DRAFT ENVIRONMENTAL IMPACT REPORT

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)

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State Water Resources Control Board
Division of Water Rights
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List of Acronyms

1994 MOU	(1994) Memorandum of Understanding for Cooperation in Research and Fish Maintenance
af	acre-feet
afa	acre-feet per annum
ACHP	Advisory Council on Historic Preservation
ANA	Above Narrows Account
BNA	Below Narrows Account
cfs	cubic feet per second
California Register	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 and Recreation 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.
MODFLOW	Three Dimensional Finite Difference Flow Model
MOA	Memorandum of Agreement
MWD	Montecito Water District
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	U.S. National Marine Fisheries Service
NOP	Notice of Preparation
NRHP	National Register of Historic Places
OHV	Off-highway vehicle
Reclamation	U.S. Bureau of Reclamation
Recreation Area	Cachuma Lake Recreation Area
Regional Board	Regional Water Quality Control Board, Central Coast Region
SBCWA	Santa Barbara County Water Agency
SHPO	California State Office of Historic Preservation
SHRC	CA - State Historical Resources Commission
SUTRA	Two-Dimensional Finite Element Solute Transport Model
SWP	State Water Project
SWRCB	State Water Resources Control Board
SYRHM	Santa Ynez River Hydrologic Model
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

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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
WY	Water Year

EXECUTIVE SUMMARY

1.0 BACKGROUND INFORMATION

The proposed project analyzed in this 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 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, Montecito Water District, Carpinteria Valley Water District, 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 State Water Resources Control Board's (SWRCB) 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 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 such time as 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 California Environmental Quality Act (CEQA) in connection with the SWRCB's consideration of modifications to Reclamation's permits. 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.

2.0 PROJECT ALTERNATIVES

As discussed above, the project analyzed in this EIR 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 downstream of 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. 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 various 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 has recently 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 NMFS evaluated in the Biological Opinion included the surcharging of Lake Cachuma 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.

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-foot surcharge is implemented, Reclamation must meet the interim target flows. Reclamation initiated the interim target flows in 2001. Upon implementation of either a 1.8-foot or 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 below Bradbury Dam.

The SWRCB developed the following alternatives for analysis in the EIR, which incorporate the requirements of the Biological Opinion:

1. Operations under the Original WR Order 89-18.
2. Current Operations under Orders WR 89-18 and 94-5 and the Biological Opinion (interim release requirements only) – environmental baseline conditions and the No Project Alternative.

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.

3.0 SUMMARY OF IMPACTS

A summary of the impacts of the various alternatives is provided in Table ES-1 and Table ES-2. The first table presents the environmental effects that are, and will be, occurring since Reclamation initiated new releases for fish in 2001 pursuant to the Biological Opinion (i.e., operations under Alternative 2), as compared to recent historic operations (i.e., Alternative 1). This comparison demonstrates the environmental benefits of the new releases for fish, and the presence of high-quality water imported from the SWP in downstream releases.

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

1. Alternative 3A would result in the fewest total impacts compared to other alternatives.

2. Each alternative would result in at least one significant, unmitigable impact (Class I). The loss of oak trees along the margins of Lake Cachuma due to surcharging is a significant unmitigable impact (at least initially) that would occur for Alternatives 3B, 3C, 4A, and 4B. While the type of impact is the same under these alternatives, the number of trees that could be lost differs: 271 for Alternative 3B at a

1.8-foot surcharge and 452 trees for Alternatives 3C, 4A, and 4B at a 3-foot surcharge.

3. Alternatives 3B, 3C, 4A, and 4B would also adversely affect recreational facilities at the Lake Cachuma County Park, and require relocation of these facilitates to maintain the park. These impacts can be mitigated through the development, funding and implementation of a facility relocation plan prior to surcharging. If this mitigation is delayed or otherwise hindered, then surcharging would cause a new significant impact (Class I) on recreation at Lake Cachuma until the relocation is completed.

4. Alternative 4A would result in several impacts that would not occur under Alternative 4B including temporary disturbance to wildlife along the river during the installation of the pipeline under the river near Lompoc; possible decrease in riparian growth in the river near Lompoc due to reduced recharge, which could affect the scenic qualities of the riverbanks for nearby park users; and disturbance of a historic archeological site along McLaughlin Road east of the river.

5. Conversely, Alternative 4B would result in a unique impact – disturbance of riparian habitat and its associated wildlife during the construction of four outlets on the east bank of the Santa Ynez River near Lompoc.

6. The additional impacts associated with Alternatives 3B, 3C, 4A, and 4B that would not occur under Alternative 3A are due to impacts to upland habitat, archeological sites, and recreational facilities due to surcharging under these alternatives.

7. Impacts of the non-flow related management actions on tributaries downstream of Bradbury Dam would occur in the same manner under current operations and under Alternatives 3A, 3B, 3C, 4A, and 4B. Hence, impacts due to these actions would not differ among alternatives.

Alternatives 3C, 4A, and 4B would avoid the reduction in water supply to the Member Units that would occur under Alternatives 3A and 3B and the associated significant, indirect environmental impacts. Alternatives 3C, 4A, and 4B would involve a 3.0-foot surcharge, which would create more storage in Cachuma Lake and thereby offset the impact to Member Units' long-term water supply. The incremental loss of 452 oak trees associated with Alternatives 3C, 4A, and 4B can be weighed against the benefits of the additional storage in the reservoir which would offset current and future water supply impacts to the Member Units. Alternative 3B would partially offset the water supply impacts, but not to the same extent as Alternative 3C.

Alternative 3A would avoid the impacts to upland habitat, archeological sites, and recreational facilities due to surcharging under Alternatives 3B, 3C, 4A, and 4B. However, it should be noted that, with the exception of the temporal impact due to the loss of oak trees, these impacts could potentially be mitigated to less than significant level.

The environmentally superior alternative, is Alternative 3A which has the fewest environmental impacts, and the fewest Class I impacts. Alternative 3A guarantees that the fish flows prescribed in the Biological Opinion are met immediately rather than being phased in over time. Also, the implementation of long-term flow requirements under Alternatives 3C, 4A, and 4B may be dependent on the feasibility of mitigating for the impacts of a 3-foot surcharge on recreational facilities. By adopting Alternative 3A, the SWRCB could ensure that the long-term flows required by the Biological Opinion are met immediately, while affording Reclamation the option of ultimately implementing a 3-foot surcharge to avoid the impacts to Cachuma Project water supply under Alternative 3A.

TABLE ES-1
SUMMARY OF CHANGES IN ENVIRONMENTAL CONDITIONS DUE TO CURRENT OPERATIONS

Issue Area	Changes Due to Current Operations Incorporating the Biological Opinion Interim Flow Requirements (Alternative 2) Compared to Recent Historic Operations (Alternative 1)	Do these Changes Cause Beneficial, Adverse, or Neutral Impacts?
Surface Water Hydrology	Lower annual lake levels and storage due to increased downstream releases for fish	Neutral
	Frequency of spills are slightly reduced	Neutral
	More frequent low flows below the dam, over a larger area	Beneficial
	Reduction in the frequency, duration, and amount of ANA water rights releases due to incidental benefits of fish release	Neutral
	Potential increase in flood hazards due to an increase in in-stream woody riparian vegetation (due to more flows) and a minor reduction in spill frequency (which maintains channel capacity)	Adverse
	Potential reduction in floods associated with spill events due to reduction in spill frequency	Neutral
Above Narrows Alluvial Aquifer	Decreased dewatered storage due to incidental recharge from fish releases (i.e., higher alluvial groundwater storage)	Beneficial
Surface Water Quality	Lower lake total dissolved solids (TDS) due to importation of SWP water	Beneficial
	TDS concentrations in water rights releases to the Above Narrows and Below Narrows aquifers are lower due to commingling of SWP water in releases	Beneficial
Groundwater quality in the Lompoc Plain	Reduced TDS levels in recharge to the Lompoc Plain	Beneficial
Fish	More frequent flows that allow for steelhead migration, spawning, and rearing	Beneficial
	More frequent flows to support spawning and rearing of non-native fish (other than steelhead) on the river	Beneficial
Riparian Vegetation	Increase in the density, vigor, and extent of riparian vegetation in the river channel over time due to greater moisture availability and lower growing season due to water from fish releases	Beneficial
	Reduction in the frequency of spills that cause natural disturbances to riparian vegetation that enhance long-term reproduction and health	Adverse
	The increased and more reliable aquatic and riparian habitats created by the releases for steelhead under current operations could expand the range and number of sensitive species along the river, particularly the willow flycatcher, least Bell's vireo, western pond turtle, and red-legged frog	Beneficial

TABLE ES-2
SUMMARY OF IMPACTS DUE TO THE PROJECT ALTERNATIVES

Occurrence of Impact Relative to Current Operations (Alternative 2)

Resource, Impact and Mitigation Measures	Alt 3A Biological Opinion with 0.75' Surcharge	Alt 3B Biological Opinion with 1.8' Surcharge	Alt 3C Biological Opinion with 3.0' Surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay
CLASS I IMPACT – SIGNIFICANT AND NOT MITIGABLE TO LESS THAN SIGNIFICANT					
Water Supply Conditions					
Water supply shortages in a critical drought year could have significant, unmitigable indirect environmental impacts if the Member Units make up for the shortages by increasing groundwater pumping, implementing a temporary water transfer, or desalinating seawater. Mitigation Measure WS-1: During a critical drought year, implement any drought contingency measures identified in the Member Units' urban water management plans.	X	X			
Riparian and Lakeshore Vegetation					
Surcharging to 1.8' (Alternative 3B) or 3.0 feet (Alternatives 3C, 4A, and 4B) would result in the loss of 271 and 452 oak trees, respectively, along the margins of Lake Cachuma over time. This impact is significant because of the length of time required to replace mature oak trees. Mitigation Measure RP-1: Implement the long-term oak tree restoration program at Cachuma Lake County Park. Replace oak trees at a ratio that ensures a final 2:1 replacement ratio.		X	X	X	X
Recreation					
Surcharging would require relocation of recreational facilities at the Lake Cachuma County Park, possibly including the water treatment plant, water intake, two sewer lift stations, a parking lot, several roads, the marina, the boat launch, a foot bridge, several stores and buildings at the marina, a picnic area, and several trails. If the relocation of a critical facility does not occur prior to surcharging, or is deemed infeasible due to funding, there is a potential for a permanent or long-term disruption of recreational uses. Mitigation Measure R-1: Design, fund, and implement recreational facility relocation prior to implementation of surcharging or provide for recreational uses on an interim basis until permanent facility relocations are completed.		X	X	X	X

Resource, Impact and Mitigation Measures	Alt 3A Biological Opinion with 0.75' Surcharge	Alt 3B Biological Opinion with 1.8' Surcharge	Alt 3C Biological Opinion with 3.0' Surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay
CLASS II IMPACT – SIGNIFICANT AND MITIGABLE TO LESS THAN SIGNIFICANT					
Riparian and Lakeshore Vegetation					
Construction of four outlets on the east bank of the Santa Ynez River to discharge SWP water for recharge into the riverbed would remove a small amount of riparian vegetation. Mitigation Measure RP-2: Design and construct facilities to avoid significant riparian vegetation. Replace any displaced riparian woodland onsite at a 2:1 ratio.					X
Sensitive Aquatic and Terrestrial Wildlife					
Placement of a water line under the Santa Ynez River near Lompoc to deliver water to the City of Lompoc could displace wildlife using the narrow riparian corridor on the riverbanks. Mitigation Measure WL-1: Construct facilities to avoid disturbance to sensitive riparian breeding birds in the vicinity, particularly the willow flycatcher. Schedule directional drilling and trenching work within 200 feet of the river to avoid the breeding season (April 15 through July 15).				X	
Installation of four discharge outlets on the banks of the Santa Ynez River near Lompoc could adversely affect sensitive breeding birds (such as the willow flycatcher). Mitigation Measure WL-1: Construct facilities to avoid disturbance to sensitive riparian breeding birds in the vicinity, particularly the willow flycatcher. Schedule construction of discharge outlets and trenching work within 200 feet of the river to avoid the breeding season (April 15 through July 15).					X
Recreation					
The relocation of recreational facilities at Lake Cachuma County Park due to surcharges would require the removal of 15 to 20 mature Coast Live Oak trees and temporarily affect freshwater marsh habitat. Mitigation Measure R-2: Avoid impacts to oak trees and wetland areas due to facility relocation. Replace oak trees and wetland habitat that would be disturbed at the County Park.		X	X	X	X
Relocation of recreational facilities could disturb unknown buried archeological sites. Mitigation Measure R-3: Identify sensitive archeological resources at the sites of proposed facility relocations in order to avoid impacts. If unknown archeological resources are identified, cease activities within 100 feet of the discovery. A professional archeologist shall evaluate the find and recommend mitigation measures in accordance with federal and state guidelines.		X	X	X	X

Resource, Impact and Mitigation Measures	Alt 3A Biological Opinion with 0.75' Surcharge	Alt 3B Biological Opinion with 1.8' Surcharge	Alt 3C Biological Opinion with 3.0' Surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay
Cultural Resources					
Two known prehistoric archeological sites along the lake margins would be subject to increased erosion due to surcharging. Mitigation Measure CR-1: Conduct data recovery 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). Mitigation Measure CR-2: Implement the *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 (2002).		X	X	X	X
Surcharging could expose unknown buried archeological resources by eroding the lake margins over time. Mitigation Measure CR-2: Implement the *Memorandum of Agreement Between the Bureau of Reclamation and the California Sate Historic Preservation Officer Regarding the Additional Surcharge to Cachuma Reservoir, Santa Barbara County, California*, prepared by West (2002). Mitigation Measure CR-3: If unknown archeological resources are identified, cease activities within 100 feet of the discovery. A professional archeologist shall evaluate the find and recommend mitigation measures in accordance with federal and state guidelines.		X	X	X	X
The proposed pipeline route would traverse a historic archeological site along McLaughlin Road east of the river. Mitigation Measure CR-4: Prior to trenching of the pipeline route, conduct a systematic program of subsurface testing along the route in unpaved areas. Evaluate and treat any cultural resources discovered according to state and federal law.				X	
The pipeline routes near Lompoc would occur in an area with a high density of archeological sites. Unknown archeological resources could be encountered during trenching for the pipeline. Mitigation Measure CR-5: If unknown archeological resources are identified, cease activities within 100 feet of the discovery. A professional archeologist shall evaluate the find and recommend mitigation measures in accordance with federal and state guidelines.				X	X

Resource, Impact and Mitigation Measures	Alt 3A Biological Opinion with 0.75' Surcharge	Alt 3B Biological Opinion with 1.8' Surcharge	Alt 3C Biological Opinion with 3.0' Surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay
CLASS III IMPACT – ADVERSE BUT NOT SIGNIFICANT					
Surface Water Quality					
Increase in TDS in Cachuma Lake.	X	X	X	X	X
Increase in mean monthly TDS of flows at the Narrows (when present) in the fall.				X	X
Riparian and Lakeshore Vegetation					
Surcharging would remove upland vegetation (chaparral and coastal sage scrub) along the margins of the lake.		X	X	X	X
Slight reduction in the frequency of spills could reduce the frequency of uncontrolled downstream flows which facilitate riparian recruitment on floodplains and may be necessary for long-term health of the riparian vegetation.	X	X	X	X	X
Surcharging would displace upland wildlife habitat along the margins of Cachuma Lake.		X	X	X	X
Slight reduction in frequency of spills could adversely affect long-term health of riparian vegetation and riparian-dependent wildlife.	X	X	X	X	X
Reduction in frequency of flows between 10-20 cfs below Alisal Bridge.				X	
Recreation					
Possible decrease in riparian growth in the river near Lompoc due to reduced recharge could affect the scenic qualities of the riverbanks for nearby park users.				X	

1.0 INTRODUCTION

1.1 PROPOSED PROJECT

The proposed project analyzed in this EIR 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.

1.2 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 annum (afa) 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 afa 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 afa. 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 release 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 the downstream alluvial basins between the dam and the Narrows (east of Lompoc) were deliberately maintained in a partially dewatered state, with the intent of capturing runoff 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 maintain a certain amount of water in 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) (comprised of the City of Santa Barbara, GWD, MWD, CVWD, and 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 such time as 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.

1.3 PUBLIC SCOPING

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 current operations alternative should reflect any changes in Cachuma Project operations that had occurred since NMFS issued the Biological Opinion.

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). 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 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 750 feet with a flashboard for a permanent 0.75-foot surcharge. 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 maximum capacity of 150 cfs; however, it is rarely used above 100 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 survey conducted in 2000 indicated that the reservoir capacity has been further reduced to 188,030 af at elevation 750.0 feet (MNS, 2000). The minimum operating pool for Cachuma Lake can be as low as 12,000 af, but pumps are required for diversions 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 2-2). 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 seven 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, when SWP water deliveries are not being made.

2.1.3 FACILITY OPERATIONS AND MAINTENANCE

As stated in section 1.2, 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 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 managed by the Santa Barbara County Parks and Recreation Department (County Parks) according to a contract between Reclamation and the County. The contract expires in 2003.

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. The 375-acre County Recreation Area is located on a peninsula on the south side of the lake. Facilities include the following: campsites, general store, marina and launch ramp, private docks, bait and tackle shop, horse campsites, rustic amphitheater, trailer storage yard, permanent and transient mobile home park, Nature Center, County Park Ranger Station, and a family center, swimming pools, outdoor roller rink and snack shop. The management area on the north side of the lake consists of open space that is leased for grazing. It is not open to public access.

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, 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. Approximately 38,000 acres of croplands are irrigated by water from the Cachuma Project. Approximately 30 percent of total deliveries is used for purposes of irrigation and 70 percent is 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 afa. Safe yield is usually defined as the amount of water a project can be expected to deliver, on average, over a sustained hydrologic period – a period that preferably is long enough to contain representative 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 safe yield was 24,800 afa (Reclamation, 1990).

Under the original Cachuma Project water supply Master Contract between Reclamation and the Member Units, the Member Units were entitled to 32,000 afa, 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.

Since 1993, the maximum annual Cachuma Project delivery was 25,714 afa. To date, Available Supply has exceeded this amount. In essence, this delivery limit constitutes an estimate of operational yield developed by the Member Units. 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.

The most recent estimate of the Project's operational yield, 25,908 afa, was developed for the Contract Renewal EIR/EIS (Reclamation and CPA, 1995). This estimate 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. A revised (and lower) estimate of operational yield has not been developed based on the new estimate of reservoir capacity completed by the Member Units in 2000 (MNS, 2000).

Recent Cachuma Project annual deliveries to the Member Units are summarized in Table 2-1. 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 22 percent for SYRWCD, ID#1 to 58 percent for the GWD.

TABLE 2-1
CACHUMA PROJECT RECENT ANNUAL DELIVERIES

Member Unit	Percentage of Project Yield (%)	Annual Deliveries Based on Operational Yield of 25,714 afa	Percent of Total Member Unit Water Supply from Cachuma	Cachuma Project Deliveries (af) during Water Year			
				1996-97	1997-98	1998-99	1999-00
Carpinteria Water District	10.938	2,813	41	3,245	3,325	4,026	2,991
Montecito Water District	10.311	2,651	34	2,800	2,202	3,036	2,993
City of Santa Barbara	32.188	8,277	45	7,499	7,099	5,046	10,785
Goleta Water District	36.250	9,321	58	14,014	11,955	14,307	11,884
SYRWCD, ID#1	10.313	2,651	22	1,869	60	70	79
Total=	100	25,713		31,326	24,641	26,485	28,732

Historical annual water deliveries from the Cachuma Project since its construction are shown on Chart 2-1 (Appendix B). Deliveries 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 winter runoff. For example, in 1991 during the recent drought, the water delivery from the Cachuma Project was reduced to 17,418 af. In 1992-93, the water deliveries from the project were about 24,624 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 (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 afa (Table 2-2). Reclamation and the Member Units reevaluated the average infiltration rate since the 1988-91 drought, and lowered the estimate to about 2,000 afa.

TABLE 2-2

Cachuma Project - Historical Operations Data (af)

Water Year (WY)	Computed Inflow	End of WY Storage	Gross Evap.	Precip. on Lake	SWP Inflow	Releases							Tunnel Infiltration	Member Unit Deliveries	Project Water Deliveries	Water Right Releases
						Direct Diversion	Tecolote Tunnel	SYRWCD ID#1	Down-Stream	Fish	Spills	Total				
1953	18,071	9,188	1,319	108					7,669			7,669				7,669
1954	18,953	21,779	2,328	598					4,632			4,632				4,632
1955	4,942	19,584	2,540	935					3,921			3,921	9,621	9,621	9,621	3,921
1956	24,329	36,629	4,198	1,481			2,117		2,450			4,567	6,734	8,851	8,851	2,450
1957	6,150	30,154	4,643	1,162			5,470		3,675			9,145	5,388	10,858	10,858	3,675
1958	223,600	196,889	11,210	4,459			4,850		5,050		35,747	45,647	5,005	9,855	9,855	5,050
1959	18,700	187,178	14,624	3,662			8,432		2,296		3,056	13,784	4,732	13,164	13,164	2,296
1960	5,300	163,149	13,614	2,669		169	11,409	300	3,850			15,728	3,626	15,504	15,504	3,850
1961	3,177	134,493	12,015	2,382		663	17,308	239	1,609			19,819	4,242	22,452	22,452	1,609
1962	105,100	190,475	12,446	4,963		402	11,921	885	6,441		17,020	36,669	3,739	16,947	16,947	6,441
1963	8,060	171,736	12,158	3,710		510	10,595	665	2,871			14,641	3,259	15,029	15,029	2,871
1964	4,820	141,506	11,786	2,339		447	17,352	1,504	3,958			23,261	3,357	22,660	22,660	3,958
1965	15,360	122,308	10,204	3,043		182	14,909	1,837	7,423			24,351	3,271	20,199	20,199	7,423
1966	83,000	168,926	12,524	3,707		345	17,522	2,129	3,862			23,858	3,137	23,133	23,133	3,862
1967	210,000	191,622	12,683	5,775		246	14,155	2,575	23,794		138,537	179,307	3,219	20,195	20,195	23,794
1968	10,400	160,871	13,525	2,414		360	18,190	3,670	7,820			30,040	3,222	25,442	25,442	7,820
1969	525,400	190,181	12,300	9,727		240	15,030	2,600	7,460		468,150	493,480	3,582	21,452	21,452	7,460
1970	28,000	176,407	13,500	1,793		340	21,450	4,110	4,890			30,790	3,065	28,965	28,965	4,890
1971	31,000	161,345	12,300	3,497		360	22,800	3,110	11,030			37,300	3,335	29,605	29,605	11,030
1972	8,800	121,314	11,452	2,231		167	28,158	4,469	6,771			39,565	3,185	35,979	35,979	6,771
1973	125,600	185,591	12,055	5,948		128	18,455	3,551	9,619		23,665	55,418	2,842	24,976	24,976	9,619
1974	33,500	182,039	12,667	4,112		114	17,805	3,519	5,842		1,405	28,685	2,878	24,314	24,314	502
1975	50,544	184,467	11,864	6,069		145	24,052	3,160	1,847		16,805	46,009	3,072	30,429	30,429	493
1976	5,837	145,187	11,802	3,187		149	26,022	4,655	5,131			35,957	2,750	33,576	33,576	4,643
1977	1,910	112,077	10,775	2,601		98	18,741	4,581	3,035			26,455	2,191	25,611	25,611	2,799
1978	329,219	193,424	13,333	9,573		114	20,703	3,013	927		219,158	243,915	3,161	26,991	26,991	56
1979	61,692	183,949	13,916	5,250		151	20,100	4,029	1,836		36,385	62,502	4,295	28,575	28,575	895
1980	154,425	187,382	13,353	5,803		139	22,057	2,483	1,166		116,915	142,760	3,346	28,025	28,025	311
1981	22,066	168,871	13,812	4,019		177	20,856	5,008	4,743			30,784	3,157	29,198	29,198	4,175
1982	26,849	159,528	11,479	3,868		187	20,956	2,963	4,474			28,580	2,964	27,070	27,070	3,963
1983	428,601	196,347	12,630	10,143		183	22,616	1,532	4,142		361,675	390,148	3,061	27,392	27,392	3,446
1984	39,074	171,599	14,534	3,354		193	25,601	5,054	4,577		17,217	52,642	3,360	34,208	34,208	3,163
1985	6,764	135,748	12,276	2,816		142	22,781	2,664	5,862			31,449	2,894	28,481	28,481	5,392
1986	76,571	171,873	12,782	4,831		108	21,690	2,686	8,010			32,494	2,287	26,771	26,771	7,391

Water Year (WY)	Computed Inflow	End of WY Storage	Gross Evap.	Precip. on Lake	SWP Inflow	Releases							Tunnel Infiltration	Member Unit Deliveries	Project Water Deliveries	Water Right Releases
						Direct Diversion	Tecolote Tunnel	SYRWCD ID#1	Down-Stream	Fish	Spills	Total				
1987	2,375	128,352	12,147	1,997		150	27,209	3,812	4,573			35,744	1,848	33,019	33,019	3,887
1988	8,733	99,150	10,294	4,042		102	23,917	2,803	4,903			31,725	1,794	28,616	28,616	4,856
1989	4,045	66,098	8,367	1,459		86	20,632	2,802	6,669			30,189	1,878	25,398	25,398	6,669
1990	2,628	34,188	6,019	909		66	16,384	863	4,792			22,105	2,031	19,344	19,344	4,792
1991	53,568	60,995	6,373	2,057		43	15,762	1,656	4,983			22,444	1,876	19,337	19,337	4,983
1992	135,828	157,066	11,239	4,022		52	18,170	891	13,427			32,540	1,899	21,012	21,012	13,099
1993	333,387	177,479	13,428	8,875		79	22,582	2,042	1,518	1,501	280,698	308,420	1,894	26,597	26,597	1,518
1994	16,694	151,046	12,526	4,144		73	22,821	1,819	9,537	494		34,744	1,937	26,650	26,650	9,192
1995	365,092	134,855	10,321	10,063		62	23,887	109	1,966	894	354,107	381,025	2,028	26,086	26,086	1,547
1996	33,243	120,503	11,627	2,653		76	24,721	2,109	9,703	2,012		38,621	2,040	28,946	28,946	9,313
1997	56,552	124,771	11,861	2,911		84	26,637	1,785	13,206	1,623		43,335	2,034	30,540	30,540	12,791
1998	475,175	185,500	11,349	12,072	1,354	62	24,473		3,956	1,976	386,055	416,522	2,057	26,592	25,238	1,684
1999	21,562	168,772	12,341	4,077	323	70	26,397		883	2,999		30,349	2,091	28,558	28,235	
2000	51,896	170,840	12,435	4,972	2,156	80	30,364		5,972	2,037	6,067	44,520	2,413	32,857	30,701	4,423
2001	150,243	173,479	11,995	7,712	818	77	26,089		3,503	2,157	112,313	144,139	2,404	28,570	27,752	1,796
Max	525,400	196,889	14,624	12,072	2,156	663	30,364	5,054	23,794	2,999	468,150	493,480	9,621	35,979	35,979	23,794
Min	1,910	9,188	1,319	108	323	43	2,117	109	883	494	1,405	3,921	1,794	8,851	8,851	56
Avg.	90,344	141,366	11,040	4,167	1,163	181	19,438	2,571	5,557	1,744	144,165	79,233	3,153	24,418	24,319	5,185

Notes:

1. Computed inflow is the sum of the change in storage, release, spill and evaporation minus precipitation on the reservoir surface.
2. In WY 1971, inflow to Lake Cachuma included roughly 5,700 af released from storage in Gibraltar Reservoir.
3. In WY 1971 - 5,580 af and in WY 1972 - 1,358 af was temporarily stored in Lake Cachuma and released through the Tecolote Tunnel for Santa Barbara.
4. Releases include leakage from around spillway gates and through river outlet works valves.
5. In WY 1995, the spill was due to large winter storms and a reservoir restriction which resulted from a Division of Safety of Dams concern.
6. The Member Unit Deliveries is the sum of the releases to SYRWCD ID #1, Direct Diversion, and Tecolote Tunnel plus infiltration into the tunnel.
7. In WY 2001, a new capacity table went into affect on July 1 which resulted in a reduction of 2,379 af of total storage capacity.
8. Data for WYs 1958-2000 is from the SWRCB Annual Progress Reports. Data for WYs 1953-1957 is from Daily Operations Reports.
9. Releases to Tecolote Tunnel in WY 1998-2000 include SWP water conveyed through the reservoir and tunnel.
10. Project Water Deliveries equals the Member Unit Deliveries minus SWP water conveyed through the reservoir and tunnel.
11. For WYs 1953-1966, Water Right Releases reported as "water released for downstream rights" in the Annual Progress Reports (includes leakage).
12. For WYs 1967-1973, Water Right Releases reported as "downstream releases from Bradbury Dam outlets for live-stream purposes" in Annual Progress Reports (includes leakage).
13. For WYs 1974-2000, Water Right Releases obtained from the monthly downstream users reports (does not include leakage).

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). 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 three 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 four miles of the river beginning at the Robinson Road Bridge.

As provided in Order WR 73-37 and Order WR 89-18, all of the inflow to Cachuma Reservoir is credited to the ANA unless there is a live stream 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 BNA is based on the difference between the estimated 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 reflects the actual 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.

Maintenance of 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 difference between measured and “constructive” percolation 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 spring 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. These releases are made 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, the releases are reduced to 50 to 70 cfs for several weeks to months, depending upon percolation rates.

Releases from Bradbury Dam from 1952 to 2000 are shown in Table 2-2. Annual releases from the ANA and the BNA are shown in Table 2-3 and on Chart 2-3 (Appendix B). Monthly releases under Order WR 89-18 are shown on Chart 2-4. For the period from 1989 to 2000, the average annual release was 5,834 acre-feet, with a range of 1,547 acre-feet (1994-1995) to 13,099 (1991-1992). 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

	Releases (afa)		
Water Year	**ANA**	**BNA**	**Total**
Releases under Order WR 73-37			
1974	1,009	0	1,009
1975	576	0	576
1976	4,643	0	4,643
1977	2,795	0	2,795
1978	56	0	56
1979	895	0	895
1980	311	0	311
1981	4,175	0	4,175
1982	3,963	0	3,963
1983	2,692	755	3,447
1984	3,162	0	3,162
1985	5,392	0	5,392
1986	5,611	1,780	7,391
1987	3,887	0	3,887
1988	3,573	1,283	4,856
Avg=	2,849	255	3,104
Releases under Order WR 89-19			
1989	6,670	0	6,670
1990	4,792	0	4,792
1991	3,415	1,568	4,983
1992	9,032	4,067	13,099
1993	228	1,290	1,518
1994	6,719	2,473	9,192
1995	8	1,539	1,547
1996	6,836	2,477	9,313
1997	9,075	3,716	12,791
1998	980	705	1,684
1999	0	0	0
2000	3,588	835	4,423
Avg=	4,279	1,556	5,834

2.2.4 CONVEYANCE AND RELEASES OF SWP WATER

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 in an exchange program 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 afa
- Montecito Water District – 3,000 afa
- City of Santa Barbara – 3,000 afa
- Goleta Water District – 7, 000 afa
- SYRWCD, ID#1 – 2,000 afa

In addition to these annual entitlements, each Member Unit has contracted with CCWA for a portion of the CCWA 3,908-afa per year Drought Buffer that CCWA purchased to firm up the reliability of the SWP entitlements to Santa Barbara County contractors. During those years that availability of SWP water exceeds project participants' demands, 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. 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 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.

Recent deliveries of SWP water to the Member Units are shown below:

TABLE 2-4
RECENT STATE WATER PROJECT DELIVERIES

Member Unit	Acre-feet		
	1997-98	**1998-99**	**1999-2000**
Carpinteria Valley Water District	59*	508*	351*
Montecito Water District	43*	122*	486*
City of Santa Barbara	0	0	0
Goleta Water District	2,113*	2,545*	2,978*
SYRWCD, ID#1	506	1,085	726
Total=	506	4,260	4,541

* 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.

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. 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

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 consultats with the Member Units and the Santa Barbara County Flood Control District. 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 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 inflows 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, the CCRB, SYRWCD, SBCWA, and the City of Lompoc. The MOU established a Fish Reserve Account of 2,000 afa 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 1993, Reclamation surcharged the reservoir 0.75 feet 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 17 times since Bradbury Dam was completed. The most recent spills occurred in 1998, 2000, and 2001. 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 acre-feet from the minimum pool ("dead storage") was dedicated to the Fish Reserve Account.

The Santa Ynez River Technical Advisory Committee (SYRTAC) directs the studies performed under the 1994 MOU and the timing and amount of releases from the Fish Reserve Account each year. The committee is comprised 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; U.S. Department of Agriculture 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 510 to 2,999 afa, as shown in Table 2-2. Monthly releases from the Fish Reserve Account are shown on Chart 2-4.

The 1994 MOU initially established a one-year commitment by the Member Units. The MOU was renewed in 1995 and 2001, and remains in effect. Order WR 94-5 required that releases under the 1994 MOU continue until the year 2000, or later if the subsequent hearing were delayed.

2.4 BIOLOGICAL OPINION

2.4.1 BACKGROUND INFORMATION

In August 1997, NMFS designated the anadromous steelhead inhabiting the Southern 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), which proposed various modifications to operations and conservation measures to protect the southern steelhead. The modifications to project operations were designed to improve the availability and quality of habitat for the steelhead 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, 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 steelhead population on the lower Santa Ynez River. NMFS also assessed impacts on critical habitat for the steelhead, 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 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 southern steelhead. 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 steelhead. 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.

2.4.2 OPERATIONAL CHANGES

2.4.2.1 Reservoir Surcharging

The operating plan that Reclamation proposed and NMFS evaluated in the Biological Opinion included the surcharging of Lake Cachuma 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 cannot meet the deadline for the 3.0-foot surcharge, the Biological Opinion requires that Reclamation re-initiate consultation with NMFS under section 7 of the ESA. There is no requirement for Reclamation to re-initiate consultation with NMFS if the 1.8-foot surcharge is not implemented.

The amounts of water stored during surcharge years for 1.8-foot and 3.0-foot surcharges are shown in Table 2-5. In addition, the amount of water stored during the current 0.75-foot surcharge is presented. 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.

TABLE 2-5
ALLOCATION OF SURCHARGED WATER

Surcharge Level (feet)	Account and Use	Surcharge Allocation (af)	Total Amount in Surcharge Years
0.75 (current)	Interim rearing target flow releases	2,300	2,300
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	

2.4.2.2 Ramping Water Rights Releases

In the Biological Assessment, 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. The ramping rates, which Reclamation has used on a trial basis for a number of years, are detailed in Table 2-6.

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

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 steelhead in the upper mainstem below Bradbury Dam, as well as in lower Hilton Creek. The target flows will be produced by a combination of natural runoff and releases from Cachuma Lake. Continuous flows will be provided in all but the driest years to Highway 154 (a distance of 2.9 miles). In very wet years and the year following a very wet year, flow will be maintained between the dam and Alisal Road (a distance of 10.5 miles).

Reclamation proposes to conjunctively operate releases made to meet the target flows with the downstream water rights releases. That is, when releases are being made for water rights, the water from this source will be used to meet the mainstem target flows. Water releases for conjunctive use will be made primarily through the Hilton Creek supplemental 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 only will be made using the dam outlet works, with up to 10 cfs released through the Hilton Creek watering system at the same time.

Under Reclamation's operating plan, the long-term target flows for each year depend on the amount of water stored in Lake Cachuma and the extent to which Lake Cachuma spills. When Lake Cachuma spills at least 20,000 af, the long-term target flow at the Highway 154 Bridge is 10 cfs. When Lake Cachuma 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, 30 af per month are reserved to provide refreshing flows to the Stilling Basin and Long Pool below Bradbury Dam. Long-term target flows at the Alisal Road Bridge are 1.5 cfs in years when Lake Cachuma spills at least 20,000 af and steelhead are present in the Alisal Reach and in the calendar year following any such year.

Long-term target flows are summarized in Table 2-7. According to the Biological Assessment, this action will result in year-round flows with good quality steelhead rearing habitat in the upper mainstem 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.

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 > 20,00 af spill year.

Until a 3-foot surcharge is implemented, the Biological Opinion provides for interim rearing target flows, as summarized in Table 2-8. 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 is currently implementing the interim target flows.

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 is contingent upon implementation of either a 1.8-foot or 3.0-foot surcharge. In addition, whether water is credited to the account depends on whether the reservoir surcharges. The Fish Passage Account will be allocated 3,200 af in years when the reservoir surcharges to 3 feet. If the reservoir surcharges to less than 3 feet, the Fish Passage Account will be credited any surcharge in excess of a 1.8-foot surcharge. Water will be released to facilitate passage beginning in the year following a surcharge year, and in subsequent years until the account has been depleted. The account will not be subject to evaporation or seepage losses, and can be carried over to subsequent years.

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 the Reclamation's operating plan, once a 3.0-foot surcharge has been implemented, Reclamation will allocate 500 acre-feet to the account in years when the reservoir surcharges 3 feet. The account will not be subject to evaporation or seepage losses, and can be carried over to subsequent years. The account will be used at the discretion of an Adaptive Management Committee to benefit steelhead and its habitat as determined by the committee, which will be composed of Reclamation, NMFS, DFG, USFWS, CCRB, and SYRWCD.

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 steelhead on the lower river. The Biological Assessment identifies 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.

Reclamation proposes to remove eleven passage impediments along tributaries, including Hilton Creek (one on federal land and one under Highway 154) and on the following tributaries: Salsipuedes Creek (Highway 1 bridge)[already completed], Quiota Creek (six road crossings), El Jaro Creek (one road crossing), and Nojoqui Creek (one road crossing). The Biological Opinion requires Reclamation to reinitiate consultation if the projects are not completed by 2005. The Biological Opinion also requires Reclamation to minimize turbidity, sedimentation, loss of riparian vegetation and steelhead relocation during implementation of tributary passage fixes.

2.4.3.2 Additional Measures on Hilton Creek

In addition to removing the passage impediments on Hilton Creek, the Biological Opinion requires 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. In addition, Reclamation proposed to extend the lower portions of the creek 1,500 feet to provide additional rearing habitat. The Biological Opinion anticipates that this project will be completed by 2004.

2.4.3.3 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 steelhead 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 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 must be conducted with the approval and requisite permits from DFG and NMFS. Reclamation successfully captured and relocated stranded steelhead 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 steelhead, 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 steelhead 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 requires Reclamation to design a strategy within six months of the issuance of the Biological Opinion to further refine the releases for steelhead migration. Such a strategy was to include shifting releases 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. Reclamation is currently evaluating alternative passage flow criteria, and determining whether alternative flow releases would have greater benefits than the approach included 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.

2.4.5 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA (16 U.S.C. § 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 steelhead 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.

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.

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.

2.5 FISH MANAGEMENT PLAN

One of the primary objectives of the 1994 MOU, discussed in section 2.3, above, was to identify management actions to improve conditions for native fish and other aquatic resources, including southern steelhead. The SYRTAC prepared a draft Fish Management Plan and issued it for public comment in 2000. 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 incorporates the requirements of the Biological Opinion for the Cachuma Project issued by NMFS in September 2000 (see section 2.4), as well as providing 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 impacts 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 in the plan have been designed to benefit steelhead 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 steelhead populations. The performance of each management action will be monitored, and modified to improve its effectiveness and respond to annual variations in hydrologic and water supply conditions.

TABLE 2-9
SUMMARY OF FISH MANAGEMENT PLAN ACTIONS

Actions by Reclamation and Member Units
Conjunctive use 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
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

3.0 PROPOSED PROJECT (ALTERNATIVES)

3.1 PROPOSED PROJECT

3.1.1 DESCRIPTION OF THE PROPOSED PROJECT

As described in greater detail in section 1, the project analyzed in this EIR 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 downstream of 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 section 2.2.3, above. The proposed project entails a potential modification of existing release requirements.

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 section 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 section 2.4, above), and the Lower Santa Ynez River Fish Management Plan (discussed in section 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.

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:

Appropriative Diverters – Above Narrows

- 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 afa, at a maximum diversion rate of 1.8 cfs. The permit expired in 1990 and the City has filed a petition for a time extension with the SWRCB.

- 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 afa. 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 afa.

- 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. Production from 1995-2000 ranged from 7 to 1,659 afa.

- 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. Production from 1995-2000 ranged from 38 to 438 afa.

- 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. No water was produced during the period 1992-2000.

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

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

- O'Brien, et al., 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 afa. License 932B allows diversion of 0.11 cfs with a diversion limit of 36 afa. License 932C allows diversion of 0.19 cfs with a diversion limit of 36 afa. Water is diverted from the Santa Rita East Subarea of the Santa Ynez River Alluvial Basin.

- Wright and Torres, License 790 (Application 4034). Maximum diversion of 0.62 cfs. No diversion occurred in 1989-1999. Diversion is from Santa Rita West Subarea of the Santa Ynez River Alluvial Basin.

<u>Appropriative Diverters – Below Narrows</u>

- SYRWCD, Permit 17447 (Application 23960). Maximum diversion of 100 cfs (40,000 afa 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. Water is diverted from the Eastern Plain Subarea of the Santa Ynez River Alluvial Basin.

- Crawford 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.

<u>Riparian Diverters – Above Narrows</u>

- 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.

- 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.

- 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.

- 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.

<u>Riparian Diverters - Below Narrows</u>

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

Groundwater Pumpers

- 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

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.
- 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 (No Project Alternative).

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 current 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 alternatives included in this EIR are listed below and described in the following subsections.

1. Operations under Order WR 89-18.

2. Current Operations under Orders WR 89-18 and WR 94-5 and the Biological Opinion interim flow requirements (no project alternative).

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 SWP water directly to the City of 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.

4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and 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.

A summary of the alternatives is provided in Tables 3-1 and 3-2.

TABLE 3-1
SUMMARY OF ALTERNATIVES ADDRESSED IN THE EIR

Alternative	Key Elements
1. Order WR 89-18 operations – recent historic operations.	Does not include Order WR 94-5 Fish Reserve Account releases, 0.75' surcharging, emergency winter storm operations, or delivery of SWP water.
2. Current operations - operations incorporating current Biological Opinion requirements, including interim rearing target flows. (No Project Alternative)	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.
3A. Operations incorporating Biological Opinion requirements, including long-term rearing target flows. No surcharging above current 0.75' surcharging.	This alternative represents the new operations to be implemented as required by NMFS by the Biological Opinion assuming Reclamation achieves a 3.0' surcharge, except that all releases for rearing and passage will be provided from water supply and current surcharging. 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.
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.

Alternative	Key Elements
3C. Operations incorporating Biological Opinion 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 assuming Reclamation achieves a 3.0’ surcharge. All releases for rearing and passage will be provided from a 3.0-foot surcharge. 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.
4. Operations incorporating Biological Opinion requirements, with additional actions to address water quality in the Lompoc Basin.	Includes fish releases under Alternative 3C, as well as one of the following options to address water quality issues in the Lompoc Basin, or other options identified based on impact assessment: • Option A: Direct delivery of SWP water to the City of Lompoc in exchange for Below Narrows Account water. • Option B: Discharge of SWP water to the river near Lompoc for recharge in exchange for Below Narrows Account water.

TABLE 3-2
KEY ELEMENTS OF THE ALTERNATIVES

	Alternatives						
Key Elements	**1**	**2**	**3A**	**3B**	**3C**	**4A**	**4B**
Releases for downstream water rights pursuant to Order WR 89-18 releases	X	X	X	X	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’		X	X				
Surcharge to 1.8’				X			
Surcharge to 3’					X	X	X
Releases for interim rearing target flows per the Biological Opinion		X					
Releases for long-term rearing target flows and for passage; Adaptive Management Account			X	X	X	X	X
Other habitat enhancement actions under Biological Opinion, primarily consisting of tributary projects		X	X	X	X	X	X
Delivery of SWP water directly to City of Lompoc in exchange for BNA water						X	
Delivery of SWP water to Lompoc Forebay in exchange for BNA water							X

3.2.2 DESCRIPTION OF ALTERNATIVES

Alternative 1 - Operations under Order WR 89-18

This alternative represents recent historic operations from 1989 through 1993 following the imposition of revised release requirements to satisfy downstream water rights under Order WR 89-18. It does not include releases for fish studies and maintenance pursuant to the 1994 MOU, nor the 0.75-foot surcharging initiated in 1993 to support releases for environmental purposes. This alternative also does not include the conveyance of SWP water through the Cachuma Project facilities (initiated in 1997), nor emergency winter storm operations (initiated in 1998). This alternative is included in the EIR to provide a historic context.

Alternative 2 – Current operations

Section 15126.6, subdivision (e) of the 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. In this case, the No Project Alternative is defined as the current operations (late 2000 to present) that are expected to continue into the near future if the SWRCB does not modify Reclamation's permits for the Cachuma Project.

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 continue to implement the requirements of the Biological Opinion issued by NMFS. The current 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 derived from the 0.75-foot surcharge and project yield rather than from a 1.8-foot surcharge. The annual amount to meet the Biological Opinion interim release requirements is estimated to be 1,300 af. The 0.75-foot surcharge produces about 2,300 af in a spill year.

Comparing this alternative to Alternative 1 (recent historic operations) will indicate how recent actions independent of the SWRCB's permit authority (i.e., a combination of new release requirements under the Biological Opinion and the importation of SWP water) are now affecting downstream groundwater quality. This comparison is important because many of the groundwater quality issues raised at the 1994 hearings were based on environmental conditions prior to the importation of higher quality SWP water.

Comparing this alternative to Alternative1 also will show how current operations are affecting public trust resources. This comparison also will indicate the environmental impacts of non-flow fish habitat enhancements on tributaries.

Alternative 3A - Operations under the Biological Opinion with Current 0.75-foot Surcharging

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 0.75-foot surcharging, conveyance of SWP water through the Cachuma Project facilities, and the emergency winter storm operations. Under this alternative, the long-term rearing and passage releases for fish required by the Biological Opinion if Reclamation achieves a 3.0-foot surcharge would be met with the 0.75-foot surcharge and project yield rather than from a 3.0-foot surcharge. The annual amount to meet the Biological Opinion long-term release requirements is estimated to be 2,600 af. The 0.75-foot surcharge produces about 2,300 af in a spill year.

Comparing this alternative to Alternative 2 (current operations) will show how greater releases for fish purposes (rearing and passage) under this alternative may affect downstream environmental conditions.

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

This alternative includes all the elements of Alternative 3A except that 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. The annual amount to meet the Biological Opinion long-term release requirements is estimated to be 2,600 af. The 1.8-foot surcharge produces about 5,500 af in a spill year.

Comparing this alternative to Alternative 2 (current operations) will show how greater releases for fish purposes (rearing and passage) under this alternative may affect downstream environmental conditions.

Comparing this alternative to Alternative 3A will also show the impacts of a 1.8-foot surcharge on resources at the lake.

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

This alternative includes all the elements of Alternative 3A 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.

Comparing this alternative to Alternative 2 (current operations) will show how greater releases for fish purposes (rearing and passage) under this alternative may affect downstream environmental conditions. Comparing this alternative to Alternative 3A will show the impacts of a 3.0-foot surcharge on resources at the lake.

Alternative 4 - 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 and its variations is to improve water quality in the Lompoc Plain for the City of Lompoc and other groundwater pumpers due 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 the 3.0-foot surcharging, conveyance of SWP water through the Cachuma Project facilities, and the emergency winter storm operations.

The two options described below involve 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 is 1,556 af (1989-2000). Annual deliveries have varied greatly (0 to 4,067 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 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 150 to 400 mg/l.

The following options represent two variations of a physical solution to address water quality issues in the Lompoc Plain using a nearby source of high quality water. Their implementation would require cooperation by all involved agencies, completion of project-specific environmental review and permitting, and secure funding and operational agreements.

Option A

Under this option, SWP water would be delivered year-round directly to the City's water treatment facility on North Avenue. A 10-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 roads and would be placed beneath the Santa Ynez River by directional drilling. It would convey 4 cfs and 2,500 afa based on year-round delivery with a 7.5 percent downtime factor.

The delivered SWP water would be commingled with the City's groundwater supplies. It is estimated that the average TDS of the commingled water would be reduced from about 900-1,100 mg/l to 650-850 mg/l. This would eliminate the need for the City to treat (demineralize) the water, thereby resulting in a cost savings. In addition, the City would reduce annual pumping from the Lompoc Basin by 2,500 af, also resulting in a cost savings due to avoided electrical power costs. The City's average annual groundwater pumping is about 5,500 af; hence, the exchange would account for about one half of its supply.

Capital facilities required for the project include the pipeline noted above, as well as the following: (1) modifications of the blowoff valve to divert water to the new pipeline; (2) 8,000 feet of 10-inch diameter plastic pipe; and (3) ammonia equipment (e.g., storage tank, feed pumps) at the treatment plant to allow the City to use chloramines for residual disinfection in the water distribution system.

Temporary construction and permanent easements would need to be acquired along the pipeline route. Construction would require about three months to complete. A 60-foot wide temporary construction disturbance zone would be required during pipeline installation. Conventional open-trench pipeline construction methods would be used. The pipeline would be placed under the Santa Ynez River using a directional drilling method, avoiding impacts to the riverbed and vegetation on the banks.

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).

Under this alternative, a fixed amount of SWP water would be delivered to the City of Lompoc based on the average annual credits in the BNA. If this alternative is 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 section 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 4A, the agreement among the parties must account for this variability in deliveries. It can be addressed in two ways. One, the City of Lompoc would be guaranteed its full amount of SWP water each year, and any shortages in the SWP water deliveries would be taken by the Member Units. Two, the City of Lompoc 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 inter-agency agreements and the operational scenario described above are speculative, as Alternative 4A is complex and there are several options for its implementation, funding, and operations. It should be noted that the City of Lompoc, through its legal representative, has notified the SWRCB in a letter regarding the EIR dated June 18, 1999, that this alternative is not considered feasible because the residents of the City have twice rejected SWP water as a new water supply.

Option B

The alternative would also involve the conveyance of SWP water to the Lompoc Valley. However, 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 1989-2000 was 1,556, with a maximum delivery of 4,067 af in 1992.

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. As with Option A, 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 for Option A would be required, including agreements on a secure delivery of SWP water for recharge even when SWP deliveries are curtailed due to shortages.

The City of Lompoc, through its legal representative, has notified the SWRCB in a letter regarding the EIR dated June 18, 1999, that this option, just like Option A, is not considered feasible because the residents of the City have twice rejected SWP water as a new water supply.

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, and (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 PURPOSES OF ANALYZING FLOW-RELATED MEASURES

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 CEQA Guidelines allows the lead agency discretion in selecting the appropriate baseline for impact assessment purposes.

In this case, the appropriate baseline conditions are current conditions. The Cachuma Project currently is being operated as described for the No Project Alternative (Alternative 2) in section 3.2.2, above. Thus, the environmental conditions maintained under the No Project Alternative now and in the future are identical to the existing environmental setting and therefore the conditions described in the No Project Alternative represent the baseline for determining the environmental impacts of the flow-related measures described in Alternatives 3A, 3B, 3C, and 4A-B.

4.1.2 IMPACT ASSESSMENT AND ALTERNATIVES COMPARISON

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. Hence, in contrast to conventional EIR documents, the focus of the alternatives analysis in this document is to compare current operations to recent historical operations; to compare Alternatives 3A, 3B, 3C, 4A, and 4B with the "No Project Alternative" (Alternative 2) to determine if they avoid any significant impacts associated with current operations. Also, the EIR compares the alternatives to one another, to determine which provide greatest protection of downstream water rights and public trust resources.

The impacts of Alternative 2 (No Project Alternative) are assessed using Alternative 1 (Operations under Order WR 89-18) as the environmental baseline. This comparison will indicate if current operations under Alternative 2 (which primarily reflect operational changes mandated by NMFS under the Biological Opinion) have improved conditions relative to downstream water rights and public trust resources. To the extent that current operations have improved these conditions, the SWRCB may or may not determine a need to modify Reclamation's permits. This comparison will also indicate if there are any incidental and unintended environmental impacts associated with the new releases for fish under the Biological Opinion.

The impacts of Alternatives 3A, 3B, 3C, 4A, and 4B are assessed using Alternative 2 as the environmental baseline. This comparison will indicate if modified operations (i.e., increased reservoir releases) would further improve conditions related to downstream water rights and public trust resources. This comparison will also indicate if there are any incidental and unintended environmental impacts associated with the modified operations (e.g., surcharge impacts on the lake, reduction of contractual water deliveries, or impacts of new delivery of water to the Lompoc Plain).

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 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 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 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 Impacts. Beneficial impacts.

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

4.1.4 IMPACT ASSESSMENT FOR NON-FLOW 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 are preparing 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

4.2.1.1 Surface Water Hydrology

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 and 4-2, 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. 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.

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	311	254
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	434	384
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	204	197
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.

4.2.1.2 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. 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 storage. The maximum lake level was 750 feet until 1993, when Reclamation implemented a 0.75-foot surcharge to support releases under the 1994 MOU (see section 2.3). Lake levels vary during the year due to runoff, diversions, releases, and evaporation. 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 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.

4.2.1.3 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.

<u>Juncal Dam (Jameson Lake)</u>

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.

<u>Gibraltar Dam and Reservoir</u>

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 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 2000 indicates that the reservoir capacity has been reduced to 188,035 af at elevation 750.0 feet (MNS, 2000). 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 is estimated to be 25,714 afa. 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 drought, 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 either from 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.

4.2.1.4 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.

<u>Historical Flood Flows</u>

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 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 1930's, 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) over the past 10 years. 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). 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 3 to 5 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 1993 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. 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.

4.2.2 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 impacts. 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. Impacts due to changes in the Cachuma Project deliveries to Member Units under different alternatives are addressed in section 4.3.

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 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 and the Member Units. 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 Stetson (2001a).

A schematic of SYRHM is shown in Figure 4-1. 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 below:

TABLE 4-1
OPERATIONAL ELEMENTS USED TO MODEL ALTERNATIVES

Operational Elements Used to Model EIR Alternatives	**Alternatives**						
	1	2	3A	3B	3C	4A	4B
Releases for downstream water rights pursuant to Order WR 89-18	X	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'		X	X				
Surcharge to 1.8'				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	X	X

Operational Elements Used to Model EIR Alternatives	Alternatives						
	1	2	3A	3B	3C	4A	4B
Delivery of SWP water directly to City of Lompoc in exchange for BNA water						X	
Delivery of SWP water to Lompoc Forebay in exchange for BNA water							X

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.

Releases from Cachuma Lake for steelhead rearing and passage have been modeled for two 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, current 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 3A, 3B, 3C, 4A, and 4B and are summarized in Table 2-7.

One element that is common to both the interim and long-term fish release operating criteria is the conjunctive operation of releases for purposes of satisfying downstream water rights with fish releases. This conjunctive use operation 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 state-wide 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 Reservoir is exported out through Tecolote Tunnel in the same month.
- SWP deliveries are not made in months when Cachuma Reservoir 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.

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

SYRTAC was formed several years ago to develop suitable modeling tools to address ongoing hydrology, groundwater, and salinity issues along the lower river. The SYRTAC is comprised of technical experts representing Reclamation, COMB, SBCWA, SYRWCD, City of Santa Barbara, and City of Lompoc. The technical consultant for the SYRTAC is Stetson Engineers. The SYRTAC meets 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 SYRTAC 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 SYRTAC met with Reclamation and the EIR project manager on three occasions (April 20, May 11, May 30, 2001) to provide comments on the four technical memoranda prepared by Stetson Engineers for the EIR, as listed below (and provided in Appendix E):

- Technical Memorandum #1. Impacts of EIR Alternatives using the Santa Ynez River Hydrology Model. (Stetson Engineers, 2001a.)

- Technical Memorandum #2. Impacts of EIR Alternatives on steelhead. (Stetson Engineers, 2001b.)

- Technical Memorandum #3. Hydrologic Analysis of Surface Water Salinity. (Stetson Engineers, 2001c.)

- Technical Memorandum #4. Cachuma Water Rights EIR Alternatives – Results of USGS and HCI Lompoc Groundwater Flow and Transport Models. (Stetson Engineers, 2001d.)

In general, the SYRTAC 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 SYRTAC on the use of the SYRHM to evaluate surface water and groundwater salinity issues is provided in section 4.5.2.1.

4.2.2.2 Lake Impacts

The average annual storage in Cachuma Lake at the end of the summer is shown on Chart 4-6 in Appendix B for the various alternatives for the simulation period. The patterns of lake storage are identical for all alternatives. The median monthly storage for the alternatives is presented in Table 4-2. Current operations (Alternative 2) exhibit slightly lower lake storage at the end of November than under recent historic operation (Alternative 1) due to releases for steelhead during the summer. Winter (peak) lake storage amounts are also slightly less than under recent historic operations, but spring and summer storage amounts are higher. Alternative 3A exhibits lower storage than under current operations (Alternative 2) throughout the year due to additional releases for fish to meet long-term rearing target flows. Storage under Alternative 3B is greater than under current operations in the summer and fall due to increasing total reservoir storage by 5,500 af by surcharging the reservoir 1.8 feet. Median monthly storage under Alternatives 3C, 4A, and 4B are greater than under current 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.

TABLE 4-2
MEDIAN MONTHLY STORAGE IN CACHUMA LAKE

Month	Median Monthly Storage (Simulation, 1918-1993) for Different Alternatives in af					
	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A-B Biological Opinion with SWP Delivery to Lompoc
November	130,855	130,485	129,605	132,600	136,080	135,135
February	153,045	152,395	147,910	150,920	154,605	154,660
April	164,740	165,535	161,900	165,020	167,875	169,135
July	146,285	146,850	146,475	149,530	153,065	154,840

Median monthly lake elevations for the various alternatives are shown on Chart 4-7 in Appendix B. The modeling results indicate the highest monthly elevations are exhibited by Alternatives 3C (Biological Opinion plus 3' surcharge) and 4A-B (SWP delivery to Lompoc). These alternatives have higher lake levels than under current operations because they involve the 3.0-foot surcharge. Alternative 3A exhibits a lower lake elevation than under current operations (Alternative 2) due to greater releases for fish than under current operations, without a new surcharge. The median monthly lake elevation for Alternative 3B is about the same as under current operations (Alternative 2) because the greater releases for fish under Alternative 3B are offset by a 1.8-foot surcharge. A comparison of median annual, winter, and fall lake elevations amongst the alternatives is also provided in Table 4-3.

TABLE 4-3
MEDIAN LAKE LEVEL

Period	Median Water Elevation (in feet)					
	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A-B Biological Opinion with SWP Delivery to Lompoc
Annual	734.0	733.7	732.3	733.3	734.6	735.2
Feb	737.5	737.2	735.5	736.7	738.1	738.1
Aug	732.5	732.2	732.3	733.6	735.0	735.2

The frequency of surcharging to specific lake elevations under Alternatives 3 and 4 is summarized in Table 4-4. The results of the simulation indicate that under recent historic operations (Alternative 1), the reservoir reached the maximum lake level in 26 of the 76 years of the simulation period. The frequency of reaching a full lake is the same under current operations (Alternative 2) and under Alternative 3A. Alternatives that include new surcharging (Alternatives 3B, 3C, and 4A-B) reach a full lake level with the same frequency as under current operations.

TABLE 4-4
FREQUENCY OF SURCHARGING

Lake Elevation Reached due to Surcharging	Number of Years Surcharging Occurred During 76-year Period					
	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4 A-B Biological Opinion with SWP Delivery to Lompoc
750 – 750.9	26	26	26	26	27	27
751 – 751.9				26	26	28
752 – 752.9					26	28
= or >753					26	24

The percentage of time that Cachuma Lake will reach maximum levels is presented in Table 4-5 based on the simulation modeling. These results indicate that under current operations (Alternative 2) and under Alternative 3A, the current maximum lake level (750.75 feet) is achieved 11 percent of the time. This is slightly greater than under recent historic operations (Alternative 1). The alternatives involving new surcharging would cause more frequent inundation of the current shoreline (750.75 feet). For example, lake levels would reach 750.75 feet about 11 percent of the time under Alternatives 2 and 3A. Under Alternatives 3C and 4A-B (with 3.0-foot surcharge), lake levels would reach or exceed 750.75 feet 16 percent of the time.

TABLE 4-5
PERCENTAGE OF TIME AT DIFFERENT ELEVATIONS

Lake Elevation	Percentage of Time that Lake Elevations are Met or Exceeded					
	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A-B Biological Opinion with SWP Delivery to Lompoc
750.75	9	11	11	14	16	16
751				11	14	14
752					11	11
753					9	8

The median period of inundation at higher lake elevations for the alternatives is presented in Table 4-6. 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 (Alternatives 3B, 3C, and 4A-B) would cause slightly more prolonged inundation of the current shoreline (750.75 feet). For example, under Alternatives 3B, 3C, and 4A-B, the median duration of flooding at 750.75 feet would be 5 months compared to Alternatives 1, 2, and 3A, which do not involve surcharging.

TABLE 4-6
DURATION OF INUNDATION

Lake Elevation	Median Number of Consecutive Months at or Above Lake Elevation					
	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A-B Biological Opinion with SWP Delivery to Lompoc
750	3	4	4	5	5	5
751				4	5	5
752					4	4
753					3	3

4.2.2.3 River Impacts

Current Flow Regime Due to Interim Biological Opinion Requirements

A summary of the key downstream hydrologic characteristics of the various alternatives is presented in Table 4-7. The spill frequency and average annual spill amount under current conditions (Alternative 2) are slightly less than under recent historic operations (Alternative 1) because of the requirement under the Biological Opinion to release water for steelhead, which creates more storage in the reservoir. Under recent historic operations (Alternative 1), the average annual release for purposes of satisfying downstream water rights was 6,322 af. The total combined annual releases for water rights and fish under current operations (Alternative 2) averaged 7,385 af (a 16 percent increase).

The number of spill months over a 76-year period has been reduced under current operations by about two percent (82 months versus 84 months). The average annual spill and leakage amounts have also been reduced under current operations by about 887 af (or 3 percent).

TABLE 4-7
KEY HYDROLOGIC CHARACTERISTICS

Parameter	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A-B Biological Opinion with SWP Delivery to Lompoc
Average spills/leakage (afa)	37,580	36,693	36,037	35,784	35,415	35,288
Average Order WR 89-18 releases (afa)	6,322	6,023	5,658	5,682	5,737	3,940
Average fish releases (afa)	0	1,362	2,690	2,701	2,715	2,801
Total discharges from the dam (afa)	43,902	44,078	44,385	44,167	43,867	42,029
No. of spill months	84	82	80	79	78	74
No. of spill water years	26	26	25	25	25	24
No. of spill water years >20,000 af	17	16	15	15	15	15

Under current operations (Alternative 2), releases from the dam are made to meet interim rearing target flows at Highway 154. As a consequence, over longer periods of time and over a larger portion of the river downstream of Cachuma Lake the flow conditions have improved as compared to the recent historic operations (Alternative 1).

The additional releases from the dam under current operations (Alternative 2) are shown in Table 4-8. Under the current operations, releases from the dam are 2 cfs or greater 99 percent of the time. In contrast, releases of 2 cfs or more under recent historic operations (Alternative 1) occur only 43 percent of the time.

TABLE 4-8
FLOWS FROM CACHUMA LAKE
DUE TO SPILLS AND DOWNSTREAM RELEASES

cfs	Percentage of Time that Spills and Downstream Releases are at or above the Indicated Flow (Simulation, 1918-1993)					
	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A-B Biological Opinion with SWP Delivery to Lompoc
2	43	99	99	99	99	99
5	35	41	67	69	69	68
10	31	30	36	36	36	34
20	26	26	27	27	27	24
50	15	15	13	13	13	8

Releases for rearing habitat and fish passage under current operations (Alternative 2) affect the magnitude and seasonal pattern of dewatered storage in the Above Narrows Aquifer (see section 4.4.2). In essence, the additional releases early in the year for fish reduce the dewatered storage in the aquifer, which in turn, reduces the credits in the ANA. Hence, the need and amount of releases for purposes of satisfying downstream water rights later in the year have been reduced under current operations (Alternative 2) compared to recent historic operations (Alternative 1) because of incidental water rights benefits of the fish releases. 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.

The additional releases under current operations (Alternative 2) result in more frequent low-flows (2-5 cfs) downstream of the dam compared to recent historic operations (Alternative 1), as shown in Table 4-9. For example, under the current operations, flows at Highway 154 are 2 cfs or greater 99 percent of the time. In contrast, flows of 2 cfs or more under recent historic operations occurred only 49 percent of the time. The increase in frequency of downstream low-flows under current 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).

TABLE 4-9
STREAMFLOWS DOWNSTREAM OF CACHUMA LAKE

	Percentage of Time that Flows are at or above the Indicated Flow (Simulation, 1981-1993)						
cfs	**Alt 1 Order WR 89-18 Operations**	**Alt 2 Current Operations under Biological Opinion**	**Alt 3A Biological Opinion and with 0.75’ surcharge**	**Alt 3B Biological Opinion and 1.8’ surcharge**	**Alt 3C Biological Opinion with 3’ surcharge**	**Alt 4A Biological Opinion with SWP Delivery to Lompoc**	**Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay**
Below Hilton Creek							
2	49	99	99	99	99	99	99
5	39	47	74	76	75	75	75
10	32	32	39	39	37	37	37
20	26	26	28	28	24	24	24
50	15	14	13	13	8	8	8
Highway 154							
2	50	82	99	99	99	99	99
5	40	47	77	77	78	78	78
10	33	34	36	36	36	34	34
20	27	27	29	29	29	25	25
50	12	12	11	11	12	8	8
Alisal Road							
2	47	53	68	68	68	68	68
5	39	43	50	50	50	48	48
10	31	33	36	36	34	34	34
20	22	23	24	25	24	18	18
50	11	12	12	11	11	12	12
Near Buellton							
2	47	51	57	57	57	55	55

cfs	Percentage of Time that Flows are at or above the Indicated Flow (Simulation, 1981-1993)						
	Alt 1 Order WR 89-18 Operations	**Alt 2 Current Operations under Biological Opinion**	**Alt 3A Biological Opinion and with 0.75' surcharge**	**Alt 3B Biological Opinion and 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4A Biological Opinion with SWP Delivery to Lompoc**	**Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay**
5	40	41	44	44	44	42	42
10	30	32	34	34	34	29	29
20	23	25	26	26	26	18	18
50	12	12	12	12	12	12	12
Above Salsipuedes Creek							
2	37	39	42	42	42	35	35
5	33	34	37	37	37	29	29
10	29	30	32	32	32	24	24
20	24	25	26	26	26	19	19
50	12	12	13	13	13	12	12
Narrows							
2	45	45	48	48	48	40	40
5	38	38	41	41	41	33	33
10	32	33	35	35	35	27	27
20	27	28	29	29	29	21	21
50	13	14	14	14	14	13	13

As shown in Chart 4-8 in Appendix B, the median monthly flows under current operations (Alternative 2) are slightly greater than, or equal to, flows under recent historic operations (Alternative 1) in most months of the year. The lower flows arise because under current operations, the fish releases earlier in the year reduce the ANA and the associated need for releases from the BNA in the late summer and fall. The overall higher median monthly flows in the summer (e.g., July) under current operations are attributed to rearing flows mandated under the Biological Opinion.

There is very little difference in the frequency of higher flows downstream of the dam (not including flood flows from spills) between current and recent historic operations because flows over 20 cfs are primarily due to natural runoff, not releases for water rights or fish, as shown in Table 4-9.

Flow Regime Under the Project Alternatives

Under Alternatives 3A-C and 4A-B, releases for fish would occur as needed to maintain rearing habitat to either Highway 154 or Alisal Road based on hydrologic conditions, as described in section 2.4. In years following spills, releases will be made during the flow recession (usually March-May) to facilitate fish passage above Solvang.

The spill frequency and average annual spill amount under Alternatives 3A, 3B, and 3C would be slightly less than under current operations (Alternative 2). The number of spill months over a 76-year period would be 78 to 80 months for Alternatives 3A to 3C compared to 82 months under the current operations (Table 4-7). The average annual spill and leakage amount would also be reduced 1-2 percent under Alternatives 3A to 3C.

The frequency and amount of spills under Alternative 4A-B would also be less than under current operations, but with a larger difference than for Alternatives 3A to 3C (Table 4-7). The number of spill months over a 76-year period under Alternative 4A-B is estimated to be 74 months, compared to 82 months under the current operations. The average annual spill and leakage amount would also be reduced 2 percent under Alternative 4A-B.

The releases for steelhead downstream of the dam under Alternatives 3A, 3B, 3C, and 4A-B would be greater than for current operations (Alternative 2) because the alternatives must meet long-term target rearing flows (which are greater than the interim target flows under current operations) and because the alternatives include releases for passage flows (Table 4-7).

The releases for purposes of satisfying downstream water rights under Alternatives 3A, 3B, and 3C would be less than under current operations because the releases for fish purposes earlier in the year reduces the need for releases to replenish groundwater basins. Releases for water rights under Alternatives 4A-B would also be less than under current operations because releases from the BNA would not be made from the dam. Instead, SWP water would be delivered to Lompoc pursuant to an exchange agreement.

The flow regime created below the dam due to spills and downstream releases are the same for Alternatives 3A-C, as shown in Table 4-8. All of these alternatives result in more frequent downstream low flows (i.e., 2 – 10 cfs) than under current operations (Alternative 2) due to greater releases for fish under the alternatives.

The releases from the dam due to spills and for fish and water rights purposes under Alternative 4A-B would also result in more frequent low flows (2-10 cfs) compared to current conditions due to greater releases for steelhead rearing. The frequency and amount of low-flows (2–10 cfs) downstream of the dam (to Alisal Road) under Alternatives 3A-C and 4A-B are similar, as shown in Table 4-9. For example, under Alternatives 3A-3C and 4A-B, flows at Highway 154 would be 5 cfs or greater about 77 percent of the time, and only 47 percent of the time under current operations (Table 4-9).

Downstream of Alisal Road, low-flows under Alternative 4A-B would be less frequent and would have less volume than Alternatives 3A–C because BNA releases to the river would not be made from the dam under Alternative 4A-B. In addition, higher flows from the dam would occur less frequently under Alternative 4A-B compared to current conditions because this alternative would not include BNA releases, which involve high release rates (e.g., 75-100 cfs) from the dam to reach the Lompoc Plain.

Chart 4-8 in Appendix B shows that median monthly flows under the project alternatives (Alternatives 3A-3C and 4A-B) are greater than under current operations (Alternative 2). An exception would occur in August at the dam and Highway 154 when median monthly flows under Alternatives 4A-B would decrease relative to current operations and the other project alternatives. The lower flows would occur under Alternative 4A-B because no BNA releases to the river from the dam would occur at that time.

4.2.2.4 Impacts on Existing Flood Hazards

Current Flood Hazards

As described in section 4.2.2.3, current operations (Alternative 2) have altered the downstream hydrology in the following manner compared to recent historic operations (Alternative 1):

- The spill frequency and average annual spill amount under current conditions are slightly less (about 3 percent) than under recent historic operations.

- Due to current fish releases, low flows downstream of Cachuma Lake occur for a slightly longer duration and over a larger portion of the river than under the recent historic operations. For example, under the current operations, flows at Highway 154 are 5 cfs or greater 47 percent of the time. In contrast, flows of 5 cfs or more under recent historic operations occurred only 40 percent of the time. The increase in frequency of downstream low-flows under current operations becomes less with distance from the dam, such that there is very little difference in the frequency of low-flows near Alisal Road.

- The median monthly flows from the dam to the Narrows under current operations are greater than, or equal to, flows under recent historic operations in most months of the year.

- There is very little difference in the frequency of high flows (i.e., 20-100 cfs, but not including flood flows) downstream of the dam between current and recent historic operations because such flows are primarily due to natural runoff, not releases for water rights or fish.

The above changes in hydrologic conditions downstream of Cachuma Lake (initiated in late 2001) are likely to 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 was generally absent from the river channel under recent historic conditions. The availability of water throughout the year in the channel will extend the growing season for phreatophytes and reduce the period of drought stress. The increase in riparian vegetation is likely to be evident in the next several years as releases for fish continue. The effect will be most pronounced in the reach between the dam and Highway 154 where rearing flows for steelhead would be continuous except in drought years. The effect would extend further downstream but would be attenuated with distance from the dam. The increase in riparian vegetation probably would not be measurable below Buellton where flows would not be maintained for fish.

The extent to which the expected increase in riparian vegetation along the river will 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. 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 and bank erosion 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.

Under current operations, the frequency of spills will be reduced about three percent compared to recent historic operations. The reduction in spill frequency 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.

In summary, current operations (Alternative 2) are expected to increase the potential for flooding hazards along the lower Santa Ynez River due to 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 adverse flooding impact may include overbank flooding, bank erosion, and blockage of bridges from increased debris production during floods. This impact will occur independent of the project because Reclamation must implement the mandated downstream release for fish habitat pursuant to the Biological Opinion.

It should also be noted that the reduction in the frequency of spills under current operations would reduce the frequency of uncontrolled downstream flows, which could cause flooding. Hence, elements of the current operations could reduce downstream flooding, rather than increase flooding as noted above.

<u>Flood Hazards Due to Project Alternatives</u>

As described in section 4.2.2.3, project alternatives (3A-C and 4A-B) would alter downstream hydrology in the following manner compared to current operations (Alternative 2):

- The spill frequency and average annual spill amount under the project alternatives would be slightly less than under current operations.

- The releases for steelhead rearing and passage flows downstream of the dam under Alternatives 3A-C and 4A-B would be greater than under current operations (Alternative 2) because they would involve higher rearing target flows.

- Total discharges from the dam would increase relative to current conditions under Alternatives 3A and 3B and decrease under Alternatives 3C and 4A-B.

- The frequency and amount of low-flows downstream of the dam (to Alisal Road) under the project alternatives (3A-C and 4A-B) are similar to one another and greater than under current operations. However, high flows would occur less frequently under Alternative 4A-B than under current operations because BNA releases to the river are not being made from the dam.

Alternatives 3A-C and 4A-B would increase downstream flows (primarily from the dam to Alisal Road), and as such, could increase the instream riparian vegetation that could reduce channel capacity and cause flooding hazards. The additional flows for fish under expected to 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 absent from the river channel under current 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. The effect is 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. The potential increase in flood hazard is considered a potentially adverse, but not significant impact, because the County FCD could take reasonable action to prevent damage to public infrastructure through its authority to conduct channel maintenance. The extent and magnitude of this potentially adverse impact is unknown, and may be offset by the reduction in uncontrolled spills, which can cause flooding.

Alternatives 3A-C also would slightly reduce (2-5 percent) the frequency of spills compared to current operations. Alternative 4A-B would result in a 10 percent reduction in the frequency of spills compared to current operations. As such, these alternatives could 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. In the event that necessary channel maintenance is not implemented, damage could occur to public infrastructure (bridges, roads, culverts, pipelines, utilities) as well as to private property. Conversely, the reduction in spill frequency under Alternatives 3A-C and 4A-B would reduce the frequency of uncontrolled downstream flows, which could cause flooding.

4.2.3 MITIGATION MEASURES

The County FCD could mitigate for increased flood hazards due to increased riparian vegetation and the reduction in spill frequency under Alternatives 3A-C and 4A-B. No other mitigation is considered because no significant adverse hydrologic impacts would occur due to the project alternatives.

4.3 WATER SUPPLY CONDITIONS

4.3.1 MEMBER UNITS' WATER SUPPLY CONDITIONS

An overview of the Cachuma Project Member Units and their water supply and demand conditions is provided below.

Carpinteria Valley Water District

The Carpinteria Valley Water District (CVWD) encompasses about 8,912 acres with a mixture of agriculture (40 percent), residential (13 percent), and industrial/commercial/institutional (14 percent) and open space (33 percent) land uses. Domestic water service is provided to a population of about 17,900 and approximately 3,240 acres of irrigated crops, ranging from lemons and avocados to nursery products. CVWD maintains 3,936 connections. It has three sources of water: Cachuma Project, groundwater pumping, and SWP water. As shown in Table 4-10, Cachuma Project water represents about 40 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 afa on average from this basin. Approximately 50 percent of the water deliveries are for agricultural customers.

TABLE 4-10
WATER SUPPLY AND DEMAND – CARPINTERIA VALLEY WATER DISTRICT

	Total (afa)	Comment
Supply (average production)		
Cachuma Project	2,813	Fixed percentage of Cachuma Project yield. Cachuma represents 41% of total supply
State Water Project	1,000	SWP entitlement is 2,000 AFY plus 200 AFY of CCWA drought buffer; CVWD assumes 50% average annual delivery
Local groundwater	3,000	
Total=	6,813	
Demand (average)		
Current (2000)	4,672	Approx. 50% for agricultural use
Build-out (2020)	5,423	Slight increase in M&I use; agricultural demands remain constant

*Source: CVWD (2001).

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). 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 400 afa. 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

	Total (afa)	Comment
Supply (average production)		
Cachuma Project	2,660	Fixed percentage of Cachuma Project yield. Cachuma represents 34% of total supply
Jameson Lake, Fox and Alder creeks	2,000	Diversions on the upper Santa Ynez River
Doulton Tunnel	375	Represents tunnel infiltration
State Water Project	2,208	SWP entitlement is 3,000 AFY plus 300 afa of CCWA drought buffer; MWD assumes 76% average annual delivery of entitlement
Local groundwater	400	
Total=	7,715	
Demand (average)		
Current (2000)	6,073	12% is losses and transfers to City of S.B.
Build-out (2020)	6,835	Slight increase in all uses

*Source: MWD (2001).

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.

The City obtains 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 Jameson Reservoir by agreement with MWD, reclaimed water, SWP water, desalination, and groundwater (see Table 4-12). The City estimates the total safe yield of the Santa Barbara Groundwater Basin (includes Unit #1, Unit #3, and the Foothill Storage Unit) is 1,900 afa. The City estimates its long-term share of the groundwater basin's perennial yield is 1,400 afa.

TABLE 4-12
WATER SUPPLY AND DEMAND – CITY OF SANTA BARBARA

	Total (afa)	Comment
Supply (average production)		
Cachuma Project	8,277	Fixed percentage of Cachuma Project yield. Cachuma represents 45% of total supply
Gibraltar Reservoir	4,600	
Devil's Canyon	115	Diversion on upper Santa Ynez River
Mission Tunnel	1,348	Infiltration; tunnel from Gibraltar Reservoir
State Water Project	2,566	SWP entitlement is 3,000 afa plus 300 afa of CCWA drought buffer; City assumes 76% average annual delivery of entitlement and drought buffer
Local groundwater	1,400	City's portion of the Santa Barbara Groundwater Basin's safe yield of about 1,850 afa; used only to replace surface water shortages due to drought
Desalination	-	For use only during emergency. Currently in storage mode. Maximum capacity = 3,125 afa
Total=	18,306	
Demand (average)		
Current (2000)	15,140	
Build-out (2020)	15,570 – 17,760	

*Source: City of Santa Barbara (2000).

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). GWD obtains 9,321 afa from the Cachuma Project. GWD also has 7,000 afa of SWP entitlement, plus 450 afa of CCWA's drought buffer. Pumping capacity currently limits delivery of SWP water. GWD can presently use 4,500 afa 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 reclaimed water project has a capacity of approximately 1,500 afa and GWD currently delivers about 1,000 afa to the University of California, Santa Barbara, several golf courses and other users who were previously using potable water. GWD extracts approximately 2,350 afa of groundwater from the Goleta Basin. GWD estimates the safe yield of the basin is 3,410 af.

TABLE 4-13
WATER SUPPLY AND DEMAND – GOLETA WATER DISTRICT

	Total (afa)	**Comment**
Supply (average production)		
Cachuma Project	9,321	Fixed percentage of Cachuma Project yield
State Water Project	3,800-7,000	SWP entitlement is 7,000 afa plus 450 afa of CCWA drought buffer. GWD assumes 51-60 percent average annual delivery of entitlement and drought buffer (51 percent of 7,450 af is 3,800 af). Current diversion is limited to 4,500 afa due to pumping capacity.
Local groundwater	2,350	
Reclaimed water project	1,500	Approximate capacity of existing project.
Total=	650971-20,171	
Demand (average)		
Current (2000)	14,000	Includes approximately 1,000 afa of reclaimed water
Build-out (2020)	16,000	Includes approximately 1,500 afa of reclaimed water

Source: GWD (2001, 2002).

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 50-60 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). 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 afa 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.

TABLE 4-14
WATER SUPPLY AND DEMAND
SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, ID#1

	Total (afa)	Comment
Supply (average production)		
Cachuma Project	2,651	Fixed percentage of Cachuma Project yield. Cachuma represents 22% of total supply
Santa Ynez Uplands Groundwater Basin	4,700	Current pumping rate. Historic rate was approx. 4,000 afa. Total diversion estimated to be 3,700 to 4,700 afa
Santa Ynez River Underflow	3,600	SYRWCD, ID#1 estimates that its future maximum production from two permitted well fields will be 3,600 afa (4 cfs field = 1,600, 6 cfs field = 2,000) and no production from river gallery. Maximum permitted amount is 6,115 af
State Water Project	1,000	SWP entitlement is 2,000 afa plus 50 afa of CCWA drought buffer. SYRWCD, ID#1 assumes long term average annual delivery is 50%
Total=	11,951	
Demand (average)		
Current (1999)	5,300	Includes 174 afa for City of Solvang
Build-out (2010)	9,050	Includes 1,500 afa for Solvang

*Source: Stetson Engineers (1994) and SYRWCD ID#1 (2000).

Recent deliveries by the Member Units to their customers are shown in Table 4-15.

TABLE 4-15
RECENT WATER DELIVERIES BY THE MEMBER UNITS TO THEIR CUSTOMERS

Year	Carpinteria	Montecito	Santa Barbara	Goleta	SYRWCD ID#1
1989-90	6,398	5,106	16,637	13,994	7,902
1990-91	4,768	3,580	9,427	9,593	6,363
1991-92	4,028	3,093	9,518	9,076	6,050
1992-93	4,330	3,900	11,073	12,172	6,343
1993-94	4,331	3,750	11,438	12,671	6,236
1994-95	4,470	4,044	12,337	11,531	6,138
1995-96	4,413	5,383	13,636	12,312	6,812
1996-97	4,688	4,202	14,230	14,667	6,506
1997-98	3,880	4,306	12,818	11,758	5,110
1998-99	4,443	4,812	14,291	13,700	6,163
1999-00	4,672	5,337	15,291	No data	6,681
Avg=	4,201	3,959	11,724.67	11,043	5,858.75

Deliveries from the Cachuma Project to the Member Units are discussed in greater detail in section 2.2.2. Recent Cachuma Project annual deliveries to the Member Units are summarized in Table 2-1. They range from 24,641 to 29,427 af. 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 is shown below:

- Carpinteria Valley Water District 41 %
- Montecito Water District 34 %
- City of Santa Barbara 45 %
- Goleta Water District 58 %
- SYRWCD, ID#1 22 %

Historical annual water deliveries from the Cachuma Project since its construction are shown on Chart 2-1 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.

4.3.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

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 Biological Opinion have been met. A constant demand of 25,714 afa was applied in the model, which represents the operational yield identified by the Member Units that would meet their water supply needs. Using this target yield, the maximum shortage in project yield would not exceed 20 percent based on the droughts observed in the modeling period. 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 afa could result in greater shortages in dry years.

TABLE 4-16
IMPACTS ON CACHUMA PROJECT DELIVERIES TO MEMBER UNITS

Water Supply Parameter	**Alt 1 Order WR 89-18 Operations**	**Alt 2 Current Operations under Biological Opinion**	**Alt 3A Biological Opinion with 0.75' surcharge**	**Alt 3B Biological Opinion with 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4A-B Biological Opinion with SWP Delivery to Lompoc**
Average Annual Deliveries and Years of Shortages						
Average annual delivery (includes 2,000 AFY from Tecolote Tunnel)	25,308	25,115	24,901	24,986	25,122	25,169
Reduction compared to current operations (Alt. 2)	+193	-	-214	-129	-7	+54
Number of years with 10% or more shortage	5	6	8	7	6	6
Number of years with 10% or more shortages – difference from Alternative 2	-1	-	+2	+1	-	-
Critical Drought Year (based on 1951 drought year, compared to target yield of 25,714 af)						
Shortage in critical drought year (af)	7,068	9,808	11,813	11,262	9,895	9,351
% shortage in Cachuma deliveries in critical drought year	27%	38%	46%	44%	38%	36%
% shortage in Cachuma deliveries in critical drought year – difference from Alt. 2	-11%	-	+8%	+6%	-	-2%
Critical 3-year Drought Period (based on 1949-51 drought, compared to target yield of 25,714 af)						
Shortage in critical drought years (af)	12,375	17,619	21,877	20,521	17,386	14,977
% shortage in Cachuma deliveries in critical drought period	16%	23%	28%	27%	23%	19%
% shortage in Cachuma deliveries in critical drought period – difference from Alternative 2	-7%	-	+5%	+4%	-	-4%

Average Annual Project Yield

The average annual project yield under current operations (Alternative 2) is 193 af (or 1 percent) less than under recent historic operations (Alternative 1) due to the implementation of the interim rearing target flows under current operations (Table 4-16).

The average annual yield under Alternatives 3A-C would be less than under current operations by the following amounts: 7 afa under Alternative 3C; 129 af under Alternative 3B; and 214 afa under Alternative 3A (Table 4-16). The reductions under these alternatives would be minor, less than 1 percent of the total average annual yield. 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.

Alternative 4A-B would increase the average annual project yield compared to current operations by a slight amount (54 afa), resulting in a beneficial impact on water supply conditions for the Member Units.

Frequency of Years with Shortages in Project Deliveries

The number of years in which project deliveries would have shortages of 10 percent or more is shown in Table 4-16. Current operations (Alternative 2) involve releases from the dam to meet interim rearing target flows, which reduce lake storage and overall project yield. As a result, the number of years in which shortages are expected is slightly greater than under recent historic operations (Alternative 1).

Compared to current operations, Alternatives 3A and 3B involve greater releases to meet long-term rearing target flows and passage supplementation flows. As a consequence, the frequency of years with shortages of 10 percent or more is greater under Alternatives 3A and 3B. 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.

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

Deliveries During Drought Periods

Using the worst drought year on record (1951) for purposes of analysis, project yield under current operations (Alternative 2) would be 15,906 af, which represents a 38 percent shortage relative to the desired project yield of 25,714 af (Table 4-16). This shortage is greater than the 27 percent shortage that would have occurred in a water year like 1951 under recent historic operations (Alternative 1). The increased shortage under current operations is due to lower overall amount of water stored in the lake because of additional releases to meet interim rearing target flows, as mandated in the Biological Opinion.

Under 1951 conditions, the shortages under Alternatives 3A and 3B would be greater than under current operations (Alternative 2) because these alternatives involve greater releases for steelhead rearing and passage flows. The shortages would be 46 percent under Alternative 3A and 44 percent under Alternative 3B. This represents an additional shortage of 2,005 af (or 8 percent) under Alternative 3A and 1,454 af (or 6 percent) under Alternative 3B (Table 4-16). In contrast, under 1951 conditions the shortages under Alternatives 3C and 4A-B would be about the same as under current operations despite the higher releases for steelhead because of the additional storage created by a 3.0-foot surcharge.

The pattern of shortages among alternatives using the worst three-year drought period on record (1949-51) for purposes of analysis is similar to the critical single-year drought, as shown in Table 4-16.

<u>Comparison of Member Units' Demand and Supply from All Sources</u>

Table 4-17 compares the Member Units' demand to their water supply from all sources, including the Cachuma Project and the SWP, in a critical drought year like 1951 under the project alternatives. Table 4-17 indicates that in a critical drought year under current conditions (Alternative 2) the Member Units' total supply would exceed current demand (based on year 2000 demand levels) by just 65 af, taking into account the Member Units' portions of the CCWA drought buffer. If the Member Units' demand increases as projected, they will experience a shortage of 9,818 af by 2020, again taking into account the CCWA drought buffer. Under Alternatives 3A, 3B, and 3C, current demand would exceed supply by 1,940 af, 1,389 af, and 22 af, respectively. Cachuma Project yield in a critical drought year would be greater under Alternatives 4A and 4B than under current conditions. Under Alternatives 4A and 4B, total supply would be adequate to meet current demand, but demand would outstrip supply by 2020.

TABLE 4-17
MEMBER UNITS' SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951)

	Alt 1	Alt 2	Alt 3A	Alt 3B	Alt 3C	Alts 4A-B
1. Cachuma Project yield in a critical drought year (SYRHM simulation, Appendix E)	18,646	15,906	13,901	14,452	15,819	16,363
2. Total supply from sources other than the Cachuma Project (Table 4-18)	28,044	28,044	28,044	28,044	28,044	28,044
3. Total supply (1 + 2)	46,690	43,950	41,945	42,496	43,863	44,407
4. Year 2000 demand (Table 4-19)	45,185	45,185	45,185	45,185	45,185	45,185
5. Surplus or shortage (3 - 4)	+1,505	-1,235	-3,240	-2,689	-1,322	-778
6. CCWA drought buffer (Tables 4-10, 4-11, 4-12, 4-13, 4-14)	NA	1,300	1,300	1,300	1,300	1,300
7. Surplus or shortage after adding CCWA drought buffer (5 + 6)	+1,505	+65	-1,940	-1,389	-22	+522
8. Year 2020 demand (Table 4-19)	55,068	55,068	55,068	55,068	55,068	55,068
9. Shortage (3 - 8)	-8,378	-11,118	-13,123	-12,572	-11,205	-10,661
10. Shortage after adding CCWA drought buffer (9 + 6)	-7,078	-9,818	-11,823	-11,272	-9,905	9,361

The 28,044 af figure for total supply from sources other than the Cachuma Project used in Table 4-17 is derived from Table 4-18. The analysis depicted in Table 4-18 assumes that the amount of water available to CVWD, GWD, and SYRWCD, ID#1, and the amount of groundwater available to MWD and the City of Santa Barbara, as set forth Tables 4-10 through 4-14, would remain the same in a critical drought year. The analysis also assumes that the Member Units would receive the average annual SWP delivery of 10,152 af. 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, which summarizes the Member Units' demand in 2000 and their projected demand in 2020.

TABLE 4-18
MEMBER UNITS' SUPPLY FROM SOURCES OTHER THAN CACHUMA PROJECT IN CRITICAL DROUGHT YEAR (1951)

CVWD	
1. Local groundwater supply (Table 4-10)	3,000
MWD	
2. Jameson Lake and Alder Creek diversions (SYRHM simulation, Appendix E)	312
3. Doulton Tunnel infiltration and Fox Creek diversion (SYRHM simulation, Appendix E)	130
4. Local groundwater supply (Table 4-11)	400
5. MWD subtotal (2 + 3 + 4)	842
City of Santa Barbara	
6. Gibraltar Reservoir (SYRHM simulation, Appendix E)	0
7. Mission Tunnel infiltration and Devil's Canyon diversion (SYRHM simulation, Appendix E)	500
8. Local groundwater supply (Table 4-12)	1,400
9. City of Santa Barbara subtotal (6 + 7 + 8)	1,900
GWD	
10. Local groundwater supply (Table 4-13)	2,350
11. Reclaimed water (Table 4-13)	1,500
12. GWD subtotal (10 + 11)	3,850
SYRWCD, ID #1 (Table 4-14)	
13. Local groundwater supply (Table 4-14)	4,700
14. Santa Ynez River diversion (Table 4-14)	3,600
15. SYRWCD, ID#1 subtotal (13 + 14)	8,300
16. Average State Water Project delivery (Technical Memorandum # 1, Table 15b)	10,152
17. Total supply from sources other than the Cachuma Project (1 + 5 + 9 + 12 + 15 + 16)	28,044

TABLE 4-19
MEMBER UNITS' DEMAND IN 2000 AND 2020

Member Unit	Year 2000 Demand in Acre-Feet	Year 2020 Demand in Acre-Feet
CVWD	4,672	5,423
MWD	6,073	6,835
City of Santa Barbara	15,140	17,760 (15,570 – 17, 760)
GWD	14,000	16,000
SYRWCD, ID#1	5,300	9,050
Total	**45,185**	**55,068**

* Source: Tables 4-10, 4-11, 4-12, 4-13, 4-14

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 3A. Table 4-21 indicates that under current demand levels, MWD would experience a shortage of 1,373 af. Table 4-22 indicates that under current demand levels, the City of Santa Barbara would experience a shortage of 6,003 af. Table 4-23 indicates that under current demand levels, GWD would experience a shortage of 1,015 af.

MWD, the City of Santa Barbara and GWD could make up for these shortages in part by buying water from other Member Units. Tables 4-20 and 4-24 indicate that CVWD and SYRWCD, ID#1 would have surpluses of 1,008 af, and 5,443 af, respectively.

TABLE 4-20
CVWD SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951) UNDER ALTERNATIVE 3A

1. Local groundwater supply (Table 4-10)	3,000
2. State Water Project supply	960
3. CCWA drought buffer (Table 4-10)	200
4. Cachuma Project supply in critical drought year	1,520
5. Total supply	**5,680**
6. Year 2000 Demand (Table 4-10)	4,672
7. Surplus (5 - 6)	**1,008**
8. Year 2020 Demand (Table 4-10)	5,423
9. Surplus (5 - 8)	**257**

TABLE 4-21
MWD SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951) UNDER ALTERNATIVE 3A

1. Jameson Lake and Alder Creek diversions (SYRHM simulations, Appendix E)	312
2. Doulton Tunnel infiltration and Fox Creek diversion (SYRHM simulations, Appendix E)	130
3. Local groundwater supply (Table 4-11)	400
4. State Water Project supply	2,120
5. CCWA drought buffer (Table 4-11)	300
6. Cachuma Project supply in critical drought year	1,438
7. Total supply	**4,700**
8. Year 2000 demand (Table 4-11)	6,073
9. Shortage (7 – 8)	**-1,373**
10. Year 2020 demand (Table 4-11)	6,835
11. Shortage (7 - 10)	**-2,135**

TABLE 4-22
CITY OF SANTA BARBARA SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951) UNDER ALTERNATIVE 3A

1. Gibraltar Reservoir (SYRHM simulations, Appendix E)	0
2. Mission Tunnel infiltration and Devil's Canyon diversion (SYRHM simulations, Appendix E)	500
3. Santa Barbara local groundwater supply (Table 4-12)	1,400
4. State Water Project supply	2,464
5. CCWA drought buffer (Table 4-12)	300
6. Cachuma Project supply in critical drought year	4,473
7. Total supply	**9,137**
8. Year 2000 demand (Table 4-12)	15,140
9. Shortage (7 – 8)	**-6,003**
10. Year 2020 demand (Table 4-12)	17,760
11. Shortage 7 – 10)	**-8,623**

TABLE 4-23
GWD SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951) UNDER ALTERNATIVE 3A

1. GWD local groundwater supply (Table 4-13)	2,350
2. GWD reclaimed water (Table 4-13)	1,500
3. State Water Project supply	3,648
4. CCWA drought buffer (Table 4-13)	450
5. Cachuma Project supply in critical drought year	5,037
6. Total supply	**12,985**
7. Year 2000 demand (Table 4-13)	14,000
8. Shortage (6 - 7)	**-1,015**
9. Year 2020 demand (Table 4-13)	16,000
10. Shortage (6 - 9)	**-3,015**

TABLE 4-24
SYRWCD, ID#1 SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951) UNDER ALTERNATIVE 3A

1. Local groundwater supply (Table 4-14)	4,700
2. Santa Ynez River diversion (Table 4-14)	3,600
3. State Water Project supply	960
4. CCWA drought buffer (Table 4-14)	50
5. Cachuma Project supply in critical drought year	1,433
6. Total supply	**10,743**
7. Year 2000 demand (Table 4-14)	5,300
8. Surplus (6 – 7)	**5,443**
9. Year 2020 demand (Table 4-14)	9,050
10. Surplus (6 - 9)	**1,693**

The source of the data presented in Tables 4-20 through 4-24 is Tables 4-10 through 4-14. For purposes of this analysis, each Member Unit's share of the 13,901 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. Similarly, each Member Unit's share of the 10,152 af of SWP water available on an average, annual basis was calculated by reducing each Member Unit's share pro rata in accordance with the amount of SWP supply claimed by each Member Unit in Tables 4-10 through 4-14.

Out of the 1918-1993 period of record analyzed using the SYRHM model, the overall shortage in supply necessary to meet current demand under Alternatives 3A, 3B, and 3C would only occur in one year, 1951. The Member Units' total water supply would be sufficient to meet current demand in any other year during the 1918-1993 period of record. For example, after 1951, the second-worst drought year in the period of record is 1950. In that year, Cachuma Project yield under Alternative 3A, which represents the worst-case scenario with regard to water supply impacts, would be 18,309 af (SYRHM, Appendix E), which exceeds Cachuma Project yield in 1951 (13,901 af) by 4,408 af. This increase in Cachuma Project yield exceeds the 1,940-af shortage in supply in 1951 under Alternative 3A. (Similarly, SYRHM simulations indicate that deliveries from Jameson Reservoir, Alder Creek, Doulton Tunnel infiltration, Gibraltar Reservoir, Mission Tunnel infiltration, and Devil's Canyon would be greater in 1950 than 1951 (SYRHM simulations, Appendix E).)

Supply under Alternatives 3A, 3B, and 3C would be adequate to meet current demand in a three-year drought period as well. Table 4-25 compares the Member Units' supply and demand in a critical three-year drought period (1949-1951) under Alternative 3A. Unlike a single critical drought year such as 1951, Table 4-21 indicates that in a three-year drought period, the Member Units' total water supply would exceed their current demand, but that the projected increase in demand would outstrip supply by 2020. Under current conditions (based on year 2000 demand levels), supply would exceed demand by 9,274 af. In 2020, demand would exceed supply by 19,075 af, taking into account the CCWA drought buffer.

TABLE 4-25
MEMBER UNITS' SUPPLY AND DEMAND DURING CRITICAL THREE-YEAR DROUGHT PERIOD (1949-1951) UNDER ALTERNATIVE 3A

CVWD	
1. Local groundwater supply (3,000 x 3)	9,000
MWD	
2. Jameson Lake and Alder Creek diversions (1,280 + 602 + 312, SYRHM simulation, Appendix E)	2,194
3. Doulton Tunnel infiltration and Fox Creek diversion (120 + 182 + 130, SYRHM simulation, Appendix E)	432
4. Local groundwater supply (400 x 3)	1,200
5. MWD subtotal (2 + 3 + 4)	3,826
City of Santa Barbara	
6. Gibraltar Reservoir (1,253 + 2,802, SYRHM simulation, Appendix E)	4,055
7. Mission Tunnel infiltration and Devil's Canyon diversion (550 + 527 + 500, SYRHM simulation, Appendix E)	1,577
8. Local groundwater supply (1,400 x 3)	4,200
9. City of Santa Barbara subtotal (6 +7 + 8)	9,832
GWD	
10. Local groundwater supply and reclaimed water (3,850 x 3)	11,550
SYRWCD, ID#1	
11. Local groundwater supply and Santa Ynez River diversion (8,300 x 3)	24,900
12. Average State Water Project delivery (10,152 x 3)	30,456
13. Cachuma Project yield in critical three-year drought period (23,055 + 18,309 + 13,901, SYRHM simulation, Appendix E)	55,265
14. Total supply in critical three-year drought period (1 + 5 + 9 + 10 + 11 + 12 + 13)	**144,829**
15. Demand for three-year period based on Year 2000 demand level (45,185 x 3)	135,555
16. Surplus (14 - 15)	**9,274**
17. Demand for three-year period based on Year 2020 demand level (55,068 x 3)	165,204
18. Shortage (14 - 17)	**-20,375**
19. CCWA drought buffer (Tables 4-10, 4-11, 4-12, 4-13, 4-14)	1,300
20. Shortage after subtracting CCWA drought buffer (18 + 19)	**-19,075**

Indirect Environmental Impacts of Water Supply Shortages

The potential impact to the Member Units' water supply in a critical drought year under Alternatives 3A, 3B, and 3C could result in indirect environmental impacts, depending on the manner in which the Member Units make up for the shortage. If the Member Units can meet current demand in a critical drought year using existing sources of supply or by implementing drought contingency measures, no indirect environmental impacts would occur. Indirect environmental impacts could occur, however, 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 Alternatives 3A, 3B, and 3C.

The Member Units could increase their annual delivery from the Cachuma Project by 22 to 1,940 af to make up for the shortages under Alternatives 3A, 3B, and 3C. Doing so, however, would exceed the 25,714 af target Cachuma Project yield and increase the risk of greater shortages in subsequent dry years. Alternatively, enough water to make up for the shortage might be available from the SWP under the Member Units' existing SWP entitlement. Another possible solution would be to implement drought contingency measures, such as fallowing agricultural land on a temporary basis.

Impacts Attributable to 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 any environmental impacts. And some groundwater aquifers are adjudicated, so additional pumping may be prohibited. But additional groundwater pumping along the coast could cause an increase in saltwater intrusion. An increase in the total concentration of soluble salts in groundwater could reduce agricultural crop yield. In addition, if the water is treated for domestic use, an increase in the concentration of soluble salts could contribute to the increased production of halogenated (organo-chlorinated) compounds such as trihalomethanes in the water supply. These substances may be carcinogenic.

Impacts Attributable to a 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 afa. The analysis of water supply impacts in a critical drought year under Alternatives 3A, 3B, and 3C, discussed above, assumes that the Member Units would receive 10,152 afa, leaving about 6,000 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's (DWR) Harvey Banks pumping plant. In similar past transfer scenarios that have conveyed water 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.

Impacts Attributable to Desalination

A third potential new source of supply is desalination. The City of Santa Barbara owns the Charles Meyer Desalination Facility. The City constructed the facility in 1991-1992 to serve as a temporary emergency source of water supply in time of drought. The City operated the facility for several months in order to test components, but then placed on the facility on long-term standby status due to increased reservoir supplies replenished by rainfall during the winter of 1992-1993 and reduced water customer demand. Currently, the facility has a capacity of 3,000 af per year. The cost of desalinated water is projected to range between $1,400 and $2,000 per acre-foot. Reactivation costs are projected to exceed $6,000,000.

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 land fills. 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 afa seawater desalination plant would require roughly two megawatts of generating capacity continuously. If the electricity were produced from existing thermal powerplants, 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 powerplants, operating on natural gas or coal, produce NOx, particulate matter, reactive organic gasses, and in some cases, sulfur dioxide. Coal-fired generation is almost all out-of-state, with the energy brought to California through the high voltage transmission system. Coal-fired powerplants 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 powerplant using the best available emissions reduction technology, a 3,000 afa facility using two megawatts of electricity would result in 1,053 pounds of NOx, 93 pounds of SO2, 693 pounds of PM10, 693 pounds of ROG, 2,000 pounds of CO, 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.

The indirect environmental impacts that could result under Alternatives 3A and 3B if the Member Units increase groundwater pumping, obtain a temporary transfer from another SWP contractor, or desalinate seawater are potentially significant. The potential indirect environmental impacts under Alternative 3C are adverse, but less than significant in light of the small amount of the water supply shortage under that alternative (Class III). The potentially significant impacts under Alternatives 3A and 3B might be mitigable to less than significant levels if the Member Units were to develop and implement a drought contingency plan to cover the water supply shortage. 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 Board. However, the feasibility of fully mitigating for all of the potential indirect environmental impacts is uncertain. Accordingly, this EIR assumes that the impacts to the Member Units' water supply under Alternatives 3A and 3B could result in significant, 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. CVWD, MWD, the City of Santa Barbara, and GWD also are required to prepare and adopt urban water management plans in accordance with the Urban Water Management Planning Act. (Wat. Code, §§ 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. (Wat. Code, § 10631.) In addition, the plans must contain an urban water supply contingency analysis. The analysis must include, among other things, actions to be undertaken in response to a water supply shortage, including up to a 50 percent reduction in water supply, 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, § 10632.)

CVWD, MWD, the City of Santa Barbara, and GWD submitted urban water management plans to DWR in 2001. Although it is not required to prepare an urban water management plan, SYRWCD, ID#1 also submitted a plan to DWR in 2001. 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.

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 under Alternatives 3A and 3B.

WS1: 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.

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, 4-2b). Groundwater storage and groundwater levels in the Above Narrows Alluvial Groundwater Basin fluctuate 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 usually becomes full shortly 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.

Groundwater storage and groundwater levels decrease in the Above Narrows Alluvial Groundwater Basin during summer, fall and dry periods due to pumping, groundwater discharge back into the Santa Ynez River as base flow, and underflow through the alluvium downstream toward the Lompoc Basin. The longer the dry period, the greater the decline in groundwater storage and groundwater levels. 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 in the dewatered storage of the basin since 1972 is shown on Chart 4-9 in Appendix B. These data show that SYRWCD has maintained dewatered storage between 10,000 and 13,000 af, approximately, 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, SYRWCD has maintained dewatered storage within a narrow range.

Groundwater quality in the Above Narrows Aquifer also fluctuates 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.

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, 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 in response to groundwater pumping 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 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.

TABLE 4-26
SUMMARY OF PUMPING IN THE
ABOVE NARROWS ALLUVIAL 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). Ninety-five percent of SYRWCD’s water supply comes from groundwater. The remaining five percent, approximately 3,000 af, comes from Cachuma Lake (via deliveries to SYRWCD, ID#1).

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.

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). 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, maximum 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 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 groundwater storage is sufficiently high such as during a period of high runoff, bank infiltration is derived from groundwater storage from 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

The mean and median monthly dewatered storage for the Above Narrows Alluvial Groundwater Basin (in its entirety and by subarea) over the simulation period is presented in Table 4-27. The modeling results indicate that dewatered storage under current operations (Alternative 2) is less than under recent historic conditions (Alternative 1). For example, the median monthly dewatered storage over the entire basin under current operations is estimated to be 10,517 af, compared to 10,952 under the recent historic operations. The reduction in dewatered storage is due to the additional downstream releases for steelhead in the summer and fall that are now being implemented. Under current operations, additional percolation occurs in the Santa Ynez Subarea, the portion of the river affected by releases for fish. The reduction in median dewatered storage in the Santa Ynez Subarea under current operations (Alternative 2) is 18 percent compared to recent historic operations (Table 4-27). In contrast, the reduction in the other two sub-areas is only 1 to 4 percent (Table 4-27).

TABLE 4-27
MONTHLY DEWATERED STORAGE IN THE ABOVE NARROWS ALLUVIAL GROUNDWATER BASIN

	Af for each Alternative based on Simulation (1918-1993)					
	1	2	3A	3B	3C	4A-B
Total Storage for the Entire Basin						
Mean	11,524	10,769	10,332	10,310	10,281	10,240
Median	10,952	10,517	10,102	10,099	10,081	10,031
% Difference Relative to Alt 1		*-4%*				
% Difference Relative to Alt 2			*-4%*	*-4%*	*-4%*	*-4%*
Minimum	2,329	2,330	2,314	2,315	2,315	2,311
Santa Ynez Subarea						
Mean	2,417	1,926	1,734	1,722	1,704	1,647
Median	2,148	1,769	1,612	1,606	1,584	1,510
% Difference Relative to Alt 1		*-18%*				
% Difference Relative to Alt 2			*-9%*	*-10%*	*-11%*	*-25%*
Minimum	0	0	0	0	0	0
Buellton Subarea						
Mean	5,691	5,634	5,485	5,482	5,471	5,438
Median	5,634	5,570	5,447	5,449	5,442	5,382
% Difference Relative to Alt 1		*-1%*				
% Difference Relative to Alt 2			*-3%*	*-3%*	*-4%*	*-4%*
Minimum	2,164	2,166	2,166	2,167	2,153	2,144

	Af for each Alternative based on Simulation (1918-1993)					
	1	2	3A	3B	3C	4A-B
Santa Rita Subarea						
Mean	3,363	3,244	3,113	3,105	3,105	3,155
Median	3,156	3,080	2,993	2,981	2,978	3,105
% Difference Relative to Alt 1		*-4%*				
% Difference Relative to Alt 2			*-3%*	*-3%*	*-3%*	*0%*
Minimum	0	0	0	0	0	0

Median monthly dewatered storage of Alternatives 3A-C and 4A-B would be less than under current operations because the project alternatives would involve additional downstream releases to support steelhead rearing and passage. <u>Hence, the proposed alternatives would have a beneficial impact (Class IV) on the alluvial basin storage conditions</u>.

Charts 4-10a-c in Appendix B show the changes in total dewatered storage in the entire Above Narrows Alluvial Groundwater Basin, based on the SYRHM. These charts also show that there is no significant difference in the year-to-year variation in dewatered storage in the aquifer. However, the charts show less total dewatered storage during low flow periods of most years. Under current conditions (Alternative 2) and under all project alternatives (Alternatives 3A-C and 4A-B), water is released from the dam during the summer and fall to support steelhead rearing to Highway 154, and in some years, to Alisal Road in Solvang (Alternatives 3A-C and 4A-B only). 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 recent historic operations (Alternative 1). Charts 4-10a-c also show 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 the dewatered storage in the Above Narrows Alluvial Groundwater Basin through the ANA releases from Cachuma Lake. No significant difference in management of the ANA releases is expected to occur under the project alternatives compared to current operations.

The results of the modeling of groundwater elevations (see Table 4-28) are essentially the same as for groundwater storage.

TABLE 4-28
MONTHLY WATER ELEVATION
IN THE ABOVE NARROWS ALLUVIAL GROUNDWATER BASIN

	Elevation in Feet for each Alternative based on Simulation (1918-1993)					
	1	2	3A	3B	3C	4A-B
Santa Ynez Subarea						
Mean	458	459	460	460	460	460
Median	459	460	460	460	460	460
% Difference Relative to Alt 2			*0%*	*0%*	*0%*	*0%*
Minimum	435	442	444	444	445	446
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%*
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%*
Minimum	163	163	165	165	165	165

4.4.3 Mitigation Measures

No significant adverse impacts on the Above Narrows Alluvial Groundwater Basin were identified for Alternatives 3A-C and 4A-B. Hence, there is no need for mitigation.

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 40 years, the DWR, City of Santa Barbara, and City of Lompoc have collected a large set of data on the TDS of Cachuma Lake. This data is displayed on Chart 4-11 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

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). 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.

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 section 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 Los Laureles Creek, Santa Cruz Creek, Salsipuedes Creek, and the mainstem of the river at Solvang and the Narrows, as shown in Table 4-30.

TABLE 4-30
KEY SALINITY CALIBRATION LOCATIONS

Location	Number Of Measurements		Period Of Record Available	Sources
	TDS	Electrical conductivity w/o TDS		
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	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 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 Reservoir 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. 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 five 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 table 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) calls this phenomenon “channel loading,” or “Above Narrows salt increase.” 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.
- Surface-groundwater interface mixing in which alluvial groundwater with high TDS near the surface mixes with surface water.

Possible sources of salts include 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. Stetson Engineers (2000) estimated the actual salt loading (i.e., quantities moved downstream) between the dam and the Narrows during the Order WR 89-18 releases. Using limited water quality data from the

USGS taken during Order WR 89-18 releases, Stetson Engineers (2001c) estimated the average annual salt loading between the dam and the Narrows is about 25 tons per day.

Based on the above information, Stetson Engineers (2001b) established a flow-salt loading relationship to estimate salt input in the salinity model at the Buellton, East Santa Rita, and West Santa Rita subareas. This relationship is shown on Chart 4-15. The amount of salt loading is proportional to flow up to 50 cfs, above which salt loading levels off.

Stetson Engineers verified whether SYRHM accurately simulates TDS at the Narrows, using historical Cachuma Reservoir operations and downstream water use data for the period 1942-1993 (52 years). 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 simulate flow-salt loading data for the 52-year period, both with and without Cachuma releases. (Stetson Engineers, 2001c.) To evaluate model accuracy, 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.

Stetson Engineers (2001c) also found that the match between the measured 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 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. Key SWP water delivery assumptions used in the salinity model simulations are discussed below.

TABLE 4-31
SWP WATER DELIVERIES USED IN THE MODELING

	AFA				
	Exchange with ID#1	BNA Exchange for Alt 4 only	SWP Delivered to Cachuma Lake	SWP Released in the Outlet Works	Total SWP Imports
Alternative	(a)	(b)	(c)	(d)	(a)+(b)+(c)+(d)
1	0	0	0	0	0
2	2,497	0	5,489	1,789	10,135
3A	2,472	0	5,878	1,802	10,152
3B	2,482	0	5,844	1,841	10,167
3C	2,497	0	5,836	1,866	10,199
4	2,501	1,770	4,853	1,245	10,369

Total SWP contract entitlements for the Member Units is 17,000 afa. The Member Units purchase additional water from the 3,908 afa 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 afa, which was then adjusted (see Table 4-31) to reflect the 74 percent average delivery rate. The reduction in SWP water supply from 17,000 afa to 13,750 afa is based on the key assumptions listed below, which restrict SWP water deliveries to Cachuma Reservoir and SWP water releases into the Santa Ynez River. The 13,750 afa 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 afa of Goleta's 7,000 afa 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 will not 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.
- No SWP water can be delivered to the reservoir when water is being released from Bradbury Dam for fish passage releases.

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 was 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.) Average TDS in SWP water is 289 mg/l, with a range of 104 to 567 mg/l.

No SWP water is delivered under Alternative 1, which represents recent historic operations prior to the completion of the Coastal Aqueduct bringing SWP water to Santa Barbara County. Under current operations and for all other alternatives, the model assumed SWP water was delivered consistent with the assumptions set forth above.

Under Alternative 4A, BNA water would be provided by direct delivery of SWP water to the City of Lompoc. 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 would not occur.

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. 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.

4.5.2.2 Impacts on Reservoir TDS

Effects of Current Operations

The predicted TDS levels in Cachuma Lake for the model simulation period are presented in Chart 4-16 in Appendix B. TDS levels fluctuate in the model, as under historic conditions, due to variation in annual inflows and storage. The results indicate that the highest annual TDS values occur under recent historic operations (Alternative 1), which did not include the importation of SWP water. In contrast, expected TDS levels in the reservoir under current operations (Alternative 2) will be about 30-50 mg/l lower, except during drought years, due to the delivery of SWP water to the reservoir where it commingles with lake water and reduces overall salinity levels.

The predicted reduction in TDS in the reservoir shown on Chart 4-16 is considered an upper limit because the salinity model included maximum reasonable deliveries of SWP water, a scenario that will not occur for many years. In reality, the reduction in reservoir TDS due to importation of SWP water will be proportional to the amount of SWP water delivered over time to Cachuma Lake.

Under current operations, 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.

Impacts of Alternatives

The simulated lake TDS under Alternatives 3A-C would be about 20-30 mg/l higher than under current operations (Alternative 2) as shown in Chart 4-16, but it is lower than under recent historic conditions (Alternative 1). The amount of SWP water delivered to the reservoir under current operations and Alternatives 3A-C would be the same, which is the reason for the net improvement in TDS. The higher TDS levels under Alternatives 3A-C as compared to Alternative 2 are probably attributable to the greater downstream releases for fish under these alternatives, which reduces the proportion of low-TDS SWP water in the reservoir compared to current operations.

Under Alternatives 4A and 4B, SWP water would be delivered to the Lompoc area via different delivery methods. (Under Alternative 4A, water would be delivered to the City's treatment facility, and under Alternative 4B, water would be delivered to the Lompoc Forebay.) The impacts at the lake would be similar under both alternatives, and therefore are described generally as Alternative 4 impacts. TDS levels under Alternative 4 would be about 40 mg/l higher than under current operations (Alternative 2) due to the additional releases under this alternative, as noted above. In addition, less SWP water would be delivered to the reservoir under Alternative 4. 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 3A-C and 4 would be essentially the same. (Stetson, 2001c.) Surcharging under Alternatives 3B, 3C, and 4 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 potential increase in TDS in Cachuma Lake under Alternatives 3A-C and 4A-B as compared to current conditions (Alternative 2) is considered an adverse, but not significant impact (Class III). The median TDS under current operations is 460 mg/l. Increasing lake TDS by 20 to 40 mg/l under Alternatives 3A-C and 4 would result in a median TDS of 480 to 500 mg/l. This impact analysis is 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. A 20 to 40 mg/l increase is small and would not adversely affect the beneficial uses of Cachuma Lake.

4.5.2.3 Impacts on River TDS

The TDS of releases for purposes of satisfying downstream water rights at Bradbury Dam and at the Narrows are shown on Charts 4-17 and 4-18, respectively. Because the salinity modeling showed no difference in TDS concentrations between Alternatives 3A-C, these charts only show a single line for "Alternative 3."

Effects of Current Operations

TDS concentrations in water rights releases below the dam under current operations (Alternative 2) are lower than under recent historic operations (Alternative 1), as shown on Chart 4-17. For example, the median TDS concentration in water rights releases under current operations is estimated to be about 460 mg/l, which is a combination of low salinity SWP water (about 300 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 median difference in TDS concentrations of water rights releases at the dam between current operations and recent historic operations is a decrease of 165 mg/l (Chart 4-17).

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 current operations (Alternative 2) is about 800 mg/l, compared to 460 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. Median TDS levels in water rights releases at the Narrows under recent historic operations (Alternative 1) are about 920 mg/l, compared to 625 mg/l at the dam. Water rights releases under current operations have a lower TDS than under recent historic operations, although salinity levels increase as water flows down the river under both scenarios.

The predicted mean monthly TDS of flows at the Narrows is shown on Chart 4-19. 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 effect of lower TDS in water rights releases under current operations (Alternative 2) compared to recent historic operations (Alternative 1) is clearly evident during July, August, and September when BNA releases are passing through the Narrows. TDS under current operations is about 875 mg/l compared to about 935 mg/l under recent historic operations, a decrease of about 60 mg/l. However, there is little to no difference in TDS between current and recent historic operations during the rest of the year when flows are dominated by runoff. The reduced TDS concentrations in flows at the Narrows associated with current operations are also shown in a frequency distribution curve in Chart 4-20.

In summary, the importation of SWP water under current operations and its commingling with releases are expected to reduce TDS concentrations of such releases. The reduced TDS would occur for both ANA and BNA flows (the latter include flows that reach the Lompoc Valley). This effect would be restricted to the period of time that water rights or fish releases are made, and only when SWP water is commingled. Water right releases are made when there is little to no flow in the river, and when tributary flow is absent. Hence, there would be little to no mixing of this higher quality water with lower quality runoff in the river.

The effects shown on Charts 4-17 to 4-20 represent the maximum improvements 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 maximum improvements have not yet occurred. The improvement in water quality in downstream water rights releases will be proportional to the amount of SWP water delivered to the reservoir and commingled with water rights releases.

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). In contrast, flows to augment steelhead passage during the period January through May (wet years only) would be made from the outlet works where SWP water could be commingled. Hence, there may be occasions when releases for passage flows have a lower TDS than reservoir water. The impact on TDS levels in the river downstream of the dam would be negligible because the passage flows would only last for 10-14 days and would mix with natural runoff from the tributaries.

TDS concentrations in spills from the reservoir under current operations (Alternative 2) may be less than under recent historic operations (Alternative 1) because SWP water is now being imported. However, SWP water is typically not stored in the reservoir when reservoir storage is high in the fall because SWP water is the first to spill from the lake. In addition, the TDS concentrations in spill water is likely to be dominated by the inflows from upstream, not the TDS levels of stored water. However, the cumulative improvement in TDS levels in the reservoir under current operations after many years may contribute to a slight reduction in TDS concentrations in spill water, although this effect is expected to be minor and is speculative.

Impacts of Alternatives 3A, 3B, and 3C

The salinity modeling results showed no difference in TDS concentrations in water rights releases at the dam and at the Narrows between Alternatives 3A-C (Charts 4-17 and 4–18). In addition, the TDS levels in the water rights releases under Alternatives 3A-C would be similar to those under current operations (Alternative 2).

SWP water is commingled with water rights and fish rearing releases. The amount of SWP water released for both purposes under current operations and under Alternatives 3A-C is essentially the same. In addition, 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 TDS of releases for steelhead rearing would be about 581 mg/l for current operations, and 582 to 583 mg/l for Alternatives 3A-C.

The mean monthly TDS of flows at the Narrows from all sources (i.e., runoff and water rights releases) under Alternatives 3A-C may be as much as 100 mg/l less than under current operations (Alternative 2) in the fall months (Chart 4-19). The reduction in TDS at the Narrows in the fall is likely due to the more prolonged flows in the river under Alternatives 3A-C which include high quality SWP water.

Impacts of Alternatives 4A and 4B

Under Alternatives 4A and 4B, BNA releases would not be made from the dam. Instead, SWP water would be delivered to the Lompoc Valley from a pipeline and delivered directly to the City's treatment plant (Alternative 4A), or discharged to the river for purposes of groundwater recharge (Alternative 4B). Hence, the only water rights releases from the dam would be ANA releases. The TDS of the releases from the ANA or for fishery purposes would be similar to the TDS in the reservoir under Alternatives 4A and 4B. Based on the modeling, the predicted median annual TDS of fish releases is 581 mg/l for current operations compared to 590 mg/l under Alternative 4. This potential slight increase in TDS is considered an adverse, but not significant impact (Class III).

The predicted TDS concentration at the Narrows under Alternative 4A is shown on Chart 4-19. The TDS at the Narrows, except during the winter months, would be higher under Alternatives 4A and 4B than it is under both historic and current operations. This is because no flows would be released at the dam from the BNA account and there would be no release of SWP water into the river. Under both alternatives, the TDS may increase from 875 mg/l to 1,200 mg/l at the Narrows.

Downstream of the Narrows, the impacts of Alternatives 4A and 4B would vary. Under Alternative 4A, TDS would remain high downstream to the point of discharge of the wastewater treatment plant where the flows would re-enter the stream system.

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 current operations during times when SWP water is being discharged to the Lompoc Forebay. (Technical Memorandum 4, p. 19.) The recharge of the Lompoc Plain Groundwater Basin using higher quality water under Alternative 4B would have a beneficial impact (Class IV) at that location because it would improve surface water quality in the Lompoc Forebay during the discharge period. The beneficial impact would be offset, however, by higher TDS levels upstream of the Lompoc Forebay.

4.5.3 MITIGATION MEASURES

If Alternatives 4A and 4B are 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).

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.

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.

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 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). 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).

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. 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.

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.

<u>Recent Trends in Groundwater Quality</u>

Historical TDS concentrations in the City of Lompoc's municipal wells are shown on Chart 4-24 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. 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.

4.6.2 MODELING PERFORMED FOR THE EIR

4.6.2.1 Overview of 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 (2001d) 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.

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

The City of Lompoc developed the HCI model, which is described in HCI (1997). The City of 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, one Main, 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.

For Alternative 4A, a constant monthly delivery of SWP water to the City was assumed throughout the simulation period, based on an annual delivery of 1,770 afa, which is the average annual BNA amount delivered by releases from the dam. A minor reduction in the TDS of WWTP discharge due to these deliveries would be expected since the groundwater TDS ranges from 1,000 to 1,500 mg/l, while SWP water has a TDS of about 300 mg/l. The estimated proportion of constant SWP deliveries to the City under Alternative 4A in relation to monthly total demand, ranged from about 45 percent in the winter to 25 percent in the summer in the model. Hence, SWP deliveries were estimated to reduce the TDS of WWTP discharge, as represented in the USGS model, from about 1,000 mg/l to about 800 mg/l.

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 in Appendix B. Annual flows are very similar for all alternatives except for Alternatives 4A and 4B. Alternative 4A often shows lower annual flows while Alternative 4B often shows higher annual flows.

The simulated mean monthly flows at the Narrows are shown on Chart 4-27. The differences between alternatives are most apparent during summer months. Flows under Alternatives 1, 2, and 3A-C are almost identical throughout the year. In contrast, Alternatives 4A and 4B show very different flows in the summer compared to the other alternatives. In Alternative 4A, SWP water is not discharged to the river, but delivered directly to the City of Lompoc, resulting in lower river flows during dry months. Under Alternative 4B, SWP water is recharged directly at or below the Narrows and increases the flow significantly in dry months.

The simulated average annual TDS of river flows at the Narrows is shown on Chart 4-28. The monthly average TDS of flows simulated at the Narrows for each EIR alternative is shown on Chart 2-29. These data show the inverse relationship between flow and TDS. The TDS for Alternatives 3A-C are almost identical to one another. The TDS under these alternatives is up to 75 mg/l lower than under current operations (Alternative 2) during the summer months.

The TDS for Alternative 4B is substantially lower than current operations and other alternatives in the summer months because, at low flows, the effects of discharging SWP water below the Narrows for recharge significantly reduces the average TDS, even though the amount of water discharged is relatively small. The TDS for Alternative 4A is substantially higher than current operations and other alternatives in the summer because these flows do not contain SWP water, which would be piped to the Lompoc Basin under Alternative 4A.

In summary, the TDS of river water at the Narrows for Alternatives 3A-C are almost identical because all three alternatives entail releases from the BNA in the same manner, and with the same commingling of SWP water. The TDS of river flow for these alternatives at the Narrows is lower in the summer months compared to current operations and the same in the winter months. In contrast, two very different approaches are used under Alternatives 4A and 4B instead of releases from the BNA, which accounts for the very high TDS values for Alternative 4A in the fall, and the very low TDS values for Alternative 4B in the fall (Chart 4-29).

The flows under current operations (Alternative 2) at the Narrows are very similar to current recent operations (Alternative 1), but the TDS is lower due to the commingling of SWP water in releases from the dam (Charts 4-28 and 4-29).

4.6.3 POTENTIAL IMPACTS OF THE ALTERNATIVES

Results of Simulation Modeling

The results of the groundwater modeling using the USGS and HCI models are summarized in this section. Stetson (2001d) 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 1998; 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. 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 by100 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
SIMULATED AVERAGE TDS FOR SELECTED WELLS
IN THE MAIN ZONE (mg/l 1952-82)

Well	Alt 1 Order WR 89-18 Operations	Alt 2 Current Operations under Biological Opinion	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Recharge to Lompoc Forebay
HCI MODEL RESULTS							
Western Plain							
Well 26F1,3, 4, 5	2,331	2,330	2,329	2,329	2,330	2,327	2,332
Well 25D1, 3	2,020	2,018	2,016	2,016	2,016	2,010	2,018
Central Plain							
Well 31A1	1,786	1,784	1,782	1,784	1,782	1,809	1,803
Well 29N6	1,785	1,784	1,786	1,784	1,986	1,800	1,794
Eastern Plain							
Well 28M2	1,733	1,728	1,726	1,726	1,723	1,711	1,731
Well 34B1	1,019	1,009	1,005	1,006	1,002	1,019	842
City Wells							
City Wells –Avg.	1,022	1,012	1,010	1,011	1,008	1,029	854
USGS MODEL RESULTS							
Western Plain							
Well 26F1,3, 4, 5	2,901	2,885	2,842	2,844	2,850	2,794	2,906
Well 25D1, 3	2,291	2,273	2,349	2,231	2,235	2,174	2,284
Central Plain							
Well 31A1	2,180	2,180	2,176	2,176	2,176	2,159	2,176
Well 29N6	1,933	1,937	1,936	1,935	1,935	1,906	1,928
Eastern Plain							
Well 28M2	1,769	1,770	1,757	1,758	1,758	1,725	1,752
Well 34B1	984	973	976	974	974	982	931
City Wells							
City Wells –Avg.	1,115	1,108	1,110	1,109	1,107	1,102	1,085

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.

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.

Effects of Current Operations

Based on the modeling analyses, the TDS levels in the Lompoc Plain may show a minor reduction under current operations, which include the commingling of SWP water in water rights releases and additional releases for fish. The average annual differences in TDS levels between current operations (Alternative 2) and recent historic operations (Alternative 1) are shown in Table 4-33. The differences are very small relative to the total TDS levels in these wells (800 to 2,500 mg/l). The results from both models indicate that TDS levels in wells in the Lompoc Basin are expected to slightly decrease under current operations. The reduced TDS levels are likely due to a combination of high quality SWP water in water rights releases to the Narrows, as well as higher and longer flows in the summer with this high quality water due to releases for rearing flows. The difference in TDS between alternatives at a single well location (Table 4-33) is less than the inherent accuracy of either model. However, the aggregate results in Table 4-33 are sufficient to exhibit a trend of increased groundwater quality under current operations.

TABLE 4-33
DIFFERENCES IN AVERAGE TDS FOR SELECTED WELLS IN THE MAIN ZONE (mg/l) FROM 1952-82 UNDER CURRENT OPERATIONS COMPARED TO RECENT HISTORIC OPERATIONS

Well	HCI Model Results	USGS Model Results
Western Plain		
Well 26F1, 3, 4, 5	-1	-16
Well 25D1, 3	-3	-17
Central Plain		
Well 31A1	-2	-1
Well 29N6	-1	-4
Eastern Plain		
Well 28M2	-5	-1
Well 34B1	-9	-11
City Wells		
City Wells –Avg.	-10	-7

Effects of Alternatives 3A-C

The modeling results indicate that TDS levels in the groundwater of the Lompoc Basin under Alternatives 3A-C would improve (see Table 4-34), particularly in the western and eastern portions of the basin. The central plain appears relatively unresponsive to Cachuma Project operations.

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 groundwater modeling results indicate that Alternatives 3A-C would potentially decrease TDS levels in the Lompoc Plain over time. As such, they would result in a beneficial impact on water quality in the Lompoc Plain, and in the quality of the drinking water for the City of Lompoc (Class IV). There was no significant difference in the water quality improvements between Alternatives 3A-C.

TABLE 4-34
CHANGE IN AVERAGE TDS FOR SELECTED WELLS
IN THE MAIN ZONE – ALTERNATIVES 3 AND 4 (mg/l 1952-82)

Well	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Recharge to Lompoc Forebay
HCI MODEL RESULTS					
Western Plain					
Well 26F1, 3, 4, 5	<1	<1	<1	-3	2
Well 25D1, 3	-2	-2	-2	-8	<1
Central Plain					
Well 31A1	-2	<1	-2	26	20
Well 29N6	1	<1	1	16	10
Eastern Plain					
Well 28M2	-3	-2	-5	-17	3
Well 34B1	-4	-3	-7	10	-167
City Wells					
City Wells – Avg.	-2	-1	-5	17/-224*	-158
USGS MODEL RESULTS					
Western Plain					
Well 26F1, 3, 4, 5	-37	-41	-35	-91	21
Well 25D1, 3	-39	-43	-38	-99	10
Central Plain					
Well 31A1	-4	-4	-4	-20	-4
Well 29N6	<1	-1	-1	-31	-8
Eastern Plain					
Well 28M2	-13	-12	-12	-45	-18
Well 34B1	3	2	2	9	-42
City Wells					
City Wells – Avg.	2	1	-1	-6/-271*	-24

* Calculated as direct mixing with 1,770 afa of SWP water at an estimated TDS of 300 mg/l.

Effects of Alternatives 4A and 4B

Alternative 4A would entail reductions in groundwater pumping in the basin, and the indirect recharge of high quality SWP water in wastewater return flows. Alternative 4B includes direct recharge of high quality SWP water in the basin. Both alternatives would reduce TDS levels in portions of the Main Zone in the Lompoc Basin, and as such, would result in a beneficial impact 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 where 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.

It is more difficult to explain the HCI model response for Alternative 4A. The relative increase in TDS in the eastern plain, at Well 34B1, and in the City wells in the central plain may be due to the sensitivity of this model to reduced pumping which reduces the amount of storage available for recharge of good quality high flows from the river. The slight improvement in TDS in the western plain may result from a lesser amount of induced inflow from saline waters to the west, also due to reduced pumping. The TDS for Well 28M2 shows improvement for Alternative 4A, probably due to the proximity to the wastewater treatment plant discharge that was assumed to have a lower TDS for this alternative only.

In the USGS modeling results, Alternative 4A shows somewhat greater improvement than Alternative 4B due to reduced pumping and increased inflow of poor quality water from underlying formations and boundaries and then improved quality of wastewater discharge near Well 28M2. Alternative 4B shows a marked improvement in water quality in the eastern and central plains under the USGS model 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.

The data for City wells in Table 4-34 for Alternative 4A were not generated by the groundwater models. Instead, the flow-weighted model output for water pumped by City wells was combined with 1,770 afa of SWP water, assuming a TDS of 300 mg/l, to obtain a flow-weighted average TDS for the mixed water supply. The results indicate a significant theoretical improvement of about 250 mg/l in the quality of the City's water supply relative to any other alternative.

Effects on Groundwater Levels – All Alternatives

The results of both models indicate no significant changes in groundwater levels in the Lompoc Basin under Alternatives 3A-C, 4A, and 4B. Detailed time series graphs of water elevation changes due to pumping and recharge over the modeling period are provided in Stetson (2001d).

4.6.4 MITIGATION MEASURES

No mitigation measures are necessary because no significant impacts were identified due to the proposed alternatives.

4.7 SOUTHERN STEELHEAD AND OTHER FISH

4.7.1 EXISTING CONDITIONS

The following information about southern steelhead 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), as well as an update prepared by Entrix (2001) for this EIR.

4.7.1.1 Species Accounts

Twenty-six species of fish inhabit the Santa Ynez River watershed (Table 4-35), including 11 native species. Steelhead/rainbow trout, 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 arroyo chub, large- and small-mouth bass, sunfishes, and catfish, among others (Table 4-34). 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 steelhead. The Santa Ynez River lagoon is not designated as critical habitat for the tidewater goby. Tidewater goby populations north of Orange County were proposed for de-listing in 1999 but no action has yet occurred.

<u>Steelhead/Rainbow Trout</u>

Coastal rainbow trout are native to the Santa Ynez River and exhibit two distinctive life history strategies. Resident rainbow trout live their entire lives in freshwater. Anadromous steelhead are born in freshwater, emigrate to the ocean to rear to maturity, and then return to freshwater to spawn. It is common to find populations exhibiting both life history strategies within the same river system. Individuals exhibiting one life history strategy can produce offspring that exhibit the other strategy. Juveniles of rainbow trout and steelhead are indistinguishable except when steelhead juveniles smolt, typically during February through May. In August 1977, the NMFS listed anadromous steelhead as an endangered species under the federal ESA.

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*	N[1]	RATCL
Threespine stickleback	*Gasterosteus aculeatus*	N	RATCL
Prickly sculpin	*Cottus asper*	N	RATCL
Pacific lamprey	*Lampetra tridentata*	N	R
Arroyo chub	*Gila orcutti*	I[2]	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*	N[1*]	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

In the Santa Ynez River system, adult steelhead migrate from the ocean to spawn mainly January 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). Steelhead 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, adult steelhead may return to the ocean (about 30% of adults). Steelhead may spend one to several years in freshwater before emigrating to the ocean. Typically, however, southern California steelhead 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, steelhead may return to spawn in later years. Resident rainbow trout may reach maturity and spawn in their second year of life, although the time of first spawning is generally in their third or fourth year.

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. A second 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 rainbow trout. This level represents a water temperature below which reasonable growth of rainbow trout may be expected. Data in the literature suggests that temperatures above 21.5°C (71°F) result in no net growth, while maximum daily water temperatures greater than 25°C (77°F) result in potentially lethal conditions.

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 were common in the Santa Ynez River lagoon in 1987 and 1993, and both young-of-the-year and adults have been collected (DFG 1988, SYRTAC 1994).

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 pre-dawn 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.

<u>Threespine Stickleback</u>

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.

<u>Prickly Sculpin</u>

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.

<u>Pacific Lamprey</u>

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.

<u>Pacific Herring</u>

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 4-34). 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 steelhead 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 as a rainbow trout fishery until 1957 when largemouth bass, a warmwater species, were introduced into the lake. Since 1957, Cachuma Lake has been stocked with a variety of warmwater 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 fisherman 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 currently 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.

Mainstem Below Bradbury Dam

SYRTAC studies conducted from 1993 to 2000 have documented steelhead/rainbow trout in the mainstem Santa Ynez River downstream of Cachuma Lake. These studies have occurred during wet and average periods. Therefore, results probably do not reflect distribution and relative abundance in dry years. Steelhead/rainbow trout are found in the mainstem below Bradbury Dam, primarily in the first three miles downstream of the dam, but they have been observed rearing as far down as the Alisal Road bridge (approximately 10 miles downstream)

(SYRTAC 1997, 2000a). Steelhead use the mainstem primarily as a migration corridor to the habitat immediately downstream of the dam and to tributaries located on the south side of the watershed that provide perennial habitat. Chart 4-30 summarizes the locations where steelhead/rainbow trout have been observed in the mainstem during SYRTAC studies.

Spawning activity has been observed in the mainstem directly downstream of Bradbury Dam in nearly every year of the SYRTAC studies (SYRTAC 1997, 1998, 2000a), but no redds were reported in 1997 (SYRTAC 1998). While no spawning has been observed downstream of the Highway 154 Reach, redds have been observed in the Refugio Reach in 1999 and in the Alisal Reach in 2000 (SYRTAC 2000a; S. Engblom, pers. com. 2000). In addition, young-of-the-year have been documented in the Refugio and Alisal reaches in 1995 and 1998.

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.

Tributaries Below Bradbury Dam

Steelhead/rainbow trout have been observed during the SYRTAC studies in all of the major south-side tributaries, although use of Nojoqui Creek has been minimal. Chart 4-30 depicts the locations where steelhead/rainbow trout have been observed in the tributaries of the lower watershed according to the SYRTAC studies. The basis for the following summaries is Entrix (2001a).

- **Hilton Creek**. Steelhead/rainbow trout 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 steelhead/rainbow trout passage to upper Hilton Creek is impeded first at a cascade and bedrock chute (located about 1,380 feet upstream from the confluence with the Santa Ynez River) and then completely blocked at a culvert under the Highway 154 crossing (about 4,200 feet upstream from the confluence). Spawning has been observed between the cascade/chute impediment and the confluence with the Santa Ynez River. No spawning or young-of-the-year have been observed between the cascade and the Reclamation property boundary (about 2,980 feet upstream). A DFG fisheries biologist observed adult steelhead/rainbow trout in the pool immediately below the Highway 154 culvert (M. Cardenas, pers. com. 2000). A COMB fish biologist also observed adult steelhead/rainbow trout immediately below the Highway 154 culvert in 2000 (S. Engbloom, pers. comm., 2001).

  Adult steelhead/rainbow trout have been documented migrating into Hilton Creek in all years that SYRTAC observations have been made (SYRTAC 1997, 1998, 2000b), but numbers were low in years with low winter runoff. Actual spawning with production of young-of-the-year was documented in 1995, 1997, and 1998. Adults migrating into Hilton Creek are often large and could be anadromous steelhead from the ocean (particularly in wet years), rainbow trout that spilled over from Cachuma Lake, or fish that are resident in the river, its tributaries or the lagoon.

Young steelhead remain in fresh water for a year or more. Because Hilton Creek goes dry during the summer, young-of-the-year cannot complete rearing in lower Hilton Creek under natural conditions (SYRTAC 1997, 1998, 2000a). The fish are either stranded or must 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.

- **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 steelhead/rainbow trout. 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.

- **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 steelhead/rainbow trout were subsequently trapped in the lower creek. Trapping in lower Alisal Creek in January 1995 captured two adult steelhead/rainbow trout 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 rainbow trout juveniles and adults were found in Alisal Creek upstream of Alisal Reservoir (SYRTAC 1997). Bass and sunfish inhabit the reservoir. Many other steelhead/rainbow trout 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 steelhead/rainbow trout were observed or captured. Two adults were captured migrating upstream in March 1998 and another adult observed in a pool, but no steelhead/rainbow trout 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.

- **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. Steelhead/rainbow trout 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 steelhead/rainbow trout 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.

- **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 rainbow trout spawn and rear in the upper creek. In 1996 surveys, young-of-the-year rainbow trout 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.

- **Lagoon**. A number of species have been found in the lagoon. 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. 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

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). Habitat types (e.g. pool, run, riffle) and other habitat variables were documented including water quality, substrate, cover, instream vegetation, and riparian canopy. In addition, water temperatures and dissolved oxygen concentrations have been monitored in several locations. 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). Habitat conditions are expected to improve along the mainstem of the river as Reclamation implements the Biological Opinion over time. Reclamation began implementation of the Biological Opinion in 2001. Reclamation's first action along the mainstem was the initiation of low flow releases in September 2001 to meet interim rearing target flows at Highway 154.

<u>Summary of Fish Habitat</u>

- **<u>Spawning Habitat</u>**. As discussed in section 4.7.1.2, spawning habitat exists in the mainstem immediately downstream of Bradbury Dam, near Refugio Road, and downstream of Alisal Bridge. Good spawning habitat for steelhead/rainbow trout 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. Steelhead/rainbow trout consistently spawn in these tributaries. Good habitat occurs above passage impediments in San Miguelito and Alisal creeks.

- **<u>Rearing Habitat</u>**. Potentially good quality steelhead/rainbow trout 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 steelhead/rainbow trout 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 steelhead/rainbow trout. High quality steelhead/rainbow trout 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

Steelhead 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). A summary of steelhead habitat conditions is presented below based on Entrix (2001).

TABLE 4-36
MAINSTEM STUDY REACHES BELOW BRADBURY DAM

Reach Name	Landmarks	Reach Length (miles)	Miles below Bradbury Dam
Highway 154	Bradbury Dam down to Highway 154 Bridge	2.9	0 - 2.9
Refugio	Highway 154 Bridge down to Refugio Road	5.0	2.9 - 7.9
Alisal	Refugio Road down to Alisal Bridge in Solvang	2.6	7.9 - 10.5
Avenue of the Flags	Alisal Bridge in Solvang down to Avenue of the Flags Bridge in Buellton	3.1	10.5 - 13.6
Buellton to Lompoc	Buellton to Highway 1 Bridge in Lompoc (includes Weister and Cargasachi study sites)	23.9	13.6 - 37.5
Below Lompoc	Highway 1 Bridge in Lompoc to lagoon	8.3	37.5 - 45.8

Highway 154 Reach. The Highway 154 Reach extends from the dam to Highway 154 Bridge, at distance of about 2.9 miles. It has a more confined channel than reaches further downstream, as well as better riparian cover in general. This reach is dominated by pool habitat. Most of the pools are less than 3 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.

From a fisheries perspective, riparian vegetation in most areas of the lower Santa Ynez River is not well developed, and does not provide significant shading for aquatic habitats. 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) indicate that this reach of the mainstem Santa Ynez River is the only portion of the river where water temperatures remain within the tolerance limits of steelhead. 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.

Refugio Reach. Flows in the 5-mile long Refugio Reach often become intermittent or non-existent during the summer. The habitat composition is about 33 percent pools, 32 percent runs, 17 percent glides, and 18 percent 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 steelhead have been observed on a regular basis in the mainstem. Temperatures suitable for steelhead 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 is almost exclusively runs. 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 steelhead (Entrix, 2001).

Buellton to Lompoc. The mainstem between Buellton and Lompoc (about 37.5 miles downstream from Bradbury at the Highway 1 Bridge) extends 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. Deep pools, formed by numerous beaver ponds, dominate habitat two miles below the Lompoc Wastewater Treatment Facility. Runs were also extensive, accounting for 37 percent of the reach (Entrix, 2001). 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. Steelhead/rainbow trout have been observed during the SYRTAC (2000a) 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.

Hilton Creek. Hilton Creek flows are intermittent and highly dependent on seasonal rainfall. During wet years, the creek typically flows until late May, sometimes later depending on runoff. 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, impede the passage of migrating steelhead. 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 comprised of 58 percent riffle/cascade, 27 percent run, and 15 percent pool. Above the chute pool to the Reclamation property boundary (1,553 feet total), the habitat consists of 61 percent riffle/cascade, 34 percent run, and 5 percent pool. The reach just above the bedrock chute (about 300 feet) is consecutive run/riffle habitat with little or no canopy cover. Above this open 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 reach 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 1999, 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.

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 steelhead 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 steelhead/rainbow trout; 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 steelhead 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.

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 steelhead/rainbow trout. 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 4 pools, 2 riffles, and 1 run, 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 trout 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 trout 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 steelhead 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.

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.

4.7.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

The impacts of the various alternatives on fish in Cachuma Lake and along the lower Santa Ynez River are assessed below based on technical analyses and modeling performed by Entrix (2002) for this EIR.

4.7.2.1 Cachuma Lake – Rainbow Trout

Rainbow trout 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 rainbow trout. Fish spawned from lake rainbow trout 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.

Rainbow trout 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, rainbow trout inhabiting Cachuma Lake would not have difficulty ascending into tributaries under the varying lake levels of all alternatives.

4.7.2.2 Cachuma Lake – Game Fish

Many different fish inhabit Cachuma Lake including rainbow trout, 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 fish. 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.

To assess the effects of different lake levels under the alternatives, Entrix conducted an analysis (2001a), which entailed estimating the amount of critical shallow water habitat for selected lake fish 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.

The change in lake levels under the various alternatives is described in Section 4.2.2. Current operations (Alternative 2) exhibit slightly lower lake elevations compared to recent historic operations (Alternative 1). However, the frequency of reaching the maximum lake level and the duration of maximum lake levels have not changed.

Alternative 3A exhibits a lower lake elevation than under current operations (Alternative 2) due to greater releases for fish than under current operations, without a new surcharge. The median monthly lake elevation for Alternative 3B is about the same as under current operations (Alternative 2) because the greater releases for fish under Alternative 3B are offset by a 1.8-foot surcharge. Operations under Alternatives 3C, 4A, and 4B would exhibit higher lake levels due to surcharging at 3.0 feet.

The seasonal pattern of fluctuation would be similar among the four alternatives. In essence, the current shoreline at 750.75 feet would be shifted to a higher shoreline at 751.8 feet (Alternative 3B) or 753 feet (Alternatives 3C and 4) where the pattern of seasonal and annual fluctuation is generally repeated.

Entrix's analysis of lake level fluctuation on game fish focused on two representative fish types: bass and sunfish. 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. 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. 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.

Largemouth Bass Spawning Habitat

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. All scoring was based on a relative scale of zero to five, with five being better and zero being worse. Entrix compiled the frequency of each score and averaged scores over the 76-year simulation period. 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 zero indicates a lower likelihood that spawning would be successful.

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)

[*] "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

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 Entrix determined the maximum inundation depth based on sunfish spawning temperature ranges which vary during the spawning period. 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)

Bass and Sunfish Fry Rearing Habitat

For the purposes of this analysis, Entrix defined fry rearing habitat as areas less than 10 feet deep, and designated May 1 the beginning of the rearing season. 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 zero represents a drawdown of greater than 5 feet based upon the even distribution of scores and poorer habitat conditions.

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 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.

<u>Evaluation of Alternatives</u>

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). Lake levels in April and May are similar for all alternatives (within two 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.

There are several small differences in the habitat scoring in April. Under current operations (Alternative 2), there is a negligible decrease (one year) in the expected number of years with high spawning habitat scores compared to recent historic operations (41 versus 42, Table 4-37). This effect is caused by a greater drawdown of the lake due to releases for downstream fish. This decrease would not occur in May.

Alternatives 3A-C and 4A-B would have four fewer years with high spawning scores in April than under current 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 3A-C and 4A-B. In addition, the number of years with spawning scores of 4 would be the same under Alternatives 3A-C and greater under Alternative 4A-B than under current conditions. Based on these results, Alternatives 3A-C and 4A-B are expected to have a neutral to slightly beneficial impact (Class IV) on bass spawning habitat along the margins of the lake.

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)
1 (historic)	42	32	1	1	0	0	4.5
2 (current)	41	33	1	1	0	0	4.5
3A	37	36	2	1	0	0	4.4
3B	37	36	2	1	0	0	4.4
3C	37	36	2	1	0	0	4.4
4A-B	37	36	2	1	0	0	4.4
MAY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	23	41	11	1	0	0	4.1
2 (current)	23	43	9	1	0	0	4.2
3A	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
4A-B	23	45	7	1	0	0	4.2

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). The average scores for each alternative are either the same or within a tenth of a point during the spawning period of March through June. The results show a general decrease in the stability of spawning habitat over the course of the spring and early summer for all alternatives.

TABLE 4-38
SCORES FOR SUNFISH SPAWNING IN CACHUMA LAKE

MARCH							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	53	18	2	0	1	2	4.5
2 (current)	53	18	2	0	1	2	4.5
3A	47	23	2	1	1	2	4.4
3B	47	23	2	1	1	2	4.4
3C	47	23	2	1	1	2	4.4
4A-B	46	22	4	1	1	2	4.4
APRIL							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	39	34	1	0	0	2	4.4
2 (current)	37	35	2	0	0	2	4.4
3A	33	37	4	0	0	2	4.3
3B	33	37	4	0	0	2	4.3
3C	33	37	4	0	0	2	4.3
4A-B	33	37	4	0	0	2	4.3
MAY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	23	38	8	6	1	0	4.0
2 (current)	23	38	7	7	1	0	4.0
3A	23	36	9	7	1	0	4.0
3B	23	36	9	7	1	0	4.0
3C	23	38	7	7	1	0	4.0
4A-B	23	36	10	6	1	0	4.0
JUNE							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	7	38	19	9	2	1	3.5
2 (current)	7	35	24	7	3	0	3.5
3A	7	31	30	4	4	0	3.4
3B	7	32	28	5	4	0	3.4
3C	7	32	29	4	4	0	3.4
4A-B	7	28	37	3	1	0	3.5

The results indicate that current operations (Alternative 2) are not adversely affecting sunfish spawning habitat compared to recent historic operations (Alternative 1). In addition, the project alternatives (Alternatives 3A-C and 4A-B) would not adversely affect sunfish spawning habitat, even with lake surcharging.

Bass and Sunfish Fry Rearing Habitat

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).

TABLE 4-39
SCORES FOR SUNFISH FRY REARING IN CACHUMA LAKE

MAY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	31	33	10	1	1	0	4.2
2 (current)	31	35	8	1	1	0	4.2
3A	29	37	8	1	1	0	4.2
3B	30	36	7	2	1	0	4.2
3C	30	36	6	3	1	0	4.2
4A-B	29	39	5	2	1	0	4.2
JUNE							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	11	40	16	6	3	0	3.7
2 (current)	11	42	15	5	3	0	3.7
3A	11	43	16	3	3	0	3.7
3B	11	42	16	4	3	0	3.7
3C	11	42	16	4	3	0	3.7
4A-B	11	45	18	1	1	0	3.8
JULY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	2	25	18	23	8	0	2.9
2 (current)	2	24	21	25	4	0	2.9
3A	2	27	21	22	4	0	3.0
3B	2	27	19	24	4	0	3.0
3C	2	27	19	24	4	0	3.0
4A-B	2	29	33	10	2	0	3.3

Table 4-40 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 equally.

TABLE 4-40
MEDIAN AVAILABLE FRY REARING HABITAT
IN CACHUMA LAKE

	Median Monthly Habitat Area (Acres) for Alternatives					
	1	**2**	**3A**	**3B**	**3C**	**4**
Start of Season	314	316	309	315	320	322
May	309	310	303	309	315	315
June	296	299	296	300	306	307
July	285	286	285	290	295	298
End of Season	277	276	276	281	286	287
Median*	293	293	289	293	299	300
Range*	148-357	147-361	145-361	146-368	147-375	148-375

Based on these analyses, current operations are not adversely affecting rearing habitat. In addition, the project alternatives (Alternatives 3A-C and 4A-B) would not adversely affect bass and sunfish rearing habitat, even with lake surcharging.

4.7.2.3 Impacts on Southern Steelhead ESU along the River

The effect of different downstream flow regimes under the various alternatives is described below based on Entrix (2000b). The analysis in this section focuses on mainstem habitat for steelhead/rainbow trout.

The primary method by which the alternatives may affect fish resources is through changes in streamflow, therefore, a score value was assigned to each monthly flow. The SYRHM computed mean daily flows for each month of years 1918 through 1993 under each alternative.

To provide an objective basis for comparing flow-related impacts under different alternatives, a scoring system was developed to evaluate the likely effect of different flow regimes on fish habitat in the lower Santa Ynez River. The 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. A separate 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 scoring criteria are shown in Table 4-41.

The frequency of each score value was calculated for the 76-year period of record for each alternative. Scores were then averaged.

TABLE 4-41
SCORING CRITERIA FOR STEELHEAD HABITAT

Life Stage	Flow Location	Months Considered	Scores					
			← better			worse →		
			(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.

Method of Analysis and Scoring

To allow steelhead/rainbow trout to migrate within the mainstem and into the tributaries, passage flows must be available within the system and the sandbar at the mouth of the lagoon must be open. A passage analysis was conducted to determine where potential low-flow impediments are located 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 provides sufficient flow to pass the identified critical riffles between Bradbury Dam and the lagoon 92 percent of the time (SYRTAC, 2000a). Therefore, 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.

Adult steelhead primarily migrate upstream in the Santa Ynez River from February through April (SYRTAC 1997, 2000a and b). 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. 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. NMFS considered 14 days of passage in a particular year to be an adequate passage opportunity (NMFS, 2000), and therefore this was given a score of 5 (Table 4-41).

The Highway 154 Reach was selected as the index location for spawning and rearing habitat. This location was used because results of studies conducted by the SYRTAC (2000a) demonstrate that good spawning and rearing habitat for steelhead/rainbow trout are found here. For mainstem spawning, there must be sufficient flow to provide some habitat during some or all of 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 habitat area to flow in the Highway 154 reach that was used to develop the flow criteria used for the spawning habitat in Table 4-41.

The scoring system developed for fry and juvenile rearing in April through August was based on the rearing target flows levels established in the Biological Opinion. The minimum, long-term rearing target flow level established by the Biological Opinion for rearing is 2.5 cfs, therefore, this flow was equated with a score of "3," which falls in the middle of the scoring range. No flow conditions 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.

Results

The scoring of passage opportunities among the alternatives was divided into two categories as shown in Table 4-42. The number of years that would meet the passage criteria established in the Biological Opinion (i.e., 14 days of passage flows at Alisal, resulting in a score of "5") under current operations and recent historic operations would be the same - in 21 of the 52 years (Table 4-42). Current operations do not include releases to facilitate passage. In contrast, Alternatives 3A-C and 4A-B would substantially increase the frequency of years with passage for steelhead due to releases to supplement passage (Table 4-42). Hence, these alternatives would result in a beneficial impact (Class IV) on steelhead passage compared to current operations.

TABLE 4-42
SCORES FOR STEELHEAD ADULT MIGRATION
AT THE ALISAL ROAD BRIDGE

Alternatives	Frequency of Scores						
	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	21	0	5	4	6	16	2.6
2 (current)	21	4	2	5	5	15	2.7
3A	31	6	0	2	1	12	3.5
3B	31	6	0	2	1	12	3.5
3C	31	6	0	2	1	12	3.5
4A-B	31	4	2	2	2	11	3.5

Under current operations (Alternative 2), spawning flows greater than 30 cfs are provided in 23 of the 52-year simulation period (Score "5" in Table 4-43). A similar frequency for spawning flows of 30 cfs would occur under recent historic operations (Alternative 1). 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. Current operations also result in fewer years in which spawning is prohibited, that is, years with score of "0" which represents spawning flows less than 2.5 cfs) compared to recent historic operations.

The frequency of high flows for spawning (30 cfs or more) under Alternatives 3A-C and 4A-B would be the same as under current operations. However, these alternatives would also increase the number of years with intermediate flows for spawning (i.e., years with spawning scores of "2" and "3"). These alternatives would have fewer years in which there is little flow (less than 5 cfs, scores of "0" and "1"). Hence, these alternatives would result in a beneficial impact (Class IV) on steelhead spawning compared to current operations.

TABLE 4-43
SCORES FOR STEELHEAD/RAINBOW TROUT SPAWNING
AT THE HIGHWAY 154 BRIDGE

Frequency of Scores							
	← better			worse →			
Alternatives	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1 (historic)	23	2	6	10	12	23	2.3
2 (current)	23	5	5	11	22	10	2.6
3A	23	7	17	17	10	2	3.1
3B	23	7	17	18	9	2	3.1
3C	23	7	17	18	9	2	3.1
4A-B	23	4	16	23	10	0	3.1

Under recent historic operations (Alternative 1), no flows or very low flows (2.5 cfs) would occur during some portion of the fry rearing period in 64 of 76 years of the simulation period (scores “0” and “1” in Table 4-44). During low and no flow conditions, fry and juvenile steelhead/rainbow trout may shelter in isolated pools. However, they are subject to predation by bass and sunfish. In contrast, poor fry rearing habitat is mostly avoided under current operations (Alternative 2). The releases for rearing under current operations (interim target flows) would provide flows of 5 to 10 cfs (a score of “4”) in 17 of 76 years, compared to one year under recent historic operations. Hence, the current operations are improving fry rearing conditions for steelhead.

The frequency and quality of fry rearing habitat flows under the project alternatives (Alternatives 3A-C and 4A-B) would significantly improve fry rearing conditions compared to current operations (Alternative 2), as shown in Table 4-44. The higher releases for rearing under these alternatives would result in 50 or more years of rearing flows with a score of 4 during the 76-year simulation period compared to 17 years under current operations. Hence, these alternatives would result in a beneficial impact (Class IV) on steelhead fry spawning along the mainstem of the river compared to current operations.

TABLE 4-44
SCORES FOR STEELHEAD/RAINBOW TROUT FRY REARING
AT THE HIGHWAY 154 BRIDGE

Frequency of Scores							
	← better			worse →			
Alternatives	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1	0	1	3	8	14	50	0.6
2	1	16	38	21	0	1	2.9
3A	0	50	25	0	0	1	3.6
3B	0	52	23	0	0	1	3.6
3C	0	54	21	0	0	1	3.7
4A-B	0	53	22	0	0	1	3.7

The results of the analysis of juvenile rearing habitat for the various alternatives (see Table 4-45) follow the same pattern and support the same conclusions as for fry rearing habitat.

TABLE 4-45
SCORES FOR STEELHEAD/RAINBOW TROUT JUVENILE REARING
AT THE HIGHWAY 154 BRIDGE

Frequency of Scores							
	← better			worse →			
Alternatives	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
1	0	0	1	0	4	71	0.1
2	0	15	39	20	0	2	2.6
3A	0	38	36	0	0	2	3.4
3B	0	39	35	0	0	2	3.4
3C	0	41	33	0	0	2	3.5
4A-B	0	41	33	0	0	2	3.5

4.7.2.4 Impacts on Resident Fish along the River

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. 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.. The study evaluated how wetted width of the river, or top width, changed as a function of flow in the various habitat types. 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 in conjunction with the evaluation in the Biological Opinion 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. The results indicate that current operations (Alternative 2) provide more rearing habitat during the driest part of the year than under recent historic operations (Alternative 1). Without the releases to meet interim rearing target flows under current operations, there would no flow at the Highway 154 bridge in 71 of 76 years used in the simulation.

The frequency and quality of rearing habitat under the project alternatives (Alternatives 3A-C and 4A-B) would be significantly greater than under current operations (Table 4-46) because these alternatives would involve higher rearing target flows, including target flows at Alisal Bridge. <u>Hence, these alternatives would result in a beneficial impact (Class IV) on resident fish rearing along the mainstem of the river compared to current operations.</u>

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)
1	0	0	1	0	4	71	0.1
2	0	15	39	30	0	2	2.6
3A	0	38	36	0	0	2	3.4
3B	0	39	35	0	0	2	3.4
3C	0	41	33	0	0	2	3.5
4A-B	0	41	33	0	0	2	3.5

4.7.3 MITIGATION MEASURES

No mitigation is required because the project alternatives would not result in any significant impacts to fish in Cachuma Lake or along the lower Santa Ynez River, including the endangered southern steelhead.

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 occur around Cachuma Lake, as summarized below and shown on Figure 4-7.

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 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 and blue 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 dumosa*).

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* sp.).

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 glutinosa)* and willow (*Salix lasiolepsis, laevigata, 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, poison oak, box elder (*Acer negundo*), hoary nettle (*Urtica holosericea*), and bristly ox tongue (*Picris echioid*). Tamarisk 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* sp.), mulefat (*Baccharis salicifolia*), coyote brush (*Baccharis pilularis* ssp. *consanguinea*), sweetclover (*Melilotus indicus*), tree tobacco (*Nicotiana glauca*), mustard (*Brassica geniculata*), *Raphanus sativus*, *Malva parviflora*, *Carduus pycnocephalus*, *Xanthium strumarium*, *Matricaria matricarioides*, and grasses such as *Bromus diandrus*, *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* sp.), sedges and bulrushes (*Carex* sp., *Cyperus* sp., *Scirpus* sp.), 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*, *laevigata*, *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 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.*) and frankenia (*Frankenia sp.*) 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* sp. 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 (*Ceonothus megacarpus*), spiny redberry (*Rhamnus crocea*), chamise (*Adenostoma fasciculatum*), sage (*Salvia* sp.), and scrub oak (*Quercus dumosa*).

- **Coastal Sage Scrub –** occurs on dry, rocky slopes. Dominant species include California sagebrush (*Artemisia californica*) and sage (*Salvia* sp.).

<u>Riparian Vegetation Conditions Within Each Reach</u>

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 and 4-8b. The dominant vegetation types, relative density ranking, relative disturbance ranking, and adjacent land uses for each reach are summarized on Figure 4-8.

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. 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.

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 become 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.

Jones & Stokes (2000) identified the following project-related factors that have affected the riparian vegetation downstream of Bradbury Dam:

- <u>Reduced Sediments.</u> 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.

- <u>Reduction in Peak Flows.</u> 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.

- <u>Effect on Channel Migration.</u> 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 three 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 Narrows 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 section 4.8.2.5.

4.8.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.8.2.1 Impacts to Lakeshore Vegetation

The maximum lake elevation under recent historic operations (Alternative 1) is 750 feet. In 1993, the maximum lake elevation was increased to 750.75 feet to store water for releases for fish under the Fish MOU. This maximum lake level is now observed under current operations (Alternative 2). Maximum lake levels would increase 1.8 feet under Alternative 3B and 3.0 feet under Alternatives 3C and 4A-B due to surcharging the reservoir.

The effect of surcharging on lake levels is discussed in Section 4.2.2.2. Surcharging would 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 (Alternative 3B) and 3.0 feet (Alternative 3C and 4A-B). The results are shown in Table 4-47. 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 (current operations – Alt. 2 and Alternative 3A)	3,056	--	--	--
751.8 (1.8’ surcharge, Alt. 3B)	3,098	42	15	218
753.0 (3’ surcharge, Alts. 3C, 4A-B	3,147	91	25	363

Increased maximum lake levels over current 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.

To estimate the effect of higher lake levels on shoreline vegetation, boat surveys were conducted 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, 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 and 4A-B (compared to current 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 Section 4.8.2.2.

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, and 4A-B would have a neutral effect on wetlands along the lake margins.

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

4.8.2.2 Impacts to Lakeshore Oak Trees

Estimate of Oak Tree Loss

As shown in Table 4-48, surcharging to 1.8 and 3.0 feet would affect oak woodlands that occur along the margins of the lake. To more precisely determine the magnitude of the impacts of surcharging under Alternatives 3B, 3C, and 4A-B, field surveys were conducted to inventory the number of trees in the inundation zone (Figure 4-9). Surveys were conducted from both the shore and from a boat. Only trees with diameters of 6 inches at breast height were counted. The only oak trees that occur in the inundation zones are coast live oak and valley oak. Field estimations were supplemented by a review of detailed topographic maps depicting large trees in the County Park (1”=100’ scale). A topographic map at scale 1”=400’ 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 estimated. The number of trees in a 3-foot wide zone above the new maximum lake levels was also estimated. 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.

Cachuma Lake exhibits a clearly visible high-water line below which oak trees are mostly absent. The few oaks that are rooted below 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. Based on the field investigations, this EIR assumes that 25 percent of trees in the wave impact zone would be destroyed, and that all others would persist due to the infrequent nature of the impact in this zone.

The loss of trees in the direct inundation zone is expected to occur over many years, possibly 10 or 15 years, unless there is a significant surcharging event with unusually high and rough wave action that physically topples trees in the wave impact zone. The loss of trees in the wave action zone is expected to occur over a longer period of time, possibly 20 or more years based on field observations of trees in the current wave action zone created over 40 years ago. A summary of the total number of oak trees that would be lost under Alternatives 3B, 3C, and 4A-B is provided in Table 4-49. No oak trees would be lost under the other alternatives because they do not involve increasing maximum lake levels over the current one.

TABLE 4-49
ESTIMATE OF OAK TREES AFFECTED IN INUNDATION ZONES

Alternative	Number of Oak Trees Affected. (All coast live oak except for Valley Oaks shown in parentheses)		
	Direct Inundation	Indirect Impacts due to Wave Action (approx)	Total
3B (1.8' surcharge)	158 (14)	113 (10)	247 (24)
3C and 4A-B (3.0' surcharge)	339 (30)	113 (10)	412 (40)

<u>The loss of oak trees under Alternatives 3B, 3C, and 4A-B along the margins of Cachuma Lake is considered a significant, unmitigable impact (Class I).</u> A proposed oak tree restoration program is described below in section 4.8.3 that is designed to compensate for the loss of trees at the lake. The loss of oak trees under both surcharging scenarios (1.8 and 3 feet) is considered significant and unmitigable until such time that the replacement trees have become well established and self-sustaining, which is estimated to be about 10 years. <u>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</u>. 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.

4.8.2.3 Impacts to Riparian Vegetation along the River

<u>Impacts of Current Operations</u>

As discussed in section 4.8.1.2, Jones and Stokes's recent study concluded that Cachuma Project operations as a whole have not adversely affected riparian vegetation along the Santa Ynez River downstream from Bradbury Dam. Similarly, current operations probably will not adversely affect riparian vegetation compared to recent historic operations.

As described in Section 4.2.2.3, current operations (Alternative 2) have altered the downstream hydrology in the following manner compared to recent historic operations (Alternative 1):

- The spill frequency and average annual spill amount under current conditions are slightly less (about 3 percent) than under recent historic operations.

- Due to current fish releases, the low flows downstream of Cachuma Lake occur for a slightly longer duration and over a larger portion of the river than under the recent historic operations. For example, under the current operations, flows at Highway 154 are 5 cfs or greater 47 percent of the time. (Table 4-9.) In contrast, flows of 5 cfs or more under recent historic operations occurred only 40 percent of the time. The increase in downstream low-flows under current operations becomes smaller with distance from the dam, such that there is very little difference in the frequency of low-flows near Alisal Road.

- The median monthly flows from the dam to the Narrows under current operations are greater than, or equal to, flows under recent historic operations in most months of the year.

- There is very little difference in the frequency of high flows (i.e., 20-100 cfs, but not including flood flows) downstream of the dam between current and recent historic operations because such flows are primarily due to natural runoff, not releases for water rights or fish.

The above changes in hydrologic conditions downstream of Cachuma Lake are likely to 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 was generally absent from the river channel under current conditions. The availability of water throughout the year in the channel would extend the growing season for phreatophytes and reduce the period of drought stress. The increase in riparian vegetation likely would be evident in the next several years as releases for fish continue. The effect is probably would be most pronounced in the reach between the dam and Highway 154 where rearing flows for steelhead would be continuous except in drought years. The effect would extend further downstream but would be attenuated with distance from the dam. The increase in riparian vegetation probably would not be measurable below Buellton where flows would not be maintained for fish.

Under current operations, the frequency of spills will be reduced about 3 percent. Flood flows during spills cause disturbance to instream riparian vegetation that creates multiple age-classes and structural diversity. Flood flows disturb floodplains and create new wetted areas that are suitable for the germination and establishment of new riparian plants. Overall, flood flows that disturb and remove riparian vegetation are important in maintaining the long-term vigor and reproduction of riparian vegetation.

The reduction in spills under the current operations may have an adverse impact on the long-term health and reproduction of existing riparian vegetation along the river. However, it is not clear that this impact is currently occurring or is likely to occur in the future for several reasons. First, the reduction in flood flows under current operations is very small, possibly too small to have a measurable effect. Second, the more substantial reduction in flood flows caused by the construction of Bradbury Dam has apparently not adversely affected riparian recruitment along the river to date. No evidence exists that the riparian recruitment along the river is limited by the frequency of flood disturbance. As discussed in section 4.8.1.2, Jones & Stokes (2000) concluded that 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.

Impact of Operations under Project Alternatives

As described in section 4.2.2.3, project alternatives (3A, 3B, 3C, and 4A-B) would alter downstream hydrology in the following manner compared to current operations (Alternative 2):

- The spill frequency and average annual spill amount under the project alternatives would be slightly less than under current operations**.**

- The releases for steelhead flows downstream of the dam under Alternatives 3A-C and 4A-B would be greater than under current operations (Alternative 2) because they would involve passage flows and higher rearing target flows.

- Releases for purposes of satisfying downstream water rights under Alternatives 3A-3C would be slightly less than under current operations because the additional releases for fish under these alternatives would reduce the need for releases to replenish groundwater basins. In contrast, releases for water rights under Alternative 4A-B would be substantially less (3,940 versus 6,023 afa) than under current operations because releases for the BNA would not be made from the dam. (Table 4-7.) Hence, there would be less flow downstream of the dam under Alternative 4A-B.

- The frequency and amount of low-flows (2-5 cfs) downstream of the dam (to Alisal Road) are similar among the project alternatives (3A-3C and 4A-B), and more than under current operations. However, downstream of Alisal Road, low-flows under Alternative 4A-B would be less frequent and would have less volume (than under all other alternatives) because BNA releases to the river would not being made from the dam.

Alternatives 3A-C would slightly reduce (2-5 percent) the frequency of spills compared to current operations. (See Table 4-7.) Alternative 4A and 4B would result in a 10 percent reduction in the frequency of spills compared to current operations. Uncontrolled downstream flows facilitate riparian recruitment on floodplains and may be necessary for long-term health of the riparian vegetation, as discussed above. The reduction in spill frequency is considered a potentially adverse, but less than significant impact (Class III).

Under Alternatives 3A-C and 4A-B, the frequency and amount of low flows (2-5 cfs) would increase, primarily from the dam to Alisal Road, compared to current conditions. The additional flows are expected to increase the instream riparian vegetation, as described above. This impact is considered beneficial (Class IV) to wetland and riparian vegetation.

Alternatives 4A and 4B would reduce the frequency of flows between 10 and 20 cfs below Alisal Bridge compared to current operations (Alternative 2) because this alternative would not include BNA releases from Bradbury Dam. (Table 4-9.) The reduction in frequency of flows between 10 and 20 cfs would be very small (3–7%) and is not likely to reduce downstream riparian vegetation growth and vigor. The reduction in flow frequency is considered a potentially adverse, but less than significant impact (Class III).

4.8.2.4 Impacts to Riparian Vegetation from the Delivery of SWP Water under Alternative 4A-B

Under Alternative 4A, SWP water would be delivered year-round directly to the City of Lompoc's water treatment facility on North Avenue. A 10-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 roads and would be placed beneath the Santa Ynez River by directional drilling. The disturbance of riparian vegetation due to construction activities related to Alternative 4A is a potentially significant but mitigable impact (Class II). Direct impacts to riparian vegetation in the river at the crossing location would be avoided by the directional drilling method.

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

None of the six sensitive plant species listed in section 4.8.1.3 occur around the margins of Cachuma Lake nor 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.

4.8.3 MITIGATION MEASURES

As described in section 4.8.2.2, surcharging under Alternatives 3B, 3C and 4A-B could result in the loss of 271 to 452 oak trees, a significant, unmitigable impact, at least in the near-term. The loss of mature oak trees eventually could be mitigated by implementing an oak tree replacement program.

The objective of an oak tree replacement program would be to replace coast live and valley oak tees lost due to periodic surcharging in a phased manner linked to the incremental loss of oak trees over time. The program would utilize 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. It may not be feasible to acquire land or easements from private landowners outside the Recreation Area for the purposes of oak tree restoration. By locating the restoration sites on federal land, Reclamation would have full control to maintain and protect new oak tree habitat.

Reclamation recently completed the preparation and initial implementation of another oak tree restoration program at the Cachuma Recreation Area (Tetra Tech, 2001). In 1996, Reclamation began modifying Bradbury Dam to correct seismic deficiencies. The Bradbury Dam Project involved excavation and fill activities at the dam and surrounding area. Reclamation issued an Environmental Assessment (EA) and Supplemental EA in 1996 and 2000, respectively, for the project. The project has resulted in the loss of about 282 coast live and valley oak trees at several borrow sites near the dam.

In March 2001, Reclamation issued a final oak tree restoration plan for the Bradbury Dam Project. The plan identifies six oak tree restoration sites in the Recreation Area where approximately 3,000 coast live and valley oak trees will be planted over the next several years. Initial planting began in early 2001. These sites are remote areas with annual grassland or rangelands and are not used for any recreational activities (Figure 4-10). Reclamation conducted a comprehensive search for suitable oak restoration sites during the preparation of the Bradbury Dam Project oak restoration plan. All suitable sites outside the Cachuma Lake County Park area have been designated for use under this program.

Accordingly, oak tree restoration opportunities at the 375-acre County Park were explored for this EIR. URS Corporation met with staff from the Santa Barbara County Parks and Recreation Department (County Parks) to discuss oak planting opportunities. As described in Section 4.10.1.1, County Parks has a 50-year lease from Reclamation to develop and manage the land within the park. The County Park staff indicated that there is no recruitment of oak trees in the park due to disturbance by park visitors. There is a severe need to plant young oak trees in the County Park to replace the mature trees that are present, and that are expected to suffer ongoing natural mortality. The park staff wishes to initiate an oak tree planting program immediately to ensure that there will be adequate shade and habitat in the park boundaries in the next 20 years.

County Parks initiated a small oak tree planting program several years ago involving the planting of about 200 coast live oak trees in the park. Most of these trees have become established saplings and are protected by stakes and fencing, as needed. However, this planting program was very limited in scope. The park staff indicated that the County Parks does not have the funding to initiate a large-scale oak restoration program.

Based on the above considerations, implementing an oak tree restoration program in the County Park would provide both mitigation for trees removed by surcharging, and would benefit recreational uses at the park. The restoration program would 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. It would be implemented in cooperation with County Parks.

The park contains a significant amount of mature coast live and valley oak woodlands – approximately 1,200 mature trees (Figure 4-11). Most of the woodland areas contain an understory of annual grassland and native shrubs. Although the entire County Park is accessible to park users, the woodlands represent remnants of a more natural woodland setting with native wildlife populations. The latter include common species such as the western fence lizard and arboreal salamander. Common small mammals at the park include the Virginia opossum, dusky-footed woodrat, striped skunk, raccoon, and coyote. Birds that use the oak woodlands at the park include red-tailed hawk, barn owl, Anna's hummingbird, Nuttal's woodpecker, northern flicker, ash–throated flycatcher, scrub jay, plain titmouse, bushtit, California quail, mourning dove, and dark-eyed junco.

Reclamation would implement the program in phases. One half of the trees to be planted would be installed immediately. Reclamation would then monitor the loss of trees during surcharge events over the next 10 years. The number of downed or dying trees would be counted immediately after surcharging events, as well as during the months when the water level recedes and bank erosion could occur. The number of trees lost during that year would be replaced at the County Park. At the end of 10 years, Reclamation would conduct a final count of trees in the inundation zone to determine the remaining number of trees that are likely to die due to inundation, and as such, need to be replaced. Final replacement trees would be planted immediately to complete the replacement process. This phased approach is recommended to ensure a precise count of trees affected by surcharging and to allow Reclamation and County Parks the opportunity to refine and enhance the oak restoration program over time based on actual planting and maintenance experience.

Oak trees would be replaced at a ratio that ensures a final 2:1 replacement ratio – that is, the target number of mature oak trees (at 20 years) would be twice the number removed by surcharging. Use of a target replacement ratio greater than 1:1 provides compensation for the loss of mature trees. To achieve the target replacement ratio, oak trees will need to be planted at a higher initial replacement ratio to compensate for the loss of trees during early development due to predation, drought stress, disease, and vandalism. The mortality observed by County Parks during their recent oak planting efforts at the park was about 33 percent. The mortality was due to predation by gophers, drought stress, and vandalism. This mortality rate is relatively low due to the ease by which County Park's personnel can protect and maintain plants. Based on this observed mortality rate, the initial replacement ratio to account for mortality would be 3:1 (incorporating a 2:1 replacement ratio and factor to account for mortality).

Coast live and valley oak trees would be planted in proportion to their occurrence in the surcharge impact zone. Approximately 90 percent of the trees to be planted would be coast live oak.

URS Corporation conducted field investigations at the County Park in May 2001 to identify oak tree restoration sites and to determine how many trees could be planted at the site. URS Corporation identified 52 "study units" at the park, which were demarcated by roads and other obvious boundaries, as shown on Figure 4-12. URS Corporation excluded active playing fields and developed areas. URS counted all oak trees in each unit and calculated density values. Based on the observed densities, URS Corporation identified and mapped (Figure 4-12) three categories of density: (low (1-12 trees per acre), moderate (13-24 trees per acre), and high (>25 trees per acre). The combined total number of mature coast live oak and valley oak trees in the study units is 1,170.

Based on observations of oak tree densities at the park, URS Corporation set the following target densities for each unit. The overall objective was to create more closed canopy groves at the park to provide shade and more habitat for birds, insects, and small mammals.

- For low-density units, one half of the units would be planted to achieve a moderate density in 20 years (19 trees per acre), and one half of the units would be planted to achieve a high density in 20 years (30 trees per acre).

- For moderate density units, one half of the units would be planted to achieve a high density in 20 years (30 trees per unit) and the remainder of the units would not be planted.

- Five units with high density would be planted with a small number of oaks, primarily to fill in open areas.

Based on this planting approach, the total number of new trees that could be successfully established over time in the park is as follows: 768 in low density units, 197 trees in moderate density units, and 89 trees in high density units, for a total of 1,054 additional trees. This value represents the maximum number of trees that should be established in 20 years at the park. Additional trees would interfere with recreational uses or would be difficult to established due to crowding.

The estimated number of trees that would be adversely affected by surcharging is presented in Table 4-50. In addition, Table 4-41 presents the final target number of trees and the initial number of trees that would be planted for each alternative. Sufficient opportunity exists to achieve the initial planting objective for the 1.8-foot surcharge under Alternative 3C, but insufficient space exists to plant the required number of trees under Alternatives 3C and 4A-B.

TABLE 4-50
OAK TREE REPLACEMENT QUANTITIES AND RATIOS

Alternative	Number of Oak Trees		
	Removed by Surcharging over Time	Final Target Number of Trees based on 2:1 Replacement Ratio	Initial Planting based on 33 % Mortality (3:1 initial replacement ratio)
3B (1.8' surcharge)	271	542	813
3C, 4A-B (3' surcharge)	452	904	1,356

As noted above in section 4.8.2.2, the loss of oak trees under both surcharging scenarios (1.8 and 3 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. 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. 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 3A-C, and 4A-B, Reclamation shall implement the proposed long-term oak tree restoration program at the Cachuma Lake County Park as described in this section. Oak trees shall be replaced at a ratio that ensures a 2:1 replacement ratio ten years after the first surcharge event. The maximum number of new trees that may be established at the 375-acre park is 1,054 coast live oak and valley oak trees. 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 shall implement the program in phases. One half of the trees to be planted based on total estimated tree loss shall be installed immediately. Reclamation shall then 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 4A is pursued, the facilities associated with Alternative 4A shall be designed and constructed to ensure avoidance of significant riparian vegetation. Any riparian vegetation displaced by construction activities shall be replaced onsite at a 2:1 ratio.

RP-3 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 DFG. 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 Southwestern Toad

The arroyo southwestern toad 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 southwestern 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 southwestern 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 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 southwestern toad occurs at scattered locations along the lower river, primarily between Bradbury Dam and Alisal Road. 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 is a federally-listed endangered 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.

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 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 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 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. 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.

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 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 4-14.

- 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 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 Highway101 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 two 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 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 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 brown pelican 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 is a state- and federally-listed endangered species. 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 peregrine falcon 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.

Western Snowy Plover

The snowy plover is a federally-listed endangered 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 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. 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

As described in section 4.8.2.1, increased maximum lake levels over current conditions due to surcharging under Alternatives 3B-C and 4A-B 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 Alternative 3B (1.8 foot surcharge), and 91 acres under Alternatives 3C and 4A-B (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 20 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.

The destruction of upland wildlife habitat (including the loss of oak woodlands) under Alternatives 3B, 3C, and 4A-B 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 section 4.8.2.1), which is considered significant and not fully mitigable until the replacement trees are well established. 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.

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, and 4A-B would have a neutral effect on wetlands and their resident wildlife populations along the lake margins.

4.9.2.2 River Impacts

Impacts of Current Operations

As described in section 4.8.2.3, current operations have altered the hydrology of the Santa Ynez River downstream of Cachuma Lake. Due to current fish releases, low flows downstream of Cachuma Lake occur for a longer duration and over a larger portion of the river than under the recent historic operations. The increase in downstream low-flows under current operations becomes smaller with distance from the dam, such that there is very little difference in the frequency of low-flows near Alisal Road. In addition, spill frequency and average annual spill amount under current conditions are slightly less (about 3 percent) than under recent historic operations.

As described in section 4.8.2.3, the above changes in hydrologic conditions downstream of Cachuma Lake are expected to 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 absent from the river channel under recent historic conditions. The increase in riparian vegetation is expected to benefit aquatic and terrestrial wildlife. For example, the availability of water throughout the year in the channel would enhance habitat for the two-striped garter snake, western pond turtle, waterfowl, herons, and shorebirds. Greater riparian cover would increase nesting and foraging areas for riparian breeding birds. Increased and more reliable aquatic and riparian habitats created by the releases for steelhead under current operations could expand the range and number of sensitive species along the river, particularly upstream of Alisal Road, including the endangered red-legged frog, least Bell's vireo, willow flycatcher, and yellow-billed cuckoo.

Impact of Operations under Project Alternatives

The releases for steelhead rearing and passage flows downstream of the dam under Alternatives 3A-C and 4A-B would be greater than under current operations (Alternative 2) because all alternatives must meet the same release requirements pursuant to the Biological Opinion. The frequency and amount of low-flows downstream of the dam (to Alisal Road) would be greater under the project alternatives (3A-C and 4A-B). However, downstream of Alisal Road, low-flows under Alternative 4A-B would be less frequent and would have less volume because releases from the BNA would not be made from the dam, although the reduction in flows would be very small.

The additional flows downstream of Bradbury Dam under Alternatives 3A-C and 4A-B could increase the vigor and extent of wetland and riparian vegetation along the river to Alisal Bridge, and indirectly benefit the associated aquatic and terrestrial wildlife, including sensitive species. This is considered a beneficial impact (Class IV) to these resources. The slight reduction in frequency of flows between 10 and 20 cfs below Alisal Bridge under Alternative 4A-B, compared to current operations, is considered a potentially adverse, but insignificant indirect impact on wildlife that relies on riparian habitat (Class III).

Alternatives 3A-C and 4A-B would slightly reduce the frequency of spills compared to current 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.

The project alternatives would not affect flows to the Santa Ynez River lagoon, and as such, would not affect the environmental conditions in the salt marsh, lagoon, and beach areas that support sensitive species such as the Brown pelican, least tern, snowy plover, and Belding savanna sparrow.

4.9.2.3 Impacts to Flycatcher Nesting

As described above, 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 willow flycatcher nesting. As described above 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 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 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:

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 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 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.

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 current operations (Alternative 2) and Alternatives 3A-C. 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 impacts to the population. Hence, impacts of releases on willow flycatcher nesting are considered neutral in consideration of all factors and available evidence.

4.9.2.4 Impacts to Wildlife from Delivery of SWP Water under Alternatives 4A and 4B

Under Alternative 4A, a 10-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 roads and would be placed beneath the Santa Ynez River by directional drilling. Direct impacts to riparian vegetation in the river at the crossing location could be avoided by the drilling method. Drilling activities during installation across the riverbed could disturb riparian-dependent species, particularly if the drilling occurs during the spring breeding season (April through July). Noise, dust, and human activities on each side of the river could displace wildlife using the narrow riparian corridor on the riverbanks. The impact would be temporary (e.g., days) and reversible. In addition, riparian vegetation on the riverbanks at this location is very narrow and does not represent high quality wildlife habitat. However, it is possible that sensitive breeding birds (such as the flycatcher) could occur in proximity to the crossing site during breeding season, as a known breeding population is located upstream. This impact is considered significant, but mitigable (Class II) by avoiding directional drilling and trenching work within 200 feet of the river during the breeding season (April 15 through July 15).

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 4A or 4B is pursued, facilities shall be constructed to avoid disturbance to sensitive riparian breeding birds in the vicinity, particularly the willow flycatcher. The following work shall be scheduled to avoid the breeding season (April 15 through July 15): directional drilling (Alternative 4A); trenching work within 200 feet of the river (Alternatives 4A and 4B); and construction of discharge outlets on the riverbank (Alternative 4B).

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). 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. Reclamation and the County executed a 50-year contract titled *Agreement to Administer Recreation Area (Contract No. 14-06-200-600)* in January 1953. 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. Contract renewal will be renegotiated between Reclamation and the County over the next two years.

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 was 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 required the County to create a reserve fund from a portion of the net income derived from Recreation Area operations. 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.

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.

Public facilities located in the County Park include the following: campsites, general store, marina and launch ramp, 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, outdoor roller rink 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. 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.

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. 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.

A number of private concessions operate in the recreation area, including Cachuma Store, Cachuma Boats, Cachuma Bikes, 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). 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, telephone, and a path under the railroad tracks leading to the ocean. At the park, visitors can hike to the surf, or fish in the ocean and the river. 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 along the river between Buellton and Lompoc.

4.10.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.10.2.1 Lake Impacts

Effect on Shoreline Conditions

The maximum lake elevation under recent historic operations (Alternative 1) is 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 now observed under current operations (Alternative 2). Maximum lake levels would increase 1.8 feet under Alternative 3B and 3.0 feet under Alternatives 3C and 4A-B, due to surcharging the reservoir. Alternative 3A would not result in increased lake elevation compared to current operations and would therefore have no impact on recreation.

The effect of surcharging on lake levels is discussed in section 4.2.2.2. Surcharging would occur, on average, about once every three years (Table 4-4). The frequency of achieving the maximum lake level under each alternative (750.75 feet under Alternative 3A; 751.8 feet under Alternative 3B; and 753.0 feet under Alternatives 3C, 4A-4B) is about 11 percent of the time under 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 (Alternative 3B) and 3.0 feet (Alternative 3C and 4A-B). 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 are 42 and 91 acres, respectively. The average widths of inundation would be 15 and 25 feet, respectively.

As discussed in section 4.8.2.1, increased maximum lake levels over current conditions (750.75 feet) 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 current operations.

The higher maximum lake levels under Alternatives 3B, 3C, and 4A-B would not have an adverse impact on game fish, as described in Section 4.7.2.2.

Effect on County Park

Higher lake levels would affect recreational facilities at the County Park. The Park Department prepared an assessment of the potential effect on facilities. (Flowers & Associates (2001).) The assessment included an inventory of the base elevations of various facilities to determine if higher lake levels could flood the facilities or otherwise affect their functions. The report examined three new maximum lake levels: 751.8, 753, and 755 feet. The report assumed that water levels would be increased by up to 3 additional feet from storm surges and waves. Hence, the maximum new lake levels used in the analysis were 754.8, 756, and 758 feet.

The report categorized facilities as critical or non-critical. Critical facilities must be protected from the highest water levels at all time, and include the drinking water treatment plant and sewer lift stations. In the study, County Parks specified that these facilities would need to be moved above elevation 758 feet to accommodate a 5-foot surcharge. Non-critical facilities would need to be located to elevation 756 feet. County Parks did not conduct a specific assessment of facility impacts for a 1.8-foot or 3-foot surcharge. The analysis for the 5-foot surcharge is highly conservative, as Reclamation has not proposed a surcharge greater than 3 feet.

Inundation of recreational facilities at the County Park due to surcharging under Alternatives 3B, 3C, and 4A-B could disrupt recreational activities and possibly cause a public safety hazard. Surcharging would initially occur in the winter months, usually in February or March during peak runoff. At that time, visitors and recreational activities at Cachuma Lake are at a low level. However, the maximum lake level can persist for many months under certain circumstances, and conflict with early summer recreation on the lake and in the campgrounds. If surcharging disrupts key park functions, it could result in restrictions on the type and location of park activity, and possibly the number of visitors. For example, if surcharging prevents use of the marina or boat launch, then a significant park use would be disrupted.

To more precisely determine the potential disruption of park functions due to the 1.8 and 3-foot surcharging, the topographic maps of the County Park contained in the Flowers & Associates

(2001) report were reviewed. A summary of the facilities that would be affected under the two surcharging scenarios is presented in Table 4-51. The locations of the facilities are shown on Figure 4-18. All facilities would need to be relocated under the 3-foot surcharge (Alternatives 3C and 4A-B), and all but the following would need to be relocated under the 1.8-foot surcharge (Alternative 3B): Sewer Lift No. 2, and work at Harvey's Cove Picnic Area, the Boat Works Shop, and the UCSB Crew building. County Parks estimates the total costs of the facility relocations to be about $10.4 million (Flowers & Associates, 2001). At this time, the Park Department, Reclamation, and the Member Units have not determined their respective responsibilities for funding the facility relocations.

<u>The potential disruption of recreational uses at the County Park due to surcharging under Alternatives 3B, 3C, and 4A-B, and the associated disruption due to relocation of facilities is considered a significant, but mitigable impact (Class II)</u>. This impact can be mitigated to less than significant levels through expedient planning, funding, and implementation of necessary facility relocations prior to implementation of the surcharging levels that would adversely affect the facilities, and scheduling the construction work to occur during off-season periods. Both measures would minimize disruption or loss of recreational uses at the County Park.

<u>If the relocation of a critical facility does not occur prior to surcharging, or is deemed infeasible due to funding, there is a potential for a permanent or long-term disruption of recreational uses at Cachuma Lake. This impact is considered significant (Class I).</u>

TABLE 4-51
RECREATIONAL FACILITIES AFFECTED BY SURCHARGING

Facility (see Figure 4-18)	Current Base Elevation (Est. in feet)	Affected by Surcharge and 3' Wave Run Up		Notes
		1.8' (new elev = 754.8')	3' (new elev – 756')	
Drinking Water Intake	755	Yes	Yes	The facility flood elevation is about 755'. Need to adjust intake pipe.
Drinking Water Treatment Plant	753	Yes	Yes	This facility includes five structures: two buildings and three tanks. The lowest structures are the northernmost building and tank at about 753'.
Sewer Lift No. 2	759	No	Yes	The aboveground portion of this facility is at 760'. Below ground elevation is unknown. This facility must be moved under 3' surcharge to maintain 50' horizontal distance from open water.
Sewer Lift No. 3	759	Yes	Yes	The aboveground portions of this facility are between 759 and 758'. This facility must be moved under 1.8' and 3' surcharge to maintain 50' horizontal distance from open water.
Marina Path and Stairs and Floating Docks	753	Yes	Yes	The existing walkway is at 753'and the floating docks are at 750'.
Boat Launch Ramp	750	Yes	Yes	The top of the launch ramp is at 750' and the turning and loading area at the top of the ramp is at 752'.
Bait and Tackle Shop, Snack Bar, retaining wall	756	Yes	Yes	The bait and tackle shop and retaining wall are at 756'. Due to the importance of accessing boats during storms, relocation of the wall and possibly the bait and tackle shop under the 1.8' surcharge is warranted as extra protection.
Marina Overflow Parking	753	Yes	Yes	The lowest point of the parking lot is 753' at the far western end, near the lake's edge. The lot gradually slopes upward towards the east to 765'.
Mohawk Road	756	Yes	Yes	The lowest point in the road is at 756', just south of sewer pump station #3. Raising the road for the 1.8' surcharge may be warranted for extra protection as this is the only access to the east.
Harvey's Cove Picnic Area	755	No	Yes	The lowest point of this picnic area is 755', just above the dock ramp. The area slopes gradually upward towards the south to approx. 758' before the slope becomes steeper.
Harvey's Cove Path	754	Yes	Yes	The lowest point of the path is at 754', both on the way to the picnic area and just before the floating ramp to the fishing dock.
Barona Shores Trail	755	Yes	Yes	The low point on the trail is near 750'.
Teepee Island foot bridge	752	Yes	Yes	The bridge abutments are located at 752'.
Sweetwater Trail	755	Yes	Yes	At its lowest point, the trail drops down to 755'.
Boat Works Shop	760	No	Yes?	The shop is near 760' on a flat ground surface. Construction of a berm may be needed under 3' surcharge to provide more boat laydown area.
Picnic Area Adjacent to Shop	751	Yes	Yes	The lowest point of the picnic area is at 751'.
UCSB Crew Building and Ramp	756	No	Yes	The building is at 756'.
Mohawk Overflow Area and Road	754	Yes	Yes	The lowest point of the picnic area/overflow is 754'. The road leading to the shore currently reaches 754'.

Relocation of the above facilities would involve physical disturbances due to grading, demolition, filling, trenching, etc. These disturbances have the potential to affect biological resources. To determine the nature and magnitude of this impact, the areas of disturbance associated with removal of the facilities and the new locations were examined in the field. A summary of the environmental setting at the facility sites and relocation sites that would be disturbed is summarized in Table 4-52. Facility relocation would primarily affect barren or developed areas or annual grassland (turf). However, 15 to 20 mature coast live oak trees would have to be removed. In addition, freshwater marsh habitat (about 0.1 acre) would be temporarily disturbed along the lake margin associated with relocation of the Teepee Island Bridge, work at Harvey's Cove picnic area, and work at the USCB Crew building and boat shop picnic area. <u>No sensitive species would be affected by the relocations</u>. Facilities can be sited to minimize impacts to wetlands and oak trees. <u>Impacts to wetlands and oak trees would be considered a significant, but mitigable impact (Class II)</u>. This impact can be mitigated to less than significant levels by avoiding direct impacts during the facility siting process to the extent feasible, and by restoring wetland habitats disturbed and replacing oak trees removed.

Impacts to oak trees around the margins of Cachuma Lake, including the County Park, due to surcharging under Alternatives 3B, 3C, and 4A-B are addressed in section 4.8.2.2.

Construction activities would not take place at any known archeological sites in the County Park. However, there is a potential to disturb unknown prehistoric archeological sites at the park, which contains numerous archeological resources. <u>This impact is considered potentially significant, but mitigable (Class II)</u>. Significant impacts can be avoided by ensuring that all relocated facilities will avoid known archeological sites, and conducting construction monitoring to address impacts to unknown buried cultural resources.

TABLE 4-52
ENVIRONMENTAL IMPACTS OF FACILITY RELOCATION

Facility	County's Proposed Improvements	Environmental Impacts
1. Water Intake and Water Treatment Plant	Demolish and remove all piping, buildings, equipment, appurtenances, and concrete pads associated with the water treatment plant. Backfill and compact any voids left, contour the grade and hydroseed with native seed mix. Abandon existing piping and cap the end. Backfill and compact the access hole, and hydroseed with native seed mix. Remove existing trees below 756 feet elevation. Replace oaks. Construct a CMU wall to 758 feet elevation. Adjust the intake structure to the new elevation. Raise the pump station and concrete pad to 758 feet elevation. Construct a driveway and parking area for the pump station. Construct a transmission line from the pump station to the new water treatment plant location (see #2).	The habitat surrounding the Water Intake facility is predominantly barren (cobbles and sand) with some annual grasses. The habitat surrounding the Water Treatment Plant is generally the same, with the exception of one large Coast Live Oak (approximately 10 feet diameter at breast height) in the center of the Plant facility that would likely be removed.
2. Proposed Water Treatment Plant, New Location	Clear and grub the existing site (directly west of the Park entrance and north of Highway 154). Construct an elevated pad and grade and compact it. Construct the water treatment facility, piping and appurtenances including concrete improvements, catch basins, and storm drains. This will also include construction of a 3-foot wide concrete "V" ditch, a water line and valve box, and rip-rap at the storm drain outlet. Connect any new piping and drains to existing piping and drains. Construct a pavement driveway.	The proposed relocation site for the Water Treatment Plant is predominantly grassland habitat, with a few scattered Coast Live Oak trees around the perimeter of the site that would likely be avoided during construction.
3. Sewer Lift No. 2	Remove existing trees below 756 feet elevation and replace oaks. Abandon the existing pump station and cut and cap the existing gravity line from the existing sewer manhole. Remove the existing pump station to 5 feet below the grade and fill and hydroseed the area. Abandon the existing gravity sewer main and the force main in place. Cut the ends of the pipes and construct a concrete plug. Construct a new sewer manhole and gravity sewer main. The existing sewer would remain active during the sewer manhole construction. Construct the new sewer pump station and valve vault (directly south of the existing site, approximately 50-75 feet). Connect it to the existing sewer force main. Relocate the existing picnic areas below 756 feet elevation. Construct emergency storage sewer manholes and the piping. Construct a standby generator and appurtenances on a concrete pad.	The existing site and proposed relocation site for the Sewer Lift No. 2 facility are predominantly grassland habitat, with a few scattered Coast Live Oak trees scattered throughout the site that would likely be avoided during construction.
4. Sewer Lift No. 3	Relocate the foot trail east (across the road) of the existing station. Abandon the existing pump station in-place. Fill it with concrete. Construct a sewer manhole and gravity sewer pipe. Connect it to the proposed sewer manhole. Construct emergency storage sewer manholes and appurtenant piping. Construct the new Sewer Pump Station No. 3 and all appurtenances (southeast of the existing station, approximately 100 feet, on the opposite side of the road). Abandon the existing sewer force main and cap it with concrete. Construct a standby generator and appurtenances and connect it to the pump station. Construct a pavement structural section and a redwood header around the pump station and sewer manholes.	Both the existing site and the proposed relocation site are predominantly barren and grassland habitat, with the exception of one large Coast Live Oak in the center of the proposed relocation site. The oak tree will likely be removed during construction of the new sewer pump station.

Facility	County's Proposed Improvements	Environmental Impacts
5. Marina	Remove existing trees below 756 feet elevation and replace oaks. Demolish and remove the existing improvements. Construct a concrete retaining wall (that extends from the north side of the marina entrance below the snack shop, to the northern end of the floating docks) with a drainage system and a top of wall elevation of 758.5 feet. Construct a concrete abutment from the wall with stairs down to the floating docks. The top step would be at 758 feet elevation, and the bottom step shall be at 755.5 feet. Modify the existing floating dock to accommodate a maximum elevation of 756 feet. Construct new access ramps anchored to the concrete abutments that can adjust to lake level fluctuations. Widen the existing walkway above the floating docks to a 10-foot wide concrete access walkway. The minimum elevation would be 758 feet. Construct another concrete retaining wall (that extends from the south side of the marina entrance to the southern end of the launch ramp) with a drainage system and a top of wall elevation of 756 feet. Construct rock rip-rap slope protection along the bank.	The habitat along the existing access walkway above the docks and along the proposed retaining walls consists of coastal sage scrub, grassland, eroding slopes and small clumps of immature oaks. Two large oaks would likely be removed in order to widen the walkway.
6. Launch Ramp	Remove existing trees below 756 feet elevation and replace oaks. Adjust the existing floating dock south of the launch ramp to a minimum of 753 feet and relocate and adjust the access ramp to the existing building just south of that floating dock. Construct a concrete retaining wall (on the bank behind these structures) with a top of wall elevation of 754 feet. Demolish and remove the existing concrete boat access ramp, and construct a panelized concrete boat access ramp. Demolish and remove the pavement and appurtenant improvements and construct a concrete staging area and ramp conforms. Construct a concrete stair extension with an expansion joint. The top step elevation shall be at 758.04 feet. Construct a 5-foot wide concrete walkway to the existing restrooms. Relocate the existing bait and tackle shop to the proposed location (south, towards the marina entrance, approximately 200 feet). Provide electrical and water services. Demolish and remove the existing pavement, fencing and appurtenant improvements and construct contour grading and a pavement structural section. Construct a redwood header at the pavement edge. Adjust the existing floating dock located below the bait and tackle shop as necessary. Construct a rock rip-rap revetment along the shore as necessary.	The only natural habitat occurs at the top, south end of the launch ramp, where there is coastal sage scrub and one large oak tree. The existing and proposed site for the bait and tack shop consists of two mature oaks and a large juniper bush. These would likely be removed for construction of the new shop.
7. Marina Overflow Parking	Remove existing trees below 756 feet elevation and replace oaks. Demolish and remove the existing parking lot and islands. Protect the existing dump station and reconstruct the parking lot with redwood headers and islands and adjust the existing manhole rims to finish grade. Contour grade westerly end of parking lot and re-landscape as required.	No natural habitat exists within the parking lot, with the exception of two large oak trees, one in the center and one at the west end. These trees would be removed when the west end of the parking area is raised (Figure 4-18).
8. Mohawk Road	Remove existing trees below 756 feet elevation and replace oaks. Construct a gabion rock wall (below the east side of the road across from the existing Sewer Lift Station No. 3) with a top of wall elevation of 758. Demolish and remove the existing road and use fill to construct a raised paved road. Remove the existing culvert and construct a new one. Modify the existing manhole and adjust the rim of the manhole to the finish grade and provide a watertight seal.	The habitat along the proposed gabion rock wall is coyote brush scrub and rocky shore. Habitat adjacent to the road is generally barren.

Facility	County's Proposed Improvements	Environmental Impacts
9. Harvey's Cove Picnic Area	Remove the existing culvert and construct a new culvert. Fill and contour grade to the existing debris basin. Contour grade, cut or fill as necessary. Construct a gabion rock wall along the south and west sides of the cove (approximately 500 feet long) with a top of wall elevation of 756 feet. Construct a ramp landing and ramp attachment to adjust to fluctuating lake levels. Demolish and remove the existing concrete walkway and construct a 6-foot concrete walkway per plan. Modify the existing dock to accommodate a water surface elevation of 756 feet.	Habitat along the proposed rock wall includes disturbed shoreline, scattered oak trees (Coast Live Oak and one Valley Oak), and mulefat bushes at the south end of the cove. Several oak trees and mulefat bushes would likely be removed for the construction of the rock wall and the culvert (approximately 2,500 square feet). The existing concrete walkway is within disturbed grassland habitat. Approximately 4,500 square feet of grassland is likely to be removed during the construction of the walkway.
10. Barona Shores Trail	Remove existing trees below 756 feet elevation and replace oaks. Construct an access trail, footbridge, and concrete abutments. Construct rock rip-rap slope protection around the abutments. Relocate the picnic areas.	The Barona Shores habitat includes oak woodland and chaparral. Several small oak trees and some chaparral (approximately 2,250 square feet) would likely be removed during construction of the trail and footbridge.
11. Tepee Island Access (Foot Bridge)	Remove existing trees below 756 feet elevation and replace oaks. The existing water line remains in its approximate location. Relocate the existing picnic tables below 756 feet elevation to a higher ground. Remove the existing footbridge. Demolish and remove the concrete abutments and fill and compact the voids. Hydroseed. Stabilize the existing soil and construct a concrete abutment and the new footbridge, approximately 100 feet north of the existing footbridge. Construct rock rip-rap for slope protection from the abutment to the shoreline. Remove any existing trees encroaching in the bridge and the abutment location and replace at a ratio of 10:1. Construct access to the existing parking area.	Habitat around the existing bridge is generally exotic weeds. There is one Valley Oak and a coyote bush directly to the southwest as well as several small mulefat bushes that may be impacted during demolition of the existing bridge. The habitat around the new bridge location is similar, with the addition of some wetland vegetation (cattails and curly dock) that would likely be removed.
12. Sweet Water Trail	Remove existing trees below 756 feet elevation and replace oaks. Construct a 500-foot long rock rip-rap revetment, along the south side of the cove, west of Harvey's Cove.	Habitat along the Sweetwater Trail consists of several small oaks and chaparral, most of which would likely be avoided.
13. Boat Works Shop and picnic area	Remove existing trees below 756 feet elevation and replace oaks. Relocate the existing picnic area location below 756 feet elevation (east of the works shop) to higher ground. Construct a 150-foot long gabion wall, north of the works shop on the shore, with a top wall elevation of 758.5 feet. Construct an earthen access ramp in front of/in between the gabion wall. Re-grade the parking areas and replace any removed trees.	The habitat surrounding the picnic area is disturbed grassland and oak woodland, neither of which would be impacted. The habitat around the boat works shop is mostly disturbed shoreline, and grassland with some scattered oak trees that would likely be avoided.
14. UCSB Crew and Overflow Area	Remove existing trees below 756 feet elevation and replace oaks. Relocate the existing picnic tables and BBQ pits east of the UCSB crew building, to higher ground (south). Re-grade the area in front of the crew building to provide the UCSB crew access to the floating dock facilities. Modify the existing floating dock to float at a maximum elevation of 756 feet and provide for lake level fluctuation. Demolish and remove the existing access road, re-grade the area and hydroseed. Construct a new pavement road, shifted south approximately 100 feet to higher ground, and re-grade as necessary. Hydroseed and replace any removed oaks.	The habitat surrounding the UCSB crew building is mostly bare dirt and some mulefat bushes that may be removed during the grading. The habitat surrounding the picnic area and access road is also mainly bare dirt with some scattered oak trees. Some oak trees may be removed during the construction of the new road.

4.10.2.2 Impacts to Recreation along the River

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.

Changes in operations under Alternatives 3A-C, and 4A-B that would affect flows in the river and the extent and condition of riparian vegetation would only have an indirect effect on recreational uses. The primary impact would be a possible decrease in riparian growth in the river adjacent to River Park and Riverbend Park under Alternative 4A. Under that alternative, BNA releases to the river that would typically reach this area would no longer occur. The riparian vegetation in the Lompoc Forebay is sparse in the river channel due to the depth of alluvium. However, any reduction in the current recharge provided by the BNA releases could reduce the extent and condition of riparian woodland on the banks. This could decrease the scenic qualities of the riverbanks for nearby park users. This impact is considered adverse, but not significant (Class III) because the riparian vegetation on the bank is not expected to be completely removed, and because the presence of the vegetation is only an incidental element of the recreational experience for park users.

The project alternatives would not affect flows to the Santa Ynez River lagoon, and as such, would not affect environmental conditions or recreation at Ocean Beach Park.

4.10.2.3 Impacts from the Delivery of SWP Water under Alternatives 4A-B

Construction of the pipelines and outlets associated with Alternatives 4A-B 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.

4.10.3 MITIGATION MEASURES

R-1 Recreational facility relocations shall be designed, funded, and implemented prior to implementation of surcharging to avoid disruption of recreational uses at the Cachuma Lake County Park, or arrangements shall be made to provide for such uses on an interim basis until the permanent facility locations are completed. Construction work shall be scheduled to occur during off-season periods.

R-2 Impacts to oak trees and wetland areas due to facility relocation shall be avoided. Wetland habitats and oak trees that would be disturbed due to facility relocation shall be replaced at the County Park.

R-3 Sensitive archeological resources at the sites of the proposed facility relocations shall be identified in order to avoid impacts to sensitive resources. An archeological monitor shall be present during construction work associated with facility relocation if work will occur in a sensitive area where unknown prehistoric resources could be encountered. 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 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. § 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. § 470a(d)(6)) and the American Indian Religious Freedom Act (42 U.S.C.A. § 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. §§ 3001-3013; 28 U.S.C.A. § 1170) and Executive Order 13007 concerning Indian Sacred Sites.

Under CEQA, historical resources are considered a part of the environment. (Pub. Resources Code, §§ 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, §§ 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, § 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, § 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 emigrated 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, with an elevation range of 738 to 760 feet. CA-SBa-2105 is a linear deposit along the lakeshore 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).

<u>CA-SBa-2101</u>

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.

<u>Historical Resources</u>

<u>Rancho San Marcos Adobe</u>. 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.

<u>Rancho San Fernando Rey</u>. 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.

<u>Bradbury Dam</u>. The surcharge requires that small flashboards be placed on top of the Bradbury Dam gate. The dam is less than 50 years of age and 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.

Other Structures that would be Periodically Flooded by a 1.8' or 3.0' Surcharge. The following structures within Cachuma Lake County Park could be periodically affected by higher lake levels during surcharging under Alternatives 3B, 3C, and 4: water treatment facility, bridge to Teepee Island, marina boat ramp, sections of road leading to and in the Mohawk Area, and the Mohawk Area boat ramp and sewage pumping stations. Neither the road nor any of the structures are 50 years old or architecturally significant. Therefore, they are not considered historic resources and warrant no further evaluation or mitigation.

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).

CA-SBa-1767H is an historic site that appears to be located along the pipeline route for Alternative 4A, which would convey SWP water from the CCWA blow-off valve on the east side of the river to the City's treatment plant on the west side of the river. The site appears to be located along McLaughlin Road on the east side of the Santa Ynez River. The site may be the original municipal dump for the Lompoc Land Colony and the City of Lompoc. CA-SBa-1767H was first recorded during a survey for the Mission Hills Interceptor and Pumping Station project

(Spanne, 1978). At the time it was recorded, the cultural deposit was exposed along an approximately 100-meter long stretch of riverbank. Spanne noted that the site extends for an undetermined distance to the west, north and south, but that the actual dimensions of the site are unknown because it is buried from one to two meters below the surface. Based on the artifacts exposed in the riverbank and on interviews with local collectors and Lompoc Valley Historical Society members, Spanne concluded that the site dates from the mid 1800s to the 1940s.

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. Gerber paid special attention to the area around the historic dump, but the site was not visible in the riverbank. 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

Impact Assessment

"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, § 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. (Pub. Resources Code, § 21084.1; Cal. Code Regs., tit. 14 § 15064.5, subd. (a)(3).) The criteria used for determining the eligibility of a resource for the California Register are similar to those developed by the National Park Service for the NRHP.

To be eligible for listing on 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 California Register were reworded to better reflect California history. The criteria include the following:

a. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

b. Is associated with the lives of persons important in our past;

c. 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

d. Has yielded, or may be likely to yield, information important in prehistory or history.

(Cal. Code Regs., tit. 14, § 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 California Register must also be considered. "The fact that a resource is not listed in, or determined to be eligible for listing in the [California Register], 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, § 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.

4.11.4.2 Impact Assessment

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, and 4A-B.
- 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 Alternatives 4A-B.

Under current operations (Alternative 2) and Alternatives 3A-C and 4A-B, 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 (see section 5). 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.

The assessment of impacts to cultural resources along the margins of Cachuma Lake is based on 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 CCIC (Maki, 2001). The assessment of impacts to cultural resources along the SWP water delivery pipeline routes is based on a record search and field study by Gerber (2001).

<u>Cachuma Lake</u>

Reclamation is conducting 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 also has consulted with the Santa Ynez Band of Mission Indians.

The two prehistoric archaeological sites, CA-SBa-891/2105 and CA-SBa-2101, along the lake margins would be subject to increased erosion under Alternatives 3B, 3C and 4.

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 Alternative 3B, and to 753.0 feet under Alternatives 3C and 4A-B. (Alternative 3A would not result in an increase in lake level elevation.) 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 impart 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 -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 -3.

SWP Water Delivery Pipeline Routes

The proposed pipeline route associated with Alternative 4A would traverse historic site CA-SBa-1767H along McLaughlin Road east of the river. Trenching for installation of the pipeline could adversely affect the site, which has the potential to provide important information about the history of Lompoc and northern Santa Barbara County. Disturbance of this site would be considered a significant, but mitigable impact (Class II). This impact could be reduced to less than significant levels if the pipeline trench could be located to avoid the site. If avoidance is not feasible, a qualified historic archaeologist should assess the vertical and horizontal boundaries of the site and design and implement a program of data recovery to mitigate the loss of data (Mitigation Measure CR-4).

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 routes (Alternatives 4A and 4B), particularly between Highway 246 along the margin of River Park and across the cultivated fields north to McLaughlin Road. <u>This impact is considered significant but mitigable (Class II)</u>. Any impacts can be mitigated by implementing the procedures in Mitigation Measures CR-4 and -5.

4.11.5 MITIGATION MEASURES

<u>Cachuma Lake Sites</u>

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, § 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*., § 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, rip-rap, 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.

Generally under CEQA, a project that follows the Secretary of Interior's Standards for the Treatment of Historic Properties shall be considered as mitigated to a level of less than a significant impact on the historical resources. (Cal Code Regs., tit. 14, § 15064.5, subd. (b)(3).) Frequently under CEQA, a project that follows the Secretary of Interior's Standards shall be considered as mitigated to a level of less than a significant impact on the historical resources. The mitigation measures listed below will reduce the impacts under Alternatives 3B, 3C, 4A and 4B to a less than significant level under both the federal regulations and CEQA.

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.

<u>SWP Water Delivery Pipeline Routes</u>

CR-4 Prior to trenching the pipeline route at the location of site CA-SBa-1767H along McLaughlin Road east of the river, a systematic program of subsurface testing shall be conducted along the route in unpaved areas. A series of short backhoe trenches shall be placed at regular intervals along the route, with screening of a percentage of the excavated materials. Any cultural resources discovered during the test trenching shall be evaluated and treated according to appropriate state and federal laws, regulations and guidelines.

CR-5 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.

5.0 ENVIRONMENTAL ANALYSIS OF NON-FLOW HABITAT ENHANCEMENTS ON TRIBUTARIES

The impacts of the various non-flow habitat enhancements described in section 2.4.3 are evaluated below in a programmatic manner. These management actions are 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. These actions will be implemented in the same manner under current operations (Alternative 2) and Alternatives 3A-C and 4. In fact, one management action was completed in January 2002. Reclamation and COMB are preparing a joint EIR/EIS for these non-flow measures, separate from, but consistent with, the programmatic analyses contained in this EIR. The Reclamation and COMB environmental document will address several projects at a project specific level.

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 steelhead 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 is predicated on the assumption that Reclamation will remove 11 passage impediments on Hilton Creek (one on federal land and one under Highway 154), Salsipuedes Creek (Highway 1 Bridge), Quita Creek (six road crossings), El Jaro Creek (one road crossing), and Nojoqui Creek (one road crossing).

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 environmental impacts associated with passage impediment removal measures are summarized in Table 5-1.

TABLE 5-1
SUMMARY OF 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 requires Reclamation to enhance spawning and rearing habitat on lower Hilton Creek on federal lands by augmenting flows via a supplemental watering system. In addition, the Biological Opinion assumed that Reclamation will re-align and extend the lower portions of the creek 1,500 feet to provide additional habitat. The impacts associated with these actions are summarized below in Table 5-2. The magnitude and extent of the individual impacts will depend upon the final design, location, and implementation of each project, as well as the specific mitigation measures incorporated into the projects. Reclamation and COMB will evaluate the project-specific impacts of each project and develop site-specific mitigation measures through their upcoming EIR/EIS, and any necessary subsequent environmental documents (e.g., supplemental EIRs or Negative Declarations).

TABLE 5-2
SUMMARY OF 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 CDFG 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 vegetation 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

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 steelhead. Fish rescue operations would occur on an as-needed basis. 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.

6.0 COMPARISON OF ALTERNATIVES

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 hearing to be held pursuant to Order WR 94-5, the SWRCB will hear testimony on the alternatives analyzed in this EIR and consider any other evidence entered into the administrative record. The impacts of the various alternatives were evaluated in sections 4.0 and 5.0. A comparison of these impacts among the alternatives is provided below.

In the first comparison, the impacts of Alternative 2 (current operations, and the "no project alternative") are assessed using Alternative 1 (recent historic operations) as the environmental baseline because this alternative represented the operations when the Order WR 94-5 hearings were noticed and conducted. This comparison indicates if current operations under Alternative 2 (which primarily reflect some of the operational changes mandated by NMFS under the Biological Opinion) have improved conditions relative to downstream water rights and public trust resources. This comparison also indicates if there are any incidental and unintended environmental impacts associated with the new releases for fish under the Biological Opinion.

In the second comparison, the impacts of Alternatives 3A-C, and 4A-B are assessed using Alternative 2 as the environmental baseline. This comparison will indicate if modified operations under these alternatives would further improve conditions related to downstream water rights and public trust resources. This comparison also indicates if there are any incidental and unintended environmental impacts associated with the modified operations (e.g., surcharge impacts on the lake, impacts of new delivery of SWP water to the Lompoc Plain). This comparison also provides a basis to determine which alternative would provide greatest protection of downstream water rights and public trust resources as well as which alternative might be identified as the environmentally superior alternative.

CEQA Guidelines section 15126.6 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." This mandate is accomplished by comparing the impacts of Alternatives 3A-C and 4A-B with the "no project" alternative (Alternative 2) to determine if they meet the basic objectives of the protection of downstream water rights and public trust resources, while avoiding significant incidental impacts.

6.1.1 BENEFITS AND IMPACTS OF CURRENT OPERATIONS

Alternative 2 represents current operations, which incorporate release requirements under Order WR 89-18, releases to meet interim rearing target flows under the Biological Opinion, and other steelhead conservation actions described in the Biological Opinion, such as the Hilton Creek and other tributary passage improvement projects. Current operations also include the 0.75-foot surcharge, conveyance of SWP water through Cachuma Project facilities, and emergency winter storm operations. Under current operations, releases for interim rearing target flows are derived from the 0.75 surcharge and project yield rather than from a 1.8-foot surcharge.

The initiation of new releases for southern steelhead downstream of Lake Cachuma and the importation of SWP water and its inclusion in water rights releases represent major changes in the operations of the Cachuma Project. The new operations are, and will be, causing beneficial effects downstream of Lake Cachuma, as listed below. In addition, there are several incidental adverse effects that are expected to arise over time.

Beneficial impacts of current operations:

- Decreased dewatered storage capacity in groundwater basins due to incidental recharge from fish releases (i.e., higher alluvial groundwater levels).
- Lower lake total dissolved solids (TDS) due to importation of SWP water.
- TDS concentrations in releases from the Above Narrows Account and Below Narrows Account are lower due to commingling of SWP water in releases and additional releases for fish.
- TDS levels in the Lompoc Plain may show a minor reduction under current operations due to commingling of SWP water in water rights releases and additional releases for fish.
- Low flows occur more frequently and over a greater distance, which provides additional steelhead rearing habitat.
- Increased low flows support spawning and rearing of non-native and native fish (other than steelhead) on the river.
- Increased density, vigor, and extent of riparian vegetation in the river channel over time due to greater moisture availability and longer growing season due to water from fish releases.
- Possible increase in the number and range of several sensitive species along the river due to increase in riparian habitat and wetted channel, particularly the willow flycatcher, least Bell's vireo, western pond turtle, red-legged frog.

Incidental adverse impacts include:

- Potential increase in flood hazards due to an increase in in-stream woody riparian vegetation (due to more flows) and a minor reduction in spill frequency (which maintains channel capacity).
- Slight decrease in game fish spawning in Lake Cachuma due to greater drawdown for fish releases.
- Slight reduction in the frequency of spills that cause natural disturbances to riparian vegetation that enhance long-term reproduction and health.

6.1.2 IMPACTS OF PROPOSED ALTERNATIVES

A summary of the number of different types of impacts under each alternative is presented in Table 6-1.

TABLE 6-1
SUMMARY OF IMPACTS OF DIFFERENT ALTERNATIVES

Impact	Alt 3A Biological Opinion with 0.75' surcharge	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4A Biological Opinion with SWP Delivery to City of Lompoc	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay
Significant, unmitigable (Class I)	1	3 (water supply oak trees recreation)	2 (oak trees recreation)	2 (oak trees recreation)	2 (oak trees recreation)
Significant, but mitigable (Class II)	0	5	5	9	8
Adverse, but not significant (Class III)	4	6	7	9	8
Total =	5	14	14	20	18

1. Alternative 3A would result in the fewest total impacts compared to other alternatives. Alternatives 4A and 4B would have the most impacts, while Alternatives 3B and 3C would result in a moderate number of impacts.

2. Each alternative will result in at least one significant, unmitigable impact (Class I). The loss of oak trees along the margins of Lake Cachuma due to surcharging is a significant unmitigable impact (at least initially) that would occur under Alternatives 3B, 3C, 4A and 4B. While the type of impact is the same under these alternatives, the number of trees that could be lost differs: 271 under Alternative 3B at a 1.8-foot surcharge and 452 trees under Alternatives 3C, 4A, and 4B at a 3-foot surcharge. The significant, indirect environmental impacts attributable to water supply shortages would occur only under Alternatives 3A and 3B.

3. Alternatives 3B, 3C, 4A, and 4B would also adversely affect recreational facilities at the Lake Cachuma County Park, and require relocation of these facilitates to maintain the park. This Class II impact can be mitigated through the development, funding and implementation of a facility relocation plan prior to surcharging. If this mitigation is delayed or otherwise hindered, then surcharging would cause a significant impact (Class I) on recreation at Lake Cachuma until the relocation is completed.

4. Alternative 4A would result in several impacts that would not occur under Alternative 4B including: temporary disturbance to wildlife along the river during the installation of the pipeline under the river near Lompoc; possible decrease in riparian growth in the river near Lompoc due to reduced recharge, which could affect the scenic qualities of the

riverbanks for nearby park users; and disturbance of a historic archeological site along McLaughlin Road east of the river.

5. Alternative 4B would result, however, in disturbance of riparian habitat and its associated wildlife during the construction of four outlets on the east bank of the Santa Ynez River near Lompoc.

6. The additional Class II impacts associated with Alternatives 3B, 3C, 4A, and 4B that would not occur under Alternative 3A are impacts to archeological sites, and recreational facilities due to surcharging under these alternatives.

Impacts of the proposed alternatives (Alternatives 3A-C and 4A-B) relative to current operations (Alternative 2) are summarized in Table 6-2.

TABLE 6-2
COMPARISON OF IMPACTS OF THE PROPOSED ALTERNATIVES

Impact	**Occurrence of Impact Relative to Current Operations (Alternative 2)**				
	Alt 3A Biological Opinion with 0.75' surcharge	**Alt 3B Biological Opinion with 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4A Biological Opinion with SWP Delivery to City of Lompoc**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**
Surface Water Hydrology					
Slightly reduce the frequency of spills which could increase flooding hazard along the lower river over time by reducing the number of times flood flows would clear riparian vegetation and restore channel capacity. (Class III)	X	X	X	X	X
Water Supply Conditions					
Water supply shortages in a critical drought year could result in indirect environmental impacts if the Member Units increase groundwater pumping, implement a temporary transfer, or desalinate seawater in order to make up for the shortages. (Class I)	X	X			
Water supply shortages in a critical drought year could result in indirect environmental impacts if the Member Units increase groundwater pumping, implement a temporary transfer, or desalinate seawater in order to make up for the shortages. (Class III)			X		
Above Narrows Alluvial Groundwater Basin					
No adverse impacts					
Surface Water Quality					
Increase in TDS in Cachuma Lake (Class III)	X	X	X	X	X
Increase in mean monthly TDS of flows at the Narrows (when present) in the fall. (Class III)				X	X

Impact	Occurrence of Impact Relative to Current Operations (Alternative 2)				
	Alt 3A Biological Opinion with 0.75' surcharge	**Alt 3B Biological Opinion with 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4A Biological Opinion with SWP Delivery to City of Lompoc**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**
Lompoc Plain Groundwater Basin					
No adverse impacts					
Southern Steelhead and other Fish					
No adverse impacts					
Riparian and Lakeshore Vegetation					
Surcharging would result in loss of oak trees along lake margins over time (Class I, until replacement trees are self-sustaining)		X	X	X	X
Construction of four outlets on the east bank of the Santa Ynez River to discharge SWP water for recharge into the riverbed would remove a small amount of riparian vegetation. (Class II)					X
Construction activity associated with installation of a water supply pipeline under the Santa Ynez River would impact riparian vegetation. (Class II)				X	
Surcharging would remove upland vegetation (chaparral and coastal sage scrub) along the margins of the lake (Class III)		X	X	X	X
Slight reduction in the frequency of spills which could reduce the frequency of uncontrolled downstream flows which could facilitate riparian recruitment on floodplains and may be necessary for long-term health of the riparian vegetation. (Class III)	X	X	X	X	X
Sensitive Aquatic and Terrestrial Wildlife					
Placement of a water line under the Santa Ynez River near Lompoc could displace wildlife using the narrow riparian corridor on the riverbanks. The impact to the willow flycatcher is potentially significant but mitigable. (Class II)				X	
Installation of four discharge outlets on the banks of the Santa Ynez River near Lompoc could adversely affect sensitive breeding birds (such as the willow flycatcher). The impact is potentially significant but mitigable. (Class II)					X
Upland wildlife habitat would be displaced along the margins of Lake Cachuma due to surcharging. (Class III)		X	X	X	X
Slight reduction in frequency of spills could adversely affect long-term health of riparian vegetation, and the riparian-dependent wildlife (Class III).	X	X	X	X	X

Impact	Occurrence of Impact Relative to Current Operations (Alternative 2)				
	Alt 3A Biological Opinion with 0.75' surcharge	**Alt 3B Biological Opinion with 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4A Biological Opinion with SWP Delivery to City of Lompoc**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**
Reduction in frequency of flows between 10-20 cfs below Alisal Bridge. (Class III)				X	X
Recreation					
Surcharging would require relocation of recreational facilities at the Lake Cachuma County Park, possibly including the water treatment plant, water intake, two sewer lift stations, a parking lot, several roads, the marina, the boat launch, a foot bridge, several stores and buildings at the marina, a picnic area, and several trails. (Class II or I)		X	X	X	X
The relocation of recreational facilities at Lake Cachuma County Park due to surcharging would remove 15 to 20 mature coast live oak trees and temporarily affect freshwater marsh habitat. (Class II)		X	X	X	X
Relocation of the recreational facilities at Lake Cachuma County Park does not appear to occur at or near any known archeological sites in the County Park. However, there is a potential to disturb unknown buried archeological sites during construction. (Class II)		X	X	X	X
Possible decrease in riparian growth in the river near Lompoc due to reduced recharge, which could affect the scenic qualities of the riverbanks for nearby park users. (Class III)				X	
Cultural Resources					
Two known prehistoric archaeological sites along the lake margins would be subject to increased erosion due to surcharging. (Class II)		X	X	X	X
Surcharging could expose unknown buried archeological resources by eroding the lake margins over time. (Class II)		X	X	X	X
The proposed pipeline route would traverse a historic archeological site along McLaughlin Road east of the river. (Class II)				X	
The pipeline routes near Lompoc would 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 routes. (Class II)				X	X

Alternatives 3C, 4A, and 4B would avoid water supply impacts and the associated potentially significant, unmitigable indirect environmental impacts that could occur under Alternatives 3A and 3B. Alternatives 3C, 4A, and 4B would involve a 3.0’ surcharge, which would create more storage in Lake Cachuma and offset the impact to the Member Units’ water supply in a critical drought year. Alternative 3B would partially offset the water supply impact, but not to a sufficient degree to reduce the indirect, environmental impacts to a less than significant level.

Alternative 3A would avoid the impacts to upland habitat, archeological sites, and recreational facilities due to surcharging under Alternatives 3B, 3C, 4A, and 4B. With the exception of the temporal impact due to the loss of oak trees, however, these impacts could be mitigated to less than significant levels.

The environmentally superior alternative is Alternative 3A, which has the fewest environmental impacts, and the fewest Class I impacts. The SWRCB could adopt Alternative 3A, which guarantees that the fish flows required in the Biological Opinion will be met immediately rather than being phased in over-time. Also, the implementation of long-term flow requirements under Alternatives 3C and 4A-B may be dependent on the feasibility of mitigating for the impacts of a 3-foot surcharge on recreational facilities. By adopting Alternative 3A, the SWRCB could meet the long-term flows required by the Biological Opinion immediately, while affording Reclamation the option of ultimately developing a 3-foot surcharge to avoid the impacts to Cachuma Project water supply under Alternative 3A.

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 3A-C and 4A-B. Hence, impacts due to these actions would not differ among alternatives.

7.0 CUMULATIVE IMPACTS

Under 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. (CEQA Guidelines section 15065.) Section 15355 of the CEQA Guidelines defines cumulative impacts as two or more individual effects, that when considered together, are either considerable or compound other environmental impacts.

Some or all of the proposed alternatives could increase the risk of flooding below Bradbury Dam and adversely affect oak trees, recreational uses and facilities, riparian habitat and associated aquatic and terrestrial wildlife, surface water and groundwater quality, and cultural resources. These resources are located at Lake Cachuma and along the Santa Ynez River between Bradbury Dam and the ocean. 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. 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 the SYRWCD. As the population in the Santa Ynez and Lompoc Valleys expand in the future, pumping from the alluvial groundwater basin may increase. Since Alternatives 4A-B bypass 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 4A-B are speculative, however, and potentially offset by beneficial impacts to riparian vegetation under those alternatives. (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.) <u>Therefore, Alternatives 4A-B will not have a significant cumulative impact to riparian vegetation or riparian-dependant wildlife.</u>

- 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, 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, 4A, and 4B 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 section 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 2, 3A-C and 4A-B could cause cumulative construction-related impacts (e.g., disturbances to aquatic and riparian habitats) but these impacts would be temporary and less than significant.

8.0 PERSONS AND 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

Cachuma Operations and Maintenance Board
Carpinteria Valley Water District
Central Coast Water Authority
City of Santa Barbara
Goleta Water District
Montecito Water District
Santa Ynez River Water Conservation District -- Improvement District No. 1
Santa Ynez River Water Conservation District
County of Santa Barbara Parks & Recreation Department
County of Santa Barbara Flood Control District
County Water Agency
City of Solvang
City of Lompoc

9.0 EIR PREPARERS

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