuously. These impacts could be mitigated in part if the desalination plant has been designed so that it can be shut down during peak power demand periods, thereby taking advantage of unused power capacity in off-peak times. As such, they may not be cumulatively considerable.

8.0 AGENCIES CONTACTED

The following agencies were contacted for information during the preparation of the EIR:

FEDERAL AGENCIES

U.S. Bureau of Reclamation
National Marine Fisheries Service
U.S. Fish and Wildlife Service
U.S. Forest Service, Los Padres National Forest

STATE AGENCIES

California Department of Fish and Game
Department of Water Resources

OTHER AGENCIES AND DISTRICTS

<u>Cachuma Conservation Release Board</u>
Cachuma Operations and Maintenance Board
Carpinteria Valley Water District
Central Coast Water Authority
City of Lompoc
City of Santa Barbara
City of Solvang
County of Santa Barbara Flood Control District
County of Santa Barbara Parks & Recreation Department
County of Santa Barbara Water Agency
Goleta Water District
Montecito Water District
Santa Ynez River Water Conservation District
Santa Ynez River Water Conservation District – Improvement District No. 1

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