REVISED
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
1001 "I" Street
Sacramento, California 95814

State Clearinghouse # 1999051051

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[1] Only those cited in text are included; for the rest, see the State Water Resources Control Board's August 2003 *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)*, referred to hereafter as the August 2003 DEIR. The August 2003 DEIR is available online at http://www.waterrights.ca.gov/hearings/cachumahearing.htm.

[2] Included under separate cover in the August 2003 DEIR.

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LIST OF ACRONYMS

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

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

EXECUTIVE SUMMARY

The proposed project analyzed in this revised Draft Environmental Impact Report (DEIR) 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 State Water Resources Control Board (SWRCB) prepared a DEIR for this project and circulated it for public comment in August 2003.[1] In comments on the 2003 DEIR, California Trout (CalTrout) argued that the DEIR should be revised to include consideration of a different project alternative designed to protect fishery resources in the Santa Ynez River. The new alternative was described as Alternative 3A2 in a 1995 Environmental Impact Report/Environmental Impact Statement prepared by Reclamation and Cachuma Project water supply contractors in connection with the renewal of the water supply contract for the Cachuma Project. In response to CalTrout's comments, the SWRCB has developed two new alternatives, Alternatives 5B and 5C, which are modified versions of Alternative 3A2. The SWRCB has revised the August 2003 DEIR to analyze those alternatives.

This document includes sections on background information and alternatives analyzed in the 2003 DEIR to establish a context for the analysis of Alternatives 5B and 5C, but focuses on the analysis of the new alternatives. In addition, this document has been updated to reflect a number of changes, including the surcharging of Cachuma Lake to 2.47 feet, that have occurred since the 2003 DEIR was prepared. Finally, this document makes some changes and corrections in response to comments on the 2003 DEIR. This document does not contain, however, a complete response to comments.

When revising a DEIR, the lead agency may recirculate only those portions of the document that have been revised, and request that reviewers limit their comments to the revised chapters or portions of the document. (Cal. Code Regs., tit. 14, § 15088.5, subd. (f)(2).) The Table of Contents of this DEIR shows the revised portions of the August 2003 DEIR in italics. The SWRCB requests that reviewers of this revised DEIR limit their comments to those revised portions. The SWRCB will combine comments made on the August 2003 DEIR and comments made on this revised DEIR, and include a complete response to all comments in the Final EIR that the SWRCB will prepare after circulating this document.

For the sake of consistency, this revised DEIR maintains the same outline and numbering as the original August 2003 DEIR. However, consistent with section 15088.5 of the CEQA Guidelines, certain portions of the August 2003 DEIR that have not been revised are not included in this revised DEIR. Accordingly, the numbering of sections, tables and figures in this document is not always sequential. Appendices A and B of this document are revised versions of Appendices A and B to the 2003 DEIR. Appendices C, D, and E to the 2003 DEIR have not been changed, and therefore they have not been reproduced and recirculated with this document. This document also includes a new Appendix F. The portions of the 2003 DEIR, including appendices, that have not been reproduced in this document are incorporated herein by reference. To the extent that the 2003 DEIR and the revised DEIR conflict, the revised DEIR supersedes the 2003 DEIR.

[1] The August 2003 DEIR is available online at http://www.waterrights.ca.gov/hearings/cachumahearing.htm.

ES.1 BACKGROUND INFORMATION

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

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

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

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

In December 1994, the SWRCB issued Order WR 94-5. The order continued the reservation of jurisdiction over Reclamation's permits until long-term permit conditions were set to protect downstream water right holders and set a deadline of December 1, 2000, to commence a hearing on this issue. Order WR 94-5 required Reclamation to conduct various studies and collect certain data for use by the SWRCB in the hearing. In addition, Order WR 94-5 required Reclamation to prepare any additional environmental documentation that the Chief of the Division of Water Rights determined was necessary to comply with the California Environmental Quality Act (CEQA) in connection with the SWRCB's consideration of modifications to Reclamation's permits. With direction from SWRCB staff, Reclamation prepared the DEIR of August 2003 to comply with the order.

ES.2 PROJECT ALTERNATIVES CONSIDERED IN AUGUST 2003 DEIR

As discussed above, the project analyzed in this revised DEIR 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 the plan that NMFS evaluated in the Biological Opinion, included the surcharging of Cachuma Lake to provide additional water for fish releases. Surcharging is a term used to describe the overflow amount left after a reservoir has been filled to capacity. Through manipulating spillways and other means of controlling dam overflow, surcharge levels can be raised or lowered depending on factors like reservoir capacity and water demand. 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 3.0-foot surcharge is implemented, Reclamation must meet the interim target flows. Reclamation initiated the interim target flows in September 2000. Reclamation initiated long-term flows with a 2.47-foot surcharge in May 2005. 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 River below Bradbury Dam.

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

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

The 2003 DEIR compared Alternative 2, then-existing conditions, to Alternative 1, historic conditions, in order to evaluate the changes that had taken place since Reclamation began to implement interim target flows pursuant to the Biological Opinion. Alternative 1 did not represent existing or baseline conditions, however, and therefore the discussion of Alternative 1 has not been incorporated into this document. Accordingly, Table ES-1, which compared the effects of using Alternative 1 versus Alternative 2 as the environmental baseline, is no longer relevant to this analysis and has been omitted. In addition, since August 2003, Reclamation has constructed the spillgate modifications allowing a surcharge of 1.8 and then 3.0 feet to be implemented. Accordingly, Alternative 3A, which was based on the assumption that Reclamation would be allowing a 0.75-foot surcharge, has been made irrelevant. Finally, the SWRCB no longer considers Alternative 4A, which to be feasible required the cooperation of the City of Lompoc, as a result of that city’s choice not to pursue the proposed arrangement. The remaining Alternatives 3B, 3C, and 4B were comprehensively evaluated in the August 2003 DEIR, but they will also be analyzed in this document in order to provide the reviewer with an adequate comparison of all project alternatives still being considered by the SWRCB.

ES.3 PROJECT ALTERNATIVES TO BE CONSIDERED IN THIS REVISED DEIR

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

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

Under Alternatives 5A, 5B and 5C, flow requirements to protect fishery resources would be the same, but the three alternatives assume that Reclamation would implement different surcharge levels at Cachuma Lake. Alternative 5A, like Alternative 3A in the August 2003 DEIR, is based on the assumption of a 0.75-foot surcharge at Bradbury Dam. Accordingly, as these conditions no longer exist, Alternative 5A has been removed from analysis. Like Alternative 3B, Alternative 5B assumes a 1.8-foot surcharge. Like Alternative 3C, Alternative 5C assumes a 3.0-foot surcharge. Thus the following six alternatives, representing baseline conditions, yet-unconsidered modified CalTrout alternatives, and previously considered alternatives included for comparison, are analyzed as part of this document:

2. Baseline 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.

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

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

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

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

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

Please see section 3.2.2 for a detailed description of Alternatives 5B and 5C.

ES.4 SUMMARY OF IMPACTS

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

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

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

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

1. Each alternative would result in at least one significant, unmitigable impact (Class I). The loss of oak trees along the margins of Cachuma Lake due to surcharging is a significant unmitigable impact (temporary) that would occur for Alternatives 3B, 3C, 4B, 5B and

5C. While the type of impact is the same under these alternatives, the number of trees that could be lost differs: 271 trees for Alternatives 3B and 5B at a 1.8-foot surcharge and 452 trees for Alternatives 3C, 4B and 5C at a 3.0-foot surcharge.

2. Alternative 5B could have significant water supply related impacts. Water supply shortages in a critical drought year or critical three-year drought period 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.

3. 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.

4. The other impacts associated with Alternatives 3B, 3C, 4B, 5B and 5C are due to impacts to upland habitat and archeological sites due to surcharging under these alternatives. Impacts to the boat launch ramp would occur under Alternatives 3C, 4B, and 5C due to surcharging to 753 feet under these alternatives.

5. Impacts of the non-flow related management actions on tributaries downstream of Bradbury Dam would occur in the same manner under baseline operations and under Alternatives 3B, 3C, 4B, 5B and 5C. Hence, impacts due to these actions would not differ among alternatives.

Alternatives 3B, 3C, 4B and 5C would avoid the potentially significant indirect impacts associated with a reduction in water supply to the Member Units that would occur under Alternative 5B. Alternative 5B would have the greatest impact on water supply because more water would be released for fishery resources under this alternative than under Alternatives 3B, 3C, 4B, and the higher release requirements would be offset only partially by a 1.8-foot surcharge. The release requirements under Alternative 5C would be the same as the release requirements under Alternative 5B, but Alternative 5C 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, 4B and 5C 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. The 1.8-foot surcharge under Alternative 5B would partially offset impacts to water supply, but not to the same extent as Alternatives 3C, 4B and 5C.

Avoidance of impacts to upland habitat and archeological sites would be impossible due to surcharging under Alternatives 3B, 3C, 4B, 5B and 5C, and avoidance of impacts to the boat launch ramp would be impossible due to surcharging under Alternatives 3C, 4B and 5C. However, it should be noted that, with the exception of the temporal impact due to the loss of oak trees, these impacts could be mitigated to a less than significant level.

Table ES-2
Summary of Impacts Due to the Project Alternatives

	Occurrence of Impact Relative to Baseline Operations (Alternative 2)				
Resource, Impact and Mitigation Measures	**Alt 3B Biological Opinion with 1.8'Surcharge**	**Alt 3C Biological Opinion with 3.0' Surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion with 1.8' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**	**Alt 5C Biological Opinion with 3.0' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**
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	
Riparian and Lakeshore Vegetation					
Surcharging to 1.8' (Alternatives 3B and 5B) or 3.0' (Alternatives 3C, 4B, and 5C) would result in the loss of 271 and 452 oak trees, respectively, along the margins of Cachuma Lake 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	X

Table ES-2
Summary of Impacts Due to the Project Alternatives

	Occurrence of Impact Relative to Baseline Operations (Alternative 2)				
Resource, Impact and Mitigation Measures	**Alt 3B Biological Opinion with 1.8'Surcharge**	**Alt 3C Biological Opinion with 3.0' Surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion with 1.8' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**	**Alt 5C Biological Opinion with 3.0' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**
CLASS II IMPACT – SIGNIFICANT AND MITIGABLE TO LESS THAN SIGNIFICANT					
Sensitive Aquatic and Terrestrial Wildlife					
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' of the river to avoid the breeding season (April 15 through July 15).			X		
Recreation					
Surcharging the reservoir to 3.0' would require the relocation of the boat launch ramp at Cachuma County Park. Mitigation Measure R-1: The County will upgrade and improve the boat launch ramp to allow launching at an increased water elevation of 753'.		X	X		X

Table ES-2
Summary of Impacts Due to the Project Alternatives

	Occurrence of Impact Relative to Baseline Operations (Alternative 2)				
Resource, Impact and Mitigation Measures	**Alt 3B Biological Opinion with 1.8'Surcharge**	**Alt 3C Biological Opinion with 3.0' Surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion with 1.8' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**	**Alt 5C Biological Opinion with 3.0' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**
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	X

Table ES-2
Summary of Impacts Due to the Project Alternatives

	Occurrence of Impact Relative to Baseline Operations (Alternative 2)				
Resource, Impact and Mitigation Measures	**Alt 3B Biological Opinion with 1.8'Surcharge**	**Alt 3C Biological Opinion with 3.0' Surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion with 1.8' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**	**Alt 5C Biological Opinion with 3.0' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**
Cultural Resources, continued					
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 State 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' 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	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' of the discovery. A professional archeologist shall evaluate the find and recommend mitigation measures in accordance with federal and state guidelines.			X		

Table ES-2
Summary of Impacts Due to the Project Alternatives

Resource, Impact and Mitigation Measures	Occurrence of Impact Relative to Baseline Operations (Alternative 2)				
	Alt 3B Biological Opinion with 1.8'Surcharge	**Alt 3C Biological Opinion with 3.0' Surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion with 1.8' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**	**Alt 5C Biological Opinion with 3.0' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**
CLASS III IMPACT – ADVERSE BUT NOT SIGNIFICANT					
Surface Water Hydrology					
Slightly reduce the frequency of spills that could increase flooding hazard along the lower river over time through reducing the times flood flows would clear riparian vegetation and restore channel capacity.	X	X	X	X	X
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		
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.	X				X

Table ES-2
Summary of Impacts Due to the Project Alternatives

	Occurrence of Impact Relative to Baseline Operations (Alternative 2)				
Resource, Impact and Mitigation Measures	**Alt 3B Biological Opinion with 1.8'Surcharge**	**Alt 3C Biological Opinion with 3.0' Surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion with 1.8' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**	**Alt 5C Biological Opinion with 3.0' Surcharge in normal or dry years, CalTrout Alternative 3A2 during wet and above-normal years**
.Riparian and Lakeshore Vegetation					
Surcharging would remove upland vegetation (chaparral and coastal sage scrub) along the margins of the lake.	X	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
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.			X		
Sensitive Aquatic and Terrestrial Wildlife					
Surcharging would displace upland wildlife habitat along the margins of Cachuma Lake.	X	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		

1.0 INTRODUCTION

As stated in the Executive Summary, this revised DEIR analyzes a set of new alternatives introduced pursuant to the circulation of the original DEIR in August 2003.[2] The following descriptions of the proposed project, background information and alternatives analyzed in the original DEIR are included to establish a context for the analysis of the new alternatives introduced after the DEIR was circulated in August 2003. As previously stated, the remainder of the document, while conveying the general theme of the original DEIR, will focus on the analysis of new alternatives introduced after the DEIR was circulated in August 2003. Also, for the sake of consistency, this revised DEIR maintains the same outline and numbering as the original August 2003 DEIR. However, consistent with section 15088.5 of the CEQA Guidelines, certain portions of the August 2003 DEIR that have not been revised are not included in this document. Accordingly, the numbering of sections, tables and figures in this document is not always sequential.

1.1 PROPOSED PROJECT

The proposed project analyzed in this revised DEIR 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

[2] The August 2003 DEIR is available online at http://www.waterrights.ca.gov/hearings/cachumahearing.htm.

Project. The Secretary of the Interior authorized construction of the Cachuma Project pursuant to section 9(a) of the Reclamation Project Act of 1939. The United States Department of the Interior, Bureau of Reclamation (Reclamation) began construction of the Cachuma Project in 1950 and completed construction in 1956.

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

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

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

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

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

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

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

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

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

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

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

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

- Santa Barbara County Public Works Department - Flood Control Water Agency

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

As explained in the Executive Summary, above, some changes have been made to this revised DEIR in response to some of the comments on the 2003 DEIR, but this revised DEIR does not contain a complete response to comments.

When revising a DEIR, the lead agency may recirculate only those portions of the document that have been revised, and request that reviewers limit their comments to the revised chapters or portions of the document (Cal. Code Regs., tit. 14, § 15088.5, subd. (f)(2)). The Table of Contents of this DEIR shows the revised portions of the August 2003 DEIR in italics. The SWRCB requests that reviewers of this revised DEIR limit their comments to those revised portions. The SWRCB will combine comments made on the August 2003 DEIR and comments made on this revised DEIR, and include a complete response to all comments in the Final EIR that the SWRCB will prepare after circulating this document.

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-foot by 50-foot radial gates, with a concrete lined chute and stilling basin, control the spillway. The gate opening is 30 vertical feet. When closed, the top of the gates is at elevation 750 feet with a flashboard for a 0.75-foot surcharge. Surcharge is a term used to describe the amount of water stored above the elevation 750 feet in the reservoir. When the gates are raised, water passes under them in a controlled manner, depending upon the height of the gate. There is an outlet at the base of the dam with a capacity of 150 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 to Tecolote Tunnel when lake storage is about 30,000 af.

2.1.2 CONVEYANCE AND LOCAL STORAGE FACILITIES

Water from Cachuma Lake is conveyed to the South Coast Member Units through the Tecolote Tunnel intake tower (Figure 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, in the event SWP water deliveries cannot be 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 LAKE RECREATION AREA

The Cachuma Lake Recreation Area (Recreation Area) encompasses approximately 9,250 acres, including Cachuma Lake and the surrounding rugged hillsides and oak woodland-covered shores (Figure 2-2). The Recreation Area is currently managed by the Santa Barbara County Parks Department (County Parks).

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

2.2.2 PROJECT YIELD AND DELIVERIES

The initial planning studies that supported the original Cachuma Project contract indicated that the project could deliver a safe yield of 32,000 afy. Safe yield is usually defined as the amount of water a project can be expected to deliver over a sustained hydrologic period – a period that preferably is long enough to contain wet periods as well as droughts. Since the 1950s, the original estimate of safe yield has been reduced several times based on: (1) use of a longer hydrologic period that incorporates a key drought period, 1946-51; and (2) loss of reservoir storage due to ongoing sedimentation. The most recent estimate of safe yield was 24,800 afy (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 afy, based on the initial estimate of the Project's safe yield (see above). However, with the exception of deliveries in 1976, the Member Units have requested annual deliveries that are lower than the original entitlement in order to avoid shortages in dry years.

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

Since 1993, the maximum Cachuma Project delivery was 25,714 afy. 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 afy, 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. The operational yield (25,714 afy) has been maintained by Member Units based on the new estimate of reservoir capacity completed in 2000 (MNS, 2000).

Cachuma Project annual deliveries to the Member Units for the years 2002-2005 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 35 percent for MWD to 53 percent for the GWD.

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

Member Unit	Percentage of Project Yield (%)	Annual Deliveries Based on Operational Yield of 25,714 afy	Percent of Total Member Unit Water Supply from Cachuma[1]	Cachuma Project Usage (afy) During Water Year [2]			
				2002	2003	2004	2005
Carpinteria Water District [3]	10.938	2,813	38	3,511	2,632	2,788	2,939
Montecito Water District [3]	10.311	2,651	35	2,646	1,721	2,820	2,298
City of Santa Barbara [3]	32.188	8,277	45	7,525	5,918	7,119	8,229
Goleta Water District [3]	36.25	9,321	53	10,118	8,545	11,308	10,404
SYRWCD, ID#1 [4]	10.313	2,652	44	2,102	3,189	2,472	2,382
Total=	100	25,714	NA	25,902	22,005	26,507	26,252

1 Based on the Member Units' testimony at the SWRCB hearings in October 2003.
2 Based on data received from COMB, January 04, 2007.
3 Includes SWP water exchanged with SYRWCD, ID#1.
4 Includes diversion to Cachuma Park and SYRWCD, ID#1 exchange.

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

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

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

Water Year	Inflow Computed	Inflow % of Average	End of WY Storage	Gross Evaporation	Precip. on Lake	SWP Inflow	Releases: Direct Diversion	Releases: Tecolote Tunnel	Releases: SYRWCD ID#1	Releases: Downstream	Releases: Fish	Releases: Spills	Releases: Total	Tunnel Infiltration	Member Unit Deliveries	Project Water Deliveries	Water Rights Releases
1953	17,942	20%	9,188	1,319	106	0	0	0	0	7,541	0	0	7,541	0	0	0	7,541
1954	18,955	26%	21,779	2,327	598	0	0	0	0	4,635	0	0	4,635	0	0	0	4,635
1955	4,941	7%	19,584	2,540	936	0	0	0	0	3,922	0	0	3,922	9,621	9,621	9,621	3,922
1956	24,330	33%	36,629	4,200	1,482	0	0	2,118	0	2,449	0	0	4,567	6,734	8,852	8,852	2,449
1957	6,150	8%	30,154	4,642	1,162	0	0	5,470	0	3,674	0	0	9,144	5,388	10,858	10,858	3,674
1958	219,129	296%	196,889	11,210	4,459	0	0	4,850	0	5,050	0	35,748	45,648	5,005	9,855	9,855	5,050
1959	15,068	20%	187,178	14,624	3,629	0	0	8,432	0	2,296	0	3,056	13,784	4,732	13,164	13,164	4,284
1960	2,643	4%	163,149	13,613	2,669	0	169	11,410	300	3,849	0	0	15,728	3,626	15,505	15,505	4,149
1961	795	1%	134,493	12,015	2,382	0	662	17,309	239	1,608	0	0	19,818	4,242	22,452	22,452	1,608
1962	100,134	135%	190,475	12,446	4,963	0	402	11,921	890	1,633	0	21,822	36,668	3,739	16,952	16,952	1,633
1963	4,270	6%	171,736	12,157	3,788	0	510	10,595	694	2,843	0	0	14,642	3,259	15,058	15,058	2,843
1964	2,439	3%	141,506	11,786	2,378	0	447	17,352	1,504	3,958	0	0	23,261	3,357	22,660	22,660	3,958
1965	12,314	17%	122,308	10,204	3,043	0	182	14,909	1,837	7,423	0	0	24,351	3,271	20,199	20,199	7,423
1966	79,292	107%	168,926	12,524	3,707	0	345	17,522	2,129	3,862	0	0	23,858	3,137	23,133	23,133	3,862
1967	208,961	282%	191,622	12,683	5,774	0	246	14,155	2,575	8,557	0	153,823	179,356	3,219	20,195	20,195	8,557
1968	10,404	14%	160,871	13,524	2,414	0	357	18,199	3,669	7,820	0	0	30,045	3,222	25,447	25,447	7,820
1969	525,370	709%	190,181	12,305	9,727	0	240	15,031	2,597	3,199	0	472,411	493,478	3,582	21,450	21,450	3,199
1970	28,740	39%	176,407	13,525	1,793	0	335	21,448	4,115	4,888	0	0	30,786	3,065	28,963	28,963	4,888
1971	31,045	42%	161,345	12,308	3,497	0	357	22,800	3,115	11,028	0	0	37,300	3,335	29,607	29,607	11,028
1972	8,754	12%	121,314	11,452	2,231	0	167	28,158	4,469	6,769	0	0	39,563	3,185	35,979	35,979	6,769
1973	125,804	170%	185,591	12,056	5,948	0	129	18,456	3,552	3,982	0	29,300	55,419	2,842	24,979	24,979	3,982
1974	33,670	45%	182,039	12,677	4,112	0	138	17,805	3,469	1,590	0	5,655	28,657	2,878	24,290	24,290	1,009
1975	50,544	68%	184,467	11,866	5,867	0	128	20,854	3,057	1,275	0	16,804	42,118	3,072	27,111	27,111	576
1976	5,310	7%	145,187	11,804	3,189	0	148	26,020	4,655	5,152	0	0	35,975	2,750	33,573	33,573	4,643
1977	1,520	2%	112,077	10,775	2,601	0	98	18,740	4,583	3,035	0	0	26,456	2,191	25,612	25,612	2,795
1978	329,219	444%	193,424	13,535	9,573	0	114	20,701	3,011	790	0	219,295	243,911	3,161	26,987	26,987	56
1979	61,692	83%	183,949	13,917	5,250	0	147	20,102	4,029	1,837	0	36,385	62,500	4,295	28,573	28,573	895
1980	153,543	207%	187,382	13,353	6,003	0	139	22,057	2,483	1,166	0	116,915	142,760	3,346	28,025	28,025	311
1981	22,066	30%	168,871	13,811	4,019	0	178	20,856	5,007	4,743	0	0	30,784	3,157	29,198	29,198	4,175
1982	26,848	36%	159,528	11,479	3,868	0	187	20,956	2,963	4,474	0	0	28,580	2,964	27,070	27,070	3,963
1983	428,601	578%	196,347	12,630	10,995	0	183	22,616	1,532	4,142	0	361,675	390,148	3,061	27,392	27,392	3,447
1984	39,074	53%	171,599	14,534	3,354	0	193	25,601	5,054	4,577	0	17,217	52,642	3,360	34,208	34,208	3,162
1985	5,057	7%	135,748	12,275	2,816	0	142	22,781	2,664	5,862	0	0	31,449	2,894	28,481	28,481	5,392
1986	76,571	103%	171,873	12,782	4,831	0	108	21,690	2,686	8,010	0	0	32,494	2,287	26,771	26,771	7,391
1987	2,374	3%	128,352	12,147	1,996	0	150	27,209	3,812	4,573	0	0	35,744	1,848	33,019	33,019	3,887
1988	8,732	12%	99,150	10,293	4,092	0	102	23,917	2,803	4,911	0	0	31,733	1,794	28,616	28,616	4,856
1989	4,044	5%	66,098	8,366	1,459	0	86	20,632	2,802	6,670	0	0	30,190	1,878	25,398	25,398	6,670
1990	2,627	4%	34,188	6,019	909	0	66	16,384	863	4,792	0	0	22,105	2,031	19,344	19,344	4,792
1991	53,566	72%	60,995	6,373	2,057	0	43	15,762	1,656	4,983	0	0	22,444	1,876	19,337	19,337	4,983
1992	135,828	183%	157,066	11,239	4,022	0	52	18,170	891	13,427	0	0	32,540	1,899	21,012	21,012	13,099
1993	333,387	450%	177,479	13,428	8,875	0	79	22,582	2,042	1,591	1,429	280,698	308,421	1,894	26,597	26,597	1,518
1994	16,729	23%	151,046	12,561	4,144	0	73	22,821	1,819	9,537	494	0	34,744	1,937	26,650	26,650	9,192
1995	365,092	493%	134,855	10,321	10,063	0	64	23,887	109	1,823	740	354,402	381,025	2,028	26,088	26,088	1,547
1996	33,243	45%	120,503	11,627	2,653	0	76	24,721	2,109	9,703	2,012	0	38,621	2,040	28,946	28,946	9,313
1997	56,552	76%	124,771	11,861	2,911	148	83	26,785	1,785	13,205	1,623	0	43,481	2,034	30,687	30,539	12,791
1998	475,175	641%	185,500	11,350	12,071	1,354	60	24,473	0	3,956	1,976	386,055	416,520	2,057	26,590	25,236	1,684
1999	21,562	29%	168,772	12,341	4,077	323	70	26,397	0	883	2,999	0	30,349	2,091	28,558	28,235	0
2000	51,895	70%	170,840	12,435	4,972	2,156	79	30,365	0	5,972	2,037	6,067	44,520	2,413	32,857	30,701	4,423
2001	152,773	206%	173,479	11,995	7,712	818	78	26,089	0	3,502	2,157	112,313	144,139	2,404	28,571	27,753	1,795
2002	5,508	7%	129,370	11,004	2,040	4,627	90	30,976	0	11,961	2,253	0	45,280	2,405	33,471	28,844	11,466
2003	18,822	25%	115,449	9,402	3,707	6,816	99	28,781	0	2,292	2,691	0	33,863	1,714	30,594	23,778	2,000
2004	5,750	8%	71,378	8,829	1,782	5,924	83	32,269	0	14,217	2,134	0	48,703	2,229	34,580	28,656	14,193
2005	401,752	542%	179,994	11,763	8,365	3,137	62	26,796	0	2,894	3,045	260,078	292,875	2,600	29,458	26,321	1,813
Maximum	525,370	709%	196,889	14,624	12,071	6,816	662	32,269	5,054	14,217	3,045	472,411	493,478	9,621	35,979	35,979	14,193
Minimum	795	1%	9,188	1,319	106	0	0	0	0	790	0	0	3,922	0	0	0	0
Average	91,068	123%	140,059	10,986	4,171	477	150	19,055	1,841	5,067	483	54,523	81,119	2,965	24,011	23,534	4,738

Footnotes for Summary of Cachuma Operations (Table 2-2)

1. The percent of average is based on the historical average annual runoff of 74,100 af estimated for the Santa Ynez River at the gaging station near the town of Santa Ynez. This average is based on 22 years of record during the period October 1929 through September 1952, excluding the no-record for water year 1932.

2. Computed inflow is the algebraic sum of the change in storage, releases, spills, and evaporation minus precipitation on the reservoir surface and SWP inflow.

3. In water year 1971, the inflow included approximately 5,700 af, which reached Cachuma Lake after being released from storage in Gibraltar Reservoir. The remaining inflow (25,300 af) was about 34 percent of the historical average.

4. In water years 1971 and 1972, 5,580 af and 1,358 af, respectively, were released through the Tecolote Tunnel for delivery to the City of Santa Barbara, which had been temporarily stored in Lake Cachuma.

5. Releases indicated include leakage from around spillway gates and through river outlet works valves.

6. In water year 1995, the water spilled down the river was due to large winter storms and a reservoir restriction which resulted from a safety of dams concern.

7. The Member Unit Deliveries is the algebraic sum of the releases to the SYRWCD, ID#1, Direct Diversion, and the Tecolote Tunnel plus infiltration into the tunnel.

8. Based on the new capacity table prepared in August 1955, the storage was reduced by 1,610 af on August 1, 1955. In March 1989, a sediment survey was completed resulting in capacity reduction of 14,465 af at 750 feet elevation. A revised capacity table went into effect on June 1, 1990, reducing the storage by 7,322 af. A new capacity table went into effect on July 1, 2001 which resulted in reducing the storage by 2,379 af.

9. Data for water years 1958–2001 were taken directly from the Annual Progress Reports submitted to the SWRCB. Data for water years 1953–1957 were taken from Daily Operations Reports.

10. Releases to Tecolote Tunnel in water years 1998–2002 include SWP water conveyed through the reservoir and tunnel.

11. Project Water Deliveries equals the Member Unit Deliveries minus the SWP water conveyed through the reservoir and tunnel.

12. For water years 1953–1966, Water Rights Releases were reported as "water released for downstream rights" in the Annual Progress Reports, not including outlet spill releases.

13. For water years 1967–1973, Water Rights Releases were reported as "downstream releases from Bradbury Dam outlets for live-stream purposes" in the Annual Progress Reports, not including outlet spill releases.

14. For water years 1974–2002, Water Rights Releases were taken directly from the monthly downstream users reports.

15. Note that from 1998 through 2005 (present), SYRWCD, ID#1 receives its Cachuma Project entitlement through an exchange with South Coast Project members.

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

The Below Narrows Account (BNA) is based on the difference between the 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 should be used to determine the differences in percolation with and without the Cachuma Project. In general, use of the upper curve provides a higher rate of credit accrual in the BNA. Pursuant to a December 17, 2002, settlement agreement, CCRB, SYRWCD, SYRWCD, ID#1, and the City of Lompoc have agreed that the upper curve should continue to be used for purposes of establishing BNA credits, but under certain conditions, a portion of the credits should be set aside for the Member Units’ use during dry conditions.

Dewatered storage capacity in the groundwater basin allows for additional percolation of rainfall and tributary runoff below Bradbury Dam. Water releases to recharge downstream groundwater basins are made in average and dry years, based on the amount of dewatered storage in the Above Narrows Alluvial Groundwater Basin and the extent of percolation from tributary flows in the Below Narrows Basin. In very wet years, downstream basins are full and do not require recharge to satisfy downstream water rights. In dry years, releases are typically made in the spring or early summer 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 water year 1953 to 2005 are shown in Table 2-2. Annual releases from the ANA and the BNA are shown in Table 2-3 by calendar year and on Chart 2-3 (Appendix B). Monthly releases under Order WR 89-18 are shown on Chart 2-4 (Appendix B). For the period from 1989 to 2005, the average annual release was 5,871 af. The average annual releases during the period from 1973 to 1988 were substantially less than the releases since 1989, particularly for the BNA.

Table 2-3
Historical Releases From the ANA and BNA

	Releases (afy)		
Calendar Year	**ANA**	**BNA**	**Total**
Releases under Order WR 73-37			
1974	1,353	0	1,353
1975	1,134	0	1,134
1976	4,237	0	4,237
1977	2,299	0	2,299
1978	62	0	62
1979	1,200	0	1,200
1980	0	0	0
1981	4,175	0	4,175
1982	6,655	755	7,410
1983	0	0	0
1984	3,162	0	3,162
1985	5,686	0	5,686
1986	5,317	1,780	7,097
1987	3,887	0	3,887
1988	5,050	1,283	6,333
Avg=	2,948	255	3,202
Releases under Order WR 89-19			
1989	5,192	0	5,192
1990	4,792	0	4,792
1991	7,745	3,638	11,383
1992	4,930	3,287	8,217
1993	0	0	0
1994	6,727	4,012	10,739
1995	0	0	0
1996	7,319	3,459	10,778
1997	9,572	3,438	13,010
1998	0	0	0
1999	0	0	0
2000	4,360	1,858	6,218
2001	0	0	0
2002	9,054	4,412	13,466
2003	0	0	0
2004	11,494	4,512	16,006
2005	0	0	0
Avg=	4,187	1,683	5,871

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 under an exchange agreement with South Coast Member Units, although this water is not included in SYRWCD, ID#1's SWP entitlement.

SWP contract entitlements for the Member Units are listed below.

- Carpinteria Valley Water District – 2,000 afy
- Montecito Water District – 3,000 afy
- City of Santa Barbara – 3,000 afy
- Goleta Water District – 7, 000 afy
- SYRWCD, ID#1 – 2,000 afy (500 afy to SYRWCD, ID#1, and 1,500 afy to the City of Solvang pursuant to an agreement)

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

The overall availability of SWP water varies with hydrologic cycles in northern California and contractor demands throughout the state. During wet years, the SWP is able to deliver sufficient amounts to meet all or most contractor requests. During dry years, the SWP experiences shortages and contractors only receive a portion of the requested deliveries. The long-term annual average delivery of SWP water to the Santa Barbara County SWP contractors is estimated to be 77 percent of total entitlement, not including the drought buffer. This estimate is based on a simulation of the SWP during the period 1922-1994, using the Department of Water Resources model DWRSIM version 9.06T, provided to Stetson Engineers for this EIR. The model utilizes the historic hydrology of the Sacramento-San Joaquin Delta to predict annual delivery in the SWP as a percentage of total entitlements. Based on the simulation model, annual deliveries are reduced to 20 – 30 percent of full entitlement during severe drought periods. Results of the simulation model are shown on Chart 2-5 in Appendix B.

Recent deliveries of SWP water to the Member Units are shown in Table 2-4.

Table 2-4
Recent State Water Project Deliveries for Cachuma Project Member Units

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

Source: Communications with CCWA.
1) Water year represents October through September.
2) Some or all of this water was delivered to SYRWCD ID#1 and exchanged for Cachuma Project water, which was delivered to the South Coast as if it were SWP water.
3) WY 1998 deliveries include 50 afy of drought buffer water. WY 1999 deliveries include 200 afy plus 841 afy of DWR Turnback Pool water. WY 2000 deliveries include 200 afy of drought buffer water.

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 consults 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 a runoff event and typically will result in a 5- to 6-foot lowering of the lake.

- **Pre-releases.** These releases match the inflows at the beginning of a flood event, designed to pass the early part of a flood while maintaining as much of the surcharge space in the reservoir as possible. Reclamation establishes a maximum allowable release level prior to initiating the releases that takes into account downstream flows and flooding hazards.
- **Gateholding.** Under this method, Reclamation opens the spillway gates in response to a rise in the reservoir as flood flows fill the lake. This action releases water downstream while maintaining a minimum freeboard on the gates in order to prevent overtopping of the gates and the dam crest.

2.3 MEMORANDUM OF UNDERSTANDING FOR FISH STUDIES

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

Reclamation has historically managed the maximum water level of Cachuma Lake at 750 feet. However, beginning in 1998, Reclamation surcharged the reservoir 0.75 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 20 times since Bradbury Dam was completed. The most recent spills occurred in 1998, 2000, 2001, 2005, and 2006. A summary of historic spills is provided in Table 2-2. When the reservoir level did not exceed 750 feet in a given year, 2,000 af from the minimum pool ("dead storage") was dedicated to the Fish Reserve Account. (Note: The Fish Reserve Account has been superseded by the requirements of the Biological Opinion, discussed in section 2.4, below.)

The Santa Ynez River Technical Advisory Committee (SYRTAC) directs the studies performed under the 1994 MOU and directed the timing and amount of releases from the Fish Reserve Account each year. The committee is composed of various biologists and resource agency personnel. In addition to the signatories to the 1994 MOU, the following agencies and organizations are participants in the SYRTAC: NMFS; U.S. Forest Service; Natural Resources Conservation Service; California Trout; Santa Barbara Urban Creeks Council; Central Coast Regional Water Quality Control Board; CCWA; Santa Barbara County Fish and Game Commission; and the California Coastal Commission. The SYRTAC provides data and recommendations to a Consensus Committee that, in turn, reviews the SYRTAC's work and provides necessary direction. A full-time fish biologist is funded under the 1994 MOU to conduct field investigations and compile data. Annual releases from the Fish Reserve Account during the period 1993 through 2000 ranged from 494 to 2,999 afy, as shown in Table 2-2. Monthly releases from the Fish Reserve Account are shown on Chart 2-4 (Appendix B).

The 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 to the 2003 DEIR), 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 to the 2003 DEIR.) 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 Cachuma Lake to provide additional water for fish releases. The Biological Opinion assumed that Reclamation would complete the spillgate modifications to allow surcharging at 1.8 feet during the calendar year 2002, and 3.0 feet during the calendar year 2005. If Reclamation did not meet the deadline for the 3.0-foot surcharge, the Biological Opinion required that Reclamation re-initiate consultation with NMFS under Section 7 of the ESA. (There was no requirement for Reclamation to re-initiate consultation with NMFS if the 1.8-foot surcharge was not implemented.) Reclamation did not implement a 3.0-foot surcharge in 2005 due to potential impacts to recreational facilities at the lake. Instead, Reclamation implemented a 2.47-foot surcharge. Reclamation is likely to implement a 3.0-foot surcharge by 2009 pursuant to a Memorandum of Understanding between CCRB, SYRWCD, ID#1, and the County of Santa Barbara.

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

Table 2-5
Allocation of Surcharged Water

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

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. These ramping rates, which are a refinement of rates recommended by the SYRTAC, are detailed in Table 2-6. They have been used since 2000.

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 years with spills exceeding 20,000 af and the years following such a spill year, flow will be maintained between the dam and Alisal Road (a distance of 10.5 miles).

Reclamation, in cooperation with the SYRWCD, has operated water rights releases conjunctively with fish water releases since 1994, and proposes to continue this operation in the future. That is, when releases are being made for water rights, the water from this source will be used to continue to meet the mainstem target flows as well as the habitat flow requirement in Hilton Creek. Currently, water rights releases are made from the outlet works and the Hilton Creek watering system (described below) that is designed to deliver water to three release points: two along Hilton Creek and one in the stilling basin (Figure 2-3). The design capacity of this system is 10 cfs. Releases made to satisfy downstream water rights 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 Cachuma Lake and the extent to which Cachuma Lake spills. When Cachuma Lake spills at least 20,000 af, the long-term target flow at the Highway 154 Bridge is 10 cfs. When Cachuma Lake spills less than 20,000 af, or does not spill at all, but storage is at least 120,000 af, the target flow at the Highway 154 Bridge is 5 cfs. When storage drops below 120,000 af, the target flow at the Highway 154 Bridge is 2.5 cfs. When storage drops below 30,000 af, no long-term target flow exists. Instead, Reclamation anticipates that 30 af per month would be available to provide refreshing flows to the Stilling Basin and Long Pool below Bradbury Dam. In addition, Reclamation must reinitiate consultation with NMFS to determine what actions, if any, will be taken for steelhead in the mainstem under these conditions. Long-term target flows at the Alisal Road Bridge are 1.5 cfs in years when Cachuma Lake spills at least 20,000 af and steelhead are present in the Alisal reach of the Santa Ynez River and in the water year following any such year.

Long-term target flows are summarized in Table 2-7. 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 3.0-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. Although Reclamation has not yet implemented a 3.0-foot surcharge, Reclamation began implementing the long-term target flows with a surcharge of 2.47 feet in 2005.

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. Though the reservoir is currently surcharged at 2.47 feet, the full 3,200 af will be allocated to the Fish Passage Account as stipulated by the Biological Opinion. 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. However, the account is reset when the reservoir surcharges.

2.4.2.5 Adaptive Management Account

Reclamation proposed to create an Adaptive Management Account to provide additional releases for future habitat needs that may be identified under an adaptive management program. Under Reclamation's operating plan, once a 3.0-foot surcharge has been implemented, Reclamation will allocate 500 af to the account in years when the reservoir surcharges at 3 feet. Though the reservoir is currently surcharged at 2.47 feet, the full 500 af will be allocated to the Adaptive Management Account as stipulated by the Biological Opinion. 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 (AMC) to benefit steelhead and its habitat as determined by the committee, which will be composed of Reclamation, NMFS, DFG, USFWS, CCRB, SYRWCD, ID#1, SYRWCD, and Lompoc.

2.4.3 HABITAT IMPROVEMENTS

2.4.3.1 Tributary Passage Impediment Removal Measures

According to the Biological Opinion, there are many natural and man-made passage impediments on tributaries below Bradbury Dam, particularly under low to moderate flow conditions. The impediments include culverts, road crossings, and boulder cascades. Removal of these impediments would increase access to suitable spawning and rearing habitats, thereby expanding the total available habitat for 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.

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

The Hilton Creek Cascade Chute Project was completed in January 2006 (CCRB 2006a). The Hilton Creek Highway 154 Culvert Project is scheduled for construction in Fall 2007 pending funding from Caltrans. Due to design revisions undertaken to meet DFG steelhead passage guidelines, plans for the construction of boulder fishways to improve passage at six crossings along Quiota Creek originally slated for Fall 2003 have been expanded to nine crossings with construction rescheduled to begin in Fall 2007. A feasibility study and design options have been developed for the Nojoqui Creek Fish Passage Project.

In addition to the passage impediment removal projects listed above, new passage impediment removal projects have been added in the lower river tributaries. These new projects include the Hilton Creek Lower Barrier Project and the El Jaro Creek Rancho San Julian Fish Passage Enhancement Project. Both projects are scheduled to begin construction in Fall 2007.

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

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 proposes to extend the lower portions of the creek 1,500 feet to provide additional rearing habitat. This project is expected to be completed in 2010.

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 required 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 River and review of storm flow decay curves (mean, median, etc.,) and other methodologies for providing increased migration opportunity. To meet this requirement of the BO, Reclamation has studied alternative passage flow criteria. The study was designed to address measures outlined in the Biological Opinion to (1) modify the Fish Passage Supplementation Program during dry years, (2) better define the adaptive management program for upstream and downstream migration, and (3) outline a method to verify the effectiveness of the migration supplementation. The results of the study are presented in a memorandum entitled “Cachuma Project Fish Passage Supplementation Program: supplementation criteria, real-time decision making, and adaptive management” (Adaptive Management Committee, 2004). NMFS approved the Fish Passage Supplementation Program on October 11, 2005 (letter from NMFS, October 11, 2005).

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 April 1999. Public meetings to accept comments were conducted in Santa Barbara and Santa Ynez. The SYRTAC issued a final Fish Management Plan in October 2000. It 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 effects to these species, which include the tidewater goby, three-spine stickleback, prickly sculpin, Pacific lamprey, arroyo chub, southwestern pond turtle, and red-legged frog.

The management actions 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. A summary of Fish Management Plan actions is provided in Table 2-9.

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
Investigate passage around Bradbury Dam
Actions that Require Cooperation of Other Agencies and Private Landowners
Tributary enhancement measures
Tributary passage impediment removal
Mainstem habitat enhancement and protection
Genetic protection of Southern Steelhead populations
Access for adult steelhead to the upper watershed
Downstream passage for outmigrating juveniles from the upper watershed

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, and the instream flow requirements advocated by CalTrout (discussed in section 3.2.2, below).

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:

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

- City of Solvang, Permit 15878 (Application 22423). Maximum diversion of 5 cfs for municipal and industrial purposes from Santa Ynez River underflow. The City has two wells located in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin. Production from 1997-1999 ranged from 879 to 1,053 afy, at a maximum diversion rate of 1.8 cfs. The permit expired in 1990 and the City has filed a petition for a time extension with the SWRCB. The City is currently preparing a draft EIR for the petition, which is scheduled to be released for public review and comment sometime in 2007.
- City of Buellton, Permit 15879 (Application 22516). Maximum diversion of 3.1 cfs for municipal and industrial purposes with an annual diversion

limit of 1,385 afy. The City has three wells in the Santa Ynez River. Buellton petitioned the SWRCB to modify its place of use and add a new well to the permit. Action on the petition is being consolidated with Buellton's request for a license for its maximum annual use in 1996 of 2.7 cfs, with an annual diversion limit of 557 afy.

- SYRWCD, ID#1, Permit 17733 (Application 24578). Maximum diversion of 4 cfs, from Santa Ynez River underflow, with an annual diversion limit of 2,220 af. Water diversion facilities include wells that are located in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.
- SYRWCD, ID#1, Permit 17734 (Application 24579). Maximum diversion of 6 cfs, from Santa Ynez River underflow, with an annual diversion limit of 3,400 af. Water diversion facilities include wells located in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.
- SYRWCD, ID#1, License 10415 (A12601). Maximum diversion of 1.73 cfs, from Santa Ynez River underflow, with an annual diversion limit of 515 af. Water is diverted from an infiltration gallery in the Santa Ynez Subarea of the Santa Ynez River Alluvial Basin.
- Edalatour, License 1313A (Application 2394A). Maximum diversion of 0.52 cfs with an annual diversion limit of 53 afy. Water is diverted from the Buellton Subarea of the Santa Ynez River Alluvial Basin.
- Mercer, License 1313B (Application 2394B). Maximum diversion of 0.30 cfs with an annual diversion limit of 50 afy limit. Water is diverted from the Buellton Subarea of the Santa Ynez River Alluvial Basin.
- O'Brien, et al., Licenses 932A, 932B and 932C (Applications 3927A, 3927B and 2927C). Total diversion of 0.81 cfs, split as follows. License 932A allows diversion of 0.51 cfs with a diversion limit of 146 afy. License 932B allows diversion of 0.11 cfs with a diversion limit of 36 afy. License 932C allows diversion of 0.19 cfs with a diversion limit of 36 afy. Water is diverted from the Santa Rita East Subarea of the Santa Ynez River Alluvial Basin.
- Wright and Torres, License 790 (Application 4034). Maximum diversion of 0.62 cfs. Diversion is from Santa Rita West Subarea of the Santa Ynez River Alluvial Basin.

Appropriative Diverters – Below Narrows

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

Riparian Diverters – Above Narrows

- 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.

Riparian Diverters - Below Narrows

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

Groundwater Pumpers

- 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 baseline operations alternative should reflect any changes in Cachuma Project operations that had occurred or other fish enhancement activities that had taken place since NMFS issued the Biological Opinion.

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

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

The 2003 DEIR compared Alternative 2, then-existing conditions, to Alternative 1, historic conditions, in order to evaluate the changes that had taken place since Reclamation began to implement interim target flows pursuant to the Biological Opinion. Alternative 1 did not represent existing or baseline conditions, however, and therefore the discussion of Alternative 1 has not been incorporated into this document.

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

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

Under Alternatives 5A, 5B and 5C, flow requirements to protect fishery resources would be the same, but the three alternatives assume that Reclamation would implement different surcharge levels at Cachuma Lake. Alternative 5A, like Alternative 3A in the August 2003 DEIR, is based on the assumption of a 0.75-foot surcharge at Bradbury Dam. Accordingly, as these conditions no longer exist, Alternative 5A will not be analyzed further. Like Alternative 3B, Alternative 5B assumes a 1.8-foot surcharge. Like Alternative 3C, Alternative 5C assumes a 3.0-foot surcharge. In summary, the alternatives included in this EIR are listed below and described in the following subsections.

- 2. Baseline Condition Operations under Orders WR 89-18 and WR 94-5 and the Biological Opinion interim flow requirements (no project alternative).
- 3B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with a 1.8-foot surcharge.
- 3C. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge.
- 4B. Operations under the Biological Opinion assuming Reclamation achieves a 3.0-foot surcharge and the discharge of SWP water to the river near Lompoc in exchange for water available for groundwater recharge in the Below Narrows Account established by Order WR 73-37, as amended by Order WR 89-18.
- 5B. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry and critical water year types, assuming Reclamation achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with a 1.8-foot surcharge.
- 5C. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry and critical water year types, assuming Reclamation achieves a 3.0-foot surcharge.

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

Table 3-1
Summary of Alternatives Addressed in the EIR

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

Table 3-2
Key Elements of the Alternatives

Key Elements	Alternatives					
	2	**3B**	**3C**	**4B**	**5B**	**5C**
Releases for downstream water rights pursuant to Order WR 89-18 releases	X	X	X	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					
Surcharge to 1.8'		X			X	
Surcharge to 3'			X	X		X
Releases for interim rearing target flows per the Biological Opinion	X					
Releases for long-term operations for fish per the Biological Opinion		X	X	X		
Fish Releases using a combination of the long-term fish releases under the Biological Opinion and the 3A2 Operating Criteria					X	X
Other habitat enhancement actions under Biological Opinion, primarily consisting of tributary projects	X	X	X	X	X	X
Delivery of SWP water to Lompoc Forebay in exchange for BNA water				X		

3.2.2 DESCRIPTION OF ALTERNATIVES

3.2.2.1 Alternative 2 – Baseline Condition Operations

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

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

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

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

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

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

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

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

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

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

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

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

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

This alternative includes all the elements of Alternative 3B except that this alternative assumes that Reclamation will modify the spill gates for a 3.0-foot surcharge. Under this alternative, long-term rearing and passage releases for fish pursuant to the Biological Opinion would be met with the 3.0-foot surcharge.

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

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

In the 2003 DEIR, the No Project Alternative was defined as baseline operations (Alternative 2), which were expected to continue into the near future if the SWRCB does not modify Reclamation’s permits for the Cachuma Project. As discussed above, however, Reclamation has since increased the surcharge of Cachuma Lake from 0.75 to 2.47 feet, and has begun to implement long-term release requirements under the Biological Opinion. Accordingly, baseline operations no longer reflect how the Cachuma Project is likely to be operated in the foreseeable future if Reclamation’s permits are unchanged. Instead, Alternative 3C should be considered the No Project Alternative because it better reflects how the Cachuma Project is likely to be operated if Reclamation’s permits are unchanged. Reclamation already has begun implementation of the long-term release requirements under the Biological Opinion. In addition, although Reclamation has not yet implemented a full 3.0-foot surcharge, Reclamation is likely to do so in the foreseeable future pursuant to the Memorandum of Understanding between CCRB, SYRWCD, ID#1, and the County of Santa Barbara.

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

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

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

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

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

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

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

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

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

Under this alternative, varying amounts of SWP water would be delivered to the forebay area for recharge based on the average annual credits in the BNA. If this alternative is 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 4B, the agreement among the parties must account for this variability in deliveries. It can be addressed in two ways. One, the deliveries to the forebay area would be guaranteed its full amount of SWP water over a fixed period of time, and any shortages in the SWP water deliveries would be taken by the Member Units. Two, deliveries to the Lompoc forebay would take shortages in the SWP water deliveries in the same proportions as the Member Units. To fulfill requests for recharge under the BNA that are not met by the SWP water deliveries, the Member Units would request releases from Cachuma Lake. Finally, in the event of an outage in the SWP system, recharge to the Lompoc Basin under Order WR 89-18 would be fulfilled in the traditional manner by releases from Cachuma Lake.

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

3.2.2.5 Alternatives 5B and 5C

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

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

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

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

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

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

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

Under Alternatives 5B and 5C, flow requirements to protect fishery resources would be the same, but the two alternatives assume that Reclamation would implement different surcharge levels at Cachuma Lake. Like Alternative 3B, Alternative 5B assumes a 1.8-foot surcharge. Like

Alternative 3C, Alternative 5C assumes a 3.0-foot surcharge. Comparing Alternatives 5B and 5C to Alternative 2 (baseline operations) will show how greater releases for fish purposes under these alternatives may affect downstream environmental conditions. Comparing these alternatives to Alternative 2 will also show the water supply related impacts of these releases coupled with implementation of a 1.8-foot or a 3.0-foot surcharge, respectively.

4.0 ENVIRONMENTAL ANALYSIS OF ALTERNATIVES (FLOW-RELATED ACTIONS)

4.1 OVERVIEW OF IMPACT ASSESSMENT

The flow-related actions associated with the project alternatives are addressed in this section. These actions include: (1) releasing water from Bradbury Dam to enhance downstream steelhead rearing and passage, as well as aquatic habitat for other species, 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 THE PURPOSES OF ANALYZING FLOW-RELATED MEASURES

Please see the August 2003 DEIR and section 3.2.1 of this document for details on the environmental baseline used to analyze flow-related measures.

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.

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

4.1.3 IMPACT THRESHOLDS

Environmental impacts of the alternatives are classified in the categories shown below. An impact was determined to be significant using guidance from: (1) Public Resources Code section 21083, (2) the definitions of "significance" in 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 Effects. Beneficial Effects.

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

4.1.4 IMPACT ASSESSMENT FOR NON-FLOW RELATED HABITAT ENHANCEMENTS

Please see the August 2003 DEIR for details on the impact assessment for non-flow related habitat enhancements.

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

Hydrologic conditions that existed in 2003 are described in the August 2003 DEIR. As described below, some changes in surface water hydrology have occurred since 2003. For the reasons explained in section 3.22, however, the baseline conditions that existed in August of 2003 are used to analyze the project alternatives.

Pursuant to the signing of an MOU entitled "Memorandum of Understanding Regarding the Surcharge of Cachuma Lake and the Protection of Recreational Resources at the Lake" in February of 2004, the County, CCRB, and ID #1 implemented a phased surcharging at Cachuma Lake. The first action undertaken was the raising of the reservoir surcharge level from the previous elevation of 750.75 feet to an interim elevation of 751.8 feet. Following a spill event in January 2005, Stetson Engineers conducted a survey of the vulnerability of the lake's recreation facilities, revealing that the facilities identified earlier as being at risk of inundation were actually located at elevations higher than had been previously thought. In April of 2005, the aforementioned MOU was amended to provide for an increase in surcharge elevation to 752.47 feet, thereby allowing for the undertaking of emergency protective measures for facilities deemed to need them. Reclamation is likely to implement a 3.0-foot surcharge by 2009 pursuant to the MOU.[3] Due to the fact that the surcharge is maintained exclusively for releases for fish in the Santa Ynez River, operational yield has not changed from the levels associated with the historic high water mark at 750 feet. However, the 3.0 surcharge would increase reservoir capacity by 9200 af to a total capacity of 198,200 af.

4.2.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

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

[3] Following the completion of the proposed emergency protective measures in May of 2006, the County, CCRB, and ID No. 1 approved an "Interim Agreement Regarding the Surcharge of Cachuma Lake," which allowed a 3.0 surcharge for one year after Lake Cachuma spilled in April of 2006.

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

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

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

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

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

The operational elements for the various EIR alternatives that were included in the modeling are listed in Table 4-1.

Table 4-1
Operational Elements Used to Model Alternatives

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

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

One element that is common to all of the operating criteria is the conjunctive operation of releases for purposes of satisfying downstream water rights with fish releases. This 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 Lake is exported out through Tecolote Tunnel in the same month.
- SWP deliveries are not made in months when Cachuma Lake is spilling. Although SWP deliveries can be made up in other months, spill conditions usually indicate a wet period in which additional SWP deliveries probably would not be needed. Therefore, it was assumed that SWP deliveries would not be made during spills and would not be made up in subsequent months.
- The proportion of the SWP water as a part of a Cachuma release for purposes of satisfying downstream water rights is limited to 50 percent of the total release to provide protection to steelhead.
- Reclamation must avoid mixing SWP water in the Santa Ynez River downstream of Bradbury Dam when steelhead smolts could be subject to imprint; hence, SWP deliveries were curtailed during releases for steelhead passage.

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

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

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

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

Peer Review of Modeling Approach and Results

The Santa Ynez River Technical Advisory Committee (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 composed 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 had meetings periodically to provide guidance on the development of modeling tools. It has provided oversight on recent updates to the SYRHM, as well as the addition of a salinity component to the model (see section 4.5).

The 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 four of the technical memoranda prepared by Stetson Engineers for the EIR, as listed below (provided in Appendix E of the August 2003 DEIR):

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

In general, the 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.

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

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

4.2.2.2 Lake Impacts

The storage in Cachuma Lake is shown on Chart 4-6 in Appendix B for the various alternatives for the 76-year 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. Alternative 5B exhibits lower storage than under the baseline operations (Alternative 2) throughout the year due to additional releases for fish. Median monthly storage under Alternatives 3C and 4B are greater than under the baseline operations (Alternative 2) throughout the year due to increasing total reservoir storage by 9,200 af as a result of a 3.0-foot surcharge. Alternatives 3B and 5C exhibit both higher and lower median storage levels throughout the year than under baseline operations (Alternative 2) due to a combination of both increased fish releases and increased reservoir surcharge during spills.

Table 4-2
Median Monthly Storage in Cachuma Lake

Month	Median Monthly Storage (Simulation, 1918-1993) for Different Alternatives in af					
	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8’ surcharge	Alt 3C Biological Opinion with 3’ surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8’ surcharge	Alt 5C: "3A2"/BO and 3’ surcharge
November	130,484	132,602	136,080	135,135	126,831	130,324
February	152,394	150,918	154,607	154,660	149,466	152,943
April	165,533	165,018	167,877	169,135	162,685	166,287
July	146,851	149,528	153,067	154,840	144,258	147,788

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

Table 4-3
Median Lake Level

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

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

Table 4-4
Frequency of Surcharging

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

The percentage of time (months) that Cachuma Lake would reach maximum levels is presented in Table 4-5 based on the simulation modeling (76 years). These results indicate that under the baseline operations (Alternative 2), the maximum lake level (750.75 feet) is achieved 11 percent of the time. The alternatives involving additional surcharging would cause more frequent inundation of the baseline shoreline (750.75 feet). For example, lake levels for Alternatives 3B and 5B (with 1.8-foot surcharge) would reach or exceed 750.75 feet about 14 and 13 percent of the time, respectively. Under Alternatives 3C, 4B, and 5C (with 3.0-foot surcharge), 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 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
750.75	11%	14%	16%	16%	13%	16%
751		11%	14%	14%	11%	13%
752			11%	11%		11%
753			9%	8%		8%

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

Table 4-6
Duration of Inundation

Lake Elevation	Median Number of Consecutive Months at or Above Lake Elevation					
	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
750	4	5	5	5	5	5
751		4	5	5	4	5
752			4	4		4
753			3	3		3

4.2.2.3 River Impacts

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

For all alternatives, releases for fish downstream of the dam would be greater than for the baseline operations (Alternative 2). Releases for fish under Alternatives 5B and 5C would be greater than Alternatives 3B, 3C, and 4B because the alternatives must meet higher flows in a wet or above-normal water year. Under the baseline operations (Alternative 2), releases from the dam averaged 1,362 afy. The average annual releases for fish would increase to 2,701; 2,715; and 2,801 afy under Alternatives 3B, 3C, and 4B respectively, which operate under the long-term BO operations. The average annual releases for fish would increase to 3,999 and 4,026 afy under Alternatives 5B and 5C, respectively, which operate under the hybrid operations for releases for fish (BO and 3A2 operations). It should be noted that releases for fish from Cachuma Lake occurs also from conjunctive use with water rights releases as well as leakage from the dam. To the extent the spillway gates are repaired to minimize the leakage, then an additional amount would be released for the purpose of fish habitat maintenance.

The spill frequency and average annual spill amount under the baseline conditions (Alternative 2) are slightly greater than the rest of the alternatives. The number of spill months over a 76-year period would range from 74 to 79 months for Alternatives 3B, 3C, 4B, 5B, and 5C compared to 82 months under the baseline operations (Table 4-7). The average annual spill amount would be reduced 2, 3, and 4 percent from the baseline conditions under Alternatives 3B, 3C, and 4B, respectively. The average annual spill amount would also be reduced 5 and 6 percent from the baseline conditions under Alternatives 5B and 5C, respectively.

Table 4-7 shows that the releases for purposes of satisfying downstream water rights under Alternatives 3B, 3C, 4B, 5B, and 5C would be less than under the baseline operations (Alternative 2) because the additional releases for fish reduces the need for releases to replenish groundwater basins, which reduces the credits in the ANA. Most of the reduction in ANA credits due to fish releases occurs in the uppermost portion of the Above Narrows Aquifer (i.e., Santa Ynez Subarea) as described in section 4.4.2. Releases for water rights under Alternative 4B would also be less than under the baseline operations because releases from the BNA would not be made from the dam. Instead, SWP water would be delivered for artificial groundwater recharge to the Lompoc Forebay pursuant to an exchange agreement. The combined average annual releases for water rights and fish are 7,385 afy under the baseline operations (Alternative 2) and 8,383; 8,452; 6,741; 9,472; and 9,555 afy under Alternatives 3B, 3C, 4B, 5B, and 5C, respectively (Table 4-7).

Table 4-7
Key Hydrologic Characteristics

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

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

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

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

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

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

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

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 2 Interim Operations under Biological Opinion**	**Alt 3B Biological Opinion and 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay**	**Alt 5B: "3A2"/BO and 1.8' surcharge**	**Alt 5C: "3A2"/BO and 3' surcharge**
Below Hilton Creek						
2	99	99	99	99	99	99
5	47	74	75	75	74	75
10	33	39	39	37	48	48
20	26	28	28	24	32	32
50	13	12	12	8	12	12
Highway 154						
2	82	99	99	99	99	99
5	48	77	78	78	76	77
10	34	39	39	37	49	49
20	27	28	28	25	33	33
50	12	12	12	8	11	11
Alisal Road						
2	53	69	69	69	70	71
5	43	49	49	47	56	56
10	34	36	36	34	48	48
20	23	25	25	18	28	28
50	12	12	12	10	11	12
Near Buellton						
2	51	57	57	56	61	61
5	41	44	44	42	52	52
10	32	34	34	29	38	38
20	24	26	26	18	28	28
50	12	12	12	12	12	12
Above Salsipuedes Creek						
2	39	42	43	36	48	48
5	35	37	37	29	40	40
10	30	32	32	25	35	35
20	25	26	26	19	29	29
50	12	13	13	12	12	12

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 2 Interim Operations under Biological Opinion**	**Alt 3B Biological Opinion and 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4B Biological Opinion with SWP Delivery to Lompoc Forebay**	**Alt 5B: "3A2"/BO and 1.8' surcharge**	**Alt 5C: "3A2"/BO and 3' surcharge**
Narrows						
2	45	48	48	40	52	53
5	38	41	41	33	44	44
10	33	35	35	27	38	38
20	28	29	29	21	31	31
50	14	14	14	14	14	14

4.2.2.4 Impacts on Existing Flood Hazards

As described in section 4.2.2.3, project alternatives (3B, 3C, 4B, 5B, and 5C) would alter downstream hydrology in the following manner compared to the baseline operations (Alternative 2):

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

Alternatives 3B, 3C, 4B, 5B, and 5C would increase downstream flows (primarily from the dam to Alisal Road), and as such, could increase the instream riparian vegetation that could reduce channel capacity and cause flooding hazards. The additional flows for fish could increase the density, vigor, and extent of riparian vegetation in the river channel over time due to greater moisture availability, particularly during the early summer when water is generally at lower quantities in the river channel under baseline conditions (Alternative 2). The availability of water throughout the year in the channel will extend the growing season for phreatophytes and reduce the period of drought stress. 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 extent to which the expected increase in riparian vegetation along the river would reduce channel capacity and create potential flooding hazards cannot be predicted with any available analytic tools. Vegetative changes reduce channel capacity by increasing channel roughness due to more vegetation in the channel, and/or a greater percentage of woody obstructive vegetation. At the same time, the vegetative changes predicted in conjunction with Alternatives 3B, 3C, 4B, 5B and 5C would also result in slope stabilization, which would help to prevent bank erosion.

Flood hazards are created if the reduction in channel capacity deflects flows that cause bank erosion, or higher water levels are created that exceed the banks. The extent of flooding and bank erosion is dependent on site-specific channel conditions, which are highly variable along the lower river.

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

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

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

4.2.3 MITIGATION MEASURES

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

4.3 WATER SUPPLY CONDITIONS

4.3.1 EXISTING CONDITIONS

Please see the August 2003 DEIR and Technical Memorandum No. 5 in Appendix F (Stetson Engineers, 2006a) for details on existing water supply conditions. Technical Memorandum No. 5 contains revised versions of Tables 4-10, 4-11, 4-12, 4-13, and 4-14, which show Member Unit water supply and demand. The tables have been updated based on information from the Member Units.

4.3.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.3.2.1 SYRHM Modeling

The Cachuma Project water supply impacts of the alternatives are summarized in Table 4-16 based on the results of SYRHM simulations over the period of 1918-1993. The model estimates project deliveries each month after the release requirements under Order WR 89-18 and the various criteria for releases for fish have been met. A constant demand of 25,714 afy 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, before releases for fish were made from the Cachuma Project and before the reservoir sedimentation-area-capacity survey of 2000. Under their water supply contract with Reclamation, the Member Units may request and receive higher project deliveries if Reclamation determines that available supply exists. However, deliveries in excess of 25,714 afy could result in greater shortages in dry years.

4.3.2.2 Average Annual Project Yield

The average annual yield under Alternatives 3B, 5B, and 5C would be less than under the baseline operations (Alternative 2) by the following amounts: 129 afy under Alternative 3B; 260 afy under Alternative 5B; and 127 afy under Alternative 5C (Table 4-16). The reductions under these alternatives would be minor, approximately 1 percent or less than 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.

Alternatives 3C and 4B would increase the average annual project yield compared to the baseline operations by a slight amount (7 and 54 afy, respectively), resulting in a beneficial effect on water supply conditions for the Member Units.

Table 4-16
Impacts on Cachuma Project Deliveries to Member Units

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

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

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

4.3.2.4 Deliveries During Drought Periods

Using the worst drought year on record (1951) for purposes of analysis, project yield under the baseline operations (Alternative 2) would be 15,906 af, which represents a 38 percent shortage relative to the desired project yield of 25,714 af (Tables 4-16 and 4-17). Under 1951 conditions, the shortages under Alternatives 3B, 5B, and 5C would be greater than under the baseline operations (Alternative 2) because these alternatives involve greater releases for fish and the additional reservoir surcharge is not large enough to compensate. The shortages would be 44 percent under Alternative 3B, and 49 percent under Alternative 5B, and 44 percent under Alternative 5C. This represents an additional shortage of 1,454 af (or 6 percent) under Alternative 3B; 2,698 af (or 10 percent) under Alternative 5B; and 1,598 af (or 6 percent) under Alternative 5C (Table 4-16). In contrast, under 1951 conditions the shortages under Alternatives 3C and 4B would be about the same as under baseline 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. The three-year period used in the analysis - from May 1, 1949 to May 1, 1951 - was the period with the most critical shortages of any 36-month period simulated by the model.

4.3.2.5 Comparison of Member Units' Demand and Supply from All Sources

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 the baseline conditions (Alternative 2) the Member Units' total supply would exceed demand (based on year 2000 demand levels) by 1,211 af. If the Member Units' demand increases as projected, they will experience a shortage of 9,069 af by 2020. Under Alternatives 3B, 5B and 5C, current demand would exceed supply by 243 af, 1,487 af, and 387 af, respectively. Total supply in a critical drought year would be similar or greater under Alternatives 3C and 4B in comparison to the baseline conditions. Demand would outstrip supply by 2020 for all project alternatives.

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

	Alt 2	Alt 3B	Alt 3C	Alt 4B	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
1. Cachuma Project yield in a critical drought year (SYRHM simulation, Appendix F, Technical Memorandum No. 5)	15,906	14,452	15,819	16,363	13,208	14,308
2. Total supply from sources other than the Cachuma Project (Table 4-18)	31,312	31,312	31,312	31,312	31,312	31,312
3. Total supply (1 + 2)	47,218	45,764	47,131	47,675	44,520	45,620
4. Year 2000 demand (Table 4-19)	46,007	46,007	46,007	46,007	46,007	46,007
5. Surplus or shortage (3 - 4)	1,211	-243	1,124	1,668	-1,487	-387
6. Year 2020 demand (Table 4-19)	56,287	56,287	56,287	56,287	56,287	56,287
7. Shortage (3 - 6)	-9,069	-10,523	-9,156	-8,612	-11,767	-10,667

The 31,312 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 is based on testimony of the individual Member Units during the SWRCB Hearings on October 23, 2003. The analysis also assumes that the Member Units would receive the average annual SWP delivery of 9,225 af based on 50% of Table A (SWP Allocation Schedule) and drought buffer. 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	4,650
MWD	
2. Jameson Lake and Alder Creek diversions (SYRHM simulation, Appendix F, Technical Memorandum No.5)	312
3. Doulton Tunnel infiltration and Fox Creek diversion (SYRHM simulation, Appendix F, Technical Memorandum No.5)	130
4. Local groundwater supply	400
5. MWD subtotal (2 + 3 + 4)	842
City of Santa Barbara	
6. Gibraltar Reservoir (SYRHM simulation, Appendix F, Technical Memorandum No.5)	0
7. Mission Tunnel infiltration and Devil's Canyon diversion (SYRHM simulation, Appendix F, Technical Memorandum No.5)	500
8. Jameson Reservoir	300
9. Local groundwater supply	4,150
10. Reclaimed water	900
11. Desalinization	3,125
12. City of Santa Barbara subtotal (6 + 7 + 8 + 9 + 10 + 11)	8,975
GWD	
13. Local groundwater supply	2,350
14. Reclaimed water	1,500
15. GWD subtotal (10 + 11)	3,850
SYRWCD, ID#1	
16. Local groundwater supply	2,320
17. Santa Ynez River diversion	1,450
18. SYRWCD, ID#1 subtotal (13 + 14)	3,770
19. Average State Water Project delivery (assume 50% of Table A (SWP Allocation Schedule) + buffer)	9,225[1)]
20. Total supply from sources other than the Cachuma Project (1 + 5 + 12 + 15 + 18 + 19)	31,312

1) Includes SWP delivery to Solvang under a water supply contract with SYRWCD, ID# 1.

Table 4-19
Member Units' Demand in 2000 and 2020

Member Unit	Year 2000 Demand (af)	Year 2020 Demand (af)
CVWD	4,300[1]	5,833
MWD	6,073	6,835
City of Santa Barbara	14,342	18,200[3]
GWD	14,000	17,300
SYRWCD, ID#1	7,292[4]	8,119[4]
Total	**46,007**	**56,287**

[1]Represents year 2001
[3]Represents year 2009
[4]Includes 1,500 afy of SWP allocated to City of Solvang under a water supply contract.

The shortages in Member Unit water supplies would vary considerably among Member Units. Tables 4-20 through 4-24 compare the supply and demand of the individual Member Units in a critical drought year such as 1951 under Alternative 5B. The source of the data presented in Tables 4-20 through 4-24 is Appendix F, Technical Memorandum No. 5, Tables 4-10 through 4-14. For Cachuma Project water supply in the critical drought year, Alternative 5B was chosen because the water supply impacts are most severe under this alternative. For purposes of this analysis, each Member Unit's share of the 13,208 af of water available from the Cachuma Project in a critical drought year was calculated by reducing each Member Unit's share pro rata in accordance with the amount of Cachuma Project supply claimed by each Member Unit in Tables 4-10 through 4-14. The total supply from other sources for the Member Units includes increased groundwater pumping which would not be sustainable on a long term basis, the maximum capacity of the desalinization plant, and 50 percent delivery of State Project water (Table A (SWP Allocation Schedule) and CCWA drought buffer).

Table 4-21 indicates that under current demand levels, MWD would experience a shortage of 2,219 af. Table 4-23 indicates that under current demand levels, GWD would experience a shortage of 1,637 af. Table 4-24 indicates that under current demand levels, SYRWCD, ID#1 would experience a shortage of 1,060 af. MWD, GWD, and SYRWCD, ID#1 could make up for these shortages in part by buying water from other Member Units. Tables 4-20 and 4-22 indicate that CVWD and the City of Santa Barbara would have surpluses of 2,895 af, and 534 af, respectively. An overall net shortage in meeting current demand is indicated in Table 4-17 for Alternatives 3B, 5B, and 5C. The Member Units would experience a net surplus under Alternatives 2, 3C, and 4B. Table 4-17 also indicates that there would be a net shortage for all alternatives under future year 2020 demand levels ranging from -8,612 af under Alternative 4B to -11,767 af under Alternative 5B.

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

1. Local groundwater supply (Table 4-10)	4,650
2. State Water Project supply (Table 4-10)	1,000
3. CCWA drought buffer (Table 4-10)	100
4. Cachuma Project supply in critical drought year	1,445
5. Total supply	**7,195**
6. Year 2000 Demand (Table 4-10)	4,300
7. Surplus (5 - 6)	**2,895**
8. Year 2020 Demand (Table 4-10)	6,819
9. Surplus (5 - 8)	**376**

Sources: CVWD (2001 and C. Hamilton, Gen. Manager, 2003)

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

1. Jameson Lake and Alder Creek diversions (SYRHM simulations, Appendix F, Technical Memorandum No. 5)	312
2. Doulton Tunnel infiltration and Fox Creek diversion (SYRHM simulations, Appendix F, Technical Memorandum No. 5)	130
3. Local groundwater supply (Table 4-11)	400
4. State Water Project supply (Table 4-11)	1,500
5. CCWA drought buffer (Table 4-11)	150
6. Cachuma Project supply in critical drought year	1,362
7. Total supply	**3,854**
8. Year 2000 demand (Table 4-11)	6,073
9. Shortage (7 – 8)	**-2,219**
10. Year 2020 demand (Table 4-11)	6,835
11. Shortage (7 – 10)	**-2,981**

Sources: MWD (2001 and T. Mosby, Operations Manager, 2003).

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

1. Gibraltar Reservoir (SYRHM simulations, Appendix F, Technical Memorandum No. 5)	0
2. Mission Tunnel infiltration and Devil's Canyon diversion (SYRHM simulations, Appendix F, Technical Memorandum No. 5)	500
3. Jameson Reservoir	300
4. Santa Barbara local groundwater supply (Table 4-12)	4,150
5. State Water Project supply	1,500
6. CCWA drought buffer (Table 4-12)	150
7. Cachuma Project supply in critical drought year	4,251
8. Reclaimed water (Table 4-12)	900
9. Desalinization (Table 4-12)	3,125
10. Total supply	**14,876**
11. Year 2000 demand (Table 4-12)	14,342
12. Surplus (7 – 8)	**534**
13. Year 2020 demand (Table 4-12)	18,200
14. Shortage 7 – 10)	**-3,324**

Source: City of Santa Barbara (2000; 1994 adopted Long Term Water Supply Program; and S. Mack, City Water Supply Manager, 2003)

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

1. GWD local groundwater supply (Table 4-13)	2,350
2. GWD reclaimed water (Table 4-13)	1,500
3. State Water Project supply	3,500
4. CCWA drought buffer (Table 4-13)	225
5. Cachuma Project supply in critical drought year	4,788
6. Total supply	**12,363**
7. Year 2000 demand (Table 4-13)	14,000
8. Shortage (6 – 7)	**-1,637**
9. Year 2020 demand (Table 4-13)	17,300
10. Shortage (6 - 9)	**-4,937**

Sources: GWD (2002 and K Walsh, GWD General Mgr, 2003)

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

1. Local groundwater supply (Table 4-14)	2,320
2. Santa Ynez River diversion (Table 4-14)	1,450
3. State Water Project supply	1,000
4. CCWA drought buffer (Table 4-14)	100
5. Cachuma Project supply in critical drought year	1,362
6. Total supply	**6,232**
7. Year 2000 demand (Table 4-14)	7,292
8. Shortage (6 – 7)	**-1,060**
9. Year 2020 demand (Table 4-14)	8,119
10. Shortage (6 - 9)	**-1,887**

Source: SYRWCD, ID#1 (Chris Dahlstrom, SYRWCD, ID#1 General Mgr, 2003).

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 5B and 5C 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 5B, which represents the worst-case scenario with regard to water supply impacts, would be 17,685 af (Appendix F, Technical Memorandum No. 5), which exceeds Cachuma Project yield in 1951 (13,208 af) by 4,477 af. This increase in Cachuma Project yield exceeds the 1,487-af shortage in supply in 1951 under Alternative 5B. (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 (Appendix F, Technical Memorandum No. 5.)

Except for Alternative 5B, supply under the alternatives would be adequate to meet current demand in a three-year drought period as well. Table 4-25a shows the Member Units' supply and demand during the critical three-year drought period (1949-1951) for all project alternatives. Table 4-25b indicates the types and quantities assumed for water supplies other than the Cachuma Project. Local groundwater is based on the critical drought year supply with a 0.8 reduction factor, except for SYRWCD, ID#1 river wells which are based on simulated water levels (dewatered storage). State Water Project imported supply is based on 50 percent delivery (Table A (SWP Allocation Schedule) and CCWA drought buffers). Also, for this analysis, the desalination plant of the City of Santa Barbara is assumed to be brought into production in the year 1951. Except for Alternative 5B, the Member Units' total water supply would exceed their current demand. The projected increase in demand would outstrip supply by 2020 for all alternatives. Under the baseline conditions (based on year 2000 demand levels), supply would exceed demand by 4,788 af. In 2020, demand would exceed supply by 26,052 af, taking into account the CCWA drought buffer and about 40,000 af of ground water pumping for three-year drought period.

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

	Alt 2	**Alt 3B**	**Alt 3C**	**Alts 4B**	**Alt 5B: "3A2"/BO and 1.8' surcharge**	**Alt 5C: "3A2"/BO and 3' surcharge**
1. Cachuma Project yield in a critical drought year (SYRHM simulation, Appendix F, Technical Memorandum No.5)	57,008	53,769	57,217	59,675	50,483	53,336
2. Total supply from sources other than the Cachuma Project (Table 4-25b)	85,801	85,801	85,801	85,801	85,801	85,801
3. Total supply (1 + 2)	142,809	139,570	143,018	145,476	136,284	139,137
4. Year 2000 demand (Table 4-19 * 3)	138,021	138,021	138,021	138,021	138,021	138,021
5. Surplus or shortage (3 - 4)	4,788	1,549	4,997	7,455	-1,737	1,116
6. Year 2020 demand (Table 4-19 *3)	168,861	168,861	168,861	168,861	168,861	168,861
7. Shortage (3 - 8)	-26,052	-29,291	-25,843	-23,385	-32,577	-29,724

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

CVWD	
1. Local groundwater	11,160
MWD	
2. Jameson Lake and Alder Creek diversions	2,194
3. Doulton Tunnel infiltration and Fox Creek diversion	432
4. Local groundwater	960
5. MWD subtotal	3,586
City of Santa Barbara	
6. Gibraltar Reservoir	4,055
7. Mission Tunnel infiltration and Devil's Canyon diversion	1,577
8. Local groundwater	9,960
9. Reclaimed water	2,700
10. Desalination	3,125
11. City of Santa Barbara subtotal	21,417
GWD	
12. Local groundwater supply	5,640
13. Reclaimed water	4,500
14. GWD subtotal	10,140
SYRWCD, ID#1	
15. Local groundwater supply	5,568
16. Santa Ynez River diversion	6,255
17. SYRWCB, ID#1 subtotal	11,823
18. State Water Project delivery (assumed 50% of Table A (SWP Allocation Schedule) + buffer)	27,675
19. Total supply from sources other than Cachuma Project in critical three-year drought period (1 + 5 + 11 + 14 + 17 + 18)	**85,801**

4.3.2.6 Indirect Environmental Impacts of Water Supply Shortages

The potential impact to the Member Units' water supply in a critical drought year under Alternatives 3B, 5B, and 5C (as shown in Table 4-17) and in a critical drought period under Alternative 5B (as shown in Table 4-25a) could result in indirect environmental impacts, depending on the manner in which the Member Units make up for the shortage. According to the Member Units' testimony (2003), the normal and drought year water supplies from sources other than Cachuma Project would vary for each Member Unit. If the Member Units can meet current demand in a critical drought year or drought period using existing sources of supply or by implementing drought contingency measures, no indirect environmental impacts would occur. 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 the alternatives.

The Member Units could increase their annual delivery from the Cachuma Project to make up for the Cachuma supply shortages under Alternatives 3B, 5B, and 5C. Doing so, however, would mean exceeding the target annual Cachuma Project yield of 25,714 af, which would increase the risk of greater shortages during subsequent dry years. 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.

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

4.3.2.8 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 afy. The analysis of water supply impacts in a critical drought year or period under the alternatives assumes that the Member Units would receive 9,225 afy, leaving about 6,800 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.

4.3.2.9 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 3,125 afy. The cost of desalinated water is projected to range between $1,400 and $2,000 per af. 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 3,125 afy seawater desalination plant would require roughly two megawatts of generating capacity continuously. If the electricity were produced from existing thermal power plants, it could result in impacts to air quality from air emissions and water quality impacts from the cooling system. Much of the electricity used in California is generated through use of fossil fuels. These power plants, operating on natural gas or coal, produce nitrogen oxides (NO_x), particulate matter, reactive organic gases (ROGs), and in some cases, sulfur dioxide (SO_2). Coal-fired generation is almost all out-of-state, with the energy brought to California through the high voltage transmission system. Coal-fired power plants produce more air pollutant emissions than gas-fired plants, including sulfur, particulates, and carbon dioxide. Assuming that new load from the desalination facility is only met through an efficient natural gas-fired power plant using the best available emissions reduction technology, a 3,125 afy facility using two megawatts of electricity would result in 1,053 pounds of NO_x, 93 pounds of SO_2, 693 pounds of particulate matter less than 10 micrometers in diameter (PM_{10}), 693 pounds of ROG, 2,000 pounds of carbon monoxide, and 2,000 tons of carbon per year. This assumes that the desalination facility operates continuously. These impacts could be mitigated in part if the desalination plant has been designed so that it can be shut down during peak power demand periods, thereby taking advantage of unused power capacity in off-peak times.

The indirect environmental impacts that could result under Alternative 5B if the Member Units increase groundwater pumping, obtain a temporary transfer from another SWP contractor, or desalinate seawater are potentially significant. The potential impact to the Member Units' water supply under Alternatives 3B and 5C (243 af and 387 af, respectively) is small enough that any indirect environmental impacts would be insignificant. Due to the cost, the Member Units are unlikely to implement a temporary transfer of water through the Bay-Delta, or to reactivate the desalination plant to make up for a shortage of several hundred af. In addition, the indirect impacts attributable to a one-year increase in groundwater pumping of 243 af or 387 af would be negligible.

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

4.3.3 MITIGATION MEASURES

Section 210 of the Reclamation Reform Act of 1982 (43 U.S.C.A. 390jj) requires water districts with repayment or water supply contracts to develop and maintain water conservation plans containing water conservation measures and time schedules for meeting conservation objectives. By 1993, all of the Member Units had conservation plans in place. 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 or period under Alternative 5B.

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

Please see the August 2003 DEIR for details on existing conditions in the Above Narrows Alluvial Aquifer.

4.4.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.4.2.1 Simulation Modeling

The Santa Ynez River Hydrologic Model (SYRHM) was used to model groundwater storage and elevations in the Above Narrows Alluvial Groundwater Basin. A general description of the model is provided in section 4.2.2.1. A detailed description of the model, as well as the model results pertaining to the basin is provided in Stetson Engineers (2000, 2001a, 2006a). In the model, the Above Narrows Alluvial Groundwater Basin is divided into four subareas between the dam and the Narrows: (1) Bradbury Dam-Solvang; (2) Solvang-Buellton Bend; (3) Buellton Bend-Salsipuedes Creek; and (4) Salsipuedes Creek-Narrows Gage. The upper segment is further subdivided into 12 smaller segments between tributaries.

Separate surface and groundwater budgets were established in the simulation model for each segment. Monthly groundwater accounting was performed for 912 months over the simulation period (1918-1993) for the following groundwater parameters: river percolation, underflow, bank infiltration, depletions by riparian vegetation, agricultural consumptive use, and municipal and industrial consumptive use. Surface water parameters included surface inflow from the mainstem, tributary inflow, and accretions from precipitation and percolation. The model estimates percolation using a function relating stream width to flow levels, and a maximum percolation rate that decreases as the groundwater basin fills. The maximum percolation rate is based on historic seepage rates, stream width, length of segment, highest percolation rates observed, and known groundwater storage in the river alluvium.

Bank infiltration represents groundwater contributions from less permeable, fractured, underlying shale and other deposits. In general, bank infiltration increases when storage in the basin declines and adjacent aquifers are sufficiently full. In times of drought when adjacent aquifers are likely to be dewatered, bank infiltration will decrease. When riparian groundwater storage is sufficiently high such as during a period of high runoff, bank flows become modeled as an outflow to adjacent formations.

Flow from tributaries in the model is based on historic streamflow measurements and represents unimpaired natural flows that occur between Bradbury Dam and the Narrows. In dry years, the Santa Ynez River would be dry except for Cachuma releases so that flows in the river decrease as they move downstream. In wet years, runoff from the tributaries accumulates in the river, so that flows increase as they move downstream.

4.4.2.2 Basin Storage and Groundwater Levels

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 the baseline operations (Alternative 2) is higher than the rest of the alternatives. For example, the median monthly dewatered storage over the entire basin under the baseline operations is estimated to be 10,517 af, compared to a range of 10,099 to 9,840 af for the other alternatives (Table 4-27). The reduction in dewatered storage is due to the additional downstream releases for steelhead under the alternatives. With additional releases for fish from the Cachuma Project, additional percolation occurs primarily in the Santa Ynez Subarea, the portion of the river affected by releases for fish.

Table 4-27
Monthly Dewatered Storage in the Above Narrows Alluvial Groundwater Basin

	Af for each Alternative based on Simulation (1918-1993)					
	2	3B	3C	4B	5B	5C
Total Storage for the Entire Basin						
Mean	10,769	10,310	10,281	10,240	10,146	10,131
Median	10,517	10,099	10,081	10,031	9,852	9,840
% Difference Relative to Alt 2		*-4%*	*-4%*	*-5%*	-6%	-6%
Minimum	2,324	2,315	2,315	2,311	2,315	2,315
Santa Ynez Subarea						
Mean	1,926	1,722	1,704	1,647	1,684	1,683
Median	1,769	1,606	1,584	1,510	1,553	1,547
% Difference Relative to Alt 2		*-9%*	*-10*	*-15%*	-12%	-13%
Minimum	0	0	0	0	0	0
Buellton Subarea						
Mean	5,634	5,482	5,471	5,438	5,435	5,432
Median	5,570	5,449	5,442	5,382	5,363	5,360
% Difference Relative to Alt 2		*-2%*	*-2%*	*-3%*	-4%	-4%
Minimum	2,166	2,167	2,153	2,144	2,168	2,169
Santa Rita Subarea						
Mean	3,244	3,105	3,105	3,155	3,027	3,016
Median	3,080	2,981	2,978	3,105	2,870	2,867
% Difference Relative to Alt 2		*-3%*	*-3%*	*1%*	-7%	-7%
Minimum	0	0	0	0	0	0

Median monthly dewatered storage under Alternatives 3B, 3C, 4B, 5B, and 5C would be less than under the baseline operations because the project alternatives would involve additional downstream releases to support steelhead. Hence, the proposed alternatives would have a beneficial effect (Class IV) on the alluvial basin storage conditions.

Chart 4-10 in Appendix B shows the changes in total dewatered storage in the entire Above Narrows Alluvial Groundwater Basin, based on the SYRHM. In general, this chart also shows that there is no significant difference in the year-to-year variation in dewatered storage in the aquifer. However, the chart shows less total dewatered storage during low flow periods of most years for all project alternatives (Alternatives 3B, 3C, 4B, 5B, and 5C) compared to the baseline conditions (Alternative 2) due to increased releases for fish. More water is released from the dam compared to the baseline conditions in these other alternatives during the summer and fall to support steelhead rearing to Highway 154, and in some years, to Alisal Road in Solvang. As a result of these new releases, there is more percolation into the Above Narrows Alluvial Groundwater Basin during the low flow period of the year compared to the baseline operations (Alternative 2). Chart 4-10 also shows that the Above Narrows Alluvial Groundwater Basin recovers to the same levels with the recharge of winter runoff under all alternatives.

It should also be noted that SYRWCD actively manages 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 the baseline 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)					
	2	3B	3C	4B	5B	5C
Santa Ynez Subarea						
Mean	459	460	460	460	460	460
Median	460	460	460	460	460	460
% Difference Relative to Alt 2		*0%*	*0%*	*0%*	*0%*	*0%*
Minimum	442	444	445	446	444	444
Buellton Subarea						
Mean	304	304	304	304	304	304
Median	304	304	304	304	304	304
% Difference Relative to Alt 2		*0%*	*0%*	*0%*	*0%*	*0%*
Minimum	295	295	295	295	295	295
Santa Rita Subarea						
Mean	176	176	176	176	176	176
Median	176	176	176	176	176	176
% Difference Relative to Alt 2		*0%*	*0%*	*0%*	*0%*	*0%*
Minimum	163	165	165	165	165	165

4.4.3 MITIGATION MEASURES

No significant adverse impacts on the Above Narrows Alluvial Groundwater Basin were identified for Alternatives 3B, 3C, 4B, 5B, and 5C. Hence, there is no need for mitigation.

4.5 SURFACE WATER QUALITY

4.5.1 EXISTING CONDITIONS

Please see the August 2003 DEIR for details on existing surface water quality conditions.

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: TDS	Number Of Measurements: Electrical conductivity w/o TDS	Period of Record Available	Sources
1. Santa Ynez River below Los Laureles Canyon	64	21	1951-54, 73, 80-89, 91-98	USGS
2. Santa Cruz Creek	65	1	1980, 92-98	USGS
5. Santa Ynez River near Solvang	223	121	1951-58, 91-98	USGS, DWR, Lompoc
6. Salsipuedes Creek near Lompoc	241	2	1971, 77-78	USGS
7. Santa Ynez River at Narrows near Lompoc	235	8	1962-64, 66-70, 72-88, 91-98	USGS, Lompoc

Stetson Engineers (2000) identified a good correlation between flow and salt loading. An example of the flow-salt loading relationship at Solvang is shown on Chart 4-13 in Appendix B.

The initial results of the salinity modeling showed that when using the flow and salt loading relationships based on available data, the TDS would be consistently overestimated in Cachuma Lake by up to 150 mg/l. Stetson Engineers (2000) attributed this error to difficulty in modeling of salinity of storm events using the very limited TDS data for high flow events in the watershed. Hence, Stetson Engineers adjusted the salinity of high flows to match the observed TDS in the reservoir to improve the model performance. This was achieved by reducing all dissolved solid inflows (inflow quantity was unchanged) by 15 percent when the average monthly combined inflow into Cachuma Lake was greater than 75 cfs. After this high flow adjustment, the simulated TDS matches the observed TDS quite well with a standard deviation of 50 mg/l or 9 percent (Stetson Engineers, 2001a).

In developing and calibrating the salinity model, Stetson Engineers (2000) examined data collected by the City of Lompoc that showed an increase in TDS from the dam to the Narrows when Reclamation releases water pursuant to Order WR 89-18 and no tributary flow exists. For example, TDS concentrations in the river during Order WR 89-18 releases in 1991-96 are shown on Chart 4-14 (Appendix B). These data show that TDS concentrations during Order WR 89-18 releases increase from about 750 mg/l at the dam to about 1,000 mg/l at the Narrows. The TDS data from the City of Lompoc in Chart 4-14 show a sharp increase in TDS about 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, 2001c) calls this phenomenon "channel loading," or "Alisal to Narrows Salinity Increase (ANSI)." The source and mechanism for the increase in TDS concentrations in river water as it passes downstream may be the result of any combination of the following:

- Remobilization of evaporated salts stored on the riverbed. Salts accumulate on the riverbed during periods of low flow, and can be re-solubilized upon contact with water.
- Upwelling of alluvial groundwater with higher salt concentrations.
- Phreatophyte transpiration, which would increase salt concentrations in the surface-groundwater system.
- River surface water evaporation.
- Surface-groundwater interface mixing in which alluvial groundwater with high TDS near the surface mixes with surface water.
- Dissolution of geologic formations in the river channel.

Possible sources of salts include percolation from the Santa Ynez River; weathering of geologic material; percolation from the Buellton and Solvang wastewater treatment plant effluent, which is discharged to percolation ponds on the river; inflow from septic systems; irrigation return flows; and lateral sub-flows from tributaries.

The TDS measurements on Chart 4-14 are based on the City of Lompoc's TDS measurements in Cachuma Lake and along the river, which are about 100 mg/l higher than data from other sources, as documented by Stetson Engineers (2000). However, the trend of increasing concentration from the dam to the Narrows appears valid. Reservoir releases result in higher flows near the dam than at the Narrows, which affects TDS concentrations. Based on limited salinity data collected by the USGS, Stetson Engineers (2000) estimated the actual salt loading between the dam and the Narrows during the Order WR 89-18 releases. Performing a water and salt balance calculation using the 13 available samples during water rights releases, Stetson Engineers estimated the average flux of the ANSI to be about 25 tons/day. In addition, the amount of flux of the ANSI is proportional to the flow as shown in Chart 4-15 (Appendix B).

Chart 4-15 also shows the flow-ANSI relationships used to calculate the amount of salt input due to the ANSI occurrence in the Buellton, East Santa Rita, and West Santa Rita subareas as used in the SYRHM.

Stetson Engineers verified the accuracy of the SYRHM simulation of TDS at the Narrows, using historical Cachuma Lake operations and downstream water use data for the period 1942-1993 (52 years). Because continuous recording of TDS at the Narrows does not exist for the period 1942-1993, the historical monthly salt outflows at the Narrows had to be independently estimated in order to verify the monthly output from the SYRHM. Using actual TDS measurements at the Narrows (Table 4-30), Stetson Engineers developed a relationship between measured daily flow at the Narrows and the flow-salt loading. Stetson Engineers used this relationship, in conjunction with measured daily flows at the Narrows, to estimate flow-salt loading data for the 52-year period, both with and without Cachuma releases (Stetson Engineers, 2001c). This method of calculating salt flux is referred to as the “estimated” historical salt flux at the Narrows, which is based on daily flows and estimated flow-salt loading relationship at the Narrows. Stetson Engineers compared the measured and estimated salt loading values for those dates when both values existed, and found that the match between the measured and estimated salt loading for the Narrows was very good. This estimated salt flux based on measured data at the Narrows produced a continuous historic monthly data set, which could then be compared with the model output from the SYRHM.

The method of calculating salt flux by the SYRHM is referred to as the “simulated” salt flux at the Narrows, which is based on the monthly time step of the model and the routing of salts from Cachuma to the Lompoc Narrows based on simulation. Stetson Engineers (2001c) found that the match between the simulated and estimated monthly salt loading at the Lompoc Narrows was very good. In addition, the TDS-flow relationships, as simulated by the SYRHM, were reasonable when compared with the estimated average monthly and measured instantaneous TDS at the Lompoc Narrows (Chart 4-12). The pattern of SYRHM simulation results compared with measured data is very similar for both surface flows (quantity) and salinity (quality) in that the simulation matches measured values better at high flows. Overall, the high correlation observed in the calibrations indicated that the salinity model is a reasonable tool for assessing impacts of operations on downstream surface water salinity, and most importantly, for comparing effects on salinity of the various alternatives.

The salinity model includes the delivery of SWP water to Cachuma Lake. A summary of the assumed SWP deliveries for each EIR alternative is shown in Table 4-31. Key SWP water delivery assumptions used in the salinity model simulations are discussed below.

Table 4-31
SWP Water Deliveries Used in the Modeling

Alternative	afy				
	Exchange with SYRWCD, ID#1 (a)	**BNA Exchange for Alt 4B only (b)**	**SWP Delivered to Cachuma Lake (c)**	**SWP Released in the Outlet Works (d)**	**Total SWP Imports (a)+(b)+(c)+(d)**
2	2,497	0	5,489	1,789	10,135
3B	2,482	0	5,844	1,841	10,167
3C	2,497	0	5,836	1,866	10,199
4B	2,501	1,770	4,853	1,245	10,369
5B	2,470	0	5,251	2,317	10,038
5C	2,484	0	5,246	2,337	10,068

Total SWP contract entitlements for the Member Units are 17,000 afy. The Member Units purchase additional water from the 3,908 afy Drought Buffer to bank for use during dry years (see section 2.2.4). The actual quantity of SWP water delivery varies based on runoff in the San Francisco-San Joaquin Bay Delta, and averages 77 percent of the contract amount (see section 2.2.6). The salinity model assumes that the average delivery rate is 74 percent. The model also assumes that South Coast average annual SWP delivery is 13,750 afy, which was then adjusted (see Table 4-31) to reflect the 74 percent average delivery rate. Key assumptions are listed below, which restrict SWP water deliveries to Cachuma Lake and SWP water releases into the Santa Ynez River. The 13,750 afy does not include Goleta Water District’s 1994 purchase of 2,500 af of additional contract water from other SWP contractors because the pipeline capacity and other factors limit delivery to 4,500 afy of Goleta’s 7,000 afy SWP entitlement at this time. The model assumes that SWP water would continue to be delivered directly to SYRWCD, ID#1 as part of its current exchange program with other Member Units.

Key assumptions about the delivery of SWP water in the salinity model include:

- Maximum delivery rate to the reservoir is 22 cfs, which provides a monthly delivery capacity of about 1,300 af, and an annual delivery of 15,930 af.
- SWP water cannot be delivered to the reservoir when it is spilling.
- SWP water delivered to the reservoir is exported out Tecolote Tunnel in the same month; hence, SWP water is not stored in Cachuma Lake.
- SWP water may be commingled with Cachuma Project releases, but SWP water must not exceed 50 percent of the total releases to the river at any time. Also, no SWP water may be mixed into downstream releases during the months of December through June unless flow is discontinuous in the mainstem.
- No SWP water can be delivered to the reservoir when water is being released from Bradbury Dam for fish passage releases.
- SWP water that cannot be delivered due to restrictions in the outlet works is allowed up to one year to be re-scheduled, subject to SWP pipeline delivery capacity and outlet restrictions in the following twelve months.

To model the effect of SWP water deliveries on TDS values downstream of Bradbury Dam, estimated or actual SWP TDS values were input into the model. Actual data were used for the period 1968 to 1993, based on TDS in the California Aqueduct near Kettleman City. The TDS from 1942 to 1967 (prior to the construction of the SWP) was estimated using monthly average values of historic measured data and average annual TDS values based on regression analysis with shortages in the Delta (Stetson Engineers, 2000, 2001c). Average TDS in SWP water is 289 mg/l, with a range of 104 to 567 mg/l.

Under the baseline operations and for all other alternatives, the model assumed SWP water was delivered consistent with the assumptions set forth above. Under Alternative 4B, BNA water would be provided by discharging SWP water to the river near Lompoc for recharge. For the simulation modeling of Alternative 4B, it was assumed that SWP water would be directly recharged at Lompoc Narrows. SWP water was not used for recharge at the Narrows in the months of December through June per a restriction in the Biological Opinion to avoid “imprinting” steelhead with Delta water. In addition, SWP water was not used for recharge when flow at the Narrows was greater than 0.5 cfs. If flow at the Narrows was greater than 0.5 cfs into summer and fall, which would occur in very wet years, then it was assumed that SWP imports for recharge would not occur. Also, as indicated in Table 4-31, the total amount of SWP water delivery to the South Coast would be reduced slightly (<1%) under Alternatives 5B and 5C compared to the baseline conditions (Alternative 2). This is due to the restrictions limiting SWP water mixing in the dam outlet works and the increased use of the outlet works for making additional releases for fish under Alternatives 5B and 5C.

As described in section 4.2.2.1, the Santa Ynez River Water Quality Technical Advisory Committee (SYRWQTAC) conducted a technical peer review of the simulation modeling performed by Stetson Engineers for the EIR, including the surface water quality calibration. The current methodology employed in determining surface water salinity in the Santa Ynez River as described above is the best available method to compare the surface water salinity impacts of the EIR alternatives. The intended use of the SYRHM is to compare EIR alternatives. The simulated salinity data generated from the SYRHM are not meant to be predictive. The model is simply an analytical tool for statistical and comparative purposes. Because the model is used for comparative analyses, some of the inherent inaccuracies in the model are expected to offset one another when comparing the results of one scenario with another. All simulation models have a limitation in predicting absolute results due to inherent errors in the mathematically derived representations of real time operations and complex natural systems.

4.5.2.2 Impacts on Reservoir TDS

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 predicted TDS levels in the reservoir shown on Chart 4-16 may be low because the salinity model included maximum reasonable deliveries of SWP water, a scenario that will not occur for many years. In reality, reservoir TDS levels will be proportional to the amount of SWP water delivered over time to Cachuma Lake and will become more evident during times of low reservoir storage.

Under all alternatives, SWP water is commingled with releases from the dam. By releasing a portion of SWP water from the outlet works (prior to it entering the reservoir), the full water quality benefits in the lake due to commingling SWP and reservoir water would not occur. However, SWP water that does not enter the reservoir is released to the river where it can reduce TDS concentrations and salt loading in downstream surface water and groundwater basins. The simulated lake TDS under Alternatives 3B, 3C, 5B, and 5C would be about 0-5 mg/l higher than under the baseline operations (Alternative 2) as shown in Chart 4-16. The amount of SWP water delivered to the reservoir under the baseline operations and Alternatives 3B, 3C, 5B, and 5C would be about the same. Under Alternative 4B, water would be delivered to the Lompoc Forebay. TDS levels in Cachuma Lake under Alternative 4B would be about 5-10 mg/l higher than under the baseline operations (Alternative 2) due to higher lake levels than the rest of the alternatives (Table 4-3) and less SWP water that would be delivered to the reservoir under Alternative 4B (Table 4-31). Instead, SWP water would be delivered directly to the Lompoc Basin.

As shown on Chart 4-16, the amount of surcharging would not appreciably affect the TDS levels in the reservoir. In other words, the TDS levels under Alternatives 3B, 3C, 5B and 5C would be essentially the same (Stetson, 2001c, 2006c). The additional surcharging under Alternatives 3B, 3C, 4B, 5B, and 5C would capture high inflows during the winter, which typically have low TDS concentrations. As such, there may be a temporary reduction in TDS in the lake after surcharging. However, the salinity modeling indicates that this improvement in TDS levels is mostly offset by the effects of evaporation on a larger lake surface during the subsequent summer months.

The median of the simulated TDS values shown on Chart 4-16 under the baseline operations (Alternative 2) is 566 mg/l. The median TDS for Alternatives 3B and 3C is 567 mg/l. The median TDS for Alternatives 5B and 5C is 570 mg/l. The median TDS for Alternative 4B is 572 mg/l. A 1 to 10 mg/l increase is small and would not affect the beneficial uses of Cachuma Lake. This potential increase is also smaller than model simulation and field measurement accuracies of +/- 5%. This impact analysis is also based on SWP deliveries that are considerably less than the Member Units' full contractual entitlements. (See Table 4-31 and accompanying text.) Since SWP water has a lower TDS than Santa Ynez River flows, modeling reduced SWP deliveries (as compared to the full contract quantities) results in a conservative analysis.

<u>The potential increase in TDS in Cachuma Lake under Alternatives 3B, 3C, 4B, 5B, and 5C as compared to the baseline conditions (Alternative 2) is considered an adverse, but not significant impact (Class III).</u>

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 3B and 3C and between Alternatives 5B and 5C, these charts only show a single line for "Alternative 3" and "Alternative 5."

The median TDS concentration in water rights releases below the dam under all alternatives is estimated to be about 450 mg/l, which is a combination of low salinity SWP water (about 250 mg/l) and higher salinity reservoir water (about 600 mg/l). Under recent historic operations prior to the importation of SWP water, the median TDS level in water rights releases is estimated to be about 625 mg/l.

The predicted TDS of releases from the BNA that reach the Narrows is shown on Chart 4-18. The median TDS concentration of these releases under the baseline operations (Alternative 2) is about 800 mg/l, compared to 450 mg/l in the same releases at the dam. Salt concentrations increase in these low flows as they pass along the river due to the salt loading factors noted above.

The predicted mean monthly TDS of flows at the Narrows is shown on Chart 4-19. These flows represent all water passing through the Narrows during the year, including winter runoff from the mainstem and tributaries, as well as BNA water rights releases. The months of July, August, September, and October are indicative mostly of the TDS of the BNA water rights releases because the quantity of summertime runoff is very small or nonexistent. During the rest of the year, flows are dominated by either runoff or spills from Cachuma Lake. Chart 4-19 also shows that the TDS for Alternatives 5B and 5C is about 5-10 mg/l less than the baseline conditions (Alternative 2) during the summer months July through September which is due to the increase of SWP water released directly into the Santa Ynez River under Alternatives 5B and 5C (Table 4-31). (Note: due to the removal of Alternative 1, which had no SWP mixing in water rights releases, Chart 4-20 has been removed.)

The effects shown on Charts 4-17 to 4-19 represent the TDS levels likely to occur when the SWP water is commingled at 50 percent in all water rights releases. Because the full contractual deliveries have not yet occurred, the lowest TDS levels have not yet occurred. The quality of water in downstream water rights releases will be proportional to the amount of SWP water delivered to the reservoir and commingled with water rights releases.

Releases for steelhead rearing, as required under the Biological Opinion, will primarily be made through the Hilton Creek supplemental watering system (maximum capacity of 10 cfs) in order to conjunctively use this water to support both Hilton Creek habitat and mainstem habitat. As a consequence, the rearing releases to maintain target flows at Highway 154 or Alisal Road will not typically contain SWP water. The TDS of these releases will reflect the current salinity levels in the reservoir (about 600 mg/l). However, the higher target flows under Alternatives 5B and 5C would require at times releases greater than 10 cfs and might contain up to 50% SWP water and a lower salinity. Hence, there may be occasions when releases for fish have a lower TDS than reservoir water.

Also, TDS concentrations in spills from the reservoir under all alternatives would not include mixing with SWP water. In addition, the TDS concentrations in spill water are likely to be dominated by the inflows from upstream, which during large storms have a low TDS.

Impacts of Alternatives 3B, 3C, 5B, and 5C

The salinity modeling results showed no significant difference in TDS concentrations in water rights releases at the dam and at the Narrows between Alternatives 3B, 3C, 5B, and 5C (Charts 4-17 and 4–18). Chart 4-19 shows that the average flow-weighted TDS at the Lompoc Narrows for Alternatives 3B, 3C, 5B, and 5C are also very similar. In addition, the TDS levels in the water rights releases under Alternatives 3B, 3C, 5B, and 5C would be similar to those under the baseline operations (Alternative 2). The varying quantities of SWP water delivered from year to year would not cause any difference in the TDS levels between these alternatives. For example, the median TDS of releases for steelhead rearing would be about 560 mg/l for the baseline operations, and 556 to 561 mg/l for Alternatives 3B, 3C, 5B, and 5C (Stetson, 2006c).

Impacts of Alternative 4B

Under Alternative 4B, BNA releases would not be made from the dam. Instead, SWP water would be delivered to the Lompoc Valley from a pipeline and discharged to the river for purposes of groundwater recharge. The only water rights releases from the dam would be ANA releases. Both the overall quantity of water rights releases from the dam (Table 4-7) and SWP imports (Table 4-31) under Alternative 4B would decrease compared to the baseline operations (Alternative 2). The TDS of releases from the dam would be similar to the TDS in the reservoir under Alternative 4B. Based on the modeling, the predicted median annual TDS of fish releases is 581 mg/l under baseline operations compared to 590 mg/l under Alternative 4B. This potential slight increase in TDS is considered an adverse, but not significant impact (Class III).

Chart 4-18 shows that the median TDS of the SWP water during the recharge operations under Alternative 4B would be significantly less than the TDS of water rights releases at the Lompoc Narrows under the baseline conditions (Alternative 2). The median TDS of water rights releases under Alternative 4B would be about 240 mg/l compared to 770 mg/l under Alternative 2 (Chart 4-18, Appendix B). The predicted TDS concentration at the Narrows under Alternative 4B is shown on Chart 4-19. The TDS at the Narrows, except during the winter months, would be higher under Alternative 4B immediately upstream of the recharge ponds than it is under the baseline operations. This increase in TDS under Alternative 4B would also impact salinity in the alluvial groundwater basin immediately upstream of the Lompoc Narrows, which is the Santa Rita sub-unit. The TDS of SWP water discharged to the river in the Lompoc Forebay under Alternative 4B would be very low, and reflect the quality of the water derived from the Delta. The water would commingle with native flows in the groundwater basin, and the resultant TDS values would be lower than the TDS under the baseline operations during times when SWP water is being discharged to the Lompoc Forebay (Technical Memorandum No. 4, p. 19.). The recharge of the Lompoc Plain Groundwater Basin using higher quality water under Alternative 4B would have a beneficial effect (Class IV) at that location because it would improve surface water quality in the Lompoc Forebay during the discharge period. The beneficial effect would be offset, however, by higher TDS levels upstream of the Lompoc Forebay.

4.5.3 MITIGATION MEASURES

If Alternative 4B is implemented, there would be an adverse impact associated with increasing river TDS from the dam to the Lompoc Forebay. To mitigate the adverse impact, water should be released from the dam in sufficient quantity to offset negative impacts to water quality.

4.6 LOMPOC GROUNDWATER BASIN CONDITIONS

4.6.1 EXISTING CONDITIONS

Please see the August 2003 DEIR for details on existing Lompoc groundwater basin conditions.

4.6.2 MODELING PERFORMED FOR THE EIR

4.6.2.1 Overview of the Modeling Approach

Please see section 4.6.2.1 of the August 2003 DEIR for a description of the modeling performed for the EIR.

4.6.2.2 Peer Review

Please see section 4.6.2.2 of the August 2003 DEIR for a description of the peer review of modeling performed for the EIR.

4.6.2.3 USGS Groundwater Model

Please see section 4.6.2.3 of the August 2003 DEIR for a description of the modeling performed for the EIR.

4.6.2.4 HCI Groundwater Model

Please see section 4.6.2.4 of the August 2003 DEIR for a description of the modeling performed for the EIR.

4.6.2.5 Key Assumptions

Please see section 4.6.2.5 of the August 2003 DEIR for a description of the key assumptions associated with the modeling performed for the EIR.

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 Alternative 4B, which 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 3B, 3C, 5B, and 5C are almost identical throughout the year. In contrast, flows in the summer under Alternative 4B would be very different compared to the other alternatives. Under Alternative 4B, SWP water would be recharged directly at or below the Narrows, increasing the flow below the point of discharge significantly in dry months.

The simulated average annual TDS of river flows at the Narrows is shown on Chart 4-28. The monthly average TDS of flows simulated at the Narrows for each EIR alternative is shown on Chart 4-19. These data show the inverse relationship between flow and TDS. Higher flows below the point of SWP water discharge under Alternative 4B would result in lower TDS levels. The TDS for Alternatives 3B, 3C, 5B, and 5C are almost identical to one another because all of these alternatives entail releases from the BNA in the same manner, and with the same commingling of SWP water.

4.6.3 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.6.3.1 Results of Simulation Modeling

The results of the groundwater modeling using the USGS and HCI models are summarized in this section. Stetson (2001d, 2006c) contains more detailed simulation modeling results. The alternatives were evaluated for impacts to groundwater levels and TDS in the Main Zone aquifer of the Lompoc Basin using the two simulation models. Modeling results are presented using predicted water level and TDS conditions at two well locations within each of the three main sub-areas within the Lompoc Basin. The following results are presented for each alternative: (1) average TDS at each location over the period 1952 through 1982; and (2) time series graphs of TDS and water levels representing the results for the entire simulated period.

The results of the USGS and HCI models were different in terms of absolute values for water levels and TDS values. However, the models showed the same relative differences amongst alternatives. As such, the reliability of the modeling analyses for comparative purposes is considered very high.

The average TDS for the Main Zone aquifer in the Lompoc Basin for each sub-area at selected locations and the flow-weighted average for the five City of Lompoc active wells are shown in Table 4-32. These results illustrate the magnitude of the average simulated TDS between and within sub areas, as well as between alternatives and between models. The values shown in Table 4-32 suggest a high level of precision because they are reported to four significant places. As noted earlier, actual TDS concentrations may vary from the models’ predictions by 100 to 300 mg/l, depending upon many factors. Hence, the values in Table 4-32 should be used cautiously, and are best used when rounded to the nearest 100 mg/l. Differences less than 100 mg/l should only be relied upon when other clear trends support these differences.

Table 4-32
Simulated Average TDS for Selected Wells
in the Main Zone (mg/l 1952-82)

Well	Alt 2 Interim Operations under Biological Opinion	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4B Biological Opinion with SWP Recharge to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
HCI MODEL RESULTS						
Western Plain						
Well 26F1,3, 4, 5	2,330	2,329	2,330	2,332	2,333	2,333
Well 25D1, 3	2,018	2,016	2,016	2,018	2,017	2,017
Central Plain						
Well 31A1	1,784	1,784	1,782	1,803	1,798	1,798
Well 29N6	1,784	1,784	1,786	1,794	1,800	1,798
Eastern Plain						
Well 28M2	1,728	1,726	1,723	1,731	1,715	1,712
Well 34B1	1,009	1,006	1,002	842	986	987
City Wells						
City Wells –Avg.	1,012	1,011	1,008	854	989	991
USGS MODEL RESULTS						
Western Plain						
Well 26F1,3, 4, 5	2,885	2,844	2,850	2,906	2,831	2,830
Well 25D1, 3	2,273	2,231	2,235	2,284	2,210	2,209
Central Plain						
Well 31A1	2,180	2,176	2,176	2,176	2,172	2,171
Well 29N6	1,937	1,935	1,935	1,928	1,934	1,934
Eastern Plain						
Well 28M2	1,770	1,758	1,758	1,752	1,753	1,754
Well 34B1	973	974	974	931	971	970
City Wells						
City Wells –Avg.	1,108	1,109	1,107	1,085	1,105	1,104

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. (Note: Table 4-33 has been deleted due to the removal of Alternative 1.)

4.6.3.2 Effects of Alternatives 3B, 3C, 5B, and 5C

The modeling results indicate that TDS levels in the groundwater of the Lompoc Basin under Alternatives 3B, 3C, 5B, and 5C would improve slightly (see Table 4-34), particularly in the western and eastern portions of the basin. The differences are very small relative to the total TDS levels in these wells (800 to 2,500 mg/l). The reduced TDS levels are likely due to a combination of higher and longer surface flows in the summer due to increased releases for fish. In addition, Alternatives 5B and 5C have an increase of SWP water mixed in the outlet works and the direct release of SWP water into the Santa Ynez River during wet and above-normal years when the outlet works must be used to meet higher target flows for fish. The HCI model results indicate very small differences between alternatives that are less than one percent, probably due to their modeling approach and use of annual stress periods. None of the alternatives exhibit conspicuous basin-wide trends. The predicted water quality improvements based on the USGS model is generally larger in magnitude compared to the HCI model, except in the extreme eastern portion of the basin. The HCI model shows a greater sensitivity to the flows and water quality of the surface water at the Narrows in the eastern plain, while the USGS model is more sensitive in the western plain.

The difference in TDS between alternatives at a single well location (Table 4-34) is less than the inherent accuracy of either model. However, the aggregate results in Table 4-34 are sufficient to exhibit a trend of improved groundwater quality in comparison to the baseline operations (Alternative 2). The groundwater modeling results indicate that Alternatives 3B, 3C, 5B, and 5C would potentially decrease TDS levels in the Lompoc Plain over time. As such, they would result in a beneficial effect on water quality in the Lompoc Plain, and in the quality of the drinking water for the City of Lompoc (Class IV).

Table 4-34
Change in Average TDS for Selected Wells in the Main Zone – Alternatives 3, 4, and 5 (mg/l, 1952-82)

Well	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4B Biological Opinion with SWP Recharge to Lompoc Forebay	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
HCI MODEL RESULTS					
Western Plain					
Well 26F1, 3, 4, 5	<1	<1	2	3	3
Well 25D1, 3	-2	-2	<1	-1	-1
Central Plain					
Well 31A1	<1	-2	20	14	14
Well 29N6	<1	1	10	16	15
Eastern Plain					
Well 28M2	-2	-5	3	-13	-16
Well 34B1	-3	-7	-167	-23	-22
City Wells					
City Wells –Avg.	-1	-5	-158	-23	-21
USGS MODEL RESULTS					
Western Plain					
Well 26F1, 3, 4, 5	-41	-35	21	-54	-55
Well 25D1, 3	-43	-38	10	-64	-65
Central Plain					
Well 31A1	-4	-4	-4	-8	-9
Well 29N6	-1	-1	-8	-3	-3
Eastern Plain					
Well 28M2	-12	-12	-18	-17	-16
Well 34B1	2	2	-42	-2	-3
City Wells					
City Wells –Avg.	1	-1	-24	-3	-4

4.6.3.3 Effects of Alternative 4B

Alternative 4B includes direct recharge of high quality SWP water in the basin. Alternative 4B would reduce TDS levels in portions of the Main Zone in the Lompoc Basin, and as such, would result in a beneficial effect on groundwater quality in the Lompoc Basin (Class IV).

Under the HCI model, the greatest improvement in groundwater quality occurs very near the Lompoc Narrows under Alternative 4B. In that case, recharging of low TDS SWP water would result in a significant improvement near the City wells, including Well 34B1, possibly due to high vertical permeability, which allows localized deep percolation of high quality SWP discharge.

In the USGS modeling results, Alternative 4B shows a marked improvement in water quality in the eastern and central plains due to direct recharge of high quality SWP waters at low flows. The magnitude of the improvement in the extreme eastern plain is far less than that simulated by the HCI model, possibly for reasons discussed above regarding vertical permeability and the greater TDS of river sub-flow in the USGS model. The cause of the relative decrease in quality in the western plain for this alternative is unknown.

4.6.3.4 Effects on Groundwater Levels – All Alternatives

The results of both models indicate no significant changes in groundwater levels in the Lompoc Basin under Alternatives 3B, 3C, 4B, 5B and 5C. Detailed time series graphs of water elevation changes due to pumping and recharge over the modeling period are provided in Stetson (2001d, 2006c).

4.6.4 MITIGATION MEASURES

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

4.7 SOUTHERN CALIFORNIA STEELHEAD AND OTHER FISHES

4.7.1 EXISTING CONDITIONS

Existing conditions are described in the August 2003 DEIR.

4.7.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

The impacts of the various alternatives on the fishes in Cachuma Lake and along the lower Santa Ynez River are assessed below based on technical analyses and modeling performed by ENTRIX (2002 and 2006) for this revised DEIR. Hydrologic data were provided by Stetson Engineers (2001a, 2001b, 2006a, 2006b).

Method of Analysis and Scoring

To provide an objective basis for comparing flow-related impacts among alternatives, a scoring system was developed to compare the effects of the different flow regimes on fish habitat in the lower Santa Ynez River and in Cachuma Lake using modeled flow. A scoring system to allow for comparison of the alternatives was set up on a relative scale of 0 to 5, with a score of 0 indicating little or no habitat value and a score of 5 indicating the higher habitat value. A score of 5 was not established to determine the best potential habitat conditions, but rather to reflect habitat conditions within the range of potential changes in operations of the Cachuma Project. A separate scoring system was set up for each species and lifestage that could potentially be affected by the proposed alternatives. If it was determined that no effect was anticipated, such as for species in the lagoon, a qualitative comparison of the alternatives was provided. The scoring system discussed above only provides a basis of comparison for the alternatives and does not predict the actual amount or quality of habitat expected under the various alternatives. In addition, the scores do not necessarily present a complete analysis of benefits of the alternatives. However, this analysis does include a class of impacts for beneficial effects of alternatives (Class IV) compared to baseline operations. Although CEQA does not require the discussion of positive environmental effects, such an analysis was included in the 2003 DEIR and for consistency will be included here.

The primary methods by which the alternatives may affect fish resources are through changes in streamflow or lake storage, therefore, a score value was assigned to each monthly flow or water surface elevation. The mean daily flows or water surface elevations were computed by the SYRHM for each month of water years 1918 through 1993 for each alternative. The score was based only on the months when the species/lifestage being evaluated would be expected to be present in the river or reservoir. The frequency of each score value was calculated for the period of record for each alternative. Scores were then averaged over the 76 years where streamflow and water surface elevations were simulated to achieve an average score for each alternative for the species/lifestage group. These scores formed the basis for habitat analyses for fish inhabiting the mainstem of the Santa Ynez River (steelhead and residents) and fish inhabiting the reservoir.

The SYRHM runs were conducted to reflect operations pursuant to the alternatives; however, some assumptions were made in the process. For example, the method/time/duration for releasing the Adaptive Management Account water is not specifically stipulated within either the Biological Opinion or the Fish Management Plan and has, in these documents, been left to the Adaptive Management Committee. Thus, for the purpose of the hydrological analysis, it was assumed that during years other than critical drought years the 500 af in the Adaptive Management Account was released to benefit fish passage in accordance with the guidelines governing the Fish Passage Account. (In essence, the Fish Passage Account was allocated 3,700 af instead of the 3,200 af included in the Biological Opinion and Fish Management Plan.)

Alternatives 5B and 5C operate under a different flow regime than Alternatives 3B, 3C and 4B. Alternatives 5B and 5C are described in Section 3.2. Under Alternatives 5B and 5C, "3A2 operations" would not become the operating criteria for fish water releases until cumulative annual inflow into Cachuma Lake exceeds 33,707 af (wet and above-normal water years). If cumulative annual inflow does not reach this criterion, then operations would proceed under the Biological Opinion, with surcharges of 1.8 feet or 3.0 feet (Alternatives 5B and 5C, respectively).

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 fishes 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 fishes. Depending upon the alternative chosen, the changes in project operations may result in a net gain or loss in aquatic habitat for different life stages. The early life history stages (egg and fry) of fish are most vulnerable to effects from fluctuations in water surface elevation.

ENTRIX's analysis of lake level fluctuation on game fish focused on two representative fish types: bass and sunfishes. A rapid drop in water surface elevation could result in nests becoming dewatered, resulting in the mortality of eggs. Fry spend their first few months rearing in shallow water in and around aquatic plants and submerged objects where they find food and shelter from predators. Largemouth bass were chosen for evaluation because they are highly sought-after by sportsmen, and because their spawning requirements are similar to smallmouth bass, which also reside in Cachuma Lake. Bluegill, redear sunfish, white crappie and black crappie are abundant in the lake (DFG Region 5 files; CDWR, 1990), and these sunfishes form an important component of the sport-fishery, as well as serving as a forage base for largemouth bass. There is considerable overlap in the spawning requirements of the sunfishes. Therefore, the important characteristics of these species were combined into a single criterion that was used to assess the effects of reservoir operations on their spawning success.

Members of the family Centrarchidae, which includes largemouth and smallmouth bass and the "sunfishes," (e.g., white and black crappie, bluegill, green sunfish, redear sunfish) often complete their early life stages in water less than 10 feet deep. Nests are generally built in shallow water, and a rapid drop in the water surface elevation could result in the nests becoming dewatered, resulting in the mortality of eggs. Fry spend their first few months rearing in shallow water in and around aquatic plants and submerged objects where they find food and shelter from predators. A rapid decrease in water surface elevation during the rearing season may result in a loss in near shore cover through dewatering, and an increase in the rate of mortality through predation. Therefore, bass and sunfish generally benefit from relatively stable water surface elevations during their spawning season and fry rearing season. A decrease in the amount of habitat during the fry growing season may increase the fry's vulnerability to predation. However, concentrating fry in a smaller area may benefit the juvenile and adult life stages of larger fish such as largemouth bass and black crappie, which feed on young fish, but this effect cannot be quantified. Older centrarchids, juveniles and adults, are relatively unaffected by changes in water level, therefore, the evaluation of the potential impacts to centrarchids concentrates on spawning and fry survival.

To assess the effects of different lake levels under the alternatives, ENTRIX conducted an analysis (2002 and 2006), which entailed estimating the amount of critical shallow water habitat for selected lake fishes under different lake levels. ENTRIX then used a scoring system to rate the amount of habitat available under the different alternatives due to different lake level fluctuations. ENTRIX examined the effects of varying lake levels amongst the alternatives for the following habitats: (1) bass spawning; (2) sunfish spawning; and (3) bass/sunfish fry rearing. A description of scoring criteria for each species and life stage is provided below. The change in lake levels under the various alternatives is described in Section 4.2.2.

The median monthly lake elevation for Alternatives 3B and 5B is about the same as under baseline operations (Alternative 2) because the greater releases for fish under Alternatives 3B and 5B are offset by a 1.8-foot surcharge. Operations under Alternatives 3C, 4B, and 5C would exhibit higher lake levels compared to baseline conditions due to surcharging at 3.0 feet.

The seasonal pattern of fluctuation would be similar among the six alternatives. Compared to baseline conditions, the shoreline would be shifted from 750.75 feet to a higher shoreline at

751.8 feet under Alternatives 3B and 5B or 753 feet under Alternatives 3C, 4B, and 5C where the pattern of seasonal and annual fluctuation generally repeats.

Largemouth Bass Spawning Habitat

Site-specific data on largemouth bass spawning requirements from Cachuma Lake were not available from the DFG Region 5 files (ENTRIX 1995). However, their spawning requirements have been well documented in other settings. Spawning occurs in the spring (typically April and May) when water temperature warms to approximately 57 to 61°F (Emig, 1966; Moyle, 1976). Largemouth bass build nests in relatively shallow water over a variety of substrates, including gravel, sand, roots and aquatic vegetation. Nests are often built near rocks, submerged logs, or other structures providing protection to the nest. Largemouth bass reportedly spawn at depths ranging between 0.5 and 24.5 feet (Stuber et al., 1982c). However, the average depth at which bass spawn is typically at the shallower end of this range. Largemouth bass nests were reported at depths of 0.5 to 2.5 feet, 3.9 to 5.9 feet, and 0.5 to 6.5 feet with an average of approximately two feet, in three studies reported in Carlander (1977) and between 3.3 and 6.5 feet (Moyle, 1976). Stuber et al. (1982c) report that nests are found, on average, between 1.0 and 3.0 feet. Nests were more likely to be located at a depth of 2.5 feet than at 1.5 feet in a California reservoir (Carlander, 1977). Largemouth bass in Millerton Lake, California, spawned at an average depth of 3.9 feet, with a range of 2.0 to 8.2 feet (Mitchell, 1982). On the basis of these data, largemouth bass spawning habitat was defined as the lake area ranging in depth from 0.5 to 8.2 feet.

Incubation (to hatching) of largemouth bass eggs is largely influenced by water temperature, and ranges from approximately 13 days at 50°F to 1.5 days at 86°F (data cited by Carlander 1977). The expected temperature range in Cachuma Lake during the April and May spawning season is approximately 59 to 68°F, which would equate to an incubation period of approximately three to seven days. The newly hatched largemouth bass spend five to eight days in the nest before they are able to rise up off the bottom and feed, and remain around the nest for an additional four to five days. Using the rates of nest construction and embryo and larval development provided by Carlander (1977), at the expected water temperatures in Cachuma Lake during April and May, larval largemouth bass would be expected to leave the nest 13 to 21 days after the onset of nest construction.

Reservoir operations, specifically changes in water surface elevation, have the potential to adversely effect spawning success. Stuber et al. (1982c) report that shallow (<4.5 foot deep) nests can be vulnerable to destruction by wave action. Decreasing water surface levels may decrease nest production through dewatering (i.e. loss of habitat), nest desertion, and disrupted spawning. Rapidly increasing water surface elevations have also been reported to negatively affect largemouth bass spawning. Potential mechanisms for declining reproductive success with increasing water surface elevations are decreasing water temperatures and nest desertion by the male, which guards the nest. Abandonment by the male, it is hypothesized, can lead to increased predation (Edwards et al. 1983). For these reasons, stable water surface elevations during spawning are optimal (Stuber et al., 1982c).

In Millerton Lake, Mitchell (1982) found that an increase in the water surface elevation of approximately 13 feet resulted in a decrease in water temperature around the nests, which were then abandoned by the adult bass. Mitchell (1982) reported that a water surface elevation increase of about 27 feet per month (10.6 inch increase/day) was the upper limit for tolerance for bass in Millerton Lake. However, Millerton Lake receives runoff from snow pack through the San Joaquin River, and the in-flowing water would be expected to be colder than in-flowing water from the Santa Ynez River, which originates primarily from rainfall. Therefore, a greater increase in water surface elevation may be required to disrupt spawning by largemouth bass in Cachuma Lake, compared to conditions found in Millerton Lake. According to Stuber et al. (1982c) an increase in water surface elevation of 33 feet can reduce the suitability of spawning habitat by 30 percent.

ENTRIX assessed the potential for alternatives to affect largemouth bass spawning habitat by analyzing the amount of spawning habitat (i.e., areas between 0.5 and 8.2 feet deep) affected by water surface elevation changes during the months of April and May for each water year for the period of record for each alternative. Using SYRHM simulations, ENTRIX compared water surface elevations at the end of each month to those at the start to determine the extent to which reservoir operations under each alternative affect the habitat available at the start of the month. ENTRIX developed a scoring system to assess potential impacts of both reservoir drawdowns and reservoir increases during the spawning period (April and May), as shown below. A high score suggests that largemouth bass have a high likelihood of reproducing successfully under the reservoir operations for the particular alternative. A score of 0 indicates a lower likelihood that spawning would be successful. These scoring criteria are designed to allow a comparison of the potential affects of the different alternatives and do not constitute an assessment of all variables that determine success of redds. For instance, direct predation, amount of shelter, specific timing of water surface elevation change to redd development, and other potential variables are difficult to quantify and are not directly assessed in this scoring analysis.

Largemouth Bass Spawning Habitat Score Criteria

Score	Criteria	
	Monthly Water Surface Elevation Decrease	**Monthly Water Surface Elevation Increase**
5	<0.5 feet	≤ 13.0 feet
4	which decreases the available spawning depth[*] by > 0 but ≤ 20% (≥ 0.5 ft to < 2.0 ft)	which decreases the available spawning depth[1] by > 0 but ≤ 20% (≥ 13 ft to < 21 ft)
3	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 2.0 ft to < 3.6 ft)	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 21 ft to < 29 ft)
2	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 3.6 ft to < 5.1 ft)	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 29 ft to < 37 ft)
1	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 5.1 ft to < 6.7 ft)	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 37 ft to < 45 ft)
0	which decreases the available spawning depth by > 80% (≥ 6.7 ft)	which decreases the available spawning depth by > 80% (≥ 45 ft)

[1] “Available spawning depth” is defined as the spawning habitat (area located between the depths of 0.5 and 8.2 feet) available at the start of the month for potential nest building.

Sunfish Spawning Habitat

Site-specific data on sunfish spawning requirements from Cachuma Lake were not available from the DFG Region 5 files (ENTRIX 1995). Information on the spawning requirements of sunfishes have been synthesized by Calhoun (1966), Moyle (1976) and Carlander (1977). Although the specific requirements vary by species, sunfishes (bluegill, redear sunfish, white crappie and black crappie) spawn during the spring and summer months in fairly shallow water over substrates of gravel, sand, mud, roots or aquatic vegetation. Nests are typically built near rocks or aquatic vegetation that provide protection. The onset of spawning is largely controlled by water temperature, with black crappie spawning at the lowest temperatures (approximately 57.0 to 62.5°F), and redear sunfish spawning at the highest temperatures (approximately 71.5 to 75.0°F). On the basis of water temperature recorded in Cachuma Lake between 1980 and 1994 (Reclamation, 1987 and Reclamation, unpubl. data) the sunfish spawning season is expected to begin in late March (for black crappie), and extend into June, and possibly July (for redear sunfish).

ENTRIX based the scoring system for sunfish spawning habitat on that described for largemouth bass, except that ENTRIX designated spawning habitat as areas at depths between 0.5 and six feet deep and determined the maximum inundation depth based on sunfish spawning temperature ranges, which vary during the spawning period. Sunfishes typically spawn at depths less than six feet, but have been reported spawning at depths up to 20 feet. The depths at which the sunfishes spawn appear to be flexible within a specific range, and have been reported to vary depending upon local conditions. The normal range of depths at which black crappie spawn are given as three to eight feet (Calhoun, 1966) and less than three feet (Moyle, 1976). Bluegill spawning depths have been reported between two and six feet (Calhoun, 1966) and between 0.5 and four feet (Carlander, 1977). Redear sunfish have been reported to spawn at greater depths than bluegill and black crappie (with the preferred range between six and ten feet). On the basis of these data, sunfish spawning habitat was defined as the area ranging in depth from 0.5 to six feet. This range of depths was used to assess the potential affects of the alternatives on the more vulnerable species (i.e., shallow spawners).

Temperatures within Cachuma Lake vary over the course of the sunfish spawning period (March through July). Spawning for each of the sunfish species begins when water temperatures become suitable for each species and the effects of inundation will vary depending on water year type and species. In the early part of the spawning season, the minimum depth at which unsuitable spawning temperatures for crappie (cooler temperatures spawner) are found is about 40 feet (SYRTAC 1997, 1998, 2000b). Later in the season, unsuitable temperatures for redear sunfish spawning occur at about 30 feet. This information was used as the foundation for the development of the sunfish scoring for months in which water surface elevation increased. An increase in water surface elevation of 30 feet was considered to provide unsuitable conditions for nest development and production. It is unknown what levels of water surface elevation increase result in no effect on sunfish nests therefore, scores were equated with increases in water surface elevation based on 16.7 percent intervals; the result of dividing the depth range evenly into six sub-categories.

ENTRIX assessed the potential for each alternative to affect sunfish spawning habitat by analyzing the amount of spawning habitat affected by water surface elevation changes during the months of March through July for each water year for the simulation period. Specific scoring criteria are shown below.

Sunfish Spawning Habitat Score Criteria

Score	Criteria	
	Monthly Water Surface Elevation Decrease	**Monthly Water Surface Elevation Increase**
5	<0.5 feet	< 5 ft
4	which decreases the available spawning depth[1] by > 0 but ≤ 20% (≥ 0.5 ft to < 1.6 ft)	which decreases the available spawning depth[1] by > 0 but ≤ 20% (≥ 5 ft to < 10 ft)
3	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 1.6 ft to < 2.7 ft)	which decreases the available spawning depth by > 20% but ≤ 40% (≥ 10 ft to < 15 ft)
2	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 2.7 ft to < 3.8 ft)	which decreases the available spawning depth by > 40% but ≤ 60% (≥ 15 ft to < 20 ft)
1	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 3.8 ft to < 4.9 ft)	which decreases the available spawning depth by > 60% but ≤ 80% (≥ 20 ft to < 25 ft)
0	which decreases the available spawning depth by > 80% (≥ 4.9 ft)	which decreases the available spawning depth by > 80% (≥ 25 ft)

[1] "Available spawning depth" is defined as the spawning habitat (area located between the depths of 0.5 and 8.2 feet) available at the start of the month for potential nest building.

Bass and Sunfish Fry Rearing Habitat

Site-specific data on largemouth bass and sunfish fry habitat requirements from Cachuma Lake were not available from the DFG Region 5 files (ENTRIX, 1995). Largemouth bass and sunfish fry ("fry") inhabit nearshore habitat with abundant cover (e.g., aquatic plants and woody debris that provide shelter from predatory fish) (Stuber et al., 1982 a, b, & c; Moyle, 1976; Nack et al., 1993). Centrarchid fry abundance was found to be higher in protected coves compared to open shoreline in the main body of a lake (Meals and Miranda, 1991; Nack et al., 1993). Nack et al. (1993) also reported that "many" centrarchid fry were collected in water less than 6.5 feet deep, but they did not provide an average depth or a range of depths preferred. Rising water surface elevations during the fry rearing season increases available habitat by flooding terrestrial vegetation, which provides shelter for the young fish.

The range of depths utilized during the rearing season were not presented in the literature reviewed. For the purposes of this analysis, ENTRIX defined fry rearing habitat as the area less than 10 feet deep. This depth was assumed to supply the necessary range of feeding and hiding habitat for largemouth bass and sunfish fry. Centrarchid spawning usually begins in March, and significant numbers of fry would be expected to be present by May. Therefore, May 1 was designated as the beginning of the rearing season.

Decreasing water surface elevation during the fry growing season (May through August), reduces the amount of available cover, which increases the fry's vulnerability to predation. Cover observed in the reservoir during a May 1994 survey at a water surface elevation of approximately 746 feet (ENTRIX, 1995) consisted of submerged woody debris, rocky points, and submerged and emergent vegetation, which should provide suitable habitat for all life stages of centrarchids. The loss of cover is associated with aquatic plants and submerged objects becoming exposed as the water surface level decreases. A drawdown of greater than three feet was considered sub-optimal by Stuber et al. (1982c) because it would increase predation due to lower amounts of cover. If, however, water surface elevations decline at a slow rate, new growth can occur to continue to provide fry shelter.

ENTRIX developed a scoring system to rate monthly reservoir drawdown, as shown below. ENTRIX equated a drawdown of three feet or less with the middle of the scoring range, given the monthly time step which provides some time for growth of aquatic plants in response to declining water surface elevation. ENTRIX divided the remaining scores evenly such that a score of “5” represented little monthly drawdown (a foot or less) and a score of one represented a more severe rate of drawdown. A score of “0” represents a drawdown of greater than 5 feet based upon the even distribution of scores and poorer habitat conditions. Some fry habitat will always be available unless the reservoir goes dry; therefore, a “0” score does not mean that there is no habitat.

Bass and Sunfish Fry Rearing Habitat Score Criteria

Score	Criteria
5	monthly water surface elevation decrease ≥ 0 and ≤ 1 ft
4	monthly water surface elevation decrease > 1 and ≤ 2 ft
3	monthly water surface elevation decrease > 2 and ≤ 3 ft
2	monthly water surface elevation decrease > 3 and ≤ 4 ft
1	monthly water surface elevation decrease > 4 and ≤ 5ft
0	monthly water surface elevation decrease > 5 ft

ENTRIX conducted a second analysis to assess the amount of rearing habitat (area < 10 feet deep) available to fry under the different alternatives. ENTRIX calculated rearing habitat area using a regression (MNS Engineers, 2000) derived from lake surface area (in acres) and water surface elevation (in feet) data.

The available fry rearing habitat area is the difference between the surface area at the elevation in question and the surface area at ten feet below the area in question. ENTRIX calculated the amount of fry rearing habitat for each month in which fry rearing is anticipated to occur in Cachuma Lake for the 76-year period of record. The median rearing habitat area is presented for each month and alternative. Monthly water surface elevation drawdown was calculated for each month (May through August) during the fry rearing season and the drawdown scored.

Evaluation of Alternatives

Largemouth Bass Spawning Habitat

Scoring of bass spawning habitat in Cachuma Lake is essentially the same under all six alternatives in both April and May (Table 4-37). 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.

Alternatives 3B, 3C and 4B would have four fewer years with high spawning scores in April than under baseline operations (Alternative 2). This effect is caused by a greater drawdown of the lake due to releases for downstream fish. However, this impact is offset by the increased number of years with spawning scores of 4. In May, the number of years with high spawning scores would be the same under current operations and Alternatives 3B, 3C and 4B. In addition, the number of years with spawning scores of 4 would be the same under Alternatives 3B and 3C and greater under Alternative 4B than under baseline conditions.

Alternatives 5B and 5C have one less year with spawning scores of 5 in both April and May than Alternatives 3B, 3C and 4B. Alternatives 5B and 5C have one more year of spawning scores of 4 in both April and May, compared to Alternatives 3B and 3C.

In summary, Alternatives 3B, 3C, 4B, 5B and 5C all have overall negligible net effects on bass spawning habitat when compared to the “Baseline Operations” alternative. The alternatives have either the same average spawning score as baseline operations or are within one-tenth of a point. Accordingly, the effect of the alternatives on bass spawning habitat would not be significant.

Table 4-37
Scores for Largemouth Bass Spawning in Cachuma Lake

APRIL							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	41	33	1	1	0	0	4.5
3B	37	36	2	1	0	0	4.4
3C	37	36	2	1	0	0	4.4
4B	37	36	2	1	0	0	4.4
5B	36	37	2	1	0	0	4.4
5C	36	37	2	1	0	0	4.4
MAY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	23	43	9	1	0	0	4.2
3B	23	43	9	1	0	0	4.2
3C	23	43	9	1	0	0	4.2
4B	23	45	7	1	0	0	4.2
5B	22	44	9	1	0	0	4.1
5C	22	44	9	1	0	0	4.1

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 two-tenths of a point during the spawning period of March through June. In July when more spawning habitat is lost due to increasing water withdrawals, scores of 2 and 3 are the most common for all alternatives. Alternatives 5B and 5C have slightly more years with scores of 2 in June and July than the other alternatives. The effect over the course of the spawning season means that fish that typically spawn in warmer temperatures (and thus later in the season), such as redear sunfish, are more likely to be affected than species that spawn earlier in the year, such as black crappie. While the results show a general decrease in the stability of spawning habitat over the course of the spring and early summer for all alternatives, the potential impacts of Alternatives 3B, 3C, 4B, 5B and 5C are not significant relative to the baseline operations alternative.

Table 4-38
Scores for Sunfish Spawning in Cachuma Lake

MARCH							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	53	18	2	0	1	2	4.5
3B	47	23	2	1	1	2	4.4
3C	47	23	2	1	1	2	4.4
4B	46	22	4	1	1	2	4.4
5B	47	22	3	1	1	2	4.4
5C	47	22	3	1	1	2	4.4
APRIL							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	37	35	2	0	0	2	4.4
3B	33	37	4	0	0	2	4.3
3C	33	37	4	0	0	2	4.3
4B	33	37	4	0	0	2	4.3
5B	32	37	5	0	0	2	4.3
5C	32	37	5	0	0	2	4.3
MAY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	23	38	7	7	1	0	4.0
3B	23	36	9	7	1	0	4.0
3C	23	38	7	7	1	0	4.0
4B	23	36	10	6	1	0	4.0
5B	22	33	13	7	1	0	3.9
5C	22	34	12	7	1	0	3.9

Table 4-38
Scores for Sunfish Spawning in Cachuma Lake

JUNE							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	7	35	24	7	3	0	3.5
3B	7	32	28	5	4	0	3.4
3C	7	32	29	4	4	0	3.4
4B	7	28	37	3	1	0	3.5
5B	7	25	32	9	3	0	3.3
5C	7	25	33	8	3	0	3.3
JULY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	1	9	33	25	8	0	2.6
3B	1	9	36	22	8	0	2.6
3C	1	9	35	23	8	0	2.6
4B	0	9	47	15	5	0	2.8
5B	1	5	36	27	7	0	2.6
5C	1	5	38	26	6	0	2.6

Bass and Sunfish Fry Rearing Habitat

Overall, from the beginning of the fry rearing season to the end, monthly reservoir drawdowns increase, which suggests a potential decrease in the amount of cover available for rearing fry. The results of the bass and sunfish fry rearing scoring analysis, however, indicate no significant difference in the amount of habitat amongst the alternatives relative to baseline operations.

Table 4-39
Scores for Bass and Sunfish Fry Rearing in Cachuma Lake Based on Reservoir Drawdown

MAY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	31	35	8	1	1	0	4.2
3B	30	36	7	2	1	0	4.2
3C	30	36	6	3	1	0	4.2
4B	29	39	5	2	1	0	4.2
5B	28	38	8	1	1	0	4.2
5C	27	39	7	2	1	0	4.2

Table 4-39
Scores for Bass and Sunfish Fry Rearing in Cachuma Lake Based on Reservoir Drawdown

JUNE							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	11	42	15	5	3	0	3.7
3B	11	42	16	4	3	0	3.7
3C	11	42	16	4	3	0	3.7
4B	11	45	18	1	1	0	3.8
5B	10	39	18	7	2	0	3.6
5C	10	39	19	6	2	0	3.6
JULY							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	2	24	21	25	4	0	2.9
3B	2	27	19	24	4	0	3.0
3C	2	27	19	24	4	0	3.0
4B	2	29	33	10	2	0	3.3
5B	2	15	30	27	2	0	2.8
5C	2	17	29	26	2	0	2.9
AUGUST							
Frequency of Scores							
Alternatives	← better			worse →			
	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	1	17	30	20	8	0	2.8
3B	1	21	26	20	7	1	2.8
3C	1	21	27	19	7	1	2.8
4B	0	22	27	21	6	0	2.9
5B	1	19	29	19	7	1	2.8
5C	1	19	31	17	7	1	2.8

Table 4-40 compares the estimated fry rearing habitat area available during the different portions of the rearing season for the different alternatives. The results demonstrate that as water surface elevation declines through the fry rearing season fry rearing habitat declines under all alternatives. Alternative 5B starts and ends the season with slightly less habitat area than Alternatives 2, 3B, 3C, and 4B. Alternative 5C begins the season with slightly more habitat area than Alternatives 2 and 3B and slightly less than Alternatives 3C and 4B. Alternative 5C ends the season with slightly more habitat area than the baseline and slightly less habitat area than Alternatives 3B, 3C and 4B.

Table 4-40
Median Available Bass and Sunfish Fry Rearing Habitat in Cachuma Lake

	Median Monthly Habitat Area (Acres) for Alternatives					
	2	3B	3C	4B	5B	5C
Start of Season (April)	316	315	320	322	311	317
May	310	309	315	315	305	311
June	299	300	306	307	295	301
July	286	290	295	298	282	287
End of Season (August)	276	281	286	287	274	279
Median*	293	293	299	300	289	294
Range*	147-361	146-368	147-375	148-375	145-368	146-375

Based on these analyses, Alternatives 3B, 3C 4B, 5B and 5C would not adversely affect bass and sunfish rearing habitat, even with lake surcharging. Alternative 5B would provide slightly less favorable habitat conditions and slightly less habitat area than baseline operations and Alternatives 3B, 3C and 4B. Alternative 5C would provide slightly better conditions and more habitat area than the baseline alternative, but still less than Alternatives 3B, 3C and 4B. However, these small physical changes would not result in a significant difference in the fry population and therefore would have no significant effect on bass and sunfish rearing habitat.

4.7.2.3 Impacts on Southern California Steelhead/Rainbow Trout along the River

In order to complete their lifecycle, steelhead must gain access to the Santa Ynez River watershed and migrate into the mainstem. Spawning can occur at locations within the mainstem or in tributaries downstream of Bradbury Dam. Perennial rearing habitat in the mainstem, tributaries, and/or lagoon must be available for young-of-the-year to successfully grow to become juveniles and sufficient flows must be available to allow for juvenile outmigration. For resident rainbow trout, passage into the system is not an issue, but flows to allow movement within the system and to provide spawning and rearing habitat are.

The effect of different downstream flow regimes under the various alternatives is described below based on ENTRIX (2002 and 2006). The analysis in this section focuses on mainstem habitat for steelhead/rainbow trout, as the Cachuma Project has the potential to affect mainstem habitat and not tributary habitat, with the exception of a portion of Hilton Creek where reservoir releases are used to supplement streamflow.

Method of Analysis and Scoring

Streamflow

The primary method by which the alternatives may affect fish resources is through changes in streamflow. Therefore, to provide an objective basis for comparing and evaluating flow-related impacts to fish habitat under different alternatives, a habitat scoring system was developed. The habitat scoring system assigns higher scores to flows that are likely to provide more habitat and lower scores to flows that are likely to provide less habitat. The habitat scores are derived from the average monthly flows calculated using simulated mean daily flows for each alternative. Monthly time steps provide adequate resolution for rearing and spawning habitat conditions in the river and lake and therefore were used for these analyses.

A separate habitat scoring system was set up for each lifestage that potentially could be affected by the proposed alternatives. The score was based only on the months when the lifestage being evaluated would be expected to be present in the river. The flow levels used in the scoring system were based on the habitat and passage analyses conducted for the SYRTAC (1999a and b) and on the flow levels that NMFS determined would result in no jeopardy to steelhead (NMFS, 2000). The frequency of each score value was calculated for the 76-year period of record for each alternative. Scores were then averaged. The scoring criteria are shown in Table 4-41. These scores only form a basis for comparison of the alternatives and do not provide an absolute prediction of the amount and quality of habitat expected under the alternatives.

Table 4-41
Scoring Criteria For 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.

Fish Migration

Adult steelhead primarily migrate upstream in the Santa Ynez River from February through April (SYRTAC 1997, 2000a and b). To allow steelhead/rainbow trout to migrate within the mainstem and into the tributaries, passage flows must be available within the system and for steelhead, the sandbar at the mouth of the lagoon must be open. A passage analysis was conducted to determine the amount of flow needed to provide passage at critical riffles in the lower mainstem of the Santa Ynez River (SYRTAC, 1999b). The result of these analyses indicate that a flow of 25 cfs at the Alisal Road Bridge is sufficient to provide passage between Bradbury Dam and the lagoon 92 percent of the time (SYRTAC, 2000a). Therefore, a passage day is defined as a day with a flow of greater than or equal to 25 cfs at the USGS gage at the Alisal Road Bridge. For suitable access to mainstem and tributary spawning habitat, there must be sufficient number of days with flow at the Alisal Road Bridge greater than or equal to 25 cfs.

Travel times for salmonids are not well defined in the literature. NMFS cites several studies of salmonid travel times which range from 8 to 31 miles per day (Groot and Margolis 1991, cited in NMFS 2000) to 1.85 to 18.4 miles per day (average of 4.6 miles per day) for steelhead in the Carmel River (Dettman and Kelly 1986, cited in NMFS 2000). NMFS also considered an analysis of recession curves derived from the Los Laureles gage (located above Cachuma Lake), which demonstrated that the recession from 150 cfs to baseflow took 14 days. Based on these studies, NMFS considered 14 days of passage in a particular year to provide adequate passage opportunities (NMFS, 2000). A score of 5 was equated with years in which the number of passage days exceeded this threshold (Table 4-41). A score of 0 was equated to years that provide no passage opportunity. The remaining scores were assigned passage days by dividing the remaining passage days evenly amongst the scores. This reflects that, given the uncertainty and variability in steelhead travel times, passage opportunities to portions of the mainstem may be provided even with smaller numbers of passage days.

In order to compare the passage opportunities between the alternatives, the total number of passage days provided under each alternative was estimated using daily data from the SYRHM. This is because fish passage events in the Santa Ynez River system can occur on a scale of hours to days. Therefore, in order to assess and compare steelhead passage opportunities between alternatives, the SYRHM was adapted to estimate daily flow. The model was run for a 52-year sub-set of the original data set (1942-1993) because these were the years in which daily information used to adapt the model was available. A similar caution must be applied to daily passage data as to the monthly habitat data; the model provides a basis for alternative comparison, but may not accurately predict the actual number of passage days that would result under each alternative.

Spawning and Rearing Habitat

Spawning and rearing habitat in the lower Santa Ynez River is restricted to the upper portion of the river where suitable habitat structure exists. As the river channel widens, sand replaces gravel as the primary substrate and riffles become less well defined. The Highway 154 Reach was selected as the index location for spawning and rearing habitat because it contains the best quality habitat available in the mainstem (SYRTAC 2000a). Much of this reach is located on private property and no additional data collection efforts have been undertaken except in the short reach near the dam. In this reach, few observations of spawning pairs have been made. Steelhead/rainbow trout appear to rely primarily on the tributaries to the Santa Ynez River (i.e., Hilton Creek and Salsipuedes Creek) for spawning and rearing.

To provide spawning habitat in the mainstem, there must be sufficient flow to provide habitat during the spawning season, which is typically between February and April in the Santa Ynez River (SYRTAC, 2000a). The period analyzed to assess spawning starts at the onset of the peak spawning season (February) through the end of the peak fry emergence period (May). A study conducted by the SYRTAC (1999a) assessed the relationship of stream flow at Highway 154 to habitat area, average depth, and average velocity in the Highway 154, Refugio, and the Alisal reaches. The relationship in the study demonstrated that large increases in the top width of habitat units occur at lower flows (<15 cfs) and lower rates of increase are found at higher flows (>30 cfs). The changes were most dramatic below 5 cfs and in riffle and run habitats where spawning frequently occurs. For riffles, changes ranged from 1.8 feet at 30 cfs (2.4 percent change) to 1.1 feet at 50 cfs (1.3 percent change), compared to 8.7 feet at 5 cfs (15.1 percent change) and 2.9 feet at 10 cfs (4.4 percent change). Similarly, changes in runs ranged from 10.3 feet at 5 cfs (17.6 percent) and 0.4 feet at 50 cfs (0.5 percent change). The SYRTAC biological team observed that spawning can occur in the mainstem at low flows (>2.5 cfs). While there is little habitat area available, compared to higher flows, there is sufficient flow in some locations to enable spawning to occur. The flow criteria used for the spawning habitat were developed to reflect the relationship between top width and flow in riffles and runs in the Highway 154 Reach and based on observations in the mainstem as outlined in Table 4-41.

Steelhead/rainbow trout need areas to seek refuge from warm summer water temperatures (NMFS 2005). Oversummering rearing habitat is an important limiting factor for steelhead/rainbow trout populations in California and in the Santa Ynez River (ENTRIX 1995). Rearing habitat must persist throughout the period when young steelhead/rainbow trout are in freshwater.

The scoring system developed for fry and juvenile rearing in April through August was based on the habitat analysis in SYRTAC (1999a) and rearing target flow levels established in the Biological Opinion. The minimum, long-term rearing target flow level established by the Biological Opinion is 2.5 cfs. This flow was equated with a score of “3,” which falls in the middle of the scoring range. Conditions without flow were scored “0.” A score of “5” was given to flows greater than 10 cfs because this is the maximum rearing flow required in the Biological Opinion for habitat maintenance. In addition, the top-width versus flow relationships developed during the habitat analysis show that the rate of increase in habitat (i.e., top-width) typically declines above 10 cfs (SYRTAC, 1999a). These rearing criteria were used for both fry and juvenile rearing; although, the period of time to which the criteria are applied varied between the two lifestages. Juveniles rear throughout the entire year and therefore the analysis was conducted for all 12 months. Fry rear in the Santa Ynez system from April through approximately August and therefore the fry analyses were conducted using only these months.

Both the fry and juvenile analyses were conducted by scoring the month in each year with the lowest flow. This corresponds to the ‘low-flow’ period that represents a critical point for these lifestages. The ‘low-flow’ score recognizes that lower flows can lead to concentration of fry, juveniles, and adults into smaller habitat spaces which can decrease habitat suitability and survival. This scoring system also highlights the importance of no-flow conditions when habitat units become discontinuous and poorer water quality conditions (i.e., high temperatures, low dissolved oxygen) can result. To further assess the effects of higher flow requirements at Alisal Road Bridge, a qualitative discussion is provided for potential impacts or benefits for Alternatives 5B and 5C.

Results

Fish Migration

The scoring of steelhead 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 resulting in a score of “5” (i.e., >14 days of passage flows at Alisal) under baseline operations would be 21 of the 52 years (Table 4-42). Baseline operations do not include releases to facilitate passage. In contrast, Alternatives 3B, 3C, 4B, 5B and 5C would substantially increase the frequency of years with passage for steelhead due to releases to supplement passage (Table 4-42). Hence, these alternatives would result in a beneficial effect (Class IV) on steelhead passage compared to baseline operations.

The score analysis shows that Alternatives 5B and 5C provided another two years with scores of “5,” reduced years with scores of “4” and “3,” and slightly increased years with scores of “2” and “1,” compared to Alternatives 3B, 3C and 4B. Alternatives 5B and 5C provide slightly fewer years (35 years) with greater than 11 passage days than Alternatives 3B and 3C (37 years). This is due to the fact that under Alternatives 3B and 3C there were more years with a small spill (<20,000 af) than under Alternatives 5B and 5C. However, in wet years in which there was not a spill, Alternatives 5B and 5C had more passage days than Alternatives 3B and 3C. Overall, all of the alternatives provide the same average score for steelhead adult migration at the Alisal Road Bridge.

Overall, Alternatives 5B and 5C provide a beneficial effect (Class IV) when compared to Alternative 2. When compared with Alternatives 3B and 3C, passage opportunities are very similar among the alternatives. Alternatives 5B and 5C provide a biologically significant number of additional days of passage flows in four years (1962, 1966, 1991, and 1992) compared to Alternatives 3B, 3C and 4B. In three years (1946, 1974, and 1986), Alternatives 5B and 5C provide a biologically significant reduction in the number of days of passage flows compared to Alternatives 3B and 3C (Stetson, 2006b).

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)
2	21	4	2	5	5	15	2.7
3B	31	6	0	2	1	12	3.5
3C	31	6	0	2	1	12	3.5
4B	31	4	2	2	2	11	3.5
5B	33	2	1	3	2	11	3.5
5C	33	2	1	3	2	11	3.5

Spawning Habitat

Under baseline operations (Alternative 2), spawning flows with scores of “5” are provided in 23 years of the 52-year simulation period (Table 4-43). The spawning habitat scores show that in a number of years, regardless of Cachuma Project operations, enough runoff occurs to provide for spawning habitat between the dam and Highway 154. These are typically years with large amounts of rainfall in which Cachuma Lake likely spills. Without the long-term operations proposed in the Biological Opinion and Fish Management Plan, there are also a substantial number of years in which there is little flow (less than 5 cfs), on average, in the mainstem at the Highway 154 Bridge during the February through May spawning/incubation season (scores of 0 and 1).

The frequency of years with scores of “5” for spawning (30 cfs or more) under Alternatives 3B, 3C and 4B would be the same as under baseline operations. However, these alternatives would increase the number of years with scores between 4 and 2 (with the exception of Alternative 4B which has one less year with a score of “4”) for spawning (i.e., years with intermediate flows). In addition, these alternatives would have fewer years in which flows are less than 5 cfs (scores of “0” and “1”). Alternatives 5B and 5C would have slightly more years with scores of “5” and “4” than the other alternatives, which is attributed to the higher flow requirements of Alternatives 5B and 5C from February through April. Under Alternatives 5B and 5C, the number of years with intermediate flows (i.e., years with spawning scores of “2” or “3”) also would increase. Based on the above, Alternatives 3B, 3C, 4B, 5B and 5C would result in a beneficial effect (Class IV) on steelhead/rainbow trout spawning compared to baseline 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)
2	23	5	5	11	22	10	2.6
3B	23	7	17	18	9	2	3.1
3C	23	7	17	18	9	2	3.1
4B	23	4	16	23	10	0	3.1
5B	26	8	16	13	11	2	3.3
5C	26	8	16	13	11	2	3.3

Rearing Habitat

Alternatives 3B, 3C, 4B, 5B and 5C all show beneficial effects (Class IV) on steelhead/rainbow trout fry rearing along the mainstem of the river compared to baseline operations. The frequency and quality of fry rearing habitat flows under Alternatives 3B, 3C and 4B would significantly improve fry rearing conditions compared to baseline operations (Alternative 2), as shown in Table 4-44. The higher releases for rearing under these alternatives would result in 50 or more years of rearing habitat with a score of “4” or greater during the 76-year simulation period compared to 17 years under baseline operations. Compared to the other alternatives, Alternatives 5B and 5C would result in the most years (29 years), with a rearing score of “5” being provided for steelhead/rainbow trout fry. Years with scores of “3” or greater would be provided in 75 of the 76 years simulation period for both Alternatives 5B and 5C.

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)
2	1	16	38	21	0	1	2.9
3B	0	52	23	0	0	1	3.6
3C	0	54	21	0	0	1	3.7
4B	0	53	22	0	0	1	3.7
5B	29	23	23	0	0	1	4.0
5C	29	26	20	0	0	1	4.1

The results of the analysis of juvenile rearing habitat for the various alternatives (see Table 4-45) follow the same pattern and support the same conclusions as for fry rearing habitat. As with fry rearing, all of the alternatives would have a beneficial effect (Class IV) compared to baseline conditions. Alternatives 3B, 3C, 4B, 5B and 5C all provide substantially more years with scores of "4" than are provided under baseline conditions. In addition, all of these alternatives provide substantially higher average scores compared to baseline conditions. Alternatives 5B and 5C provide one more year with a score of "5" than all of the other alternatives, but slightly lower average scores than Alternatives 3C and 4B.

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)
2	0	15	39	20	0	2	2.6
3B	0	39	35	0	0	2	3.4
3C	0	41	33	0	0	2	3.5
4B	0	41	33	0	0	2	3.5
5B	1	35	38	0	0	2	3.4
5C	1	37	36	0	0	2	3.4

As indicated by the scoring system described above, the additional flows provided by Alternatives 5B and 5C generally result in beneficial effects on steelhead/rainbow trout habitat. However, this relationship is not always proportional given other complicating factors such as habitat structure, predation, water temperatures, and dissolved oxygen. The following discussion provides a qualitative frame of reference.

Under Alternatives 5B and 5C in wet and above-normal years, 20 cfs would be required at the Highway 154 and Alisal Road bridges from April 15 to June 1. Flows would gradually decrease to 10 cfs by the end of June and would be held until October 1.

The Highway 154 Reach extends 2.9 miles from the dam to Highway 154 Bridge. It has a more confined channel than reaches further downstream and better riparian cover in general. The reach is dominated by pool habitat, with perennial pools present in portions of the reach. Overall, the Highway 154 Reach provides more complex habitat components and structure than what is observed downstream.

The Refugio Reach is located below the Highway 154 Reach and consists mostly of pools and runs. In the summer, flows often become intermittent. Riparian vegetation is not well developed and canopy coverage is low. Algae growth is the most extensive in this reach, compared with other mainstem reaches.

The Alisal Reach extends from the Refugio Road Bridge down to the Alisal Road Bridge. Surface flows tend to go subsurface in the summer and fall months, except in very wet years. Pools only comprise 9 percent of the habitat composition, with riffles dominating at 35 percent. Riparian vegetation is not well developed and canopy cover is poor. Floating mats of algae can be extensive in the summer.

Studies indicate that predatory fish may limit the ability of steelhead/rainbow trout to use pools in the Refugio, Alisal and Highway 154 reaches. Because stream flow is low or absent at times, all fish are forced into these stream habitats. These pools provide good habitat for largemouth bass, as they tend to prefer habitat with little flow variation and warm water temperatures. Bullfrogs also prosper in areas with year-round flows. Studies show that numbers of young steelhead/rainbow trout decline rapidly in habitats occupied by largemouth bass (Engblom, unpubl. data). Steelhead/rainbow trout tend to be more productive in areas where predators are absent, or few in number (i.e., Hilton and Salsipuedes creeks).

Water temperature may also be a limiting factor for steelhead/rainbow trout in the mainstem of the Santa Ynez River. Water temperature increases longitudinally in distance from Bradbury Dam (SYRTAC 1997). The Highway 154 Reach is about the limit of where releases from Bradbury Dam can provide water temperatures in the preferred range for steelhead/rainbow trout. Even with larger releases of water, such as the WR 89-18 releases, water temperature tends to remain high as distance increases from the Bradbury Dam (SYRTAC 1997). For example, before the 1996 WR 89-18 release, water temperatures were 18.6 to 19.6°C at 7.8 miles from Bradbury Dam (Alisal Reach). After the release, water temperatures were 17.0 to 25.1°C (SYRTAC 1997). At 9.5 miles from Bradbury Dam, water temperatures were 19.4 to 22.5°C before the release and 17.0 to 27.1°C after the release at the bottom of a pool (SYRTAC 1997). Cool water refuges, caused by groundwater upwelling, have been found in several pools in the Refugio and Alisal reaches, creating cool pockets of water in these reaches. These thermal refuges play an important role during periods of warm temperatures for steelhead/rainbow trout rearing.

In summary, Alternatives 3B-C, 4B, and 5B-C show a beneficial effect over baseline conditions, with Alternatives 5B and 5C showing the most benefits to rearing. Given the habitat complexity and favorable habitat conditions for rearing steelhead/rainbow trout observed in the Highway

154 Reach, additional flow would provide the greatest biological benefit in this reach. The Alisal Reach lacks habitat complexity and favorable rearing conditions for steelhead/rainbow trout. Accordingly, additional flow would not necessarily provide favorable rearing conditions in the Alisal reach.

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. As indicated previously, the scoring system is intended to compare the alternatives and does not necessarily provide an accurate measure of habitat quantity or quality. Prior to the construction of Bradbury Dam, summer and fall flows were absent downstream of the dam site. The low-flow period is an important factor in fish population size. Therefore, flows during this time of the year were used to compare the alternatives. The scores in this system range from zero to five, with “0” representing poorer habitat conditions and “5” representing better habitat. The Highway 154 Bridge was selected as the index location for comparing the effects of reservoir releases on mainstem rearing habitat because the river downstream of Highway 154 becomes discontinuous in most years, and as such, habitat downstream of the Highway 154 is often not directly related to mainstem flow.

Scores were equated with flow ranges based on the flow habitat study conducted by the SYRTAC in conjunction with DFG (SYRTAC 1999a). Several habitat types (e.g. pool run, glide, and riffle) were selected for the study. Although top width is not a complete description of habitat, it does provide an index of the amount of available habitat (Swift, 1976; Annear and Condor, 1983; Nelson, 1984). The top width versus flow curves developed in the SYRTAC study were used to assign rankings for habitat. Habitat scores between 0 and 5 were assigned.

In assigning habitat scores, the shape of the wetted perimeter versus flow curve was used as well as the total amount of habitat. At flows below 5 cfs, an increase in flow results in a large increase in top width. At flows from 5 cfs to 10 cfs, moderate increases in top width occur. At flows above 10 cfs, for most habitat types, increases in flow result in slightly wider top width, but the rate of increase is much slower than at lower flows (SYRTAC, 1999a). Therefore, under low-flow conditions, much of the habitat benefits of higher flows is reached by 10 cfs. A score of “5” was assigned to years when flow in the summer would be 10 cfs or more at Highway 154. A score of “0” was assigned to years in which there was no flow during at least one month of the year. Scores associated with intermediate flows are shown below.

Score	Flow Criteria for Highway 154 Bridge
5	≥10 cfs
4	≥5 to <10 cfs
3	≥2.5 to <5 cfs
2	≥1.5 to <2.5 cfs
1	>0 to <1.5 cfs
0	0 cfs

The score for the month in each water year with the lowest average flow for rearing is reported in Table 4-46.

The quantity and quality of rearing habitat under the project alternatives (Alternatives 3B, 3C, 4B, 5B and 5C) would be significantly greater than under baseline operations (Table 4-46) because these alternatives would involve higher rearing target flows, including target flows at Alisal Bridge. Alternatives 3B, 3C and 4B provide significantly more years with scores of “4”and less years with scores of “2” compared to baseline conditions. Alternatives 5B and 5C follow a similar pattern to Alternatives 3B, 3C, and 4B. Alternatives 5B and 5C provide one year when flows are greater than or equal to 10 cfs. There are slightly fewer years with scores of “4,” but more years with a score of “3” (intermediate flows) provided by Alternatives 5B and 5C, compared with Alternatives 3B, 3C, and 4B. The additional flow provided under Alternatives 5B and 5C would likely provide slightly more pool depth within the Alisal Reach, which should improve conditions for the other fish inhabiting these pools because it would increase habitat space for these warm water fish in spill years and the year following a spill year. Hence, these alternatives would result in a beneficial effect (Class IV) on resident fish rearing along the mainstem of the river compared to baseline operations.

Table 4-46
Scores for Resident Fish Rearing at the Highway 154 Bridge

Frequency of Scores							
	← better			worse →			
Alternatives	(5)	(4)	(3)	(2)	(1)	(0)	(AVG)
2	0	15	39	30	0	2	2.6
3B	0	39	35	0	0	2	3.4
3C	0	41	33	0	0	2	3.5
4B	0	41	33	0	0	2	3.5
5B	1	35	38	0	0	2	3.4
5C	1	37	36	0	0	2	3.4

Santa Ynez River Lagoon

The water release operations under the six alternatives are focused on providing benefits in the reaches just below the dam. The releases for passage flows and some emergency winter storm operational releases made predominately during February through May would reach the estuary when the sandbar is open.

Emergency winter operations include precautionary drawdown of Cachuma Lake, releases of initial storm run-off, and temporary surcharging. These operations are implemented under specific guidelines which require the reservoir to have spilled at least once already that year before implementation. The same volume of stormwater passes through the lagoon with or without the emergency winter operations. Qualitative analysis of these operations suggest that a slight (hours) modification of the peak storm flow will produce slightly lower peak inflows into the lagoon for a slightly prolonged period of time. An analysis of historic flow and precipitation records indicate that emergency winter operations would occur in about 30 percent of years (in 14 of the 47 post-Cachuma years studied) (Reclamation, 1999). River flows under emergency winter operations are well within the range of natural storm events to which lagoon species are adapted and are not substantially modified from baseline conditions. Thus, the emergency winter operations are anticipated to have, at most, slight changes in water quality (decrease in salinity or increase in dissolved oxygen). The same may be true of the passage releases, but they would likely be of lower magnitude than the releases for emergency storm operations, but of longer duration.

Alternatives 3B, 3C, 4B, 5B and 5C are anticipated to have a slight beneficial effect on lagoon residents due to increases in flow to the lagoon during emergency winter operations and passage releases, which would likely slightly increase dissolved oxygen levels and reduce the salinity in the upper portion of the lagoon. The increase in flow under Alternatives 3B, 3C, 4B, 5B and 5C, relative to Alternative 2, may have a beneficial effect on steelhead and other marine species that enter the lagoon to spawn (such as Pacific herring). Higher flows also allow for a breach to be maintained.

4.7.3 MITIGATION MEASURES

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

4.8 RIPARIAN AND LAKESHORE VEGETATION

4.8.1 EXISTING CONDITIONS

Existing conditions are described in the August 2003 DEIR.

4.8.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.8.2.1 Impacts to Lakeshore Vegetation

The maximum lake level under baseline operations (Alternative 2) is 750.75 feet. Maximum lake levels would increase 1.8 feet under Alternatives 3B and 5B, and 3.0 feet under Alternatives 3C, 4B and 5C due to surcharging the reservoir, relative to the 750.75 feet elevation.

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 (Alternatives 3B and 5B) and 3.0 feet (Alternatives 3C, 4B and 5C). The results are shown in Table 4-47. They indicate that the total acreages affected by the 1.8-foot and 3.0-foot surcharging are 42 and 91 acres, respectively. The average widths of effect are 15 and 25 feet, respectively.

Table 4-47
Inundation Acreage and Width Due to Surcharging

Maximum Lake Elevation (feet)	Area (acres)	Increase in Area (acres)	Average Width of Inundation Zone	Maximum Width of Inundation Zone (feet)
750.75 (baseline operations – Alt. 2)	3,056	--	--	--
751.8 (1.8’ surcharge, Alts. 3B & 5B)	3,098	42	15	218
753.0 (3’ surcharge, Alts. 3C, 4B & 5C)	3,147	91	25	363

Increased maximum lake levels over baseline conditions (750.75 feet) would alter the vegetation along the margins of the lake above the water level. The periodic inundation during surcharge years is likely to destroy upland vegetation types over time. The effect could require up to 10 years to occur. For example, inundation of upland vegetation for one month or less may not be sufficient to kill woody plants. However, prolonged inundation over one year, or repeated inundation over many years, may have a severe effect.

Upland vegetation above the current lake levels would be converted to one of several other habitat types, depending upon the slope and substrate of the shoreline: (1) bare shoreline would develop on steep slopes that were once vegetated with chaparral or coastal sage scrub; (2) annual grassland with a small percentage of wetland herbs would develop on moderate slopes that were vegetated with grassland or oak woodlands; and (3) emergent wetland would develop on very flat slopes that contained annual grassland because the depth of water would be shallow during surcharging.

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, 4B, 5B and 5C (compared to baseline operations) is considered an adverse, but not significant impact (Class III) because of the small acreage involved compared to the total acreage of these common vegetation types in the area. Impacts of surcharging on oak woodlands are addressed below in Section 4.8.2.2.

Chaparral vegetation comprises the largest percentage of lake margin vegetation (39.5%, Table 4-48). Although chaparral is not considered a sensitive plant community, it does have habitat value for a variety of species. The Cachuma Lake Recreation Area, managed by Santa Barbara County, encompasses approximately 9,250 acres. Of this 9,250 acres, Cachuma Lake covers over 3,000 acres and chaparral vegetation covers nearly 1200 acres. At the 3.0-foot surcharge level 35.9 acres of chaparral habitat would be lost over a period of time. This 35.9 acres of lost habitat is 3% of the total chaparral vegetation contained within the Cachuma Lake Recreation Area. Because of the small percent of total acreage lost, this is considered an adverse, but not significant impact.

Freshwater marsh areas around the margins of the lake are expected to persist under higher maximum lake levels. Wetlands are located in shallow water areas around the lake where there are flat or very low gradient slopes under water. Raising the lake level at these locations would essentially shift the wetlands upslope. Hence, surcharging the reservoir under Alternatives 3B, 3C, 4B, 5B and 5C would have a neutral effect on wetlands along the lake margins.

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

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 determine more precisely the magnitude of the impacts of surcharging under Alternatives 3B, 3C, 4B, 5B and 5C, field surveys were conducted to inventory the number of trees in the inundation zone (Figure 4-9). 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 the former high water mark at 750.75 feet elevation are in poor condition due to root flooding, as well as damage from wave action that has caused the trees to become unstable or topple. Oak trees located at or within several feet of the current high-water line (see Section 4.2.1 for further information on current conditions) 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 former 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, 4B, 5B and 5C is provided in Table 4-49.

Table 4-49
Estimate of Oak Trees Affected in Inundation Zones

Alternatives	**Number of Oak Trees Affected (All coast live oaks except for valley oaks, shown in parentheses)**		
	Direct Inundation	**Indirect Impacts due to Wave Action (approx)**	**Total**
3B & 5B (1.8’ surcharge)	158 (14)	113 (10)	247 (24)
3C, 4B & 5C (3.0’ surcharge)	339 (30)	113 (10)	412 (40)

The loss of oak trees under Alternatives 3B, 3C, 4B, 5B and 5C along the margins of Cachuma Lake is considered a significant, unmitigable impact (Class I) until such time that replacement trees become well established and self-sustaining, estimated to be about 10 years. After this time, the loss of oak trees under Alternatives 3B, 3C, 4B, 5B and 5C along the margins of Cachuma Lake is considered a significant, but mitigable impact (Class II). An oak tree restoration program, described below in section 4.8.3, has been designed and is being implemented to compensate for the loss of trees at the lake. Depending upon 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

As described in section 4.2.2.3, Alternatives 3B, 3C, 4B, 5B and 5C would alter downstream hydrology in the following manner compared to baseline operations (Alternative 2):

- The spill frequency and average annual spill amount under the project alternatives would be slightly less than under baseline operations.
- The releases for steelhead flows downstream of the dam under Alternatives 3B, 3C, 4B, 5B and 5C would be greater than under baseline operations (Alternative 2) because they would involve passage flows and higher rearing target flows.
- Releases for purposes of satisfying downstream water rights under Alternatives 3B, 3C, 4B, 5B and 5C would be slightly less than under baseline operations because the additional releases for fish under these alternatives would reduce the need for releases to replenish groundwater basins.
- The frequency and amount of low-flows (2-5 cfs) downstream of the dam (to Alisal Road) are similar among project alternatives 3B, 3C, 4B, 5B and 5C, and more than under baseline operations.

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

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

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

Please see the August 2003 DEIR for details on impacts to riparian vegetation from the delivery of SWP water under Alternative 4B.

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 or in the Santa Ynez River channel between the dam and the ocean. Hence, changes in lake elevation and flow regime downstream of the dam would not affect these species.

4.8.3 MITIGATION MEASURES

As described in section 4.8.2.2, surcharging under Alternatives 3B, 3C, 4B, 5B and 5C could result in the loss of 271 to 452 oak trees, a significant, unmitigable impact, at least in the near-term. Reclamation has begun efforts to mitigate the loss of mature oak trees by implementing an oak tree replacement program.

The objective of Reclamation's oak tree replacement program is to replace coast live and valley oak trees lost due to periodic surcharging in a phased manner linked to the incremental loss of oak trees over time. The program utilizes opportunities for establishing new oak woodlands and enhancing existing ones within the Cachuma Recreation Area, which includes all federal lands around the lake and the County Park on federal lands. As Reclamation prefers to have full control to maintain and protect new oak tree habitat, the acquisition of land or easements from private landowners for the purposes of oak tree restoration outside the Recreation Area has been deemed infeasible.

The oak tree replacement program being implemented is the same as the one described in the August 2003 DEIR (CCRB 2006b). The program is designed to achieve a 2:1 replacement ratio for all trees that might be affected as a result of surcharging Cachuma Lake by 3 feet. This program will be accomplished by maintaining and monitoring the planted trees over a 20 year period in order to ensure that the trees are self-sustaining and reproducing. As is stated above, a projected possible loss of up to 452 coast live oak and valley oak trees is being mitigated in a phased program. An initial planting ratio is 5:1, or 2260 trees, but the final number will be adjusted as necessary based on observed mortality. The phased approach entails planting the number of oaks required to offset half the number of expected losses, estimated at 1130 trees, over a three year period. Accordingly, 375 oak trees will be planted per year for the first three years. For the next ten years, the loss of trees along the shoreline will be monitored. Replacement trees that do not survive will be replaced on an annual basis.

At year 10, the number of oak trees around the perimeter of the lake that do not appear healthy and are expected to perish in the future, will be counted and replaced (using the appropriate replacement ratio), and the monitoring of tree loss along the shoreline will be terminated. For years 10-20, all planted trees will be maintained and monitored. At year 20, a final count will be performed to determine if a sufficient number of self-sustaining trees are present to offset the observed tree loss at a 2:1 ratio.

Although there has been no change to the mitigation program, there has been a change to the location of where the replacement oak trees have been planted to date. However, the new area designated for Year 1 and Year 2 plantings is still within the Cachuma Recreation Area. The initial Planting Plan identified in the August 2003 DEIR identified a project scope within the public boundaries of the County’s Cachuma Lake Park. Restoration sites outside the park were also explored for future plantings. However, the Cachuma Member Units and the County were concerned that newly planted oak trees would be at a substantially greater risk of damage by the recreating public if the trees were installed within the Park. Therefore, after extensive discussions with the County Parks personnel, it was agreed that as many oak trees as possible should be planted in a less recreated area of the Cachuma Recreation Area to ensure maximum survival of the young oak trees. This resulted in project relocation for Year 1 and Year 2 plantings to the wild-land setting along Storke Flats, approximately two miles south of the Cachuma Park entrance, off of Highway 154. Cachuma Park will be reconsidered for placement of the third year’s planting of replacement oak trees.

From September 2004 through June 2006, approximately 1,500 acorns and thousands of native understory seeds were collected, planted in containers, and placed in a nursery for a year in preparation for the first year’s planting in 2005. In December 2005, the first year’s fieldwork began at the Storke Flats location. 375 suitable planting sites were identified just below and along the existing oak tree canopy of the mature woodlands bordering the upper slopes of Storke Flats along Highway 154. The planting efforts were conducted in accordance with the techniques detailed in the Modified Oak Tree Restoration Program approved by CCRB and Santa Barbara County in 2005. The oak trees were planted as proposed for Year 1, and with the excellent rainfall patterns of winter/spring 2006, all but 5 Coast Live Oak are presently flourishing and show tremendous new growth. Many of the trees have doubled in size and three of the large 5-gallon Coast Live Oak trees bore seed in the first year. The success rate for the first year is 98.6%, which is far above survival rates normally assumed to be about 70%. Assuming the current projected survival continues at the same rate, the target of 904 replacement trees would be reached by Year 3 of the program, rather than by Year 20.

The second year’s planting locations have been surveyed within the Storke Flats pasture area once again. Pin-flag markers were placed in the proposed 380 planting locations, and will be subject to weed clearing activities between now and scheduled planting hole excavation. The 380 number includes the proposed 375 trees for Year 2, plus a replacement of the five trees that died during the first project year. The Year 2 planting locations are outside, and separated from the first year’s sites and will be easily distinguishable for maintenance activities. The second year planting locations will supplement the borders of existing ancient oak woodland canopies bordering the Highway 154 corridor, and the lakeshore boundaries along the northwestern edge of the Storke Flats pasture. Attention has been maintained in planting site location to retain and promote diversification of habitat.

As noted above in section 4.8.2.2, the loss of oak trees under both surcharging scenarios (1.8 and 3.0 feet) is considered significant until such time that the replacement trees have become well established and self-sustaining, which is estimated to be about 10 years. 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 3B, 3C, 4B, 5B and 5C, 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 exact number of trees to be replaced shall be based on actual tree loss over time. The restoration program shall be designed to create new oak woodlands, as well as to enhance existing oak woodlands in the park, without creating conflicts with ongoing and future recreational uses. Reclamation has begun to implement the program in phases. Reclamation shall monitor the loss of trees annually in the 10 years following the first surcharge event, and replace lost trees on an annual basis.

RP-2 In the event that Alternative 4B is pursued, the facilities associated with Alternative 4B shall be designed and constructed to ensure avoidance of significant riparian vegetation. Any riparian vegetation displaced by construction activities and the new facilities on the riverbank shall be replaced onsite at a 2:1 ratio.

4.9 SENSITIVE AQUATIC AND TERRESTRIAL WILDLIFE

4.9.1 EXISTING CONDITIONS

Existing conditions are described in the August 2003 DEIR.

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 baseline conditions due to surcharging under Alternatives 3B, 3C, 4B, 5B and 5C would alter the vegetation that currently exists along the margins of the lake above the water level. The periodic inundation during surcharge years is likely to destroy upland vegetation types over time. The effect could take up to 10 years to occur. The total area around the margins of the lake that would be affected would be 42 acres under Alternatives 3B and 5B (1.8-foot surcharge), and 91 acres under Alternatives 3C, 4B and 5C (3.0-foot surcharge) (Table 4-48).

The most common upland vegetation types that would be affected are chaparral and oak woodland. The removal of a narrow band of upland vegetation along the perimeter of the lake would reduce cover and food sources for common wildlife. Wildlife using these habitats would be displaced to adjacent similar habitats. No sensitive wildlife species occur in these habitats. The loss of trees along the lakeshore is expected to occur over many years, possibly 10 to 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.

<u>The destruction of upland wildlife habitat (including the loss of oak woodlands) under Alternatives 3B, 3C, 4B, 5B and 5C is considered an adverse, but not significant impact (Class III) because: (1) a small acreage is involved compared to the total acreage of these common habitat types in the area which is sufficient to support large wildlife populations; (2) the loss of a narrow band of habitat (15 to 25 feet) around the lake margin would not substantially degrade wildlife cover and foraging opportunities at the lake because a similar margin of upland habitats will remain after surcharging; (3) the impact would occur slowly over time, allowing wildlife populations to adjust to the change; and (4) no sensitive wildlife species would be affected.</u> 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.

Chaparral vegetation comprises the largest percentage of lake margin vegetation (39.5%, Table 4-48). Although chaparral is not considered a sensitive plant community, it does have habitat value for a variety of species. At the 3.0-foot surcharge level 35.9 acres of chaparral habitat would be lost over a period of time. The 35.9 acres of lost habitat is 3% of the approximately 1200 acres of chaparral vegetation contained within the Cachuma Lake Recreation Area. Because of the small percent of total acreage lost, this is considered an adverse, but not significant impact.

Freshwater marsh areas around the margins of the lake are expected to persist if maximum lake levels increase due to surcharging. Wetlands are located in shallow water areas around the lake where there are flat or very low gradient slopes under water. Raising the lake level at these locations would essentially shift the wetlands upslope. Hence, surcharging the reservoir under Alternatives 3B, 3C, 4B, 5B and 5C would have a neutral effect on wetlands and their resident wildlife populations along the lake margins.

Impacts to Bald Eagles

Currently there is at least one pair of bald eagles that breed at Cachuma Lake and from 2 to 18 birds have been observed to winter at the lake. The gradual loss of oak trees around the lake margin due to inundation will eventually decrease the number of trees available as roost sites for bald eagles. This loss is expected to occur over a 10 to 15-year period. During this period many of the trees would still be accessible for roost sites. Trees above the inundation zone would remain available for roost sites for resting or foraging. The oak tree replacement program is expected to achieve a replacement ration of 2:1 at the end of 20 years. With the loss of oaks occurring at a gradual rate and the implementation of the tree replacement program, the impact to bald eagles or other raptors from loss of roosting sites is not expected to be significant.

Impacts to Southwestern Pond Turtle

Southwestern pond turtles have been observed in Cachuma Lake and may use upland areas around the lake to breed. Depending on latitude, the peak nesting season is from late May through early July but can extend from late April through August (Holland 1994). Female pond turtles move to upland locations to nest. Nests are typically located along stream or pond margins; however, they may be located over 100 meters and up to 400 meters from water on hillsides (Holland 1991). If suitable nesting sites are not available, females have been observed to travel up to 1.2 miles along a waterway to lay their eggs (Rathbun et al. 1992). Terrestrial nest locations (6) inspected by Rathbun et al. (1992) were all found in open, grassy areas with a southern exposure, probably to ensure that substrate temperatures will be high enough to incubate the eggs.

Incubation period varies with latitude but is typically 80 to 126 days (Goodman 1997a; Holland 1994). Complete failure of nests is not uncommon in some years or locations (Holland 1994). Goodman (1997) observed an 80 percent hatchling success rate for 15 eggs in three nests; Holland (1994) reports an overall average of 70 percent. In the northern portions of their range, hatchlings remain in the nest through the winter, although in southern California, most emerge in the early fall (Holland 1994).

Western pond turtles frequently bask on logs or other objects out of the water when water temperatures are low and/or air temperatures are greater than water temperatures. Habitat quality seems to vary with the availability of aerial and aquatic basking sites (Holland 1991); western pond turtles often reach higher densities where many aerial and aquatic basking sites are available. Hatchlings require shallow water habitat with relatively dense submergent or short emergent vegetation in which to forage.

Surcharge of the lake has the potential to inundate some possible nest locations. Surcharge will occur during the rainy season, usually November to April. Since nesting typically occurs from late May to July and nest sites are chosen to keep the eggs dry and at a suitable temperature for hatching, little or no direct impact to nests or hatchlings is expected. Availability and location of nesting sites may change after surcharge, depending on terrain adjacent to the lake at the new surcharge level.

Conversely, inundation of vegetation around the margin of the lake may provide an increased number of logs and vegetation for basking sites and submerged or emergent vegetation that will provide cover from predators for hatchlings. Impacts to southwestern pond turtles from surcharge of the lake are not expected to be significant.

4.9.2.2 River Impacts

The releases for steelhead rearing and passage flows downstream of the dam under Alternatives 3B, 3C, 4B, 5B and 5C would be greater than under baseline operations (Alternative 2). The frequency and amount of low-flows downstream of the dam (to Alisal Road) would be greater under all the alternatives, and they would be greater downstream to the Narrows under Alternatives5B and 5C.

The additional flows downstream of Bradbury Dam under Alternatives 3B, 3C, 4B, 5B and 5C could increase the vigor and extent of wetland and riparian vegetation along the river, and indirectly benefit the associated aquatic and terrestrial wildlife, including sensitive species. <u>This is considered a beneficial effect (Class IV) to these resources.</u>

Alternatives 3B, 3C, 4B, 5B and 5C would slightly reduce the frequency of spills compared to baseline operations. As described in Section 4.8.2.3, the reduction in uncontrolled downstream flows could adversely affect riparian plant recruitment and the long-term health of the riparian vegetation. Riparian-dependent wildlife could be indirectly affected if there is a decrease in the extent or condition of riparian vegetation over time. <u>This impact is considered a potentially adverse, but less than significant impact (Class III).</u> It is not considered significant because the reduction in spill frequency is very small, and there is no evidence that the riparian recruitment along the river is limited by the frequency of flood disturbance.

Alternatives 3B, 3C, 4B, 5B and 5C are anticipated to have a slight beneficial effect on the Santa Ynez River lagoon due to increases in flow to the lagoon during emergency winter operations and passage releases, which would likely slightly increase dissolved oxygen and reduce the salinity in the upper portion of the lagoon, an area that supports sensitive species such as the brown pelican, least tern, snowy plover, and Belding savanna sparrow.

4.9.2.3 Impacts to Flycatcher Nesting

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 baseline operations (Alternative 2) and Alternatives 3B, 3C, 4B, 5B and 5C. However, if such impacts were significant, it is likely that the flycatcher population between Buellton and the Narrows would not have exhibited the steady increase in numbers over recent years during which time ANA and BNA releases have occurred regularly. Furthermore, the releases provide additional water to support aquatic insects and provide more riparian growth – both beneficial effects to the population. Hence, impacts of releases on willow flycatcher nesting are considered neutral in consideration of all factors and available evidence.

4.9.2.4 Impacts to Wildlife from the Delivery of SWP Water under Alternative 4B

the August 2003 DEIR for details on impacts to wildlife from the delivery of SWP water under Alternative 4B.

4.9.3 MITIGATION MEASURES

WL-1 In the event that Alternative 4B is pursued, facilities shall be constructed to avoid disturbance to sensitive riparian breeding birds in the vicinity, particularly the willow flycatcher. The following work shall be scheduled to avoid the breeding season (April 15 through July 15): trenching work within 200 feet of the river, and construction of discharge outlets on the riverbank.

4.10 RECREATION

4.10.1 EXISTING CONDITIONS

Please see the 2003 DEIR for a description of the Cachuma Recreation Area.

Reclamation has begun implementing a 2.47 foot surcharge, as described in section 4.2.1. For the reasons described in section 3.2.2, however, Alternative 2, which includes a 0.75-foot surcharge, will be used as the baseline for purposes of evaluating the impacts of the other alternatives on recreation.

4.10.2 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.10.2.1 Lake Impacts

Effect on Shoreline Conditions

The maximum lake elevation under historic operations was 750 feet. In 1993, Reclamation increased the maximum lake elevation to 750.75 feet to store water for releases for fish. This maximum lake level is reflected under baseline operations (Alternative 2). Maximum lake levels would increase 1.8 feet under Alternatives 3B and 5B and 3.0 feet under Alternatives 3C, 4B and 5C due to surcharging the reservoir.

Surcharging is a term used to describe the amount left after a reservoir has been filled to capacity. Through manipulating spillways and outlet works, surcharge levels can be raised or lowered depending on reservoir capacity. The effect of surcharging on lake levels is discussed in section 4.2.2.2. As simulation modeling using historic data shows that surcharging would occur in 26 out of the 76 years modeled, it can be assumed that surcharging under each alternative (751.8 feet under Alternatives 3B and 5B; and 753.0 feet under Alternatives 3C, 4B and 5C) would occur, on average, about every three years (Table 4-4). Of the total time that the lake was surcharged during the period modeled for the simulation (at 750.75 feet under baseline conditions), the maximum lake level (750.75 feet) was achieved about 11 percent of the time (Table 4-5). Due to additional surcharging under Alternatives 3B, 3C, 4B, 5B and 5C, inundation of the shoreline would occur more frequently. Accordingly, lake levels under Alternatives 3B and 5B (with a 1.8-foot surcharge) would reach or exceed 750.75 feet about 13 or 14 percent of the time. Alternatives 3C, 4B and 5C (with a 3.0-foot surcharge) would reach or exceed 750.75 feet about 16 percent of the time. Thus implementation of Alternatives 3B, 3C, 4B, 5B and 5C would result in a 3 percent to 5 percent increase in the amount of time that surcharging occurs at Cachuma Lake. The median number of consecutive months at or above 750.75 feet elevation ranges from four to five months (Table 4-6) under all alternatives. The area affected by increased lake levels is dependent upon the slope of the shore. Using topographic and bathymetric maps, an estimate was developed of the total area inundated by surcharging at 1.8 feet (Alternatives 3B and 5B) and 3.0 feet (Alternatives 3C, 4B and 5C). The results are shown in Table 4-47. They indicate that the total acreages that would be affected by the 1.8-foot and 3.0-foot surcharging compared to baseline conditions are 42 and 91 acres, respectively. The average widths of inundation would be 15 and 25 feet, respectively.

As discussed in section 4.8.2.1, increased maximum lake levels over baseline conditions would adversely affect native vegetation along the margins of the lake. The periodic inundation during surcharge years is likely to destroy upland vegetation types over time. The most common upland vegetation types that would be affected are chaparral and oak woodland, including oak trees. Freshwater marsh areas around the margins of the lake are expected to persist under higher maximum lake levels. Wetlands are located in shallow water areas around the lake where there are flat or very low gradient slopes under water. Raising the lake level at these locations would effectively shift the wetlands upslope.

The loss of upland vegetation along the lakeshore is not expected to have an impact on recreational uses and experiences at Cachuma Lake. In essence, the shoreline would shift upslope. Increased lake levels would not cause any perceptible change in shoreline configuration, or increase the visibility or frequency of exposure of the barren slopes below the maximum water level. Lake level fluctuations would remain essentially the same as under baseline operations.

The higher maximum lake levels under Alternatives 3B, 3C, 4B, 5B and 5C would not have an adverse impact on game fish, as described in Section 4.7.2.2.

Effect on County Park

Higher lake levels would adversely affect one recreational facility at the County Park: the boat launch ramp. In May of 2006, the County, CCRB, and SYRWCD, ID#1 approved the "Interim Agreement Regarding the Surcharge of Cachuma Lake," which allowed a temporary 3.0-foot surcharge after Cachuma Lake spilled in April of 2006. The decision to implement the 3.0-foot surcharge was preceded by a topographic site survey conducted at the County Park by Stetson Engineers in January 2005. The survey provided evidence that the elevations previously used by the County in its assessment of the potential effect on park facilities such as the water treatment plant, water intake work and other park facilities (Flowers & Associates [2001]) were incorrect, and that these facilities were actually situated at higher elevations. Consequently, the County's assertion that the water treatment plant and water intake work would be inundated with a surcharge over 751.8 feet was an error. The survey was conducted at a lake elevation of 753.18 feet in January of 2005, and it showed that there would be no inundation of those facilities at present locations and elevations. The survey also negated the claim that other park facilities would be negatively impacted, such as the water treatment plant intake and electrical facilities, the sewage lift stations near Teepee Island and Mohawk, and access to the Marina and concessions.

With this new information, the County acknowledged that there would be no inundation of facilities at elevation 753.0 feet. However, park personnel were still concerned about use of the existing boat launch ramp and potential impacts to the water treatment plant from wave run-up. In April 2005, SYRWCD, ID#1 and CCRB constructed a gabion basket barrier around the water treatment plant at an elevation of 756 feet to protect the plant from the effect of potential wave run-up. Protective measures and modifications to the water treatment plant's backwash system were also completed in April 2005 (CCRB 2006c) and have operated effectively since that time. As a result, no impacts to the water treatment plant from wave run-up or inundation have occurred during surcharge periods, and no concerns regarding the impact of wave run-up on the facility have been raised since the gabion basket barrier was constructed.
Though no impacts from wave run-up or inundation have occurred, the County Park Department plans to construct a new water treatment plant at a higher elevation. Preliminary engineering designs have been completed, and the County has secured partial funding of close to $1 million

from Reclamation and through federal legislation. Unrelated to the effects of surcharging the reservoir, Reclamation has submitted a request for $12 million in federal funding for other park facilities including wastewater treatment facilities. That request is still pending.

Pursuant to the January 2005 study, it was determined that the boat launch ramp could be operated without negative effects from a 2.47-foot surcharge. In order to ensure safe operation of the boat ramp, the County Parks Department plans to upgrade the existing boat launch ramp to allow it to be operated at 753.0 feet. The County Parks Department has received a grant of approximately $2.4 million from the Department of Boating and Waterways for the construction of the new boat ramp. As of May 2007, final plans for the facility were completed and, pending County Board of Supervisors approval, construction is slated to begin in August 2007.

There would be no impact to the water treatment plant or the boat launch ramp under Alternatives 3B and 5B, which entail a 1.8-foot surcharge. The potential disruption of recreational uses at the County Park due to surcharging under Alternatives 3C, 4B and 5C and the associated disruption due to the construction of improvements to the boat launch ramp has been determined to be less than significant with mitigation (Class II). Pursuant to the installation of a gabion basket barrier to protect the water treatment plant from wave run-up, there would be no impact to the water treatment plant under Alternatives 3C, 4B and 5C.

Though initially described as a temporary emergency protective measure, the gabion basket barrier's ability to protect the water treatment plant from potential wave run-up has proven sufficient to preclude any need for other measures to protect the facility. In order to ensure the continued viability of the gabion basket barrier, regular, small-scale maintenance (i.e., monitoring of the integrity of the barrier and conducting repairs if necessary) similar in scale to that already performed on the water treatment plant will be required to maintain the barrier's effectiveness.

The upgrade of the boat launch ramp would involve physical disturbance due to grading, demolition, filling, trenching, etc. The County has prepared a Mitigated Negative Declaration that has found that significant adverse impacts associated with the planned improvements to the boat launch ramp can be mitigated to less than significant levels. Significant but mitigable impacts on the environment are anticipated in the following areas: Air Quality, Fire Protection, Geologic Processes, Recreation, Transportation and Water Resources. The only potentially significant impact on recreation relates to safety issues posed to the public during construction. This impact will be mitigated by including the following in construction specifications: measures to separate staging areas from the public by the installation of fencing and signage; assignment of a construction monitor to ensure that construction equipment is placed and secured within fenced areas after park hours and on weekends; and assignment of a construction monitor to ensure that construction areas are cordoned off and outfitted with signage warning of possible dangers in English and Spanish.

4.10.2.2 Impacts to Recreation along the River

Recreation opportunities and facilities upstream of Cachuma Lake are not expected to be affected by changes in operations under any of the alternatives.

Most of the river downstream of Cachuma Lake is private property with limited access. No public recreational facilities are located within the river channel. Several public parks are located adjacent to the river, including Riverbend and River Park in Lompoc Valley, Santa Rosa Park, and Ocean Park at the mouth of the river. Alisal Golf Course, a private facility, is located on the river near Solvang.

Changes in operations under Alternatives 3B, 3C, 4B, 5B and 5C that would affect flows in the river and the extent and condition of riparian vegetation would only have an indirect effect on downstream recreational uses.

Alternatives 3B, 3C, 4B, 5B and 5C are anticipated to increase flows to the Santa Ynez River lagoon during emergency winter operations and passage releases. This increase in flow would have a slightly beneficial effect on anadromous fish and sensitive aquatic and terrestrial wildlife, but would not affect recreation at Ocean Beach Park.

4.10.2.3 Impacts to Recreation from the Delivery of SWP Water under Alternative 4B

Please see the August 2003 DEIR for details on impacts to recreation from the delivery of SWP water under Alternative 4B.

4.10.3 MITIGATION MEASURES

R-1 The boat launch ramp shall be upgraded to allow for launching at an increased water elevation of 753 feet. Construction work is scheduled to occur while the lake water elevation is approximately 738 to 742 feet.

4.11 CULTURAL RESOURCES

4.11.1 REGULATORY REQUIREMENTS

Regulatory requirements are described in the August 2003 DEIR.

4.11.2 REGIONAL SETTING

The regional setting is described in the August 2003 DEIR.

4.11.3 SITE SPECIFIC SETTING

The site specific setting is described in the August 2003 DEIR.

4.11.4 POTENTIAL IMPACTS OF THE ALTERNATIVES

4.11.4.1 Impact Thresholds

"A project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." (Pub. Resources Code, § 21084.1.) In evaluating historical resources, several criteria are considered. A resource shall generally be considered "historically significant" if the resource is listed or the lead agency determines that the resource meets the criteria for listing on the California Register of Historical Resources (CRHR) (Pub. Resources Code, § 21084.1; Cal. Code Regs., tit. 14 § 15064.5, subd. (a)(3).) The criteria used for determining the eligibility of a resource for the CRHR are similar to those developed by the National Park Service for the National Register of Historic Places (NRHP).

To be eligible for listing in the NRHP, historic properties must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of the following NRHP criteria:

- Association with events that have made significant contributions to the broad patterns of the history of the United States;
- Association with the lives of people significant in United States history;
- Embodiment of the distinctive characteristics of a type, period, or method of construction; representation of the work of a master; possession of high artistic value; or representation of a significant and distinguishable entity whose components may lack individual distinction; or
- Has yielded, or is likely to yield, information important in prehistory or history.

The criteria of eligibility for the CRHR were reworded to better reflect California history. The criteria include the following:

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 CRHR must also be considered. “The fact that a resource is not listed in, or determined to be eligible for listing in the [CRHR], not included in a local register of historical resources (pursuant to section 5020.1(k) of the Public Resources Code), or identified in an historical resources survey (meeting the criteria in section 5024.1(g) of the Public Resources Code) does not preclude a lead agency from determining that the resource may be an historical resource as defined in Public Resources Code sections 5020.1(j) or 5024.1.” (Cal. Code Regs., tit. 14, § 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, 4B, 5B and 5C.
- Potential impacts to prehistoric archeological sites due to the installation of a pipeline and associated facilities in order to deliver SWP water to the Lompoc Valley under Alternative 4B.

Under baseline operations (Alternative 2) and Alternatives 3B, 3C, 4B, 5B and 5C, Reclamation and the Member Units will implement many non-flow related habitat enhancements in the watershed to improve conditions for steelhead and other aquatic species (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 evaluation of impacts to cultural resources along the margins of Cachuma Lake is based on an assessment of the project area entitled "Data Recovery Excavation at Two Prehistoric Archaeological Sites on Cachuma Reservoir, Santa Barbara County, California" (Bever et. al., 2004) completed in October of 2004. This assessment builds upon archaeological surveys conducted by Reclamation in 1986-1987 and 2001 (West and Slaymaker, 1987; West and Welch, 2001), and supplemented by archaeological site records and additional survey reports on file at the Central Coastal Information Center (CCIC) (Maki, 2001).

Cachuma Lake

Pacific Legacy, Inc. prepared the aforementioned report, as a contractor to Reclamation, in order to satisfy the terms laid out in the 2002 Memorandum of Agreement (MOA) between Reclamation and State Historic Preservation Officer (SHPO) (CCRB 2006d). The report presents the results of excavation, analysis and interpretation of two prehistoric archaeological sites, CA-SBa-891/2105 and CA-SBa-2101, located along the lake margins that would be subject to increased erosion under both the 1.8 and 3.0-foot surcharge schemes.

The sites may be subjected to erosion by wave action and inundation for periods longer than have occurred under previous reservoir operations. Findings of the report also indicate that both sites are to be considered historic properties eligible for listing in the National Register of Historic Places. Because of this determination, and the potential effects of the proposed project, the project is considered an "undertaking" subject to Section 106 of the National Historic Preservation Act (NHPA).

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

West and Welch (2001) evaluated CA-SBa-891/2105 as follows: "In summary, while portions of the cultural deposit within the draw down zone have been destroyed or have been more or less permanently inundated, undisturbed deposits still remain above the inundation zone. Because of the high likelihood that large areas of undisturbed cultural deposits still remain at SBa-891/2105, the site appears to have significant research potential in clarifying the region's prehistory and thus we conclude that it is eligible to the National Register under criterion D."

West and Welch (2001) conclude their evaluation of CA-SBa-2101 as follows: "While much of this site has been destroyed it appears that some cultural deposit remains and that the site still contains, albeit incomplete, information that would be useful for interpreting the area's prehistory and would be eligible under criterion D. The site may provide chronological data that may be useful in reconstructing settlement patterns. The presence of marine shell indicates connections with the coast. Several test pits may help to clarify the significance of this site."

During 2001, Reclamation completed a Determination of Effect for the surcharge (West and Welch, 2001) after consultations with the California State Office of Historic Preservation

(SHPO). Modification of flashboards on the spillway gates would increase maximum lake level from 750.75 feet to 751.8 feet under Alternatives 3B and 5B, and to 753.0 feet under Alternatives 3C, 4B and 5C. Reclamation determined the Area of Potential Effect to be the zone of changed reservoir elevation, plus the rise that may occur during exceptionally high flows such as occurred in 1969 for cultural resource purposes. This includes the rise to 753 feet for normal operations plus an additional approximated 7 feet that may occur during peaks in runoff during exceptional high flow events. While most adverse affects will occur within the 750-753 zone, infrequent short-term inundations and wave actions could possibly occur up to the 760-foot elevation level. It is expected that these short-term events will be less than 24 hours in length and occur infrequently.

The type of impacts prehistoric sites within project area would be subjected to include: erosion by wave action, and inundation for periods longer than have occurred under the current reservoir operations. Inundation effects to sites will vary with landforms, contours, water depth, rock type, soil type, length of fetch for wave generation, currents, sediment load, debris, and temporal factors. Erosion of the sites could destroy their integrity and the elements of the sites that constitute their historic significance. <u>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)</u>. Impacts could be reduced to less than significant by the application of Mitigation Measures CR-1 and CR-2.

<u>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)</u>. These impacts could be reduced to less than significant levels by the application of Mitigation Measures CR-2 and CR-3.

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

Please see the 2003 DEIR for a description of potential impacts under Alternative 4B.

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.

The mitigation measures listed below will reduce the impacts under Alternatives 3B, 3C, 4B, 5B and 5C to a less than significant level.

Data recovery, as outlined in the MOA, took place throughout 2003, well before Reclamation began to implement a phased surcharge. The data is presented in "Data Recovery Excavation at Two Prehistoric Archaeological Sites on Cachuma Reservoir, Santa Barbara County, California" (Bever et al., 2004).

CR-1 Data recovery excavation shall be conducted of a representative sample of the features and artifacts contained within those portions of CA-SBa-891/2105 and CA-SBa-2101, which will be impacted by surcharging. The excavations shall be conducted in accordance with the *Treatment Plan for Prehistoric Archeological Sites Sba-891/2105 and Sba-2101/481, Cachuma Reservoir (Bradbury Dam), Santa Barbara County, California*, prepared by West (2002). All cultural materials collected shall be curated at a qualified institution that has proper facilities and staffing for insuring research access to the collections. Reports of the scientifically consequential information that is recovered from the site shall be deposited with the California Historical Resources Regional Information Center.

CR-2 Reclamation shall implement the Memorandum of Agreement, titled *Memorandum of Agreement Between the Bureau of Reclamation and the California State Historic Preservation Officer Regarding the Additional Surcharge to Cachuma Reservoir Santa Barbara County, California* prepared by West in 2002 and developed in consultation with the Santa Ynez Band of Mission Indians and the State Historic Preservation Officer.

CR-3 If any currently unknown archaeological resources or archeological materials are identified within the project area, activities shall cease within 100 feet of the discovery and a professional archeologist shall evaluate the find, and recommend appropriate mitigation measures in accordance with the applicable federal and state guidelines. Project-related activities shall not resume within 100 feet of the find until all approved mitigation measures have been completed to the satisfaction of the appropriate federal and state agencies.

SWP Water Delivery Pipeline Route

CR-4 If any currently unknown archeological resources or archeological materials are identified within the project area, activities shall cease within 100 feet of the discovery and a professional archeologist shall evaluate the find, and recommend appropriate mitigation measures in accordance with the applicable federal and state guidelines. Project-related activities shall not resume within 100 feet of the find until all approved mitigation measures have been completed to the satisfaction of the appropriate federal and state agencies.

5.0 ENVIRONMENTAL ANALYSIS OF NON-FLOW HABITAT ENHANCEMENTS ON TRIBUTARIES

Non-flow habitat enhancements on tributaries will be implemented in the same manner under all of the alternatives being considered by the SWRCB. The August 2003 DEIR evaluated the impacts of most of the non-flow habitat enhancements described in section 2.4.3 on a programmatic level. The 2003 DEIR contained an explanation of why it was appropriate to evaluate those measures on a programmatic level. (2003 DEIR, pp. 4-3 - 4-4.) One of the reasons was because Reclamation and COMB were preparing a joint EIR/EIS for implementation of those measures for which sufficient information was available. Unlike flow-related actions, for which the SWRCB is the appropriate lead agency, it is appropriate for COMB to serve as CEQA lead agency and conduct a project-level environmental review of any non-flow habitat enhancement measures that COMB is funding and implementing.

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 pending hearing being held pursuant to Order WR 94-5, the SWRCB will consider testimony concerning the alternatives analyzed in this EIR and any other evidence entered into the administrative record. The impacts of the various alternatives were evaluated in Sections 4.0 using Alternative 2 as the environmental baseline. A comparison of these impacts among the alternatives is provided below.

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 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4B Biological Opinion with 3' surcharge & SWP Discharge to Lompoc Forebay	Alt 5B BO/CalTrout 3A2 with 1.8' surcharge	Alt 5C BO/CalTrout 3A2 with 3' surcharge
Significant, unmitigable (Class I)	1 (oak trees)	1 (oak trees)	1 (oak trees)	2 (water supply, oak trees)	1 (oak trees)
Significant, but mitigable (Class II)	2	3	5	2	3
Adverse, but not significant (Class III)	7	6	9	6	7
Total =	10	10	15	10	11

1. Alternative 5B would result in the same number of impacts as Alternatives 3B and 3C, and Alternative 5C would result in one more impact compared to Alternatives 3B, 3C and 5B. Alternative 4B would result in the most impacts.
2. Each alternative will result in at least one significant, unmitigable impact (Class I). The loss of oak trees along the margins of Cachuma Lake due to surcharging is a significant unmitigable impact (at least initially) that would occur under all alternatives. While the type of impact is the same under all alternatives, the number of trees that could be lost differs: 271 under Alternatives 3B and 5B at a 1.8-foot surcharge and 452 trees under Alternatives 3C, 4B and 5C at a 3.0-foot surcharge. The significant, indirect environmental impacts attributable to water supply shortages would occur only under Alternative 5B.

3. The Class II impacts associated with Alternatives 3B, 3C, 4B, 5B and 5C are impacts to archeological sites due to surcharging under these alternatives. Also, a Class II impact to recreation would occur under Alternatives 3C, 4B and 5C. Additional Class II impacts attributable to the discharge of SWP water into the Santa Ynez River could occur under Alternative 4B.

Impacts of the proposed alternatives relative to baseline operations (Alternative 2) are summarized in Table 6-2.

Table 6-2
Comparison of Impacts of the Proposed Alternatives

	Occurrence of Impact Relative to Baseline operations (Alternative 2)				
Impact	**Alt 3B Biological Opinion with 1.8' surcharge**	**Alt 3C Biological Opinion with 3' surcharge**	**Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay**	**Alt 5B Biological Opinion/ CalTrout 3A2 with 1.8' surcharge**	**Alt 5C Biological Opinion/ CalTrout 3A2 with 3' surcharge**
Surface Water Hydrology					
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	
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				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		
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	X

Table 6-2
Comparison of Impacts of the Proposed Alternatives

Impact	Occurrence of Impact Relative to Baseline operations (Alternative 2)				
	Alt 3B Biological Opinion with 1.8' surcharge	Alt 3C Biological Opinion with 3' surcharge	Alt 4B Biological Opinion with SWP Discharge to Lompoc Forebay	Alt 5B Biological Opinion/ CalTrout 3A2 with 1.8' surcharge	Alt 5C Biological Opinion/ CalTrout 3A2 with 3' surcharge
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 III)			X		
Surcharging would remove upland vegetation (chaparral and coastal sage scrub) along the margins of the lake (Class III)	X	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					
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 Cachuma Lake due to surcharging. (Class III)	X	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
Reduction in frequency of flows between 10-20 cfs below Alisal Bridge. (Class III)			X		
Recreation					
Surcharging to 3.0 feet would require modification of the boat launch ramp at the Cachuma Lake County Park. (Class II)		X	X		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	X
Surcharging could expose unknown buried archeological resources by eroding the lake margins over time. (Class II)	X	X	X	X	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		

Alternatives 3B, 3C, 4B and 5C would avoid water supply impacts and the associated potentially significant, unmitigable indirect environmental impacts that could occur under Alternative 5B. Alternatives 3B, 3C and 4B would not require as much water to be released for purposes of protecting the fishery as Alternatives 5B and 5C. In addition, Alternatives 3C, 4B, and 5C would involve a 3.0-foot surcharge, which would create more storage in Cachuma Lake and offset the impact to the Member Units’ water supply in a critical drought year. The impact to the Member Units’ water supply would be partially offset by a 1.8-foot surcharge under Alternative 5B, but the surcharge would not offset water supply impacts to a sufficient degree to reduce the indirect, environmental impacts to a less than significant level.

6.2 NON-FLOW RELATED ACTIONS ON TRIBUTARIES

Please see the August 2003 DEIR for details on non-flow related actions on tributaries.

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, a recreational facility (the boat launch ramp), riparian habitat and associated aquatic and terrestrial wildlife, surface water and groundwater quality, and cultural resources. These resources are located at Cachuma Lake and along the Santa Ynez River between Bradbury Dam and the ocean. 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 expands in the future, pumping from the alluvial groundwater basin may increase. Since Alternative 4B bypasses the BNA flows around select stream reaches, the extent and vigor of riparian vegetation and wildlife in these stream reaches could be affected. The potential impacts to riparian vegetation under Alternative 4B are speculative, however, and potentially offset by beneficial effects to riparian vegetation. (In addition, as more diversions occur from the Above Narrows Alluvial Groundwater Basin, the amount of water released from the ANA may increase because there will be an increase in dewatered storage in the groundwater basin.) Therefore, Alternative 4B will not have a significant cumulative impact to riparian vegetation or riparian-dependant wildlife.
- The City of Lompoc, Vandenberg Village Community Services District, Mission Hills Community Services District, and private landowners pump from the Lompoc Basin, which includes the Lompoc Uplands and Lompoc Terrace (both hydrologically connected to the river) and the Lompoc Plain, which receives direct recharge from the river. At the present time, pumping levels appear to be static. None of the alternatives result in increased groundwater pumping in the Lompoc Basin, and therefore, do not contribute to a cumulative impact to the groundwater basin.
- In the past 5 to 8 years, there has been a substantial increase in the acreage of vineyards in Northern Santa Barbara County, particularly in the Los Alamos Valley. As a result, hundreds of native oak trees were legally removed as part of agricultural development. The County has initiated several efforts to control the loss of oak trees, and recently proposed a

permit program for oak tree removal on agricultural lands. The loss of oak trees at Cachuma Lake under Alternatives 3B, 3C, 4B, 5B, and 5C would contribute to this past and ongoing significant impact to native trees. The contribution of these alternatives to loss of oak trees in Santa Barbara County can be mitigated by implementing Mitigation Measure RP-1 identified in 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 3B, 3C, 4B 5B and 5C could cause cumulative construction-related impacts (e.g., disturbances to aquatic and riparian habitats) but these impacts would be temporary and less than significant.

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 PREPARERS OF THE REVISED DEIR

State Water Resource Control Board

U.S. Bureau of Reclamation

URS

David Fee – Project Manager
Tom Baily – QA/QC
Steve Kellogg – QA/QC
Bill Martin – QA/QC
Jason D. Jones – Environmental Planner
Michael Carbiener – Fisheries Biologist

Stetson Engineers

Ali Shahroody – Project Manager
Curtis Lawler – Hydrology And Salinity Modeling
Peter Pyle – Groundwater Modeling
Matt Smeltzer – Geomorphology
Dawn (Harrison) Taffler – Hydraulic Modeling

ENTRIX

Gina Morimoto – Aquatic Ecologist
Larry Wise – Fisheries Biologist

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Appendix A
Figures

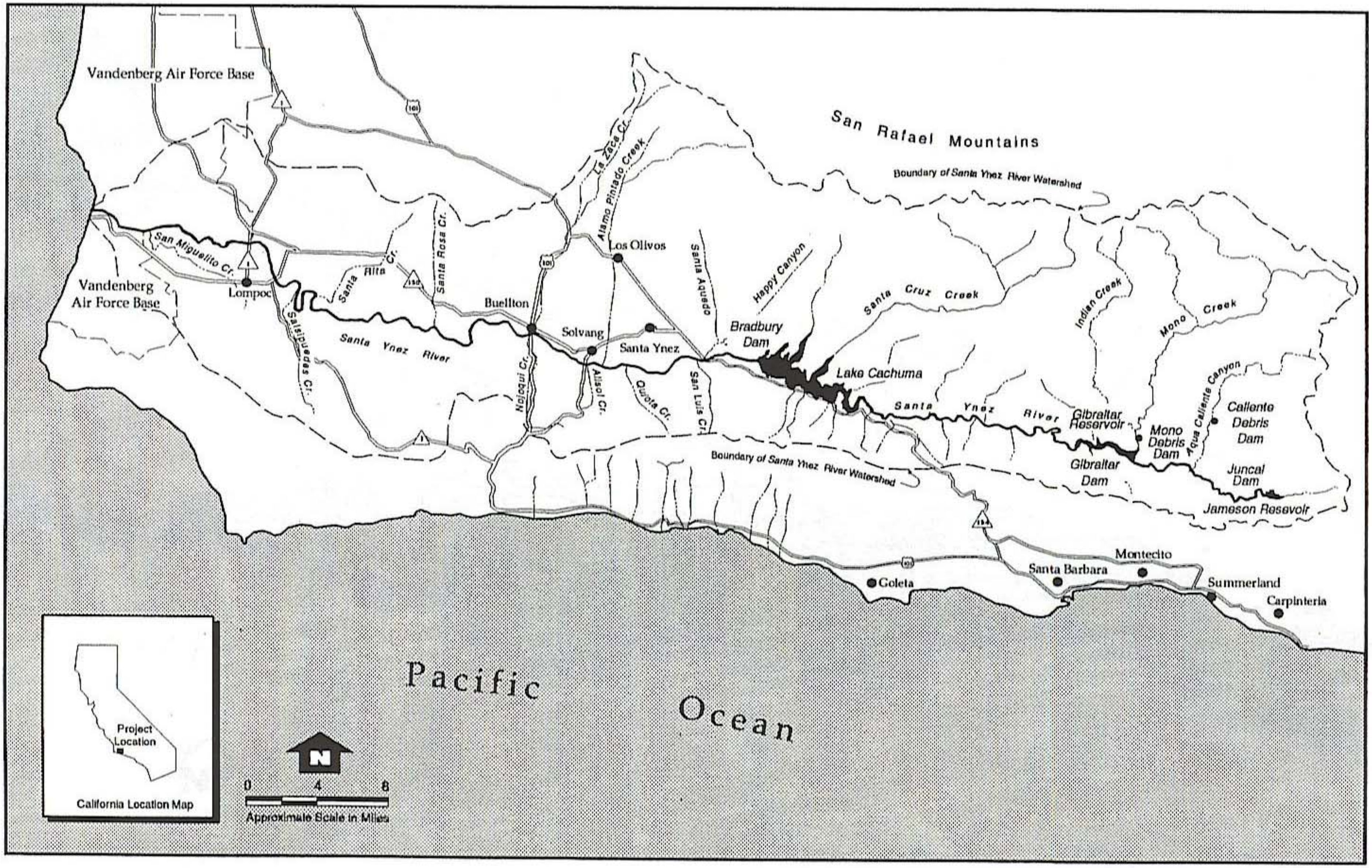


Figure 1-1. Santa Ynez River Watershed

T/Ladd/Cachuma/601-303

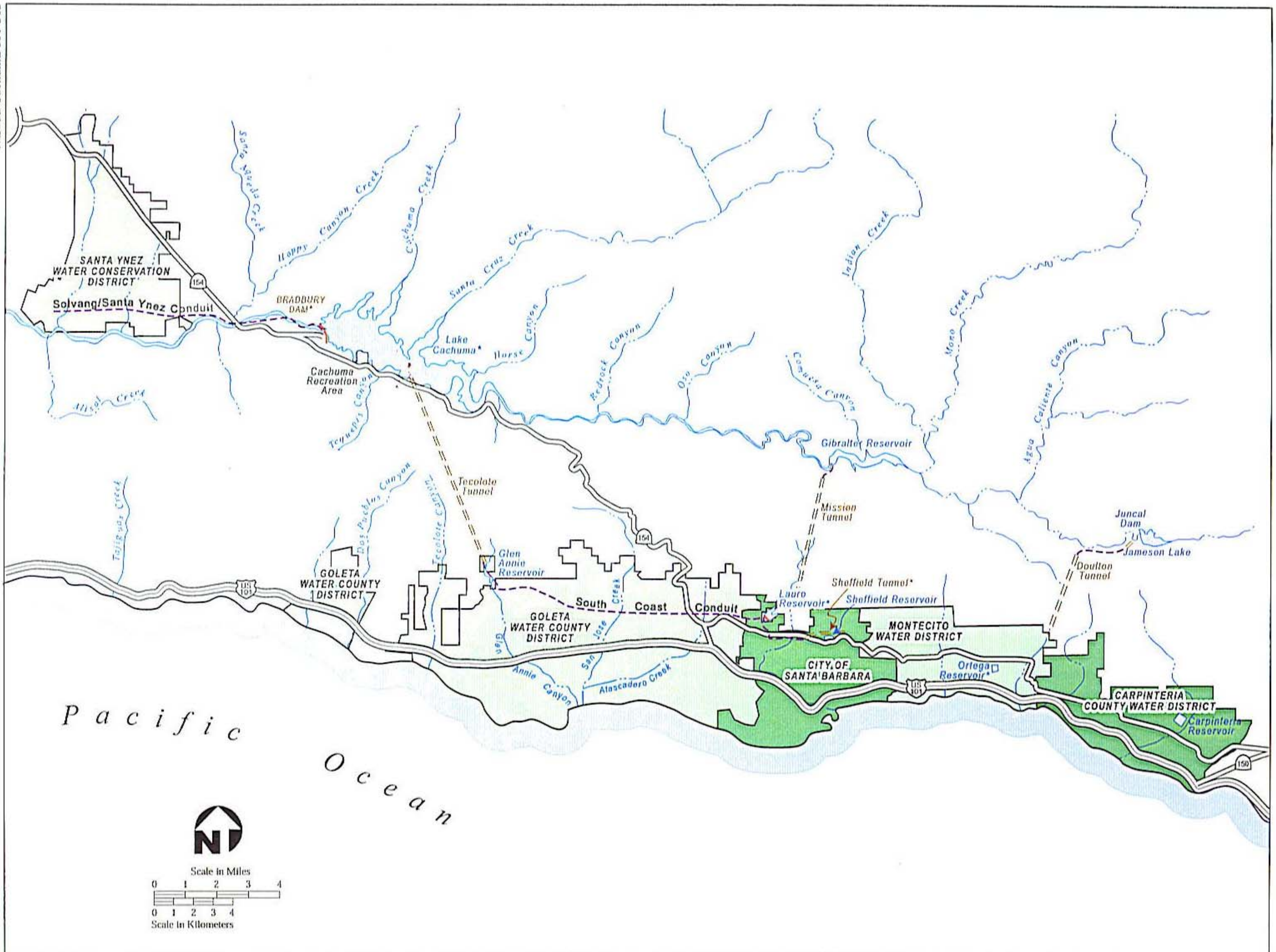


Figure 1-2. Cachuma Project Facilities and Member Units

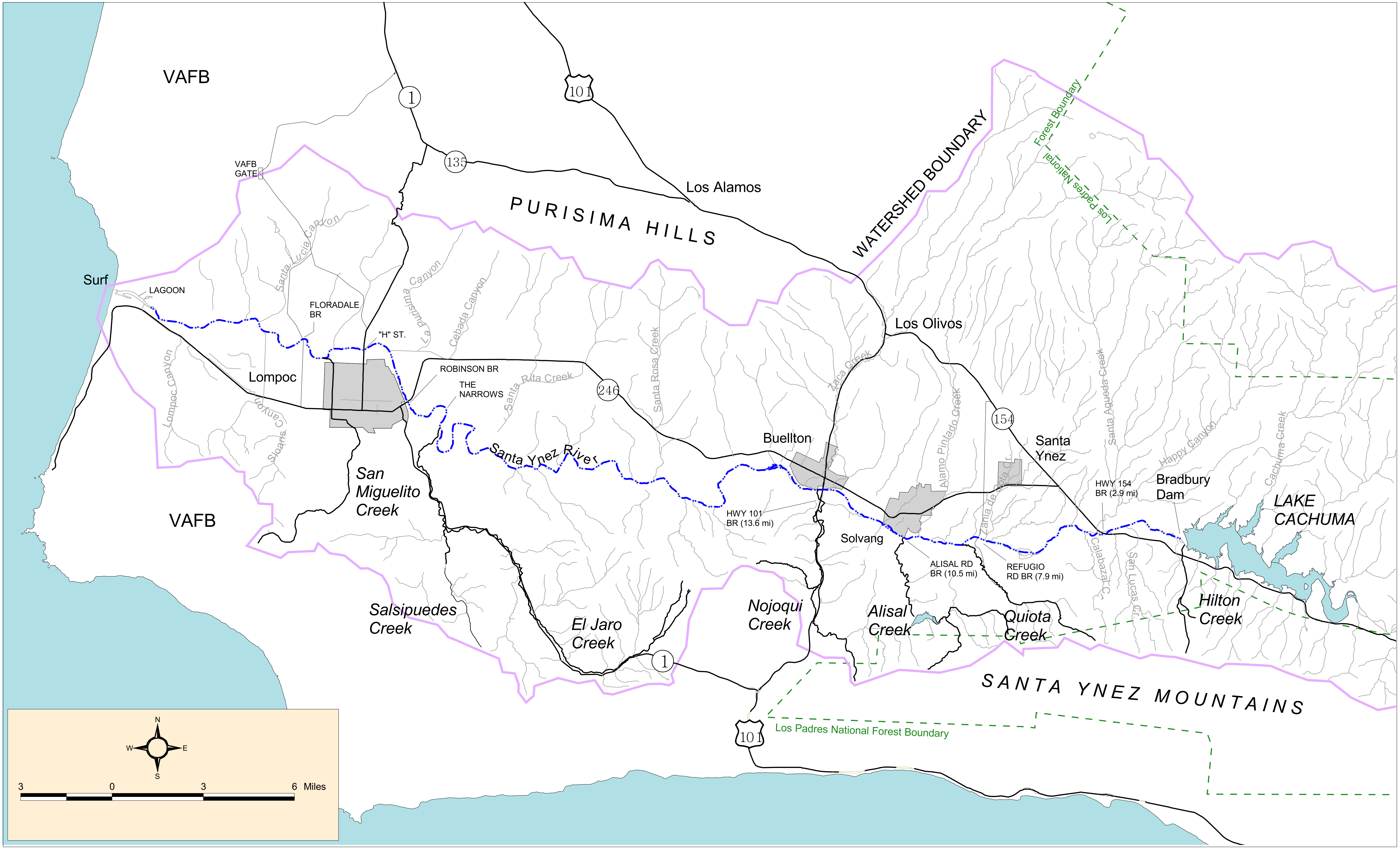


FIGURE 1-3. Lower Santa Ynez River Below Bradbury Dam

t:\lakecachuma\deliverables\syr_base_2.apr

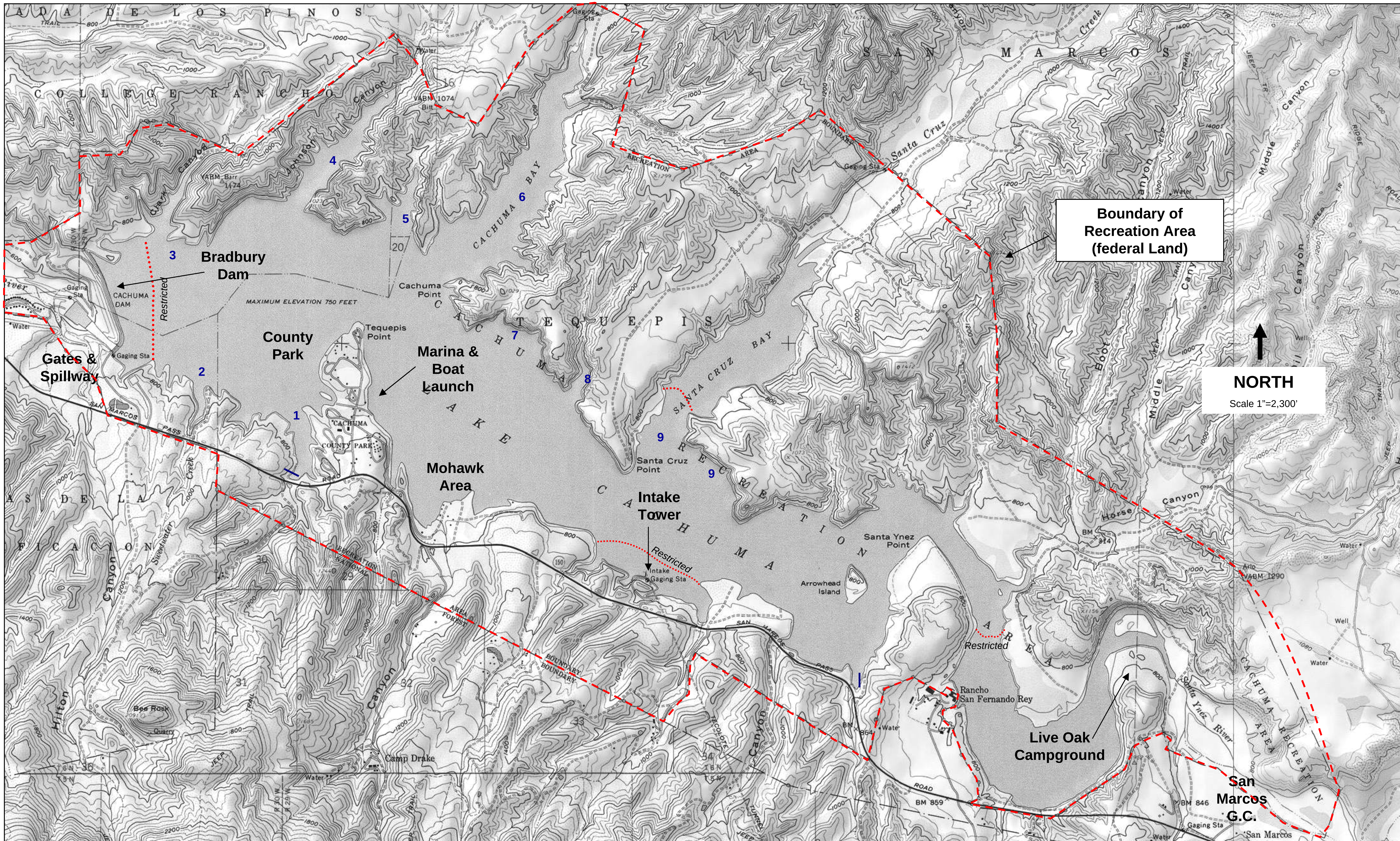


Figure 2-2. Lake Cachuma

T/Ladd/Cachuma/501-248

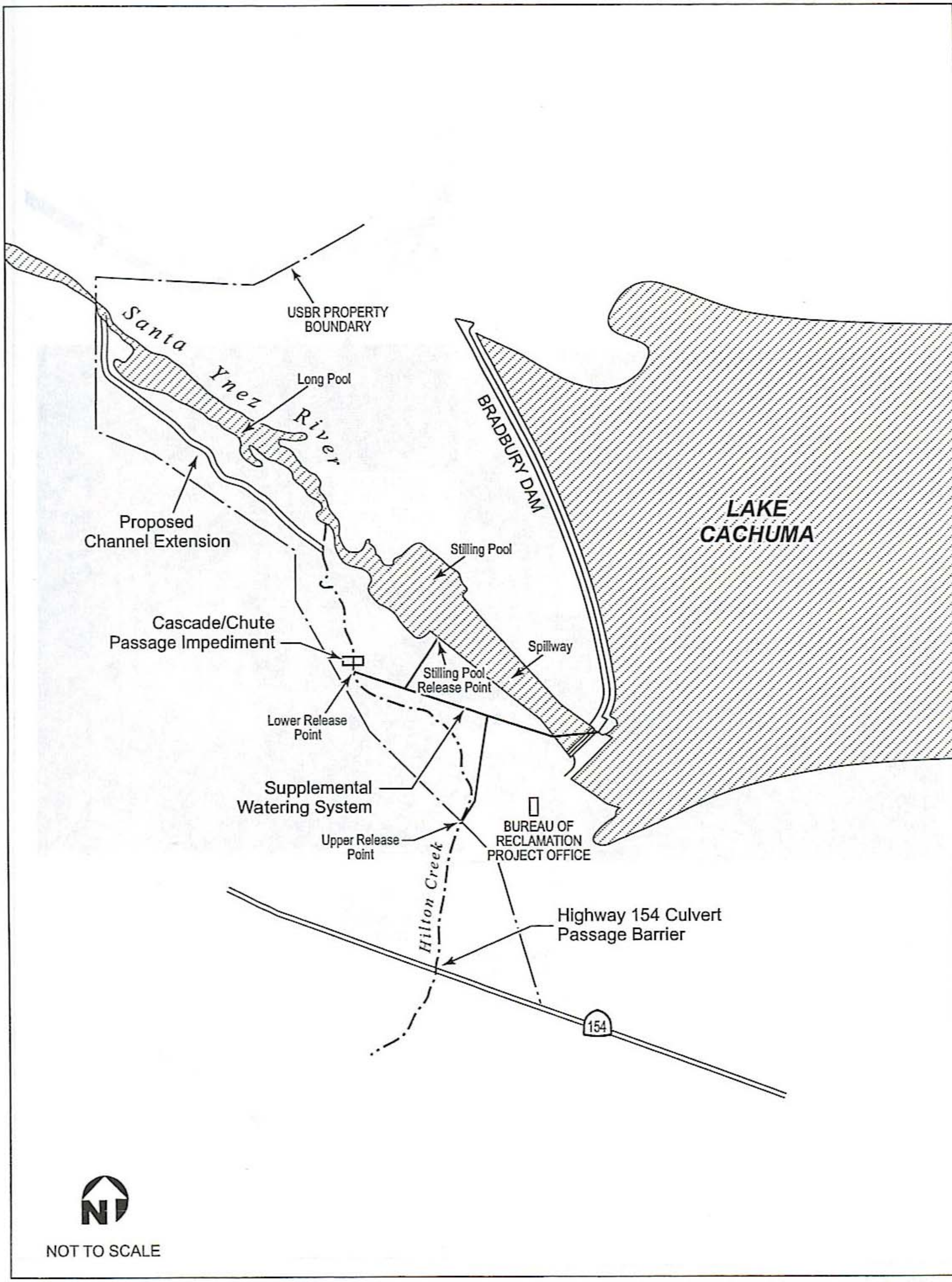


Figure 2-3. Hilton Creek Enhancement Projects

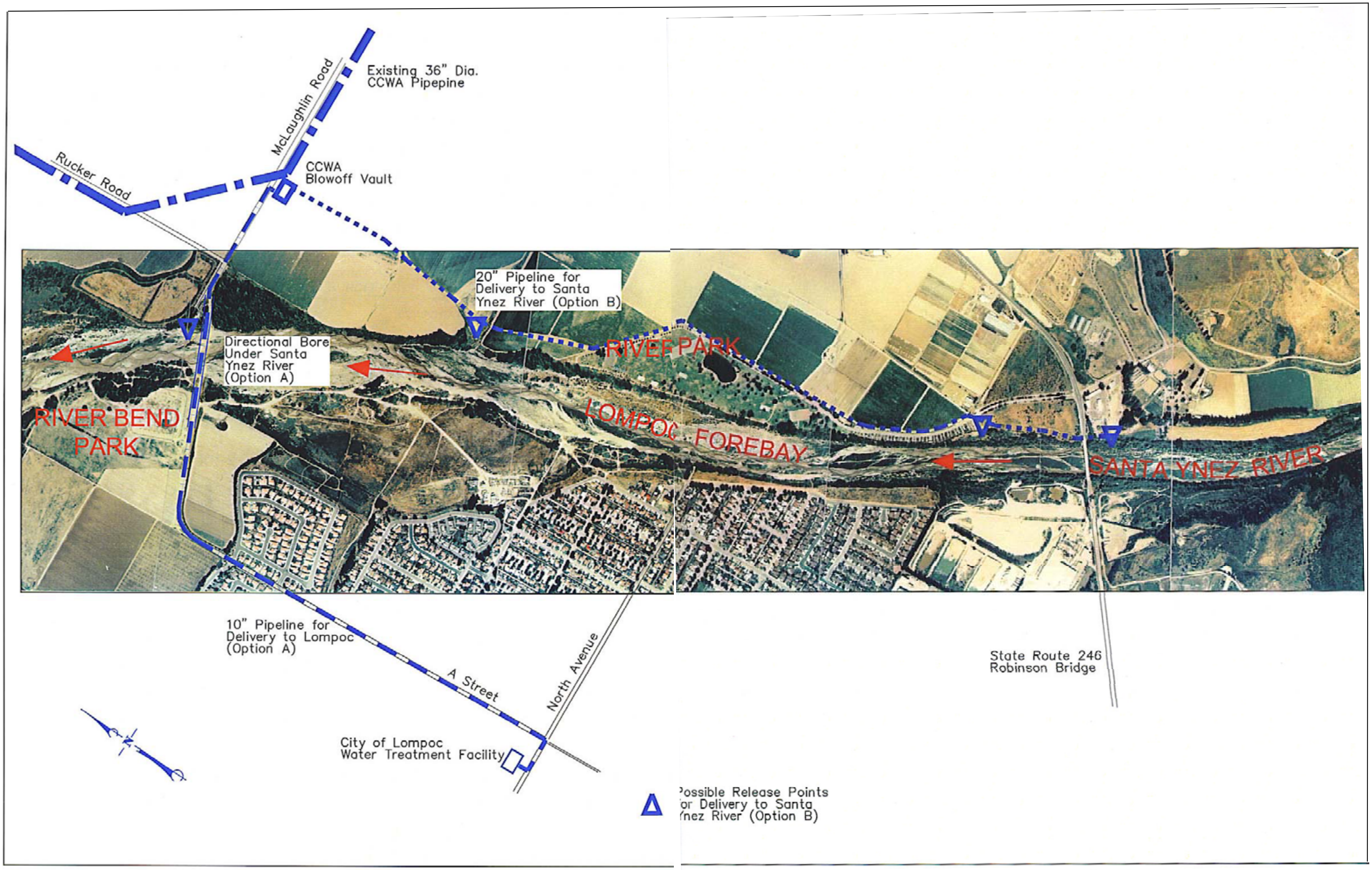


Figure 3-1. Below Narrows Exchange Project Facilities

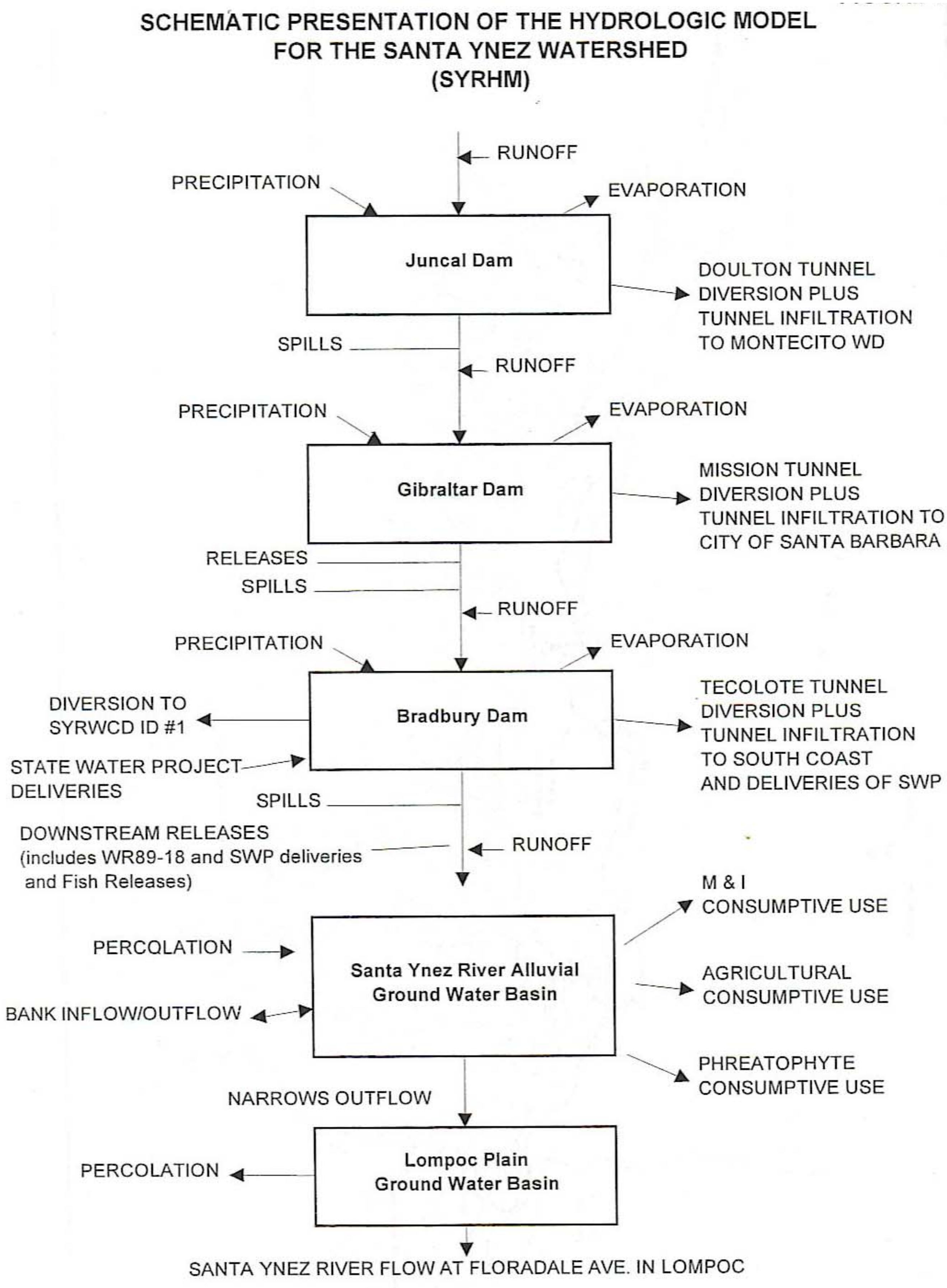


Figure 4-1 Overview of Santa Ynez River Hydrology Model

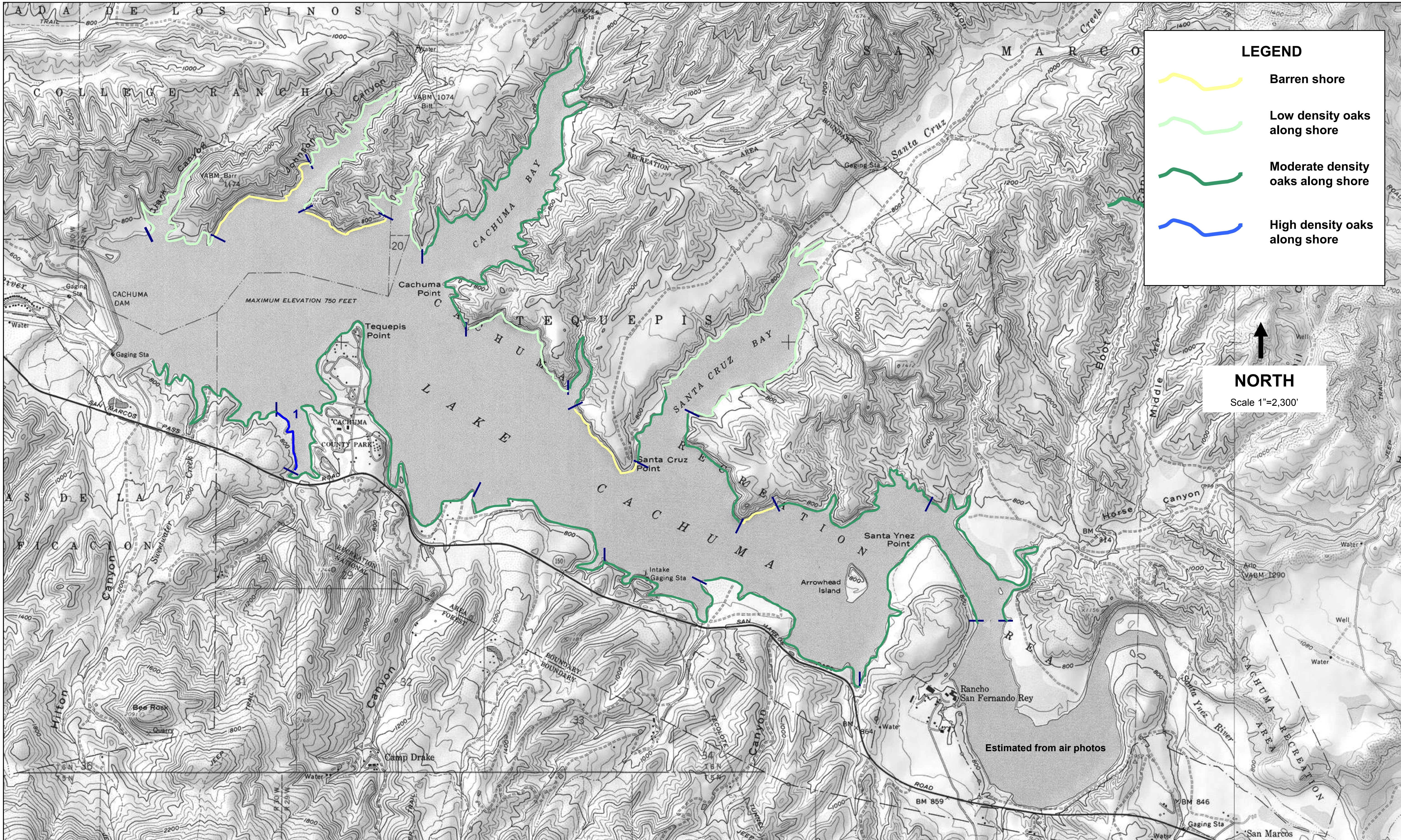


Figure 4-9. Oak Trees Along the Margins of Lake Cachuma

Appendix B
Charts

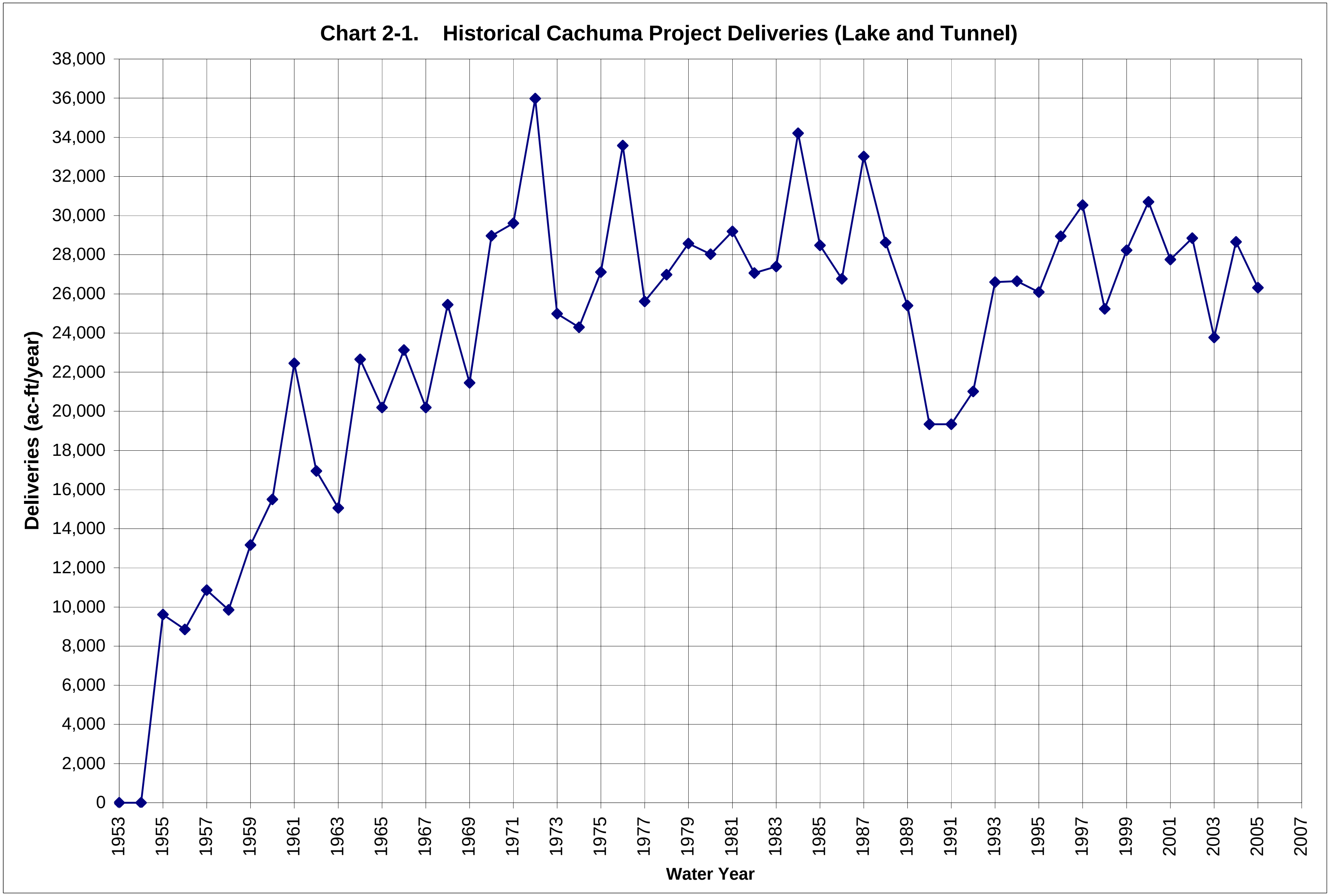
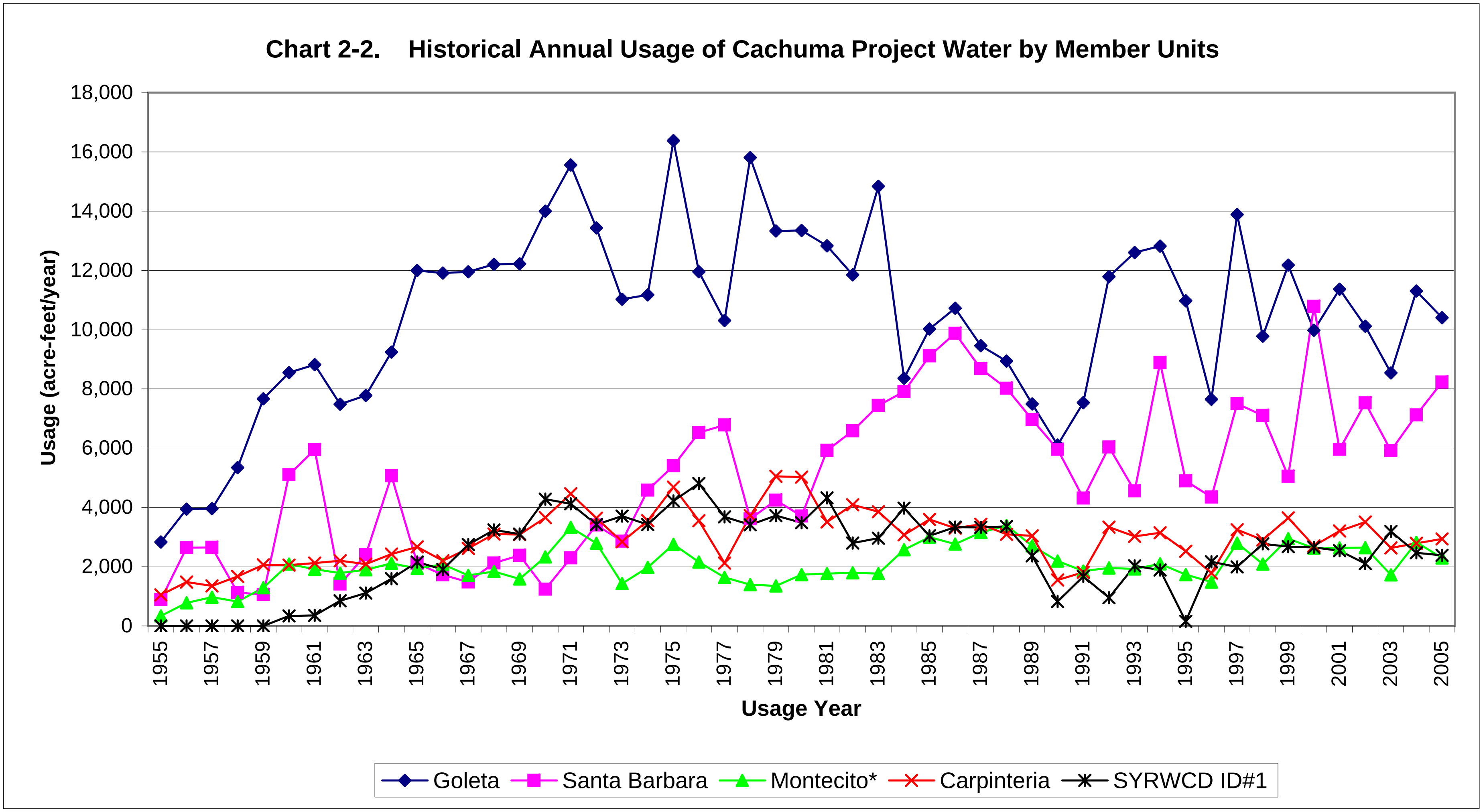


Chart 2-1. Historical Cachuma Project Deliveries (Lake and Tunnel)
Deliveries (ac-ft/year)
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
Water Year



1) Usage reporting years vary (1955-1994 represent 5/15 to 5/14 of following year; 1995 represent 5/15 to 4/14 of following year; 1996 represents 4/15-9/30 of same same year; and years 1997-2005 represent water year (Oct-Sep).

2) Montecito usage includes Summerland WD totals (merged in Dec. 1995).

3) Since 1997, ID No. 1 receives its entitlement througn an exchange with South Coast Project members and Park deliveries.

4) ID No. 1 Project Water is not included in Project usage by other Member Units via the water exchange.

Chart 2-3. Historical Annual ANA and BNA WR89-18 Releases

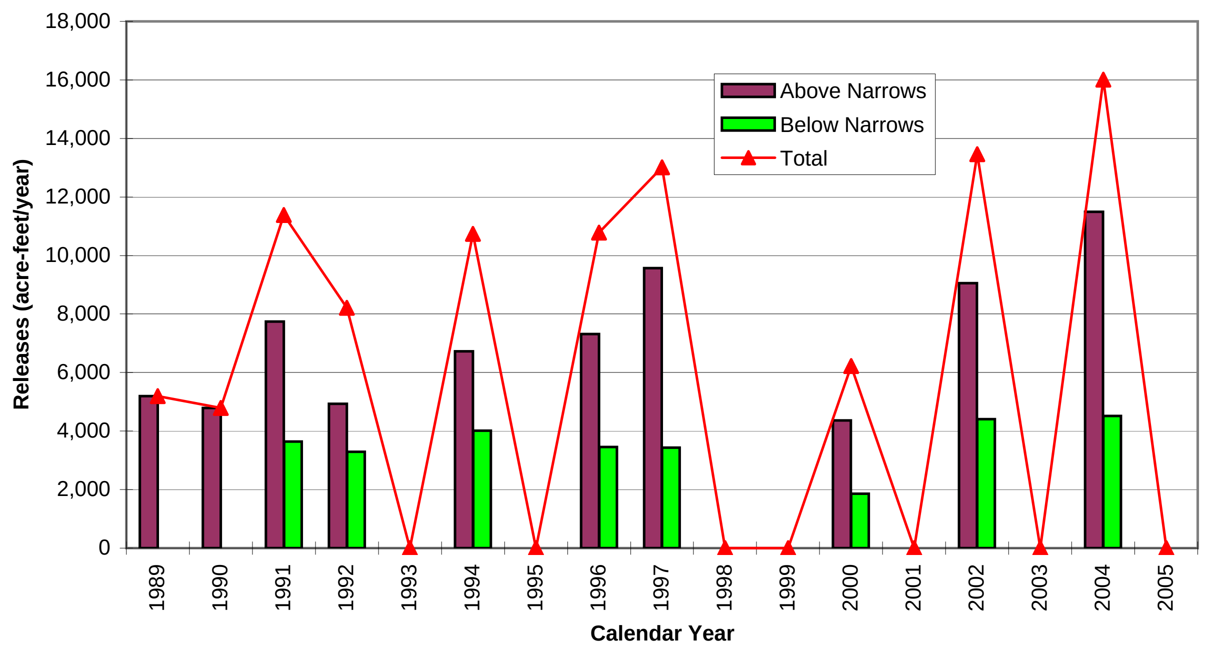


Chart 2-4. Historical Monthly WR89-18 Water Rights and Fish Releases

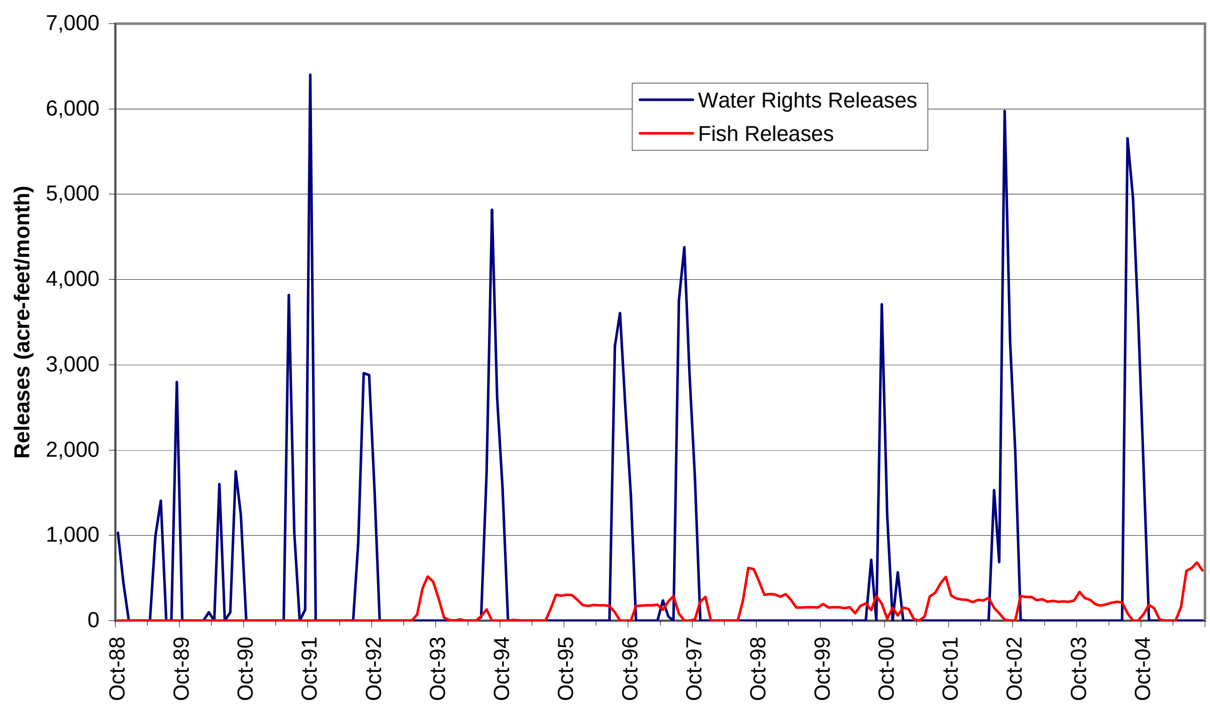
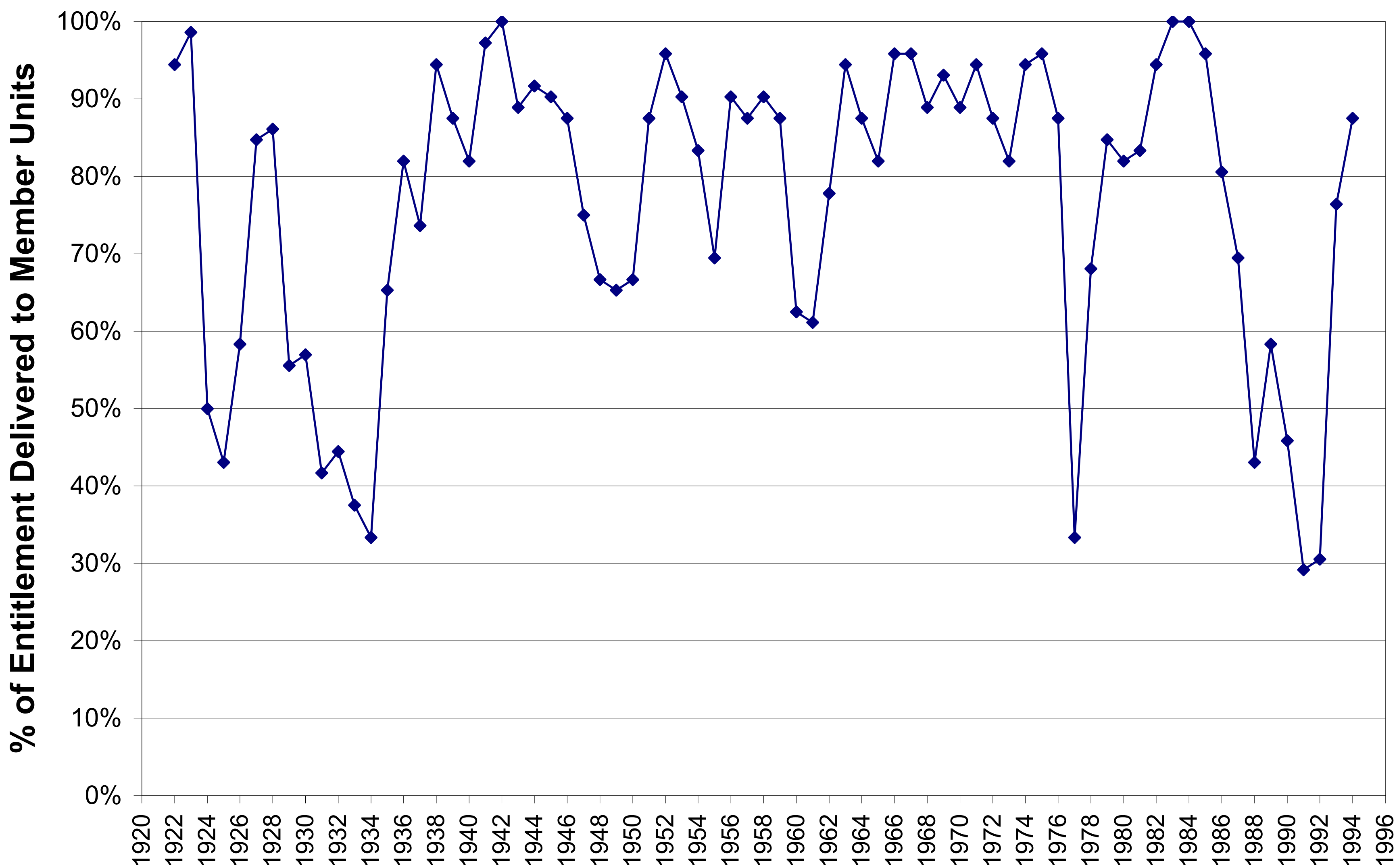
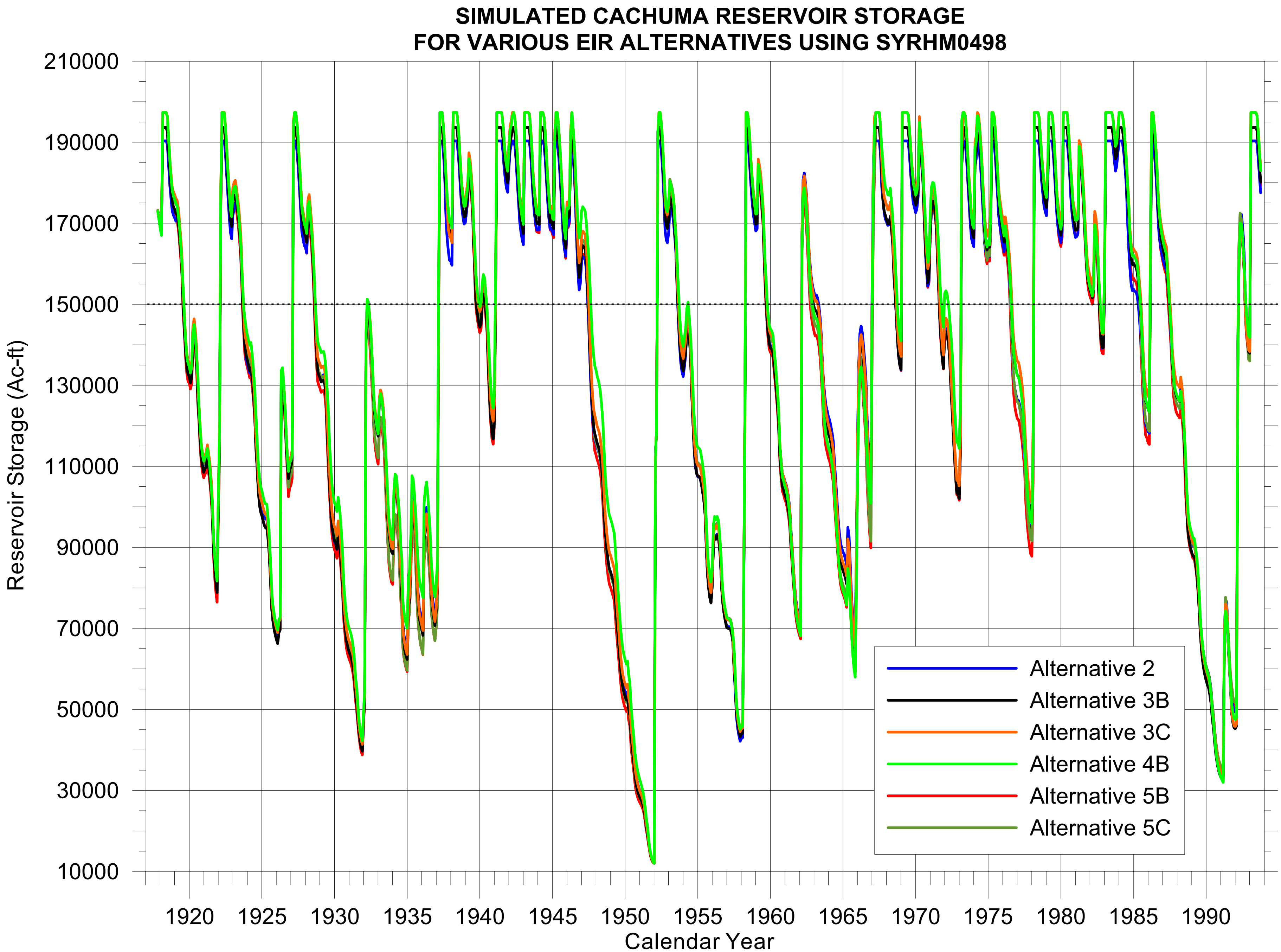


Chart 2-5. Simulated Shortages in SWP Water Deliveries





SIMULATED CACHUMA RESERVOIR STORAGE
FOR VARIOUS EIR ALTERNATIVES USING SYRHM0498
Reservoir Storage (Ac-ft)
210000
190000
170000
150000
130000
110000
90000
70000
50000
30000
10000
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Calendar Year
Alternative 2
Alternative 3B
Alternative 3C
Alternative 4B
Alternative 5B
Alternative 5C

Chart 4-6

Chart 4-7 Median Monthly Cachuma Lake Elevations (Simulation 1918-93)

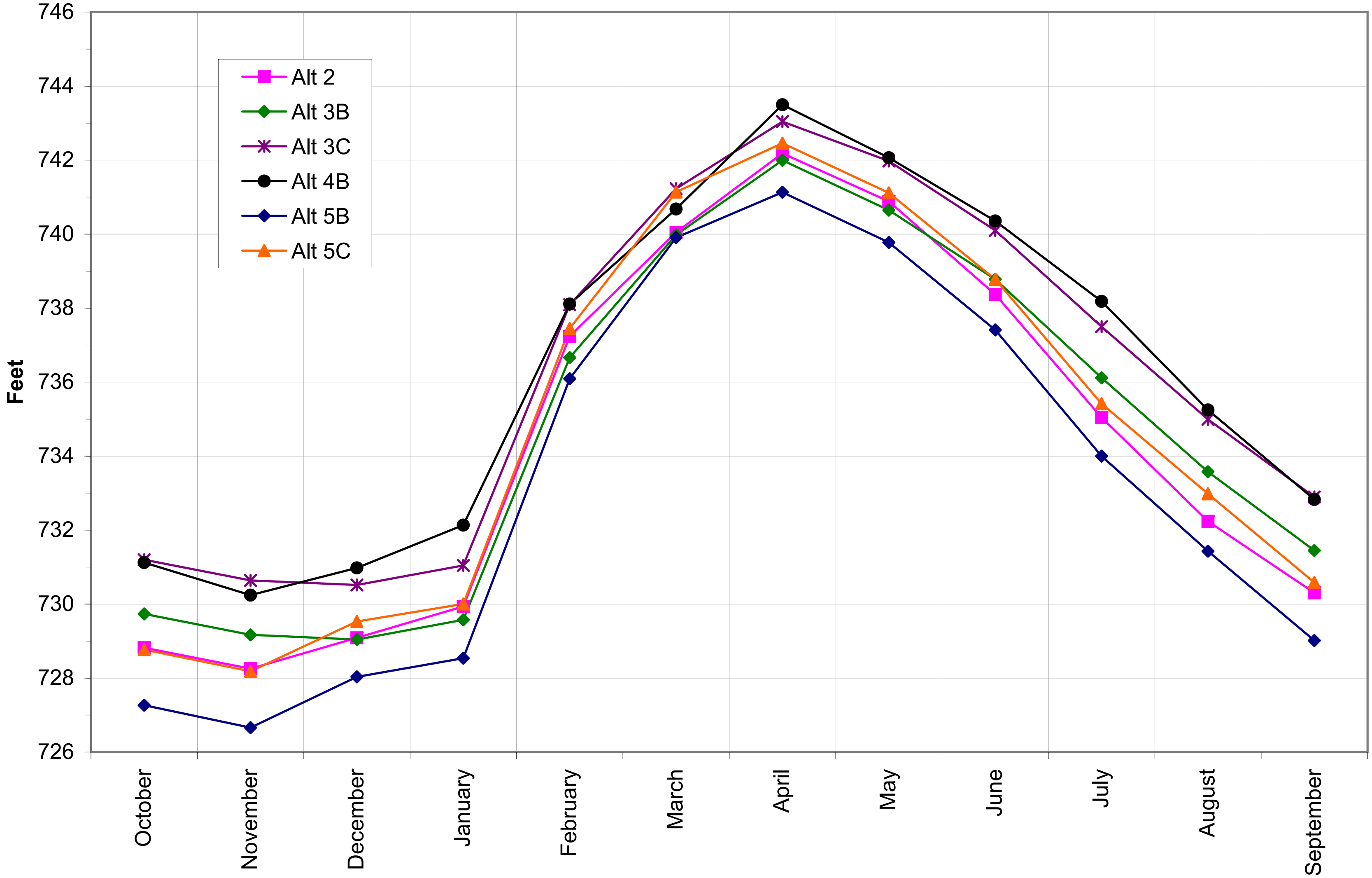
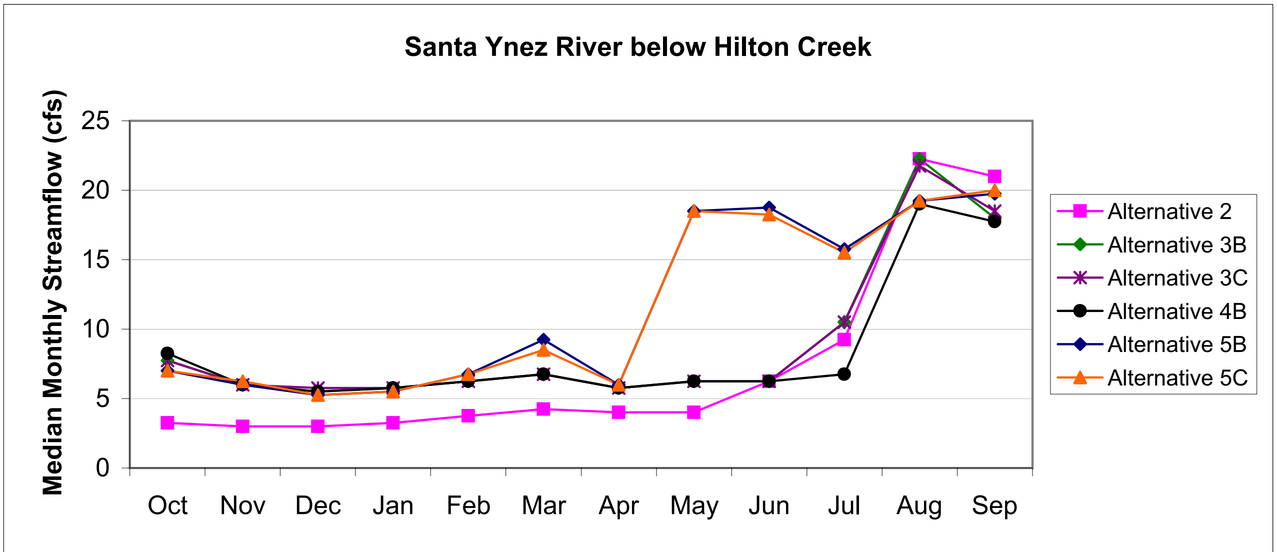
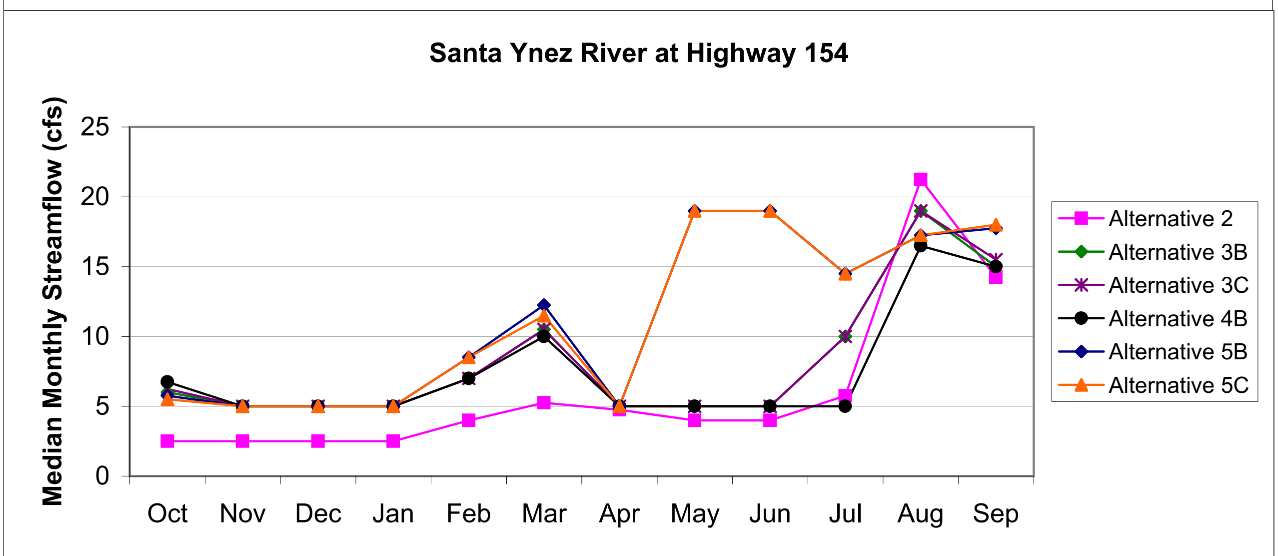


CHART 4-8a. MEDIAN MONTHLY STREAMFLOW BELOW LAKE CACHUMA





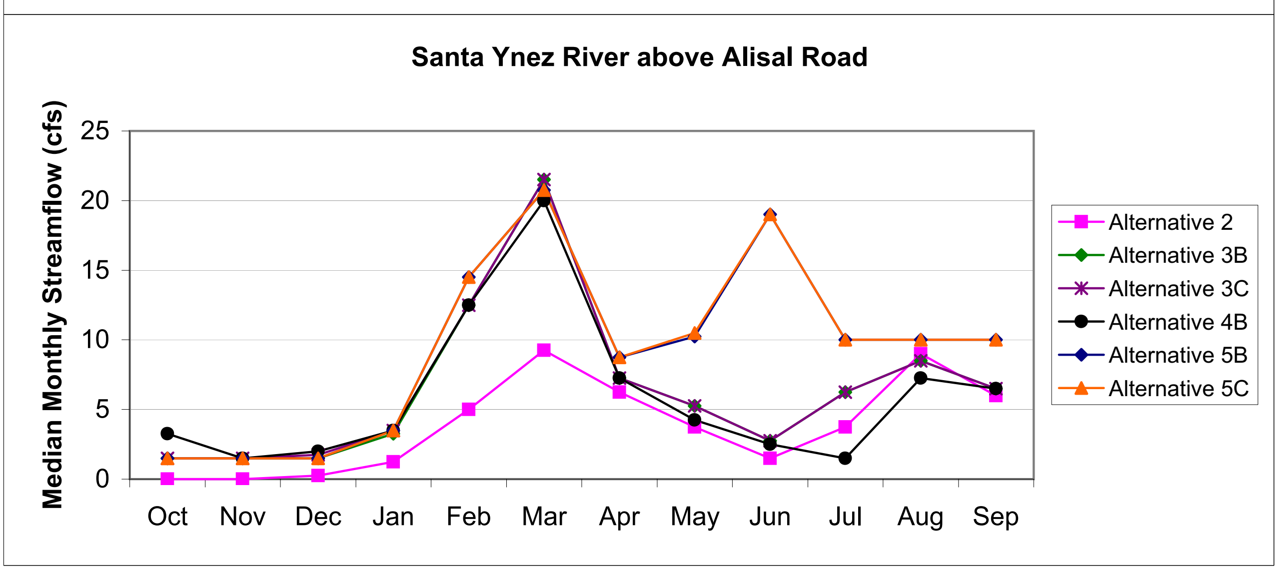
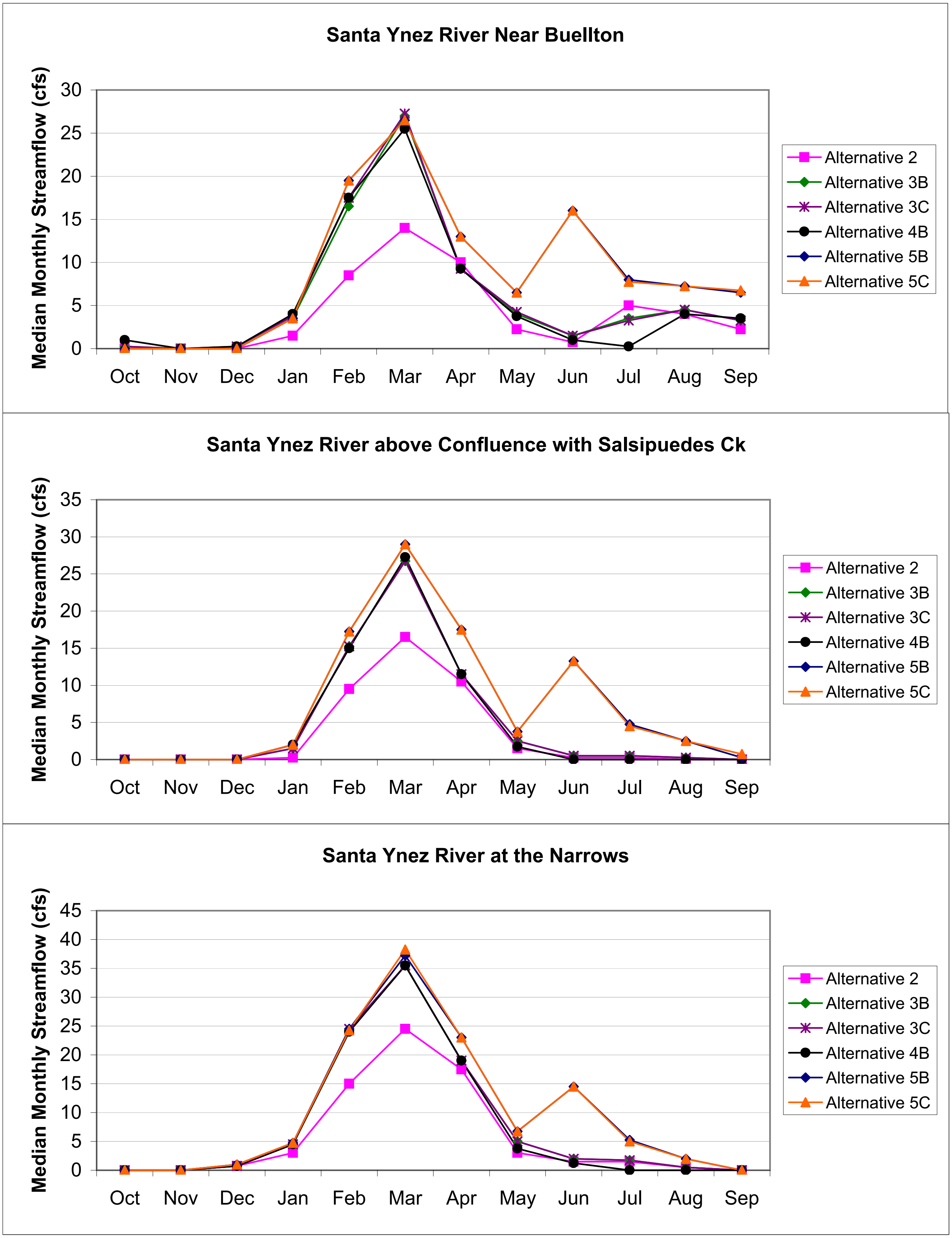
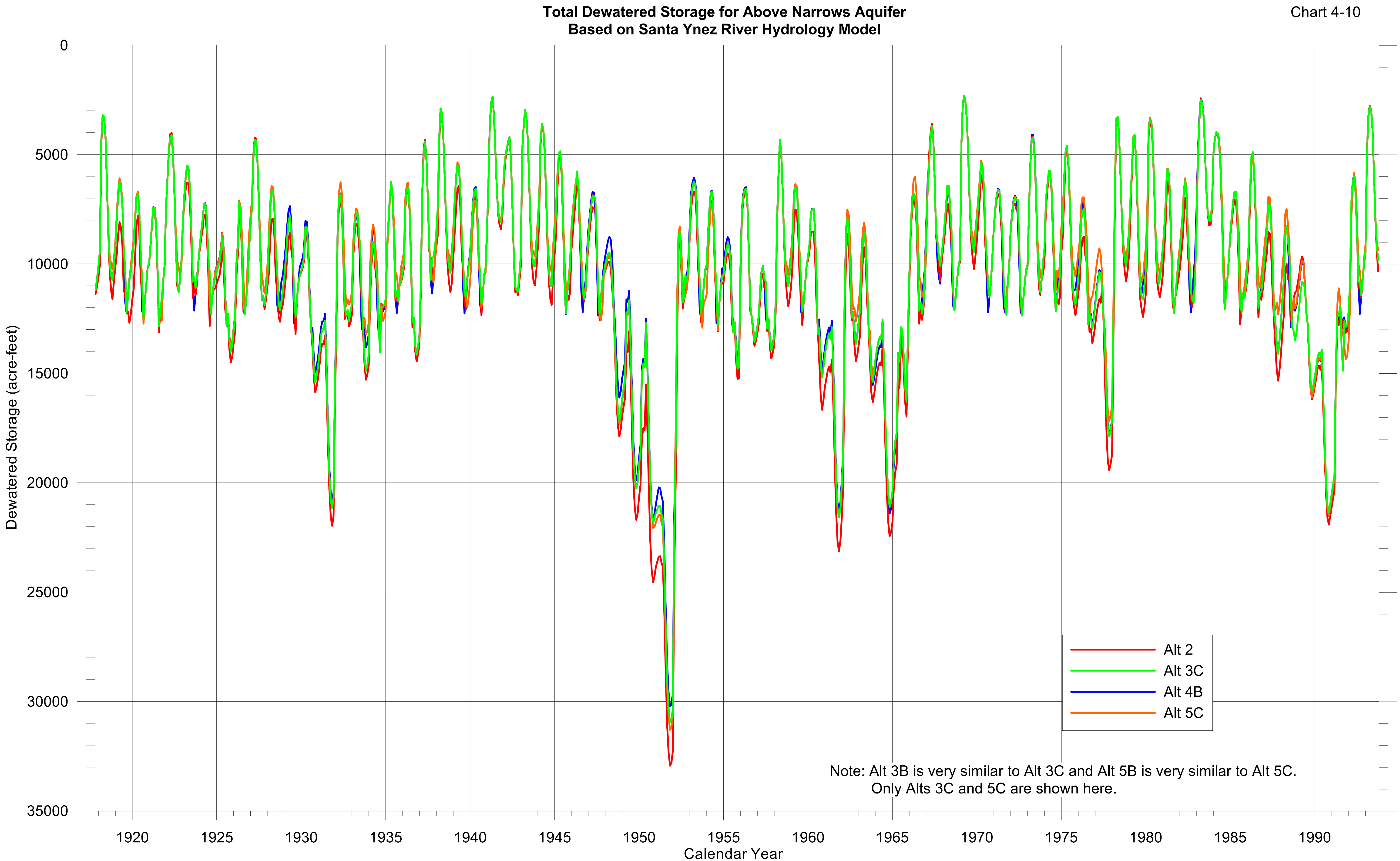


CHART 4-8b. MEDIAN MONTHLY STREAMFLOW BELOW LAKE CACHUMA





Total Dewatered Storage for Above Narrows Aquifer
Based on Santa Ynez River Hydrology Model
Dewatered Storage (acre-feet)
0
5000
10000
15000
20000
25000
30000
35000
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Calendar Year
Alt 2
Alt 3C
Alt 4B
Alt 5C
Note: Alt 3B is very similar to Alt 3C and Alt 5B is very similar to Alt 5C.
Only Alts 3C and 5C are shown here.

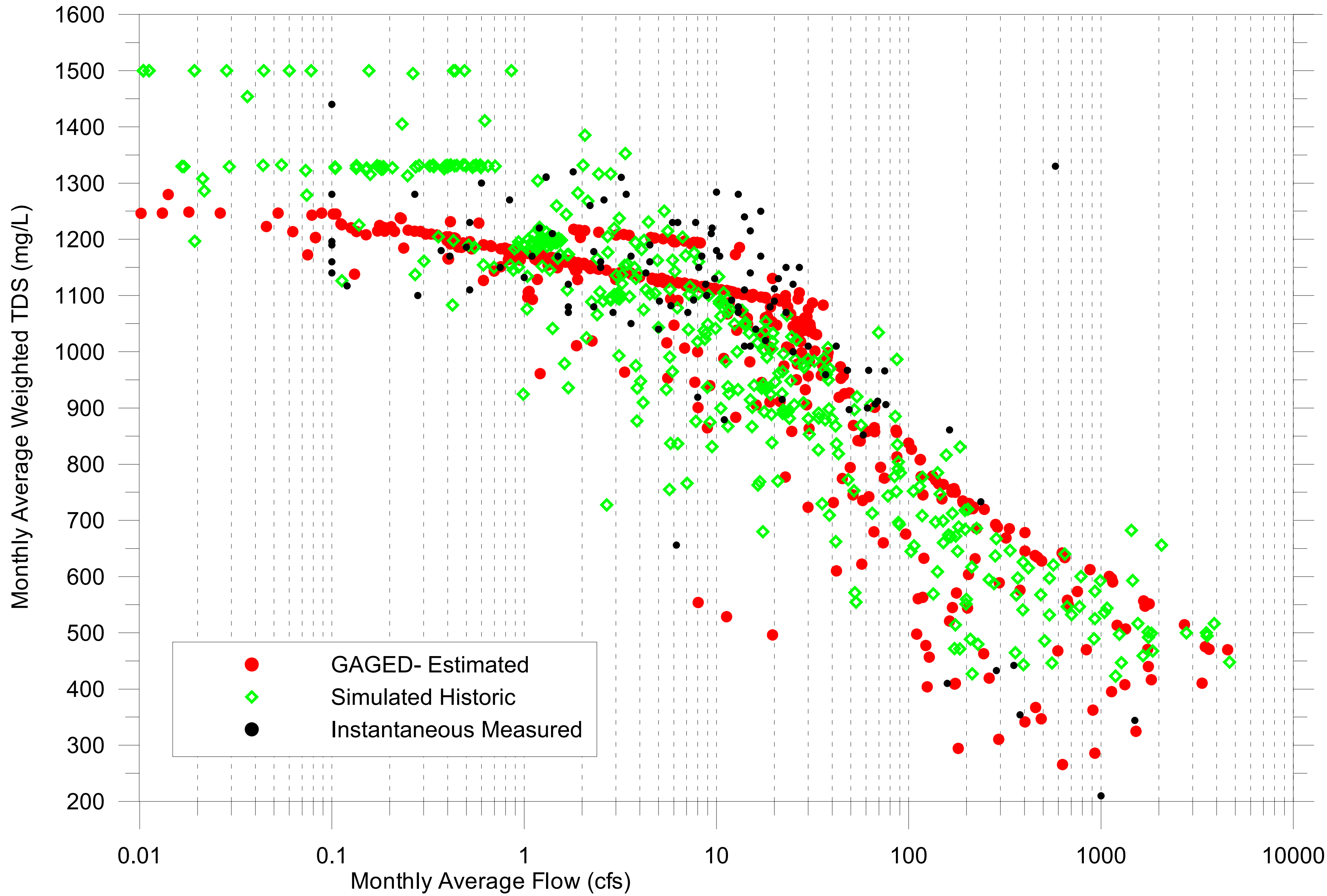


Chart 4-12. TDS-Flow Relationship at the Narrows

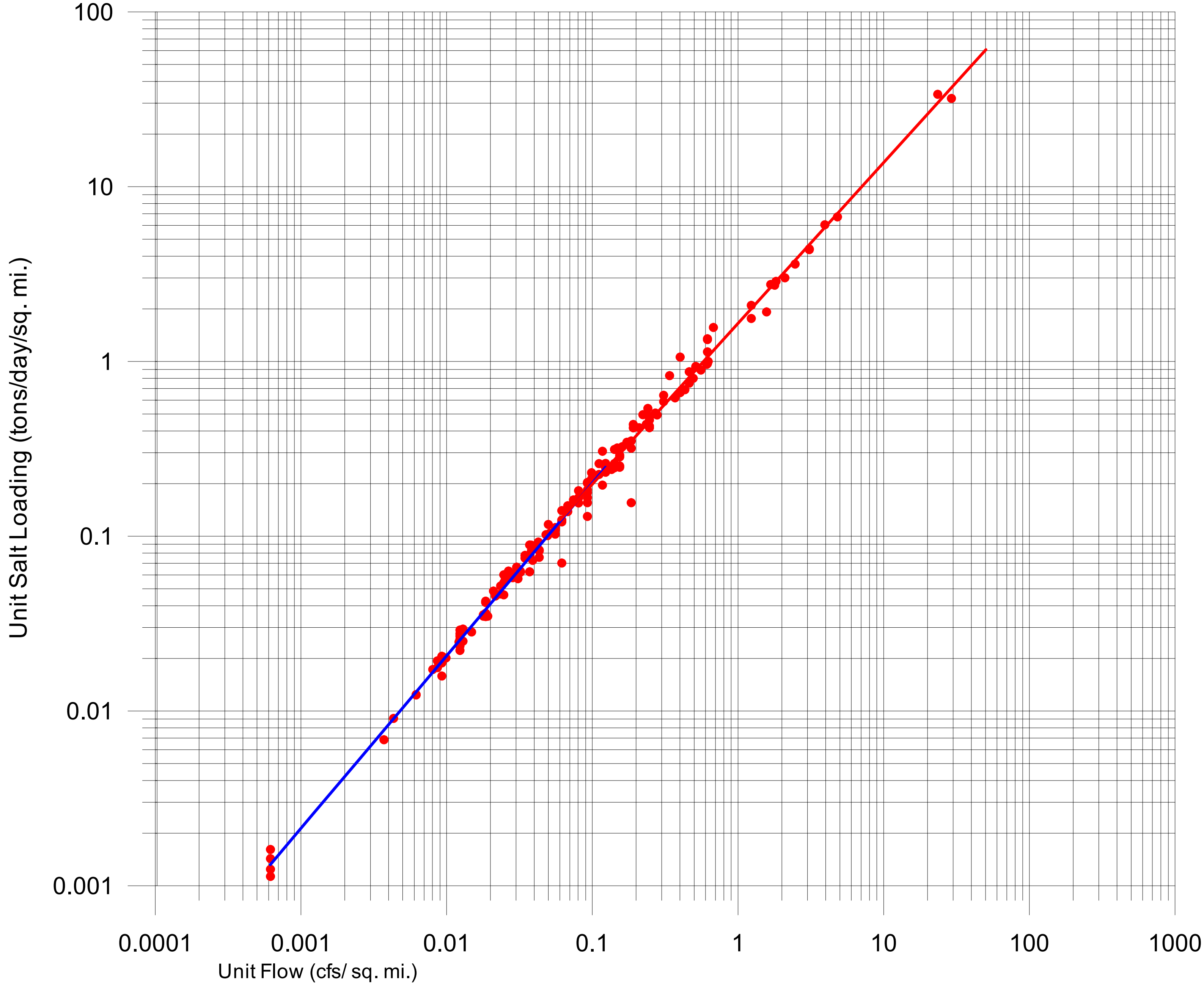


Chart 4-13. Example of Salt Loading-Flow Data at Solvang

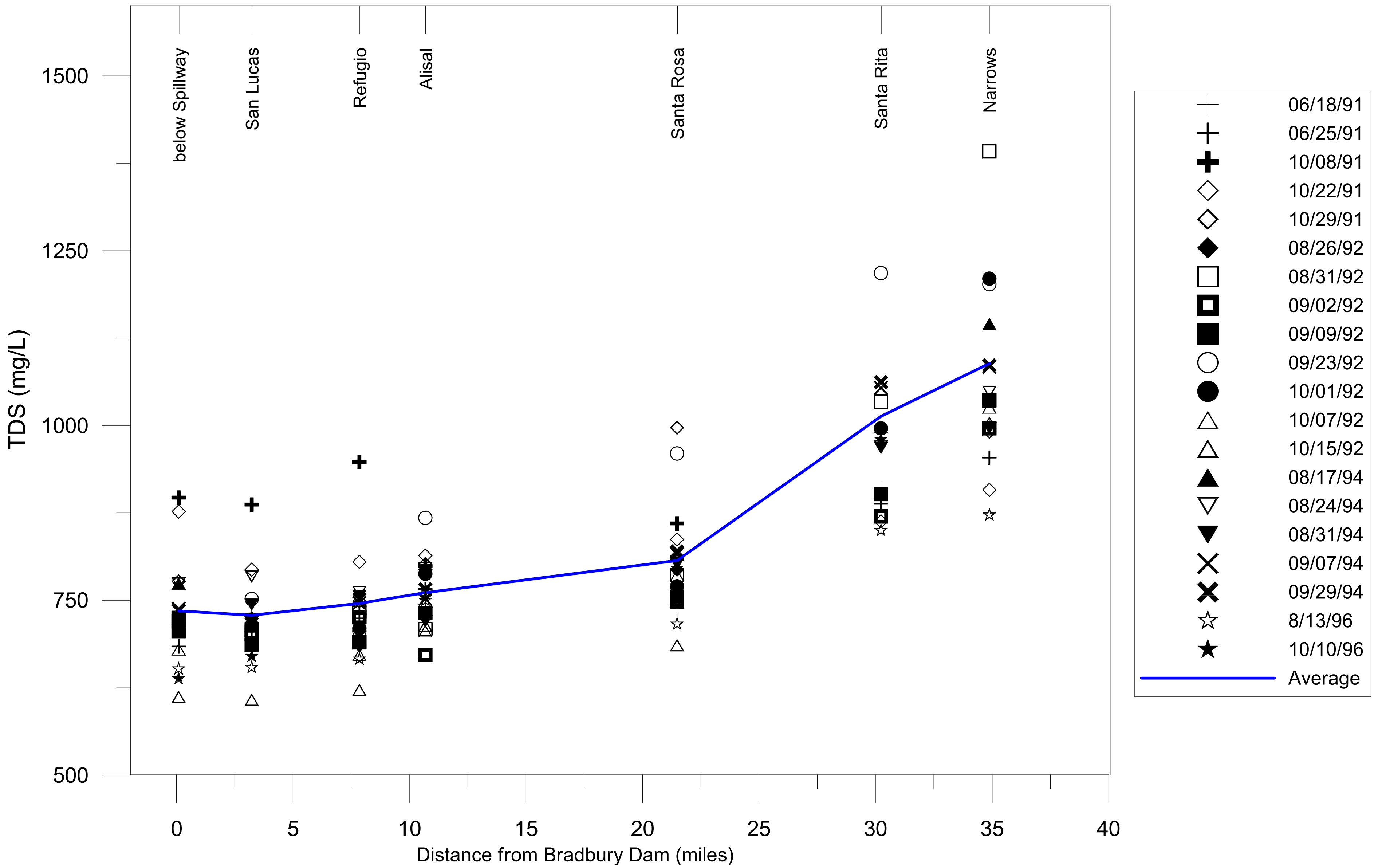


Chart 4-14. TDS Measurements During WR 89-18 Releases

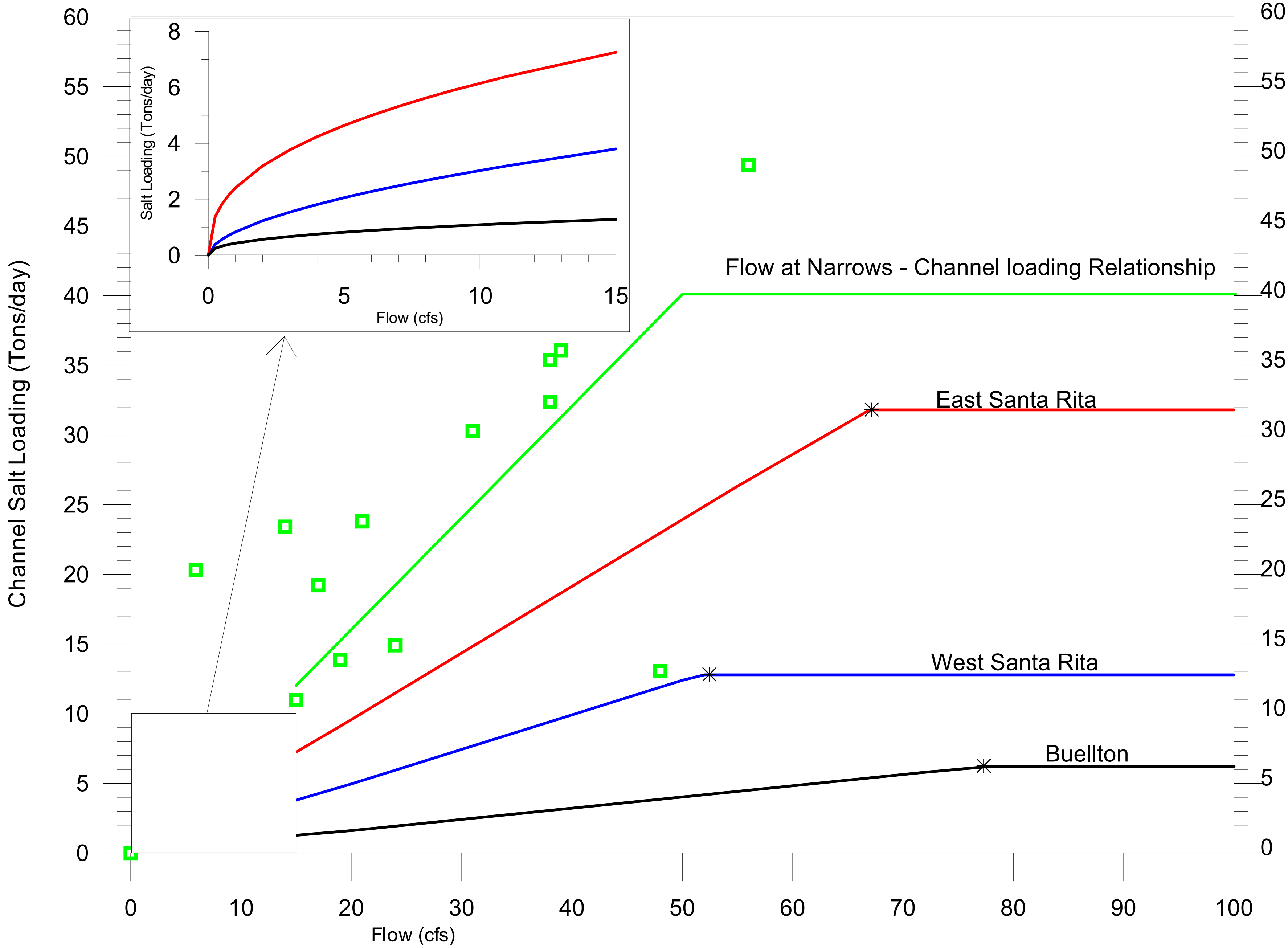
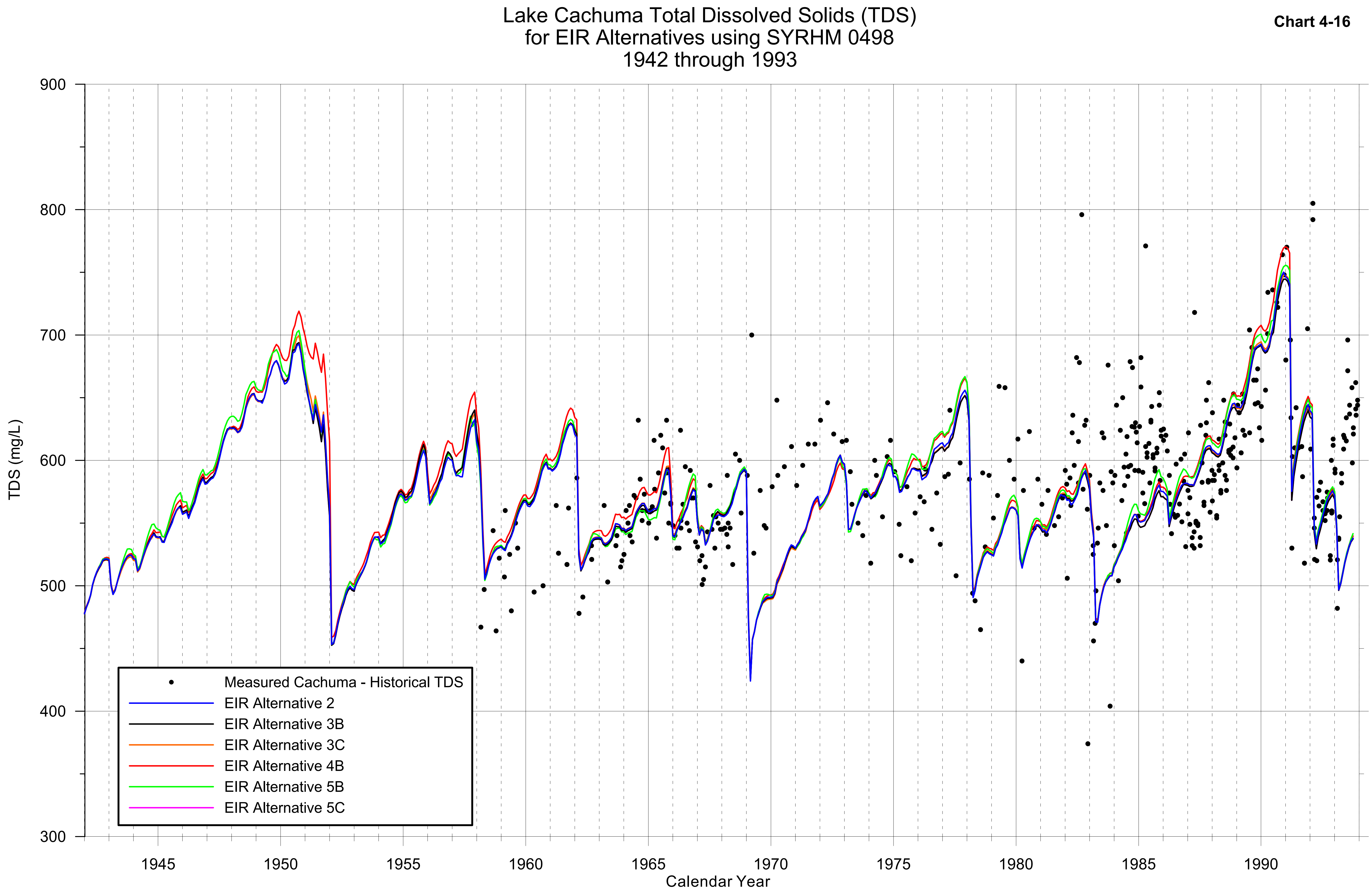
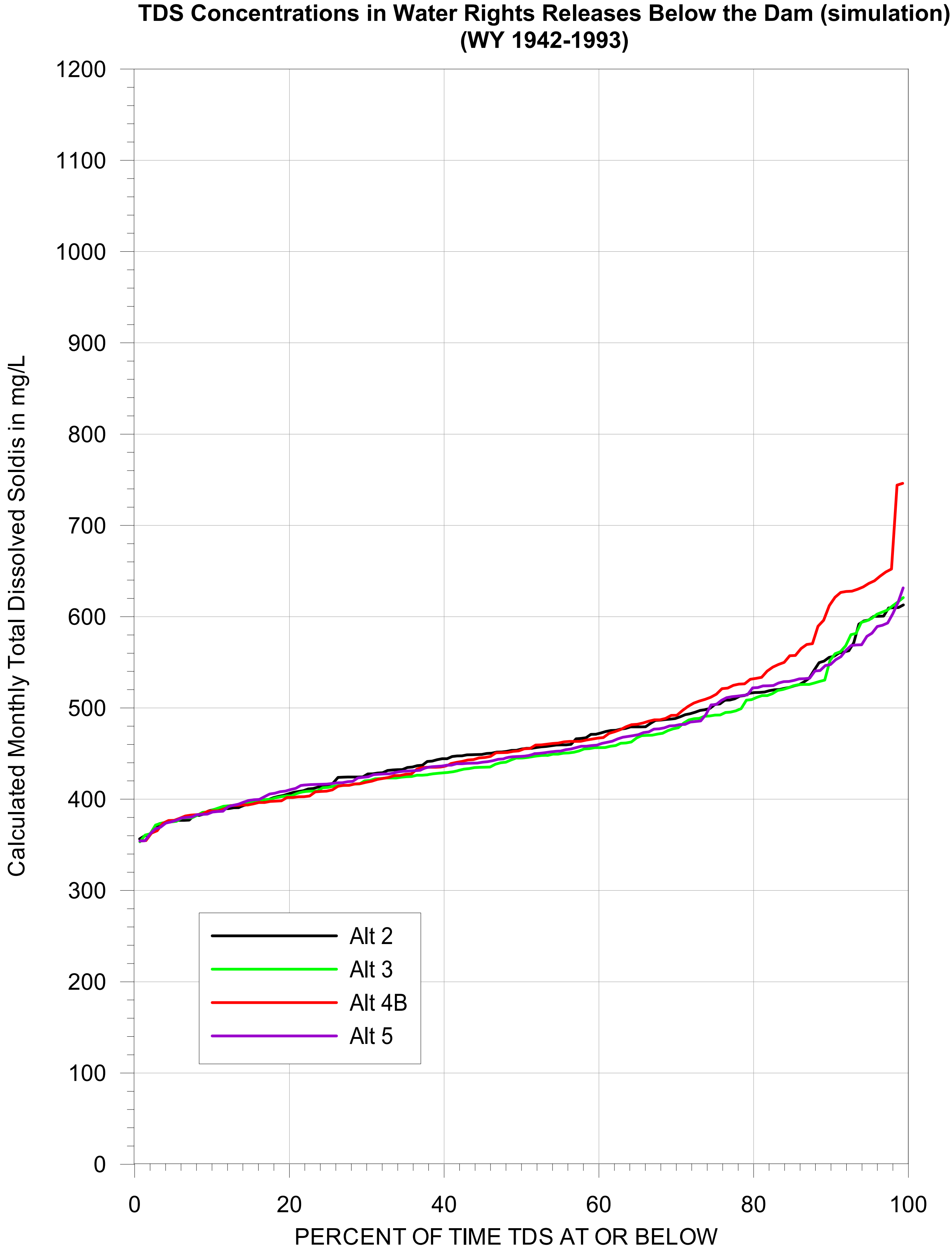


Chart 4-15. Relationship Between Salt Loading and Flows at the Narrows

Chart 4-16



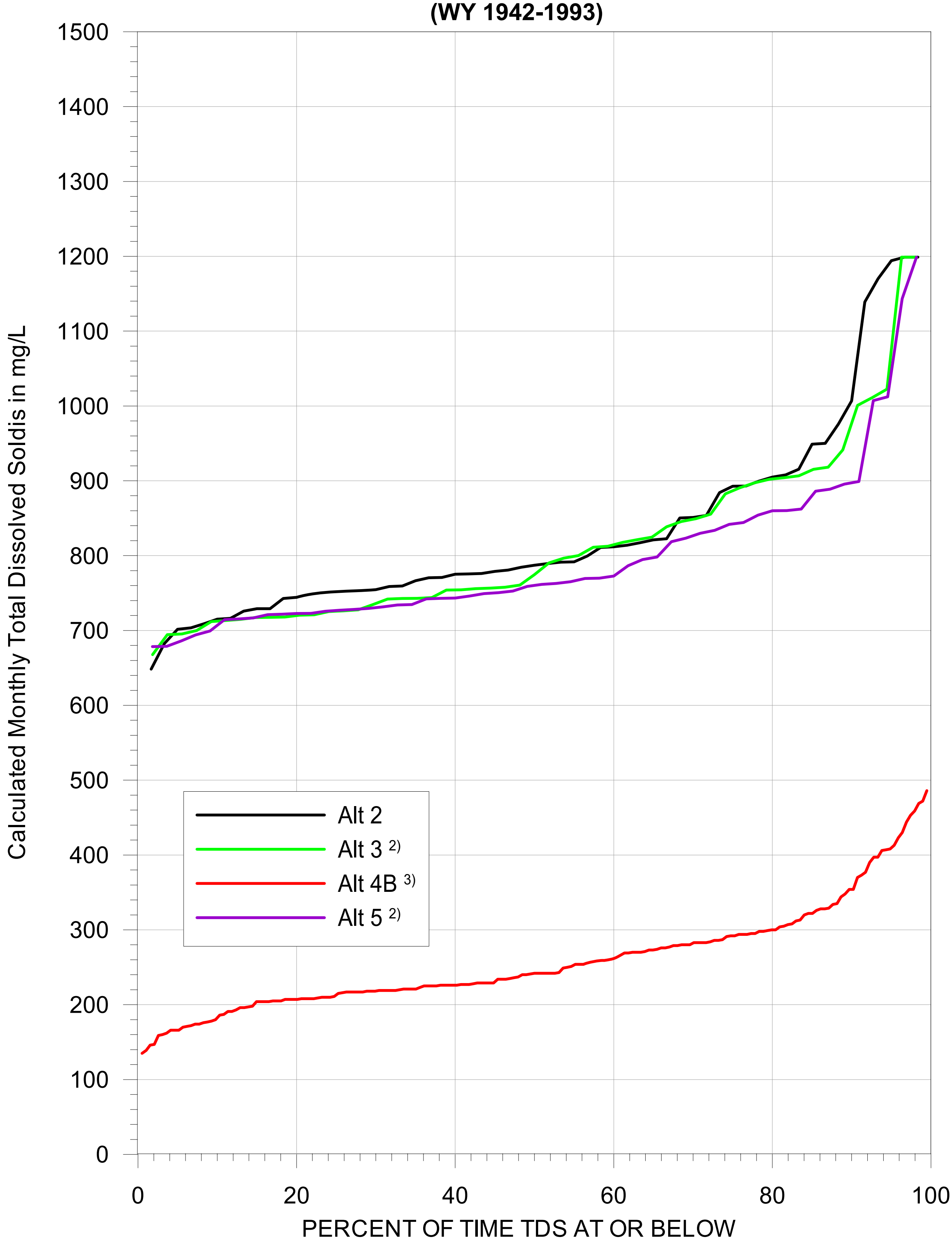
Lake Cachuma Total Dissolved Solids (TDS)
for EIR Alternatives using SYRHM 0498
1942 through 1993
TDS (mg/L)
900
800
700
600
500
400
300
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Calendar Year
Measured Cachuma - Historical TDS
EIR Alternative 2
EIR Alternative 3B
EIR Alternative 3C
EIR Alternative 4B
EIR Alternative 5B
EIR Alternative 5C



1) Results from EIR Alternatives 3C and 5C are plotted here; Alts 3B and 5B are very similar to 3C and 5C, respectively.
2) Water rights release TDS for ANA releases are shown here for 4B.

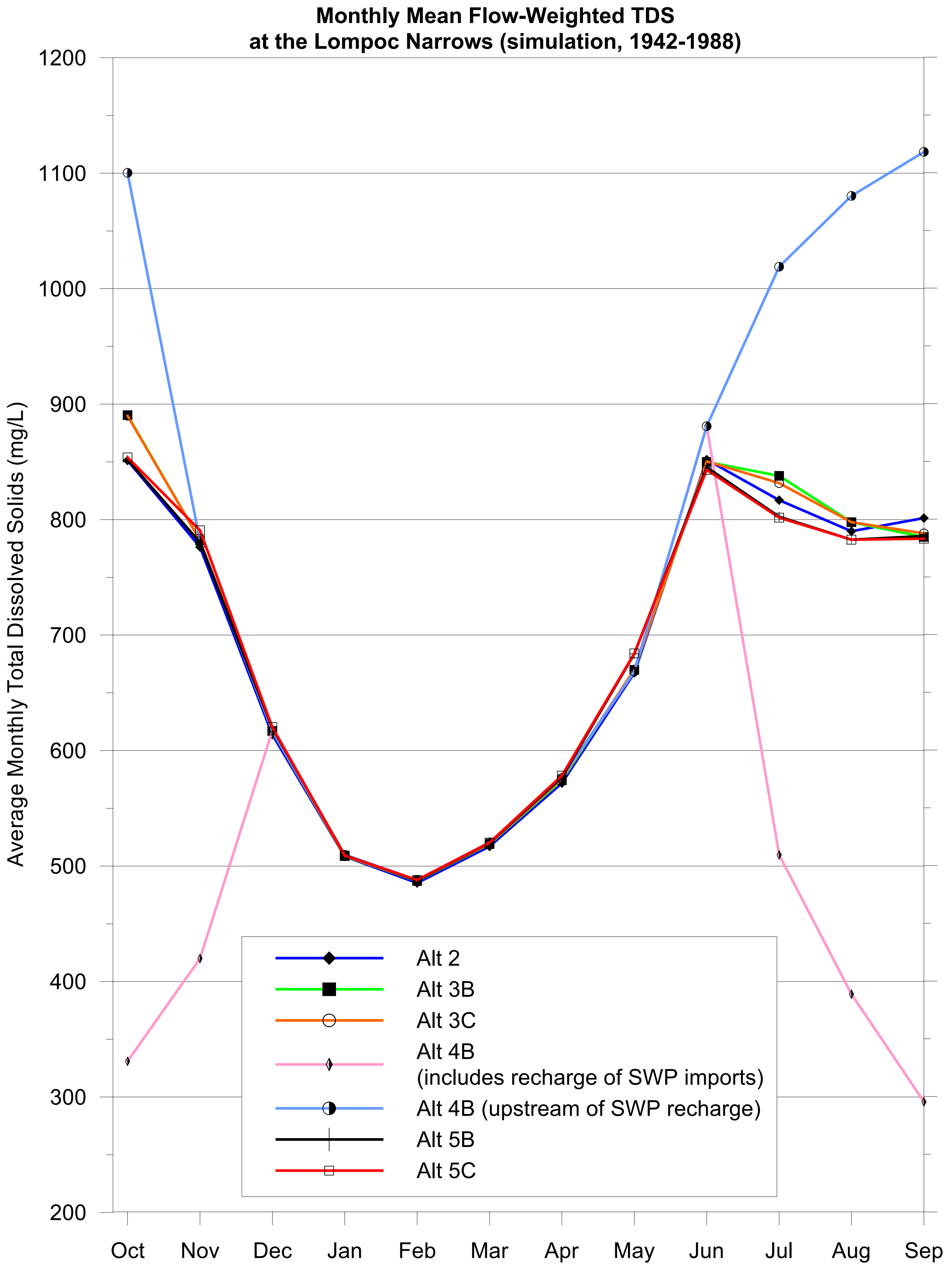
Chart 4-18

TDS Concentrations in Water Rights Releases at the Narrows (simulation) [1] (WY 1942-1993)

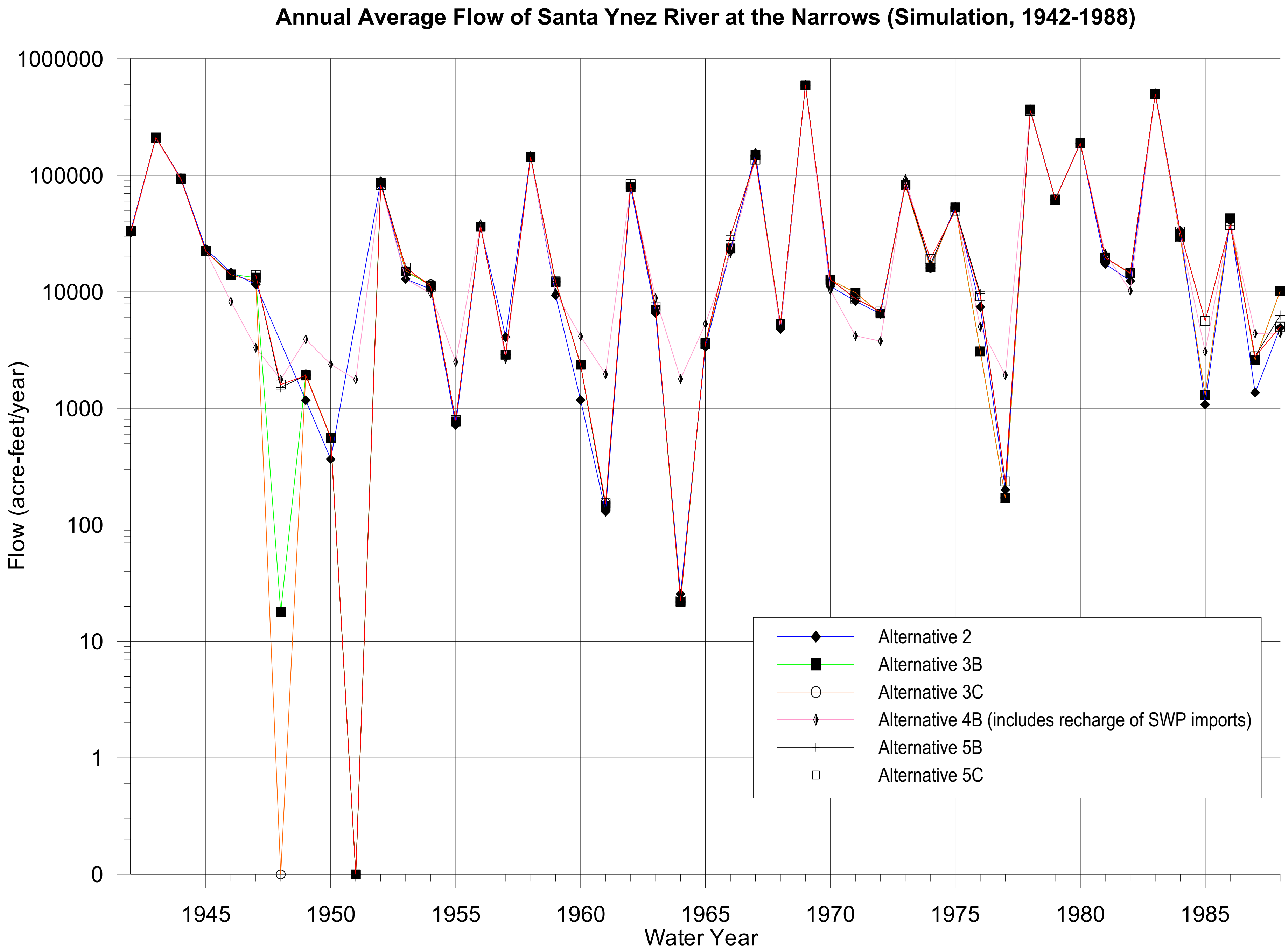


1) Frequency does not include months of no flow or flows less than 0.5 cfs at the Narrows.
2) Results from EIR Alternatives 3C and 5C are plotted here; Alts 3B and 5B are very similar to 3C and 5C, respectively.
3) State Water Project TDS during Below Narrows Account water right releases.

Chart 4-19



Monthly Mean Flow-Weighted TDS
at the Lompoc Narrows (simulation, 1942-1988)
Average Monthly Total Dissolved Solids (mg/L)
1200
1100
1000
900
800
700
600
500
400
300
200
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Alt 2
Alt 3B
Alt 3C
Alt 4B
(includes recharge of SWP imports)
Alt 4B (upstream of SWP recharge)
Alt 5B
Alt 5C

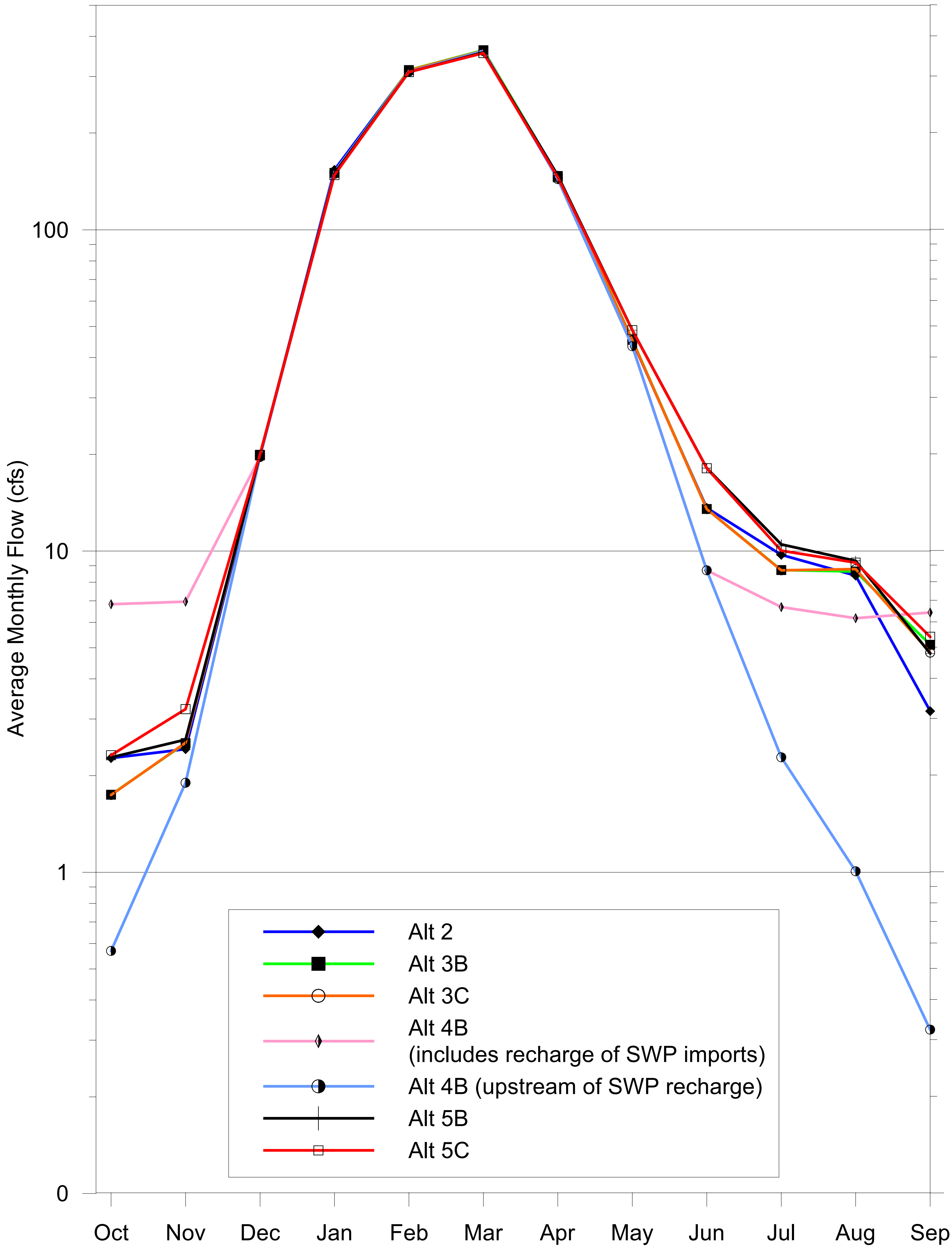


Annual Average Flow of Santa Ynez River at the Narrows (Simulation, 1942-1988)
Flow (acre-feet/year)
1000000
100000
10000
1000
100
10
1
0
1945
1950
1955
1960
1965
1970
1975
1980
1985
Water Year
Alternative 2
Alternative 3B
Alternative 3C
Alternative 4B (includes recharge of SWP imports)
Alternative 5B
Alternative 5C

Chart 4-26

Chart 4-27

Simulated Mean Streamflow at the LompocNarrows (1942-1988)



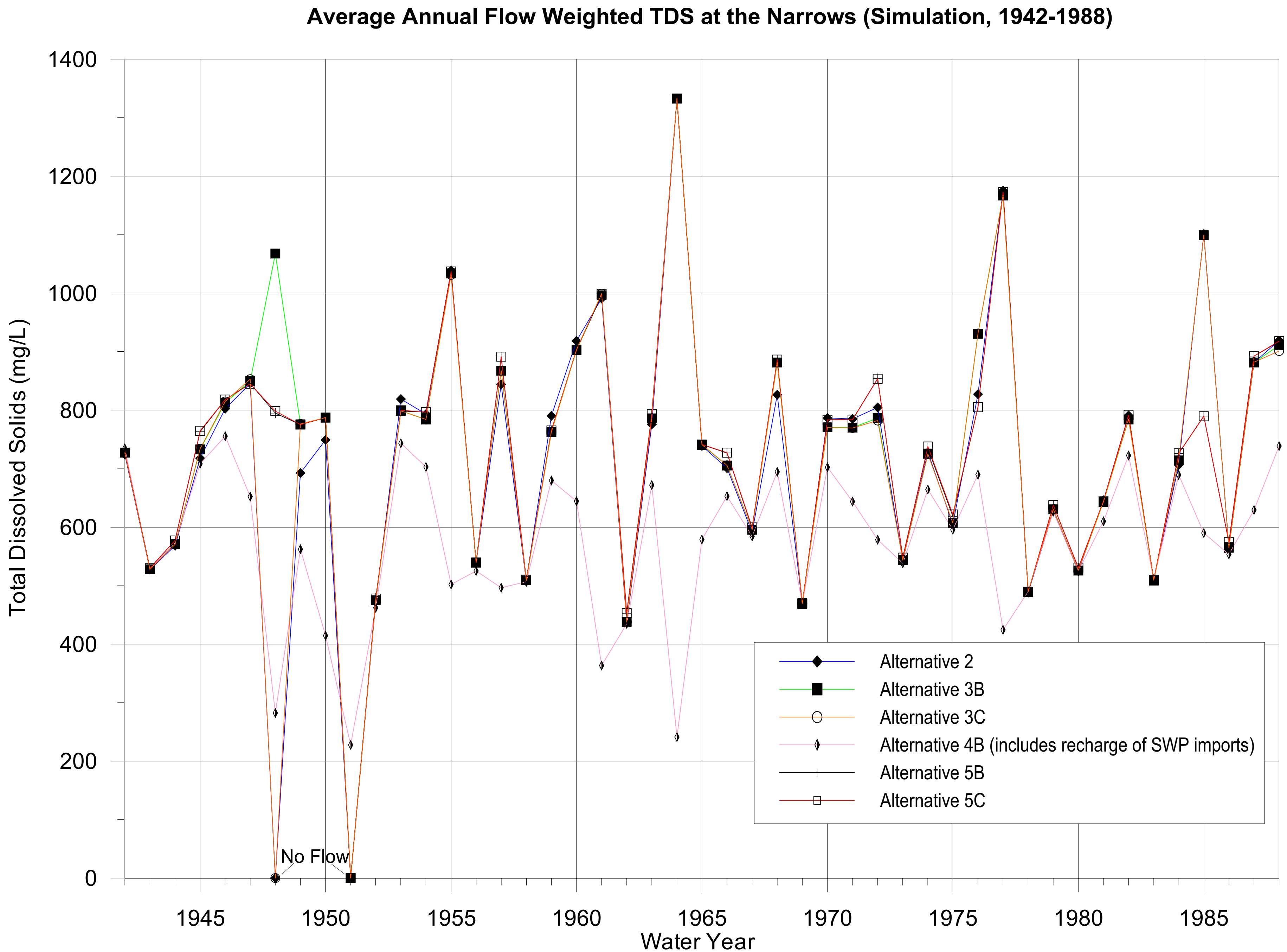

Average Annual Flow Weighted TDS at the Narrows (Simulation, 1942-1988)
Total Dissolved Solids (mg/L)
1400
1200
1000
800
600
400
200
0
No Flow
1945
1950
1955
1960
1965
1970
1975
1980
1985
Water Year
Alternative 2
Alternative 3B
Alternative 3C
Alternative 4B (includes recharge of SWP imports)
Alternative 5B
Alternative 5C

Chart 4-28

Appendix F
Hydrologic Modeling Technical Memoranda
(Stetson Engineers, 2006)

Draft Technical Memorandum No. 5
Hydrologic Impact Analysis of
Possible Cachuma Operations Alternatives

STETSON ENGINEERS INC.

DRAFT
TECHNICAL MEMORANDUM No. 5

2171 E. Francisco Blvd., Suite K • San Rafael, California • 94901
TEL: (415) 457-0701 FAX: (415) 457-1638 E-mail: alis@stetsonengineers.com

TO: Ernest Mona
State Water Resources Control Board

DATE: August 11, 2005
rev. October 2, 2006

cc: Diane Riddle (SWRCB)
Dana Heinrich (SWRCB)
David Fee (URS)

FROM: Ali Shahroody and Curtis Lawler

JOB NO: 1893

RE: Hydrologic Impact Analysis of Possible Cachuma Operations Alternatives

1. INTRODUCTION

Three variations of CalTrout's proposed Alternative 3A2 were identified for analysis by the State Water Resources Control Board's (SWRCB) staff. The additional analyses requested by the Board staff (12/20/04) were in connection with the Draft Environmental Impact Report (DEIR) on the "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)" dated August 2003. The three possible alternatives (identified as Alternatives 5A, 5B and 5C) are essentially identical to the DEIR Alternatives 3A, 3B and 3C except that the new alternatives would use the CalTrout Alternative 3A2 operating criteria for releases from Cachuma Reservoir for fish during wet and above-normal water year types. Otherwise, during below-normal, dry, and critical year types, the releases would be the same as Alternatives 3A, 3B and 3C of the Draft EIR as set forth in the Biological Opinion (BO).

Hydrologic impact analyses were performed using the Santa Ynez River Hydrology Model (SYRHM) to determine impacts to water supply of Cachuma Project Member Units. Included in this memorandum are the results of hydrologic impact analyses (similar to those presented in the Draft EIR) for:

- Cachuma Reservoir Releases
- Cachuma Storage and Elevations
- Santa Ynez River Flows

- Groundwater Storage in the Above Narrows Alluvial Basin
- Water Rights Releases (WR 89-18)
- Member Unit's Supply and Demand
- State Water Project Deliveries

2. ANALYSIS OF NEW ALTERNATIVES

2A. BACKGROUND

The Draft EIR alternatives are briefly described below for reference, followed by a brief description of the three possible new Alternatives 5A, 5B, and 5C.

Draft EIR Alternatives

The alternatives included in the Draft EIR are described as follows:

1. Operations under the Order WR 89-18.

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

3A. Operations under the Biological Opinion assuming the U.S. Bureau of Reclamation (USBR) 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 USBR 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 USBR achieves a 3.0-foot surcharge.

4A. Operations under the Biological Opinion assuming USBR 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 ground-water 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 USBR 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.

Three New Alternatives:

The three new alternatives identified for analysis are described as follows:

5A. Operations under the proposed CalTrout Alternative 3A2 during wet and above-normal water year types, with operations under the Biological Opinion during below-normal, dry and critical water year types, assuming USBR achieves a 3.0-foot surcharge, except that releases for fish rearing and passage will be provided with current 0.75-foot surcharge.

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

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

2B. MODIFICATION OF FLASHBOARDS FOR 3-FOOT SURCHARGE

Historically, Cachuma Reservoir was filled to the lake elevation of 750 feet with the one-foot flashboards providing freeboard at the top of the four radial gates. In year 1998, USBR used 0.75 feet of the flashboards to increase the reservoir storage to a new elevation of 750.75 feet, leaving 0.25 feet of freeboard when the four radial gates at the spillway were closed. Similarly, USBR surcharged the reservoir by about 0.75 feet in years 2000 and 2001.

USBR replaced the one-foot flashboards with 4-foot flashboards in 2004. The new flash boards were constructed as extensions at the top of existing radial gates. The new flashboards will be used to surcharge 3.0 feet of storage above the historical lake elevation of 750 feet while providing one foot of freeboard.

In February 2004, County of Santa Barbara (County), Cachuma Conservation Release Board (CCRB), Improvement District No. 1 (ID No. 1), and Santa Barbara County Water Agency (SBCWA) entered into a Memorandum of Understanding (MOU) on the reservoir surcharge and recreational resources at the lake. The MOU allowed USBR to surcharge

Cachuma Reservoir by 1.8 feet after April 1, 2004. The County agreed to modify the boat launch ramp to raise it to 751.8 feet elevation prior to that date. USBR was allowed to surcharge the reservoir by 3.0 feet five years from the execution of the MOU or upon relocation of the County park's water treatment plant and associated facilities, whichever occurs first.

With the storm events of late December 2004 and early January 2005, Cachuma Reservoir spilled on January 10, 2005. The winter storm operations at Bradbury Dam provided an opportunity to observe the lake elevation near 753 feet in relation to the County park facilities. On January 14, 2005, a survey of the water treatment plant, intake facility and boat launch area was undertaken by Stetson Engineers while the lake elevation was held at 753.1 feet. Based on the results of January 14, 2005 survey, the parties agreed to revise the February 2004 MOU. According to the revised MOU (2005), CCRB and ID No. 1 agreed to construct a barrier (gabion) to protect water treatment plant from damage due to potential wave run-up. The revised MOU allowed USBR to raise the lake elevation to 752.47 starting in 2005. The revised MOU also provided that the County will complete the modification of the boat launch ramp to accommodate the lake elevation of 753.0 feet by February 14, 2009.

With the surcharge of Cachuma Reservoir to 2.47 feet (actual surcharge was 2.32 feet) in 2005, USBR and Cachuma Member Unites (CCRB and ID No. 1) have initiated releases to meet the long-term flow requirements under the Biological Opinion, which are set for the 3.0-foot surcharge. As a result of above events, the reservoir was not operated under the 1.8-foot surcharge.

The SWRCB staff has indicated that Alternative 2 is the baseline for the CEQA analysis and provides a conservative representation of existing conditions for the water supply impact analysis in this technical memorandum (7/22/05). The surcharge analyses for 1.8 feet (Alternative 3B) and 3.0 feet (Alternative 3C) would provide a range for the 2.47-foot surcharge for the purpose of impact evaluation. The SWRCB staff has requested to delete Alternatives 1 and 3A because those conditions do not exist any more (6/9/05). Similarly, the new Alternative 5A is deleted. The SWRCB staff has also requested (6/9/05) to delete Alternative 4A because the City of Lompoc is not agreeable to this arrangement which makes the alternative infeasible.

In light of the present surcharge, the SWRCB staff has requested to undertake a sensitivity analysis in relation to the 2.47-foot surcharge (8/2/05). The results of sensitivity analysis are presented in Section 4 of this technical memorandum.

2C. MODELING OF ALTERNATIVES

The SYRHM was utilized for the hydrologic analysis of the alternatives. Stetson's Technical Memoranda (Dec. 2000, revised Dec. 2001) provide an overview of the SYRHM and modeling results prepared for the SWRCB Draft EIR (August 2003) which included hydrologic analyses for the seven alternatives (Alternatives 1, 2, 3A, 3B, 3C, 4A and 4B). The model documentation is provided in the "Santa Ynez River Hydrology Model Manual" dated April 2004.

The proposed releases from Cachuma Reservoir for fish in the Draft EIR alternatives (Alternatives 3A, 3B, 3C, 4A and 4B) are based on the Biological Opinion by the National Marine Fisheries Service (NOAA Fisheries) (Sep. 2000) and the Lower Santa Ynez River Fish Management Plan (FMP) (Oct. 2000). According to the Biological Opinion, these long-term releases would begin when the reservoir is surcharged 3.0 feet as shown in Table 1.

TABLE 1
PROPOSED PROJECT REARING TARGET FLOWS

Lake Storage Conditions (acre-feet)	Reservoir Spill? (AF = acre-feet)	Long Term Target Flow (cfs)	Long Term Target Site
> 120,000	Spill is greater than 20,000 AF	10[1]	Highway 154
> 120,000	Spill is greater than 20,000 AF	1.5 (if steelhead present)[2]	Alisal Road
> 120,000	No spill or spill is less than 20,000 AF	5	Highway 154
> 120,000	If spill greater than 20,000 AF in previous year	1.5 (if steelhead present)[2]	Alisal Road
30,000 - 120,000	No spill	2.5	Highway 154
< 30,000	No spill	Periodic release; < or = 30 AF/month[3]	Stilling basin & long pool

[1]*Only up to 10 cfs will be released from Cachuma Reservoir to meet target flows if reservoir is not spilling or WR 89-18 releases are not being made.*

[2]*Only if steelhead are present in the Alisal Reach.*

[3]*Reclamation must also consult with NMFS in this situation.*

In addition to the above long-term flow targets, the Biological Opinion requires a 2 cfs target flow in Hilton Creek as part of the terms and conditions to implement reasonable and prudent measure No. 2. Once the 3.0-foot surcharge is achieved, an additional amount of about 9,200 acre-feet of water will be stored in Cachuma Reservoir. According to the Biological Opinion, up to 3,200 acre-feet of the surcharge will be dedicated to the fish passage account and 500 acre-feet will be allocated to the adaptive management account. The remaining surcharge water (5,500 acre-feet) will be dedicated for the mainstem rearing target flows. The water in these two accounts is allowed to carryover from one year to the next; however, the accounts are deemed to spill first and are then reset to their maximum amount of 3,700 acre-feet. Water in the passage account would be used to supplement naturally occurring storms by augmenting the descending limb of the storm hydrograph in the Santa Ynez River downstream of Bradbury Dam.

The variation in the possible Cachuma Operations Alternatives 5B and 5C from the Draft EIR Alternatives 3B and 3C operations for fish and downstream habitat is the incorporation of the release criteria under the proposed CalTrout Alternative 3A2 during wet and above-normal year types. The origin of the CalTrout Alternative 3A2 is from the Cachuma Contract Renewal EIS/EIR (1995). The 1995 EIS/EIR describes Alternative 3A2 as follows (pg. 6.1-11):

> **Alternative 3A2** involves operation of Lake Cachuma with releases to maintain the following minimum streamflows at selected locations downstream of the dam in order to improve steelhead habitat and general aquatic and riparian habitat conditions.
>
> - 48 cfs 15 February to 14 April, then
> - 20 cfs to 1 June, then
> - 25 cfs for one week, then
> - Ramp releases to 10 cfs by 30 June, then
> - Hold at 10 cfs to 1 October, then
> - 5 cfs for the rest of the year.
>
> Under this alternative, the above flows are to be maintained at both San Lucas and Alisal bridges. These flows would be created by both natural streamflow and releases from the dam.

Figure 1 shows the flow requirements under Alternative 3A2. Please note that the rearing flow targets under Alternative 3A2 for July to January are similar to the long-term targets of the BO/FMP in a spill year (spill of greater than 20,000 acre-feet) in which rearing flows would be 10 cfs after the spill and then 5 cfs starting in the next water year when the storage in Cachuma Reservoir remains above 120,000 acre-feet. However, Alternative 3A2 has these flow requirements (10 and 5 cfs) at both the Highway 154 Bridge (San Lucas Bridge) and the Alisal Bridge, while the long-term BO/FMP has these flow requirements at the Highway 154 Bridge with 1.5 cfs flows at Alisal Bridge in the spill year and year after spill. Other major differences between Alternative 3A2 releases and the long-term BO/FMP releases are that the BO/FMP fish flow targets at the Highway 154 Bridge drop to 2.5 cfs (no target requirements at the Alisal Bridge) when Cachuma storage recedes below 120,000 acre-feet. The long-term BO/FMP uses a different strategy for passage flows for steelhead. The operating criteria under Alternative 3A2 use steady releases for passage regardless of the occurrence of storm events while the long-term BO/FMP plan for passage releases is based on augmenting the descending limb of a storm hydrograph in non-spill years and non-dry years.

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

2D. DESCRIPTION OF ALTERNATIVES 5B AND 5C

The new Alternatives 5B and 5C are variants of the CalTrout Alternative 3A2. These alternatives would operate under two different sets of hydrologic conditions for releases of water from Cachuma Reservoir for fish. In years when the runoff condition is determined to be wet or above normal, the criteria for fish water releases would be based on the proposed CalTrout Alternative 3A2. In other years when the runoff condition is determined to be below normal, dry, or critical, the criteria for fish water releases would be under the long-term BO/FMP. The attempt is to reduce the impacts to water supplies by switching to the long-term BO/FMP operating criteria in years of below-normal, dry, and critical runoff conditions. In years of wet and above-normal runoff conditions, the releases would be under the proposed CalTrout 3A2 operating criteria.

2E. SANTA YNEZ RIVER HYDROLOGIC YEAR CLASSIFICATION

The water year hydrologic classification for the Santa Ynez River is based on inflows to Cachuma Reservoir for the period 1918-1993 (76 years). Cachuma Reservoir inflows are from the SYRHM used in the analysis of the Draft EIR alternatives. The water year types are defined consistent with the SWRCB classification method and Cachuma Reservoir inflows are used as an index for water year classification. Figure 2 shows a frequency analysis of Cachuma Reservoir inflows, which includes operations of Jameson and Gibraltar and 50% cloud seeding. Water year classification was conducted to determine five water-year types based on roughly twenty-percentile grouping of ranked data. The developed five-water year types are shown in Table 2 below:

TABLE 2
CACHUMA RESERVOIR INFLOW INDEX FOR WATER YEAR CLASSIFICATION

Water Year Classification	Index (Cachuma Reservoir Inflow) (AF)
Wet	Greater than 117,842
Above Normal	Equal to or less than 117,842 and greater than 33,707
Below Normal	Equal to or less than 33,707 and greater than 15,366
Dry	Equal to or less than 15,366 and greater than 4,550
Critical	Equal to or less than 4,550

2F. MODEL ANALYSIS OF ALTERNATIVES 5B AND 5C

For the purpose of modeling the new Alternatives 5B and 5C, the following reservoir operating criteria had to be programmed in the SYRHM. Once the cumulative annual inflow into Cachuma Reservoir exceeds 33,707 acre-feet, then the proposed CalTrout Alternative 3A2 flows shown in Figure 1 would become the operating criteria for fish water releases. Figure 3 shows the SYRHM operating criteria for fish water releases from Cachuma Reservoir for the possible new Alternatives 5B and 5C. Please note that at the beginning of a water year, it is not known what type of water year it would be, so Alternative 3A2 flows would be triggered when the cumulative Cachuma inflow (from October 1) of 33,307 acre-feet is reached. For example, based on the SWRCB classification the water year 1991 would be classified as an above-normal year, but until the March "Miracle" storm, it was not known whether that year would be above normal. The March storm also occurred at the end of a long drought period in the late 80s and early 90s. Table 3 shows the months in which the runoff conditions for wet and above-normal year types are met. The probability of reaching the wet or above-normal year classification is highest in the month of February. According to Table 3, about 70% of these year classes (wet or above-normal) would be known by February or earlier.

TABLE 3
NUMBER OF OCCURRENCES OF WHEN INFLOW INTO CACHUMA RESERVOIR REACHES WATER YEAR WET/ABOVE-NORMAL CLASSIFICATION (>33,707 AF)

Month	Occurrence (1918-1993)	Frequency Percentage
Dec	2	6%
Jan	7	23%
Feb	13	42%
Mar	4	13%
Apr	4	13%
May	1	3%
Total	**31**	**100%**

At all other times when the cumulative inflow (from October 1) to Cachuma Reservoir has not reached the wet or above-normal year classification, the operating criteria for fish water releases in Alternatives 5B and 5C would be the same as the long-term BO/FMP. These criteria are based on meeting the Highway 154 Bridge target flows of 5.0 cfs when storage is greater than 120,000 acre-feet and 2.5 cfs when storage is less than 120,000 acre-feet. Releases would still be limited to 30 acre-feet per month when storage is less than 30,000 acre-feet. Also there would still be the minimum target flow of 2 cfs in Hilton Creek, the 1.5 cfs target flow at Alisal Bridge in the year after a spill year of 20,000 acre-feet or greater, and the passage and adaptive management accounts of 3,700 acre-feet. The new alternatives (Alternatives 5B and 5C) have the same criteria for releases for fish, except that under Alternatives 5B and 5C, Cachuma Reservoir would be surcharged to 1.8 feet and 3.0 feet, respectively (similar to the Draft EIR Alternatives 3B and 3C). Aside from the above changes in the criteria for releases of fish water from Cachuma Reservoir, all other modeling assumptions and limitations in the SYRHM are the same for these new Alternatives 5B and 5C. The model analysis for Alternatives 5B and 5C is consistent with the previous hydrologic analyses performed for the August 2003 SWRCB Draft EIR.

3. SYRHM RESULTS

3A. CACHUMA RESERVOIR OPERATIONS

Key hydrologic characteristics of Cachuma Reservoir operations for the new Alternatives 5B and 5C as well as the Draft EIR Alternatives 2, 3B, 3C, and 4B are shown in Table 4 for the hydrologic period 1918-1993. Table 4 shows that on average over the 76-year period, the total amount of water discharged from Cachuma Reservoir, as spills and leakage, water right releases, and releases for fish, is relatively the same (except for Alt. 4B) or with less than 2% variation. For example, the total discharge from Bradbury Dam on average ranges from 43,867 to 44,167 acre-feet per year in Alternatives 3B and 3C and ranges from 44,092 to 44,388 acre-feet per year in Alternatives 5B and 5C. Table 4 indicates that more low flow releases (fish water) would result in less spills or high flow releases. The reduction in spills is relatively small compared with the overall magnitude of spills. Table 4 also shows that the number of spill years slightly decreases for the Alternatives 5B and 5C to 23 years (30% of years) compared with the DEIR Alternatives 3B and 3C of 25 spill years (33% of years). Significant spill years with spills greater than 20,000 acre-feet are the same at 15 years (20% of years).

Figures 4a through 4b show the frequency of releases and spills from Cachuma Reservoir. Figures 4a-b indicate that comparative differences between the Alternative 3B-C series and Alternative 5B-C series are the same. The frequency of releases and spills for Alternatives 5B and 5C are basically the same as the DEIR Alternatives 3B and 3C during low flow periods because they operate under the same criteria for releases for fish. As shown on Figures 4a-b, the frequency of releases for the 7-20 cfs range would increase under Alternatives 5B and 5C compared to the long-term BO/FMP alternatives (Alternatives 3B and 3C). This is attributed to the higher flow requirements under Alternatives 5B and 5C. Project releases for fish (not including conjunctive use of spills, leakage, and water rights) would be increased on average from about 2,700 acre-feet per year in the DEIR Alternatives 3B and 3C to about 4,000 acre-feet per year in the new Alternatives 5B and 5C (Table 4).

Table 5 displays key frequencies for spills and downstream releases from Cachuma Reservoir. Frequency of occurrence of releases and spills at or above 10 cfs increases by about 10% in Alternatives 5B and 5C compared to Alternatives 3B and 3C. The frequency of releases and spills of 5 cfs or above is similar between Alternatives 3B and 3C and Alternatives 5B and 5C, which would be expected since Alternatives 5B and 5C would switch to the operating

TABLE 4
(DEIR TABLE 4-7, AUGUST 2003)
KEY HYDROLOGIC CHARACTERISTICS OF CACHUMA RESERVOIR OPERATIONS
BASED ON SYRHM, 1918-1993

Parameter	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and with 3' surcharge
Average spills/leakage (AFY)	36,693	35,784	35,415	35,288	34,916	34,537
Average 89-18 releases (AFY)	6,023	5,682	5,737	3,940	5,473	5,529
Average fish releases (AFY)	1,362	2,701	2,715	2,801	3,999	4,026
Total discharges from the dam (AFY)	44,078	44,167	43,867	42,029	44,388	44,092
No. of spill months	82	79	78	74	75	74
No. of spill water years	26	25	25	24	23	23
No. of spill water years > 20,000 acre-feet	16	15	15	15	15	15

TABLE 5
(DEIR TABLE 4-8, AUG. 2003)
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 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
2	99	99	99	99	99	99
5	42	67	68	68	68	69
10	30	36	36	34	45	45
20	26	27	27	24	31	31
50	13	12	12	8	12	12

criteria under Alternatives 3B and 3C in years when the runoff conditions are below normal, dry, or critical.

3B. LAKE STORAGE AND ELEVATION

In the modeling analysis, the minimum storage level (minimum pool) in Cachuma Reservoir for all alternatives is 12,000 acre-feet. The minimum storage condition would occur during the critical drought period (1947-1951). Due to several concerns, including recreation, aesthetics, inundation of Lake Cachuma facilities, Hilton Creek siphon and Tecolote Tunnel intake valves, the reservoir water surface elevation and duration of the 3.0' surcharge were analyzed. Tables 6 and 7 summarize median Lake Cachuma storage and elevation for each alternative. Tables 8, 9, and 10 characterize the frequency of surcharging and the duration of inundation.

3C. SANTA YNEZ RIVER FLOWS

As indicated above (Section 3A), since the comparative differences between the Alternatives 3B-C series and the Alternatives 5B-C series are the same (Figures 4a-c), the flow frequency graphs for the downstream locations show Alternative 3C and Alternative 5C for the purpose of comparison. Figures 5a through 5f show the frequency of flows at six different locations downstream of Cachuma Reservoir for various alternatives based on the SYRHM results. Table 11 shows the frequency of flows in tabular format. Alternative 5C, when compared to Alternative 3C, would result in an increase in frequency of flows between 5 and 50 cfs by about 0 to 12 percent of the time in the reach from Bradbury Dam to Alisal Bridge. The increase in the frequency of flows between 5 and 50 cfs would be about 0 to 8 percent for the reach below Alisal Bridge to the Lompoc Narrows. Monthly flows for Alternatives 5B and 5C at various locations in the Santa Ynez River for the period 1918-1993 are included in Appendix A.

TABLE 6
(DEIR TABLE 4-2, AUG. 2003)
MEDIAN MONTHLY STORAGE IN CACHUMA LAKE (SIMULATION, 1918-1993)
(ACRE-FEET)

Month	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8’ surcharge	Alt 3C: BO with 3’ surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8’ surcharge	Alt 5C: "3A2"/BO and 3’ surcharge
November	130,484	132,602	136,080	135,135	126,831	130,324
February	152,394	150,918	154,607	154,660	149,466	152,943
April	165,533	165,018	167,877	169,135	162,685	166,287
July	146,851	149,528	153,067	154,840	144,258	147,788
					Difference with Alt 3B	**Difference with Alt 3C**
				November	-5,772	-5,756
				February	-1,452	-1,664
				April	-2,334	-1,591
				July	-5,270	-5,279

TABLE 7
(DEIR TABLE 4-3, AUG. 2003)
MEDIAN LAKE LEVEL (SIMULATION, 1918-1993)
(FEET)

Month	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
Annual	733.7	733.3	734.6	735.2	732.5	733.7
Feb	737.2	736.7	738.1	738.1	736.1	737.4
Aug	732.2	733.6	735.0	735.2	731.4	733.0
					Difference with Alt 3B	**Difference with Alt 3C**
				Annual	-0.8	-0.9
				Feb	-0.6	-0.6
				Aug	-2.1	-2.0

TABLE 8
(DEIR TABLE 4-4, AUG. 2003)
FREQUENCY OF SURCHARGING
NO. OF YEARS SURCHARGING PREDICTED TO OCCUR IN 76-YEAR PERIOD (SIMULATION, 1918-1993)

Elevation (feet)	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
750-750.9	26	26	27	27	26	27
751-751.9		25	26	26	26	26
752-752.9			26	26		26
= or > 753			25	24		23

TABLE 9
(DEIR TABLE 4-5, AUG. 2003)
PERCENTAGE OF TIME THAT LAKE ELEVATIONS ARE MET OR EXCEEDED (SIMULATION, 1918-1993)

750	11%	14%	16%	16%	13%	16%
751		11%	14%	14%	11%	13%
752			11%	11%		11%
753			9%	8%		8%

TABLE 10
(DEIR TABLE 4-6, AUG. 2003)
DURATION OF INUNDATION
MEDIAN NUMBER OF CONSECUTIVE MONTHS AT OR ABOVE LAKE ELEVATION (SIMULATION 1918-1993)

750	4	5	5	5	5	5
751		4	5	5	4	5
752			4	4		4
753			3	3		3

TABLE 11
(DEIR TABLE 4-9, AUG. 2003)
STREAMFLOWS DOWNSTREAM OF CACHUMA LAKE

Location	cfs	Percentage of Time that Flows are at or above the Indicated Flow (simulation, 1918-1993)					
		Alt 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
Below Hilton Creek	2	99	99	99	99	99	99
	5	47	74	75	75	74	75
	10	33	39	39	37	48	48
	20	26	28	28	24	32	32
	50	13	12	12	8	12	12
Highway 154	2	82	99	99	99	99	99
	5	48	77	78	78	76	77
	10	34	39	39	37	49	49
	20	27	28	28	25	33	33
	50	12	12	12	8	11	11
Above Alisal Road	2	53	69	69	69	70	71
	5	43	49	49	47	56	56
	10	34	36	36	34	48	48
	20	23	25	25	18	28	28
	50	12	12	12	10	11	12
Near Buellton	2	51	57	57	56	61	61
	5	41	44	44	42	52	52
	10	32	34	34	29	38	38
	20	24	26	26	18	28	28
	50	12	12	12	12	12	12
Above Salsipuedes Creek	2	39	42	43	36	48	48
	5	35	37	37	29	40	40
	10	30	32	32	25	35	35
	20	25	26	26	19	29	29
	50	12	13	13	12	12	12
Narrows	2	45	48	48	40	52	53
	5	38	41	41	33	44	44
	10	33	35	35	27	38	38
	20	28	29	29	21	31	31
	50	14	14	14	14	14	14

3D. Groundwater Storage in the Above Narrows Alluvial Basin

Percolation into the above Narrows alluvial basin would tend to increase when there are more releases during low flow periods. The effect on the Santa Ynez sub-basin (Bradbury to Alisal Bridge) is more pronounced. Table 12 shows the dewatered storage in the above Narrows alluvial basin for each of the alternatives.

3E. Water Rights Releases (WR 89-18)

Table 13 shows the impacts to water rights releases for the various alternatives as determined by the Santa Ynez River Hydrology Model. The average annual reductions in water rights releases under various alternatives are compared to Alternative 2 (CEQA baseline). The reduction in the downstream water rights releases under Alternatives 3B and 3C would be about 5-6 percent. The reduction would be about 8-9 percent under Alternatives 5B and 5C.

Table 13
Simulated Impacts to Average Water Rights Releases for Water Years 1918-1993 (acre-feet/year)

Water Rights Releases	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8’ surcharge	Alt 3C: BO with 3’ surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8’ surcharge	Alt 5C: "3A2"/BO and 3’ surcharge
WR 89-18 Releases	6,023	5,682	5,737	5,711	5,473	5,529
Difference in WR 89-18 Releases from Alt 2	---	-341	-286	-312	-550	-494
Percent Reduction in WR 89-18 Releases from Alt 2	---	-5.7%	-4.7%	-5.2%	-9.1%	-8.2%

TABLE 12
(DEIR TABLE 4-27, AUG. 2003)
MONTHLY DEWATERED STORAGE IN THE ABOVE NARROWS ALLUVIAL GROUNDWATER BASIN
(ACRE-FEET)

	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
Entire Basin						
Mean	10,769	10,310	10,281	10,240	10,146	10,131
Median	10,517	10,099	10,081	10,031	9,852	9,840
% Difference Relative to Alt 2	---	-4%	-4%	-5%	-6%	-6%
Minimum	2,324	2,315	2,315	2,311	2,315	2,315
Santa Ynez Subarea						
Mean	1,926	1,722	1,704	1,647	1,684	1,683
Median	1,769	1,606	1,584	1,510	1,553	1,547
% Difference Relative to Alt 2	---	-9%	-10%	-15%	-12%	-13%
Minimum	0	0	0	0	0	0
Buellton Subarea						
Mean	5,634	5,482	5,471	5,438	5,435	5,432
Median	5,570	5,449	5,442	5,382	5,363	5,360
% Difference Relative to Alt 2	---	-2%	-2%	-3%	-4%	-4%
Minimum	2,166	2,167	2,153	2,144	2,168	2,169
Santa Rita Subarea						
Mean	3,244	3,105	3,105	3,155	3,027	3,016
Median	3,080	2,981	2,978	3,105	2,870	2,867
% Difference Relative to Alt 2	---	-3%	-3%	1%	-7%	-7%
Minimum	0	0	0	0	0	0

3F. CACHUMA PROJECT DELIVERIES

The results of SYRHM analysis indicate that Alternatives 5B and 5C would produce greater shortages in Cachuma Project water supply during drought periods in comparison with Alternative 2, CEQA baseline (Table 14). The results of modeling analysis also indicate that the new Alternatives 5B and 5C would produce greater shortages in the Cachuma Project water supply compared to DEIR Alternatives 3B and 3C, respectively. Impacts on Project deliveries to Member Units are shown in Table 14 for the various alternatives. Table 14 shows that in the critical drought year (1951) shortages in Cachuma Project water supply would be 9,810 acre-feet for Alternative 2. The shortages in the critical drought year would increase to 11,260 acre-feet and 9,890 acre-feet under the DEIR Alternatives 3B and 3C, respectively. Table 14 also indicates that shortages in the critical drought year would be further increased under the new Alternatives 5B and 5C to 12,510 acre-feet and 11,410 acre-feet, respectively.

During the last three years of the critical drought period (1949-1951), the cumulative shortages under the new Alternatives 5B and 5C would be increased to 26,660 acre-feet and 23,810 acre-feet, respectively, compared to the DEIR Alternatives 3B and 3C with the three-year cumulative shortages of 23,370 acre-feet, and 19,920 acre-feet, respectively. Table 14 also indicates that the frequency of years with shortages greater than 10% increases under Alternatives 5B and 5C.

Simulated monthly Cachuma Project deliveries for Alternative 5B and 5C for the period 1918-1993 are included in Appendix B. Simulated monthly Cachuma Project shortages for Alternative 5B and 5C for the period 1918-1993 are included in Appendix C.

TABLE 14
(DEIR TABLE 4-16, AUG. 2003)
IMPACTS ON CACHUMA PROJECT DELIVERIES TO MEMBER UNITS

Water Supply Parameter	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8' surcharge	Alt 3C: BO with 3' surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
Average Annual Deliveries and Years of Shortages (1918-1993)						
Average annual delivery (afy)	25,115	24,986	25,122	25,169	24,855	24,988
Difference compared to Alt 2 (afy)	---	-129	7	54	-260	-127
Number of years with 10% or more shortage	6	7	6	6	8	7
Number of years with 10% or more shortage – difference from Alt 2	---	1	0	0	2	1
Critical Drought Year (based on 1951 drought year)						
Shortage (af)	9,808	11,262	9,895	9,351	12,506	11,406
% Shortage in Cachuma deliveries	38%	44%	38%	36%	49%	44%
% Shortage in Cachuma deliveries – difference from Alternative 2	---	6%	0%	-2%	10%	6%
Critical 3-Year Drought Period (based on 1949-51 drought)						
Shortage (af)	20,134	23,373	19,925	17,467	26,659	23,806
% Shortage in Cachuma deliveries	26%	30%	26%	23%	35%	31%
% Shortage in Cachuma deliveries – difference from Alternative 2	---	4%	0%	-3%	8%	5%

Based on Project draft of 25,714 acre-feet per year.
Cumulative shortage in critical drought period based on 36 consecutive months starting in May 1949.

3G. MEMBER UNITS WATER SUPPLY IN CRITICAL DROUGHT

Table 15 shows the Member Units' supply and demand in the critical drought year (1951) which include Member Units' demands and supplies from sources other than the Cachuma Project. The source of data for demand and water supplies other than the Cachuma Project is from the water supply managers. Tables 16, 17, and 18a-e are the updates to the Draft EIR Tables 4-18, 4-19, 4-20, 4-21, 4-22, 4-23, and 4-24 which provide the source data for Table 15 (EIR Table 4-17). The Member Units' water supply from the Cachuma Project in the critical drought year (1951) as shown in Tables 18a-e is based on Alternative 5B, because the water supply impacts were greatest under this alternative. The total supply from other sources for the Member Units includes groundwater pumping which would not be sustainable on a long term basis, the maximum capacity of the desalinization plant, and 50 percent delivery of State Project water (Table A and CCWA drought buffer). Table 15 shows that Alternatives 5B and 5C will increase the water supply impacts in the critical drought year (1951) and the shortages already associated with the steelhead fish water releases under the Biological Opinion.

Tables 19a-b (EIR Table 4-25) show the Member Units' supply and demand during the critical three-year drought period (1949-1951) for DEIR Alternatives 3B and 3C and the new Alternatives 5B and 5C. Local groundwater is based on the critical drought year supply with a 0.8 reduction factor, except for ID No. 1 river wells which are based on simulated water levels (dewatered storage). State Water Project import supply is based on 50 percent delivery (Table A and CCWA drought buffers). Based on data provided by the water supply managers, the desalinization plant for the City of Santa Barbara would operate only in the critical drought year of 1951 in the three-year drought period (1949-1951). The comparisons in Tables 19a-b indicate that the additional releases for fish under Alternatives 5B and 5C would further increase water shortages for both current demand and planned growth future water demands.

TABLE 15
(DEIR TABLE 4-17, AUG. 2003)
MEMBER UNITS' SUPPLY AND DEMAND IN CRITICAL DROUGHT YEAR (1951)
(ACRE-FEET)

Parameter	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8’ surcharge	Alt 3C: BO with 3’ surcharge	Alt 4B: BO with SWP delivery to Lompoc	Alt 5B: "3A2"/BO and 1.8’ surcharge	Alt 5C: "3A2"/BO and 3’ surcharge
Cachuma Project Yield	15,906	14,452	15,819	16,363	13,208	14,308
Total Supply From Other Sources (includes CCWA drought buffer)	31,312	31,312	31,312	31,312	31,312	31,312
Total Supply	47,218	45,764	47,131	47,675	44,520	45,620
Year 2000 demand	46,007	46,007	46,007	46,007	46,007	46,007
Surplus or shortage	1,211	-243	1,124	1,668	-1,487	-387
Year 2020 demand	56,287	56,287	56,287	56,287	56,287	56,287
Surplus or shortage	-9,069	-10,523	-9,156	-8,612	-11,767	-10,667

TABLE 16
(DEIR TABLE 4-18, AUG. 2003)
MEMBER UNITS' SUPPLY FROM SOURCES OTHER THAN CACHUMA PROJECT IN CRITICAL DROUGHT YEAR (1951)
(ACRE-FEET)

CVWD	
1. Local groundwater supply (Table 18a)	4,650
MWD	
2. Jameson Lake and Alder Creek diversions (SYRHM simulation, DEIR Appendix E)	312
3. Doulton Tunnel infiltration and Fox Creek diversion (SYRHM simulation, DEIR Appendix E)	130
4. Local groundwater supply (Table 18b)	400
5. MWD subtotal	842
City of Santa Barbara	
6. Gibraltar Reservoir (SYRHM simulation, DEIR Appendix E)	0
7. Mission Tunnel infiltration and Devil Canyon diversions (SYRHM simulation, DEIR Appendix E)	500
8. Jameson Reservoir (Table 18c)	300
9. Local groundwater supply (Table 18c)	4,150
10. Reclaimed water (Table 18c)	900
11. Desalinization (Table 18c)	3,125
12. City of SB subtotal	8,975
GWD	
13. Local groundwater supply (Table 18d)	2,350
14. Reclaimed water (Table 18d)	1,500
15. GWD (subtotal)	3,850
SYRWCD, ID No. 1	
16. Local groundwater supply (Table 18e)	2,320
17. Santa Ynez River Diversion (Table 18e)	1,450
18. SYRWCD, ID No. 1 subtotal	3,770
19. State Water Project delivery (assume 50% of Table A + buffer)	9,225[1)]
20. Total Supply for sources other than Cachuma Project	**31,312**

1) Includes SWP delivery to Solvang under a water supply contract with ID No. 1.

TABLE 17
(DEIR TABLE 4-19, AUG. 2003)
MEMBER UNITS' DEMAND IN ACRE-FEET

Member Unit	Year 2002	Year 2020
Carpinteria Valley Water District	4,300[1]	5,833
Montecito Water District	6,073[2]	6,835
City of Santa Barbara	14,342	18,200[3]
Goleta Water District	14,000	17,300
Santa Ynez River Water Conservation District, ID No. 1	7,292[4]	8,119[4]
Total	**46,007**	**56,287**

[1] *Represents year 2001*

[2] *Represents year 2000*

[3] *Represents year 2009*

[4] *Includes 1,500 AFY of SWP allocated to City of Solvang under a water supply contract.*

TABLE 18A
(DEIR TABLE 4-10, AUG. 2003)
WATER SUPPLY AND DEMAND - CARPINTERIA VALLEY WATER DISTRICT [1)]

	Normal Year	Critical Drought Year [2)]	Comment
	(acre-feet per year)		
Supplies			
Cachuma Project	2,813	1,445	Fixed percentage of Cachuma Project yield. Cachuma represents 38% of total supply
State Water Project	1,650	1,100	SWP Table A amount is 2,000 AFY plus 200 AFY of CCWA drought buffer; CVWD assumes 75% average annual delivery and 50% during droughts
Local groundwater	3,000	4,650	Share of local groundwater basin
Total	**7,463**	**7,195**	
Demand			
Current (2001)	4,300		Approx. 50% for agricultural use
Planned Future (2020)	5,833	6,819	Because of agricultural needs, assumes higher demand in drought

1) *Sources: CVWD (2001 and C. Hamilton, Gen. Manager, 2003)*

2) *Based on simulation of Alternative 5B from the Santa Ynez River Hydrology Model (SYRHM).*

TABLE 18B
(DEIR TABLE 4-11, AUG. 2003)
WATER SUPPLY AND DEMAND – MONTECITO WATER DISTRICT [1)]

	Normal Year	Critical Drought Year [2)]	Comment
	(acre-feet per year)		
Supplies			
Cachuma Project	2,651	1,362	Fixed percentage of Cachuma Project yield. Cachuma represents 35% of total supply
Jameson Lake, Fox and Alder creeks	2,000	312	Diversions on the upper Santa Ynez River. Drought year values are from SYRHM.
Doulton Tunnel	375	130	Drought year values are from SYRHM.
State Water Project	2,280	1650	SWP Table A amount is 3,000 AFY plus 300 AFY of CCWA drought buffer; MWD assumes 76% average annual delivery of Table A amount
Local groundwater	200	400	District's portion of Montecito Groundwater Basin's safe yield of 1,650 AFY. Maximum pumping is 400 AFY.
Total	**7,506**	**3,854**	
Demand			
Current (2000)	6,073		12% is losses and transfers to City of S.B (300 AF).
Planned Future (2020)	6,835		Slight increase in all uses, allows for reserve

1) *Sources: MWD (2001 and T. Mosby, Operations Manager, 2003).*

2) *Based on simulation of Alternative 5B from the Santa Ynez River Hydrology Model (SYRHM).*

TABLE 18C
(DEIR TABLE 4-12, AUG. 2003)
WATER SUPPLY AND DEMAND – CITY OF SANTA BARBARA [1)]

	Normal	Critical Drought Year [2)]	Comment
	(acre-feet per year)		
Supplies			
Cachuma Project	8,277	4,251	Fixed percentage of Cachuma Project yield. Cachuma represents 45% of total supply
Gibraltar Reservoir and Devils Canyon	4,310	0	
Mission Tunnel	1,109	500	Infiltration; tunnel from Gibraltar Reservoir
Juncal Reservoir	300	300	Water from Montecito Water District per prior agreement
State Water Project	2,200	1,650	SWP Table A amount is 3,000 AFY plus 300 AFY of CCWA drought buffer. The City assumes 75% average annual delivery of Table A amount.
Local groundwater	1,104	4,150	City's portion of the Santa Barbara Groundwater Basin's safe yield of about 1,850 AFY; used for seasonal peaking and to replace surface water shortages due to drought
Reclaimed water	900	900	
Desalinization	0	3,125	For use only during emergency. Currently in storage mode. Max. capacity = 3,125 AFY
Total	**18,200**	**14,876**	
Demand			
Current (2002)	14,342		
Planned Future (2009 per LTWSP)	18,200		

1) *Source: City of Santa Barbara (2000; 1994 adopted Long Term Water Supply Program; and S. Mack, City Water Supply Manager, 2003)*
2) *Based on simulation of Alternative 5B from the Santa Ynez River Hydrology Model (SYRHM).*

TABLE 18D
(DEIR TABLE 4-13, AUG. 2003)
WATER SUPPLY AND DEMAND – GOLETA WATER DISTRICT [1)]

	Normal	Critical Drought Year [2)]	Comment
	(acre-feet per year)		
Supplies			
Cachuma Project	9,321	4,788	Fixed percentage of Cachuma Project yield; Cachuma represents about 53% of total supply
State Water Project	4,500	3,725	SWP Table A amount is 7,000 AFY plus 450 AFY of CCWA drought buffer. The District assumes 60 percent average annual delivery of Table A amount and drought buffer and 50 percent during drought. The District's right to CCWA facility capacity is 4,500 AFY.
Local groundwater	2,350	2,350	District's portion of the Goleta Basin. Safe yield estimated at 3,410 AFY.
Reclaimed water project	1,500	1,500	Approximate capacity of built out project. Current production is approximately 1,000 AFY.
Total	**17,671**	**12,363**	
Demand			
Current (2000)	14,000		Includes approximately 1,000 AFY of recycled water
Planned Future (2020)	17,300		Includes approximately 1,500 AFY of recycled water

1) *Sources: GWD (2001 and K Walsh, GWD General Mgr, 2003)*
2) *Based on simulation of Alternative 5B from the Santa Ynez River Hydrology Model (SYRHM).*

TABLE 18E
(DEIR TABLE 4-14, AUG. 2003)
WATER SUPPLY AND DEMAND – SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, ID NO. 1 [1)]

	Normal	Critical Drought Year [2)]	Comment
	(acre-feet per year)		
Supplies			
Cachuma Project	2,651	1,362	Fixed percentage of Cachuma Project. Cachuma Project represents approximately 44% of total supply.
Santa Ynez Uplands Groundwater Basin	1,430	2,320	Production for normal year is based on an average of the last five years (1998-2002) which reflects Well Nos. 3, 4, and 5A remaining out of production (destroyed or water quality problems) and Well No. 7 producing at a reduced rate due to lower water levels. Drought supply is based upon average annual production during the 1987-1991 drought adjusted for Well Nos. 3, 4, and 5A and reduced production from Well No. 7.
Gallery Well	0	0	Currently inactive due to proximity of the river. Maximum permitted diversion is 515 AFY
Santa Ynez River Underflow	1,480	1,450	This is estimate of future maximum production from two permitted well fields
State Water Project	1,650	1,100	SWP Table A amount is 2,000 AFY plus 200 AFY of CCWA drought buffer. District's Table A amount is 500 AFY plus 200 AFY of drought buffer. The remaining 1500 AFY is allocated to the City of Solvang under a water supply contract. District assumes 75% delivery of its 2,200 AFY allocation in normal year and 50% during drought.
Total	**7,211**	**6,232**	
Demand			
Current (2002)	7,292		Includes 1,500 AFY of SWP under contract to City of Solvang
Planned Future (2020)	8,119		Includes 1,500 AFY of SWP under contract to City of Solvang

1) *Source: ID No. 1 (Chris Dahlstrom, ID No. 1 General Mgr, 2003).*

2) *Based on simulation of Alternative 5B from the Santa Ynez River Hydrology Model (SYRHM).*

TABLE 19A
(DEIR TABLE 4-25, AUG. 2003)
MEMBER UNITS' SUPPLY AND DEMAND DURING CRITICAL THREE-YEAR DROUGHT PERIOD (1949-1951)
DRAFT EIR ALTERNATIVE 3B AND NEW ALTERNATIVE 5B

(ACRE-FEET)

	Alt. 3B	Alt. 5B
CVWD		
1. Local groundwater	11,160	11,160
MWD		
2. Jameson Lake and Alder Creek diversions	2,194	2,194
3. Doulton Tunnel infiltration and Fox Creek diversions	432	432
4. Local groundwater	960	960
5. MWD subtotal	3,586	3,586
City of Santa Barbara		
6. Gibraltar Reservoir	4,055	4,055
7. Mission Tunnel infiltration and Devil's Canyon diversion	1,577	1,577
8. Local groundwater	9,960	9,960
9. Reclaimed water	2,700	2,700
10. Desalinization	3,125	3,125
11. City of SB subtotal	21,417	21,417
GWD		
12. Local groundwater and reclaimed water	10,140	10,140
SYRWCD, ID No. 1		
13. Local groundwater and Santa Ynez River diversion	11,823	11,823
14. State Water Project Delivery (assumed 50% of Table A + buffer)	27,675	27,675
15. Cachuma Project yield	53,769	50,483
16. Total Supply in Critical 3-year Period	**139,570**	**136,284**
17. Demand for three-year period based on current demand level	138,021	138,021
18. Difference between 3-year drought supply and current demand	1,549	-1,737
19. Demand for three-year period based on planned future growth	168,861	168,861
20. Difference between 3-year drought supply and planned future growth	-29,291	-32,577

TABLE 19B
(DEIR TABLE 4-25, AUG. 2003)
MEMBER UNITS' SUPPLY AND DEMAND DURING CRITICAL THREE-YEAR DROUGHT PERIOD (1949-1951)
DRAFT EIR ALTERNATIVE 3C AND NEW ALTERNATIVE 5C

(ACRE-FEET)

	Alt. 3C	Alt. 5C
CVWD		
1. Local groundwater	11,160	11,160
MWD		
2. Jameson Lake and Alder Creek diversions	2,194	2,194
3. Doulton Tunnel infiltration and Fox Creek diversions	432	432
4. Local groundwater	960	960
5. MWD subtotal	3,586	3,586
City of Santa Barbara		
6. Gibraltar Reservoir	4,055	4,055
7. Mission Tunnel infiltration and Devil's Canyon diversion	1,577	1,577
8. Local groundwater	9,960	9,960
9. Reclaimed water	2,700	2,700
10. Desalinization	3,125	3,125
10. City of SB subtotal	21,417	21,417
GWD		
11. Local groundwater and reclaimed water	10,140	10,140
SYRWCD, ID No. 1		
12. Local groundwater and Santa Ynez River diversion	11,823	11,823
13. State Water Project Delivery (assumed 50% of Table A + buffer)	27,675	27,675
14. Cachuma Project yield	57,217	53,336
15. Total Supply in Critical 3-year Period	**143,018**	**139,137**
16. Demand for three-year period based on current demand level	138,021	138,021
17. Difference between 3-year drought supply and current demand	4,997	1,116
18. Demand for three-year period based on planned future growth	168,861	168,861
19. Difference between 3-year drought supply and planned future growth	-25,843	-29,724

3H. IMPACTS ON STATE WATER PROJECT DELIVERIES

Impacts on State Water Project deliveries for each of the alternatives are based upon entitlements and modeling results, which take into consideration the limitations due to shortages in SWP supply during state-wide droughts, pipeline capacity, and Cachuma Reservoir operations. The South Coast entitlement (Table A) amount of SWP water is 13,750 acre-feet per year, not including drought buffer and additional water (4,500 afy) contracted by Goleta Water District. The modeling results actually uses two hydrologic models, the Santa Ynez River Hydrology Model (used for Cachuma Reservoir) and the Department of Water Resources' DWRSIM model (used for shortages in SWP deliveries). Table 20 shows the SWP deliveries for the period 1942-1993. The period 1942-1993 was chosen because this period coincides with Lompoc groundwater models, which was used to determine impacts on salinity in Lompoc under the draft EIR alternatives.

TABLE 20
SUMMARY OF STATE WATER PROJECT DELIVERIES
AVERAGE FOR PERIOD 1942-1993 (ACRE-FEET/YEAR)

Alternative	Total Imports under South Coast Contracts	Delivery as Percentage of 13,750 AF
2	10,135	74%
3B	10,167	74%
3C	10,199	74%
4B	10,369	75%
5B	10,038	73%
5C	10,068	73%

Table 20 shows the impacts to SWP imports to the South Coast. The total amount of imported water shown includes the ID No. 1 exchange with the South Coast Member Units. The detailed analysis for Alternatives 5B and 5C is shown in Appendix D. As indicated in Table 20, the total amount of SWP water delivery to the South Coast would be reduced slightly under Alternatives 5B and 5C.

4. SENSITIVITY ANALYSIS FOR 2.47 FEET OF SURCHARGE

Section 15126.2 of the *CEQA Guidelines* states that the impacts of the proposed project on the environment should be assessed against changes in the physical conditions in the affected area as they exist at the time the notice of preparation (NOP) is published. For the alternatives analyzed in the DEIR on the "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)" dated August 2003, the existing conditions are represented as Alternative 2. As discussed above in Section 2B of this memorandum, physical conditions in the affected area have changed since publication of the NOP. Cachuma Reservoir has been surcharged to 2.47 feet (actual surcharge was 2.32 feet) in 2005, and USBR and Cachuma Member Unites (CCRB and ID No. 1) have initiated releases to meet the long-term flow requirements under the Biological Opinion, which are set for 3.0-foot surcharge.

In order to determine if this change in physical conditions is captured within the parameters of the impact analysis of alternatives in the DEIR a sensitivity analysis was performed using the SYRHM. The sensitivity analysis was undertaken to evaluate the water supply impacts of 2.47 feet of surcharge in relation to 1.8 feet and 3.0 feet of surcharge. For the purposes of sensitivity analysis, two new alternatives were analyzed: Alternative 3D and Alternative 5D. Alternative 3D is the same as Alternative 3B and 3C, except that Cachuma Reservoir is surcharged to 2.47 feet. Likewise, Alternative 5D is the same as Alternative 5B and 5C, except that Cachuma Reservoir is surcharged to 2.47 feet.

As expected, simulation results for Alternative 3D with a surcharge of 2.47 feet are in between simulation results for surcharges of 1.8 feet (Alternative 3B) and 3.0 feet (Alternative 3C). Similarly, simulation results for Alternative 5D are in between Alternatives 5B and 5C. For example, Table 21 compares the median lake levels. Simulated lake levels for Alternative 3D (2.47') falls in between the lake levels under Alternative 3B (1.8') and Alternative 3C (3.0'). Similarly, Alternative 5D (2.47') falls in between the lake levels under Alternative 5B (1.8') and Alternative 5C (3.0') as shown in Table 21.

TABLE 21
(DEIR TABLE 4-3, AUG. 2003)
MEDIAN LAKE LEVEL (SIMULATION, 1918-1993)
(FEET)

Month	Alt 3B: BO and 1.8' surcharge	Alt 3D: BO with 2.47' surcharge	Alt 3C: BO with 3' surcharge	Alt 5B: "3A2"/BO and 1.8' surcharge	Alt 5D 3A2"/BO and 2.47' surcharge	Alt 5C: "3A2"/BO and 3' surcharge
Annual	733.3	734.0	734.6	732.5	733.1	733.7
Feb	736.7	737.5	738.1	736.1	736.9	737.4
Aug	733.6	734.4	735.0	731.4	732.3	733.0

Water supply impacts for the 2.47-foot surcharge similarly fall within water supply impacts for surcharges of 1.8 and 3.0 feet. As shown in Table 22, shortages of 10,382 acre-feet, in the critical drought year (1951), under Alternative 3D fall in between shortages of 11,262 and 9,895 acre-feet for Alternatives 3B and 3C, respectively. Similarly, shortages of 11,889 acre-feet, in critical drought year, under Alternative 5D fall in between 12,506 and 11,406 acre-feet for Alternatives 5B and 5C, respectively.

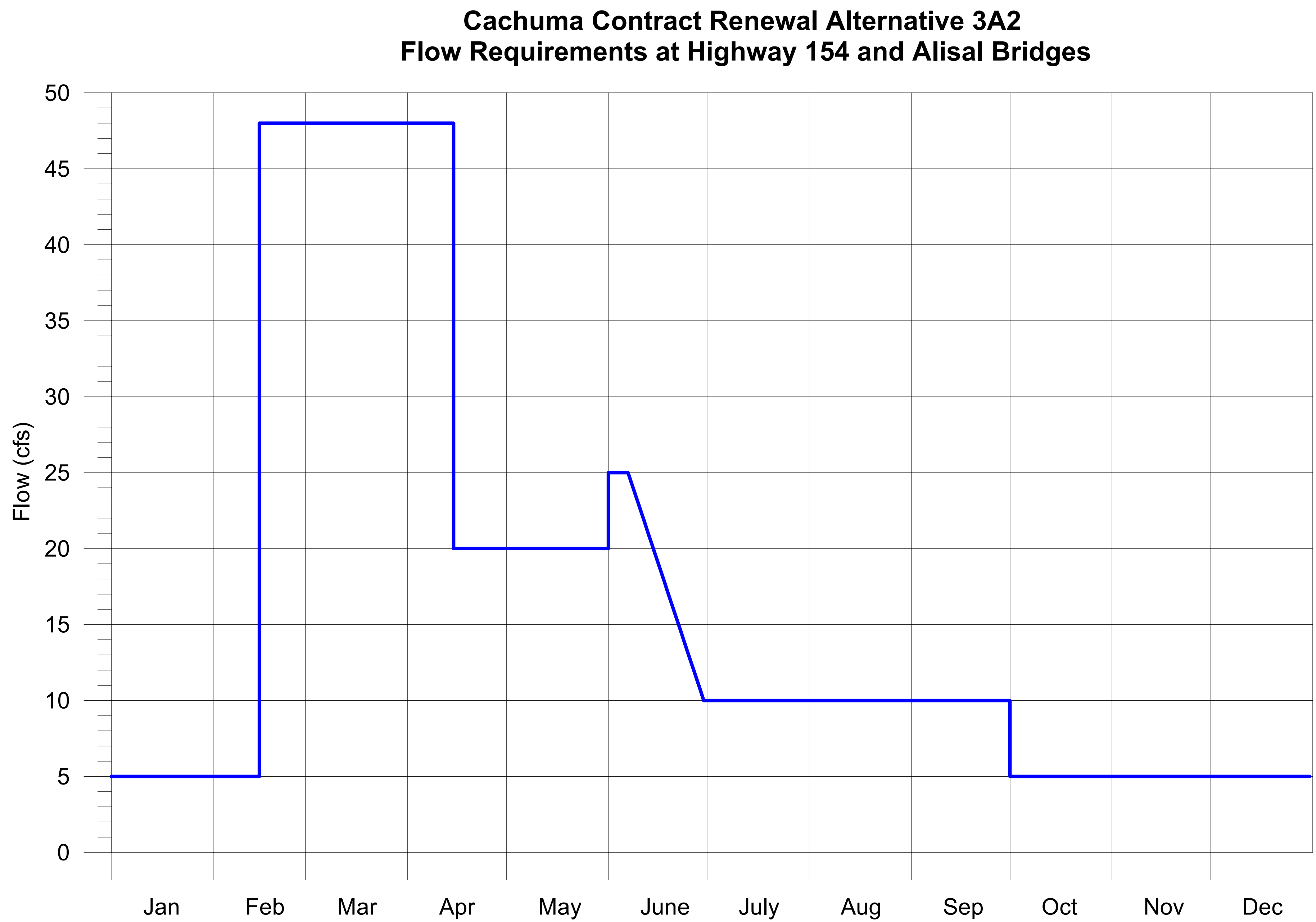
With respect to water supply impacts, relative comparisons of the 2.47-foot surcharge with the 1.8-foot and 3.0-foot surcharges are varied. For example, in terms of number of years with greater than 10% shortages, the 2.47-foot surcharge is more similar to the 1.8-foot surcharge than the 3.0-foot surcharge. However, in terms of the critical drought year supply (1951), Cachuma Project deliveries to the Member Units under the 2.47-foot surcharge are closer to the 3.0-foot surcharge than the 1.8-foot surcharge.

TABLE 22
(DEIR TABLE 4-16, AUG. 2003)
IMPACTS ON CACHUMA PROJECT DELIVERIES TO MEMBER UNITS

Water Supply Parameter	Alt 2: CEQA Baseline	Alt 3B: BO and 1.8’ surcharge	Alt 3D: BO and 2.47’ surcharge	Alt 3C: BO with 3’ surcharge	Alt 5B: "3A2"/BO and 1.8’ surcharge	Alt 5D: "3A2"/BO and 2.47’ surcharge	Alt 5C: "3A2"/BO and 3’ surcharge
Average Annual Deliveries and Years of Shortages (1918-1993)							
Average annual delivery (afy)	25,115	24,986	25,069	25,122	24,855	24,927	24,988
Reduction compared to Alt 2 (afy)	---	-129	-46	7	-260	-188	-127
Number of years with 10% or more shortage	6	7	7	6	8	8	7
Number of years with 10% or more shortage – difference from Alt 2	---	1	1	0	2	2	1
Critical Drought Year (based on 1951 drought year)							
Shortage (af)	9,808	11,262	10,382	9,895	12,506	11,889	11,406
% Shortage in Cachuma deliveries	38%	44%	40%	38%	49%	46%	44%
% Shortage in Cachuma deliveries – difference from Alternative 2	---	6%	2%	0%	10%	8%	6%
Critical 3-Year Drought Period (based on 1949-51 drought)							
Shortage (af)	20,134	23,373	21,114	19,925	26,659	25,047	23,806
% Shortage in Cachuma deliveries	26%	30%	27%	26%	35%	32%	31%
% Shortage in Cachuma deliveries – difference from Alternative 2	---	4%	1%	0%	8%	6%	5%

Based on Project draft of 25,714 acre-feet per year.
Cumulative shortage in critical drought period based on 36 consecutive months starting in May 1949.

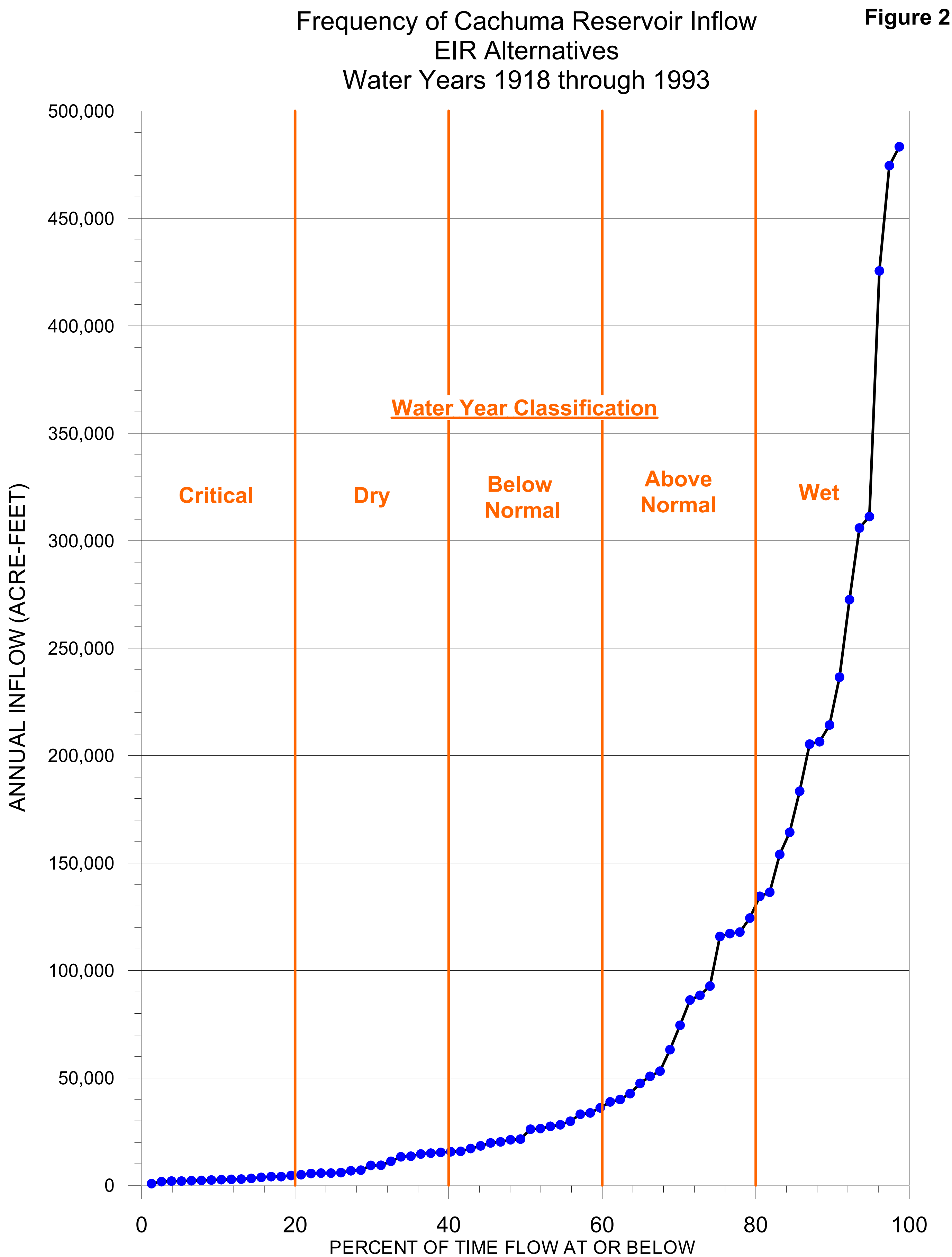
Figures



Cachuma Contract Renewal Alternative 3A2
Flow Requirements at Highway 154 and Alisal Bridges
Flow (cfs)
0
5
10
15
20
25
30
35
40
45
50
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec

Figure 1

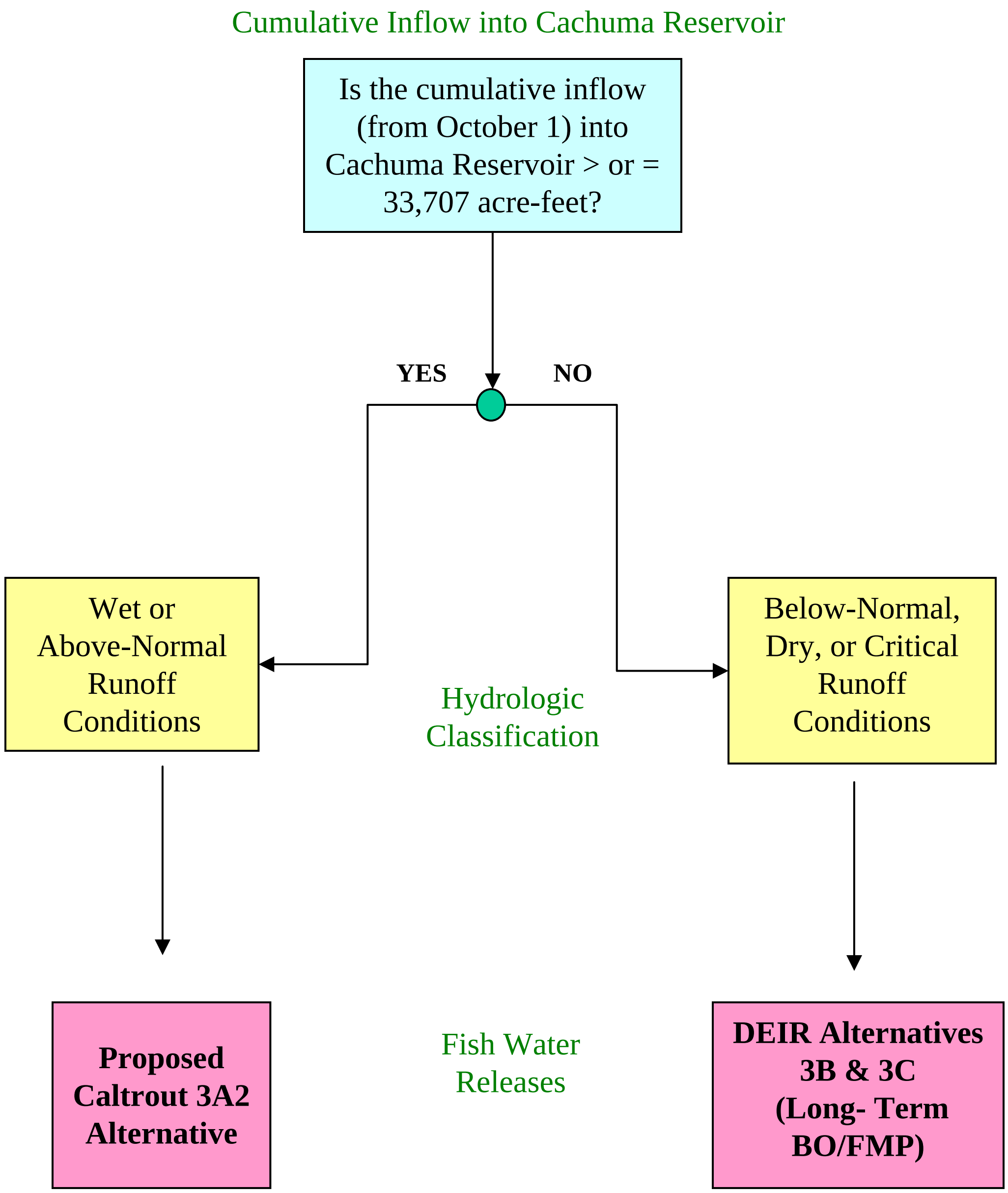
Figure 2



Frequency of Cachuma Reservoir Inflow
EIR Alternatives
Water Years 1918 through 1993
Water Year Classification
Critical
Dry
Below Normal
Above Normal
Wet
ANNUAL INFLOW (ACRE-FEET)
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
0
20
40
60
80
100
PERCENT OF TIME FLOW AT OR BELOW

Figure 3

SYRHM Operations Criteria for Fish Water Releases from Cachuma Reservoir for Alternatives 5B & 5C



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March 31, 2005

Figure 4a

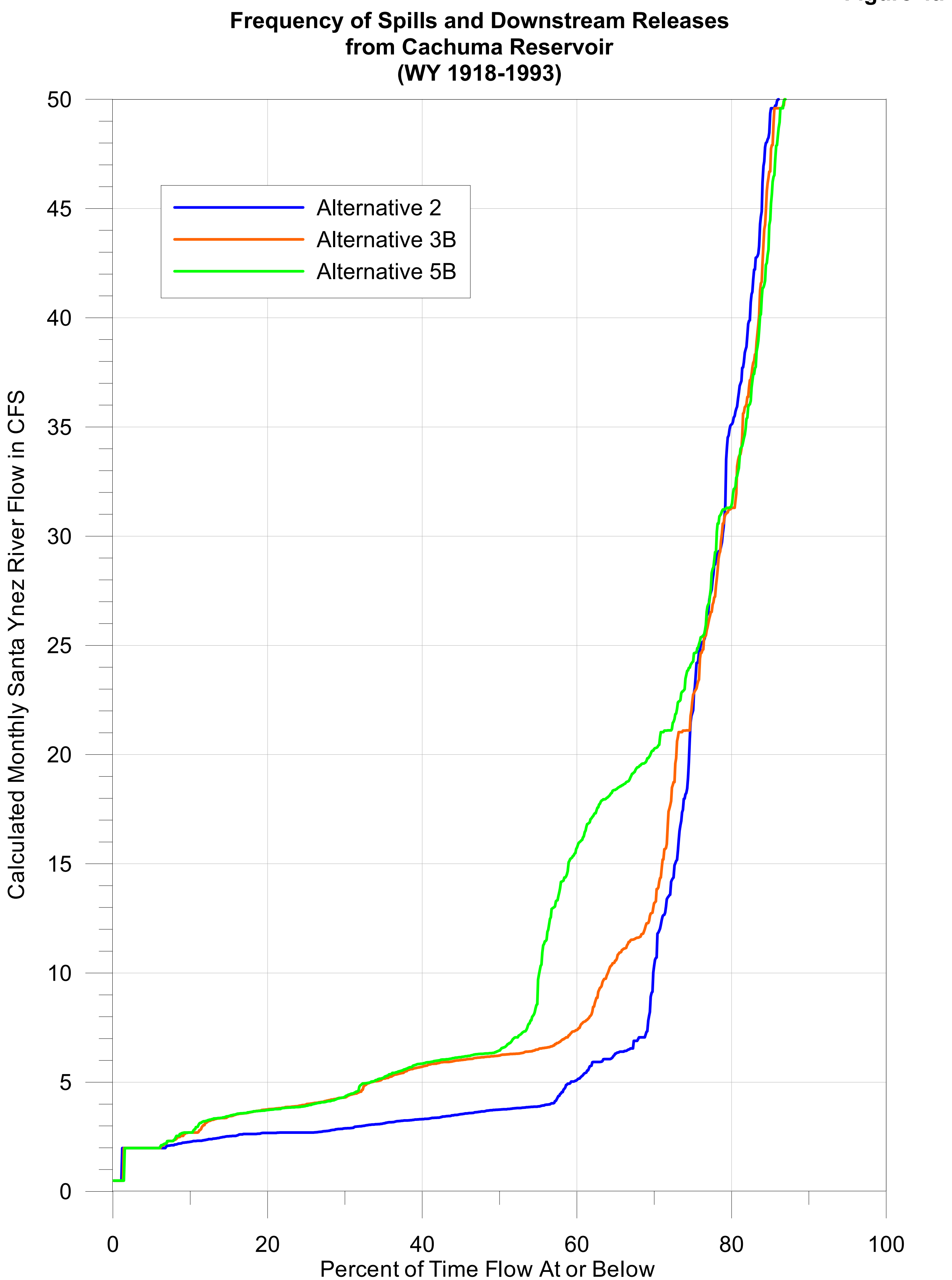
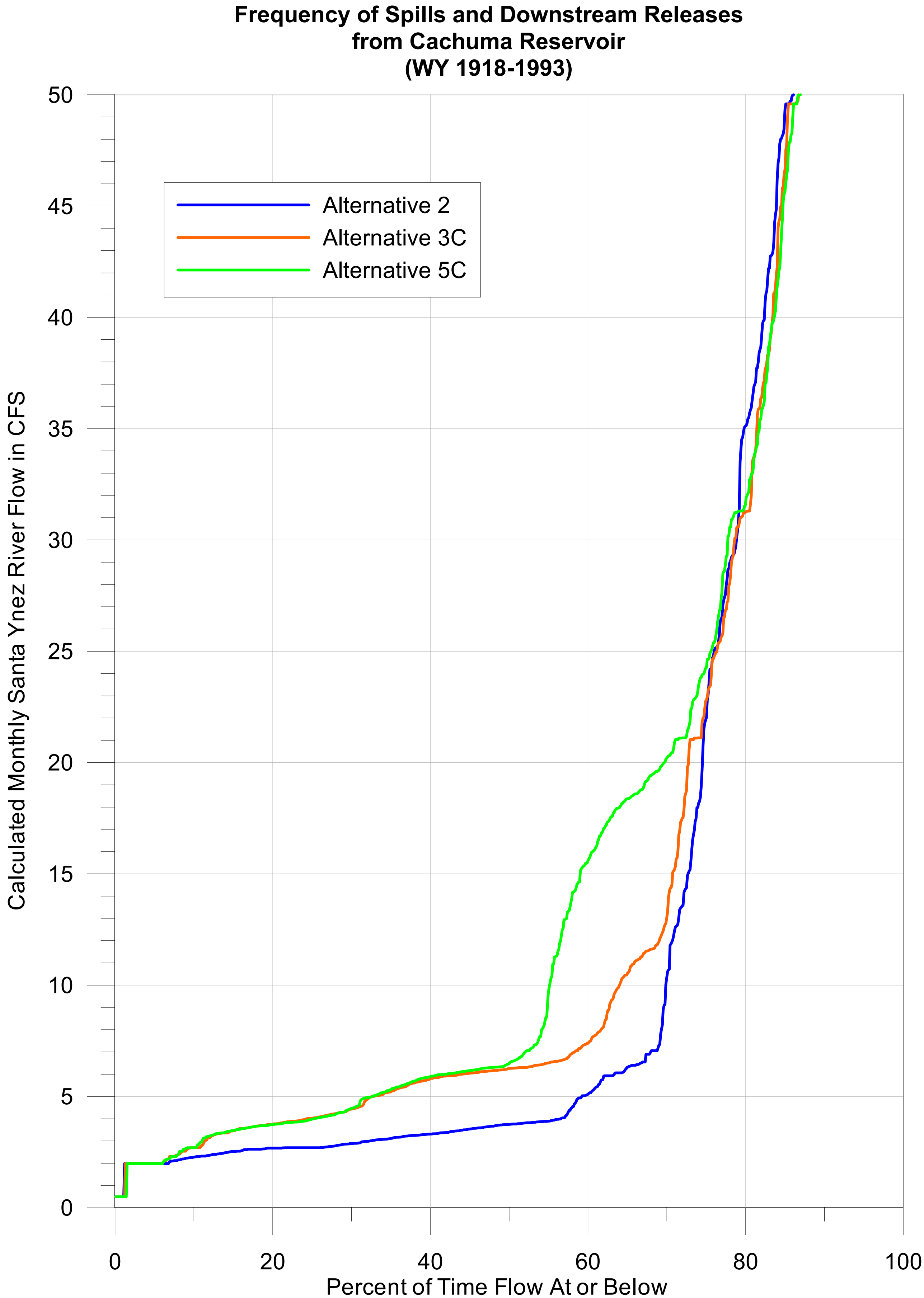
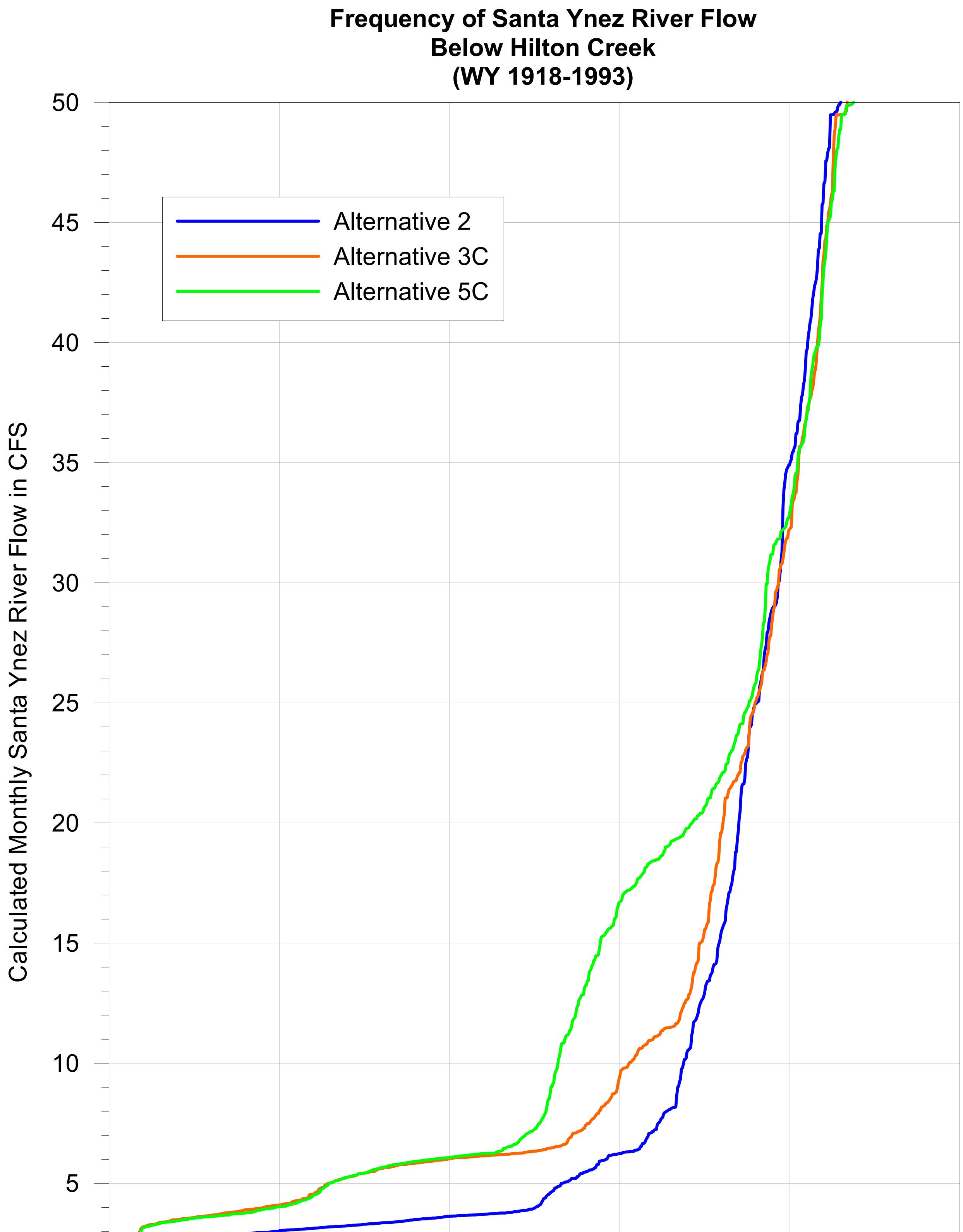

Frequency of Spills and Downstream Releases
from Cachuma Reservoir
(WY 1918-1993)
Alternative 2
Alternative 3B
Alternative 5B
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 4b



Frequency of Spills and Downstream Releases
from Cachuma Reservoir
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 5a



Frequency of Santa Ynez River Flow
Below Hilton Creek
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 5b

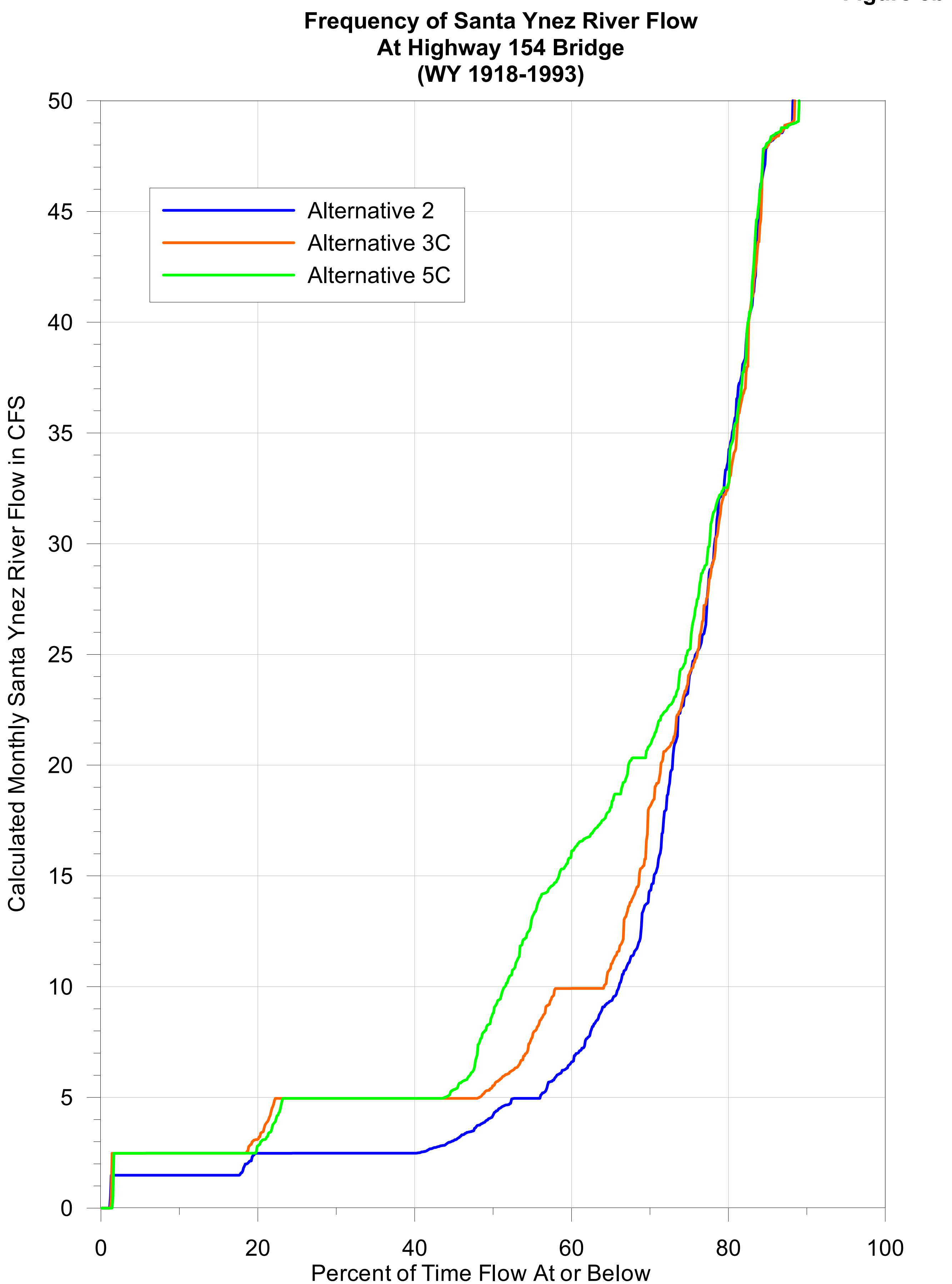

Frequency of Santa Ynez River Flow
At Highway 154 Bridge
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 5c

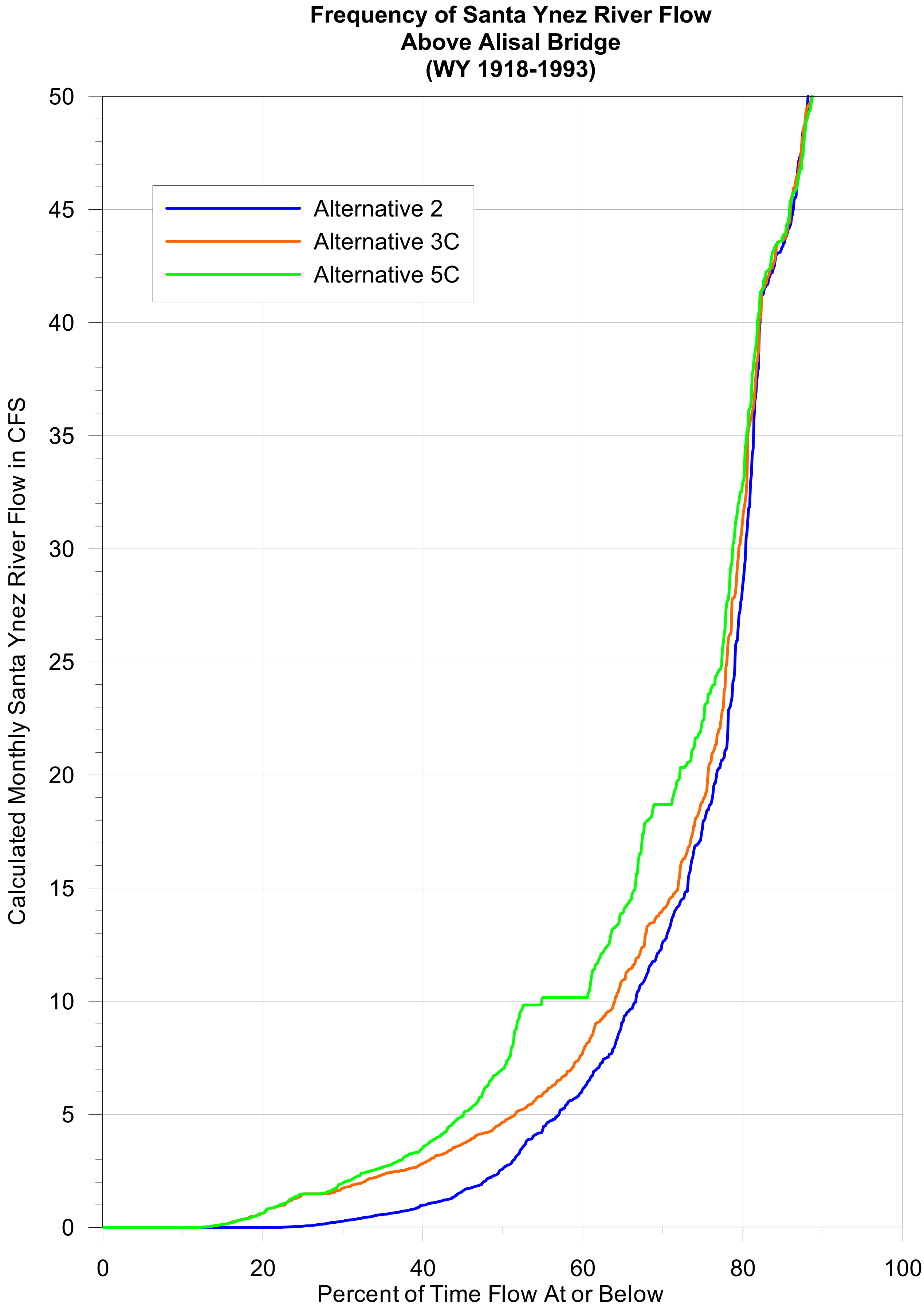

Frequency of Santa Ynez River Flow
Above Alisal Bridge
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 5d

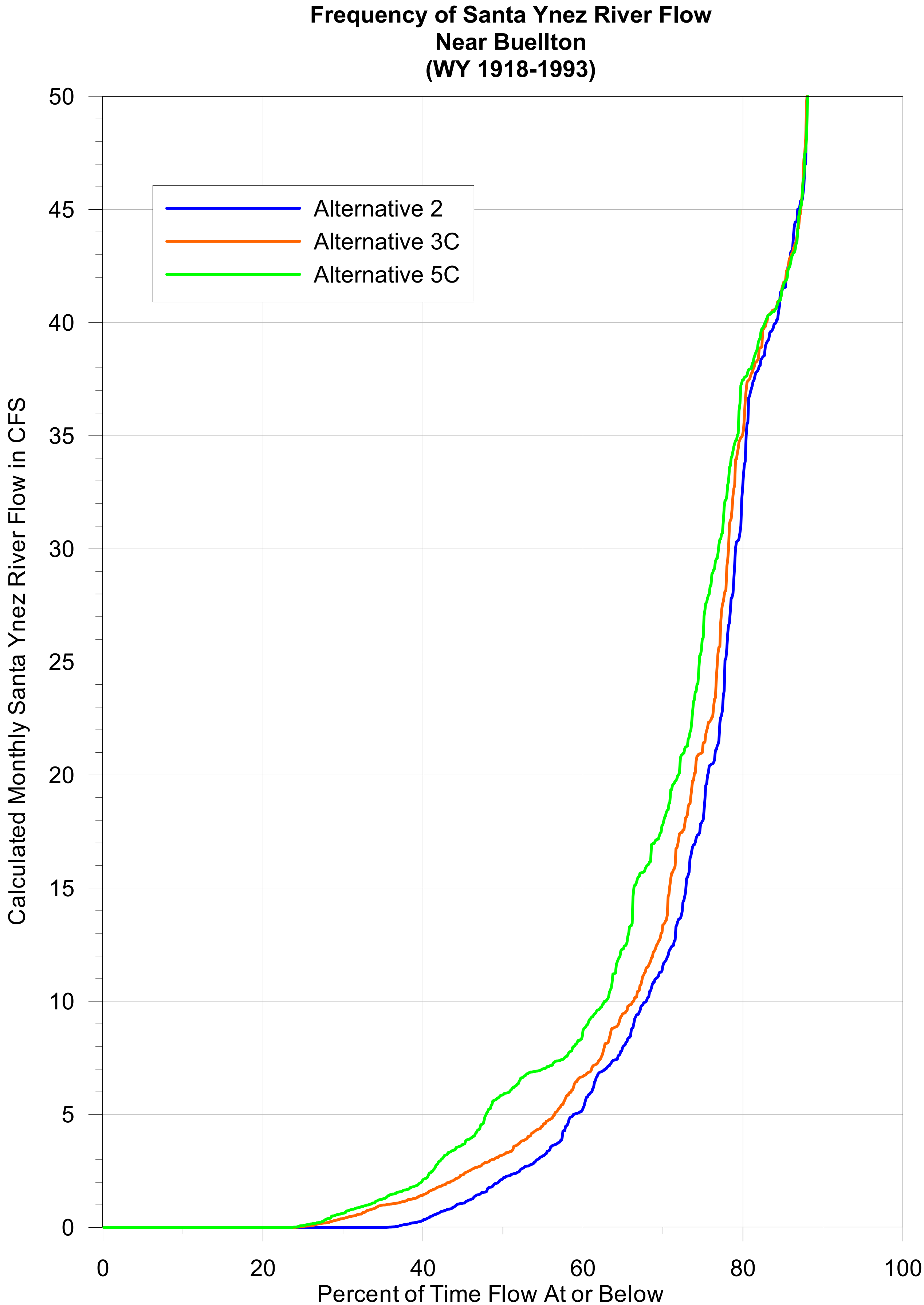
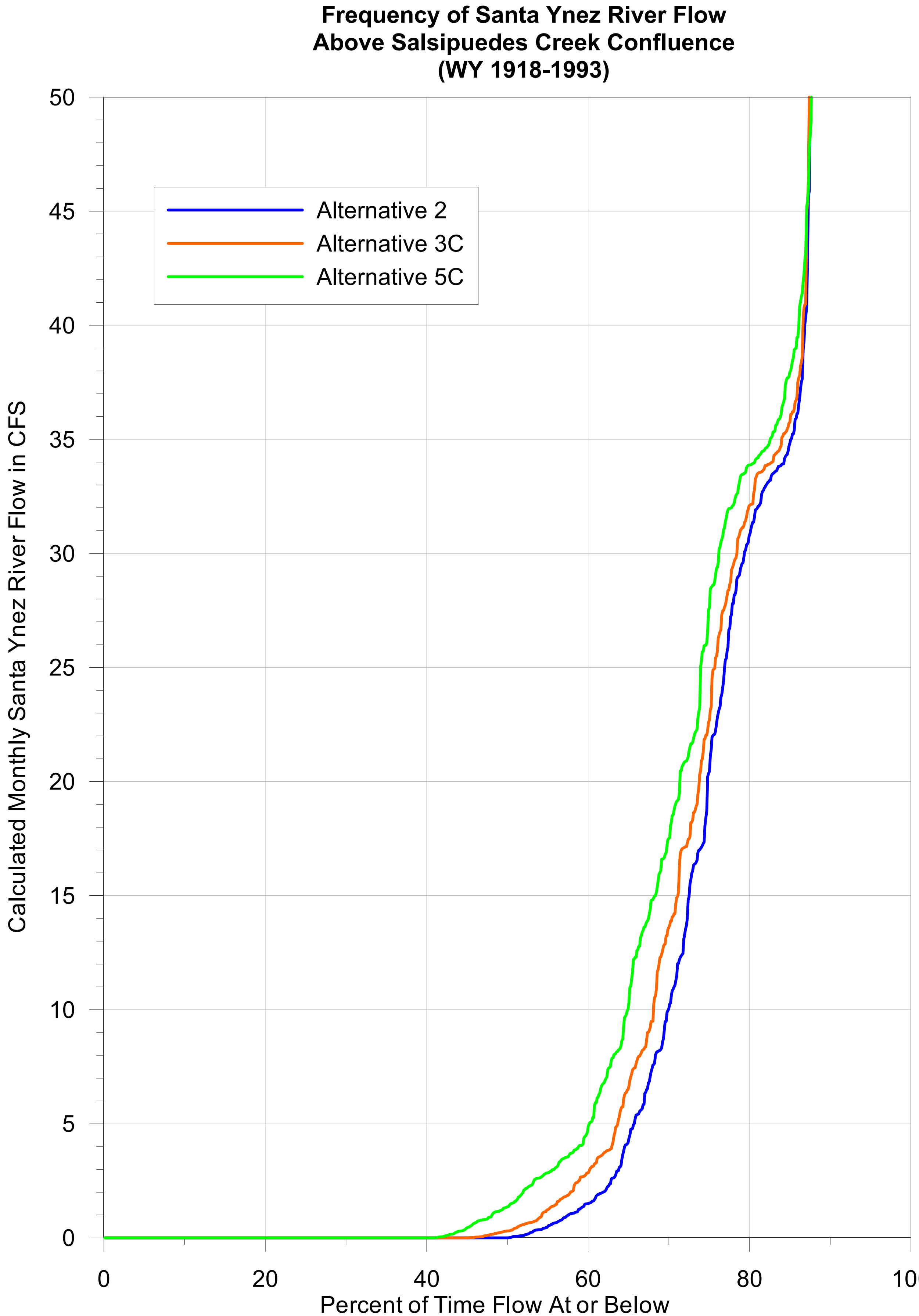
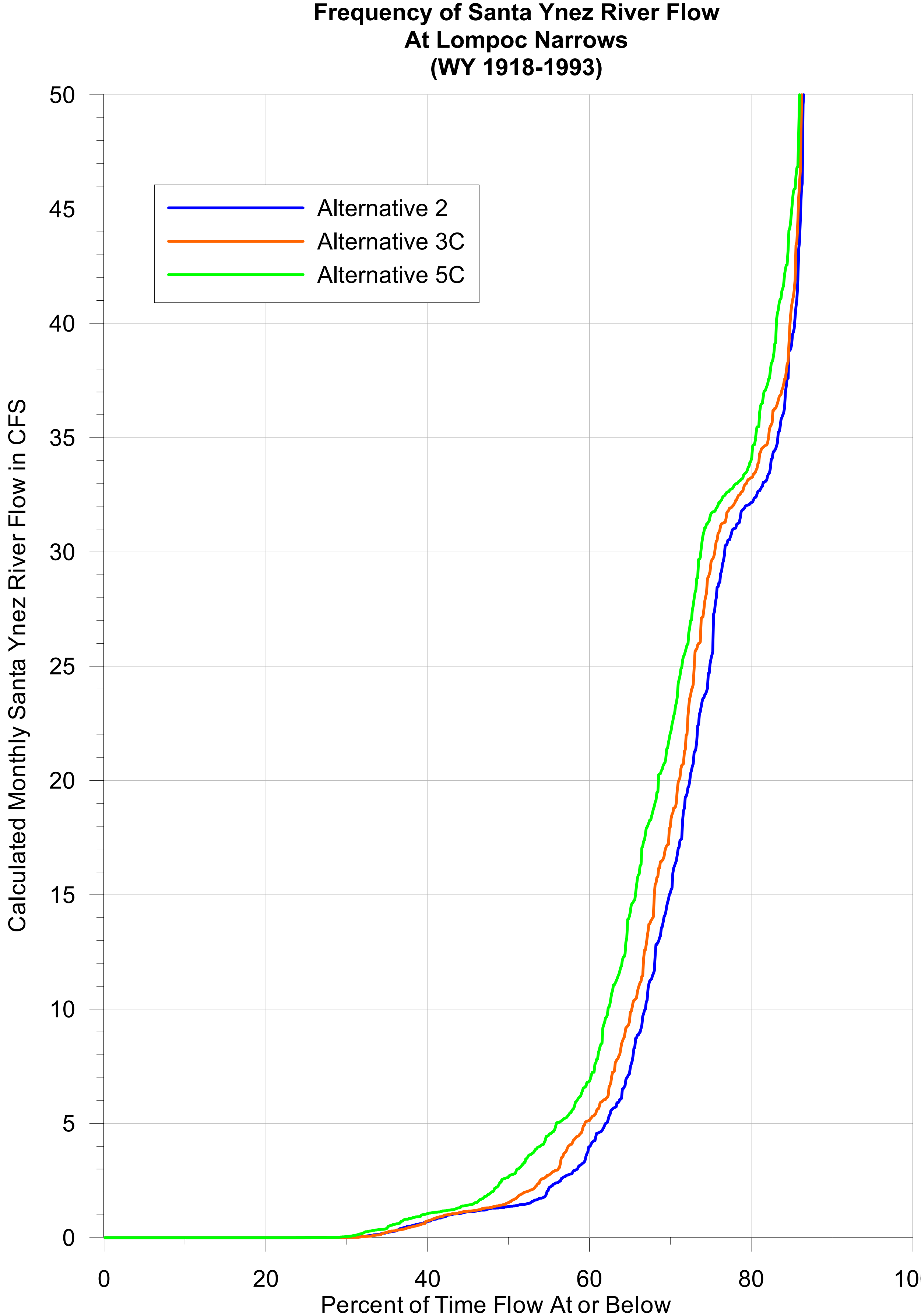

Frequency of Santa Ynez River Flow
Near Buellton
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 5e



Frequency of Santa Ynez River Flow
Above Salsipuedes Creek Confluence
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Figure 5f



Frequency of Santa Ynez River Flow
At Lompoc Narrows
(WY 1918-1993)
Alternative 2
Alternative 3C
Alternative 5C
Calculated Monthly Santa Ynez River Flow in CFS
Percent of Time Flow At or Below
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100

Appendix A

Monthly Flows Downstream of
Bradbury Dam (simulation, 1918-1993)

New Alternatives 5B and 5C

Alternative 5B

SANTA YNEZ RIVER BELOW HILTON CREEK (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	476	453	433	414	51,309	127,900	17,791	5,025	1,061	839	1,086	1,108	207,895
1919	427	378	365	1,273	1,296	1,294	351	361	374	3,789	441	2,162	12,512
1920	1,460	515	342	356	273	329	239	352	378	3,857	375	2,717	11,193
1921	1,642	911	197	163	162	183	196	206	229	235	4,837	2,173	11,135
1922	2,575	736	615	395	1,048	2,427	7,462	1,186	1,308	934	1,112	1,166	20,963
1923	382	390	302	1,299	1,307	1,283	314	346	364	378	4,271	3,037	13,674
1924	2,938	685	382	378	372	309	369	376	384	227	2,054	2,082	10,554
1925	1,411	436	201	212	220	206	171	221	229	1,318	2,797	469	7,892
1926	212	223	223	222	270	166	927	1,235	1,492	1,030	1,203	1,931	9,133
1927	4,466	225	171	169	1,581	10,682	4,178	1,219	1,358	951	1,139	1,198	27,334
1928	383	386	378	1,272	1,385	1,336	332	354	364	3,804	3,038	3,026	16,058
1929	3,017	401	394	380	343	310	326	372	3,546	2,853	1,489	2,411	15,843
1930	1,617	503	200	210	216	220	205	219	229	1,339	1,861	205	7,021
1931	223	233	237	238	219	231	229	1,518	266	226	246	259	4,125
1932	265	264	438	250	957	2,728	1,945	1,343	1,458	1,048	1,195	1,937	13,829
1933	687	208	217	294	277	189	198	219	3,560	2,994	2,601	2,065	13,509
1934	204	219	226	292	193	165	220	227	3,829	2,275	2,491	2,488	12,830
1935	191	208	218	308	188	327	450	1,268	1,489	1,055	4,097	2,561	12,360
1936	1,208	866	205	212	633	215	201	198	223	235	2,479	399	7,073
1937	221	231	235	205	1,220	9,761	16,948	1,174	1,236	923	1,127	1,176	34,459
1938	458	861	367	1,273	31,827	187,357	15,936	2,270	1,137	795	1,075	1,106	244,462
1939	417	425	347	1,314	1,331	1,378	274	345	367	3,560	3,037	3,035	15,831
1940	403	406	403	350	239	265	326	375	390	3,940	3,019	1,986	12,103
1941	1,525	191	253	588	56,612	193,797	120,506	18,381	2,979	555	722	879	396,987
1942	322	324	525	413	400	654	6,350	486	383	350	372	1,069	11,648
1943	370	361	361	46,094	28,923	66,500	10,315	1,171	1,190	849	1,081	1,109	158,324
1944	391	384	329	288	17,474	36,001	4,724	1,158	1,207	936	1,098	1,149	65,138
1945	446	325	349	344	470	4,433	2,641	1,250	1,459	1,016	1,180	1,226	15,139
1946	1,295	718	239	347	328	274	410	1,459	1,518	3,455	3,038	3,035	16,116
1947	3,036	342	338	374	347	358	372	3,430	3,037	3,028	3,017	3,011	20,689
1948	2,802	1,443	206	216	222	228	232	238	778	1,240	222	240	8,068
1949	250	253	252	245	244	1,956	211	1,812	291	218	240	254	6,225
1950	260	261	244	250	1,908	200	215	3,174	194	213	236	251	7,408
1951	26	25	25	24	23	23	22	842	24	23	22	213	1,291
1952	22	22	29	1,561	2,147	1,619	10,557	1,156	1,372	922	1,052	1,525	21,983
1953	887	319	359	2,041	279	317	327	369	378	3,889	3,038	2,467	14,670
1954	2,170	357	369	676	1,323	337	268	370	374	4,138	2,791	3,013	16,186
1955	1,886	802	194	155	177	197	204	194	230	2,091	3,112	514	9,757
1956	207	220	765	952	243	177	213	165	210	218	1,885	1,111	6,366
1957	228	214	217	205	160	155	190	203	4,189	778	2,943	800	10,283
1958	255	303	218	166	833	1,234	35,698	9,161	1,043	776	1,040	1,113	51,841
1959	422	421	378	330	2,085	274	322	356	369	3,849	3,038	2,123	13,967
1960	1,713	944	359	350	1,912	351	321	367	377	228	2,737	203	9,862
1961	221	216	215	230	228	226	227	1,754	315	222	243	256	4,354
1962	262	303	172	168	2,771	2,225	1,870	1,230	1,451	1,013	1,175	1,699	14,339
1963	362	377	376	363	321	303	238	327	366	395	2,364	204	5,994
1964	222	227	227	226	225	225	225	1,912	350	215	237	251	4,542
1965	258	260	257	173	229	211	378	199	3,976	2,912	1,126	377	10,356
1966	212	377	368	431	1,336	2,956	2,151	1,394	1,431	1,031	4,151	2,995	18,832
1967	2,994	2,993	306	747	1,197	18,846	53,303	20,350	1,115	925	3,643	2,672	109,091
1968	430	436	368	363	342	1,928	322	366	3,429	370	1,034	2,158	11,544
1969	1,482	715	358	128,084	188,359	78,226	17,932	5,643	1,051	812	1,009	1,077	424,749
1970	395	356	352	309	297	2,186	338	362	378	3,589	3,037	1,085	12,684
1971	1,529	864	247	301	328	342	359	376	3,428	3,038	3,036	1,926	15,774
1972	1,504	812	244	334	345	370	372	3,413	3,020	212	1,523	2,341	14,491
1973	1,596	158	198	667	1,328	15,660	7,670	1,167	1,253	968	1,118	1,152	32,935
1974	453	778	364	546	280	441	463	1,404	1,501	1,040	1,177	1,480	9,928
1975	1,313	349	316	326	2,285	5,367	4,966	1,161	1,252	926	1,115	1,148	20,524
1976	372	377	377	375	1,946	318	335	361	3,430	3,038	3,027	2,306	16,263
1977	1,351	355	362	365	367	203	211	220	228	2,667	215	227	6,769
1978	240	245	245	687	10,330	145,578	35,267	7,452	1,041	622	941	1,071	203,718
1979	357	362	349	312	670	21,177	11,033	1,150	1,170	923	1,129	1,163	39,794
1980	854	655	354	276	67,729	40,858	7,000	1,117	1,115	865	1,122	1,153	123,099
1981	433	428	377	319	290	2,408	237	319	354	419	1,212	2,269	9,065
1982	1,544	750	353	340	348	1,953	340	313	372	3,656	3,038	3,035	16,042
1983	400	374	364	14,059	57,338	196,356	56,416	29,397	5,124	546	653	893	361,920
1984	288	337	13,141	4,828	1,686	467	2,001	1,392	1,436	993	1,166	1,209	28,944
1985	1,051	675	306	356	334	338	362	377	3,428	3,029	688	2,244	13,187
1986	1,104	196	199	175	767	2,035	1,952	1,235	1,389	1,014	1,171	1,216	12,453
1987	1,115	361	364	352	368	1,949	351	363	373	392	2,014	1,076	9,080
1988	366	380	378	343	366	1,924	319	191	3,594	2,239	1,654	2,048	13,800
1989	195	211	220	221	211	219	223	227	1,135	2,210	594	218	5,886
1990	233	240	242	243	243	238	240	1,361	212	478	310	296	4,338
1991	434	319	249	248	247	711	1,975	1,590	1,966	1,610	2,416	1,096	12,862
1992	330	217	208	159	1,036	2,608	1,845	1,220	1,311	969	4,032	3,037	16,972
1993	1,010	780	360	26,050	113,851	65,385	28,710	6,367	1,038	656	973	1,121	246,300
AVG	904	459	473	3,290	8,829	16,744	6,623	2,130	1,315	1,465	1,740	1,480	45,452
MEDIAN	429	361	322	342	370	560	355	1,134	1,115	960	1,178	1,171	13,737

Alternative 5B

SANTA YNEZ RIVER AT 154 BRIDGE (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	300	300	300	300	52,797	129,234	18,272	5,180	1,131	794	988	1,005	210,601
1919	351	308	300	1,163	1,252	1,249	300	300	300	3,581	360	1,919	11,383
1920	1,329	464	300	300	300	567	300	300	300	3,646	300	2,449	10,556
1921	1,509	840	150	150	181	234	150	150	150	150	4,541	2,102	10,307
1922	2,321	670	1,397	810	2,529	2,966	7,611	1,230	1,260	861	1,008	1,045	23,708
1923	300	300	463	1,223	1,275	1,217	300	300	300	300	4,040	2,961	12,979
1924	2,849	571	300	300	300	300	300	300	300	150	1,765	1,896	9,330
1925	1,286	381	150	150	150	150	195	150	150	1,077	2,550	406	6,794
1926	150	150	150	150	449	186	2,172	1,230	1,394	936	1,083	1,717	9,766
1927	4,318	365	218	207	3,831	10,886	4,331	1,230	1,299	876	1,031	1,073	29,664
1928	300	300	300	1,153	1,486	1,362	300	300	300	3,610	2,961	2,930	15,302
1929	2,914	300	300	300	300	300	300	300	3,353	2,780	1,276	2,208	14,630
1930	1,488	446	150	150	150	326	150	150	150	1,095	1,646	150	6,051
1931	150	150	150	150	150	150	150	1,290	205	150	150	150	2,994
1932	150	150	847	386	2,222	2,951	1,968	1,310	1,380	956	1,081	1,726	15,126
1933	610	150	150	501	300	150	150	150	3,346	2,917	2,507	1,789	12,720
1934	150	150	150	503	254	150	150	150	3,601	2,203	2,221	2,310	11,992
1935	150	150	150	549	244	605	932	1,230	1,385	952	3,912	2,495	12,754
1936	1,031	776	150	150	1,419	323	285	150	150	150	2,146	326	7,057
1937	150	150	150	272	2,927	11,123	17,253	1,230	1,209	857	1,023	1,057	37,402
1938	373	746	300	1,162	33,200	190,967	16,284	2,246	1,131	754	977	1,001	249,141
1939	342	341	300	1,268	1,344	1,475	300	300	300	3,372	2,958	2,936	15,237
1940	300	300	300	300	305	300	300	300	300	3,715	2,937	1,745	11,101
1941	1,376	150	411	1,264	60,794	199,689	123,216	18,828	3,073	615	717	829	410,963
1942	300	300	1,065	654	485	893	6,421	552	378	300	304	878	12,530
1943	300	300	300	47,254	29,574	68,069	10,575	1,230	1,173	800	982	1,002	161,558
1944	320	310	300	300	18,614	36,716	4,871	1,230	1,185	863	997	1,036	66,742
1945	361	300	300	300	860	4,520	2,684	1,230	1,375	926	1,061	1,094	15,012
1946	1,110	636	300	300	300	336	481	1,367	1,409	3,301	2,964	2,940	15,444
1947	2,931	300	300	300	300	300	300	3,252	2,969	2,938	2,908	2,891	19,688
1948	2,683	1,188	150	150	150	150	150	150	630	1,003	150	150	6,703
1949	150	150	150	150	150	1,959	150	1,608	236	150	150	150	5,153
1950	150	150	150	150	1,834	150	150	2,911	155	150	150	150	6,250
1951	0	0	0	0	0	0	0	496	0	0	0	29	525
1952	0	0	0	3,570	1,940	3,764	10,610	1,230	1,335	869	977	1,353	25,648
1953	817	300	633	2,188	300	300	300	300	300	3,686	2,964	2,378	14,465
1954	1,908	300	300	680	1,299	582	300	300	300	3,915	2,715	2,743	15,342
1955	1,757	738	150	169	150	150	150	150	150	1,806	2,893	455	8,719
1956	150	150	1,756	2,283	404	227	317	189	150	150	1,600	957	8,333
1957	174	150	150	150	170	150	150	150	3,952	688	2,699	730	9,313
1958	194	230	150	187	1,949	2,951	38,280	9,542	1,131	749	956	1,010	57,330
1959	347	342	303	300	2,302	300	300	300	300	3,647	2,960	1,889	13,290
1960	1,566	871	300	300	1,876	300	300	300	300	150	2,410	150	8,823
1961	150	150	150	150	150	150	150	1,510	252	150	150	150	3,261
1962	150	187	150	173	7,085	2,951	1,968	1,230	1,376	928	1,064	1,507	18,769
1963	300	300	300	300	531	480	300	300	300	300	2,083	150	5,644
1964	150	150	150	150	150	150	150	1,677	294	150	150	150	3,471
1965	150	150	150	183	150	150	719	150	3,649	2,785	1,029	321	9,585
1966	150	734	716	865	1,472	2,951	2,089	1,346	1,356	940	3,975	2,927	19,521
1967	2,910	2,901	524	1,663	1,472	18,873	53,533	20,719	1,131	859	3,492	2,611	110,688
1968	351	349	300	300	300	1,868	300	300	3,252	300	848	1,960	10,428
1969	1,358	652	300	131,128	192,576	79,723	18,445	5,828	1,131	768	926	977	433,812
1970	324	300	300	300	300	2,395	306	300	300	3,380	2,958	897	12,061
1971	1,357	804	344	300	300	300	300	300	3,236	2,961	2,939	1,664	14,805
1972	1,348	738	349	300	300	300	300	3,246	2,959	150	1,293	2,136	13,419
1973	1,467	150	150	1,526	3,279	16,162	7,880	1,230	1,222	889	1,014	1,041	36,009
1974	369	674	300	1,124	300	555	476	1,332	1,397	941	1,060	1,300	9,828
1975	1,172	300	528	300	2,859	6,620	5,111	1,230	1,225	857	1,010	1,036	22,248
1976	300	300	300	300	1,927	300	300	300	3,260	2,967	2,932	2,030	15,217
1977	1,213	300	300	300	300	150	150	150	150	2,354	159	150	5,675
1978	150	150	150	1,522	13,768	149,276	36,421	7,678	1,131	630	880	976	212,731
1979	300	300	300	500	1,083	21,529	11,365	1,230	1,165	857	1,024	1,050	40,703
1980	755	569	300	411	69,887	42,110	7,167	1,230	1,131	810	1,015	1,039	126,424
1981	356	347	301	300	300	3,167	324	300	300	328	1,002	2,068	9,092
1982	1,414	684	300	300	300	1,950	596	300	300	3,466	2,964	2,941	15,515
1983	300	300	637	15,687	59,567	198,927	57,864	30,208	5,357	615	658	836	370,956
1984	300	300	13,186	4,932	1,742	503	1,968	1,333	1,353	906	1,047	1,078	28,648
1985	881	591	300	300	300	300	300	300	3,235	2,951	571	1,976	12,005
1986	975	150	150	150	1,751	2,951	1,968	1,230	1,320	923	1,053	1,085	13,707
1987	942	300	300	300	300	1,935	300	300	300	300	1,743	932	7,951
1988	300	300	300	300	300	1,898	300	150	3,417	2,173	1,431	1,862	12,731
1989	150	150	150	150	150	150	150	150	920	1,992	517	150	4,779
1990	150	150	150	150	150	150	150	1,114	150	372	209	187	3,080
1991	302	207	150	150	150	1,583	1,980	1,527	1,806	1,473	2,244	1,013	12,583
1992	263	150	150	150	2,461	2,951	1,968	1,230	1,260	890	3,858	2,967	18,297
1993	892	676	300	27,036	116,182	66,737	29,303	6,577	1,131	650	900	1,012	251,396
AVG	803	392	483	3,473	9,377	17,222	6,799	2,116	1,246	1,363	1,608	1,347	46,230
MEDIAN	345	300	300	300	467	749	300	1,172	1,131	883	1,060	1,054	13,135

Alternative 5B													
SANTA YNEZ RIVER ABOVE ALISAL BRIDGE (acre-feet/month)													
Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	9	13	29	61	59,197	134,099	20,067	5,796	1,358	615	615	595	222,455
1919	90	90	119	858	1,163	1,173	197	181	126	2,919	90	1,000	8,005
1920	750	258	166	157	411	1,358	550	231	134	2,976	52	1,399	8,443
1921	898	560	29	127	255	418	96	70	9	3	3,456	1,776	7,698
1922	1,340	397	3,544	2,190	7,908	5,016	8,337	1,452	1,131	615	615	595	33,140
1923	51	49	801	1,052	1,243	1,108	312	222	158	97	3,179	2,633	10,906
1924	2,495	228	93	116	147	311	176	149	106	0	802	1,076	5,700
1925	729	174	21	20	20	63	283	37	11	402	1,553	127	3,441
1926	0	0	2	2	838	217	6,210	1,308	1,131	615	615	876	11,814
1927	3,629	689	325	348	12,610	11,974	4,931	1,311	1,131	615	615	595	38,774
1928	41	52	84	799	1,835	1,492	249	192	149	2,962	2,638	2,534	13,025
1929	2,506	30	59	99	214	313	273	155	2,807	2,502	529	1,320	10,805
1930	903	232	25	23	28	691	71	37	5	420	812	0	3,246
1931	0	0	0	0	5	0	0	555	10	0	0	0	571
1932	0	0	1,584	577	7,057	3,862	2,088	1,230	1,131	615	615	882	19,642
1933	285	0	0	1,097	390	104	84	36	2,780	2,628	2,133	800	10,337
1934	0	0	0	1,023	414	145	33	13	2,954	1,924	1,206	1,453	9,163
1935	5	0	0	1,236	426	1,566	2,651	1,287	1,131	615	3,165	2,199	14,281
1936	408	444	15	19	4,134	741	631	92	20	0	1,055	49	7,608
1937	0	0	0	380	8,924	16,341	18,372	1,444	1,131	615	615	595	48,417
1938	90	365	122	864	38,524	205,659	17,613	2,204	1,154	615	615	595	268,421
1939	90	90	166	1,172	1,450	1,898	421	228	151	2,771	2,639	2,546	13,622
1940	19	21	38	172	505	437	292	161	96	2,986	2,592	853	8,174
1941	744	19	789	3,387	74,521	222,371	133,834	20,156	3,309	734	615	595	461,074
1942	187	200	2,215	1,236	717	1,499	6,822	754	358	152	90	238	14,468
1943	52	92	118	52,678	31,761	74,506	11,422	1,427	1,131	615	615	595	175,011
1944	90	90	197	329	22,944	39,178	5,388	1,494	1,131	615	615	595	72,665
1945	90	203	161	198	2,425	5,168	3,019	1,244	1,131	615	615	595	15,463
1946	458	337	527	208	289	611	863	1,230	1,131	2,767	2,656	2,558	13,634
1947	2,533	177	201	133	201	196	168	2,829	2,757	2,628	2,500	2,434	16,758
1948	2,238	429	6	7	8	10	8	1	257	315	0	0	3,278
1949	0	0	0	0	0	1,481	0	815	30	0	0	0	2,326
1950	0	0	1	0	1,091	2	0	1,716	1	0	0	0	2,811
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	11,177	1,472	9,586	10,538	1,375	1,131	615	615	617	37,127
1953	480	167	1,075	2,612	407	318	283	164	122	3,016	2,637	2,004	13,285
1954	948	83	88	736	1,250	1,198	482	157	139	3,179	2,380	1,646	12,285
1955	1,123	479	31	166	103	78	66	92	4	948	1,912	174	5,174
1956	0	0	3,563	5,353	806	394	643	321	53	25	688	331	12,177
1957	0	0	0	11	142	145	83	55	3,245	349	1,677	375	6,083
1958	2	8	0	193	4,849	8,378	48,456	10,850	1,403	615	615	595	75,963
1959	90	90	90	218	2,966	414	284	200	147	2,986	2,630	992	11,107
1960	923	583	132	174	1,762	196	265	161	115	0	1,265	0	5,574
1961	0	7	7	0	0	0	0	707	34	0	0	0	754
1962	0	0	18	44	19,361	4,850	2,316	1,243	1,131	615	615	734	30,925
1963	65	55	74	122	838	773	408	248	152	55	1,083	0	3,873
1964	0	0	0	0	0	0	0	875	75	0	0	0	949
1965	0	0	0	51	4	4	1,280	14	2,293	1,965	488	63	6,163
1966	0	1,094	1,273	1,934	1,781	3,028	1,968	1,230	1,131	615	3,227	2,611	19,892
1967	2,556	2,562	1,309	4,419	2,823	19,625	54,672	22,381	1,194	615	2,900	2,341	117,397
1968	90	90	116	149	232	1,826	293	160	2,779	91	243	1,097	7,167
1969	787	406	135	145,627	212,039	86,547	20,150	6,562	1,404	615	615	595	475,482
1970	90	126	154	307	381	3,386	279	180	129	2,747	2,638	272	10,689
1971	678	576	663	328	254	251	207	153	2,747	2,689	2,564	757	11,865
1972	702	448	709	242	226	167	165	2,866	2,767	2	504	1,241	10,041
1973	876	88	24	3,724	10,015	17,938	8,624	1,475	1,131	615	615	595	45,720
1974	90	315	115	2,685	407	901	587	1,230	1,131	615	615	595	9,286
1975	595	116	876	240	4,326	9,953	5,632	1,490	1,131	615	615	595	26,185
1976	60	61	83	106	1,858	271	241	180	2,797	2,705	2,560	1,040	11,962
1977	621	102	113	129	143	50	37	24	3	1,391	0	0	2,614
1978	0	0	0	3,191	24,119	163,611	40,167	8,508	1,442	615	615	595	242,862
1979	100	103	154	982	2,270	22,809	12,552	1,502	1,131	615	615	595	43,428
1980	374	265	138	802	78,208	46,299	7,814	1,672	1,202	615	615	595	138,598
1981	90	90	90	235	363	5,475	629	298	189	90	325	1,193	9,066
1982	841	434	146	202	210	2,131	1,600	344	138	2,860	2,656	2,558	14,119
1983	21	94	1,680	20,296	66,402	210,882	63,112	33,466	6,146	762	615	595	404,072
1984	291	176	13,275	5,310	2,004	705	1,990	1,230	1,131	615	615	595	27,937
1985	309	297	235	171	236	244	199	149	2,738	2,679	192	1,000	8,450
1986	439	11	25	87	4,333	5,191	2,132	1,276	1,131	615	615	595	16,449
1987	343	90	109	163	146	1,885	199	163	123	61	839	346	4,468
1988	57	50	71	165	142	1,988	288	72	2,915	1,927	651	1,059	9,385
1989	3	0	0	1	31	17	12	6	363	1,191	189	0	1,813
1990	0	0	0	0	0	0	0	317	0	16	0	0	333
1991	0	0	0	0	0	3,524	1,968	1,230	1,131	831	1,393	595	10,672
1992	26	0	13	130	7,315	4,283	2,607	1,353	1,131	615	3,140	2,655	23,268
1993	464	332	131	30,916	124,308	72,428	31,723	7,460	1,491	615	615	595	271,077
AVG	459	193	502	4,131	11,318	19,023	7,505	2,151	1,064	1,031	1,122	855	49,354
MEDIAN	90	90	90	205	822	1,278	516	631	1,131	615	615	595	11,839

Alternative 5B

SANTA YNEZ RIVER NEAR BUELLTON (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	4	68,310	135,767	21,941	6,622	1,751	564	457	431	235,846
1919	4	9	56	680	1,110	1,136	95	100	38	2,571	0	533	6,331
1920	354	89	74	54	612	1,994	917	222	49	2,606	0	813	7,784
1921	433	300	0	146	405	722	90	52	0	0	2,872	1,536	6,556
1922	743	167	6,531	4,067	13,212	7,389	9,282	1,763	1,075	490	426	379	45,523
1923	0	0	1,412	1,055	1,307	1,027	359	186	94	24	2,732	2,405	10,601
1924	2,262	67	11	31	56	418	108	62	24	0	393	591	4,023
1925	334	31	0	0	0	46	505	6	0	127	976	0	2,025
1926	0	0	0	0	1,564	359	9,658	1,541	978	444	354	417	15,316
1927	3,062	1,116	504	582	21,409	12,598	5,669	1,435	1,028	485	417	361	48,666
1928	0	0	10	589	2,106	1,672	219	121	65	2,600	2,421	2,288	12,091
1929	2,252	0	0	21	244	449	346	97	2,478	2,315	182	755	9,138
1930	442	58	0	0	0	1,268	40	0	0	130	354	0	2,292
1931	0	0	0	0	0	0	0	200	0	0	0	0	200
1932	0	0	3,121	1,195	10,087	5,304	2,275	1,216	937	417	359	424	25,335
1933	80	0	0	2,064	606	114	74	0	2,451	2,439	1,901	318	10,047
1934	0	0	0	1,939	650	222	0	0	2,567	1,729	649	823	8,579
1935	0	0	0	2,296	740	2,567	4,449	1,455	970	421	2,713	1,980	17,590
1936	100	209	0	0	6,955	1,325	910	75	0	0	558	0	10,132
1937	0	0	0	745	16,925	22,292	19,794	1,719	1,134	501	420	367	63,898
1938	0	170	53	678	45,873	215,248	19,260	2,138	1,288	629	459	421	286,216
1939	6	6	159	1,285	1,718	2,523	596	194	69	2,447	2,441	2,315	13,759
1940	0	0	0	189	938	744	391	108	16	2,596	2,369	403	7,754
1941	330	0	1,374	6,369	85,090	241,980	141,859	21,864	3,705	1,025	723	581	504,902
1942	214	239	3,894	2,104	1,057	2,342	7,427	1,037	411	105	35	31	18,898
1943	0	11	35	57,518	34,283	80,016	12,418	1,694	1,185	561	457	419	188,597
1944	15	14	208	484	26,776	41,622	5,993	1,856	1,171	493	446	378	79,455
1945	1	261	138	195	4,499	5,695	3,494	1,310	968	446	400	346	17,753
1946	149	147	949	193	360	678	1,452	1,194	948	2,448	2,464	2,332	13,315
1947	2,297	236	261	88	206	176	102	2,534	2,607	2,457	2,278	2,179	15,421
1948	1,982	104	0	0	0	0	0	0	99	56	0	0	2,241
1949	0	0	0	0	0	1,577	0	415	0	0	0	0	1,992
1950	0	0	0	0	951	0	0	1,039	0	0	0	0	1,990
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	18,904	1,825	18,927	11,630	1,723	981	504	474	248	55,218
1953	277	110	1,786	3,357	572	368	245	65	31	2,636	2,403	1,751	13,600
1954	420	0	0	808	1,287	2,038	753	53	53	2,732	2,134	963	11,239
1955	563	217	0	109	75	40	22	100	0	489	1,208	5	2,829
1956	0	0	6,248	8,383	1,330	608	949	542	8	8	286	37	18,400
1957	0	0	0	0	177	217	84	45	2,801	150	1,024	111	4,609
1958	0	0	0	258	8,935	15,692	60,087	12,322	1,804	532	446	395	100,473
1959	1	0	2	232	4,085	585	237	115	80	2,614	2,411	500	10,863
1960	451	317	13	60	1,683	86	224	60	24	0	696	0	3,614
1961	0	0	0	0	0	0	0	264	0	0	0	0	264
1962	0	0	0	0	34,328	7,505	2,801	1,260	922	424	358	306	47,905
1963	0	0	0	8	1,279	1,181	567	239	85	0	541	0	3,901
1964	0	0	0	0	0	0	0	380	0	0	0	0	380
1965	0	0	0	17	0	0	2,032	0	1,489	1,259	97	0	4,894
1966	0	1,650	2,088	3,441	2,267	3,181	1,747	1,100	959	418	2,758	2,373	21,982
1967	2,296	2,309	2,478	8,334	4,110	20,063	55,064	23,680	1,201	465	2,666	2,194	124,860
1968	6	2	55	103	264	1,957	341	66	2,480	10	44	616	5,942
1969	374	194	20	163,134	230,185	94,929	21,420	7,373	1,760	528	481	440	520,837
1970	13	100	113	447	589	4,520	234	88	44	2,432	2,447	38	11,066
1971	297	415	884	433	253	200	132	58	2,441	2,528	2,350	343	10,335
1972	306	222	1,187	251	206	76	77	2,581	2,630	0	176	707	8,420
1973	430	50	0	6,102	18,587	19,597	9,513	1,635	1,038	455	425	374	58,204
1974	0	129	35	4,992	598	1,407	778	1,211	947	430	384	242	11,153
1975	238	5	1,398	224	6,442	14,516	6,283	1,848	1,039	470	426	374	33,262
1976	0	0	1	13	1,988	276	203	91	2,491	2,532	2,336	543	10,474
1977	232	0	3	16	31	0	0	0	0	866	0	0	1,148
1978	0	0	0	5,301	38,433	181,400	44,830	9,581	1,781	711	572	427	283,036
1979	25	32	118	1,789	4,005	24,705	13,982	1,854	1,115	472	418	361	48,875
1980	169	94	38	1,433	89,201	51,466	8,585	2,097	1,264	503	430	383	155,662
1981	1	0	4	273	548	8,803	1,047	351	157	10	71	680	11,947
1982	414	216	30	122	154	2,416	2,919	406	48	2,540	2,454	2,325	14,044
1983	0	60	3,002	27,080	75,244	218,177	67,010	36,383	7,292	1,076	786	582	436,692
1984	471	168	13,961	5,715	2,284	933	1,944	1,088	952	446	409	354	28,724
1985	62	119	243	109	235	235	144	57	2,439	2,514	47	537	6,740
1986	128	0	0	82	7,924	8,335	2,373	1,265	1,031	443	399	348	22,327
1987	78	0	11	78	45	1,927	109	65	33	0	432	61	2,840
1988	0	0	0	112	57	2,305	330	18	2,582	1,760	276	558	7,997
1989	0	0	0	0	9	0	0	0	114	722	22	0	866
1990	0	0	0	0	0	0	0	39	0	0	0	0	39
1991	0	0	0	0	0	6,779	2,469	1,170	704	419	803	276	12,621
1992	0	0	0	202	14,034	6,168	3,410	1,532	1,097	450	2,703	2,428	32,024
1993	220	132	38	36,548	134,352	78,997	34,776	8,317	1,841	641	555	416	296,834
AVG	296	129	691	5,040	13,627	20,920	8,277	2,281	998	873	884	607	54,624
MEDIAN	5	1	4	213	1,084	1,624	766	393	950	479	439	381	11,593

Alternative 5B													
SANTA YNEZ RIVER ABOVE SALSIPUEDES CREEK CONFLUENCE (acre-feet/month)													
Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	0	77,294	135,579	24,007	7,780	2,263	493	225	159	247,800
1919	0	0	0	358	897	1,061	26	48	0	2,046	0	6	4,444
1920	0	0	0	0	606	2,088	1,249	234	0	2,055	0	79	6,310
1921	0	4	0	55	403	907	84	42	0	0	1,934	1,166	4,595
1922	70	0	8,784	5,965	17,702	9,906	10,584	2,302	1,135	384	188	103	57,123
1923	0	0	1,572	969	1,341	1,017	477	211	68	0	2,031	2,049	9,736
1924	1,897	0	0	0	0	427	45	2	0	0	0	10	2,381
1925	0	0	0	0	0	0	515	0	0	0	118	0	633
1926	0	0	0	0	1,660	303	11,002	1,786	845	244	60	0	15,901
1927	2,139	1,270	584	796	29,309	13,026	6,714	1,728	1,022	359	155	65	57,166
1928	0	0	0	237	1,882	1,728	213	80	3	2,083	2,086	1,899	10,211
1929	1,852	0	0	0	176	486	371	48	2,074	2,052	0	54	7,114
1930	0	0	0	0	0	1,555	1	0	0	0	0	0	1,556
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	3,768	1,145	10,425	6,810	2,496	1,291	773	201	66	0	26,975
1933	0	0	0	2,595	686	112	69	0	2,054	2,177	1,543	0	9,236
1934	0	0	0	2,319	657	246	0	0	2,069	1,455	45	81	6,873
1935	0	0	0	2,894	932	3,245	5,943	1,742	871	215	2,063	1,659	19,564
1936	0	0	0	0	8,783	1,933	1,093	97	0	0	19	0	11,925
1937	0	0	0	705	24,499	28,033	21,667	2,215	1,266	398	174	83	79,041
1938	0	0	0	372	53,403	221,402	21,363	2,237	1,570	668	245	157	301,416
1939	0	0	47	1,238	1,930	3,218	831	222	21	2,025	2,137	1,943	13,612
1940	0	0	0	81	1,179	964	487	82	0	2,042	2,027	0	6,862
1941	0	0	1,565	9,060	88,843	258,205	147,333	23,837	4,163	1,302	744	471	535,522
1942	160	194	4,811	2,781	1,349	3,030	8,162	1,407	498	50	0	0	22,442
1943	0	0	0	60,529	37,287	85,042	13,742	2,096	1,344	503	246	162	200,951
1944	0	0	92	509	28,962	44,099	6,859	2,388	1,310	380	210	90	84,899
1945	0	166	41	131	6,670	6,112	4,243	1,531	895	270	120	40	20,219
1946	0	0	1,158	130	412	500	2,175	1,254	810	2,049	2,171	1,972	12,631
1947	1,922	176	233	35	183	170	70	2,296	2,470	2,225	1,936	1,774	13,491
1948	1,578	0	0	0	0	0	0	0	0	0	0	0	1,578
1949	0	0	0	0	0	824	0	0	0	0	0	0	824
1950	0	0	0	0	189	0	0	47	0	0	0	0	236
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	26,393	1,005	27,314	12,221	2,063	760	321	237	0	70,315
1953	21	0	1,813	3,854	761	475	213	15	0	2,121	2,053	1,365	12,692
1954	0	0	0	589	1,120	2,559	1,056	0	0	2,110	1,768	163	9,365
1955	9	0	0	0	0	0	0	56	0	3	233	0	301
1956	0	0	6,741	8,909	1,721	824	1,151	841	0	0	0	0	20,186
1957	0	0	0	0	7	108	13	0	2,095	0	171	0	2,395
1958	0	0	0	69	11,628	22,684	71,961	14,253	2,357	407	202	127	123,689
1959	0	0	0	115	4,822	738	159	47	30	2,078	2,068	2	10,061
1960	0	10	0	0	1,259	0	109	0	0	0	11	0	1,390
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	46,773	8,394	2,909	1,115	622	166	45	0	60,024
1963	0	0	0	0	911	1,000	450	134	3	0	0	0	2,498
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	1,263	0	244	243	0	0	1,750
1966	0	907	1,935	4,361	2,482	3,354	1,579	1,041	838	205	2,076	2,023	20,800
1967	1,909	1,940	3,566	12,002	5,472	20,712	55,715	25,194	1,239	319	2,282	1,950	132,301
1968	0	0	0	14	237	2,052	418	10	2,163	0	0	17	4,911
1969	0	0	0	182,825	249,459	105,364	22,324	8,329	2,156	410	280	208	571,354
1970	0	17	20	523	801	5,601	218	45	2	2,027	2,154	0	11,408
1971	0	112	744	450	214	138	75	5	2,126	2,312	2,019	0	8,195
1972	0	0	1,394	210	172	18	27	2,326	2,504	0	0	40	6,690
1973	0	0	0	6,852	26,940	20,818	10,728	1,845	975	303	175	88	68,723
1974	0	0	0	6,613	762	1,833	1,005	1,275	815	227	97	0	12,629
1975	0	0	1,260	117	7,843	18,229	7,081	2,363	945	308	180	91	38,417
1976	0	0	0	0	1,777	224	140	16	2,120	2,275	1,972	11	8,536
1977	0	0	0	0	0	0	0	0	0	63	0	0	63
1978	0	0	0	5,248	51,203	200,998	50,149	10,997	2,169	772	446	158	322,141
1979	0	0	11	2,280	5,477	26,521	15,842	2,359	1,103	296	143	54	54,086
1980	0	0	0	1,732	100,092	57,413	9,688	2,615	1,324	351	181	93	173,488
1981	0	0	0	140	593	11,694	1,515	454	149	0	0	18	14,563
1982	0	0	0	0	33	2,537	4,316	489	0	2,086	2,139	1,948	13,548
1983	0	0	4,011	32,757	84,010	223,674	69,591	39,092	8,684	1,379	896	494	464,587
1984	563	94	14,397	6,294	2,754	1,334	2,024	1,058	860	276	137	51	29,842
1985	0	0	70	10	159	186	101	2	2,102	2,280	0	5	4,914
1986	0	0	0	0	10,274	10,565	2,728	1,258	1,007	268	127	49	26,275
1987	0	0	0	0	0	1,609	23	0	0	0	0	0	1,632
1988	0	0	0	0	0	2,249	281	0	2,053	1,489	0	0	6,073
1989	0	0	0	0	0	0	0	0	0	40	0	0	40
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	8,992	2,392	894	168	1	68	0	12,514
1992	0	0	0	79	20,246	8,210	4,488	1,861	1,162	265	2,092	2,100	40,503
1993	1	0	0	42,101	145,553	86,807	38,779	9,324	2,201	603	423	156	325,947
AVG	159	64	771	5,756	15,582	22,595	9,007	2,479	954	680	595	332	58,975
MEDIAN	0	0	0	116	968	1,780	1,031	228	792	286	149	18	12,220

Alternative 5B

SANTA YNEZ RIVER AT LOMPOC NARROWS (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	54	83,154	144,219	25,699	8,326	2,672	670	289	218	265,302
1919	68	67	73	414	1,087	1,249	19	133	0	1,946	0	0	5,057
1920	23	47	55	59	842	3,030	1,662	323	84	1,974	0	22	8,120
1921	0	0	0	158	634	1,292	166	122	27	64	1,795	1,122	5,381
1922	23	0	12,076	7,500	22,255	11,823	11,440	2,522	1,227	462	159	71	69,557
1923	0	0	2,549	1,178	1,633	1,106	618	304	156	79	1,933	2,007	11,564
1924	1,849	0	66	71	74	692	132	84	79	0	0	0	3,048
1925	0	0	0	0	0	10	730	49	49	0	17	0	855
1926	0	0	10	20	2,476	670	15,662	2,198	930	317	35	0	22,317
1927	1,964	1,908	960	1,084	35,421	14,451	7,357	1,934	1,107	431	122	33	66,772
1928	0	49	56	276	2,575	2,146	305	167	86	2,003	2,042	1,844	11,550
1929	1,796	0	61	74	258	679	563	131	2,010	2,016	0	3	7,592
1930	0	0	0	0	21	1,922	77	69	0	0	0	0	2,089
1931	0	0	0	0	62	20	37	0	0	0	0	0	119
1932	0	0	5,392	1,568	16,635	7,786	2,923	1,486	851	219	38	0	36,900
1933	0	0	0	3,267	1,050	203	163	83	1,987	2,140	1,493	0	10,387
1934	0	0	0	3,071	1,085	434	85	32	1,996	1,419	7	18	8,147
1935	0	0	0	3,669	1,315	4,266	7,584	1,946	952	234	1,973	1,620	23,559
1936	0	0	0	48	11,067	2,455	1,538	193	37	0	0	0	15,338
1937	0	0	0	984	29,702	32,627	22,957	2,434	1,361	475	144	53	90,736
1938	0	0	55	400	58,126	235,308	22,657	2,338	1,673	751	312	220	321,840
1939	0	0	199	1,477	2,325	3,801	1,134	317	110	1,962	2,095	1,889	15,309
1940	0	0	0	208	1,571	1,367	705	169	33	1,959	1,980	0	7,993
1941	0	0	2,288	11,640	108,116	277,073	156,986	25,527	4,878	1,800	1,124	744	590,176
1942	438	472	8,215	4,461	2,260	4,857	9,290	1,919	793	231	167	55	33,158
1943	66	157	165	63,415	39,245	88,983	14,704	2,512	1,543	684	315	227	212,016
1944	74	73	359	884	33,115	46,628	7,500	2,810	1,509	460	277	63	93,753
1945	21	321	209	305	7,526	6,722	4,473	1,636	881	247	90	14	22,446
1946	0	0	1,239	199	497	1,296	2,482	1,343	887	1,993	2,131	1,921	13,988
1947	1,867	331	413	118	368	283	159	2,253	2,445	2,185	1,880	1,710	14,012
1948	1,515	0	0	0	0	0	0	0	0	0	0	0	1,515
1949	0	0	0	0	0	1,916	0	0	0	0	0	0	1,916
1950	0	0	0	0	555	2	0	0	0	0	0	0	557
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	32,930	1,267	36,012	12,515	2,096	753	321	253	0	86,147
1953	55	212	3,670	4,904	959	588	363	51	31	2,023	2,002	1,309	16,167
1954	0	0	0	649	1,382	3,938	1,257	0	76	2,001	1,717	91	11,112
1955	0	0	0	275	147	68	85	120	1	0	93	0	790
1956	0	0	12,858	16,085	2,831	1,334	1,895	1,142	87	79	0	1	36,311
1957	0	0	1	44	342	268	95	73	1,985	1	87	0	2,896
1958	1	0	0	309	16,916	29,651	80,416	15,138	2,770	583	280	187	146,251
1959	68	66	68	280	6,177	1,036	360	135	114	1,995	2,022	0	12,321
1960	0	0	3	49	1,747	84	411	77	0	0	0	0	2,370
1961	0	47	85	2	3	8	0	0	0	0	0	0	144
1962	1	0	114	436	65,393	12,134	3,529	1,408	712	237	21	0	83,983
1963	0	2	36	54	2,660	2,609	1,319	513	182	71	0	0	7,446
1964	0	0	1	3	4	6	7	0	0	0	0	0	22
1965	0	0	0	337	23	83	2,716	80	223	176	1	0	3,639
1966	1	3,540	4,318	6,691	3,862	3,871	1,745	1,225	913	220	1,974	1,978	30,338
1967	1,858	1,888	4,031	15,926	5,934	21,130	56,630	25,656	1,431	298	2,206	1,915	138,903
1968	0	20	69	87	305	2,208	513	4	2,098	0	1	0	5,307
1969	0	0	0	190,943	257,779	108,154	24,160	8,965	2,562	571	348	271	593,753
1970	74	93	190	696	987	6,348	311	38	0	1,939	2,109	0	12,785
1971	0	54	1,032	609	399	223	170	1	2,052	2,272	1,966	0	8,777
1972	0	0	1,528	268	240	8	17	2,247	2,474	0	0	0	6,783
1973	0	101	1	10,934	33,715	23,587	11,581	2,147	1,158	376	186	56	83,842
1974	18	16	62	9,255	1,068	2,744	1,408	1,467	894	246	108	0	17,285
1975	2	11	2,725	293	11,276	24,993	8,015	2,780	1,228	397	244	103	52,066
1976	66	65	68	72	2,315	422	340	101	2,064	2,240	1,919	0	9,672
1977	0	3	5	43	51	70	0	55	0	2	0	0	230
1978	0	0	0	9,539	66,397	213,004	54,199	11,955	2,574	1,052	610	234	359,564
1979	147	163	182	3,353	7,618	29,191	16,826	2,777	1,389	383	154	64	62,247
1980	18	16	73	2,369	108,757	61,596	10,436	3,032	1,614	507	194	103	188,715
1981	21	19	65	396	862	15,362	2,026	654	240	31	13	0	19,689
1982	0	5	43	137	93	2,688	4,957	583	37	2,019	2,099	1,897	14,557
1983	0	62	4,342	41,368	93,640	233,629	74,810	41,016	9,541	1,879	1,179	669	502,135
1984	844	372	15,773	6,822	3,076	1,551	2,225	1,152	892	253	104	22	33,086
1985	0	10	389	89	328	371	182	0	2,030	2,241	0	0	5,638
1986	0	1	35	110	15,034	16,102	3,149	1,556	1,097	246	97	22	37,449
1987	7	16	61	157	72	2,340	109	35	0	0	0	0	2,797
1988	0	0	18	114	51	2,230	373	80	1,983	1,454	0	0	6,304
1989	0	0	0	0	3	2	1	0	0	0	0	0	6
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	12,810	2,252	710	0	0	0	0	15,773
1992	0	0	2	10	24,758	9,365	4,672	2,038	1,236	330	1,997	2,054	46,463
1993	0	0	138	45,488	153,103	90,065	39,960	9,863	2,506	782	491	126	342,522
AVG	170	134	1,137	6,694	17,850	24,621	9,814	2,689	1,044	710	591	328	65,781
MEDIAN	0	0	56	287	1,348	2,285	1,364	418	866	319	115	0	14,000

Alternative 5C

SANTA YNEZ RIVER BELOW HILTON CREEK (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	476	453	433	414	47,567	127,927	17,774	5,003	1,061	839	1,086	1,108	204,142
1919	428	378	365	1,273	1,296	1,294	351	361	374	3,790	441	2,163	12,513
1920	1,460	515	342	356	273	329	239	352	378	3,857	375	2,717	11,193
1921	1,642	911	197	163	162	183	196	206	229	235	4,837	2,165	11,126
1922	2,576	736	615	395	1,048	2,412	7,035	1,187	1,310	934	1,113	1,166	20,527
1923	382	390	302	1,299	1,307	1,283	314	346	364	378	4,272	3,037	13,674
1924	3,022	673	382	378	372	309	369	376	384	394	1,887	2,092	10,636
1925	1,411	595	200	211	219	206	171	220	229	1,229	2,801	553	8,046
1926	211	222	222	222	270	166	927	1,234	1,490	1,029	1,203	1,920	9,116
1927	4,466	225	171	169	1,553	9,303	4,165	1,220	1,359	952	1,139	1,198	25,919
1928	383	386	378	1,272	1,385	1,336	332	354	364	3,805	3,038	3,026	16,059
1929	3,017	401	394	380	343	310	326	372	3,546	2,801	1,495	2,411	15,796
1930	1,617	503	200	210	216	220	205	219	229	1,338	1,861	205	7,022
1931	223	233	237	238	219	231	229	1,518	266	226	246	259	4,125
1932	265	264	438	250	949	2,728	1,945	1,343	1,458	1,049	1,195	1,925	13,809
1933	679	208	217	294	277	355	194	216	3,538	2,994	2,993	2,053	14,019
1934	204	219	226	292	193	165	220	227	3,821	2,890	2,392	2,463	13,312
1935	192	209	218	308	188	327	450	1,268	1,489	1,055	4,097	2,646	12,446
1936	1,196	875	205	212	633	215	201	198	223	235	2,478	399	7,069
1937	221	231	235	205	1,220	5,978	16,930	1,173	1,237	924	1,128	1,177	30,659
1938	459	876	366	1,273	31,689	187,385	15,924	2,249	1,137	795	1,075	1,106	244,334
1939	417	425	347	1,314	1,331	1,378	274	345	367	3,560	3,037	3,035	15,831
1940	403	406	403	350	239	265	326	375	390	3,940	3,019	1,986	12,103
1941	1,525	191	260	588	56,272	193,829	120,510	18,361	2,956	555	722	879	396,648
1942	322	324	525	413	400	577	6,339	486	383	350	372	1,071	11,561
1943	370	361	361	45,990	28,932	66,502	10,302	1,171	1,190	849	1,081	1,109	158,217
1944	391	384	329	288	17,370	35,994	4,713	1,158	1,207	936	1,098	1,149	65,016
1945	446	325	349	344	470	4,302	2,625	1,251	1,460	1,016	1,180	1,226	14,994
1946	1,296	718	239	347	328	274	410	1,459	1,518	3,455	3,038	3,035	16,118
1947	3,036	342	338	374	347	358	372	3,430	3,037	3,028	3,017	3,015	20,693
1948	2,908	1,432	206	216	222	228	232	238	772	1,246	222	240	8,162
1949	250	253	252	245	244	1,956	211	1,812	291	218	240	254	6,224
1950	260	261	244	250	1,908	200	215	3,174	194	213	236	251	7,408
1951	26	25	25	24	23	23	22	842	24	23	22	213	1,291
1952	22	22	29	1,561	2,147	1,559	6,802	1,172	1,418	945	1,069	1,659	18,404
1953	944	317	359	2,041	279	317	327	369	377	3,887	3,038	2,398	14,655
1954	2,171	357	369	676	1,323	337	268	370	374	4,139	2,779	3,016	16,179
1955	1,886	802	194	155	177	197	204	194	230	2,091	3,112	514	9,757
1956	207	220	765	952	243	177	213	165	210	218	1,885	1,111	6,366
1957	228	214	217	205	160	155	190	203	4,189	778	2,943	800	10,283
1958	255	303	218	166	833	1,234	33,425	9,142	1,044	776	1,040	1,114	49,552
1959	422	421	378	330	2,085	274	322	356	369	3,850	3,038	2,124	13,969
1960	1,713	943	359	350	1,912	351	321	367	377	396	2,739	202	10,030
1961	221	215	215	229	228	226	227	1,754	315	222	243	256	4,351
1962	262	303	172	168	2,771	2,225	1,870	1,230	1,449	1,012	1,174	1,716	14,353
1963	362	376	376	363	321	303	238	327	366	395	2,362	204	5,992
1964	222	227	227	226	225	225	225	1,912	350	215	237	251	4,542
1965	258	260	257	173	229	211	378	199	3,976	2,909	1,127	377	10,353
1966	212	377	368	431	1,336	2,956	2,151	1,394	1,431	1,031	4,151	2,995	18,832
1967	2,994	2,993	306	747	1,197	16,729	53,310	20,330	1,115	926	3,646	2,683	106,976
1968	430	436	368	362	342	1,928	322	366	3,429	370	1,035	2,158	11,545
1969	1,482	715	358	127,823	188,394	78,219	17,924	5,623	1,051	812	1,009	1,077	424,489
1970	395	356	352	309	297	2,186	338	362	378	3,589	3,037	1,085	12,684
1971	1,529	864	247	301	328	342	359	376	3,428	3,038	3,036	1,926	15,774
1972	1,504	812	244	334	345	370	372	3,413	3,020	377	1,358	2,350	14,500
1973	1,597	158	199	667	1,328	15,146	7,653	1,167	1,253	969	1,118	1,152	32,407
1974	453	778	364	546	280	441	463	1,404	1,501	1,040	1,177	4,389	12,837
1975	361	656	315	333	2,284	2,857	4,957	1,164	1,257	929	1,118	1,150	17,381
1976	372	378	377	376	1,946	318	335	361	3,430	3,038	2,539	2,384	15,853
1977	1,042	358	364	366	368	367	208	218	226	2,731	204	227	6,679
1978	240	245	245	687	10,410	145,614	35,264	7,427	1,041	622	941	1,071	203,807
1979	357	362	349	312	585	21,188	11,015	1,150	1,170	923	1,129	1,163	39,703
1980	854	655	354	276	67,612	40,857	6,987	1,117	1,115	865	1,122	1,153	122,970
1981	433	428	377	319	290	2,408	237	319	354	419	1,212	2,269	9,065
1982	1,544	750	353	340	348	1,953	340	313	372	3,656	3,038	3,035	16,042
1983	400	374	364	13,684	57,349	196,392	56,422	29,378	5,102	546	653	893	361,556
1984	288	337	13,090	4,824	1,679	467	2,001	1,392	1,436	993	1,166	1,209	28,881
1985	1,051	675	306	356	334	338	362	377	3,428	3,029	688	2,244	13,187
1986	1,115	357	196	173	767	2,033	1,951	1,234	1,387	1,013	1,170	1,215	12,612
1987	1,100	361	365	352	368	1,949	351	363	373	392	2,015	1,812	9,801
1988	357	374	374	340	363	1,924	318	353	3,465	205	1,977	2,333	12,384
1989	311	207	217	218	209	218	222	226	875	2,219	695	220	5,837
1990	234	241	243	243	243	238	241	1,361	212	478	310	296	4,343
1991	434	319	249	248	247	711	1,978	1,592	1,967	1,582	2,426	1,097	12,850
1992	330	217	208	159	1,036	2,608	1,845	1,220	1,312	969	4,032	3,037	16,973
1993	1,001	3,018	366	20,915	113,879	65,394	28,690	6,343	1,038	656	973	1,121	243,392
AVG	892	496	472	3,213	8,771	16,612	6,535	2,130	1,309	1,452	1,739	1,536	45,157
MEDIAN	425	368	322	340	370	522	355	1,134	1,088	948	1,178	1,187	13,742

Alternative 5C

SANTA YNEZ RIVER AT 154 BRIDGE (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	300	300	300	300	49,070	129,261	18,256	5,158	1,131	794	988	1,005	206,862
1919	351	308	300	1,163	1,252	1,249	300	300	300	3,581	360	1,920	11,384
1920	1,329	464	300	300	300	567	300	300	300	3,646	300	2,449	10,555
1921	1,509	840	150	150	181	234	150	150	150	150	4,541	2,093	10,299
1922	2,322	670	1,397	810	2,529	2,951	7,187	1,230	1,261	862	1,008	1,045	23,272
1923	300	300	463	1,223	1,275	1,217	300	300	300	300	4,040	2,961	12,979
1924	2,932	560	300	300	300	300	300	300	300	300	1,618	1,903	9,413
1925	1,285	533	150	150	150	150	195	150	150	995	2,550	486	6,944
1926	150	150	150	150	449	186	2,172	1,230	1,392	935	1,082	1,705	9,753
1927	4,318	365	218	207	3,803	9,514	4,313	1,230	1,300	877	1,032	1,074	28,249
1928	300	300	300	1,153	1,486	1,362	300	300	300	3,611	2,961	2,930	15,303
1929	2,914	300	300	300	300	300	300	300	3,353	2,729	1,281	2,208	14,584
1930	1,488	446	150	150	150	326	150	150	150	1,095	1,646	150	6,052
1931	150	150	150	150	150	150	150	1,290	205	150	150	150	2,994
1932	150	150	847	386	2,214	2,951	1,968	1,310	1,380	956	1,081	1,715	15,107
1933	602	150	150	501	300	300	150	150	3,330	2,918	2,895	1,782	13,227
1934	150	150	150	503	254	150	150	150	3,593	2,812	2,130	2,284	12,476
1935	150	150	150	549	244	604	932	1,230	1,385	952	3,912	2,579	12,837
1936	1,020	785	150	150	1,419	323	285	150	150	150	2,145	326	7,053
1937	150	150	150	272	2,927	7,373	17,199	1,230	1,211	858	1,024	1,058	33,603
1938	374	760	300	1,163	33,063	190,994	16,271	2,225	1,131	754	977	1,001	249,013
1939	342	341	300	1,268	1,344	1,475	300	300	300	3,372	2,958	2,936	15,237
1940	300	300	300	300	305	300	300	300	300	3,715	2,937	1,745	11,101
1941	1,376	150	418	1,264	60,454	199,720	123,221	18,808	3,050	615	717	829	410,624
1942	300	300	1,065	654	485	818	6,408	552	378	300	304	880	12,443
1943	300	300	300	47,150	29,583	68,071	10,562	1,230	1,173	800	982	1,002	161,452
1944	320	310	300	300	18,510	36,709	4,860	1,230	1,185	863	997	1,036	66,620
1945	361	300	300	300	860	4,391	2,667	1,230	1,375	926	1,061	1,094	14,867
1946	1,112	635	300	300	300	336	481	1,367	1,409	3,301	2,964	2,940	15,446
1947	2,931	300	300	300	300	300	300	3,252	2,969	2,938	2,908	2,896	19,693
1948	2,787	1,178	150	150	150	150	150	150	624	1,008	150	150	6,798
1949	150	150	150	150	150	1,959	150	1,608	236	150	150	150	5,153
1950	150	150	150	150	1,834	150	150	2,911	155	150	150	150	6,250
1951	0	0	0	0	0	0	0	496	0	0	0	29	525
1952	0	0	0	3,570	1,940	3,706	6,889	1,230	1,371	888	990	1,480	22,065
1953	874	300	634	2,189	300	300	300	300	300	3,684	2,964	2,311	14,455
1954	1,908	300	300	680	1,299	582	300	300	300	3,916	2,703	2,747	15,334
1955	1,758	738	150	169	150	150	150	150	150	1,806	2,893	455	8,719
1956	150	150	1,756	2,283	404	227	317	189	150	150	1,600	957	8,333
1957	174	150	150	150	170	150	150	150	3,952	688	2,699	730	9,313
1958	194	230	150	187	1,949	2,951	36,013	9,518	1,131	749	956	1,010	55,040
1959	348	342	303	300	2,302	300	300	300	300	3,648	2,960	1,890	13,292
1960	1,566	871	300	300	1,876	300	300	300	300	300	2,426	150	8,989
1961	150	150	150	150	150	150	150	1,510	252	150	150	150	3,262
1962	150	187	150	173	7,085	2,951	1,968	1,230	1,374	927	1,063	1,524	18,782
1963	300	300	300	300	531	480	300	300	300	300	2,082	150	5,643
1964	150	150	150	150	150	150	150	1,677	294	150	150	150	3,471
1965	150	150	150	183	150	150	719	150	3,649	2,782	1,029	321	9,583
1966	150	734	716	865	1,472	2,951	2,089	1,346	1,356	940	3,975	2,927	19,521
1967	2,910	2,901	524	1,663	1,472	16,766	53,525	20,705	1,131	859	3,495	2,622	108,573
1968	351	349	300	300	300	1,868	300	300	3,252	300	850	1,960	10,429
1969	1,358	652	300	130,867	192,612	79,716	18,437	5,809	1,131	768	926	977	433,552
1970	324	300	300	300	300	2,395	306	300	300	3,380	2,958	897	12,061
1971	1,357	804	344	300	300	300	300	300	3,236	2,961	2,939	1,664	14,805
1972	1,348	738	349	300	300	300	300	3,246	2,959	300	1,147	2,142	13,429
1973	1,467	150	150	1,526	3,279	15,650	7,862	1,230	1,222	889	1,014	1,041	35,480
1974	369	674	300	1,124	300	555	476	1,333	1,397	941	1,060	4,200	12,728
1975	300	570	518	300	2,849	4,128	5,084	1,230	1,229	859	1,012	1,037	19,116
1976	300	300	300	300	1,927	300	300	300	3,260	2,967	2,449	2,102	14,806
1977	917	300	300	300	300	300	150	150	150	2,419	150	150	5,586
1978	150	150	150	1,523	13,847	149,313	36,419	7,653	1,131	630	880	976	212,822
1979	300	300	300	500	1,001	21,536	11,348	1,230	1,165	857	1,024	1,050	40,611
1980	756	569	300	411	69,770	42,109	7,154	1,230	1,131	810	1,015	1,039	126,294
1981	356	347	301	300	300	3,167	324	300	300	328	1,002	2,068	9,092
1982	1,414	684	300	300	300	1,950	596	300	300	3,466	2,964	2,941	15,515
1983	300	300	637	15,315	59,574	198,967	57,866	30,190	5,335	615	658	836	370,592
1984	300	300	13,136	4,927	1,734	503	1,968	1,333	1,353	906	1,047	1,078	28,585
1985	882	591	300	300	300	300	300	300	3,235	2,951	571	1,976	12,005
1986	985	300	150	150	1,754	2,951	1,968	1,230	1,318	922	1,052	1,085	13,866
1987	928	300	300	300	300	1,935	300	300	300	300	1,743	1,638	8,643
1988	300	300	300	300	300	1,901	300	300	3,300	150	1,734	2,147	11,331
1989	260	150	150	150	150	150	150	150	734	1,948	607	150	4,749
1990	150	150	150	150	150	150	150	1,113	150	371	209	187	3,080
1991	302	207	150	150	150	1,583	1,983	1,528	1,807	1,446	2,253	1,014	12,571
1992	263	150	150	150	2,461	2,951	1,968	1,230	1,260	891	3,858	2,967	18,298
1993	884	2,934	300	21,907	116,166	66,785	29,262	6,557	1,131	650	900	1,012	248,488
AVG	792	429	483	3,396	9,319	17,090	6,711	2,115	1,241	1,349	1,607	1,402	45,935
MEDIAN	333	300	300	300	467	711	300	1,172	1,131	883	1,060	1,066	13,260

Alternative 5C

SANTA YNEZ RIVER ABOVE ALISAL BRIDGE (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	9	13	29	61	55,454	134,126	20,051	5,775	1,358	615	615	595	218,701
1919	90	90	119	858	1,163	1,173	197	181	126	2,919	90	1,001	8,006
1920	750	258	166	157	411	1,358	550	231	134	2,976	52	1,399	8,443
1921	898	560	29	127	255	418	96	70	9	3	3,456	1,769	7,690
1922	1,341	397	3,544	2,190	7,908	5,002	7,916	1,451	1,131	615	615	595	32,704
1923	51	49	801	1,052	1,243	1,108	312	221	158	97	3,179	2,633	10,906
1924	2,575	221	93	116	147	311	176	149	106	55	728	1,088	5,764
1925	733	297	25	23	22	65	288	38	12	348	1,545	182	3,578
1926	0	0	2	2	843	219	6,216	1,310	1,131	615	615	868	11,820
1927	3,628	689	325	348	12,584	10,612	4,908	1,309	1,131	615	615	595	37,360
1928	40	52	84	799	1,835	1,492	249	192	149	2,962	2,638	2,533	13,025
1929	2,506	30	59	99	214	313	273	155	2,807	2,452	532	1,320	10,759
1930	903	232	25	23	28	691	71	37	5	420	812	0	3,247
1931	0	0	0	0	5	0	0	555	10	0	0	0	571
1932	0	0	1,584	578	7,050	3,862	2,088	1,230	1,131	615	615	872	19,625
1933	278	0	0	1,096	390	217	88	39	2,776	2,631	2,503	805	10,824
1934	0	0	0	1,026	415	146	33	13	2,948	2,508	1,145	1,428	9,664
1935	5	0	0	1,235	426	1,565	2,651	1,287	1,131	615	3,166	2,279	14,359
1936	402	451	15	19	4,134	741	631	92	20	0	1,054	49	7,608
1937	0	0	0	380	8,924	12,640	18,279	1,443	1,131	615	615	595	44,622
1938	90	376	122	865	38,387	205,686	17,601	2,184	1,154	615	615	595	268,289
1939	90	90	166	1,172	1,450	1,898	421	228	151	2,771	2,639	2,546	13,622
1940	19	21	38	172	505	437	292	161	96	2,986	2,592	853	8,174
1941	744	19	795	3,388	74,182	222,403	133,838	20,136	3,286	734	615	595	460,735
1942	187	200	2,215	1,236	717	1,428	6,806	754	358	152	90	239	14,381
1943	52	92	118	52,574	31,769	74,508	11,409	1,427	1,131	615	615	595	174,905
1944	90	90	197	329	22,841	39,170	5,377	1,494	1,131	615	615	595	72,544
1945	90	203	161	198	2,425	5,042	3,001	1,244	1,131	615	615	595	15,319
1946	459	337	527	208	289	611	863	1,230	1,131	2,767	2,656	2,558	13,635
1947	2,533	177	201	133	201	196	168	2,829	2,757	2,628	2,500	2,438	16,762
1948	2,336	424	6	7	8	10	8	1	253	319	0	0	3,371
1949	0	0	0	0	0	1,481	0	815	30	0	0	0	2,327
1950	0	0	1	0	1,091	2	0	1,716	1	0	0	0	2,811
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	11,177	1,472	9,533	6,983	1,322	1,131	615	615	705	33,552
1953	529	169	1,079	2,616	408	318	283	164	122	3,014	2,637	1,940	13,279
1954	946	82	88	735	1,249	1,198	482	157	139	3,180	2,368	1,649	12,273
1955	1,123	479	31	166	103	78	66	92	4	948	1,912	174	5,175
1956	0	0	3,563	5,353	806	394	643	321	53	25	688	331	12,177
1957	0	0	0	11	142	145	83	55	3,245	349	1,677	375	6,083
1958	2	8	0	193	4,849	8,378	46,198	10,820	1,402	615	615	595	73,675
1959	90	90	90	218	2,966	414	284	200	147	2,986	2,630	993	11,108
1960	923	583	132	174	1,762	196	265	161	115	51	1,324	0	5,685
1961	0	7	7	0	0	0	0	721	36	0	0	0	772
1962	0	0	19	45	19,361	4,859	2,320	1,245	1,131	615	615	748	30,958
1963	65	55	75	122	839	774	408	249	152	55	1,082	0	3,877
1964	0	0	0	0	0	0	0	875	75	0	0	0	950
1965	0	0	0	51	4	4	1,281	14	2,293	1,963	489	63	6,161
1966	0	1,094	1,273	1,934	1,781	3,028	1,968	1,230	1,131	615	3,227	2,611	19,892
1967	2,556	2,562	1,309	4,419	2,823	17,532	54,647	22,371	1,194	615	2,902	2,352	115,282
1968	90	90	116	150	232	1,826	293	160	2,779	91	243	1,098	7,167
1969	787	406	135	145,366	212,075	86,540	20,142	6,543	1,404	615	615	595	475,222
1970	90	126	154	307	381	3,386	279	180	129	2,747	2,638	272	10,689
1971	678	576	663	328	254	251	207	153	2,747	2,689	2,564	757	11,865
1972	702	448	709	242	226	167	165	2,866	2,767	77	424	1,246	10,041
1973	877	88	24	3,725	10,016	17,430	8,605	1,475	1,131	615	615	595	45,197
1974	90	315	115	2,685	407	901	587	1,230	1,131	615	615	3,385	12,075
1975	80	273	834	224	4,283	7,476	5,581	1,484	1,131	615	615	595	23,190
1976	59	61	82	106	1,858	271	240	180	2,797	2,705	2,100	1,085	11,544
1977	393	92	105	123	137	157	39	25	4	1,451	0	0	2,526
1978	0	0	0	3,193	24,199	163,650	40,163	8,484	1,442	615	615	595	242,956
1979	100	103	154	982	2,193	22,811	12,535	1,502	1,131	615	615	595	43,337
1980	375	265	138	802	78,091	46,299	7,802	1,672	1,202	615	615	595	138,468
1981	90	90	90	235	363	5,475	629	298	189	90	325	1,193	9,066
1982	841	434	146	202	210	2,131	1,600	344	138	2,860	2,656	2,558	14,119
1983	21	94	1,680	19,930	66,401	210,927	63,109	33,451	6,124	762	615	595	403,709
1984	291	176	13,226	5,305	1,996	704	1,990	1,230	1,131	615	615	595	27,874
1985	310	297	235	171	236	244	199	149	2,738	2,679	192	1,000	8,450
1986	446	99	30	93	4,356	5,203	2,136	1,278	1,131	615	615	595	16,597
1987	334	89	109	163	146	1,884	199	163	123	61	840	892	5,003
1988	78	65	85	179	153	2,012	294	189	2,829	6	856	1,312	8,061
1989	61	1	1	5	38	23	16	9	367	1,088	241	0	1,850
1990	0	0	0	0	0	0	0	312	0	15	0	0	327
1991	0	0	0	0	0	3,522	1,968	1,230	1,131	809	1,398	595	10,653
1992	26	0	13	130	7,314	4,283	2,607	1,353	1,131	615	3,140	2,655	23,267
1993	457	2,623	126	25,781	124,268	72,481	31,679	7,440	1,491	615	615	595	268,172
AVG	453	228	501	4,054	11,259	18,893	7,419	2,150	1,062	1,014	1,122	905	49,059
MEDIAN	90	90	90	205	823	1,278	516	638	1,131	615	615	595	11,843

Alternative 5C

SANTA YNEZ RIVER NEAR BUELLTON (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	4	64,586	135,789	21,923	6,600	1,751	563	457	430	232,103
1919	4	8	56	680	1,110	1,136	95	100	38	2,571	0	534	6,331
1920	354	89	74	54	612	1,994	917	222	49	2,606	0	813	7,784
1921	433	300	0	146	405	722	90	52	0	0	2,872	1,529	6,548
1922	744	167	6,531	4,067	13,212	7,375	8,867	1,762	1,075	490	426	379	45,092
1923	0	0	1,411	1,055	1,307	1,027	359	186	94	24	2,732	2,405	10,601
1924	2,338	62	11	31	56	418	108	62	24	0	342	604	4,057
1925	339	112	0	0	0	50	510	7	0	94	971	17	2,101
1926	0	0	0	0	1,573	363	9,668	1,544	979	445	355	411	15,338
1927	3,062	1,116	504	582	21,383	11,253	5,645	1,433	1,027	485	416	360	47,267
1928	0	0	10	589	2,105	1,672	219	120	65	2,600	2,421	2,288	12,090
1929	2,252	0	0	21	244	449	346	97	2,478	2,266	184	755	9,092
1930	442	59	0	0	0	1,268	40	0	0	130	354	0	2,292
1931	0	0	0	0	0	0	0	200	0	0	0	0	200
1932	0	0	3,121	1,195	10,080	5,304	2,275	1,216	937	417	359	417	25,320
1933	76	0	0	2,063	605	205	78	1	2,449	2,443	2,258	325	10,503
1934	0	0	0	1,945	653	223	0	0	2,562	2,294	604	804	9,086
1935	0	0	0	2,295	739	2,566	4,448	1,454	970	421	2,713	2,058	17,666
1936	96	215	0	0	6,956	1,325	910	75	0	0	557	0	10,133
1937	0	0	0	745	16,925	18,629	19,697	1,716	1,133	500	419	366	60,131
1938	0	178	53	678	45,736	215,274	19,247	2,118	1,287	629	459	420	286,080
1939	6	6	159	1,285	1,718	2,523	596	194	69	2,447	2,441	2,315	13,759
1940	0	0	0	189	938	744	391	108	16	2,596	2,369	403	7,754
1941	330	0	1,380	6,370	84,752	242,011	141,863	21,845	3,683	1,025	723	581	504,563
1942	214	239	3,894	2,104	1,057	2,273	7,412	1,036	411	105	35	32	18,813
1943	0	11	35	57,415	34,291	80,017	12,406	1,694	1,185	561	457	419	188,490
1944	15	14	208	484	26,675	41,614	5,982	1,856	1,171	493	446	378	79,334
1945	1	261	138	195	4,499	5,572	3,476	1,310	968	446	400	346	17,611
1946	150	146	949	193	360	678	1,452	1,194	948	2,448	2,464	2,332	13,316
1947	2,297	236	261	88	206	176	102	2,534	2,607	2,457	2,278	2,183	15,425
1948	2,076	102	0	0	0	0	0	0	96	58	0	0	2,332
1949	0	0	0	0	0	1,577	0	415	0	0	0	0	1,992
1950	0	0	0	0	951	0	0	1,039	0	0	0	0	1,990
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	18,904	1,825	18,874	8,145	1,669	978	500	470	309	51,674
1953	316	111	1,789	3,361	573	369	245	66	31	2,634	2,403	1,690	13,587
1954	418	0	0	807	1,286	2,037	753	53	53	2,733	2,123	965	11,226
1955	564	217	0	109	75	40	22	100	0	489	1,208	5	2,829
1956	0	0	6,248	8,383	1,330	608	949	542	8	8	286	37	18,400
1957	0	0	0	0	177	217	84	45	2,801	150	1,024	111	4,609
1958	0	0	0	258	8,935	15,692	57,841	12,291	1,803	532	446	394	98,194
1959	1	0	2	232	4,085	585	237	115	80	2,614	2,411	500	10,862
1960	451	317	13	60	1,683	86	224	60	24	0	753	0	3,671
1961	0	0	0	0	0	0	0	278	0	0	0	0	278
1962	0	0	0	1	34,340	7,516	2,806	1,262	923	424	358	317	47,947
1963	0	0	0	9	1,281	1,182	568	240	86	0	541	0	3,905
1964	0	0	0	0	0	0	0	380	0	0	0	0	380
1965	0	0	0	17	0	0	2,033	0	1,489	1,257	97	0	4,892
1966	0	1,651	2,088	3,441	2,267	3,181	1,747	1,100	959	418	2,758	2,373	21,982
1967	2,296	2,309	2,478	8,334	4,110	17,990	55,035	23,668	1,200	465	2,667	2,204	122,758
1968	6	2	55	102	264	1,957	341	66	2,479	10	44	616	5,942
1969	374	194	20	162,873	230,220	94,922	21,411	7,355	1,759	528	481	440	520,577
1970	13	100	113	447	589	4,520	234	88	44	2,432	2,447	38	11,066
1971	297	415	884	433	253	200	132	58	2,441	2,528	2,350	343	10,335
1972	306	222	1,187	251	206	76	77	2,581	2,630	5	127	717	8,386
1973	434	51	0	6,106	18,590	19,095	9,494	1,635	1,038	455	425	374	57,696
1974	0	129	35	4,992	598	1,407	778	1,211	947	430	384	2,877	13,789
1975	0	89	1,353	208	6,396	12,066	6,227	1,840	1,038	469	425	372	30,482
1976	0	0	0	13	1,986	276	202	91	2,491	2,532	1,891	577	10,058
1977	81	0	0	11	25	49	0	0	0	916	0	0	1,082
1978	0	0	0	5,304	38,514	181,441	44,827	9,557	1,781	711	572	427	283,133
1979	25	32	118	1,789	3,930	24,706	13,965	1,853	1,115	472	418	361	48,785
1980	170	94	38	1,433	89,084	51,465	8,573	2,097	1,264	503	430	383	155,533
1981	1	0	4	273	548	8,803	1,047	351	157	10	71	680	11,947
1982	414	216	30	122	154	2,416	2,919	406	48	2,540	2,454	2,325	14,044
1983	0	60	3,002	26,717	75,243	218,221	67,007	36,368	7,270	1,076	786	582	436,331
1984	471	168	13,912	5,709	2,276	933	1,944	1,088	952	446	409	354	28,662
1985	62	119	243	109	235	235	144	57	2,439	2,514	47	537	6,740
1986	133	0	0	90	7,961	8,352	2,379	1,268	1,032	444	400	349	22,408
1987	73	0	10	78	45	1,926	109	65	33	0	433	449	3,223
1988	0	0	0	131	71	2,344	339	101	2,507	0	423	762	6,677
1989	0	0	0	0	13	0	0	0	181	634	49	0	878
1990	0	0	0	0	0	0	0	36	0	0	0	0	36
1991	0	0	0	0	0	6,777	2,468	1,170	704	401	806	276	12,604
1992	0	0	0	202	14,033	6,168	3,409	1,532	1,097	450	2,703	2,428	32,021
1993	215	2,395	36	31,467	134,304	79,045	34,731	8,297	1,841	640	555	416	293,942
AVG	294	161	690	4,964	13,569	20,790	8,192	2,279	997	855	884	651	54,326
MEDIAN	3	1	3	205	1,084	1,625	766	393	950	471	439	399	12,018

Alternative 5C

SANTA YNEZ RIVER ABOVE SALSIPUEDES CREEK CONFLUENCE (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	0	73,601	135,576	23,988	7,758	2,262	493	225	159	244,061
1919	0	0	0	358	897	1,061	26	48	0	2,047	0	6	4,443
1920	0	0	0	0	606	2,088	1,249	234	0	2,055	0	79	6,310
1921	0	4	0	55	403	907	84	42	0	0	1,934	1,160	4,588
1922	70	0	8,785	5,965	17,702	9,892	10,169	2,300	1,135	384	188	103	56,692
1923	0	0	1,572	969	1,341	1,017	476	211	68	0	2,031	2,049	9,735
1924	1,969	0	0	0	0	427	45	2	0	0	0	9	2,453
1925	0	0	0	0	0	0	528	0	0	0	116	0	644
1926	0	0	0	0	1,671	307	11,017	1,790	847	245	60	0	15,937
1927	2,138	1,269	584	796	29,283	11,687	6,688	1,725	1,021	358	154	64	55,767
1928	0	0	0	237	1,882	1,727	213	79	3	2,083	2,086	1,899	10,209
1929	1,852	0	0	0	176	486	371	48	2,074	2,005	0	54	7,067
1930	0	0	0	0	0	1,555	1	0	0	0	0	0	1,556
1931	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	3,768	1,145	10,418	6,810	2,495	1,291	773	201	66	0	26,967
1933	0	0	0	2,591	685	181	72	0	2,056	2,183	1,879	0	9,647
1934	0	0	0	2,334	664	250	0	0	2,068	1,992	32	73	7,413
1935	0	0	0	2,891	930	3,244	5,942	1,741	871	215	2,063	1,732	19,629
1936	0	0	0	0	8,786	1,934	1,093	97	0	0	18	0	11,929
1937	0	0	0	705	24,500	24,394	21,559	2,210	1,264	396	173	82	75,282
1938	0	0	0	372	53,269	221,427	21,350	2,217	1,570	668	245	157	301,276
1939	0	0	47	1,238	1,930	3,218	831	222	21	2,025	2,137	1,943	13,612
1940	0	0	0	81	1,179	964	487	82	0	2,042	2,027	0	6,862
1941	0	0	1,570	9,061	88,506	258,234	147,337	23,817	4,141	1,302	744	471	535,184
1942	160	194	4,811	2,781	1,349	2,962	8,147	1,406	498	50	0	0	22,357
1943	0	0	0	60,426	37,296	85,044	13,729	2,096	1,344	503	246	162	200,844
1944	0	0	92	509	28,862	44,090	6,848	2,388	1,310	380	210	90	84,779
1945	0	166	41	131	6,670	5,991	4,225	1,530	895	270	120	40	20,077
1946	0	0	1,158	131	412	500	2,175	1,254	810	2,049	2,171	1,972	12,631
1947	1,922	176	233	35	183	170	70	2,296	2,470	2,225	1,936	1,778	13,495
1948	1,665	0	0	0	0	0	0	0	0	0	0	0	1,665
1949	0	0	0	0	0	824	0	0	0	0	0	0	824
1950	0	0	0	0	189	0	0	47	0	0	0	0	237
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	26,393	1,005	27,262	8,874	1,975	739	306	225	0	66,780
1953	38	0	1,825	3,866	764	477	214	16	0	2,122	2,053	1,310	12,685
1954	0	0	0	588	1,119	2,557	1,056	0	0	2,110	1,758	164	9,351
1955	9	0	0	0	0	0	0	56	0	3	233	0	301
1956	0	0	6,741	8,909	1,721	824	1,151	841	0	0	0	0	20,186
1957	0	0	0	0	7	108	13	0	2,095	0	171	0	2,395
1958	0	0	0	69	11,628	22,684	69,721	14,220	2,355	407	202	127	121,412
1959	0	0	0	115	4,821	738	159	47	30	2,079	2,068	3	10,059
1960	0	10	0	0	1,259	0	109	0	0	0	28	0	1,406
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	46,785	8,405	2,924	1,122	625	168	46	0	60,076
1963	0	0	0	0	917	1,004	452	135	4	0	0	0	2,511
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	1,265	0	245	242	0	0	1,752
1966	0	907	1,935	4,361	2,482	3,354	1,579	1,041	838	205	2,076	2,023	20,801
1967	1,909	1,940	3,566	12,002	5,472	18,648	55,682	25,181	1,238	319	2,284	1,959	130,200
1968	0	0	0	14	237	2,052	418	10	2,163	0	0	17	4,911
1969	0	0	0	182,564	249,494	105,357	22,316	8,310	2,156	410	280	208	571,094
1970	0	17	20	523	801	5,601	218	45	2	2,027	2,154	0	11,408
1971	0	112	744	450	214	138	75	5	2,126	2,312	2,019	0	8,195
1972	0	0	1,394	210	172	18	27	2,326	2,504	0	0	38	6,688
1973	0	0	0	6,846	26,936	20,317	10,708	1,844	975	303	175	87	68,191
1974	0	0	0	6,613	762	1,833	1,005	1,275	815	227	97	2,066	14,694
1975	0	0	1,314	133	7,887	15,853	7,035	2,358	945	308	180	91	36,105
1976	0	0	0	0	1,775	224	139	16	2,120	2,275	1,554	19	8,122
1977	0	0	0	0	0	0	0	0	0	74	0	0	74
1978	0	0	0	5,251	51,284	201,008	50,148	10,975	2,169	772	446	158	322,211
1979	0	0	11	2,280	5,405	26,521	15,825	2,359	1,103	296	143	54	53,997
1980	0	0	0	1,732	99,976	57,412	9,675	2,615	1,324	350	181	93	173,359
1981	0	0	0	140	593	11,694	1,515	454	149	0	0	18	14,563
1982	0	0	0	0	33	2,537	4,316	489	0	2,086	2,139	1,948	13,548
1983	0	0	4,011	32,398	84,005	223,717	69,588	39,076	8,662	1,379	895	494	464,226
1984	563	94	14,349	6,288	2,746	1,334	2,024	1,058	860	276	137	51	29,780
1985	0	0	70	10	159	186	101	2	2,102	2,280	0	5	4,914
1986	0	0	0	0	10,316	10,584	2,736	1,262	1,009	268	128	49	26,351
1987	0	0	0	0	0	1,608	23	0	0	0	0	0	1,631
1988	0	0	0	0	0	2,388	319	7	2,050	0	0	48	4,812
1989	0	0	0	0	0	0	0	0	0	28	0	0	28
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	8,990	2,413	902	173	0	70	0	12,548
1992	0	0	0	80	20,248	8,210	4,488	1,861	1,162	265	2,092	2,100	40,505
1993	0	2,049	0	37,236	145,478	86,855	38,734	9,304	2,201	602	423	156	323,037
AVG	162	91	772	5,683	15,525	22,467	8,924	2,475	953	667	594	360	58,672
MEDIAN	0	0	0	123	967	1,780	1,031	228	792	273	149	39	12,238

Alternative 5C

SANTA YNEZ RIVER AT LOMPOC NARROWS (acre-feet/month)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	54	79,462	144,216	25,679	8,304	2,671	670	289	218	261,563
1919	68	67	73	414	1,086	1,248	19	133	0	1,946	0	0	5,056
1920	23	47	55	59	842	3,030	1,662	323	84	1,974	0	22	8,120
1921	0	0	0	158	634	1,292	166	122	27	64	1,795	1,116	5,374
1922	23	0	12,076	7,500	22,255	11,808	11,026	2,520	1,227	462	158	71	69,126
1923	0	0	2,549	1,178	1,633	1,106	618	304	156	79	1,933	2,007	11,563
1924	1,921	0	67	71	74	692	132	84	79	0	0	0	3,120
1925	0	0	0	0	0	10	742	49	49	0	16	0	866
1926	0	0	10	20	2,486	674	15,677	2,201	931	318	35	0	22,353
1927	1,963	1,908	960	1,084	35,394	13,112	7,331	1,931	1,106	431	122	33	65,374
1928	0	49	56	275	2,574	2,146	305	167	86	2,003	2,042	1,844	11,547
1929	1,796	0	61	74	257	679	563	131	2,010	1,970	0	3	7,545
1930	0	0	0	0	21	1,922	77	69	0	0	0	0	2,089
1931	0	0	0	0	62	20	37	0	0	0	0	0	119
1932	0	0	5,392	1,569	16,628	7,786	2,923	1,486	851	219	38	0	36,892
1933	0	0	0	3,262	1,049	269	168	84	1,990	2,146	1,826	0	10,793
1934	0	0	0	3,086	1,093	438	85	32	1,996	1,953	1	13	8,697
1935	0	0	0	3,665	1,310	4,262	7,583	1,946	952	234	1,973	1,692	23,617
1936	0	0	0	48	11,071	2,456	1,538	194	37	0	0	0	15,343
1937	0	0	0	983	29,702	28,987	22,849	2,429	1,358	473	142	52	86,978
1938	0	0	55	401	57,992	235,333	22,645	2,318	1,673	751	312	220	321,699
1939	0	0	199	1,477	2,325	3,801	1,134	317	110	1,962	2,095	1,889	15,309
1940	0	0	0	208	1,571	1,367	705	169	33	1,959	1,980	0	7,993
1941	0	0	2,293	11,641	107,780	277,103	156,990	25,507	4,856	1,800	1,124	744	589,837
1942	438	472	8,215	4,461	2,260	4,789	9,274	1,918	792	231	167	55	33,073
1943	66	157	165	63,311	39,253	88,984	14,691	2,512	1,543	684	315	227	211,910
1944	74	73	359	884	33,014	46,619	7,489	2,810	1,509	460	277	63	93,633
1945	21	321	209	305	7,526	6,600	4,455	1,635	881	247	90	14	22,305
1946	0	0	1,239	199	497	1,296	2,482	1,343	887	1,993	2,131	1,921	13,989
1947	1,867	331	413	118	368	283	159	2,253	2,445	2,185	1,880	1,714	14,016
1948	1,601	0	0	0	0	0	0	0	0	0	0	0	1,601
1949	0	0	0	0	0	1,917	0	0	0	0	0	0	1,917
1950	0	0	0	0	555	2	0	0	0	0	0	0	557
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	32,930	1,267	35,959	9,168	2,008	735	307	242	0	82,616
1953	67	213	3,684	4,916	962	590	364	51	31	2,024	2,003	1,254	16,158
1954	0	0	0	648	1,381	3,937	1,257	0	76	2,001	1,707	92	11,097
1955	0	0	0	275	147	68	85	120	1	0	93	0	790
1956	0	0	12,858	16,085	2,831	1,334	1,895	1,142	87	79	0	1	36,311
1957	0	0	1	44	342	268	95	73	1,985	1	87	0	2,896
1958	1	0	0	309	16,916	29,651	78,176	15,104	2,768	582	280	187	143,974
1959	68	66	68	280	6,176	1,036	360	135	114	1,995	2,022	0	12,320
1960	0	0	3	49	1,747	84	411	77	0	0	0	0	2,370
1961	0	51	88	2	4	9	0	0	0	0	0	0	153
1962	1	0	116	438	65,405	12,148	3,544	1,415	715	239	22	0	84,042
1963	0	2	36	54	2,665	2,613	1,322	515	182	71	0	0	7,461
1964	0	0	1	3	4	6	7	0	0	0	0	0	22
1965	0	0	0	337	24	83	2,718	80	224	175	1	0	3,641
1966	1	3,540	4,318	6,691	3,862	3,871	1,745	1,225	913	220	1,974	1,978	30,339
1967	1,858	1,888	4,031	15,926	5,934	19,067	56,596	25,643	1,430	298	2,207	1,924	136,802
1968	0	20	69	87	305	2,208	513	4	2,098	0	1	0	5,307
1969	0	0	0	190,682	257,814	108,147	24,152	8,947	2,562	571	348	271	593,494
1970	74	93	190	696	987	6,348	311	38	0	1,939	2,109	0	12,785
1971	0	54	1,032	609	399	223	170	1	2,052	2,272	1,966	0	8,777
1972	0	0	1,528	268	240	8	17	2,247	2,474	0	0	0	6,783
1973	0	101	1	10,928	33,710	23,086	11,561	2,147	1,158	376	185	56	83,309
1974	18	16	62	9,254	1,068	2,744	1,408	1,467	894	246	108	1,950	19,234
1975	24	22	2,835	316	11,339	22,619	7,969	2,775	1,228	397	244	102	49,871
1976	66	65	68	72	2,313	422	340	101	2,064	2,240	1,505	0	9,255
1977	0	4	5	44	51	71	0	55	0	6	0	0	236
1978	0	0	0	9,542	66,477	213,021	54,197	11,933	2,574	1,053	610	235	359,642
1979	147	163	182	3,353	7,546	29,192	16,810	2,776	1,389	383	154	64	62,158
1980	18	16	73	2,369	108,642	61,595	10,423	3,032	1,614	507	194	103	188,585
1981	21	19	65	396	862	15,362	2,026	654	240	31	13	0	19,689
1982	0	5	43	137	93	2,688	4,957	583	37	2,019	2,099	1,897	14,557
1983	0	62	4,342	41,009	93,636	233,672	74,807	41,000	9,519	1,879	1,179	669	501,774
1984	844	372	15,724	6,817	3,068	1,551	2,225	1,152	892	253	104	22	33,024
1985	0	10	389	89	328	371	182	0	2,030	2,241	0	0	5,638
1986	0	1	35	110	15,075	16,121	3,157	1,560	1,098	247	98	22	37,525
1987	7	16	61	157	72	2,340	109	35	0	0	0	0	2,796
1988	0	0	18	114	51	2,366	411	87	1,981	0	0	0	5,028
1989	0	0	0	0	3	2	1	0	0	0	0	0	6
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	12,808	2,274	719	0	0	0	0	15,801
1992	0	0	2	10	24,760	9,365	4,679	2,039	1,236	331	1,997	2,054	46,473
1993	0	1,982	155	40,673	153,028	90,113	39,915	9,843	2,505	782	491	125	339,613
AVG	172	161	1,139	6,621	17,794	24,492	9,731	2,685	1,043	697	589	354	65,478
MEDIAN	0	0	56	293	1,345	2,353	1,365	419	866	302	115	2	14,002

Appendix B

Monthly Cachuma Project Deliveries
(simulation, 1918-1993)

New Alternatives 5B and 5C

Cachuma Project Deliveries in Acre-feet - Alternative 5B (SYRHM simulation 1918-1993)													
Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1919	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1920	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1921	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1922	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1923	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1924	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1925	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,536	2,856	3,465	3,290	2,536	25,163
1926	1,817	1,270	1,226	1,160	1,095	1,565	1,967	2,631	2,963	3,595	3,414	2,631	25,335
1927	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1928	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1929	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1930	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,415	2,719	3,299	3,132	2,415	24,459
1931	1,730	1,209	1,167	1,105	1,042	1,490	1,873	1,813	2,041	2,476	2,351	1,813	20,110
1932	1,299	907	876	829	782	1,624	2,041	2,631	2,963	3,595	3,414	2,631	23,593
1933	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1934	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,515	2,832	3,436	3,263	2,515	25,040
1935	1,802	1,259	1,216	1,151	1,085	1,552	1,951	2,584	2,909	3,530	3,351	2,584	24,974
1936	1,851	1,293	1,249	1,182	1,115	1,594	2,004	2,485	2,798	3,395	3,223	2,485	24,674
1937	1,780	1,244	1,201	1,137	1,072	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,334
1938	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1939	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1940	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1941	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1942	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1943	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1944	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1945	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1946	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1947	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1948	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1949	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,114	2,381	2,889	2,743	2,114	22,721
1950	1,515	1,059	1,022	967	913	1,305	1,640	1,600	1,802	2,186	2,076	1,600	17,685
1951	1,146	801	773	732	691	987	1,241	1,181	1,330	1,613	1,532	1,181	13,208
1952	846	591	571	540	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	22,583
1953	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1954	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1955	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1956	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,497	2,811	3,411	3,239	2,497	24,934
1957	1,789	1,250	1,207	1,142	1,078	1,541	1,937	2,033	2,290	2,778	2,638	2,033	21,714
1958	1,457	1,018	983	930	878	1,255	2,041	2,631	2,963	3,595	3,414	2,631	23,796
1959	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1960	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1961	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,535	2,854	3,463	3,288	2,535	25,155
1962	1,816	1,269	1,225	1,160	1,094	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,464
1963	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1964	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1965	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,332	2,627	3,187	3,026	2,332	23,983
1966	1,671	1,168	1,127	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,206
1967	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1968	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1969	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1970	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1971	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1972	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1973	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1974	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1975	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1976	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1977	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1978	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1979	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1980	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1981	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1982	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1983	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1984	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1985	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1986	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1987	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1988	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1989	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,310	2,601	3,156	2,996	2,310	23,851
1990	1,655	1,156	1,116	1,057	997	1,425	1,792	1,721	1,938	2,351	2,232	1,721	19,161
1991	1,233	862	832	787	743	1,062	1,335	2,145	2,415	2,930	2,782	2,145	19,269
1992	1,537	1,074	1,037	981	926	1,624	2,041	2,631	2,963	3,595	3,414	2,631	24,453
1993	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
AVG	1,817	1,269	1,226	1,162	1,104	1,591	2,007	2,536	2,855	3,464	3,289	2,536	24,855
MEDIAN	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714

Cachuma Project Deliveries in Acre-feet - Alternative 5C
(SYRHM simulation 1918-1993)

Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1919	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1920	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1921	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1922	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1923	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1924	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1925	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,597	2,925	3,549	3,369	2,597	25,517
1926	1,861	1,300	1,256	1,188	1,121	1,603	2,015	2,631	2,963	3,595	3,414	2,631	25,578
1927	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1928	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1929	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1930	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,489	2,803	3,401	3,229	2,489	24,892
1931	1,784	1,246	1,203	1,139	1,074	1,536	1,931	1,913	2,154	2,614	2,482	1,913	20,991
1932	1,371	958	925	875	826	1,624	2,041	2,631	2,963	3,595	3,414	2,631	23,854
1933	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1934	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,540	2,860	3,471	3,295	2,540	25,186
1935	1,820	1,272	1,228	1,162	1,096	1,568	1,971	2,591	2,917	3,540	3,361	2,591	25,116
1936	1,856	1,297	1,252	1,185	1,118	1,599	2,010	2,496	2,810	3,410	3,238	2,496	24,767
1937	1,788	1,250	1,206	1,142	1,077	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,363
1938	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1939	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1940	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1941	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1942	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1943	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1944	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1945	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1946	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1947	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1948	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1949	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,205	2,482	3,012	2,860	2,205	23,243
1950	1,579	1,104	1,066	1,009	951	1,360	1,710	1,708	1,923	2,333	2,215	1,708	18,667
1951	1,224	855	826	781	737	1,054	1,325	1,297	1,460	1,771	1,682	1,297	14,308
1952	929	649	627	593	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	22,833
1953	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1954	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1955	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1956	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,559	2,882	3,496	3,320	2,559	25,295
1957	1,833	1,281	1,237	1,171	1,104	1,579	1,985	2,115	2,381	2,889	2,743	2,115	22,434
1958	1,515	1,059	1,022	967	913	1,305	2,041	2,631	2,963	3,595	3,414	2,631	24,057
1959	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1960	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1961	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,596	2,924	3,548	3,368	2,596	25,512
1962	1,860	1,300	1,255	1,188	1,121	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,624
1963	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1964	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1965	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,392	2,694	3,268	3,103	2,392	24,329
1966	1,714	1,198	1,156	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,307
1967	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1968	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1969	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1970	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1971	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1972	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1973	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1974	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1975	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1976	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1977	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1978	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1979	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1980	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1981	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1982	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1983	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1984	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1985	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1986	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1987	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1988	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
1989	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,392	2,694	3,269	3,103	2,392	24,330
1990	1,714	1,198	1,156	1,094	1,033	1,476	1,856	1,829	2,060	2,499	2,373	1,829	20,117
1991	1,310	916	884	837	789	1,129	1,419	2,203	2,481	3,010	2,858	2,203	20,038
1992	1,578	1,103	1,065	1,008	951	1,624	2,041	2,631	2,963	3,595	3,414	2,631	24,604
1993	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714
AVG	1,827	1,277	1,233	1,168	1,110	1,597	2,013	2,550	2,872	3,484	3,308	2,550	24,988
MEDIAN	1,885	1,317	1,272	1,204	1,136	1,624	2,041	2,631	2,963	3,595	3,414	2,631	25,714

Appendix C

Monthly Cachuma Project Shortages
(simulation, 1918-1993)

New Alternatives 5B and 5C

Cachuma Project Shortages in Acre-feet - Alternative 5B (SYRHM simulation 1918-1993)													
Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	0	0	0	0	0	0	0	0	0	0
1919	0	0	0	0	0	0	0	0	0	0	0	0	0
1920	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	95	107	130	124	95	551
1926	68	48	46	44	41	59	74	0	0	0	0	0	379
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	217	244	296	281	217	1,255
1931	155	108	105	99	94	134	168	819	922	1,119	1,062	819	5,604
1932	587	410	396	375	353	0	0	0	0	0	0	0	2,121
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	116	131	159	151	116	674
1935	83	58	56	53	50	72	90	48	54	65	62	48	740
1936	34	24	23	22	21	30	37	147	165	200	190	147	1,040
1937	105	73	71	67	63	0	0	0	0	0	0	0	380
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	517	582	706	671	517	2,993
1950	370	259	250	236	223	319	401	1,031	1,161	1,409	1,338	1,031	8,029
1951	739	516	498	472	445	636	800	1,451	1,634	1,982	1,882	1,451	12,506
1952	1,039	726	701	664	0	0	0	0	0	0	0	0	3,131
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	135	152	184	175	135	780
1957	97	67	65	62	58	83	104	598	674	817	776	598	4,000
1958	429	299	289	274	258	369	0	0	0	0	0	0	1,918
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	97	109	132	125	97	559
1962	69	48	47	44	42	0	0	0	0	0	0	0	250
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	299	337	408	388	299	1,731
1966	214	150	144	0	0	0	0	0	0	0	0	0	508
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	322	362	440	417	322	1,863
1990	230	161	156	147	139	199	250	911	1,025	1,244	1,181	911	6,553
1991	652	456	440	417	393	562	706	487	548	665	631	487	6,445
1992	349	244	235	223	210	0	0	0	0	0	0	0	1,261
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
AVG	69	48	46	42	31	32	35	96	108	131	124	96	859
MEDIAN	0	0	0	0	0	0	0	0	0	0	0	0	0

Cachuma Project Shortages in Acre-feet - Alternative 5C (SYRHM simulation 1918-1993)													
Water Year	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM
1918	0	0	0	0	0	0	0	0	0	0	0	0	0
1919	0	0	0	0	0	0	0	0	0	0	0	0	0
1920	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	34	38	47	44	34	197
1926	24	17	16	16	15	21	26	0	0	0	0	0	136
1927	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	142	160	194	184	142	822
1931	102	71	69	65	61	88	110	718	809	981	932	718	4,723
1932	514	360	347	329	310	0	0	0	0	0	0	0	1,860
1933	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	91	103	125	118	91	528
1935	65	46	44	42	39	56	71	41	46	56	53	41	598
1936	29	20	20	19	18	25	32	136	153	185	176	136	947
1937	97	68	66	62	59	0	0	0	0	0	0	0	351
1938	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	427	481	583	554	427	2,471
1950	306	214	206	195	184	263	331	924	1,040	1,262	1,198	924	7,047
1951	662	462	446	423	399	570	716	1,335	1,503	1,824	1,732	1,335	11,406
1952	956	668	645	611	0	0	0	0	0	0	0	0	2,881
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	72	81	99	94	72	419
1957	52	36	35	33	31	45	56	517	582	706	670	517	3,280
1958	370	259	250	236	223	319	0	0	0	0	0	0	1,657
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	35	39	48	45	35	202
1962	25	17	17	16	15	0	0	0	0	0	0	0	90
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	239	269	327	310	239	1,385
1966	171	120	116	0	0	0	0	0	0	0	0	0	407
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	239	269	327	310	239	1,384
1990	171	120	116	109	103	148	185	802	903	1,096	1,041	802	5,597
1991	575	402	388	367	346	495	622	428	483	585	556	428	5,676
1992	307	215	207	196	185	0	0	0	0	0	0	0	1,110
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
AVG	58	41	39	36	26	27	28	81	92	111	105	81	726
MEDIAN	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix D

Annual State Water Project Water
Deliveries to South Coast
(simulation, 1942-1993)

New Alternatives 5B and 5C

SUMMARY OF STATE WATER PROJECT DELIVERIES
FOR ALTERNATIVE 5B
(ACRE-FEET/YEAR)

WATER YEAR	DEMAND TOTAL SWP Demand [1]	ID No. 1 Exchange	SUPPLY M&I Projected Delivery as Percentage of Full Entitlement [2]	ID No. 1 Exchange Shortage [3]	Reduced Delivery due to Spill [4]	DELIVERY ID No. 1 Exchange	SWP in Cachuma [5]	SWP in Outlet Works [6]	Total Imports under South Coast Contracts
1942	13,750	2,571	100%	100%	1,868	2,571	8,392	521	11,483
1943	13,750	2,571	89%	100%	3,173	2,571	2,831	1,421	6,822
1944	13,750	2,571	92%	100%	2,467	2,571	5,367	1,500	9,438
1945	13,750	2,571	90%	100%	1,645	2,571	6,589	1,659	10,819
1946	13,750	2,571	88%	100%	0	2,571	6,589	4,988	14,148
1947	13,750	2,571	75%	100%	0	2,571	3,203	4,888	10,662
1948	13,750	2,571	67%	100%	0	2,571	4,007	2,588	9,166
1949	13,750	2,571	65%	88%	0	2,272	5,649	1,055	8,976
1950	13,750	2,571	67%	69%	0	1,768	6,162	1,236	9,167
1951	13,750	2,571	88%	51%	0	1,321	10,196	515	12,031
1952	13,750	2,571	96%	88%	1,820	2,258	5,022	1,647	8,927
1953	13,750	2,571	90%	100%	0	2,571	9,207	3,065	14,843
1954	13,750	2,571	83%	100%	0	2,571	5,892	2,995	11,458
1955	13,750	2,571	69%	100%	0	2,571	4,123	2,855	9,549
1956	13,750	2,571	90%	97%	0	2,493	8,174	1,494	12,161
1957	13,750	2,571	88%	84%	0	2,171	5,863	3,101	11,135
1958	13,750	2,571	90%	93%	1,677	2,379	7,350	1,171	10,900
1959	13,750	2,571	88%	100%	0	2,571	7,283	3,162	13,016
1960	13,750	2,571	63%	100%	0	2,571	3,749	2,274	8,594
1961	13,750	2,571	61%	98%	0	2,515	4,848	1,040	8,403
1962	13,750	2,571	78%	99%	0	2,546	3,216	2,047	7,810
1963	13,750	2,571	94%	100%	0	2,571	12,415	885	15,871
1964	13,750	2,571	88%	100%	0	2,571	9,285	175	12,031
1965	13,750	2,571	82%	93%	0	2,398	5,642	3,227	11,267
1966	13,750	2,571	96%	98%	0	2,520	3,591	3,177	9,288
1967	13,750	2,571	96%	100%	3,545	2,571	2,705	5,665	10,942
1968	13,750	2,571	89%	100%	0	2,571	7,153	2,684	12,409
1969	13,750	2,571	93%	100%	4,230	2,571	2,705	2,044	7,321
1970	13,750	2,571	89%	100%	0	2,571	8,760	2,168	13,499
1971	13,750	2,571	94%	100%	0	2,571	5,157	5,523	13,251
1972	13,750	2,571	88%	100%	0	2,571	4,945	3,857	11,373
1973	13,750	2,571	82%	100%	1,453	2,571	3,453	2,333	8,356
1974	13,750	2,571	94%	100%	0	2,571	7,793	2,171	12,535
1975	13,750	2,571	96%	100%	1,773	2,571	4,015	2,142	8,728
1976	13,750	2,571	88%	100%	0	2,571	7,732	5,506	15,809
1977	13,750	2,571	33%	100%	0	2,571	888	1,364	4,823
1978	13,750	2,571	68%	100%	2,231	2,571	3,421	922	6,914
1979	13,750	2,571	85%	100%	2,214	2,571	3,271	1,515	7,357
1980	13,750	2,571	82%	100%	2,875	2,571	2,705	2,179	7,455
1981	13,750	2,571	83%	100%	0	2,571	9,572	1,485	13,628
1982	13,750	2,571	94%	100%	0	2,571	6,004	4,412	12,986
1983	13,750	2,571	100%	100%	5,544	2,571	4,716	384	7,671
1984	13,750	2,571	100%	100%	2,779	2,571	3,345	1,632	7,548
1985	13,750	2,571	96%	100%	0	2,571	6,292	5,291	14,154
1986	13,750	2,571	81%	100%	699	2,571	4,958	2,178	9,706
1987	13,750	2,571	69%	100%	0	2,571	7,928	1,666	12,166
1988	13,750	2,571	43%	100%	0	2,571	1,433	1,958	5,962
1989	13,750	2,571	58%	93%	0	2,385	3,749	1,887	8,021
1990	13,750	2,571	46%	75%	0	1,916	3,189	1,197	6,302
1991	13,750	2,571	29%	75%	0	1,927	0	2,084	4,011
1992	13,750	2,571	31%	95%	0	2,445	44	1,713	4,202
1993	13,750	2,571	76%	100%	3,282	2,571	2,460	1,835	6,866
AVG	13,750	2,571	80%	96%	832	2,470	5,251	2,317	10,038

NOTES
1) Based on total South Coast contractual agreements with CCWA not including drought buffers and additional water (4,500 afy) contracted by Goleta.
2) Based on DWR's SWP model DWRSIM v. 9.06T
Uses results from DWR's No Action scenario 786 which uses Delta historic hydrology
with regulations (including 1995 WQCP Bay-Delta Accord, 1997 AFRP CVPIA(b) and the New Melones Interim Operation plan)
and no new storage facilities. The percentages in this table do not include the option of purchasing the 10% drought buffer.
3) Based on shortages in Cachuma Project estimated by the SYRHM 0498
4) Assumes no CCWA deliveries when Cachuma is spilling and also that South Coast would not want to make-up that delivery water
because of the wetness of the basin and already assuming full deliveries of 13750 pending spills
5) SWP reductions in delivery (due to restrictions of 50% SWP during water right releases and 0% SWP during passage releases)
are redistributed to the following months up to one year.
6) Limited to being 50% of outlet releases

SUMMARY OF STATE WATER PROJECT DELIVERIES
FOR ALTERNATIVE 5C
(ACRE-FEET/YEAR)

	DEMAND		SUPPLY			DELIVERY			
WATER YEAR	TOTAL SWP Demand [1)]	ID No. 1 Exchange	M&I Projected Delivery as Percentage of Full Entitlement [2)]	ID No. 1 Exchange Shortage [3)]	Reduced Delivery due to Spill [4)]	ID No. 1 Exchange	SWP in Cachuma [5)]	SWP in Outlet Works [6)]	Total Imports under South Coast Contracts
1942	13,750	2,571	100%	100%	919	2,571	9,341	522	12,434
1943	13,750	2,571	89%	100%	3,173	2,571	2,830	1,421	6,821
1944	13,750	2,571	92%	100%	2,467	2,571	5,367	1,500	9,438
1945	13,750	2,571	90%	100%	1,645	2,571	6,589	1,660	10,820
1946	13,750	2,571	88%	100%	0	2,571	6,589	4,989	14,149
1947	13,750	2,571	75%	100%	0	2,571	3,203	4,887	10,661
1948	13,750	2,571	67%	100%	0	2,571	4,004	2,591	9,166
1949	13,750	2,571	65%	90%	0	2,324	5,595	1,057	8,976
1950	13,750	2,571	67%	73%	0	1,866	6,080	1,220	9,166
1951	13,750	2,571	88%	56%	0	1,431	10,086	515	12,031
1952	13,750	2,571	96%	89%	1,816	2,283	5,014	1,735	9,032
1953	13,750	2,571	90%	100%	0	2,571	9,207	2,965	14,743
1954	13,750	2,571	83%	100%	0	2,571	5,892	2,995	11,458
1955	13,750	2,571	69%	100%	0	2,571	4,124	2,854	9,549
1956	13,750	2,571	90%	98%	0	2,529	8,144	1,491	12,165
1957	13,750	2,571	88%	87%	0	2,243	5,819	3,094	11,156
1958	13,750	2,571	90%	94%	1,673	2,405	7,317	1,167	10,889
1959	13,750	2,571	88%	100%	0	2,571	7,274	3,162	13,007
1960	13,750	2,571	63%	100%	0	2,571	3,749	2,274	8,594
1961	13,750	2,571	61%	99%	0	2,551	4,817	1,035	8,403
1962	13,750	2,571	78%	100%	0	2,562	3,209	2,055	7,827
1963	13,750	2,571	94%	100%	0	2,571	12,398	885	15,854
1964	13,750	2,571	88%	100%	0	2,571	9,285	175	12,031
1965	13,750	2,571	82%	95%	0	2,433	5,612	3,223	11,268
1966	13,750	2,571	96%	98%	0	2,530	3,588	3,177	9,295
1967	13,750	2,571	96%	100%	3,545	2,571	2,705	5,666	10,942
1968	13,750	2,571	89%	100%	0	2,571	7,153	2,685	12,409
1969	13,750	2,571	93%	100%	4,230	2,571	2,705	2,044	7,321
1970	13,750	2,571	89%	100%	0	2,571	8,760	2,168	13,498
1971	13,750	2,571	94%	100%	0	2,571	5,157	5,523	13,251
1972	13,750	2,571	88%	100%	0	2,571	4,945	3,778	11,295
1973	13,750	2,571	82%	100%	1,453	2,571	3,531	2,333	8,435
1974	13,750	2,571	94%	100%	0	2,571	7,793	2,754	13,118
1975	13,750	2,571	96%	100%	1,773	2,571	4,058	1,816	8,445
1976	13,750	2,571	88%	100%	0	2,571	7,732	5,449	15,752
1977	13,750	2,571	33%	100%	0	2,571	1,251	1,357	5,178
1978	13,750	2,571	68%	100%	2,231	2,571	3,324	1,019	6,914
1979	13,750	2,571	85%	100%	2,214	2,571	3,271	1,515	7,357
1980	13,750	2,571	82%	100%	2,875	2,571	2,705	2,179	7,455
1981	13,750	2,571	83%	100%	0	2,571	9,571	1,485	13,628
1982	13,750	2,571	94%	100%	0	2,571	6,004	4,412	12,986
1983	13,750	2,571	100%	100%	5,544	2,571	4,716	384	7,671
1984	13,750	2,571	100%	100%	2,779	2,571	3,345	1,632	7,548
1985	13,750	2,571	96%	100%	0	2,571	6,292	5,291	14,154
1986	13,750	2,571	81%	100%	699	2,571	4,953	2,202	9,725
1987	13,750	2,571	69%	100%	0	2,571	7,917	1,701	12,189
1988	13,750	2,571	43%	100%	0	2,571	1,391	1,958	5,920
1989	13,750	2,571	58%	95%	0	2,433	3,653	1,935	8,021
1990	13,750	2,571	46%	78%	0	2,011	3,096	1,195	6,302
1991	13,750	2,571	29%	78%	0	2,004	296	1,711	4,010
1992	13,750	2,571	31%	96%	0	2,460	0	1,741	4,201
1993	13,750	2,571	76%	100%	3,282	2,571	1,337	2,958	6,866
AVG	13,750	2,571	80%	97%	814	2,484	5,246	2,337	10,068

NOTES

1) Based on total South Coast contractual agreements with CCWA not including drought buffers and additional water (4,500 afy) contracted by Goleta.

2) Based on DWR's SWP model DWRSIM v. 9.06T
Uses results from DWR's No Action scenario 786 which uses Delta historic hydrology
with regulations (including 1995 WQCP Bay-Delta Accord, 1997 AFRP CVPIA(b) and the New Melones Interim Operation plan)
and no new storage facilities. The percentages in this table do not include the option of purchasing the 10% drought buffer.

3) Based on shortages in Cachuma Project estimated by the SYRHM 0498

4) Assumes no CCWA deliveries when Cachuma is spilling and also that South Coast would not want to make-up that delivery water
because of the wetness of the basin and already assuming full deliveries of 13750 pending spills

5) SWP reductions in delivery (due to restrictions of 50% SWP during water right releases and 0% SWP during passage releases)
are redistributed to the following months up to one year.

6) Limited to being 50% of outlet releases

Draft Technical Memorandum No. 6
Santa Ynez River Flow Analysis for Impact Assessment on Steelhead

D R A F T
TECHNICAL MEMORANDUM No. 6

2171 E. Francisco Blvd., Suite K • San Rafael, California • 94901
TEL: (415) 457-0701 FAX: (415) 457-1638 E-mail: alis@stetsonengineers.com

STETSON ENGINEERS INC.

TO: David Fee, URS
Gina Morimoto, ENTRIX

DATE: April 24, 2006
rev. August 22, 2006

FROM: Curtis Lawler

JOB NO: 1893

RE: Santa Ynez River Flow Analysis for Impact Assessment on Steelhead

1. INTRODUCTION

This technical memorandum was prepared to provide hydrologic data in connection with the impact assessment on Alternatives 5B and 5C. The two additional alternatives (Alternatives 5B and 5C) were identified for the revised Draft Environmental Impact Report on 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) dated August 2003. The Draft Technical Memorandum No. 5 (Re: Hydrologic Impact Analysis of Possible Cachuma Operations Alternatives) provides a detailed discussion on how these alternatives (Alternatives 5B and 5C) were analyzed using the Santa Ynez River Hydrology Model (SYRHM). Draft Technical Memorandum No. 5 includes the results on: (1) Cachuma Reservoir operations; (2) Santa Ynez River flows; (3) above Narrows groundwater storage; (4) water rights releases; (5) Cachuma Project water supply; (6) State Water Project deliveries; and (7) sensitivity analysis.

Tables A-1 and A-2 (Appendix A) of this memorandum provide the simulated monthly flows for Alternatives 5B and 5C for the period from 1918 through 1993. This technical memorandum provides additional hydrologic data used in assessing impacts on steelhead including daily flow data generated from the monthly flow output of the SYRHM for the two additional alternatives (Alternatives 5B and 5C). The daily flow data is utilized to assess impacts on passage flows. The daily flow analysis uses the monthly results from the SYRHM as presented in Draft Technical Memorandum No. 5. Monthly flows from the SYRHM were converted to daily flows based on daily variations of gaged flow in Salsipuedes Creek (WY 1942-1993). The same procedures as used in the Biological Assessment (BA) and Fish Management Plan (FMP) were used in utilizing the daily flow data for the impact analysis. Hydrologic impacts analyzed in this technical memorandum are coordinated with the work of ENTRIX.

2. EFFECTS ON SPAWNING AND REARING HABITAT

Table 1 shows the exceedance flows for various alternatives and for various seasons within the year based on the daily flow data. The daily flow exceedances in Table 1 generally match the monthly flow frequency curves presented in Figures 5A, 5B, and 5C and Table 11 of Draft Technical Memorandum No. 5. The relative difference between Alternatives 5B and 5C is insignificant because they operate under the same operational release criteria for fish. The most significant differences between Alternatives 3B and 5B and between Alternatives 3C and 5C are shown in Table 1 for the months of April through September for the 50% exceedance. These months (April-September) are affected the most because the trigger to switch to the 3A2 operations under Alternatives 5B and 5C (see Draft Technical Memorandum No. 5) is usually not reached until around March and then ends in September. These months show a comparative increase in flows of 6 to 10 cfs in the reach from Bradbury Dam to Highway 154 Bridge at the 50% exceedance for Alternative 5B and 5C in comparison to Alternatives 3B and 3C, respectively. This is primarily due to the 3A2 criteria that flow targets have to be met all the way to Alisal Bridge under Alternatives 5B and 5C. Table 1 also shows that during low flow periods (80% exceedance) Alternatives 5B and 5C are basically the same as Alternatives 3B and 3C because they operate under the same criteria for releases for fish. Because of similarities in the results of daily and monthly flow analyses, comparisons of rearing and spawning flows in the August 2003 DEIR were based on the simulated monthly flows which has a longer period of record (76 years) than the daily flows (52 years). However, due to the flashy nature of the Santa Ynez River, passage flows for steelhead occur primarily during storms and spill events, so daily flows are used for the passage analysis described below.

TABLE 1
FLOW EXCEEDANCES FOR EIR ALTERNATIVES
USING SANTA YNEZ RIVER HYDROLOGY MODEL AND DAILY FLOW ANALYSIS [1)]
(all flows in cfs)

Alt 2

	Flow Exceedance 80%	50%	20%
Bradbury Dam to Highway 154			
Jan-April	2.6	3.3	46.3
Jan-Mar	2.5	3.2	19.7
April-Jun	3.1	5.1	55.7
Jul-Sep	3.7	10.4	45.3
Oct-Dec	2.9	3.4	7.0
Highway 154 to Refugio Road			
Jan-April	2.0	2.5	50.7
Jan-Mar	2.0	2.5	26.7
April-Jun	2.5	4.8	52.5
Jul-Sep	2.5	9.5	42.6
Oct-Dec	1.5	2.5	5.5
Refugio Road to Alisal Bridge			
Jan-April	0.2	2.5	70.3
Jan-Mar	0.1	2.3	39.9
April-Jun	0.4	4.7	45.8
Jul-Sep	0.0	4.8	29.0
Oct-Dec	0.0	0.1	4.2

Alt 3B

	Flow Exceedance 80%	50%	20%
Bradbury Dam to Highway 154			
Jan-April	3.5	5.5	51.7
Jan-Mar	3.3	5.4	30.8
April-Jun	5.0	6.3	55.5
Jul-Sep	6.0	11.7	46.9
Oct-Dec	3.6	5.8	9.5
Highway 154 to Refugio Road			
Jan-April	2.7	5.0	59.6
Jan-Mar	2.7	5.0	36.5
April-Jun	4.9	5.0	52.8
Jul-Sep	4.9	10.1	42.7
Oct-Dec	2.4	4.9	8.4
Refugio Road to Alisal Bridge			
Jan-April	1.1	4.5	76.7
Jan-Mar	0.8	4.1	54.7
April-Jun	2.3	5.2	46.2
Jul-Sep	0.8	6.1	31.2
Oct-Dec	0.0	1.5	5.5

Alt 3C

	Flow Exceedance 80%	50%	20%
Bradbury Dam to Highway 154			
Jan-April	3.5	5.5	49.9
Jan-Mar	3.3	5.4	29.9
April-Jun	5.0	6.3	55.5
Jul-Sep	6.2	11.7	46.3
Oct-Dec	3.8	5.9	9.6
Highway 154 to Refugio Road			
Jan-April	2.7	5.0	59.3
Jan-Mar	2.7	5.0	35.9
April-Jun	4.9	5.0	52.8
Jul-Sep	4.9	10.1	42.9
Oct-Dec	2.5	4.9	8.5
Refugio Road to Alisal Bridge			
Jan-April	1.1	4.5	75.7
Jan-Mar	0.8	4.1	53.6
April-Jun	2.3	5.2	46.2
Jul-Sep	0.8	6.1	31.1
Oct-Dec	0.0	1.5	5.5

Alt 4B

	Flow Exceedance 80%	50%	20%
Bradbury Dam to Highway 154			
Jan-April	3.6	5.5	47.7
Jan-Mar	3.4	5.4	27.3
April-Jun	4.8	6.2	28.0
Jul-Sep	6.3	11.2	35.2
Oct-Dec	3.7	5.8	12.3
Highway 154 to Refugio Road			
Jan-April	2.8	5.0	54.2
Jan-Mar	2.8	5.0	32.1
April-Jun	4.9	5.0	24.7
Jul-Sep	4.9	9.8	30.6
Oct-Dec	2.5	4.9	11.2
Refugio Road to Alisal Bridge			
Jan-April	1.5	4.6	70.9
Jan-Mar	1.2	4.1	51.2
April-Jun	1.9	4.5	19.0
Jul-Sep	0.8	5.3	15.4
Oct-Dec	0.0	1.5	7.1

Alt 5B

	Flow Exceedance 80%	50%	20%
Bradbury Dam to Highway 154			
Jan-April	3.8	5.5	48.0
Jan-Mar	3.8	5.3	42.5
April-Jun	5.0	17.8	55.5
Jul-Sep	6.5	18.3	45.0
Oct-Dec	3.8	5.8	12.0
Highway 154 to Refugio Road			
Jan-April	2.5	5.0	50.8
Jan-Mar	2.5	5.0	48.0
April-Jun	5.0	16.5	53.0
Jul-Sep	5.0	16.5	44.0
Oct-Dec	2.5	5.0	11.0
Refugio Road to Alisal Bridge			
Jan-April	0.5	4.8	70.0
Jan-Mar	0.3	4.0	51.5
April-Jun	2.3	14.3	46.5
Jul-Sep	1.5	10.0	31.0
Oct-Dec	0.0	1.5	5.8

Alt 5C

	Flow Exceedance 80%	50%	20%
Bradbury Dam to Highway 154			
Jan-April	3.8	5.8	48.0
Jan-Mar	3.8	5.5	35.5
April-Jun	5.0	16.0	51.5
Jul-Sep	6.3	18.3	45.0
Oct-Dec	3.8	5.8	12.0
Highway 154 to Refugio Road			
Jan-April	2.5	5.0	50.5
Jan-Mar	2.5	5.0	48.0
April-Jun	5.0	16.5	53.0
Jul-Sep	5.0	16.5	44.0
Oct-Dec	2.5	5.0	10.8
Refugio Road to Alisal Bridge			
Jan-April	0.5	4.8	69.8
Jan-Mar	0.3	4.0	51.5
April-Jun	2.3	14.3	46.5
Jul-Sep	1.3	10.0	31.0
Oct-Dec	0.0	1.5	5.8

1) Monthly flows from the Santa Ynez River Model were converted to daily flows based on daily variations of gaged flow in Salsipuedes Creek (1941-1993) and releases from Cachuma Reservoir.

3. EFFECTS ON PASSSAGE

Tables 2A and 2B show the summary of passage days generated for each of the alternatives. A passage day is defined as a condition when natural flows of the Santa Ynez River at Solvang were 25 cfs or greater during the period from January through April. In general, Table 2A shows that in wet years all of the alternatives analyzed have many passage days; and in normal and dry years, Alternatives 3B, 3C, 4B, 5B and 5C have more passage days than Alternative 2 (Baseline) because these five alternatives have passage flow releases as set forth in the Biological Opinion (BO). The criteria for the quantity and timing of passage releases used in Alternatives 3B, 3C, and 4B were also used for the new alternatives (Alternatives 5B and 5C) for consistency.

The passage releases for the 3A2 operations under Alternatives 5B and 5C occur in different years than the BO passage supplementation. This is because the criteria for the different operations are based on different hydrologic year types. BO passage releases (Alternatives 3B, 3C, 4B, 5B, and 5C) are targeted for normal years after a spill year; the 3A2 releases (Alternatives 5B and 5C) are targeted for wet and above-normal years which could be (and often are) a spill year. The BO passage releases augment passage flows in normal years after spill years, and the 3A2 operations increases passage flows in years of spill and/or wet or above-normal years.

However, Table 2A shows that the expected increase of passage days in spill years due to the 3A2 operations do not necessarily show up in Alternatives 5B and 5C because the 3A2 operations more likely do not trigger until the prime season for passage (February through March) is over. Also when the 3A2 operations are triggered, there is often a spill so that there is not an increase in the number of passage days like water years 1943, 1969, 1983, and 1993 under Alternatives 5B and 5C. However, wet years that do not have a spill show a significant increase in the number of passage days like water years 1966 and 1992 under Alternatives 5B and 5C.

TABLE 2A

SUMMARY OF PASSAGE DAYS UNDER EIR ALTERNATIVES

JANUARY THROUGH APRIL

YEAR	Hydrologic Year Type Classification 1)	ALT 2 # of Passage Days 2)	Indicator of > 14 days	ALT 3B # of Passage Days	Indicator of > 14 days	ALT 3C # of Passage Days	Indicator of > 14 days	ALT 4B # of Passage Days	Indicator of > 14 days	ALT 5B # of Passage Days	Indicator of > 14 days	ALT 5C # of Passage Days	Indicator of > 14 days
1942	normal	47	X	41	X	41	X	40	X	40	X	40	X
1943	wet	120	X	120	X	120	X	120	X	120	X	120	X
1944	wet	90	X	91	X	91	X	89	X	89	X	88	X
1945	wet	66	X	66	X	66	X	66	X	66	X	66	X
1946	normal	33	X	25	X	23	X	7		6		6	
1947	normal	0		0		0		0		0		0	
1948	dry	0		0		0		0		0		0	
1949	dry	1		14	X	14	X	15	X	16	X	16	X
1950	dry	0		14	X	14	X	14	X	14	X	14	X
1951	dry	0		0		0		0		0		0	
1952	wet	76	X	73	X	73	X	73	X	98	X	98	X
1953	normal	5		18	X	18	X	19	X	19	X	19	X
1954	normal	9		24	X	24	X	24	X	24	X	24	X
1955	dry	0		0		0		1		1		1	
1956	normal	11		11		11		11		11		11	
1957	dry	0		0		0		0		1		1	
1958	wet	68	X	70	X	70	X	70	X	75	X	75	X
1959	normal	4		15	X	15	X	15	X	15	X	15	X
1960	dry	1		15	X	15	X	15	X	15	X	15	X
1961	dry	0		0		0		0		0		0	
1962	wet	39	X	42	X	42	X	42	X	81	X	81	X
1963	dry	5		6		6		6		6		6	
1964	dry	0		0		0		0		0		0	
1965	normal	5		5		5		5		5		5	
1966	wet	11		11		11		11		72	X	72	X
1967	wet	97	X	97	X	97	X	97	X	96	X	96	X
1968	dry	1		15	X	15	X	15	X	15	X	15	X
1969	wet	104	X	104	X	104	X	104	X	104	X	104	X
1970	normal	9		17	X	17	X	17	X	16	X	16	X
1971	normal	0		1		1		1		0		0	
1972	dry	0		0		0		0		0		0	
1973	wet	86	X	87	X	87	X	87	X	87	X	87	X
1974	normal	28	X	12		12		10		9		9	
1975	normal	67	X	74	X	74	X	74	X	73	X	73	X
1976	dry	1		16	X	16	X	16	X	16	X	16	X
1977	dry	0		0		0		0		0		0	
1978	wet	92	X	92	X	92	X	91	X	91	X	91	X
1979	wet	85	X	84	X	81	X	76	X	76	X	76	X
1980	wet	95	X	95	X	95	X	95	X	95	X	95	X
1981	normal	11		22	X	22	X	22	X	21	X	21	X
1982	normal	6		19	X	19	X	19	X	19	X	19	X
1983	wet	100	X	100	X	100	X	100	X	100	X	100	X
1984	normal	60	X	60	X	60	X	60	X	74	X	74	X
1985	dry	0		0		0		0		0		0	
1986	wet	61	X	62	X	62	X	57	X	58	X	58	X
1987	dry	2		15	X	15	X	15	X	16	X	16	X
1988	dry	0		15	X	15	X	15	X	15	X	15	X
1989	dry	0		0		0		0		0		0	
1990	dry	0		0		0		0		0		0	
1991	normal	11		11		11		11		23	X	23	X
1992	wet	28	X	29	X	29	X	31	X	65	X	65	X
1993	wet	120	X	120	X	120	X	120	X	120	X	119	X
AVG 42-93		32		35		35		34		38		38	
SUM 42-93			21		33		33		32		34		34
			40%		63%		63%		62%		65%		65%

Notes

1) A wet, normal, or dry year represents a third of the years analyzed of the inflow into Lake Cachuma using USGS Los Laureles gage data.

2) Passage days are defined as number of days when flows at Solvang were 25 cfs or greater, January through April

TABLE 2B

SUMMARY OF PASSAGE DAYS UNDER EIR ALTERNATIVES

JANUARY THROUGH APRIL

For Years When Passage Supplementation Releases Are Made

YEAR	**Hydrologic Year Type Classification 1)**	**Alt 2** # of Passage Days 2)	**Alt 2** Indicator of > 14 days	**Alt 3B** # of Passage Days	**Alt 3B** Indicator of > 14 days	**Alt 3C** # of Passage Days	**Alt 3C** Indicator of > 14 days	**Alt 4B** # of Passage Days	**Alt 4B** Indicator of > 14 days	**Alt 5B** # of Passage Days	**Alt 5B** Indicator of > 14 days	**Alt 5C** # of Passage Days	**Alt 5C** Indicator of > 14 days
1949	dry	1		14	X	14	X	15	X	16	X	16	X
1950	dry	0		14	X	14	X	14	X	14	X	14	X
1953	normal	5		18	X	18	X	19	X	19	X	19	X
1954	normal	9		24	X	24	X	24	X	24	X	24	X
1959	normal	4		15	X	15	X	15	X	15	X	15	X
1960	dry	1		15	X	15	X	15	X	15	X	15	X
1968	dry	1		15	X	15	X	15	X	15	X	15	X
1970	normal	9		17	X	17	X	17	X	16	X	16	X
1975	normal	67	X	74	X	74	X	74	X	73	X	73	X
1976	dry	1		16	X	16	X	16	X	16	X	16	X
1981	normal	11		22	X	22	X	22	X	21	X	21	X
1982	normal	6		19	X	19	X	19	X	19	X	19	X
1987	dry	2		15	X	15	X	15	X	16	X	16	X
1988	dry	0		15	X	15	X	15	X	15	X	15	X
AVG 42-93		8		21		21		21		21		21	
SUM 42-93			1		14		14		14		14		14
			7%		100%		100%		100%		100%		100%

Notes

1) A wet, normal, or dry year represents a third of the years analyzed of the inflow into Lake Cachuma using USGS Los Laureles gage data.

2) Passage days are defined as number of days when flows at Solvang were 25 cfs or greater, January through April

4. EFFECTS ON FISH IN CACHUMA LAKE

Tables B-1 and B-2 (Appendix B) show the simulated monthly Cachuma Reservoir storage, elevation and surcharge for the two new alternatives (Alternatives 5B and 5C) for the period 1918 through 1993. Lake elevations may affect shallow lake habitat in Cachuma Reservoir and ability of resident fish to migrate into tributaries for spawning and rearing.

Appendix A

Table A-1								
Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Oct-17	0	8.00	7.75	5.00	0.25	0.00	0.00	0.00
Nov-17	0	7.75	7.50	5.00	0.25	0.00	0.00	0.00
Dec-17	0	7.25	7.00	5.00	0.50	0.00	0.00	0.00
Jan-18	0	6.75	6.75	5.00	1.00	0.00	0.00	1.00
Feb-18	0	903.25	923.75	950.75	1066.00	1230.00	1391.75	1497.25
Mar-18	1	2067.50	2080.00	2101.75	2181.00	2208.00	2205.00	2345.50
Apr-18	1	293.75	299.00	307.00	337.25	368.75	403.50	432.00
May-18	1	79.75	81.75	84.25	94.25	107.75	126.50	135.50
Jun-18	1	16.75	17.75	19.00	22.75	29.50	38.00	45.00
Jul-18	1	13.50	13.75	13.00	10.00	9.25	8.00	11.00
Aug-18	1	17.75	17.75	16.00	10.00	7.50	3.75	4.75
Sep-18	1	18.75	18.50	17.00	10.00	7.25	2.75	3.75
Oct-18	0	7.00	7.00	5.75	1.50	0.00	0.00	1.00
Nov-18	0	6.25	6.25	5.25	1.50	0.25	0.00	1.25
Dec-18	0	6.00	6.00	5.00	2.00	1.00	0.00	1.25
Jan-19	0	20.75	20.75	19.00	14.00	11.00	5.75	6.75
Feb-19	0	23.00	23.25	22.50	21.00	20.00	16.25	19.50
Mar-19	0	20.75	21.00	20.25	19.00	18.50	17.25	20.25
Apr-19	0	6.00	6.00	5.00	3.25	1.50	0.50	0.25
May-19	0	6.00	5.75	5.00	3.00	1.75	0.75	2.25
Jun-19	0	6.50	6.25	5.00	2.00	0.75	0.00	0.00
Jul-19	0	62.00	61.75	58.25	47.50	41.75	33.25	31.75
Aug-19	0	7.25	7.25	5.75	1.50	0.00	0.00	0.00
Sep-19	0	36.75	36.25	32.25	16.75	9.00	0.00	0.00
Oct-19	0	23.75	23.75	21.50	12.25	5.75	0.00	0.25
Nov-19	0	8.75	8.75	7.75	4.25	1.50	0.00	0.75
Dec-19	0	5.50	5.50	5.00	2.75	1.25	0.00	1.00
Jan-20	0	5.75	5.75	5.00	2.50	1.00	0.00	1.00
Feb-20	0	4.00	4.75	5.25	7.25	10.75	10.50	14.75
Mar-20	0	2.50	5.25	9.25	22.00	32.50	34.00	49.25
Apr-20	0	3.00	4.00	5.00	9.25	15.50	21.00	28.00
May-20	0	5.50	5.75	5.00	3.75	3.50	3.75	5.25
Jun-20	0	6.50	6.25	5.00	2.25	0.75	0.00	1.50
Jul-20	0	63.00	62.75	59.25	48.50	42.50	33.50	32.00
Aug-20	0	6.25	6.00	5.00	0.75	0.00	0.00	0.00
Sep-20	0	46.00	45.75	41.25	23.50	13.75	1.25	0.25
Oct-20	0	26.75	26.75	24.50	14.50	7.00	0.00	0.00
Nov-20	0	15.50	15.25	14.00	9.50	5.00	0.00	0.00
Dec-20	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-21	0	2.25	2.75	2.50	2.00	2.25	1.00	2.50
Feb-21	0	2.25	3.00	3.25	4.50	7.25	7.25	11.50
Mar-21	0	2.00	3.00	3.75	6.75	11.75	14.75	21.00
Apr-21	0	3.25	3.25	2.50	1.50	1.50	1.50	2.75
May-21	0	3.25	3.25	2.50	1.25	0.75	0.75	2.00
Jun-21	0	4.00	3.75	2.50	0.25	0.00	0.00	0.50
Jul-21	0	4.00	3.75	2.50	0.00	0.00	0.00	1.00
Aug-21	0	79.00	78.75	73.75	56.25	46.75	31.50	29.25
Sep-21	0	36.50	36.50	35.25	29.75	25.75	19.50	18.75
Oct-21	0	42.25	41.75	37.75	21.75	12.00	1.25	0.25
Nov-21	0	12.50	12.25	11.25	6.75	2.75	0.00	0.00
Dec-21	0	2.00	10.00	22.75	57.75	106.25	142.75	196.50
Jan-22	0	2.00	6.50	13.25	35.50	66.25	97.00	122.00
Feb-22	1	2.50	18.75	45.50	142.50	238.00	318.75	400.75
Mar-22	1	33.50	39.50	48.25	81.50	120.25	161.00	192.25
Apr-22	1	123.00	125.50	128.00	140.00	156.00	177.75	192.25
May-22	1	18.50	19.25	20.00	23.50	28.75	37.50	41.00
Jun-22	1	21.75	22.00	21.25	19.00	18.00	19.00	20.75
Jul-22	1	15.25	15.25	14.00	10.00	8.00	6.25	7.50
Aug-22	1	18.25	18.00	16.50	10.00	7.00	3.00	2.50
Sep-22	1	19.75	19.50	17.50	10.00	6.25	1.75	1.25
Oct-22	0	6.25	6.25	5.00	0.75	0.00	0.00	0.00
Nov-22	0	6.75	6.50	5.00	0.75	0.00	0.00	0.00
Dec-22	0	2.75	5.00	7.50	13.00	23.00	25.50	41.50
Jan-23	0	20.75	21.25	20.00	17.00	17.25	15.75	19.25
Feb-23	0	23.00	23.50	23.00	22.50	23.50	24.25	29.50
Mar-23	0	20.75	20.75	19.75	18.00	16.75	16.50	18.00
Apr-23	0	5.00	5.25	5.00	5.25	6.00	8.00	10.50
May-23	0	5.50	5.75	5.00	3.50	3.00	3.50	5.00

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Jun-23	0	6.25	6.00	5.00	2.75	1.50	1.25	2.75
Jul-23	0	6.25	6.25	5.00	1.50	0.50	0.00	1.25
Aug-23	0	69.75	69.50	65.75	51.75	44.50	33.00	31.50
Sep-23	0	51.00	51.00	49.75	44.25	40.50	34.50	33.75
Oct-23	0	48.00	47.75	46.25	40.50	36.75	30.75	30.00
Nov-23	0	11.75	11.50	9.50	3.75	1.00	0.00	0.00
Dec-23	0	6.25	6.25	5.00	1.50	0.25	0.00	1.00
Jan-24	0	6.25	6.25	5.00	2.00	0.50	0.00	1.25
Feb-24	0	6.50	6.50	5.25	2.50	1.00	0.00	1.25
Mar-24	0	4.50	5.00	5.00	5.00	6.75	7.00	11.25
Apr-24	0	6.25	6.25	5.00	3.00	1.75	0.75	2.25
May-24	0	6.25	6.00	5.00	2.50	1.00	0.00	1.25
Jun-24	0	6.50	6.50	5.00	1.75	0.50	0.00	1.25
Jul-24	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Aug-24	0	33.75	33.50	28.75	13.00	6.50	0.00	0.00
Sep-24	0	35.25	35.00	31.75	18.00	10.00	0.25	0.00
Oct-24	0	23.00	23.00	21.00	11.75	5.50	0.00	0.00
Nov-24	0	7.50	7.25	6.50	3.00	0.50	0.00	0.00
Dec-24	0	3.25	3.25	2.50	0.25	0.00	0.00	0.00
Jan-25	0	3.50	3.50	2.50	0.25	0.00	0.00	0.00
Feb-25	0	4.00	4.00	2.75	0.25	0.00	0.00	0.00
Mar-25	0	3.25	3.25	2.50	1.00	0.75	0.00	0.25
Apr-25	0	2.00	3.00	3.25	4.75	8.50	8.75	12.25
May-25	0	3.50	3.50	2.50	0.50	0.00	0.00	0.75
Jun-25	0	4.00	3.75	2.50	0.25	0.00	0.00	0.75
Jul-25	0	21.75	21.50	17.50	6.50	2.00	0.00	0.00
Aug-25	0	45.75	45.50	41.50	25.25	15.75	2.00	0.25
Sep-25	0	8.00	8.00	6.75	2.25	0.00	0.00	0.00
Oct-25	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Nov-25	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-25	0	3.75	3.75	2.50	0.00	0.00	0.00	0.25
Jan-26	0	3.75	3.50	2.50	0.00	0.00	0.00	0.25
Feb-26	0	2.25	4.75	8.00	15.00	28.25	30.00	44.50
Mar-26	0	2.00	2.75	3.00	3.50	5.75	5.00	11.00
Apr-26	0	2.25	15.50	36.50	104.25	162.25	185.00	263.25
May-26	1	19.25	20.00	20.00	21.25	25.00	29.00	35.75
Jun-26	1	25.00	25.00	23.50	19.00	16.50	14.25	15.75
Jul-26	1	16.75	16.75	15.25	10.00	7.25	4.00	5.25
Aug-26	1	19.75	19.50	17.50	10.00	5.75	1.00	0.50
Sep-26	1	32.75	32.50	28.75	14.75	7.00	0.00	0.00
Oct-26	0	72.75	72.75	70.25	59.00	49.75	34.75	32.00
Nov-26	0	2.00	3.75	6.25	11.50	18.75	21.25	32.00
Dec-26	0	2.00	2.75	3.50	5.25	8.25	9.50	15.50
Jan-27	0	2.00	2.75	3.25	5.75	9.50	13.00	17.75
Feb-27	0	3.75	28.50	69.00	227.00	385.50	527.75	637.75
Mar-27	1	170.50	173.75	177.00	194.75	205.00	211.75	235.00
Apr-27	1	68.25	70.25	72.75	82.75	95.25	112.75	123.75
May-27	1	19.25	19.75	20.00	21.25	23.25	28.00	31.50
Jun-27	1	22.75	22.75	21.75	19.00	17.25	17.25	18.50
Jul-27	1	15.50	15.50	14.25	10.00	8.00	5.75	7.00
Aug-27	1	18.75	18.50	16.75	10.00	6.75	2.50	2.00
Sep-27	1	20.25	20.25	18.00	10.00	6.00	1.00	0.50
Oct-27	0	6.25	6.25	5.00	0.75	0.00	0.00	0.00
Nov-27	0	6.50	6.50	5.00	1.00	0.00	0.00	0.75
Dec-27	0	6.25	6.25	5.00	1.25	0.25	0.00	1.00
Jan-28	0	20.75	20.75	18.75	13.00	9.50	3.75	4.50
Feb-28	0	22.00	24.00	25.75	32.00	36.50	32.75	44.75
Mar-28	0	20.75	21.75	22.25	24.25	27.25	28.00	35.00
Apr-28	0	5.50	5.50	5.00	4.25	3.75	3.50	5.25
May-28	0	5.75	5.75	5.00	3.25	2.00	1.25	2.75
Jun-28	0	6.25	6.00	5.00	2.50	1.00	0.00	1.50
Jul-28	0	62.00	61.75	58.75	48.25	42.25	34.00	32.50
Aug-28	0	49.50	49.50	48.25	43.00	39.50	34.00	33.25
Sep-28	0	51.00	50.75	49.25	42.50	38.50	32.00	31.00
Oct-28	0	49.25	49.00	47.50	40.75	36.50	30.00	29.25
Nov-28	0	6.75	6.75	5.00	0.50	0.00	0.00	0.00
Dec-28	0	6.50	6.50	5.00	1.00	0.00	0.00	1.00
Jan-29	0	6.25	6.25	5.00	1.50	0.25	0.00	1.25

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Feb-29	0	5.75	6.25	5.50	3.75	4.50	3.25	4.75
Mar-29	0	4.50	5.00	5.00	5.00	7.25	8.00	11.00
Apr-29	0	5.00	5.50	5.00	4.50	5.75	6.25	9.50
May-29	0	6.00	6.00	5.00	2.50	1.50	0.75	2.25
Jun-29	0	59.75	59.50	56.25	47.25	41.75	34.75	33.75
Jul-29	0	46.50	46.50	45.25	40.75	37.75	33.25	32.75
Aug-29	0	24.50	24.25	20.75	8.50	3.00	0.00	0.00
Sep-29	0	40.75	40.50	37.00	22.25	12.75	1.00	0.00
Oct-29	0	26.50	26.25	24.25	14.75	7.25	0.00	0.00
Nov-29	0	8.50	8.50	7.50	4.00	1.00	0.00	0.00
Dec-29	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-30	0	3.50	3.50	2.50	0.25	0.00	0.00	0.00
Feb-30	0	4.00	4.00	2.75	0.50	0.00	0.00	0.25
Mar-30	0	2.00	3.50	5.25	11.25	20.50	25.25	31.25
Apr-30	0	3.50	3.50	2.50	1.25	0.75	0.00	1.25
May-30	0	3.50	3.50	2.50	0.50	0.00	0.00	1.00
Jun-30	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jul-30	0	22.00	21.75	17.75	6.75	2.00	0.00	0.00
Aug-30	0	30.50	30.25	26.75	13.25	5.75	0.00	0.00
Sep-30	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Oct-30	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-30	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Dec-30	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jan-31	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Feb-31	0	4.00	4.00	2.75	0.00	0.00	0.00	1.00
Mar-31	0	3.75	3.75	2.50	0.00	0.00	0.00	0.25
Apr-31	0	4.00	3.75	2.50	0.00	0.00	0.00	0.50
May-31	0	25.00	24.75	21.00	9.00	3.25	0.00	0.00
Jun-31	0	4.50	4.50	3.50	0.25	0.00	0.00	0.00
Jul-31	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Aug-31	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Sep-31	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Oct-31	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Nov-31	0	4.50	4.50	2.50	0.00	0.00	0.00	0.00
Dec-31	0	2.00	7.00	13.75	25.75	50.75	61.25	87.75
Jan-32	0	2.00	4.00	6.25	9.50	19.50	18.50	25.50
Feb-32	0	2.50	16.75	38.50	122.75	175.25	181.25	289.25
Mar-32	1	41.00	44.25	48.00	62.75	86.25	110.75	126.75
Apr-32	1	31.75	32.75	33.00	35.00	38.25	42.00	49.00
May-32	1	21.50	21.75	21.25	20.00	19.75	21.00	24.25
Jun-32	1	24.50	24.50	23.25	19.00	15.75	13.00	14.25
Jul-32	1	17.25	17.00	15.50	10.00	6.75	3.25	3.50
Aug-32	1	19.50	19.50	17.50	10.00	5.75	1.00	0.50
Sep-32	1	32.75	32.50	29.00	14.75	7.00	0.00	0.00
Oct-32	0	11.25	11.25	10.00	4.75	1.25	0.00	0.00
Nov-32	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Dec-32	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Jan-33	0	2.00	4.75	8.25	17.75	33.50	42.25	53.25
Feb-33	0	4.00	5.00	5.50	7.00	11.00	12.25	19.00
Mar-33	0	3.00	3.00	2.50	1.75	1.75	1.75	3.25
Apr-33	0	3.25	3.25	2.50	1.50	1.25	1.25	2.75
May-33	0	3.50	3.50	2.50	0.50	0.00	0.00	1.25
Jun-33	0	60.00	59.75	56.25	46.75	41.25	34.50	33.50
Jul-33	0	48.75	48.75	47.50	42.75	39.75	35.50	34.75
Aug-33	0	42.50	42.25	40.75	34.75	31.00	25.00	24.25
Sep-33	0	35.00	34.75	30.00	13.50	5.25	0.00	0.00
Oct-33	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Nov-33	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-33	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Jan-34	0	2.00	4.75	8.25	16.75	31.50	37.75	50.00
Feb-34	0	2.25	3.50	4.50	7.50	11.75	11.75	19.50
Mar-34	0	2.25	2.75	2.50	2.25	3.50	4.00	7.00
Apr-34	0	3.75	3.75	2.50	0.50	0.00	0.00	1.50
May-34	0	3.75	3.75	2.50	0.25	0.00	0.00	0.50
Jun-34	0	64.75	64.25	60.50	49.75	43.25	34.75	33.50
Jul-34	0	37.00	37.00	35.75	31.25	28.00	23.75	23.00
Aug-34	0	40.75	40.50	36.00	19.50	10.50	0.75	0.00
Sep-34	0	42.00	41.75	38.75	24.50	13.75	1.25	0.25

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
	Indicator	Cachuma	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River
	that 3A2	Total Discharges	Below	at 154	above Alisal	near	above Salsipuedes	at Lompoc
MONTH	in effect	Downstream	Hilton Creek	Bridge	Bridge	Buellton	Creek Confluence	Narrows
	(1=yes)	cfs	cfs	cfs	cfs	cfs	cfs	cfs
Oct-34	0	3.25	3.00	2.50	0.00	0.00	0.00	0.00
Nov-34	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Dec-34	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jan-35	0	2.00	5.00	9.00	20.00	37.25	47.00	59.75
Feb-35	0	2.25	3.50	4.50	7.75	13.25	16.75	23.75
Mar-35	0	2.00	5.25	9.75	25.50	41.75	52.75	69.50
Apr-35	0	2.00	7.50	15.75	44.50	74.75	100.00	127.50
May-35	1	20.00	20.50	20.00	21.00	23.75	28.25	31.75
Jun-35	1	25.00	25.00	23.25	19.00	16.25	14.75	16.00
Jul-35	1	17.25	17.25	15.50	10.00	6.75	3.50	3.75
Aug-35	1	66.75	66.75	63.50	51.50	44.00	33.50	32.00
Sep-35	1	43.25	43.00	42.00	37.00	33.25	28.00	27.25
Oct-35	0	19.75	19.75	16.75	6.75	1.50	0.00	0.00
Nov-35	0	14.75	14.50	13.00	7.50	3.50	0.00	0.00
Dec-35	0	3.50	3.25	2.50	0.25	0.00	0.00	0.00
Jan-36	0	3.50	3.50	2.50	0.25	0.00	0.00	0.75
Feb-36	0	2.00	11.00	24.75	71.75	121.00	152.75	192.50
Mar-36	0	2.00	3.50	5.25	12.00	21.50	31.50	40.00
Apr-36	0	2.00	3.50	4.75	10.50	15.25	18.25	25.75
May-36	0	3.25	3.25	2.50	1.50	1.25	1.50	3.25
Jun-36	0	3.75	3.75	2.50	0.25	0.00	0.00	0.50
Jul-36	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Aug-36	0	40.75	40.25	35.00	17.25	9.00	0.25	0.00
Sep-36	0	6.75	6.75	5.50	0.75	0.00	0.00	0.00
Oct-36	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-36	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Dec-36	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jan-37	0	2.00	3.25	4.50	6.25	12.00	11.50	16.00
Feb-37	0	2.50	22.00	52.75	160.75	304.75	441.25	534.75
Mar-37	1	144.00	158.75	181.00	265.75	362.50	456.00	530.50
Apr-37	1	281.00	284.75	290.00	308.75	332.75	364.00	385.75
May-37	1	18.25	19.00	20.00	23.50	28.00	36.00	39.50
Jun-37	1	20.50	20.75	20.25	19.00	19.00	21.25	22.75
Jul-37	1	15.00	15.00	14.00	10.00	8.25	6.50	7.75
Aug-37	1	18.50	18.25	16.75	10.00	6.75	2.75	2.25
Sep-37	1	20.00	19.75	17.75	10.00	6.25	1.50	1.00
Oct-37	0	7.50	7.50	6.00	1.50	0.00	0.00	0.00
Nov-37	0	14.50	14.50	12.50	6.25	2.75	0.00	0.00
Dec-37	0	6.00	6.00	5.00	2.00	0.75	0.00	1.00
Jan-38	0	20.75	20.75	19.00	14.00	11.00	6.00	6.50
Feb-38	0	556.00	573.00	597.75	693.75	826.00	961.50	1046.50
Mar-38	1	3013.00	3047.00	3105.75	3344.75	3500.75	3600.75	3827.00
Apr-38	1	263.75	267.75	273.75	296.00	323.75	359.00	380.75
May-38	1	36.75	37.00	36.50	35.75	34.75	36.50	38.00
Jun-38	1	18.75	19.00	19.00	19.50	21.75	26.50	28.00
Jul-38	1	12.75	13.00	12.25	10.00	10.25	10.75	12.25
Aug-38	1	17.50	17.50	16.00	10.00	7.50	4.00	5.00
Sep-38	1	18.75	18.50	16.75	10.00	7.00	2.75	3.75
Oct-38	0	7.00	6.75	5.50	1.50	0.00	0.00	0.00
Nov-38	0	7.25	7.25	5.75	1.50	0.00	0.00	0.00
Dec-38	0	5.50	5.75	5.00	2.75	2.50	0.75	3.25
Jan-39	0	20.75	21.25	20.50	19.00	21.00	20.25	24.00
Feb-39	0	23.00	24.00	24.25	26.00	31.00	34.75	41.75
Mar-39	0	20.75	22.50	24.00	30.75	41.00	52.25	61.75
Apr-39	0	4.00	4.50	5.00	7.00	10.00	14.00	19.00
May-39	0	5.50	5.50	5.00	3.75	3.25	3.50	5.25
Jun-39	0	6.25	6.25	5.00	2.50	1.25	0.25	1.75
Jul-39	0	58.00	58.00	54.75	45.00	39.75	33.00	32.00
Aug-39	0	49.50	49.50	48.00	43.00	39.75	34.75	34.00
Sep-39	0	51.00	51.00	49.25	42.75	39.00	32.75	31.75
Oct-39	0	6.75	6.50	5.00	0.25	0.00	0.00	0.00
Nov-39	0	7.00	6.75	5.00	0.25	0.00	0.00	0.00
Dec-39	0	6.75	6.50	5.00	0.75	0.00	0.00	0.00
Jan-40	0	5.50	5.75	5.00	2.75	3.00	1.25	3.50
Feb-40	0	2.75	4.25	5.25	8.75	16.25	20.50	27.25
Mar-40	0	3.25	4.25	5.00	7.00	12.00	15.75	22.25
Apr-40	0	5.00	5.50	5.00	5.00	6.50	8.25	11.75
May-40	0	6.00	6.00	5.00	2.50	1.75	1.25	2.75

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Jun-40	0	6.75	6.50	5.00	1.50	0.25	0.00	0.50
Jul-40	0	64.25	64.00	60.50	48.50	42.25	33.25	31.75
Aug-40	0	49.25	49.00	47.75	42.25	38.50	33.00	32.25
Sep-40	0	33.75	33.25	29.25	14.25	6.75	0.00	0.00
Oct-40	0	25.00	24.75	22.50	12.00	5.25	0.00	0.00
Nov-40	0	3.25	3.25	2.50	0.25	0.00	0.00	0.00
Dec-40	0	2.00	4.00	6.75	12.75	22.25	25.50	37.25
Jan-41	0	2.50	9.50	20.50	55.00	103.50	147.25	189.25
Feb-41	0	972.50	1019.25	1094.75	1341.75	1532.25	1599.75	1946.75
Mar-41	1	3096.25	3151.75	3247.50	3616.50	3935.50	4199.25	4506.25
Apr-41	1	1997.50	2025.25	2070.75	2249.25	2384.00	2476.00	2638.25
May-41	1	294.75	299.00	306.25	327.75	355.50	387.75	415.25
Jun-41	1	48.75	50.00	51.75	55.50	62.25	70.00	82.00
Jul-41	1	8.00	9.00	10.00	12.00	16.75	21.25	29.25
Aug-41	1	11.25	11.75	11.75	10.00	11.75	12.00	18.25
Sep-41	1	14.50	14.75	14.00	10.00	9.75	8.00	12.50
Oct-41	0	5.00	5.25	5.00	3.00	3.50	2.50	7.25
Nov-41	0	5.00	5.50	5.00	3.25	4.00	3.25	8.00
Dec-41	0	2.75	8.50	17.25	36.00	63.25	78.25	133.50
Jan-42	0	3.75	6.75	10.75	20.00	34.25	45.25	72.50
Feb-42	0	5.75	7.25	8.75	13.00	19.00	24.25	40.75
Mar-42	0	7.75	10.75	14.50	24.50	38.00	49.25	79.00
Apr-42	0	104.50	106.75	108.00	114.75	124.75	137.25	156.00
May-42	0	7.00	8.00	9.00	12.25	16.75	23.00	31.25
Jun-42	0	6.00	6.50	6.25	6.00	7.00	8.50	13.25
Jul-42	0	5.50	5.75	5.00	2.50	1.75	0.75	3.75
Aug-42	0	6.00	6.00	5.00	1.50	0.50	0.00	2.75
Sep-42	0	18.25	18.00	14.75	4.00	0.50	0.00	1.00
Oct-42	0	6.00	6.00	5.00	0.75	0.00	0.00	1.00
Nov-42	0	6.00	6.00	5.00	1.50	0.25	0.00	2.75
Dec-42	0	5.75	5.75	5.00	2.00	0.50	0.00	2.75
Jan-43	0	735.50	749.75	768.50	856.75	935.50	984.50	1031.25
Feb-43	1	514.00	520.75	532.50	572.00	617.25	671.50	706.75
Mar-43	1	1065.75	1081.50	1107.00	1211.75	1301.25	1383.00	1447.25
Apr-43	1	170.75	173.25	177.75	192.00	208.75	231.00	247.00
May-43	1	18.25	19.00	20.00	23.25	27.50	34.00	40.75
Jun-43	1	19.75	20.00	19.75	19.00	20.00	22.50	26.00
Jul-43	1	13.75	13.75	13.00	10.00	9.00	8.25	11.25
Aug-43	1	17.75	17.50	16.00	10.00	7.50	4.00	5.25
Sep-43	1	18.75	18.75	16.75	10.00	7.00	2.75	3.75
Oct-43	0	6.50	6.25	5.25	1.50	0.25	0.00	1.25
Nov-43	0	6.50	6.50	5.25	1.50	0.25	0.00	1.25
Dec-43	0	5.00	5.25	5.00	3.25	3.50	1.50	5.75
Jan-44	0	4.00	4.75	5.00	5.25	7.75	8.25	14.50
Feb-44	0	289.75	303.75	323.50	398.75	465.50	503.50	575.75
Mar-44	1	578.25	585.50	597.25	637.25	677.00	717.25	758.25
Apr-44	1	77.75	79.50	81.75	90.50	100.75	115.25	126.00
May-44	1	17.75	18.75	20.00	24.25	30.25	38.75	45.75
Jun-44	1	20.00	20.25	20.00	19.00	19.75	22.00	25.25
Jul-44	1	15.25	15.25	14.00	10.00	8.00	6.25	7.50
Aug-44	1	18.00	17.75	16.25	10.00	7.25	3.50	4.50
Sep-44	1	19.50	19.25	17.50	10.00	6.25	1.50	1.00
Oct-44	0	7.25	7.25	6.00	1.50	0.00	0.00	0.25
Nov-44	0	5.00	5.50	5.00	3.50	4.50	2.75	5.50
Dec-44	0	5.50	5.75	5.00	2.75	2.25	0.75	3.50
Jan-45	0	5.25	5.50	5.00	3.25	3.25	2.00	5.00
Feb-45	0	3.50	8.50	15.50	43.75	81.00	120.00	135.50
Mar-45	0	69.75	72.00	73.50	84.00	92.75	99.50	109.25
Apr-45	1	43.25	44.50	45.00	50.75	58.75	71.25	75.25
May-45	1	20.00	20.25	20.00	20.25	21.25	25.00	26.50
Jun-45	1	24.75	24.50	23.00	19.00	16.25	15.00	14.75
Jul-45	1	16.75	16.50	15.00	10.00	7.25	4.50	4.00
Aug-45	1	19.25	19.25	17.25	10.00	6.50	2.00	1.50
Sep-45	1	20.75	20.50	18.50	10.00	5.75	0.75	0.25
Oct-45	0	21.25	21.00	18.00	7.50	2.50	0.00	0.00
Nov-45	0	12.25	12.00	10.75	5.75	2.50	0.00	0.00
Dec-45	0	2.75	4.00	5.00	8.50	15.50	18.75	20.25
Jan-46	0	5.50	5.75	5.00	3.50	3.25	2.00	3.25

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Feb-46	0	5.50	6.00	5.50	5.25	6.50	7.50	9.00
Mar-46	0	3.25	4.50	5.50	10.00	11.00	8.25	21.00
Apr-46	0	5.50	7.00	8.00	14.50	24.50	36.50	41.75
May-46	1	23.50	23.75	22.25	20.00	19.50	20.50	21.75
Jun-46	1	25.50	25.50	23.75	19.00	16.00	13.50	15.00
Jul-46	1	56.50	56.25	53.75	45.00	39.75	33.25	32.50
Aug-46	1	49.50	49.50	48.25	43.25	40.00	35.25	34.75
Sep-46	1	51.00	51.00	49.50	43.00	39.25	33.25	32.25
Oct-46	0	49.50	49.25	47.75	41.25	37.25	31.25	30.25
Nov-46	0	5.25	5.75	5.00	3.00	4.00	3.00	5.50
Dec-46	0	5.00	5.50	5.00	3.25	4.25	3.75	6.75
Jan-47	0	6.00	6.00	5.00	2.25	1.50	0.50	2.00
Feb-47	0	6.00	6.25	5.50	3.50	3.75	3.25	6.50
Mar-47	0	5.75	5.75	5.00	3.25	2.75	2.75	4.50
Apr-47	0	6.25	6.25	5.00	2.75	1.75	1.25	2.75
May-47	0	56.00	55.75	53.00	46.00	41.25	37.25	36.75
Jun-47	0	51.00	51.00	50.00	46.25	43.75	41.50	41.00
Jul-47	0	49.25	49.25	47.75	42.75	40.00	36.25	35.50
Aug-47	0	49.25	49.00	47.25	40.75	37.00	31.50	30.50
Sep-47	0	50.75	50.50	48.50	41.00	36.50	29.75	28.75
Oct-47	0	45.75	45.50	43.75	36.50	32.25	25.75	24.75
Nov-47	0	24.50	24.25	20.00	7.25	1.75	0.00	0.00
Dec-47	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Jan-48	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Feb-48	0	4.00	3.75	2.50	0.25	0.00	0.00	0.00
Mar-48	0	3.75	3.75	2.50	0.25	0.00	0.00	0.00
Apr-48	0	4.00	4.00	2.50	0.25	0.00	0.00	0.00
May-48	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jun-48	0	13.25	13.00	10.50	4.25	1.75	0.00	0.00
Jul-48	0	20.50	20.25	16.25	5.25	1.00	0.00	0.00
Aug-48	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Sep-48	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Oct-48	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Nov-48	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Dec-48	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Jan-49	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Feb-49	0	4.50	4.50	2.75	0.00	0.00	0.00	0.00
Mar-49	0	30.00	31.75	31.75	24.00	25.75	13.50	31.25
Apr-49	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
May-49	0	29.75	29.50	26.25	13.25	6.75	0.00	0.00
Jun-49	0	5.00	5.00	4.00	0.50	0.00	0.00	0.00
Jul-49	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Aug-49	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Sep-49	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Oct-49	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Nov-49	0	4.50	4.50	2.50	0.00	0.00	0.00	0.00
Dec-49	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Jan-50	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Feb-50	0	33.25	34.25	33.00	19.75	17.00	3.50	10.00
Mar-50	0	3.25	3.25	2.50	0.00	0.00	0.00	0.00
Apr-50	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
May-50	0	52.00	51.50	47.25	28.00	17.00	0.75	0.00
Jun-50	0	3.25	3.25	2.50	0.00	0.00	0.00	0.00
Jul-50	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Aug-50	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Sep-50	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Oct-50	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Nov-50	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Dec-50	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Jan-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Feb-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Mar-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Apr-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
May-51	0	14.25	13.75	8.00	0.00	0.00	0.00	0.00
Jun-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Jul-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Aug-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Sep-51	0	3.75	3.50	0.50	0.00	0.00	0.00	0.00

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
	Indicator	Cachuma	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River
	that 3A2	Total Discharges	Below	at 154	above Alisal	near	above Salsipuedes	at Lompoc
MONTH	in effect	Downstream	Hilton Creek	Bridge	Bridge	Buellton	Creek Confluence	Narrows
	(1=yes)	cfs	cfs	cfs	cfs	cfs	cfs	cfs
Oct-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Nov-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Dec-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Jan-52	0	2.00	25.50	58.00	181.75	307.50	429.25	535.50
Feb-52	1	35.75	37.25	33.75	25.50	31.75	17.50	22.00
Mar-52	1	4.00	26.25	61.25	156.00	307.75	444.25	585.75
Apr-52	1	174.75	177.50	178.25	177.00	195.50	205.50	210.25
May-52	1	17.75	18.75	20.00	22.25	28.00	33.50	34.00
Jun-52	1	22.75	23.00	22.50	19.00	16.50	12.75	12.75
Jul-52	1	14.75	15.00	14.25	10.00	8.25	5.25	5.25
Aug-52	1	17.00	17.00	16.00	10.00	7.75	3.75	4.00
Sep-52	1	25.75	25.50	22.75	10.50	4.25	0.00	0.00
Oct-52	0	14.50	14.50	13.25	7.75	4.50	0.25	1.00
Nov-52	0	5.00	5.25	5.00	2.75	1.75	0.00	3.50
Dec-52	0	2.75	5.75	10.25	17.50	29.00	29.50	59.75
Jan-53	0	30.75	33.25	35.50	42.50	54.50	62.75	79.75
Feb-53	0	4.25	5.00	5.50	7.25	10.25	13.75	17.25
Mar-53	0	4.75	5.25	5.00	5.25	6.00	7.75	9.50
Apr-53	0	5.25	5.50	5.00	4.75	4.00	3.50	6.00
May-53	0	6.00	6.00	5.00	2.75	1.00	0.25	0.75
Jun-53	0	6.50	6.25	5.00	2.00	0.50	0.00	0.50
Jul-53	0	63.50	63.25	60.00	49.00	42.75	34.50	33.00
Aug-53	0	49.50	49.50	48.25	43.00	39.00	33.50	32.50
Sep-53	0	41.50	41.50	40.00	33.75	29.50	23.00	22.00
Oct-53	0	35.50	35.25	31.00	15.50	6.75	0.00	0.00
Nov-53	0	6.00	6.00	5.00	1.50	0.00	0.00	0.00
Dec-53	0	6.00	6.00	5.00	1.50	0.00	0.00	0.00
Jan-54	0	10.25	11.00	11.00	12.00	13.25	9.50	10.50
Feb-54	0	23.00	23.75	23.50	22.50	23.25	20.25	25.00
Mar-54	0	2.75	5.50	9.50	19.50	33.25	41.50	64.00
Apr-54	0	3.75	4.50	5.00	8.00	12.75	17.75	21.25
May-54	0	6.00	6.00	5.00	2.50	0.75	0.00	0.00
Jun-54	0	6.25	6.25	5.00	2.25	1.00	0.00	1.25
Jul-54	0	67.50	67.25	63.75	51.75	44.50	34.25	32.50
Aug-54	0	45.50	45.50	44.25	38.75	34.75	28.75	28.00
Sep-54	0	51.00	50.75	46.00	27.75	16.25	2.75	1.50
Oct-54	0	30.75	30.75	28.50	18.25	9.25	0.25	0.00
Nov-54	0	13.50	13.50	12.50	8.00	3.75	0.00	0.00
Dec-54	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-55	0	2.00	2.50	2.75	2.75	1.75	0.00	4.50
Feb-55	0	3.00	3.25	2.75	1.75	1.25	0.00	2.75
Mar-55	0	3.25	3.25	2.50	1.25	0.75	0.00	1.00
Apr-55	0	3.50	3.50	2.50	1.00	0.25	0.00	1.50
May-55	0	3.00	3.25	2.50	1.50	1.75	1.00	2.00
Jun-55	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jul-55	0	34.25	34.00	29.25	15.50	8.00	0.00	0.00
Aug-55	0	50.75	50.50	47.00	31.00	19.75	3.75	1.50
Sep-55	0	8.75	8.75	7.75	3.00	0.00	0.00	0.00
Oct-55	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Nov-55	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-55	0	2.00	12.50	28.50	58.00	101.50	109.75	209.00
Jan-56	0	2.00	15.50	37.25	87.00	136.25	145.00	261.50
Feb-56	0	2.00	4.25	7.00	14.00	23.25	30.00	49.25
Mar-56	0	2.00	3.00	3.75	6.50	10.00	13.50	21.75
Apr-56	0	2.00	3.50	5.25	10.75	16.00	19.25	31.75
May-56	0	2.00	2.75	3.00	5.25	8.75	13.75	18.50
Jun-56	0	3.50	3.50	2.50	1.00	0.25	0.00	1.50
Jul-56	0	3.50	3.50	2.50	0.50	0.25	0.00	1.25
Aug-56	0	31.00	30.75	26.00	11.25	4.75	0.00	0.00
Sep-56	0	18.75	18.75	16.00	5.50	0.50	0.00	0.00
Oct-56	0	3.75	3.75	2.75	0.00	0.00	0.00	0.00
Nov-56	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Dec-56	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Jan-57	0	3.25	3.25	2.50	0.25	0.00	0.00	0.75
Feb-57	0	2.25	3.00	3.00	2.50	3.25	0.25	6.25
Mar-57	0	2.00	2.50	2.50	2.25	3.50	1.75	4.25
Apr-57	0	3.00	3.25	2.50	1.50	1.50	0.25	1.50
May-57	0	3.25	3.25	2.50	1.00	0.75	0.00	1.25

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Jun-57	0	70.75	70.50	66.50	54.50	47.00	35.25	33.25
Jul-57	0	12.75	12.75	11.25	5.75	2.50	0.00	0.00
Aug-57	0	48.25	47.75	44.00	27.25	16.75	2.75	1.50
Sep-57	0	13.50	13.50	12.25	6.25	1.75	0.00	0.00
Oct-57	0	4.25	4.25	3.25	0.00	0.00	0.00	0.00
Nov-57	0	5.25	5.00	3.75	0.25	0.00	0.00	0.00
Dec-57	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jan-58	0	2.00	2.75	3.00	3.25	4.25	1.00	5.00
Feb-58	0	2.25	15.00	35.00	87.25	161.00	209.25	304.50
Mar-58	1	3.00	20.00	48.00	136.25	255.25	369.00	482.25
Apr-58	1	572.50	600.00	643.25	814.25	1009.75	1209.25	1351.50
May-58	1	145.50	149.00	155.25	176.50	200.50	231.75	246.25
Jun-58	1	16.25	17.50	19.00	23.50	30.25	39.50	46.50
Jul-58	1	12.25	12.50	12.25	10.00	8.75	6.50	9.50
Aug-58	1	17.00	17.00	15.50	10.00	7.25	3.25	4.50
Sep-58	1	18.75	18.75	17.00	10.00	6.75	2.25	3.25
Oct-58	0	7.00	6.75	5.75	1.50	0.00	0.00	1.00
Nov-58	0	7.25	7.00	5.75	1.50	0.00	0.00	1.00
Dec-58	0	6.25	6.25	5.00	1.50	0.00	0.00	1.00
Jan-59	0	5.00	5.25	5.00	3.50	3.75	1.75	4.50
Feb-59	0	34.00	37.50	41.50	53.50	73.50	86.75	111.25
Mar-59	0	3.75	4.50	5.00	6.75	9.50	12.00	16.75
Apr-59	0	5.00	5.50	5.00	4.75	4.00	2.75	6.00
May-59	0	5.75	5.75	5.00	3.25	1.75	0.75	2.25
Jun-59	0	6.25	6.25	5.00	2.50	1.25	0.50	2.00
Jul-59	0	62.75	62.50	59.25	48.50	42.50	33.75	32.50
Aug-59	0	49.50	49.50	48.25	42.75	39.25	33.75	33.00
Sep-59	0	36.00	35.75	31.75	16.75	8.50	0.00	0.00
Oct-59	0	28.00	27.75	25.50	15.00	7.25	0.00	0.00
Nov-59	0	16.00	15.75	14.75	9.75	5.25	0.25	0.00
Dec-59	0	6.00	5.75	5.00	2.25	0.25	0.00	0.00
Jan-60	0	5.75	5.75	5.00	2.75	1.00	0.00	0.75
Feb-60	0	32.50	33.25	32.50	30.75	29.25	22.00	30.25
Mar-60	0	5.75	5.75	5.00	3.25	1.50	0.00	1.25
Apr-60	0	5.00	5.50	5.00	4.50	3.75	1.75	7.00
May-60	0	6.00	6.00	5.00	2.50	1.00	0.00	1.25
Jun-60	0	6.50	6.25	5.00	2.00	0.50	0.00	0.00
Jul-60	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Aug-60	0	45.00	44.50	39.25	20.50	11.25	0.25	0.00
Sep-60	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Oct-60	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-60	0	3.50	3.75	2.50	0.00	0.00	0.00	0.75
Dec-60	0	3.50	3.50	2.50	0.00	0.00	0.00	1.50
Jan-61	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Feb-61	0	4.25	4.00	2.75	0.00	0.00	0.00	0.00
Mar-61	0	3.75	3.75	2.50	0.00	0.00	0.00	0.25
Apr-61	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
May-61	0	28.75	28.50	24.50	11.50	4.25	0.00	0.00
Jun-61	0	5.50	5.25	4.25	0.50	0.00	0.00	0.00
Jul-61	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Aug-61	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Sep-61	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Oct-61	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Nov-61	0	5.25	5.00	3.25	0.00	0.00	0.00	0.00
Dec-61	0	2.25	2.75	2.50	0.25	0.00	0.00	1.75
Jan-62	0	2.00	2.75	2.75	0.75	0.00	0.00	7.00
Feb-62	0	2.50	50.00	127.50	348.50	618.00	842.25	1177.50
Mar-62	1	28.50	36.25	48.00	79.00	122.00	136.50	197.25
Apr-62	1	29.75	31.50	33.00	39.00	47.00	49.00	59.25
May-62	1	19.50	20.00	20.00	20.25	20.50	18.25	23.00
Jun-62	1	24.25	24.50	23.00	19.00	15.50	10.50	12.00
Jul-62	1	16.50	16.50	15.00	10.00	7.00	2.75	3.75
Aug-62	1	19.25	19.00	17.25	10.00	5.75	0.75	0.25
Sep-62	1	28.75	28.50	25.25	12.25	5.25	0.00	0.00
Oct-62	0	6.00	6.00	5.00	1.00	0.00	0.00	0.00
Nov-62	0	6.50	6.25	5.00	1.00	0.00	0.00	0.00
Dec-62	0	6.25	6.00	5.00	1.25	0.00	0.00	0.50
Jan-63	0	6.00	6.00	5.00	2.00	0.25	0.00	1.00

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Feb-63	0	2.75	5.75	9.50	15.00	23.00	16.50	48.00
Mar-63	0	2.75	5.00	7.75	12.50	19.25	16.25	42.50
Apr-63	0	2.75	4.00	5.00	6.75	9.50	7.50	22.25
May-63	0	5.00	5.25	5.00	4.00	4.00	2.25	8.25
Jun-63	0	6.00	6.25	5.00	2.50	1.50	0.00	3.00
Jul-63	0	6.50	6.50	5.00	1.00	0.00	0.00	1.25
Aug-63	0	38.75	38.50	34.00	17.50	8.75	0.00	0.00
Sep-63	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Oct-63	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-63	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Dec-63	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Jan-64	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Feb-64	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Mar-64	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Apr-64	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
May-64	0	31.50	31.00	27.25	14.25	6.25	0.00	0.00
Jun-64	0	6.00	6.00	5.00	1.25	0.00	0.00	0.00
Jul-64	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Aug-64	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Sep-64	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Oct-64	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Nov-64	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Dec-64	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Jan-65	0	2.00	2.75	3.00	0.75	0.25	0.00	5.50
Feb-65	0	4.00	4.00	2.75	0.00	0.00	0.00	0.50
Mar-65	0	3.25	3.50	2.50	0.00	0.00	0.00	1.25
Apr-65	0	2.00	6.25	12.00	21.50	34.25	21.25	45.75
May-65	0	3.00	3.25	2.50	0.25	0.00	0.00	1.25
Jun-65	0	67.25	66.75	61.25	38.50	25.00	4.00	3.75
Jul-65	0	47.50	47.25	45.25	32.00	20.50	4.00	2.75
Aug-65	0	18.50	18.25	16.75	8.00	1.50	0.00	0.00
Sep-65	0	6.50	6.25	5.50	1.00	0.00	0.00	0.00
Oct-65	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Nov-65	0	2.00	6.25	12.25	18.50	27.75	15.25	59.50
Dec-65	0	2.00	6.00	11.75	20.75	34.00	31.50	70.25
Jan-66	1	2.25	7.00	14.00	31.50	56.00	71.00	108.75
Feb-66	1	21.50	24.00	26.50	32.00	40.75	44.75	69.50
Mar-66	1	47.00	48.00	48.00	49.25	51.75	54.50	63.00
Apr-66	1	36.00	36.25	35.00	33.00	29.25	26.50	29.25
May-66	1	22.50	22.75	22.00	20.00	18.00	17.00	20.00
Jun-66	1	24.00	24.00	22.75	19.00	16.00	14.00	15.25
Jul-66	1	16.75	16.75	15.25	10.00	6.75	3.25	3.50
Aug-66	1	67.75	67.50	64.75	52.50	44.75	33.75	32.00
Sep-66	1	50.50	50.25	49.25	44.00	40.00	34.00	33.25
Oct-66	0	48.75	48.75	47.25	41.50	37.25	31.00	30.25
Nov-66	0	50.50	50.25	48.75	43.00	38.75	32.50	31.75
Dec-66	0	2.25	5.00	8.50	21.25	40.25	58.00	65.50
Jan-67	1	2.50	12.25	27.00	71.75	135.50	195.25	259.00
Feb-67	1	17.75	21.50	26.50	50.75	74.00	98.50	106.75
Mar-67	1	304.25	306.50	307.00	319.25	326.25	336.75	343.75
Apr-67	1	892.75	895.75	899.75	918.75	925.50	936.25	951.75
May-67	1	327.00	331.00	337.00	364.00	385.00	409.75	417.25
Jun-67	1	18.25	18.75	19.00	20.00	20.25	20.75	24.00
Jul-67	1	15.25	15.00	14.00	10.00	7.50	5.25	4.75
Aug-67	1	59.25	59.25	56.75	47.25	43.25	37.00	36.00
Sep-67	1	45.00	45.00	44.00	39.25	36.75	32.75	32.25
Oct-67	0	7.00	7.00	5.75	1.50	0.00	0.00	0.00
Nov-67	0	7.50	7.25	5.75	1.50	0.00	0.00	0.25
Dec-67	0	6.00	6.00	5.00	2.00	1.00	0.00	1.25
Jan-68	0	5.75	6.00	5.00	2.50	1.75	0.25	1.50
Feb-68	0	5.75	6.00	5.25	4.00	4.50	4.00	5.25
Mar-68	0	30.75	31.25	30.50	29.75	31.75	33.25	36.00
Apr-68	0	5.25	5.50	5.00	5.00	5.75	7.00	8.75
May-68	0	6.00	6.00	5.00	2.50	1.00	0.25	0.00
Jun-68	0	57.75	57.75	54.75	46.75	41.75	36.25	35.25
Jul-68	0	6.00	6.00	5.00	1.50	0.25	0.00	0.00
Aug-68	0	17.00	16.75	13.75	4.00	0.75	0.00	0.00
Sep-68	0	36.50	36.25	33.00	18.50	10.25	0.25	0.00

1) Rounded to nearest 0.25 cfs

Table A-1

Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5B

Based on SYRHM , WY 1918-1993

MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Oct-68	0	24.25	24.00	22.00	12.75	6.00	0.00	0.00
Nov-68	0	12.00	12.00	11.00	6.75	3.25	0.00	0.00
Dec-68	0	6.00	5.75	5.00	2.25	0.25	0.00	0.00
Jan-69	0	2050.00	2083.00	2132.50	2368.50	2653.00	2973.25	3105.50
Feb-69	1	3347.25	3391.50	3467.50	3818.00	4144.75	4491.75	4641.50
Mar-69	1	1257.25	1272.25	1296.50	1407.50	1543.75	1713.50	1759.00
Apr-69	1	296.25	301.25	310.00	338.75	360.00	375.25	406.00
May-69	1	89.50	91.75	94.75	106.75	120.00	135.50	145.75
Jun-69	1	16.50	17.75	19.00	23.50	29.50	36.25	43.00
Jul-69	1	13.00	13.25	12.50	10.00	8.50	6.75	9.25
Aug-69	1	16.50	16.50	15.00	10.00	7.75	4.50	5.75
Sep-69	1	18.25	18.00	16.50	10.00	7.50	3.50	4.50
Oct-69	0	6.50	6.50	5.25	1.50	0.25	0.00	1.25
Nov-69	0	6.00	6.00	5.00	2.00	1.75	0.25	1.50
Dec-69	0	5.50	5.75	5.00	2.50	1.75	0.25	3.00
Jan-70	0	4.50	5.00	5.00	5.00	7.25	8.50	11.25
Feb-70	0	4.75	5.25	5.50	6.75	10.50	14.50	17.75
Mar-70	0	32.50	35.50	39.00	55.00	73.50	91.00	103.25
Apr-70	0	5.50	5.75	5.25	4.75	4.00	3.75	5.25
May-70	0	6.00	6.00	5.00	3.00	1.50	0.75	0.75
Jun-70	0	6.50	6.25	5.00	2.25	0.75	0.00	0.00
Jul-70	0	58.50	58.25	55.00	44.75	39.50	33.00	31.50
Aug-70	0	49.50	49.50	48.00	43.00	39.75	35.00	34.25
Sep-70	0	18.50	18.25	15.00	4.50	0.75	0.00	0.00
Oct-70	0	25.00	24.75	22.00	11.00	4.75	0.00	0.00
Nov-70	0	14.50	14.50	13.50	9.75	7.00	2.00	1.00
Dec-70	0	2.75	4.00	5.50	10.75	14.50	12.00	16.75
Jan-71	0	4.50	5.00	5.00	5.25	7.00	7.25	10.00
Feb-71	0	5.50	6.00	5.50	4.50	4.50	3.75	7.25
Mar-71	0	5.50	5.50	5.00	4.00	3.25	2.25	3.75
Apr-71	0	6.00	6.00	5.00	3.50	2.25	1.25	2.75
May-71	0	6.25	6.00	5.00	2.50	1.00	0.00	0.00
Jun-71	0	57.75	57.50	54.50	46.25	41.00	35.75	34.50
Jul-71	0	49.50	49.50	48.25	43.75	41.00	37.50	37.00
Aug-71	0	49.50	49.50	47.75	41.75	38.25	32.75	32.00
Sep-71	0	32.75	32.25	28.00	12.75	5.75	0.00	0.00
Oct-71	0	24.75	24.50	22.00	11.50	5.00	0.00	0.00
Nov-71	0	13.75	13.75	12.50	7.50	3.75	0.00	0.00
Dec-71	0	2.50	4.00	5.75	11.50	19.25	22.75	24.75
Jan-72	0	5.25	5.50	5.00	4.00	4.00	3.50	4.25
Feb-72	0	5.75	6.00	5.25	4.00	3.50	3.00	4.25
Mar-72	0	6.00	6.00	5.00	2.75	1.25	0.25	0.00
Apr-72	0	6.25	6.25	5.00	2.75	1.25	0.50	0.25
May-72	0	55.75	55.50	52.75	46.50	42.00	37.75	36.50
Jun-72	0	50.75	50.75	49.75	46.50	44.25	42.00	41.50
Jul-72	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Aug-72	0	25.00	24.75	21.00	8.25	2.75	0.00	0.00
Sep-72	0	39.50	39.25	36.00	20.75	12.00	0.75	0.00
Oct-72	0	26.00	26.00	23.75	14.25	7.00	0.00	0.00
Nov-72	0	2.50	2.75	2.50	1.50	0.75	0.00	1.75
Dec-72	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-73	0	2.00	10.75	24.75	60.50	99.25	111.50	177.75
Feb-73	0	2.50	24.00	59.00	180.25	334.75	485.00	607.00
Mar-73	1	248.50	254.75	262.75	291.75	318.75	338.50	383.50
Apr-73	1	126.50	129.00	132.50	145.00	159.75	180.25	194.75
May-73	1	18.00	19.00	20.00	24.00	26.50	30.00	35.00
Jun-73	1	20.75	21.00	20.50	19.00	17.50	16.50	19.50
Jul-73	1	15.75	15.75	14.50	10.00	7.50	5.00	6.00
Aug-73	1	18.25	18.25	16.50	10.00	7.00	2.75	3.00
Sep-73	1	19.50	19.25	17.50	10.00	6.25	1.50	1.00
Oct-73	0	7.50	7.25	6.00	1.50	0.00	0.00	0.25
Nov-73	0	13.25	13.00	11.25	5.25	2.25	0.00	0.25
Dec-73	0	6.00	6.00	5.00	1.75	0.50	0.00	1.00
Jan-74	0	2.75	9.00	18.25	43.75	81.25	107.50	150.50
Feb-74	0	4.25	5.00	5.50	7.25	10.75	13.75	19.25
Mar-74	0	5.50	7.25	9.00	14.75	23.00	29.75	44.50
Apr-74	0	7.00	7.75	8.00	9.75	13.00	17.00	23.75
May-74	1	22.50	22.75	21.75	20.00	19.75	20.75	23.75

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
	Indicator	Cachuma	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River
	that 3A2	Total Discharges	Below	at 154	above Alisal	near	above Salsipuedes	at Lompoc
MONTH	in effect	Downstream	Hilton Creek	Bridge	Bridge	Buellton	Creek Confluence	Narrows
	(1=yes)	cfs	cfs	cfs	cfs	cfs	cfs	cfs
Jun-74	1	25.25	25.25	23.50	19.00	16.00	13.75	15.00
Jul-74	1	17.00	17.00	15.25	10.00	7.00	3.75	4.00
Aug-74	1	19.25	19.25	17.25	10.00	6.25	1.50	1.75
Sep-74	1	25.00	25.00	21.75	10.00	4.00	0.00	0.00
Oct-74	0	21.50	21.25	19.00	9.75	3.75	0.00	0.00
Nov-74	0	6.00	5.75	5.00	2.00	0.00	0.00	0.25
Dec-74	0	2.75	5.25	8.50	14.25	22.75	20.50	44.25
Jan-75	0	5.00	5.25	5.00	4.00	3.75	2.00	4.75
Feb-75	0	34.00	41.25	51.50	78.00	116.00	141.25	203.00
Mar-75	0	74.50	87.25	107.75	161.75	236.00	296.50	406.50
Apr-75	1	81.25	83.50	86.00	94.75	105.50	119.00	134.75
May-75	1	17.75	19.00	20.00	24.25	30.00	38.50	45.25
Jun-75	1	20.75	21.00	20.50	19.00	17.50	16.00	20.75
Jul-75	1	15.00	15.00	14.00	10.00	7.75	5.00	6.50
Aug-75	1	18.25	18.25	16.50	10.00	7.00	3.00	4.00
Sep-75	1	19.50	19.25	17.50	10.00	6.25	1.50	1.75
Oct-75	0	6.25	6.00	5.00	1.00	0.00	0.00	1.00
Nov-75	0	6.50	6.25	5.00	1.00	0.00	0.00	1.00
Dec-75	0	6.25	6.25	5.00	1.25	0.00	0.00	1.00
Jan-76	0	6.25	6.00	5.00	1.75	0.25	0.00	1.25
Feb-76	0	32.75	33.75	33.50	32.25	34.50	31.00	40.25
Mar-76	0	5.00	5.25	5.00	4.50	4.50	3.75	6.75
Apr-76	0	5.50	5.75	5.00	4.00	3.50	2.25	5.75
May-76	0	6.00	6.00	5.00	3.00	1.50	0.25	1.75
Jun-76	0	57.75	57.75	54.75	47.00	41.75	35.75	34.75
Jul-76	0	49.50	49.50	48.25	44.00	41.25	37.00	36.50
Aug-76	0	49.25	49.25	47.75	41.75	38.00	32.00	31.25
Sep-76	0	39.00	38.75	34.00	17.50	9.25	0.25	0.00
Oct-76	0	22.25	22.00	19.75	10.00	3.75	0.00	0.00
Nov-76	0	6.00	6.00	5.00	1.75	0.00	0.00	0.00
Dec-76	0	6.00	6.00	5.00	1.75	0.00	0.00	0.00
Jan-77	0	6.00	6.00	5.00	2.00	0.25	0.00	0.75
Feb-77	0	6.75	6.50	5.50	2.50	0.50	0.00	1.00
Mar-77	0	3.25	3.25	2.50	0.75	0.00	0.00	1.25
Apr-77	0	3.50	3.50	2.50	0.75	0.00	0.00	0.00
May-77	0	3.75	3.50	2.50	0.50	0.00	0.00	1.00
Jun-77	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jul-77	0	43.75	43.25	38.25	22.75	14.00	1.00	0.00
Aug-77	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Sep-77	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Oct-77	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Nov-77	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Dec-77	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Jan-78	0	2.00	11.25	24.75	52.00	86.25	85.25	155.25
Feb-78	0	147.50	186.00	248.00	434.25	692.00	922.00	1195.50
Mar-78	1	2331.25	2367.50	2427.75	2660.75	2950.25	3269.00	3464.25
Apr-78	1	581.50	592.75	612.00	675.00	753.50	842.75	910.75
May-78	1	118.50	121.25	124.75	138.25	155.75	178.75	194.50
Jun-78	1	16.25	17.50	19.00	24.25	30.00	36.50	43.25
Jul-78	1	9.50	10.00	10.25	10.00	11.50	12.50	17.00
Aug-78	1	15.00	15.25	14.25	10.00	9.25	7.25	10.00
Sep-78	1	18.00	18.00	16.50	10.00	7.25	2.75	4.00
Oct-78	0	5.75	5.75	5.00	1.75	0.50	0.00	2.50
Nov-78	0	6.00	6.00	5.00	1.75	0.50	0.00	2.75
Dec-78	0	5.50	5.75	5.00	2.50	2.00	0.25	3.00
Jan-79	0	2.75	5.00	8.25	16.00	29.00	37.00	54.50
Feb-79	0	6.75	12.00	19.50	40.75	72.00	98.50	137.25
Mar-79	0	339.00	344.50	350.25	371.00	401.75	431.25	474.75
Apr-79	1	182.00	185.50	191.00	211.00	235.00	266.25	282.75
May-79	1	17.75	18.75	20.00	24.50	30.25	38.25	45.25
Jun-79	1	19.25	19.75	19.50	19.00	18.75	18.50	23.25
Jul-79	1	15.00	15.00	14.00	10.00	7.75	4.75	6.25
Aug-79	1	18.50	18.25	16.75	10.00	6.75	2.25	2.50
Sep-79	1	19.75	19.50	17.75	10.00	6.00	1.00	1.00
Oct-79	0	14.00	14.00	12.25	6.00	2.75	0.00	0.25
Nov-79	0	11.00	11.00	9.50	4.50	1.50	0.00	0.25
Dec-79	0	5.75	5.75	5.00	2.25	0.50	0.00	1.25
Jan-80	0	2.75	4.50	6.75	13.00	23.25	28.25	38.50

1) Rounded to nearest 0.25 cfs

Table A-1								
Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5B								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Feb-80	0	1152.00	1177.50	1215.00	1359.75	1550.75	1740.00	1890.75
Mar-80	1	652.75	664.50	684.75	753.00	837.00	933.75	1001.75
Apr-80	1	115.50	117.75	120.50	131.25	144.25	162.75	175.50
May-80	1	16.75	18.25	20.00	27.25	34.00	42.50	49.25
Jun-80	1	18.00	18.75	19.00	20.25	21.25	22.25	27.00
Jul-80	1	14.00	14.00	13.25	10.00	8.25	5.75	8.25
Aug-80	1	18.50	18.25	16.50	10.00	7.00	3.00	3.25
Sep-80	1	19.50	19.50	17.50	10.00	6.50	1.50	1.75
Oct-80	0	7.25	7.00	5.75	1.50	0.00	0.00	0.25
Nov-80	0	7.25	7.25	5.75	1.50	0.00	0.00	0.25
Dec-80	0	6.25	6.25	5.00	1.50	0.00	0.00	1.00
Jan-81	0	4.75	5.25	5.00	3.75	4.50	2.25	6.50
Feb-81	0	4.50	5.25	5.50	6.50	9.75	10.75	15.50
Mar-81	0	30.75	39.25	51.50	89.00	143.25	190.25	249.75
Apr-81	0	2.75	4.00	5.50	10.50	17.50	25.50	34.00
May-81	0	4.75	5.25	5.00	4.75	5.75	7.50	10.75
Jun-81	0	5.75	6.00	5.00	3.25	2.75	2.50	4.00
Jul-81	0	7.00	6.75	5.25	1.50	0.25	0.00	0.50
Aug-81	0	20.00	19.75	16.25	5.25	1.25	0.00	0.25
Sep-81	0	38.50	38.25	34.75	20.00	11.50	0.25	0.00
Oct-81	0	25.25	25.00	23.00	13.75	6.75	0.00	0.00
Nov-81	0	12.75	12.50	11.50	7.25	3.75	0.00	0.00
Dec-81	0	5.75	5.75	5.00	2.25	0.50	0.00	0.75
Jan-82	0	5.50	5.50	5.00	3.25	2.00	0.00	2.25
Feb-82	0	6.25	6.25	5.50	3.75	2.75	0.50	1.75
Mar-82	0	30.75	31.75	31.75	34.75	39.25	41.25	43.75
Apr-82	0	2.75	5.75	10.00	27.00	49.00	72.50	83.25
May-82	0	4.75	5.00	5.00	5.50	6.50	8.00	9.50
Jun-82	0	6.25	6.25	5.00	2.25	0.75	0.00	0.50
Jul-82	0	59.75	59.50	56.25	46.50	41.25	34.00	32.75
Aug-82	0	49.50	49.50	48.25	43.25	40.00	34.75	34.25
Sep-82	0	51.00	51.00	49.50	43.00	39.00	32.75	32.00
Oct-82	0	6.75	6.50	5.00	0.25	0.00	0.00	0.00
Nov-82	0	6.25	6.25	5.00	1.50	1.00	0.00	1.00
Dec-82	0	2.50	6.00	10.25	27.25	48.75	65.25	70.50
Jan-83	0	211.00	228.75	255.25	330.00	440.50	532.75	672.75
Feb-83	1	1008.25	1032.50	1072.50	1195.75	1354.75	1512.75	1686.00
Mar-83	1	3168.50	3193.50	3235.25	3429.75	3548.25	3637.75	3799.50
Apr-83	1	933.75	948.00	972.50	1060.75	1126.25	1169.50	1257.25
May-83	1	469.75	478.00	491.25	544.25	591.75	635.75	667.00
Jun-83	1	83.50	86.00	90.00	103.25	122.50	146.00	160.25
Jul-83	1	7.75	8.75	10.00	12.50	17.50	22.50	30.50
Aug-83	1	10.00	10.50	10.75	10.00	12.75	14.50	19.25
Sep-83	1	14.75	15.00	14.00	10.00	9.75	8.25	11.25
Oct-83	0	4.00	4.75	5.00	4.75	7.75	9.25	13.75
Nov-83	0	5.50	5.75	5.00	3.00	2.75	1.50	6.25
Dec-83	0	211.00	213.75	214.50	216.00	227.00	234.25	256.50
Jan-84	0	77.25	78.50	80.25	86.25	93.00	102.25	111.00
Feb-84	0	28.25	29.25	30.25	34.75	39.75	48.00	53.50
Mar-84	0	7.00	7.50	8.25	11.50	15.25	21.75	25.25
Apr-84	1	33.25	33.75	33.00	33.50	32.75	34.00	37.50
May-84	1	22.50	22.75	21.75	20.00	17.75	17.25	18.75
Jun-84	1	24.25	24.25	22.75	19.00	16.00	14.50	15.00
Jul-84	1	16.25	16.25	14.75	10.00	7.25	4.50	4.00
Aug-84	1	19.00	19.00	17.00	10.00	6.75	2.25	1.75
Sep-84	1	20.50	20.25	18.00	10.00	6.00	0.75	0.25
Oct-84	0	17.25	17.00	14.25	5.00	1.00	0.00	0.00
Nov-84	0	11.50	11.25	10.00	5.00	2.00	0.00	0.25
Dec-84	0	4.50	5.00	5.00	3.75	4.00	1.25	6.25
Jan-85	0	5.75	5.75	5.00	2.75	1.75	0.25	1.50
Feb-85	0	5.75	6.00	5.50	4.25	4.25	2.75	6.00
Mar-85	0	5.25	5.50	5.00	4.00	3.75	3.00	6.00
Apr-85	0	6.00	6.00	5.00	3.25	2.50	1.75	3.00
May-85	0	6.25	6.25	5.00	2.50	1.00	0.00	0.00
Jun-85	0	57.75	57.50	54.25	46.00	41.00	35.25	34.00
Jul-85	0	49.25	49.25	48.00	43.50	41.00	37.00	36.50
Aug-85	0	11.25	11.25	9.25	3.25	0.75	0.00	0.00
Sep-85	0	38.00	37.75	33.25	16.75	9.00	0.00	0.00

1) Rounded to nearest 0.25 cfs

Table A-1

Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5B

Based on SYRHM , WY 1918-1993

MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Oct-85	0	18.00	18.00	15.75	7.25	2.00	0.00	0.00
Nov-85	0	3.25	3.25	2.50	0.25	0.00	0.00	0.00
Dec-85	0	3.25	3.25	2.50	0.50	0.00	0.00	0.50
Jan-86	0	2.50	2.75	2.50	1.50	1.25	0.00	1.75
Feb-86	0	2.50	13.75	31.50	78.00	142.75	185.00	270.75
Mar-86	1	23.50	33.00	48.00	84.50	135.50	171.75	262.00
Apr-86	1	31.75	32.75	33.00	35.75	40.00	45.75	53.00
May-86	1	19.50	20.00	20.00	20.75	20.50	20.50	25.25
Jun-86	1	23.25	23.25	22.25	19.00	17.25	17.00	18.50
Jul-86	1	16.50	16.50	15.00	10.00	7.25	4.25	4.00
Aug-86	1	19.25	19.00	17.25	10.00	6.50	2.00	1.50
Sep-86	1	20.50	20.50	18.25	10.00	5.75	0.75	0.25
Oct-86	0	18.25	18.25	15.25	5.50	1.25	0.00	0.00
Nov-86	0	6.25	6.00	5.00	1.50	0.00	0.00	0.25
Dec-86	0	6.00	6.00	5.00	1.75	0.25	0.00	1.00
Jan-87	0	5.75	5.75	5.00	2.75	1.25	0.00	2.50
Feb-87	0	6.75	6.75	5.50	2.50	0.75	0.00	1.25
Mar-87	0	30.75	31.75	31.50	30.75	31.25	26.25	38.00
Apr-87	0	6.00	6.00	5.00	3.25	1.75	0.50	1.75
May-87	0	6.00	6.00	5.00	2.75	1.00	0.00	0.50
Jun-87	0	6.25	6.25	5.00	2.00	0.50	0.00	0.00
Jul-87	0	6.50	6.50	5.00	1.00	0.00	0.00	0.00
Aug-87	0	33.00	32.75	28.25	13.75	7.00	0.00	0.00
Sep-87	0	18.25	18.00	15.75	5.75	1.00	0.00	0.00
Oct-87	0	6.00	6.00	5.00	1.00	0.00	0.00	0.00
Nov-87	0	6.50	6.50	5.00	0.75	0.00	0.00	0.00
Dec-87	0	6.25	6.25	5.00	1.25	0.00	0.00	0.25
Jan-88	0	5.25	5.50	5.00	2.75	1.75	0.00	1.75
Feb-88	0	6.25	6.25	5.25	2.50	1.00	0.00	1.00
Mar-88	0	30.50	31.25	30.75	32.25	37.50	36.50	36.25
Apr-88	0	5.00	5.25	5.00	4.75	5.50	4.75	6.25
May-88	0	3.00	3.00	2.50	1.25	0.25	0.00	1.25
Jun-88	0	60.50	60.50	57.50	49.00	43.50	34.50	33.25
Jul-88	0	36.50	36.50	35.25	31.25	28.50	24.25	23.75
Aug-88	0	27.25	27.00	23.25	10.50	4.50	0.00	0.00
Sep-88	0	34.75	34.50	31.25	17.75	9.25	0.00	0.00
Oct-88	0	3.25	3.25	2.50	0.00	0.00	0.00	0.00
Nov-88	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Dec-88	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jan-89	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Feb-89	0	3.75	3.75	2.75	0.50	0.25	0.00	0.00
Mar-89	0	3.75	3.50	2.50	0.25	0.00	0.00	0.00
Apr-89	0	3.75	3.75	2.50	0.25	0.00	0.00	0.00
May-89	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Jun-89	0	19.25	19.00	15.50	6.00	2.00	0.00	0.00
Jul-89	0	36.25	36.00	32.50	19.25	11.75	0.75	0.00
Aug-89	0	9.75	9.75	8.50	3.00	0.25	0.00	0.00
Sep-89	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Oct-89	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Nov-89	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Dec-89	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Jan-90	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Feb-90	0	4.50	4.25	2.75	0.00	0.00	0.00	0.00
Mar-90	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Apr-90	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
May-90	0	22.50	22.25	18.00	5.25	0.75	0.00	0.00
Jun-90	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jul-90	0	8.00	7.75	6.00	0.25	0.00	0.00	0.00
Aug-90	0	5.25	5.00	3.50	0.00	0.00	0.00	0.00
Sep-90	0	5.25	5.00	3.25	0.00	0.00	0.00	0.00
Oct-90	0	7.25	7.00	5.00	0.00	0.00	0.00	0.00
Nov-90	0	5.50	5.25	3.50	0.00	0.00	0.00	0.00
Dec-90	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Jan-91	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Feb-91	0	4.50	4.50	2.75	0.00	0.00	0.00	0.00
Mar-91	0	2.00	11.50	25.75	57.25	110.25	146.25	208.25
Apr-91	1	31.75	33.25	33.25	33.00	41.50	40.25	37.75
May-91	1	25.50	25.75	24.75	20.00	19.00	14.50	11.50

1) Rounded to nearest 0.25 cfs

Table A-1

Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5B

Based on SYRHM , WY 1918-1993

MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Jun-91	1	33.25	33.00	30.25	19.00	11.75	2.75	0.00
Jul-91	1	26.25	26.25	24.00	13.50	6.75	0.00	0.00
Aug-91	1	39.50	39.25	36.50	22.75	13.00	1.00	0.00
Sep-91	1	18.50	18.50	17.00	10.00	4.75	0.00	0.00
Oct-91	0	5.50	5.25	4.25	0.50	0.00	0.00	0.00
Nov-91	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-91	0	3.25	3.50	2.50	0.25	0.00	0.00	0.00
Jan-92	0	2.00	2.50	2.50	2.00	3.25	1.25	0.25
Feb-92	0	2.25	18.00	42.75	127.25	244.00	352.00	430.50
Mar-92	1	38.00	42.50	48.00	69.75	100.25	133.50	152.25
Apr-92	1	29.00	31.00	33.00	43.75	57.25	75.50	78.50
May-92	1	19.25	19.75	20.00	22.00	25.00	30.25	33.25
Jun-92	1	21.75	22.00	21.25	19.00	18.50	19.50	20.75
Jul-92	1	15.75	15.75	14.50	10.00	7.25	4.25	5.25
Aug-92	1	65.75	65.50	62.75	51.00	44.00	34.00	32.50
Sep-92	1	51.00	51.00	49.75	44.50	40.75	35.25	34.50
Oct-92	0	16.50	16.50	14.50	7.50	3.50	0.00	0.00
Nov-92	0	13.25	13.00	11.25	5.50	2.25	0.00	0.00
Dec-92	0	5.75	5.75	5.00	2.25	0.75	0.00	2.25
Jan-93	0	411.75	423.75	439.75	502.75	594.50	684.75	739.75
Feb-93	1	2025.75	2050.00	2092.00	2238.25	2419.25	2620.75	2756.75
Mar-93	1	1049.75	1063.50	1085.50	1178.00	1284.75	1411.75	1464.75
Apr-93	1	476.50	482.50	492.50	533.00	584.50	651.75	671.50
May-93	1	101.00	103.50	107.00	121.25	135.25	151.75	160.50
Jun-93	1	16.25	17.50	19.00	25.00	31.00	37.00	42.00
Jul-93	1	10.25	10.75	10.50	10.00	10.50	9.75	12.75
Aug-93	1	15.75	15.75	14.75	10.00	9.00	7.00	8.00
Sep-93	1	19.00	18.75	17.00	10.00	7.00	2.50	2.00

1) Rounded to nearest 0.25 cfs

Table A-2

Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5C

Based on SYRHM , WY 1918-1993

MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Oct-17	0	8.00	7.75	5.00	0.25	0.00	0.00	0.00
Nov-17	0	7.75	7.50	5.00	0.25	0.00	0.00	0.00
Dec-17	0	7.25	7.00	5.00	0.50	0.00	0.00	0.00
Jan-18	0	6.75	6.75	5.00	1.00	0.00	0.00	1.00
Feb-18	0	835.75	856.50	883.50	998.50	1163.00	1325.25	1430.75
Mar-18	1	2068.00	2080.50	2102.25	2181.25	2208.50	2205.00	2345.50
Apr-18	1	293.50	298.75	306.75	337.00	368.50	403.25	431.50
May-18	1	79.50	81.25	84.00	94.00	107.25	126.25	135.00
Jun-18	1	16.75	17.75	19.00	22.75	29.50	38.00	45.00
Jul-18	1	13.50	13.75	13.00	10.00	9.25	8.00	11.00
Aug-18	1	17.75	17.75	16.00	10.00	7.50	3.75	4.75
Sep-18	1	18.75	18.50	17.00	10.00	7.25	2.75	3.75
Oct-18	0	7.00	7.00	5.75	1.50	0.00	0.00	1.00
Nov-18	0	6.25	6.25	5.25	1.50	0.25	0.00	1.25
Dec-18	0	6.00	6.00	5.00	2.00	1.00	0.00	1.25
Jan-19	0	20.75	20.75	19.00	14.00	11.00	5.75	6.75
Feb-19	0	23.00	23.25	22.50	21.00	20.00	16.25	19.50
Mar-19	0	20.75	21.00	20.25	19.00	18.50	17.25	20.25
Apr-19	0	6.00	6.00	5.00	3.25	1.50	0.50	0.25
May-19	0	6.00	5.75	5.00	3.00	1.75	0.75	2.25
Jun-19	0	6.50	6.25	5.00	2.00	0.75	0.00	0.00
Jul-19	0	62.00	61.75	58.25	47.50	41.75	33.25	31.75
Aug-19	0	7.25	7.25	5.75	1.50	0.00	0.00	0.00
Sep-19	0	36.75	36.25	32.25	16.75	9.00	0.00	0.00
Oct-19	0	23.75	23.75	21.50	12.25	5.75	0.00	0.25
Nov-19	0	8.75	8.75	7.75	4.25	1.50	0.00	0.75
Dec-19	0	5.50	5.50	5.00	2.75	1.25	0.00	1.00
Jan-20	0	5.75	5.75	5.00	2.50	1.00	0.00	1.00
Feb-20	0	4.00	4.75	5.25	7.25	10.75	10.50	14.75
Mar-20	0	2.50	5.25	9.25	22.00	32.50	34.00	49.25
Apr-20	0	3.00	4.00	5.00	9.25	15.50	21.00	28.00
May-20	0	5.50	5.75	5.00	3.75	3.50	3.75	5.25
Jun-20	0	6.50	6.25	5.00	2.25	0.75	0.00	1.50
Jul-20	0	63.00	62.75	59.25	48.50	42.50	33.50	32.00
Aug-20	0	6.25	6.00	5.00	0.75	0.00	0.00	0.00
Sep-20	0	46.00	45.75	41.25	23.50	13.75	1.25	0.25
Oct-20	0	26.75	26.75	24.50	14.50	7.00	0.00	0.00
Nov-20	0	15.50	15.25	14.00	9.50	5.00	0.00	0.00
Dec-20	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-21	0	2.25	2.75	2.50	2.00	2.25	1.00	2.50
Feb-21	0	2.25	3.00	3.25	4.50	7.25	7.25	11.50
Mar-21	0	2.00	3.00	3.75	6.75	11.75	14.75	21.00
Apr-21	0	3.25	3.25	2.50	1.50	1.50	1.50	2.75
May-21	0	3.25	3.25	2.50	1.25	0.75	0.75	2.00
Jun-21	0	4.00	3.75	2.50	0.25	0.00	0.00	0.50
Jul-21	0	4.00	3.75	2.50	0.00	0.00	0.00	1.00
Aug-21	0	79.00	78.75	73.75	56.25	46.75	31.50	29.25
Sep-21	0	36.50	36.50	35.25	29.75	25.75	19.50	18.75
Oct-21	0	42.25	42.00	37.75	21.75	12.00	1.25	0.25
Nov-21	0	12.50	12.25	11.25	6.75	2.75	0.00	0.00
Dec-21	0	2.00	10.00	22.75	57.75	106.25	142.75	196.50
Jan-22	0	2.00	6.50	13.25	35.50	66.25	97.00	122.00
Feb-22	1	2.50	18.75	45.50	142.50	238.00	318.75	400.75
Mar-22	1	33.25	39.25	48.00	81.25	120.00	161.00	192.00
Apr-22	1	115.75	118.25	120.75	133.00	149.00	171.00	185.25
May-22	1	18.50	19.25	20.00	23.50	28.75	37.50	41.00
Jun-22	1	22.00	22.00	21.25	19.00	18.00	19.00	20.50
Jul-22	1	15.25	15.25	14.00	10.00	8.00	6.25	7.50
Aug-22	1	18.25	18.00	16.50	10.00	7.00	3.00	2.50
Sep-22	1	19.75	19.50	17.50	10.00	6.25	1.75	1.25
Oct-22	0	6.25	6.25	5.00	0.75	0.00	0.00	0.00
Nov-22	0	6.75	6.50	5.00	0.75	0.00	0.00	0.00
Dec-22	0	2.75	5.00	7.50	13.00	23.00	25.50	41.50
Jan-23	0	20.75	21.25	20.00	17.00	17.25	15.75	19.25
Feb-23	0	23.00	23.50	23.00	22.50	23.50	24.25	29.50
Mar-23	0	20.75	20.75	19.75	18.00	16.75	16.50	18.00
Apr-23	0	5.00	5.25	5.00	5.25	6.00	8.00	10.50

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
May-23	0	5.50	5.75	5.00	3.50	3.00	3.50	5.00
Jun-23	0	6.25	6.00	5.00	2.75	1.50	1.25	2.75
Jul-23	0	6.25	6.25	5.00	1.50	0.50	0.00	1.25
Aug-23	0	69.75	69.50	65.75	51.75	44.50	33.00	31.50
Sep-23	0	51.00	51.00	49.75	44.25	40.50	34.50	33.75
Oct-23	0	49.25	49.25	47.75	41.75	38.00	32.00	31.25
Nov-23	0	11.50	11.25	9.50	3.75	1.00	0.00	0.00
Dec-23	0	6.25	6.25	5.00	1.50	0.25	0.00	1.00
Jan-24	0	6.25	6.25	5.00	2.00	0.50	0.00	1.25
Feb-24	0	6.50	6.50	5.25	2.50	1.00	0.00	1.25
Mar-24	0	4.50	5.00	5.00	5.00	6.75	7.00	11.25
Apr-24	0	6.25	6.25	5.00	3.00	1.75	0.75	2.25
May-24	0	6.25	6.00	5.00	2.50	1.00	0.00	1.25
Jun-24	0	6.50	6.50	5.00	1.75	0.50	0.00	1.25
Jul-24	0	6.50	6.50	5.00	1.00	0.00	0.00	0.00
Aug-24	0	31.00	30.75	26.25	11.75	5.50	0.00	0.00
Sep-24	0	35.50	35.25	32.00	18.25	10.25	0.25	0.00
Oct-24	0	23.00	23.00	21.00	12.00	5.50	0.00	0.00
Nov-24	0	10.00	10.00	9.00	5.00	2.00	0.00	0.00
Dec-24	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-25	0	3.50	3.50	2.50	0.25	0.00	0.00	0.00
Feb-25	0	4.00	4.00	2.75	0.50	0.00	0.00	0.00
Mar-25	0	3.25	3.25	2.50	1.00	0.75	0.00	0.25
Apr-25	0	2.00	3.00	3.25	4.75	8.50	8.75	12.50
May-25	0	3.50	3.50	2.50	0.50	0.00	0.00	0.75
Jun-25	0	4.00	3.75	2.50	0.25	0.00	0.00	0.75
Jul-25	0	20.25	20.00	16.25	5.75	1.50	0.00	0.00
Aug-25	0	45.75	45.50	41.50	25.25	15.75	2.00	0.25
Sep-25	0	9.50	9.25	8.25	3.00	0.25	0.00	0.00
Oct-25	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Nov-25	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-25	0	3.75	3.50	2.50	0.00	0.00	0.00	0.25
Jan-26	0	3.75	3.50	2.50	0.00	0.00	0.00	0.25
Feb-26	0	2.25	4.75	8.00	15.25	28.25	30.00	44.75
Mar-26	0	2.00	2.75	3.00	3.50	6.00	5.00	11.00
Apr-26	0	2.25	15.50	36.50	104.50	162.50	185.25	263.50
May-26	1	19.25	20.00	20.00	21.25	25.00	29.00	35.75
Jun-26	1	25.00	25.00	23.50	19.00	16.50	14.25	15.75
Jul-26	1	16.75	16.75	15.25	10.00	7.25	4.00	5.25
Aug-26	1	19.75	19.50	17.50	10.00	5.75	1.00	0.50
Sep-26	1	32.50	32.25	28.75	14.50	7.00	0.00	0.00
Oct-26	0	72.75	72.75	70.25	59.00	49.75	34.75	32.00
Nov-26	0	2.00	3.75	6.25	11.50	18.75	21.25	32.00
Dec-26	0	2.00	2.75	3.50	5.25	8.25	9.50	15.50
Jan-27	0	2.00	2.75	3.25	5.75	9.50	13.00	17.75
Feb-27	0	3.25	28.00	68.50	226.50	385.00	527.25	637.25
Mar-27	1	148.00	151.25	154.75	172.50	183.00	190.00	213.25
Apr-27	1	68.00	70.00	72.50	82.50	94.75	112.50	123.25
May-27	1	19.25	19.75	20.00	21.25	23.25	28.00	31.50
Jun-27	1	22.75	22.75	21.75	19.00	17.25	17.25	18.50
Jul-27	1	15.50	15.50	14.25	10.00	8.00	5.75	7.00
Aug-27	1	18.75	18.50	16.75	10.00	6.75	2.50	2.00
Sep-27	1	20.25	20.25	18.00	10.00	6.00	1.00	0.50
Oct-27	0	6.25	6.25	5.00	0.75	0.00	0.00	0.00
Nov-27	0	6.50	6.50	5.00	1.00	0.00	0.00	0.75
Dec-27	0	6.25	6.25	5.00	1.25	0.25	0.00	1.00
Jan-28	0	20.75	20.75	18.75	13.00	9.50	3.75	4.50
Feb-28	0	22.00	24.00	25.75	32.00	36.50	32.75	44.75
Mar-28	0	20.75	21.75	22.25	24.25	27.25	28.00	35.00
Apr-28	0	5.50	5.50	5.00	4.25	3.75	3.50	5.25
May-28	0	5.75	5.75	5.00	3.25	2.00	1.25	2.75
Jun-28	0	6.25	6.00	5.00	2.50	1.00	0.00	1.50
Jul-28	0	62.00	62.00	58.75	48.25	42.25	34.00	32.50
Aug-28	0	49.50	49.50	48.25	43.00	39.25	34.00	33.25
Sep-28	0	51.00	50.75	49.25	42.50	38.50	32.00	31.00
Oct-28	0	49.25	49.00	47.50	40.75	36.50	30.00	29.25
Nov-28	0	6.75	6.75	5.00	0.50	0.00	0.00	0.00

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Dec-28	0	6.50	6.50	5.00	1.00	0.00	0.00	1.00
Jan-29	0	6.25	6.25	5.00	1.50	0.25	0.00	1.25
Feb-29	0	5.75	6.25	5.50	3.75	4.50	3.25	4.75
Mar-29	0	4.50	5.00	5.00	5.00	7.25	8.00	11.00
Apr-29	0	5.00	5.50	5.00	4.50	5.75	6.25	9.50
May-29	0	6.00	6.00	5.00	2.50	1.50	0.75	2.25
Jun-29	0	59.75	59.50	56.25	47.25	41.75	34.75	33.75
Jul-29	0	45.75	45.50	44.50	40.00	36.75	32.50	32.00
Aug-29	0	24.50	24.25	20.75	8.75	3.00	0.00	0.00
Sep-29	0	40.75	40.50	37.00	22.25	12.75	1.00	0.00
Oct-29	0	26.50	26.25	24.25	14.75	7.25	0.00	0.00
Nov-29	0	8.50	8.50	7.50	4.00	1.00	0.00	0.00
Dec-29	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-30	0	3.50	3.50	2.50	0.25	0.00	0.00	0.00
Feb-30	0	4.00	4.00	2.75	0.50	0.00	0.00	0.25
Mar-30	0	2.00	3.50	5.25	11.25	20.50	25.25	31.25
Apr-30	0	3.50	3.50	2.50	1.25	0.75	0.00	1.25
May-30	0	3.50	3.50	2.50	0.50	0.00	0.00	1.00
Jun-30	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jul-30	0	22.00	21.75	17.75	6.75	2.00	0.00	0.00
Aug-30	0	30.50	30.25	26.75	13.25	5.75	0.00	0.00
Sep-30	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Oct-30	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-30	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Dec-30	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jan-31	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Feb-31	0	4.00	4.00	2.75	0.00	0.00	0.00	1.00
Mar-31	0	3.75	3.75	2.50	0.00	0.00	0.00	0.25
Apr-31	0	4.00	3.75	2.50	0.00	0.00	0.00	0.50
May-31	0	25.00	24.75	21.00	9.00	3.25	0.00	0.00
Jun-31	0	4.50	4.50	3.50	0.25	0.00	0.00	0.00
Jul-31	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Aug-31	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Sep-31	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Oct-31	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Nov-31	0	4.50	4.50	2.50	0.00	0.00	0.00	0.00
Dec-31	0	2.00	7.00	13.75	25.75	50.75	61.25	87.75
Jan-32	0	2.00	4.00	6.25	9.50	19.50	18.50	25.50
Feb-32	0	2.25	16.50	38.50	122.50	175.25	181.00	289.00
Mar-32	1	41.00	44.25	48.00	62.75	86.25	110.75	126.75
Apr-32	1	31.75	32.75	33.00	35.00	38.25	42.00	49.00
May-32	1	21.50	21.75	21.25	20.00	19.75	21.00	24.25
Jun-32	1	24.50	24.50	23.25	19.00	15.75	13.00	14.25
Jul-32	1	17.25	17.00	15.50	10.00	6.75	3.25	3.50
Aug-32	1	19.50	19.50	17.50	10.00	5.75	1.00	0.50
Sep-32	1	32.50	32.25	28.75	14.75	7.00	0.00	0.00
Oct-32	0	11.25	11.00	9.75	4.50	1.25	0.00	0.00
Nov-32	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Dec-32	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Jan-33	0	2.00	4.75	8.25	17.75	33.50	42.25	53.00
Feb-33	0	4.00	5.00	5.50	7.00	11.00	12.25	19.00
Mar-33	0	5.75	5.75	5.00	3.50	3.25	3.00	4.50
Apr-33	0	3.25	3.25	2.50	1.50	1.25	1.25	2.75
May-33	0	3.50	3.50	2.50	0.75	0.00	0.00	1.25
Jun-33	0	59.75	59.50	56.00	46.75	41.25	34.50	33.50
Jul-33	0	48.75	48.75	47.50	42.75	39.75	35.50	35.00
Aug-33	0	48.75	48.75	47.00	40.75	36.75	30.50	29.75
Sep-33	0	34.75	34.50	30.00	13.50	5.50	0.00	0.00
Oct-33	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Nov-33	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-33	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Jan-34	0	2.00	4.75	8.25	16.75	31.75	38.00	50.25
Feb-34	0	2.25	3.50	4.50	7.50	11.75	12.00	19.75
Mar-34	0	2.25	2.75	2.50	2.25	3.75	4.00	7.00
Apr-34	0	3.75	3.75	2.50	0.50	0.00	0.00	1.50
May-34	0	3.75	3.75	2.50	0.25	0.00	0.00	0.50
Jun-34	0	64.50	64.25	60.50	49.50	43.00	34.75	33.50

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1) in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
	Indicator	Cachuma	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River	Santa Ynez River
	that 3A2	Total Discharges	Below	at 154	above Alisal	near	above Salsipuedes	at Lompoc
MONTH	in effect	Downstream	Hilton Creek	Bridge	Bridge	Buellton	Creek Confluence	Narrows
	(1=yes)	cfs	cfs	cfs	cfs	cfs	cfs	cfs
Jul-34	0	47.00	47.00	45.75	40.75	37.25	32.50	31.75
Aug-34	0	39.25	39.00	34.75	18.75	9.75	0.50	0.00
Sep-34	0	41.50	41.50	38.50	24.00	13.50	1.25	0.25
Oct-34	0	3.25	3.00	2.50	0.00	0.00	0.00	0.00
Nov-34	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Dec-34	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jan-35	0	2.00	5.00	9.00	20.00	37.25	47.00	59.50
Feb-35	0	2.25	3.50	4.50	7.75	13.25	16.75	23.50
Mar-35	0	2.00	5.25	9.75	25.50	41.75	52.75	69.25
Apr-35	0	2.00	7.50	15.75	44.50	74.75	99.75	127.50
May-35	1	20.00	20.50	20.00	21.00	23.75	28.25	31.75
Jun-35	1	25.00	25.00	23.25	19.00	16.25	14.75	16.00
Jul-35	1	17.25	17.25	15.50	10.00	6.75	3.50	3.75
Aug-35	1	66.75	66.75	63.50	51.50	44.25	33.50	32.00
Sep-35	1	44.50	44.50	43.25	38.25	34.50	29.00	28.50
Oct-35	0	19.75	19.50	16.50	6.50	1.50	0.00	0.00
Nov-35	0	14.75	14.75	13.25	7.50	3.50	0.00	0.00
Dec-35	0	3.50	3.25	2.50	0.25	0.00	0.00	0.00
Jan-36	0	3.50	3.50	2.50	0.25	0.00	0.00	0.75
Feb-36	0	2.00	11.00	24.75	71.75	121.00	152.75	192.50
Mar-36	0	2.00	3.50	5.25	12.00	21.50	31.50	40.00
Apr-36	0	2.00	3.50	4.75	10.50	15.25	18.50	25.75
May-36	0	3.25	3.25	2.50	1.50	1.25	1.50	3.25
Jun-36	0	3.75	3.75	2.50	0.25	0.00	0.00	0.50
Jul-36	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Aug-36	0	40.75	40.25	35.00	17.25	9.00	0.25	0.00
Sep-36	0	6.75	6.75	5.50	0.75	0.00	0.00	0.00
Oct-36	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-36	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Dec-36	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jan-37	0	2.00	3.25	4.50	6.25	12.00	11.50	16.00
Feb-37	0	2.50	22.00	52.75	160.75	304.75	441.25	534.75
Mar-37	1	82.50	97.25	120.00	205.50	303.00	396.75	471.50
Apr-37	1	280.75	284.50	289.00	307.25	331.00	362.25	384.00
May-37	1	18.25	19.00	20.00	23.50	28.00	36.00	39.50
Jun-37	1	20.50	20.75	20.25	19.00	19.00	21.25	22.75
Jul-37	1	15.00	15.00	14.00	10.00	8.25	6.50	7.75
Aug-37	1	18.50	18.25	16.75	10.00	6.75	2.75	2.25
Sep-37	1	20.00	19.75	17.75	10.00	6.25	1.50	1.00
Oct-37	0	7.50	7.50	6.00	1.50	0.00	0.00	0.00
Nov-37	0	14.75	14.75	12.75	6.25	3.00	0.00	0.00
Dec-37	0	6.00	6.00	5.00	2.00	0.75	0.00	1.00
Jan-38	0	20.75	20.75	19.00	14.00	11.00	6.00	6.50
Feb-38	0	553.50	570.50	595.25	691.25	823.50	959.25	1044.25
Mar-38	1	3013.50	3047.50	3106.25	3345.25	3501.00	3601.25	3827.25
Apr-38	1	263.75	267.50	273.50	295.75	323.50	358.75	380.50
May-38	1	36.50	36.50	36.25	35.50	34.50	36.00	37.75
Jun-38	1	18.75	19.00	19.00	19.50	21.75	26.50	28.00
Jul-38	1	12.75	13.00	12.25	10.00	10.25	10.75	12.25
Aug-38	1	17.50	17.50	16.00	10.00	7.50	4.00	5.00
Sep-38	1	18.75	18.50	16.75	10.00	7.00	2.75	3.75
Oct-38	0	7.00	6.75	5.50	1.50	0.00	0.00	0.00
Nov-38	0	7.25	7.25	5.75	1.50	0.00	0.00	0.00
Dec-38	0	5.50	5.75	5.00	2.75	2.50	0.75	3.25
Jan-39	0	20.75	21.25	20.50	19.00	21.00	20.25	24.00
Feb-39	0	23.00	24.00	24.25	26.00	31.00	34.75	41.75
Mar-39	0	20.75	22.50	24.00	30.75	41.00	52.25	61.75
Apr-39	0	4.00	4.50	5.00	7.00	10.00	14.00	19.00
May-39	0	5.50	5.50	5.00	3.75	3.25	3.50	5.25
Jun-39	0	6.25	6.25	5.00	2.50	1.25	0.25	1.75
Jul-39	0	58.00	58.00	54.75	45.00	39.75	33.00	32.00
Aug-39	0	49.50	49.50	48.00	43.00	39.75	34.75	34.00
Sep-39	0	51.00	51.00	49.25	42.75	39.00	32.75	31.75
Oct-39	0	6.75	6.50	5.00	0.25	0.00	0.00	0.00
Nov-39	0	7.00	6.75	5.00	0.25	0.00	0.00	0.00
Dec-39	0	6.75	6.50	5.00	0.75	0.00	0.00	0.00
Jan-40	0	5.50	5.75	5.00	2.75	3.00	1.25	3.50

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Feb-40	0	2.75	4.25	5.25	8.75	16.25	20.50	27.25
Mar-40	0	3.25	4.25	5.00	7.00	12.00	15.75	22.25
Apr-40	0	5.00	5.50	5.00	5.00	6.50	8.25	11.75
May-40	0	6.00	6.00	5.00	2.50	1.75	1.25	2.75
Jun-40	0	6.75	6.50	5.00	1.50	0.25	0.00	0.50
Jul-40	0	64.25	64.00	60.50	48.50	42.25	33.25	31.75
Aug-40	0	49.25	49.00	47.75	42.25	38.50	33.00	32.25
Sep-40	0	33.75	33.25	29.25	14.25	6.75	0.00	0.00
Oct-40	0	25.00	24.75	22.50	12.00	5.25	0.00	0.00
Nov-40	0	3.25	3.25	2.50	0.25	0.00	0.00	0.00
Dec-40	0	2.25	4.25	6.75	13.00	22.50	25.50	37.25
Jan-41	0	2.50	9.50	20.50	55.00	103.50	147.25	189.25
Feb-41	0	966.50	1013.25	1088.50	1335.75	1526.00	1593.75	1940.75
Mar-41	1	3096.75	3152.25	3248.25	3617.00	3936.00	4199.75	4506.75
Apr-41	1	1997.75	2025.25	2070.75	2249.25	2384.00	2476.00	2638.25
May-41	1	294.25	298.50	306.00	327.50	355.25	387.25	414.75
Jun-41	1	48.25	49.75	51.25	55.25	62.00	69.50	81.50
Jul-41	1	8.00	9.00	10.00	12.00	16.75	21.25	29.25
Aug-41	1	11.25	11.75	11.75	10.00	11.75	12.00	18.25
Sep-41	1	14.50	14.75	14.00	10.00	9.75	8.00	12.50
Oct-41	0	5.00	5.25	5.00	3.00	3.50	2.50	7.25
Nov-41	0	5.00	5.50	5.00	3.25	4.00	3.25	8.00
Dec-41	0	2.75	8.50	17.25	36.00	63.25	78.25	133.50
Jan-42	0	3.75	6.75	10.75	20.00	34.25	45.25	72.50
Feb-42	0	5.75	7.25	8.75	13.00	19.00	24.25	40.75
Mar-42	0	6.50	9.50	13.25	23.25	37.00	48.25	78.00
Apr-42	0	104.50	106.50	107.75	114.50	124.50	137.00	155.75
May-42	0	7.00	8.00	9.00	12.25	16.75	22.75	31.25
Jun-42	0	6.00	6.50	6.25	6.00	7.00	8.25	13.25
Jul-42	0	5.50	5.75	5.00	2.50	1.75	0.75	3.75
Aug-42	0	6.00	6.00	5.00	1.50	0.50	0.00	2.75
Sep-42	0	18.25	18.00	14.75	4.00	0.50	0.00	1.00
Oct-42	0	6.00	6.00	5.00	0.75	0.00	0.00	1.00
Nov-42	0	6.00	6.00	5.00	1.50	0.25	0.00	2.75
Dec-42	0	5.75	5.75	5.00	2.00	0.50	0.00	2.75
Jan-43	0	733.75	748.00	766.75	855.00	933.75	982.75	1029.75
Feb-43	1	514.25	521.00	532.75	572.00	617.50	671.50	706.75
Mar-43	1	1065.75	1081.50	1107.00	1211.75	1301.25	1383.00	1447.25
Apr-43	1	170.50	173.25	177.50	191.75	208.50	230.75	247.00
May-43	1	18.25	19.00	20.00	23.25	27.50	34.00	40.75
Jun-43	1	19.75	20.00	19.75	19.00	20.00	22.50	26.00
Jul-43	1	13.75	13.75	13.00	10.00	9.00	8.25	11.25
Aug-43	1	17.75	17.50	16.00	10.00	7.50	4.00	5.25
Sep-43	1	18.75	18.75	16.75	10.00	7.00	2.75	3.75
Oct-43	0	6.50	6.25	5.25	1.50	0.25	0.00	1.25
Nov-43	0	6.50	6.50	5.25	1.50	0.25	0.00	1.25
Dec-43	0	5.00	5.25	5.00	3.25	3.50	1.50	5.75
Jan-44	0	4.00	4.75	5.00	5.25	7.75	8.25	14.50
Feb-44	0	288.00	302.00	321.75	397.00	463.75	501.75	574.00
Mar-44	1	578.25	585.50	597.00	637.00	676.75	717.00	758.25
Apr-44	1	77.50	79.25	81.75	90.25	100.50	115.00	125.75
May-44	1	17.75	18.75	20.00	24.25	30.25	38.75	45.75
Jun-44	1	20.00	20.25	20.00	19.00	19.75	22.00	25.25
Jul-44	1	15.25	15.25	14.00	10.00	8.00	6.25	7.50
Aug-44	1	18.00	17.75	16.25	10.00	7.25	3.50	4.50
Sep-44	1	19.50	19.25	17.50	10.00	6.25	1.50	1.00
Oct-44	0	7.25	7.25	6.00	1.50	0.00	0.00	0.25
Nov-44	0	5.00	5.50	5.00	3.50	4.50	2.75	5.50
Dec-44	0	5.50	5.75	5.00	2.75	2.25	0.75	3.50
Jan-45	0	5.25	5.50	5.00	3.25	3.25	2.00	5.00
Feb-45	0	3.50	8.50	15.50	43.75	81.00	120.00	135.50
Mar-45	0	67.75	70.00	71.50	82.00	90.50	97.50	107.25
Apr-45	1	43.00	44.00	44.75	50.50	58.50	71.00	75.00
May-45	1	20.00	20.25	20.00	20.25	21.25	25.00	26.50
Jun-45	1	24.75	24.50	23.00	19.00	16.25	15.00	14.75
Jul-45	1	16.75	16.50	15.00	10.00	7.25	4.50	4.00
Aug-45	1	19.25	19.25	17.25	10.00	6.50	2.00	1.50

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Sep-45	1	20.75	20.50	18.50	10.00	5.75	0.75	0.25
Oct-45	0	21.25	21.00	18.00	7.50	2.50	0.00	0.00
Nov-45	0	12.25	12.00	10.75	5.75	2.50	0.00	0.00
Dec-45	0	2.75	4.00	5.00	8.50	15.50	18.75	20.25
Jan-46	0	5.50	5.75	5.00	3.50	3.25	2.00	3.25
Feb-46	0	5.50	6.00	5.50	5.25	6.50	7.50	9.00
Mar-46	0	3.25	4.50	5.50	10.00	11.00	8.25	21.00
Apr-46	0	5.50	7.00	8.00	14.50	24.50	36.50	41.75
May-46	1	23.50	23.75	22.25	20.00	19.50	20.50	21.75
Jun-46	1	25.50	25.50	23.75	19.00	16.00	13.50	15.00
Jul-46	1	56.50	56.25	53.75	45.00	39.75	33.25	32.50
Aug-46	1	49.50	49.50	48.25	43.25	40.00	35.25	34.75
Sep-46	1	51.00	51.00	49.50	43.00	39.25	33.25	32.25
Oct-46	0	49.50	49.25	47.75	41.25	37.25	31.25	30.25
Nov-46	0	5.25	5.75	5.00	3.00	4.00	3.00	5.50
Dec-46	0	5.00	5.50	5.00	3.25	4.25	3.75	6.75
Jan-47	0	6.00	6.00	5.00	2.25	1.50	0.50	2.00
Feb-47	0	6.00	6.25	5.50	3.50	3.75	3.25	6.50
Mar-47	0	5.75	5.75	5.00	3.25	2.75	2.75	4.50
Apr-47	0	6.25	6.25	5.00	2.75	1.75	1.25	2.75
May-47	0	56.00	55.75	53.00	46.00	41.25	37.25	36.75
Jun-47	0	51.00	51.00	50.00	46.25	43.75	41.50	41.00
Jul-47	0	49.25	49.25	47.75	42.75	40.00	36.25	35.50
Aug-47	0	49.25	49.00	47.25	40.75	37.00	31.50	30.50
Sep-47	0	50.75	50.75	48.75	41.00	36.75	30.00	28.75
Oct-47	0	47.50	47.25	45.25	38.00	33.75	27.00	26.00
Nov-47	0	24.50	24.00	19.75	7.00	1.75	0.00	0.00
Dec-47	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Jan-48	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Feb-48	0	4.00	3.75	2.50	0.25	0.00	0.00	0.00
Mar-48	0	3.75	3.75	2.50	0.25	0.00	0.00	0.00
Apr-48	0	4.00	4.00	2.50	0.25	0.00	0.00	0.00
May-48	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jun-48	0	13.25	13.00	10.50	4.25	1.50	0.00	0.00
Jul-48	0	20.50	20.25	16.50	5.25	1.00	0.00	0.00
Aug-48	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Sep-48	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Oct-48	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Nov-48	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Dec-48	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Jan-49	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Feb-49	0	4.50	4.50	2.75	0.00	0.00	0.00	0.00
Mar-49	0	30.00	31.75	31.75	24.00	25.75	13.50	31.25
Apr-49	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
May-49	0	29.75	29.50	26.25	13.25	6.75	0.00	0.00
Jun-49	0	5.00	5.00	4.00	0.50	0.00	0.00	0.00
Jul-49	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Aug-49	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Sep-49	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Oct-49	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Nov-49	0	4.50	4.50	2.50	0.00	0.00	0.00	0.00
Dec-49	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Jan-50	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Feb-50	0	33.25	34.25	33.00	19.75	17.00	3.50	10.00
Mar-50	0	3.25	3.25	2.50	0.00	0.00	0.00	0.00
Apr-50	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
May-50	0	52.00	51.50	47.25	28.00	17.00	0.75	0.00
Jun-50	0	3.25	3.25	2.50	0.00	0.00	0.00	0.00
Jul-50	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Aug-50	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Sep-50	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Oct-50	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Nov-50	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Dec-50	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Jan-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Feb-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Mar-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Apr-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
May-51	0	14.25	13.75	8.00	0.00	0.00	0.00	0.00
Jun-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Jul-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Aug-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Sep-51	0	3.75	3.50	0.50	0.00	0.00	0.00	0.00
Oct-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Nov-51	0	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Dec-51	0	0.50	0.50	0.00	0.00	0.00	0.00	0.00
Jan-52	0	2.00	25.50	58.00	181.75	307.50	429.25	535.50
Feb-52	1	35.75	37.25	33.75	25.50	31.75	17.50	22.00
Mar-52	1	3.00	25.25	60.25	155.00	307.00	443.25	584.75
Apr-52	1	111.50	114.25	115.75	117.25	137.00	149.25	154.00
May-52	1	18.00	19.00	20.00	21.50	27.25	32.00	32.75
Jun-52	1	23.50	23.75	23.00	19.00	16.50	12.50	12.25
Jul-52	1	15.25	15.25	14.50	10.00	8.25	5.00	5.00
Aug-52	1	17.25	17.50	16.00	10.00	7.75	3.75	4.00
Sep-52	1	28.00	28.00	25.00	11.75	5.25	0.00	0.00
Oct-52	0	15.25	15.25	14.25	8.50	5.25	0.50	1.00
Nov-52	0	5.00	5.25	5.00	2.75	1.75	0.00	3.50
Dec-52	0	2.75	5.75	10.25	17.50	29.00	29.75	60.00
Jan-53	0	30.75	33.25	35.50	42.50	54.75	62.75	80.00
Feb-53	0	4.25	5.00	5.50	7.25	10.25	13.75	17.25
Mar-53	0	4.75	5.25	5.00	5.25	6.00	7.75	9.50
Apr-53	0	5.25	5.50	5.00	4.75	4.00	3.50	6.00
May-53	0	6.00	6.00	5.00	2.75	1.00	0.25	0.75
Jun-53	0	6.50	6.25	5.00	2.00	0.50	0.00	0.50
Jul-53	0	63.50	63.25	60.00	49.00	42.75	34.50	33.00
Aug-53	0	49.50	49.50	48.25	43.00	39.00	33.50	32.50
Sep-53	0	40.50	40.25	38.75	32.50	28.50	22.00	21.00
Oct-53	0	35.50	35.25	31.00	15.50	6.75	0.00	0.00
Nov-53	0	6.00	6.00	5.00	1.50	0.00	0.00	0.00
Dec-53	0	6.00	6.00	5.00	1.50	0.00	0.00	0.00
Jan-54	0	10.25	11.00	11.00	12.00	13.00	9.50	10.50
Feb-54	0	23.00	23.75	23.50	22.50	23.25	20.25	24.75
Mar-54	0	2.75	5.50	9.50	19.50	33.25	41.50	64.00
Apr-54	0	3.75	4.50	5.00	8.00	12.75	17.75	21.00
May-54	0	6.00	6.00	5.00	2.50	0.75	0.00	0.00
Jun-54	0	6.25	6.25	5.00	2.25	1.00	0.00	1.25
Jul-54	0	67.50	67.25	63.75	51.75	44.50	34.25	32.50
Aug-54	0	45.25	45.25	44.00	38.50	34.50	28.50	27.75
Sep-54	0	51.00	50.75	46.25	27.75	16.25	2.75	1.50
Oct-54	0	30.75	30.75	28.50	18.25	9.25	0.25	0.00
Nov-54	0	13.50	13.50	12.50	8.00	3.75	0.00	0.00
Dec-54	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-55	0	2.00	2.50	2.75	2.75	1.75	0.00	4.50
Feb-55	0	3.00	3.25	2.75	1.75	1.25	0.00	2.75
Mar-55	0	3.25	3.25	2.50	1.25	0.75	0.00	1.00
Apr-55	0	3.50	3.50	2.50	1.00	0.25	0.00	1.50
May-55	0	3.00	3.25	2.50	1.50	1.75	1.00	2.00
Jun-55	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jul-55	0	34.25	34.00	29.25	15.50	8.00	0.00	0.00
Aug-55	0	50.75	50.50	47.00	31.00	19.75	3.75	1.50
Sep-55	0	8.75	8.75	7.75	3.00	0.00	0.00	0.00
Oct-55	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Nov-55	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-55	0	2.00	12.50	28.50	58.00	101.50	109.75	209.00
Jan-56	0	2.00	15.50	37.25	87.00	136.25	145.00	261.50
Feb-56	0	2.00	4.25	7.00	14.00	23.25	30.00	49.25
Mar-56	0	2.00	3.00	3.75	6.50	10.00	13.50	21.75
Apr-56	0	2.00	3.50	5.25	10.75	16.00	19.25	31.75
May-56	0	2.00	2.75	3.00	5.25	8.75	13.75	18.50
Jun-56	0	3.50	3.50	2.50	1.00	0.25	0.00	1.50
Jul-56	0	3.50	3.50	2.50	0.50	0.25	0.00	1.25
Aug-56	0	31.00	30.75	26.00	11.25	4.75	0.00	0.00
Sep-56	0	18.75	18.75	16.00	5.50	0.50	0.00	0.00
Oct-56	0	3.75	3.75	2.75	0.00	0.00	0.00	0.00

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Nov-56	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Dec-56	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Jan-57	0	3.25	3.25	2.50	0.25	0.00	0.00	0.75
Feb-57	0	2.25	3.00	3.00	2.50	3.25	0.25	6.25
Mar-57	0	2.00	2.50	2.50	2.25	3.50	1.75	4.25
Apr-57	0	3.00	3.25	2.50	1.50	1.50	0.25	1.50
May-57	0	3.25	3.25	2.50	1.00	0.75	0.00	1.25
Jun-57	0	70.75	70.50	66.50	54.50	47.00	35.25	33.25
Jul-57	0	12.75	12.75	11.25	5.75	2.50	0.00	0.00
Aug-57	0	48.25	47.75	44.00	27.25	16.75	2.75	1.50
Sep-57	0	13.50	13.50	12.25	6.25	1.75	0.00	0.00
Oct-57	0	4.25	4.25	3.25	0.00	0.00	0.00	0.00
Nov-57	0	5.25	5.00	3.75	0.25	0.00	0.00	0.00
Dec-57	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jan-58	0	2.00	2.75	3.00	3.25	4.25	1.00	5.00
Feb-58	0	2.25	15.00	35.00	87.25	161.00	209.25	304.50
Mar-58	1	3.00	20.00	48.00	136.25	255.25	369.00	482.25
Apr-58	1	534.25	561.75	605.25	776.50	972.00	1171.75	1313.75
May-58	1	145.00	148.75	154.75	176.00	200.00	231.25	245.75
Jun-58	1	16.25	17.50	19.00	23.50	30.25	39.50	46.50
Jul-58	1	12.25	12.50	12.25	10.00	8.75	6.50	9.50
Aug-58	1	17.00	17.00	15.50	10.00	7.25	3.25	4.50
Sep-58	1	18.75	18.75	17.00	10.00	6.50	2.25	3.25
Oct-58	0	7.00	6.75	5.75	1.50	0.00	0.00	1.00
Nov-58	0	7.25	7.00	5.75	1.50	0.00	0.00	1.00
Dec-58	0	6.25	6.25	5.00	1.50	0.00	0.00	1.00
Jan-59	0	5.00	5.25	5.00	3.50	3.75	1.75	4.50
Feb-59	0	34.00	37.50	41.50	53.50	73.50	86.75	111.25
Mar-59	0	3.75	4.50	5.00	6.75	9.50	12.00	16.75
Apr-59	0	5.00	5.50	5.00	4.75	4.00	2.75	6.00
May-59	0	5.75	5.75	5.00	3.25	1.75	0.75	2.25
Jun-59	0	6.25	6.25	5.00	2.50	1.25	0.50	2.00
Jul-59	0	62.75	62.50	59.25	48.50	42.50	33.75	32.50
Aug-59	0	49.50	49.50	48.25	42.75	39.25	33.75	33.00
Sep-59	0	36.00	35.75	31.75	16.75	8.50	0.00	0.00
Oct-59	0	28.00	27.75	25.50	15.00	7.25	0.00	0.00
Nov-59	0	16.00	15.75	14.75	9.75	5.25	0.25	0.00
Dec-59	0	6.00	5.75	5.00	2.25	0.25	0.00	0.00
Jan-60	0	5.75	5.75	5.00	2.75	1.00	0.00	0.75
Feb-60	0	32.50	33.25	32.50	30.75	29.25	22.00	30.25
Mar-60	0	5.75	5.75	5.00	3.25	1.50	0.00	1.25
Apr-60	0	5.00	5.50	5.00	4.50	3.75	1.75	7.00
May-60	0	6.00	6.00	5.00	2.50	1.00	0.00	1.25
Jun-60	0	6.50	6.25	5.00	2.00	0.50	0.00	0.00
Jul-60	0	6.50	6.50	5.00	0.75	0.00	0.00	0.00
Aug-60	0	45.00	44.50	39.50	21.50	12.25	0.50	0.00
Sep-60	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Oct-60	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-60	0	3.50	3.50	2.50	0.00	0.00	0.00	0.75
Dec-60	0	3.50	3.50	2.50	0.00	0.00	0.00	1.50
Jan-61	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Feb-61	0	4.25	4.00	2.75	0.00	0.00	0.00	0.00
Mar-61	0	3.75	3.75	2.50	0.00	0.00	0.00	0.25
Apr-61	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
May-61	0	28.75	28.50	24.50	11.75	4.50	0.00	0.00
Jun-61	0	5.50	5.25	4.25	0.50	0.00	0.00	0.00
Jul-61	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Aug-61	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Sep-61	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Oct-61	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Nov-61	0	5.25	5.00	3.25	0.00	0.00	0.00	0.00
Dec-61	0	2.25	2.75	2.50	0.25	0.00	0.00	2.00
Jan-62	0	2.00	2.75	2.75	0.75	0.00	0.00	7.25
Feb-62	0	2.50	50.00	127.50	348.50	618.25	842.50	1177.75
Mar-62	1	28.50	36.25	48.00	79.00	122.25	136.75	197.50
Apr-62	1	29.75	31.50	33.00	39.00	47.25	49.25	59.50
May-62	1	19.50	20.00	20.00	20.25	20.50	18.25	23.00

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Jun-62	1	24.25	24.25	23.00	19.00	15.50	10.50	12.00
Jul-62	1	16.50	16.50	15.00	10.00	7.00	2.75	4.00
Aug-62	1	19.25	19.00	17.25	10.00	5.75	0.75	0.25
Sep-62	1	29.00	28.75	25.50	12.50	5.25	0.00	0.00
Oct-62	0	6.00	6.00	5.00	1.00	0.00	0.00	0.00
Nov-62	0	6.50	6.25	5.00	1.00	0.00	0.00	0.00
Dec-62	0	6.25	6.00	5.00	1.25	0.00	0.00	0.50
Jan-63	0	5.75	6.00	5.00	2.00	0.25	0.00	1.00
Feb-63	0	2.75	5.75	9.50	15.00	23.00	16.50	48.00
Mar-63	0	2.75	5.00	7.75	12.50	19.25	16.25	42.50
Apr-63	0	2.75	4.00	5.00	6.75	9.50	7.50	22.25
May-63	0	5.00	5.25	5.00	4.00	4.00	2.25	8.25
Jun-63	0	6.00	6.25	5.00	2.50	1.50	0.00	3.00
Jul-63	0	6.50	6.50	5.00	1.00	0.00	0.00	1.25
Aug-63	0	38.75	38.50	33.75	17.50	8.75	0.00	0.00
Sep-63	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Oct-63	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Nov-63	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Dec-63	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Jan-64	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Feb-64	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Mar-64	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Apr-64	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
May-64	0	31.50	31.00	27.25	14.25	6.25	0.00	0.00
Jun-64	0	6.00	6.00	5.00	1.25	0.00	0.00	0.00
Jul-64	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Aug-64	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Sep-64	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Oct-64	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Nov-64	0	4.50	4.25	2.50	0.00	0.00	0.00	0.00
Dec-64	0	4.25	4.25	2.50	0.00	0.00	0.00	0.00
Jan-65	0	2.00	2.75	3.00	0.75	0.25	0.00	5.50
Feb-65	0	4.00	4.00	2.75	0.00	0.00	0.00	0.50
Mar-65	0	3.25	3.50	2.50	0.00	0.00	0.00	1.25
Apr-65	0	2.00	6.25	12.00	21.50	34.25	21.25	45.75
May-65	0	3.00	3.25	2.50	0.25	0.00	0.00	1.25
Jun-65	0	67.25	66.75	61.25	38.50	25.00	4.00	3.75
Jul-65	0	47.50	47.25	45.25	32.00	20.50	4.00	2.75
Aug-65	0	18.50	18.25	16.75	8.00	1.50	0.00	0.00
Sep-65	0	6.50	6.25	5.50	1.00	0.00	0.00	0.00
Oct-65	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Nov-65	0	2.00	6.25	12.25	18.50	27.75	15.25	59.50
Dec-65	0	2.00	6.00	11.75	20.75	34.00	31.50	70.25
Jan-66	1	2.25	7.00	14.00	31.50	56.00	71.00	108.75
Feb-66	1	21.50	24.00	26.50	32.00	40.75	44.75	69.50
Mar-66	1	47.00	48.00	48.00	49.25	51.75	54.50	63.00
Apr-66	1	36.00	36.25	35.00	33.00	29.25	26.50	29.25
May-66	1	22.50	22.75	22.00	20.00	18.00	17.00	20.00
Jun-66	1	24.00	24.00	22.75	19.00	16.00	14.00	15.25
Jul-66	1	16.75	16.75	15.25	10.00	6.75	3.25	3.50
Aug-66	1	67.75	67.50	64.75	52.50	44.75	33.75	32.00
Sep-66	1	50.50	50.25	49.25	44.00	40.00	34.00	33.25
Oct-66	0	48.75	48.75	47.25	41.50	37.25	31.00	30.25
Nov-66	0	50.50	50.25	48.75	43.00	38.75	32.50	31.75
Dec-66	0	2.25	5.00	8.50	21.25	40.25	58.00	65.50
Jan-67	1	2.50	12.25	27.00	71.75	135.50	195.25	259.00
Feb-67	1	17.75	21.50	26.50	50.75	74.00	98.50	106.75
Mar-67	1	270.00	272.00	272.75	285.25	292.50	303.25	310.00
Apr-67	1	893.00	896.00	899.50	918.25	925.00	935.75	951.00
May-67	1	326.75	330.75	336.75	363.75	385.00	409.50	417.00
Jun-67	1	18.25	18.75	19.00	20.00	20.25	20.75	24.00
Jul-67	1	15.25	15.00	14.00	10.00	7.50	5.25	4.75
Aug-67	1	59.50	59.25	56.75	47.25	43.50	37.25	36.00
Sep-67	1	45.25	45.00	44.00	39.50	37.00	33.00	32.25
Oct-67	0	7.00	7.00	5.75	1.50	0.00	0.00	0.00
Nov-67	0	7.50	7.25	5.75	1.50	0.00	0.00	0.25
Dec-67	0	6.00	6.00	5.00	2.00	1.00	0.00	1.25

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Jan-68	0	5.75	6.00	5.00	2.50	1.75	0.25	1.50
Feb-68	0	5.75	6.00	5.25	4.00	4.50	4.00	5.25
Mar-68	0	30.75	31.25	30.50	29.75	31.75	33.25	36.00
Apr-68	0	5.25	5.50	5.00	5.00	5.75	7.00	8.50
May-68	0	6.00	6.00	5.00	2.50	1.00	0.25	0.00
Jun-68	0	57.75	57.75	54.75	46.75	41.75	36.25	35.25
Jul-68	0	6.00	6.00	5.00	1.50	0.25	0.00	0.00
Aug-68	0	17.00	16.75	13.75	4.00	0.75	0.00	0.00
Sep-68	0	36.50	36.25	33.00	18.50	10.25	0.25	0.00
Oct-68	0	24.25	24.00	22.00	12.75	6.00	0.00	0.00
Nov-68	0	12.00	12.00	11.00	6.75	3.25	0.00	0.00
Dec-68	0	6.00	5.75	5.00	2.25	0.25	0.00	0.00
Jan-69	0	2045.75	2078.75	2128.25	2364.25	2649.00	2969.00	3101.25
Feb-69	1	3348.00	3392.25	3468.25	3818.50	4145.25	4492.50	4642.25
Mar-69	1	1257.00	1272.00	1296.50	1407.50	1543.75	1713.50	1758.75
Apr-69	1	296.00	301.25	309.75	338.50	359.75	375.00	406.00
May-69	1	89.25	91.50	94.50	106.50	119.50	135.25	145.50
Jun-69	1	16.50	17.75	19.00	23.50	29.50	36.25	43.00
Jul-69	1	13.00	13.25	12.50	10.00	8.50	6.75	9.25
Aug-69	1	16.50	16.50	15.00	10.00	7.75	4.50	5.75
Sep-69	1	18.25	18.00	16.50	10.00	7.50	3.50	4.50
Oct-69	0	6.50	6.50	5.25	1.50	0.25	0.00	1.25
Nov-69	0	6.00	6.00	5.00	2.00	1.75	0.25	1.50
Dec-69	0	5.50	5.75	5.00	2.50	1.75	0.25	3.00
Jan-70	0	4.50	5.00	5.00	5.00	7.25	8.50	11.25
Feb-70	0	4.75	5.25	5.50	6.75	10.50	14.50	17.75
Mar-70	0	32.50	35.50	39.00	55.00	73.50	91.00	103.25
Apr-70	0	5.50	5.75	5.25	4.75	4.00	3.75	5.25
May-70	0	6.00	6.00	5.00	3.00	1.50	0.75	0.75
Jun-70	0	6.50	6.25	5.00	2.25	0.75	0.00	0.00
Jul-70	0	58.50	58.25	55.00	44.75	39.50	33.00	31.50
Aug-70	0	49.50	49.50	48.00	43.00	39.75	35.00	34.25
Sep-70	0	18.50	18.25	15.00	4.50	0.75	0.00	0.00
Oct-70	0	25.00	24.75	22.00	11.00	4.75	0.00	0.00
Nov-70	0	14.50	14.50	13.50	9.75	7.00	2.00	1.00
Dec-70	0	2.75	4.00	5.50	10.75	14.50	12.00	16.75
Jan-71	0	4.50	5.00	5.00	5.25	7.00	7.25	10.00
Feb-71	0	5.50	6.00	5.50	4.50	4.50	3.75	7.25
Mar-71	0	5.50	5.50	5.00	4.00	3.25	2.25	3.75
Apr-71	0	6.00	6.00	5.00	3.50	2.25	1.25	2.75
May-71	0	6.25	6.00	5.00	2.50	1.00	0.00	0.00
Jun-71	0	57.75	57.50	54.50	46.25	41.00	35.75	34.50
Jul-71	0	49.50	49.50	48.25	43.75	41.00	37.50	37.00
Aug-71	0	49.50	49.50	47.75	41.75	38.25	32.75	32.00
Sep-71	0	32.75	32.25	28.00	12.75	5.75	0.00	0.00
Oct-71	0	24.75	24.50	22.00	11.50	5.00	0.00	0.00
Nov-71	0	13.75	13.75	12.50	7.50	3.75	0.00	0.00
Dec-71	0	2.50	4.00	5.75	11.50	19.25	22.75	24.75
Jan-72	0	5.25	5.50	5.00	4.00	4.00	3.50	4.25
Feb-72	0	5.75	6.00	5.25	4.00	3.50	3.00	4.25
Mar-72	0	6.00	6.00	5.00	2.75	1.25	0.25	0.00
Apr-72	0	6.25	6.25	5.00	2.75	1.25	0.50	0.25
May-72	0	55.75	55.50	52.75	46.50	42.00	37.75	36.50
Jun-72	0	50.75	50.75	49.75	46.50	44.25	42.00	41.50
Jul-72	0	6.25	6.25	5.00	1.25	0.00	0.00	0.00
Aug-72	0	22.25	22.00	18.75	7.00	2.00	0.00	0.00
Sep-72	0	39.75	39.50	36.00	21.00	12.00	0.75	0.00
Oct-72	0	26.00	26.00	23.75	14.25	7.00	0.00	0.00
Nov-72	0	2.50	2.75	2.50	1.50	0.75	0.00	1.75
Dec-72	0	3.25	3.25	2.50	0.50	0.00	0.00	0.00
Jan-73	0	2.00	10.75	24.75	60.50	99.25	111.25	177.75
Feb-73	0	2.50	24.00	59.00	180.25	334.75	485.00	607.00
Mar-73	1	240.00	246.25	254.50	283.50	310.50	330.50	375.50
Apr-73	1	126.00	128.50	132.00	144.50	159.50	180.00	194.25
May-73	1	18.00	19.00	20.00	24.00	26.50	30.00	35.00
Jun-73	1	20.75	21.00	20.50	19.00	17.50	16.50	19.50
Jul-73	1	15.75	15.75	14.50	10.00	7.50	5.00	6.00

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Aug-73	1	18.25	18.25	16.50	10.00	7.00	2.75	3.00
Sep-73	1	19.50	19.25	17.50	10.00	6.25	1.50	1.00
Oct-73	0	7.50	7.25	6.00	1.50	0.00	0.00	0.25
Nov-73	0	13.25	13.00	11.25	5.25	2.25	0.00	0.25
Dec-73	0	6.00	6.00	5.00	1.75	0.50	0.00	1.00
Jan-74	0	2.75	9.00	18.25	43.75	81.25	107.50	150.50
Feb-74	0	4.25	5.00	5.50	7.25	10.75	13.75	19.25
Mar-74	0	5.50	7.25	9.00	14.75	23.00	29.75	44.50
Apr-74	0	7.00	7.75	8.00	9.75	13.00	17.00	23.75
May-74	1	22.50	22.75	21.75	20.00	19.75	20.75	23.75
Jun-74	1	25.25	25.25	23.50	19.00	16.00	13.75	15.00
Jul-74	1	17.00	17.00	15.25	10.00	7.00	3.75	4.00
Aug-74	1	19.25	19.25	17.25	10.00	6.25	1.50	1.75
Sep-74	1	74.00	73.75	70.50	57.00	48.25	34.75	32.75
Oct-74	0	6.00	6.00	5.00	1.25	0.00	0.00	0.50
Nov-74	0	11.00	11.00	9.50	4.50	1.50	0.00	0.25
Dec-74	0	2.75	5.25	8.50	13.50	22.00	21.25	46.00
Jan-75	0	5.25	5.50	5.00	3.75	3.50	2.25	5.25
Feb-75	0	34.00	41.25	51.25	77.25	115.25	142.00	204.25
Mar-75	0	33.75	46.50	67.25	121.50	196.25	257.75	367.75
Apr-75	1	81.25	83.25	85.50	93.75	104.75	118.25	134.00
May-75	1	17.75	19.00	20.00	24.25	30.00	38.25	45.25
Jun-75	1	20.75	21.25	20.75	19.00	17.50	16.00	20.75
Jul-75	1	15.00	15.00	14.00	10.00	7.75	5.00	6.50
Aug-75	1	18.25	18.25	16.50	10.00	7.00	3.00	4.00
Sep-75	1	19.50	19.25	17.50	10.00	6.25	1.50	1.75
Oct-75	0	6.25	6.00	5.00	1.00	0.00	0.00	1.00
Nov-75	0	6.50	6.25	5.00	1.00	0.00	0.00	1.00
Dec-75	0	6.25	6.25	5.00	1.25	0.00	0.00	1.00
Jan-76	0	6.25	6.00	5.00	1.75	0.25	0.00	1.25
Feb-76	0	32.75	33.75	33.50	32.25	34.50	30.75	40.25
Mar-76	0	5.00	5.25	5.00	4.50	4.50	3.75	6.75
Apr-76	0	5.50	5.75	5.00	4.00	3.50	2.25	5.75
May-76	0	6.00	6.00	5.00	3.00	1.50	0.25	1.75
Jun-76	0	57.75	57.75	54.75	47.00	41.75	35.75	34.75
Jul-76	0	49.50	49.50	48.25	44.00	41.25	37.00	36.50
Aug-76	0	41.50	41.25	39.75	34.25	30.75	25.25	24.50
Sep-76	0	40.50	40.00	35.25	18.25	9.75	0.25	0.00
Oct-76	0	17.00	17.00	15.00	6.50	1.25	0.00	0.00
Nov-76	0	6.00	6.00	5.00	1.50	0.00	0.00	0.00
Dec-76	0	6.00	6.00	5.00	1.75	0.00	0.00	0.00
Jan-77	0	6.00	6.00	5.00	2.00	0.25	0.00	0.75
Feb-77	0	6.75	6.75	5.50	2.50	0.50	0.00	1.00
Mar-77	0	6.00	6.00	5.00	2.50	0.75	0.00	1.25
Apr-77	0	3.50	3.50	2.50	0.75	0.00	0.00	0.00
May-77	0	3.50	3.50	2.50	0.50	0.00	0.00	1.00
Jun-77	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Jul-77	0	44.75	44.50	39.25	23.50	15.00	1.25	0.00
Aug-77	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Sep-77	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Oct-77	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Nov-77	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Dec-77	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Jan-78	0	2.00	11.25	24.75	52.00	86.25	85.50	155.25
Feb-78	0	149.00	187.50	249.25	435.75	693.50	923.50	1197.00
Mar-78	1	2331.75	2368.25	2428.25	2661.50	2950.75	3269.00	3464.50
Apr-78	1	581.50	592.75	612.00	675.00	753.25	842.75	910.75
May-78	1	118.25	120.75	124.50	138.00	155.50	178.50	194.00
Jun-78	1	16.25	17.50	19.00	24.25	30.00	36.50	43.25
Jul-78	1	9.50	10.00	10.25	10.00	11.50	12.50	17.00
Aug-78	1	15.00	15.25	14.25	10.00	9.25	7.25	10.00
Sep-78	1	18.00	18.00	16.50	10.00	7.25	2.75	4.00
Oct-78	0	5.75	5.75	5.00	1.75	0.50	0.00	2.50
Nov-78	0	6.00	6.00	5.00	1.75	0.50	0.00	2.75
Dec-78	0	5.50	5.75	5.00	2.50	2.00	0.25	3.00
Jan-79	0	2.75	5.00	8.25	16.00	29.00	37.00	54.50
Feb-79	0	5.25	10.50	18.00	39.50	70.75	97.25	135.75

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Mar-79	0	339.25	344.50	350.25	371.00	401.75	431.25	474.75
Apr-79	1	181.50	185.00	190.75	210.75	234.75	266.00	282.50
May-79	1	17.75	18.75	20.00	24.50	30.25	38.25	45.25
Jun-79	1	19.25	19.75	19.50	19.00	18.75	18.50	23.25
Jul-79	1	15.00	15.00	14.00	10.00	7.75	4.75	6.25
Aug-79	1	18.50	18.25	16.75	10.00	6.75	2.25	2.50
Sep-79	1	19.75	19.50	17.75	10.00	6.00	1.00	1.00
Oct-79	0	14.00	14.00	12.25	6.00	2.75	0.00	0.25
Nov-79	0	11.00	11.00	9.50	4.50	1.50	0.00	0.25
Dec-79	0	5.75	5.75	5.00	2.25	0.50	0.00	1.25
Jan-80	0	2.75	4.50	6.75	13.00	23.25	28.25	38.50
Feb-80	0	1150.00	1175.50	1213.00	1357.50	1548.75	1738.00	1888.75
Mar-80	1	652.75	664.50	684.75	753.00	837.00	933.75	1001.75
Apr-80	1	115.25	117.50	120.25	131.00	144.00	162.50	175.25
May-80	1	16.75	18.25	20.00	27.25	34.00	42.50	49.25
Jun-80	1	18.00	18.75	19.00	20.25	21.25	22.25	27.00
Jul-80	1	14.00	14.00	13.25	10.00	8.25	5.75	8.25
Aug-80	1	18.50	18.25	16.50	10.00	7.00	3.00	3.25
Sep-80	1	19.50	19.50	17.50	10.00	6.50	1.50	1.75
Oct-80	0	7.25	7.00	5.75	1.50	0.00	0.00	0.25
Nov-80	0	7.25	7.25	5.75	1.50	0.00	0.00	0.25
Dec-80	0	6.25	6.25	5.00	1.50	0.00	0.00	1.00
Jan-81	0	4.75	5.25	5.00	3.75	4.50	2.25	6.50
Feb-81	0	4.50	5.25	5.50	6.50	9.75	10.75	15.50
Mar-81	0	30.75	39.25	51.50	89.00	143.25	190.25	249.75
Apr-81	0	2.75	4.00	5.50	10.50	17.50	25.50	34.00
May-81	0	4.75	5.25	5.00	4.75	5.75	7.50	10.75
Jun-81	0	5.75	6.00	5.00	3.25	2.75	2.50	4.00
Jul-81	0	7.00	6.75	5.25	1.50	0.25	0.00	0.50
Aug-81	0	20.00	19.75	16.25	5.25	1.25	0.00	0.25
Sep-81	0	38.50	38.25	34.75	20.00	11.50	0.25	0.00
Oct-81	0	25.25	25.00	23.00	13.75	6.75	0.00	0.00
Nov-81	0	12.75	12.50	11.50	7.25	3.75	0.00	0.00
Dec-81	0	5.75	5.75	5.00	2.25	0.50	0.00	0.75
Jan-82	0	5.50	5.50	5.00	3.25	2.00	0.00	2.25
Feb-82	0	6.25	6.25	5.50	3.75	2.75	0.50	1.75
Mar-82	0	30.75	31.75	31.75	34.75	39.25	41.25	43.75
Apr-82	0	2.75	5.75	10.00	27.00	49.00	72.50	83.25
May-82	0	4.75	5.00	5.00	5.50	6.50	8.00	9.50
Jun-82	0	6.25	6.25	5.00	2.25	0.75	0.00	0.50
Jul-82	0	59.75	59.50	56.25	46.50	41.25	34.00	32.75
Aug-82	0	49.50	49.50	48.25	43.25	40.00	34.75	34.25
Sep-82	0	51.00	51.00	49.50	43.00	39.00	32.75	32.00
Oct-82	0	6.75	6.50	5.00	0.25	0.00	0.00	0.00
Nov-82	0	6.25	6.25	5.00	1.50	1.00	0.00	1.00
Dec-82	0	2.50	6.00	10.25	27.25	48.75	65.25	70.50
Jan-83	0	204.75	222.50	249.00	324.00	434.50	527.00	667.00
Feb-83	1	1008.50	1032.75	1072.75	1195.50	1354.75	1512.50	1686.00
Mar-83	1	3169.00	3194.00	3236.00	3430.50	3549.00	3638.50	3800.25
Apr-83	1	933.75	948.25	972.50	1060.50	1126.00	1169.50	1257.25
May-83	1	469.50	477.75	491.00	544.00	591.50	635.50	666.75
Jun-83	1	83.00	85.75	89.75	103.00	122.25	145.50	160.00
Jul-83	1	7.75	9.00	10.00	12.50	17.50	22.50	30.50
Aug-83	1	10.00	10.50	10.75	10.00	12.75	14.50	19.25
Sep-83	1	14.75	15.00	14.00	10.00	9.75	8.25	11.25
Oct-83	0	4.00	4.75	5.00	4.75	7.75	9.25	13.75
Nov-83	0	5.50	5.75	5.00	3.00	2.75	1.50	6.25
Dec-83	0	210.25	213.00	213.75	215.00	226.25	233.25	255.75
Jan-84	0	77.00	78.50	80.25	86.25	92.75	102.25	110.75
Feb-84	0	28.25	29.25	30.25	34.75	39.50	47.75	53.25
Mar-84	0	7.00	7.50	8.25	11.50	15.25	21.75	25.25
Apr-84	1	33.25	33.75	33.00	33.50	32.75	34.00	37.50
May-84	1	22.50	22.75	21.75	20.00	17.75	17.25	18.75
Jun-84	1	24.25	24.25	22.75	19.00	16.00	14.50	15.00
Jul-84	1	16.25	16.25	14.75	10.00	7.25	4.50	4.00
Aug-84	1	19.00	19.00	17.00	10.00	6.75	2.25	1.75
Sep-84	1	20.50	20.25	18.00	10.00	6.00	0.75	0.25

1) Rounded to nearest 0.25 cfs

Table A-2

Simulated Monthly Average Flows[1] in Santa Ynez River under Alternative 5C

Based on SYRHM , WY 1918-1993

MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
Oct-84	0	17.25	17.00	14.25	5.00	1.00	0.00	0.00
Nov-84	0	11.50	11.25	10.00	5.00	2.00	0.00	0.25
Dec-84	0	4.50	5.00	5.00	3.75	4.00	1.25	6.25
Jan-85	0	5.75	5.75	5.00	2.75	1.75	0.25	1.50
Feb-85	0	5.75	6.00	5.50	4.25	4.25	2.75	6.00
Mar-85	0	5.25	5.50	5.00	4.00	3.75	3.00	6.00
Apr-85	0	6.00	6.00	5.00	3.25	2.50	1.75	3.00
May-85	0	6.25	6.25	5.00	2.50	1.00	0.00	0.00
Jun-85	0	57.75	57.50	54.25	46.00	41.00	35.25	34.00
Jul-85	0	49.25	49.25	48.00	43.50	41.00	37.00	36.50
Aug-85	0	11.25	11.25	9.25	3.25	0.75	0.00	0.00
Sep-85	0	38.00	37.75	33.25	16.75	9.00	0.00	0.00
Oct-85	0	18.25	18.25	16.00	7.25	2.25	0.00	0.00
Nov-85	0	6.00	6.00	5.00	1.75	0.00	0.00	0.00
Dec-85	0	3.25	3.25	2.50	0.50	0.00	0.00	0.50
Jan-86	0	2.50	2.75	2.50	1.50	1.50	0.00	1.75
Feb-86	0	2.50	13.75	31.50	78.50	143.25	185.75	271.50
Mar-86	1	23.50	33.00	48.00	84.50	135.75	172.25	262.25
Apr-86	1	31.75	32.75	33.00	36.00	40.00	46.00	53.00
May-86	1	19.50	20.00	20.00	20.75	20.75	20.50	25.25
Jun-86	1	23.25	23.25	22.25	19.00	17.25	17.00	18.50
Jul-86	1	16.50	16.50	15.00	10.00	7.25	4.25	4.00
Aug-86	1	19.25	19.00	17.00	10.00	6.50	2.00	1.50
Sep-86	1	20.50	20.50	18.25	10.00	5.75	0.75	0.25
Oct-86	0	18.00	18.00	15.00	5.50	1.25	0.00	0.00
Nov-86	0	6.25	6.00	5.00	1.50	0.00	0.00	0.25
Dec-86	0	6.00	6.00	5.00	1.75	0.25	0.00	1.00
Jan-87	0	5.75	5.75	5.00	2.75	1.25	0.00	2.50
Feb-87	0	6.75	6.75	5.50	2.50	0.75	0.00	1.25
Mar-87	0	30.75	31.75	31.50	30.75	31.25	26.25	38.00
Apr-87	0	6.00	6.00	5.00	3.25	1.75	0.50	1.75
May-87	0	6.00	6.00	5.00	2.75	1.00	0.00	0.50
Jun-87	0	6.25	6.25	5.00	2.00	0.50	0.00	0.00
Jul-87	0	6.50	6.50	5.00	1.00	0.00	0.00	0.00
Aug-87	0	33.00	32.75	28.25	13.75	7.00	0.00	0.00
Sep-87	0	30.75	30.50	27.50	15.00	7.50	0.00	0.00
Oct-87	0	6.00	5.75	5.00	1.25	0.00	0.00	0.00
Nov-87	0	6.25	6.25	5.00	1.00	0.00	0.00	0.00
Dec-87	0	6.25	6.00	5.00	1.50	0.00	0.00	0.25
Jan-88	0	5.25	5.50	5.00	3.00	2.25	0.00	1.75
Feb-88	0	6.25	6.25	5.25	2.75	1.25	0.00	1.00
Mar-88	0	30.50	31.25	31.00	32.75	38.25	38.75	38.50
Apr-88	0	5.00	5.25	5.00	5.00	5.75	5.25	7.00
May-88	0	5.75	5.75	5.00	3.00	1.75	0.00	1.50
Jun-88	0	58.50	58.25	55.50	47.50	42.25	34.50	33.25
Jul-88	0	3.50	3.25	2.50	0.00	0.00	0.00	0.00
Aug-88	0	32.50	32.25	28.25	14.00	7.00	0.00	0.00
Sep-88	0	39.50	39.25	36.00	22.00	12.75	0.75	0.00
Oct-88	0	5.00	5.00	4.25	1.00	0.00	0.00	0.00
Nov-88	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Dec-88	0	3.50	3.50	2.50	0.00	0.00	0.00	0.00
Jan-89	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Feb-89	0	3.75	3.75	2.75	0.75	0.25	0.00	0.00
Mar-89	0	3.50	3.50	2.50	0.25	0.00	0.00	0.00
Apr-89	0	3.75	3.75	2.50	0.25	0.00	0.00	0.00
May-89	0	3.75	3.75	2.50	0.25	0.00	0.00	0.00
Jun-89	0	15.00	14.75	12.25	6.25	3.00	0.00	0.00
Jul-89	0	36.50	36.00	31.75	17.75	10.25	0.50	0.00
Aug-89	0	11.50	11.25	9.75	4.00	0.75	0.00	0.00
Sep-89	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Oct-89	0	4.00	3.75	2.50	0.00	0.00	0.00	0.00
Nov-89	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Dec-89	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Jan-90	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Feb-90	0	4.50	4.50	2.75	0.00	0.00	0.00	0.00
Mar-90	0	4.00	4.00	2.50	0.00	0.00	0.00	0.00
Apr-90	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00

1) Rounded to nearest 0.25 cfs

Table A-2								
Simulated Monthly Average Flows[1)] in Santa Ynez River under Alternative 5C								
Based on SYRHM , WY 1918-1993								
MONTH	Indicator that 3A2 in effect (1=yes)	Cachuma Total Discharges Downstream cfs	Santa Ynez River Below Hilton Creek cfs	Santa Ynez River at 154 Bridge cfs	Santa Ynez River above Alisal Bridge cfs	Santa Ynez River near Buellton cfs	Santa Ynez River above Salsipuedes Creek Confluence cfs	Santa Ynez River at Lompoc Narrows cfs
May-90	0	22.50	22.25	18.00	5.00	0.50	0.00	0.00
Jun-90	0	3.75	3.50	2.50	0.00	0.00	0.00	0.00
Jul-90	0	8.00	7.75	6.00	0.25	0.00	0.00	0.00
Aug-90	0	5.25	5.00	3.50	0.00	0.00	0.00	0.00
Sep-90	0	5.25	5.00	3.25	0.00	0.00	0.00	0.00
Oct-90	0	7.25	7.00	5.00	0.00	0.00	0.00	0.00
Nov-90	0	5.50	5.25	3.50	0.00	0.00	0.00	0.00
Dec-90	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Jan-91	0	4.25	4.00	2.50	0.00	0.00	0.00	0.00
Feb-91	0	4.50	4.50	2.75	0.00	0.00	0.00	0.00
Mar-91	0	2.00	11.50	25.75	57.25	110.25	146.25	208.25
Apr-91	1	31.75	33.25	33.25	33.00	41.50	40.50	38.25
May-91	1	25.50	26.00	24.75	20.00	19.00	14.75	11.75
Jun-91	1	33.25	33.00	30.25	19.00	11.75	3.00	0.00
Jul-91	1	26.00	25.75	23.50	13.25	6.50	0.00	0.00
Aug-91	1	39.75	39.50	36.75	22.75	13.00	1.25	0.00
Sep-91	1	18.50	18.50	17.00	10.00	4.75	0.00	0.00
Oct-91	0	5.50	5.25	4.25	0.50	0.00	0.00	0.00
Nov-91	0	3.75	3.75	2.50	0.00	0.00	0.00	0.00
Dec-91	0	3.25	3.50	2.50	0.25	0.00	0.00	0.00
Jan-92	0	2.00	2.50	2.50	2.00	3.25	1.25	0.25
Feb-92	0	2.25	18.00	42.75	127.25	244.00	352.00	430.50
Mar-92	1	38.00	42.50	48.00	69.75	100.25	133.50	152.25
Apr-92	1	29.00	31.00	33.00	43.75	57.25	75.50	78.75
May-92	1	19.25	19.75	20.00	22.00	25.00	30.25	33.25
Jun-92	1	21.75	22.00	21.25	19.00	18.50	19.50	20.75
Jul-92	1	15.75	15.75	14.50	10.00	7.25	4.25	5.50
Aug-92	1	65.75	65.50	62.75	51.00	44.00	34.00	32.50
Sep-92	1	51.00	51.00	49.75	44.50	40.75	35.25	34.50
Oct-92	0	16.50	16.25	14.50	7.50	3.50	0.00	0.00
Nov-92	0	50.75	50.75	49.25	44.00	40.25	34.50	33.25
Dec-92	0	6.00	6.00	5.00	2.00	0.50	0.00	2.50
Jan-93	0	328.25	340.25	356.25	419.25	511.75	605.50	661.50
Feb-93	1	2026.25	2050.50	2091.75	2237.50	2418.25	2619.50	2755.50
Mar-93	1	1050.00	1063.50	1086.25	1178.75	1285.50	1412.50	1465.50
Apr-93	1	476.00	482.25	491.75	532.50	583.75	651.00	670.75
May-93	1	100.75	103.25	106.75	121.00	135.00	151.25	160.00
Jun-93	1	16.25	17.50	19.00	25.00	31.00	37.00	42.00
Jul-93	1	10.25	10.75	10.50	10.00	10.50	9.75	12.75
Aug-93	1	15.75	15.75	14.75	10.00	9.00	7.00	8.00
Sep-93	1	19.00	18.75	17.00	10.00	7.00	2.50	2.00

1) Rounded to nearest 0.25 cfs

Appendix B

Table B-1
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5B
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-17	173,182	744.95	0.00		Oct-22	168,979	743.44	0.00
Nov-17	171,008	744.17	0.00		Nov-22	167,657	742.96	0.00
Dec-17	169,056	743.47	0.00		Dec-22	173,220	744.96	0.00
Jan-18	167,446	742.89	0.00		Jan-23	174,527	745.42	0.00
Feb-18	193,585	751.80	1.80		Feb-23	175,061	745.60	0.00
Mar-18	193,585	751.80	1.80		Mar-23	172,939	744.86	0.00
Apr-18	193,585	751.80	1.80		Apr-23	171,065	744.19	0.00
May-18	193,585	751.80	1.80		May-23	167,658	742.96	0.00
Jun-18	192,606	751.48	1.48		Jun-23	163,681	741.50	0.00
Jul-18	187,091	749.69	0.00		Jul-23	158,580	739.60	0.00
Aug-18	181,534	747.83	0.00		Aug-23	149,389	736.06	0.00
Sep-18	177,486	746.45	0.00		Sep-23	143,001	733.50	0.00
Oct-18	173,699	745.13	0.00		Oct-23	137,733	731.33	0.00
Nov-18	172,967	744.87	0.00		Nov-23	135,661	730.46	0.00
Dec-18	171,991	744.52	0.00		Dec-23	134,492	729.97	0.00
Jan-19	171,014	744.17	0.00		Jan-24	133,175	729.41	0.00
Feb-19	170,656	744.05	0.00		Feb-24	131,848	728.85	0.00
Mar-19	168,677	743.33	0.00		Mar-24	132,595	729.17	0.00
Apr-19	165,169	742.05	0.00		Apr-24	130,164	728.12	0.00
May-19	161,485	740.69	0.00		May-24	126,415	726.49	0.00
Jun-19	156,887	738.96	0.00		Jun-24	121,971	724.51	0.00
Jul-19	147,642	735.37	0.00		Jul-24	116,754	722.13	0.00
Aug-19	142,829	733.43	0.00		Aug-24	109,935	718.91	0.00
Sep-19	136,823	730.95	0.00		Sep-24	104,465	716.23	0.00
Oct-19	132,982	729.33	0.00		Oct-24	100,759	714.36	0.00
Nov-19	130,937	728.46	0.00		Nov-24	98,885	713.40	0.00
Dec-19	130,614	728.32	0.00		Dec-24	97,949	712.91	0.00
Jan-20	129,099	727.66	0.00		Jan-25	96,696	712.26	0.00
Feb-20	130,456	728.25	0.00		Feb-25	95,570	711.67	0.00
Mar-20	139,478	732.05	0.00		Mar-25	95,015	711.37	0.00
Apr-20	141,408	732.85	0.00		Apr-25	95,107	711.42	0.00
May-20	138,600	731.69	0.00		May-25	92,392	709.97	0.00
Jun-20	134,606	730.02	0.00		Jun-25	88,677	707.94	0.00
Jul-20	125,570	726.12	0.00		Jul-25	82,694	704.55	0.00
Aug-20	121,058	724.10	0.00		Aug-25	75,751	700.45	0.00
Sep-20	114,637	721.14	0.00		Sep-25	72,193	698.24	0.00
Oct-20	110,625	719.24	0.00		Oct-25	70,094	696.90	0.00
Nov-20	108,351	718.14	0.00		Nov-25	68,588	695.93	0.00
Dec-20	107,160	717.56	0.00		Dec-25	67,395	695.15	0.00
Jan-21	107,999	717.97	0.00		Jan-26	66,432	694.52	0.00
Feb-21	108,587	718.26	0.00		Feb-26	69,159	696.30	0.00
Mar-21	110,545	719.20	0.00		Mar-26	69,786	696.70	0.00
Apr-21	108,647	718.29	0.00		Apr-26	130,882	728.43	0.00
May-21	106,090	717.04	0.00		May-26	131,842	728.84	0.00
Jun-21	102,733	715.36	0.00		Jun-26	127,518	726.98	0.00
Jul-21	97,989	712.94	0.00		Jul-26	121,406	724.25	0.00
Aug-21	88,683	707.94	0.00		Aug-26	115,192	721.40	0.00
Sep-21	83,439	704.98	0.00		Sep-26	109,371	718.64	0.00
Oct-21	78,700	702.22	0.00		Oct-26	102,503	715.25	0.00
Nov-21	76,459	700.88	0.00		Nov-26	104,742	716.37	0.00
Dec-21	96,400	712.10	0.00		Dec-26	105,378	716.68	0.00
Jan-22	112,914	720.33	0.00		Jan-27	106,940	717.45	0.00
Feb-22	171,814	744.46	0.00		Feb-27	188,056	750.01	0.01
Mar-22	193,585	751.80	1.80		Mar-27	193,585	751.80	1.80
Apr-22	193,585	751.80	1.80		Apr-27	193,585	751.80	1.80
May-22	193,585	751.80	1.80		May-27	191,010	750.97	0.97
Jun-22	189,334	750.42	0.42		Jun-27	186,296	749.43	0.00
Jul-22	183,123	748.37	0.00		Jul-27	180,022	747.32	0.00
Aug-22	177,454	746.44	0.00		Aug-27	174,321	745.35	0.00
Sep-22	172,686	744.77	0.00		Sep-27	169,529	743.64	0.00

Table B-1 Simulated End-of-Month Storage, Elevation, and Surcharge in Cachuma Reservoir Under Alterantive 5B Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-27	166,554	742.56	0.00		Oct-32	113,705	720.70	0.00
Nov-27	164,806	741.92	0.00		Nov-32	112,061	719.93	0.00
Dec-27	164,067	741.65	0.00		Dec-32	110,520	719.19	0.00
Jan-28	162,603	741.11	0.00		Jan-33	118,619	722.99	0.00
Feb-28	169,335	743.57	0.00		Feb-33	120,616	723.90	0.00
Mar-28	170,775	744.09	0.00		Mar-33	119,578	723.42	0.00
Apr-28	167,555	742.93	0.00		Apr-33	117,274	722.37	0.00
May-28	163,851	741.57	0.00		May-33	113,582	720.65	0.00
Jun-28	159,735	740.04	0.00		Jun-33	105,922	716.95	0.00
Jul-28	150,706	736.58	0.00		Jul-33	98,099	712.99	0.00
Aug-28	142,957	733.48	0.00		Aug-33	90,989	709.21	0.00
Sep-28	136,417	730.78	0.00		Sep-33	85,546	706.18	0.00
Oct-28	131,036	728.50	0.00		Oct-33	83,188	704.84	0.00
Nov-28	129,928	728.02	0.00		Nov-33	81,397	703.80	0.00
Dec-28	129,298	727.75	0.00		Dec-33	80,853	703.49	0.00
Jan-29	128,274	727.30	0.00		Jan-34	93,084	710.34	0.00
Feb-29	128,567	727.43	0.00		Feb-34	97,139	712.49	0.00
Mar-29	128,767	727.52	0.00		Mar-34	96,810	712.32	0.00
Apr-29	127,602	727.01	0.00		Apr-34	94,096	710.88	0.00
May-29	124,240	725.53	0.00		May-34	90,478	708.93	0.00
Jun-29	116,279	721.91	0.00		Jun-34	82,757	704.59	0.00
Jul-29	108,621	718.27	0.00		Jul-34	75,986	700.59	0.00
Aug-29	102,626	715.31	0.00		Aug-34	69,287	696.38	0.00
Sep-29	96,853	712.34	0.00		Sep-34	63,667	692.67	0.00
Oct-29	92,834	710.21	0.00		Oct-34	61,725	691.34	0.00
Nov-29	90,761	709.08	0.00		Nov-34	60,340	690.37	0.00
Dec-29	89,365	708.32	0.00		Dec-34	59,341	689.67	0.00
Jan-30	88,739	707.97	0.00		Jan-35	71,800	697.99	0.00
Feb-30	87,307	707.17	0.00		Feb-35	74,070	699.41	0.00
Mar-30	90,922	709.17	0.00		Mar-35	82,401	704.38	0.00
Apr-30	88,793	708.00	0.00		Apr-35	97,601	712.73	0.00
May-30	85,729	706.29	0.00		May-35	96,907	712.37	0.00
Jun-30	81,940	704.12	0.00		Jun-35	92,696	710.13	0.00
Jul-30	76,096	700.66	0.00		Jul-35	86,857	706.92	0.00
Aug-30	70,248	697.00	0.00		Aug-35	77,456	701.48	0.00
Sep-30	67,279	695.08	0.00		Sep-35	71,740	697.95	0.00
Oct-30	64,918	693.51	0.00		Oct-35	68,299	695.74	0.00
Nov-30	63,515	692.57	0.00		Nov-35	66,023	694.25	0.00
Dec-30	62,307	691.74	0.00		Dec-35	64,916	693.51	0.00
Jan-31	61,696	691.32	0.00		Jan-36	63,499	692.56	0.00
Feb-31	60,872	690.75	0.00		Feb-36	86,832	706.91	0.00
Mar-31	59,147	689.53	0.00		Mar-36	90,607	709.00	0.00
Apr-31	57,118	688.07	0.00		Apr-36	92,394	709.97	0.00
May-31	53,461	685.35	0.00		May-36	89,439	708.36	0.00
Jun-31	50,456	683.05	0.00		Jun-36	85,626	706.23	0.00
Jul-31	47,230	680.47	0.00		Jul-36	80,963	703.55	0.00
Aug-31	44,028	677.82	0.00		Aug-36	74,098	699.43	0.00
Sep-31	41,523	675.66	0.00		Sep-36	70,610	697.23	0.00
Oct-31	39,648	674.00	0.00		Oct-36	68,522	695.89	0.00
Nov-31	38,782	673.21	0.00		Nov-36	66,999	694.89	0.00
Dec-31	46,267	679.69	0.00		Dec-36	70,175	696.95	0.00
Jan-32	52,027	684.26	0.00		Jan-37	75,864	700.51	0.00
Feb-32	139,788	732.18	0.00		Feb-37	143,641	733.76	0.00
Mar-32	148,479	735.70	0.00		Mar-37	193,585	751.80	1.80
Apr-32	145,587	734.55	0.00		Apr-37	193,585	751.80	1.80
May-32	140,802	732.60	0.00		May-37	193,585	751.80	1.80
Jun-32	135,760	730.50	0.00		Jun-37	190,129	750.68	0.68
Jul-32	129,418	727.80	0.00		Jul-37	184,024	748.67	0.00
Aug-32	122,959	724.96	0.00		Aug-37	178,289	746.72	0.00
Sep-32	116,898	722.19	0.00		Sep-37	173,448	745.04	0.00

Table B-1
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5B
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-37	169,647	743.68	0.00		Oct-42	170,911	744.14	0.00
Nov-37	166,766	742.64	0.00		Nov-42	168,932	743.42	0.00
Dec-37	166,526	742.55	0.00		Dec-42	167,433	742.88	0.00
Jan-38	165,391	742.13	0.00		Jan-43	193,585	751.80	1.80
Feb-38	193,585	751.80	1.80		Feb-43	193,585	751.80	1.80
Mar-38	193,585	751.80	1.80		Mar-43	193,585	751.80	1.80
Apr-38	193,585	751.80	1.80		Apr-43	193,585	751.80	1.80
May-38	193,585	751.80	1.80		May-43	193,293	751.71	1.71
Jun-38	191,181	751.03	1.03		Jun-43	189,250	750.40	0.40
Jul-38	185,932	749.31	0.00		Jul-43	183,357	748.45	0.00
Aug-38	180,345	747.43	0.00		Aug-43	177,857	746.58	0.00
Sep-38	175,790	745.86	0.00		Sep-43	173,296	744.99	0.00
Oct-38	172,089	744.56	0.00		Oct-43	169,810	743.74	0.00
Nov-38	170,156	743.87	0.00		Nov-43	167,923	743.06	0.00
Dec-38	170,311	743.92	0.00		Dec-43	167,752	743.00	0.00
Jan-39	172,931	744.86	0.00		Jan-44	167,675	742.97	0.00
Feb-39	175,206	745.66	0.00		Feb-44	193,585	751.80	1.80
Mar-39	182,335	748.10	0.00		Mar-44	193,585	751.80	1.80
Apr-39	180,360	747.43	0.00		Apr-44	193,585	751.80	1.80
May-39	176,929	746.26	0.00		May-44	192,542	751.46	1.46
Jun-39	172,457	744.69	0.00		Jun-44	188,492	750.15	0.15
Jul-39	163,411	741.40	0.00		Jul-44	182,435	748.14	0.00
Aug-39	155,566	738.46	0.00		Aug-44	176,797	746.21	0.00
Sep-39	149,072	735.94	0.00		Sep-44	172,080	744.55	0.00
Oct-39	146,486	734.91	0.00		Oct-44	168,336	743.21	0.00
Nov-39	144,452	734.09	0.00		Nov-44	168,358	743.22	0.00
Dec-39	143,021	733.51	0.00		Dec-44	167,392	742.87	0.00
Jan-40	143,705	733.79	0.00		Jan-45	166,432	742.51	0.00
Feb-40	148,912	735.87	0.00		Feb-45	187,247	749.74	0.00
Mar-40	151,229	736.78	0.00		Mar-45	193,585	751.80	1.80
Apr-40	150,491	736.49	0.00		Apr-45	193,585	751.80	1.80
May-40	146,937	735.09	0.00		May-45	190,688	750.86	0.86
Jun-40	142,979	733.49	0.00		Jun-45	185,589	749.19	0.00
Jul-40	133,838	729.69	0.00		Jul-45	179,075	747.00	0.00
Aug-40	126,311	726.44	0.00		Aug-45	173,135	744.93	0.00
Sep-40	120,844	724.00	0.00		Sep-45	167,326	742.84	0.00
Oct-40	117,003	722.24	0.00		Oct-45	163,653	741.49	0.00
Nov-40	115,477	721.53	0.00		Nov-45	161,364	740.64	0.00
Dec-40	119,845	723.55	0.00		Dec-45	169,184	743.52	0.00
Jan-41	147,446	735.29	0.00		Jan-46	168,926	743.42	0.00
Feb-41	193,585	751.80	1.80		Feb-46	169,980	743.80	0.00
Mar-41	193,585	751.80	1.80		Mar-46	186,714	749.56	0.00
Apr-41	193,585	751.80	1.80		Apr-46	193,520	751.78	1.78
May-41	193,585	751.80	1.80		May-46	190,291	750.74	0.74
Jun-41	193,585	751.80	1.80		Jun-46	184,618	748.87	0.00
Jul-41	191,089	751.00	1.00		Jul-46	174,606	745.44	0.00
Aug-41	187,026	749.67	0.00		Aug-46	166,667	742.60	0.00
Sep-41	183,472	748.49	0.00		Sep-46	159,997	740.13	0.00
Oct-41	180,787	747.58	0.00		Oct-46	154,497	738.05	0.00
Nov-41	179,626	747.18	0.00		Nov-46	156,051	738.64	0.00
Dec-41	185,562	749.18	0.00		Dec-46	161,273	740.61	0.00
Jan-42	189,931	750.62	0.62		Jan-47	162,370	741.02	0.00
Feb-42	191,420	751.10	1.10		Feb-47	161,991	740.88	0.00
Mar-42	193,585	751.80	1.80		Mar-47	161,383	740.65	0.00
Apr-42	193,585	751.80	1.80		Apr-47	158,548	739.59	0.00
May-42	192,343	751.40	1.40		May-47	151,189	736.77	0.00
Jun-42	188,737	750.23	0.23		Jun-47	144,451	734.09	0.00
Jul-42	183,424	748.47	0.00		Jul-47	136,398	730.77	0.00
Aug-42	178,407	746.77	0.00		Aug-47	128,681	727.48	0.00
Sep-42	173,377	745.01	0.00		Sep-47	122,174	724.60	0.00

Table B-1 Simulated End-of-Month Storage, Elevation, and Surcharge in Cachuma Reservoir Under Alterantive 5B Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-47	116,893	722.19	0.00		Oct-52	170,247	743.90	0.00
Nov-47	113,830	720.76	0.00		Nov-52	169,773	743.73	0.00
Dec-47	112,830	720.29	0.00		Dec-52	172,000	744.52	0.00
Jan-48	111,621	719.72	0.00		Jan-53	177,527	746.46	0.00
Feb-48	110,768	719.31	0.00		Feb-53	176,429	746.08	0.00
Mar-48	109,657	718.77	0.00		Mar-53	175,267	745.68	0.00
Apr-48	107,540	717.75	0.00		Apr-53	172,954	744.86	0.00
May-48	104,199	716.10	0.00		May-53	169,203	743.52	0.00
Jun-48	99,227	713.57	0.00		Jun-53	164,890	741.95	0.00
Jul-48	93,266	710.44	0.00		Jul-53	155,691	738.51	0.00
Aug-48	88,858	708.04	0.00		Aug-53	147,917	735.48	0.00
Sep-48	85,324	706.06	0.00		Sep-53	141,974	733.08	0.00
Oct-48	82,723	704.57	0.00		Oct-53	137,229	731.12	0.00
Nov-48	80,909	703.52	0.00		Nov-53	136,112	730.65	0.00
Dec-48	80,141	703.07	0.00		Dec-53	134,520	729.98	0.00
Jan-49	79,141	702.48	0.00		Jan-54	136,792	730.94	0.00
Feb-49	78,033	701.82	0.00		Feb-54	139,032	731.87	0.00
Mar-49	76,892	701.14	0.00		Mar-54	144,181	733.98	0.00
Apr-49	72,997	698.74	0.00		Apr-54	145,846	734.65	0.00
May-49	68,613	695.94	0.00		May-54	142,590	733.33	0.00
Jun-49	65,141	693.66	0.00		Jun-54	138,260	731.55	0.00
Jul-49	61,392	691.11	0.00		Jul-54	128,899	727.58	0.00
Aug-49	57,656	688.46	0.00		Aug-54	121,437	724.27	0.00
Sep-49	54,778	686.34	0.00		Sep-54	114,949	721.29	0.00
Oct-49	52,628	684.72	0.00		Oct-54	110,495	719.18	0.00
Nov-49	51,324	683.72	0.00		Nov-54	108,412	718.17	0.00
Dec-49	50,356	682.97	0.00		Dec-54	107,645	717.80	0.00
Jan-50	49,487	682.28	0.00		Jan-55	107,556	717.75	0.00
Feb-50	50,470	683.06	0.00		Feb-55	107,111	717.54	0.00
Mar-50	47,423	680.63	0.00		Mar-55	105,737	716.86	0.00
Apr-50	45,923	679.40	0.00		Apr-55	103,731	715.86	0.00
May-50	40,591	674.84	0.00		May-55	101,707	714.84	0.00
Jun-50	38,013	672.49	0.00		Jun-55	98,253	713.07	0.00
Jul-50	35,213	669.81	0.00		Jul-55	91,321	709.39	0.00
Aug-50	32,380	666.95	0.00		Aug-55	83,924	705.26	0.00
Sep-50	30,202	664.63	0.00		Sep-55	80,241	703.13	0.00
Oct-50	28,625	662.90	0.00		Oct-55	77,662	701.60	0.00
Nov-50	27,811	661.98	0.00		Nov-55	76,328	700.80	0.00
Dec-50	27,138	661.20	0.00		Dec-55	80,502	703.28	0.00
Jan-51	26,590	660.56	0.00		Jan-56	90,586	708.99	0.00
Feb-51	25,975	659.84	0.00		Feb-56	92,738	710.15	0.00
Mar-51	24,991	658.66	0.00		Mar-56	92,049	709.78	0.00
Apr-51	23,647	657.03	0.00		Apr-56	93,027	710.31	0.00
May-51	21,347	654.14	0.00		May-56	92,512	710.03	0.00
Jun-51	19,552	651.80	0.00		Jun-56	89,817	708.56	0.00
Jul-51	17,442	648.93	0.00		Jul-56	85,622	706.23	0.00
Aug-51	15,479	646.06	0.00		Aug-56	79,408	702.64	0.00
Sep-51	13,816	643.41	0.00		Sep-56	75,370	700.21	0.00
Oct-51	12,841	641.76	0.00		Oct-56	73,160	698.85	0.00
Nov-51	12,275	640.75	0.00		Nov-56	71,765	697.97	0.00
Dec-51	12,030	640.30	0.00		Dec-56	70,309	697.04	0.00
Jan-52	112,132	719.96	0.00		Jan-57	70,144	696.93	0.00
Feb-52	119,701	723.48	0.00		Feb-57	70,128	696.92	0.00
Mar-52	190,701	750.87	0.87		Mar-57	69,917	696.79	0.00
Apr-52	193,585	751.80	1.80		Apr-57	68,682	695.99	0.00
May-52	193,585	751.80	1.80		May-57	66,880	694.81	0.00
Jun-52	190,357	750.76	0.76		Jun-57	60,039	690.16	0.00
Jul-52	184,942	748.98	0.00		Jul-57	55,842	687.13	0.00
Aug-52	179,108	747.01	0.00		Aug-57	49,749	682.49	0.00
Sep-52	173,537	745.07	0.00		Sep-57	46,654	680.01	0.00

Table B-1
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5B
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-57	45,027	678.66	0.00		Oct-62	146,837	735.05	0.00
Nov-57	43,684	677.53	0.00		Nov-62	144,661	734.17	0.00
Dec-57	44,401	678.13	0.00		Dec-62	143,336	733.64	0.00
Jan-58	44,627	678.32	0.00		Jan-63	142,199	733.17	0.00
Feb-58	76,911	701.15	0.00		Feb-63	142,300	733.21	0.00
Mar-58	122,188	724.61	0.00		Mar-63	141,481	732.88	0.00
Apr-58	193,585	751.80	1.80		Apr-63	139,726	732.16	0.00
May-58	193,585	751.80	1.80		May-63	136,904	730.99	0.00
Jun-58	191,747	751.21	1.21		Jun-63	132,883	729.29	0.00
Jul-58	186,688	749.56	0.00		Jul-63	127,606	727.01	0.00
Aug-58	181,332	747.76	0.00		Aug-63	120,317	723.76	0.00
Sep-58	176,714	746.18	0.00		Sep-63	117,130	722.30	0.00
Oct-58	172,807	744.81	0.00		Oct-63	114,690	721.17	0.00
Nov-58	170,536	744.00	0.00		Nov-63	113,437	720.58	0.00
Dec-58	168,409	743.23	0.00		Dec-63	112,060	719.93	0.00
Jan-59	168,663	743.33	0.00		Jan-64	111,246	719.54	0.00
Feb-59	180,846	747.60	0.00		Feb-64	109,780	718.83	0.00
Mar-59	179,309	747.08	0.00		Mar-64	108,081	718.01	0.00
Apr-59	177,188	746.34	0.00		Apr-64	105,877	716.93	0.00
May-59	173,318	744.99	0.00		May-64	100,592	714.28	0.00
Jun-59	169,224	743.53	0.00		Jun-64	96,294	712.05	0.00
Jul-59	159,836	740.07	0.00		Jul-64	91,541	709.51	0.00
Aug-59	152,057	737.11	0.00		Aug-64	86,894	706.94	0.00
Sep-59	146,370	734.86	0.00		Sep-64	83,335	704.92	0.00
Oct-59	141,884	733.04	0.00		Oct-64	80,840	703.48	0.00
Nov-59	139,044	731.88	0.00		Nov-64	79,445	702.66	0.00
Dec-59	138,132	731.50	0.00		Dec-64	78,462	702.08	0.00
Jan-60	137,756	731.34	0.00		Jan-65	77,692	701.62	0.00
Feb-60	136,925	730.99	0.00		Feb-65	76,642	700.99	0.00
Mar-60	133,421	729.52	0.00		Mar-65	75,206	700.11	0.00
Apr-60	130,979	728.47	0.00		Apr-65	84,381	705.52	0.00
May-60	127,277	726.87	0.00		May-65	82,248	704.30	0.00
Jun-60	122,898	724.93	0.00		Jun-65	75,617	700.36	0.00
Jul-60	117,569	722.50	0.00		Jul-65	69,038	696.22	0.00
Aug-60	110,032	718.96	0.00		Aug-65	64,345	693.13	0.00
Sep-60	106,536	717.25	0.00		Sep-65	61,143	690.94	0.00
Oct-60	103,858	715.93	0.00		Oct-65	59,165	689.54	0.00
Nov-60	102,994	715.49	0.00		Nov-65	80,635	703.36	0.00
Dec-60	101,838	714.91	0.00		Dec-65	109,940	718.91	0.00
Jan-61	101,059	714.51	0.00		Jan-66	127,341	726.90	0.00
Feb-61	99,726	713.83	0.00		Feb-66	134,517	729.98	0.00
Mar-61	97,823	712.85	0.00		Mar-66	135,289	730.31	0.00
Apr-61	95,146	711.44	0.00		Apr-66	131,008	728.49	0.00
May-61	90,025	708.68	0.00		May-66	125,691	726.17	0.00
Jun-61	85,817	706.34	0.00		Jun-66	121,021	724.08	0.00
Jul-61	81,230	703.71	0.00		Jul-66	115,099	721.36	0.00
Aug-61	76,789	701.08	0.00		Aug-66	105,452	716.72	0.00
Sep-61	73,331	698.95	0.00		Sep-66	99,253	713.59	0.00
Oct-61	70,915	697.42	0.00		Oct-66	93,800	710.72	0.00
Nov-61	69,404	696.46	0.00		Nov-66	89,873	708.59	0.00
Dec-61	68,492	695.87	0.00		Dec-66	137,164	731.09	0.00
Jan-62	67,390	695.15	0.00		Jan-67	168,455	743.25	0.00
Feb-62	162,147	740.94	0.00		Feb-67	182,772	748.25	0.00
Mar-62	176,603	746.14	0.00		Mar-67	193,585	751.80	1.80
Apr-62	176,732	746.19	0.00		Apr-67	193,585	751.80	1.80
May-62	172,795	744.81	0.00		May-67	193,585	751.80	1.80
Jun-62	168,092	743.12	0.00		Jun-67	193,585	751.80	1.80
Jul-62	161,645	740.75	0.00		Jul-67	189,831	750.59	0.59
Aug-62	154,863	738.19	0.00		Aug-67	181,562	747.84	0.00
Sep-62	149,433	736.08	0.00		Sep-67	175,477	745.75	0.00

Table B-1
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5B
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-67	172,738	744.79	0.00		Oct-72	103,031	715.51	0.00
Nov-67	171,770	744.44	0.00		Nov-72	102,724	715.36	0.00
Dec-67	170,618	744.03	0.00		Dec-72	101,617	714.80	0.00
Jan-68	169,649	743.68	0.00		Jan-73	114,342	721.00	0.00
Feb-68	169,661	743.69	0.00		Feb-73	182,566	748.18	0.00
Mar-68	171,531	744.36	0.00		Mar-73	193,585	751.80	1.80
Apr-68	168,359	743.22	0.00		Apr-73	193,585	751.80	1.80
May-68	164,887	741.95	0.00		May-73	192,769	751.54	1.54
Jun-68	157,151	739.06	0.00		Jun-73	188,462	750.14	0.14
Jul-68	152,500	737.28	0.00		Jul-73	182,247	748.07	0.00
Aug-68	146,641	734.97	0.00		Aug-73	176,464	746.09	0.00
Sep-68	140,878	732.63	0.00		Sep-73	171,724	744.43	0.00
Oct-68	137,150	731.09	0.00		Oct-73	167,970	743.08	0.00
Nov-68	134,854	730.12	0.00		Nov-73	165,510	742.18	0.00
Dec-68	133,622	729.60	0.00		Dec-73	164,810	741.92	0.00
Jan-69	193,585	751.80	1.80		Jan-74	184,788	748.93	0.00
Feb-69	193,585	751.80	1.80		Feb-74	186,257	749.41	0.00
Mar-69	193,585	751.80	1.80		Mar-74	192,887	751.58	1.58
Apr-69	193,585	751.80	1.80		Apr-74	192,369	751.41	1.41
May-69	193,585	751.80	1.80		May-74	189,196	750.38	0.38
Jun-69	193,069	751.63	1.63		Jun-74	184,073	748.69	0.00
Jul-69	188,947	750.30	0.30		Jul-74	177,350	746.40	0.00
Aug-69	184,040	748.68	0.00		Aug-74	171,520	744.35	0.00
Sep-69	179,620	747.18	0.00		Sep-74	165,506	742.18	0.00
Oct-69	175,823	745.87	0.00		Oct-74	161,666	740.76	0.00
Nov-69	174,537	745.42	0.00		Nov-74	159,957	740.12	0.00
Dec-69	173,105	744.92	0.00		Dec-74	161,574	740.72	0.00
Jan-70	173,838	745.18	0.00		Jan-75	160,649	740.38	0.00
Feb-70	176,676	746.17	0.00		Feb-75	168,157	743.14	0.00
Mar-70	191,322	751.07	1.07		Mar-75	193,585	751.80	1.80
Apr-70	187,634	749.87	0.00		Apr-75	193,585	751.80	1.80
May-70	184,026	748.67	0.00		May-75	192,405	751.42	1.42
Jun-70	180,152	747.36	0.00		Jun-75	188,063	750.01	0.01
Jul-70	171,085	744.20	0.00		Jul-75	181,814	747.93	0.00
Aug-70	163,180	741.32	0.00		Aug-75	176,167	745.99	0.00
Sep-70	158,278	739.49	0.00		Sep-75	171,448	744.33	0.00
Oct-70	154,150	737.92	0.00		Oct-75	167,844	743.03	0.00
Nov-70	155,427	738.40	0.00		Nov-75	165,853	742.30	0.00
Dec-70	166,666	742.60	0.00		Dec-75	164,043	741.64	0.00
Jan-71	172,975	744.87	0.00		Jan-76	162,100	740.92	0.00
Feb-71	174,273	745.33	0.00		Feb-76	164,677	741.87	0.00
Mar-71	174,174	745.29	0.00		Mar-76	162,305	741.00	0.00
Apr-71	171,661	744.40	0.00		Apr-76	160,200	740.21	0.00
May-71	168,879	743.40	0.00		May-76	156,622	738.86	0.00
Jun-71	161,680	740.76	0.00		Jun-76	148,875	735.86	0.00
Jul-71	153,750	737.76	0.00		Jul-76	140,874	732.63	0.00
Aug-71	145,823	734.64	0.00		Aug-76	133,225	729.43	0.00
Sep-71	140,258	732.38	0.00		Sep-76	128,148	727.25	0.00
Oct-71	136,367	730.76	0.00		Oct-76	124,657	725.71	0.00
Nov-71	134,025	729.77	0.00		Nov-76	123,051	725.00	0.00
Dec-71	142,334	733.23	0.00		Dec-76	121,761	724.42	0.00
Jan-72	143,140	733.56	0.00		Jan-77	121,467	724.28	0.00
Feb-72	142,494	733.29	0.00		Feb-77	120,054	723.64	0.00
Mar-72	140,310	732.40	0.00		Mar-77	118,424	722.90	0.00
Apr-72	137,405	731.19	0.00		Apr-77	115,751	721.66	0.00
May-72	130,198	728.14	0.00		May-77	113,006	720.37	0.00
Jun-72	123,633	725.26	0.00		Jun-77	109,067	718.49	0.00
Jul-72	118,903	723.12	0.00		Jul-77	101,193	714.58	0.00
Aug-72	112,564	720.16	0.00		Aug-77	96,482	712.15	0.00
Sep-72	106,862	717.41	0.00		Sep-77	93,023	710.31	0.00

Table B-1								
Simulated End-of-Month Storage, Elevation, and Surcharge								
in Cachuma Reservoir Under Alterantive 5B								
Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-77	90,338	708.85	0.00		Oct-82	137,965	731.43	0.00
Nov-77	88,405	707.78	0.00		Nov-82	137,783	731.35	0.00
Dec-77	87,804	707.45	0.00		Dec-82	152,166	737.15	0.00
Jan-78	106,400	717.19	0.00		Jan-83	193,585	751.80	1.80
Feb-78	193,585	751.80	1.80		Feb-83	193,585	751.80	1.80
Mar-78	193,585	751.80	1.80		Mar-83	193,585	751.80	1.80
Apr-78	193,585	751.80	1.80		Apr-83	193,585	751.80	1.80
May-78	193,585	751.80	1.80		May-83	193,585	751.80	1.80
Jun-78	192,431	751.43	1.43		Jun-83	193,585	751.80	1.80
Jul-78	187,704	749.89	0.00		Jul-83	192,061	751.31	1.31
Aug-78	182,958	748.31	0.00		Aug-83	189,084	750.34	0.34
Sep-78	179,090	747.00	0.00		Sep-83	185,795	749.26	0.00
Oct-78	175,286	745.68	0.00		Oct-83	186,375	749.45	0.00
Nov-78	173,811	745.17	0.00		Nov-83	189,595	750.51	0.51
Dec-78	172,650	744.76	0.00		Dec-83	193,585	751.80	1.80
Jan-79	179,235	747.05	0.00		Jan-84	193,585	751.80	1.80
Feb-79	193,585	751.80	1.80		Feb-84	193,585	751.80	1.80
Mar-79	193,585	751.80	1.80		Mar-84	192,719	751.52	1.52
Apr-79	193,585	751.80	1.80		Apr-84	190,191	750.70	0.70
May-79	192,931	751.59	1.59		May-84	184,871	748.95	0.00
Jun-79	188,592	750.18	0.18		Jun-84	179,634	747.19	0.00
Jul-79	182,634	748.20	0.00		Jul-84	173,091	744.91	0.00
Aug-79	176,857	746.23	0.00		Aug-84	167,429	742.88	0.00
Sep-79	171,866	744.48	0.00		Sep-84	161,825	740.82	0.00
Oct-79	167,469	742.89	0.00		Oct-84	157,813	739.31	0.00
Nov-79	165,325	742.11	0.00		Nov-84	156,106	738.66	0.00
Dec-79	164,279	741.72	0.00		Dec-84	156,460	738.80	0.00
Jan-80	166,737	742.63	0.00		Jan-85	155,815	738.55	0.00
Feb-80	193,585	751.80	1.80		Feb-85	155,528	738.44	0.00
Mar-80	193,585	751.80	1.80		Mar-85	154,362	738.00	0.00
Apr-80	193,585	751.80	1.80		Apr-85	151,793	737.01	0.00
May-80	193,585	751.80	1.80		May-85	147,878	735.46	0.00
Jun-80	190,491	750.80	0.80		Jun-85	140,061	732.29	0.00
Jul-80	185,328	749.11	0.00		Jul-85	132,162	728.98	0.00
Aug-80	179,650	747.19	0.00		Aug-85	126,747	726.64	0.00
Sep-80	174,855	745.53	0.00		Sep-85	121,070	724.10	0.00
Oct-80	170,879	744.13	0.00		Oct-85	117,668	722.55	0.00
Nov-80	168,626	743.31	0.00		Nov-85	117,050	722.26	0.00
Dec-80	166,916	742.69	0.00		Dec-85	115,796	721.68	0.00
Jan-81	166,971	742.71	0.00		Jan-86	115,388	721.49	0.00
Feb-81	167,468	742.89	0.00		Feb-86	158,936	739.74	0.00
Mar-81	185,396	749.13	0.00		Mar-86	192,313	751.39	1.39
Apr-81	184,628	748.87	0.00		Apr-86	193,585	751.80	1.80
May-81	181,476	747.81	0.00		May-86	190,701	750.87	0.87
Jun-81	177,003	746.28	0.00		Jun-86	186,020	749.33	0.00
Jul-81	171,555	744.37	0.00		Jul-86	179,511	747.14	0.00
Aug-81	165,139	742.04	0.00		Aug-86	173,503	745.06	0.00
Sep-81	159,237	739.85	0.00		Sep-86	168,113	743.13	0.00
Oct-81	155,254	738.34	0.00		Oct-86	164,145	741.67	0.00
Nov-81	153,162	737.53	0.00		Nov-86	162,411	741.03	0.00
Dec-81	151,833	737.02	0.00		Dec-86	160,758	740.42	0.00
Jan-82	151,138	736.75	0.00		Jan-87	159,365	739.90	0.00
Feb-82	150,021	736.31	0.00		Feb-87	158,146	739.44	0.00
Mar-82	152,206	737.16	0.00		Mar-87	157,402	739.16	0.00
Apr-82	167,900	743.05	0.00		Apr-87	153,130	737.52	0.00
May-82	166,287	742.46	0.00		May-87	149,120	735.96	0.00
Jun-82	163,042	741.27	0.00		Jun-87	144,524	734.12	0.00
Jul-82	154,305	737.98	0.00		Jul-87	139,232	731.95	0.00
Aug-82	146,588	734.95	0.00		Aug-87	132,092	728.95	0.00
Sep-82	140,237	732.37	0.00		Sep-87	127,452	726.95	0.00

Table B-1 Simulated End-of-Month Storage, Elevation, and Surcharge in Cachuma Reservoir Under Alterantive 5B Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-87	125,379	726.03	0.00		Oct-92	140,311	732.40	0.00
Nov-87	123,734	725.30	0.00		Nov-92	137,785	731.35	0.00
Dec-87	122,873	724.92	0.00		Dec-92	137,377	731.18	0.00
Jan-88	122,508	724.75	0.00		Jan-93	193,585	751.80	1.80
Feb-88	121,925	724.49	0.00		Feb-93	193,585	751.80	1.80
Mar-88	124,564	725.67	0.00		Mar-93	193,585	751.80	1.80
Apr-88	122,128	724.58	0.00		Apr-93	193,585	751.80	1.80
May-88	118,763	723.05	0.00		May-93	193,585	751.80	1.80
Jun-88	111,288	719.56	0.00		Jun-93	192,891	751.58	1.58
Jul-88	104,220	716.11	0.00		Jul-93	188,635	750.20	0.20
Aug-88	98,408	713.15	0.00		Aug-93	183,774	748.59	0.00
Sep-88	93,157	710.38	0.00		Sep-93	179,262	747.06	0.00
Oct-88	90,841	709.13	0.00					
Nov-88	89,250	708.25	0.00					
Dec-88	88,422	707.79	0.00					
Jan-89	87,301	707.17	0.00					
Feb-89	87,281	707.16	0.00					
Mar-89	85,821	706.34	0.00					
Apr-89	83,290	704.90	0.00					
May-89	80,278	703.15	0.00					
Jun-89	75,665	700.39	0.00					
Jul-89	69,612	696.59	0.00					
Aug-89	65,409	693.84	0.00					
Sep-89	62,572	691.93	0.00					
Oct-89	60,589	690.55	0.00					
Nov-89	59,024	689.44	0.00					
Dec-89	57,681	688.48	0.00					
Jan-90	56,885	687.90	0.00					
Feb-90	56,065	687.30	0.00					
Mar-90	54,493	686.13	0.00					
Apr-90	52,302	684.47	0.00					
May-90	48,565	681.55	0.00					
Jun-90	46,294	679.71	0.00					
Jul-90	42,814	676.78	0.00					
Aug-90	39,921	674.24	0.00					
Sep-90	37,943	672.43	0.00					
Oct-90	36,279	670.85	0.00					
Nov-90	35,182	669.78	0.00					
Dec-90	34,553	669.16	0.00					
Jan-91	33,881	668.49	0.00					
Feb-91	33,398	668.00	0.00					
Mar-91	67,616	695.30	0.00					
Apr-91	76,258	700.75	0.00					
May-91	73,454	699.03	0.00					
Jun-91	68,700	696.00	0.00					
Jul-91	63,175	692.34	0.00					
Aug-91	57,616	688.43	0.00					
Sep-91	54,961	686.48	0.00					
Oct-91	52,210	684.40	0.00					
Nov-91	50,914	683.40	0.00					
Dec-91	50,771	683.29	0.00					
Jan-92	51,436	683.81	0.00					
Feb-92	137,141	731.08	0.00					
Mar-92	164,131	741.67	0.00					
Apr-92	171,637	744.40	0.00					
May-92	169,943	743.79	0.00					
Jun-92	165,907	742.32	0.00					
Jul-92	159,909	740.10	0.00					
Aug-92	150,196	736.38	0.00					
Sep-92	143,694	733.78	0.00					

Table B-2
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5C
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-17	173,182	744.95	0.00		Oct-22	172,588	744.73	0.00
Nov-17	171,008	744.17	0.00		Nov-22	171,265	744.26	0.00
Dec-17	169,056	743.47	0.00		Dec-22	176,857	746.23	0.00
Jan-18	167,446	742.89	0.00		Jan-23	178,169	746.68	0.00
Feb-18	197,343	753.00	3.00		Feb-23	178,700	746.87	0.00
Mar-18	197,343	753.00	3.00		Mar-23	176,562	746.13	0.00
Apr-18	197,343	753.00	3.00		Apr-23	174,679	745.47	0.00
May-18	197,343	753.00	3.00		May-23	171,247	744.26	0.00
Jun-18	196,339	752.68	2.68		Jun-23	167,246	742.81	0.00
Jul-18	190,796	750.90	0.90		Jul-23	162,120	740.93	0.00
Aug-18	185,209	749.07	0.00		Aug-23	152,903	737.43	0.00
Sep-18	181,147	747.70	0.00		Sep-23	146,496	734.91	0.00
Oct-18	177,340	746.40	0.00		Oct-23	141,134	732.74	0.00
Nov-18	176,616	746.15	0.00		Nov-23	139,066	731.88	0.00
Dec-18	175,637	745.81	0.00		Dec-23	137,893	731.40	0.00
Jan-19	174,659	745.46	0.00		Jan-24	136,574	730.85	0.00
Feb-19	174,302	745.34	0.00		Feb-24	135,240	730.29	0.00
Mar-19	172,311	744.63	0.00		Mar-24	135,996	730.60	0.00
Apr-19	168,785	743.37	0.00		Apr-24	133,553	729.57	0.00
May-19	165,085	742.02	0.00		May-24	129,784	727.96	0.00
Jun-19	160,464	740.31	0.00		Jun-24	125,316	726.01	0.00
Jul-19	151,190	736.77	0.00		Jul-24	120,069	723.65	0.00
Aug-19	146,350	734.85	0.00		Aug-24	113,230	720.48	0.00
Sep-19	140,328	732.40	0.00		Sep-24	107,732	717.84	0.00
Oct-19	136,475	730.81	0.00		Oct-24	104,014	716.01	0.00
Nov-19	134,421	729.94	0.00		Nov-24	101,975	714.98	0.00
Dec-19	134,106	729.81	0.00		Dec-24	101,039	714.50	0.00
Jan-20	132,586	729.16	0.00		Jan-25	99,783	713.86	0.00
Feb-20	133,957	729.74	0.00		Feb-25	98,655	713.28	0.00
Mar-20	142,985	733.49	0.00		Mar-25	98,108	713.00	0.00
Apr-20	144,903	734.27	0.00		Apr-25	98,194	713.04	0.00
May-20	142,067	733.12	0.00		May-25	95,405	711.58	0.00
Jun-20	138,052	731.46	0.00		Jun-25	91,601	709.54	0.00
Jul-20	128,999	727.62	0.00		Jul-25	85,602	706.22	0.00
Aug-20	124,463	725.63	0.00		Aug-25	78,553	702.13	0.00
Sep-20	118,023	722.71	0.00		Sep-25	74,831	699.88	0.00
Oct-20	114,000	720.84	0.00		Oct-25	72,678	698.54	0.00
Nov-20	111,722	719.76	0.00		Nov-25	71,139	697.57	0.00
Dec-20	110,529	719.19	0.00		Dec-25	69,917	696.79	0.00
Jan-21	111,388	719.60	0.00		Jan-26	68,930	696.15	0.00
Feb-21	111,976	719.89	0.00		Feb-26	71,638	697.89	0.00
Mar-21	113,930	720.81	0.00		Mar-26	72,220	698.25	0.00
Apr-21	112,017	719.91	0.00		Apr-26	133,282	729.46	0.00
May-21	109,448	718.67	0.00		May-26	134,229	729.86	0.00
Jun-21	106,066	717.02	0.00		Jun-26	129,889	728.01	0.00
Jul-21	101,295	714.63	0.00		Jul-26	123,760	725.31	0.00
Aug-21	91,965	709.74	0.00		Aug-26	117,544	722.49	0.00
Sep-21	86,713	706.84	0.00		Sep-26	111,709	719.76	0.00
Oct-21	81,960	704.13	0.00		Oct-26	104,831	716.41	0.00
Nov-21	79,709	702.82	0.00		Nov-26	107,079	717.52	0.00
Dec-21	99,695	713.82	0.00		Dec-26	107,713	717.83	0.00
Jan-22	116,225	721.88	0.00		Jan-27	109,275	718.59	0.00
Feb-22	175,141	745.63	0.00		Feb-27	190,438	750.78	0.78
Mar-22	197,343	753.00	3.00		Mar-27	197,343	753.00	3.00
Apr-22	197,343	753.00	3.00		Apr-27	197,343	753.00	3.00
May-22	197,343	753.00	3.00		May-27	194,748	752.17	2.17
Jun-22	193,048	751.63	1.63		Jun-27	190,008	750.64	0.64
Jul-22	186,805	749.59	0.00		Jul-27	183,701	748.56	0.00
Aug-22	181,103	747.69	0.00		Aug-27	177,968	746.61	0.00
Sep-22	176,311	746.04	0.00		Sep-27	173,151	744.93	0.00

Table B-2
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5C
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-27	170,173	743.87	0.00		Oct-32	115,255	721.43	0.00
Nov-27	168,419	743.24	0.00		Nov-32	113,607	720.66	0.00
Dec-27	167,686	742.97	0.00		Dec-32	112,064	719.93	0.00
Jan-28	166,218	742.44	0.00		Jan-33	120,178	723.70	0.00
Feb-28	172,960	744.87	0.00		Feb-33	122,172	724.60	0.00
Mar-28	174,400	745.37	0.00		Mar-33	121,129	724.13	0.00
Apr-28	171,161	744.23	0.00		Apr-33	118,658	723.00	0.00
May-28	167,437	742.88	0.00		May-33	114,954	721.29	0.00
Jun-28	163,300	741.36	0.00		Jun-33	107,309	717.63	0.00
Jul-28	154,244	737.95	0.00		Jul-33	99,473	713.70	0.00
Aug-28	146,469	734.90	0.00		Aug-33	91,962	709.73	0.00
Sep-28	139,912	732.23	0.00		Sep-33	86,526	706.74	0.00
Oct-28	134,518	729.98	0.00		Oct-33	84,164	705.40	0.00
Nov-28	133,411	729.51	0.00		Nov-33	82,370	704.37	0.00
Dec-28	132,794	729.25	0.00		Dec-33	81,832	704.06	0.00
Jan-29	131,770	728.81	0.00		Jan-34	94,065	710.87	0.00
Feb-29	132,062	728.94	0.00		Feb-34	98,121	713.00	0.00
Mar-29	132,258	729.02	0.00		Mar-34	97,788	712.83	0.00
Apr-29	131,083	728.52	0.00		Apr-34	95,069	711.40	0.00
May-29	127,700	727.05	0.00		May-34	91,419	709.44	0.00
Jun-29	119,715	723.49	0.00		Jun-34	83,672	705.12	0.00
Jul-29	112,082	719.94	0.00		Jul-34	76,246	700.75	0.00
Aug-29	106,055	717.02	0.00		Aug-34	69,611	696.59	0.00
Sep-29	100,262	714.11	0.00		Sep-34	63,988	692.89	0.00
Oct-29	96,228	712.01	0.00		Oct-34	62,027	691.55	0.00
Nov-29	94,145	710.91	0.00		Nov-34	60,629	690.58	0.00
Dec-29	92,743	710.16	0.00		Dec-34	59,618	689.87	0.00
Jan-30	92,132	709.83	0.00		Jan-35	72,067	698.16	0.00
Feb-30	90,694	709.05	0.00		Feb-35	74,325	699.57	0.00
Mar-30	94,321	711.00	0.00		Mar-35	82,641	704.52	0.00
Apr-30	92,177	709.85	0.00		Apr-35	97,822	712.85	0.00
May-30	89,021	708.13	0.00		May-35	97,119	712.48	0.00
Jun-30	85,125	705.95	0.00		Jun-35	92,898	710.24	0.00
Jul-30	79,152	702.49	0.00		Jul-35	87,047	707.03	0.00
Aug-30	73,181	698.86	0.00		Aug-35	77,636	701.58	0.00
Sep-30	70,120	696.92	0.00		Sep-35	71,827	698.01	0.00
Oct-30	67,694	695.35	0.00		Oct-35	68,393	695.80	0.00
Nov-30	66,251	694.40	0.00		Nov-35	66,103	694.30	0.00
Dec-30	64,999	693.57	0.00		Dec-35	64,993	693.56	0.00
Jan-31	64,363	693.14	0.00		Jan-36	63,572	692.61	0.00
Feb-31	63,509	692.56	0.00		Feb-36	86,903	706.95	0.00
Mar-31	61,725	691.34	0.00		Mar-36	90,673	709.03	0.00
Apr-31	59,628	689.87	0.00		Apr-36	92,454	710.00	0.00
May-31	55,857	687.14	0.00		May-36	89,488	708.38	0.00
Jun-31	52,718	684.79	0.00		Jun-36	85,662	706.25	0.00
Jul-31	49,331	682.16	0.00		Jul-36	80,983	703.56	0.00
Aug-31	45,979	679.45	0.00		Aug-36	74,106	699.43	0.00
Sep-31	43,359	677.25	0.00		Sep-36	70,606	697.23	0.00
Oct-31	41,400	675.55	0.00		Oct-36	68,510	695.88	0.00
Nov-31	40,487	674.75	0.00		Nov-36	66,981	694.88	0.00
Dec-31	47,940	681.05	0.00		Dec-36	70,152	696.94	0.00
Jan-32	53,659	685.50	0.00		Jan-37	75,835	700.50	0.00
Feb-32	141,394	732.84	0.00		Feb-37	143,608	733.75	0.00
Mar-32	150,088	736.34	0.00		Mar-37	197,343	753.00	3.00
Apr-32	147,178	735.18	0.00		Apr-37	197,343	753.00	3.00
May-32	142,383	733.25	0.00		May-37	197,343	753.00	3.00
Jun-32	137,331	731.16	0.00		Jun-37	193,842	751.88	1.88
Jul-32	130,976	728.47	0.00		Jul-37	187,706	749.89	0.00
Aug-32	124,509	725.65	0.00		Aug-37	181,938	747.97	0.00
Sep-32	118,446	722.91	0.00		Sep-37	177,072	746.30	0.00

Table B-2
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5C
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-37	173,253	744.97	0.00		Oct-42	174,523	745.42	0.00
Nov-37	170,345	743.93	0.00		Nov-42	172,535	744.71	0.00
Dec-37	170,114	743.85	0.00		Dec-42	171,034	744.18	0.00
Jan-38	168,980	743.44	0.00		Jan-43	197,343	753.00	3.00
Feb-38	197,343	753.00	3.00		Feb-43	197,343	753.00	3.00
Mar-38	197,343	753.00	3.00		Mar-43	197,343	753.00	3.00
Apr-38	197,343	753.00	3.00		Apr-43	197,343	753.00	3.00
May-38	197,343	753.00	3.00		May-43	197,031	752.90	2.90
Jun-38	194,915	752.23	2.23		Jun-43	192,964	751.60	1.60
Jul-38	189,636	750.52	0.52		Jul-43	187,042	749.67	0.00
Aug-38	184,018	748.67	0.00		Aug-43	181,510	747.82	0.00
Sep-38	179,440	747.12	0.00		Sep-43	176,926	746.25	0.00
Oct-38	175,721	745.84	0.00		Oct-43	173,425	745.03	0.00
Nov-38	173,777	745.15	0.00		Nov-43	171,527	744.36	0.00
Dec-38	173,950	745.21	0.00		Dec-43	171,371	744.30	0.00
Jan-39	176,580	746.13	0.00		Jan-44	171,296	744.27	0.00
Feb-39	178,851	746.92	0.00		Feb-44	197,343	753.00	3.00
Mar-39	185,986	749.32	0.00		Mar-44	197,343	753.00	3.00
Apr-39	183,991	748.66	0.00		Apr-44	197,343	753.00	3.00
May-39	180,535	747.49	0.00		May-44	196,280	752.66	2.66
Jun-39	176,031	745.94	0.00		Jun-44	192,204	751.36	1.36
Jul-39	166,956	742.71	0.00		Jul-44	186,116	749.37	0.00
Aug-39	159,087	739.79	0.00		Aug-44	180,447	747.46	0.00
Sep-39	152,574	737.31	0.00		Sep-44	175,706	745.83	0.00
Oct-39	149,972	736.29	0.00		Oct-44	171,944	744.50	0.00
Nov-39	147,929	735.48	0.00		Nov-44	171,973	744.51	0.00
Dec-39	146,499	734.91	0.00		Dec-44	171,005	744.17	0.00
Jan-40	147,197	735.19	0.00		Jan-45	170,040	743.82	0.00
Feb-40	152,413	737.24	0.00		Feb-45	190,872	750.92	0.92
Mar-40	154,722	738.14	0.00		Mar-45	197,343	753.00	3.00
Apr-40	153,971	737.85	0.00		Apr-45	197,343	753.00	3.00
May-40	150,392	736.46	0.00		May-45	194,424	752.07	2.07
Jun-40	146,408	734.88	0.00		Jun-45	189,299	750.41	0.41
Jul-40	137,244	731.13	0.00		Jul-45	182,750	748.24	0.00
Aug-40	129,692	727.92	0.00		Aug-45	176,777	746.20	0.00
Sep-40	124,207	725.51	0.00		Sep-45	170,943	744.15	0.00
Oct-40	120,355	723.78	0.00		Oct-45	167,260	742.82	0.00
Nov-40	118,815	723.08	0.00		Nov-45	164,965	741.98	0.00
Dec-40	123,204	725.07	0.00		Dec-45	172,809	744.81	0.00
Jan-41	150,825	736.63	0.00		Jan-46	172,545	744.72	0.00
Feb-41	197,343	753.00	3.00		Feb-46	173,599	745.09	0.00
Mar-41	197,343	753.00	3.00		Mar-46	190,353	750.76	0.76
Apr-41	197,343	753.00	3.00		Apr-46	197,141	752.94	2.94
May-41	197,343	753.00	3.00		May-46	193,892	751.90	1.90
Jun-41	197,343	753.00	3.00		Jun-46	188,192	750.05	0.05
Jul-41	194,822	752.20	2.20		Jul-46	178,146	746.68	0.00
Aug-41	190,733	750.88	0.88		Aug-46	170,178	743.87	0.00
Sep-41	187,158	749.71	0.00		Sep-46	163,490	741.43	0.00
Oct-41	184,458	748.82	0.00		Oct-46	157,978	739.37	0.00
Nov-41	183,289	748.42	0.00		Nov-46	159,544	739.96	0.00
Dec-41	189,248	750.40	0.40		Dec-46	164,771	741.91	0.00
Jan-42	193,615	751.81	1.81		Jan-47	165,864	742.31	0.00
Feb-42	195,099	752.28	2.28		Feb-47	165,480	742.17	0.00
Mar-42	197,336	753.00	3.00		Mar-47	164,870	741.94	0.00
Apr-42	197,343	753.00	3.00		Apr-47	162,022	740.89	0.00
May-42	196,081	752.60	2.60		May-47	154,641	738.10	0.00
Jun-42	192,451	751.43	1.43		Jun-47	147,876	735.46	0.00
Jul-42	187,108	749.69	0.00		Jul-47	139,798	732.19	0.00
Aug-42	182,060	748.01	0.00		Aug-47	132,058	728.94	0.00
Sep-42	177,005	746.28	0.00		Sep-47	125,528	726.10	0.00

Table B-2
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5C
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-47	120,126	723.67	0.00		Oct-52	173,561	745.08	0.00
Nov-47	117,067	722.27	0.00		Nov-52	173,093	744.91	0.00
Dec-47	116,063	721.81	0.00		Dec-52	175,342	745.70	0.00
Jan-48	114,849	721.24	0.00		Jan-53	180,865	747.61	0.00
Feb-48	113,995	720.84	0.00		Feb-53	179,757	747.23	0.00
Mar-48	112,889	720.32	0.00		Mar-53	178,582	746.83	0.00
Apr-48	110,765	719.31	0.00		Apr-53	176,253	746.02	0.00
May-48	107,405	717.68	0.00		May-53	172,475	744.69	0.00
Jun-48	102,415	715.20	0.00		Jun-53	168,136	743.14	0.00
Jul-48	96,422	712.12	0.00		Jul-53	158,913	739.73	0.00
Aug-48	91,989	709.75	0.00		Aug-53	151,112	736.74	0.00
Sep-48	88,438	707.80	0.00		Sep-53	145,218	734.40	0.00
Oct-48	85,823	706.34	0.00		Oct-53	140,460	732.46	0.00
Nov-48	84,002	705.31	0.00		Nov-53	139,342	732.00	0.00
Dec-48	83,240	704.87	0.00		Dec-53	137,745	731.34	0.00
Jan-49	82,241	704.29	0.00		Jan-54	140,028	732.28	0.00
Feb-49	81,129	703.65	0.00		Feb-54	142,272	733.20	0.00
Mar-49	79,991	702.98	0.00		Mar-54	147,429	735.28	0.00
Apr-49	76,077	700.64	0.00		Apr-54	149,077	735.94	0.00
May-49	71,585	697.85	0.00		May-54	145,800	734.63	0.00
Jun-49	67,991	695.54	0.00		Jun-54	141,449	732.87	0.00
Jul-49	64,092	692.96	0.00		Jul-54	132,061	728.94	0.00
Aug-49	60,213	690.29	0.00		Aug-54	124,587	725.68	0.00
Sep-49	57,228	688.15	0.00		Sep-54	118,078	722.74	0.00
Oct-49	55,002	686.51	0.00		Oct-54	113,609	720.66	0.00
Nov-49	53,651	685.50	0.00		Nov-54	111,522	719.67	0.00
Dec-49	52,645	684.73	0.00		Dec-54	110,759	719.30	0.00
Jan-50	51,739	684.04	0.00		Jan-55	110,681	719.27	0.00
Feb-50	52,683	684.76	0.00		Feb-55	110,235	719.05	0.00
Mar-50	49,574	682.35	0.00		Mar-55	108,850	718.38	0.00
Apr-50	47,994	681.09	0.00		Apr-55	106,839	717.40	0.00
May-50	42,537	676.54	0.00		May-55	104,800	716.40	0.00
Jun-50	39,816	674.15	0.00		Jun-55	101,321	714.65	0.00
Jul-50	36,846	671.39	0.00		Jul-55	94,363	711.03	0.00
Aug-50	33,853	668.46	0.00		Aug-55	86,942	706.97	0.00
Sep-50	31,555	666.08	0.00		Sep-55	83,243	704.87	0.00
Oct-50	29,895	664.30	0.00		Oct-55	80,650	703.37	0.00
Nov-50	29,025	663.34	0.00		Nov-55	79,314	702.58	0.00
Dec-50	28,296	662.53	0.00		Dec-55	83,518	705.03	0.00
Jan-51	27,699	661.85	0.00		Jan-56	93,609	710.62	0.00
Feb-51	27,035	661.09	0.00		Feb-56	95,756	711.76	0.00
Mar-51	25,981	659.85	0.00		Mar-56	95,056	711.39	0.00
Apr-51	24,549	658.13	0.00		Apr-56	96,031	711.91	0.00
May-51	22,126	655.13	0.00		May-56	95,440	711.60	0.00
Jun-51	20,194	652.64	0.00		Jun-56	92,653	710.11	0.00
Jul-51	17,919	649.59	0.00		Jul-56	88,351	707.75	0.00
Aug-51	15,797	646.54	0.00		Aug-56	82,035	704.17	0.00
Sep-51	14,015	643.74	0.00		Sep-56	77,917	701.75	0.00
Oct-51	12,955	641.96	0.00		Oct-56	75,652	700.39	0.00
Nov-51	12,331	640.85	0.00		Nov-56	74,212	699.50	0.00
Dec-51	12,030	640.30	0.00		Dec-56	72,721	698.57	0.00
Jan-52	112,079	719.93	0.00		Jan-57	72,537	698.45	0.00
Feb-52	119,648	723.46	0.00		Feb-57	72,498	698.43	0.00
Mar-52	190,708	750.87	0.87		Mar-57	72,244	698.27	0.00
Apr-52	197,343	753.00	3.00		Apr-57	70,954	697.45	0.00
May-52	197,343	753.00	3.00		May-57	69,063	696.24	0.00
Jun-52	194,051	751.95	1.95		Jun-57	62,111	691.61	0.00
Jul-52	188,561	750.17	0.17		Jul-57	57,779	688.55	0.00
Aug-52	182,502	748.16	0.00		Aug-57	51,563	683.91	0.00
Sep-52	176,927	746.25	0.00		Sep-57	48,373	681.40	0.00

Table B-2 Simulated End-of-Month Storage, Elevation, and Surcharge in Cachuma Reservoir Under Alterantive 5C Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-57	46,681	680.03	0.00		Oct-62	149,223	736.00	0.00
Nov-57	45,293	678.88	0.00		Nov-62	147,039	735.13	0.00
Dec-57	45,980	679.45	0.00		Dec-62	145,712	734.60	0.00
Jan-58	46,169	679.61	0.00		Jan-63	144,572	734.14	0.00
Feb-58	78,433	702.06	0.00		Feb-63	144,681	734.18	0.00
Mar-58	123,667	725.27	0.00		Mar-63	143,865	733.85	0.00
Apr-58	197,343	753.00	3.00		Apr-63	142,106	733.13	0.00
May-58	197,343	753.00	3.00		May-63	139,275	731.97	0.00
Jun-58	195,479	752.41	2.41		Jun-63	135,242	730.29	0.00
Jul-58	190,391	750.77	0.77		Jul-63	129,949	728.03	0.00
Aug-58	185,004	749.00	0.00		Aug-63	122,646	724.81	0.00
Sep-58	180,361	747.43	0.00		Sep-63	119,452	723.37	0.00
Oct-58	176,434	746.08	0.00		Oct-63	117,006	722.24	0.00
Nov-58	174,149	745.28	0.00		Nov-63	115,755	721.66	0.00
Dec-58	172,011	744.53	0.00		Dec-63	114,373	721.02	0.00
Jan-59	172,277	744.62	0.00		Jan-64	113,562	720.64	0.00
Feb-59	184,488	748.83	0.00		Feb-64	112,088	719.94	0.00
Mar-59	182,931	748.30	0.00		Mar-64	110,384	719.13	0.00
Apr-59	180,793	747.58	0.00		Apr-64	108,174	718.06	0.00
May-59	176,894	746.24	0.00		May-64	102,876	715.43	0.00
Jun-59	172,767	744.80	0.00		Jun-64	98,562	713.23	0.00
Jul-59	163,347	741.38	0.00		Jul-64	93,789	710.72	0.00
Aug-59	155,544	738.45	0.00		Aug-64	89,125	708.18	0.00
Sep-59	149,836	736.24	0.00		Sep-64	85,555	706.19	0.00
Oct-59	145,333	734.44	0.00		Oct-64	83,053	704.76	0.00
Nov-59	142,483	733.29	0.00		Nov-64	81,660	703.96	0.00
Dec-59	141,568	732.91	0.00		Dec-64	80,680	703.38	0.00
Jan-60	141,202	732.76	0.00		Jan-65	79,909	702.93	0.00
Feb-60	140,372	732.42	0.00		Feb-65	78,854	702.31	0.00
Mar-60	136,860	730.97	0.00		Mar-65	77,413	701.45	0.00
Apr-60	134,409	729.94	0.00		Apr-65	86,593	706.77	0.00
May-60	130,685	728.35	0.00		May-65	84,387	705.52	0.00
Jun-60	126,281	726.43	0.00		Jun-65	77,674	701.61	0.00
Jul-60	120,926	724.04	0.00		Jul-65	71,000	697.48	0.00
Aug-60	113,196	720.46	0.00		Aug-65	66,213	694.37	0.00
Sep-60	109,680	718.79	0.00		Sep-65	62,940	692.18	0.00
Oct-60	106,989	717.48	0.00		Oct-65	60,905	690.77	0.00
Nov-60	106,138	717.06	0.00		Nov-65	82,361	704.36	0.00
Dec-60	104,980	716.49	0.00		Dec-65	111,644	719.73	0.00
Jan-61	104,206	716.10	0.00		Jan-66	129,048	727.64	0.00
Feb-61	102,865	715.43	0.00		Feb-66	136,221	730.70	0.00
Mar-61	100,953	714.46	0.00		Mar-66	136,988	731.02	0.00
Apr-61	98,257	713.07	0.00		Apr-66	132,700	729.21	0.00
May-61	93,054	710.32	0.00		May-66	127,373	726.91	0.00
Jun-61	88,754	707.98	0.00		Jun-66	122,691	724.83	0.00
Jul-61	84,059	705.34	0.00		Jul-66	116,756	722.13	0.00
Aug-61	79,516	702.70	0.00		Aug-66	107,097	717.53	0.00
Sep-61	75,977	700.58	0.00		Sep-66	100,890	714.43	0.00
Oct-61	73,501	699.06	0.00		Oct-66	95,429	711.59	0.00
Nov-61	71,963	698.09	0.00		Nov-66	91,504	709.49	0.00
Dec-61	71,026	697.50	0.00		Dec-66	138,799	731.77	0.00
Jan-62	69,896	696.77	0.00		Jan-67	170,096	743.84	0.00
Feb-62	164,659	741.86	0.00		Feb-67	184,409	748.80	0.00
Mar-62	179,112	747.01	0.00		Mar-67	197,343	753.00	3.00
Apr-62	179,227	747.05	0.00		Apr-67	197,343	753.00	3.00
May-62	175,271	745.68	0.00		May-67	197,343	753.00	3.00
Jun-62	170,549	744.01	0.00		Jun-67	197,343	753.00	3.00
Jul-62	164,086	741.65	0.00		Jul-67	193,541	751.79	1.79
Aug-62	157,309	739.12	0.00		Aug-67	185,239	749.08	0.00
Sep-62	151,830	737.02	0.00		Sep-67	179,121	747.01	0.00

Table B-2
Simulated End-of-Month Storage, Elevation, and Surcharge
in Cachuma Reservoir Under Alterantive 5C
Based on SYRHM, WY 1918-1993

Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-67	176,360	746.06	0.00		Oct-72	106,215	717.10	0.00
Nov-67	175,396	745.72	0.00		Nov-72	105,918	716.95	0.00
Dec-67	174,243	745.32	0.00		Dec-72	104,810	716.40	0.00
Jan-68	173,271	744.98	0.00		Jan-73	117,552	722.49	0.00
Feb-68	173,279	744.98	0.00		Feb-73	185,809	749.26	0.00
Mar-68	175,142	745.63	0.00		Mar-73	197,343	753.00	3.00
Apr-68	171,951	744.51	0.00		Apr-73	197,343	753.00	3.00
May-68	168,453	743.25	0.00		May-73	196,507	752.73	2.73
Jun-68	160,691	740.39	0.00		Jun-73	192,173	751.34	1.34
Jul-68	156,012	738.63	0.00		Jul-73	185,928	749.30	0.00
Aug-68	150,122	736.35	0.00		Aug-73	180,115	747.35	0.00
Sep-68	144,338	734.04	0.00		Sep-73	175,352	745.71	0.00
Oct-68	140,602	732.52	0.00		Oct-73	171,581	744.38	0.00
Nov-68	138,300	731.57	0.00		Nov-73	169,119	743.49	0.00
Dec-68	137,068	731.05	0.00		Dec-73	168,422	743.24	0.00
Jan-69	197,343	753.00	3.00		Jan-74	188,425	750.13	0.13
Feb-69	197,343	753.00	3.00		Feb-74	189,885	750.60	0.60
Mar-69	197,343	753.00	3.00		Mar-74	196,517	752.74	2.74
Apr-69	197,343	753.00	3.00		Apr-74	195,985	752.57	2.57
May-69	197,343	753.00	3.00		May-74	192,794	751.54	1.54
Jun-69	196,809	752.83	2.83		Jun-74	187,643	749.87	0.00
Jul-69	192,662	751.50	1.50		Jul-74	180,887	747.61	0.00
Aug-69	187,725	749.90	0.00		Aug-74	175,029	745.59	0.00
Sep-69	183,284	748.42	0.00		Sep-74	165,845	742.30	0.00
Oct-69	179,467	747.13	0.00		Oct-74	163,531	741.45	0.00
Nov-69	178,173	746.68	0.00		Nov-74	160,876	740.46	0.00
Dec-69	176,737	746.19	0.00		Dec-74	162,813	741.18	0.00
Jan-70	177,474	746.44	0.00		Jan-75	161,886	740.84	0.00
Feb-70	180,311	747.42	0.00		Feb-75	169,390	743.59	0.00
Mar-70	194,962	752.24	2.24		Mar-75	197,343	753.00	3.00
Apr-70	191,257	751.05	1.05		Apr-75	197,343	753.00	3.00
May-70	187,622	749.86	0.00		May-75	196,143	752.62	2.62
Jun-70	183,720	748.57	0.00		Jun-75	191,775	751.22	1.22
Jul-70	174,619	745.45	0.00		Jul-75	185,492	749.16	0.00
Aug-70	166,688	742.61	0.00		Aug-75	179,812	747.25	0.00
Sep-70	161,767	740.79	0.00		Sep-75	175,069	745.61	0.00
Oct-70	157,626	739.24	0.00		Oct-75	171,449	744.33	0.00
Nov-70	158,912	739.73	0.00		Nov-75	169,449	743.61	0.00
Dec-70	170,166	743.87	0.00		Dec-75	167,634	742.95	0.00
Jan-71	176,472	746.10	0.00		Jan-76	165,683	742.24	0.00
Feb-71	177,762	746.54	0.00		Feb-76	168,279	743.19	0.00
Mar-71	177,649	746.50	0.00		Mar-76	165,900	742.32	0.00
Apr-71	175,119	745.62	0.00		Apr-76	163,789	741.54	0.00
May-71	172,319	744.64	0.00		May-76	160,191	740.21	0.00
Jun-71	165,096	742.03	0.00		Jun-76	152,414	737.25	0.00
Jul-71	157,143	739.06	0.00		Jul-76	144,386	734.06	0.00
Aug-71	149,188	735.98	0.00		Aug-76	137,204	731.11	0.00
Sep-71	143,604	733.74	0.00		Sep-76	132,042	728.93	0.00
Oct-71	139,703	732.15	0.00		Oct-76	128,852	727.56	0.00
Nov-71	137,356	731.17	0.00		Nov-76	127,237	726.85	0.00
Dec-71	145,687	734.59	0.00		Dec-76	125,933	726.28	0.00
Jan-72	146,488	734.91	0.00		Jan-77	125,648	726.15	0.00
Feb-72	145,835	734.65	0.00		Feb-77	124,227	725.52	0.00
Mar-72	143,637	733.76	0.00		Mar-77	122,596	724.79	0.00
Apr-72	140,716	732.56	0.00		Apr-77	119,730	723.49	0.00
May-72	133,489	729.55	0.00		May-77	116,978	722.23	0.00
Jun-72	126,902	726.70	0.00		Jun-77	113,021	720.38	0.00
Jul-72	122,147	724.59	0.00		Jul-77	105,049	716.52	0.00
Aug-72	115,785	721.68	0.00		Aug-77	100,525	714.24	0.00
Sep-72	110,057	718.97	0.00		Sep-77	96,832	712.33	0.00

Table B-2 Simulated End-of-Month Storage, Elevation, and Surcharge in Cachuma Reservoir Under Alterantive 5C Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-77	94,131	710.90	0.00		Oct-82	141,308	732.81	0.00
Nov-77	91,989	709.75	0.00		Nov-82	141,134	732.74	0.00
Dec-77	91,596	709.54	0.00		Dec-82	155,522	738.44	0.00
Jan-78	110,214	719.04	0.00		Jan-83	197,343	753.00	3.00
Feb-78	197,343	753.00	3.00		Feb-83	197,343	753.00	3.00
Mar-78	197,343	753.00	3.00		Mar-83	197,343	753.00	3.00
Apr-78	197,343	753.00	3.00		Apr-83	197,343	753.00	3.00
May-78	197,343	753.00	3.00		May-83	197,343	753.00	3.00
Jun-78	196,164	752.62	2.62		Jun-83	197,343	753.00	3.00
Jul-78	191,410	751.10	1.10		Jul-83	195,792	752.51	2.51
Aug-78	186,633	749.54	0.00		Aug-83	192,794	751.55	1.55
Sep-78	182,747	748.24	0.00		Sep-83	189,485	750.47	0.47
Oct-78	178,924	746.94	0.00		Oct-83	190,062	750.66	0.66
Nov-78	177,449	746.43	0.00		Nov-83	193,292	751.71	1.71
Dec-78	176,286	746.03	0.00		Dec-83	197,343	753.00	3.00
Jan-79	182,900	748.29	0.00		Jan-84	197,343	753.00	3.00
Feb-79	197,343	753.00	3.00		Feb-84	197,343	753.00	3.00
Mar-79	197,343	753.00	3.00		Mar-84	196,463	752.72	2.72
Apr-79	197,343	753.00	3.00		Apr-84	193,915	751.91	1.91
May-79	196,666	752.78	2.78		May-84	188,563	750.17	0.17
Jun-79	192,300	751.39	1.39		Jun-84	183,291	748.42	0.00
Jul-79	186,310	749.43	0.00		Jul-84	176,710	746.18	0.00
Aug-79	180,500	747.48	0.00		Aug-84	171,016	744.17	0.00
Sep-79	175,481	745.75	0.00		Sep-84	165,390	742.13	0.00
Oct-79	171,071	744.19	0.00		Oct-84	161,366	740.64	0.00
Nov-79	168,920	743.42	0.00		Nov-84	159,660	740.01	0.00
Dec-79	167,876	743.04	0.00		Dec-84	160,026	740.14	0.00
Jan-80	170,346	743.93	0.00		Jan-85	159,380	739.90	0.00
Feb-80	197,343	753.00	3.00		Feb-85	159,089	739.79	0.00
Mar-80	197,343	753.00	3.00		Mar-85	157,917	739.35	0.00
Apr-80	197,343	753.00	3.00		Apr-85	155,329	738.37	0.00
May-80	197,343	753.00	3.00		May-85	151,388	736.85	0.00
Jun-80	194,206	752.00	2.00		Jun-85	143,542	733.72	0.00
Jul-80	189,014	750.32	0.32		Jul-85	135,617	730.44	0.00
Aug-80	183,304	748.43	0.00		Aug-85	130,175	728.13	0.00
Sep-80	178,486	746.79	0.00		Sep-85	124,481	725.63	0.00
Oct-80	174,488	745.40	0.00		Oct-85	121,056	724.10	0.00
Nov-80	172,221	744.60	0.00		Nov-85	120,448	723.82	0.00
Dec-80	170,507	743.99	0.00		Dec-85	119,022	723.17	0.00
Jan-81	170,574	744.02	0.00		Jan-86	118,620	722.99	0.00
Feb-81	171,073	744.19	0.00		Feb-86	162,196	740.95	0.00
Mar-81	189,024	750.32	0.32		Mar-86	195,615	752.45	2.45
Apr-81	188,243	750.07	0.07		Apr-86	197,343	753.00	3.00
May-81	185,064	749.02	0.00		May-86	193,967	751.92	1.92
Jun-81	180,552	747.50	0.00		Jun-86	189,261	750.40	0.40
Jul-81	175,068	745.61	0.00		Jul-86	182,736	748.24	0.00
Aug-81	168,622	743.31	0.00		Aug-86	176,659	746.16	0.00
Sep-81	162,703	741.14	0.00		Sep-86	171,271	744.26	0.00
Oct-81	158,709	739.65	0.00		Oct-86	167,288	742.83	0.00
Nov-81	156,614	738.86	0.00		Nov-86	165,547	742.19	0.00
Dec-81	155,281	738.35	0.00		Dec-86	163,892	741.58	0.00
Jan-82	154,596	738.09	0.00		Jan-87	162,497	741.07	0.00
Feb-82	153,472	737.65	0.00		Feb-87	161,276	740.61	0.00
Mar-82	155,667	738.50	0.00		Mar-87	160,533	740.33	0.00
Apr-82	171,360	744.30	0.00		Apr-87	156,243	738.72	0.00
May-82	169,727	743.71	0.00		May-87	152,209	737.17	0.00
Jun-82	166,462	742.53	0.00		Jun-87	147,588	735.35	0.00
Jul-82	157,700	739.27	0.00		Jul-87	142,274	733.20	0.00
Aug-82	149,955	736.28	0.00		Aug-87	135,113	730.23	0.00
Sep-82	143,590	733.74	0.00		Sep-87	129,721	727.93	0.00

Table B-2								
Simulated End-of-Month Storage, Elevation, and Surcharge								
in Cachuma Reservoir Under Alterantive 5C								
Based on SYRHM, WY 1918-1993								
Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)		Month	Storage (acre-feet)	Elevation (feet)	Surcharge (feet)
Oct-87	127,644	727.03	0.00		Oct-92	141,168	732.75	0.00
Nov-87	126,006	726.31	0.00		Nov-92	136,406	730.78	0.00
Dec-87	125,165	725.94	0.00		Dec-92	135,994	730.60	0.00
Jan-88	124,807	725.78	0.00		Jan-93	197,343	753.00	3.00
Feb-88	124,226	725.52	0.00		Feb-93	197,343	753.00	3.00
Mar-88	126,860	726.69	0.00		Mar-93	197,343	753.00	3.00
Apr-88	124,423	725.61	0.00		Apr-93	197,343	753.00	3.00
May-88	121,042	724.09	0.00		May-93	197,343	753.00	3.00
Jun-88	113,518	720.61	0.00		Jun-93	196,624	752.77	2.77
Jul-88	108,664	718.29	0.00		Jul-93	192,343	751.40	1.40
Aug-88	102,285	715.14	0.00		Aug-93	187,453	749.81	0.00
Sep-88	96,727	712.28	0.00		Sep-93	182,918	748.30	0.00
Oct-88	94,082	710.88	0.00					
Nov-88	92,684	710.12	0.00					
Dec-88	91,869	709.68	0.00					
Jan-89	90,747	709.07	0.00					
Feb-89	90,731	709.07	0.00					
Mar-89	89,261	708.26	0.00					
Apr-89	86,710	706.84	0.00					
May-89	83,595	705.07	0.00					
Jun-89	79,125	702.47	0.00					
Jul-89	72,912	698.69	0.00					
Aug-89	68,476	695.86	0.00					
Sep-89	65,540	693.93	0.00					
Oct-89	63,481	692.54	0.00					
Nov-89	61,862	691.44	0.00					
Dec-89	60,471	690.47	0.00					
Jan-90	59,641	689.88	0.00					
Feb-90	58,783	689.27	0.00					
Mar-90	57,151	688.09	0.00					
Apr-90	54,882	686.42	0.00					
May-90	51,019	683.48	0.00					
Jun-90	48,602	681.58	0.00					
Jul-90	44,949	678.59	0.00					
Aug-90	41,892	675.98	0.00					
Sep-90	39,789	674.12	0.00					
Oct-90	38,033	672.51	0.00					
Nov-90	36,874	671.42	0.00					
Dec-90	36,189	670.76	0.00					
Jan-91	35,466	670.06	0.00					
Feb-91	34,938	669.54	0.00					
Mar-91	69,111	696.27	0.00					
Apr-91	77,662	701.60	0.00					
May-91	74,784	699.85	0.00					
Jun-91	69,981	696.83	0.00					
Jul-91	64,365	693.14	0.00					
Aug-91	58,710	689.22	0.00					
Sep-91	55,990	687.24	0.00					
Oct-91	53,192	685.15	0.00					
Nov-91	51,863	684.14	0.00					
Dec-91	51,696	684.01	0.00					
Jan-92	52,335	684.50	0.00					
Feb-92	138,025	731.45	0.00					
Mar-92	165,017	742.00	0.00					
Apr-92	172,518	744.71	0.00					
May-92	170,818	744.10	0.00					
Jun-92	166,776	742.64	0.00					
Jul-92	160,772	740.42	0.00					
Aug-92	151,052	736.71	0.00					
Sep-92	144,545	734.13	0.00					

Draft Technical Memorandum No. 7
Hydrologic Impacts of Alternatives 5B and 5C on Salinity

C

D R A F T
TECHNICAL MEMORANDUM No. 7

STETSON ENGINEERS INC.
2171 E. Francisco Blvd., Suite K • San Rafael, California • 94901
TEL: (415) 457-0701 FAX: (415) 457-1638 E-mail: alis@stetsonengineers.com

TO: David Fee, URS

DATE: June 16, 2006
rev. August 22, 2006

FROM: Curtis Lawler

JOB NO: 1893

RE: Hydrologic Impacts of Alternatives 5B and 5C on Salinity

1. INTRODUCTION

This technical memorandum was prepared to determine the hydrologic impacts of Alternatives 5B and 5C on surface water salinity and ground water salinity in the Lompoc Plain. The two additional alternatives (Alternatives 5B and 5C) were identified for the revised Draft Environmental Impact Report on 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) dated August 2003. Draft Technical Memorandum No. 5 (Re: Hydrologic Impact Analysis of Possible Cachuma Operations Alternatives) provides a detailed discussion on how these alternatives (Alternatives 5B and 5C) were analyzed using the Santa Ynez River Hydrology Model (SYRHM). Draft Technical Memorandum No. 5 includes the results on: (1) Cachuma Reservoir operations; (2) Santa Ynez River flows; (3) above Narrows groundwater storage; (4) water rights releases; (5) Cachuma Project water supply; (6) State Water Project (SWP) deliveries; and (7) sensitivity analysis.

Presented in this memorandum are the results of hydrologic impact analyses of Alternatives 5B and 5C for:

- Effects on salinity in Cachuma Reservoir;
- Effects on salinity of surface flows at Lompoc Narrows; and
- Effects on salinity of ground water in Lompoc Plain.

The focus of this salinity analysis is on concentrations of total dissolved solids (TDS) in the Santa Ynez River (surface flow) at the Lompoc Narrows. The Santa Ynez River passes through the Lompoc Narrows, then flows across the Lompoc Plain, where the Lompoc Plain ground water basin is located. The TDS concentrations of the groundwater in the central and

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western Lompoc plains have increased from less than 1,000 milligrams per liter (mg/L) in the 1940s to greater than 2,000 mg/L in the 1960s (USGS, 1997). The surface water flow of Santa Ynez River reaching the Lompoc Narrows is a significant source of recharge for the Lompoc Plain aquifer. This study has been undertaken, primarily, for the purpose of determining the impacts, if any, of the Cachuma Project operations (including SWP water deliveries) on the TDS concentrations of surface flows at the Lompoc Narrows.

Hydrologic impact analyses were performed using three different models. The SYRHM was used to determine impacts to the surface water at the Lompoc Narrows. The Lompoc groundwater models by the U.S. Geological Survey (USGS) and Hydrologic Consultants, Inc (HCI) were used to determine impacts on salinity in the Lompoc Plain main aquifer.

2. SURFACE WATER SALINITY ANALYSIS OF ALTERNATIVES 5B AND 5C

This section covers the methodology utilized for modeling the salinity in the Santa Ynez River and the impact analysis for Alternatives 5B and 5C.

2A. METHODOLOGY FOR MODELING SALINITY IN SANTA YNEZ RIVER FROM CACHUMA RESERVOIR TO LOMPOC NARROWS

The SYRHM was utilized for the surface water salinity analysis of the EIR alternatives. Technical Memorandum No. 1 provides an overview of the SYRHM and modeling results prepared for the SWRCB Draft EIR (August 2003) which included hydrologic analyses for seven alternatives (Alternatives 1, 2, 3A, 3B, 3C, 4A and 4B). Technical Memorandum No. 3 explains the methodology of modeling surface water salinity in the SYRHM, including model calibration. An overview of the main sources of salts in the surface water as modeled in the SYRHM is summarized below.

- Salinity varies in the local runoff within the Santa Ynez River watershed according to the magnitude of surface flows, where high flows have low salinity and low flows have high salinity. Five different flow-salinity relationships were used in the SYRHM based on five geographic regions with measured salinity data.

- Imports of SWP water with lower salinity affects the TDS concentrations when blended with Santa Ynez River water. In the SYRHM, the SWP imports are either mixed directly in Cachuma Reservoir or released as commingled water into the Santa Ynez River through the Cachuma outlet works.

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- Another source of salt loading incorporated in the SYRHM is channel loading where the salinity of the Santa Ynez River increases from Solvang to the Lompoc Narrows due to salt contributions from the river channel and associated subflow in the alluvial deposits.

Alternatives 5B and 5C are very similar to Alternatives 3B and 3C in terms of how the surface water salinity is modeled in the SYRHM. Table 1 shows the SWP deliveries under various alternatives including Alternative 5B and 5C. Alternatives 5B and 5C would involve slightly different operations of the SWP imports as discussed below.

TABLE 1
SWP WATER DELIVERIES USED IN SYRHM

	Average for Period 1942-1993 , afa				
	Exchange with ID#1	BNA Exchange for Alt 4B 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
4B	2,501	1,770	4,853	1,245	10,369
5B	2,470	0	5,251	2,317	10,038
5C	2,484	0	5,246	2,337	10,068

The total amount of SWP water delivery to the South Coast would be reduced slightly (<1%) under Alternatives 5B and 5C in comparison to the baseline condition (Alternative 2). However, more SWP is released directly into the river in Alternatives 5B and 5C. This is due to the increased use of the outlet works for making additional releases for fish under Alternatives 5B and 5C. The higher target flows under Alternatives 5B and 5C would require at times releases greater than 10 cfs (Hilton Creek watering system capacity) and releases for fish might contain up to 50% SWP water and have a lower salinity. However, during the months of December through June, no SWP water could be delivered if releases are being made for fish through the outlet works.

Tables 2 and 3 show the annual SWP imports under Alternatives 5B and 5C. Please note that tables in Appendix D of Draft Technical Memorandum No. 5 of August 11, 2005 were revised

Table 2
SUMMARY OF STATE WATER PROJECT DELIVERIES
FOR ALTERNATIVE 5B
(ACRE-FEET/YEAR)

	DEMAND		SUPPLY			DELIVERY			
WATER YEAR	TOTAL SWP Demand [1]	ID No. 1 Exchange	M&I Projected Delivery as Percentage of Full Entitlement [2]	ID No. 1 Exchange Shortage [3]	Reduced Delivery due to Spill [4]	ID No. 1 Exchange	SWP in Cachuma [5]	SWP in Outlet Works [6]	Total Imports under South Coast Contracts
1942	13,750	2,571	100%	100%	1,868	2,571	8,392	521	11,483
1943	13,750	2,571	89%	100%	3,173	2,571	2,831	1,421	6,822
1944	13,750	2,571	92%	100%	2,467	2,571	5,367	1,500	9,438
1945	13,750	2,571	90%	100%	1,645	2,571	6,589	1,659	10,819
1946	13,750	2,571	88%	100%	0	2,571	6,589	4,988	14,148
1947	13,750	2,571	75%	100%	0	2,571	3,203	4,888	10,662
1948	13,750	2,571	67%	100%	0	2,571	4,007	2,588	9,166
1949	13,750	2,571	65%	88%	0	2,272	5,649	1,055	8,976
1950	13,750	2,571	67%	69%	0	1,768	6,162	1,236	9,167
1951	13,750	2,571	88%	51%	0	1,321	10,196	515	12,031
1952	13,750	2,571	96%	88%	1,820	2,258	5,022	1,647	8,927
1953	13,750	2,571	90%	100%	0	2,571	9,207	3,065	14,843
1954	13,750	2,571	83%	100%	0	2,571	5,892	2,995	11,458
1955	13,750	2,571	69%	100%	0	2,571	4,123	2,855	9,549
1956	13,750	2,571	90%	97%	0	2,493	8,174	1,494	12,161
1957	13,750	2,571	88%	84%	0	2,171	5,863	3,101	11,135
1958	13,750	2,571	90%	93%	1,677	2,379	7,350	1,171	10,900
1959	13,750	2,571	88%	100%	0	2,571	7,283	3,162	13,016
1960	13,750	2,571	63%	100%	0	2,571	3,749	2,274	8,594
1961	13,750	2,571	61%	98%	0	2,515	4,848	1,040	8,403
1962	13,750	2,571	78%	99%	0	2,546	3,216	2,047	7,810
1963	13,750	2,571	94%	100%	0	2,571	12,415	885	15,871
1964	13,750	2,571	88%	100%	0	2,571	9,285	175	12,031
1965	13,750	2,571	82%	93%	0	2,398	5,642	3,227	11,267
1966	13,750	2,571	96%	98%	0	2,520	3,591	3,177	9,288
1967	13,750	2,571	96%	100%	3,545	2,571	2,705	5,665	10,942
1968	13,750	2,571	89%	100%	0	2,571	7,153	2,684	12,409
1969	13,750	2,571	93%	100%	4,230	2,571	2,705	2,044	7,321
1970	13,750	2,571	89%	100%	0	2,571	8,760	2,168	13,499
1971	13,750	2,571	94%	100%	0	2,571	5,157	5,523	13,251
1972	13,750	2,571	88%	100%	0	2,571	4,945	3,857	11,373
1973	13,750	2,571	82%	100%	1,453	2,571	3,453	2,333	8,356
1974	13,750	2,571	94%	100%	0	2,571	7,793	2,171	12,535
1975	13,750	2,571	96%	100%	1,773	2,571	4,015	2,142	8,728
1976	13,750	2,571	88%	100%	0	2,571	7,732	5,506	15,809
1977	13,750	2,571	33%	100%	0	2,571	888	1,364	4,823
1978	13,750	2,571	68%	100%	2,231	2,571	3,421	922	6,914
1979	13,750	2,571	85%	100%	2,214	2,571	3,271	1,515	7,357
1980	13,750	2,571	82%	100%	2,875	2,571	2,705	2,179	7,455
1981	13,750	2,571	83%	100%	0	2,571	9,572	1,485	13,628
1982	13,750	2,571	94%	100%	0	2,571	6,004	4,412	12,986
1983	13,750	2,571	100%	100%	5,544	2,571	4,716	384	7,671
1984	13,750	2,571	100%	100%	2,779	2,571	3,345	1,632	7,548
1985	13,750	2,571	96%	100%	0	2,571	6,292	5,291	14,154
1986	13,750	2,571	81%	100%	699	2,571	4,958	2,178	9,706
1987	13,750	2,571	69%	100%	0	2,571	7,928	1,666	12,166
1988	13,750	2,571	43%	100%	0	2,571	1,433	1,958	5,962
1989	13,750	2,571	58%	93%	0	2,385	3,749	1,887	8,021
1990	13,750	2,571	46%	75%	0	1,916	3,189	1,197	6,302
1991	13,750	2,571	29%	75%	0	1,927	0	2,084	4,011
1992	13,750	2,571	31%	95%	0	2,445	44	1,713	4,202
1993	13,750	2,571	76%	100%	3,282	2,571	2,460	1,835	6,866
AVG	13,750	2,571	80%	96%	832	2,470	5,251	2,317	10,038

NOTES
1) Based on total South Coast contractual agreements with CCWA not including drought buffers and additional water (4,500 afy) contracted by Goleta.
2) Based on DWR's SWP model DWRSIM v. 9.06T
Uses results from DWR's No Action scenario 786 which uses Delta historic hydrology
with regulations (including 1995 WQCP Bay-Delta Accord, 1997 AFRP CVPIA(b) and the New Melones Interim Operation plan)
and no new storage facilities. The percentages in this table do not include the option of purchasing the 10% drought buffer.
3) Based on shortages in Cachuma Project estimated by the SYRHM 0498
4) Assumes no CCWA deliveries when Cachuma is spilling and also that South Coast would not want to make-up that delivery water
because of the wetness of the basin and already assuming full deliveries of 13750 pending spills
5) SWP reductions in delivery (due to restrictions of 50% SWP during water right releases and 0% SWP during passage releases)
are redistributed to the following months up to one year.
6) Limited to being 50% of outlet releases

Table 3
SUMMARY OF STATE WATER PROJECT DELIVERIES
FOR ALTERNATIVE 5C
(ACRE-FEET/YEAR)

	DEMAND		SUPPLY			DELIVERY			
WATER YEAR	TOTAL SWP Demand [1)]	ID No. 1 Exchange	M&I Projected Delivery as Percentage of Full Entitlement [2)]	ID No. 1 Exchange Shortage [3)]	Reduced Delivery due to Spill [4)]	ID No. 1 Exchange	SWP in Cachuma [5)]	SWP in Outlet Works [6)]	Total Imports under South Coast Contracts
1942	13,750	2,571	100%	100%	919	2,571	9,341	522	12,434
1943	13,750	2,571	89%	100%	3,173	2,571	2,830	1,421	6,821
1944	13,750	2,571	92%	100%	2,467	2,571	5,367	1,500	9,438
1945	13,750	2,571	90%	100%	1,645	2,571	6,589	1,660	10,820
1946	13,750	2,571	88%	100%	0	2,571	6,589	4,989	14,149
1947	13,750	2,571	75%	100%	0	2,571	3,203	4,887	10,661
1948	13,750	2,571	67%	100%	0	2,571	4,004	2,591	9,166
1949	13,750	2,571	65%	90%	0	2,324	5,595	1,057	8,976
1950	13,750	2,571	67%	73%	0	1,866	6,080	1,220	9,166
1951	13,750	2,571	88%	56%	0	1,431	10,086	515	12,031
1952	13,750	2,571	96%	89%	1,816	2,283	5,014	1,735	9,032
1953	13,750	2,571	90%	100%	0	2,571	9,207	2,965	14,743
1954	13,750	2,571	83%	100%	0	2,571	5,892	2,995	11,458
1955	13,750	2,571	69%	100%	0	2,571	4,124	2,854	9,549
1956	13,750	2,571	90%	98%	0	2,529	8,144	1,491	12,165
1957	13,750	2,571	88%	87%	0	2,243	5,819	3,094	11,156
1958	13,750	2,571	90%	94%	1,673	2,405	7,317	1,167	10,889
1959	13,750	2,571	88%	100%	0	2,571	7,274	3,162	13,007
1960	13,750	2,571	63%	100%	0	2,571	3,749	2,274	8,594
1961	13,750	2,571	61%	99%	0	2,551	4,817	1,035	8,403
1962	13,750	2,571	78%	100%	0	2,562	3,209	2,055	7,827
1963	13,750	2,571	94%	100%	0	2,571	12,398	885	15,854
1964	13,750	2,571	88%	100%	0	2,571	9,285	175	12,031
1965	13,750	2,571	82%	95%	0	2,433	5,612	3,223	11,268
1966	13,750	2,571	96%	98%	0	2,530	3,588	3,177	9,295
1967	13,750	2,571	96%	100%	3,545	2,571	2,705	5,666	10,942
1968	13,750	2,571	89%	100%	0	2,571	7,153	2,685	12,409
1969	13,750	2,571	93%	100%	4,230	2,571	2,705	2,044	7,321
1970	13,750	2,571	89%	100%	0	2,571	8,760	2,168	13,498
1971	13,750	2,571	94%	100%	0	2,571	5,157	5,523	13,251
1972	13,750	2,571	88%	100%	0	2,571	4,945	3,778	11,295
1973	13,750	2,571	82%	100%	1,453	2,571	3,531	2,333	8,435
1974	13,750	2,571	94%	100%	0	2,571	7,793	2,754	13,118
1975	13,750	2,571	96%	100%	1,773	2,571	4,058	1,816	8,445
1976	13,750	2,571	88%	100%	0	2,571	7,732	5,449	15,752
1977	13,750	2,571	33%	100%	0	2,571	1,251	1,357	5,178
1978	13,750	2,571	68%	100%	2,231	2,571	3,324	1,019	6,914
1979	13,750	2,571	85%	100%	2,214	2,571	3,271	1,515	7,357
1980	13,750	2,571	82%	100%	2,875	2,571	2,705	2,179	7,455
1981	13,750	2,571	83%	100%	0	2,571	9,571	1,485	13,628
1982	13,750	2,571	94%	100%	0	2,571	6,004	4,412	12,986
1983	13,750	2,571	100%	100%	5,544	2,571	4,716	384	7,671
1984	13,750	2,571	100%	100%	2,779	2,571	3,345	1,632	7,548
1985	13,750	2,571	96%	100%	0	2,571	6,292	5,291	14,154
1986	13,750	2,571	81%	100%	699	2,571	4,953	2,202	9,725
1987	13,750	2,571	69%	100%	0	2,571	7,917	1,701	12,189
1988	13,750	2,571	43%	100%	0	2,571	1,391	1,958	5,920
1989	13,750	2,571	58%	95%	0	2,433	3,653	1,935	8,021
1990	13,750	2,571	46%	78%	0	2,011	3,096	1,195	6,302
1991	13,750	2,571	29%	78%	0	2,004	296	1,711	4,010
1992	13,750	2,571	31%	96%	0	2,460	0	1,741	4,201
1993	13,750	2,571	76%	100%	3,282	2,571	1,337	2,958	6,866
AVG	13,750	2,571	80%	97%	814	2,484	5,246	2,337	10,068

NOTES
1) Based on total South Coast contractual agreements with CCWA not including drought buffers and additional water (4,500 afy) contracted by Goleta.
2) Based on DWR's SWP model DWRSIM v. 9.06T
Uses results from DWR's No Action scenario 786 which uses Delta historic hydrology
with regulations (including 1995 WQCP Bay-Delta Accord, 1997 AFRP CVPIA(b) and the New Melones Interim Operation plan)
and no new storage facilities. The percentages in this table do not include the option of purchasing the 10% drought buffer.
3) Based on shortages in Cachuma Project estimated by the SYRHM 0498
4) Assumes no CCWA deliveries when Cachuma is spilling and also that South Coast would not want to make-up that delivery water
because of the wetness of the basin and already assuming full deliveries of 13750 pending spills
5) SWP reductions in delivery (due to restrictions of 50% SWP during water right releases and 0% SWP during passage releases)
are redistributed to the following months up to one year.
6) Limited to being 50% of outlet releases

to reflect rescheduling of the SWP imports when water rights releases are made. This is consistent with the modeling of other EIR alternatives, except Alternative 1 which does not have SWP imports. This rescheduling of SWP imports is done in accordance with the Settlement Agreement of 2002 which states that the parties will "make best efforts to maximize the delivery by the Central Coast Water Authority ('CCWA') of State Water Project (SWP) water with lower concentrations of total dissolved solids ('TDS') into the outlet works at Bradbury Dam during WR 89-18 water rights releases consistent with the NMFS BO."

In performing the surface water salinity modeling for Alternatives 5B and 5C, a computer programming "bug" was found in the SYRHM model code for surface water salinity modeling originally performed in 2001. The bug relates to Cachuma Reservoir salinity. Releases for fish are made from Cachuma Reservoir on an iterative basis in the SYRHM model code for each month until downstream flow targets are met. Due to these iterations within the model's monthly timestep, the salts from the incremental releases for fish were not properly taken out of Cachuma Reservoir. The results of this model programming bug is that the salinity in Cachuma Reservoir was about 8 mg/L higher than it should have been for Alternative 2 and about 18 mg/L higher than it should have been for Alternatives 3A, 3B, and 3C. Because Alternative 1 did not have releases for fish, the Cachuma Reservoir salinity in Alternative 1 is unchanged. Likewise, the model calibration of the SYRHM for surface water salinity modeling did not change because the model calibration did not have releases for fish. Table 4 summarizes the median Cachuma Reservoir salinity for the period 1942-1993 for the previous and revised surface water salinity model runs performed in 2001 and 2006, respectively. This programming bug created errors in Cachuma Reservoir salinity of about 1.5 to 3 percent based on the median salinity.

Table 4
Corrections in Simulated Cachuma Reservoir Salinity (1942-1993)

Alternative	Median Salinity (mg/L)			
	Technical Memorandum 2001	Technical Memorandum 2006	Difference	Percentage
1	605	605	0	0
2	575	566	-8	-1.5%
3A	585	567	-18	-3.1%
3B	585	567	-18	-3.2%
3C	585	567	-18	-3.2%
4B	591	572	-19	-3.3%
5B	NA	569	0	0
5C	NA	570	0	0

The error from the programming bug was even smaller in the salinity of surface flows at the Lompoc Narrows due to attenuation from the above Narrows riparian reach. The results of this model programming bug is that the surface water salinity at the Lompoc Narrows was about 2 mg/L higher than it should have been for Alternative 2 and about 5 mg/L higher than it should have been for Alternatives 3A, 3B, and 3C. Table 5 summarizes the surface water salinity for the flows for the Lompoc Narrows for the previous and revised surface water salinity model runs performed in 2001 and 2006, respectively. This programming bug created errors in the Santa Ynez River salinity at the Lompoc Narrows of less than one percent based on the average salinity.

Table 5
Corrections in Simulated Salinity of Santa Ynez River at Lompoc Narrows (1942-1993)

Alternative	**Average Annual Flow Weighed TDS (mg/L)**			
	Technical Memorandum 2001	**Technical Memorandum 2006**	**Difference**	**Percentage**
1	766	766	0	0
2	743	741	-2	-0.3%
3A	752	747	-5	-0.7%
3B	758	753	-5	-0.7%
3C	751	746	-5	-0.7%
4B	562	560	-2	-0.4%
5B	NA	747	0	0
5C	NA	747	0	0

The quantity of surface water flows for any of the alternatives is not affected by the above corrections. Since the revised surface water salinity changes are small, none of the conclusions from the previous Stetson technical memoranda have changed. However, all surface water salinity figures have been updated here. Aside from the above changes, all other modeling assumptions and limitations in the SYRHM are the same for all of the alternatives, including Alternatives 5B and 5C.

2B. Results of Surface Water Analysis – Alternatives 5B and 5C

Overall, the SYRHM results indicate that the surface water salinity under Alternatives 5B and 5C is very similar to Alternatives 3B and 3C due to similar operations for WR 89-18 and releases for fish and similar import quantities of SWP water.

Figure 1 shows the TDS concentrations in Cachuma Reservoir for each alternative. Alternative 1 has the highest TDS due to no imports of SWP. All of the TDS concentrations are very similar, except during droughts when the amount of storage in Cachuma Reservoir decreases so that SWP imports become a larger percentage of the storage.

Figure 2 shows the frequency of TDS concentrations in water rights releases directly below the dam. SWP mixing in the outlet works is limited to 50% of the WR 89-18 releases, and SWP imports are typically about 300 mg/L lower in TDS concentration than the TDS in Cachuma Reservoir. For these reasons, the TDS of WR 89-18 releases under Alternative 2, 3A, 3B, 3C, 4B, 5B, and 5C are typically about 150 mg/L lower than Alternative 1 as shown in Figure 2.

The simulated flow and TDS of the Santa Ynez River at the Lompoc Narrows from the SYRHM are the inputs to the Lompoc Plain groundwater models. The differences in flow and TDS concentrations of the surface water at the Lompoc Narrows are discussed briefly here in order to facilitate the understanding of the simulated response in TDS concentrations of the Lompoc Plain ground water for the EIR alternatives.

The primary difference between the EIR alternatives regarding the salinity at the Narrows is related to the importation of SWP water. In Alternative 1, there are no SWP imports. In Alternative 4B, SWP imports are recharged directly into Lompoc Plain aquifer in exchange for the Below Narrows Account (WR 89-18) water. All of the other alternatives (including Alternatives 5B and 5C) are very similar in terms of SWP imports. Figure 3 shows the frequency of TDS concentrations of water rights releases (WR 89-18) at the Narrows. The frequency analysis does not include months of no flows or flows less than 0.5 cfs at the Narrows. Figure 3 indicates that imports of SWP water improve the salinity at the Narrows during WR 89-18 releases. The median difference in TDS concentrations between Alternative 1 and other alternatives (including Alternatives 5B and 5C) is about 130 mg/L.

The total surface flow at the Lompoc Narrows is very similar for the EIR alternatives because of the tributary contributions in the reach between Bradbury Dam and the Lompoc Narrows and the similarity in total amount of water discharged from Cachuma Reservoir as either spills, water rights releases, or releases for fish (Stetson, 2001, 2005). Figure 4 shows the annual average flows of the Santa Ynez River at the Lompoc Narrows. The monthly average simulated flows based on the SYRHM for the period 1942-1988 are shown in Figure 5. The differences between the alternatives are most apparent during summer months. The greatest differences exist between Alternatives 2, 3, and 5, which are very similar, and Alternative 4. In Alternative 4B,

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SWP water is recharged directly at or below the Narrows and increases the flow significantly in dry months. However, directly upstream of the recharge point near the Lompoc Narrows, surface flows are actually smaller than the rest of the alternatives due to the proposed Below Narrows Exchange as shown in Figure 5.

The average annual flow weighted TDS of the Santa Ynez River (simulated by SYRHM) at the Narrows for the EIR alternatives is shown in Figure 6. The monthly average TDS of flows simulated at the Narrows for each EIR alternative is shown in Figure 7. These graphs clearly show the inverse relationship between flow and TDS. The wintertime TDS is 300 to 600 mg/L lower than summertime TDS because of the higher flows. The TDS concentrations for Alternatives 2, 3B, 3C, 5B, and 5C are very similar. There is less similarity in the TDS for Alternative 4. Alternative 4B stands out because, at low flows, the effects of discharging State Project water below the Narrows for recharge significantly reduce the average TDS, even though the amount of water discharged is relatively small. However, the TDS at the Narrows, except during the winter months, would be higher under Alternative 4B immediately upstream of the recharge area than it is under the baseline operation (Alternative 2) because Below Narrows Account releases would no longer be made from Cachuma Reservoir.

3. GROUND WATER SALINITY ANALYSIS OF ALTERNATIVES 5B AND 5C

This section covers the methodology utilized for modeling salinity in the Lompoc ground water basin and the results of analysis using the USGS and HCI models.

3A. METHODOLOGY FOR MODELING SALINITY IN LOMPOC PLAIN GROUND WATER BASIN

Two sets of Lompoc Plain groundwater models were utilized for the ground water salinity analysis of the alternatives. These models are generally referred to as the USGS and HCI flow and solute transport models. Technical Memorandum No. 4 explains the methodology of modeling groundwater salinity in the Lompoc Plain. The reader is also referred to the USGS (1997) and HCI (1997, 1999) reports that provide a detailed description of the models.

The objective of this analysis is to simulate the relative change in the quality of ground-water in the Main Zone aquifer of the Lompoc Plain that will result from various Cachuma Reservoir operational alternatives to be considered in the EIR. The USGS and HCI flow and transport model simulations for the Cachuma EIR alternatives both use the same Santa Ynez River flow and TDS input data at the Lompoc Narrows produced as outputs by the SYRHM.

The common time period for all models is controlled by the USGS model period which was January 1941 to December 1988. Although the models were run for their respective calibration periods, the hydrologic period selected for evaluation of the EIR alternatives using the ground water models is 1952 to 1988. This period was selected for averaging the effects of model results for each alternative because it was a more balanced hydrologic period that overlaps the calibration periods of both sets of models, and because it limits the effect of using different initial conditions. In other words, the same initial conditions were used for all of the EIR alternatives in each model.

The most significant modifications made to the ground-water flow and transport models from the calibrated versions that were provided by the USGS and HCI was to utilize the 1988 ground-water pumping data as a constant throughout the simulations. The purpose in using constant pumping is to better represent current conditions, and allow for a suitable comparison between the EIR alternatives. Also, initial water levels and TDS were reset to those simulated at the end of 1988 for the original calibration of each model.

From the limited evaluation of the models that could be conducted within the scope of this study, it is believed that the TDS results of models are only accurate for future predictions to within a range of roughly 100 to 300 mg/L, depending upon location, magnitude of changes in input data, hydrologic conditions, length of simulation period and other factors. For use in comparative analysis, such as between EIR alternatives where changes in input are limited, the differences in TDS between simulations in a single model of less than 100 mg/L may be useful in cases where clear trends are exhibited.

The differences between EIR alternatives are best viewed within one model rather than between models since the differences in model construction and approach to calibration and the complexity of the system and limitation of data make it difficult to compare the models directly. The predictive capability of these models to simulate ground water quality conditions in the future is limited by: (1) the conversion of monthly SYRHM output into the biannual and annual stress periods in the USGS and HCI transport models, respectively; (2) the use of constant 1988 pumping, as originally developed for the model calibration, which may not represent present or future pumping amounts or pumping distribution by aquifer and subregion.

3B. Ground Water Model Results for Cachuma EIR Alternatives

For this study two well locations were selected from each of the primary subareas, Eastern, Central and Western Plain in order to evaluate the effects of each alternative in the regions of the majority of ground water pumping (Figure 8). The wells were selected on the basis of location, availability of measured water quality data at that location, and the fact that they were used as calibration wells by the USGS (Bright, and others, 1997). The following is a summary of the simulated water levels and TDS for selected sites within the Main Zone of the Lompoc Plain for the Cachuma EIR alternatives. The results are presented for each Alternative as tables representing the average TDS at each location over the period 1952 through 1982, and time series graphs of TDS and water levels representing the results for the entire simulated period used in the USGS and HCI models.

1. Average Simulated TDS for the 1952 – 1982 Base Period

The average TDS for the Main Zone aquifer in the Lompoc Plain for each subarea at selected locations and the flow-weighted average for the City of Lompoc active wells (five wells) are shown in Table 6. The average difference in TDS between Alternative 2 and other alternatives are shown in Table 7 as both a difference in TDS in mg/L and as a percentage. Alternative 2 was selected as the baseline, by which other alternatives can be compared for the purpose of the Cachuma EIR. The results shown in Table 6 illustrate the magnitude of the average simulated TDS in each subarea and within a given subarea. The values in Table 6 can provide an indication of the relative precision of the model results that, although presented to the nearest 1 mg/L, may be best evaluated by rounding to the nearest 100 mg/L. However, for comparisons between alternatives, differences of less than 100 mg/L may be useful where clear trends are observed.

Table 6 shows that, within the HCI model, the overall magnitude of the average TDS ranges from about 2000 to 2300 mg/L in the Western Plain, a relatively uniform 1800 mg/L in the Central Plain, over 800 to 1700 mg/L in the Eastern Plain, and about 900 to 1000 mg/L for the City of Lompoc wells. The range of TDS in the HCI model is approximately 1500 mg/L basin wide. The differences in results within each subarea range from about 900 mg/L in the Eastern Plain, 300 mg/L in the Western Plain, and no significant difference within the Central Plain. The new EIR alternatives (Alternatives 5B and 5C) also fall within these ranges of TDS in the HCI model.

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Table 6
Lompoc Plain Groundwater Quality
Simulated Average TDS for Selected Locations
Main Zone Aquifer (1952-1982)
[mg/L]

HCI Model

	Alt 1	Alt 2	Alt 3B	Alt 3C	Alt 4B	Alt5B	Alt 5C
Western Plain							
Well 26F1,3,4,5	2331	2330	2329	2330	2332	2333	2333
Well 25D1,3	2020	2018	2016	2016	2018	2017	2017
Central Plain							
Well 31A3	1786	1784	1784	1782	1803	1798	1798
Well 29N6	1785	1784	1784	1786	1794	1800	1799
Eastern Plain							
Well 28M2	1733	1728	1726	1723	1731	1715	1712
Well 34B1	1019	1009	1006	1002	842	986	987
City Wells - Avg	1022	1012	1011	1008	854	989	991

USGS Model

	Alt 1	Alt 2	Alt 3B	Alt 3C	Alt 4B	Alt 5B	Alt 5C
Western Plain							
Well 26F1,3,4,5	2901	2885	2844	2850	2906	2831	2830
Well 25D1,3	2291	2273	2231	2235	2284	2210	2209
Central Plain							
Well 31A3	2180	2180	2176	2176	2176	2172	2171
Well 29N6	1933	1937	1935	1935	1928	1934	1934
Eastern Plain							
Well 28M2	1769	1770	1758	1758	1752	1753	1754
Well 34B1	984	973	975	974	931	971	970
City Wells - Avg	1115	1108	1109	1107	1085	1105	1104

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Within the USGS model, Table 6 shows that the overall magnitude of the average TDS ranges from about 2200 to 2900 mg/L in the Western Plain, 1900 to 2200 mg/L in the Central Plain, about 900 to 1800 mg/L in the Eastern Plain, and about 1100 mg/L for the City of Lompoc wells. The range of TDS in the USGS model is approximately 2000 mg/L basin wide. The differences in results within each sub-area range from about 700 mg/L in the Western Plain, about 300 mg/L within the Central Plain, and 800 mg/L in the Eastern Plain. Alternatives 5B and 5C also fall within these ranges of TDS in the USGS model.

Table 7 was created to show the extremely small simulated TDS differences between the EIR alternatives. Results shown in Table 7 have been normalized relative to Alternative 2. The difference in TDS between alternatives at a given location may be considered below the absolute accuracy of either model. However, it is hoped that they may exhibit trends that would allow evaluation of the alternatives.

The results shown in Table 7 are primarily for comparisons between the EIR alternatives as simulated by a single model. These indicate only minor differences in the water quality in the Main Zone aquifer of the Lompoc Plain that result from the changes in Cachuma operations for the EIR alternatives. Cachuma operations that result in higher dry season flows due to increased releases for fish (Alternatives 3 and 5) provide benefits to the Eastern Plain (HCI and USGS) and possibly to the Western Plain (USGS). Alternatives that involve changes in operations directly within the Lompoc Plain basin such as Alternative 4B, which includes direct recharge of high quality SWP water in the basin, result in the most significant changes throughout the Main Zone in the Lompoc Plain. In general, the HCI model appears to be more sensitive to Cachuma operations in the Eastern Plain, and the USGS model appears to be more sensitive in the Western Plain.

None of the Alternatives considered for future operations exhibit conspicuous basin wide trends that would suggest it was superior to the others. Alternative 1 is more representative of past operations, but does exhibit a clear trend of inferior water quality basin wide, although the magnitude is relatively minor or even insignificant. Locally, the greatest improvement in ground water quality occurs near the Lompoc Narrows under Alternative 4B where recharging of low TDS SWP water results 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. Slight improvements in TDS are shown in the HCI model results for Alternatives 3B and 3C. Alternatives 5B and 5C show slight improvements compared to

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Table 7
Lompoc Plain Groundwater Quality
Simulated Average TDS for Selected Locations
Main Zone Aquifer (1952-1982)
[Alternatives - Alternative 2]

	HCI Model											
	Alt 1		Alt 3B		Alt 3C		Alt 4B		Alt 5B		Alt 5C	
	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%
Western Plain												
Well 26F1,3,4,5	1.4	0.1%	-0.4	0.0%	0.0	0.0%	2.0	0.1%	3.4	0.1%	3.4	0.1%
Well 25D1,3	2.6	0.1%	-1.9	-0.1%	-2.0	-0.1%	-0.1	0.0%	-0.7	0.0%	-0.7	0.0%
Central Plain												
Well 31A3	2.3	0.1%	-0.1	0.0%	-1.5	-0.1%	19.6	1.1%	14.2	0.8%	14.2	0.8%
Well 29N6	1.0	0.1%	-0.3	0.0%	1.2	0.1%	9.9	0.6%	15.6	0.9%	14.6	0.8%
Eastern Plain												
Well 28M2	5.0	0.3%	-1.6	-0.1%	-4.8	-0.3%	3.1	0.2%	-13.1	-0.8%	-16.1	-0.9%
Well 34B1	9.3	0.9%	-3.2	-0.3%	-6.8	-0.7%	-167.1	-16.6%	-23.2	-2.3%	-22.2	-2.2%
City Wells - Avg	10.3	1.0%	-1.4	-0.1%	-4.5	-0.4%	-158.2	-15.6%	-23.0	-2.3%	-21.0	-2.1%

	USGS Model											
	Alt 1		Alt 3B		Alt 3C		Alt 4B		Alt 5B		Alt 5C	
	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%	mg/l	%
Western Plain												
Well 26F1,3,4,5	15.5	0.5%	-41.0	-1.4%	-35.0	-1.2%	21.1	0.7%	-54.2	-1.9%	-55.2	-1.9%
Well 25D1,3	17.3	0.8%	-42.6	-1.9%	-38.3	-1.7%	10.4	0.5%	-63.5	-2.8%	-64.5	-2.8%
Central Plain												
Well 31A3	-0.1	0.0%	-4.0	-0.2%	-4.0	-0.2%	-4.5	-0.2%	-8.1	-0.4%	-9.1	-0.4%
Well 29N6	-3.6	-0.2%	-1.1	-0.1%	-1.2	-0.1%	-8.4	-0.4%	-2.6	-0.1%	-2.6	-0.1%
Eastern Plain												
Well 28M2	-0.7	0.0%	-11.9	-0.7%	-11.9	-0.7%	-17.5	-1.0%	-16.9	-1.0%	-15.9	-0.9%
Well 34B1	10.8	1.1%	1.7	0.2%	1.6	0.2%	-42.0	-4.3%	-1.8	-0.2%	-2.8	-0.3%
City Wells - Avg	7.0	0.6%	1.0	0.1%	-1.1	-0.1%	-23.5	-2.1%	-3.4	-0.3%	-4.4	-0.4%

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Alternatives 2, 3B and 3C due to both increased low flows at the Narrows resulting from more releases for fish from Cachuma Reservoir and more releases of SWP water directly into the river during the releases for fish through the outlet works during wet and above-normal years.

In general, the results for both models are generally consistent, although some differences in magnitude occur that may be explained by differences in boundary conditions, calibration approach and conceptual models. The ground water model results tend to favor Alternative 4B in the Eastern Plain. However, Alternative 4B would increase the TDS in the alluvial groundwater basin immediately upstream of the Lompoc Narrows, which is the Santa Rita sub-unit, due to the Below Narrows Exchange.

2. Time Series Graphs of USGS Model Results

Time series graph of water levels and TDS are presented as Figures 9 to 32 and are discussed briefly below for each of the six locations (Figure 8) selected for comparisons between the EIR alternatives. In general, the graphs show a degree of similarity between the alternatives which make it difficult to identify clear difference between them. In comparison, the changes in TDS shown in Stetson Technical Memorandum No. 4 showed large historical increases in TDS compared to the relatively minor differences simulated for most of the EIR alternatives. The times series graphs are shown for the entire calibration period of each model, unlike the TDS Tables 6 and 7 which are based on averages from the period 1952-82.

Eastern Lompoc Plain

The Eastern Plain is greatly influenced by flows and TDS of surface water at the Narrows. The simulated TDS in the Main Zone in the eastern Lompoc Plain using the USGS model are shown for two selected well locations in Figures 9 and 10. Figure 9 shows the simulated TDS at Eastern Plain well 34B1. Alternative 4B clearly results in a lower TDS than the others at this location. At increasing distances from the Narrows, a greater influence on ground water quality in the Main Zone appears to be the TDS of water in overlying or underlying aquifers or along margins as shown in Figures 10 which shows the simulated TDS in the Main Zone for Well 28M2 on the western side of the eastern Lompoc Plain. There is little difference between the results for each alternative at this location, which begins to show a more subdued response more characteristic of wells in the Central Plain.

Figure 11 shows the water level response in the Main Zone near the Lompoc Narrows. Figure 12 shows a similar but more subdued water level response. The simulated water level response in the Eastern Plain to all alternatives is very similar and none stands out as having a clear advantage over the others with respect to ground water levels in the Main Zone in this area.

Central Lompoc Plain

The simulated TDS response in the Central Plain shows the dampened response to flow and TDS changes at the Narrows with increasing distance (Figures 13 and 14). The lower permeability of overlying sediments and distance from the Narrows has the effect of allowing the simulated TDS for all alternatives to become very similar. The simulated water levels for these same locations in the Lompoc Plain are shown in Figures 15 and 16. Both locations show a similar response to each Alternative such that none is clearly superior over the others. Alternatives 5B and 5C are slightly higher than Alternatives 2, 3B, and 3C due to the increased releases for fish from Cachuma Reservoir.

Western Lompoc Plain

The simulated TDS graphs for each alternative in the Western Plain are shown in Figures 17 and 18. The differences between alternatives are small relative to the magnitude of the TDS in the Main Zone in the Western Plain sub-area but shows more variation than TDS in the Central Plain (Figures 13 and 14) caused by greater inflow of poor quality water from adjacent boundaries of underlying formations. Figures 19 and 20 show the water level response in the Main Zone beneath the Western Lompoc Plain. The water levels in this region show similar responses as those in the Eastern and Central Plain. There appears to be little difference between the alternatives.

3. Time Series Graphs of HCI Model Results

The graphs of results for the HCI model contrast with those of the USGS model. The HCI model results appear smoother due to the annual stress periods.

Eastern Lompoc Plain

The simulated TDS in the Main Zone in the eastern Lompoc Plain using the HCI model are shown in Figures 21 and 22. Figure 21 shows the simulated TDS at Eastern Plain Well 34B1. The simulated TDS in the Main Zone is similar for all the EIR alternatives, except Alternative 4B. In Alternative 4B, the direct recharge of much lower TDS water (approximately 300 mg/L) in the Santa Ynez River bed near this well location, lowers the simulated TDS in the aquifer in that area by about 150 mg/L relative to the other alternatives. The minor differences in

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simulated TDS at this location between the other alternatives are a result of the similarity in the simulated flow and TDS at the Narrows for those alternatives.

Figure 22 shows the simulated TDS in the Main Zone for Well 28M2 on the western side of the Eastern Plain. There is little significant difference between the results for each alternative at this location. The effects of direct recharge of high quality water in Alternative 4B appear to provide little benefit at this distance from the recharge area. The long-term trend is relatively flat, showing little response to hydrology.

Figures 23 and 24 show the water level response in the Main Zone near the Lompoc Narrows. The simulated water level response in the Eastern Plain to all alternatives is very similar and none stands out as showing clear advantages over another in the Main Zone. Water levels under Alternatives 5B and 5C are slightly higher than Alternatives 2, 3B, and 3C due to the increased releases for fish from Cachuma Reservoir. Figure 24 shows a similar water level response to that shown in Figure 23, but is more subdued due to distance from the area of highest recharge and highest degree of hydraulic communication with surface water near the Narrows.

Central Lompoc Plain

The simulated TDS response in the Central Plain is more subdued than near the Narrows due to the lower permeability of overlying sediments and increased distance from the primary area of stream recharge (below Lompoc Narrows) (Figures 25 and 26). There is no significant difference between the alternatives in this area. However, the TDS for Alternatives 5C and 4B is slightly higher compared to other alternatives although they would be expected to be slightly lower. There is no explanation for these apparently anomalous results.

The simulated water levels for these Central Lompoc Plain locations are shown in Figures 27 and 28. Both locations show a similar response to each alternative. Alternatives 5B and 5C are slightly higher than Alternatives 2, 3B, and 3C possibly due to the increased releases for fish from Cachuma Reservoir.

Western Lompoc Plain

The simulated TDS for each alternative in the Western Plain is shown in Figures 29 and 30. The results for each of the alternatives are very similar and show little variation over time, due to hydrology. Figures 31 and 32 show the water level response in the Main Zone beneath the Western Lompoc Plain. There is little difference in water levels between the alternatives and

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they show only a minor response to hydrologic trends particularly in the model study period from 1952 through 1982.

4. REFERENCES

Bright, D.J., Stamos, C.L., Martin, P., and D.B. Nash. 1992. Groundwater Hydrology and Quality in the Lompoc Area, Santa Barbara County, California, 1987-88. USGS Water-Resources Investigations Report 91-4172.

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Stetson Engineers. 2005. Technical Memorandum #5. Hydrologic Impact Analysis of Possible Cachuma Operations Alternatives. Prepared for State Water Resources Board. August 11, 2005.

Stetson Engineers. 2006. Technical Memorandum #6. Hydrologic Analyses of Daily Flows for Impact Assessment on Steelhead. April 24, 2006.

Figures

Figure 1

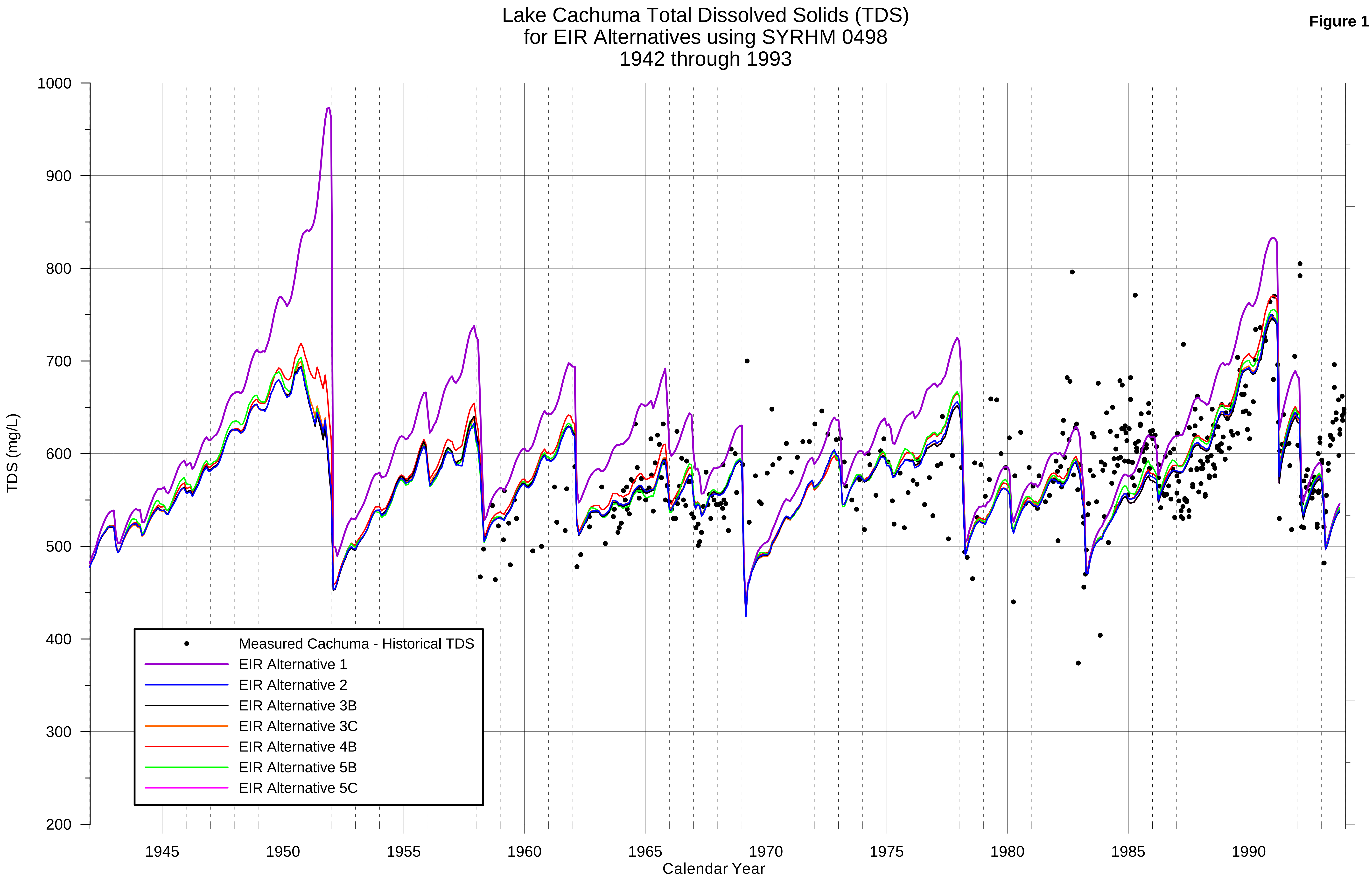
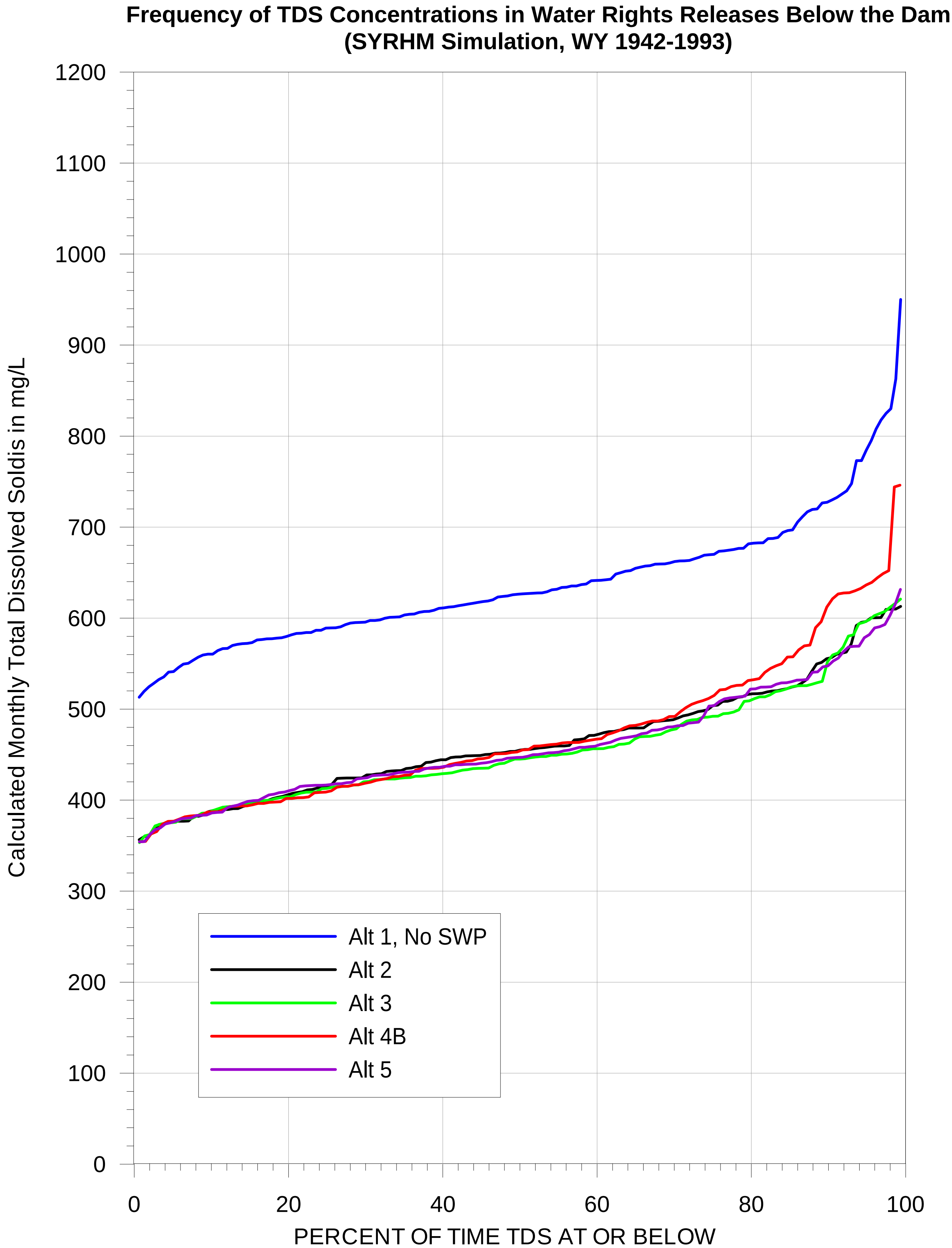
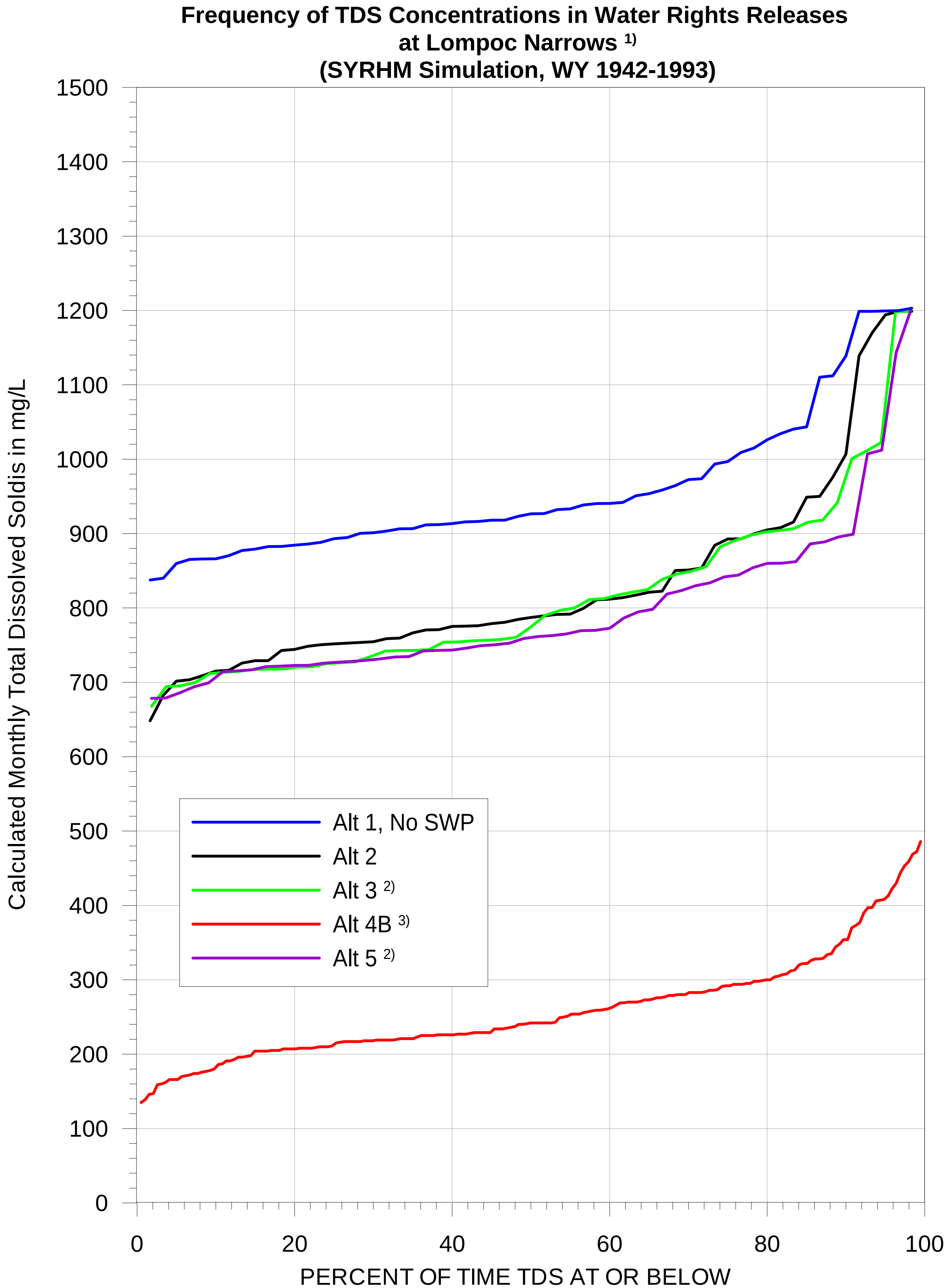

Lake Cachuma Total Dissolved Solids (TDS)
for EIR Alternatives using SYRHM 0498
1942 through 1993
TDS (mg/L)
Calendar Year
1000
900
800
700
600
500
400
300
200
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Measured Cachuma - Historical TDS
EIR Alternative 1
EIR Alternative 2
EIR Alternative 3B
EIR Alternative 3C
EIR Alternative 4B
EIR Alternative 5B
EIR Alternative 5C

Figure 2



1) Results from EIR Alternatives 3C and 5C are plotted here; Alts 3B and 5B are very similar to 3C and 5C, respectively.
2) Water rights release TDS for ANA releases are shown here for 4B.

Figure 3



1) Frequency does not include months of no flow or flows less than 0.5 cfs at the Narrows.
2) Results from EIR Alternatives 3C and 5C are plotted here; Alts 3B and 5B are very similar to 3C and 5C, respectively.
3) State Water Project TDS during Below Narrows Account water right releases.

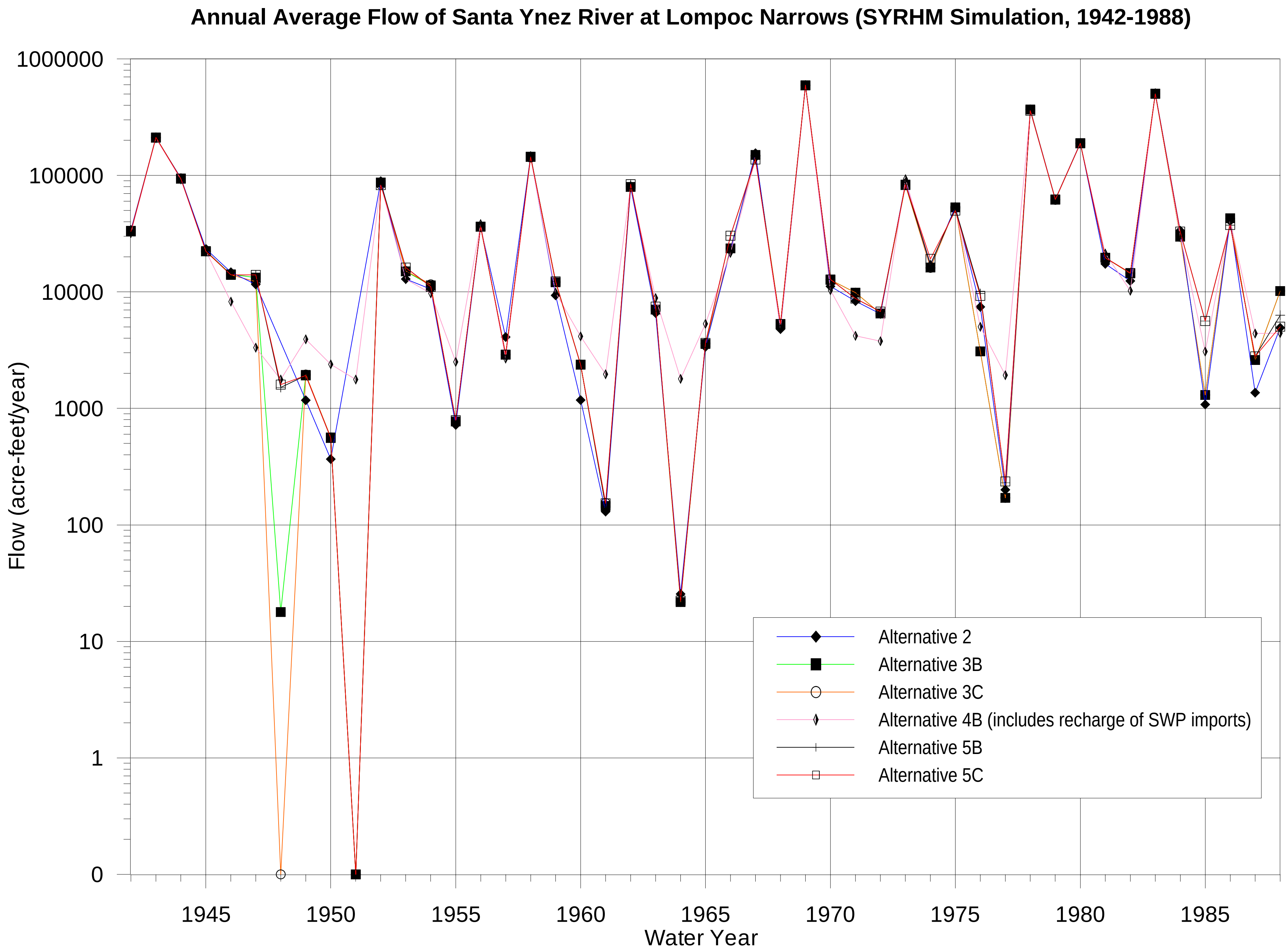
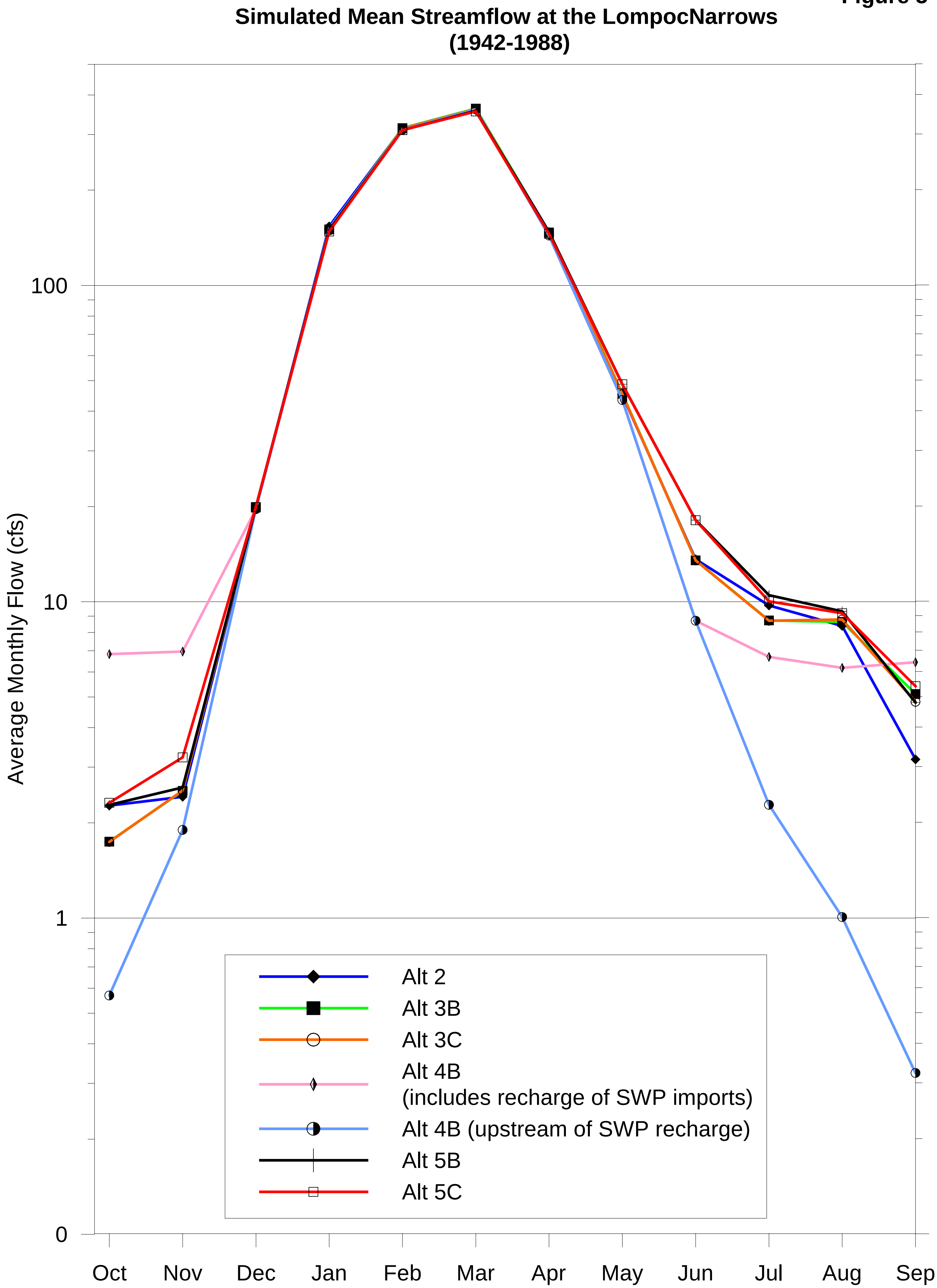
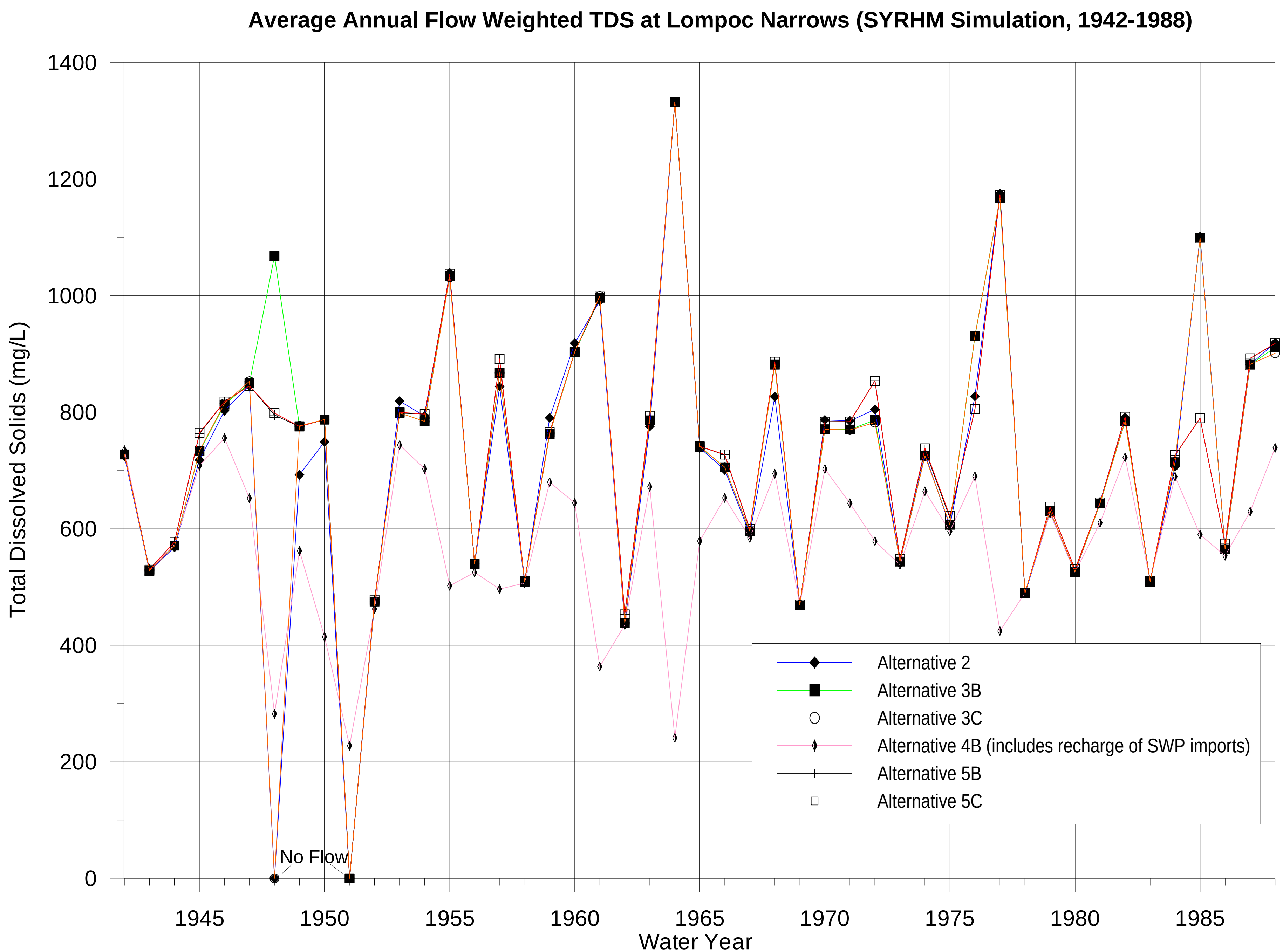

Annual Average Flow of Santa Ynez River at Lompoc Narrows (SYRHM Simulation, 1942-1988)
Flow (acre-feet/year)
1000000
100000
10000
1000
100
10
1
0
1945
1950
1955
1960
1965
1970
1975
1980
1985
Water Year
Alternative 2
Alternative 3B
Alternative 3C
Alternative 4B (includes recharge of SWP imports)
Alternative 5B
Alternative 5C

Figure 4

Figure 5

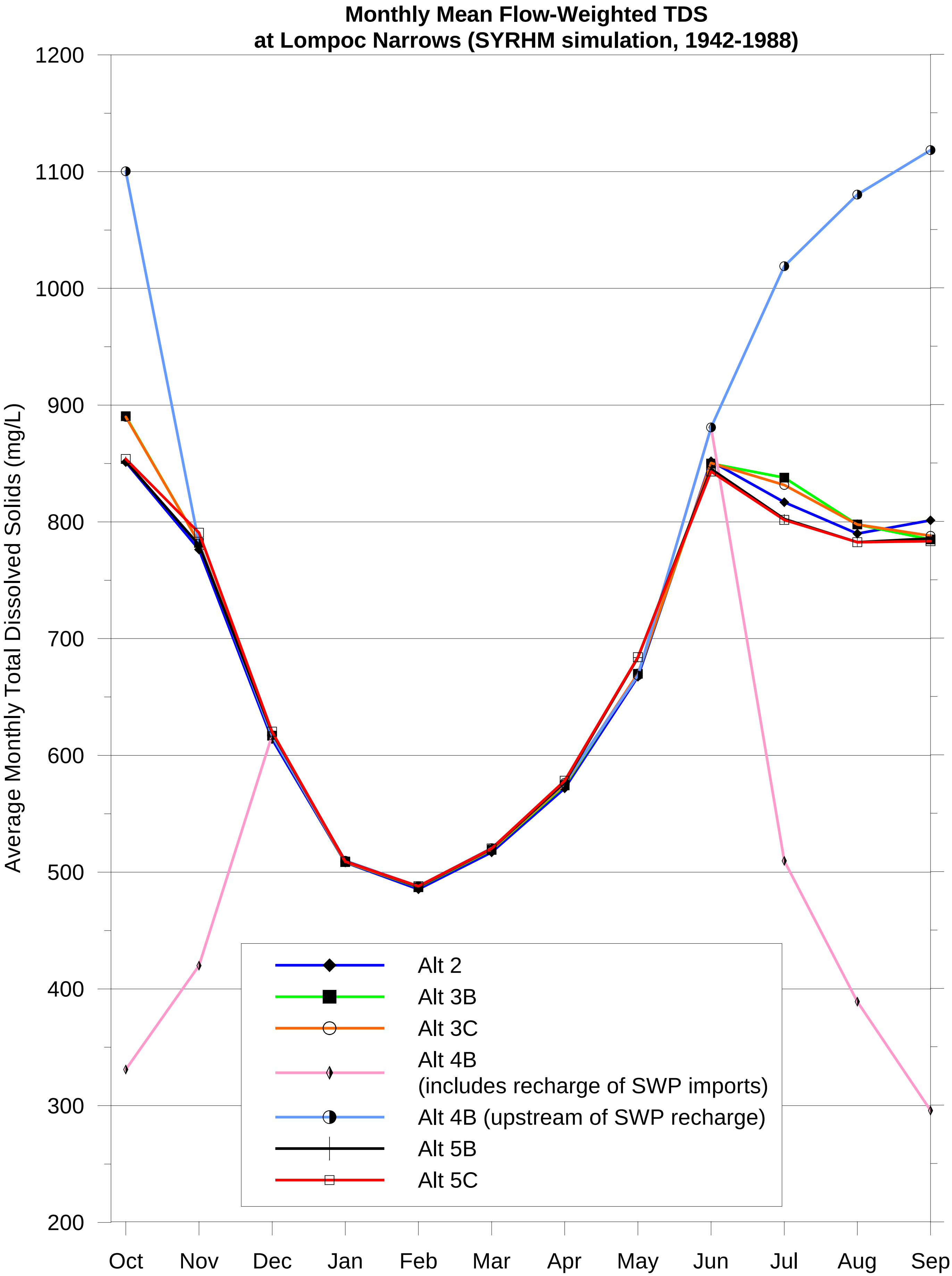

Simulated Mean Streamflow at the LompocNarrows
(1942-1988)
Average Monthly Flow (cfs)
100
10
1
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Alt 2
Alt 3B
Alt 3C
Alt 4B
(includes recharge of SWP imports)
Alt 4B (upstream of SWP recharge)
Alt 5B
Alt 5C



Average Annual Flow Weighted TDS at Lompoc Narrows (SYRHM Simulation, 1942-1988)
Total Dissolved Solids (mg/L)
1400
1200
1000
800
600
400
200
0
No Flow
1945
1950
1955
1960
1965
1970
1975
1980
1985
Water Year
Alternative 2
Alternative 3B
Alternative 3C
Alternative 4B (includes recharge of SWP imports)
Alternative 5B
Alternative 5C

Figure 6

Figure 7


Monthly Mean Flow-Weighted TDS
at Lompoc Narrows (SYRHM simulation, 1942-1988)
Average Monthly Total Dissolved Solids (mg/L)
1200
1100
1000
900
800
700
600
500
400
300
200
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Alt 2
Alt 3B
Alt 3C
Alt 4B
(includes recharge of SWP imports)
Alt 4B (upstream of SWP recharge)
Alt 5B
Alt 5C

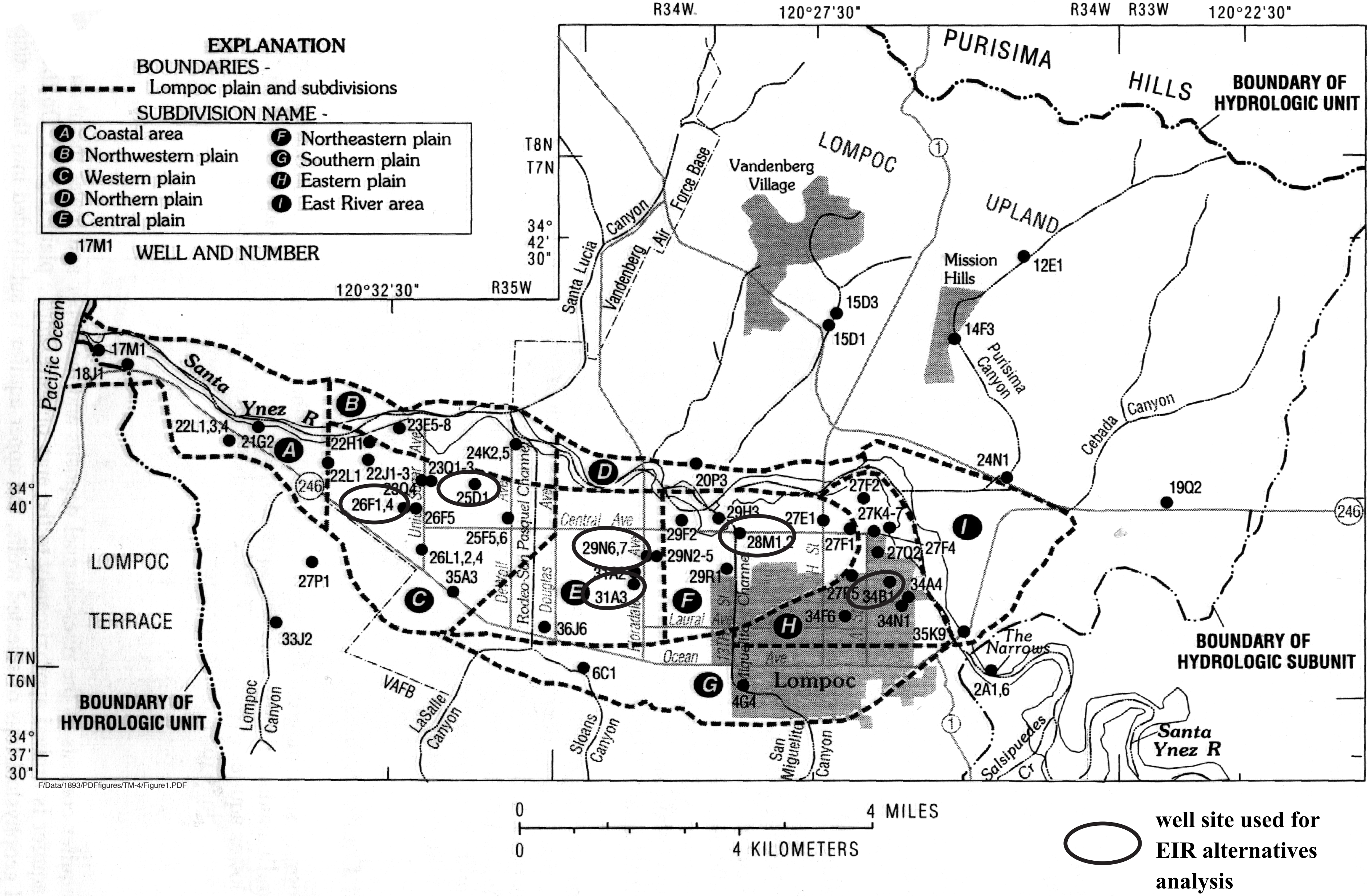


FIGURE 8

Subdivisions of Lompoc Plain and Location of Wells
(Source: Bright, et. al. 1997)

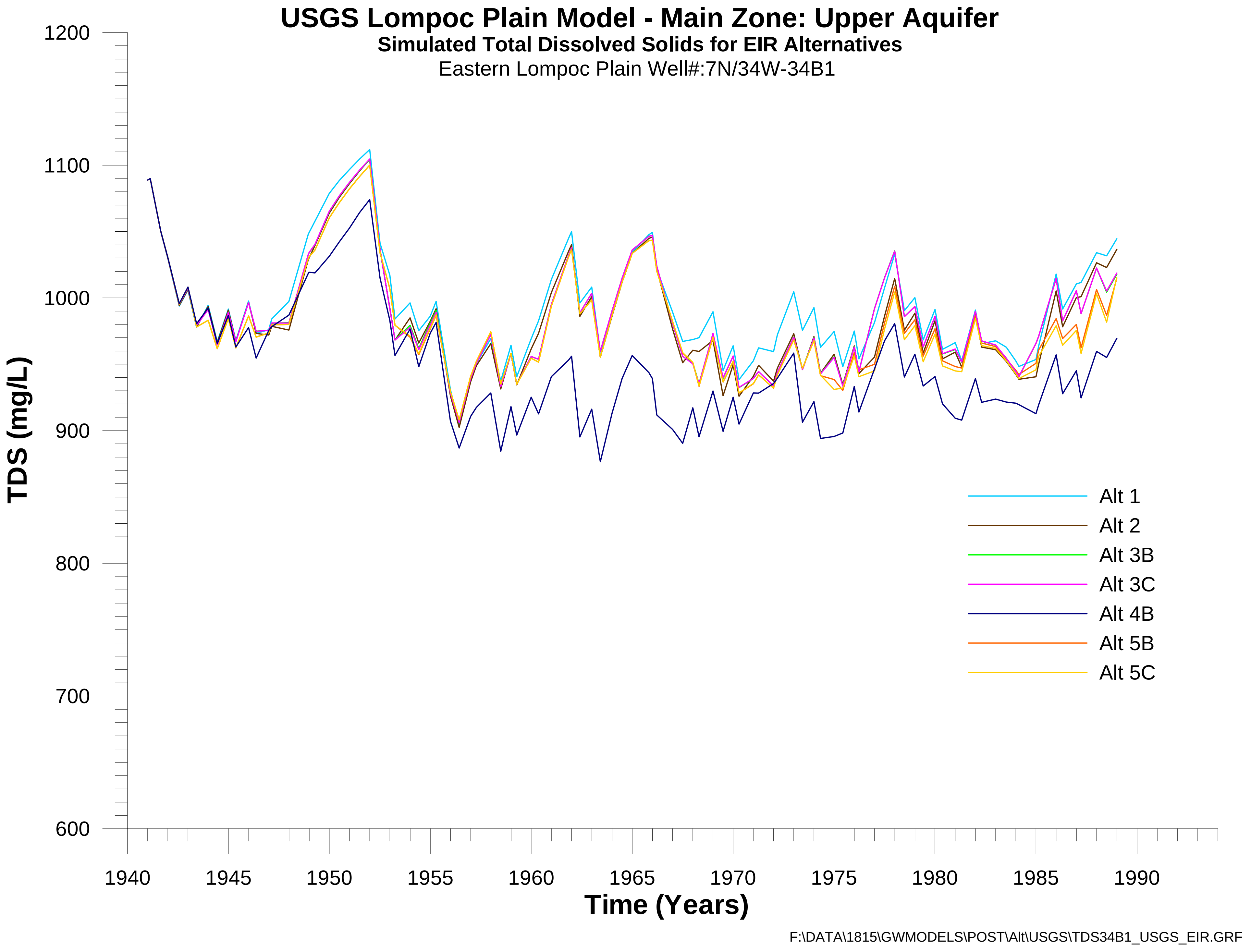

USGS Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Eastern Lompoc Plain Well#:7N/34W-34B1
1200
1100
1000
900
800
700
600
TDS (mg/L)
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\USGS\TDS34B1_USGS_EIR.GRF

FIGURE 9

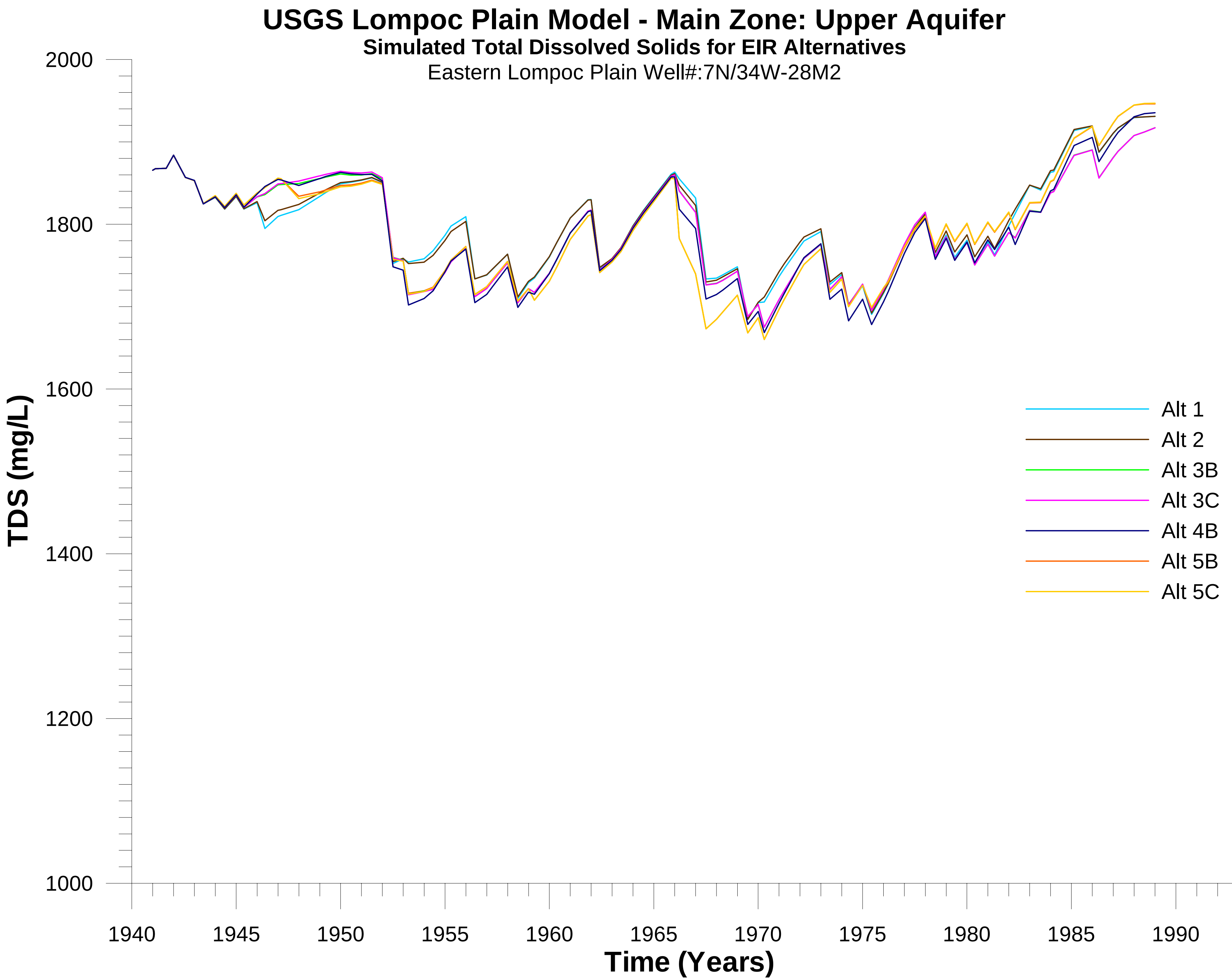
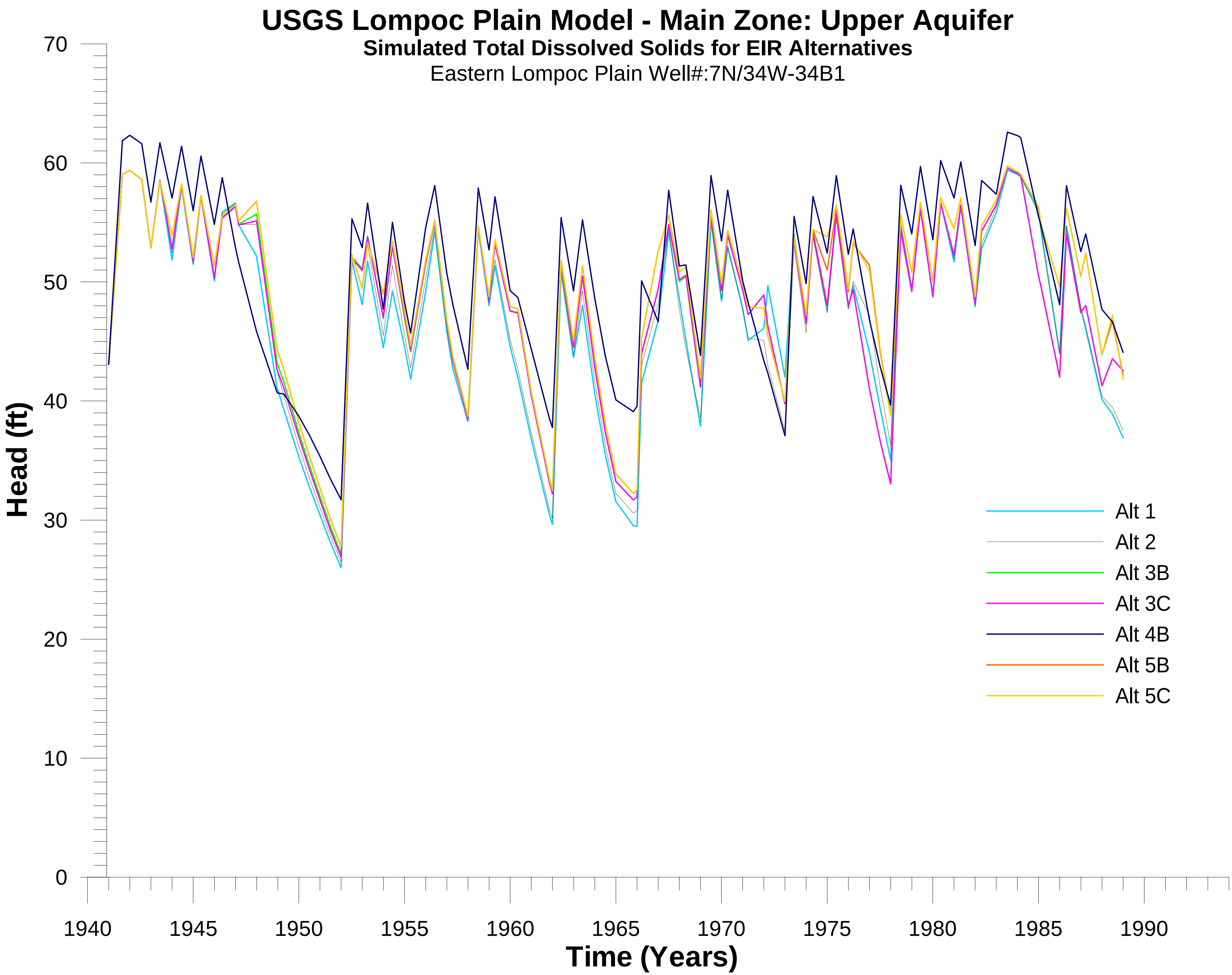


FIGURE 10

F:\DATA\1815\GWMODELS\POST\Alt\USGS\TDS28M2_USGS_EIR.GRF



F:\DATA\1815\GWMODELS\POST\Alt\USGS\WL\WL34B1_USGS_EIR.GRF

FIGURE 11

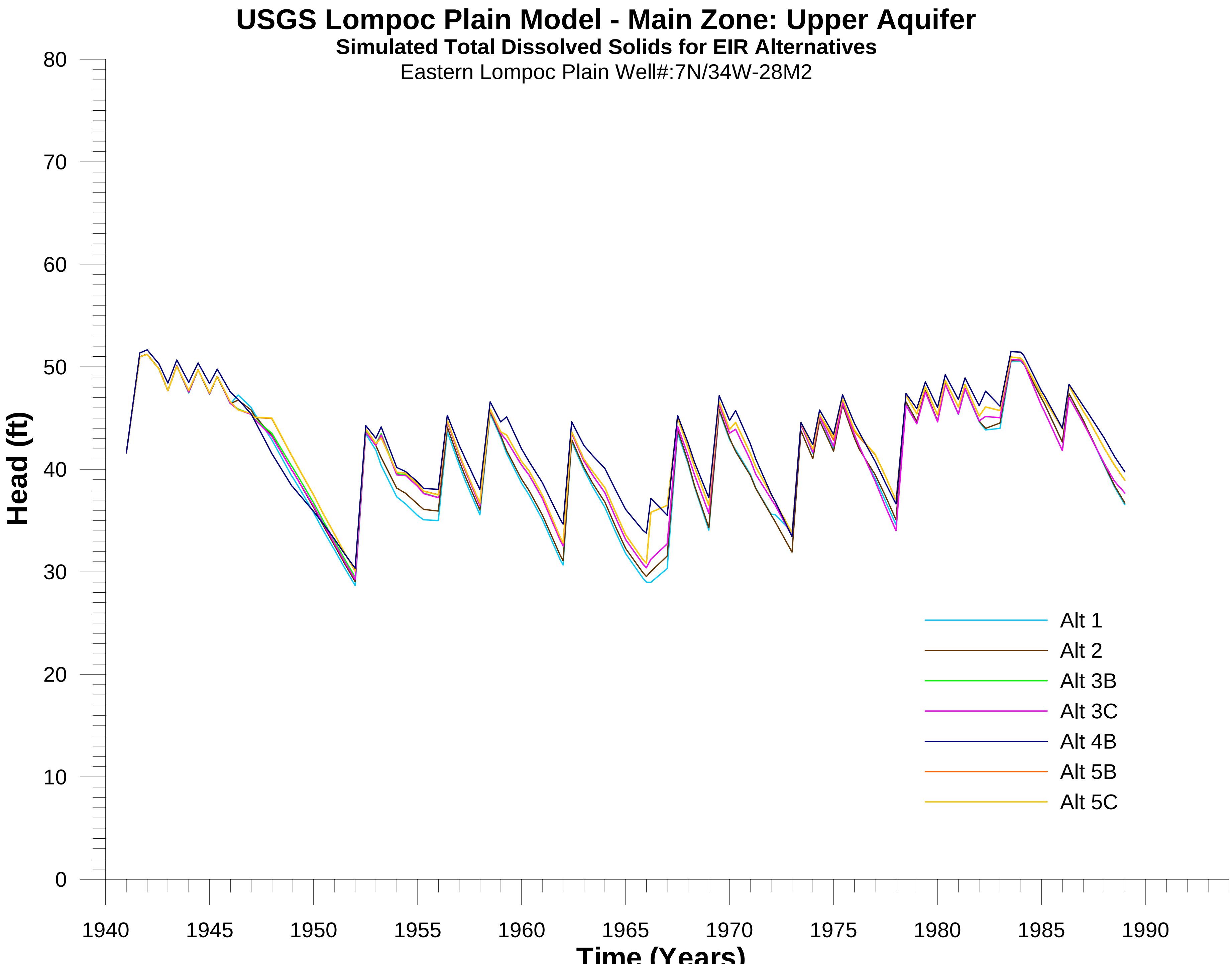


FIGURE 12

F:\DATA\1815\GWMODELS\POST\Alt\USGS\WL\WL28M2_USGS_EIR.GRF

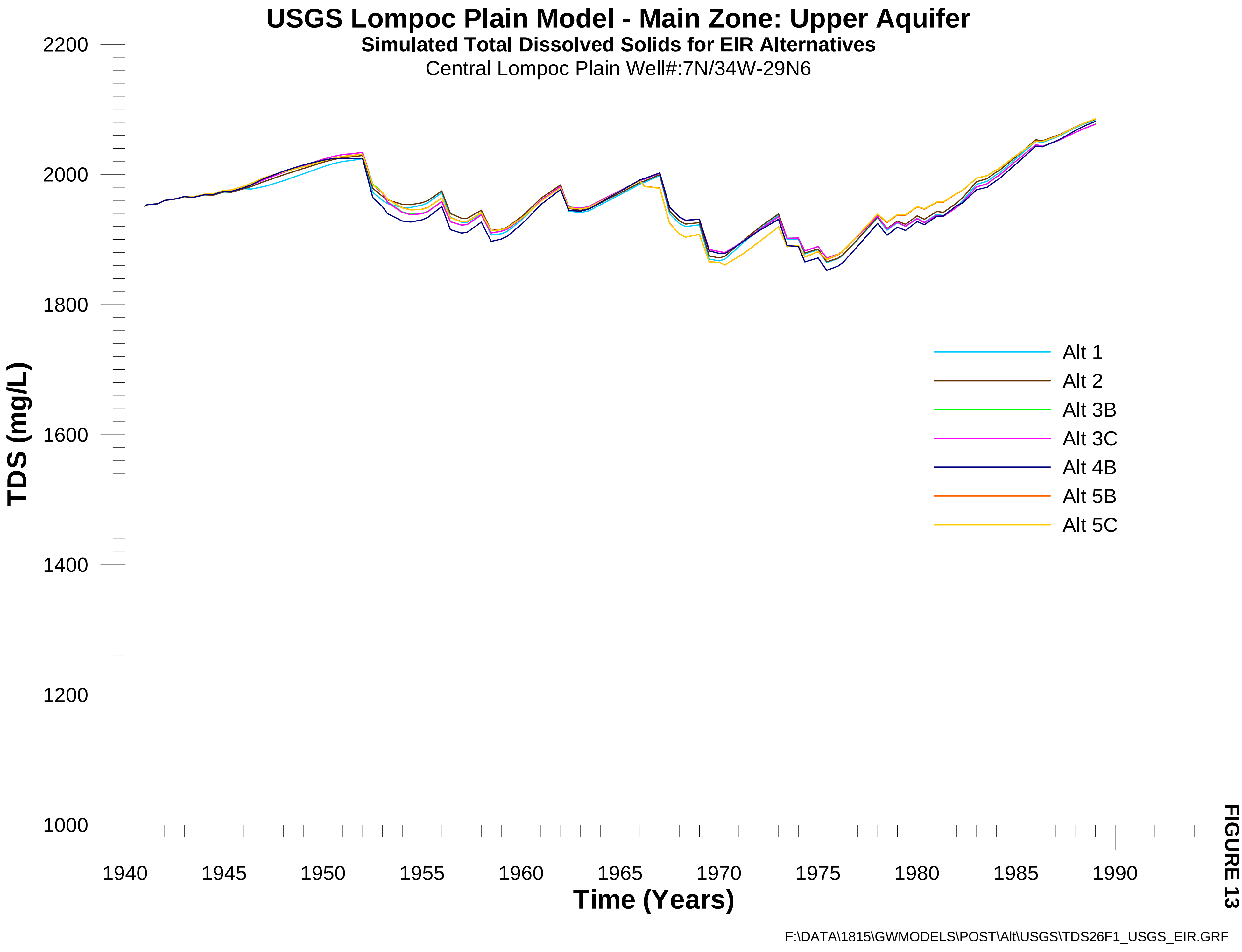
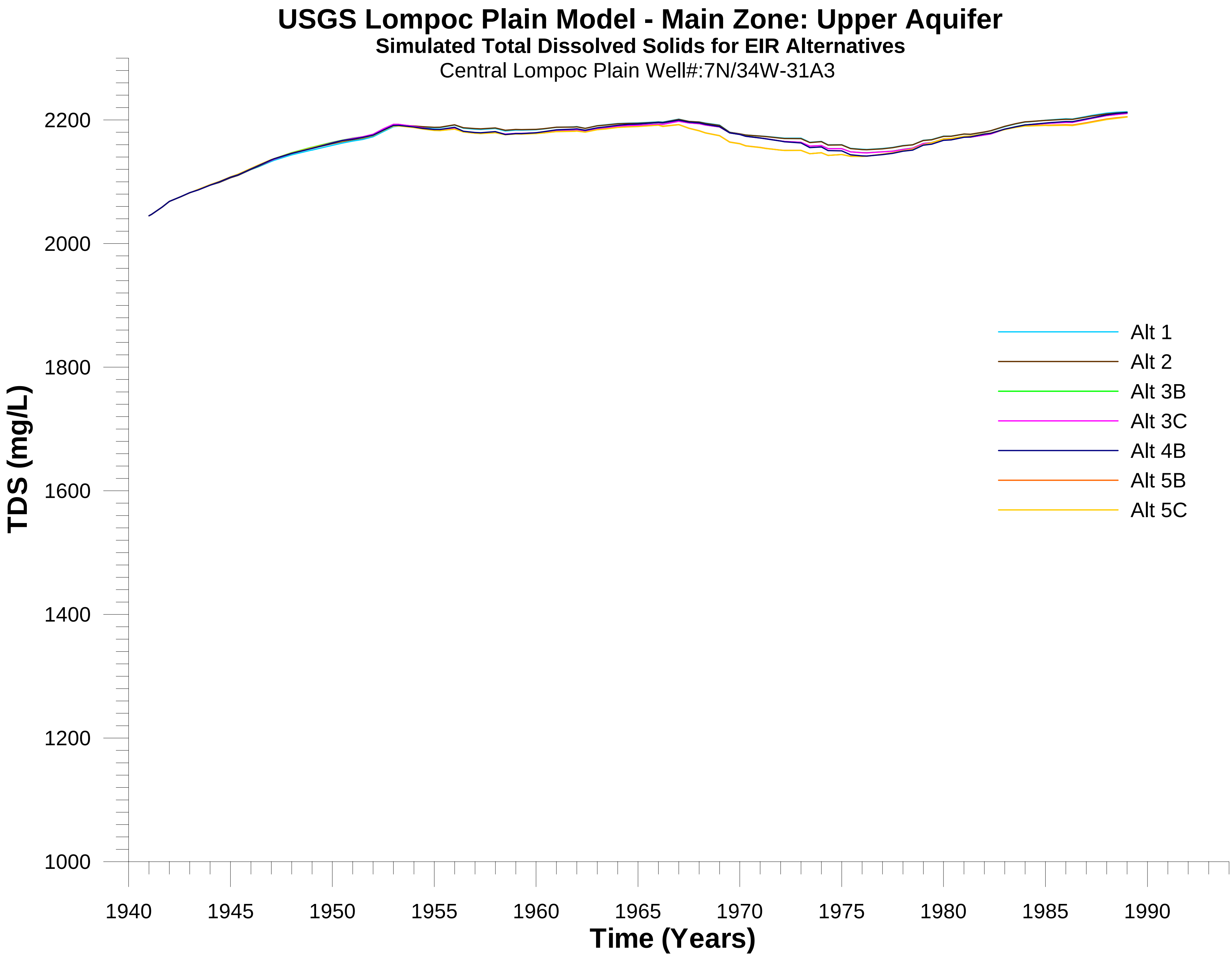
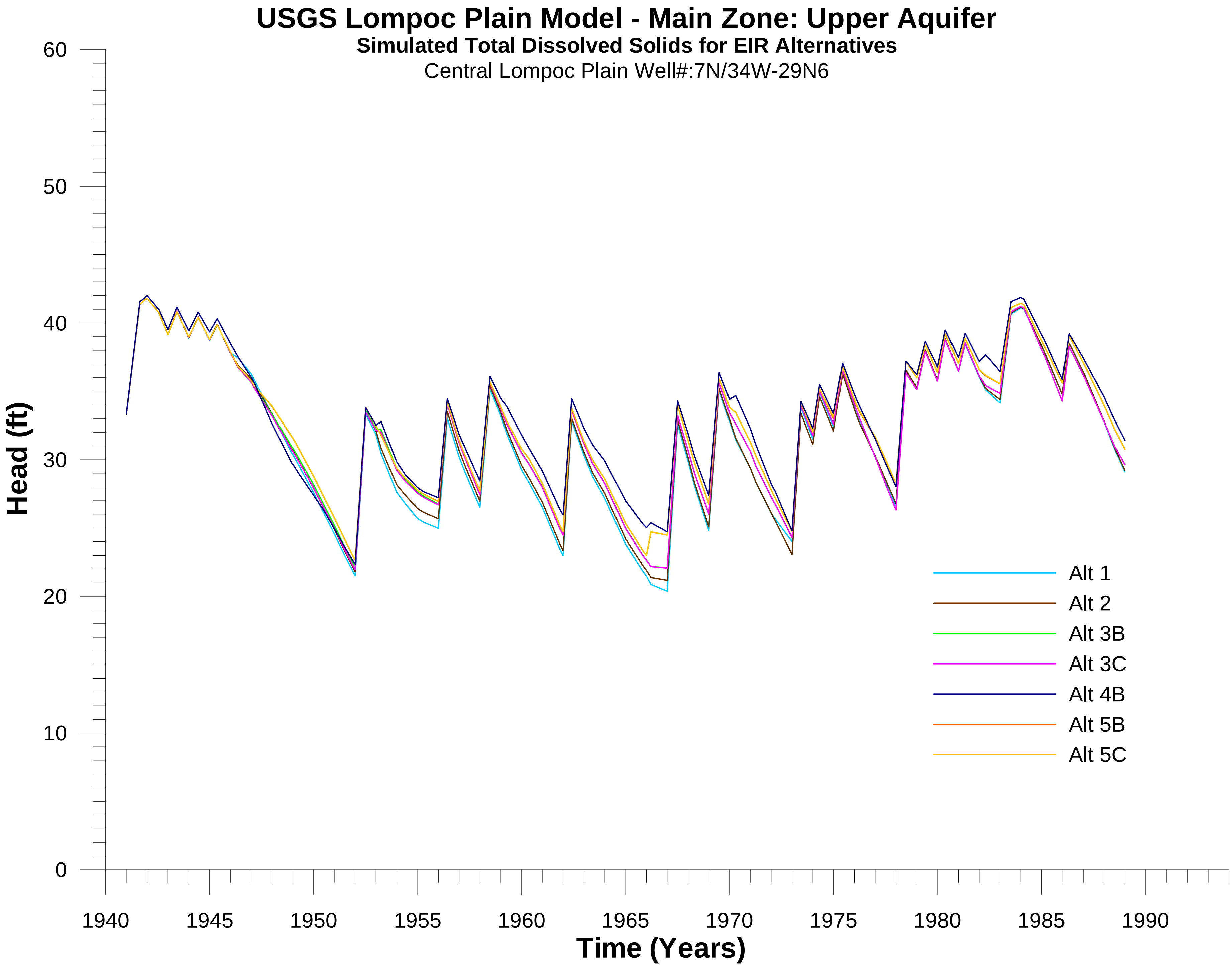

USGS Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Central Lompoc Plain Well#:7N/34W-29N6
TDS (mg/L)
2200
2000
1800
1600
1400
1200
1000
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\USGS\TDS26F1_USGS_EIR.GRF

FIGURE 13



F:\DATA\1815\GWMODELS\POST\Alt\USGS\TDS31A3_USGS_EIR.GRF

FIGURE 14



F:\DATA\1815\GWMODELS\POST\Alt\USGS\WL\WL26F1_USGS_EIR.GRF

FIGURE 15

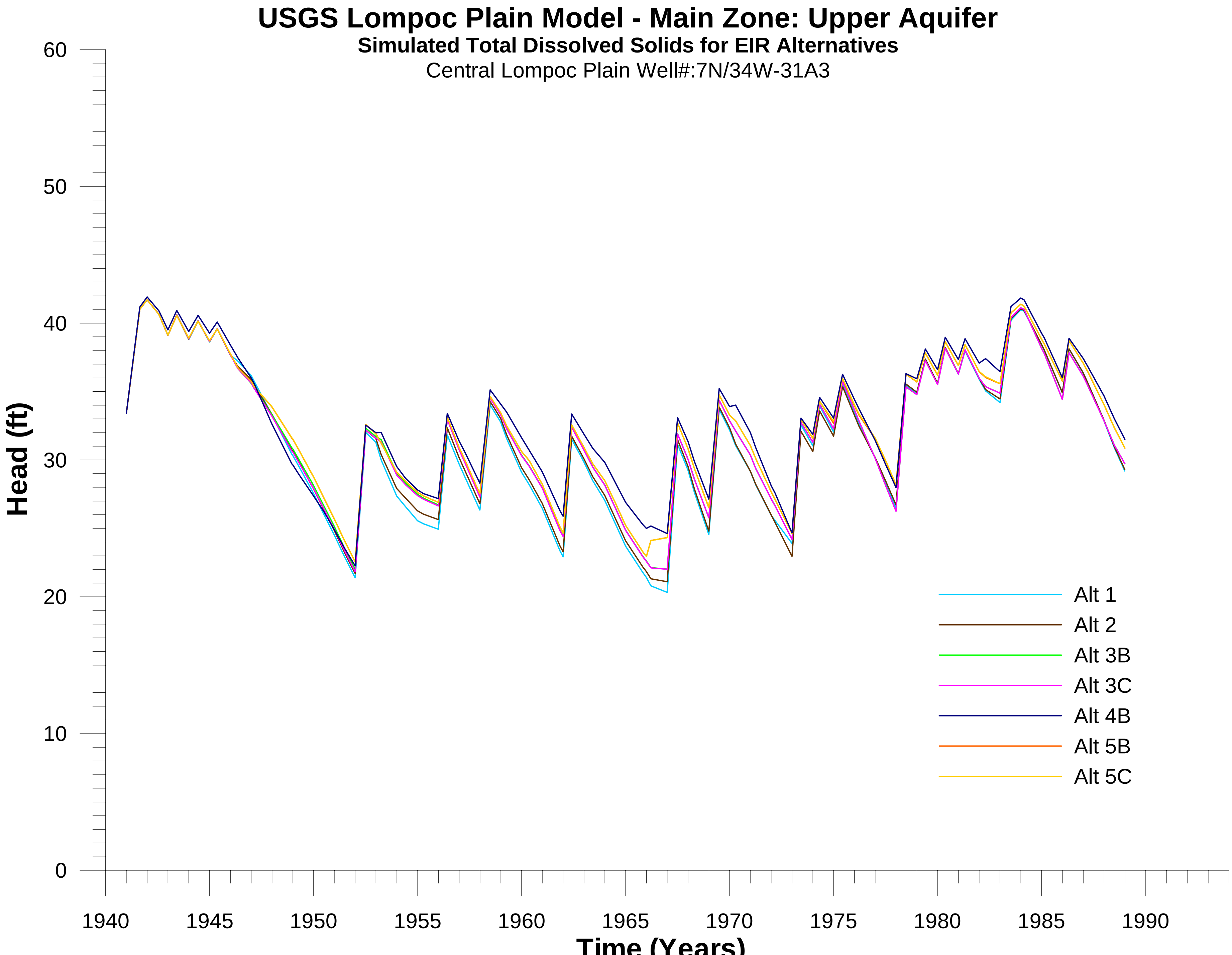


FIGURE 16

F:\DATA\1815\GWMODELS\POST\Alt\USGS\WL\WL31A3_USGS_EIR.GRF

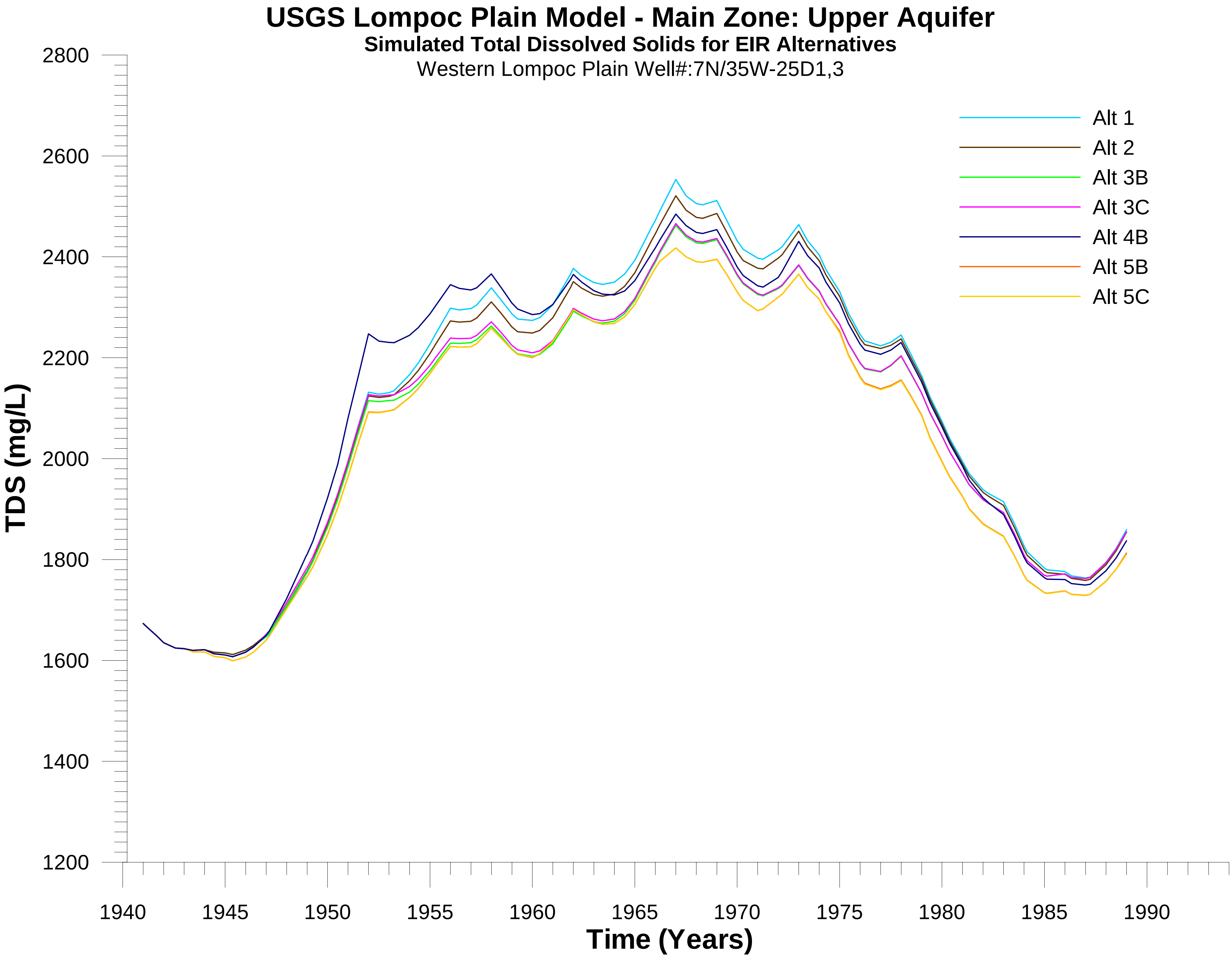
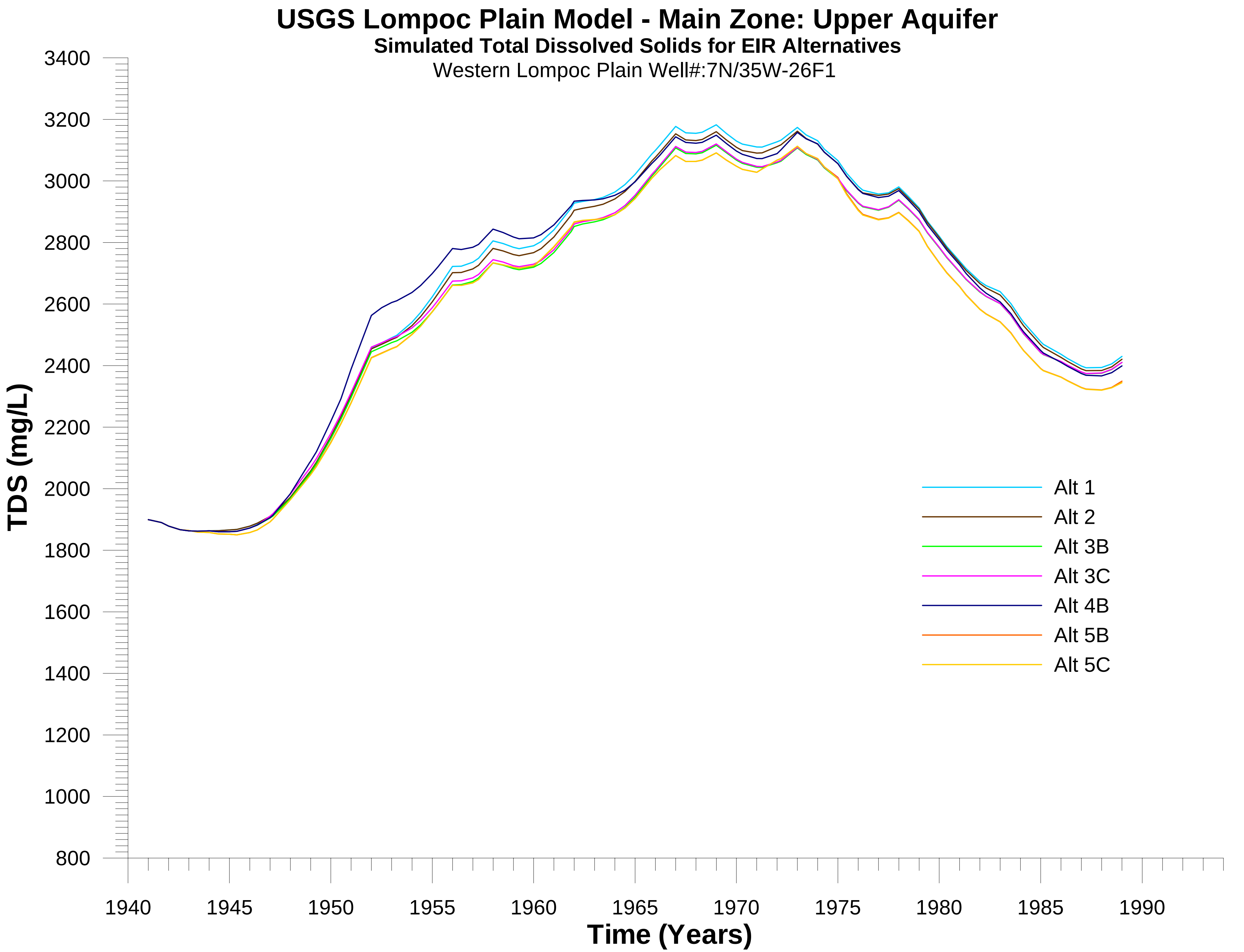


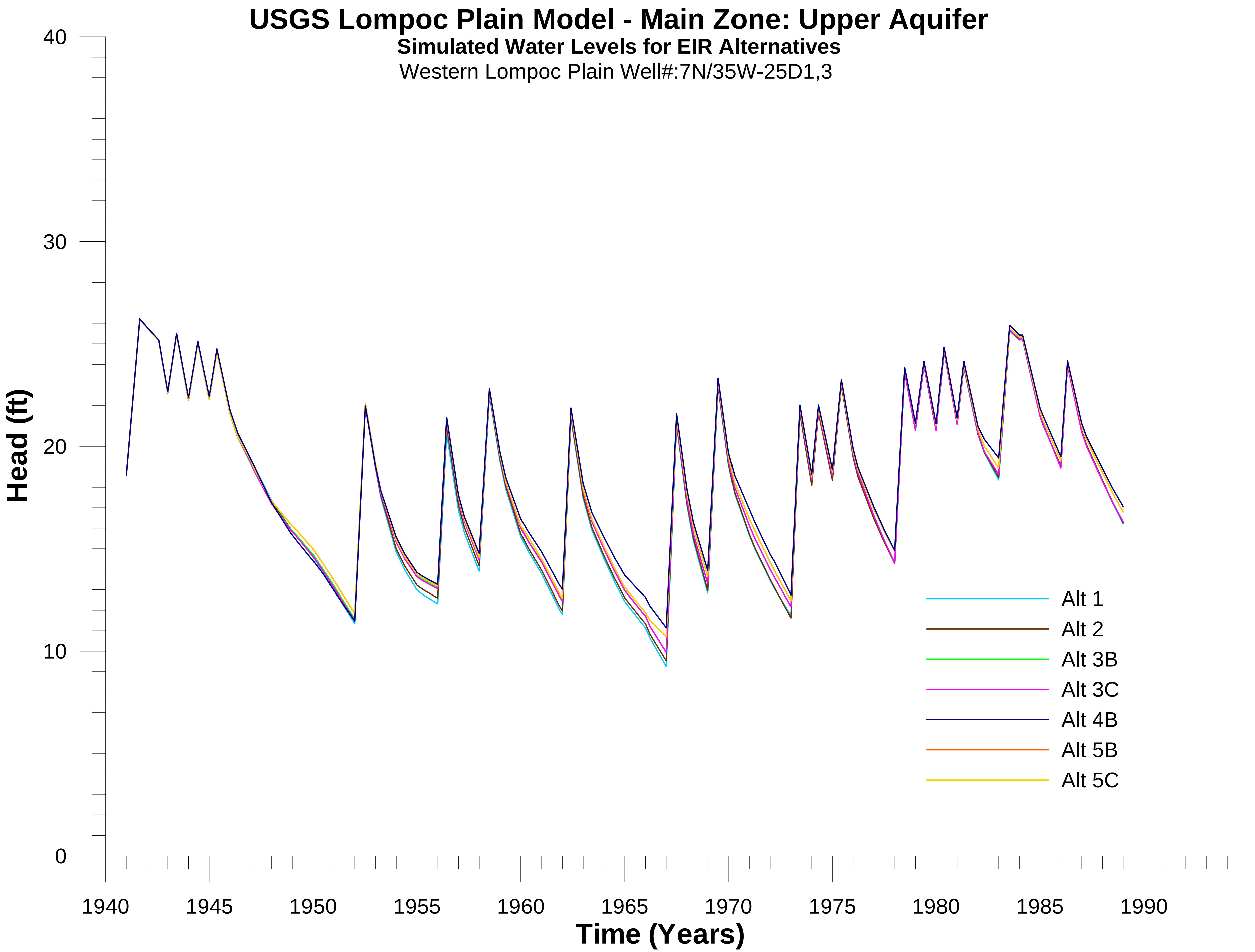
FIGURE 17

F:\DATA\1815\GWMODELS\POST\Alt\USGS\TDS25D1 AltsEIR.GRF



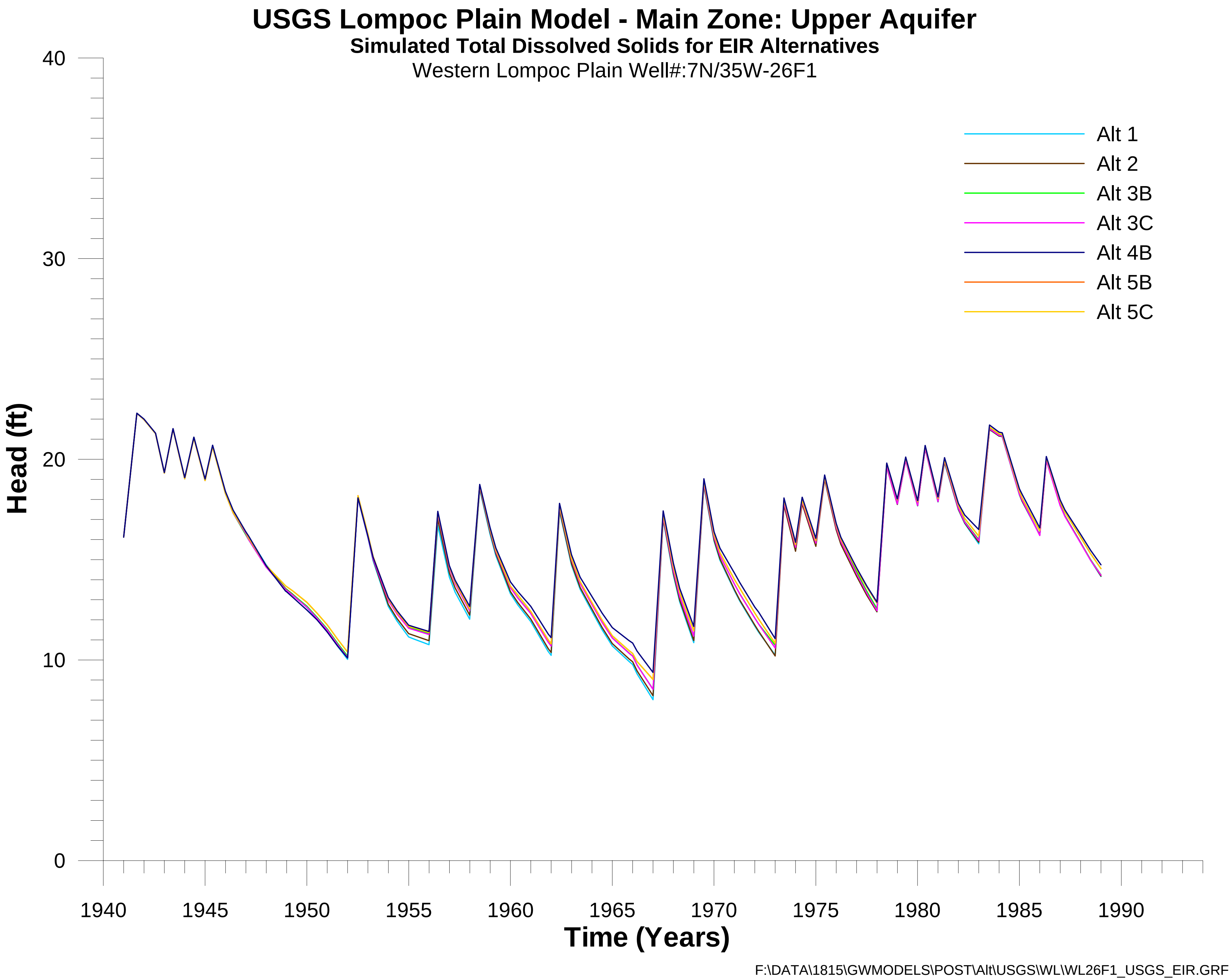
USGS Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Western Lompoc Plain Well#:7N/35W-26F1
TDS (mg/L)
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\USGS\TDS26F1_USGS_EIR.GRF

FIGURE 18



USGS Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Water Levels for EIR Alternatives
Western Lompoc Plain Well#:7N/35W-25D1,3
Head (ft)
0
10
20
30
40
Time (Years)
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alts\USGS\WL\WL25D1_USGS_EIR.GRF

FIGURE 19



USGS Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Western Lompoc Plain Well#:7N/35W-26F1
Head (ft)
Time (Years)
0
10
20
30
40
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\USGS\WL\WL26F1_USGS_EIR.GRF

FIGURE 20

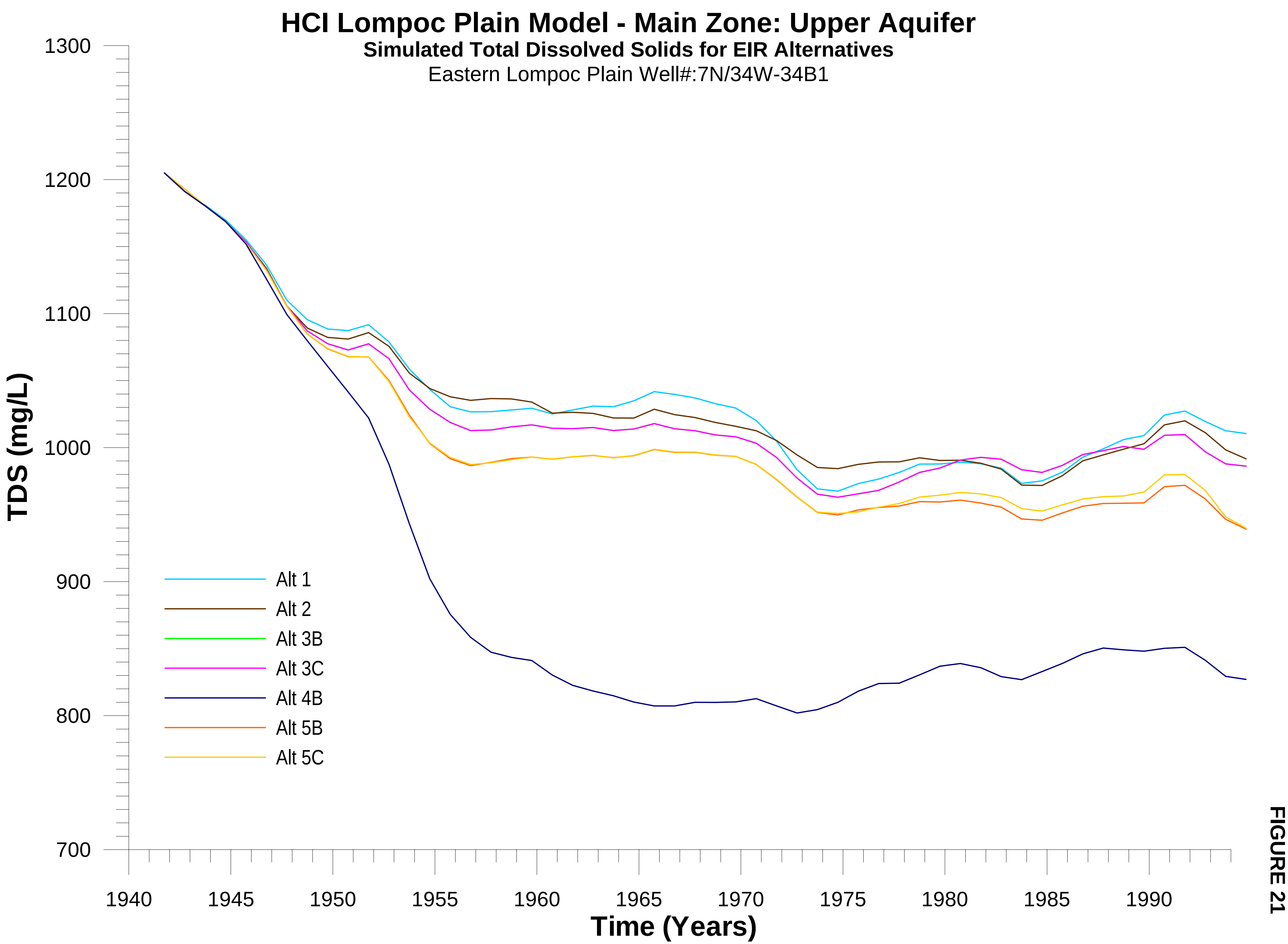
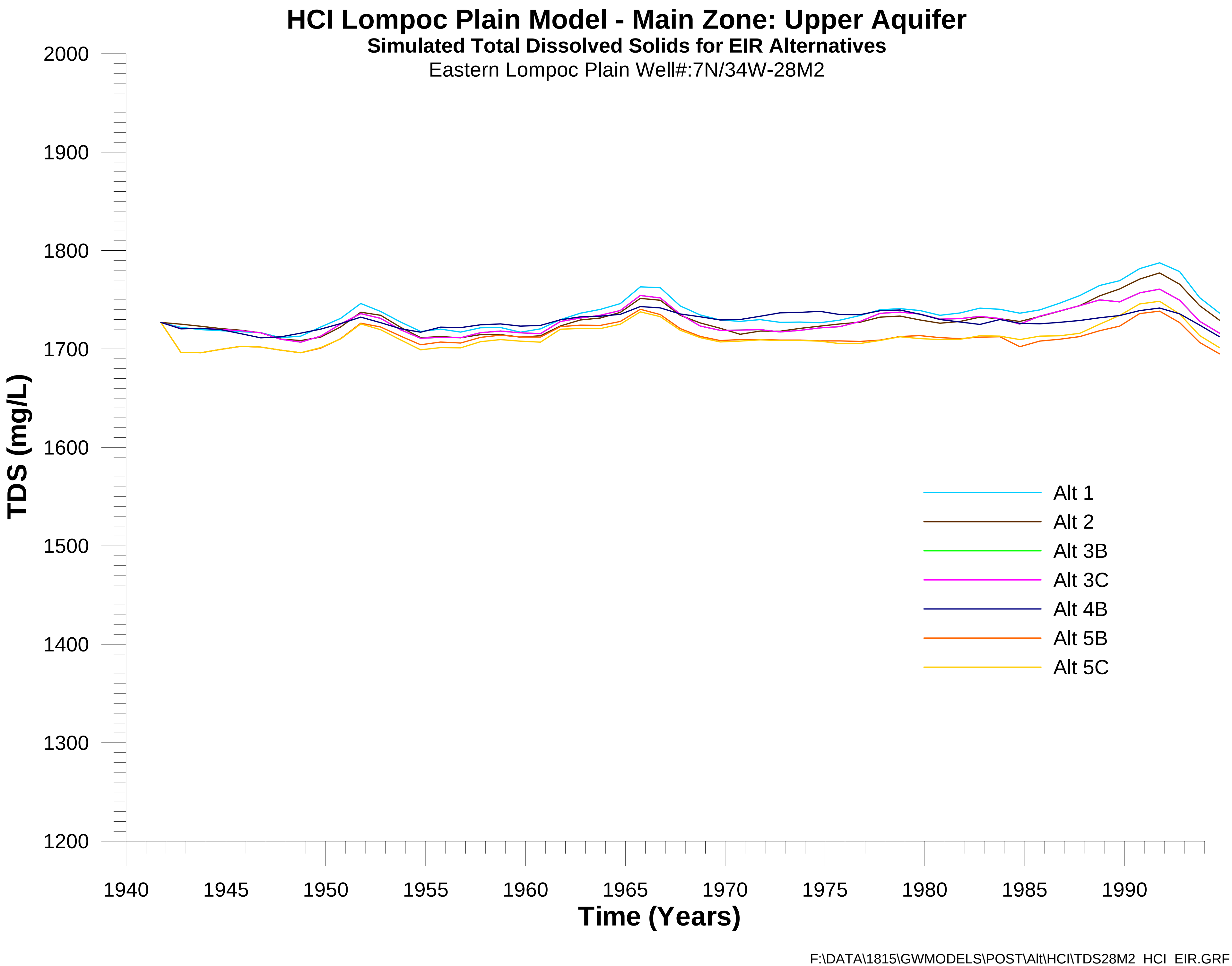


FIGURE 21

F:\DATA\1815\GWMODELS\POST\Alt\HCI\TDS34B1 HCI EIR.GRF


HCI Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Eastern Lompoc Plain Well#:7N/34W-28M2
TDS (mg/L)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\HCI\TDS28M2 HCI EIR.GRF
FIGURE 22

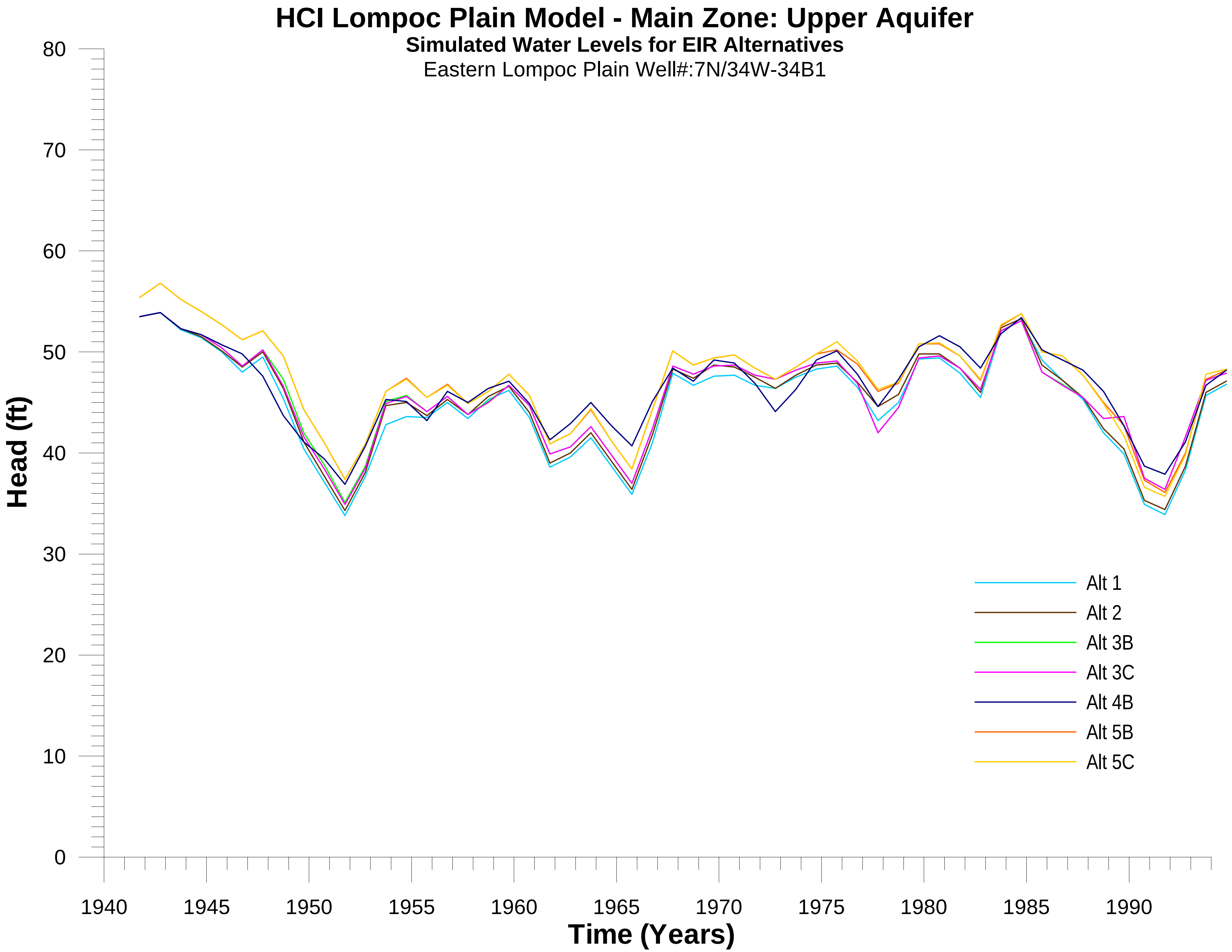


FIGURE 23

F:\DATA\1815\GWMODELS\POST\Alt\HCI\WL\WL34B1_HCI_EIR.GRF

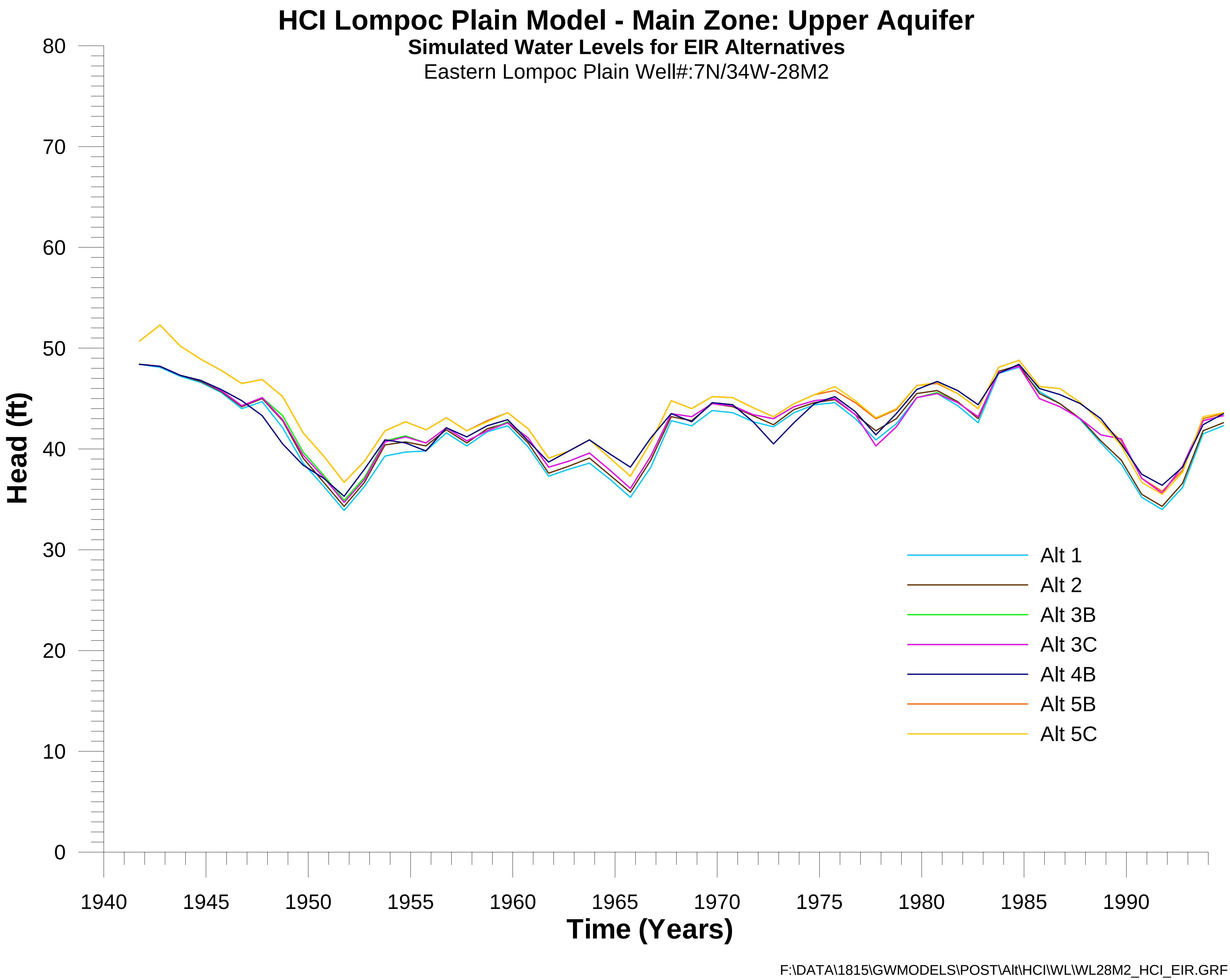

HCI Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Water Levels for EIR Alternatives
Eastern Lompoc Plain Well#:7N/34W-28M2
Head (ft)
Time (Years)
0
10
20
30
40
50
60
70
80
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\HCI\WL\WL28M2_HCI_EIR.GRF

FIGURE 24

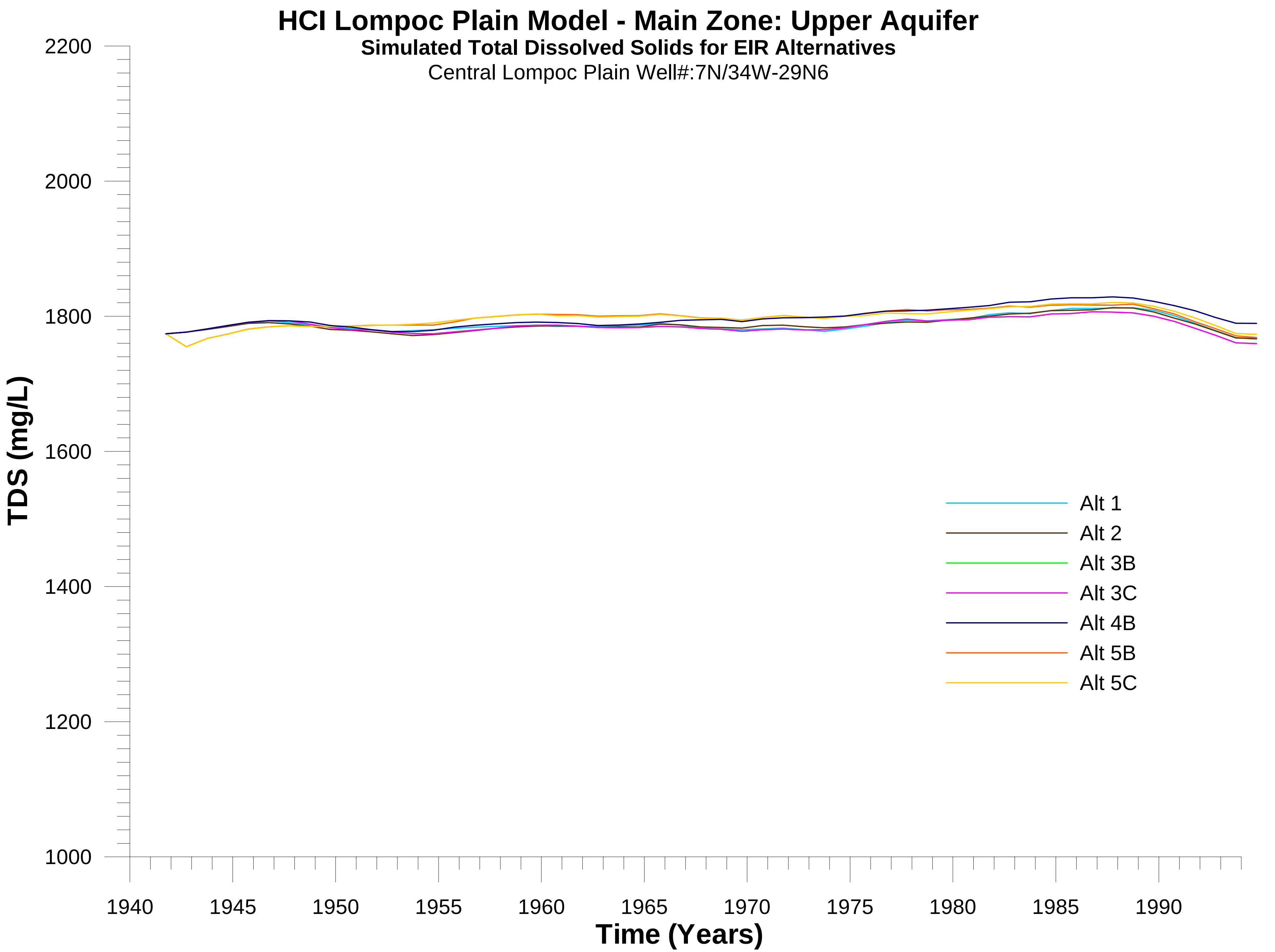

HCI Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Central Lompoc Plain Well#:7N/34W-29N6
TDS (mg/L)
2200
2000
1800
1600
1400
1200
1000
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\HCI\TDS26F1 HCI EIR.GRF

FIGURE 25

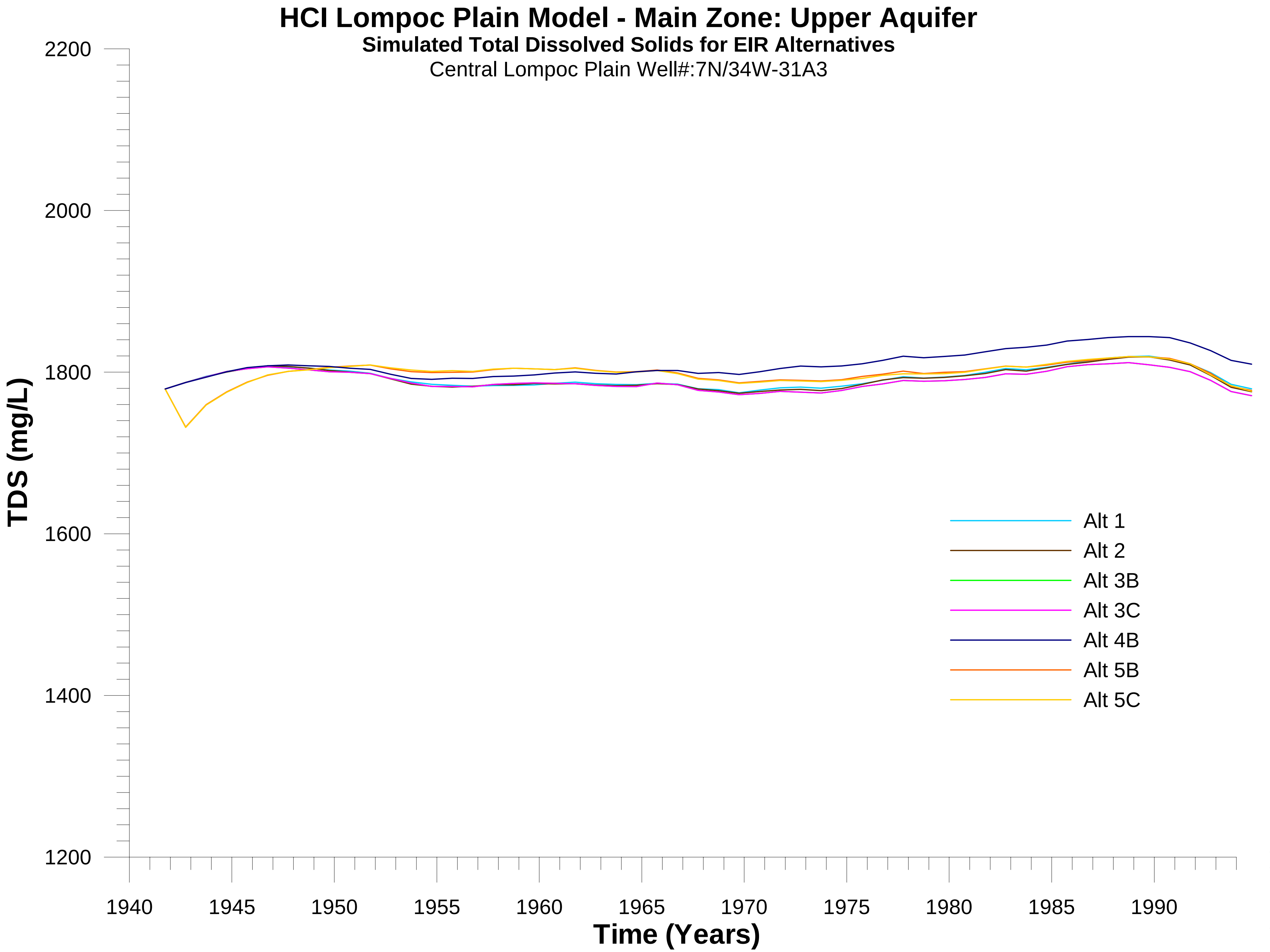


FIGURE 26

F:\DATA\1815\GWMODELS\POST\Alt\HCI\TDS31A3_HCI_EIR.GRF

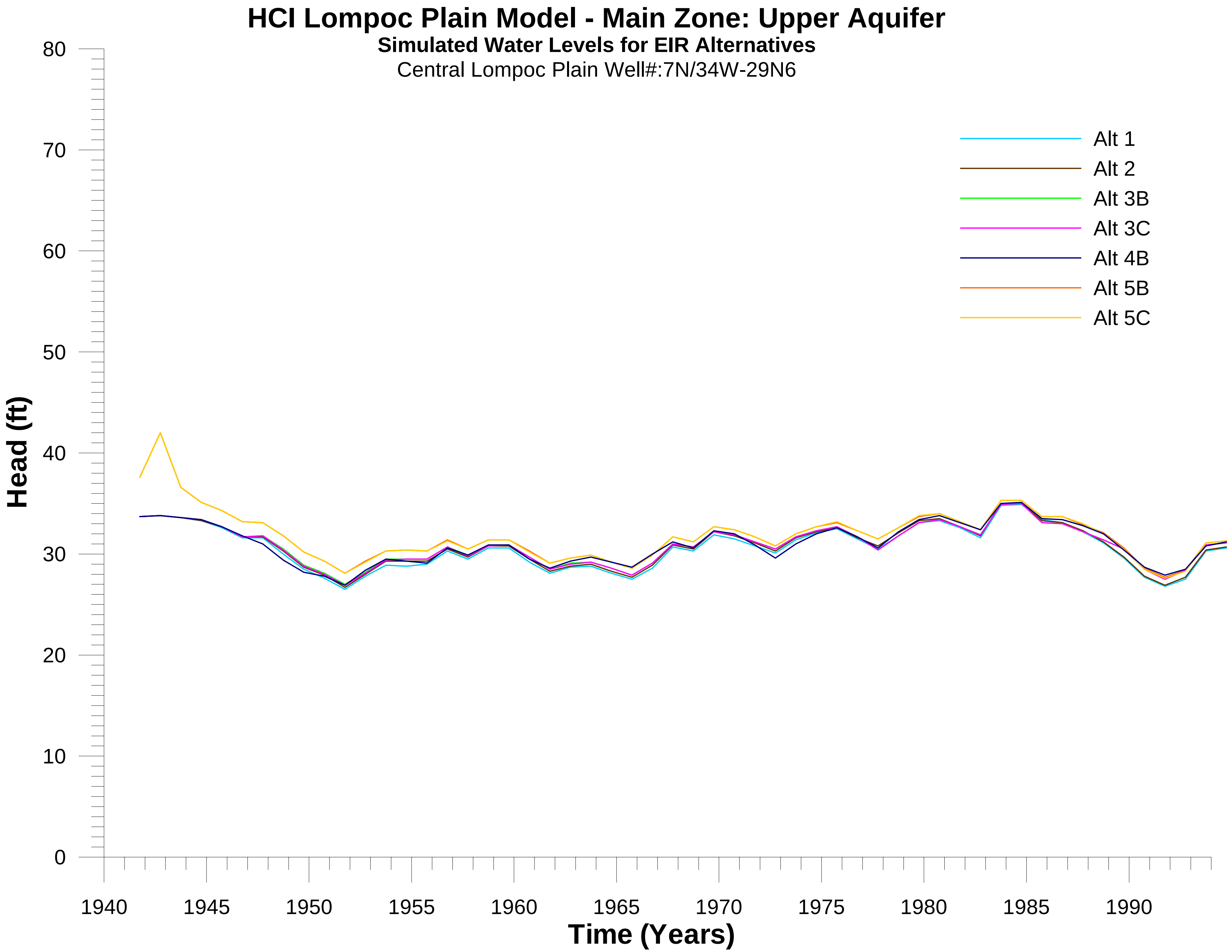


FIGURE 27

F:\DATA\1815\GWMODELS\POST\Alt\HCI\WL\WL26F1_HCI_EIR.GRF

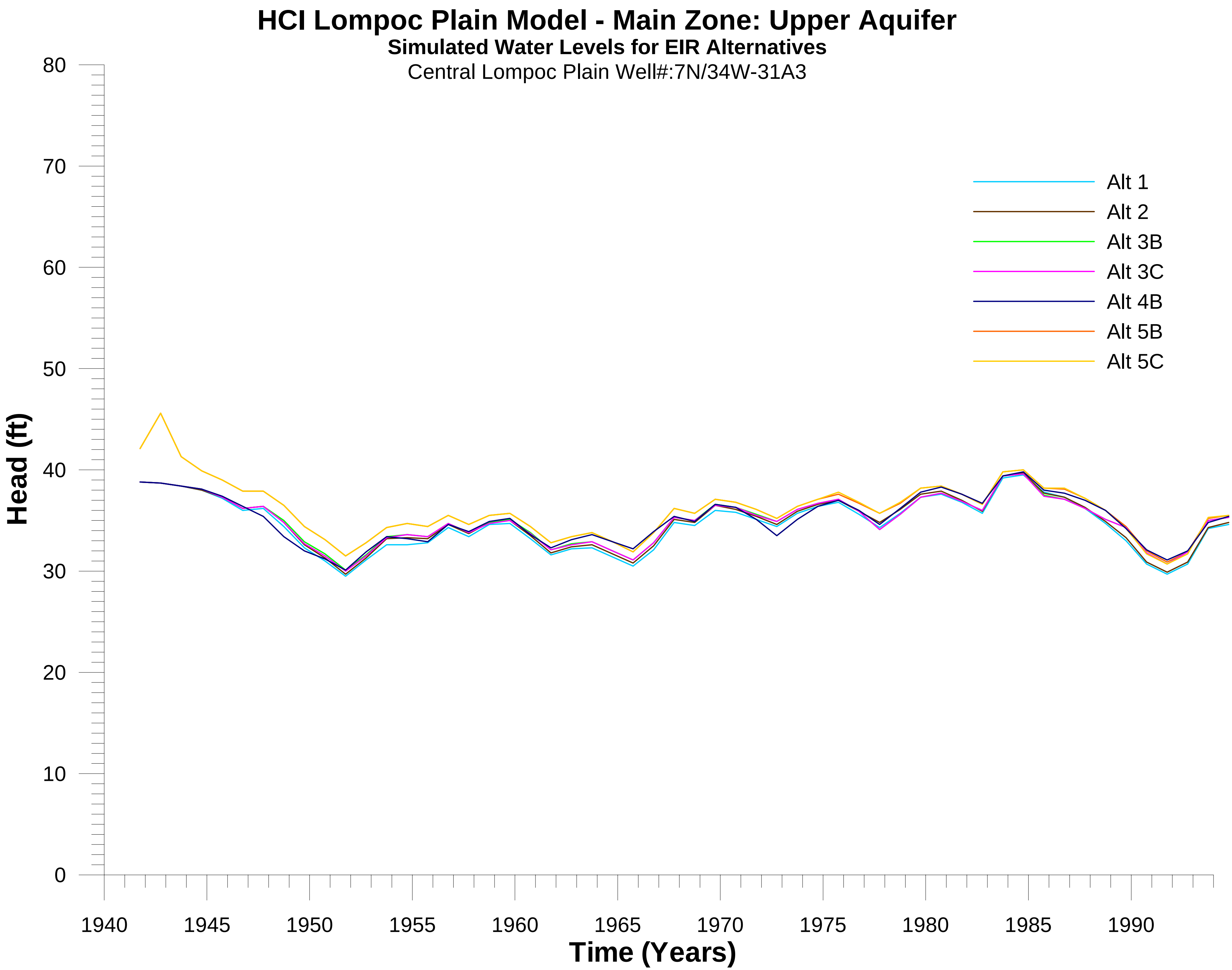
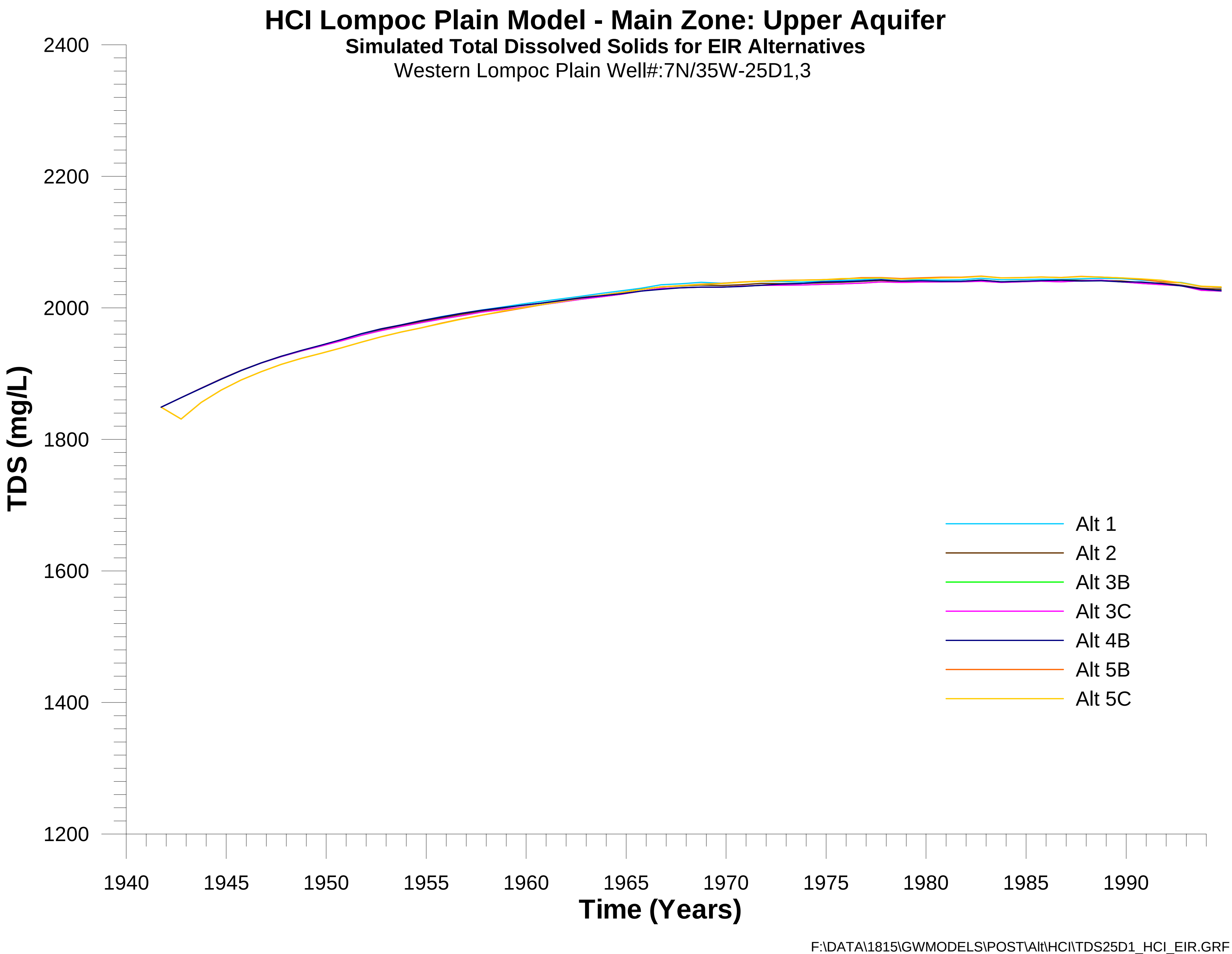


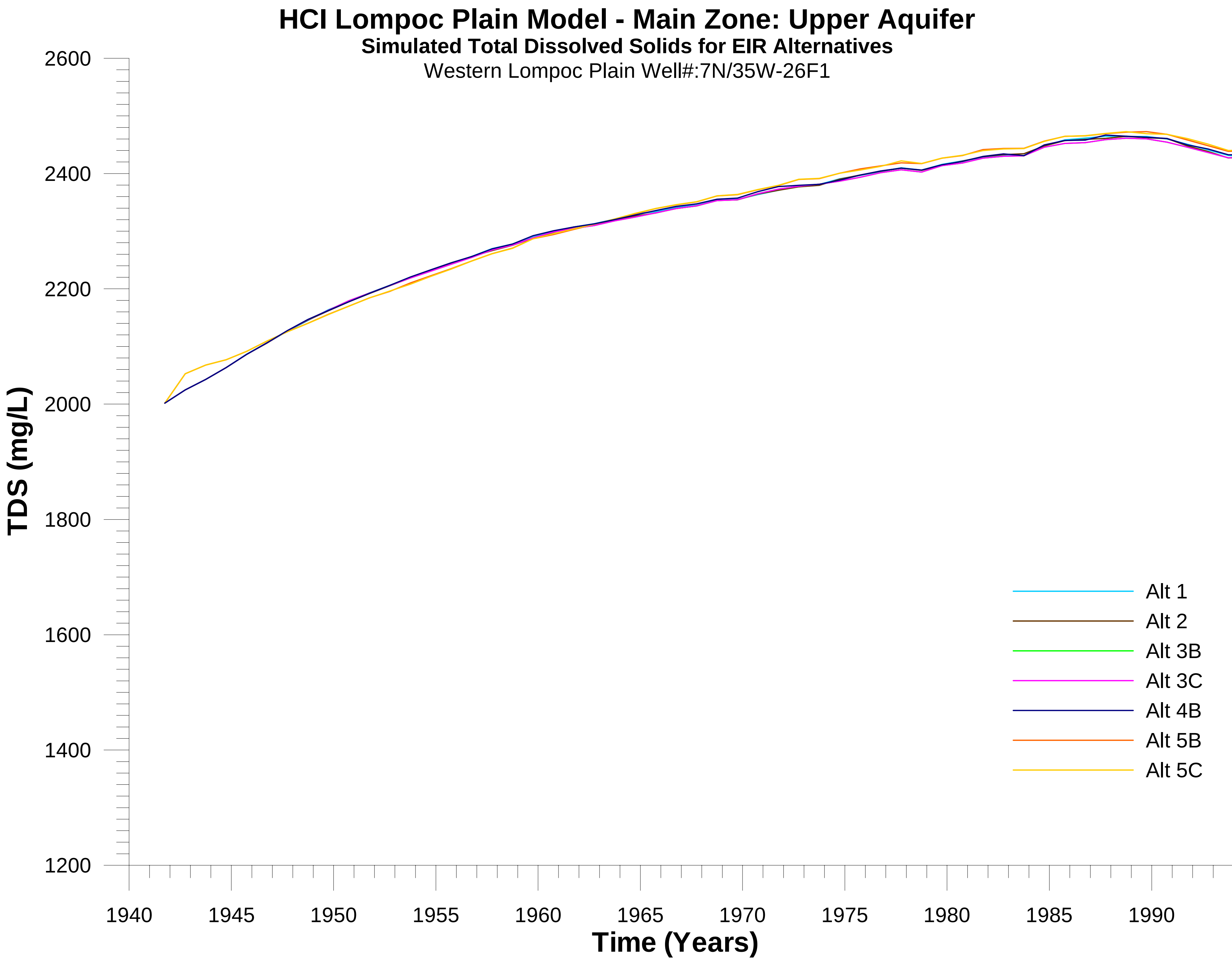
FIGURE 28

F:\DATA\1815\GWMODELS\POST\Alt\HCI\WL\WL31A3_HCI_EIR.GRF



HCI Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Total Dissolved Solids for EIR Alternatives
Western Lompoc Plain Well#:7N/35W-25D1,3
TDS (mg/L)
2400
2200
2000
1800
1600
1400
1200
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
F:\DATA\1815\GWMODELS\POST\Alt\HCI\TDS25D1_HCI_EIR.GRF

FIGURE 29



F:\DATA\1815\GWMODELS\POST\Alt\HCI\TDS26F1_HCI_EIR.GRF

FIGURE 30

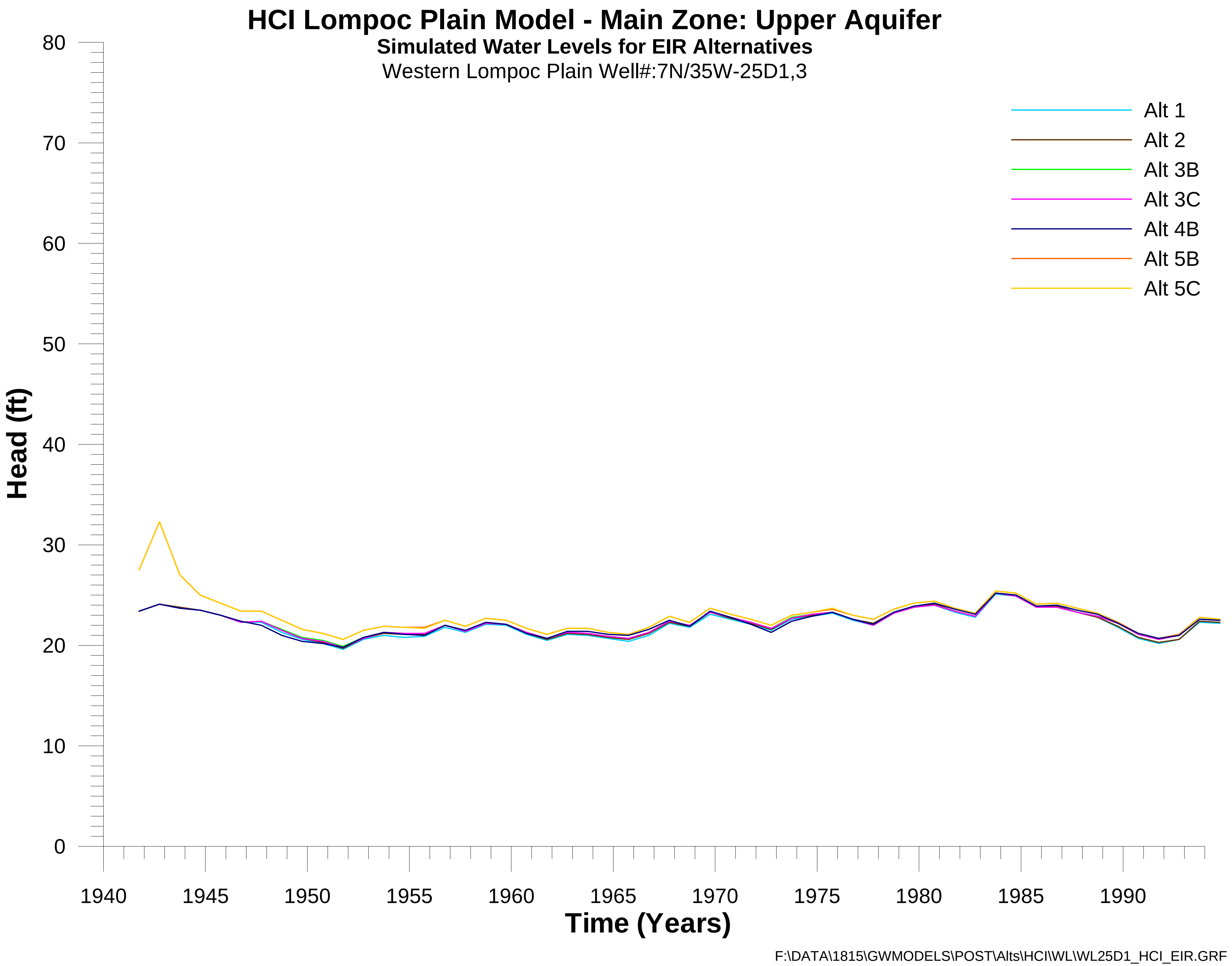

HCI Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Water Levels for EIR Alternatives
Western Lompoc Plain Well#:7N/35W-25D1,3
Head (ft)
80
70
60
50
40
30
20
10
0
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
F:\DATA\1815\GWMODELS\POST\Alts\HCI\WL\WL25D1_HCI_EIR.GRF

FIGURE 31

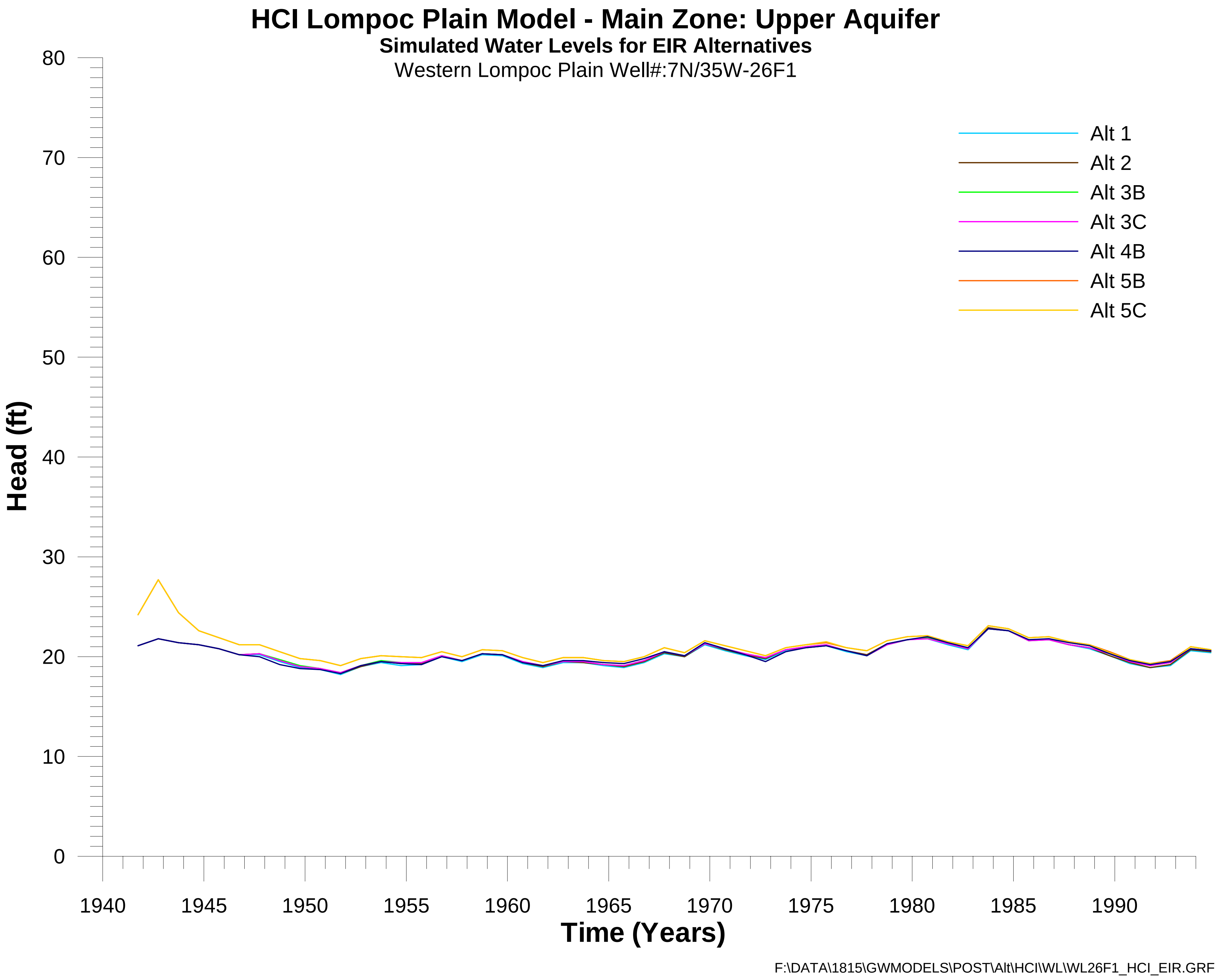

HCI Lompoc Plain Model - Main Zone: Upper Aquifer
Simulated Water Levels for EIR Alternatives
Western Lompoc Plain Well#:7N/35W-26F1
Head (ft)
0
10
20
30
40
50
60
70
80
Alt 1
Alt 2
Alt 3B
Alt 3C
Alt 4B
Alt 5B
Alt 5C
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
Time (Years)
F:\DATA\1815\GWMODELS\POST\Alt\HCI\WL\WL26F1_HCI_EIR.GRF

FIGURE 32