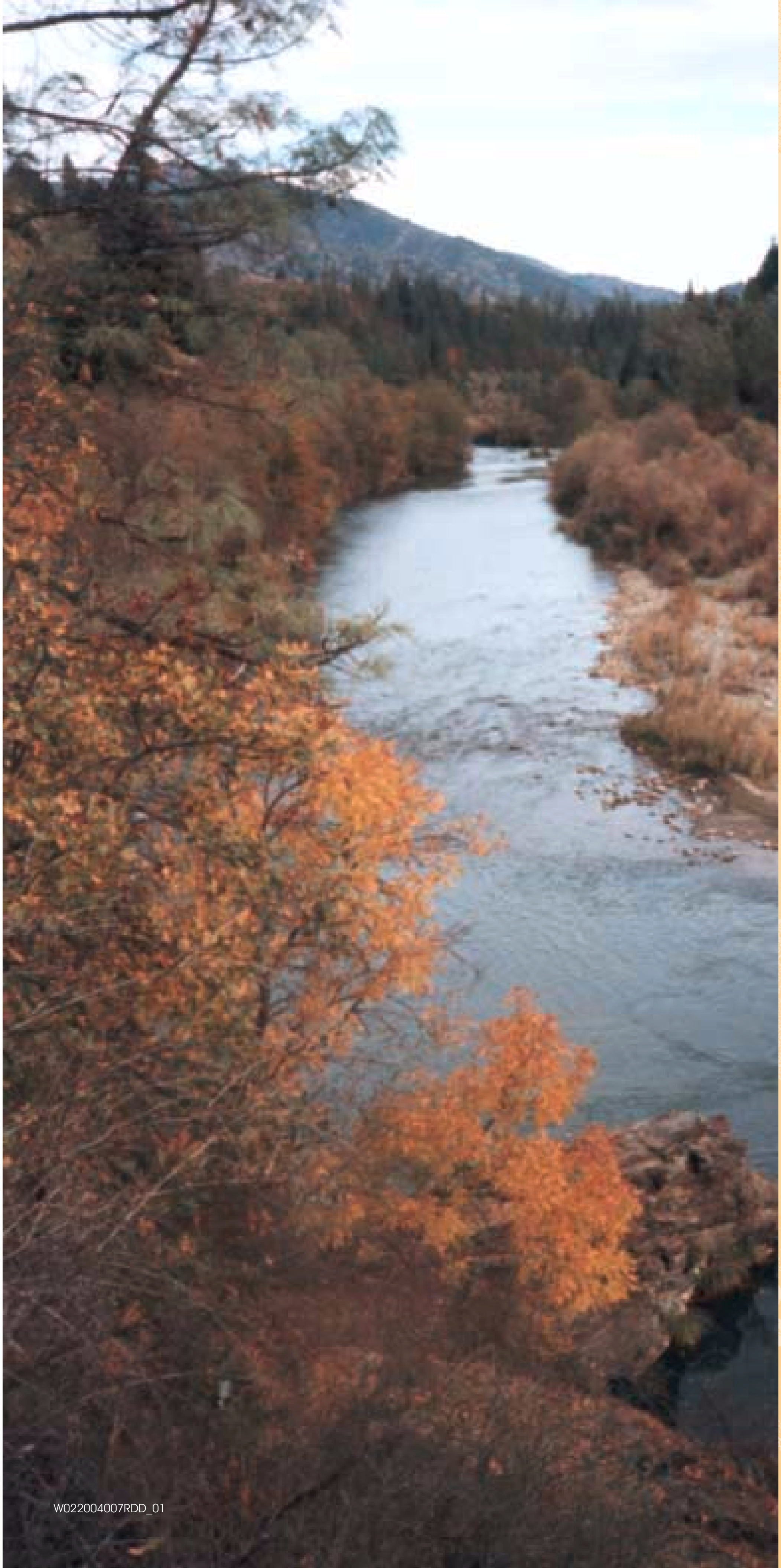
Lead Agencies:

U.S. Fish and Wildlife Service
U.S. Bureau of Reclamation
Hoopa Valley Tribe
Trinity County



Trinity River Fishery Restoration

Supplemental Environmental Impact Statement/ Environmental Impact Report

April 2004

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Contents

Page

Contents, Continued

Contents, Continued

Page

Tables

Contents, Continued

Contents, Continued

Contents, Continued

Contents, Continued

Acronyms and Abbreviations

°C	degree Celsius
°F	degree Fahrenheit
5C	Five Counties Salmonid Conservation Program
A	adverse change
AEAM	Adaptive Environmental Assessment and Management
B	beneficial change
BA	biological assessment
BETTER	Box Exchange Transport Temperature and Ecology of Reservoirs Model
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BO	biological opinion
CALSIM	California Simulation Model
CAPX	California Power Exchange
CCWD	Contra Costa Water District
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
COA	Coordinated Operating Agreement
columnaris	*Flavobacter columnare*
Court	U.S. District Court
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DBP	disinfection by-products

Delta	Sacramento-San Joaquin River Delta
DOI	U.S. Department of the Interior
Draft EIS/EIR	Draft Environmental Impact Statement/Environmental Impact Report
DSM2	Delta Simulation Model 2
DWR	California Department of Water Resources
EC	electrical conductivity
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
EWA	Environmental Water Account
FERC	Federal Energy Regulatory Commission
GWh	gigawatt hours
HB	highly beneficial change
ICH	*Ichthyopthirius multifilis*
IOU	investor-owned utilities
ISO	California Independent System Operator
km	kilometer
kW	kilowatt
kWh	kilowatt-hour
LKRP	Lower Klamath Restoration Partnership
M&I	municipal and industrial
maf	million acre-feet
MDO	Memorandum Decision and Order
msl	mean sea level
MW	megawatt
NC	no change

NCRWQCB	North Coast Regional Water Quality Control Board
NEPA	National Environmental Policy Act
NOAA Fisheries	National Marine Fisheries Service
NOI	Notice of Intent
NOP	Notice of Preparation
No_x	oxides of nitrogen
NP15	California ISO North Path 15
OCAP	Operations Criteria and Plan
PEIS	Programmatic Environmental Impact Statement
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas and Electric Company
ppt	parts per thousand
Program	Trinity River Restoration Program
Reclamation	U.S. Bureau of Reclamation
RM	river mile
ROD	Record of Decision
RTM	U.S. Bureau of Reclamation's Temp-erature Model
RTO	regional transmission organization
SCE	Southern California Edison
SDIP	South Delta Improvements Project
SDWA	Safe Drinking Water Act
Service	U.S. Fish and Wildlife Service
SLC	State Lands Commission
SNTEMP	Service's Stream Network Temperature Model
SO_2	sulfur oxide
SP15	California ISO South Path 15
Supplemental EIS/EIR	Trinity River Fishery Restoration Supplemental Environmental Impact

	Statement/Environmental Impact Report
SVWMA	Sacramento Valley Water Management Agency
SWP	California State Water Project
SWRCB	State Water Resources Control Board
taf	thousand acre-feet
TAMWG	Trinity Adaptive Management Working Group
Task Force	Trinity River Basin Fish and Wildlife Task Force
TCD	Temperature Control Device
THM	trihalomethanes
TMDL	Total Maximum Daily Load
TRD	Trinity River Division
TRFES	Trinity River Flow Evaluation Study
TRRP	Trinity River Restoration Program
TRSAAM	Trinity River System Attribute Analysis Method
TRSSH	Trinity River Salmon and Steelhead Hatchery
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
Wanger Decision	Memorandum Decision and Order re: Cross Motions for Summary Judgement in the Case of Westlands, et al., v. United States, et al.
Western	Western Area Power Administration
WQCP	Water Quality Control Plan
yd^3	cubic yards
yd^3/year	cubic yards per year

SECTION 1.0

Introduction and Purpose and Need

1.1 Introduction

This Trinity River Fishery Restoration Supplemental Environmental Impact Statement/Environmental Impact Report (Supplemental EIS/EIR) addresses the environmental issues, alternatives, and impacts associated with restoration of the natural production of anadromous fish on the Trinity River downstream of Lewiston Dam. This document updates, amends, and, in some cases, affirms assumptions, analyses, and conclusions of the previous environmental documents associated with Trinity River Fishery Restoration. These prior documents were prepared pursuant to both the National Environmental Policy Act (NEPA) (42 United States Code [USC] § 4321 et seq.) and the California Environmental Quality Act (CEQA) (Cal. Pub. Resources Code, § 21000 et seq.). (See section 1.8, "Similarities and Differences between NEPA and CEQA.") NEPA is a federal law setting forth the parameters and principles of environmental review for federal agencies, while CEQA is a California law governing environmental review conducted by state, regional, and local agencies.

Those aspects of this Supplemental EIS/EIR intended to satisfy NEPA requirements were prepared in response to federal court rulings that resulted from a legal challenge to the original EIS. The original EIS/EIR was circulated as a public draft in October 1999, finalized in October 2000, and resulted in a signed Record of Decision (ROD) in December 2000. These documents are available from U.S. Bureau of Reclamation (Reclamation) and Trinity County.

Although the above-mentioned federal court rulings did not address issues arising under CEQA, this new document is also intended to satisfy CEQA requirements. Although entitled a Supplemental EIR for ease of reference (because the federal court rulings required preparation of a Supplemental EIS), the portions of the document devoted to CEQA compliance are more precisely characterized as a "partially recirculated draft EIR." (See Cal. Code of Regulations, tit. 14, § 15088.5, subd. (c).) The CEQA portions of the new document do not constitute a true Supplemental EIR, in the normal sense of state law term-of-art, in that Supplemental EIRs normally are prepared only after an original EIR has been "certified" and a proposed project has received at least one or more project approvals subject to CEQA. (See Cal. Pub. Resources Code, § 21166; Cal. Code of Regs., tit. 14, §§ 15162, 15163).

Although the federal co-lead agencies and CEQA lead agency (Trinity County) together published in October 2000 a document entitled, Final EIS/EIR for the Trinity River Fishery Restoration, that document was not a true Final EIR, as it was never "certified" by the Board of Supervisors of Trinity County. (See Cal. Code Regs., tit. 14, § 15090.) Thus, that Final EIS/EIR was not a joint NEPA/CEQA document, but rather was a pure NEPA document only, despite its title. Trinity County intends that, once this Supplemental EIS/EIR is circulated for public review and comment, the County, together with the other lead agencies, will respond to all comments on both the original Draft EIS/EIR and this Supplemental EIS/EIR. In doing so, Trinity County reserves the right to use some of the material provided in the original Final EIS/EIR.

This Supplemental EIS/EIR was prepared by the U.S. Fish and Wildlife Service (Service), Hoopa Valley Tribe, Trinity County, and Reclamation (see Section 5.1 of the Draft EIS/EIR for agency involvement and a list of the agency approvals for the project to proceed [Service et al., 1999]). This Supplemental EIS/EIR meets the legal requirements of NEPA and CEQA. This document discloses relevant information to all interested parties and invites such parties to play a role in both the decisionmaking process and the implementation of that decision. This Supplemental EIS/EIR also provides federal, state, and local decisionmakers with detailed information concerning the significant environmental, social, economic, cultural, and other impacts associated with the alternative courses of action.

1.2 Court Proceedings

A Final EIS on the Trinity River Restoration Program (TRRP or Program) was published in October 2000, and a ROD was executed on December 19, 2000. Central Valley water and power interests filed suit in the U.S. District Court (or Court) for the Eastern District of California seeking to enjoin implementation of the ROD. On December 9, 2002, Judge Oliver Wanger of the court issued a Memorandum Decision and Order (MDO) re: Cross Motions for Summary Judgement in the Case of Westlands, et al., v. United States, et al., (sometimes referred to as the "Wanger Decision" or "Judge's ruling" in this document). (See 275 F. Supp. 2d 1157 (E.D. Cal. 2002).) The MDO identified a number of instances in which, according to Judge Wanger, the federal defendants had not fully complied with NEPA and the Endangered Species Act (ESA) (16 USC § 1531 et seq.). Therefore, the MDO enjoined the federal defendants from implementing any of the flow-related aspects of the ROD pending completion of a Supplemental EIS. The Supplemental EIS was required to cure certain problems with the original NEPA documents, and to address certain information that came to light after completion of the Draft EIS/EIR for the proposal. Because the original documents had included what the court considered an overly narrow statement of purpose, and had failed to include an adequate range of project alternatives, the court required the Supplemental EIS to revisit those issues. The document was also required to address the environmental effects of certain "reasonable and prudent measures" required by two Biological Opinions (BO) issued by the Service and the National Marine Fisheries Service (now NOAA Fisheries) after completion and circulation of the Draft EIS/EIR. Finally, the Supplemental EIS was to examine the effects of the proposed actions on electrical power production, specifically in relation to the California energy crisis that occurred in late 2000, and conditions continuing thereafter. The court also found that the BOs exceeded the authority granted to Service and NOAA Fisheries under ESA, in that the BOs impermissibly required what amounted to major modifications to operations of the Central Valley Project (CVP). Following the MDO, the court issued final judgment in the case on February 20, 2003. The final judgment is summarized in Table 1-1, which includes references to the parts of this document that address the final judgment.

The Court's ruling in this case emphasized the need for Interior to take into account ESA impacts throughout the CVP in developing reasonable and prudent measures and implementing terms and conditions for any authorized incidental take of listed species. With respect to the treatment of ESA impacts in the original EIS, the Court found that it "was arbitrary and capricious for the EIS and Final EIS not to address impacts of X2 [Delta salinity] reasonable and prudent measures and CVP re-operation." Westlands Water Dist. v. U.S. Department of the Interior, 275 F.Supp.2d at 1196. To comply with the Court's ruling, the federal defendants recognized that Reclamation needs to assess the impacts on listed species throughout the entire CVP system to the extent that those species may be affected by the range of possible Trinity operations under the various alternatives under consideration in the Supplemental EIS/EIR. Ideally, Reclamation would have been able to complete its renewed consultation with the Service and the NOAA Fisheries so that new Supplemental BOs would have been provided before publication of the Public Draft EIS/EIR. However, that early coordination simply has not been possible because of the complicated nature of the comprehensive Operations Criteria and Plan (OCAP) ESA consultation, and the timeline required for completion of this document.

The OCAP process includes consultation with Service and NOAA Fisheries under section 7 of the ESA to determine the potential impacts on ESA-listed endangered and threatened species throughout the entire CVP, including the Trinity River Division (TRD). Pursuant to the ESA regulations, 50 C.F.R. § 402.12, as the lead federal "action" agency for OCAP, Reclamation must prepare a biological assessment (BA) that takes into account the range of ongoing and proposed actions that comprise CVP operations. These OCAP-related actions include several developments that were not in place in 2002 at the time of the initial BOs and the initial EIS for the Trinity River fishery restoration. These developments include the following:

- Proposed new water diversion on the Sacramento River near Freeport, California
- Proposed inter-tie between the Delta Mendota Canal and the State Water Project's California Aqueduct
- California Department of Water Resources' South Delta Improvement Plan, which includes both possible increased diversions at the Banks Pumping Plant and construction and operation of in-channel barriers in the South Delta area.

Reclamation's BA also must include assumptions regarding management of the Environmental Water Account (EWA), itself a complicated operational assessment. *Cf.* Laub v. U.S. Department of the Interior, 342 F.3d 1080, 1083-84 (9th Cir. 003)(describing EWA in context of CALFED).

Consistent with the direction provided by the U.S. District Court, this Supplemental EIS/EIR addresses the shortcomings of the original

Draft EIS/EIR identified by the court. Anticipating the possible need for a Supplemental EIS in the aftermath of a March 2001 decision granting a preliminary injunction, the co-lead agencies began the scoping process for such a document in January 2002.

TABLE 1-1
Summary of Court-identified Shortcomings in Previous EIS/EIR

Summary Issues	Supplemental EIS/EIR Reference	Comment
Purpose and scope of the Draft EIS/EIR was unfairly and unlawfully narrowed.	Section 1.3, Purpose and Need for the Action	Note change from Purpose Statement in 1999 EIS/EIR.
Reasonable Integrated Management Alternative was not fairly considered.	Section 2.0, Description of Alternatives	Note clarification made to alternatives regarding integrated management, also alterations made to Revised Mechanical Restoration (formerly Mechanical Restoration) and Modified Percent Inflow (formerly Percent Inflow), and the addition of the 70 Percent Inflow Alternative. "Integrated Management" is defined as the use of both flow and non-flow measures to restore the Trinity River fishery.
Consideration of power supply and reliability was inadequate.	Section 3.5, Power Resources	Note revised methodology used to evaluate alternatives, discussion of power supply reliability with regard to the California energy crisis, and relative measures of power supply reliability.
Service BO improperly identified "reasonable and prudent measures" for salinity control that were impermissible because they required more than "minor changes" to the proposed action.	Section 3.4, Fisheries	Note updated analysis of the impact of alternatives on relative habitat provided by X2 position.
National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) improperly mandated implementation of the instream flow releases proposed in the preferred alternative as a purported reason-able and prudent measure to minimize the harm of channel rehabilitation and gravel placement projects.	Section 3.3, Water Quality; Section 3.4, Fisheries; Section 3.5, Power Resources	Note updated analysis on the impact of the alternatives on relative mortality of winter-run Chinook salmon. Also note analysis of the frequency of Power Plant Bypasses in Section 3.3 Water Quality and the cost of possible bypasses in Section 3.5 Power Resources.

Note: NOAA Fisheries was formerly known as and referred to in the 1999 EIS/EIR as National Marine Fisheries Services (NMFS)

As this Supplemental EIS/EIR is available for public review, the Ninth Circuit Court of Appeals is considering appeals filed in the aftermath of the U.S. District Court decision. Notably, the federal defendants appealed on only one issue: whether the U.S. District Court was correct in invalidating the statement of purpose in the original Draft EIS/EIR. Although this Supplemental EIS/EIR reflects the U.S. District Court's direction, it is possible that the Court of Appeals will disagree with the U.S. District Court on this issue, and will uphold the original version. The Hoopa Valley Tribe, another co-lead agency, filed an appeal of a much broader scope: its appeal seeks to overturn virtually all aspects of the U.S. District Court decision finding problems with the EIS and ROD. Again, it is possible that the appellate court will overrule the U.S. District Court and, therefore, render the Supplemental EIS process unnecessary, in whole, or in part.

1.3 Purpose and Need for the Action

NEPA regulations require that each EIS briefly specify the purpose and need to which the agency is responding in proposing the various alternatives, including the proposed action. Similarly, CEQA requires that each EIR include a statement of the objectives sought by the proposed project. The objectives are intended to help the implementing agency develop a reasonable range of alternatives and aid decisionmakers in preparing findings or a statement of overriding considerations, if necessary.

1.3.1 Purpose and Need Statement

The purpose and need as stated in the original Draft EIS/EIR is as follows:

> The purpose of the proposed action is to restore and maintain the natural production of anadromous fish on the Trinity River downstream of Lewiston Dam[1].
>
> The need for this action results from Congress' (1) mandate that diversions of water from the Trinity River to the CVP not be detrimental to Trinity River fish and wildlife resources; (2) finding that construction and operation of the TRD has contributed to detrimental effects to habitat and has resulted in drastic reductions in anadromous fish populations; (3) finding that restoration of depleted stocks of naturally-produced anadromous fish is critical to the dependent tribal, commercial, and sport fisheries; and (4) confirmation of the federal trust responsibility to protect tribal fishery resources affected by the TRD (see Section 1.3 for Congressional actions).

In response to the judgement of the U.S. District Court (see Section 1.2), the statement of the Program's purpose has been revised as follows:

> The proposed action is to restore and maintain the natural production of anadromous fish in the Trinity River Basin downstream of Lewiston Dam, including fishery restoration to pre-TRD levels, and to meet the U.S. Government's tribal trust obligations.

Secondary consideration is given to (1) meeting the other restoration goals of the Act of October 24, 1984, Public Law 98-541, as amended, and (2) achieving a reasonable balance among competing demands

[1] For purposes of this document, "restore" is defined as reviving the well-being, vitality, and use thereof, but not necessarily to an original or other pre-established condition.

for use of CVP water, including the requirements of fish and wildlife, agricultural, municipal and industrial (M&I), and power contractors.

The need for this action remains unchanged as a result of the following Judge's Ruling and results from Congress':

1. Mandate that diversions of water from the Trinity River to CVP not be detrimental to Trinity River fish and wildlife resources.
2. Finding that construction and operation of the TRD has contributed to detrimental effects to habitat and has resulted in drastic reductions in anadromous fish populations.
3. Finding that restoration of depleted stocks of naturally-produced anadromous fish is critical to the dependent tribal, commercial, and sport fisheries.
4. Confirmation of the federal trust responsibility to protect tribal fishery resources affected by the TRD. (See Section 1.5 for Congressional actions.)

In formulating the preferred alternative and other alternatives, the federal lead agencies have proposed restoration options in which actions increasing and managing flows and improving conditions within the Trinity River would be closely integrated with ongoing or proposed actions to improve conditions in the tributaries of the Trinity River and within the entire Trinity River watershed. Such coordination is intended to take full advantage of non-flow means of improving fishery habitat within the mainstem while striking a reasonable balance between efforts to increase natural anadromous fish production and the need to continue providing water and power for CVP contractors within the Central Valley and elsewhere.

1.3.2 Goals and Objectives

The following goal established a framework for the Draft EIS/EIR and was the primary CEQA driver in the development of alternatives:

∉ Restore and maintain a "healthy" Trinity River downstream of Lewiston Dam. (See Section 3.2 of the Draft EIS/EIR for discussion of the "healthy river" concept.)

As CEQA lead agency, Trinity County believes that this general goal is consistent with the above-described statement of federal purpose and need, and with the statutory mandates and responsibilities of the state "responsible agencies" that must rely on the EIR portion of the joint EIS/EIR. The goal was clarified by establishing qualitative "healthy river" objectives. These objectives relied heavily on the known and presumed attributes of the pre-dam Trinity River. These pre-dam attributes provided the diverse habitats that once supported the bountiful fish and wildlife populations. The healthy river objectives are as follows:

- Re-establish and maintain pre-dam habitats, especially alternate bar features.
- Mobilize and transport a wide variety of sediment sizes.
- Restore dynamic riparian plant communities in the river channel and its floodplain.

Objectives specific to salmonid population restoration are as follows:

- Provide suitable habitats below Lewiston Dam for all inriver salmonid life stages.
- Provide appropriate temperature regimes for salmonids below the dams.

The following project objectives apply only to Trinity County as the lead agency for CEQA purposes:

- Minimize high Trinity River water levels that would displace large numbers of existing Trinity County residents from their homes.
- Maximize the potential for the Trinity River to attract additional recreationalists into Trinity County, such as anglers and boaters.
- Minimize avoidable impacts to recreational activities on Lewiston and Trinity Reservoirs.
- Protect County of Origin and Area of Origin Water Rights.
- Comply with requirements and water quality objectives under the California Porter-Cologne Act and the federal Clean Water Act.
- Comply with Trinity County General Plan.

The following are project objectives for CEQA compliance that apply to state responsible and trustee agencies such as the North Coast Regional Water Quality Control Board (NCRWQCB), the California Department of Fish and Game (CDFG), and (possibly) the State Water Resources Control Board (SWRCB), and the State Lands Commission (SLC):

- Comply with the Water Code to ensure the highest reasonable quality of waters of the state, while allocating those waters to achieve the optimum balance of beneficial uses.
- Protect the public trust assets of the Trinity River watershed.
- Conserve, restore, and manage fish, wildlife, and native plant resources.

∉ Double populations of naturally-produced salmon, steelhead, and anadromous fish in the waters of California, including the Trinity and Sacramento Rivers and the Sacramento-San Joaquin River Delta (Delta), pursuant to the Fish and Game Code Section 6900-6924, the Salmon, Steelhead Trout, and Anadromous Fisheries Program Act.

The role, if any, of the SWRCB in Trinity River restoration efforts remains to be seen. At present, there are no pending plans to seek SWRCB approval of higher flows, and no such approval is necessary for the Secretary of Interior to voluntarily opt not to divert from the Trinity River the full amounts of water authorized under its current water rights permits. However, SWRCB involvement remains a possibility because, following completion of a ROD, Trinity County may re-initiate a 1990 petition to the SWRCB related to Water Right Orders 90-05 and 91-01. The petition may request amendment of Reclamation's seven Trinity River water permits for protection of Trinity River Basin public trust resources through increased minimum instream flows and implementation of Trinity River water quality objectives, and implementation of feasible mitigation measures identified in this Supplemental EIS/EIR.

As the CEQA lead agency, Trinity County has decided that the EIR portion of the EIS/EIR should be sufficient for any future action taken by SWRCB, should it get involved in some fashion. For this reason, the EIS/EIR contemplates possible action by the SWRCB. Many of the proposed mitigation measures could ultimately be within the jurisdiction of the SWRCB if not implemented voluntarily by the federal lead agencies.

The role, if any, of the SLC in Trinity River restoration efforts remains to be seen. The SLC has not claimed jurisdiction or permitting requirements for Trinity River Restoration Projects. However, the SLC has reserved the right to claim jurisdiction at a later date.

Trinity River Restoration Program Goals. Congressional directives identified the goals as the restoration and maintenance of fish populations in the Trinity River in order to meet the federal government's trust responsibility to area Indian tribes and to provide a meaningful tribal, commercial, and sport fishery. Although quantifiable project objectives for fish numbers and habitat area were considered for the Draft EIS/EIR, they were ultimately not adopted because of the complexity, uncertainty, and other confounding factors involved in establishing and monitoring such targets. However, the Trinity River Basin Fish and Wildlife Task Force (Task Force) adopted the Trinity River inriver spawner escapement goals and Trinity River Salmon and Steelhead Hatchery (TRSSH) production goals developed by CDFG (Table 1-2). These goals were subsequently documented in the 1983 EIS on the Trinity River Basin Fish and Wildlife Management Program (Service, 1983). Because the Task Force no longer exists, the goals are sometimes referred to as the TRRP goals. They are provided here for reference purposes only and are non-binding on the program.

TABLE 1-2
Trinity River Restoration Program Goals

Species	Inriver Spawning Goals	Hatchery Goals	Total
Fall Chinook Salmon	62,000	9,000	71,000
Spring Chinook Salmon	6,000	3,000	9,000
Coho Salmon	1,400	2,100	3,500
Steelhead	40,000	10,000	50,000

Current spawner escapement levels are extremely low compared to historical estimates (see Section 3.4) and the TRRP inriver spawner escapement goals. The post-dam average of naturally-produced fall Chinook salmon represents only 20 percent of the 62,000 goal; whereas, the averages for naturally-produced spring Chinook salmon, coho salmon, and steelhead (winter only) represent 40, 14, and 5 percent, respectively, of their inriver escapement goals. Although the fall Chinook spawner escapement has occasionally exceeded the inriver goals, many of those fish were hatchery produced. These infrequent large escapements are not indicative of healthy, naturally producing populations, but of hatchery surplus (see Section 3.4 for additional information on historical and current fish populations).

Restoration and maintenance of natural production requires that a sufficient number of the fish that spawn inriver begin their lives not in the hatchery, but as eggs in the river. Unfortunately, a very small proportion of inriver eggs survive to return as spawning adults; whereas, a large proportion of hatchery-produced fish do return to spawn. Assuming that naturally-produced and hatchery-produced fish are subject to the same environmental conditions and mortality factors (e.g., harvest) after the hatchery releases them (typically as smolts), the comparatively low returns of naturally-produced fish indicate poor survival rates of the younger freshwater life stages (eggs, fry, and/or juvenile fish). These low inriver survival and recruitment rates are compelling evidence that rearing habitat is a substantial limiting factor in the restoration and maintenance of anadromous fish populations (see Section 3.4).

In the future, quantitative population objectives for Trinity River salmonids may be established by NOAA Fisheries and/or the CDFG as part of the recovery planning process under the federal and/or state ESA, respectively. Currently, Trinity River naturally-produced coho salmon are listed as threatened under the federal and state ESA.

1.4 General Setting and Location

The Trinity River originates in the rugged Salmon-Trinity Mountains of northwest California, at a point approximately 10 miles southwest of the town of Weed, California. The river flows generally southward until it is impounded by Trinity and Lewiston Dams. From Lewiston Dam the river flows generally westward for 112 miles until entering the Klamath River near the town of Weitchpec on the Yurok Reservation. The Trinity River passes through Trinity and Humboldt Counties and the Hoopa Valley and Yurok Reservations, and it drains approximately 2,965 square miles. The Klamath River flows northwesterly from its confluence with the Trinity River for approximately 40 miles before entering the Pacific Ocean. (For a map of the general setting and location refer to Figure 1-1.)

In general, the proposed alternatives focus on the 40 miles of Trinity River below Lewiston Dam (i.e., the portion of the river upstream of the confluence with the North Fork). The detrimental impacts of the dams are particularly severe in this stretch because tributary inflows are relatively minor (whereas tributary inflow downstream of the North Fork, in combination with the minor inflows above the confluence, is significant enough to maintain a semblance of the pre-dam channel). The direct and indirect impacts of the alternatives occur within and outside the Trinity River Basin, which requires active coordination with ongoing or proposed efforts in Trinity River tributaries and the larger watershed to improve habitat conditions for anadromous fish. Such integrated efforts will ensure that the lead agencies take advantage of non-flow means of habitat improvements while attempting to strike a reasonable balance between efforts to increase natural anadromous fish production and the need to continue providing water and power for CVP contractors within the central valley and elsewhere. Although the alternatives focus on the mainstem, each action alternative includes components requiring active integration with ongoing or proposed efforts in Trinity River tributaries and the larger watershed to improve habitat conditions for anadromous fish. Anticipated impacts and benefits are generally discussed in the context of three geographic areas: the Trinity River Basin, the Lower Klamath River Basin/Coastal Area, and the Central Valley (see Section 3.0). The extent of analysis for each geographic area varies depending on the resource issue.

There are no changes from the original Draft EIS/EIR except for those changes identified in court order. (See Table 1-1.)

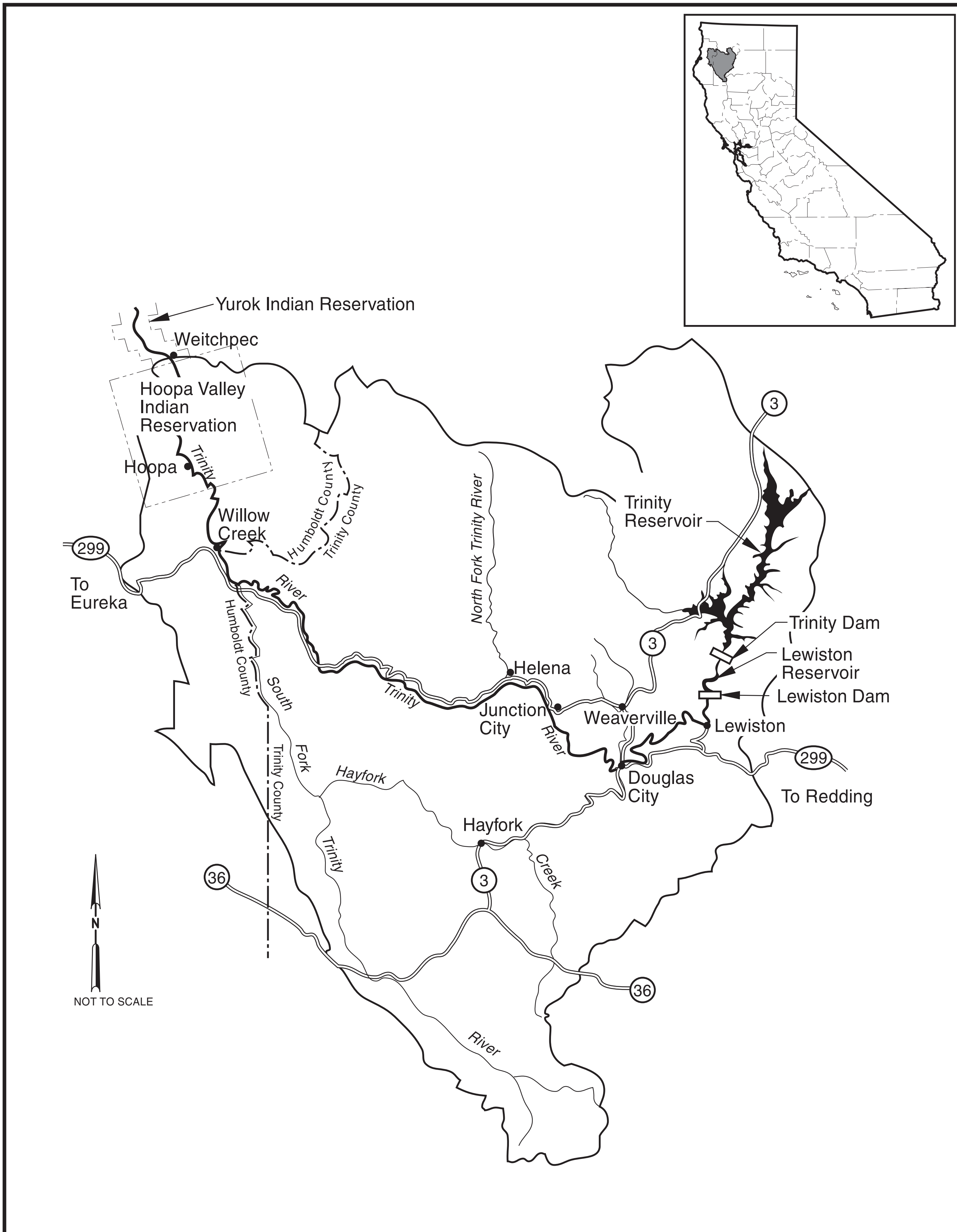


FIGURE 1-1
TRINITY RIVER BASIN
(EXCLUDING PORTION UPSTREAM OF TRINITY RESERVOIR)

TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

W022004007RDD_380 (4/2/04)

1.5 Legislative and Management History

The following is a brief chronology of the most pertinent legislation, authorities, and management actions.

In 1855, President Pierce established the Klamath River Reservation, a strip of territory commencing at the Pacific Ocean and extending 1 mile in width on each side of the Klamath River for a distance of 20 miles. On August 21, 1864, the federal government established the Hoopa Valley Reservation on the Trinity River, 12 miles square and bisected by 5 miles of the Trinity River. In 1891, an executive order extended the Hoopa Valley Reservation from the mouth of the Trinity River to the ocean, thereby encompassing and including the original Hoopa Valley Reservation, the Klamath River Reservation, and the connecting strip between. In 1988, Congress, under the Hoopa-Yurok Settlement Act, separated the Hoopa Valley Reservation into the present Yurok Reservation (a combination of the original Klamath River Reservation and extension) and the Hoopa Valley Reservation (the Reservation as proclaimed in 1864). Several court rulings in the 1970s established that an important "Indian purpose" for the reservations was to reserve the tribes' rights to take fish from the Klamath and Trinity Rivers, rights that were confirmed as part of the Hoopa-Yurok Settlement Act. Courts have also recognized that sufficient water is reserved to achieve the purposes of Indian reservations.

The Rivers and Harbors Act of 1938 authorized construction of the CVP and stipulated the use of dams and reservoirs for improvement of river navigation and flood control, irrigation and domestic water use, and power generation. The Rivers and Harbors Act also provided for wildlife conservation to be given "due regard" in planning federal water projects.

Congress authorized the construction and operation of the TRD by statute in 1955 (P.L. 84-386). Although the 1955 Act provided for the diversion of water from the Trinity Basin to the Central Valley, Congress specifically directed the Secretary "to adopt appropriate measures to insure the preservation and propagation of fish and wildlife(.)" Legislative history for the 1955 Act further elaborated on the expected diversions, stating that only water deemed "surplus"– those waters "wasting away to the Pacific Ocean," the diversion of which would not have a "detrimental effect to the Fishery Resources" of the Trinity and Klamath Rivers – be exported to the Central Valley. The TRD was completed in 1963, and full operation began in 1964.

The Task Force, composed of federal, state, and local agencies and tribes, was initially established in 1971 in response to concerns and observed negative effects of the TRD on fish and wildlife in the

Trinity River Basin. The Task Force developed the Trinity River Basin Comprehensive Action Program to restore anadromous fish populations and to formulate a long-term management program.

In 1976, the Magnuson Fishery Conservation and Management Act was passed to better manage salmon, partially in response to decreased Trinity runs. The act established the Pacific Fishery Management Council (PFMC), which established fishery management plans based on input from federal, state, tribal, and other entities.

An EIS prepared by the Service and released in November 1980, determined that an 80 percent decline in Chinook salmon and 60 percent decline in steelhead populations had occurred since commencement of TRD operations. The EIS further estimated total habitat losses in the Trinity River Basin to be 80 to 90 percent.

In January 1981, continued concerns about the fishery led to the Secretary signing a Secretarial Decision directing the Service to conduct a 12-year Trinity River Flow Evaluation Study (TRFES) "summarizing the effectiveness of restoration of flows and other measures including intensive stream and watershed management programs." The Secretary's action was based on statutory requirements as well as tribal trust responsibilities that compelled the "restoration of the river's salmon and steelhead resources to pre-project levels."

In 1983, an EIS on the Trinity River Basin Fish and Wildlife Management Program was prepared by the Service (Service, 1983). The environmental document analyzed habitat restoration actions, watershed rehabilitation, and improvements to the TRSSH. The EIS clarified that the hatchery's purpose was to mitigate for the loss of the 109 miles of habitat upstream of Lewiston Dam; whereas, the restoration and rehabilitation projects were explicitly designed to increase natural fish production below the dam.

In 1984, the Trinity River Basin Fish and Wildlife Management Act (P.L. 98-541) was enacted. It formalized the TRRP, reaffirmed the restoration goals established by the Task Force, and directed the Secretary to implement measures to restore fish and wildlife habitat in the Trinity River and its tributaries, and to modernize and otherwise increase the effectiveness of the Trinity River fish hatchery. The TRRP was aimed at implementing a fish and wildlife management program "to restore natural fish and wildlife populations to levels approximating those which existed immediately prior to the construction of the Trinity Division."

In October 1992, Congress enacted the Central Valley Project Improvement Act (CVPIA) (P.L. 102-575). One purpose of CVPIA was to protect, restore, and enhance fish, wildlife, and associated habitats in the Trinity River Basin. The act also directed the Secretary to finish the TRFES and to develop recommendations "based on the best available scientific data, regarding permanent instream fishery flow requirements and TRD operating criteria and procedures for the restoration and maintenance of the Trinity River fishery." The CVPIA also recognized the importance of protecting and restoring the Trinity River fishery in order to meet the federal government's trust responsibility, and specifically provided for the Secretary to consult with the Hoopa Valley Tribe on the TRFES and, upon concurrence, to implement the recommendations accordingly.

In 1993, the Service and Trinity County initiated an Environmental Assessment/Environmental Impact Report evaluating the Trinity River channel rehabilitation projects being promoted by the TRRP. However, ongoing construction work on several pilot projects generated numerous citizen complaints about the resulting turbidity of the river. In July 1994, the office of the Secretary mandated that an EIS be prepared prior to construction of any new channel rehabilitation projects. In addition, the Secretary's office determined that the EIS must also evaluate the permanent commitment of water as recommended in the TRFES. Therefore, the preparation of an EIS/EIR was initiated to evaluate the mechanical restoration activities and TRFES recommendations along with a range of reasonable alternatives. The Notice of Intent (NOI) to prepare the EIS/EIR was published on October 12, 1994.

In 1996, Congress re-authorized and amended the 1984 Trinity River Basin Fish and Wildlife Management Act (P.L. 104-143). The 1996 amendments clarified that "restoration is to be measured not only by returning adult anadromous fish spawners, but by the ability of dependent tribal, commercial, and sport fisheries to participate fully in the benefits of restoration." The amendments also confirmed that the purpose of the hatchery was to mitigate for the loss of habitat above the dams, and that the hatchery should not impair "efforts to restore and maintain naturally reproducing anadromous fish stocks within the basin."

Developments in the restoration program since the December 2000 ROD include, as directed by the court ("∗ all other non-flow related activities identified in ROD should proceed∗ "), the following:

∉ The TMC has been established

∉ An Executive Director has been hired

∉ The TAMWG has been chartered and members appointed

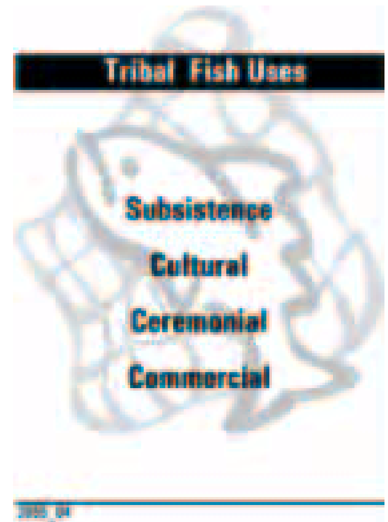
∉ A physical office has been constructed

- A 13-member staff has been hired
- The initial members of the Science Advisory Board have been appointed

Continuation of these efforts would be re-evaluated pending final approval of ROD.

1.6 Indian Tribes

Secretarial Order No. 3175 states that the U.S. Department of the Interior (DOI), "when engaged in the planning of any proposed project or action, will ensure that any anticipated effects on Indian trust resources are explicitly addressed in the planning, decision and operational documents; i.e.,... Environmental Impact Statements...that are prepared for the project" (DOI, Office of the Secretary, 1993: although expired, the order was incorporated into the DOI, 512 DM Part 2). This mandate was affirmed in a Presidential directive reaffirming the sovereign rights of Indian tribes and the government-to-government status of relations between the United States and recognized tribes. Accordingly, the Draft EIS/EIR provides a detailed assessment of potential effects on Indian trust resources and how these effects may impact Indian tribes. Consistent with DOI policy, the analysis addresses only those tribes of the Klamath/Trinity Region that are officially recognized by the United States (Pevar, 1992) – the Hoopa Valley[2], Karuk, Klamath, and Yurok. Local unrecognized tribes include the Nor-El-Muk Band of Wintu Indians (Hayfork) and the Tsnungwe Tribe (Salyer/Burnt Ranch).



The traditional and current homeland of the Hoopa Valley Tribe lies along the banks of the Trinity River in the Hoopa Valley. The river is central to Hupa culture, society, economy, and language; its physical condition is a major determinant of the tribe's material, psychological, sociological, economic, and spiritual well-being. The condition of the Trinity River also has important implications for the Yurok Tribe. The traditional homeland of the Yurok Tribe extends from the Pacific Ocean along the lower Klamath River and into the Trinity River Basin. The Yurok Tribe has always depended on the fish, water, and other resources of the Trinity and Klamath Rivers. The traditional and present territories of the Karuk and Klamath (Oregon) Tribes are located along the upper Klamath River, above the river's confluence with the Trinity. Both of these tribes also depend on the resources of the Trinity River, primarily as it influences the Klamath River ecosystem.

The tribal trust discussion focuses principally on the Hoopa Valley and Yurok Tribes, because, of the Indian tribes of the Klamath/Trinity Region, they would be the most directly affected by the project. It should be understood, however, that the impacts are pertinent to the Karuk and Klamath people because they share a common regional heritage with the Hupa and Yurok and may be

[2] In this discussion, the terms Hoopa Valley and Hupa refer to separate designations for the *Natinixwe*, or Indian people of the Hoopa Valley. Hoopa Valley is used when referring to the tribal designation; Hupa refers to the people that share a language and culture.

impacted by the project, particularly as it affects the hydrology of the Klamath River.

1.6.1 Tribal Trust Responsibility

From their earliest contact with the Indians of North America, the European powers and the United States have dealt with Indians on a government-to-government basis. In principle, all treaties, statutes, and executive orders implementing federal Indian policy are premised upon this long-standing relationship.

Numerous court cases have found that the United States has a duty of protection toward Indians. In United States v. Mitchell (463 U.S. 206, 225 [1983]), the Supreme Court reaffirmed the principle of "the undisputed existence of a general trust relationship between the United States and the Indian people." The federal government's obligation to honor the trust relationship and to fulfill its treaty commitments is the trust responsibility. The federal government has extended the trust responsibility through federal statutes, agreements, and executive orders. These documents can create trust obligations in the same way that a treaty does. The trust responsibility imposes an independent obligation upon the federal government to remain loyal to Indians and to advance their interests, including their interest in self-government. The American Indian Policy Review Commission's Final Report stated:

> "The purpose behind the trust doctrine is and always has been to ensure the survival and welfare of Indian tribes and people. This includes an obligation to provide those services required to protect and enhance Indian lands, resources, and self-governance, and also includes those economic and social programs which are necessary to raise the standard of living and social well-being of the Indian people to a level comparable to the non-Indian society" (United States American Indian Policy Review Commission, 1997).

1.7 Project Facilities

The TRD is integrated and coordinated with operations of the CVP. CVP operations are directed in part by the Coordinated Operating Agreement (COA) between Reclamation and the State of California Department of Water Resources (DWR), the CVP Operations Criteria and Plan (OCAP), various water quality standards, and BOs for winter Chinook salmon and Delta smelt. These operational prescriptions are used by Reclamation and DWR to manage both the CVP and the California State Water Project (SWP). For a thorough description of water operations and management of the CVP and the SWP, refer to Section 3.3.

1.7.1 Trinity River Division

The TRD, constructed as part of the CVP, is operated and maintained by Reclamation in conjunction with eight other CVP divisions. Congressional committee reports on the authorizing act of the TRD stated that an average supply of 704,000 acre-feet, considered "surplus" to the present and future needs of the Trinity River Basin, could be exported from the Trinity River Basin to the Central Valley without detrimental effects on fishery resources. From 1964-1997, approximately 988,000 acre-feet have been diverted annually to the Central Valley (range 218,000 to 1,799,000), representing about 74 percent of the inflow above Trinity Dam (see Figure 1-2 and Water Resources [Section 3.2] for additional information). Diversions during the first 21 years of operation were substantially greater, an average of 1,146,800 acre-feet annually, or 79 percent of inflow, than were diversions during the most recent 13 years, which averaged 732,400 acre-feet annually, or 64 percent of inflow (however, a portion of the recent increase in instream releases is due to winter storm events, which provide limited benefits to salmon).

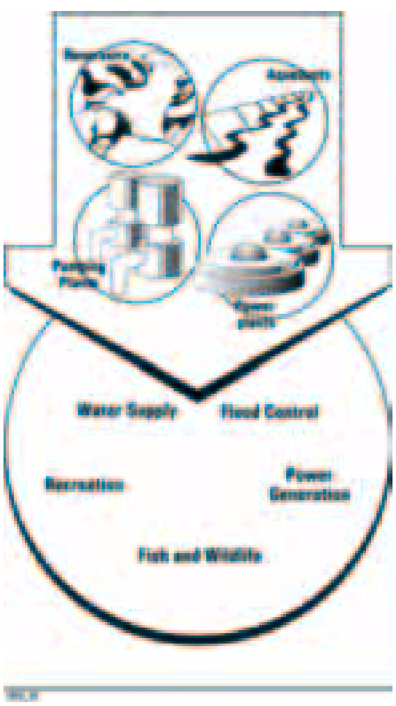
The TRD stores and regulates the entire runoff of the Trinity River upstream of Lewiston Dam. Diverted water is transported via the Clear Creek Tunnel to Whiskeytown Reservoir. From there, Trinity River water can either be transported via a second tunnel (Spring Creek Conduit) to Keswick Reservoir or released down Clear Creek to enter the Sacramento River.

The TRD has the capacity to generate substantial amounts of hydropower. Releases from Trinity and Lewiston Reservoirs can generate up to 139,650 and 350 kilowatts (kW), respectively. Water diverted from Lewiston Reservoir can generate 146,000 kW at the J.F. Carr Powerhouse (at the end of the Clear Creek Tunnel) and 200,000 kW at the Spring Creek Powerplant.

In total, the TRD represents approximately 25 percent of the total power generation capability of the CVP.

1.7.2 Central Valley Project

The CVP provides water for irrigation, M&I use, hydropower, and fish and wildlife purposes in and outside of the Central Valley of California. The CVP supplies irrigation water to approximately 200 water districts, individuals, and companies pursuant to annual demand for approximately 4.5 million acre-feet (maf) of water. These supplies are provided to entities with pre-1914 water rights, and through contracts to water service, water rights settlement, and exchange water contract holders. M&I water is supplied to about 40 districts and utilities under contracts totaling about 0.5 maf. Except in times of water shortage, Reclamation operates the CVP to deliver the amounts of water specified in its water service contracts and other water rights agreements. Major structures of the CVP include 20 reservoirs, with combined storage capacity of 11 maf; 9 powerplants and 2 pumping-generating plants with a maximum capacity of about 2.0 million kW; and approximately 500 miles of major canals and aqueducts.

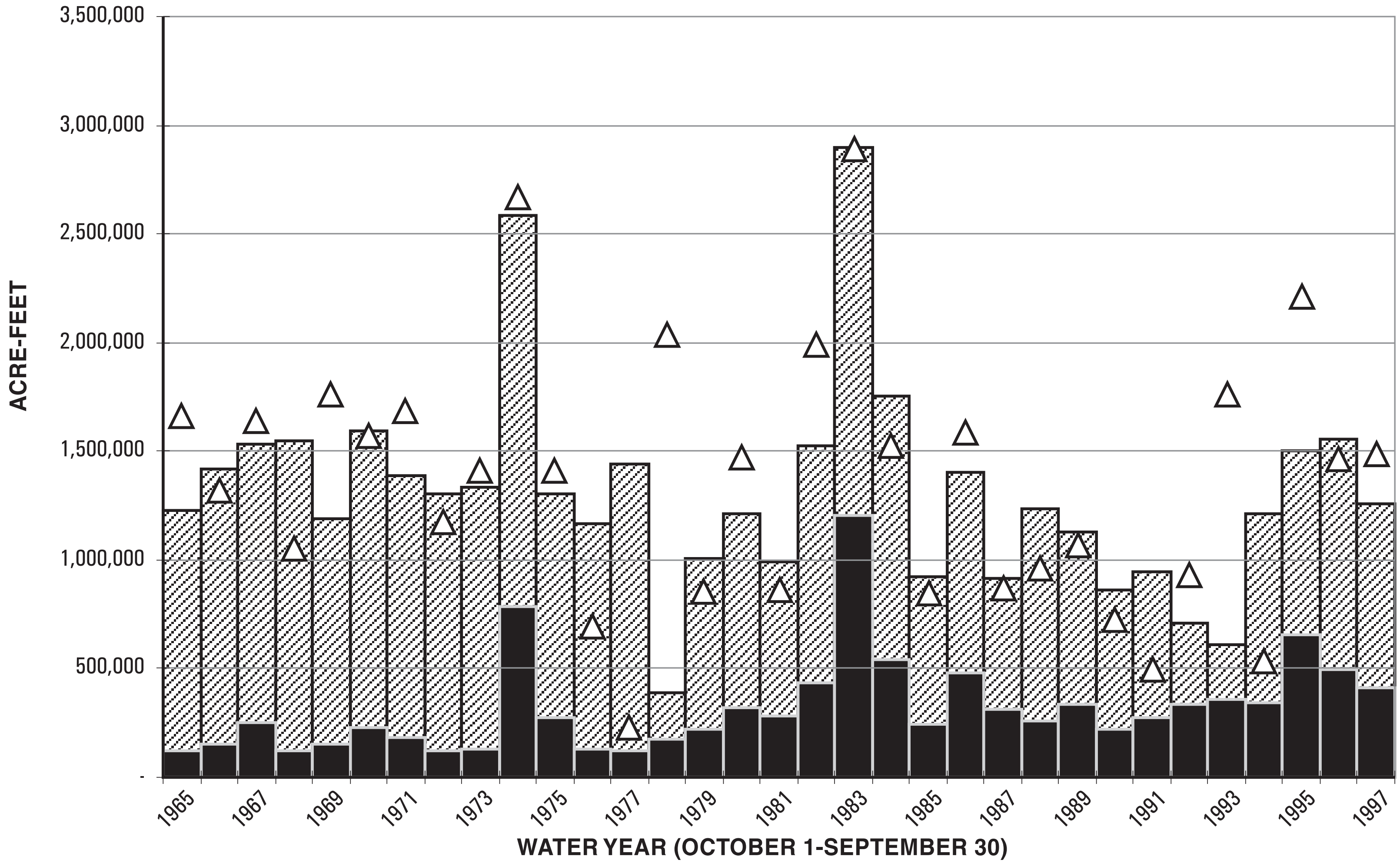


Although Reclamation is responsible for hydropower generation within Reclamation's water operating constraints, power dispatch functions and the marketing of the hydropower are the responsibility of Western Area Power Administration (Western). The power function is subordinate to the following higher priority, legislatively defined functions of the CVP: river regulation, flood control, domestic uses, improvement of navigation, irrigation, and fish and wildlife. Reclamation law states that surplus hydroelectric power and energy (net of project use) must be transmitted and disposed of "in a manner as to encourage the most widespread use thereof at the lowest possible rates to consumers consistent with sound business principles."

1.7.3 State Water Project

The SWP, a water storage and delivery system of reservoirs, aqueducts, powerplants, and pumping plants, extends for more than 600 miles, two-thirds the length of California. Project functions include water supply, flood control, power generation, recreation, and fish and wildlife enhancement.

The DWR, the operator of the SWP, has contracted to supply 4.16 maf annually to 30 public agencies in the San Joaquin Valley, south coast, and Southern California. Current annual deliveries are approximately 3.5 maf.



LEGEND

- Trinity River Exports
- Trinity River Release at Lewiston Dam
- Trinity Reservoir Inflow

NOTE

Differences between Trinity River inflow and sum of releases and exports (e.g., 1978-1979 and 1994-1995) are primarily attributable to carryover storage operations from previous water year.

Source: U.S. Bureau of Reclamation, Central Valley Operations

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FIGURE 1-2
TRINITY RIVER INFLOWS, INSTREAM RELEASES, AND EXPORTS

1.8 Similarities and Differences between NEPA and CEQA

This document is designed to comply with both NEPA and CEQA. NEPA and CEQA are laws that require governmental agencies to evaluate the environmental impacts of their proposed decisions before making formal commitments to carry them out, and that such evaluation be done in detail, and with public involvement. NEPA is a federal law and applies to federal agencies, whereas CEQA is a California law and applies to state and local agencies. For this project, NEPA requires preparation of an EIS, and CEQA requires preparation of an EIR. In 1999, by preparing a single Draft EIS/EIR that complied with both statutes, the involved agencies were able to avoid unnecessary duplication of effort. As explained in Sections 1.1 and 1.2, the November 2000 document styled a "Final EIS/EIR" was in fact a pure NEPA document, as Trinity County has not treated it as a Final EIR. This Supplemental EIS/EIR, in contrast, is a joint CEQA/NEPA document, as was the original Draft EIS/EIR. As also explained in Section 1.1, the CEQA portion of this new document could more precisely be described as a partially recirculated Draft EIR. (See Cal. Code Regs., tit. 14, § 15088.5.)

Despite the similarities between the two laws, important differences remain. NEPA is a procedural law requiring agencies to evaluate a range of reasonable alternatives, disclose potential impacts, and identify feasible mitigation. Under NEPA, reasonable alternatives must be rigorously and objectively evaluated, with the common practice being that all alternatives are examined at virtually the same level of detail as any "preferred alternative." Under CEQA, in contrast, lead agencies typically analyze a "proposed project," akin to a preferred alternative, and address alternatives at a lesser level of detail ("meaningful detail," according to the California Supreme Court). In this document, the Revised Mechanical Alternative and Modified Percent Inflow Alternative have been prepared in response to the order of the U.S. District Court for the Eastern District of California. (See Section 1.2.) Because the plaintiff in the litigation resulting in that order did not and could not raise any CEQA issues, the order does not dictate any particular course of action to Trinity County as CEQA lead agency. Even so, the County treats these new alternatives as CEQA and NEPA alternatives.

The CEQA practice of identifying a "significance threshold" for expected impacts presents an important or critical feature of the document. Impacts to be covered include those to endangered, threatened, and rare species and their habitats (*CEQA Guidelines*, § 15065, subd. [a]). Thus, when an EIR shows that a project has the potential to reduce the number of, or restrict the range of, a species officially listed under either the federal ESA or the California Endangered Species Act (CESA), the lead agency has a mandatory legal obligation to treat that impact as significant, and to mitigate if feasible. Thresholds of significance for other issue areas/resources are developed using applicable regulations where they exist, the standard “Environmental Checklist” used in CEQA practice (Appendix G to the *CEQA Guidelines*), or best professional judgment. Notably, CEQA generally requires the determination as to whether a proposed project would have a “significant environmental effect” to be based on a comparison between project effects and *existing environmental conditions*. Under NEPA, in contrast, federal agencies are required to compare the environmental effects of “action alternatives” against those of the “no action” alternative. Such comparisons frequently compare possible *future* scenarios. In this document, sections within each chapter entitled, “Existing Conditions versus Preferred Alternative” are intended to comply with the CEQA requirement.

CEQA requires that this Supplemental EIS/EIR propose mitigation measures for each significant effect of the project subject to the approval of an agency governed by California law, even where the mitigation measure cannot be adopted by the “lead agency” (Trinity County for this project), but can only be imposed by another responsible agency. The primary responsible agencies, defined as entities other than the lead agency that must use this EIR to approve some aspect of the approved program, are the NCRWQCB and Department of Fish and Game. As explained in Section 1.3.2, it is unclear at present whether the SWRCB or the SLC will also function as responsible agencies.

1.9 Scoping and Public Involvement

1.9.1 Original Draft EIS/EIR

The Service began the public process by preparing an NOI to prepare an EIS, which was published in the Federal Register on October 12, 1994. Trinity County forwarded a Notice of Preparation (NOP) of an EIR to the State Clearinghouse (No. 94123009) on November 16, 1994. The new State Clearinghouse number is 1994123009.

Joint NEPA/CEQA scoping meetings were held from October 27, 1994, through November 3, 1994, in Willows, Weaverville, Hoopa, and Eureka, California. During those meetings, members of the public were asked what issues they felt should be addressed. As this environmental process continued, the lead agencies also received letters that helped to identify areas of concern. Issues identified included:

- Fishery resources
- Tribal trust obligations
- Impacts to CVP agriculture and/or M&I water contractors
- Vegetation and wildlife resources
- Water quality, including inriver temperature concerns
- Water management
- CVP power generation
- Recreation, including recreation economics
- Socioeconomics
- Land use
- Flooding along the Trinity River
- Aesthetics, as it relates to drawdown of reservoirs
- Ocean sport and commercial fishing
- Upland watershed rehabilitation

These issues were used to develop the resource areas described in Section 3.0 of the original Draft EIS/EIR.

Public meetings were held March 25 through April 4, 1996, in the following locations: Orleans, Eureka, Hoopa, Weaverville, Willows, Fresno, Sausalito, and Coos Bay (Oregon). These meetings included a legislative update, the preliminary TRFES recommendations, range of EIS/EIR alternatives, potential impact areas, analytical tool description, and schedule. Public input was accepted in each of these areas, as well as others.

A second round of public information meetings was held October 28, 29, and 30, 1997, at Hoopa, Weaverville, and Sacramento, respectively. These meetings provided an update on the alternatives and preliminary analysis results. Additionally, a public meeting was held February 17, 1998, in Weaverville, to present some of the proposed significance criteria that have been developed to help identify the significance of various impacts.

In addition to the public meetings, a series of newsletters (January 1996, September 1996, and October 1997) were mailed out to a large number of interested parties. In the fall of 1998, the Service posted an Internet web page about the EIS/EIR (http://www.ccfwo.r1.fws.gov/ccfwo/treis.htm). Trinity County also maintained a public list server concerning Trinity River activities[3].

1.9.2 Supplemental EIS/EIR

The second scoping process for this project undertaken in the aftermath of the U.S. District Court's preliminary injunction of March 2001 (see Section 1.2), was designed to further refine issues identified in previous scoping efforts prior to issuance of the original Draft EIS/EIR, and to allow the public to comment on aspects of the program that have changed during the court proceedings.

Public notification was made through a notice that was published March 25, 2002, in the Federal Register. Notices were also sent to about 730 individuals, interest groups, and other organizations (including the Sacramento and Redding area media). An NOP (NOP-1994123009) was filed with the State Clearinghouse on April 19, with the comment period ending May 23, 2002. The scoping process for the Program formally began with an NOI and ended with final acceptance of all written comments on May 23, 2002. A scoping meeting was held on May 9, 2002, in Redding, California, and is described below. A CEQA-only scoping meeting was held at the Trinity County Board of Supervisors in Weaverville on May 21, 2002.

A second notification, after the U.S. District Court entered its final judgement, was made through a notice that was published June 17, 2003, in the Federal Register. Notices were also sent to the Sacramento, Redding, and Eureka media via legal notices in the Sunday, July 6, 2003, edition of each cities' newspaper. The scoping process formally began with the NOI and ended with final acceptance of all written comments on July 18, 2003. Two scoping meetings were held, one on July 8, 2003, in Redding, California, and one on July 10, 2003, in Hoopa, California. Additional CEQA scoping did not take place.

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[3] To subscribe to the "env-trinity" list server, send a blank e-mail message to env-trinity-subscribe@igc.topica.com or by sending an e-mail message to tstokely@trinityalps.net to request a subscription invitation.

1.9.3 Future Actions

This environmental process includes a public comment period, during which the public is asked to supply the lead agencies with comments on this Supplemental EIS/EIR. (See cover sheet for public comment timetable and addresses.) During the public comment period, public meetings or hearings will be held so that the lead agencies can receive the public's oral and written comments.

After the public comment period closes, the lead agencies will consider and respond to the comments and produce a Final Supplemental EIS/EIR. No earlier than 30 days after the availability of the Final Supplemental EIS/EIR, the lead NEPA agencies will produce a ROD. The Trinity River Supplemental EIS/EIR is a non-delegated NEPA action because both the Assistant Secretary for Water and Science and the Assistant Secretary for Fish, Wildlife, and Parks have signatory authority. Trinity County as the CEQA lead agency intends to certify the EIR no earlier than 10 days after providing state responsible and other commenting public agencies a written response to their comments.

1.10 Other Related Environmental Processes

Implementation of the selected alternative could require, as appropriate, permits from the Army Corps of Engineers (USACE), Trinity County, CDFG, NCRWQCB, SLC, and others. Implementation of the selected alternative would also require consultation with the Service and NOAA Fisheries on impacts to endangered, threatened, and proposed species.

The CVPIA Programmatic Environmental Impact Statement (PEIS), prepared by Reclamation, addresses the operation and impacts of the CVP, including the TRD. Conversely, this Trinity River Supplemental EIS/EIR addresses many Central Valley issues.

The CALFED San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) program is attempting to develop long-term solutions for resolving water use, ecosystem restoration, water quality, and levee stability issues in the Delta. CALFED is analyzing a variety of storage, conveyance, and other activities. Trinity River exports affect water quality and quantity in the Sacramento River and Delta. An EIS/EIR completed in the summer of 2000, has been prepared for this action as well. The Sacramento County Superior Court upheld the EIR portion of the joint document against a CEQA challenge, and the matter is now on appeal in the California Court of Appeal for the Third Appellate District.

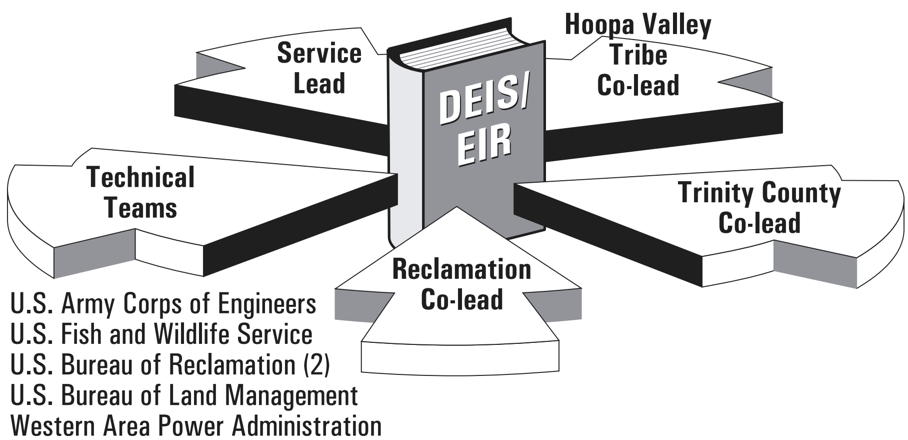
An EIS is being prepared by Reclamation on long-term operations of the Klamath Project. Changes in present project management could impact both Klamath River and Trinity River resources. For example, Trinity River anadromous fish must pass through the lower Klamath River during both juvenile outmigration and adult migration. Furthermore, juvenile fish from the Trinity River may spend an extended time rearing in the Klamath River estuary. The Klamath Project Operations EIS is in the early stages of preparation.

The CVP-OCAP is currently being revised and will undergo formal Section 7 consultation under the ESA with Service and NOAA Fisheries. Operation of the TRD is conducted in an integrated fashion with the other facilities that comprise the CVP. The effects of proposed changes in the operation of the TRD will be part of the project description of the CVP-OCAP for the Section 7 format consultation process. Potential effects upon listed species and the environmental effects resulting from possible compensatory actions associated with proposed changes in the TRD are disclosed in this document. CVP-OCAP is not subject to NEPA review in part because the CVP facilities pre-date NEPA.

Accordingly, because these environmental reviews are occurring simultaneously, Service, Reclamation, and other involved parties are making every effort to assure that the analyses, models, data, and assumptions are fully coordinated.

1.11 Preparers of the Draft EIS/EIR

In 1994, the Secretary initiated the Trinity River EIS/EIR. The Secretary directed the Service to be the lead agency on the project. On October 12, 1994, the Service published NOI to prepare an EIS in the Federal Register. It was determined that the Hoopa Valley Tribe, Trinity County, and Reclamation would be co-leads. Six technical teams were established to collect, analyze, and present technical information. The teams were lead by representatives of Western, USACE, Bureau of Land Management (BLM), Service, and Reclamation (see Section 5.2 of the Draft EIS/EIR for a list of individuals). Thirteen agencies (either cooperating, responsible, or trustee agencies) provided input on this Draft EIS/EIR (see Section 5.2 of the Draft EIS/EIR for a list of the agencies and individuals). In addition, the Karuk and Yurok Tribes were actively involved in preparation of the EIS/EIR. All of these same agencies have participated in the preparation of the Supplemental EIS/EIR.



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1.12 Areas of Controversy

The following issues associated with the proposed Trinity River Fishery Restoration action are controversial:

- Water supply impacts on various CVP contractors
- Impacts on Central Valley fisheries, including the winter-run salmon and Delta smelt
- Flooding issues in the Trinity River Basin
- Changes in power generation at CVP facilities
- Water quality impacts in the Trinity River Basin due to channel modification projects

SECTION 2.0

Description of Alternatives

This section presents alternatives that were developed to restore the natural production of anadromous fish in the Trinity River watershed (as described in the purpose and need statement), as well as the No Action baselines. The alternatives were formulated from public input, scientific information, and professional judgment, in a manner consistent with NEPA and CEQA. Analysis of the anticipated impacts associated with each alternative is presented in Section 3.0. Presented in the Draft EIS/EIR, but omitted here, are additional alternatives, including alternatives that were determined to be infeasible or inconsistent with the purpose and need. Two alternatives from the Draft EIS/EIR have been amended to improve their feasibility, per the judges ruling. A third alternative, the 70 Percent Alternative was added as a result of the scoping process.

2.1 Alternatives

The following alternatives were fully analyzed in this Supplemental EIS/EIR and are described in detail below:

∉ No Action (future without the proposed action) – This alternative is the measure against which for NEPA purposes the environmental impacts and other aspects of the action alternatives were compared. (For CEQA purposes, effects are determined against a "baseline" of existing conditions. See Section 1.8; Cal. Code Regs., tit. 14, Section 15125, Subd. (a).) Unless otherwise noted, the operations, policies, requirements, and other assumptions incorporated into the No Action are adopted into the other alternatives.

∉ Revised Mechanical – This alternative is included as a result of the December 9, 2002 MDO re: Cross Motions for Summary Judgment by Judge Oliver Wanger. This alternative was derived from public input received during the comment period for the EIS/EIR comment process, including comments submitted by the Sacramento Municipal Utility District and the Northern California Power Agency. The alternative is intended to aggressively employ non-flow measures to minimize instream flow needs in the Trinity River, and to maximize restoration of tributaries and watershed areas as means of improving mainstem conditions. Trinity River Restoration Projects with mechanical maintenance are proposed to meet the goal of restoring Trinity fisheries. Additional upslope erosion control work and tributary habitat restoration projects are proposed with this alternative. Flow schedules are dependent on water-year class (see Table 2-1): critically dry, dry, normal, wet, and extremely wet.

TABLE 2-1
Water-year Class

Water-year Class	Exceedance Probability	Occurrence Every 100 Years	Trinity Reservoir Inflow for Designation (acre-feet)
Critically dry	p > .88	12	<650,000
Dry	.60 < p < .88	28	650,000-1,024,999
Normal	.40 < p < .60	20	1,025,000-1,349,999
Wet	.12 < p < .40	28	1,350,000-1,999,999
Extremely wet	p < .12	12	>=2,000,000

Note: Water-year classifications would be forecast using 50 percent exceedance methodology.

- Flow Evaluation – This alternative has variable flow schedules dependent on five water-year classes: critically dry, dry, normal, wet, and extremely wet as described in Table 2-1. Trinity River Restoration Projects maintained by streamflow are proposed to meet the goal of restoring Trinity fisheries. Additional upslope erosion control work is proposed with this alternative. Streamflow is used to maintain stream channel.

- Modified Percent Inflow – This alternative determines each year's release schedule by calculating 30 percent of the previous week's inflow to Trinity Reservoir on the ascending hydrograph limb and 50 percent of the previous week's inflow to Trinity Reservoir on the descending hydrograph limb. Peak releases would be determined by water-year class. Minimum flow levels during the remainder of the year are intended to meet water temperature requirements. Stream restoration projects maintained by stream flow are proposed to meet the goal of restoring Trinity fisheries. This alternative also responds to the decision of the U.S. District Court, which found the original Percent Inflow Alternative to be infeasible, as it did not always guarantee minimum flows of at least 340,000 acre-feet annually, as required by the CVPIA. The new version does guarantee such minimum flows.

- 70 Percent Inflow – This alternative is similar to the Modified Percent Inflow, except that releases for any given week are equal to approximately 70 percent of the previous week's Trinity Reservoir inflow and there are no target peak releases. This 70 percent figure is based on a large number of comments received on the Draft EIS/EIR from people who believed that the Preferred Alternative allowed too little water to flow down the Trinity River, and reported in Scoping Comments on the

Supplemental EIS/EIR. Trinity River Restoration Projects maintained by stream flow are proposed to meet the goal of restoring Trinity fisheries. Because the U.S. District Court suggested that the Maximum Flow Alternative was unrealistic, the 70 Percent Inflow Alternative is intended to be a more viable means of using high instream flows to achieve various geomorphic and other environmental objectives in the mainstem. Inclusion of this alternative also improves the ability to differentiate effects between alternatives.

∉ Maximum Flow – This alternative has variable flow schedules dependent on five water-year classes: critically dry, dry, normal, wet, and extremely wet outlined in Table 2-1. This alternative does not include stream rehabilitation projects.

In practice, the actual amount and pattern of water released from Lewiston Dam could on occasion exceed the flow schedules described in this Supplemental EIS/EIR. For example, releases may be increased for short periods to meet Safety of Dam criteria (i.e., to protect public health and safety during periods of intense precipitation, when the reservoirs are in danger of overflowing). Although the alternatives in this Supplemental EIS/EIR accommodate a wide range of hydrological, meteorological, and operational conditions, they cannot predict all possible scenarios.

Although actions unique to some alternatives could be applied to all alternatives, unless otherwise noted they are not, for reasons of clarity and evaluation. Associating certain actions with certain alternatives in a Draft EIS/EIR does not preclude hybridizing alternatives in a ROD; both NEPA and CEQA allow decisionmakers to integrate components from various alternatives where the environmental impacts of such hybrids can be ascertained from analyses of the alternatives from which they are put together.

The No Action Alternative, or future without the proposed action, is the measure against which the environmental impacts and other aspects of the action alternatives were compared. Unless otherwise noted, the operations, policies, requirements, and other assumptions incorporated into the No Action are adopted into the other alternatives.

CEQA also required that the Preferred Alternative be compared to an existing conditions baseline. The year 2001 was used as the existing conditions baseline because of the transition from PROSIM to California Simulation Model (CALSIM).

2.1.1 Selection of the Proposed Action and Preferred Alternative

The Flow Evaluation Alternative, coupled with additional watershed protection efforts (described in the Mechanical Restoration Alternative in the original EIS/EIR), was identified as the Preferred Alternative in terms of best meeting the purpose and need and goals and objectives, while also minimizing adverse impacts. The selection of the Preferred Alternative also used the following screening criteria, which were jointly developed by the four co-leads (Service, Reclamation, Hoopa Valley Tribe, and Trinity County). The Preferred Alternative:

- Substantially increases natural production of anadromous fish on the Trinity River
- Substantially restores inriver and ocean fishing opportunities
- Improves tribal access to trust resources
- Balances environmental and social beneficial and adverse impacts across the Trinity River Basin, Lower Klamath River Basin/Coastal Area, and Central Valley Basin while meeting the mandate from the SWRCB in Water Rights Orders 90-05 and 90-01 to cause no harm to the Trinity River fishery as a result of diversions to the Sacramento River for temperature control
- Allows for the continued operation of the TRD, including water exports
- Limits flooding impacts on the Trinity River

These screening criteria were developed not only to respond directly to the stated purpose and need (restoring and maintaining natural production of anadromous fish), but to minimize adverse impacts as a result of implementing the project. Given these criteria, the co-leads determined that the Flow Evaluation Alternative represented the best overall approach to substantially increasing natural production of anadromous fish and fishing opportunities, while allowing for continued water exports and flood control. Subsequent analysis has confirmed that the flow evaluation is likely to be the most efficient alternative in terms of meeting the healthy river objectives described in Section 1.3.2, Goals and Objectives.

The watershed protection component of the Mechanical Restoration Alternative was included within the Preferred Alternative because the lead agencies believe it would enhance the benefits derived from the Flow Evaluation Alternative (although the model used to evaluate changes in fish production did not detect a measurable increase). Furthermore, the proposed watershed protection activities were included as part of the Preferred Alternative because (1) they have been determined in the past to help restore fish habitat by reducing sediment inputs to the Trinity River; (2) they are consistent with the ROD for the Northwest Forest Plan and its Aquatic Conservation Strategy to reduce upslope sediment production by improving drainage on necessary roads, while also decommissioning roads that no longer serve management purposes; (3) they are consistent with the Total Maximum Daily Load (TMDL) process established under the Clean Water Act, which has identified the Trinity River as a waterbody impaired by sediment and in need of remedial measures; and (4) a broad range of interest groups (e.g., environmentalists and Central Valley water users) specifically requested that non-flow watershed protection measures be fully considered for inclusion into the Preferred Alternative.

The 600 thousand acre-feet (taf) carryover storage level associated with the Flow Evaluation Alternative would be maintained for the Preferred Alternative except in exceedingly dry years if deemed necessary to avoid potentially infeasible operations at Shasta Dam. In such years (identified as potentially occurring in the future per the modeling analysis), carryover storage would be reduced to 400 taf.

Additionally, the Preferred Alternative included provisions for short-term operations in the case of potential power emergencies. If requested by Western, the lead agencies agreed to consider short-term changes in operation that would maximize power generation over projected periods of emergency needs, such as during rolling blackouts.

2.1.2 No Action Alternative

The No Action Alternative represents ongoing activities and operations and is intended to meet the both the NEPA requirement for a "No Action" alternative (40 C.F.R. Section 1502.14(d) and the CEQA requirements for a "No Project" alternative (Cal. Code Regs., tit. 14 Section 15126.6, Sub(e) ("existing conditions…as well as what would be reasonably expected to occur if the project were not approved, based on current plans and consistent with available infrastructure and community services.") Components of this alternative are approved programs that have obtained all environmental clearances and permits. The No Action Alternative reflects conditions in the year 2020 and includes projections concerning future growth and land use changes per the DWR Water Plan Update (Bulletin 160-98). The year 2020 was identified as the planning horizon because of the interrelationship with the DWR Bulletin 160-98, data from the Trinity County General Plan, and the Central Valley Draft PEIS. The No Action Alternative includes assumptions concerning concurrent but separate issues, such as the assumption that ocean harvest limitations for sport and commercial salmon fishing would be consistent with policies that have been in place since 1992, and have been evaluated in a separate process by NOAA Fisheries and other groups.

Table 2-2 identifies the operations, policies, and regulatory requirements assumed under the No Action Alternative.

TABLE 2-2
Operations, Policies, and Regulatory Requirements Assumed under the No Action Alternative

Issue or Policy	Description
Acreage Limitations in Contracts	Existing acreage limitation regulations adopted to implement Reclamation Reform Act of 1982.
CVP Operations	Continued operations as presented in CVP-OCAP 1992 and other operational procedures for CVP, adjusted for BOs and water quality standards. (BO [May 1995] for Winter-run Chinook Salmon and Delta Smelt. BO for Winter-run Chinook Salmon (NOAA Fisheries, 1993) assumptions include maintenance of minimum Shasta Reservoir carryover storage of 1.9 maf in all years, except in driest 10 percent of years where reconsultation is needed. Monthly temperature targets at Bend Bridge and Jellys Ferry per the BO, Bay-Delta Plan Accord, and SWRCB Order 95-06).
Contract Amounts for CVP (including shortage criteria)	Contracts would be renewed, per 1956 and 1963 Acts, prior to year 2020, including contracts with CVP and DWR associated with the Cross-Valley Canal.
	Maximum Contract Amount: Not-to-exceed existing contract amounts. Water deliveries not-to-exceed capacity of existing conveyance facilities.
	Agricultural Water Service Contracts, Water Rights Contracts, and Exchange Contracts: CVP water deliveries limited by maximum contract; projected use as addressed in environmental documentation or maximum contract amount, whichever is less. Shortage criteria per OCAP.
	Municipal and Industrial Water Service Contracts: Total demand based upon year 2020 demands in DWR Bulletin 160-93. CVP water deliveries limited by (1) maximum use between 1980 and 1993; (2) projected use as addressed in approved environmental documentation; or (3) maximum contract amount, whichever is less. Shortage criteria with maximum shortage of 50 percent.
	Refuges: Delivery of Level 1 and Level 2 water supplies by existing suppliers. Shortage criteria using SWRCB Shasta criteria.
CVP Conservation Program	A long-term adaptive management program to address biological needs of special-status species with an emphasis on habitat in areas affected by the CVP.
Coordinated Operations of CVP and SWP	Based on COA framework with additional assumptions to implement new provisions of Bay-Delta Plan.
Delta Factors	Continued use of seasonal barriers at Old River and continued operation of Delta Cross-Channel gates.
Land Retirement	Retirement of 45,000 acres between 1992 and 2020 under existing California land retirement programs, per DWR Bulletin 160-93.
Minimum Instream Flow Requirements	**Sacramento River:** Per SWRCB Order 91-01 and the Winter-run Chinook Salmon BO.

TABLE 2-2
Operations, Policies, and Regulatory Requirements Assumed under the No Action Alternative

Issue or Policy	Description
for CVP Facility	**American River:** Per Modified SWRCB D-1400 strategy of CVP operations with a fixed amount of flood control storage under the USACE interim requirements. **Stanislaus River:** Per SWRCB D-1422, including water quality standards on the San Joaquin River at Vernalis and dissolved oxygen requirements at Ripon, and 155,700 acre-feet/year in all years but critically dry years, then 98,300 acre-feet/year per initial studies conducted under the 1987 agreements with CDFG and the Service. **Trinity River:** Per Secretary's 1991 Decision, a flow not less then 340,000 acre-feet/year in all years. The flow criteria described in the Wanger Decision was not used for continuity between model runs, allowing the results of the CALSIM to be compared to the results of the PROSIM.
Shortage Criteria for SWP	Monterey Agreement provisions for SWP.
Non-CVP Water Users	Use water demands in DWR Bulletin 160-93.
Power Marketing	Existing agreement between United States and Pacific Gas and Electric Company (PG&E) would not be renewed. Project use load met at all times.
Red Bluff Diversion Dam Gate Closure	Mid-May through mid-September per Winter-run Chinook Salmon BO.
Tracy Direct Loss Mitigation Agreement	Reduces and offsets direct fish loss associated with operations of the Tracy Pumping Plant and Fish Facility.
Water Conservation	Water conservation levels based on assumptions presented in DWR Bulletin 160-93 for all water users, plus requirements by 1982 Reclamation Reform Act for CVP contractors.
CVP Rate Setting and Water Pricing	Existing rate setting and cost-allocation policies, and ability-to-pay policies per Reclamation Mid-Pacific Region Policies, including 1988 policies, and Reclamation Reform Act draft rules and regulations.
Water Transfer	CVP water can be transferred between CVP water service contractors. SWP water can be transferred per the Monterey Agreement, and water rights holders can transfer water under SWRCB guidelines.
Water Rights	Total water rights would be delivered in all water-year classes (except in shortage conditions) even if water rights had not been previously fully used.
U.S. Department of Agriculture (USDA) Farm Commodities Program	Program would remain in place and would follow 1992 policies.

Water Management. The flow schedule for the No Action Alternative is based on existing CVP operations and Section 3406(b)(23)(B) of the CVPIA, which states:

> "If the Hoopa Tribe and the Secretary do not concur, the minimum Trinity River instream fishery releases established

> under this paragraph (340,000 acre-feet annually) shall remain in effect unless increased by an Act of Congress, appropriate judicial decree, or agreement between the Secretary and the Hoopa Valley Tribe."

The No Action release pattern (called a hydrograph) is shown on Figure 2-1. The TRD would be operated such that not less than 340,000 acre-feet of water would be released annually, regardless of water-year class. Although this quantity of water could be exceeded in the future for other purposes, such as Trinity Reservoir Safety of Dams releases (Reclamation, 1979), this alternative assumes an annual flow not less than 340,000 acre-feet. Spills and other releases in excess of proposed flow schedules are assumed to continue for all alternatives, and are included in the analysis in Section 3.0 in the context of monthly projected reservoir inflows and storage. It should be noted that the flow schedule for No Action and Mechanical Restoration Alternatives does not use the flow criteria described in the Wanger Decision. This was done because 340,000 acre-feet represent the minimum flows contemplated by the CVPIA in the absence of higher flows set by the Secretary of Interior with the Hoopa Valley Tribe's concurrence, and because Judge Wanger, in response to requests by the Hoopa Valley Tribe, has set differing flows each of the last three years based on hydrological and meteorological conditions each such year, as opposed to a set of flows that can be applied predictably each year. (See Section 3.2 Water Resources for a description of the change from analysis with PROSIM to CALSIM.) The use of 340,000 acre-feet also permits consistency between model runs, allowing CALSIM and PROSIM results to be comparable. The CALSIM used in identifying water supplies does not take into account daily or weekly flood control operations, which generally vary substantially from monthly values. Instead, flood operations are considered under a monthly time step. Refer to the Water Resources/Water Quality Technical Appendix A for a more detailed analysis of projected Safety of Dam releases.

Water Operations. It is assumed that the CVP, including the TRD, would operate based on the current (1992) CVP-OCAP, stipulations included in various water quality standards, long-term BO for the Sacramento River Winter-run Chinook Salmon (NMFS, 1993), and the 1995 BO for Delta Smelt (Service, 1995). In addition, this alternative includes operating the CVP and SWP in accordance with the COA, and it complies with the December 15, 1994, Bay-Delta Accord Principles of Agreement. Overall operation of CVP facilities, including coordinated operations with SWP facilities, is currently the

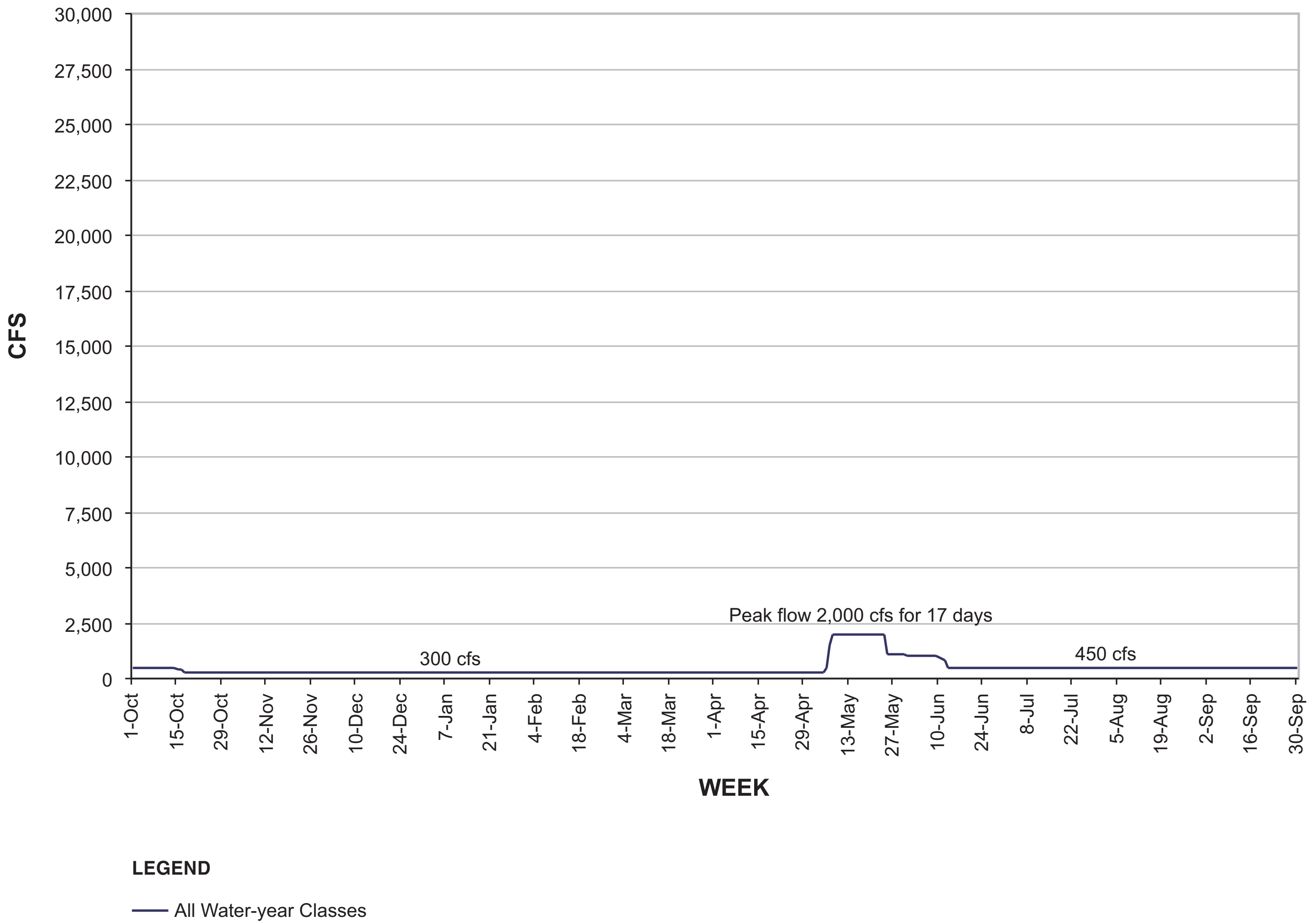

FIGURE 2-1
NO ACTION HYDROGRAPH
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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subject of proposed update to CVP-OCAP. The updated CVP-OCAP will be the basis for updated BOs for both winter-run salmon and Delta smelt. For more information on the updated CVP-OCAP, see Section 4.0 Cumulative Effects. Exports from Lewiston Reservoir to the Sacramento River would typically be highest in the spring to achieve temperature needs on the upper Sacramento River and to meet other CVP demands. Trinity Reservoir would be operated to maintain a minimum carryover storage of 400,000 acre-feet between water years (i.e., on October 1). Powerplant bypass operations are assumed to continue at a similar frequency as historical operations. Future powerplant bypasses would be evaluated on a case-by-case basis.

Subsequent to the modeling analyses conducted for the original 1999 Draft EIS/EIR, the California Court of Appeal for the Third Appellate Court in 2000 struck down a portion of the Monterey Agreement signed by the DWR and SWP contractors in 1994. (See *Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal. App. 4th 892.) The agreement amendments changed the prior method of allocating water supply deficiencies, which reduced supplies to agricultural contractors before those to urban contractors were cut. The No Action and all other Trinity alternatives assume the Monterey Agreement is in place, and SWP supplies are allocated among agricultural and M&I contractors evenly in proportion to their entitlement. The Monterey Agreement, as simulated in the No Action Alternative, has no effect on the total amounts of SWP water deliveries, rather it only affects the delivery allocation to contractors south of the Delta once an overall delivery level has been determined. Therefore, the Monterey Agreement does not have any impact on the amount of water the SWP exports from the Delta. The amount of water exported is a function of demand, available supply, and export restrictions.

Accordingly, it is not anticipated that this court decision will have any significant impact on the results of the modeling analyses conducted for the Draft EIS/EIR and the Supplemental EIS/EIR.

Watershed Protection. It is assumed that the following programs and ordinances, relating to overall watershed protection in the Trinity River Basin (including tributaries to the mainstem), would continue:

- Riparian habitat improvements, such as Watershed protection under the jurisdiction of U.S. Forest Service (USFS) and BLM, would continue, including implementation of existing land management plans and the ROD on the President's Northwest Forest Plan (USDA and DOI, 1994).

- Trinity County's Decomposed Granite Grading Ordinance (No. 379) would be enforced for lands and projects under its jurisdiction.
- California Forest Practice Rules that regulate timber harvest activities on private lands within the Trinity River Basin would be enforced by California Department of Forestry and Fire Protection.
- Implementation of the South Fork Trinity River Action Plan would continue. The plan includes watershed restoration to reduce sediment sources, upgrading inefficient irrigation systems and dedicating the saved water to instream fishery flows, cattle exclusion fencing to decrease sediment inputs and improve water quality, and riparian plantings to help decrease water temperatures and conserve streambanks.
- The BLM would continue to acquire sensitive lands in the Grass Valley Creek watershed and along the Trinity River corridor.
- Upslope Watershed restoration, including upslope sediment management and land treatment, will assist in meeting the stated mandate of the December 2000 ROD; the goals and objectives of the TRRP, P.L. 98-541; and the Trinity River TMDL for controlling fine sediment.
- Fish passage restoration types will include the removal of structures impeding the migration of anadromous and resident fish species.
- Instream habitat improvements would continue. These activities include mechanical alterations and coarse sediment augmentations.
- Water conservation and water right acquisition are components of water supply restoration. These restoration types are aimed at improving water quantity and quality.
- Land conservation, including acquisition of the fee title or conservation easements, will allow for management activities consistent with watershed and tributary restoration riparian reserve allocations and Wild and Scenic River Corridor Criteria.

Additional Information about these Watershed Protection strategies can be found in Technical Appendix E.

Fish Habitat Management. The No Action Alternative assumes current habitat improvement projects and programs, such as the dredging of sediment control ponds in Grass Valley Creek, operation of Buckhorn Reservoir, placement of spawning gravel, and maintenance of the 27 existing channel rehabilitation projects would continue. Though not guaranteed, these projects are administered by a variety of federal and state agencies.

The existing 27 channel rehabilitation projects constructed between the early 1980s and 1994 would be mechanically maintained. If side channels are blocked by sediment two or three times following sediment removal, those projects will be abandoned.

Spawning gravel would be placed as needed in the river below Lewiston Dam. Spawning gravel would be obtained from within Trinity River Watershed. The gravel would be screened to eliminate fine sediments, excessive amounts of which are detrimental to fish habitat. Spawning gravel placement for this alternative is estimated to average 3,400 cubic yards (yd^3) per year; however, much of the placement is associated with Safety of Dam releases (i.e., gravel placement volumes would likely be significantly higher in wetter years). In the absence of Safety of Dam releases, spawning gravel needs excluding Safety of Dam releases are estimated to range from 600 to 750 yd^3 annually.

Fish Population Management. Fishing would continue under current harvest plans approved by the Klamath Fishery Management Council, PFMC, Hoopa Valley Tribe, Yurok Tribe, and California Fish and Game Commission. Fisheries that do not have comprehensive management plans would continue to be managed by the responsible agencies or tribes. The TRSSH would continue to produce fish at current levels, as shown in Table 2-3.

TABLE 2-3
Trinity River Salmon and Steelhead Hatchery Production

Species	Egg Take	Smolt Release	Yearling Releases
Spring Chinook	3,000,000	1,000,000	400,000
Fall Chinook	6,000,000	2,000,000	900,000
Coho	1,200,000	N/A	500,000
Steelhead	2,000,000	N/A	800,000

Dam Modifications. The No Action Alternative assumes no modifications of Trinity or Lewiston Dams.

Estimated Costs. To manually remove vegetation from all 27 sites would cost a total of about $30,000 every 3 years. To mechanically remove root systems on channel rehabilitation projects, and to modify side-channel openings as needed, would cost a total of about $30,000 every 5 years.

Spawning gravel costs were derived from estimates of gravel requirements and costs of dredging, sifting, purchase, transportation, and placement. For this alternative, the spawning gravel requirements were estimated to average 3,400 cubic yards per year

(yd^3/year). A cost of $30 per yd^3 was estimated for dredging and sifting, purchase, transportation, and placement. Average annual spawning gravel costs were therefore estimated at $102,000 (with significant inter-year variability due to Safety of Dam releases).

Integrated Management. The No Action Alternative would not include an integrated management component.

2.1.3 Revised Mechanical

This alternative replaces the Mechanical Restoration Alternative described in the 1999 Draft EIS/EIR.

The Revised Mechanical Alternative is included as a result of the December 9, 2002 Wanger Decision. The Wanger Decision concludes that an alternative using non-flow measures and minimizing impacts on CVP interests was not fairly considered in the Draft EIS/EIR. The decision also concludes that such an alternative might achieve the statutory goal of restoring the Trinity River fishery. The basis for this conclusion is described on page 91 of the Wanger Decision:

> "The ultimate NEPA issue centers on whether the intentional narrowing of the EIS purpose to concentrate on increased water flows and channel rehabilitation prevented the decision-maker and the Court from assessing the utility of a variable flow alternative that uses non-flow measures to serve all the statutory objectives of the 1984 Act as amended, the CVPIA, and the secondary purposes of minimizing effects on all other CVP water users."

This Revised Mechanical Alternative was derived from public input received during the comment period for the Draft EIS/EIR comment process.

The Revised Mechanical Alternative also includes an adaptive management plan similar to the plan that is described in the Flow Evaluation Alternative. However, the adaptive management plan under this alternative would combine the Trinity Adaptive Management Working Group with the Trinity Management Council to form one consolidated Federal Advisory Committee reporting directly to the Secretary.

Water Management. Annual releases would vary by water-year class as shown in Table 2-4. These releases are consistent with information provided by Sacramento Municipal Utilities District in its comment submittals on the Draft EIS/EIR and during the scoping for the Supplemental EIS/EIR.

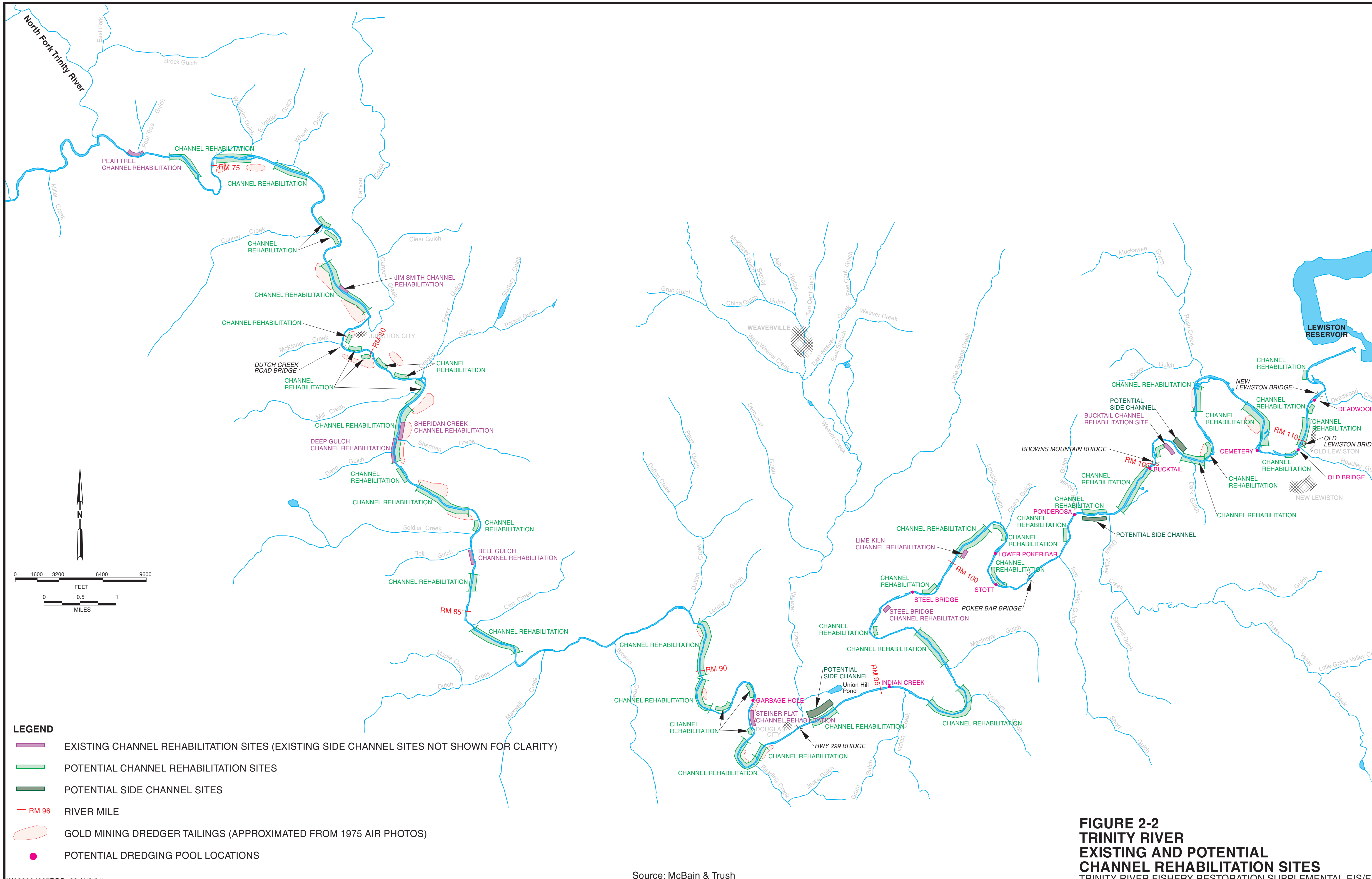

FIGURE 2-2
TRINITY RIVER
EXISTING AND POTENTIAL CHANNEL REHABILITATION SITES
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

TABLE 2-4
Annual Volumes and Peak Releases – Revised Mechanical Alternative

Water-year Class	Acre-feet	Peak Flow (cfs)
Critically Dry	340,000	1,500
Dry	380,000	4,500
Normal	485,000	6,000
Wet	513,000	6,000
Extremely Wet	556,000	6,000

Note:
cfs = cubic feet per second

The release pattern for each water-year class is illustrated on Figure 2-3. This flow schedule was developed to maintain minimum base flow releases of 300 cfs for suitable fisheries habitat during the fall and winter salmonid spawning and rearing periods, and minimum flow releases of 450 cfs for the summer holding period. In addition, peak flows are capped at 6,000 cfs. This capped peak flow is supplemented by mechanical habitat maintenance including dredging of silt and sand from mainstem ponds, increasing sediment trapping in tributaries, and mechanical control of point bar revegetation where needed, as discussed below.

Water Operations. The timing of diversions through the Clear Creek Tunnel would be based on water availability and CVP demand, as presently operated by Reclamation. Timing would mimic historical operations to establish in late spring and maintain through fall the thermal connection between Carr Powerhouse discharge and Spring Creek Tunnel intake, so as to attempt to improve temperatures on the upper Sacramento River for anadromous fish, listed and otherwise. Trinity Reservoir would be operated to maintain a minimum carryover storage of 500,000 acre-feet between water years.

Watershed Protection. The Revised Mechanical Restoration Alternative would include measures to limit sediment inputs into the Trinity River beyond those assumed under the No Action Alternative, including accelerated road decommissioning, road maintenance, and road rehabilitation on public and private lands. These additional measures would essentially represent a modification of a portion of a 1993 proposal by the Committee for Healthy Communities in Healthy Forests, as endorsed by the Trinity BioRegional Group and Trinity County for implementation of the President's Forest Plan.

Accelerated road decommissioning, road maintenance, and road rehabilitation would primarily be focused on public lands within Trinity National Forest watershed (South Fork and mainstem areas below Lewiston Dam), which contains approximately 3,450 miles of mostly unpaved roads. The area would also include a small portion of the Six Rivers National Forest in the lower South Fork and lower mainstem watersheds, as well as the private lands and county roads within the entire Trinity River watershed. This type of proposed work is identified as critical in restoring salmon and steelhead habitat as part of the ROD on the President's Forest Plan (Option 9: USDA and DOI, 1994). The USFS, through the plan, adopted new Riparian Management Zone Standards and Guidelines prescribing improved standards for roads and decommissioning of those roads deemed unnecessary.

Road decommissioning would consist of removing culverts, out-sloping, and ripping roads (primarily Level 1 roads) that cannot be maintained with existing and foreseeable budgets. Many of the roads are already closed to public traffic, but pose potential and ongoing erosion problems. Rehabilitation of the remaining roads would consist of resurfacing or culvert replacement over 22 years to support ongoing USFS, county, and private efforts, which are currently very limited due to funding and staffing. Annual maintenance would ensure that all drainage structures perform as designed.

BLM's Trinity River Watershed Analysis contains an average annual sediment yield estimate at Hoopa of 1,283 yd^3 per square mile (BLM, 1995). Extrapolating this to the entire basin (exclusive of the areas upstream of Lewiston Dam and federally designated roadless/ wilderness areas), the 2,223-square-mile area in question would produce approximately 2.85 million yd^3 of sediment per year. Full-scale implementation of the watershed protection program would result in a reduction of 240,00 to 80,000 yd^3/year, which is approximately 7 percent of the average annual sediment produced in the Trinity River Basin.

Fish Habitat Management. This fish habitat management component of the Revised Mechanical Alternative has incorporated much of the research and conclusions provided by Sacramento Municipal Utility District in its comment submittals on the Draft EIS/EIR and during the scoping for the Supplemental EIS/EIR.

Mechanical restoration efforts under the Revised Mechanical Alternative would include the following:

∉ Mechanical removal of tributary mouth bars (deltas) at Rush Creek, Indian Creek, Reading Creek, Weaver Creek, and others to eliminate the backwater effects caused by these bars and, thus, reduce siltation and improve habitat upstream in the Trinity River. The intent is to also provide anadromous fish (primarily coho and steelhead) access to the tributaries, thus providing additional fishery habitat. Material mechanically removed from the bars (deltas) will be sorted, and the gravel component suitable for spawning gravel replacement (estimated

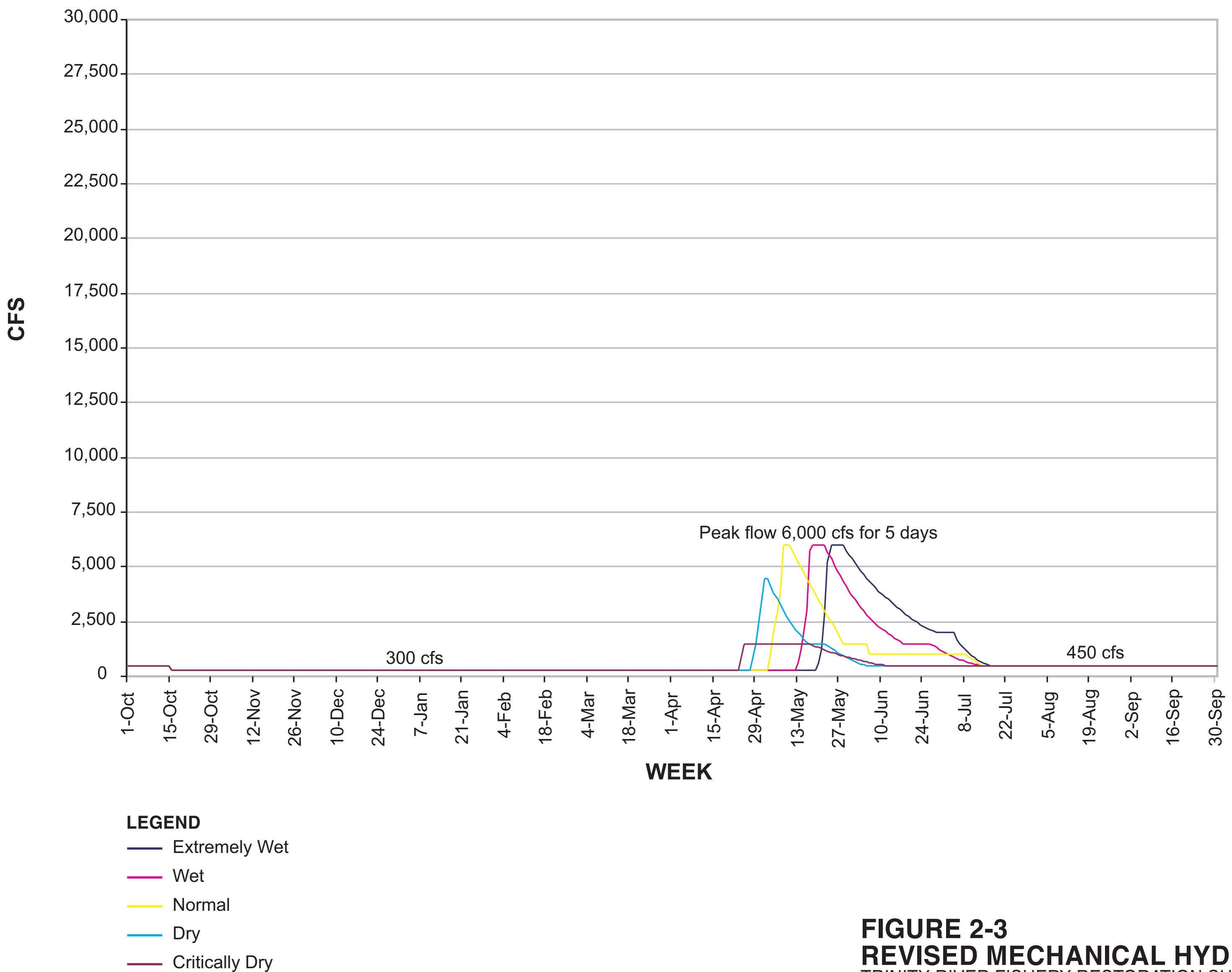

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FIGURE 2-3
REVISED MECHANICAL HYDROGRAPH
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

requirement 10,000 yd^3/year [Service et al., 1999]) will be used for that purpose. The remainder will be disposed of outside the floodplain, thereby removing a source of finer sediments that could contribute to spawning gravel degradation.

- Removal of single-sided berms and construction of large, sloping gravel banks would not proceed until sites where both banks could be treated are identified and hydraulically evaluated.
- Dredging sand and silt from specific pools in the mainstem below the confluence of Grass Valley Creek by mechanical means.
- Expansion of the capacity and increased the frequency of sediment removal at the two existing Grass Valley Creek sediment ponds.
- Removal of vegetation, whenever possible, by both mechanical means and hand crews rather than just by hand crews.

Gravel introduction will be required at a rate that balances the transport capacity of the released flows.

Sediment transport analyses for the Revised Mechanical hydrographs for the flow year classes for the reach upstream of the Rush Creek confluence indicate that the average annual volume of gravel augmentation required to balance the loss of spawning gravel would be approximately 3,000 yd^3/year. However, consultants for Sacramento Municipal Utility District have advocated different methodology for determining sediment transport rates.

Accordingly, development of a hydraulic model to provide guidance on appropriate locations for local gravel placement and to provide more cost-effective designs, would also be required.

Fish Population Management. Under this alternative, fish population management would occur under three categories: harvest restrictions, predator control, and increased hatchery production. Previous analyses have determined that these measures would not increase production of anadromous salmonids because habitat was limiting potential production of salmonids. Therefore, these measures could not be undertaken until the alternative had been implemented over sufficient time to maximize its habitat-creating potential. Measures described below would be implemented after habitat has been maximized under this alternative.

The implementation of harvest restrictions would be pursued following habitat improvements in the river. Harvest restrictions were previously analyzed for effectiveness in increasing natural production of anadromous fish in the Trinity River. However, the 1984 TRB Act, Pub. L. 104-143, Section 2, emphasizes that restoration is measured by the ability of tribal and other fishermen to harvest.

Therefore, harvest restrictions are inconsistent with the purpose of the action. The results of the analysis indicated that although spawner escapement increased due to increasing harvest restrictions, natural production, as indicated by the production index, actually decreased. After the habitat improvement projects are complete and after a sufficient time it is determined that available habitat is being underused, then harvest restrictions would be implemented. See the Draft EIS/EIR for additional information.

An increase in hatchery production does not meet the purpose of the proposed action, which is to restore the natural production of anadromous fish. Evidence suggests that increasing hatchery production can significantly impair efforts to restore and maintain naturally reproducing fish stocks. Increases in hatchery releases would not be successful unless habitat in the Trinity River was improved to accommodate the increased number of fish.

After salmonid habitat conditions improve, a reassessment of harvest management, predator control, and increased hatchery production would be conducted. Assuming improved habitat conditions, modifications to exiting fish population management could be employed in some cases to speed restoration.

Dam Modifications. The maximum release of 6,000 cfs associated with this alternative would not require modification to either Trinity or Lewiston Dam.

Estimated Costs. Estimated cost for implementation of the mechanical stream restoration projects is identical to those costs included in the Mechanical Restoration Alternative.

Integrated Management. The Revised Mechanical Alternative would include both flow and non-flow measures intended to improve fishery habitat. The combination of flows, flow timing, ongoing mechanical maintenance, and conditions throughout the watershed would be monitored, and modified if necessary, in an attempt to optimize fish production. However, annual flow volumes would be capped at the levels described above. An assessment of hatchery operations, harvest options, and predator effect would also be conducted following stabilization of habitat improvements.

2.1.4 Flow Evaluation

This alternative has been designated as the Preferred Alternative.

The Flow Evaluation Alternative is based on recommendations in the TRFES (Service and Hoopa Valley Tribe, 1999). This alternative would restore and maintain the fishery through managed flows and mechanical rehabilitation projects designed to restore a necessary level of ecosystem function. Flows would be higher than the No

Action Mechanical and Revised Mechanical Alternatives in all water-year classes. Flow volumes and timing are designed to address both habitat and temperature needs for all riverine life stages of salmonids. Peak flows are designed to support the physical processes necessary to maintain habitat in an alluvial river. In addition, the alternative includes significant mechanical habitat management and watershed protection components. The management and protection components are included because it was concluded that the recommended variable flow release schedule alone would not be adequate to remove the vegetation necessary to restore fishery habitat.

The Flow Evaluation Alternative also includes an adaptive management program. The adaptive management program would initially operate within the bounds of the TRFES recommendations. Adaptive management is a formal, systematic, and rigorous program of learning from the outcomes of management actions. Adaptive management accommodates change and improves management, which may alter some findings of the TRFES. Decisionmakers use adaptive management programs to manage environments characterized by complexity, shifting conditions, and any remaining uncertainty.

The Flow Evaluation adaptive management program would combine assessment and management by using conceptual and numerical models, and the scientific method to develop and test management choices. The adaptive management program would assess the effects of reservoir operations, instream flows, and mechanical habitat manipulations on biotic resources of the Trinity River. Specifically, the program would perform the following:

1. Define objectives in measurable terms
2. Develop hypotheses, build models, compare options, and design system manipulations and monitoring programs
3. Propose modifications to operations that protect, conserve, and enhance biotic resources
4. Implement monitoring and research programs to examine how selected management actions meet resource management objectives

The Adaptive Environmental Assessment and Management (AEAM) program would be administered by an executive director hired by the Trinity Management Council, the decisionmaking group within the AEAM program. The Council would serve as a policy group that initiates actions, reviews, modifies, accepts, or remands recommendations made by the Executive Director and staff. Also included in the process would be the TRRP staff (Technical Modeling and analysis Group, Rehabilitation Implementation Group), Science Advisory Board, Stakeholder group (TAMWG), and regulatory agencies. The TMC and TAMWG would typically convene on a quarterly basis throughout the year to make decisions (or advise in the case of TAMWG) concerning the coming year's dam releases, budgeting activities, and other management actions. A detailed description of the AEAM was given in the TRFES, pages 278 through 289. Appendix F of the Trinity River Mainstem Fishery Restoration Final EIS/EIR further refines the structure of the AEAM program. Roles and responsibilities of these groups have since been refined and clarified in their respective bylaws and the TAMWG charter signed by the Secretary of the Interior.

The adaptive management program could result in modifications to the Flow Evaluation hydrographs described in this Supplemental EIS/EIR. Modifications to the proposed restoration activities (flow schedules and channel rehabilitation projects) resulting from the AEAM program could be subject to additional NEPA and CEQA review. All mechanical ground-disturbing actions taken under this alternative would be subject to site-specific environmental review.

Water Management. Annual releases would vary by water-year class as shown in Table 2-5

TABLE 2-5
Annual Volumes and Peak Releases – Flow Evaluation Alternative

Water-year Class	Acre-feet	Peak Flow (cfs)
Critically Dry	369,000	1,500
Dry	453,000	4,500
Normal	647,000	6,000
Wet	701,000	8,500
Extremely Wet	815,000	11,000

Note: Peak flow releases and timing: 11,000 cfs/5 days in May (extremely wet water-year class only).

The release pattern for each water-year class (Figure 2-4) was developed to address the needs of each of the life stages of the anadromous fish present in the Trinity River, including the ability of the river to move sediment and reshape itself (i.e., fluvial geomorphic process). Flow releases are different for each water-year class because different geomorphic processes are addressed in different water years, as was the case prior to dam construction. The following four primary components were identified and are addressed by the release patterns:

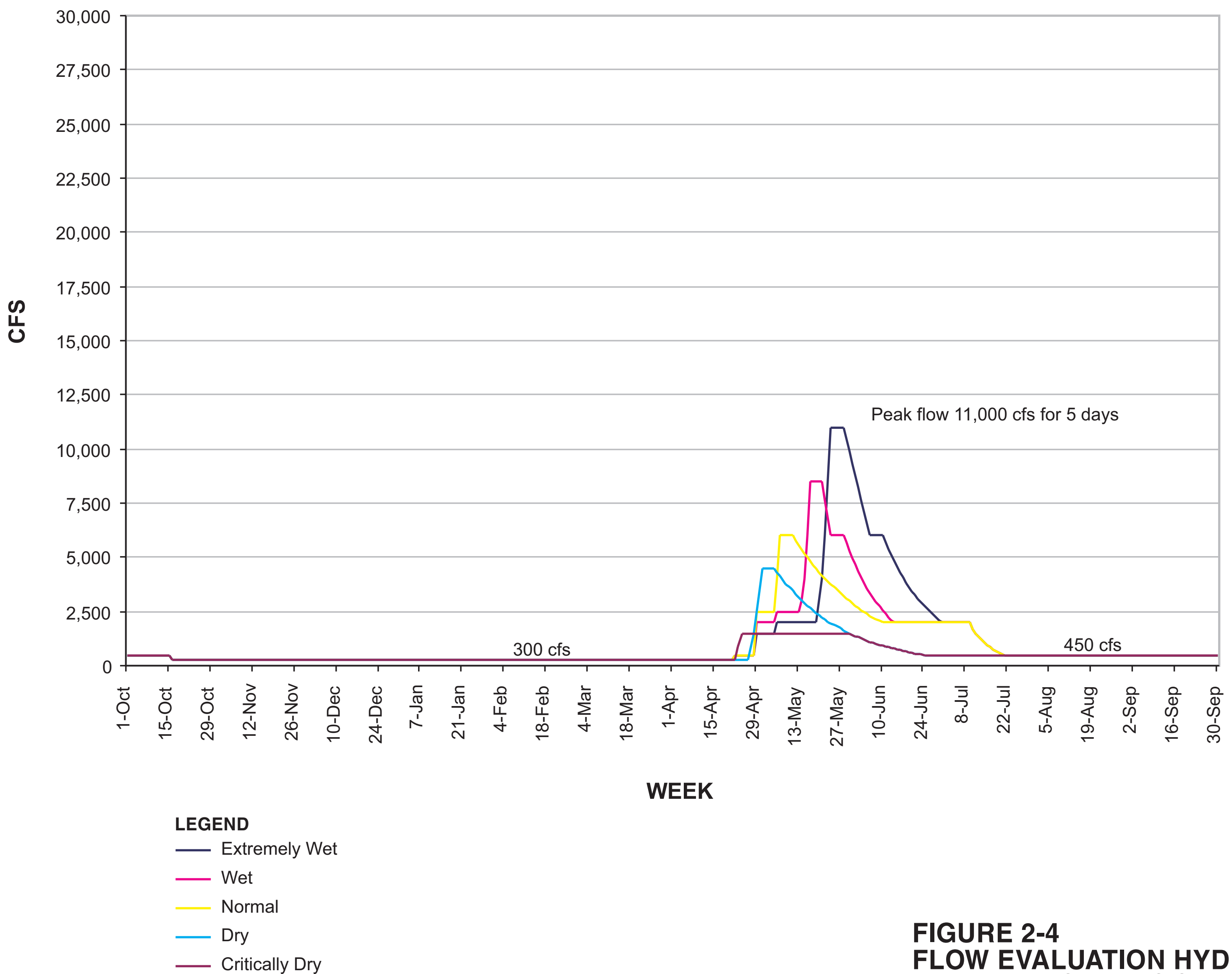

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FIGURE 2-4
FLOW EVALUATION HYDROGRAPH
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

- **Summer/fall temperature control flows (July 1 through mid-October) –** These were developed in response to summer and early fall conditions when warm water temperatures are a concern for holding and spawning spring Chinook salmon. NCRWQCB criteria follow: from July 1 to September 14, temperatures no greater than 60 degrees Fahrenheit (°F) at Douglas City; from September 15 to September 30, temperatures no greater than 56°F at Douglas City; and from October 1 to December 31, temperatures no greater than 56°F at the confluence with the North Fork. Generally, flows of 450 cfs would be required during these periods to meet these temperatures.

- **Salmonid spawning/rearing flows (mid-October through late April/mid-May depending on water-year class) –** These were developed to provide suitable spawning and rearing habitat for Chinook and coho salmon and steelhead. Flows of 300 cfs would be released during this period, because effective spawning has been observed at this flow level. In addition, such flows would provide habitat, minimize the potential for dewatering of redds, and protect early life stages of salmonids.

- **Fluvial geomorphic/salmonid smolt temperature control flows (late April/mid-May through June 30) –** These were developed to provide fluvial geomorphic processes and suitable temperature and flow conditions for outmigrating salmonid smolts. Peak flows of 11,000 cfs would be released for 5 days beginning May 24 during extremely wet water years to assist in geomorphic processes such as mobilizing sediment, scouring the riverbed, reshaping the channel, and removing encroaching vegetation. These higher magnitude flows are geomorphically more efficient (more sediment transport per unit of water, and greater depth of scour) than lower flows, and the magnitude of 11,000-cfs flows was found to cause scour depths on exposed point bars sufficient to scour away 2- to 3-year-old willow seedlings, which is a critical process to prevent future riparian encroachment and habitat simplification. The peak levels would vary for each water-year class, down to a minimum of 1,500 cfs in critically dry years. During such years, these flows would not be sufficient to recontour the channel, but would help prevent the germination of unwanted vegetation.

- **Ramping rates (all times of year) –** The rate at which flow releases are either increased (ramped up) or decreased (ramped down) were developed in the TRFES to mimic natural ramping rates for the Trinity River.

Water Operations. The timing of diversions through the Clear Creek Tunnel would be shifted from spring/summer to the summer and early fall periods to maintain suitable release temperatures for the inriver fishery resources. Summer/fall is a critical period for holding/spawning spring Chinook salmon, migrating/spawning fall Chinook salmon, and holding summer steelhead. Shifting exports to the summer/early fall maintains coldwater reserves in Trinity Reservoir for use in the Trinity River, versus exporting this water earlier to assist coldwater maintenance in the Sacramento River. Additionally, exporting water through the Clear Creek Tunnel during summer/early fall results in water moving quickly through Lewiston Reservoir, thereby not allowing the water (which is eventually released from Lewiston Dam) to warm. The alternative assumes that Trinity Reservoir would be operated to maintain a minimum carryover storage of 600,000 acre-feet between water years. The increased carryover provides cooler water for dam releases for the benefit of the inriver fishery resources and reduces the need for Trinity Powerplant bypasses to provide cooler water. Operations under this alternative are conditioned by the 2000 NOAA Fisheries BO, as modified by the Judge's ruling.

Watershed Protection. Watershed protection for the Flow Evaluation Alternative is identical to the watershed protection described for the Mechanical Restoration Alternative.

Fish Habitat Management. In addition to those described in No Action, 47 mechanical rehabilitation projects would be constructed because the flow schedule associated with this alternative is too low to remove the existing riparian berms along the river. Figure 2-2 shows the location of each proposed potential rehabilitation site and existing sites. Actual sites may deviate slightly from those labeled on the figure and will undergo their own NEPA/CEQA analysis. After portions of the berms are mechanically removed, projected high flows and gravel transport would naturally create and maintain dynamic alluvial features and floodplain riparian communities. Consequently, no additional mechanical maintenance is planned for the proposed or existing channel rehabilitation projects. However, adaptive management would allow for future instream projects to be evaluated and implemented if they are deemed necessary.

The proposed mechanical rehabilitation projects would involve the following:

∉ A total of 47 mechanical rehabilitation projects would be constructed between the Lewiston Dam and the confluence with the North Fork Trinity River. The sites would encompass approximately 665 acres. Construction would be scheduled between June 15 and October 15 (based on consultation with NOAA Fisheries) to minimize impacts to Chinook, coho, and steelhead.

- Of these 47 mechanical rehabilitation projects, 44 would be channel rehabilitation projects, and the remaining three would be side-channel projects. Twenty-four of the channel projects would be built in the first 3 years following finalization of ROD, and the remainder would be completed contingent upon an evaluation by the adaptive management program. A typical mainstem rehabilitation project would be approximately 150 feet wide (measured from the water's edge) and 500 to 5,000 feet long. A typical side-channel improvement would be 80 feet wide and 800 feet long.
- A typical project would take 6 weeks to construct and would require the use of front-end loaders, bulldozers, screens, and trucks.
- Each bank rehabilitation project will remove the confining riparian berms, remove the large volumes of sand stored within the berms from frequently flooded areas, reconstruct functional floodplains that are frequently inundated by the proposed high flow regime, and revegetate portions of the newly constructed floodplains with native woody riparian vegetation that increases overall riparian structure, cover, and diversity within the Trinity River corridor.
- Several bank rehabilitation projects may include reclaiming historical gravel mining pits and gold dredger tailings into off-channel riparian and aquatic wetlands.

Spawning gravel placement would average about 10,300 yd^3 annually, with an estimated range from 0 yd^3 in critically dry water years to 60,000 yd^3 or more in extremely wet water years (actual amounts would be determined by ongoing monitoring). The estimates assume that there would be no need for additional gravel placement as a result of Safety of Dam releases.

Fish Population Management. Population management under this alternative would be the same as the No Action Alternative.

Dam Modifications. The maximum release of 11,000 cfs associated with this alternative would not require modification to either Trinity or Lewiston Dam.

Estimated Costs. The cost of constructing the 47 new channel rehabilitation projects follows: 44 channel rehabilitation projects at $300,000 each and three side-channel projects at $100,000 each. Of the total cost of $13,500,000, approximately 25 percent is expected to be incurred in the first 3 years.

Spawning gravel costs are estimated to average $206,000 annually, with a range of $0 in critically dry water years to $982,000 in extremely wet water years.

Cost estimates for the adaptive management program range from $2,450,000 to $4,450,000 annually. Because of the inherent flexibility of adaptive management, future costs may significantly vary from these estimates.

Integrated Management. The Flow Evaluation Alternative would include both flow and non-flow measures intended to improve fishery habitat. The combination of flows, flow timing, ongoing mechanical maintenance, and conditions throughout the watershed would be monitored, and modified if necessary, in an attempt to optimize fish production. However, annual flow volumes would be capped at the levels described above.

2.1.5 Modified Percent Inflow

This alternative replaces the Percent Inflow Alternative described in the 1999 Draft EIS/EIR.

The Modified Percent Inflow Alternative would approximate natural flow patterns, at a reduced scale, by releasing water into the Trinity River at a proportion of the rate it flows into Trinity Reservoir. Each water year would have a set schedule from July 1 to April 14, with base flows and peak releases determined by water-year class. However, the ascending and descending limb of the hydrograph would be determined by calculating 30 percent of the previous week's inflow to Trinity Reservoir on the ascending limb and 50 percent of the previous week's inflow to Trinity Reservoir on the descending limb. Peak flows under this alternative, are outlined in Table 2-6. Each year's release schedule would be unique, varying according to the hydrology of a specific year. The minimum instream release built into the alternative is 250 cfs, and the maximum release would be 13,000 cfs. The 250-cfs release would occur on a single day in October for most water year types in an effort to keep spawners from grouping to tightly in the region immediately below Lewiston. For all other days, the minimum flow would be 300 cfs. All mechanical ground-disturbing actions taken under this alternative would be subject to site-specific environmental review. AEAM would not be included under this alternative because flow levels are fixed.

Water Management. Annual flows would vary each year. However, for comparison and modeling purposes, Table 2-6 presents the average annual release for each water-year class. The release pattern for each water-year class is shown on Figure 2-5.

TABLE 2-6
Representative Annual Volumes and Peak Releases – Modified Percent Inflow Alternative

Water-year Class	Acre-feet	Peak Flow (cfs)
Critically Dry	369,000	1,500
Dry	438,000	4,500
Normal	483,000	6,000
Wet	540,000	8,500
Extremely Wet	720,000	13,000

Note: This table presents median release volumes for each water-year class.

Water Operations. The timing of diversions through the Clear Creek Tunnel would be altered similar to the altered diversion timing for the Flow Evaluation Alternative. Diversions would be shifted to the summer and early fall to maintain suitable release temperatures for the inriver fishery. Trinity Reservoir would be operated to maintain a minimum carryover storage of 600,000 acre-feet between water years. The increased carryover, relative to No Action, provides cooler water for dam releases for the benefit of the inriver fishery and reduces the need for Trinity Powerplant bypasses to provide cooler water.

Watershed Protection. Watershed protection practices under this alternative would be identical to the No Action Alternative.

Fish Habitat Management. This alternative would incorporate the same mechanical channel rehabilitation projects and schedule described in the Flow Evaluation and No Action Alternatives; however, because this alternative does not include an adaptive management program, with regard to flow volumes, a less systematic review of the projects would be conducted at year 3 before commencing with the balance of the proposed projects. As in the Flow Evaluation Alternative, the Percent Inflow Alternative assumes that flow alone would maintain the proposed and existing projects. Consequently, no mechanical maintenance would be necessary. Spawning gravel requirements for this alternative are estimated to average 950 yd^3/year, with a range from 0 yd^3 in critically dry water years to 4,650 yd^3 in extremely wet water years. These estimates assume that no gravel placement would be necessary as a result of Safety of Dam releases.

Fish Population Management. Population management under this alternative would be the same as the No Action Alternative.

Dam Modifications. Reviews of historical hydrology, in terms of scheduled peaks to the Trinity Reservoir, indicate the maximum release would be about 13,500 cfs. Accordingly, no modification to either Trinity or Lewiston Dam was assumed necessary.

Estimated Costs. The cost of constructing the 47 new channel rehabilitation projects follows: 44 channel rehabilitation projects at $300,000 each and three side-channel projects at $100,000 each. Of the total cost of $13,500,000, approximately 25 percent is expected to be incurred in the first 3 years.

Spawning gravel costs are estimated to average $19,000 annually, with a range of $0 in critically dry and dry water years to $93,000 in extremely wet water years.

Integrated Management. The Modified Percent Inflow Alternative would include both flow and non-flow measures intended to improve fishery habitat. The combination of flows, flow timing, ongoing mechanical maintenance, and conditions throughout the watershed would be monitored, and modified if necessary, in an attempt to optimize fish production. However, annual flow volumes would be capped at the levels described above.

2.1.6 70 Percent Inflow

This alternative was not analyzed in the 1999 Draft EIS/EIR, but was suggested by hundreds of commentors, and thus was added for consideration in the Supplemental EIS/EIR.

The 70 Percent Inflow Alternative is similar to the Modified Percent Inflow Alternative, except that releases for any given week are equal to approximately 70 percent of the previous week's Trinity Reservoir inflow. There are no target peak releases; however, the No Action hydrograph serves as a "floor" (defining the minimum potential releases) to ensure that annual releases do not fall below the 340,000 acre-feet minimum allowable by federal law. Each year's release schedule would be unique, varying according to the hydrology of a specific year. The 70 percent figure is based on a large number of comments received on the Draft EIS/EIR. Commentors referred to this calculation as the "Tennant Method."[4] The minimum instream release built into the alternative is 300 cfs, and the maximum release, based on the period of record, would be 11,000 cfs. That figure is comparable to 70 percent of the highest recorded inflow above Trinity Dam, with minimum yearly releases of 340,000 acre-feet. All mechanical ground-disturbing actions taken under this alternative would be subject to site-specific environmental review. AEAM would not be included under this alternative because flow levels are fixed. The timing of releases under this alternative

[4] The "Tennant Method" is a shorthand approximation for determining optimum flow releases.

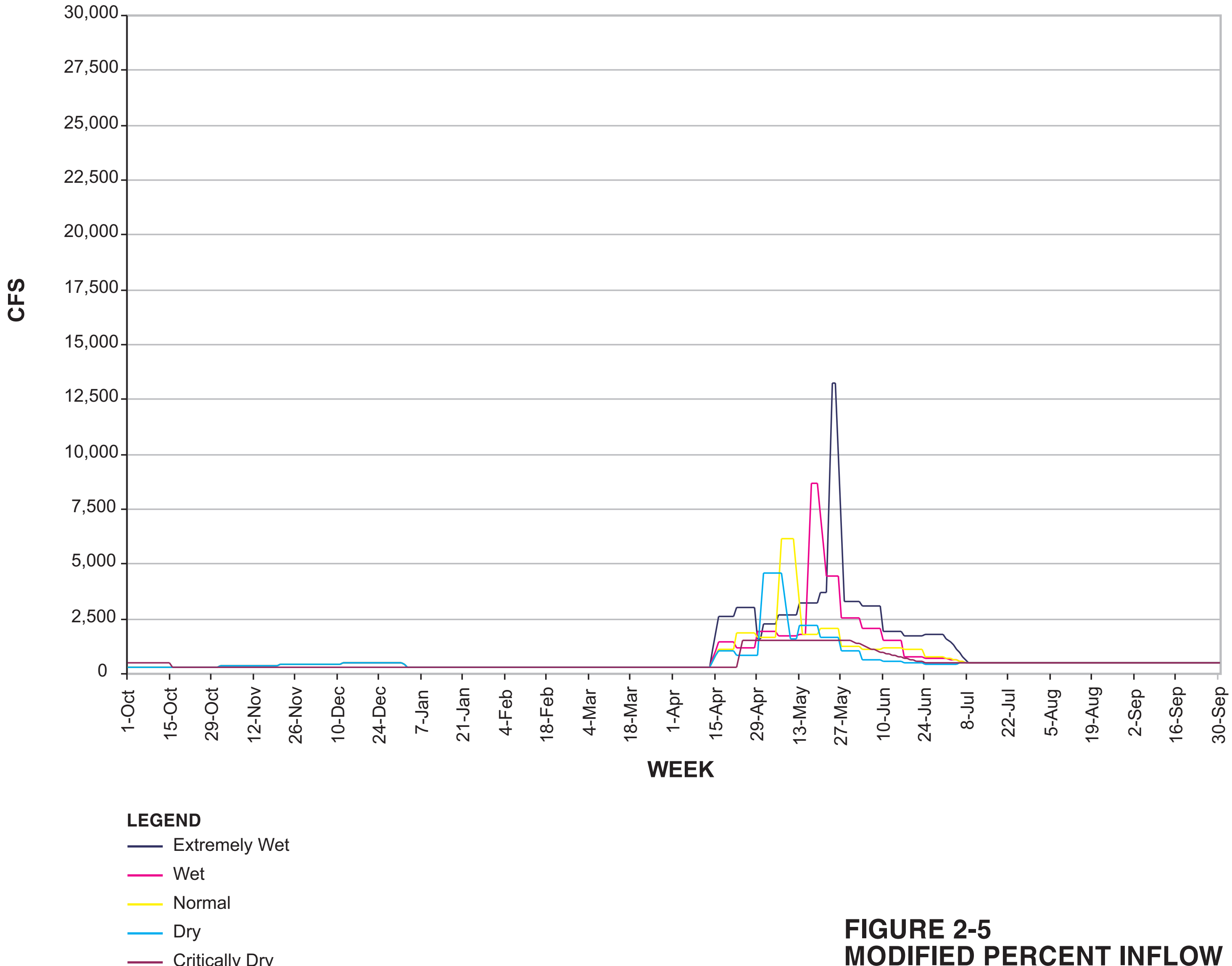

FIGURE 2-5
MODIFIED PERCENT INFLOW HYDROGRAPH
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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would be more likely to "piggy back" on flows caused by winter rain events. This may reduce the need for dredging tributary deltas.

Water Management. Annual flows would vary each year. However, for comparison and modeling purposes, Table 2-7 presents the average annual release for each water-year class. The release pattern for each water-year class is shown on Figure 2-6.

TABLE 2-7
Annual Volumes and Peak Releases – 70 Percent Inflow Alternative

Water-year Class	Acre-feet	Peak Flow (acre-feet)
Critically Dry	421,000	2,000
Dry	632,000	2,286
Normal	833,000	3,045
Wet	1,187,000	4,333
Extremely Wet	1,732,000	6,554

Note: Peak flow over modeled hydrologic record: 11,000 cfs.

Water Operations. The timing of diversions through the Clear Creek Tunnel would be altered similar to the altered diversion timing for the Flow Evaluation Alternative. Diversions would be shifted to the summer and early fall to maintain suitable release temperatures for the inriver fishery. Trinity Reservoir would be operated to maintain a minimum carryover storage of 600,000 acre-feet between water years. The increased carryover, relative to No Action, provides cooler water for dam releases for the benefit of the inriver fishery and reduces the need for Trinity Powerplant bypasses to provide cooler water.

Watershed Protection. Watershed protection practices under this alternative would be identical to the No Action Alternative.

Fish Habitat Management. Fish habitat management would be identical to the No Action Alternative. However, this alternative assumes seasonal flows large enough to maintain the planned improvement projects. Consequently, no mechanical maintenance would be necessary. Spawning gravel requirements for this alternative are estimated to average 950 yd^3/year, with a range from 0 yd^3 in critically dry water years to 4,650 yd^3 in extremely wet water years. These estimates assume that no gravel placement would be necessary as a result of Safety of Dam releases.

Fish Population Management. Population management under this alternative would be the same as the No Action Alternative.

Dam Modifications. Reviews of historical hydrology, in terms of weekly inflows to the Trinity Reservoir, indicate the maximum release would be about 11,000 cfs. Accordingly, no modification to either Trinity or Lewiston Dam was assumed necessary.

Estimated Costs. Cost would be identical to the No Action Alternative, less the site maintenance costs. Spawning gravel costs are estimated to average $19,000 annually, with a range of $0 in critically dry and dry water years to $93,000 in extremely wet water years.

Integrated Management. The 70 Percent Inflow Alternative would include both flow and non-flow measures intended to improve fishery habitat. The combination of mechanical maintenance, and conditions throughout the watershed would be monitored, and modified if necessary, in an attempt to optimize fish production.

2.1.7 Maximum Flow

The Maximum Flow Alternative would use all of the Trinity River inflows above Trinity Dam to restore the river ecosystem through managed flows, which would include periodic peak flow releases of 30,000 cfs that would promote streambed movement and restoration of pre-dam channel geomorphology. These occasional large releases would occur in extremely wet water years and would be intended to approximate pre-dam floods. This alternative restores and maintains the river and its fishery resources using only flows and spawning gravel placement. All mechanical ground-disturbing actions taken under this alternative would be subject to site-specific environmental review.

Water Management. Annual releases would vary by water-year class, as shown in Table 2-8. The release pattern for each water-year class is shown on Figure 2-7.

TABLE 2-8
Annual Volumes and Peak Releases – Maximum Flow Alternative

Water-year class	Acre-feet	Peak Flow (cfs)
Critically Dry	463,000	2,000
Dry	889,000	3,800
Normal	1,206,000	5,429
Wet	1,508,000	6,786
Extremely Wet	2,146,000	30,000

Note: Peak flow releases and timing: 30,000 cfs/5 days in May (extremely wet years only).

Water Operations. This alternative plans for no exports to the Central Valley because the water entering the Trinity Reservoir would be needed to meet the flow schedule shown in Table 2-8 and on Figure 2-7. The alternative calls for a ramping up of releases as early as January (depending on water-year class); hence, Reclamation would need to modify its methods of determining water-year classes (i.e., make their determinations earlier). This alternative assumes that Trinity Reservoir would be operated to maintain a minimum

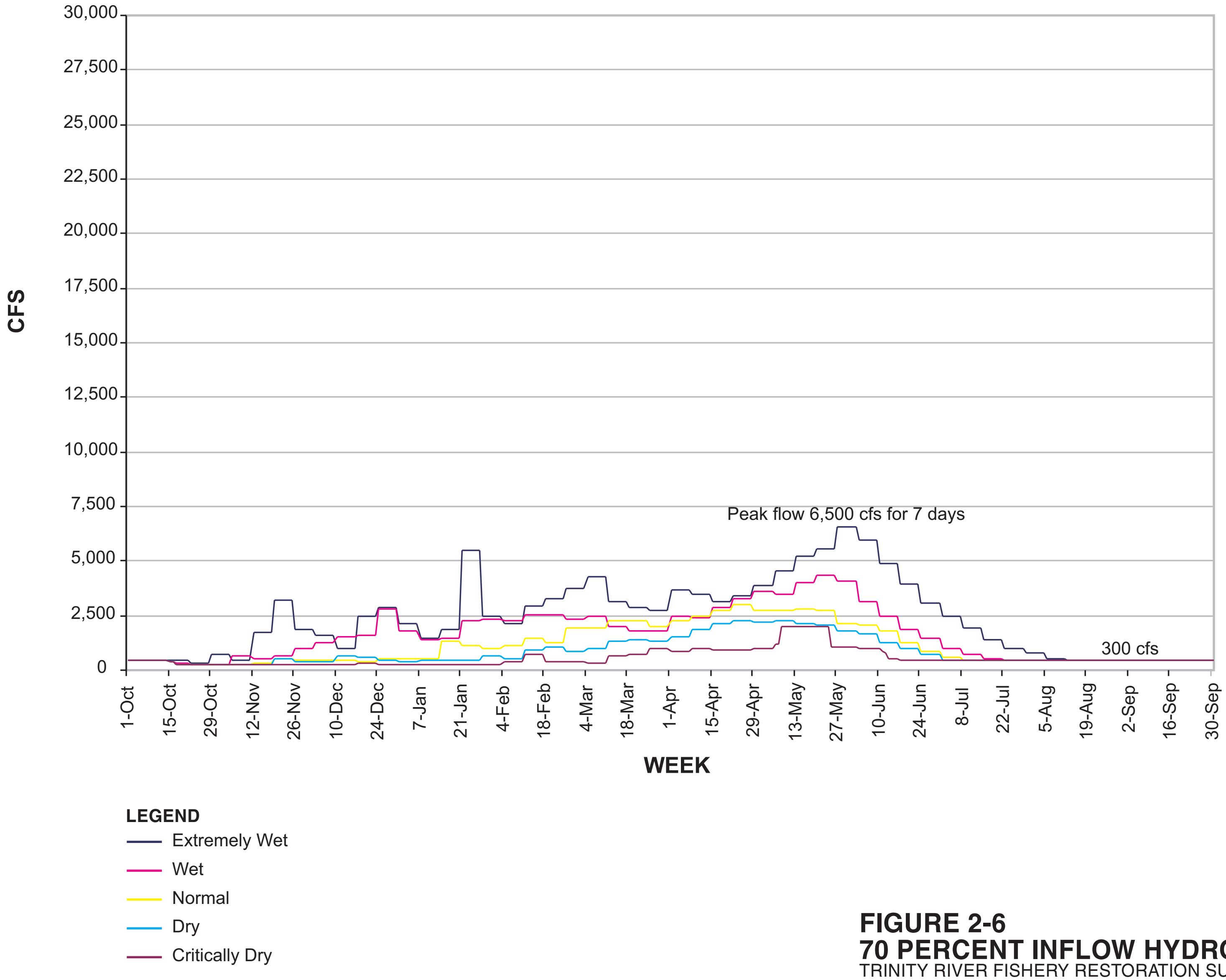

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FIGURE 2-6
70 PERCENT INFLOW HYDROGRAPH
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

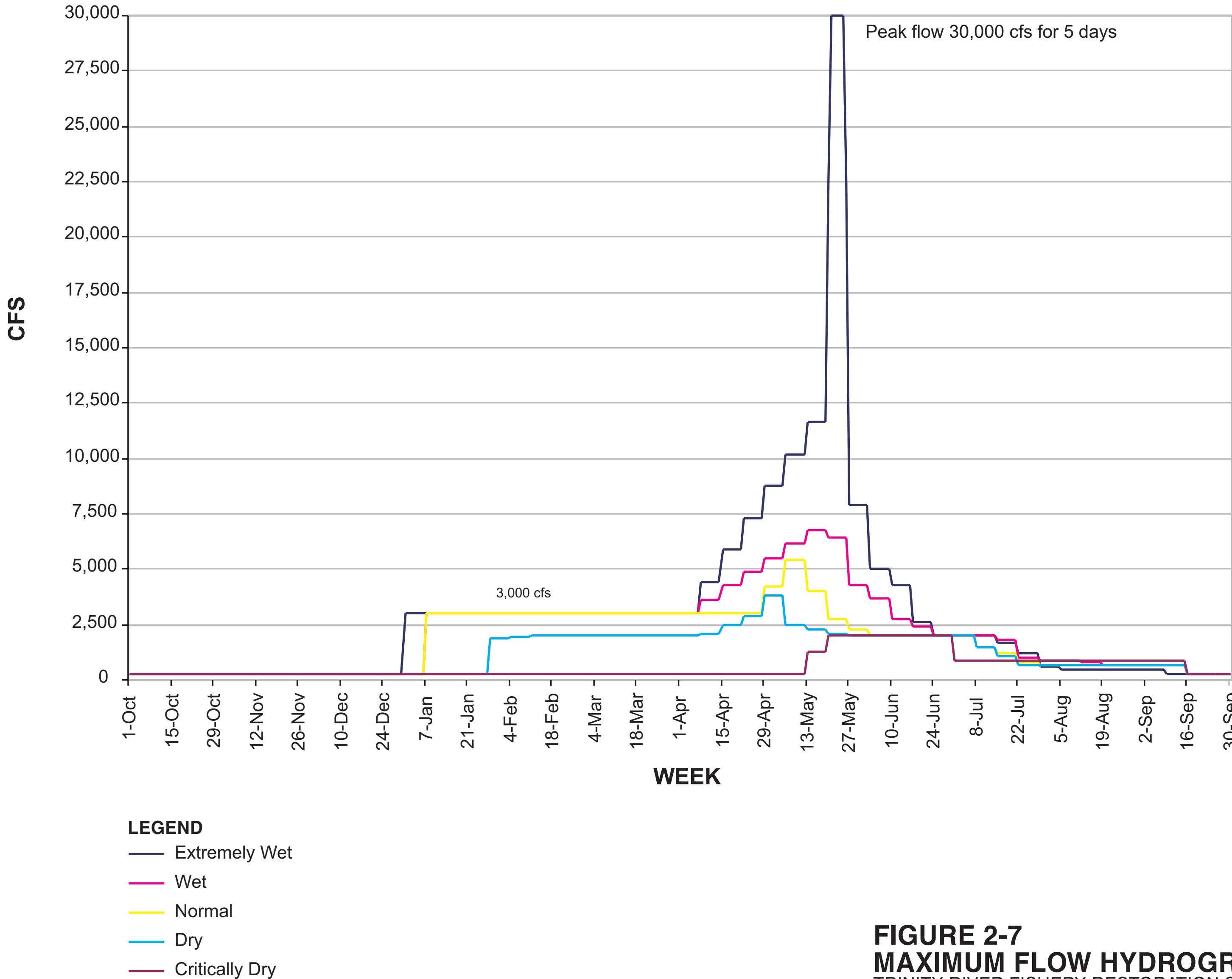

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FIGURE 2-7
MAXIMUM FLOW HYDROGRAPH
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

carryover storage of 400,000 acre-feet between water years. (Although the Flow Evaluation, Modified Percent Inflow and 70 Percent Inflow Alternatives assume a minimum carryover of 600,000 acre-feet for temperature benefits, the high peak flows associated with this alternative preclude an increase in minimum carryover.)

Watershed Protection. Watershed protection practices under this alternative would be the same as the No Action Alternative.

Fish Habitat Management. Because this alternative assumes periodic major flow events with the ability to dramatically reshape the river, no mechanical rehabilitation projects would be constructed, nor would mechanical maintenance be needed for existing projects.

This alternative's large releases would transport and distribute more spawning gravel than any other alternative. Estimates of spawning gravel replacement average 16,400 yd^3/year, ranging from 0 yd^3 in critically dry water years to more than 100,000 yd^3 during extremely wet water years (a lack of data from large magnitude flows precludes a more precise upper-end estimate). The actual amounts of gravel placement would be determined by ongoing monitoring.

Fish Population Management. Fish population management under this alternative would be the same as the No Action Alternative.

Dam Modifications. Trinity Dam would be modified to accommodate the increased peak flows associated with this alternative (modifications to Lewiston Dam would not be necessary). Modifications to Trinity Dam would affect the release capability and, therefore, the Safety of Dams operational requirements because more flow can be released under controlled conditions. One of the following options could be used for these modifications (the options would be fully evaluated in a subsequent environmental document):

- **New penstock and tunnel connection –** Construction would take a minimum of 1 year and include the installation of an 11-foot-diameter penstock, one new guard and regulating gate, a control structure, and a one-half-acre stilling basin at Trinity Dam. It would also require the construction of a tunnel connection between the main outlet and the fixed-crest morning-glory spillway tunnel, plus a gate chamber housing a guard and a regulating gate.

- **Tunnel connection and spillway ring gate –** Construction would take a minimum of 1 year and include construction of a tunnel connection between the main outlet and the spillway tunnel at Trinity Dam, plus a gate chamber housing a guard and a regulating gate. It would also require replacing the fixed-crest morning-glory spillway with a 54-foot-diameter sliding ring gate.

∉ **New penstock and spillway ring gate –** Construction would take approximately 1 year and include construction of an 11-foot-diameter penstock, one new guard and regulating gate, a control structure, and a 0.5-acre stilling basin at Trinity Dam. It would also require replacing the fixed-crest morning-glory spillway with a 54-foot-diameter sliding ring gate.

Similar equipment would be needed for all three methods, such as boom cranes, concrete batch and mixing plants, backhoes, dump - trucks, concrete trucks, pumps, and drilling equipment. A temporary construction staging area would be required for each method, ranging in size from 6 to 12 acres.

A new stilling basin and control house would be constructed in the river for the penstock-and-tunnel-connection and the penstock-and-spillway-ring-gate methods. This work would start with the installation of a temporary cofferdam and dewatering facilities, continue with the construction of the stilling basin and control structures, and end with the removal of the cofferdam and the restoration of the river channel. These activities would last about 6 months, during which reservoir releases would occur through the auxiliary outlet. The auxiliary outlet connects to the spillway tunnel and chute, which discharges about 600 feet downstream from the embankment toe.

New access roads would not be required for any of the methods, provided the dam crest road could be reserved for contractor use only. All existing roads and temporary staging areas that were used for construction would be restored to pre-project conditions.

Estimated Costs. Cost estimates for each of the three Trinity Dam modification options (Reclamation, 1996) are as follows:

∉ New penstock and tunnel connection – $72,980,000
∉ Tunnel connection and spillway ring gate – $63,600,000
∉ New penstock and spillway ring gate – $23,080,000

Spawning gravel costs are estimated to average $328,000 annually, ranging from $0 to over $2,000,000.

A detailed flood plain review would be necessary to determine the total number of properties to be purchased because of increased peak flows.

Integrated Management. The Maximum Flow Alternative would include both flow and non-flow measures intended to improve fishery habitat. The combination of flows, flow timing, ongoing mechanical maintenance, and conditions throughout the watershed would be monitored, and modified if necessary, in an attempt to optimize fish production. However, annual flow volumes would be capped at the levels described above.

SECTION 3.0

Affected Environment and Environmental Consequences

3.1 Introduction

Section 3.0 describes the affected environment and the environmental consequences of implementing the various alternatives described in Section 2.0. Issues discussed include water resources, water quality, fishery resources, and hydroelectric power resources.

Each section includes a discussion of the affected environment (CEQA existing conditions) and environmental consequences (CEQA environmental impacts). Section 4.0 will provide a summary of significant adverse environmental impacts and proposed mitigation, the anticipated level of significance after mitigation is implemented, and those impacts that cannot be avoided and remain significant in accordance with Public Resources Code §21100, subd. (b)(2) and *CEQA Guidelines* §15126.2 Subd. (b).

Section 3.2 identifies specific adverse effects to the water delivery systems caused by potential implementation of these alternatives. However, it is understood that the change in water delivery patterns prescribed in these alternatives will have effects on water quality and fisheries. Those effects are identified and described, and mitigation is recommended in the appropriate sections.

Each resource area discussion is organized as follows:

- Affected Environment (CEQA Existing Conditions): These subsections describe the existing regional and local conditions. Information presented is the most current available and is used as the CEQA baseline for analysis for all sections that are qualitatively analyzed. Existing conditions with regard to sections that use hydrologic models (see Section 3.2, Water Resources, and the Water Resources/Water Quality Technical Appendix A for information regarding the use of water-related models) assume a modeled 1995 condition with regard to CVP/SWP operations.

- Environmental Consequences (CEQA Environmental Impacts): These subsections identify the anticipated impacts within the context of each section. Those impacts that are deemed to be potentially significant prior to mitigation are identified as such in the text. For some sections, impacts are analyzed and identified based on modeling simulations. The following subsections are also presented under Environmental Consequences:

- Methodology: These subsections identify the method used to analyze impacts, as well as the key assumptions used in the analysis process. All sections that incorporate quantitative assessments reference complimentary technical appendices within each of the relevant Methodology subsections. Key assumptions used in qualitative analyses are also described for those sections that did not include the use of quantitative tools.

- Significance Criteria: These subsections identify what the lead agencies believe to be potentially significant effects on the environment in accordance with *CEQA Guidelines* §§15065 and consistent with guidance provided by Appendix G of the *CEQA Guidelines* (Environmental Checklist Form), and agency standards, any applicable legislative or regulatory requirements, and to professional judgement. All impacts that do not exceed the stated significance criteria described for each section are determined to be less than significant and are therefore not discussed in detail in the document (Public Resources Code §21100 and *CEQA Guidelines* §§15128).

- Mitigation: These subsections identify what lead agency staff and consultants believe to be potentially feasible mitigation measures that would reduce significant impacts associated with each of the alternatives. Where no feasible mitigation can be identified, such impacts are identified as significant and unavoidable.

Numerous models were used to assist in the identification of potential impacts associated with the implementation of any of the alternatives. Figure 3.1-1 illustrates the relationship of the primary modeling tools used to analyze impacts in the Draft EIS/EIR. Arrows indicate what data is used for additional model runs. Figure 3.1-2 illustrates the relationship of those models used to analyze impacts for this Supplemental EIS/EIR. A description of each model, key assumptions, and use is provided in each section where a given model is used, as well as the associated technical appendices. As indicated in the figure, model runs were performed to address shortcomings identified by the court. Specifically, CALSIM (the replacement for PROSIM) was used to evaluate changes to Water Resources; Reclamation Salmon mortality and temperature models

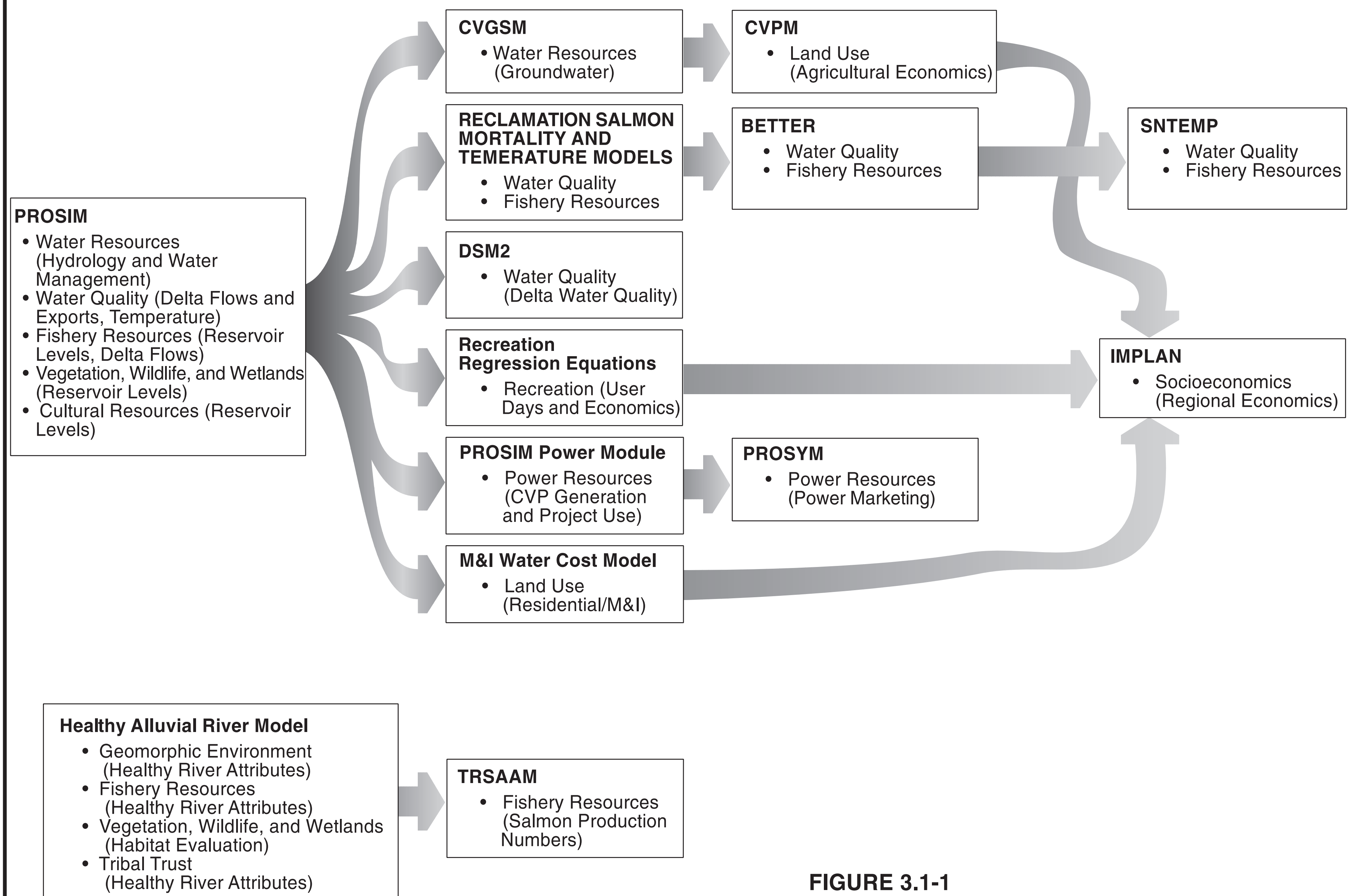

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FIGURE 3.1-1
RELATIONSHIP OF MODELS USED FOR RESOURCE ANALYSES (DRAFT EIS/EIR)
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

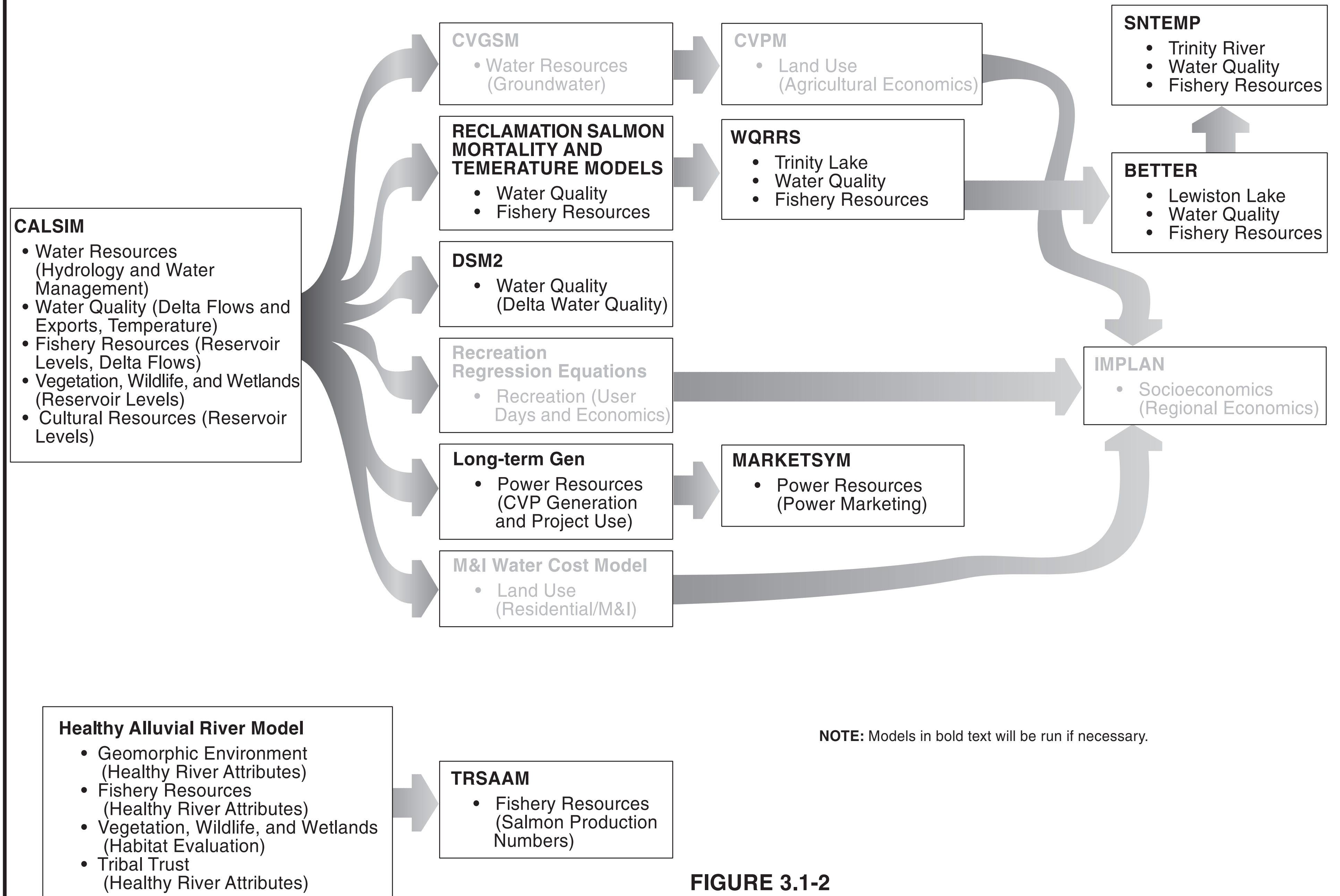

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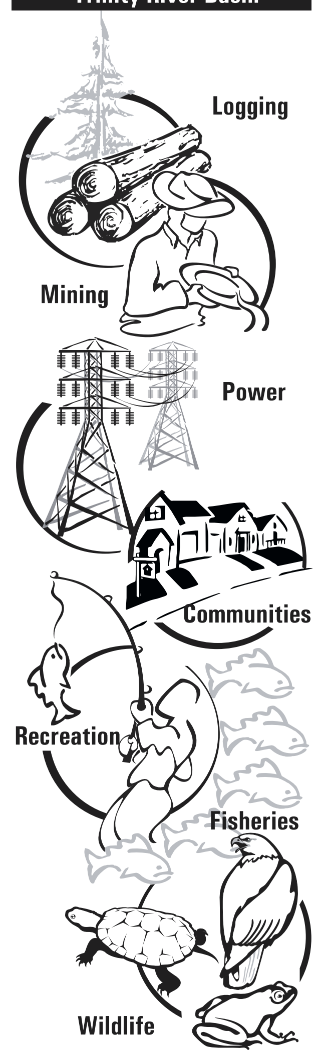
FIGURE 3.1-2
RELATIONSHIP OF MODELS USED FOR RESOURCE ANALYSES (SUPPLEMENTAL EIS/EIR)

were used to evaluate temperature and mortality effects, WQRRS, Box Exchange Transport Temperature and Ecology of Reservoirs Model (BETTER), and Service's Stream Network Temperature Model (SNTEMP) were run to evaluate temperature effects on the Trinity River. Delta Simulation Model 2 (DSM2) was used to evaluate the effects on constituents in the Bay Delta. Long-term Gen and MARKETSYM were used to update impacts to Power Resources. Figures 3.1-1 and 3.1-2 graphically illustrate the models used in this Supplemental EIS/EIR and the previous 1999 Draft EIS/EIR. Model results were then compared to previous model results to evaluate whether further analysis was warranted in resource areas not addressed by the Court in every case, the model results were found to be similar to pervious model results. Many of these models have been used in other large-scale water management studies, including the CVPIA PEIS (and technical appendices), which includes a very detailed description of the same models used to identify potential water management effects.

For most issues the discussion is divided into the Trinity River Basin, the Lower Klamath River Basin/Coastal Area, and the Central Valley. However, the power section is not subdivided because the power system operation spans all basin areas. Figure 3.1-3 shows the three geographic impact areas.

The following describes the general setting of the Trinity River Basin, the Lower Klamath River Basin/Coastal Area, and the Central Valley.

Trinity River Basin



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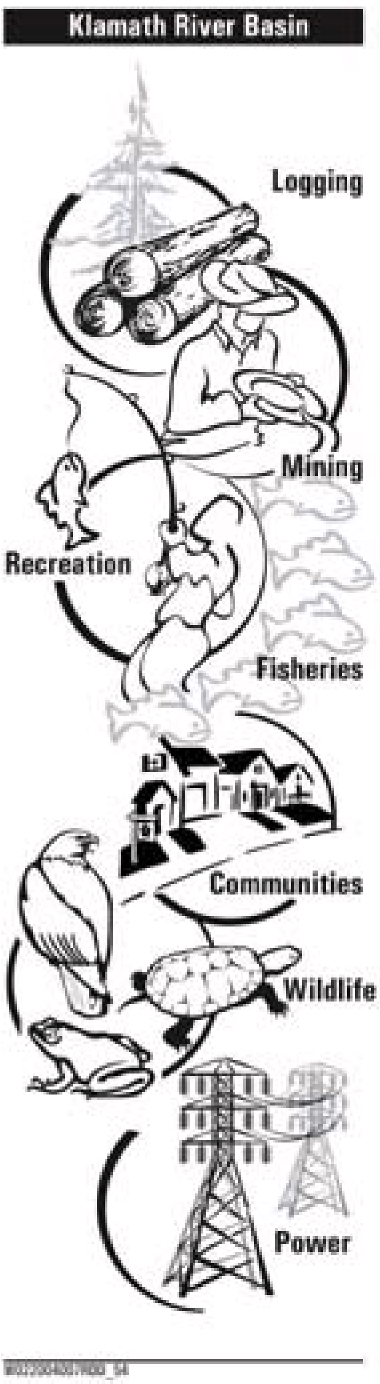
3.1.1 Trinity River Basin

The Trinity River drains a watershed of approximately 3,000 square miles; approximately one-quarter of which is above Lewiston Dam. The terrain is predominantly mountainous and forested, with little available farming area. Elevations in the basin range from 8,888 feet above sea level in the headwater areas to less than 300 feet at the confluence with the Klamath River.

The Trinity River is the largest tributary to the Klamath River. It consists primarily of the mainstem and the North and South Forks, and New River. The Trinity River originates approximately 20 miles southwest of Mount Shasta in the canyons bordered by the Scott Mountains, the Eddy Mountains, and the Salmon-Trinity Alps.

Trinity and Lewiston Dams regulate Trinity River flows beyond approximately RM (river mile) 112. The mainstem flows a total of 170 miles west from its origins to the Klamath River confluence at Weitchpec, which is located 43.5 miles upstream from the Pacific Ocean. The majority of lands directly adjacent to the river are managed by either the USFS or the BLM; however, about half of the land bordering the river between Lewiston Dam and the North Fork is private.

Trinity Reservoir, impounded by Trinity Dam, stores Trinity River water. Lewiston Dam regulates releases from Lewiston Reservoir to the Trinity River and provides a forebay for the diversion of flows from the Trinity River Basin through the Clear Creek Tunnel.



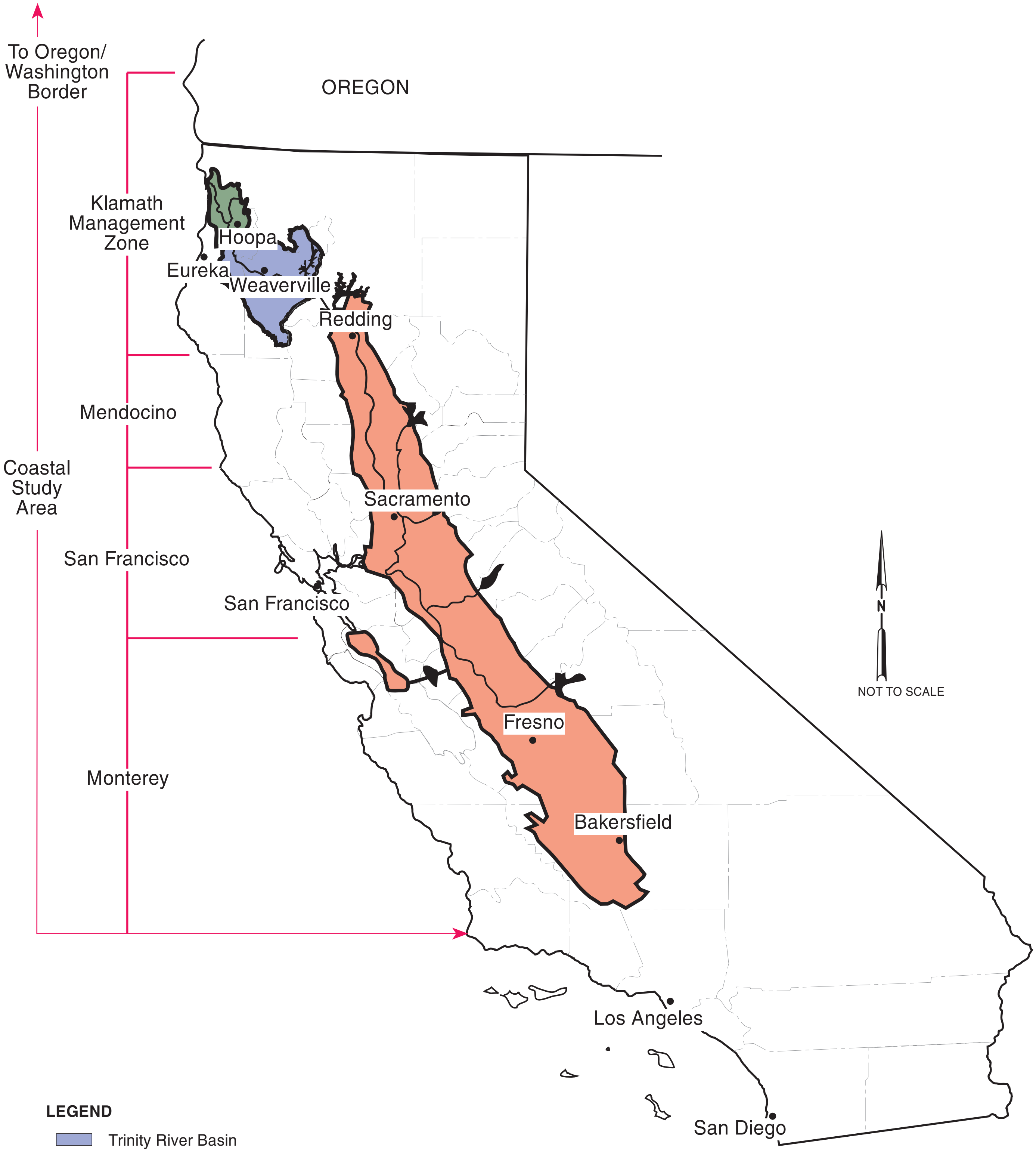
Urban development within the Trinity River Basin is primarily limited to the communities of Lewiston, Weaverville, Junction City, Hayfork, Willow Creek, Trinity Center, and Hoopa. In addition, several smaller communities have sprung up along State Highway 299 on level terrain adjacent to the Trinity River. Access to the river is provided by State Highway 299, which follows it from Junction City to Willow Creek. At this point, the river veers north, and State Highway 96 parallels it to its confluence with the Klamath River. Numerous recreation sites exist along the river (see Section 3.8 of the Draft EIS/EIR).

The Hoopa Valley Indian Reservation is located north of Willow Creek along the Trinity River and State Highway 96. The reservation is approximately 144 square miles, with the northern border lying near Weitchpec at the confluence with the Klamath River.

3.1.2 Lower Klamath River Basin/Coastal Area

The Klamath River Basin is located adjacent to and north of the Trinity River Basin. The entire basin drains approximately 15,600 square miles. Most of the land is under public ownership in the form of eight national forests; two national parks; BLM lands, Reclamation lands, Department of Defense lands, and Hoopa Valley and Yurok Indian Reservations, held in trust by the Bureau of Indian Affairs (BIA); as well as state and county properties. The lower Klamath River Basin extends from the confluence of the Trinity and Klamath Rivers to the Pacific Ocean. Private timber companies and the federal government own much of the land in the lower basin. The Yurok Indian Reservation extends along the entire length of the lower Klamath River. Land uses in the lower Klamath River Basin have generally been tied to natural resources, predominantly logging, mining, fisheries, and recreation. Klamath, Klamath Glen, and Requa are the primary communities.

The coastal component of this assessment area extends from southern California to the Oregon/Washington border. The area includes all ocean waters and resources that could be impacted by the proposed action and alternatives.



LEGEND

- Trinity River Basin
- Lower Klamath River Basin/Coastal Area
- Central Valley (and San Felipe Division of CVP)

NOTE

Geographic scope for individual resource areas varies slightly. Power resources uses the Western Area Power Administration Area as a geographic scope.

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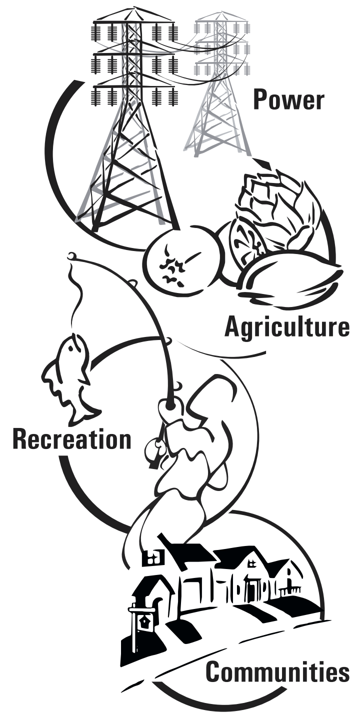
FIGURE 3.1-3
GEOGRAPHIC SCOPE OF DRAFT EIS/EIR
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

3.1.3 Central Valley

The Central Valley consists of the Sacramento River Basin (Sacramento Valley), the San Joaquin River Basin (San Joaquin Valley), and the Tulare Basin. The Sacramento River and its tributaries flow southward, draining the Sacramento River Basin. The San Joaquin River and its tributaries flow northward, draining the San Joaquin Basin. The Tulare Basin lies south of the San Joaquin River and includes the Kings, Tule, Kaweah, and Kern Rivers. The Sacramento and San Joaquin River systems join at the Delta and flow through Suisun Bay and Carquinez Straits into San Francisco Bay and the Pacific Ocean.

Central Valley



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Major water management features of the Central Valley include 20 reservoirs, with a combined storage capacity of approximately 11 maf; 9 powerplants and 2 pumping-generating plants, with a maximum capacity of about 2 million kW; and approximately 500 miles of major canals and aqueducts. The federally operated CVP and state-operated SWP are the primary water conveyance systems in the state, which together deliver an annual total of approximately 9 maf of water. The Central Valley is one of the world’s premier agricultural regions, accounting for 40 percent of the United States vegetable, fruit, and nut production. Approximately 6 percent of the region is urbanized. The largest urban area in the valley is the City of Sacramento, and the primary access route through the valley is Interstate 5.

3.2 Water Resources

This section describes the hydrology and management of water associated with CVP operations. Because operations span the Trinity River Basin and Central Valley areas, operations and facilities are discussed in both geographic areas, as appropriate.

Reservoir inflows, stream gains, diversion requirements, irrigation efficiencies, return flows, and groundwater operation are all components of the Project study area hydrology. The hydrologic analysis determines project operational effects of each listed alternative, while balancing reservoir operations, making water delivery allocations, and meeting fish and wildlife requirements.

To evaluate the effects to reservoir operations, water delivery allocations and meeting fish and wildlife requirements the CALSIM flow evaluation model was used. The choice of models is discussed in the Methodology section of this section. Flows used for the hydrologic model are based on the historical record, modified to reflect a constant future level of development. Historical flows are modified to account for changes in storage and diversion; examples follow:

- Construction of new storage or regulation facilities
- Changes in the projected operation of existing storage facilities
- Changes in upstream (i.e., external to model) imports and exports

The results presented in this section should only be used in a comparative mode. The Analysis of Alternatives section presents the results of each Action Alternative simulation compared to the results of the No Action and/or Existing Conditions simulation(s), to determine the incremental effects, of each alternative. The results from a single simulation might not necessarily represent the exact operations for a specific month or year, but are intended to reflect long-term trends.

3.2.1 Surface-water Hydrology and Management

Affected Environment.

Trinity River Basin. The Trinity River drains a watershed of approximately 2,965 square miles, about one-quarter of which is above Lewiston Dam. Elevations range from 8,888 feet mean sea level (msl) at Sawtooth Mountain in the Trinity Alps to 300 feet msl at the confluence of the Trinity and Klamath Rivers. Average precipitation for this watershed is approximately 62 inches per year; throughout the basin it varies from 30 to 70 inches and typically occurs as rain in the lower elevations and snow at the higher elevations.

The Trinity River is the largest tributary to the Klamath River. The Trinity River flows a total of 170 miles from its headwaters to its confluence with Klamath River at Weitchpec, 43.5 miles upstream from the Pacific Ocean. Trinity and Lewiston Dams currently regulate Trinity River flows below RM 112. Prior to the completion of the TRD, flows in the Trinity River were highly variable, ranging from summer flows of 25 cfs to extreme winter events with instantaneous peak flows greater than 100,000 cfs. Annual hydrographs typically followed a seasonal pattern of high winter and spring flows followed by low summer and fall flows. Total annual flow volumes at Lewiston ranged from 0.27 to 2.7 maf, with an average of 1.2 maf.

The TRD was authorized in 1955, and began operating in 1964. The TRD consists of a series of dams, tunnels, and powerplants that export water from the Trinity River Basin into the Sacramento River Basin. With a capacity of 2.448 maf, Trinity Reservoir is the centerpiece of the TRD. Releases from Trinity Reservoir are re-regulated in Lewiston Reservoir prior to release downstream into the Trinity River. Lewiston Reservoir also acts as a forebay for the trans-basin export of water into Whiskeytown Reservoir via the Clear Creek Tunnel.

Since completion of the dam in 1964, an average of 74 percent of the river's inflow from above Lewiston Dam has been exported annually, or about 988,000 acre-feet (for example, see Figure 1-2). In recent years (1985 to 1997), annual exports have decreased to an average of 732,400 acre-feet, reflecting an increase in instream releases from 120,500 to 340,000 acre-feet. Post-dam Trinity River flows at Lewiston have been as low as 120,100 acre-feet annually (10 percent of pre-dam levels). Current minimum releases to the Trinity River are not less than 340,000 acre-feet annually, as mandated by the 1992 CVPIA. Although these releases are larger than most from 1965 through 1992, they still represent drought-level flow conditions relative to pre-dam hydrology (Figure 3.2-1). According to records of pre-dam flows at Lewiston and post-dam inflow to Trinity Reservoir, 340,000 acre-feet approximates the third lowest natural flow since 1912. Recent administrative and legal proceedings have further increased releases to the Trinity River. According to the February 20, 2003 Wanger Decision, releases are 453,000 acre-feet in dry and wetter water years, and 369,000 acre-feet in critically dry water years. These flow releases represent the current release schedule for the Trinity River.

All but the largest runoff events are retained in the reservoirs for later export or downstream release, eliminating most of the variability in flow below Lewiston Dam. The decrease in flows is most pronounced in the late winter and early spring months (January to June). From 1965 to 1992, post-dam flows (excluding unplanned releases) were a fairly constant 150 to 300 cfs year-round, as opposed

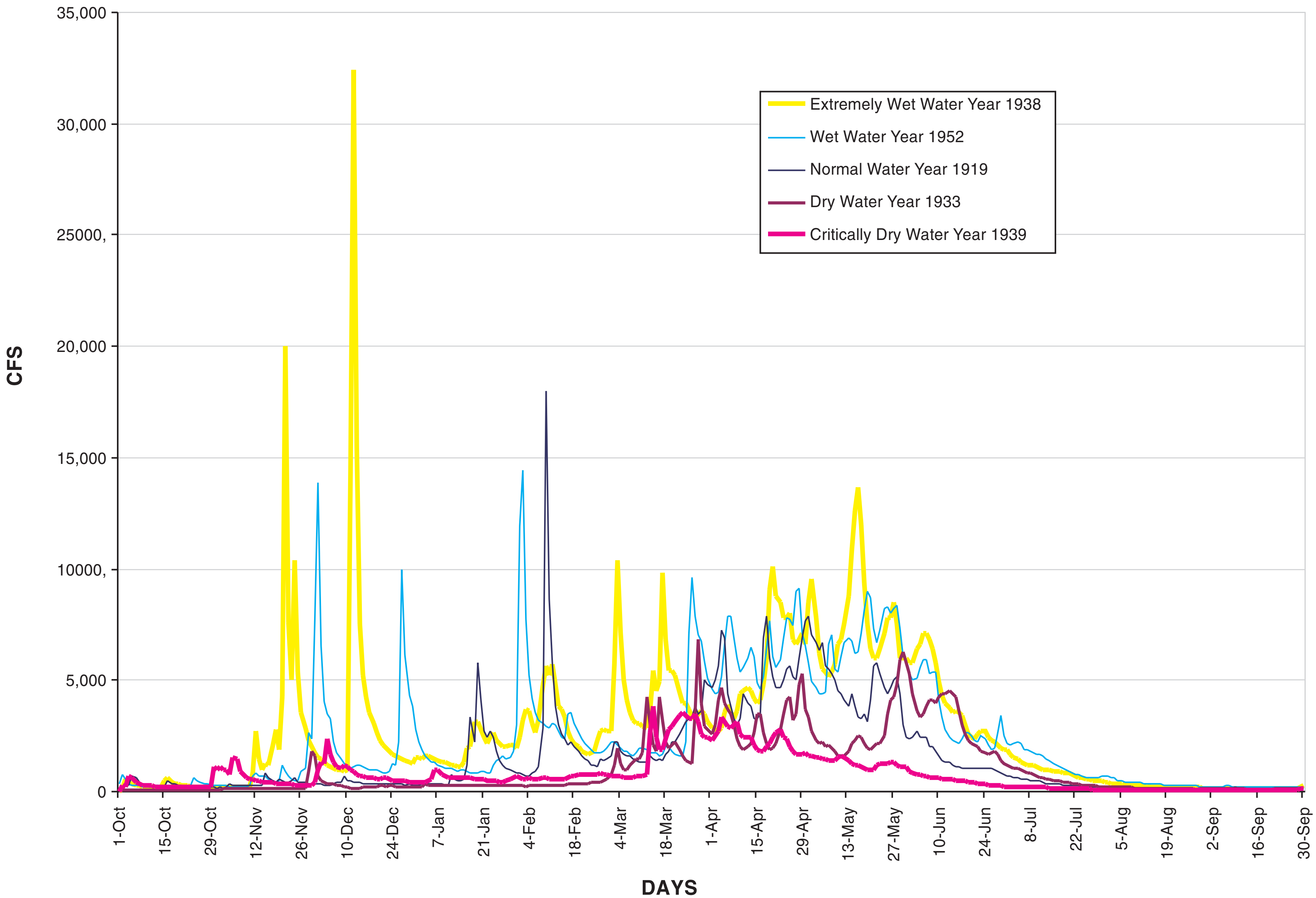

FIGURE 3.2-1
PRE-DAM DAILY FLOW COMPARISONS
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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to the pre-dam flows of 25 to 71,000 cfs or more. Since 1992, spring releases have occasionally ranged up to 6,000 cfs. Lewiston Dam releases are the major component of Trinity River flows until the confluence with the North Fork Trinity River. Downstream of the confluence, the accretion of tributary inflows reduces the dampening effects of the TRD. Accordingly, the frequency and magnitude of flood events have decreased dramatically at Lewiston, but much less so downstream at Burnt Ranch and Hoopa because of the increasing influence of tributary accretions (approximately 60 and 100 miles downstream of Lewiston Dam, respectively). (See Geomorphic Environment, Section 3.2, in the Draft EIS/EIR for more information on pre- and post-dam conditions.)

Although flood control is not an expressly authorized function of the TRD, Reclamation's Safety of Dams criteria provide a measure of downstream flood control. During the flood season, exports to the Central Valley are made to provide additional space within Trinity Reservoir as necessary (however, exports are not made if the Sacramento River is at or near flood stage).

TRD operations are integrated with operations of the Shasta Division of the CVP (Figures 3.2-2 and 3.2-3). For example, TRD exports have been made in consideration of minimum flow requirements in the Trinity and Sacramento Rivers, storage levels in Trinity and Shasta Reservoirs, and other CVP operating requirements (e.g., CVP deliveries, water quality requirements, the Winter-run BO). Trinity Reservoir is also operated to maximize power production during the summer and fall, in coordination with the Shasta Division.

The Winter-run BO mandates temperature requirements in the Sacramento River below Keswick Dam. Compliance with the BO is a major influence on Shasta Division operations. The TRD exports are used in conjunction with releases from Shasta Reservoir to meet temperature requirements and manage the coldwater pool in Shasta Reservoir. The majority of TRD exports occur in the spring and summer. At the same time, temperature objectives to protect Trinity River salmon must also be met. Addressing the temperature needs of the two systems is only one of the factors driving operations.

The TRD water is also used to dilute and transport acid mine drainage from the Spring Creek Debris Dam adjacent to Keswick Reservoir. The Spring Creek Debris Dam receives polluted runoff from Iron Mountain Mine, an EPA-identified Superfund site. Flows from the Spring Creek Powerplant are typically maintained at a minimum of 200 cfs to help dilute the polluted runoff and to avoid pollution events. Additional information on the operation of the TRD and CVP is provided in the Water Resources/Water Quality Technical Appendix A.

Lower Klamath River Basin/Coastal Area. The Klamath River Basin is located adjacent to and north of the Trinity River Basin. It drains approximately 15,600 square miles. Basin elevations range from more than 9,500 feet msl at the headwaters near Mount McLoughlin to sea level at the mouth of the river. Discharge near the mouth of the Klamath River averages approximately 13 maf per year. Prior to dam completion, the Trinity River contributed approximately 33 percent of the flow at the mouth of the Klamath River. After dam completion, Trinity River contributions averaged 28 percent.

The Upper Klamath River Basin supports over 2,000 private farms operating on approximately 556,000 acres. Approximately 40 percent (220,000 acres) of these lands are irrigated with Reclamation water. The potential for agricultural drought and impacts to endangered species, in addition to tribal trust issues, has led to competing interest in the Klamath River water supply.

During the spring of 2001, over 1,300 farms in the Klamath River Basin endured significant water shortages as a result of drought conditions. Additionally, in September 2002, the combination of an early peak in the return of a large run of fall Chinook salmon, low river discharges, warm water temperatures, and possible extended residence time of salmon created optimal conditions for parasite proleferation and precipitated an epizootic of *Ichthyopthirius multifilis* (Ich) and *Flavobacter columnare* (columnaris) that caused the death of an estimated 34,056 fish in the Klamath river (Service, 2003). An additional CDFG Report stated that "the cause of death for adult steelhead, coho salmon, and Chinook salmon during September 2002 was disease from the ciliated protozoan ICH and the bacterial pathogen columnaris. These parasites occur naturally, are common worldwide, and are present at all times in the Klamath River and other aquatic systems. Fish entering the lower Klamath River during mid-September 2002 encountered low flows and high water temperatures (69°F or 20.5 degrees Celsius [°C]). Temperatures in this range are stressful to coldwater fish species, and provide favorable conditions for certain fish pathogens such as ICH and columnaris." (CDFG, 2003) Ongoing review and resolution of the Upper Klamath resource issues might eventually affect flows in the Lower Klamath River. However, the possible effects of such changes are not known at this time.

In a March 5, 2003 court hearing, Judge Oliver Wanger directed the DOI to determine what actions would be necessary to "assure against the risk of fish losses that occurred late in the season last year." Judge Wanger subsequently issued a ruling on April 4, 2003, allowing Reclamation to use an additional

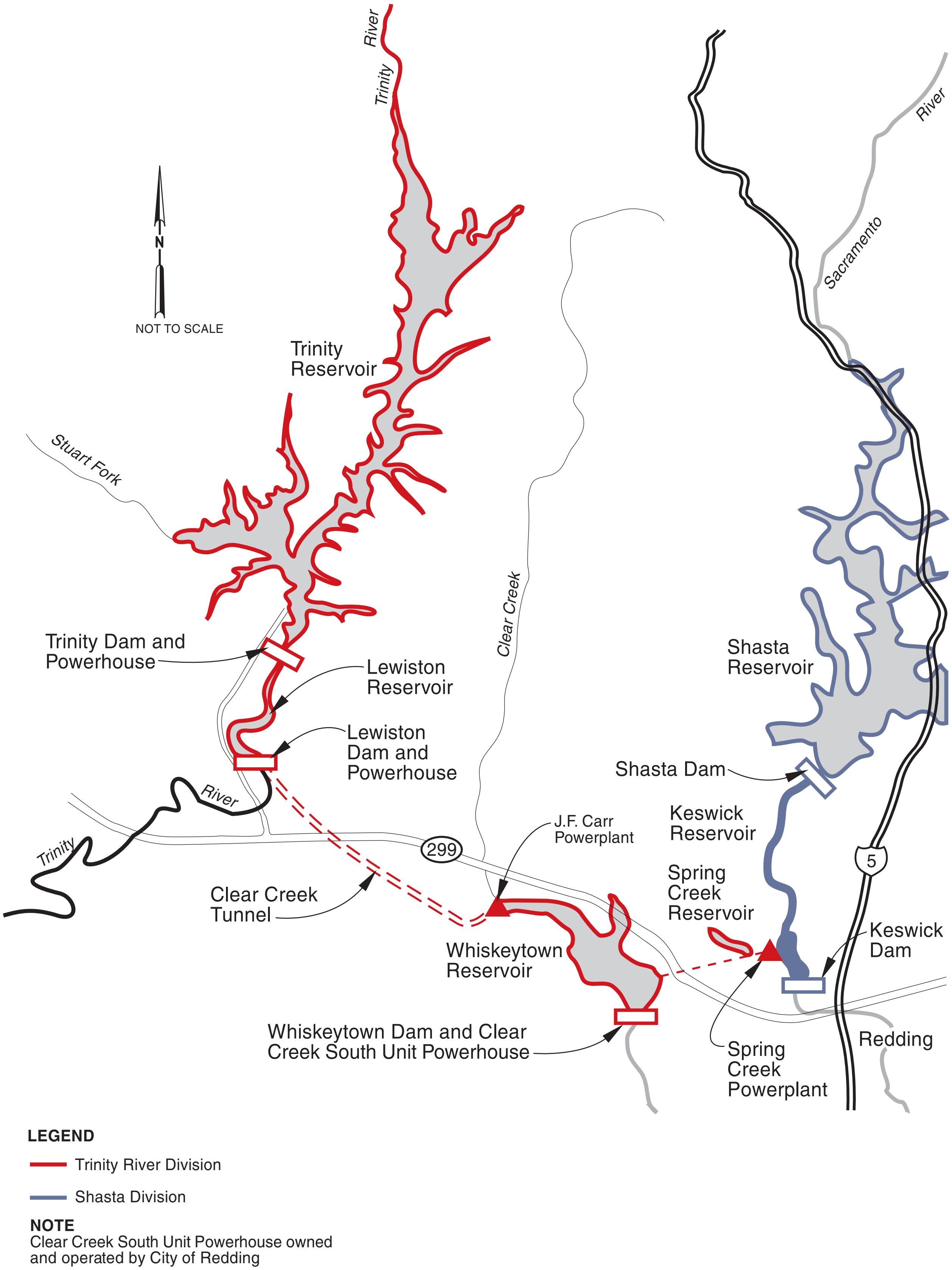

FIGURE 3.2-2
TRINITY RIVER DIVISION AND NEIGHBORING SHASTA DIVISION

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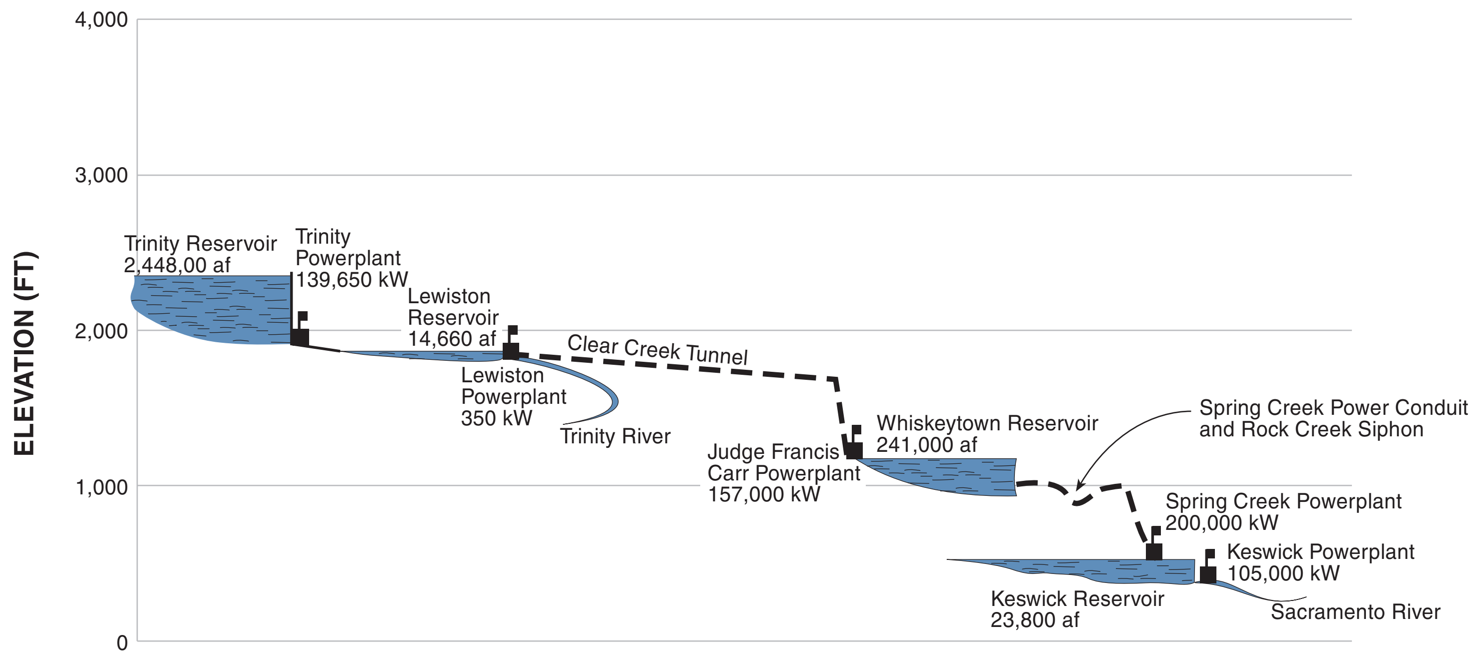

FIGURE 3.2-3
DEVELOPED PROFILE, TRINITY RIVER DIVERSION
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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50,000 acre-feet from the TRD of the CVP "at its reasonable discretion" to prevent a recurrence of the September 2002 fish die-off.

In late summer of 2003, an Action Plan was developed that recommended increased Trinity River flows to reduce the likelihood, and potentially reduce the severity, of a fish die-off occurring during the fall-run Chinook salmon migration. The Action Plan provided flows known to be adequate for unimpaired salmon migration through the lower Klamath River. It was expected that increasing flows would reduce or eliminate adverse in-river conditions that contributed to the adult fish die-off of 2002.

An initial presentation of increased late-summer Trinity River Dam release options and request for written comments was given at the TMC meeting on June 26, 2003. Written comments were received through July 18, 2003. A technical workgroup of state, federal, and tribal biologists was convened on July 23 and 24, 2003, to consider comments received and evaluate alternatives. The group developed a revised alternative, the Action Plan Flows option, that addressed these concerns. Additional updates were provided to a broadly representative group of stakeholders on July 29, 2003, at a TAMWG meeting in Weaverville, California, and a TMC conference call on July 30, 2003. A letter of support for the proposed action was forwarded directly to the Secretary of the Interior from the TMC and TAMWG in a letter dated August 8, 2003.

Projected flow conditions and a large fall-run Chinook salmon escapement on the lower Klamath River in 2003 were similar to conditions that existed during the die-off in 2002. The two triggers established for initiating the preventive flow release (low flow and a large return of fall-run Chinook salmon) were met as of August 20, 2003. Reclamation implemented the release schedule proposed in the Action Plan; 33,000 acre-feet of water, obtained through a water transfer with MWD, was used as a preventative means to reduce the likelihood of another fish die-off in 2003. No fish die-off was observed in 2003. An assessment of the Action Plan is included in the Water Resources Technical Appendix.

Central Valley. The CVP, of which the TRD and Shasta Division are key components, is the largest surface-water storage and delivery system in California, covering 35 of the state's 58 counties. The project includes 20 reservoirs, with a combined storage capacity of approximately 11 maf; and 9 powerplants and 2 pump-generating plants, with a combined generation capacity of approximately 2 million kW (Figures 3.2-4 and 3.2-5). Operations of the CVP are quite complex given the multiple demands that must be met.

Key Shasta Division operational issues include the following:

- Flood control
- Storage and release of water for agricultural, M&I, fish and wildlife, refuges, and other needs
- Navigation flows
- Temperature control as specified by the 1993 Winter-run Chinook BO
- Bay-Delta water quality requirements
- Generation of hydroelectric energy

Historically, the vast majority of CVP water has been delivered to agricultural users. However, continued urban growth is resulting in greater demand from CVP M&I customers (see Land Use, Section 3.9, of the Draft EIS/EIR). In contrast to CVP, where most of the customers are agricultural, over 50 percent of SWP deliveries go to urban areas, primarily in Southern California.

Current CVP operations are guided by a series of documents including the 1992 CVP-OCAP, various BOs for endangered species, the COA between the CVP and SWP, and the Regional Water Resources Control Board water quality plans. The 1992 OCAP is currently being updated and will likely be finalized in 2004. Additional information on the operation of CVP and assumptions made for this analysis are provided in the Water Resources/Water Quality Technical Appendix A, as well as the CVPIA PEIS and associated appendices (Reclamation, 1997a).

In his final ruling, Judge Wanger identified two specific measures in the original BOs that were improperly adopted by Reclamation, one each from NOAA Fisheries and the Service. The determination was that the environmental effects resulting from the implementation of reasonable and prudent measures for the project were not analyzed or disclosed to the public in a proper form or in a timely manner. The reasonable and prudent measures are outlined in two BOs received on the program: one from the National Marine Fisheries Service (since renamed NOAA Fisheries), dated October 12, 2000; and one from the Service, dated October 12, 2000. Judge Wanger's December 10, 2002 Summary Judgement ruling set aside the X2 reasonable and prudent measures[1] in the Service BO

[1] X2 is measured as km from the Golden Gate Bridge. Higher X2 values indicate saltwater intrusion into the Delta. The X2 is also discussed in Section 3.4, Fishery Resources. The X2 reasonable and prudent measure states: If Reclamation in its annual operations planning process detects that implementation of the Preferred Alternative will result in upstream (eastward) movement of X2 in any month between February 1 through June 30 of 0.5 km, Reclamation shall incorporate within its operating plan measures that can and will be implemented to minimize or eliminate such upstream movements.

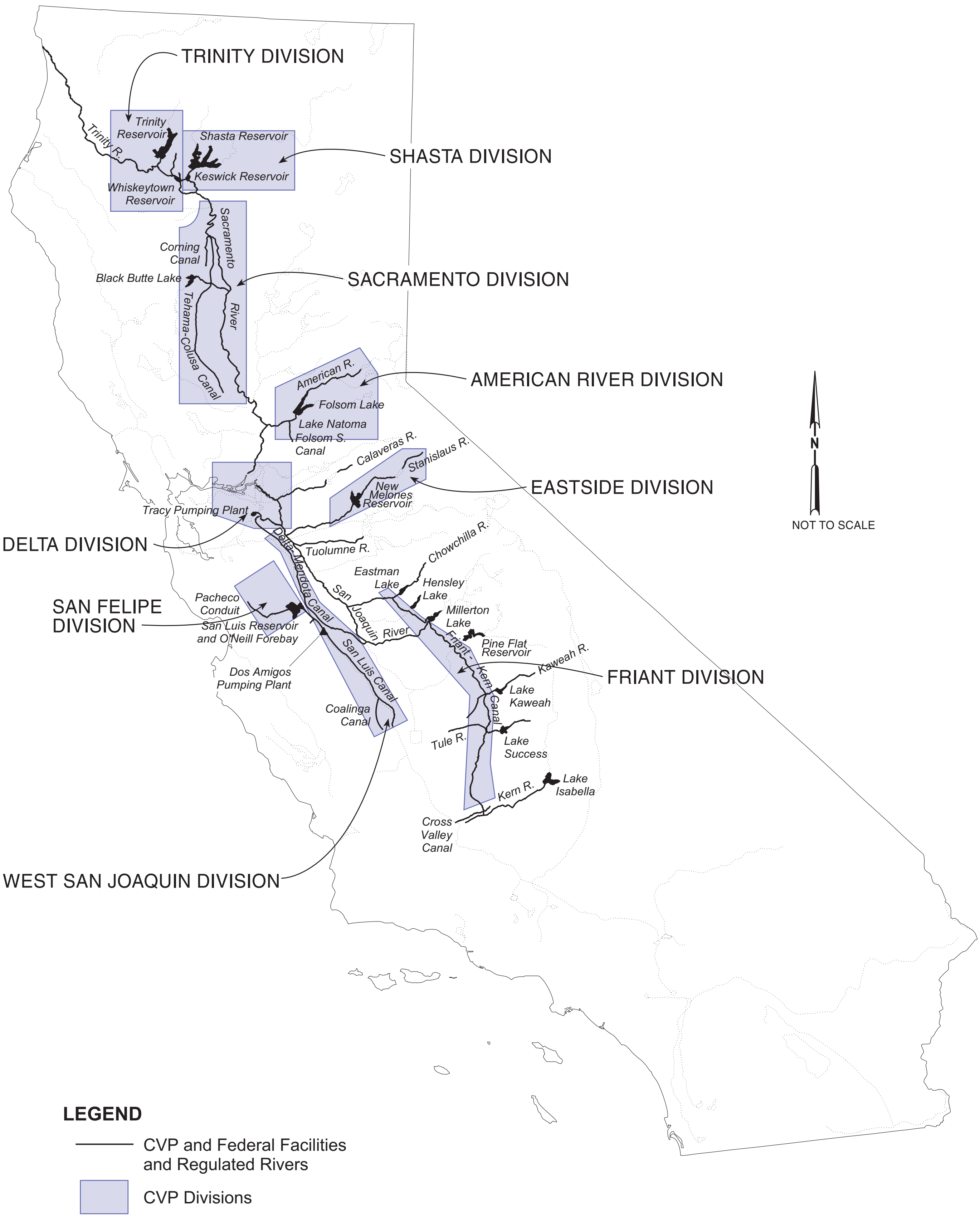

FIGURE 3.2-4
CENTRAL VALLEY PROJECT FACILITIES, REGULATED RIVERS, AND DIVISIONS
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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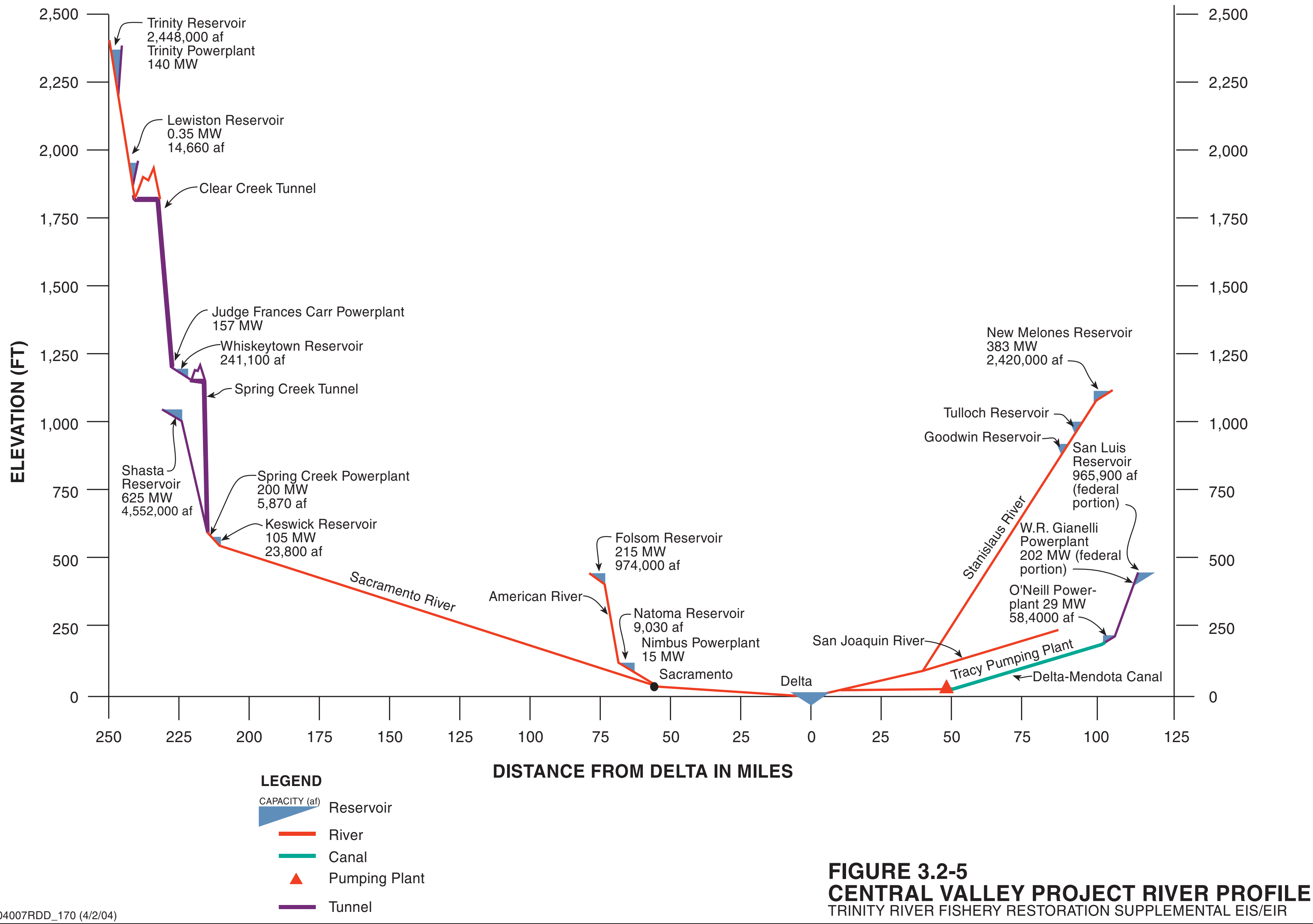


FIGURE 3.2-5
CENTRAL VALLEY PROJECT RIVER PROFILE
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

and the temperature reasonable and prudent measures in the NOAA Fisheries BO because of undisclosed impacts.

The Court's ruling in this case emphasized the need for Interior to take into account ESA impacts throughout the CVP in developing reasonable and prudent measures and implementing terms and conditions for any authorized incidental take of listed species. With respect to the treatment of ESA impacts in the original EIS, the Court found that it "was arbitrary and capricious for the EIS and Final EIS not to address impacts of X2 [Delta salinity] reasonable and prudent measures and CVP re-operation." Westlands Water District v. U.S. Department of the Interior, 275 F.Supp.2d at 1196. To comply with the Court's ruling, the federal defendants recognized that Reclamation needs to assess the impacts on listed species throughout the entire CVP system to the extent that those species may be affected by the range of possible Trinity operations under the various alternatives under consideration in the Supplemental EIS/EIR. Ideally, Reclamation would have been able to complete its renewed consultation with the Service and the NOAA Fisheries so that new Supplemental BOs would have been provided before publication of the Public Draft EIS/EIR. While consultation is not formally complete, the results of the informal consultation are presented in this document. The results of the impact analyses for both winter-run Chinook and Delta smelt (X2 position) are discussed in Section 3.4 Fishery Resources. Specifically, impacts to winter-run Chinook salmon are discussed under Environmental Consequences of Section 3.4.1 Native Anadromous Species; and a detailed analysis of X2 position is discussed in the methodology section of Section 3.4.2 Resident Native and Non-native Fish.

ESA consultation for the Trinity Supplemental EIS/EIR is occurring through the Reclamation OCAP process, currently underway among Reclamation, FWS, and NOAA Fisheries. The OCAP consultation will consider the effect of all CVP facilities and current programs and projects on endangered and threatened species. By including the Trinity Division program into the OCAP consultation process, Reclamation will address one of the district court's concerns regarding the need to consider the aggregate impacts of all CVP operations and thereby achieve a consistent approach between numerous projects that comprise the CVP operations. Based on discussions to date with biologists at FWS and NOAA Fisheries, Reclamation does not expect either of the reasonable and prudent measures from the 2000 BOs on Trinity, both of which were set aside by Judge Wanger in his December 2002 ruling, to be carried forward into the forthcoming OCAP BOs. The absence of the previous reasonable and prudent measures from the forthcoming OCAP BOs means that there is would be no legal requirement for the Trinity Supplemental

EIS/EIR to address the possible environmental impacts of those specific reasonable and prudent measures.

The OCAP process includes consultation with Service and NOAA Fisheries under section 7 of the ESA to determine the potential impacts on ESA-listed endangered and threatened species throughout the entire CVP, including the TRD. Pursuant to the ESA regulations, 50 C.F.R. § 402.12, as the lead federal "action" agency for OCAP, Reclamation must prepare a BA that takes into account the range of ongoing and proposed actions that comprise CVP operations. These OCAP-related actions include several developments that were not in place in 2002 at the time of the initial BOs and the initial EIS for the Trinity River fishery restoration. These developments include the following:

- Proposed new water diversion on the Sacramento River near Freeport, California
- Proposed inter-tie between the Delta Mendota Canal and the State Water Project's California Aqueduct
- California Department of Water Resources' South Delta Improvement Plan, which includes both possible increased diversions at the Banks Pumping Plant and construction and operation of in-channel barriers in the South Delta area.

Reclamation's BA also must include assumptions regarding management of the EWA, itself a complicated operational assessment. *Cf.* Laub v. U.S. Department of the Interior, 342 F.3d 1080, 1083-84 (9th Cir. 003)(describing EWA in context of CALFED).

Flows in the upper Sacramento River are primarily regulated by Shasta Dam and are re-regulated 15 miles downstream at Keswick Dam. The watershed above Shasta Dam drains approximately 6,650 square miles with an average annual runoff of 5.7 maf. With a capacity of 4.6 maf, Shasta Dam has the largest capacity of any reservoir in the state. Annual releases range from 9 maf in wet years to 3 maf in dry years. From 1964-1996, Keswick releases averaged 7.3 maf annually, of which TRD exports accounted for 14 percent. In recent years (1986-1996), Keswick annual releases averaged 5.9 maf, of which 12 percent was TRD export.

The Winter-run BO is one of the most influential factors governing Shasta releases, both in terms of quantity and timing. The BO sets water temperature requirements below Keswick Dam for April through October, and establishes an end-of-September minimum carryover storage for Shasta Reservoir of 1.9 maf. To meet the temperature objectives, a dynamic evaluation of ambient air temperature, weather forecasts, water temperature at the release point, and release rate occurs. Determination of the appropriate release rate is often made based on the temperature of the water released rather than the rate needed to support CVP operations. Generally, it takes higher releases to meet temperature targets with warmer water and lower releases with colder water. The coldwater pool in the reservoir is essentially a function of the volume of water in the reservoir. More cold water is available when the reservoir is full, less is available as the reservoir is drawn down. In years when CVP facilities cannot be operated to meet required temperature and storage objectives, Reclamation re-initiates consultation with NOAA Fisheries.

To meet daily temperature requirements at Bend Bridge (or Jellys Ferry in dry years) in the summer and early fall, Reclamation attempts to maintain a minimum coldwater pool in Shasta Reservoir, as well as Trinity and Whiskeytown Reservoirs, throughout the summer. Spring exports from the TRD allow cold water to be held in Shasta for summer release during the critical salmon incubation period. In addition, Reclamation operates the system to attempt to minimize warming within Whiskeytown Reservoir, which is prone to warming in a similar manner to Lewiston Reservoir. Excessive warming of Whiskeytown Reservoir can in turn require that additional Shasta releases be made to dilute warm Whiskeytown releases through Keswick. Alternatively, exports from Trinity can also be increased to reduce warming affects to Whiskeytown. Typically, CVP operations include bringing exports into Whiskeytown Reservoir in late May and June.

Aside from making water available for downstream uses, Trinity exports for the remainder of the water year are managed to maximize the following:

- Movement of water through Whiskeytown Reservoir to inhibit warming so that releases to the Sacramento river stay relatively cold
- Conservation of Shasta coldwater reserves
- Production of high-value summer and early fall power generation

The TRD water not only assists in Sacramento temperature needs, but is also used for agricultural, M&I, and Delta water quality purposes. The agricultural contractors account for the vast majority of consumptive uses of water along the Sacramento River. Of the total amount that is diverted for agricultural use, a portion of the water that is applied to fields but is not actually used by crops is assumed to return to the Sacramento River either through surface-water runoff or groundwater subsurface drainage. This water is then available for other downstream uses, including CVP contractors within the Bay Area (e.g., Contra Costa Water District) or those served through Delta exports (e.g., the San Joaquin Exchange contractors, or agricultural and M&I water service contractors located south of the Delta).

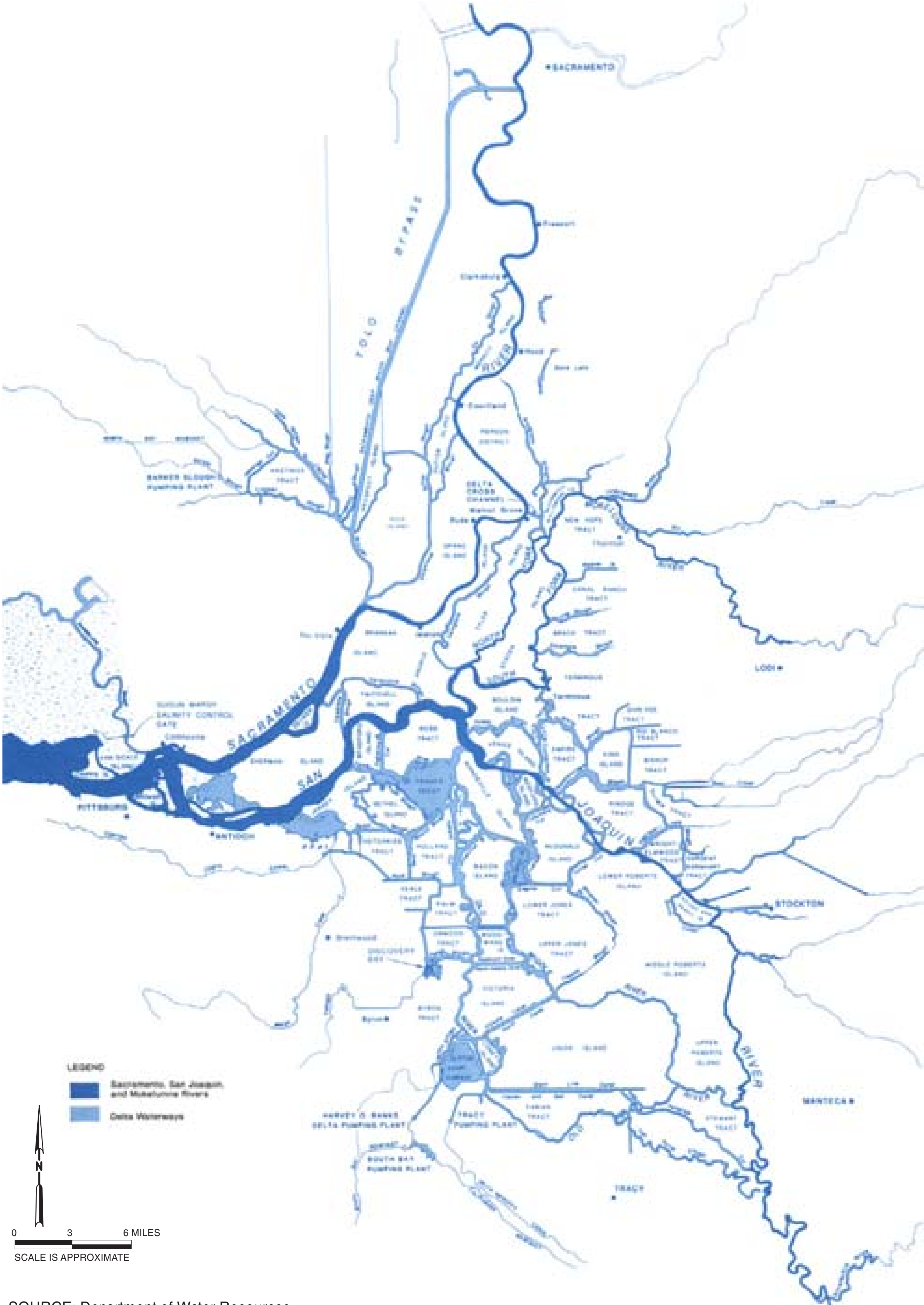
The CVP supplies up to approximately 6.2 maf annually to water contractors in the Central and Santa Clara Valleys as well as Contra Costa County. (The Friant Division, which holds contracts for 1.9 maf, is not included in this discussion because those contractors are independent of CVP operations that might be affected by changes in the TRD.) The CVP is required by contracts to make deliveries up to the contract amount, if requested, except in periods of water shortage. During periods of reduced supply, water deliveries are decreased according to terms in the contracts. Contractors are grouped into the following three general categories:

1. **Sacramento River Water Rights Settlement Contractors.** These contractors claimed water rights in the Sacramento Basin prior to construction of Shasta Dam. Contract provisions allow for reductions of up to 25 percent of contracted amounts during dry conditions (as determined by the Shasta Inflow Index).

2. **San Joaquin River Exchange Contractors.** These contractors claimed water rights in the San Joaquin River and agreed to exchange these rights for CVP water diverted from the Bay-Delta and delivered to the Mendota Pool. Contract provisions allow for reductions of up to 25 percent of contracted amounts under dry conditions (as determined by the Shasta Inflow Index).

3. **CVP Water Service Contractors.** These agricultural and M&I water service contractors entered into agreements with Reclamation for delivery of CVP water as a supplemental supply. Water deliveries to agricultural water service contractors can be reduced to zero in particularly dry years. Maximum curtailment levels are not specified for most M&I water service contractors. Historically, Reclamation has limited maximum curtailments to M&I contractors to 25 percent; future system demands are assumed to potentially require curtailments of up to 50 percent. Water availability for delivery to CVP water service contractors during periods of insufficient supply is determined based on a combination of operational objectives, hydrologic conditions, and reservoir storage conditions.

The Bay-Delta is located at the confluence of the Sacramento and San Joaquin Rivers and consists of a maze of channels, sloughs, and dredger cuts that drain to the ocean through an area of 1,200 square miles (Figure 3.2-6). Average annual flow into the Bay-Delta is about 27.8 maf, accounting for approximately 40 percent of all the surface



SOURCE: Department of Water Resources,
Sacramento-San Joaquin Delta Atlas

FIGURE 3.2-6
DELTA WATERWAYS

water in California. The Sacramento Basin contributes approximately 75 percent of the freshwater flows into the Bay-Delta. Trinity River exports on average 4 percent of the annual Sacramento River inflow to the Bay-Delta. Annual Bay-Delta inflow varies widely, as evident during a recent 10-year period when annual flows ranged from 5.9 maf (1977) to 70 maf (1986). Bay-Delta outflow is greatly influenced by tidal and seasonal variations, largely due to the influence of the Pacific Ocean. For example, average tidal flow (ebb or flood tide) at Chipps Island near Pittsburg is approximately 170,000 cfs, compared to an average net winter freshwater outflow of 32,000 cfs and a summer net outflow of 6,000 cfs. (The effect of flows on salinity levels and other water quality parameters in the Delta are discussed in Water Quality, Section 3.4, in the 1999 EIS/EIR.)

Environmental Consequences.

Methodology. CALSIM II is a general-purpose planning simulation model developed by DWR and Reclamation for simulating the operation of California's water resources system, specifically CVP and SWP, and has become the new standard for evaluating systemwide water resource operations in the Central Valley. On a monthly time-step, CALSIM II routes water through a simulation network representing the CVP and SWP systems. The model user describes the physical system (e.g., dams, reservoirs, channels, or pumping plants), operational rules (e.g., flood-control diagrams, minimum flows, and delivery requirements), and priorities for allocating water to different uses in programming statements, which are typically reviewed by a broad array of water resource interests. CALSIM II is the replacement for the PROSIM/SANJASM (Reclamation) computer models used to analyze potential water supply-related impacts in the 1999 EIS/EIR. CALSIM and PROSIM are both monthly planning models designed to simulate the hydraulic system composed of the CVP and SWP. They assess impacts to the hydrology system potentially impacted by the project alternatives. Operations of CVP and SWP for the purpose of water supply, flood control, recreation, maintenance of instream flows as set forth in the CVPIA, water quality, fish and wildlife, reservoir storage, Delta flow and water quality requirements, and hydroelectric power generation are defined by the user via input data files. For this analysis, CALSIM II results are very comparable to previous results from PROSIM. However, CALSIM II also includes recent programs such as CVPIA 3406b(2) water accounting and EWA neither of which was fully included in previous analysis. Accurate portrayals of CVPIA 3406b(2), EWA, and other operational updates necessitated the use of CALSIM II.

CALSIM II is intended for use in a comparative mode. The results from alternatives are compared to the results of the No Action

Alternative, to determine the incremental effects of each alternative. For CEQA purposes, comparisons are made against existing conditions (see Section 1.8).

The results from a single simulation are not intended to necessarily represent the exact operations for a specific month or year, but instead reflect long-term trends.

CALSIM II includes a variety of model enhancements to better characterize and simulate the operations of both the CVP and SWP systems. These enhancements are briefly described below.

CALSIM II includes an updated hydrology developed jointly by DWR and Reclamation that represents an improvement over the hydrology used previously. As defined in CALSIM II, hydrology includes water diversion requirements (demands), stream accretions and depletions, rim basin inflows, irrigation efficiency, return flows, nonrecoverable losses, and groundwater operation. Historical hydrology is adjusted to account for constant future levels of development. Adjustments to historical water supplies are determined by imposing future projections of land use on historical meteorological and hydrologic conditions.

Alternatives that include release schedules that vary by water-year class all determine the type of water year according to Trinity Reservoir inflow. CALSIM uses perfect foresight to predict water-year classification, whereas during normal operations some forecasting is necessary to predict the type of water year during the spring runoff period. To maintain the desired exceedance probabilities prescribed for the alternatives, a 50 percent exceedance forecast would be used. Use of a 50 percent exceedance forecast would ensure over the long-term that the desired year-type probabilities are achieved, and also that the effects of implementing the alternatives most closely matches the CALSIM results. See Table 3.2-1 for water-year class.

TABLE 3.2-1
Water-year Class

Water-year Class	Exceedance Probability	Occurrence Every 100 Years	Trinity Reservoir Inflow for Designation (acre-feet)
Critically dry	p > .88	12	<650,000
Dry	.60 < p < .88	28	650,000-1,024,999
Normal	.40 < p < .60	20	1,025,000-1,349,999
Wet	.12 < p < .40	28	1,350,000-1,999,999
Extremely wet	p < .12	12	>=2,000,000

Note: Water-year classifications would be forecast using 50 percent exceedance methodology.

CALSIM II has improved allocation logic and assumptions compared to the PROSIM model that govern deliveries to north of the Delta and south of the Delta CVP and south of the Delta SWP contractors. Deliveries are determined using runoff forecast information that incorporates uncertainty and standardized rule curves (i.e., Water Supply Index versus Demand Index Curve) to estimate the water available for delivery and carryover storage. Updates of delivery levels occur monthly, January through May for SWP and March through May for CVP, as water supply parameters become more certain and forecasts become more accurate. The south of the Delta SWP delivery is determined according to water supply parameters and operational constraints. The CVP systemwide delivery and south of the Delta delivery are determined similarly, with specific consideration for export constraints.

CALSIM II incorporates new procedures for dynamic modeling of CVPIA 3406(b)(2) water and the EWA. Per the October 1999 Decision and the subsequent February 2002 Decision, CVPIA 3406(b)(2) accounting procedures are based on system conditions under operations associated with SWRCB D-1485 and D-1641 regulatory requirements. Similarly, the operating guidelines for selection of actions and allocation of assets under the EWA are based on system conditions under operations associated with SWRCB D-1641 regulatory requirements. This requires sequential layering of multiple system requirements and simulations.

CALSIM II focuses on the major CVP and SWP facilities, but operations of many other municipal- and irrigation district-operated facilities are also included to varying degrees. CALSIM assumptions can also be adjusted to account for varying levels of development, as evaluated by the No action (2020) and Existing Conditions (2000).

Similar to the PROSIM model used for analysis in the Draft EIS/EIR, assumptions used in the CALSIM II represent the best efforts of expert hydrologists to simulate the CVP and SWP, and to predict future changes to the systems. CALSIM II separates CVP and SWP into a number of nodes that can each be assigned operational rules for inputs (i.e., streamflow from upstream areas) or outputs (i.e., water diversions). Accordingly, assumptions as to inputs and outputs are key when determining what effects are to be studied. The nodes are interconnected such that they approximate the flow of water in the joint CVP-SWP systems. Future projections are based on the assumption that the hydrology that occurred and was recorded over an approximately 72-year period (1922 to 1993) is representative of the range of hydrology that will again occur in the future. Particularly dry (1928 to 1934) and wet (1967 to 1971) periods over the historical record can be isolated to simulate relatively extreme circumstances that might occur in the future. Key facilities for which operations are modeled with CALSIM II include the following:

- Trinity/Lewiston, Whiskeytown, and Shasta Reservoirs
- Folsom Reservoir
- San Luis Reservoir
- Oroville Reservoir (SWP)
- Tracy (CVP) and Banks (SWP) Pumping Plants

Key operational parameters to the Trinity River Basin include Trinity River flows and associated exports to the Central Valley, as well as carryover storage in Trinity Reservoir. Key operational parameters in the Central Valley include Trinity exports via the Clear Creek Tunnel through the Spring Creek Powerhouse, carryover storage at Shasta Reservoir, CVP deliveries (both north and south of the Delta), and Bay-Delta inflow and outflow.

CVPIA 3406(b)(2) allocates 800 taf (600 taf in Shasta index critical dry years) of CVP water to targeted fish actions. The full amount provides support for SWRCB D-1641 implementation. According to monthly accounting, 3406(b)(2) actions are dynamically selected according to an action matrix. Several actions in this matrix have defined reserve amounts that limit 3406(b)(2) expenditures for lower priority actions early in the year so that the higher priority actions can be met later in the year.

Under CALFED, the EWA acquires water through “operational” and “fixed” assets, and then allocates water to targeted fish actions. Operational assets include relaxation of regulatory requirements and dedication of conveyance capacities to EWA purposes. Fixed assets include water purchased from willing sellers or previously banked supplies. According to monthly accounting, EWA assets are evaluated and actions are dynamically selected according to an action matrix similar to that used in the simulation of 3406 (b)(2) Water Management. Several actions in this matrix have defined reserve amounts that limit EWA allocation for lower priority actions early in the year so that the higher priority actions can be met later in the year, subject to uncertain operational assets.

CALSIM II represents the best tool currently available for attempting to predict future impacts on a hydrological system that, by any assessment, is extremely complex. Accordingly, model output and associated conclusions embody the best information that can be obtained in light of current levels of knowledge and modeling ability.

Alternative Analysis.

<u>Analysis of Alternatives</u>**.** For NEPA purposes, the No Action Alternative is used as the baseline for comparison of alternatives. For CEQA purposes, comparisons are made against existing

conditions (see Section 1.8). The No Action and the other alternatives reflect future conditions at the year 2020 level of development. These future conditions are based on projections concerning future growth, land use changes, and changes in CVP operational policies that are being considered and are undergoing separate environmental documentation. The hydrology and demands included in these simulations are based on information contained in DWR Bulletin 160-98. At the year 2020 level of development, annual CVP contracts are assumed to total 6.5 maf (with annual demands ranging from 6.2 to 6.5 maf), and annual SWP entitlements are assumed to total 4.2 maf (with annual demands ranging from 3.4 to 4.2 maf)[2]. The greatest increases in CVP demands are assumed to occur north of the Delta in association with M&I water rights and water service contracts with the CVP's American River Division (approximately a 251,000- acre-feet increase in annual demand). See Table 2-2 of Draft EIS/EIR for a complete table of assumptions used in the No Action Alternative.

The impacts of the alternatives were analyzed for three representative periods: the long-term period (1922-1993), the wet hydrologic period (1967-1971), and the dry hydrologic period (1928-1934). The periods were based on Sacramento River Basin hydrology. It should be noted that hydrologic conditions in the Sacramento River Basin do not always match those in the Trinity River Basin.

As described previously with regard to potential curtailments, the agricultural water service contractors are the CVP contract holders that are assumed to be most affected by reductions in CVP water supplies. The Sacramento River Water Rights Settlement and San Joaquin River Exchange Contractors are assumed to be generally unaffected by a reduction in Trinity exports, as their respective contracts tie curtailments in dry years (of up to 25 percent) to the Shasta Inflow Index. This index accounts only for inflow in Shasta Reservoir. Because Trinity exports enter the Sacramento River downstream of Shasta Reservoir (through Keswick Reservoir), it was assumed that no additional curtailments would be experienced by the Sacramento River Water Rights Settlement and San Joaquin River Exchange Contractors as a result of decreased Trinity exports.

Significance Criteria. Significance criteria were not developed for Surface-water Hydrology and Management because changes to releases, reservoir levels, and water deliveries were not considered to be impacts relative to the surface hydrology of the CVP system. However, it is understood that the change in water delivery patterns

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[2] Elsewhere in this document, current deliveries for CVP and SWP are described at current levels. Because the SWP does not include certain storage facilities originally envisioned, its actual yield is only about half of what the "entitlements" counted on by various water contractors. See for example *Planning and Conservation League versus Department of Water Resources*, (2000) 83 Cal.App.4th 83; and *Santa Clarita Organization for Planning the Environment versus County of Los Angeles*, 2003 106 Cal.App.4th 715.

prescribed in these alternatives will have a significant effect on water quality, fisheries, power resources, and other uses. Those effects are identified and described, and mitigation is recommended in the appropriate sections.

No Action. The No Action Alternative would essentially maintain recent historical operations of the TRD and the CVP at a projected 2020 level of development.

This alternative assumes an annual Trinity River minimum instream flow requirement not less than 340,000 acre-feet for all water-year classes. TRD exports are assumed to continue to be used to conserve the coldwater pool in Shasta Reservoir through spring and early summer diversions in response to the Winter-run BO. Figure 3.2-7 illustrates how to read a frequency distribution curve. Table 3.2-2 and Figures 3.2-8 through 3.2-12 present the results of the No Action Alternative as compared to the other alternatives.

Revised Mechanical. Compared to the No Action Alternative, this alternative generally has a larger spring peak release. The long-term average annual instream release would increase by 99,000 acre-feet (23 percent) compared to the No Action Alternative.

Compared to the No Action Alternative, this alternative would reduce long-term average annual exports from the TRD by about 95,000 acre-feet (12 percent). Dry-period annual exports would be reduced by 61,000 acre-feet (12 percent). Whiskeytown water levels would be generally unaffected, including during the dry period.

Shasta Reservoir storage would be only slightly impacted due to reduced TRD exports in the long-term average, and dry-period effects would be more substantial. Under this alternative, long-term average end-of-water-year storage is only slightly less than the No Action Alternative (14,000 acre-feet decrease, or 1 percent), and dry-period levels drop 41,000 acre-feet (3 percent). The BO end-of-water-year minimum storage criterion of 1.9 maf is not met in 14 percent of the years, compared to 11 percent for the No Action Alternative.

Long-term average annual CVP deliveries decrease by 36,000 acre-feet (1 percent). Reductions during the dry period average 80,000 acre-feet (2 percent). Annual Delta exports through the Tracy Pumping Plant are reduced by 24,000 acre-feet (1 percent) over the long term and 24,000 acre-feet (1 percent) during the dry period. Annual Delta inflow would decrease by 84,000 acre-feet (less than 1 percent) over the long term and 71,000 acre-feet (1 percent) during the dry period. Average annual Delta outflow would decrease by

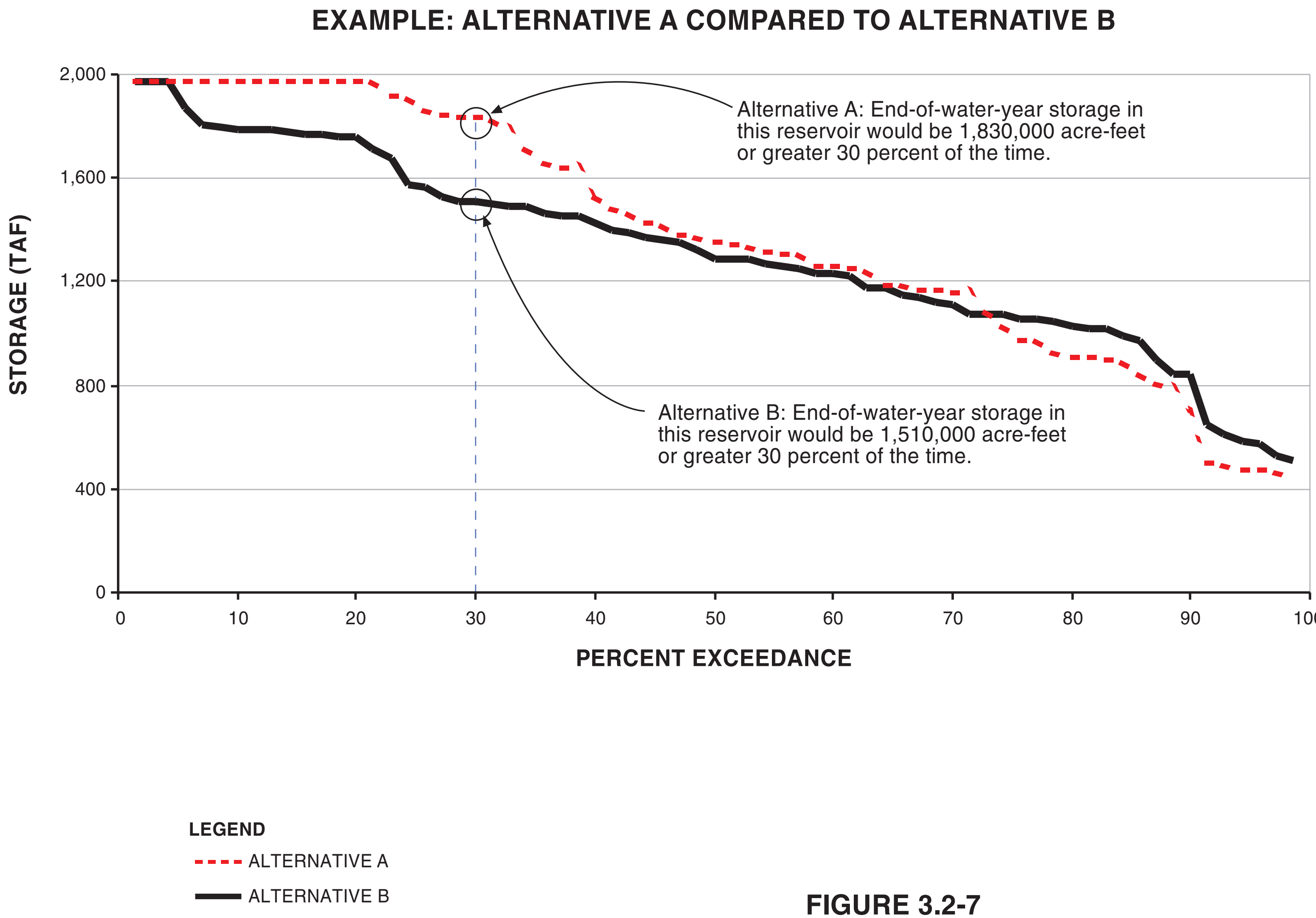

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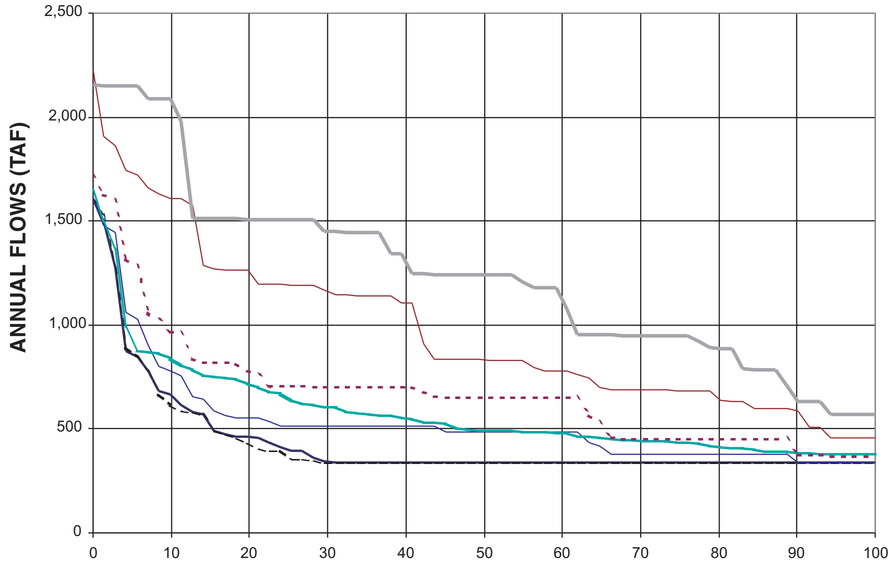
FIGURE 3.2-7
HOW TO READ A FREQUENCY DISTRIBUTION CURVE
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

TABLE 3.2-2
Comparison of Impacts on Water Resources

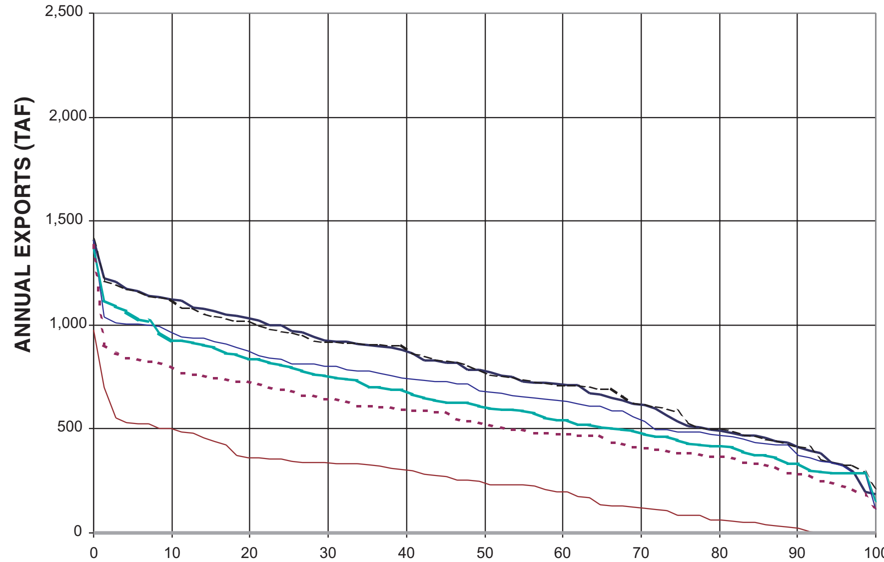
Parameter	Hydrologic Conditions	Alternatives Compared to No Action: No Action	Revised Mechanical	Flow Evaluation	Modified Percent Inflow	70 Percent Inflow	Maximum Flow	Existing Condition
Trinity Reservoir Elevation (feet)								
30-May	Dry	2,261	-7	-4	-9	-29	-39	2,261
	Wet	2,363	-2	-6	-1	-25	-131	2,363
	Average	2,328	-6	-9	-6	-28	-92	2,328
30-Sep	Dry	2,205	-8	8	-9	-12	-12	2,203
	Wet	2,327	-4	-6	0	-8	-112	2,327
	Average	2,286	-8	-6	-5	-11	-69	2,286
Shasta Reservoir Elevation (feet)								
30-May	Dry	987	-4	-3	-2	-16	-22	988
	Wet	1,060	0	0	0	-1	-1	1,060
	Average	1,043	-1	-3	-2	-7	-12	1,042
30-Sep	Dry	914	-4	-3	-2	-20	-27	919
	Wet	1,012	0	-2	-1	-9	-8	1,012
	Average	987	-1	-5	-3	-17	-23	988
San Luis Reservoir Elevation (feet)								
30-May	Dry	518	7	69	71	74	-55	514
	Wet	566	-3	-5	-3	-11	-5	565
	Average	527	6	1	1	-7	-11	568
30-Sep	Dry	397	4	65	70	70	3	459
	Wet	407	1	1	1	87	99	499
	Average	404	0	6	6	12	11	417
Trinity River Exports (taf/year)	Dry	525	-12%	-28%	-15%	-57%	-100%	524
	Wet	1,024	-15%	-35%	-17%	-74%	-100%	1,027
	Average	773	-12%	-30%	-18%	-68%	-100%	769
Trinity Reservoir Storage (taf)								
30-Sep	Dry	693	-10%	3%	-7%	-15%	-16%	673
	Wet	1,814	-3%	-4%	0%	-5%	-61%	1,816
	Average	1,403	-6%	-6%	-4%	-9%	-47%	1,403
Shasta Reservoir Storage (taf)								
30-Sep	Dry	1,506	-3%	-3%	-2%	-17%	-24%	1,540
	Wet	3,120	0%	-1%	0%	-6%	-5%	3,117
	Average	2,680	-1%	-4%	-2%	-11%	-14%	2,692
San Luis Reservoir Storage (taf)								
30-Sep	Dry	541	5%	9%	16%	17%	4%	570

TABLE 3.2-2
Comparison of Impacts on Water Resources

Parameter	Hydrologic Conditions	Alternatives Compared to No Action						Existing Condition
		No Action	Revised Mechanical	Flow Evaluation	Modified Percent Inflow	70 Percent Inflow	Maximum Flow	
	Wet	684	1%	0%	1%	2%	12%	726
	Average	554	0%	0%	1%	1%	8%	568
CVP Deliveries North of the Delta (taf/year)	Dry	2,422	-1%	-2%	-1%	-3%	-9%	2,200
	Wet	2,878	0%	0%	0%	0%	-3%	2,566
	Average	2,730	0%	-1%	0%	-1%	-4%	2,448
CVP Deliveries South of the Delta (taf/year)	Dry	1,770	-4%	-8%	-6%	-11%	-15%	1,730
	Wet	3,040	-1%	-2%	-1%	-6%	-13%	3,050
	Average	2,600	-1%	-2%	-1%	-5%	-11%	2,630
Exports, Tracy Pumping Plant (taf/year)	Dry	1,688	-1%	-5%	-3%	-8%	-13%	1,640
	Wet	2,584	-1%	-1%	-1%	-6%	-11%	2,562
	Average	2,333	-1%	-2%	-1%	-5%	-11%	2,337
Exports, Banks Pumping Plant (taf/year)	Dry	1,863	1%	-1%	1%	-2%	-1%	1,754
	Wet	3,791	0%	0%	0%	-1%	-1%	3,620
	Average	3,109	0%	0%	0%	-1%	-2%	3,012
Exports, Tracy and Banks Pumping Plants (taf/year)	Dry	3,551	0%	-3%	-1%	-5%	-7%	3,395
	Wet	6,375	0%	0%	0%	-3%	-5%	6,181
	Average	5,441	0%	-1%	-1%	-3%	-5%	5,349
Delta Inflow (taf/year)	Dry	11,635	-1%	-1%	-1%	-2%	-3%	11,564
	Wet	28,231	0%	-1%	-1%	-2%	-3%	28,379
	Average	21,214	0%	-1%	-1%	-2%	-3%	21,274
Delta Outflow (taf/year)	Dry	6,551	0%	1%	0%	-1%	-1%	6,605
	Wet	20,440	-1%	-1%	-1%	-2%	-2%	20,686
	Average	14,399	0%	-1%	0%	-2%	-2%	14,501
Trinity River Releases by Sacramento River Index (taf/year)	Critically dry	341	0%	8%	13%	24%	36%	341
	Dry	341	11%	33%	31%	86%	158%	341
	Below Normal	341	42%	90%	40%	145%	264%	341
	Above Normal	341	50%	106%	58%	249%	343%	341
	Wet	341	63%	140%	107%	410%	531%	341



ANNUAL FLOWS IN THE TRINITY RIVER BELOW LEWISTON



TRINITY RIVER BASIN EXPORTS

LEGEND

- No Action Alternative
- Revised Mechanical Alternative
- Flow Evaluation Alternative
- Modified Percent Inflow Alternative
- 70 Percent Inflow Alternative
- Maximum Flow Alternative
- Existing Condition

FIGURE 3.2-8
SIMULATED FREQUENCY OF ANNUAL FLOWS IN THE TRINITY RIVER BELOW LEWISTON AND ANNUAL TRINITY RIVER BASIN EXPORTS
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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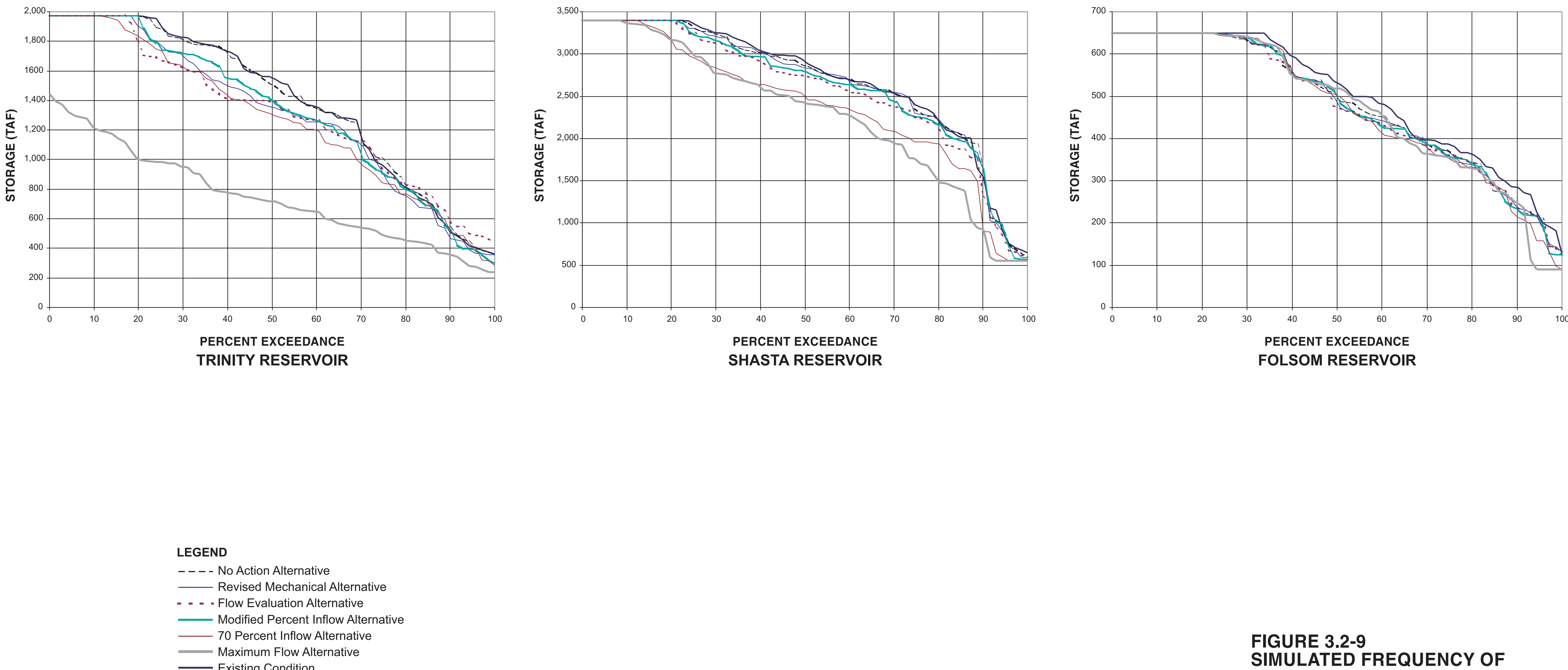

FIGURE 3.2-9
SIMULATED FREQUENCY OF END-OF-WATER-YEAR STORAGE – SHASTA, TRINITY, AND FOLSOM RESERVOIRS
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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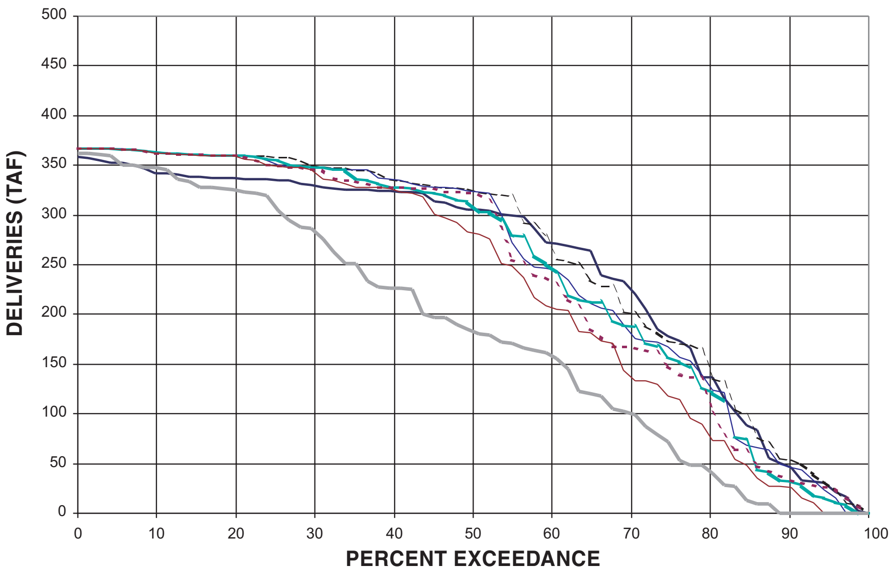
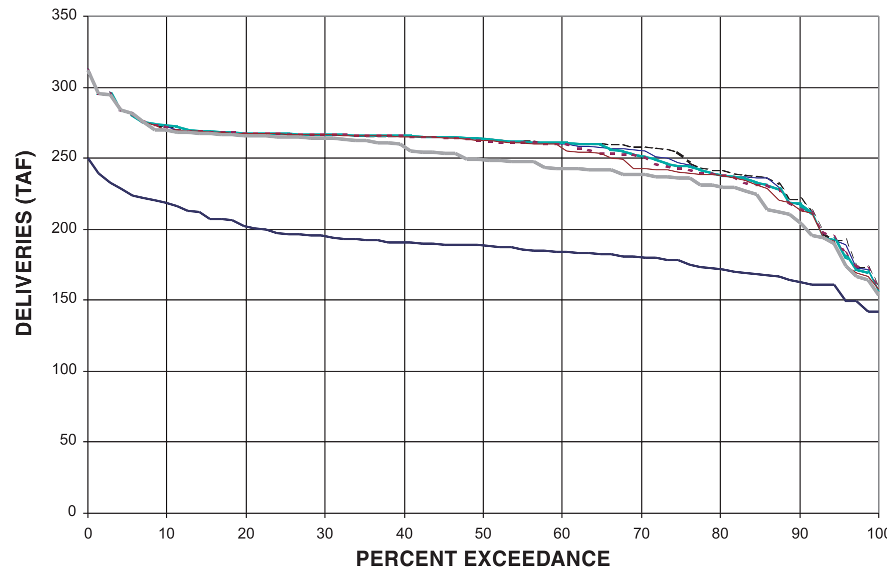


CVP AGRICULTURAL WATER SERVICE CONTRACTORS NORTH OF DELTA



CVP M&I WATER SERVICE CONTRACTORS NORTH OF DELTA

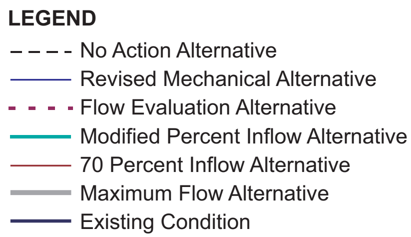


FIGURE 3.2-10
SIMULATED FREQUENCY OF ANNUAL DELIVERIES – CVP WATER SERVICE CONTRACTORS NORTH OF THE DELTA
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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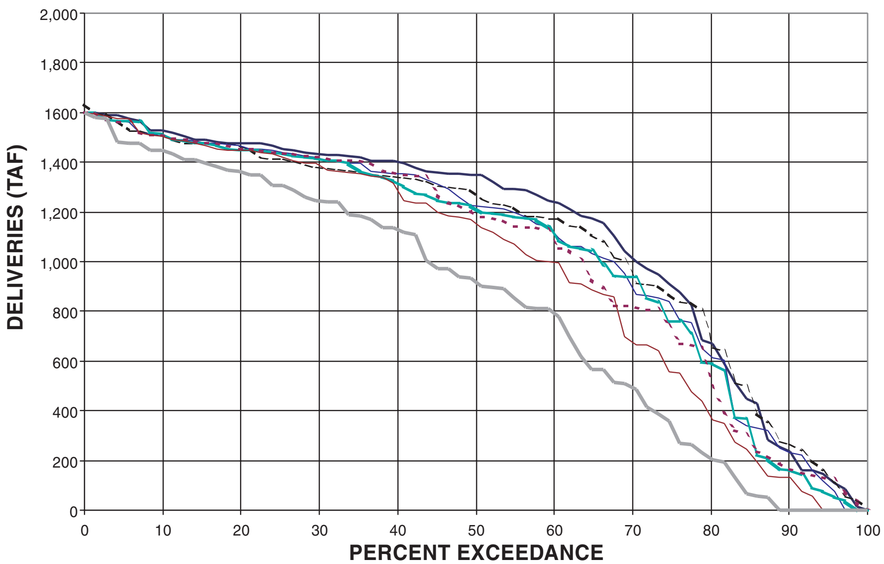
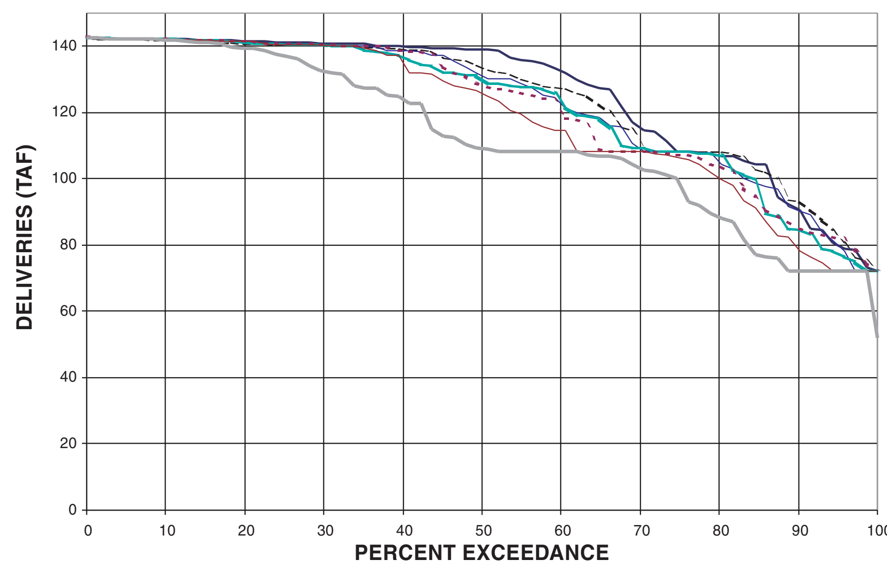


CVP AGRICULTURAL WATER SERVICE CONTRACTORS
SOUTH OF DELTA



CVP M&I WATER SERVICE CONTRACTORS
SOUTH OF DELTA

LEGEND

- No Action Alternative
- Revised Mechanical Alternative
- Flow Evaluation Alternative
- Modified Percent Inflow Alternative
- 70 Percent Inflow Alternative
- Maximum Flow Alternative
- Existing Condition

FIGURE 3.2-11
SIMULATED FREQUENCY OF ANNUAL DELIVERIES –
CVP WATER SERVICE CONTRACTORS SOUTH OF THE DELTA
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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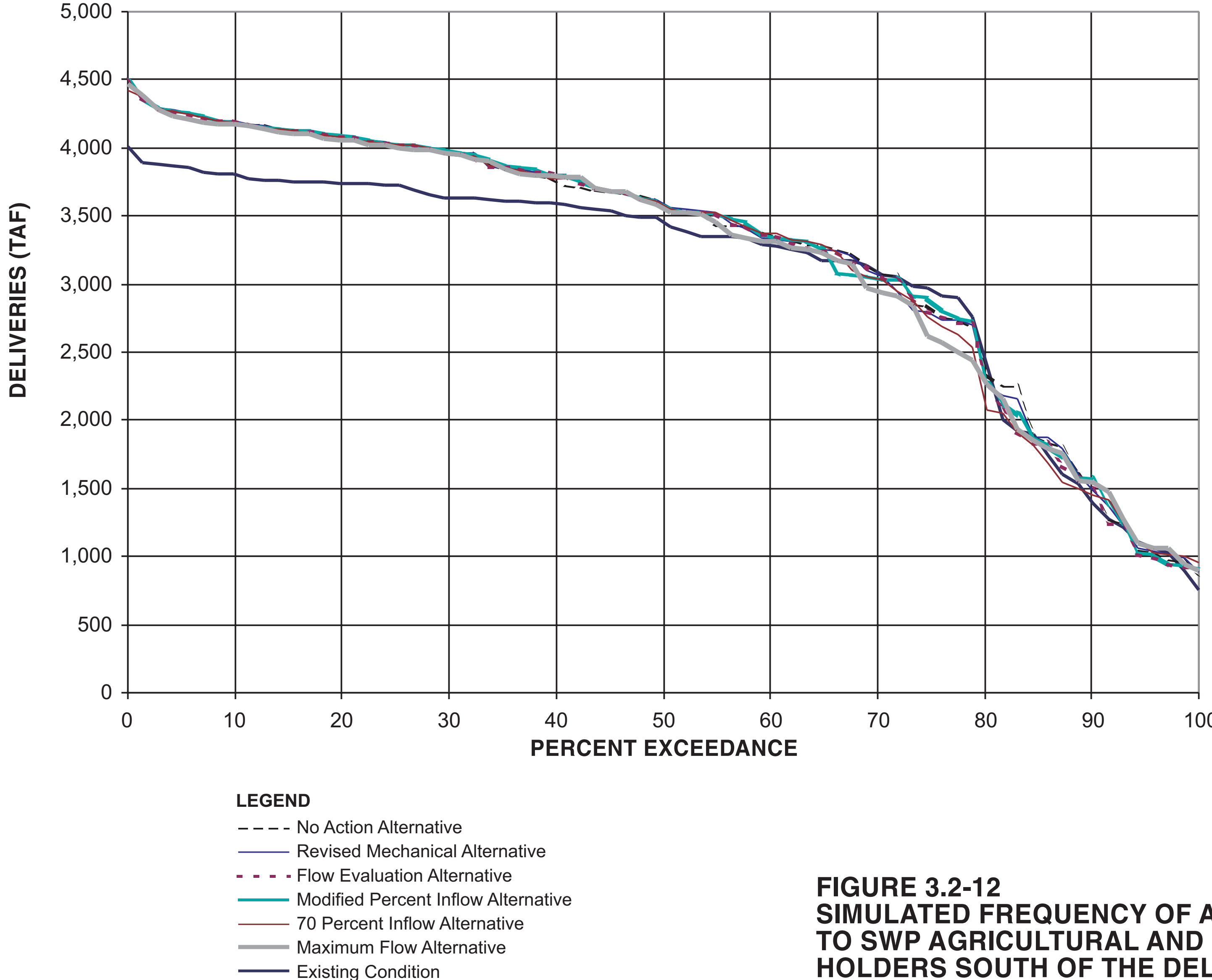

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FIGURE 3.2-12
SIMULATED FREQUENCY OF ANNUAL DELIVERIES TO SWP AGRICULTURAL AND M&I ENTITLEMENT HOLDERS SOUTH OF THE DELTA
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

less than 1 percent (53,000 acre-feet in the long-term period and 15,000 acre-feet in the dry period).

Flow Evaluation. Compared to the No Action Alternative, the TRD would be operated to release more Trinity Reservoir water to the Trinity River. Compared to the No Action Alternative, this alternative generally has a larger spring peak release. The long-term average annual instream release would increase by 238,000 acre-feet (55 percent) compared to the No Action Alternative.

Compared to the No Action Alternative, this alternative would reduce long-term average annual exports from the TRD by about 232,000 acre-feet (30 percent). Dry-period annual exports would be reduced by 145,000 acre-feet (28 percent). Under this alternative, the target minimum storage in Trinity Reservoir would be 600,000 acre-feet. Dry-period storage would average 3 percent more than No Action, reflecting the greater carryover storage level. In spite of this increase in required minimum carryover storage, average end-of-water-year carryover storage would decrease by 82,000 acre-feet (6 percent). Whiskeytown water levels would be generally unaffected, including during the dry period.

In this alternative, long-term average end-of-water-year Shasta Reservoir storage decreases compared to the No Action Alternative (95,000-acre-feet decrease, or 4 percent), and dry-period levels drop 51,000 acre-feet (3 percent). The BO for Winter-run Chinook salmon (NOAA Fisheries, 1993) end-of-water-year minimum storage criterion of 1.9 maf is not met in 17 percent of the years, as opposed to 11 percent under the No Action Alternative. Long-term average annual CVP deliveries decrease by 77,000 acre-feet (1 percent). Reductions during the dry period average 187,000 acre-feet (4 percent). Annual Delta exports through the Tracy Pumping Plant are reduced by 52,000 acre-feet (2 percent) over the long term and 83,000 acre-feet (5 percent) during the dry period. Annual Delta inflow would decrease by 204,000 acre-feet (1 percent) over the long term and 154,000 acre-feet (1 percent) during the dry period. Average annual Delta outflow would decrease by 123,000 acre-feet (1 percent) over the long term, but would be similar to No Action for the dry period. The effect of this alternative on X2 position in the Bay-Delta is discussed under Section 3.4 Fishery Resources, see specifically the Methodology Section.

Modified Percent Inflow. This alternative was designed to partially mimic natural flow patterns and variability by releasing from Lewiston Dam a percentage of the previous week's inflow to Trinity Reservoir during the ascending and descending limits of the spring hydrograph. Accordingly, Trinity River flows would vary each week during Spring runoff depending on inflow and, therefore, would be more unpredictable than the other alternatives.

Compared to the No Action Alternative, this alternative would reduce long-term average annual TRD exports by 143,000 acre-feet (18 percent), and the export pattern may help meet Trinity River instream temperature requirements. Trinity Reservoir end-of-water-year storage decreases by 47,000 acre-feet during the dry period as compared to No Action. Shasta Reservoir storage levels would be slightly affected, particularly during the dry period. The end-of-water-year Shasta storage decreases by 2 percent for both the long-term and the dry periods. End-of-water-year storage in Shasta Reservoir would be below the BO minimum threshold (1.9 maf) in 14 percent of the years.

Long-term average annual CVP deliveries decrease by 61,000 acre-feet (1 percent). Reductions during the dry period average 146,000 acre-feet (3 percent). Compared to the No Action Alternative, long-term average annual Delta inflow would be reduced by 125,000 acre-feet (1 percent), and Delta outflow would be reduced by 66,000 acre-feet (less than 1 percent).

<u>70 Percent Inflow</u>. This alternative was designed to mimic natural flow patterns and variability by releasing from Lewiston Dam 70 percent of the previous week's inflow to Trinity Reservoir throughout the year. Accordingly, Trinity River flows would vary each week depending on inflow and would, therefore, be more unpredictable than the other alternatives.

Compared to the No Action Alternative, this alternative would reduce long-term average annual TRD exports by 523,000 acre-feet (68 percent), and the export pattern may help meet Trinity River instream temperature requirements. Thus, average end-of-water-year storage in Trinity Reservoir would decrease during the dry period by 101,000 acre-feet (15 percent). Shasta Reservoir end-of-water-year storage levels would decrease by 296,000 acre-feet (11 percent) on the long-term average and 261,000 acre-feet (17 percent) over the dry period. End-of-water-year storage in Shasta Reservoir would be below the BO minimum threshold (1.9 maf) in 20 percent of the years.

Annual exports through the Tracy Pumping Plant would decrease by 110,000 acre-feet (5 percent) on the long-term average and 135,000 acre-feet (8 percent) over the dry period. Compared to the No Action Alternative, long-term average annual Delta inflow would be reduced by 483,000 acre-feet (2 percent), and Delta outflow would be reduced by 318,000 acre-feet (2 percent). Long-term average annual CVP deliveries would be reduced by 160,000 acre-feet (3 percent).

<u>Maximum Flow</u>. This alternative would increase Trinity River instream flows by a greater degree than any other alternative. The

long-term average annual instream release schedule would increase by approximately 806,000 acre-feet more water than No Action, or 185 percent of No Action levels.

Under this alternative, TRD exports would be eliminated. In essence, the reservoir would be managed to ensure the availability of water for the spring peak releases, with no increase by minimum storage level. Thus, average end-of-water-year storage (September 30) in Trinity Reservoir would decrease during the dry period by about 113,000 acre-feet (16 percent) compared to the No Action Alternative. Storage would decrease over the long term by about 653,000 acre-feet (47 percent) due to the spring geomorphic flow requirements and the low refill potential of the reservoir.

Operations of the remaining CVP facilities would need to be modified due to the reduction in available water (773,000 acre-feet on an average annual basis) from the TRD. In the absence of exports from the TRD, Whiskeytown Reservoir storage would fall below No Action levels during the dry period. During this period, local inflow would be insufficient to meet Clear Creek minimum flow requirements, and Whiskeytown Reservoir would have to be drawn down to provide additional releases.

Long-term average end-of-water-year Shasta Reservoir storage would be less than the No Action Alternative by approximately 387,000 acre-feet (14 percent). Dry-period average annual storage would be reduced by 361,000 acre-feet (24 percent). The reduction in Shasta Reservoir storage would reduce the ability of CVP to maintain the coldwater pool for releases to meet the 1993 Winter-run Chinook BO temperature requirements and associated 1.9-maf minimum carryover storage level, as well as all other Central Valley demands. End-of-water-year storage in Shasta Reservoir would be below the 1.9-maf storage criterion more frequently than under the No Action Alternative (28 percent of the years as compared to 11 percent). In comparison to the No Action Alternative, the elimination of Trinity exports would result in a decrease in average annual CVP deliveries during the dry period by about 490,000 acre-feet (12 percent). Long-term average annual CVP deliveries would decrease by 401,000 acre-feet (8 percent).

Average annual Delta exports through Tracy Pumping Plant during the dry period would be reduced by 224,000 acre-feet (13 percent). Compared to the No Action Alternative, long-term average annual Delta inflow would be reduced 666,000 acre-feet (3 percent), and long-term average annual Delta outflow would be reduced 325,000 acre-feet (2 percent).

<u>Existing Conditions versus Proposed Action</u>. Consistent with *CEQA Guidelines* Section 15125, Subdivision(a), which provides that the

normal "baseline" for impact assessment is normally existing conditions at the time of release of a NOP for an EIR, the following discussion identifies differences between 2001 existing conditions and conditions in 2020 under the Proposed Action, and what portion of this change is attributable to the project (by comparing Proposed Action impact levels to both existing condition and No Action levels). Compared to existing conditions (i.e., 2001), the Proposed Action would release more water to the Trinity River. It is important to note that the 2001 existing conditions analysis assumed a release hydrograph identical to the No Action Alternative (not less than 340,000 acre-feet/year); however, actual Trinity River flows in recent years have varied due to a variety of factors (e.g., altered flow schedules that were being evaluated as part of the TRFES, Safety of Dam releases and releases ordered by the U.S. District Court in response to petitions for higher releases filed by Hoopa Valley and Yurok Tribes).

A large portion of the change in water impacts between 2001 existing conditions and the year 2020 under the Proposed Action is attributed to growth and development that is expected to occur independent of the preferred alternative. Existing conditions assumes a 2001 level of social and economic development, whereas the Proposed Action assumes a 2020 level of development (as do the other alternatives).

Implementation of the Proposed Action would reduce long-term average annual exports from the TRD by 232,000 acre-feet (30 percent) and attempt to increase Trinity Reservoir minimum storage from 400,000 to 600,000 acre-feet. However, end-of-water-year Trinity Reservoir storage over the average period decreased by 82,000 acre-feet (6 percent) compared to 2001 conditions, but dry-year storage increased 39,000 acre-feet as a result of higher dry-year carryover storage targets in the Proposed Action. Shasta Reservoir long-term end-of-water-year storage would be less than existing conditions by 107,000 acre-feet (4 percent). This reduction is attributable to decreased TRD exports as well as increased demand levels in 2020. The BO storage threshold of 1.9 maf would be met less frequently than in existing conditions (17 percent of years compared to 13 percent). The reduced frequency of meeting the threshold is attributable to non-project changes between 2001 and 2020.

Compared to existing conditions, long-term annual Delta exports through the Tracy Pumping Plant would be reduced by 52,000 acre-feet (2 percent) under the Proposed Action. Long-term average annual Delta inflow would be reduced by 204,000 acre-feet (1 percent). This reduction is primarily due to decreased TRD exports as a result of the Proposed Action. Average annual Delta outflow would be reduced by 123,000 acre-feet (1 percent). The effect on relative X2 position in the Bay Delta is discussed under Section 3.4 Fishery Resources, see specifically the Methodology Section.

Mitigation. As described previously, significance criteria only identifies specific adverse effects to the water delivery systems caused by potential implementation of these alternatives. However, it is understood that the change in water delivery patterns prescribed in these alternatives will have a significant effect on water quality and fisheries. Those impacts are discussed in the Water Quality (Section 3.3), Fishery Resources (Section 3.4), and Power Resources (Section 3.5) sections. ***In light of the beneficial impacts of using late-summer Trinity River Dam releases in 2003 to avoid or minimize a recurrence of the 2002 die-off in the lower Klamath, the use of similar late-summer releases in future years is identified as a possible mitigation measure to protect the fishery resources of the Trinity River and lower Klamath River, which could be selected as part of any of the alternatives under consideration.***

Numerous demand- and supply-related programs are currently being studied across California, many of which are being addressed through the ongoing CALFED and CVPIA programs and planning processes. Although none of these actions would be directly implemented as part of the alternatives discussed in this Supplemental EIS/EIR, each could assist in offsetting impacts resulting from decreased Trinity River exports. Examples of actions being assessed in the CALFED and CVPIA planning processes include the following:

- Develop and implement additional groundwater and/or surface-water storage. Such programs could include the construction of new surface reservoirs and groundwater storage facilities, as well as expansion of existing facilities. Potential locations include sites throughout the Sacramento and San Joaquin Valley watersheds, the Trinity River Basin, and the Delta.
- Purchase long- and/or short-term water supplies from willing sellers (both in-basin and out-of-basin) through actions including, but not limited to, temporary or permanent land fallowing.
- Facilitate willing buyer/willing seller inter- and intra-basin water transfers that derive water supplies from activities such as conservation, crop modification, land fallowing, land retirement, groundwater substitution, and reservoir re-operation.
- Promote and/or provide incentive for additional water conservation to reduce demand.
- Decrease demand through purchasing and/or promoting the temporary or permanent fallowing of agricultural lands.
- Conserve water supplies by promoting additional water recycling.

3.3 Water Quality

Affected Environment.

Trinity River Basin. Trinity River water temperatures are influenced by Trinity and Lewiston Reservoir release temperatures, flow rates, channel geometry, regional meteorology, and tributary flows and temperatures (the effect of Trinity and Lewiston Reservoirs diminishes with distance downstream). Generally speaking, the greater the release volumes from the dams, the less susceptible the river's temperature is to other factors. Trinity Reservoir releases tend to be cold (42 to 47°F), whereas Lewiston Reservoir, which is much shallower, tends to provide releases that are more affected by ambient temperatures.

During storm periods, turbidity in the Trinity River from Lewiston Dam to the South Fork is caused primarily by heavy inflows of suspended sediment from tributaries and the reservoirs. Highly erosive soils comprise approximately 17 percent of the Trinity River Basin, resulting in significant sediment loads entering the river. The reduced flows since the construction of the dams are partially responsible for these sediments to accumulate in the river. High flows, which historically flushed these sediments through the system, have become less frequent and of lower magnitude (see Geomorphic Environment [Section 3.2] of the Draft EIS/EIR).

Elevated concentrations of mercury have been found in water, sediment, and biota (fish, frogs and predatory aquatic insects) in the Trinity River Basin similar to other river basins in California that have been subjected to historical gold mining operations (U. S. Geological Survey, unpubl. data). Recent sediment samples collected within and adjacent to some planned channel rehabilitation project sites of the TRRP in the Trinity River have contained mercury concentrations that are above what are considered naturally occurring levels. (Ashley and Rytuba, 2002).

Natural sources of mercury to the watershed may include wet and dry deposition of mercury from the atmosphere, and indigenous mercury that naturally occurs in rocks and soils. Some elemental mercury was likely introduced to the basin during mining operations. This elemental mercury was likely subject to chemical and biological processes that transform some of the elemental mercury into new mercury phases. Transformation of elemental mercury into dissolved mercury species that can become methylated can be a concern because of the potential for biota to bioaccumulate mercury, thus passing toxins on to more complex life forms. Sulfate reducing bacteria in anaerobic environments are typically the source of methylation. The potential for methylation is not only dependent on solubility of mercury species present, but also many other chemical variables, such as sulfate and organic carbon, and physical parameters such as temperature, pH, oxidation-reduction potential, and the bacterial community.

Methylmercury is the form of mercury that is of most concern because it most readily bioaccumulates at successive trophic levels within food webs such that very high concentrations of methylmercury can occur in fish and other organisms high in the food chain. Methylmercury contamination and exposure can adversely affect reproductive success and health of fish and other species. It can potentially diminish productivity of affected species and poses a potential health risk to populations of wildlife who consume fish or other contaminated species because it is a potent neurotoxin.

The primary source for the gold in the Trinity watershed is low sulfide quartz gold vein deposits. Gold in these deposits is commonly associated with pyrite, and minor amounts of base metals. Weathering of these deposits may also locally cause elevated sulfate concentrations and enhance mercury methylation by exposure to sulfate-reducing bacteria. In the upper Trinity River Basin (above Trinity Lake), the Altoona mercury mine in the East Fork Trinity River watershed releases mercury and sulfate that results in methylation of mercury and elevated levels of mercury in downstream biota. Although mercury deposits are widespread in western California and the source of mercury used in placer mining, the Altoona is the only mercury district in the Trinity Watershed (Rytuba, 2002). No information exists to indicate that methyl mercury contamination from the Altoona Mine has migrated in significant amounts to areas downstream of Lewiston and Trinity Dams, although some preliminary sampling efforts in the basin have been initiated.

Water quality objectives regarding Trinity River temperature, turbidity, and sediment were determined by the NCRWQCB in conjunction with federal, state, and local agencies. Temperature standards are effective from July 1 through December 31 for the upper reach between Lewiston Dam and the North Fork Trinity River. Standards for the Trinity River are presented in Table 3.3-1. The objectives also stipulate that water released into the Trinity River may be no more than 5\F warmer than receiving water temperatures. Turbidity standards state that turbidity shall not increase more than 20 percent above naturally occurring background levels. The NCRWQCB does issue permits and waivers that identify allowable dilution zones within which higher percentages can be tolerated. The NCRWQCB criteria for sediment, suspended material, and settable material in the basin are narrative, meaning that standards are not based on numerical goals. Rather, criteria are set to avoid nuisance and maintain beneficial uses in the river. These standards are used to condition activities that affect, or potentially affect, water quality. When appropriate, the NCRWQCB may establish appropriate numeric water quality standards in waste discharge orders for narrative standards. Waste discharge orders are considered on a case-by-case basis, and are typically tied to naturally occurring water quality background conditions. In addition to the state criteria, the Hoopa Valley Tribe has established water quality standards pursuant to the Clean Water Act; and the U.S. Environmental Protection Agency (EPA) completed a sediment TMDL criteria for the middle and lower Trinity River at the end of 2001 (see Section 4.0, Cumulative Effects, of the Draft EIS/EIR) and a sediment TMDL for the South Fork Trinity River in 1999. Implementation of the TMDL criteria is still pending.

TABLE 3.3-1
NCRWQCB Temperature Objectives for the Trinity River

Temperature Not to Exceed	Time Period	River Reach
60°F (15.6°C)	July 1 through September 14	Lewiston Dam to Douglas City Bridge
56°F (13.3°C)	September 15 through October 1	Lewiston Dam to Douglas City Bridge
56°F (13.3°C)	October 1 through December 31	Lewiston Dam to confluence with North Fork

Trinity River water quality is also explicitly protected by Water Right Orders 90-05 and 91-01. These orders state that exports from the TRD to the Central Valley for Sacramento River temperature control shall not harm Trinity River fisheries, as measured by compliance with specific temperature requirements in the Trinity River. The temperature requirements contained in Water Right Orders 90-05 and 91-01 for the Trinity River is 56°F (13.3°C), respectively, at Douglas City and the North Fork confluence, as shown in Table 3.3-1. The summer objective at Douglas City of 60°F (15.6°C) is not a requirement of Water Right Orders 90-05 and 91-01.

On May 17, 1996, EPA granted program authorization to the Hoopa Valley Tribe with respect to Section 303 of the Clean Water Act. Since that time, the Hoopa Valley Tribe has pursued development of a Water Quality Control Plan (WQCP) through the Hoopa EPA. An important component of the Hoopa Valley WQCP is water temperature criteria for waters within the Reservation, which includes part of the Trinity River and several tributaries to the river. The temperature criteria presented in Table 3.3-2 were adopted by the Hoopa Valley Tribal Council on June 8, 2000. The EPA approved the temperature criteria on September 2002. Water temperature in this Hoopa Valley WQCP is measured near the confluence of the

Trinity River at Weitchpec. The water temperature standards developed for the Hoopa Valley WQCP were designed to conform with the flow regime specified by the TRFES, which is the basis of the Proposed Action of the 1999 Draft EIS/EIR, and this Supplemental EIS/EIR. A complete description of the Hoopa Valley temperature requirements can be found in Technical Appendix B (Service et al., 2000).

TABLE 3.3-2
Water Temperature Criteria (∀C) of the Hoopa Valley Tribe Water Quality Control Plan for the Trinity River

Water-year Class	Time Periods				
Extremely Wet, Wet, and Normal	May 23 - Jun 4	Jun 5 - Jul 9	Jul 10 - Sep 14	Sep 15 - Oct 31	Nov 1 - May 22
Criteria[a]	15.0	17.0	22.1	19.0	13.0
Dry and Critically Dry	May 23 - Jun 4	Jun 5 - Jun 15	Jun 16 - Sep 14	Sep 15 - Oct 31	Nov 1 - May 22
Criteria[a]	17.0	20.0	23.5	19.0	15.0

[a]Criteria represent 7-day running averages and are not to be exceeded.

Lower Klamath River Basin/Coastal Area. Water quality in the lower Klamath River is regulated by the NCRWQCB. Standards for the Trinity River generally apply to the Klamath River because beneficial uses are similar, except that there are no time- and location-specific temperature objectives. Current water quality concerns in the Klamath River Basin are the result of agricultural practices, water management, timber harvesting activities, natural geologic instability, and mining operations.

Water quality in the lower Klamath River can be influenced by dam releases from Iron Gate Dam on the Klamath River or dam releases from Lewiston Dam on the Trinity River. Water quality in the upper Klamath River Basin is at times characterized as being turbid and high in nutrients. As a consequence of the excess nutrients from agricultural runoff, at times the water quality of the Klamath River is degraded. Excessive nutrients have resulted in an abundance of phytoplankton blooms that have periodically lowered dissolved oxygen concentrations to levels considered to be unsafe for aquatic life. Lower in the Klamath River, the effects of the high nutrient loads from the upper basin are typically diluted by tributary flow, including the Trinity River, the largest of tributaries.

Lower Klamath River water temperatures may be influenced by releases from Iron Gate Dam. However, the Trinity River has a greater influence on water temperature of the Lower Klamath River than the releases from Iron Gate Dam. The two systems are different in that the coldwater storage of Trinity Reservoir is much greater than that of the upper Klamath River Basin reservoirs. Empirical data and a temperature model of the Trinity River has provided insight into the effects that variable Lewiston Dam releases may have on water temperatures at the confluence of the Klamath River at Weitchpec (Service and Hoopa Valley Tribe, 1999). Empirical data have shown the influence of a high Lewiston Dam release on Klamath River water temperatures. In June of 1992, a 10-day Lewiston Dam release of 6,000 cfs occurred and greatly influenced the temperature of the lower Klamath River. This release decreased temperature in the mainstem Klamath River (immediately below the confluence) by nearly 4.5\F. Because 1992 was a critically dry year, tributary accretion in both the Klamath and Trinity Rivers was very small. As a consequence, the high release from Lewiston Dam resulted in the Trinity River becoming the dominant cold water source at the confluence. These interactions were confirmed during 2003 operations for late fall temperature maintenance.

Modeled dam releases from Lewiston Dam also provided assessments of the likely effects of releases on water temperatures at the confluence of the Klamath River during the spring and early summer (Service and Hoopa Valley Tribe, 1999). These evaluations focused on recommended flows identified in the Analysis of Alternatives, and the following generalities were identified from this evaluation. First, the model predicts that high-level releases can result in Trinity River water temperatures being colder than the Klamath River. Conversely, low-magnitude releases can result in Trinity River water temperatures becoming warmer than the Klamath River in the lower reaches. The main factor that can offset temperature differentials is likely the quantity of tributary accretion. When the Lewiston Dam release is large under drought conditions (low tributary accretion) or small during wet conditions, the temperature differentials become greatest. Marked temperature differentials may have a harmful effect on sensitive fishery resources. When dam release magnitudes are matched to emulate pre-TRD hydrologic conditions, the differences are lessened. For more detailed information on this subject see Appendix L of the *Trinity River Flow Evaluation Report* (Service and Hoopa Valley Tribe, 1999).

<u>Central Valley</u>. Shasta Dam is a major influence on Sacramento River water quality and, consequently, on the Bay-Delta. Operation of the TRD also affects water quality in the Sacramento River through the timing, magnitude, and temperature of exports, and the coordination with Shasta releases. Sacramento River water quality from Keswick Dam to the Red Bluff Diversion Dam is primarily influenced by Shasta Division releases and Trinity River exports. Downstream of the Red Bluff Diversion Dam, tributary inflow lessens the influence of the Shasta Division and TRD exports. During warm weather, Sacramento River water temperatures tend to increase downstream from Keswick Dam. This effect is magnified during dry water years with lower instream flows.

Following adoption of Water Right Orders 90-05 and 91-01 by SWRCB and implementation of the 1993 Winter-run Chinook BO, temperature requirements became a much more important constraint in the operation of the Shasta Division. Water Right Orders 90-05 and 91-01 implement the year-round 56°F Sacramento River temperature objective contained in the Sacramento River Basin Plan (Basin Plan) for the protection of all Sacramento River Chinook runs (winter, spring, fall, and late fall). The BO requires a minimum Shasta Reservoir carryover storage of 1.9 maf on September 30. The BO also set temperature compliance standards at downstream measuring points (Table 3.3-3 and Figure 3.3-1). Before the BO and Water Right Orders 90-05 and 91-01, Shasta Dam was operated to maximize water deliveries, power generation, and flood control.

TABLE 3.3-3
Temperature Standards Required by 1993 Winter-run Chinook BO

Water-year Class[a, b]	September 30 Storage in Shasta[c]	Temperature Compliance Standards (Daily Average Water Temperature Not to Exceed)
Wet	All levels	56°F at Bend Bridge April 15 through September 30 60°F at Bend Bridge October 1 through October 30
Above Normal	All levels	56°F at Bend Bridge April 15 through September 30 60°F at Bend Bridge October 1 through October 30
Dry	3.2 maf	56°F at Bend Bridge April 15 through September 30 60°F at Bend Bridge October 1 through October 30
Dry	2.5 maf	56°F at Bend Bridge April 15 through August 31 56°F at Jellys Ferry September 1 through September 30 60°F at Jellys Ferry October 1 through October 30
Dry	1.7 maf	56°F at Jellys Ferry April 15 through September 30 60°F at Jellys Ferry October 1 through October 30
Critical	All levels	56°F at Jellys Ferry April 15 through September 30 60°F at Jellys Ferry October 1 through October 30
Extremely Critical	3.2 maf	56°F at Jellys Ferry April 15 through September 30 60°F at Jellys Ferry October 1 through October 30
Extremely Critical	2.5 maf	Reclamation must re-initiate consultation with NOAA Fisheries 14 days prior to the first announcement of water delivery allocations
Extremely Critical	2.0 maf	Reclamation must re-initiate consultation with NOAA Fisheries 14 days prior to the first announcement of water delivery allocations
Extremely Critical	1.7 maf	Reclamation must re-initiate consultation with NOAA Fisheries 14 days prior to the first announcement of water delivery allocations

[a]Based on the Sacramento River Index, which differs from water-year index used elsewhere in document.
[b]Water-year class projections must be Reclamation’s 90 percent probability of exceedance forecast of runoff released in February, or an exceedance forecast at least as conservative. Actual runoff will be less than a 90 percent forecast in only 10 percent of years. Forecasts made later in the water year are more accurate than forecasts made earlier in the year.
[c]When carryover storage is less than 1.9 maf, Reclamation must re-initiate consultation with NOAA Fisheries prior to first water allocation announcement.

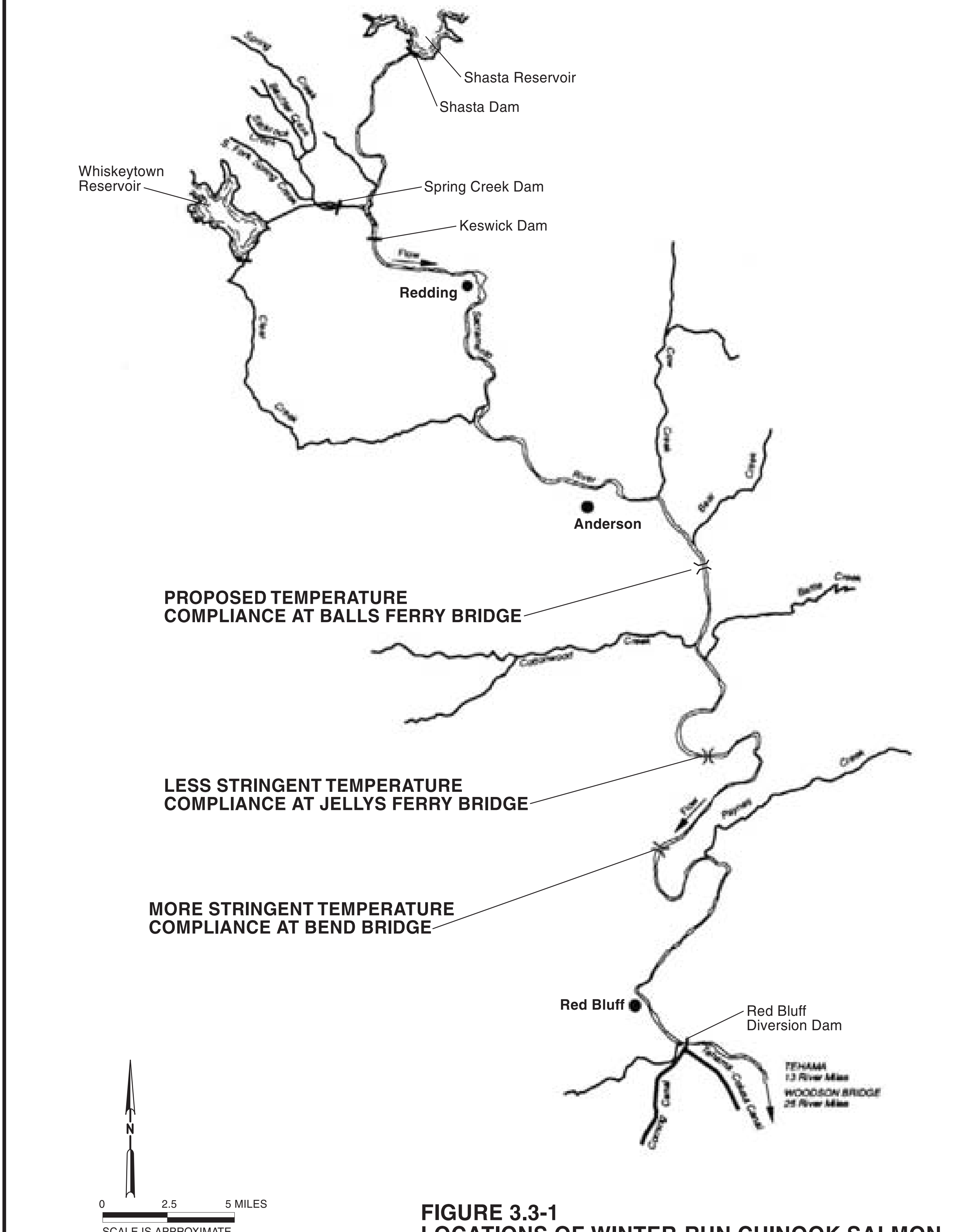

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FIGURE 3.3-1
LOCATIONS OF WINTER-RUN CHINOOK SALMON BIOLOGICAL OPINION TEMPERATURE COMPLIANCE
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

The Shasta Division currently imports Trinity water in the spring and summer to conserve the coldwater pool in Shasta Reservoir for release later in the year. An important aspect of this coordination is to move Trinity water through Whiskeytown Reservoir at a rate sufficient to prevent warming. Water moving too slowly can result in warming, requiring additional coldwater releases from Shasta Dam to meet downstream temperature standards, which can reduce the amount of cold water available to meet standards later in the year and also affect water quality and deliveries in the Bay-Delta. Lower storage levels in Shasta Reservoir can also increase Shasta release temperatures, again requiring higher flows to comply with downstream temperature objectives. Alternatively, exports from Trinity can also be increased to reduce warming affects to Whiskeytown. Reclamation recently added a TCD to the upstream (reservoir side) face of Shasta Dam. The TCD allows dam operators to pull cold water from lower depths throughout the year, increasing the ability to generate power while assisting in meeting temperature objectives in the Sacramento River.

Dilution of Iron Mountain Mine runoff is also an important Sacramento River water quality consideration. Runoff from the mine, an EPA Superfund site near Redding, can be highly acidic and contain toxic metals. Runoff is held at Spring Creek Debris Dam, located upstream from the tailrace of Spring Creek Powerplant.

The debris dam allows mine runoff to be released into Keswick Reservoir on a controlled schedule so that it can be diluted to safe levels. During wet periods when the debris dam fills and spills, runoff flows directly into Keswick Reservoir, and metal concentrations occasionally exceed desirable levels in the Sacramento River.

Releases of water from Whiskeytown Reservoir (of which Trinity River exports are a major part) to the Spring Creek Powerplant are typically maintained at a minimum level of 200 cfs to help dilute the polluted water prior to entry into Keswick Reservoir. In the future, minimum releases may be lowered. This number should be considered very conservative given the ongoing construction of metal emission control systems associated with Iron Mountain Mine.

Water quality in the Bay-Delta is primarily affected by the way water moves through the region. Freshwater inflows are continuously influenced by the tidal cycle, which moves into and out of the Bay-Delta approximately twice a day. This tidal interaction is important because it moves the saltwater/freshwater interface back and forth, which influences water quality at specific locations throughout the Bay-Delta, both daily and seasonally. Water exports from the Bay-Delta are impacted by these changing water quality characteristics.

Currently, a combination of agreements and directives are used to maintain water quality in the Bay-Delta, including the following:

- Bay-Delta Accord
- SWRCB D-1485, as amended by WR 95-1, and 95-6 and 98-9
- Coordinated Operations Agreement

These agreements and directives outline standards and operating procedures that, when used in conjunction with upstream water quality plans and BOs for endangered species, determine water quality in the Bay-Delta.

The Bay-Delta Accord, formulated by CALFED and representatives of several urban, agricultural, and environmental groups, is effective until the adoption of final Delta water quality standards. Originally intended to be valid for 3 years, the Bay-Delta Accord has been extended twice. The Bay-Delta Accord established new outflow standards, modified BOs for winter-run Chinook salmon and Delta smelt to increase water project flexibility, and established a funding mechanism for non-flow-related measures.

SWRCB Bay-Delta water quality standards are conditioned by water-year class and, in general, become less stringent in critically dry years. The SWRCB May 1995 Water Quality Control Plan, as amended by WR 95-1, 95-6, and 98-9, outlines standards for salinity, chloride, and habitat protection (X2 criteria for example). X2 criteria refer to the management of upstream movement of water with 2 parts-per-thousand (ppt) concentration of salt. X2 is measured as kilometers (km) from the Golden Gate Bridge. Higher X2 values indicate salt water intrusion into the Delta. X2 is also discussed in Section 3.4, Fishery Resources. X2 is sometimes used as a measure of Delta smelt habitat.

Water quality standards are much more difficult to meet in critically dry years because there is less water supply to meet them and multi-objective CVP purposes must be made on a tradeoff basis with limited resources. Water quality standards become more protective (or enhanced) as conditions become wetter, and there are generally more water resources and project flexibility to meet these competing multi-objective needs. Because of their ability to significantly alter flows, and therefore water quality in the Bay-Delta, the major export pumps are also regulated. Exports from the pumps are restricted according to Delta inflow and San Joaquin River flow. These limits are intended to be monitored in real time in order to detect fish in the areas adjacent to the pumps. Currently, exports are limited to 35 percent of Delta inflow from February through June and 65 percent of inflow for the remainder of the year. In 1995, the export/inflow ratio averaged 18.4 percent, with a low of 6.2 and a daily maximum of 64.3. Exports are also limited between April 15 and May 15 to 1,500 cfs or 100 percent of San Joaquin River flow at Vernalis, whichever is greater. The San Joaquin export limit is only used if it is more restrictive than the 35 percent limit.

The Delta provides drinking water for about 20 million people, making water quality, and the ability to adequately treat Delta water, a major concern. Fresh water that is not used in the Delta, or not exported from the Delta flows, to the Pacific Ocean through San Francisco Bay, which helps prevent saline water from encroaching into the Delta and degrading water quality. Managing the balance between water taken from the Delta for drinking water and water left in the Delta to protect water quality is a key concern.

The Safe Drinking Water Act (SDWA) was enacted and signed into law in 1974. Through the SDWA, the EPA was given the authority to set standards for contaminants in drinking water supplies. The EPA was required to establish primary regulations for the control of contaminants that affect public health, and secondary regulations for compounds that affect the taste or aesthetics of drinking water. Under the SDWA, Department of Health Services has the primary enforcement responsibility (referred to as “primacy”). The Health and Safety Code and Title 22 of the California Code of Regulations establishes Department of Health Services authority and stipulates drinking water quality and monitoring standards. To maintain primacy, a state’s drinking water regulations can be no less stringent than the federal standards. Water in the Delta generally meets public water supply water quality standards identified by EPA and the Department of Health Services. However, stricter federal standards have been promulgated and are significantly more difficult and costly to meet. The standards of concern relate to disinfection byproducts and the potential requirements for more rigorous disinfection. Since 1914, chlorine has been the preferred disinfectant in most United States public surface-water systems. It is relatively easy to use, inexpensive, and it persists in water, continuing to kill bacteria throughout the distribution system. In the mid-1970s, concern arose over newly discovered compounds that form when chlorine combines with naturally occurring organic, carbon-based materials, such as decaying vegetation or some salts. Known as disinfection by-products (DBP), these synthetic organic compounds are suspected carcinogens.

For drinking water, DBPs have only been consistently measured since the early 1980s, because EPA first adopted a maximum contaminant level for trihalomethanes (THM) in 1981. Constituents that can cause DBPs include bromide (naturally occurring in seawater) and organic carbon. Tidal currents created by the rise and fall of sea levels modify stream flow, particularly when outflows are low or when tides are high. Intruded seawater is a major source of bromide, particularly in the western Delta. Intrusion profoundly affects Delta water withdrawn at the CCWD, SWP, and CVP intakes. The presence of bromide in a drinking water source complicates the disinfection process because it is heavier than chlorine and the THM standard is based on weight. Hence, it takes fewer molecules of brominated THMs to exceed the drinking water standard. Another method of disinfection, ozone treatment, is also complicated by the presence of bromide because it forms bromate, which is also a DBP.

Of the agricultural land acreage in the Delta, 80 percent contain peat soils. The organic carbon content of peat soil is 50 to 80 percent, and intermediate organic-type soils have 30 to 50 percent organic matter. High organic content makes peat soil highly productive for agriculture, but prone to wind erosion and subsidence. Subsidence is the result of exposure of peat to oxygen, which converts the organic carbon solids to carbon dioxide gas and aqueous carbon. Organic carbon can also form THMs, including the most common THM, chloroform.

Environmental Consequences.

Methodology. Several water temperature models were used to evaluate the effects of each alternative on Trinity River water temperatures. These models included: (1) Reclamation's Temperature Model (RTM), which predicts Trinity Dam release temperatures as a function of storage and outlet works used; (2) a 2-dimensional temperature model of Lewiston Reservoir based on the BETTER, which predicts temperatures at outflow locations; and (3) the SNTEMP, which predicts Trinity River water temperatures below Lewiston Reservoir. These models were used in sequence, with output of upstream models used as input for downstream models.

The monthly RTM (sometimes referred to as the Sacramento River Basin Temperature model) is used as an analytical tool for evaluating the effects of reservoir operations on riverine water quality conditions. The RTM simulates temperature profiles in five major reservoirs (Trinity, Whiskeytown, Shasta, Folsom, and Oroville Reservoirs), four downstream regulating reservoirs (Lewiston Reservoir, Keswick Reservoir, Thermalito Afterbay, and Natoma Reservoir), and three major river systems (Sacramento, Feather, and American Rivers). The model was developed as a tool for evaluating the effects of monthly simulated CVP-SWP reservoir operations on basin water temperatures. For this analysis the BETTER model was used to predict temperatures in Lewiston Reservoir because it was developed specifically for Lewiston, rather than as a piece of the entire CVP. The RTM was also used for the CVPIA EIS.

For each alternative, simulations of the RTM and BETTER were performed for five specific years (1983, 1986, 1989, 1990, and 1977) representing five different water-year classes (extremely wet, wet, normal, dry, and critically dry). Lewiston Dam release temperatures predicted from the BETTER model were subsequently modeled in the SNTEMP under projected cold-wet, median, and hot-dry hydrometeorological conditions. Model results identified the percentage of time that NCRWQCB temperature objectives would be met. Table 3.3-4 presents the combinations of flows and temperatures necessary to meet temperature objectives under median weather conditions. Table 3.3-5 presents the modeling results for each alternative under median conditions. Cold-wet and hot-dry conditions are presented in the Water Resources/Water Quality Technical Appendix A.

TABLE 3.3-4

Combinations of Discharge and Water Temperatures Necessary to Meet SWRCB Temperature Objectives for the Trinity River Under Median Climatic Conditions

Water Temperature of Releases (\F)	Lewiston Dam Discharge (cfs)					
	150	300	450	600	900	1,200
	July 1 through September 14: Target 60\F at Douglas City[a]					
46	59.9	55.9	53.7	52.3	50.7	49.8
47	60.2	56.4	54.3	53.0	51.4	50.6
48	60.6	56.9	55.0	53.7	52.3	51.5
49	60.9	57.4	55.6	54.4	53.0	52.2
50	61.2	58.0	56.3	55.1	53.9	53.1
51	61.5	58.6	57.0	55.9	54.7	54.0
52	61.8	59.1	57.5	56.6	55.4	54.8
53	62.2	59.6	58.2	57.3	56.3	55.7
54	62.5	60.1	58.8	58.0	57.0	56.4
55	62.8	60.7	59.5	58.7	57.8	57.3
56	63.1	61.1	60.0	59.3	58.5	58.1
57	63.4	61.7	60.7	60.1	59.4	58.9
58	63.7	62.1	61.3	60.7	60.1	59.7
59	64.0	62.7	62.0	61.5	60.9	60.6
60	64.3	63.2	62.6	62.2	61.8	61.5
	September 15 through September 30: Target 56\F at Douglas City[a]					
46	56.2	52.6	50.9	50.0	48.9	48.3
47	56.6	53.2	51.6	50.7	49.7	49.2
48	57.1	53.9	52.4	51.5	50.6	50.1
49	57.5	54.4	53.1	52.3	51.4	50.9
50	57.9	55.2	53.9	53.1	52.3	51.9
51	58.4	55.8	54.7	54.0	53.2	52.8
52	58.8	56.4	55.3	54.7	54.0	53.6
53	59.2	57.1	56.1	55.5	54.9	54.6
54	59.6	57.7	56.8	56.2	55.7	55.4
55	60.0	58.4	57.6	57.1	56.6	56.3
56	60.4	58.9	58.2	57.8	57.3	57.1
57	60.9	59.6	59.0	58.6	58.3	58.0

TABLE 3.3-4

Combinations of Discharge and Water Temperatures Necessary to Meet SWRCB Temperature Objectives for the Trinity River Under Median Climatic Conditions

Water Temperature of Releases (°F)	Lewiston Dam Discharge (cfs)					
	150	300	450	600	900	1,200
58	61.2	60.1	59.6	59.3	59.0	58.8
59	61.6	60.8	60.4	60.2	59.9	59.8
60	62.1	61.5	61.2	61.0	60.8	60.7
	October 1 through December 31: Target 56°F at North Fork Confluence[a]					
46	56.8	54.4	52.9	51.8	50.6	49.8
47	56.9	54.8	53.3	52.4	51.2	50.5
48	57.1	55.1	53.9	53.0	51.9	51.3
49	57.3	55.5	54.3	53.5	52.5	51.9
50	57.4	55.9	54.8	54.1	53.3	52.7
51	57.6	56.2	55.3	54.7	54.0	53.5
52	57.7	56.5	55.8	55.3	54.6	54.2
53	57.9	56.9	56.3	55.9	55.3	55.0
54	58.0	57.2	56.7	56.4	55.9	55.7
55	58.2	57.6	57.2	57.0	56.6	56.5
56	58.3	57.9	57.7	57.5	57.3	57.1
57	58.4	58.3	58.2	58.1	58.0	57.9
58	58.6	58.6	58.6	58.6	58.6	58.6
59	58.7	58.9	59.1	59.1	59.3	59.3
60	58.9	59.3	59.5	59.7	60.0	60.1

[a]Shaded cells indicate combinations that can meet temperature objectives.

TABLE 3.3-5

Water Quality Summary Table Sacramento River Impacts (CALSIM)

	No Action	Revised Mechanical	Preferred Flow	Modified Percent	70 Percent	Maximum Flow	Existing Condition
Sacramento River Violations							
Percentage of months with violations	30.8%	33.5%	35.7%	34.3%	39.1%	42.5%	29.0%
Shasta Carryover Storage Violations							
Percentage of years less than 1.9 maf	11.1%	13.9%	16.7%	13.9%	19.4%	27.8%	12.5%
Average Modeled Position of X2 in Delta, Distance from Golden Gate Bridge (km)							
Average Period (1922-1993)	75.8	75.8	75.9	75.9	76.1	76.1	75.7
Wet Period (1967-1971)	71.2	71.3	71.4	71.2	71.4	71.6	70.8
Dry Period (1928-1934)	80.8	80.8	80.8	80.7	80.8	80.8	80.7

Each alternative was also evaluated for its ability to meet the water temperature objectives of the Hoopa Valley Tribe's WQCP (Hoopa Valley Tribe, 2000). This evaluation relied upon model-predicted dam-release water temperatures from the SNTEMP, as well as hydrometeorological conditions of representative years modeled by BETTER. These years included 1977 (critically dry), 1990 (dry), 1989 (normal), 1986 (wet), and 1983 (extremely wet). This evaluation provided estimates of the percentage of time the objectives would be met.

Each alternative's effect on turbidity, sediment, and water quality of the lower Klamath River were analyzed qualitatively. An evaluation of the flow schedules of the Proposed Action (Service and Hoopa Valley Tribe, 1999) provided information to provide qualitative assessments of the likely effects of alternative flows on water quality in the lower Klamath River. Flow alternatives were assessed for their ability to provide temperatures beneficial to salmonids in the Klamath River and their ability to provide dilution for potentially polluted Klamath River water.

Temperature effects in the Sacramento River were analyzed using CALSIM and RTM; the Shasta TCD was assumed to be fully operational. Although these models are the best available tools for analyzing temperature impacts, they do use monthly time steps, whereas actual operations would be dependent on daily, and sometimes hourly, variations in flow, climate, and exports (therefore, daily impacts could be masked). The ability to dilute uncontrolled acid mine runoff from Spring Creek Debris Dam is assumed to be relatively unaffected by any of the alternatives because of uncontrolled spills from Spring Creek Debris Dam (which would typically be in the winter/early spring months) would correlate with increased inflow to Shasta and Whiskeytown Reservoirs, which, in turn, would be available for release to dilute water in Keswick Reservoir.

A minimum 200-cfs release through Spring Creek Powerhouse to mobilize acid mine drainage into Keswick Reservoir is assumed in all alternatives (except Maximum Flow because no exports are assumed). As described above under Affected Environment, this should be viewed as a conservative number.

CALSIM operations ensure facilities within the CVP remain viable. In the case of Whiskeytown Reservoir, elevations are maintained at a sufficient level to assure diversion capability for all uses, including utilities that divert water from Whiskeytown for domestic and agricultural uses. CALSIM operating rules also ensure that flows are sufficient to provide minimum water quality standards are maintained in the Bay-Delta for all alternatives on a monthly basis. However, inflows to the Bay-Delta and Delta exports were further evaluated for their effects on water quality using DWR's DSM2 Delta model to analyze potential impacts associated with each alternative to drinking water quality versus the No Action Alternative. The hydrodynamic model, DSM2, simulates the channel flows, tidal effects, and water quality of the Bay-Delta estuary. For the purposes of this analysis, model simulations were conducted for a 15-year historical hydrologic sequence (water years 1976-1990). This period was selected to cover a broad range of Delta inflows and exports and is generally representative of the 72-year historical hydrologic sequence used in CALSIM. DSM2 results may identify modeled exceedances for some standards in some locations for individual months, assuming the model provides a more detailed representation of the Delta. DSM2 results were evaluated for changes in electrical conductivity (EC) concentrations at six Delta locations critical to drinking water quality. These locations include Greens Landing on the Sacramento River, North Bay Aqueduct, Contra Costa Canal Intake, Old River at Highway 4, Delta-Mendota Canal Intake, and Clifton Court Forebay, as shown on Figure 3.3-2.

Mercury.

It is assumed that those alternatives, which may increase mercury's bioavailability via methylation (or potential for methylation) and concentration in biota, may cause significant impacts. The primary causes of increased bioavailability of mercury is through inadvertant release of mercury to stream courses or through creation of habitats prone to creation of methylmercury. Alternatives were evaluated for the potential to cause either of these conditions.

Water Quality.

Significance Criteria. The following impacts were considered significant for both the Trinity River Basin and the Central Valley:

- Substantial degradation of water quality, such that existing beneficial uses are precluded specifically because of adverse water quality.
- Violation of any water quality standards or waste discharge requirements.
- Substantial alterations of the course of a stream or river in a manner that would result in substantial erosion or siltation on- or offsite.
- Short- or long-term increases in turbidity of 20 percent or more over naturally occurring background levels.
- Contamination of a public water supply.

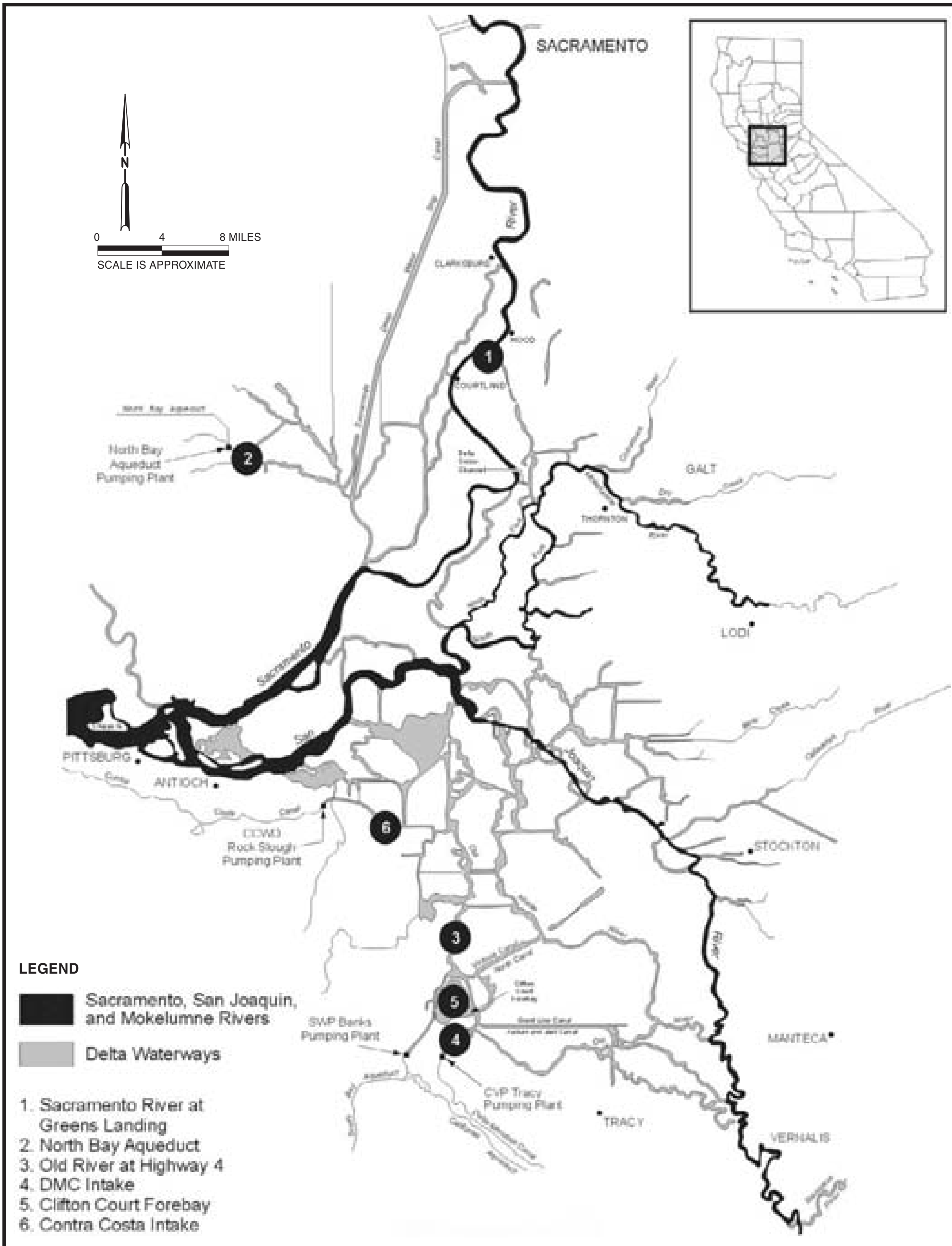

FIGURE 3.3-2
OUTPUT LOCATIONS FOR SIMULATED AVERAGE MONTHLY WATER QUALITY
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

W022004007RDD_926 (4/2/04)

∉ Variation in instream temperatures so as to cause mortality to state or federally listed aquatic species. For purposes of analysis, this is defined as an increase in the frequency of temperature violations[3], or a relative change in carryover storage meeting targets at Shasta Reservoir compared to No Action.

∉ Degradation of a water quality constituent for which a waterbody is listed as impaired (e.g., under California's Clean Water Act 303(d) list).

∉ Existing standards are exceeded for mobilization of mercury.

∉ Conditions are created which would increase the potential for formation of mercury methylation beyond naturally occurring rates.

If an alternative will increase mobilization of mercury to the stream course and will increase potential for mercury methylation in the local area (i.e., will increase severity of mercury contamination within the lower Trinity River watershed), such that quantities may be deleterious to water quality, aquatic and terrestrial life, it is considered significant.

No Action. Exports to the Central Valley would be similar to current operations and would generally maintain current temperatures in the Trinity River (Table 3.3-4). Under the No Action Alternative, Sacramento River temperature objectives established in the BO would not be met in some months (Table 3.3-3). These months are distributed across wet to dry hydrology due to the variable nature of the standards depending on water-year class. Carryover violations at Shasta Reservoir would occur in 11.1 percent of the years (Table 3.3-5). Existing Trinity River channel rehabilitation projects would be maintained, resulting in occasional, short-term increases in turbidity. Because this alternative does not provide dam releases sufficient in magnitude or duration to emulate pre-TRD flow patterns during the spring and early summer, except possibly in critically dry years, there would be times when water temperatures would be warmer than the Klamath River. Minimum Bay-Delta water quality standards are assumed to be met on a monthly basis.

Revised Mechanical.

Trinity River Basin. The frequency of Trinity River modeled temperature violations remain similar or decreased compared to No Action levels. Construction of the 47 new channel rehabilitation projects associated with this alternative would result in potentially

[3] For this study, an increase of 0.5\F as established in the 1993 Winter run BO issued. Notably, the use of a 0.5\F change in temperature as a significant impact represents a very conservative approach, in that the Central Valley Regional Water Quality Control Board normally considers a temperature change to be significant if a 1.0-degree change occurs.

significant short-term turbidity impacts in relation to NCRWQCB objectives (actual implementation of the projects would undergo a site-specific environmental review).

The use of suitably sized floating dredges that can pump water-sediment mixtures to off-channel holding impoundments will eliminate turbidity problems associated with other forms of mechanical removal from the river.

The Revised Mechanical Restoration Alternative was considered to have potentially significant impacts relative to increased levels of mercury in-river due to the construction of channel rehabilitation projects, which have the potential to increase mobilization of mercury to the stream course and to increase potential for mercury methylation.

Lower Klamath River Basin/Coastal Area. Because this alternative provides releases greater than the No Action Alternative, and flows are sufficient in magnitude and duration to partially emulate pre-TRD flow patterns during the spring and early summer, water quality of the lower Klamath River would improve. Water temperatures of the lower Trinity River would be reduced compared to the No Action Alternative, and as a consequence, the water temperature of the lower Klamath River would also be reduced. As compared to the No Action Alternative, the additional flows of this alternative would dilute Klamath River flow that could be of poor quality due to sediments or nutrients. During the late summer and early fall when flows are equal to the No Action Alternative there would be no significant differences in water quality.

Central Valley. Sacramento River modeled temperature violations occurred at a significantly higher frequency than under the No Action Alternative (33.5 versus 30.8 percent). Violations occurred in both wet and dry conditions due to the variable nature of the standards. The modeled frequency of Shasta carryover violations was slightly greater than the No Action Alternative with an increase of 2.8 percentage points. The increase in frequency of temperature violations and the change in carryover storage violations is at least partially attributable to the increase in demand for water under the 2020 condition. Because demand is forecast to occur downstream of compliance points in the Sacramento River, water deliveries assist in meeting temperature standards. Increased demand in the 2020 period results in lower carryover storage in the Central Valley reservoirs as system wide resources are used to meet demand.

CALSIM results indicate that carryover storage at Shasta Reservoir is significantly reduced compared to No Action. However, the increase in public demand in the year 2020 has a larger incremental effect on carryover storage compared to the impacts of the modeled alternative.

There was no change in the modeled position of X2 over the period of record compared to No Action. During the wet and dry period, X2 position showed no significant change. Delta standards continue to be met under this alternative.

DSM2 Delta water quality results show that the long-term average monthly EC values do not change significantly from those for the No Action Alternative. The maximum increase in dry-period monthly EC values is 5 percent, for the month of January at Contra-Costa Canal Intake.

Flow Evaluation.

Trinity River Basin. The frequency of Trinity River modeled temperature violations remain the same or decreased in all water-year classes compared to No Action levels. This improvement in water temperature, of up to 16 percent in dry and critical dry water years, is the result of increased flows and a higher carryover storage target. Construction of the 47 new channel rehabilitation projects associated with this alternative would result in potentially significant short-term turbidity impacts in relation to NCRWQCB objectives (actual implementation of the projects would undergo a site-specific environmental review).

The Flow Evaluation Alternative was considered to have potentially significant impacts relative to increased levels of mercury in-river due to the construction of channel rehabilitation projects, which have the potential to increase mobilization of mercury to the stream course and to increase potential for mercury methylation.

Lower Klamath River Basin/Coastal Area. Because this alternative provides releases greater than the No Action Alternative, and flows are sufficient in magnitude and duration to partially emulate pre-TRD flow patterns during the spring and early summer, water quality of the lower Klamath River would improve. Water temperatures of the lower Trinity River would be reduced compared to No Action, and, as a consequence, the water temperature of the lower Klamath River would be reduced. Furthermore, the additional flows of this alternative would dilute Klamath River flows that could be of poor quality due to sediment and nutrients. During the late summer and early fall when flows are equal to the No Action Alternative there would be no significant differences in water quality.

Central Valley. Sacramento River modeled temperature violations occurred at a higher frequency than under the No Action Alternative (35.7 versus 30.8 percent). Violations occurred in both wet and dry conditions due to the variable nature of the standards. This impact would be significant. Shasta Reservoir carryover storage violations would increase 5.6 percentage points compared to No Action. The increase in frequency of temperature violations and the lack of change in carryover storage violations is at least partially attributable to the increase in demand for water under the 2020 condition. Because demand is forecast to occur downstream of compliance points in the Sacramento River, water deliveries assist in meeting temperature standards.

The modeled position of X2 increased (moved east) by 0.1 km over the period of record compared to No Action. During the wet period, X2 position increased 0.2 km, and during the dry period, X2 showed no change. Delta standards continue to be met under this alternative. Graphic representations of relative X2 position under the No Action and Flow Evaluation is included in the Water Resources/Water Quality Technical Appendix A.

DSM2 Delta water quality results show that the long-term average monthly EC values do not change significantly from those for the No Action Alternative. The maximum increase in dry-period monthly EC values is 10 percent for the month of January at Contra-Costa Canal Intake.

Modified Percent Inflow.

Trinity River Basin. Except for wet water years (5 percent greater) modeled Trinity River water temperature violations would be less in comparison to No Action. Construction of 47 new channel rehabilitation projects would result in potentially significant short-term turbidity impacts in relation to NCRWQCB objectives (actual implementation of the projects would undergo a site-specific environmental review).

The Modified Percent Inflow Alternative was considered to have potentially significant impacts relative to increased levels of mercury in-river due to the construction of channel rehabilitation projects, which have the potential to increase mobilization of mercury to the stream course and to increase potential for mercury methylation.

Lower Klamath River Basin/Coastal Area. Because this alternative does provide releases greater than the No Action Alternative, and flow patterns are sufficient in magnitude and timing to partially emulate pre-TRD flow patterns during the spring and early summer, water quality of the Klamath River would improve relative to the No Action Alternative. Water temperatures would improve, and the additional flows of this alternative would dilute Klamath River flow that can be of poor quality due to sediments and nutrients during the early summer. During the late summer and early fall; compared to No Action, the projected low releases under this alternative would significantly reduce the benefits of Trinity River dilution effect, and would result in significantly increased water temperatures of the Klamath River.

Central Valley. Sacramento River modeled temperature violations would occur more frequently than No Action levels (34.3 versus 30.8 percent), resulting in a significant impact. The months with violations occur across wet and dry conditions due to the variable nature of the standards.

The modeled frequency of Shasta carryover violations was slightly greater than the No Action Alternative with an increase of 2.8 percentage points.

In comparison with No Action, modeled position of X2 would increase (move east) 0.1 km over the period of record. In the wet condition and in the dry period, X2 would remain unchanged or have approximately 0.1 km westward. Delta standards continue to be met under this alternative.

DSM2 Delta water quality results are very similar to the No Action Alternative. The maximum increase in long-term average EC levels is limited to 2 percent. The maximum increase in dry-period monthly EC values is 8 to 9 percent for the month of December at Contra-Costa Canal Intake and Old River at Highway 4.

70 Percent Inflow.

Trinity River Basin. Modeled Trinity River water temperature violations increased substantially during extremely wet and wet water years in comparison to No Action because of the relatively low reservoir inflows in the fall months, with subsequent low releases under this alternative. The resultant Trinity River temperature increases would be significant. Construction of 20 new channel rehabilitation projects would result in potentially significant short-term turbidity impacts in relation to NCRWQCB objectives (actual implementation of the projects would undergo a site-specific environmental review).

The 70 Percent Inflow Alternative was not considered to have potentially significant impacts because no increase in bioavailability of mercury would be realized.

Lower Klamath River Basin/Coastal Area. Because this alternative does provide releases greater than the No Action Alternative, and flow patterns are sufficient in magnitude and timing to partially emulate pre-TRD flow patterns during the spring and early summer, water quality of the Klamath River would improve relative to the No Action Alternative. Water temperatures would improve and the additional flows of this alternative would dilute Klamath River flows during the early summer. During the late summer and early fall the projected low releases under this alternative would significantly reduce the benefits of Trinity River dilution, and would significantly increase water temperatures of the Klamath River compared to No Action.

Central Valley. Sacramento River modeled temperature violations would occur more frequently than No Action levels (39.1 versus 30.8 percent), resulting in a significant impact. The months with violations occur across wet and dry conditions due to the variable nature of the standards.

The modeled frequency of Shasta carryover violations was significantly greater than the No Action Alternative with an increase of 8.3 percentage points. This change is considered significant.

In comparison with No Action, the modeled position of X2 would increase (move east) 0.3 km over the period of record. During the wet period, X2 position increased 0.2 km, while during the dry period, X2 showed no change. Delta standards continue to be met under this alternative.

CALSIM results also project reductions in Delta outflow. DSM2 Delta water quality results show a small increase (over No Action) in the long-term monthly averaged values of EC. The maximum increase in long-term values is 5 to 6 percent in the months of October and November at Contra-Costa Canal Intake and Old River at Highway 4. The maximum increase in the dry-period averaged monthly values is also limited to 6 percent.

Maximum Flow.

Trinity River Basin. The elimination of TRD exports resulted in additional modeled Trinity River temperature violations of NCRWQCB temperature standards in all five water-year classes, compared to No Action levels. The increased frequency of violations reflects the slower rate at which water moves through Lewiston Reservoir (i.e., lack of diversions to the Central Valley), and the associated warming effect (due to the reservoir's relatively shallow depth). Typically, these violations would occur in fall months. The resultant Trinity River temperature impact would be significant. Because this alternative does not include mechanical channel rehabilitation there would be no associated impacts to turbidity.

The Maximum Flow Alternative was not considered to have potentially significant impacts because no increase in bioavailability of mercury would be realized.

Lower Klamath River Basin/Coastal Area. Because this alternative does provide dam releases greater than the No Action Alternative, and flows are sufficient in magnitude and duration to partially emulate pre-TRD flow patterns during the spring and early summer relative to the No Action Alternative, the increased flow during the spring and early summer would improve water temperatures of the lower Klamath River. As compared to the No Action Alternative, the additional flows of this alternative would dilute Klamath River flow that could be of poor quality. During the late summer and early fall (beginning in September) when dam releases are reduced to less than those of the No Action Alternative, there would be a slight reduction in Klamath River water quality.

Central Valley. The elimination of TRD exports would significantly reduce the ability to meet temperature criteria in the Sacramento River. River temperatures would exceed the BO temperature objectives on average, approximately 12 percent more frequently compared to the No Action Alternative.

Shasta Reservoir carryover storage violations would increase 16.7 percentage points compared to No Action due to increased reliance on the reservoir to meet river temperature requirements in spring and early summer. This would be a significant effect.

Relative to No Action, modeled X2 position would increase (move east) 0.4 km in the average condition, 0.5 km in the wet condition resulting in a significant impact, and would have no increase in the dry condition. However, as previously noted, CALSIM operates the system to meet water quality standards in the Delta.

CALSIM results project reductions in Delta outflow compared to No Action, resulting in a general elevation of EC values compared to No Action. The greatest increase is at the Delta-Mendota Canal Intake, where January EC levels rise up to 9 percent in critical dry years. The maximum increase in the long-term averaged monthly values is 8 percent in October at Contra-Costa Canal Intake.

Existing Conditions versus Proposed Action.

Trinity River Basin. The modeled Proposed Action in the year 2020 has similar or fewer temperature violations in the Trinity River depending on water-year class than the modeled existing conditions. This is largely due to the diversion pattern under the Proposed Action that reduces Lewiston Reservoir warming in mid- to late-summer and the difference in minimum carryover storage. The greatest improvements (approximately 8 to 16 percent) are modeled to occur in the dry and critically dry water-year classes. Construction of the channel rehabilitation projects would result in an increase in short-term turbidity impacts compared to existing conditions, resulting in potentially significant short-term turbidity impacts in relation to NCRWQCB objectives (actual implementation of the projects would undergo a site-specific environmental review). However, the watershed protection component of the Proposed

Action would reduce sediment inputs into tributaries and, subsequently, into the Trinity River by 240,000 to 480,000 yd^3/year, which is approximately 9 to 17 percent of the average annual sediment produced in the basin. Implementation of this alternative is assumed to result in beneficial effects.

The Flow Evaluation Alternative was considered to have potentially significant impacts as compared to Existing Conditions relative to increased levels of mercury in-river due to the construction of channel rehabilitation projects, which have the potential to increase mobilization of mercury to the stream course and to increase potential for mercury methylation.

Lower Klamath River Basin/Coastal Area. The Proposed Action in the year 2020 provides variable releases by year class and large-magnitude flows during the spring and into mid-summer, thereby improving water quality of the lower Klamath River compared to existing conditions. Water temperatures of the lower Trinity River would be reduced compared to the existing conditions; and, as a consequence, the water temperature of the lower Klamath River would be maintained or slightly improved. The Proposed Action would provide additional flows that would contribute to dilution of Klamath River water. During the late summer and early fall when flows are equal to existing conditions, there would be no significant differences in water quality.

Central Valley. Modeled Sacramento River temperature violations would occur more frequently under the Proposed Action than under existing conditions (35.7 versus 29.0 percent of the months). However, 27 percent of the noncompliance is attributed to the increase in water demand assumed for the 2020 level of development. In spite of the large share of noncompliance attributed to increased demand, the increased frequency of violations attributable to Trinity is considered significant.

Proposed Action carryover storage violations also increased compared to existing conditions. For these reasons, the Preferred Alternative would cause significant effects relating to carryover storage.

Although CALSIM operates system resources to meet Delta water quality standards, there is a slight increase in modeled X2 position between existing conditions and the Proposed Action. Over the period of record average X2 position would increase approximately 0.1 km. In the wet period, X2 would increase approximately 0.6 km, and in the dry period, X2 is essentially unchanged. Delta standards continue to be met under this alternative. This change is considered less than significant.

CALSIM results also project general reductions in Delta inflow and outflow, as well as a substantial increase in SWP exports at Banks Pumping Plant to meet increased 2020-level demands in the Proposed Action relative to existing conditions. Due to these changes in Delta conditions, DSM2 Delta water quality results show increases in average monthly EC concentrations. The greatest increase is at the Contra-Costa Canal Intake, where April EC levels rise up to 10 percent in critical dry years. The maximum increase in the long-term averaged monthly values is 9 percent in January at Contra-Costa Canal Intake. However, these changes are primarily the result of increased demand, and the increment attributable to the preferred alternative is considered less than significant.

Mitigation.

The following mitigation would be implemented to reduce significant Trinity River turbidity-related impacts associated with the Flow Evaluation, 70 Percent Inflow, Modified Percent Inflow, and Revised Mechanical Restoration Alternatives to less than significant levels:

- A 401 water quality certification would be obtained from the NCRWQCB, after completion of site-specific environmental review, and a construction procedure would be developed to meet the Basin Plan turbidity requirements. Monitoring would be conducted as specified by the NCRWQCB, and efforts would be taken to reduce levels if they are 20 percent or more over background (e.g., isolating the work area and/or slowing or halting construction until the 20 percent level is achieved).
- Notify individual diverters with state diversion permits and riparian water rights within 2 miles downstream of any mechanical channel rehabilitation activity at least 2 days in advance of activities likely to produce turbidity.
- The Service and Reclamation shall provide the opportunity for full NOAA Fisheries participation on the technical team ("designated team of scientists" [Service and Reclamation, 2000], "technical modeling and analysis team" [TRMFR Draft EIS]) offering restoration program recommendations, and on the Trinity Management Council polity group (described in the TRMFR Draft EIS and Service and Reclamation [2000]). (Term from NOAA Fisheries BO.)
- The Service and/or Reclamation shall meet with NOAA Fisheries annually in March to coordinate during the advanced development and scheduling of habitat rehabilitation projects, including mainstem channel rehabilitation projects, sediment augmentation program, and dredging of sediment collection pools. (Term from NOAA Fisheries BO.)

Significant Trinity River temperature impacts identified for the Maximum Flow, 70 Percent Inflow, and Modified Percent Inflow Alternatives would need to be evaluated by the NCRWQCB and NOAA Fisheries.

The following mitigation could reduce impacts of temperature violations in the Trinity River:

- Bypassing the Trinity Powerplant could offset impacts to temperature related to Trinity Reservoir releases. Preliminary analysis of powerplant bypasses indicates that pulling colder water from lower in the reservoir could help alleviate temperature impacts in the Trinity and Sacramento Rivers. The magnitude, timing, costs, and benefits of powerplant bypasses would need to be evaluated on a case-by-case basis during specific dry/critically dry years with low carryover storage (see Section 3.5, Power Resources). (Term from NOAA Fisheries BO.)
- Changing operations of the TRSSH to use colder water from lower in Lewiston Reservoir to rear hatchery-produced fish. Currently, warmer water from the upper levels of Lewiston Reservoir is used to promote growth in rearing salmon and steelhead.
- "Slugging" Lewiston Reservoir with large quantities of cold water from Trinity Reservoir could reduce the warming effect of Lewiston Reservoir. This technique has been used in the past when climatic or hydrologic conditions have induced temperature violations.
- Increasing minimum storage requirements in Trinity Reservoir could increase the coldwater pool available for summer and fall releases.
- In years that Reclamation has reinitiated consultation pursuant to criteria established in the winter-run Chinook salmon CVP-OCAP BO, evaluate drawdowns of Trinity Reservoir below the 600 TAF minimum end-of-water year carryover level to the extent needed to avoid significant temperature-related loss of the early life stages of winter-run Chinook salmon (>10 percent as predicted by Reclamation's Salmon Mortality Model). Implementation of drawdowns below the 600 TAF minimum end-of-year carryover level in Trinity Reservoir shall be determined by Reclamation, Service, and NMFS on a case-by-case basis in dry and critically dry water years. (Term from NOAA Fisheries BO.)

The following mitigation measures would reduce potentially significant impacts from mercury release and mercury methylation to less than significant levels:

- Sediments removed during construction of restoration sites would be disposed in compliance with applicable hazardous materials regulations. Initial indications from sampling efforts in the watershed indicate that mercury levels are within allowable thresholds. However, sampling for presence of mercury in sediments excavated during construction of restoration sites will be conducted. Sediments slated to be excavated will be sampled once for every twenty feet of linear distance parallel to the river. Two thresholds will be used to determine hazardous nature of mercury contaminants. The first, called a NOAA ERL benchmark, will be used to determine whether sampled sediments must be removed from the river course or may be left within the normal course of the river. Sediment will be left in place where samples were recorded below 0.15 mg/kg for mercury. Sediment samples above the NOAA ERL benchmark, but below the TTLC and STLC thresholds (20 mg/Kg and 0.2 mg/L respectively) will be excavated and deposited above the 100 year flood plain. Deposits will be covered with topsoil and revegetated. Samples above TTLC and STLC thresholds will be treated as hazardous waste, removed, and transported to an approved hazardous waste treatment site. All activities will be performed pursuant to applicable laws.
- During the normal permitting process for construction of the restoration sites, TRRP staff will coordinate with the NCRWQCB to ensure that water quality objectives are met. During coordination with NCRWQCB staff, it may be determined that the above standards should be modified to better reflect local conditions at the restoration sites. Should alternate thresholds be identified by NCRWQCB staff, they would supercede the thresholds outlined above.
- Final design of the restoration projects shall include consideration of potential sources of sulfate and possible creation of anaerobic wetland environments that would accelerate mercury methylation. Restoration sites that create an interface between a known source of sulfate and an anaerobic condition are to be avoided.

Significant impacts identified for the increased frequency of Sacramento Basin temperature and carryover storage violations for the Maximum Flow, Flow Evaluation, 70 Percent Inflow, Revised mechanical, and Modified Percent Inflow Alternatives would need to be evaluated by NOAA Fisheries pursuant to the ESA. Such consultation could result in modification of the existing BO. An evaluation of effects on Sacramento fisheries and potential mitigation is presented in Section 3.4 fishery resources. Currently, ongoing ESA consultation with NOAA Fisheries is occurring through the OCQP process , as described in Section 1.

The following mitigation could reduce impacts of temperature violations in the Sacramento River:

- Bypassing the Trinity Powerplant in order to provide colder water for diversion to the Sacramento River (see above). (Term from NOAA Fisheries BO.)
- Reducing wet-season instream flow requirements for the Sacramento River to increase dry-season carryover storage in Shasta Reservoir.
- If approved by EPA, rescheduling the wet-season portion of the 200-cfs Iron Mountain Mine dilution flows to spring/summer in a way that would improve Sacramento River temperatures.
- Be prepared to make use of the auxiliary bypass outlets on Trinity Dam as needed, and pursuant to reinitiation of ESA Section 7 consultation regarding Sacramento River winter-run Chinook salmon, to protect water quality standards; associated actions may include modification of the export schedule of Trinity Basin diversions to the Sacramento River. (Term from NOAA Fisheries BO.)

In addition to consultation under ESA, the potentially significant water quality-related impacts (impacts to listed salmonids in the Sacramento River) could be lessened by the development of additional water supplies to meet demands. A number of demand- and supply-related programs are currently being studied across California, many of which are being addressed through the on-going CALFED and CVPIA programs and planning processes. Although none of these actions would be directly implemented as part of the alternatives discussed in this Supplemental EIS/EIR, each could assist in offsetting impacts resulting from decreased Trinity River exports. Examples of actions being assessed in the CALFED and CVPIA planning processes include:

- Develop and implement additional groundwater and/or surface-water storage. Such programs could include the construction of new surface reservoirs and groundwater storage facilities, as well as expansion of existing facilities. Potential locations include sites throughout the Sacramento and San Joaquin Valley watersheds, the Trinity River Basin, and the Delta.

- Purchase long- and/or short-term water supplies from willing sellers (both in-basin and out-of-basin) through actions including, but not limited to, temporary or permanent land fallowing.
- Facilitate willing buyer/willing seller inter- and intra-basin water transfers that derive water supplies from activities such as conservation, crop modification, land fallowing, land retirement, groundwater substitution, and reservoir re-operation.
- Promote and/or provide incentive for additional water conservation to reduce demand.
- Decrease demand through purchasing and/or promoting the temporary fallowing of agricultural lands.
- Increase water supplies by promoting additional water recycling.

Because the outcome of the planning processes described above remains unknown, water quality impacts to salmonid species in the Sacramento River are considered at present to be significant and unavoidable. It is anticipated as a result of presently ongoing consultation with NOAA fisheries on the revised CVP-OCAP that some or all of the above mitigation measures may be adopted as terms and conditions of any BO that results from that consultation. Additional discussion of these impacts are addressed in Section 3.4, Fishery Resources.

3.4 Fishery Resources

Fishery resources include fish populations and their habitats. This section discusses the existing environment within the Trinity River Basin, Lower Klamath River Basin/Coastal Area, and Central Valley with regard to native anadromous fish, resident native and non-native fish, and reservoir species, as well as the environmental consequences of implementing each of the alternatives presented in Section 2.0.

The conclusions reached through this section are based on detailed technical studies described at much greater length in the Fishery Resources Technical Appendix B. To the degree possible, the conclusions described in this section are expressed in language understandable to lay readers, as well as in relatively uncomplicated quantitative terms embodied in tables.

3.4.1 Native Anadromous Species

Anadromous fisheries have been impacted by a number of factors, including dams, which have substantially reduced habitat on the Trinity and Klamath Rivers and rivers in the Central Valley. In spite of those impacts, reduced anadromous salmonid fishery resources are still found within the Trinity River Basin, Lower Klamath River Basin/Coastal Area, and the Central Valley. Many of the fish species found within the lower Klamath River Basin are also found within the Trinity River Basin. The coastal areas adjacent to the Klamath River Basin provide habitat for maturing and adult anadromous fish species that return to the lower Klamath and Trinity River Basins. The TRSSH is intended to mitigate for the reduced salmon and steelhead production resulting from the loss of habitat and associated production upstream of Lewiston Dam by releasing steelhead, coho salmon, and Chinook salmon young into the Trinity River. Other native anadromous fish species found in the areas affected by the project include Pacific lamprey, green and white sturgeon, and eulachon.

Affected Environment.

Trinity River Basin. The native anadromous salmonid species of interest in the Trinity River and its tributaries include steelhead, coho salmon, and Chinook salmon. Of the three species, there are two spawning populations of Chinook salmon (spring and fall) and two spawning populations of steelhead (winter and summer). All anadromous species begin their life in fresh water, then migrate to the ocean to mature, and return to spawn in fresh water. Some life history and habitat requirements of these species and the spawning populations within species are presented in Table 3.4-1.

Although the three species have similar growth and migration patterns (Figure 3.4-1), they differ in the time of year they migrate and spawn, as well as when egg incubation typically occurs (Figure 3.4-2).

TABLE 3.4-1
Life History and Habitat Needs for Anadromous Salmonid Fish in the Trinity River Basin

Name	Migration	Spawning	Rearing	Rearing Habitat Description
Chinook (spring)	Spring-Summer	Early Fall	Winter-Spring-Summer	Shallow, slow-moving waters adjacent to higher water velocities for feeding.
Chinook (fall)	Fall	Fall	Winter-Spring-Summer	Shallow, slow-moving waters adjacent to higher water velocities for feeding.
Steelhead (winter)	Fall-winter	February-April	Year round	Areas of clean cobble where there is refuge from high velocities; juveniles overwinter for 1 to 2 or more years.
Steelhead (summer)	Spring-Summer	February-April	Year round	Areas of clean cobble where there is refuge from high velocities; juveniles overwinter for 1 to 2 or more years.
Coho	October-December	November-December	Year round	Backwater areas of slow water and pool margins; juveniles overwinter 1 year.

Adequate flows, temperatures, water depths and velocities; appropriate spawning and rearing substrates (e.g., riverbed gravels); and availability of instream cover and food are critical for the production of all anadromous salmonids. Spring Chinook salmon and summer steelhead also need long-term adult holding habitat in which pool size and depth, temperature, cover, and proximity to spawning gravel are important requirements. Newly emerged fry and juveniles of all species require rearing habitat with low velocities, open cobble substrate, and cool water temperatures. Emigration of smolts to the ocean and the immigration of spawning adults require adequately timed flows with the appropriate temperature, depth, and velocity.

Native non-salmonid anadromous species found in the Trinity River Basin include green and white sturgeon and Pacific lamprey. These fish spend their early life stages in fresh water, migrate to the ocean

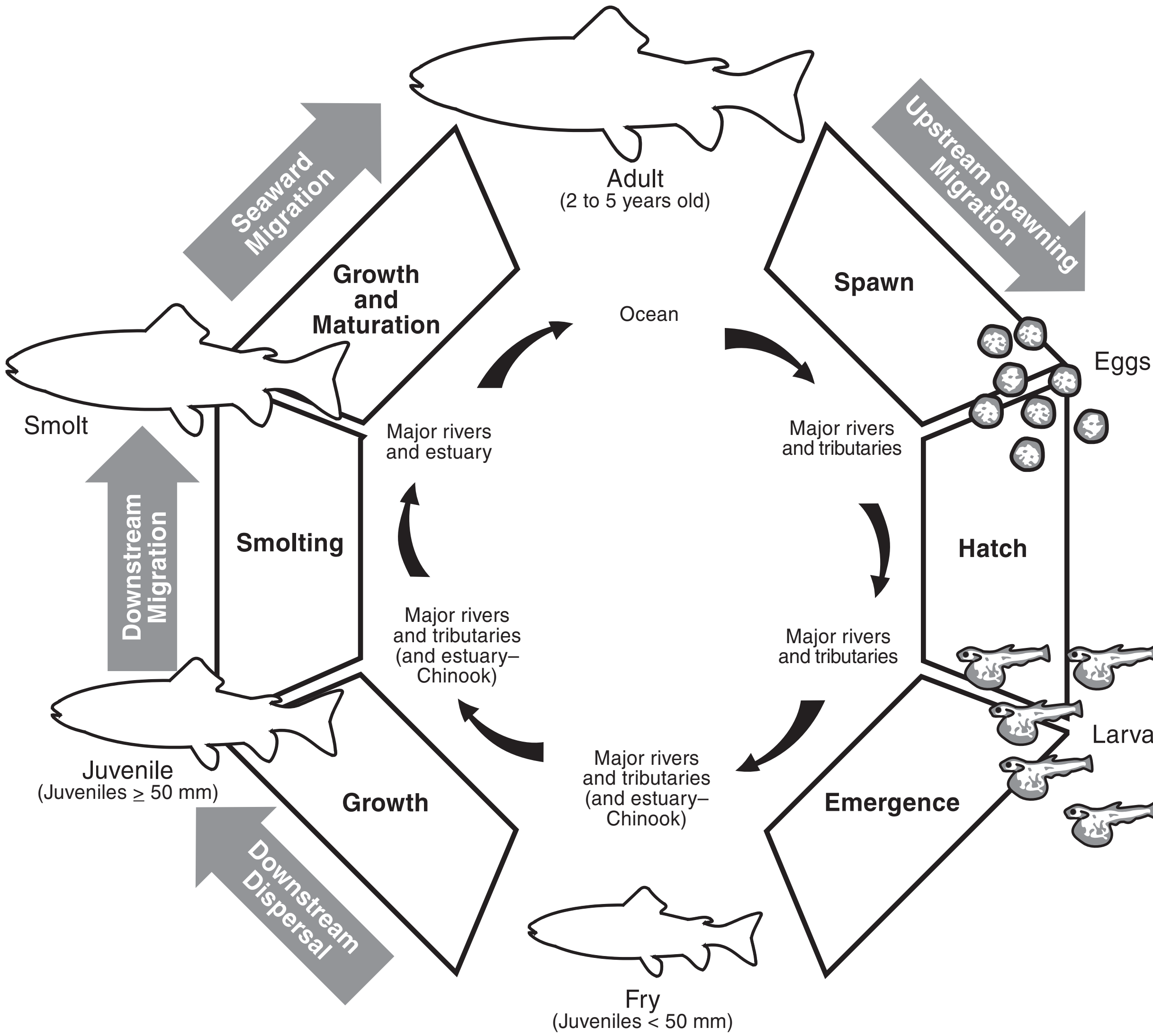

FIGURE 3.4-1
GENERAL LIFE HISTORY OF ANADROMOUS SALMONIDS
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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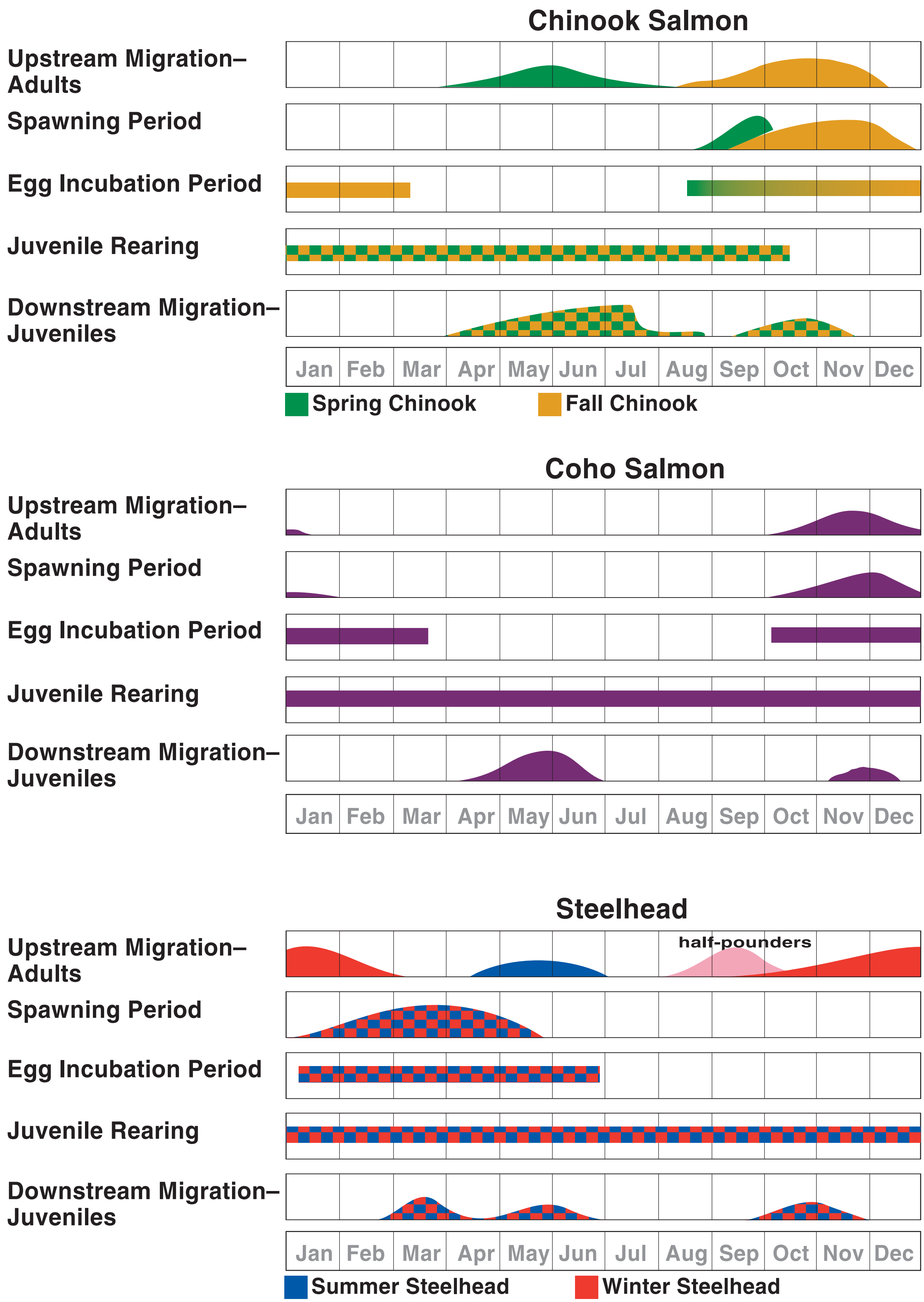

FIGURE 3.4-2
TEMPORAL DISTRIBUTION OF ANADROMOUS SALMONID
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

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for maturation, and return to their natal stream to spawn (Table 3.4-2). Status information on native non-salmonid anadromous species residing in the Trinity River Basin is very limited. However, the Klamath/Trinity River Basin is known to contain the largest spawning population of green sturgeon in California. In contrast, only small runs of white sturgeon occur.

TABLE 3.4-2
Life History and Habitat Characteristics of Non-salmonid Native Anadromous Fish in the Trinity River and/or Klamath River Basins

Name	Migration	Spawning	Rearing	Rearing Habitat Descriptions
Pacific Lamprey	April-July	Spring-early summer	Year round	Developing larvae burrow into silty river-bottom substrates, where they remain for 4 to 5 years before emigrating to the ocean.
Green and White Sturgeon	February-July	March - July	Year round	Juveniles inhabit estuarine environments for 4 to 6 years before migrating to the ocean.
Eulachon	March-April	March-April	--	Adhesive eggs anchored to bottom until hatched; larvae quickly transported to ocean.

<u>*Trinity River Restoration Program Goals*</u>. The 1983 EIS on the Trinity River Basin Fish and Wildlife Management Program (Service, 1983) documented the inriver spawner escapement goals and the TRSSH production goals developed by CDFG. The goals were subsequently adopted by the TRRP as escapement numbers. The inriver goals represent the total number of naturally-produced adult spawners (excluding jacks) for the Trinity River Basin below Lewiston Dam and exclude fish caught by the commercial, recreational, and tribal fisheries (Table 3.4-3). The hatchery goals represent numbers of adult fish needed by the hatchery, exclusive of fisheries for Chinook and coho salmon (an undefined inriver harvest is included in the restoration program goals for steelhead).

TABLE 3.4-3
Trinity River Restoration Program Goals

Species	Inriver Spawner Goals	Hatchery Goals	Total
Fall Chinook Salmon	62,000	9,000	71,000
Spring Chinook Salmon	6,000	3,000	9,000
Coho Salmon	1,400	2,100	3,500
Steelhead	40,000	10,000	50,000

Because the project purpose is the restoration and maintenance of the natural production of anadromous salmonids below Lewiston Dam, the following discussions concern the inriver spawner escapement goals (adults only) and the numbers of fish returns (jacks and adults) that were naturally produced. Restoration and maintenance of natural production implies that the fish spawning in river began their life as eggs in the river and that a sufficient percentage of those eggs spawned in the river survive to return as adults to spawn; in other words, naturally producing populations are self-sustaining.

Inriver spawner escapement is the number of fish returning to spawning grounds, which in reality consists of two factions: naturally-produced fish and hatchery-produced fish. However, hatchery-produced fish are not considered to contribute towards the inriver spawner escapement goals of the TRRP, although their offspring do (i.e., if hatchery-produced fish spawn inriver and their offspring survive to return to spawn, these offspring are naturally produced by definition [see "natural production" in glossary]). The best available data indicate that large numbers of hatchery-produced fish spawn inriver. Typically, more fish spawn inriver than are spawned at the hatchery, and relatively fewer inriver eggs survive to return as adults. Assuming that hatchery- and naturally-produced fish are subject to the same environmental conditions after the hatchery releases its fish (typically as smolts), the relatively low returns of naturally-produced fish are indicative of low survival rates of young freshwater life stages (eggs, fry, and/or juvenile fish).

Fall Chinook Salmon Populations. Although annual pre-dam escapement data are sporadic, estimates of Chinook salmon in the Trinity River prior to 1964 above the North Fork have ranged from 19,000 to 75,600, and averaged 45,600 for the 5 years of available data. Comparisons between pre- and post-dam averages are problematic because (1) few pre-dam estimates exist; (2) pre-dam estimates typically represent fish spawning in the river above the North Fork, while post-dam estimates are above Willow Creek; and (3) post-dam estimates are only for the river below Lewiston and are confounded by large numbers of hatchery-produced fish that spawn in natural areas (recent changes have been implemented to reduce competition of hatchery-produced fish with naturally-produced spawners).

Comparisons between pre-dam escapements and the TRRP inriver spawner escapement goals are also problematic because the inriver goals represent the numbers of fish that could be produced in the entire Trinity River Basin below Lewiston Dam once successful restoration is completed, whereas the pre-dam numbers are sporadic and limited to the Trinity River above the North Fork. Because of these problems, the following discussions focus on the current post-dam estimates relative to the TRRP inriver spawner escapement goals as an indicator.

According to the TRRP goals, the hatchery is to produce 9,000 returning fall Chinook spawners for the hatchery, and the river below Lewiston is supposed to produce 62,000 naturally-produced fall Chinook spawners. Both of these goals are exclusive of harvest. Yearly estimates of fall Chinook salmon runs in the Trinity River Basin have been made by the CDFG since 1978, as a part of the Klamath Basin Fall Chinook Salmon Spawning Escapement Estimate (see the Fishery Resources Technical Appendix B). CDFG's post-dam inriver spawner escapement estimates for the Trinity River Basin upstream of the Willow Creek weir from 1982 through 2002 averaged 31,848 fall Chinook salmon, of which an average of 19,801 are hatchery-produced/origin fish. The river below Lewiston produced an average of 12,047 naturally-produced fall Chinook spawners, which is approximately 19 percent of the TRRP goal of 62,000 naturally-produced fall Chinook salmon (Table 3.4-4). Naturally-produced fish have ranged from 10 to 94 percent of inriver spawner escapements (Figure 3.4-3), with an annual average of 42 percent.

TABLE 3.4-4
Comparison of TRRP Inriver Spawner Escapement Goals to Average Numbers of Naturally-produced Fish

Species	TRRP Inriver Spawner Escapement Goals	Average Inriver Escapement of Naturally-produced Fish	Years of Available Data	Percent of TRRP Goal Met
Fall Chinook Salmon	62,000	12,047	1982-2002	19
Spring Chinook Salmon	6,000	3,217	1982-2002 (excluding 1983 and 1995)	54
Coho Salmon	1,400	582	1991-2002 (excluding 1996)	42
Steelhead	40,000	2,326	1992-2002 (excluding 1995-2001)	6

<u>*Spring Chinook Salmon Populations*</u>. Escapement surveys for the years 1982 through 2002 (excluding 1983 and 1995 because surveys were not conducted in those years) indicate that an average of 61 percent of the inriver spawner escapement of Trinity River spring Chinook salmon is hatchery produced/origin. Conversely, only 39 percent (3,217 annually) were naturally produced, which represents approximately 71 percent of the TRRP goal of 6,000 spring Chinook in the Trinity River (Table 3.4-4).

<u>*Coho Salmon Populations*</u>. Trinity River coho salmon populations were historically much smaller than Chinook salmon populations. Pre-dam estimates for coho salmon spawning above Lewiston were 5,000 fish (Service/CDFG, 1956). Total run size for Trinity River

coho salmon below Lewiston Dam for 1973 through 1980 averaged 3,300 adults (Leidy and Leidy, 1984). The estimate includes hatchery production. From 1991 through 2002 (excluding 1995 when no surveys were made), naturally-produced coho salmon spawning in the Trinity River upstream of the Willow Creek weir averaged 582 fish, ranging from 0 to 19 percent of the total annual inriver escapement (an annual average of 7 percent). Approximately 11,332 of the coho salmon spawning inriver are produced by the hatchery. The average of 582 naturally-produced coho salmon represents approximately 42 percent of the TRRP goal (Table 3.4-4).

Steelhead. Pre-dam winter steelhead spawner escapements in the Trinity River and its tributaries upstream of Lewiston have been estimated to range from 6,900 to 24,000 adults. From the years 1980, 1982-1984, and 1988-2002, the estimated total inriver spawner escapement of the fall/early winter portion of winter steelhead upstream of the Willow Creek weir averaged 7,880 adult fish. Estimates of inriver naturally-produced spawning steelhead for the years 1992 through 1995 and 2002 averaged 2,326 fish upstream of the Willow Creek weir (surveys from fall and early winter period only). This average represents approximately 6 percent of the TRRP inriver spawner escapement goal of 40,000 adult steelhead (Table 3.4-4). Estimates for the remaining winter portion of the escapement are unavailable because increased river flows render fish-counting weirs inoperable.

Pre-dam summer steelhead spawner escapements for the Trinity River upstream of Lewiston were estimated to average 8,000 adults annually. Recent post-dam CDFG survey estimates have ranged from 20 to 1,037 adult summer steelhead in the tributaries and Trinity River. The TRRP escapement goals do not establish specific targets for summer steelhead in the Trinity River, nor does the TRSSH mitigate specifically for summer steelhead.

Some Trinity River steelhead return to the river 4 to 6 months after first emigrating to the ocean. Upon their return these fish are known as half-pounders. They feed in the river but do not spawn. They subsequently return to the ocean before returning to spawn. When in the half-pounder phase, these fish are not counted as part of the escapement, but they are important to the sport fishery.

Species Listed and Proposed for Listing under the Endangered Species Act and California Endangered Species Act. The Southern Oregon/ Northern California Evolutionary Significant Unit (ESU) of naturally-produced coho salmon was listed as threatened pursuant to the ESA on April 25, 1997. This listing includes naturally-produced coho from the Trinity River and Klamath River Basins. Critical

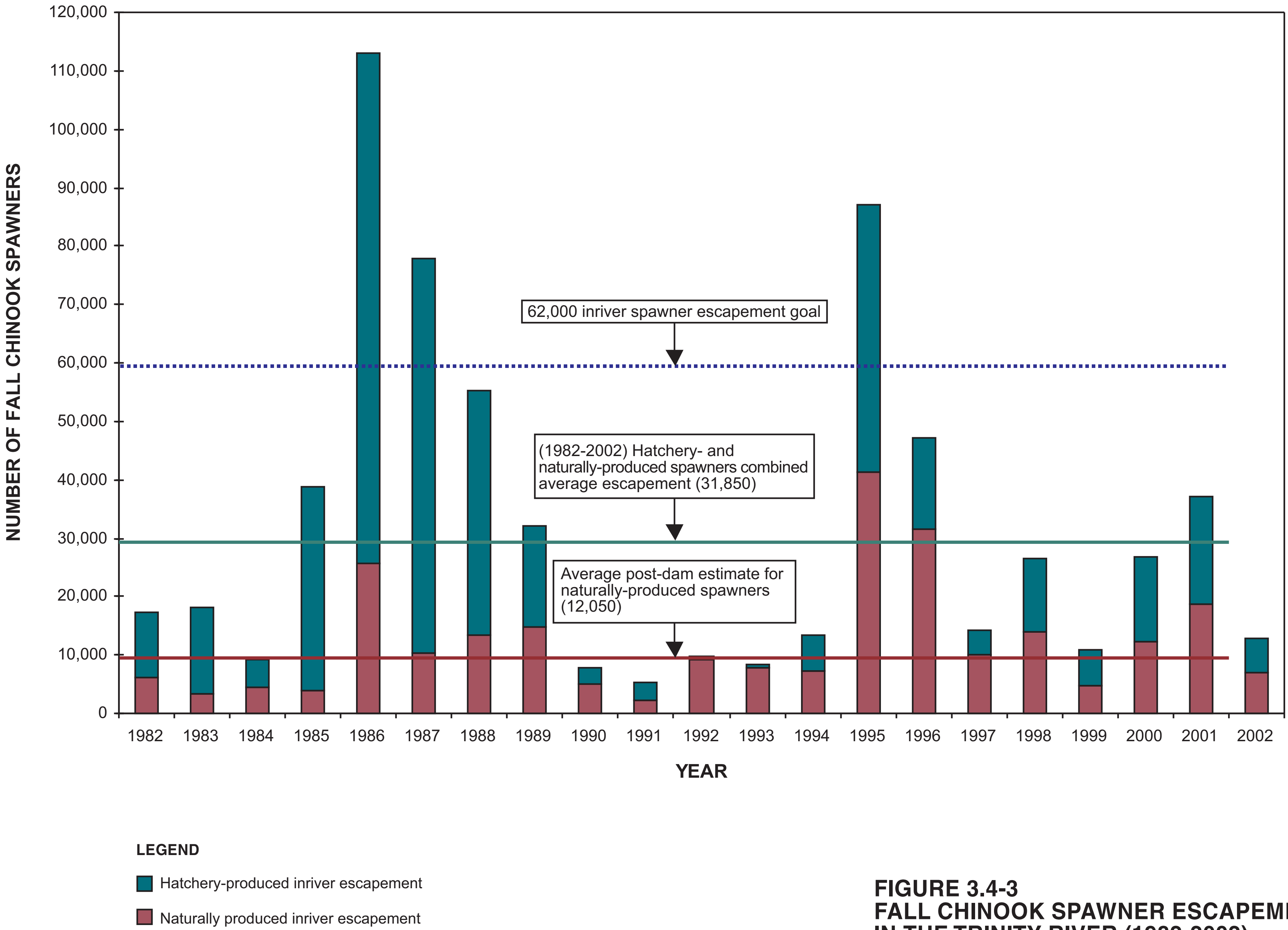

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FIGURE 3.4-3
FALL CHINOOK SPAWNER ESCAPEMENT IN THE TRINITY RIVER (1982-2002)
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

habitat for the ESU was designated on May 5, 1999. Under CESA, coho salmon runs north of San Francisco are a state species of special concern.

The Klamath Mountains Province ESU steelhead, which includes stocks from the Trinity River, was first proposed for listing as threatened on March 16, 1995; but on April 4, 2001, NOAA Fisheries, following a re-evaluation of the status of the species, determined that the population did not warrant threatened status.

Trinity River Salmon and Steelhead Hatchery. The TRSSH is operated by CDFG and funded by Reclamation to mitigate for the loss of salmonid production above Lewiston Dam. TRSSH's current goals are to release sufficient juveniles to provide for returns to the hatchery of 12,000 Chinook (3,000 spring and 9,000 fall), 2,100 coho, and 10,000 steelhead through artificial propagation. Concerns regarding the potential impacts of hatchery operations on naturally-produced populations of the Klamath River Basin (including the Trinity River) prompted the CDFG to institute new hatchery operations in 1996 to minimize future impacts.

Fish Harvest. The harvest of Klamath River Basin fall Chinook salmon (including Trinity River Basin) is managed jointly by the CDFG, Oregon Department of Fish and Wildlife, California Fish and Game Commission, Yurok Tribe, Hoopa Valley Tribe, NOAA Fisheries, and BIA. The PFMC and the Klamath Fishery Management Council are allocation forums for the ocean and ocean/inriver fisheries, respectively. The mixed-stock ocean population is harvested by commercial and sport fisheries; and the inriver population is harvested by tribal (ceremonial, subsistence, and commercial) and sport fisheries. Chinook salmon harvest (both fall and spring) includes both naturally-produced and hatchery-produced fish.

Coho harvest in the ocean commercial troll fishery has been prohibited in California and Oregon, and reduced in Washington, since 1994. Coho harvest has also been prohibited in the California ocean sport fishery, and reduced in Oregon. Coho harvest is only allowed in the tribal inriver fisheries as incidental take during the harvest of Chinook salmon.

Steelhead are rarely caught in the ocean commercial and sport fisheries, but are harvested by the inriver tribal and sport fisheries.

Historically, Klamath/Trinity River Chinook and coho populations have been harvested in the ocean from Monterey County, California, to the Oregon/Washington border. Ocean harvest of naturally-produced salmon may have been sufficient in the late 1970s to cause declines in Klamath River Basin (including Trinity River) populations, but, based on the best available data, fall Chinook harvest management restrictions implemented since 1986 have decreased harvest impacts to levels believed to be sustainable.

Habitat Conditions. Construction and operation of the TRD, combined with watershed erosion, large-scale gold dredging, and other harmful land management activities, have caused major changes in habitat conditions in the Trinity River. Factors that have resulted in adverse effects on fish habitat include:

- Obstruction to river reaches upstream of Lewiston Dam
- Changes to quantity and timing of flows
- Changes in channel geomorphology
- Changes in substrate composition caused by addition of fine sediments and restriction of gravel recruitment
- Changes in water temperature

The TRD dams blocked access to 59 miles of Chinook salmon habitat, 109 miles of steelhead habitat, and an undetermined amount of coho salmon habitat (Service, 1994). Much of this habitat was prime spawning and rearing habitat. In the case of the Chinook, it represented 50 percent of spawning habitat in the basin. As early as 1980, overall decline in spawning habitat was estimated at 80 to 90 percent (Service, 1980). Furthermore, elimination of the upstream reaches greatly reduced the diversity of the entire river system, thereby reducing habitat choices for salmonids.

For the first 21 years of TRD operations, Lewiston Dam releases to the Trinity River were only 21 percent of natural flows. The volume of water initially set aside for Trinity River fishery resources during this time period was 120 taf, which was only exceeded during extreme storm events or for fishery studies. Perhaps more significantly, the peak winter and spring flows were eliminated or greatly reduced. The harmful effects of the reduced flows were manifested in several ways, including changes to channel geomorphology, substrate composition, and water temperatures. Ultimately, the reduction in flows has lead to a reduction in habitat. For example, spawning habitat losses have been estimated to be 80 percent in the first 2 miles below Grass Valley Creek, and 50 percent in the 6 miles downstream of that confluence (Service, 1994).

Reduced river flows, increases in fine sediment input, and reductions in coarse sediment recruitment are the primary factors in changes to channel geomorphology resulting in the reduced quality, quantity, and suitability of fish habitat and reduced survival of freshwater life stages. The altered channel geomorphology reduced the number and quality of alternate bar sequences. Important salmonid habitats associated with alternate bars include: pools that provide cover from predators and cool resting places for juveniles and adults; gravelly riffles where adults typically spawn; open gravel/cobble bars that create shallow, low-velocity zones important for emerging fry; and slack-water habitats for rearing juveniles.

Since TRD operation, the Trinity River has become channelized (i.e., the river banks have become more vertical, and there is little lateral movement of the channel within the floodplain). Consistently low river flows allowed the encroachment and establishment of riparian vegetation. The roots of the vegetation, which bound spawning gravel, and the stalks of the vegetation, which encouraged deposition of fine sediment, lead to the formation of sand berms along the river banks. This encroachment of riparian vegetation and subsequent berm formation further narrows the channel and reduces shallow, low-velocity salmonid rearing habitat and habitat diversity. (See Geomorphic Environment [Section 3.2] in the Draft EIS/EIR for additional information.)

Changes in substrate composition have occurred because of increases in fine sediment (from increased watershed erosion and attenuation of sediment-transporting flows) and the reduction of coarse sediment (e.g., gravel) recruitment (due to the dams). Fine sediment fills in spaces between gravels and cobbles, which inhibits the percolation of water through these areas, degrading and reducing available spawning habitats. Sedimentation of spawning areas can inhibit flow (and thus oxygen) to incubating eggs as well as create an impenetrable barrier that prevents salmon sac-fry from emerging from their gravel nest. Accumulation of fine sediments can also decrease the amount of space between gravel and cobble, thereby decreasing the amount of available habitat for overwintering juvenile coho salmon and steelhead that burrow into the substrate. Sedimentation may also decrease aquatic invertebrate production and diversity, thereby limiting the primary food source for juvenile salmonids.

Construction and operation of the TRD changed the thermal diversity available to Trinity River anadromous salmonids. The dams blocked access to the upstream reaches that are dominated by snowmelt runoff and remain cool throughout the year. Prior to the dam, these areas provided important juvenile rearing and adult holding habitats for salmonids when the majority of the lower mainstem habitats (i.e., below Lewiston) had likely become too warm. The upstream tributaries (dominated by snowmelt) provided increased flows and decreased temperatures during the spring and early summer that aided smolt emigration through much of the mainstem. Because these habitats are now blocked by the TRD, and much of the snowmelt is retained in the TRD reservoirs, it is necessary to artificially maintain cooler temperatures below the dam than those that existed prior to the dam. In other words, the mainstem below the dam must now function thermally like the upstream reaches and tributaries (for anadromous salmonids). Exacerbating the problem is the decrease in geomorphic diversity below the dam. Prior to the TRD, water temperatures in the deep mainstem pools stratified; bottom layers were documented as much as 7°F cooler than upper layers (Moffett and Smith, 1950). The cool temperatures at the bottom of the pools provided important thermal refugia for migrating adult and rearing juvenile salmonids. The altered flow regime and channel geomorphology decreased or eliminated the temperature stratification in pools in the summer/ early fall months. Although average post-dam monthly water temperatures at Lewiston are cooler than pre-dam temperatures during June to November, this benefit has not fully compensated for the lost thermal diversity in the system (i.e., above the dams) or for the reduction in stratified pools.

Habitat Restoration Projects. Since the early 1980s, the Trinity River Basin Fish and Wildlife Restoration Program has conducted a variety of restoration activities in the Trinity River and its tributaries. Some activities conducted in tributaries include watershed restoration work, as well as habitat enhancement projects, and dam construction and pool dredging in Grass Valley Creek to decrease the amount of fine sediment entering the Trinity River. Restoration activities that have been implemented in the mainstem include gravel placement, pool dredging, and construction of several channel rehabilitation projects (side channels and bank rehabilitation of point bars).

The Trinity River Basin Fish and Wildlife Restoration Program constructed 27 channel rehabilitation projects on the Trinity River between Lewiston Dam and the North Fork: 18 side-channel projects and 9 bank rehabilitation projects (also known as feathered-edge projects). Monitoring documented Chinook salmon spawning within the constructed side-channels. Observations also indicate that the side channels are used extensively during the spring by rearing Chinook salmon juveniles and coho fry. (Glase, 1994 pers. comm).

The remaining nine projects were bank rehabilitation projects between Lewiston Dam and the North Fork. The projects were constructed by physically removing vegetated sand berms along the bank to restore the channel to a pre-dam configuration. Channel rehabilitation sites are significantly wider and shallower than corresponding control sites at intermediate and high flows. Along with promoting formation of alluvial features characteristic of unregulated rivers, channel rehabilitation projects have been shown to increase the amount and diversity of habitat for adult and juvenile salmon and steelhead. During recent investigations, salmonid fry habitat indexes were greater at rehabilitation sites than at corresponding control sites. Catch-per-effort for Chinook salmon fry was also greater at rehabilitation sites than at control sites, suggesting greater habitat use at these sites. Spawning surveys at project locations have also shown high use of these areas by spawning Chinook salmon.

The Trinity County Planning Department and the Trinity County Resource Conservation District compiled a database of 477 known fishery and watershed restoration projects in the Trinity River Basin and the Lower Klamath River Basin between the confluence of the Trinity River and the mouth of the Klamath River (Trinity County Planning Department, 2003).

Lower Klamath River Basin/Coastal Area. The Klamath River is California's second largest river, with an average annual flow in excess of 13 maf. The river provides habitat for Chinook and coho salmon, and winter and summer steelhead. Coastal cutthroat trout are also found in the lower reaches.

Native non-salmonid anadromous fish found in the Klamath River include Pacific lamprey and green and white sturgeon. Large runs of candlefish (eulachon) occurred in the lower Klamath River as recently as the 1970s; however, today the run size is small and sporadic. In some years, e.g., 1999, a small run is documented, while in other years the run goes unnoticed. The reasons for their decline are not known.

The coastal area adjacent to the Klamath River Basin provides habitat for the oceanic stages of anadromous fish found in the lower Klamath and Trinity River Basins. Habitat conditions in the coastal area and ocean environment are subject to natural ecosystem productivity as affected by physical and biological oceanic processes, weather, and climate. The primary influence of humans on anadromous salmonids in the coastal areas adjacent to the Klamath River Basin is ocean commercial and sport harvest.

CDFG compiles annual estimates of fall Chinook spawner escapements and tribal and sport harvests in the Klamath River Basin. The average inriver fall-run Chinook salmon estimate for the Klamath River Basin for the period 1982 through 2002 is approximately 128,700 adults and jacks. The estimated total spawner escapement (inriver run: inriver harvest and harvest mortality) in the Klamath River Basin during that period has averaged approximately 90,500 spawners. Klamath River Basin fall Chinook are managed for a 33 to 34 percent brood escapement rate, or a minimum escapement level of 35,000 fish, whichever is greater (excluding returns to hatcheries). This minimum was established in 1989 by the PFMC. Long-term declines of Klamath River Basin fish populations have been attributed to land use conflicts, water diversions, harvest, ocean conditions, dams, and inriver habitat conditions.

The lower Klamath River supports a sport fishery for anadromous salmonids. In addition, approximately 80 percent of the Klamath/ Trinity Indian gill-net harvest of salmon occurs in the lower Klamath River.

Central Valley. The Central Valley provides habitat for several species of native anadromous fish, including freshwater stages of Chinook salmon and steelhead. (A thorough discussion of Central Valley fisheries is provided in the CVPIA PEIS and associated appendices.) The Sacramento and San Joaquin Rivers provide corridors to the ocean for anadromous salmonids spawned and reared within Central Valley rivers, streams, and hatcheries.

The Sacramento River is the largest river system in California and, along with the hatcheries on its tributaries, produces more than 90 percent of the Central Valley salmon and steelhead. The Sacramento River supports four runs of Chinook salmon: fall, late-fall, winter, and spring, with fall Chinook being the most abundant. From 1967-1991 the fall Chinook spawner escapement in the mainstem Sacramento River averaged 77,000 fish; for late-fall Chinook it averaged 14,000 fish, and for spring Chinook it averaged 11,000 (Reclamation, 1997). Most of the Central Valley fall steelhead are also found in the Sacramento River Basin. Coho salmon and cutthroat trout are not currently known to reside in the Central Valley.

Many factors affect the abundance of anadromous fishery resources in the Central Valley. Many of the same factors that resulted in declines in fishery resources over the past 150 years continue to plague existing populations. Those factors include: modification and loss of habitat, reduction in magnitude and change in timing of streamflows, damming and diversions, deterioration of water quality (including temperature), sport and commercial harvest, and competition and loss of genetic diversity through cross breeding with hatchery-produced fish. The direct cause and effect relationships of any one or all of these factors as they may have and continue to affect anadromous fish populations are unknown. Cumulatively, they have taken their toll on these species' ability to exist in the Central Valley. Ongoing efforts to arrest the decline and restore native anadromous fish populations, including projects resulting from the 1992 CVPIA, are ongoing in an attempt to reverse the decline of those populations.

Native non-salmonid anadromous fish in the Central Valley include green sturgeon, white sturgeon, and Pacific lamprey. The population of adult white sturgeon in the Central Valley has been estimated to be

64,000 fish. Adult green sturgeon abundance is estimated at 870 fish. There are no estimates of Pacific lamprey in the Central Valley.

The population status of most, if not all, of these species are less precisely known than that of the anadromous salmonids in the Central Valley. With the exception of hatchery and commercial harvest, the factors affecting the abundance of native non-salmonid anadromous species are likely similar to those for native salmonid species. Reductions and timing of flows, loss of habitat quantity and quality, and water diversions likely have been largely responsible for declines in population of these species.

Limiting Factors. Major factors limiting native anadromous fish populations in the Central Valley include:

- Water diversions, including several large diversions and hundreds of unscreened diversions throughout the Sacramento and San Joaquin Rivers.
- Water diversions at the state and federal pumps in the Delta.
- Increased water temperatures within Central Valley rivers and the Delta.
- Blockage of habitat by major dams (e.g., Shasta Dam).
- Habitat loss and degradation in the rivers and the Delta.
- M&I, agricultural, and mining waste discharge that degrades water quality.
- Predation by introduced species.
- Inadequate instream flows within the rivers and reduced outflows in the Delta.
- Altered Delta inflow and outflow that affect salinity, currents, nutrient levels, and pollutant concentrations.

Species Listed and Proposed for Listing under the Endangered Species Act and California Endangered Species Act. Winter-run Chinook salmon were listed endangered under the CESA in 1989. They were listed as threatened under the ESA in 1989 under emergency provisions, and formally listed in 1990. (For a discussion of the legal requirements created by both CESA and ESA, see Section 5.0 of the Draft EIS/EIR.) On January 4, 1994, they were reclassified as endangered. On June 16, 1993, NOAA Fisheries designated critical habitat for the species as the Sacramento River from Keswick Dam to San Francisco Bay. The Central Valley ESU steelhead was listed as threatened under the ESA on May 18, 1998. Central Valley ESU spring Chinook salmon were listed as threatened under the CESA on February 6, 1999, and were listed as threatened under the ESA on November 15, 1999. Fall and late-fall Chinook salmon ESUs remain candidates for listing under ESA.

Environmental Consequences.

Methodology. Alternatives were compared against one another under the following set of conditions likely to be in place by the year 2020:

- The Trinity River Hatchery would be operated as it is currently, and operations would not impact natural production of anadromous salmonids.
- All anadromous salmonid species would respond similarly to actions of any particular project, except as noted below.
- Any rehabilitation sites and/or watershed work are assumed to be complete, and the river system processes would be functioning at the full level of their ability within the given flow regime(s). The anadromous fish populations, although not constant from year to year because of varying environmental conditions (especially oceanic factors), would be at their long-term average.
- Except as noted, the analysis assumed the historical distribution of Trinity River Basin water-year classes.

The Trinity River System Attribute Analysis Method (TRSAAM) was developed to analyze the proposed alternatives. The TRSAAM was developed using the fundamentals and relationships of key river system characteristics and functions that create and maintain diverse salmonid habitats (Service and Hoopa Valley Tribe, 1999) (see the Geomorphic Environment [Section 3.2] of the Draft EIS/EIR). The methodology used to analyze the geomorphic environment (i.e., healthy alluvial river model) was modified and used to evaluate the impacts of the alternatives on fishery resources. The TRSAAM used 9 of the same 10 attributes and objectives presented in Table 3-1 of the Draft EIS/EIR. Water temperatures were evaluated separately as to their ability to meet salmonid smolt emigration requirements because of the possible independent nature of temperature effects separate from structural habitat considerations (Fishery Resources Technical Appendix B). Together, the 10 TRSAAM attributes and the smolt water temperatures assessment were identified as essential to the integrity of a healthy alluvial river system and to the restoration of naturally-produced salmon and steelhead populations.

The TRSAAM analysis assumes that the geomorphic environment and the quality and quantity of fish habitat are intrinsically connected. Restoring these attributes would restore the diverse, high-quality habitats that salmon and steelhead need to survive and successfully reproduce; the more high-quality habitat available, the better the populations' recovery will be. Because there are three species of salmonids, each with different depth and velocity preferences for each life stage, a wide variety of habitats is needed to provide suitable conditions for all life stages of all species.

Each alternative's flow schedule was assessed for its ability to meet the thresholds and frequencies associated with 9 of the 10 attributes (flow schedules did not include consideration of uncontrolled spills). Each objective of the attributes was assigned a score of 0, 1, or 2, depending on how well the objective was satisfied. For each alternative, the total score was divided by the maximum potential score. The assumptions used in the TRSAAM analysis included the following:

- If actions are made that move closer to meeting desirable system attributes, fish production will increase.
- Except as noted below, all attributes are weighted equally for evaluation of fish production. (This assumption was made because data were not available to determine relative weighting of the attributes.)
- Attributes provide and maintain habitat for all freshwater life stages of anadromous fish.
- Decline of one attribute can negate the benefits to fish of all other attributes. (For example, the benefit of increased spawning habitat may be negated if there is insufficient rearing habitat to support the resulting higher numbers of fry. In this case, limited rearing habitat could act as a bottleneck to fish production, thereby negating the benefits of attributes that affect earlier life stages.)
- Numbers derived from this analysis are considered an index, intended to show differences in habitat restoration potential for alternatives.

The methods for assessment of water-temperature influences on potential salmonid smolt production in the Trinity River are found as Attachment B5 to the Fishery Resources Technical Appendix B. The object of this analysis was to assess, evaluate, and discriminate differences (if any) among proposed project alternatives with regards to the effects of water temperature on the smolting success of anadromous salmonids in the mainstem Trinity River. Water temperature is crucial to the success of salmonid populations. To assess temperature effects on smolt outmigration as a potentially limiting factor, the evaluation of water temperature effects was removed from TRAASM and evaluated independently. Adverse water temperature conditions could result in large losses of sensitive salmonid life stages (i.e., smolts) regardless of other habitat conditions within the watershed. A detailed evaluation of the effects of water temperature on emigrating smolts for the three principal salmonid species, steelhead, coho salmon, and Chinook salmon, in the Trinity River was conducted because of its importance to survival during outmigration and recruitment to the population.

This analysis focused on potential smolt survivability, using smolt life-stage-specific temperature threshold criteria identified for these species in the Trinity River (Service and Hoopa Valley Tribe, 1999). Additional information used in this analysis included smolt emigration timing, specific river flows, and flow/temperature relationship estimates. These factors were used to estimate smolt survival estimates and to develop an index of smolt survival suitability for each of the species for each alternative and No Action. These indices, predicting smolt outmigration success at Weitchpec, were then compared to distinguish performance of proposed project alternatives in meeting the water temperature needs of steelhead, coho salmon, and Chinook salmon the Trinity River.

Furthermore, the influence of differing flow regimes and resulting water temperatures on Chinook salmon smolt survival was used to develop an adult Chinook harvest index. This index, which used input parameters developed from the Trinity River Chinook salmon life cycle (SALMOD) model (Williamson, et al., 1993; and Service and Hoopa Valley Tribe, 1999), was calculated for each alternative and No Action. The calculated Chinook salmon harvest index for each alternative was compared to that estimated for the No Action Alternative to distinguish the effects of water temperature conditions on Chinook salmon populations in the future.

Additionally, as a comparative tool, fine- and coarse-sediment transport was computed for each alternative and for each water-year class for that alternative. The weighted annual fine- and coarse-sediment transport rates for the Lewiston and Limekiln gaging stations as reported in the Trinity River Flow Evaluation Study (Service and Hoopa Valley Tribe, 1999) were averaged and summarized. The implications of the computed fine- and coarse-sediment transport rates were considered in light of the following:

1. Ability to transport and route coarse sediment delivered from tributaries
2. Coarse-sediment imbalance in the reach immediately downstream of Lewiston Dam, which would require compensating coarse-sediment introduction to maintain coarse-sediment storage

3. Ability to transport large volumes of fine sediment, which would reduce fine-sediment storage in the mainstem Trinity River

To assess the ability of each alternative to provide conditions conducive to riparian seed dispersal and riparian forest regeneration along the mainstem Trinity River, the stage-discharge curve at the Lewiston gaging station, and assumptions of target floodplain surface for riparian inundation, the hydrograph for each alternative was evaluated for riparian initiation. The hydrographs for extremely wet and wet water years were plotted, and the receding hydrograph necessary for riparian initiation was also plotted. For the 70 Percent Inflow Alternative and Modified Percent Inflow Alternative, median extremely wet and wet years were used from the 1912 through 2002 period of record.

The following additional assumptions were used to qualitatively evaluate effects of project alternatives on native anadromous species in the Lower Klamath River Basin:

∉ Increased coldwater releases to the Trinity River are not harmful for emigrating and immigrating anadromous salmonids in the Lower Klamath River Basin.

∉ Large increments of increased flow in the Trinity River would improve habitat conditions and river health in the Lower Klamath River Basin.

∉ Mechanical rehabilitation of riverine habitats within the Trinity River would not affect anadromous salmonids in the Lower Klamath River Basin.

∉ Watershed protection in the Trinity River would improve habitat conditions and system health in the Lower Klamath River Basin.

Except as noted below, it was assumed that any benefits or adverse effects on native non-salmonid anadromous fish in the Trinity and Klamath River Basins would be the same as those for anadromous salmonids. This assumption is based on the fact that native non-salmonid anadromous fish evolved in and adapted to the same pre-dam environment that native salmonids did.

It was assumed that there would be no measurable effects on food availability, rates of survival, or other impacts to anadromous salmonids in the adjacent coastal areas as a result of any of the alternatives.

The effects of each alternative on the anadromous salmonids in the Sacramento River were evaluated using Reclamation's Sacramento River Salmon Mortality Model (see the Fishery Resources Technical Appendix B). The Sacramento River Salmon Mortality Model estimated effects to Chinook salmon eggs and fry for all four runs of Chinook salmon spawning in the Sacramento River from Keswick Dam to Woodson Bridge. Because there is no model similar to the salmon mortality model, effects on steelhead were estimated by extrapolating late-fall Chinook salmon mortality estimates because of the similarity in temporal distribution and relatively similar effects of temperature on the early life stages of this species.

Increases in salmon egg and fry life-stage mortality are assumed to occur as the result of increased water temperatures. The Reclamation salmon loss model uses weekly average water temperatures obtained from the Sacramento River Water Temperature Model and tracks water temperature impacts on Chinook salmon egg and larval (sac-fry) development. Algorithms are used to compute cumulative survival of eggs spawned in a particular week through fry emergence from the spawning gravel. Temperature mortality schedules (relationships) for Chinook salmon eggs and larvae were developed establishing temperature-related instantaneous daily mortality rates for modeling salmon losses. The model uses spatial and temporal distribution information of spawning activity specific for each salmon run in the Sacramento River. Three river reaches: Keswick to Ball's Ferry (upper), Ball's Ferry to Red Bluff (middle), and downstream of Red Bluff (lower) are used in the analysis of temperature-related losses of Chinook salmon. Within each river reach, a specific temperature-related loss estimate is calculated. From these three partial loss estimates, a cumulative salmon loss estimate for each run is then calculated for each water year for the simulated period of 1922 through 1993. The average annual estimated loss for the period of simulation for each alternative was then compared to that for No Action. The precision of the mortality model is unknown; however, for this analysis, it is assumed that differences in estimated mortality greater than 1 percent (rounded to whole numbers) would be significant.

Impacts to winter-run Chinook salmon were subject to an additional level of detailed analysis, in part because of their endangered status under the ESA. Winter-run mortality estimates were evaluated by year class to discern particular classes of water years and conditions that would result in greater impacts than others. For this evaluation, a standard Sacramento water-year classification was used (sometimes referred to as the 40-30-30 index). This index has slightly different terminology than that used for designation of water year classes on the Trinity River.

To distinguish differences among project alternatives and the No Action Alternative for non-salmonid anadromous fish, including sturgeons, comparisons of Sacramento River flows and outflows from the Delta were conducted. Changes in these flows were assumed to affect habitat quantity and quality within the Delta. Significant decreases in flows in the Sacramento River may reduce habitat area for spawning, rearing, and food production, and may result in increased water temperatures and poorer habitat quality within the river. These factors may act to adversely affect populations of the life stages of those species while occupying the Sacramento River. Reductions of outflows from the Delta may result in reduced habitat area and quality for spawning and rearing life stages of Delta species. Additionally, food production is affected by outflows in the Delta. Changes in food productivity may adversely affect growth and survival of young life stages while in the Delta.

Significance Criteria. Effects were considered significant for anadromous salmonids and other native anadromous species if they resulted in any of the following:

- Potential for reductions in the number, or restrictions of the range, of an endangered or threatened native anadromous species or a native anadromous species that is a candidate for state listing or proposed for federal listing as endangered or threatened
- Potential for substantial reductions in the habitat of any native anadromous species other than those that are listed as endangered or threatened or are candidates (CESA) or proposed (ESA) for endangered or threatened status
- Potential for causing a native anadromous fish population to drop below self-sustaining levels
- Substantial adverse effect, either directly or through habitat modifications, on any native anadromous species identified as a sensitive or special-status species in local or regional plans, policies, or regulations
- Substantial interference with the movement of any native anadromous species
- A conflict with, or violation of, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan relating to the protection of native anadromous species
- Mortality of state or federally listed anadromous species, or species that are candidates for listing (CESA) or proposed for listing (ESA)
- Reductions in the size of a native anadromous species' population sufficient to jeopardize its long-term persistence

- Temporary impacts to habitats such that native anadromous species suffer increased mortality or lowered reproductive success that jeopardizes the long-term persistence of those local populations
- Permanent loss of essential habitat of a listed species or special-status native anadromous species
- Reduction in the quantity or quality of habitats in which native anadromous populations occur sufficient to reduce the long-term abundance and productivity of local populations

No Action. The No Action Alternative performed poorly in meeting the river system attributes and habitat requirements necessary for restoring the natural production of anadromous salmonids in the Trinity River. The TRSAAM results indicated that fishery habitat in the Trinity River in the year 2020 would not provide the conditions necessary to restore and maintain salmonid populations, including the threatened (federal) coho salmon population (Table 3.4-5). In addition, the smolt temperature survival analysis resulted in survival indices of 0.60, 0.84, and 0.41 (on a scale of 0.0 to 1.0) for steelhead, coho salmon, and Chinook salmon, respectively. The Chinook harvest index was estimated to be approximately 4,400 adults (Table 3.4-5). The weighted average sediment transport for No Action and each alternative is summarized in Table 3.4-6. The fine- and coarse-sediment transport rates for the Lewiston and Limekiln gaging stations, as reported in the Trinity River Flow Evaluation Study, were averaged for the results shown in Table 3.4-6. For the No Action Alternative, coarse- and fine-sediment transport averaged approximately 680 and 230 yd^3, respectively. The No Action Alternative hydrograph has a recession limb steeper than that required to initiate riparian vegetation on floodplains. Therefore, the No Action Alternative is not conducive to riparian regeneration during any water-year class.

TABLE 3.4-5
Results of the Analysis of Impacts to Anadromous Salmonids in the Mainstem Trinity River

	Alternative					
Result	No Action	Revised Mechanical	Flow Evaluation	Modified Percent	70 Percent Inflow	Maximum Flow
TRAASM Score	4	37	49	51	50	58
TRAASM Score – (percent of total possible)	6%	53%	70%	73%	71%	83%
Average Annual Releases (taf) [a]	340	455	595	501	934	1,225
Percent Increase of Release Compared to No Action	NA	34%	75%	47%	175%	260%
Minimum River Release as a Percentage of Total Inflow to Trinity Reservoir	28%	37%	49%	41%	76% [b]	100%
Steelhead Survival Index	0.60	0.67	0.80	0.58	0.74	0.81
Steelhead Survival Index – Percent Change from No Action	NA	12%	33%	-3%	23%	35%
Coho Survival Index	0.84	0.91	0.95	0.91	0.94	0.99
Coho Survival Index – Percent Change from No Action	NA	8%	13%	8%	12%	18%
Chinook Survival Index	0.41	0.51	0.60	0.49	0.55	0.76
Chinook Survival Index – Percent Change from No Action	NA	23%	45%	21%	32%	84%
Chinook Harvest Index	4,364	20,506 to 32,013[c]	44,486	30,794	37,311	66,646
Chinook Harvest Index –Difference from No Action	NA	16,142 to 27,649[c]	40,122	26,430	32,947	62,282
Percent Increase in Chinook Harvest Index from No Action	NA	370% to 634%[c]	919%	606%	755%	1,427%

[a] Weighted Annual Mean derived from frequency of release schedules over time.

[B] This alternative has a floor of 340,000 acre-feet/year and has minimum flow releases of 450 cfs during summer months and 300 cfs during winter months that increases the total yield above the 70% of total on average.

[c]Results for this alternative vary based on habitat assumptions.

TABLE 3.4-6
Summary of Weighted Average Annual Fine- and Coarse-sediment Transport for Differing Alternatives

Alternative	Weighted Average Coarse-sediment Transport (yd^3)	% Different from No Action	Weighted Average Fine-sediment Transport (yd^3)	% Different from No Action
No Action	680	0	230	0
Revised Mechanical	1,070	57	370	61
Preferred	8,570	1,160	1,870	73
Modified Percent Inflow	5,370	690	1,100	378
70 Percent Inflow	16,900	2,385	3,220	1,300
Maximum Flow[a]	156,000	22,841	21,500	9,248

[a]Rating curve is extended far beyond measured data, resulting in abnormally large predictions of sediment transport. Results should be considered qualitatively “very large.”

Revised Mechanical. This alternative would result in benefits to habitat for native anadromous species in the Trinity River relative to the No Action Alternative. Improved habitat conditions would benefit rearing and juvenile life stages and improve juvenile emigration, which would result in greater production and substantial increases in anadromous fish populations. This alternative had a TRAASM score of 37 (53 percent of possible) and had smolt temperature survival index scores of 0.67, 0.91, and 0.51 for steelhead, coho salmon, and Chinook salmon, respectively (Table 3.4-5). The increase in TRAASM score was approximately nine times greater than the No Action Alternative. The smolt temperature survival indices were 12, 8, and 23 percent greater than No Action for steelhead, coho salmon, and Chinook salmon, respectively. Depending on the assumptions used for the level of habitat created/restored for this alternative, the adult Chinook salmon harvest index ranged from approximately 20,500 to 32,000 adults, an increase of approximately 370 to 630 percent greater than the No Action Alternative. For this alternative, the estimated annual coarse- and fine-sediment transport volumes are modest, similar to those for No Action, and are approximately 1,070 and 370 yd^3, respectively (Table 3.4-6). These estimates are approximately 80 to 90 percent less than those estimated for the Preferred Alternative. The recession limbs of the hydrograph during extremely wet years would likely result in riparian initiation on floodplains and initiate riparian regeneration during those water years. This alternative would also provide small benefits to native anadromous species in the Lower Klamath River Basin by providing increased juvenile outmigration flows and somewhat lower water temperatures.

Revised Mechanical would result in adverse effects to Sacramento River fall- and spring-run chinook due to an estimated 1 percent average increase in mortality compared to No Action (Table 3.4-7). Impacts to spring-run Chinook would be significant due to incremental increases in early life stage mortality, principally, in below normal, dry, and critical water years (Table 3.4-8). Likewise, impacts to winter-run would be significant due to an incremental increase in mortality of 2.7 percent in critical water years (Tables 3.4-9 and 3.4-10). The Revised Mechanical Alternative may adversely impact habitat for other native anadromous species in the Central Valley through reductions in flow into/from the Delta.

TABLE 3.4-7
Percent Change in Temperature-related Losses of the Early Life Stages of Anadromous Salmonids in the Sacramento River as Compared to the No Action Alternative[a]

	Estimated Change in Average Annual Losses					
Species	**Revised Mechanical**	**Flow Evaluation**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Flow Evaluation Compared to Existing Conditions**
Fall Chinook	1	3	2	7	9	3
Late-fall Chinook	0	0	0	0	0	0
Winter Chinook	0	1	0	3	8	1
Spring Chinook	1	8	4	23	31	8
Steelhead	0	0	0	0	0	0

[a]Estimated average annual losses over the 1922 through 1993 simulation period compared to No Action.

TABLE 3.4-8
Temperature-related Losses of the Early Life Stages of Spring Chinook Salmon in the Sacramento River by Water-year Class

	Estimated Average Annual Losses of Early Life Stage Spring-run Salmon						
Year Class[a]	**No Action**	**Revised Mechanical**	**Flow Evaluation**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Existing Conditions**
Wet	5.7	6.4	8.2	6.8	14.4	17.3	5.3
Above Normal	4.8	5.3	8.4	6.3	20.3	34.4	4.7
Below Normal	19.6	21.3	29.3	25.3	50.9	57.0	19.2
Dry	24.1	25.6	40.9	30.2	71.5	85.4	22.4
Critical	81.2	84.0	87.8	85.1	94.1	98.9	86.1

[a]Based on Sacramento River Index (40-30-30).

TABLE 3.4-9
Temperature-related Losses of the Early Life Stages of Winter-run Chinook Salmon in the Sacramento River by Water-year Class (Percent)

	Estimated Average Annual Losses of Early Life Stage Winter-run Salmon						
Year Class[a]	**No Action**	**Revised Mechanical**	**Flow Evaluation**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Existing Conditions**
Wet	0.2	0.3	0.3	0.3	0.5	0.5	0.2
Above Normal	0.3	0.3	0.3	0.3	0.3	0.7	0.3
Below Normal	0.7	0.8	1.2	1.2	3.8	6.8	0.6
Dry	3.5	3.8	2.8	3.6	5.4	12.6	2.9
Critical	45.9	48.6	50.1	47.9	59.2	79.5	45.6

[a]Based on Sacramento River Index (40-30-30).

TABLE 3.4-10
Percent Change in Temperature-related Losses of the Early Life Stages of Winter-run Chinook Salmon in the Sacramento River by Water-year Class Compared to No Action (Percent)

	Change in Estimated Average Annual Losses of Early Life Stage Winter-run Salmon Compared to No Action					
Year Class[a]	**Revised Mechanical**	**Flow Evaluation**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Existing Conditions versus Flow Evaluation**
Wet	0.0	0.0	0.0	0.2	0.3	0.1
Above Normal	0.0	0.0	0.0	0.1	0.4	0.0
Below Normal	0.1	0.5	0.5	3.1	6.2	0.6
Dry	0.3	-0.7	0.1	1.9	9.1	-0.1
Critical	2.7	4.2	2.0	13.3	33.6	4.5

[a]Based on Sacramento River Index (40-30-30).

Flow Evaluation. This alternative would result in benefits to habitat for native anadromous species in the Trinity River relative to the No Action Alternative. Improved habitat conditions would benefit rearing and juvenile life stages and improve juvenile emigration, which would result in greater production and substantial increases in anadromous fish populations. This alternative had a TRAASM score of 49 (70 percent of possible) and had smolt temperature survival index scores of 0.80, 0.95, and 0.60 for steelhead, coho salmon, and Chinook salmon, respectively (Table 3.4-5). Except for the Maximum Flow Alternative, this alternative had the largest estimated smolt survival indices. The increase in TRAASM score was approximately 12 times greater than the No Action Alternative. The smolt temperature survival indices were 33, 13, and 45 percent greater than No Action for steelhead, coho salmon, and Chinook salmon, respectively. The adult Chinook salmon harvest index was estimated to be approximately 44,500 adults, an increase of approximately 920 percent greater than the No Action Alternative. For this alternative, the estimated annual coarse- and fine-sediment transport volumes are balanced, from 8- to 12-fold greater than those for No Action, and are approximately 8,570 and 1,870 yd^3, respectively (Table 3.4-2). The recession limbs of the hydrograph during extremely wet years would likely result in riparian initiation on floodplains and initiate riparian regeneration during those water years. This alternative would also provide some benefit to native anadromous species in the Lower Klamath River Basin by providing increased juvenile outmigration flows and lower water temperatures.

Under the Flow Evaluation (Preferred) Alternative, the average winter-run mortality in the Sacramento River for critical dry water years is estimated to be 50.1 percent, an increase of 4.2 percent over No Action (Tables 3.4-9 and 3.4-10). This increase in mortality would be a significant impact. For dry water years, the average mortality is estimated to be 2.8 percent, a reduction of 0.7 percent compared to No Action. The average for dry years is largely influenced by temperature operations in water-year 1932, a dry year within a string of dry and critical dry years, when mortality under No Action was 46.2 percent compared to mortality of 35.7 percent under Flow Evaluation. Discounting the effects of this single year results in an average mortality of 0.6 percent under both Flow Evaluation and No Action. In below-normal years, winter-run mortality under Flow Evaluation, on average, would be 1.2 percent, an increase of 0.5 percent over No Action. This would be a significant impact. However, if water-year 1935 is discounted, the incremental increase would be 0.1 percent, a less than significant impact. Water-year 1935 is notable because of the relatively low carryover storage in Shasta Reservoir at the beginning of the water year. There is no significant incremental impact on winter-run Chinook salmon in above-normal or wet water years.

There would be significant adverse impacts to early life stages of Sacramento River fall-run (3 percent) and spring-run (8 percent) Chinook salmon during dry, critically dry, or below normal water years (Tables 3.4-7 and 3.4-8). Increased losses of eggs and sac-fry fall- and spring-run Chinook salmon would occur as a result of increased water temperatures during drought conditions (1924-1925, 1935-1936, 1959-1963, and 1988-1991). These temperature increases would result in higher mortality, compared to No Action, of incubating and developing salmon eggs and pre-emergent fry life stages. Incremental increases in early life stage mortalities of fall, winter, and spring Chinook salmon, as determined in this Supplemental EIS/SEIR (beyond those estimated for the 2000 EIS/EIR), are a result of a less conservative assumption of the efficiency of the Shasta TCD that is used in the water temperature model. The Flow Evaluation Alternative may also adversely impact habitat for other native anadromous species in the Central Valley through reductions of inflows and outflow to the Delta.

<u>Modified Percent Inflow</u>. This alternative would result in benefits to habitat for native anadromous species in the Trinity River relative to the No Action Alternative. This alternative would provide flow conditions that would greatly improve the geomorphic condition of the Trinity River. However, under this alternative, water temperatures could likely be limiting to salmonids and could adversely affect and limit populations of these species. This alternative had a TRAASM score of 51 (73 percent of possible) and had smolt temperature survival index scores of 0.58, 0.91, and 0.49 for steelhead, coho salmon, and Chinook salmon, respectively (Table 3.4-5). The increase in TRAASM score was approximately 13 times greater than the No Action Alternative. However, compared to No Action, the smolt temperature survival indices were

3 percent less for steelhead, and 8 and 21 percent greater for coho and Chinook salmon, respectively. The adult Chinook salmon harvest index was estimated to be approximately 30,800 adults, an increase of approximately 600 percent greater than the No Action Alternative. For this alternative, the estimated annual coarse- and fine-sediment transport volumes are more robust than those for the No Action Alternative, and are approximately 5,370 and 1,100 yd^3, respectively (Table 3.4-6). However, these estimates are approximately 40 percent less than those estimated for the Preferred Alternative. The Modified Percent Inflow Alternative has recession limbs steeper than that required to initiate riparian vegetation on floodplains. Because the analyses for the Modified Percent Inflow Alternative uses the median years for extremely wet and wet water years, the median year does not represent all years for those two water-year classes. Therefore, there could be an individual year within the record where the recession limb is sufficient to initiate riparian vegetation. This alternative may provide some benefit to native anadromous species in the Lower Klamath River Basin by providing increased juvenile outmigration flows and moderation of water temperatures.

Under the Modified Percent Inflow Alternative, the average Sacramento River winter-run mortality for critical dry water years is estimated to be 47.9 percent, an increase of 2 percent over No Action (Tables 3.4-9 and 3.4-10). This increase in mortality would be a significant impact. For dry water years, the average mortality is estimated to be 3.6 percent, an increase of 0.1 percent compared to No Action. In below-normal years, winter-run mortality under Modified Percent Inflow, on average, would be 1.2 percent, an increase of 0.5 over No Action. This would be a significant impact. There is no significant incremental impacts on winter-run Chinook salmon in above-normal or wet water years.

In the Central Valley there would be significant adverse impacts to early life stages of Sacramento River fall- and spring-run Chinook salmon (Tables 3.4-7and 3.4-8). Impacts to spring-run Chinook would be significant due to incremental increases in early life stage mortality, in all water year types but principally, in below normal, dry, and critical water years (Table 3.4-8). Similar to the case for the Maximum Flow, Flow Evaluation, and 70 Percent Inflow Alternatives, increased losses of eggs and sac-fry of fall- and spring-run Chinook salmon (2 and 4 percent, respectively) would occur because of increased water temperatures during drought conditions. These temperature increases would result in higher mortality, compared to No Action, of incubating and developing salmon eggs and pre-emergent fry life stages. During a few water years, such as those drought years of 1926, 1935, 1977, and 1990, Chinook salmon would experience larger mortalities than those for the No Action

Alternative. Inflows to the Delta would be significantly less than those for No Action for a substantial number of years, and, on average, Delta outflows in some months would be significantly less, compared to the No Action Alternative. These reductions may be sufficient so as to result in adverse effects to other native anadromous species in the Delta.

70 Percent Inflow. This alternative would result in benefits to habitat for native anadromous species in the Trinity River relative to the No Action Alternative. Improved habitat conditions would benefit rearing and juvenile life stages and improve juvenile emigration, which would result in greater production and substantial increases in anadromous fish populations. This alternative had a TRAASM score of 50 (71 percent of possible) and had smolt temperature survival index scores of 0.74, 0.94, and 0.55 for steelhead, coho salmon, and Chinook salmon, respectively (Table 3.4-5). The increase in TRAASM score was approximately 13 times greater than the No Action Alternative. The smolt temperature survival indices were 23, 12, and 32 percent greater than No Action for steelhead, coho salmon, and Chinook salmon, respectively. The adult Chinook salmon harvest index was estimated to be approximately 37,300 adults, an increase of approximately 750 percent greater than the No Action Alternative. For this alternative, the estimated annual coarse- and fine-sediment transport volumes are very large, and are approximately 16,900 and 3,220 yd^3, respectively (Table 3.4-6). These estimates are approximately 12- to 18-fold greater than those for the Preferred Alternative. The huge volume of coarse sediment transported by this alternative would require a much larger gravel supplementation program to keep coarse-sediment volumes balanced in the mainstem Trinity River. The recession limbs of the hydrograph during extremely wet years would likely result in riparian initiation on floodplains and initiate riparian regeneration during those water years. This alternative would also provide some benefit to native anadromous species in the Lower Klamath River Basin by providing increased juvenile outmigration flows and lower water temperatures.

Under the 70 Percent Inflow Alternative, the average Sacramento River winter-run mortality for critical dry water years is estimated to be 59.2 percent, an increase of 13.3 percent over No Action (Tables 3.4-9 and 3.4-10). This increase in mortality would be a significant impact. For dry water years, the average mortality is estimated to be 5.4 percent, an increase of 1.9 percent compared to No Action. In below-normal years, winter-run mortality under 70 Percent Inflow, on average, would be 3.8 percent, an increase of 3.1 over No Action. This would be a significant impact. There is no incremental impact on winter-run Chinook salmon in above-normal or wet water years.

There would be significant adverse impacts to early life stages of Sacramento River fall-run (5 percent) and spring-run (23 percent) Chinook salmon (Tables 3.4-7 and 3.4-8). Impacts to spring-run Chinook would be significant due to incremental increases in early life stage mortality, in all water year types (Table 3.4-8). Similar to the case for the Maximum Flow, Modified Percent Inflow, and Flow Evaluation Alternatives, increases in losses of eggs and sac-fry fall- and spring-run Chinook salmon would occur because of increased water temperatures during drought conditions (1923-1933, 1935-1936, 1959-1964, and 1987-1992). However, large increases in losses are also expected in many below normal and dry water years as well. The reductions in streamflows in the Sacramento River , are the result of the lower diversion to the Sacramento River from the TRD. Additionally, while some of the reductions in the inflows to and from the Delta are a result of increased demands expected at the 2020 level of development, a significant portion of these reductions are a result of implementation of the 70 Percent Inflow Alternative. The 70 Percent Inflow Alternative may also adversely impact habitat for other native anadromous species in the Central Valley through reductions in flow in the Sacramento River and/or into/from the Delta.

Maximum Flow. This alternative would result in substantial improvements to habitat for native anadromous salmonids in the Trinity River relative to the No Action Alternative. Improved habitat would benefit rearing and juvenile life stages and improve juvenile emigration, which would result in greater production and substantial increases in anadromous salmonid populations. This alternative had a TRAASM score of 58 (83 percent of possible) and had smolt temperature survival index scores of 0.81, 0.99, and 0.76 for steelhead, coho salmon, and Chinook salmon, respectively (Table 3.4-5). The increase in TRAASM score was approximately 15 times greater than the No Action Alternative. The smolt temperature survival indices were 35, 18, and 84 percent greater than No Action for steelhead, coho salmon, and Chinook salmon, respectively. The adult Chinook salmon harvest index was estimated to be approximately 66,700 adults, an increase of approximately 1,430 percent greater than the No Action Alternative. For this alternative, the estimated annual coarse- and fine-sediment transport volumes are estimated to be huge, and are approximately 156,000 and 21,500 yd^3, respectively (Table 3.4-6). However, the rating curve was extended far beyond measured data, resulting in abnormally large predictions of sediment transport. Therefore, the results should be considered qualitatively "very large." The huge volume of coarse sediment transported by this alternative would require a much larger gravel supplementation program to keep coarse-sediment volumes balanced in the mainstem Trinity River. The recession limbs of the hydrograph during extremely wet years would likely result in riparian initiation on floodplains and initiate riparian regeneration during those water years. This alternative would also provide some benefit to native anadromous species in the Lower Klamath River Basin by providing increased juvenile outmigration flows and lower water temperatures.

Under the Maximum Flow Alternative, the average Sacramento River winter-run Chinook salmon mortality for critical dry water years is estimated to be 79.5 percent, an increase of 33.6 percent over No Action (Tables 3.4-9 and 3.4-10). This increase in mortality would be a significant impact. For dry water years, the average mortality is estimated to be 12.6 percent, an increase of 9.1 percent compared to No Action. In below-normal years, winter-run mortality under Maximum Flow, on average, would be 6.8 percent, an increase of 6.2 over No Action. This would be a significant impact. There is no significant incremental impact on winter-run Chinook salmon in above-normal or wet water years.

Compared to the No Action Alternative, the Maximum Flow Alternative, which does not include diversions to the Sacramento Valley, would result in an adverse increase in water temperatures in the Sacramento River, thereby significantly increasing early life-stage losses of fall-run (9 percent) and spring-run Chinook salmon (31 percent) (Tables 3.4-7 and 3.4-8). Impacts to spring-run Chinook would be significant due to incremental increases in early life stage mortality, in all water year types (Table 3.4-8). Increased losses of eggs and sac-fry of fall- and spring-run Chinook salmon as compared to No Action primarily occurred because of increased water temperatures during drought conditions (1922-1926, 1930-1936, 1976-1977, and 1985-1991). However, very large increases in losses are also expected in many years in all water year classes. These temperature increases would result in higher mortality of incubating and developing salmon eggs and pre-emergent fry life stages as compared to No Action. Incremental increases in early life stage mortalities of fall, winter, and spring Chinook salmon, as determined in this SUPPLEMENTAL EIS/SEIR (beyond those estimated for the 2000 EIS/EIR), are a result of a less conservative assumption of the efficiency of the Shasta TCD that is used in the water temperature model. The Maximum Flow Alternative may adversely impact habitat for other native anadromous species in the Central Valley through reductions in flows in the Sacramento River and/or into/from the Delta.

Existing Conditions versus Proposed Action. Implementation of the Proposed Action would substantially restore the diverse fish habitats necessary for restoration and maintenance of anadromous fish populations compared to existing conditions. The degree of improvement is similar to that of the Flow Evaluation Alternative over the No Action Alternative. Although the river and its fish habitats would continue to gradually degrade under the No Action Alternative, the majority of the degradation occurred in the decades immediately following dam construction. Therefore, naturally producing anadromous fish numbers are not expected to substantially change from existing conditions versus the projected numbers for the No Action Alternative (TRSAAM was not designed to detect temporal changes). Because the Proposed Action also includes the watershed protection component of the Revised Mechanical Alternative, it would likely accelerate and enhance the improvements in habitat and the resultant increases in fish production. The Proposed Action would also benefit the Klamath River beyond the benefits accrued by either the Flow Evaluation Alternative or Revised Mechanical Alternative individually.

Compared to existing conditions, the Proposed Action would significantly affect native anadromous fish in the Central Valley similar in magnitude to the impacts of the Flow Evaluation Alternative compared to the No Action Alternative. Compared to existing conditions, the Proposed Action would adversely affect fall-run (3 percent), winter-run (0.6 percent in Below Normal years and 4.5 percent in critical years), and spring-run Chinook salmon (from 18 percent in critical years to 18.5 percent in dry years) by increasing mortality of early life stages of these species within the upper Sacramento River (Table 3.4-7, 3.4-8, and 3.4-9).

Mitigation.

Per the NOAA Fisheries BO (NOAA Fisheries, 2000; under separate cover), implementation of the Proposed Action is not likely to jeopardize Southern Oregon/Northern California Coast (SONCC) coho salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, or Central Valley steelhead. NOAA Fisheries does anticipate that SONCC coho salmon habitat adjacent to and downstream of the channel rehabilitation projects associated with the Proposed Action may be temporarily degraded during construction. Construction of these projects, which will create a substantial amount of additional suitable habitat, may temporarily displace an unknown number of juvenile coho salmon but is not expected to result in a lethal take.

In the NOAA Fisheries BO, implementation of the proposed action was determined to avoid incidental take of Central Valley spring-run Chinook or Central Valley steelhead. The BO also concluded that the Proposed Action will result in a minute increase in the level of Sacramento River winter-run Chinook incidentally taken in all years except critically dry years. Results from this Supplemental EIS/EIR confirm the incremental increase in winter-run Chinook salmon mortality in below normal and dryer water years, but also result in higher mortality for spring-run Chinook than previously estimated in the 2000 EIS/EIR. Mitigation for impacts to spring-run Chinook salmon in the Sacramento River follows.

Spring-run mitigation includes the following: continued use of the optional 45-day closure of the Delta Cross Channel gates, as is current practice, would offset the incremental spring-run mortality caused by reduced export of Trinity water into the Sacramento River. Closure of the Delta Cross Channel gates is currently an optional management tool available to NOAA Fisheries as described under SWRCB D-1641. Implementation of this mitigation measure would prescribe continued use of this mitigation. Impacts of the continued use of the Delta Cross Channel gates was included in the assumptions governing CALSIM (see Table 2-1 in Section 2.0, Description of Alternatives).

NOAA Fisheries outlined the following reasonable and prudent measures to minimize the effects of incidental take of SONCC coho salmon and Sacramento River winter-run chinook salmon. It is important to note that Judge Wanger's MDO invalidated several aspects of the NOAA Fisheries BO; however the following RPMs are assumed to remain in effect.

The Service and Reclamation shall:

1. Ensure that NOAA Fisheries is provided the opportunity to be represented during implementation of the AEAM program.
2. Ensure that the replacement bridges and other infrastructure modifications, needed to fully implement the proposed flow schedule, are designed and completed as soon as possible.
3. Periodically coordinate with NOAA Fisheries during the advanced development and scheduling of the habitat rehabilitation projects described in the Draft EIS/EIR.
4. Complete "the first phase of the channel rehabilitation projects" (Service and Reclamation, 2000) in a timely fashion.
5. Implement emergency consultation procedures during implementation of flood control or "safety of dams" releases from Lewiston Dam to the Trinity River.
6. In dry and critically dry water-year classes, Reclamation and Service shall work cooperatively with the upper Sacramento River Temperature Task Group to develop temperature control plans that provide for compliance

with temperature objectives in both the Trinity and Sacramento Rivers.

The detailed mitigation measure outlined below describes the re-consultation process for temperature compliance for winter-run Chinook salmon, which would reduce impacts associated with the Flow Evaluation to a less than significant level and maintain consistency with the measures outlined in the NOAA Fisheries BO. The effectiveness of this measure as mitigation for other action alternatives varies, as outlined in Table 3.4-11 and 3.4-12.

TABLE 3.4-11
Estimated Mortality of Winter-run Chinook during Critical Water Years with Compliance Target at Bend Bridge/Jelly's Ferry

	Chinook Salmon Mortality (%) during Critical Water-year Classes						
Year	**No Action Alternative**	**Revised Mechanical**	**Preferred Alternative**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Existing Conditions**
1924	98.7	99.6	99.1	99.4	100	100	99.4
1929	0.6	0.6	0.2	0.7	1.8	16.0	1.2
1931	87.8	92.1	93.9	89.7	100	100	95.0
1933	58.9	73.0	59.8	62.4	89.9	95.9	23.4
1934	100	100	100	100	100	100	96.3
1976	0.4	0.4	0.4	0.4	0.5	3.4	0.4
1977	93.6	93.4	94.5	93.5	100	100	93.0
1988	0.8	2.7	2.8	1.3	10.1	79.3	5.1
1990	0.6	1.4	4.4	2.1	14.3	80.0	1.0
1991	1.8	3.0	17.0	4.8	36.2	100	4.8
1992	62.1	68.3	79.1	72.6	98.4	100	81.9
Average	45.9	48.6	50.1	47.9	59.2	79.5	45.6

TABLE 3.4-12
Estimated Mortality of Winter-run Chinook during Critical Water Years with Compliance Target at Ball's Ferry

	Chinook Salmon Mortality (%) during Critical Water-year Classes						
Year	**No Action Alternative**	**Revised Mechanical**	**Preferred Alternative**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Existing Conditions**
1924	82.7	85.9	85.2	84.6	99.1	100.0	85.6
1929	2.3	2.3	1.3	2.7	0.7	1.9	3.2
1931	76.6	81.6	84.2	79.6	98.8	100.0	85.8
1933	24.6	38.2	25.5	33.6	72.9	85.2	10.3
1934	93.6	99.7	96.1	99.9	100.0	100.0	82.6
1976	2.3	2.5	2.5	2.5	2.7	4.1	1.9
1977	85.3	83.9	85.6	84.9	93.1	100.0	83.7
1988	0.6	4.7	1.0	1.8	3.1	34.4	2.0
1990	0.7	0.7	1.0	0.7	4.6	53.3	0.6
1991	0.7	0.7	1.6	1.0	22.5	87.2	0.9
1992	27.0	30.3	35.3	34.8	88.2	99.9	40.3
Average	36.0	39.1	38.1	38.7	53.2	69.6	36.1

Adverse impacts would result from the implementation of the Maximum Flow, Flow Evaluation, Modified Percent Inflow, Revised Mechanical, and the 70 Percent Inflow Alternatives to federal- and state-listed endangered winter-run Chinook salmon when drawdown of Shasta Reservoir results in storage levels of less than 1.9 maf on September 30 or in critically dry water years. Under such conditions it would be necessary to re-consult with NOAA Fisheries under terms of the 1993 Winter-run Chinook BO (NOAA Fisheries, 1993). This mitigation measure would make such re-consultation mandatory and would require upstream movement of the temperature compliance point in years when it was determined that there was not enough cold water to maintain temperature compliance at Bend Bridge/Jelly's Ferry.

Re-consultation would result in changes to operations that would act to minimize losses to Chinook salmon according to actual and forecast conditions, typically an adjustment to the location of downstream temperature targets. Adjustment to targets would most likely occur in drier water years (critical dry, dry, or below-normal water-year classes), especially in consecutive dry years, although it is possible that no adjustment would be made because of unusually cool climatic conditions or unusual rainfall patterns. The more likely outcome of re-consultation would be to move the existing target for temperature compliance from Bend Bridge/Jelly's Ferry (depending on date) to a location farther upstream, such as Ball's Ferry. Movement of the compliance point would avoid catastrophic loss of the coldwater pool, by making it more likely to provide cold water throughout the early life stage, albeit over a reduced habitat area. Moving the target upstream has the result of reducing mortality below the modeled levels in Table 3.4-9.

Section 3.2, Water Resources, outlines the basic relationship among reservoir storage, release rate, and downstream temperature, and how these three factors govern water management on the upper Sacramento River. Generally, it takes higher releases to meet temperature targets with warmer water or lower releases with colder water. For an example of flow-temperature relationships and the effect of instream warming, see Table 3.3-4 in Section 3.4, Water Quality. The coldwater pool in a reservoir is essentially a function of the volume of water in the reservoir. More cold water is available when a reservoir is full; less is available as the reservoir is drawn down. As described in this mitigation, changes in the compliance point would result in changes to scheduled operations of the TCD, and therefore temperatures of water released from Shasta Reservoir, but not the rate of release (e.g., flow or cfs). Raising the temperature of the water released from Shasta Reservoir increases the amount of time that cold water is available, but decreases the total area of habitat covered by the colder water. Conceptually, this improves the likelihood that at least a portion of the early life-stage winter-run Chinook salmon would be protected by adequate temperatures, rather than subjecting the entire run to catastrophic temperatures when the coldwater pool is exhausted. Specific recommendations for implementing these actions are outlined below.

Re-initiation of consultation has been a regular practice between Reclamation and NOAA Fisheries. Between 1993 and 2003, formal re-consultation between Reclamation and NOAA Fisheries occurred 24 times. Of these formal re-consultations, 9 have resulted in upstream movement of the compliance point, primarily as a measure to conserve the coldwater pool. The remaining 15 re-consultations have been advisory notices alerting NOAA Fisheries of temperature exceedances. Upstream movement of compliance points has ranged from early adjustment from Bend Bridge to Jelly's Ferry to late-season adjustments to Clear Creek. Figure 3-3.1 in Section 3.3, Water Quality, provides a graphic description of the relative locations of compliance points. Re-initiation of consultation has occurred in both wet and dry years, and under variable carryover storage scenarios. Table 3.4-13 provides specific details regarding re-initiation of consultation between 1993 and 2003.

Consistent with the 1993 Winter-run Chinook BO, under this mitigation measure, re-consultation with NOAA Fisheries would be required in water years with Shasta carryover storage less than 1.9 maf and in critical dry years. The results of the consultation would likely be to move the temperature compliance point for winter-run salmon to an upstream point such as Ball's Ferry (approximately 10 river miles upstream). This would likely reduce incremental mortality during the critical period of spawning, incubation, and alevin swim-out.

The estimated average mortality of winter-run Chinook salmon (with Ball's Ferry as a compliance point) for the Preferred Alternative for critical dry water years is 38.1 percent (Table 3.4-12). This is a reduction in mortality of 12 percent and is approximately 8 percent less mortality than that estimated for the No Action Alternative. As shown in Table 3.4-11, by moving the compliance point to Ball's Ferry in some critical dry water years, the resulting improvement in winter-run early life-stage survival is very large. In water-year 1933, for example, the estimate improvement is approximately 34 percent. For water-year 1992, the improvement is approximately 45 percent. However, because of the vagaries of climate and the variable hydrologic influence of tributaries to the Sacramento River (particularly with regard to temperature of accretions), implementation of this mitigation is not a guarantee of reduced impacts. It is also important to note that although this mitigation will tend to reduce the incremental impact from implementation of an action

TABLE 3.4-13
History of Re-initiation between Reclamation and NOAA Fisheries

Water Year	Water Year Starting Shasta Storage (taf)	End of April Shasta Storage (taf)	Water-year Class (40-30-30 Index)	Starting Compliance Point	Date	Action	Change in Compliance Point
1993	1,683	4,263	Above Normal	Bend Bridge			
1994	3,102	3,534	Critical	Jelly's Ferry			
1995	2,102	4,165	Wet	Bend Bridge	07/13	Conserve cold water	Jelly's Ferry
1996	3,136	4,308	Wet	Bend Bridge	05/17	Exceed 56°F 04/26	
					07/12	Exceed 56°F 05/27	
					07/18	Conserve cold water	Jelly's Ferry
					08/28	Conserve cold water	Ball's Ferry
					09/23	Transition to stable min. flow for fall-run salmon by 10/15	Clear Creek
1997[a]	3,089	3,937	Wet	Bend Bridge	05/20	Exceed 56°F at Bend Bridge 3 days	
					07/30	Exceed 56°F at Bend Bridge 4 days	
					08/08	Conserve cold water	Jelly's Ferry
					09/19	Exceed 56°F at Jelly's Ferry 08/29 to 09/13	
					10/15	Exceed 56°F at Jelly's Ferry 09/20 to 09/30	
1998	2,308	4,061	Wet	Bend Bridge	06/09	Exceed 56°F at Bend Bridge 3 days	
					06/25	Exceed 56°F at Bend Bridge 4 days	
					09/18	Temp. exceed 56°F since 09/12	Jelly's Ferry
1999	3,441	4,256	Wet	Bend Bridge	08/19	Exceed 56°F at Bend Bridge 4 days	
2000	3,327	4,153	Above Normal	Bend Bridge	06/02	Exceed 56°F at Bend Bridge 3 days	

TABLE 3.4-13
History of Re-initiation between Reclamation and NOAA Fisheries

Water Year	Water Year Starting Shasta Storage (taf)	End of April Shasta Storage (taf)	Water-year Class (40-30-30 Index)	Starting Compliance Point	Date	Action	Change in Compliance Point
					07/14	Conserve cold water	Jelly's Ferry
					08/29	Conserve cold water	Ball's Ferry
					10/16	Exceed 56°F at Ball's Ferry 3 days	
2001	2,985	4,020	Dry	Jelly's Ferry	07/17	Exceed 56.5°F at Jelly's Ferry 2 days	
					01/10/	Exceed 56°F at Jelly's Ferry 08/28 to 09/1 and 09/15 to 09/30	
2002	2,200	4,297	Dry	Jelly's Ferry	06/05	Exceed 56°F at Jelly's Ferry 05/18	
2003	2,558	4,537	Above Normal	Bend Bridge	06/18	Exceed 56°F at Bend Bridge 05/14	
					08/28	Conserve cold water	Ball's Ferry

[a]Operation of the Shasta TCD began.

alternative (compared to No Action) to less than significant levels, the absolute level of mortality may remain substantial. Furthermore, implementation of this mitigation may be applicable and assist in reducing impacts to spring-run Chinook salmon in the upper Sacramento River.

During other, wetter water-year classes with adequate carryover storage there would be no need to initiate consultation with NOAA Fisheries or to move compliance points upstream because there are no significant differences between the Preferred Alternative and No Action.

As noted previously, implementation of this mitigation measure is based only on the movement of the temperature compliance point upstream. The intent of this measure is to modify temperature management solely through manipulation of the TCD, maximizing the amount of time that cold water is available to early-stage winter-run salmon. Accordingly, there are no projected impacts to other water users, such as South-of-Delta exporters beyond those described in Section 3.2, Water Resources. Implementation of this mitigation measure is expected to be consistent with the CVP-OCAP BO expected to be released June 30, 2004.

It is possible that additional measures may be required through the OCAP ESA consultation to offset impacts to winter-run salmon resulting from other aspects of CVP or SWP operations beyond increases to Trinity River instream flow. Possible results of the OCAP ESA consultation include the following:

- Changes to gate operations at Red Bluff Diversion Dam
- Earlier closures of the Delta Cross Channel gates
- Improvements in fish screens at the CVP Delta pumping plant (Tracy)
- Improvements in fish screens at the SWP Delta pumping plant (Banks)
- Reductions in the pre-screen loss rate at Clifton Court Forebay (adjacent to the Banks Pumping Plant)

At this time, it is unknown whether any of these conditions will be included as conditions to the OCAP ESA consultation. However, all of these measures would be subject to individual environmental review and are beyond the scope of this Supplemental EIS/EIR.

3.4.2 Resident Native and Non-Native Fish

Affected Environment.

Trinity River Basin. Resident native fish species found in the Trinity River Basin include gamefish such as rainbow trout, and non-gamefish such as speckled dace, Klamath smallscale sucker, three-spined stickleback, and coast range sculpin. The abundance of resident native species, and the factors affecting their abundance within the basin, are not well understood; however, all these species existed in the pre-dam Trinity River and are presumably adapted to those conditions.

Non-native fish species found in the Trinity and Klamath River Basins include striped bass, American shad, brown trout, and brook trout. Striped bass have only recently been reported to occur in the Trinity and Klamath River Basins; reports are rare. American shad are known to occur in the lowermost portions of the Trinity River Basin, but are primarily found in the lower Klamath River Basin. Anadromous brown trout were propagated in the TRSSH until 1977, when this practice was discontinued because of the small numbers and the lack of anadromous characteristics of fish entering the hatchery. Currently, brown trout are largely limited to the upper portions of the river, although CDFG, on occasion, capture brown trout in the estuary during the spring. Brook trout provide a significant sport fishery in the tributary streams and high elevation reservoirs of the Trinity River Basin. Its life cycle and habitat requirements are similar to that of brown trout.

The abundance of all of these species in the Trinity and lower Klamath River Basins is unknown. Factors that affect their abundance in the Trinity and lower Klamath River Basins are generally unknown, but may be similar to those factors affecting native anadromous species.

Lower Klamath River Basin/Coastal Area. In addition to the native resident species found in the Trinity River Basin, marbled sculpin, threespine stickleback, staghorn sculpin, coastal cutthroat, and starry flounder are known to occur in the lower Klamath River Basin. Marine species such as topsmelt, shiner perch, arrow goby, and sharpnose sculpin may occasionally occur in the lower Klamath River estuary. The abundance and distribution of all of these species, and the factors affecting their abundance in the lower Klamath River Basin, are not known.

Non-native species known to occur in the lower Klamath River are similar to those found in upstream areas including the reservoirs. Some of these species include yellow perch, black crappie, green sunfish, gold shiner, and brown bullhead.

In the coastal area, numerous native marine species are found in tidepool and nearshore habitats adjacent to the lower Klamath River Basin. There are as many as 250 species of tidepool and nearshore fish in the coastal waters of California, most of which would be expected to occur in the coastal waters adjacent to the project. Important recreational species include halibut and sanddab, herring, surf perch, lingcod, greenling, smelt, sole, flounder, and rockcod. In addition, important commercial fisheries exist for the flatfish, sablefish, Pacific hake, rockfish, albacore tuna, and lingcod. Most or all of these species are landed in Eureka and Crescent City, California, and Brookings, Oregon.

Central Valley. Many of the native fish found in the lower Klamath and Trinity River Basins also occur in the Central Valley. In addition to those, the following native resident species also occur: Pacific brook lamprey, hardhead, hitch, blackfish, California roach, Sacramento pikeminnow, Sacramento sucker, tule perch, prickly sculpin, longfin smelt, Sacramento splittail, and Delta smelt.

The Delta smelt was listed as threatened by federal and state governments in 1993. The species occurs in the Delta and within the lower Sacramento River downstream of Isleton and in the lower San Joaquin River downstream of Mossdale. It is rarely found in habitats where salinity is greater than 10 to 12 ppt; it prefers salinity of approximately 2 ppt. Critical habitat for Delta smelt was determined by the Service to include portions of Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties (Service, 1994). Provisions within the Bay-Delta Accord, including the allowable ratio of Delta inflows to exports (generally 35 percent inflows/exports for February through June and 65 percent inflows/exports for July through January) have direct bearing on the abundance of aquatic species in the Delta. Reduction of Delta outflows, high Delta outflows, losses to entrainment at water diversions, changes in food organisms, toxic substances, disease, competition, predation, and loss of genetic integrity in the Delta are suspected causes in the population declines of Delta smelt. The Sacramento splittail was listed as threatened on February 8, 1999. However, after a thorough review, Service removed the Sacramento splittail from the list of threatened species effective September 22, 2003. They are found in the Sacramento San Joaquin estuary, although their historical range was greater. They have declined by 62 percent over a 13-year period.

Many of the fish in the Central Valley and Bay-Delta are introduced species. CDFG estimates that at least 50 species of fish have been introduced at one time or another into the Delta and San Francisco Bay estuary. Of 79 total fish species in the Central Valley, 32 were introduced. Principal introduced gamefish include striped bass, other basses, channel and white catfish, American shad, and sunfish. Notable non-gamefish include threadfin shad, goldfish, carp, golden shiners, fathead minnows, mosquitofish, and yellowfin goby.

Environmental Consequences.

Methodology. Except as noted below it was assumed that any benefits or adverse effects on resident native fish species in the

Trinity and Klamath River Basins would be similar to those for anadromous salmonids. This assumption is based on the premise that native resident fish evolved in and adapted to the same pre-dam environment that native anadromous salmonids did (the assumption does not apply to non-native resident fish).

Additional assumptions included the following:

- Mechanical rehabilitation projects in Trinity River would not affect resident native or non-native species in the lower Klamath River Basin.
- Watershed protection in the Trinity River would benefit resident native and non-native fish in the lower Klamath River.

Impacts to resident native and non-native fish in the Sacramento River were assessed qualitatively based on known population status, life history, and habitat needs. Impacts on fish in the Delta were assessed based on changes in Delta flows. A detailed evaluation was conducted on the Delta smelt because of their threatened status.

To distinguish differences between project alternatives and the No Action Alternative for resident fish, including Delta smelt, comparisons of Delta inflow to export ratios, position of X2 (salinity in the Delta equal to 2 ppt), and outflow from the Delta were conducted. The months most critical to Delta smelt, February through June, were scrutinized to determine if changes in flows in those months would be significant enough to potentially adversely affect those species in the Delta regions of the Central Valley. The detailed review of Modeled X2 position is described below. Graphic representations of relative X2 position are presented in Appendix B. Changes in the ratio of inflow to exports, position of X2, and out-flows from the Delta could negatively affect sensitive Delta species by adversely moving the position of optimal larval and juvenile rearing habitat area in Suisun Bay. Changes in flows in the Delta may also adversely affect those species by transporting larvae and juveniles into areas in the Delta where they may become entrained by the state and federal pumps.

The 2000 Service BO included a condition related to X2 that was the subject of specific comment in Judge Wanger's ruling, and, subsequently, a detailed analysis in this Supplemental EIS/EIR. Following is the specific reasonable and prudent measure (Reasonable and Prudent Measure) text from the 2000 Service BO:

- If Reclamation in its annual operations planning process detects that implementation of the Preferred Alternative will result in upstream (eastward) movement of X2 in any month between February 1 through June 30 of 0.5 km, Reclamation shall incorporate within its operating plan measures that can and will be implemented to minimize or eliminate such upstream movements.

During the court proceeding, testimony was heard from both Service and USBR regarding the likely effect that implementation of the reasonable and prudent measure would have on CVP operations. Judge Wanger's ruling on the matter focused on the likelihood that the reasonable and prudent measure would result in additional water for X2 management that would be re-allocated away from another existing use and the impact to the existing use was not disclosed in the EIS/EIR. Specifically, the MDO states:

> Whenever CVP water is diverted to a different use, an impact is experienced throughout the system. The effects on the Preferred Alternative from the X2 reasonable and prudent measure pose potential unquantified but significant environmental and other consequences. The conflict between Service's "insignificance" opinion and the Bureau's views of the FEIS's X2 reasonable and prudent measure consequences … are not addressed or resolved … making impossible a finding that further analysis of X2 reasonable and prudent measures was not required. It was arbitrary and capricious for the EIS and FEIS not to address impacts of X2 reasonable and prudent measures and CVP re-operation.

First, it is important to note that, as currently stated, the reasonable and prudent measure is not implementable because there is no operational mechanism for direct comparison of monthly X2 position between No Action and the Preferred Alternative on either a real time or predictive basis. This likely accounts for the "conflict" identified in the MDO. The reasonable and prudent measure is based entirely on the CALSIM model, which is only a tool for comparing alternatives, not for real-time operations. For the reasonable and prudent measure to be implementable, two pieces are needed. First, a theoretical model of how the system would be operated under current conditions (i.e., how operations would be conducted if Trinity Restoration did not occur) would need to be developed in order to track a modeled value for X2 into the future. Secondly, because the current month's X2 position is partially driven by operations from the previous month, some mechanism would be needed to retroactively manage the previous month's operations. Thus, disclosure of the water cost of implementing the X2 reasonable and prudent measure is not feasible because implementation of the reasonable and prudent measure is not feasible.

However, impacts of the alternatives to X2 position were analyzed in an effort to disclose impacts from implementing action alternatives. CALSIM output was evaluated using mapping software to track relative X2 position between alternatives. Output from this analysis indicates that there is no substantial change in critical habitat between the Existing Conditions and Preferred Alternative model runs (2001 Level of Development). Contrary to NEPA-focused analysis, ESA consultation requires comparison of the action alternative to existing conditions. NEPA review is described below. This is partially a result of X2 moving in both the upstream and downstream direction under the Preferred Alternative when compared to Existing Conditions, and also a result of the majority of exceedances (differences greater than 0.5 km) occurring in above normal or wet water years, when critical habitat is not limiting. Additionally, in a large number of the below normal or drier years, X2 exceedances occur when both the Existing Condition and the Preferred Alternatives are greater than 73 km, thus limiting habitat to the less desirable area east of Chipps Island. None of the modeled output identifies a case when the Preferred Alternative causes a loss of the critical habitat in Honker Bay that would have otherwise been available under the Existing Condition. However, the modeling does indicate that X2 does trend slightly (approximately 0.14 km, on average between February and June of the modeled period) to the east under the Preferred Alternative, when compared to the Existing Condition. This conclusion is expected to be consistent with the CVP-OCAP BO due to be released June 30, 2004. Further discussion of impacts under the CVP-OCAP consultation is presented in Chapter 4.

As noted above, NEPA analysis requires a slightly different comparison than ESA consultation. However, the same general conclusion is reached for NEPA analysis as for the ESA consultation. Compared to No Action, Maximum Flow causes the largest X2 shift towards the east between February and June, 0.13 km on average. Other action alternatives were lower. For example, Revised Mechanical resulted in a shift of 0.01 km; Modified Percent Inflow was 0.02 km; and Flow Evaluation was 0.04 km, on average, between February and June. In all cases, X2 shifts occurred in both the upstream and downstream direction, compared to No Action, and the large majority of exceedances occur in wetter years, when habitat is not limiting. Because there was no impact under the action alternatives, there is no need for mitigation, and the reasonable and prudent measure identified by the Service is no longer necessary.

To distinguish differences between project alternatives and the No Action Alternative for non-native resident fish, including striped bass and American shad, comparisons of Sacramento River flows, Delta inflow to export ratios, position of X2, and outflow from the Delta were also conducted. Excessive water exports compared to inflows in the Delta result in flow patterns in the Delta that can lead to greater numbers of fish eggs and larvae being entrained and lost at the Delta Pumps. Food productivity may also be negatively affected by changes in Delta outflows. Reductions in food availability could adversely affect populations of important gamefish species such as striped bass and shad.

<u>Significance Criteria</u>. Impacts are considered significant to resident native and non-native fish species if they result in any of the following:

- Potential for reductions in the number, or restrictions of the range, of an endangered or threatened resident or non-resident fish or a resident or non-resident fish that is a candidate for state listing or proposed for federal listing as endangered or threatened
- Potential for substantial reductions in the habitat of any resident or non-resident fish other than those that are listed as endangered or threatened or are candidates (CESA) or proposed (ESA) for endangered or threatened status
- Potential for causing a resident or non-resident fish population to drop below self-sustaining levels
- Substantial adverse effect, either directly or through habitat modifications, on any resident or non-resident fish identified as a sensitive or special-status species in local or regional plans, policies, or regulations
- Substantial interference with the movement of any resident or non-resident fish.
- More than 10 percent modeled exceedance in the ratio of Delta inflows to exports, Delta outflows, over the 72-year simulation period (this percentage was judged to be conservative given it would be applied over the entire the analysis period). Such reductions in Delta flows are considered to be significant with regard to potentially adversely affecting habitats for Delta species, particularly Delta smelt.
- A change in Modeled X2 position such that habitat for Delta smelt is significantly reduced.
- A conflict with, or violation of, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan relating to the protection of resident fish
- Mortality of state or federally listed resident fish, or species that are candidates for listing (CESA) or proposed for listing (ESA)
- Reductions in the size of a resident fish population sufficient to jeopardize its long-term persistence

- Temporary impacts to habitats such that resident fish suffer increased mortality or lowered reproductive success that jeopardizes the long-term persistence of those local populations
- Permanent loss of critical habitat of a listed species or special-status resident fish
- Reduction in the quantity or quality of habitats in which resident fish populations occur sufficient to reduce the long-term abundance and productivity of local populations
- Upstream X2 movement greater than 0.5 km in any month compared to No Action in February through June of any year[4]

No Action. As described under the Native Anadromous Species discussion above, the No Action Alternative performed poorly in achieving the Trinity River system attributes that benefit fish. Implementation of the No Action Alternative would result in the continued degradation of Trinity River habitat for resident native and non-native fish, although the degradation would not be as great as occurred immediately following TRD implementation. Impacts to resident native and non-native species in the Lower Klamath River Basin/Coastal Area and Central Valley would likely be relatively unchanged from existing conditions.

Revised Mechanical. Implementation of the Revised Mechanical Alternative would benefit resident native and non-native species in the Trinity River by enhancing habitat conditions for juvenile and adult life stages compared to the No Action Alternative. Conditions in the lower Klamath River would likely improve somewhat relative to the No Action Alternative. Populations of resident species in the lower Klamath River and estuary may benefit from implementation of this alternative as a result of increased flows into the Klamath River.

In the Central Valley, the allowable ratio of Delta inflows to exports, agreed upon in the Bay-Delta Accord, were not exceeded for any year simulated. On average, the change in monthly outflow from the delta is less than 1 percent less that that from the No Action Alternative (Table 3.4-14). The average X2 positions are, on average, are approximately -0.1 percent less than No Action for the months critical to Delta sensitive species. The average monthly X2 position moved greater than 0.5 km upstream compared to the No Action Alternative in as many as 7 of the 72 years (9.7 percent) simulated (June) (Table 3.4-15). However, the position of X2 also moved downstream (westward) greater than 0.5 km compared to No Action in as many as 4 of the 72 years (5.8 percent) simulated. Taken

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[4] This criterion was the foundation of why the court found the original FWS BO unlawful. This may be withdrawn from the service, and may not be carried forward in the new Section 7 consultation.

together, the net change in X2 position is not significantly different than those estimated for No Action. The frequency and magnitude of these changes may result in significant impacts to habitat conditions for resident Delta species, including Delta smelt.

TABLE 3.4-14
Percent Change in the Average Monthly Outflows (CFS) from the Delta (1922-1993)

	Compared to No Action					
Month	**Revised Mechanical**	**Flow Evaluation**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Flow Evaluation Compared to Existing Conditions**
February	0	0	0	-1	-1	-1
March	0	0	0	-1	0	0
April	0	0	0	-1	-1	0
May	0	-1	-1	-2	-2	-2
June	-2	-2	-2	-2	-3	-3
Average	0	-1	-1	-1	-1	-1

TABLE 3.4-15
Summary of the Change in X2 Position in the Delta during February through June compared to the No Action Alternative (1922-1993)

	Compared to No Action Alternative					
Alternative	**Revised Mechanical**	**Flow Evaluation**	**Modified Percent Inflow**	**70 Percent Inflow**	**Maximum Flow**	**Flow Evaluation Compared to Existing Conditions**
Number months > 0.5 km upstream	17	35	23	54	55	44
% months > 0.5km upstream	4.7%	9.7%	6.4%	15.0%	15.3%	12.2%
Number months > 0.5 Km downstream	14	29	19	12	23	39
% months > 0.5km downstream	3.9%	8.1%	5.3%	3.3%	6.4%	10.8%

Flow Evaluation. The Flow Evaluation Alternative would provide greatly enhanced conditions for resident native and non-native species in the Trinity River compared to the No Action Alternative. Conditions in the lower Klamath River would be somewhat improved relative to the No Action Alternative.

In the Central Valley, the allowable ratio of Delta inflows to exports, agreed upon in the Bay-Delta Accord, were not exceeded for any year simulated. During May and June, Delta outflows are up to 2 percent less than those for No Action (Table 3.4-15). Those reductions in Delta outflows may be significant and may adversely affect habitat for Delta species. Compared to No Action for the months critical to sensitive Delta species, the relative changes in position of X2 for the Flow Evaluation Alternative are on average, less than or equal to 0.1 percent (Table 3.4-16). During February through June the estimated position of X2 moved upstream greater than 0.5 km in 35 (9.7 percent) of the months from 1922 through 1993 (Table 3.4-15). However, the position of X2 also moved downstream (westward) greater than 0.5 km compared to No Action in 29 (8.1 percent) of those month during the same period. Taken together, the net change in X2 position is not significantly different than those estimated for No Action. The frequency and magnitude of these changes would not result in significant reduction in habitat for resident species in the Delta.

TABLE 3.4-16
Comparison of No Action to Project Alternatives for Delta X2 Position (in km) for Months Critical to Sensitive Delta Species during the Period 1922 through 1993

	Alternative					
	Revised Mechanical	Flow Evaluation	Modified Percent Inflow	70 Percent Inflow	Maximum Flow	Existing Conditions
Month	Average Relative Change (Percent)					
February	0.0	-0.1	-0.1	-0.4	-0.4	-0.1
March	0.0	-0.1	-0.1	-0.2	-0.2	-0.1
April	0.0	-0.1	-0.1	-0.3	-0.1	-0.1
May	0.0	0.0	-0.1	-0.1	-0.1	-0.1
June	0.0	0.0	-0.1	-0.2	-0.1	-0.1

Modified Percent Inflow. Implementation of the Modified Percent Inflow Alternative would benefit resident native and non-native species in the Trinity River by enhancing habitat conditions for juvenile and adult life stages compared to the No Action Alternative. Conditions in the lower Klamath River would likely be unchanged relative to the No Action Alternative.

In the Central Valley, the allowable ratio of Delta inflows to exports, agreed upon in the Bay-Delta Accord, were not exceeded for any year simulated. During May and June, Delta outflows are up to 2 percent less than those for No Action (Table 3.4-15). Those reductions in Delta outflows are not significantly different than those for the No Action Alternative. Compared to No Action for the months critical to sensitive Delta species, the relative changes in position of X2 for the Modified Percent Inflow Alternative are on average, nearly unchanged (Table 3.4-16). During February through June the estimated position of X2 moved upstream greater than 0.5 km in 23 (6.4 percent) of the months from 1922 through 1993 (Table 3.4-15). However, the position of X2 also moved downstream (westward) greater than 0.5 km compared to No Action in 19 (5.3 percent) of those months during the same period. Taken together, the net change in X2 position is not significantly different than those estimated for No Action. The frequency and magnitude of these changes would not result in significant reduction in habitat for resident species in the Delta.

<u>70 Percent Inflow</u>. The Flow Evaluation Alternative would provide greatly enhanced conditions for resident native and non-native species in the Trinity River compared to the No Action Alternative. Conditions in the lower Klamath River would be somewhat improved relative to the No Action Alternative.

In the Central Valley, the allowable ratio of Delta inflows to exports, agreed upon in the Bay-Delta Accord, were not exceeded for any year simulated. During all months from February through June, Delta outflows are up to 2 percent less than those for No Action (Table 3.4-15). Compared to No Action for the months critical to sensitive Delta species, the relative changes in position of X2 for the 70 Percent Inflow Alternative are generally less than or equal to 0.4 percent (Table 3.4-16). Compared to the No Action Alternative the relative changes in X2 position during February through June are less than 0.4 percent (Table 3.4-16). During February through June the estimated position of X2 moved upstream greater than 0.5 km in 54 (15.0 percent) of the months from 1922 through 1993 (Table 3.4-15). However, the position of X2 also moved downstream (westward) greater than 0.5 km compared to No Action in 12 (3.3 percent) of those months during the same period. Taken together, the net change in X2 position is significantly different (>10%) than those estimated for No Action. Therefore overall, the frequency and magnitude of these changes may result in significant reductions in Delta habitat for resident species, including Delta smelt. These impacts could be not be mitigated for.

<u>Maximum Flow</u>. The Maximum Flow Alternative would provide suitable habitat and greatly enhanced conditions for resident native and non-native species in the Trinity River compared to the No Action Alternative. The impacts of improved habitat conditions on non-native brown trout in the Trinity River are unknown, but it is unlikely they would benefit to a greater extent than native salmonid species. Conditions in the lower Klamath River would be somewhat improved relative to the No Action Alternative due to additional flows and habitat water quality.

In the Central Valley, the allowable ratio of Delta inflows to exports, were not exceeded for any year simulated. During the months February, April, May and June, Delta outflows are up to 3 percent less than those for No Action (Table 3.4-15). Those reductions in Delta outflows are not significantly different than those for the

No Action Alternative. Compared to the No Action Alternative the relative changes in X2 position during February through June are less than 0.4 percent (Table 3.4-16). During February through June the estimated position of X2 moved upstream greater than 0.5 km in 55 (15.3 percent) of the months from 1922 through 1993 (Table 3.4-15). However, the position of X2 also moved downstream (westward) greater than 0.5 km compared to No Action in 23 (6.4 percent) of those months during the same period. Taken together, the net change in X2 position is not significantly different (<10%) than those estimated for No Action. Therefore overall, the frequency and magnitude of these changes would not likely result in significant reductions in Delta habitat for resident species, including Delta smelt.

<u>Existing Conditions versus Proposed Action</u>. Trinity River impacts of the Proposed Action to existing conditions would be similar to the impacts of the Flow Evaluation Alternative compared to the No Action conditions in the year 2020. However, the watershed protection component of the Proposed Action would benefit resident native fish by reducing sediment inputs to the Trinity River.

In the Central Valley, the allowable ratio of Delta inflows to exports, agreed upon in the Bay-Delta Accord, were not exceeded for any year simulated. During the months February, May and June, Delta outflows are up to 3 percent less than those for No Action (Table 3.4-15). Those reductions in Delta outflows are not significantly different than those for existing conditions. Compared to No Action for the months critical to sensitive Delta species, the relative changes in position of X2 for the existing conditions are, on average, -0.1 percent (Table 3.4-16). Compared to the existing conditions the relative changes in X2 position for the Flow Evaluation Alternative, during February through June, are less than 0.1 percent (Table 3.4-16). During February through June the estimated position of X2 moved upstream greater than 0.5 km in 44 (12.2 percent) of the months from 1922 through 1993 (Table 3.4-14). However, the position of X2 also moved downstream (westward) greater than 0.5 km compared to existing conditions in 39 (10.8 percent) of those months during the same period. Taken together, the net change in X2 position is not significantly different (<10%) than those estimated for existing conditions. Therefore overall, the frequency and magnitude of these changes would not likely result in significant reductions in Delta habitat for resident species, including Delta smelt.

3.4.3 Reservoirs

Affected Environment.

Trinity River Basin. Trinity Reservoir supports a trophy smallmouth bass fishery and provides significant sport fishing for largemouth bass, trout, kokanee salmon, landlocked Chinook salmon, and other gamefish. The maximum surface area of the reservoir is 16,500 acres, with an irregular shoreline of about 145 miles. As is typical with most reservoirs, Trinity Reservoir is characterized by steep sides, with the upper one-fifth of the reservoir consisting of gentle slopes. Thermal stratification occurs between May and November, while the remainder of the year the reservoir is relatively isothermal (i.e., water temperature is the same at all depths). The banks of Trinity Reservoir have high erosion potential, and under windy conditions contribute to high turbidity near the shoreline.

Lewiston Reservoir is principally a trout fishery. Its total storage capacity is 14,600 acre-feet, covering about 610 acres with 15 miles of shoreline. Because Lewiston Reservoir is fairly shallow, thermal stratification can develop quickly when discharge from Trinity Reservoir is low. Historically, exports to the Central Valley have been intermittent, which results in rapid swings in Lewiston Reservoir surface temperatures.

Habitat and Life History Characteristics of Principal Species. Habitat conditions and forage for smallmouth bass in Trinity Reservoir appear to be nearly ideal. The cool water and the high percentage of gravel-rubble bottom have resulted in record-size smallmouth bass being taken. The species requires clean sand, gravel, or debris-littered bottoms to spawn, at depths of 1 to 3 feet up to 23 feet. Spawning begins in April. Optimal water temperatures for spawning are 55 to 61°F; optimal temperature for growth and survival is 68 to 81°F. Largemouth bass also begin spawning in April, typically when water temperatures reach 61°F. Spawning occurs at depths of 3 to 6 feet on sand, gravel, or debris-littered bottoms. Optimal growth and survival for largemouth bass occurs at water temperatures of 68 to 86°F.

Kokanee salmon are the non-anadromous (i.e., land-locked) form of sockeye salmon. They were introduced and have become well established in both Trinity and Lewiston Reservoirs. The species makes its spawning migration into streams between early August and February. They prefer spawning in water temperatures between 43 to 55°F.

Rainbow trout are the most abundant salmonid found in the two reservoirs. They spawn in the spring in streams flowing into the reservoirs. Juvenile trout migrate out of the spawning streams to enter the reservoir to forage and mature where the cold, deep water provides suitable habitat. Optimum temperatures for growth are between 55∀and 70∀F.

Variable numbers of hatchery trout are stocked by CDFG into Trinity and Lewiston Reservoirs each year to support the sport fisheries. The timing and numbers of planted fish are dependent upon several factors, including water temperature, availability of hatchery fish, and reservoir surface acreage.

Factors Affecting Abundance. Fluctuating water level is frequently identified as the main adverse impact affecting reservoir fish production. Limited cover, associated with surface-level fluctuation, has also been identified as a primary limiting factor in terms of production. Rising water elevations during spring could cause largemouth bass to abandon nests. Conversely, severe drawdown of Trinity Reservoir could adversely affect both smallmouth and largemouth bass production in some years.

Temperatures within the reservoirs are dependent on season and reservoir storage conditions. Generally, temperatures are adequate to sustain reservoir fisheries. However, cool water in Trinity Reservoir might not be optimal for largemouth bass and kokanee salmon. Cold water in the reservoir appears to cause low zooplankton production and could be responsible for the stunted size (6 to 8 inches) of kokanee salmon.

Lower Klamath River Basin/Coastal Area. No reservoirs exist in this area.

Central Valley. The Central Valley contains numerous reservoirs supporting both coldwater and warmwater sport fisheries. The principal reservoirs include Shasta, Whiskeytown, San Luis, Folsom, and Oroville. These reservoirs were evaluated because they are the principal storage elements of the CVP and SWP, contain significant sport fisheries, and habitats supporting those fisheries that may be affected by project operations. Operations of the CVP and the SWP may affect the fish habitat by changing reservoir storage conditions (surface area and volume of reservoirs). Changes in reservoir surface area, depths, and timing of these changes may decrease or increase spawning and rearing habitats and food production supporting those reservoirs' warmwater gamefish. Principally, those CVP and SWP reservoirs are warmwater (bass, catfish, and sunfish) fisheries that are self-sustaining by natural reproduction. Coldwater fisheries in those reservoirs are supplemented by stocking programs and, as such, are less affected by changes in reservoir operations and habitat conditions.

Shasta Reservoir provides an outstanding fishery, with both coldwater and warmwater species commonly pursued by recreational anglers. Coldwater gamefish include Chinook and kokanee salmon and rainbow and brown trout. Warmwater gamefish include largemouth, smallmouth, and spotted bass, sunfish, black crappie, channel and white catfish, and bullhead. Whiskeytown Reservoir receives diverted water from Lewiston Reservoir via the Clear Creek Tunnel. Gamefish found in Whiskeytown Reservoir include rainbow and brown trout, kokanee salmon, largemouth bass, crappie, sunfish, catfish, and bullhead.

San Luis Reservoir principally serves to store and deliver water received from the Delta diversions for delivery to farmland in western Merced, Fresno, and Kings Counties. Due to pattern of water deliveries, drawdowns in excess of 60 feet occur annually. More than 30 fish species are known to occur in San Luis Reservoir. The species were generally introduced by transport as larvae or fry from the Delta. CDFG has periodically stocked catfish and largemouth bass in this reservoir, but the principal gamefish has been striped bass.

Folsom Reservoir contains a warmwater fishery of large and smallmouth bass, sunfish, and catfish, and a coldwater fishery of rainbow trout that is stocked by CDFG on an annual basis. Oroville Reservoir's warmwater sport fishery is for largemouth, spotted, and smallmouth bass and catfish. The coldwater fishery consists of rainbow and brown trout and Chinook salmon.

Lake Oroville is a DWR storage reservoir on the Feather River. Water is delivered out of the Reservoir to Thermolito forebay/afterbays and from there to downstream users. Drawdown averages approximately 75 feet per year. Both warmwater and coldwater sportfisheries ("two story fishery") exist in Lake Oroville. Bass fishing is a popular sport and is recognized as a top bass angling fishery in the Western U.S. Species include spotted bass, largemouth, redeye, and smallmouth bass. In addition, black crappie, white crappie, and channel catfish up to 25 pounds are commonly caught in Lake Oroville. The principal coldwater species are planted brown trout and Chinook salmon. Brown trout up to 15 pounds and Chinook salmon up to 19 pounds have been caught in Lake Oroville in recent years.

Environmental Consequences.

Methodology. In the Draft EIS/EIR, a spreadsheet model was developed for the Trinity and Lewiston Reservoirs to evaluate the changes in reservoir habitat resulting from fluctuations of water-surface elevations and area. Impacts of the alternatives on warmwater fish communities in Trinity Reservoir were evaluated by calculating a spawning habitat index and a rearing habitat index for largemouth and smallmouth bass. The changes in surface elevations and area were assumed to directly affect fish abundance and production. Changes in habitat indices, therefore, reflect expected changes in relative population abundance and production. For this Supplemental EIS, impacts of the alternatives on both warmwater and coldwater fish communities were evaluated qualitatively based on changes in reservoir surface acreages or in the case of San Luis Reservoir, storage.

Changes in reservoir acreages were evaluated for each alternative. Mean reservoir surface acreage for the primary spawning and rearing months of largemouth and small mouth bass (March through July) were compared among the alternatives to evaluate impacts to warmwater reservoir species over the 72-year simulation period.

Significance Criteria. Impacts to reservoir fisheries are considered significant if they result in any of the following:

- Potential for reductions in the number, or restrictions of the range, of an endangered or threatened reservoir fish or a reservoir fish that is a candidate for state listing or proposed for federal listing as endangered or threatened
- Potential for substantial reductions in the habitat of any reservoir fish other than those that are listed as endangered or threatened or are candidates (CESA) or proposed (ESA) for endangered or threatened status
- Potential for causing a reservoir fish population to drop below self-sustaining levels
- Substantial adverse effect, either directly or through habitat modifications, on any reservoir fish identified as a sensitive or special-status species in local or regional plans, policies, or regulations
- Substantial interference with the movement of any reservoir fish
- A conflict with, or violation of, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan relating to the protection of reservoir fish
- Mortality of state or federally listed reservoir fish, or species that are candidates for listing (CESA) or proposed for listing (ESA)
- Reductions in the size of a reservoir fish population sufficient to jeopardize its long-term persistence

- Temporary impacts to habitats such that reservoir fish suffer increased mortality or lowered reproductive success that jeopardizes the long-term persistence of those local populations
- Permanent loss of critical habitat of a listed species or special-status reservoir fish
- Reduction in the quantity or quality of habitats in which reservoir fish populations occur sufficient to reduce the long-term abundance and productivity of local populations

Potentially significant impacts to reservoir fisheries were judged to occur if reservoir water surface areas (which correlate with habitat quantity and fish abundance) were reduced over 10 percent during the months of March through July over the 72-year simulation period.

No Action. Conditions under the No Action Alternative would remain relatively unchanged compared to existing conditions.

Revised Mechanical. There would be no impacts to reservoirs.

Flow Evaluation. Trinity Reservoir spawning habitat for bass would diminish due to decreased average water-surface areas, but to a less than significant degree. Impacts to other reservoirs would be negligible.

Modified Percent Inflow. Impacts to reservoirs would be negligible.

70 Percent Inflow. This alternative would likely adversely affect both largemouth and smallmouth bass spawning in Trinity Reservoir and, to a lesser degree, Shasta Reservoir. The annual change in surface area of Trinity Reservoir decreased nearly 10 percent (9.4 percent). Reductions of Trinity Reservoir surface areas ranged from 9 to 13 percent during the months of March through July as compared to No Action. An annual reduction of approximately 5.6 percent of Shasta Reservoir surface area was estimated. These decreases may result in adverse impacts to spawning warmwater reservoir species in Shasta Reservoir, but were not considered significant for this analysis. These decreases may result in adverse impacts to spawning warmwater reservoir species in Trinity Reservoir during March through July. Impacts to other reservoirs would be negligible (Table 3.4-10).

Maximum Flow. The Maximum Flow Alternative would likely adversely affect both largemouth and smallmouth bass spawning in Trinity Reservoir and, to a lesser degree, Shasta Reservoir. The decrease in surface area of Trinity Reservoir exceeded 10 percent (greater than 30 percent), a significant adverse impact to spawning for warmwater reservoir species. The range in decreases in surface area of Shasta Reservoir were up to nearly 8 percent. These decreases may result in adverse impacts to spawning warmwater reservoir species in Shasta Reservoir, but were not considered significant for this analysis. Impacts to other Central Valley reservoirs would be negligible (Table 3.4-17).

Existing Conditions versus Proposed Action. The difference between existing conditions and the Proposed Action would be nearly identical to the difference between the No Action and the Flow Evaluation Alternative. This is because the other components of the Proposed Action (i.e., watershed protection) would not affect reservoirs.

Mitigation.

To reduce the impact of the Maximum Flow and the 70 Percent Inflow Alternatives on warmwater reservoir fish species in Trinity Reservoir to a less than significant level, the following mitigation should be implemented:

A smallmouth and largemouth bass stocking program should be initiated similar to the existing stocking program for coldwater species.

TABLE 3.4-17
Summary of Impact Analysis for Fishery Resources (Compared to the No Action Alternative)

Resource Concern	Geographical Area	Mechanical Restoration	Revised Mechanical	Flow Evaluation	Modified Percent Inflow	70 Percent Inflow	Maximum Flow	Flow Evaluation Compared to Existing Conditions
Native Anadromous Species	Trinity River Basin	B	HB	HB	HB	HB	HB	HB
	Lower Klamath River Basin	NC	B	B	B	B	B	B
	Central Valley	NC	NC	A	A	A	A	A
Resident Native Species	Trinity River Basin	B	B	B	B	B	B	B
	Lower Klamath River Basin	NC	B	B	B	B	B	B
	Central Valley	NC	A	A	A	A	A	A
Reservoir Species-Trinity Basin	Warmwater species	NC	NC	NC	NC	A	A	NC
	Coldwater species	NC	NC	NC	NC	NC	NC	NC
Reservoir Species-Central Valley	All species	NC	NC	NC	NC	NC	NC	NC

Notes:
A = Adverse Change
NC = No Change
B = Beneficial Change
HB = Highly Beneficial Change

3.5 Power Resources

The TRD is a key component of CVP hydropower as it provides approximately 30 percent of the power generation capability of the CVP through approximately 1 percent of overall generation capability statewide. This analysis of potential impacts on power resources focuses on effects on power generation, market value of power, and preference power customers. This section does not differentiate between the Trinity River Basin, Lower Klamath River Basin/Coastal Area, and Central Valley because impacts to power span the Trinity River Basin and Central Valley areas and beyond.

Affected Environment.

One of the conclusions stated in the Wanger Decision is that "inadequate consideration was given to power supply and reliability impacts in a changing hydropower environment." This section presents an overview of recent changes in the California power market and the role of the CVP within that market.

California Power Crisis. California's electric deregulation created a statewide electricity market with its own characteristics and governance.

When California deregulated, it established the California Power Exchange (CAPX) to operate a power exchange system from which the state's investor-owned utilities (IOU) (PG&E, Southern California Edison [SCE], and San Diego Gas & Electric) had to buy their power on a day-ahead and hour-ahead basis. The highest price power supply bid that was needed for each hour of the next day set the price for the entire market for that hour. The IOUs were also prevented from hedging into future markets. This eliminated new bilateral, negotiated agreements from the market place.

The winter of 2000-01 marked the second driest water year on record in the Pacific Northwest, reducing the amount of hydroelectric produced in the region, which increased the demand for natural gas in the region and decreased the amount available for export to California. Decreased natural gas exports coupled with historically low natural gas storage in California caused natural gas prices to rise dramatically. (Marcus and Hamrin, How we got in the California Energy Crisis, www.jbsenergy.com), also (Electricity Shortage in California: Issues for Petroleum and Natural Gas Supplies, www.eia.doe.gov.

In late May 2000, after the first unanticipated heat wave of the year, wholesale market prices became extremely volatile and provided opportunities for market manipulation. The California Independent System Operator (ISO) had responsibility to provide the system with "spinning reserves," which it had to purchase on the spot market, and also had to make up for any differences between actual real-time loads and forecasted day-ahead and hour-ahead loads. ISO real-time purchases drove wholesale power prices even higher. By late 2000, market prices for electricity were routinely well over $100 per MWh, well in excess of retail rates.

The IOUs were unable to pass the increased costs on to their retail customers. As a result, their financial capabilities were quickly lost and they approached bankruptcy in late 2000. This eventually led to credit concerns on the part of power suppliers who withheld supplies over payment concerns.

The state became involved in purchasing power supplies in January 2001. At the end of January 2001, CAPX suspended its day-ahead and day-of market operations.

In early March 2001, DWR negotiated and executed 40 contracts for nearly 8,900 megawatts (MW) for periods ranging from 1-12 years to meet SCE and PG&E's needs. These contracts, negotiated during the power crisis, are at levels above current market prices, and the state is making an ongoing effort to renegotiate the contracts. The state has had some success in this regard.

In April 2001, PG&E filed a voluntary petition for bankruptcy protection under Chapter 11 of the U.S. Bankruptcy Code. Also in April, the Federal Energy Regulatory Commission (FERC) issued its initial order to provide market mitigation for summer 2001, followed by a second order in June that revised, clarified, and expanded the April order. By June 2001 prices had returned to levels far below those of the previous 12 months, where they have largely remained since. In May, the state authorized the sale of $13.4 billion in bonds to finance power purchases and other measures to ease the crisis.

In June 2001, a FERC administrative law judge mediated negotiations on the appropriate level of refunds due California from power suppliers. The talks broke down over a lack of documentation. Separately, a FERC order required ISO market participants to offer their generation to the market whenever it was physically available unless given a prior waiver by ISO. This "must-offer" requirement prevented withholding of supplies to drive up prices and contribute greatly to the stabilization of market prices in June 2001 and thereafter.

With the October 2001 California Public Utilities Commission order ending direct access in the state, California's deregulation of its retail electricity markets came to an end. The state is now in a position of being a major power purchaser and seller, and longer term bilateral contracts dominate the market.

In December 2001, FERC issued additional extensive orders clarifying the market mitigation framework that exists in California today. Parts of that framework expired on September 30, 2002. There are efforts underway to redesign the California wholesale power market.

In May 2002, documents surfaced indicating deliberate market manipulation by various power marketers, which in turn have led to calls for refunds, increased regulatory scrutiny, and possible litigation, over the events and prices of the 2000-2001 period. Meanwhile, the "must-offer" requirement, the construction of thousands of MW of new generation since 2000, and demand reductions which left 2003 consumption no higher than 2000 consumption have all worked together to produce relatively stable supplies and prices since June 2001.

California and the Western Systems Coordinating Council System. California moved toward deregulating its electric utility industry in 1996 with Assembly Bill 1890, which made fundamental changes to the electric market structure to increase competitive market forces.

This was, and is, part of a broader national transition from a highly regulated, vertically integrated industry to one with a competitive wholesale power supply market, common carrier bulk power transmission systems, and local distribution companies.

Industry restructuring began with passage of the 1992 Energy Policy Act, which required FERC-regulated, transmission-owning utilities to offer transmission service across their systems to eligible entities (e.g., utilities, power marketers, Independent Power Producers, etc.) under terms and conditions comparable to those the utility affords its own merchant function. FERC-regulated utilities are almost always IOU. Publicly owned utilities and federal power marketing agencies are not subject to the 1992 Energy Policy Act. However in practical terms, transmission-owning utilities have found it desirable to conform to the 1992 Energy Policy Act's requirements.

Although electric utilities have always traded electricity among themselves, it was not until passage of this Act that electricity became a commodity, traded among various parties in a manner similar to other energy commodities such as natural gas and crude oil. Non-utility generators were able to sell power across utility transmission systems. Today, it is not uncommon for the same kilowatt-hour (kWh) of electricity to be purchased and resold by multiple entities before reaching the end-use consumer.

As a result, the entire western North America interconnected electrical transmission system, composed of 13 western states and the Canadian provinces of British Columbia and Alberta, now functions as a single wholesale market (see Figure 3.5-1). This market is often referred to as the Western Electricity Coordinating Council (WECC) region.

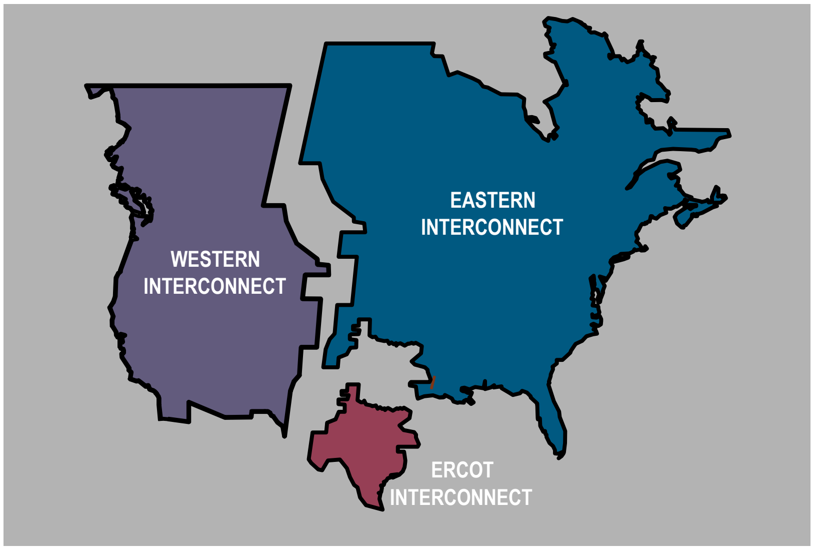

FIGURE 3.5-1
North America Interconnected Electrical Transmission System

A significant amount of business is conducted throughout the region using bilateral transactions as well as short-term or spot market transactions. Bilateral transactions occur at posted, cost-based rates or via negotiations between willing buyers and sellers.

Except for periods of transmission congestion, when electricity cannot move efficiently from one part of the system to another, prices throughout the west are highly correlated, as shown on Figure 3.5-2. Events in one subregion of the west (e.g., unit outage, extreme weather, etc.) impact the price of electricity throughout the western United States, as surplus power from one subregion moves to a power-short region. Short-term or spot market transactions are typically priced to reflect the indexed prices associated with particular “market hubs,” which establish spot market (next day) prices that are used to index transactions at these hubs. The electricity trading hubs shown on Figure 3.5-2 are the Mid-Columbia, California-Oregon Border, California ISO North of Path 15 (NP15), California ISO South of Path 15 (SP15), and Palo Verde.

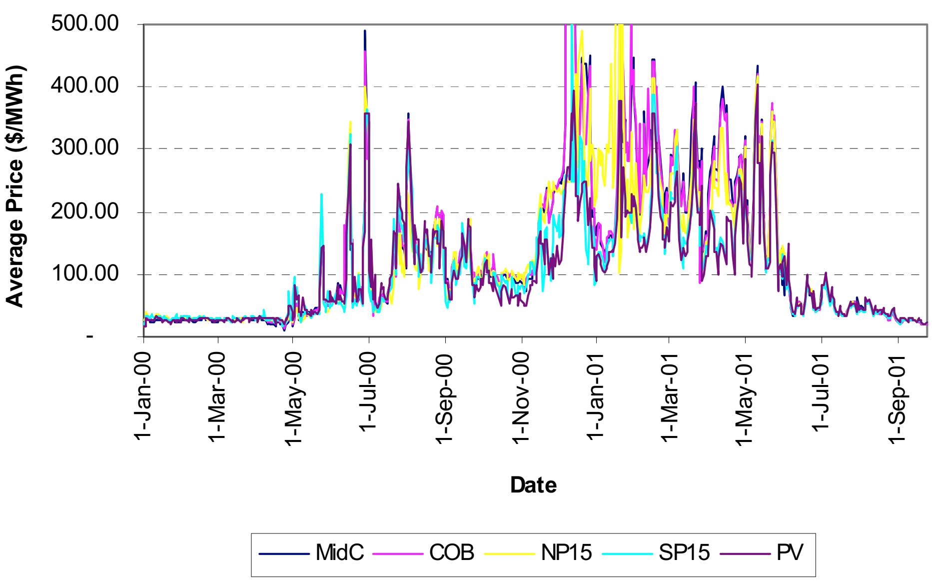

FIGURE 3.5-2
Average Daily Electricity Prices in the Western U.S. Calendar Year 2000 and 2001

The dramatic increase in electricity spot market price volatility, starting about May 2000 and continuing through June 2001, has been the subject of much discussion and analysis. It is generally agreed that contributing causes included some or all of the following:

- Structural flaws in California's wholesale power markets (the forced use of the day-ahead and day-of markets by the state's IOUs for all of their power supply)
- Increased load growth without new power generation to meet it
- A drought in the Pacific Northwest
- A lack of natural gas pipeline capacity into and within California
- Electric transmission system constraints
- The exercise of market power by the owners and/or marketers of power generation facilities and gas pipeline facilities, which was reinforced by the above

Recently discovered documents indicate that the exercise of market power and "gaming" of the system was a significant factor in the crisis. Enron and other power marketers engaged in various trading practices that took advantage of the market structure to create shortages and higher market prices. Recent documents have come to light indicating that some of the practices used by power marketers were possibly illegal and could constitute fraud.

Two studies commissioned after extreme prices first began appearing during the summer of 2000 point to supply tightness as a contributing factor. The Northwest Power Planning Council stated in its report, *"…we believe the prices experienced this summer* (summer of 2000) *are symptomatic of an overall tightening of supply, exacerbated by a number of factors."*[5] Similarly, the Compliance Unit of the CAPX cited *"an inadequate supply of electricity"* as one of the factors that contributed to the high prices experienced during the summer of 2000 and that continued into the spring of 2001[6].

FERC noted the strong correlation between the California electricity market and western United States bilateral prices during the summer of 2000. "The events of this summer provide dramatic evidence of the interstate nature of electric systems and markets in the Western Interconnection. California is not an electrical island. Operationally, the transmission facilities currently controlled by the ISO are part of the much larger Western Interconnection. The reliability of California's electric system depends on access to generating resources located throughout the Western Interconnection" (Order in San Diego Gas & Electric Company, et al., 93 FERC 61,1231 (2000)).

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[5] Study of Western Power Market Prices Summer 2000, document 2000-18, Northwest Power Planning Council, October 11, 2000.

[6] Price Movements in California Power Exchange Markets Analysis of Price Activity: May-September 2000, California Power Exchange Compliance Unit, November 1, 2000.

It should be noted that federal, municipal, and other non-IOU utilities in California were not required to use the CAPX or ISO for power supply. They continued to use the traditional bilateral contract approach. As a result, and to the extent they did not need to make purchases in the wholesale markets, their consumers were generally sheltered from the high electricity prices.

Western wholesale power market prices have generally returned to historical levels, the result of increased regulatory scrutiny, new power generation coming online, an improved hydroelectric power generation outlook in the Pacific Northwest, significant load reductions and a slowing of the economy, and lower natural gas prices and increased natural gas storage levels within California.

The California deregulated retail market came largely to an end when the California Public Utilities Commission ended the ability of retail electric customers in the state to have "direct access" to the wholesale market. The financial aftermath of the experiment will continue for many years.

California is in the process of redesigning its wholesale power markets and is developing mechanisms requiring load-serving entities to have adequate capacity to meet the loads served. This is intended to reduce wholesale power market volatility by assuring that there is sufficient capacity available to meet peak loads.

<u>Bulk Transmission Systems Operating Structure</u>. In the meantime, FERC continues to push the formation of regional transmission organizations (RTO) which will be responsible for the operation, planning, and control of the bulk electric transmission systems. FERC has indicated that the entire western United States system should be under one RTO. The ISO has acted in this function in California. There are ongoing efforts to establish one or more RTOs in the remaining Western Systems Coordinating Council area. Whether there are ultimately one or more RTOs in the west is yet to be determined.

Within its geographic area, an RTO is responsible for tariff administration and design, congestion management, management of parallel path flows, provider of last resort for ancillary services, administration of the Open Access Same-time Information System site, market monitoring, system planning and expansion, and inter-regional coordination. In performing these functions, it is expected that an RTO will provide a nondiscriminatory bulk power transmission system that will foster fully competitive wholesale markets.

It is expected that the western United States will continue to function as an interrelated market, with any spot market price volatility reflected throughout the region.

The WECC region has historically relied upon transmission capacity to enable economic generation dispatch throughout the region and to use seasonal excess capacity among subregions. This also avoided the need to develop additional generation capacity. Utilities in the Northwest have been able to share summer-peaking capacity located in the Northwest to help meet winter peaks in the Southwest and vice-versa.

The bulk power transmission system that serves the West Coast was largely built in the 1960s and 1970s and is frequently loaded to capacity. The congestion now associated with the West Coast transmission system has been aggravated by heavy use encouraged by deregulation. Much of the increased use is attributed to open market access that was not contemplated when the system was developed.

Congestion management efforts now play a significant role in the operation of the transmission system. These efforts consist of identifying transmission solutions as well as generation location and demand side (load interruption) solutions to relieve system constraints.

Adequate, unconstrained transmission enables orderly and cost-effective dispatch of power throughout the western United States and Canada. Transmission constraints effectively reduce the size of the market and lead to sub-optimal generation dispatch, higher production costs, and higher market prices of available power. Evidence has emerged that during the 2000 power crisis various energy traders gamed the system to create transmission system congestion and thereby raise prices.

Market Drivers. Market drivers are conditions or actions that cause changes to the market. These drivers include the load-resource balance within an area or region, transmission access and constraints, natural gas prices, marginal costs of power generation, regulatory considerations, water availability for Pacific Northwest hydropower, and subregional interaction.

Load Resource Balance. A primary driver of the market price of power is the relationship between loads and resources. When loads are less than the power resources available, the market is in surplus and the price should fall or be steady. Conversely, when loads exceed available power resources, the market is in deficit and the market price can be expected to rise.

In California, for various reasons, few new power generation facilities were built for over 10 years.[7] Moreover, in the year 2000, ISO-area energy consumption increased 5 percent above the level the year before.[8] This situation has since reversed, as a large amount of power generation facilities have been built and electrical demand has receded. Figure 3.5-3 displays the amount of power generation facilities built by year in the entire WECC, and includes a projection for 2004.[9] As a point of comparison, the nameplate capacity of the CVP is approximately 2,000 MW. Longer term, the California Energy Commission was identified over 8,500 MW of new powerplants under construction as of February 2004, plus another 13,000 MW already permitted, another 17,000 MW in permitting, and a further 14,000 MW in the initial stages of development. (CEC, 2/5/04, http://www.energy.ca.gov/electricity/wscc_proposed_generation.html)

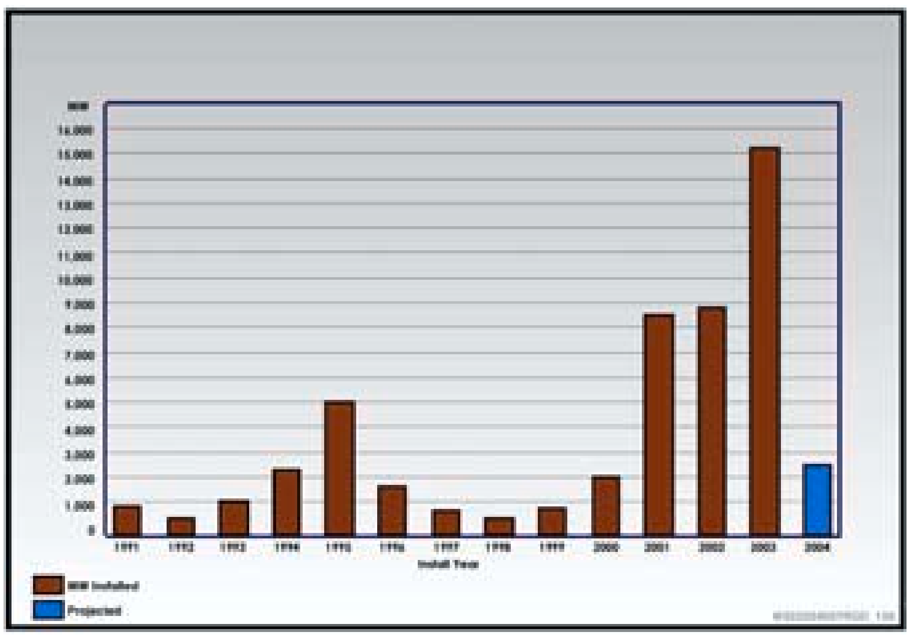

FIGURE 3.5-3
Power Generation Facilities Built by Year

[7] http://www.energy.ca.gov/sitingcases/backgrounder.html lists slightly over 1,000 Mw of CEC-licensed powerplants which came on line in California in the 1991-2000 period. This list does not include hydro or wind plants, or powerplants under 50 MW in size.

[8] However, peak demand in 2000 fell from 1999 levels.

[9] The CEC has a plant-by-plant listing of WECC resource additions on its website (see http:www.energy.ca.gov/electricity/wscc_proposed_generation.html). That listing shows approximate new resource additions of 2,200 MW in 2000, 8,600 MW in 2001, 9,600 MW in 2002, 16,400 MW in 2003, and 11,400 MW for 2004 (2,800 MW of which is listed as under construction as of October 2003). The CEC numbers for 2001-2 are somewhat higher than the numbers on Figure 3.5-3, probably because of different accounting for wind projects.

Hydroelectric Water Conditions. Hydroelectric water conditions (snowfall and rainfall) have a tremendous influence on the availability and price of power in the region. Hydroelectric generation is the predominant source of power in the Pacific Northwest and Canada (over 30,000 MW of capacity in the U.S. Pacific Northwest and over 10,000 MW of capacity in British Columbia, Canada). Temperature greatly influences the magnitude and runoff pattern and the short-term availability of hydropower. Endangered species considerations also have a significant effect on hydropower system operations.

Most WECC utilities that operate hydroelectric generation plants rely upon critical water planning; that is, they base their "firm" power capabilities on the historical low water runoff periods. Whenever water conditions are better than "critical" there is additional "non-firm" energy available. While the amount of non-firm energy can be substantial, it is by its very nature uncertain. Based on 50 years of record, the Pacific Northwest produces on average 2,500 to 2,700 MW of non-firm energy each year.

Within the region, the general practice has been to schedule thermal plant maintenance during periods of increased water availability, the "expected runoff pattern." Deviations in the expected pattern can greatly affect the overall supply of power.

Natural Gas Availability. As with any commodity, natural gas prices are a combination of supply and demand.

Demand for natural gas is increasing because it is a relatively clean fuel and easily transported to the end user. Proposed new electric power generation in the United States is predominantly natural-gas fired.

On the supply side, natural gas availability to the end user is a combination of production, pipeline capacity, and storage. The California Energy Commission issued its final report on Natural Gas Infrastructure Issues, October 2001. Quotes from that report follow:

> "Natural gas supplies in North America appear to be sufficient to meet demand in California and the remainder of the United States for the next 50 years, according to the United States Geological Survey.
>
> "Upstream demand for natural gas on the interstate pipelines serving California is diverting gas supplies from California. This reduces the effective capacity on the interstate pipeline system serving California. Interstate pipeline capacity expansions will be necessary to meet the level of demand experienced on interstate pipelines in 2000 and early 2001 and to meet expected increases in demand throughout the West.

Market forces are currently spurring expansions of these pipelines. "

"Increasing electric generator demand for natural gas in California calls for an integrated assessment of the interactions between the electricity and natural gas markets. The natural gas and electricity markets are becoming increasingly intertwined. Major uncertainties exist over how much natural gas California will need in the longer term as a result of in-state versus out-of-state gas-fired power plant development."

"The drought experienced throughout the West has reduced the supply of hydroelectric power to historically low levels. This reduction has driven the demand for natural gas by electric generators to very high levels, which has in turn strained the natural gas infrastructure. Core demand was likewise higher throughout the state during the winter of 2000-2001 due to colder than average temperature conditions.

This higher demand coupled with inadequate natural gas infrastructure on the SoCal Gas systems that limited the ability of California to receive gas was a factor that contributed to high prices for natural gas experienced in California in late 2000 and early 2001. Inadequate capacity on the El Paso interstate pipeline system to serve both upstream demand and California end users was also a factor.

The extraordinary high prices during this period appear to be the result of either the competitive market's rationing of supply thorough a scarcity premium or price manipulation through the exercise of market power by market participants, or both. In any case, prices would have been lower if the receipt capacity in Southern California has been greater."

"Infrastructure inadequacies resulting from high demand and low natural gas storage levels contributed to high gas prices and gas price volatility in 2000 and early 2001. The Energy Commission is optimistic that steps being taken will mitigate these inadequacies. The number of drilling rigs in-use has increased, and correspondingly, the supply of natural gas should increase. Intrastate pipeline companies are responding to demand for more capacity; the pipeline capacity serving California should increase. Intrastate receipt facilities are being expanded and should ameliorate the premium charged to California customers. Storage facilities are being optimized and expanded. Increased pipeline capacity planned and underway and expanded storage should allow consumers to use gas-on-gas competition, reducing opportunities for charging premiums for natural gas in the future."

Based on the above, it appears that there will be increased pipeline capacity to import natural gas into California and increased in-state storage. This coupled with more typical water conditions in the Pacific Northwest should provide for adequate gas supplies in the state. In addition, numerous liquified natural gas (LNG) projects are in licensing in both California and Baja California, which will, if built, provide additional points of delivery for natural gas supplies from outside North America. (CEC letter to Tom Stokley and Russell Smith, May 23, 2002).

Central Valley Project Hydroelectric System.

Hydroelectric Operations and Generation Facilities. Western operates, maintains, and upgrades the transmission grid that was constructed by the CVP. Hydroelectric generation facilities were constructed as part of 11 CVP water supply facilities (Figure 3.5-4). Hydroelectric generation facilities include the turbines, generators, and powerplant substations and switchyards used to generate electricity and deliver it to a transmission system. CVP hydroelectric facilities have an installed generation capability of approximately 2,000 MW (Table 3.5-1).

TABLE 3.5-1
Hydroelectric Generation Facilities

CVP Division	Powerplant	Location	Generating Units	Capability (kW)
Trinity River	Trinity	Trinity Dam/ Trinity River	2	139,650
	Lewiston	Lewiston Dam/ Trinity River	1	350
	J.F. Carr	Whiskeytown Dam	2	157,000
	Spring Creek	Spring Creek Power Conduit	2	200,000
Shasta	Shasta	Shasta Dam/ Sacramento River	7[a]	625,000[b]
	Keswick	Keswick Dam/ Sacramento River	3	105,000
American River	Folsom	Folsom Dam/ American River	3	215,000
	Nimbus	Nimbus Dam/ American River	2	14,900
Delta	San Luis	San Luis Reservoir	8 (total)	202,000 (CVP share) (424,000 total)
	O'Neill	San Luis Canal	6	29,000
East Side	New Melones	New Melones Dam/Stanislaus River	2	383,000
Total Capability				**2,070,900**

[a]Includes two station service units.
[b]Installed capacity after all rewinds were completed in year 2000.

Western dispatches and markets CVP power to preference power customers. Preference power customers are entities such as municipalities and irrigation districts that are specifically entitled to preference under Reclamation law. Western is also responsible for meeting all project use load, which is the power required to operate CVP facilities. Although developed primarily for irrigation, this multiple-purpose project also provides flood control, improves Sacramento River navigation, supplies domestic and industrial water, generates electric power, conserves fish and wildlife, creates opportunities for recreation, and enhances water supply. Although the generation of power is not a primary operational objective, it is nonetheless a major economic benefit of CVP operations and, accordingly, affects project operations.

Among the CVP facilities, the TRD is a key component of the overall generation capability. The TRD, including the Trinity Powerplant, is efficient in terms of energy production per unit of water. Under normal operating conditions, 1 acre-foot of water generates 1,100 kWh as it moves through Carr, Spring Creek, and Keswick Powerplants. For comparison, 1 acre-foot of water from behind Shasta Dam (home to the largest powerplant in the CVP) generates between 370 and 550 kWh (depending on reservoir elevation) as it moves through Shasta and Keswick Powerplants. Efficiency of the TRD is approximately three to four times that of Shasta or New Melones Plants, and almost five times that of the Folsom Powerplant. The TRD is a peak power resource. Its power is dedicated first to meeting the requirements of CVP facilities. The remaining energy is marketed to various preference customers in Northern California.

The TRD includes the Trinity, Lewiston, J.F. Carr, and Spring Creek Powerplants. Water from Trinity Dam flows through the Trinity Powerplant into Lewiston Reservoir. The majority of this water is then exported to the Central Valley where it passes through the Clear Creek Tunnel and the J.F. Carr Powerplant before entering Whiskeytown Reservoir. Water released from Whiskeytown Reservoir flows to Clear Creek, the Clear Creek South Unit (owned by the City of Redding), or to Keswick Reservoir through the Spring Creek Power Conduit and Spring Creek Powerplant.

Water released through Lewiston Dam generates power at the Lewiston Powerplant. This power is used for station service and the TRSSH; the remaining power is delivered to the PG&E power grid.

CVP Generation in Relation to Total California Generation and Demand. California's annual energy demand in 1998 was approximately 250,000 gigawatt-hours (GWh) (California Energy

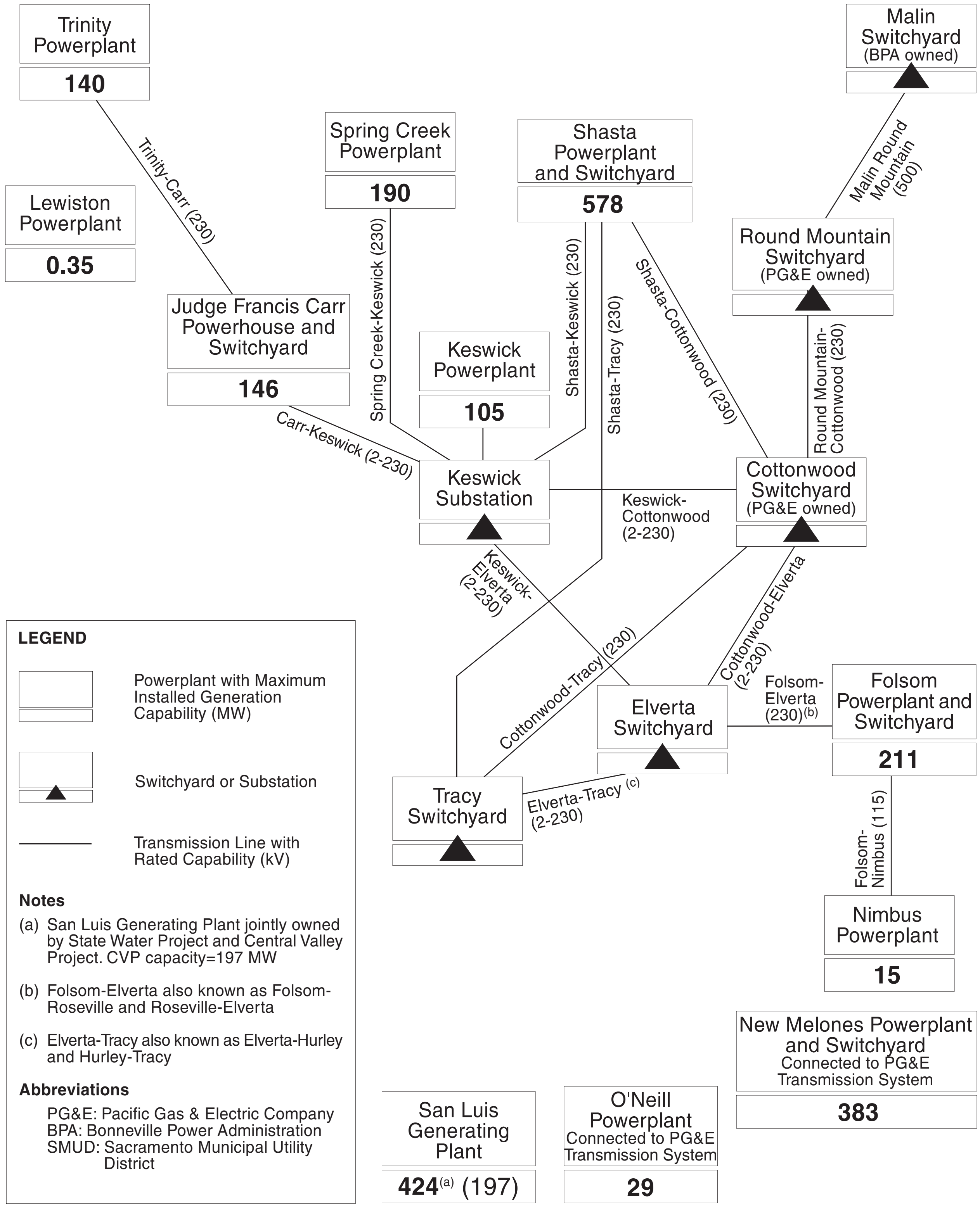

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FIGURE 3.5-4
CVP POWER GENERATION FACILITIES AND ASSOCIATED TRANSMISSION FACILITIES
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

Commission, 2000). Four years later, in 2002, it had grown only slightly, to about 254,000 GWh.[10] The CEC projects that demand for electricity will grow at approximately 2.0 percent annually between 2002 and 2013, resulting in a projected demand of 318,000 GWh in 2013. Peak demand in California typically occurs in late afternoons during the month of August in response to a string of days with high temperatures (California Energy Commission, 1999). California's peak demand in 2002 was approximately 50,700 MW and is projected to grow at approximately 1.7 percent annually between 2002 and 2013, resulting in a peak demand of 63,000 MW in 2013.[11] In comparison, total installed capacity of CVP generation is approximately 2,000 MW, although actual capacity is typically less. Actual capacity is less than installed capacity because hydrologic variation and competing uses such as water delivery and environmental requirements reduce the ability of the generators to operate at maximum capacity. The total installed CVP generation capacity of 2,000 MW equates to 4 percent of California demand in 1999, and 3 percent of projected 2010 demand. The TRD accounts for 25 percent (approximately 500 MW) of CVP installed capacity, which equates to approximately 1 percent of current California demand, and less than 1 percent of projected 2010 demand.

The role of the CVP in the context of the power market is further reduced when considered against the WECC[12] as a whole. As of 2003, approximately 185,000 MW of power generation capacity are in WECC. This includes approximately 60,000 MW of hydroelectric capacity. The single hour highest (peak) load in WECC in 2003 was approximately 135,000 MW. The average hourly load over the year 2003 is expected to be approximately 92,000 MW (805,920 GWh in the year).

In general, it is believed that, with 185,000 MW of generating capacity and 135,000 MW of peak load, there is somewhat of an overbuild of power generation facilities in WECC today. This is a much different situation than the one that existed in December of 2000 when the ROD for the Trinity River Fishery Restoration was issued. As shown on Figure 3.5-3, an exceedingly large amount of new generation has been added in WECC in the years 2001, 2002, and 2003.

Power Generation and Purchase. Power generation from CVP facilities fluctuates with reservoir releases and storage levels. Climatic condi-

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[10] CEC, http://www.energy.ca.gov/energypolicy/documents/2003-02-25+26_workshop/2003-02-100-03-002SD.PDF,_Table_1.

[11] CEC, http://www.energy.ca.gov/energypolicy/documents/2003-02-25+26_workshop/2003-02-100-03-002SD.PDF,_Table_5.

[12] WECC is the new name of the WSCC. The name change occurred mid-2002.

tions such as drought or wet conditions are the primary factors affecting releases and storage, and the associated ability to generate power. For example, dry periods reduced the water level in the New Melones Reservoir to below the minimum power-pool levels, resulting in no power being generated at the facility from August through January in 1991 and August through January in 1992. Reservoir releases are also affected by mandated minimum streamflow requirements, flow fluctuation restrictions, water delivery contracts, and water quality requirements. For example, prior to construction of the Shasta Dam TCD, the BO on Sacramento River winter-run Chinook salmon has required Reclamation to release cold water from Shasta Dam outlets that bypass the powerplants. The BO has also increased the winter and spring water releases into the Sacramento River, thereby resulting in less water being available for release in the summer, when power needs are highest (the installation of the Shasta TCD in 1997 essentially eliminated the need to bypass the powerplants at Shasta Dam). These factors have resulted in actual generation typically being less than full capability.

Peak power loads typically occur in summer months when water conveyance, groundwater pumping, industrial loads, and air conditioning loads are greatest. In the past, CVP generation has been integrated with other power generation resources operated by PG&E to meet project use load and CVP preference power customer loads. The integration of CVP and PG&E generation is subject to a contract signed by DOI and PG&E, referred to as Contract 2948-A. In recent years this integration has also been affected by changes in the power supply industry. Contract 2948-A will expire after 2004 and will not be renewed. Future project power operations will be based on project use loads and CVP preference power customer loads. Currently, project use loads account for about 30 percent of the energy generated by CVP. In FY 2001, CVP net generation was 4,175 GWh and Project Use was 1,158 GWh (28 percent of net generation). In FY 2002, CVP net generation was 4,280 GWh and Project Use was 1,375 GWh (32 percent of net generation). During droughts and other times of low CVP generation, Western has exchanged or banked power with PG&E and purchased power from other entities (particularly those in the Pacific Northwest) to meet demands.

Reclamation, Western, and PG&E work together on a daily basis, comparing hydropower availability, total loads (including PG&E loads), and availability of PG&E resources and transmission capabilities. Daily operations are scheduled one day prior to actual use when the Reclamation dispatch center determines the necessary releases from Keswick, Lewiston, Tulloch, and Nimbus Reservoirs to meet hourly stream flows, water demands, water quality requirements, and power generation needs. Reclamation communicates the dam releases to Western's Folsom dispatch office, which coordinates with the PG&E dispatch center. The three entities confirm and, if necessary, adjust the schedule.

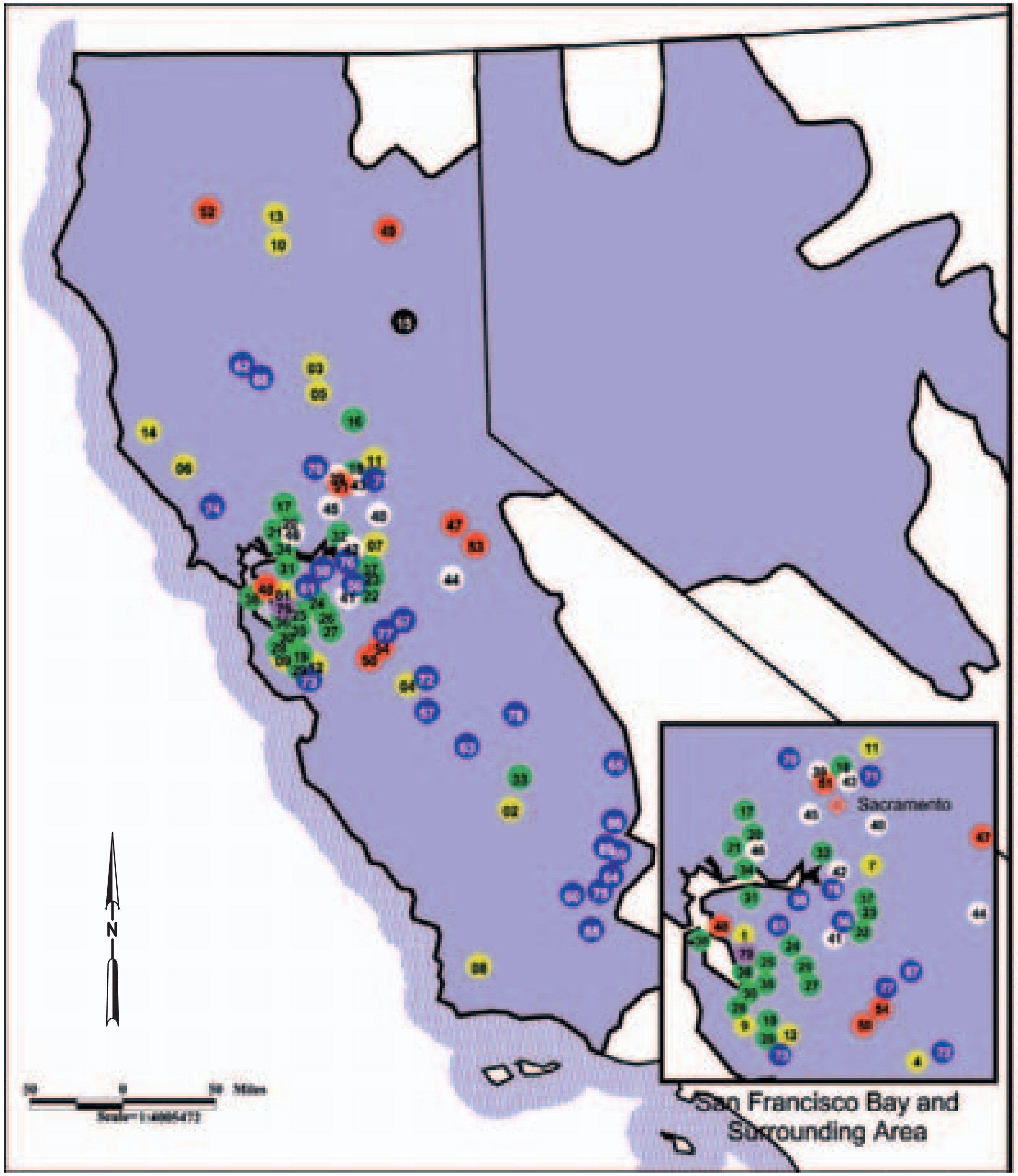
Preference Power. CVP power generation was initially intended to supply electricity for the power-consuming portions of the CVP (e.g., Delta export pumps, aqueducts, etc.). Power consumption by the CVP is referred to as project use. The Reclamation Act of 1939 provided for surplus power, which is power not needed for project use loads, to be sold first to preference power customers. Current Western preference power customers (in the Sierra Nevada Customer Service Region, see Figure 3.5-5) include irrigation and reclamation districts, cooperatives, public utility districts, municipalities, state and federal agencies, and other public bodies. Power surplus to preference power customer needs may be sold, if available, to non-preference power customers on a non-firm or short-term basis.

Table 3.5-2 presents a summary of the relative purchases by the five largest preference power customers. Currently, there are 77 CVP preference power customers (see Table 3.5-3). The five preference power customers with the largest energy purchases in federal fiscal year 1995 were the Sacramento Municipal Utility District and the cities of Santa Clara, Palo Alto, Redding, and Roseville. Figure 3.5-6 presents a summary of relative purchases by Western customers. Western power is typically a low-cost component of customers' overall resource mix. Other sources of electricity are typically more expensive. The concept of "first preference," that customers could have priority consideration for contracts to purchase power generated at specific plants, was added for Trinity County by the 1955 act authorizing the TRD, and for Tuolumne and Calaveras Counties by the Flood Control Act of 1962. By law, 25 percent of the excess energy (after project use power needs) resulting from power generated by the TRD must first be offered to preference power customers in Trinity County. Currently, the Trinity County Public Utility District, located in Weaverville, is a preference power customer falling under the first preference criterion for the TRD generation.

Current Power Marketing. Western sets prices for CVP hydropower based on its costs for delivering power to customers. However, the value of the electricity that Western sells to customers is set by the external markets and can fluctuate based on supply and demand. Although the value and annual project output can fluctuate, Western's costs remain essentially unchanged. This causes Western's

TABLE 3.5-2
Summary of Relative Purchases by the Five Largest Preference Power Customers

Customer	Contract Rate of Delivery (Annual kW)	FY 2002 Energy MWh	FY 2002 Revenue ($)	FY 2002 Total Revenue ($)	FY 2001 Energy MWh	FY 2001 Revenue ($)	FY 2001 Total Revenue (%)
Sacramento Municipal Utility District	361,000	2,103,719	49,969,934	27	2,237,711	43,884,582	26
Silicon Valley Power	216,532	678,572	20,976,531	11	1,466,957	27,160,036	16
Palo Alto	175,000	929,324	22,044,904	12	1,038,313	19,424,763	12
Redding	116,000	611,630	14,777,451	8	607,215	11,371,122	7
Roseville	69,000	552,680	12,860,275	7	614,201	10,928,684	7
CVP Power Sales to Customers		7,317,680	182,968,531		8,546,774	166,133,172	



MUNICIPALITIES
01. City of Alameda
02. City of Avenal
03. City of Biggs
04. Castle Joint Powers Authority *
05. City of Gridley
06. City of Healdsburg
07. City of Lodi
08. City of Lompoc
09. City of Palo Alto
10. City of Redding
11. City of Roseville
12. City of Santa Clara
13. City of Shasta Lake
14. City of Ukiah

RURAL ELECTRIC COOPERATIVES
15. Plumas-Sierra

FEDERAL AGENCIES

DEPARTMENT OF THE AIR FORCE
16. Beale AFB
17. David Grant Medical Center (Travis AFB)
18. McClellan AFB
19. Onizuka AFB
20. Travis AFB
21. Travis Whorry Housing (Travis AFB)

DEFENSE LOGISTICS AGENCY
22. Defense Distribution Depot (Sharpe Facility)
23. Defense Distribution Depot (Tracy Facility)
24. Parks Reserve Forces Training Area, Dublin

DEPARTMENT OF ENERGY
25. Lawrence Berkeley National Laboratory
26. Lawrence Livermore National Laboratory
27. Site 300
28. Stanford Linear Accelerator Center

NATIONAL AERONAUTICS & SPACE ADMIN.
29. Ames Research Center
30. Moffet Federal Airfield *

DEPARTMENT OF THE NAVY
31. Concord Naval Weapons Station
32. Dixon Naval Radio Station
33. Lemoore Naval Air Station
34. Mare Island Naval Shipyard
35. Oakland Army Base
36. Oakland Naval Supply Center
37. Stockton Naval Communications Station
38. Treasure Island Naval Station

STATE AGENCIES
39. California State Prison-Sacramento
40. California State University, Sacramento-Nimbus
41. Deuel Vocational Institution
42. Northern California Youth Center
43. Parks & Recreation, American River District
44. Sierra Conservation Center
45. University of California, Davis
46. Vacaville Medical Facility

PUBLIC UTILITY DISTRICTS
47. Calaveras Public Power Agency
48. East Bay Municipal Utility District
49. Lassen Municipal Utility District
50. Modesto Irrigation District
51. Sacramento Municipal Utility District
52. Trinity County Public Utilities District
53. Tuolumne Public Power Agency
54. Turlock Irrigation District

IRRIGATION & WATER DISTRICTS
55. Arvin-Edison Water Storage District
56. Banta-Carbona Irrigation District
57. Broadview Water District
58. Byron-Bethany Irrigation District
59. Cawelo Water District
60. Delano-Earlimart Irrigation District
61. East Contra Costa Irrigation District
62. Glenn-Colusa Irrigation District
63. James Irrigation District
64. Kern-Tulare Water District
65. Lindsay-Strathmore Irrigation District
66. Lower Tule River Irrigation District
67. Patterson Water District
68. Provident Irrigation District
69. Rag Gulch Water District
70. Reclamation District 2035
71. San Juan Water District
72. San Luis Water District
73. Santa Clara Valley Water District
74. Sonoma County Water Agency
75. Terra Bella Irrigation District
76. West Side Irrigation District
77. West Stanislaus Irrigation District
78. Westlands Water District

LOCAL & SUBURBAN PASSENGER TRANSPORTATION
79. Bay Area Rapid Transit District

* NDA Act Economic Development Allocations

Sierra Nevada Regional Office Marketing Area

W022004007RDD_071 (4/2/04)

FIGURE 3.5-5
WESTERN AREA POWER ADMINISTRATION, SIERRA NEVADA REGION, MARKETING AREA

CHART 1: WESTERN PREFERENCE POWER CUSTOMERS BY BASE RESOURCE ALLOCATIONS

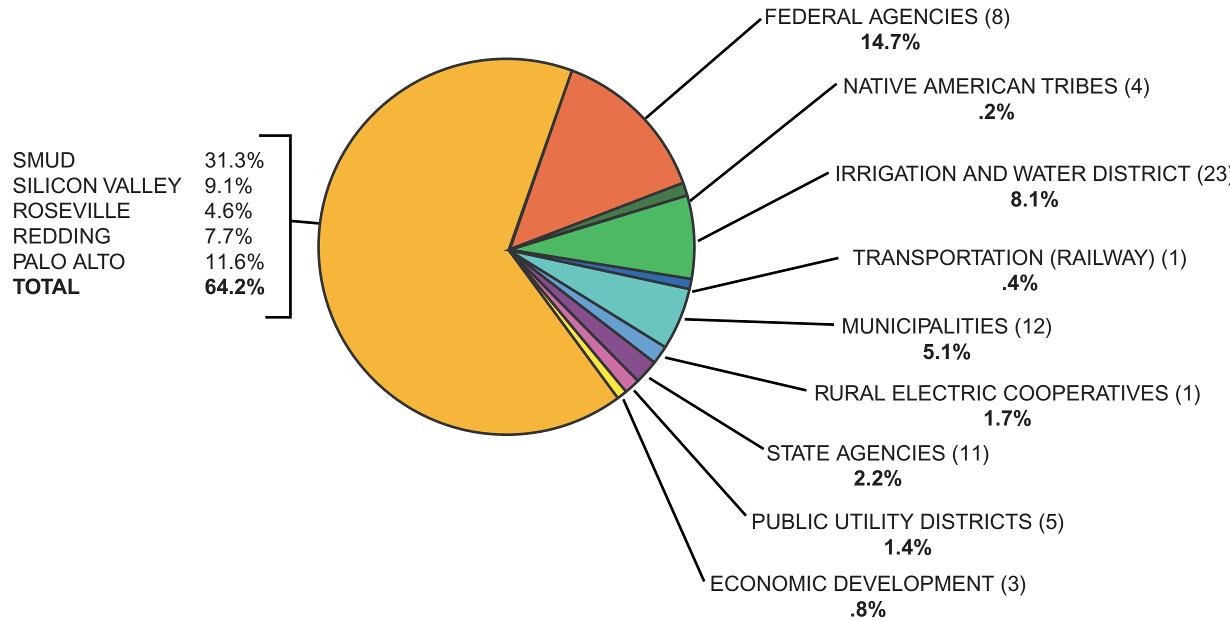
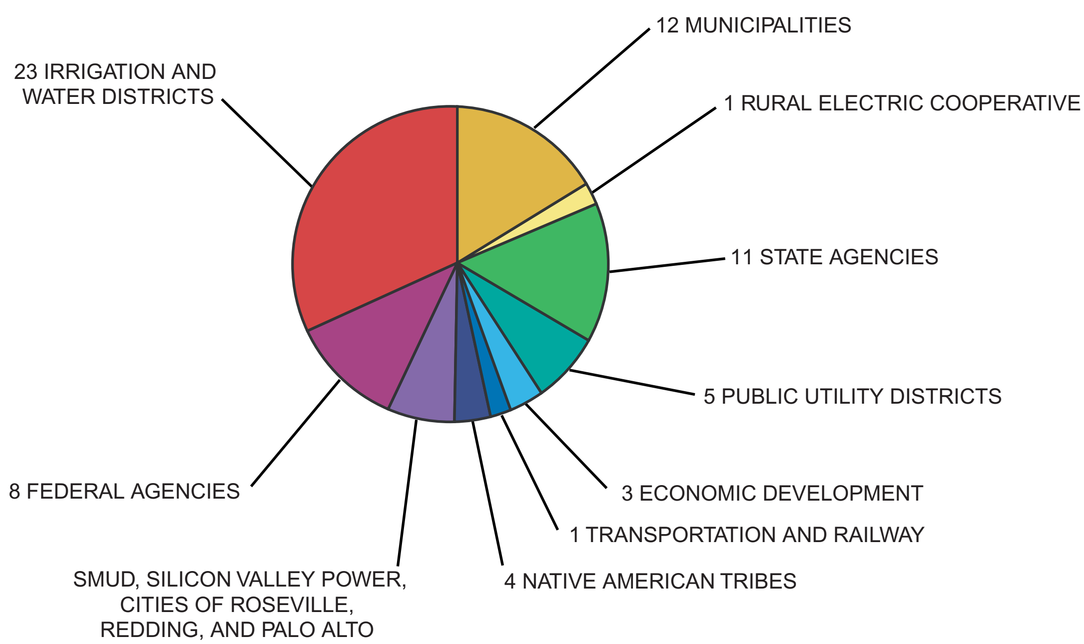


CHART 2: WESTERN PREFERENCE POWER CUSTOMERS SORTED BY CUSTOMER CLASS



SOURCE: WAPA POST-2004
POWER MARKETING PLAN
IMPLEMENTATION BROCHURE

W022004007RDD_100 (4/2/04)

FIGURE 3.5-6
WESTERN PREFERENCE POWER CUSTOMERS

per-unit cost of electricity to vary. When long-term average generation decreases, Western's customers receive less electricity and are required to pay a higher per-unit cost. If Western rates are relatively low, Western customers are likely to continue to purchase power from Western as part of their long-term resource mix. For planning purposes, power customers evaluate capacity resources based on dry conditions to ensure reliability.

Reductions in reliable Western power supplies are likely to be offset by more expensive power from other sources.

Western has wide discretion within its statutory guidelines regarding with whom and on what terms it will contract for the sale of federal power. The sale of excess power is conducted so as not to impair the efficiency of CVP irrigation deliveries. Contract 2948-A allows for the sale, interchange, and transmission of electrical power and energy between the federal government and PG&E. The agreement allows PG&E to provide energy and capacity as required to meet project use and preference power customer loads; in return, the CVP generating units provide energy and capacity for integration with other PG&E resources. The agreement also recognizes the federal government's 400-MW entitlement on the Pacific Northwest/Pacific Southwest Intertie.

Under the terms of Contract 2948-A, Western delivers the generation of CVP Powerplants to PG&E, along with its wholesale purchases; and PG&E supports firm power deliveries to the preference power customers up to a maximum simultaneous demand of 1,152 MW. Western also purchases additional power to support the CVP marketing program and primarily imports it through use of

Western's share of the Pacific Northwest/Pacific Southwest Intertie and the California-Oregon Transmission Project.

Environmental Consequences.

<u>Methodology</u>. Every 6 months, Henwood Energy Services, Inc., develops an independent proprietary forecast of power prices in WECC that is used by many entities to evaluate future operations and investments relating to power resources. Over 50 entities have purchased Henwood's spring 2003 price forecast. These entities include both investor-owned and consumer-owned utilities, power plant developers, banks, and rating agencies. The forecast is widely accepted as a reasonable forecast. Henwood's spring 2003 price forecast was used as a starting point to evaluate the power impact of alternatives for Trinity River Fishery Restoration. The forecast is a fundamental-based forecast that uses Henwood's proprietary MARKETSYM model and updated database to forecast hourly market clearing prices in the WECC.

TABLE 3.5-3
Western Customers by Agency and Sub-agency Type and Associated Firm Power

Customers by Agency and Sub-agency Types	Long-term Firm (kW)
Federal Agencies	
Air Force, U.S. Department of	
Beale Air Force Base	20,507
David Grant Medical Facility, Travis	3,552
McClellan Air Force Base	10,655
Onizuka Air Force Base	3,500
Travis Air Force Base	11,299
Travis Wherry Housing (Air Force Base)	100
Category Total:	**49,613**
Defense Logistics Agency	
Parks Reserve Forces Training Area	500
Sharpe Facility	4,000
Tracy Defense Distribution Depot	3,800
Category Total:	**8,300**
Energy, U.S. Department of	
DOE/Lawrence Livermore/Site 300	2,000
DOE/Lawrence Berkeley National Laboratory	9,000
DOE/Lawrence Livermore National Laboratory	23,897
DOE/Stanford Linear Accelerator Center	12,903
Category Total:	**47,800**
National Aeronautics and Space Administration	
Ames Research Center	80,000
Moffett Federal Airfield	3,984
Category Total:	**83,984**
Navy, U.S. Department of	
Naval Air Station, Lemoore	21,869
Naval Communications Station, Stockton	2,943
Naval Radio Station, Dixon	915
Naval Weapons Station, Concord	2,687
Oakland Army Base	2,275
Category Total:	**30,689**
State Agencies	
Department Of Corrections	
California Medical Facility, Vacaville	1,800
California State Prison, Sacramento	2,300
Deuel Vocational Institution	1,700
Northern California Youth Center	2,200
Sierra Conservation Center	3,000
Category Total:	**11,000**
Department of Parks and Recreation	
California State Parks & Recreation, Folsom	100
Category Total:	**100**

TABLE 3.5-3
Western Customers by Agency and Sub-agency Type and Associated Firm Power

Customers by Agency and Sub-agency Types	Long-term Firm (kW)
State Universities	
CSUS Nimbus	40
University Of California, Davis	21,500
Category Total:	**21,540**
Municipalities	
Alameda, City of	21,145
Avenal, City of	622
Biggs, City of	1,300
Gridley, City of	4,200
Healdsburg, City of	1,490
Lodi, City of	5,173
Lompoc, City of	2,042
Oakland, Port of	745
Palo Alto, City of	171,200
Redding, City of	91,000
Roseville, City of	69,000
San Francisco, City & County of	2,012
Shasta Lake, City of	11,450
Silicon Valley Power	73,000
Ukiah, City of	4,917
Category Total	**459,296**
Public Utility Districts	
Calaveras Public Power Agency	8,000
East Bay Municipal Utility District	3,914
Lassen Municipal Utility District	23,500
Modesto Irrigation District	4,845
Sacramento Municipal Utility District	361,000
Trinity County PUD	17,000
Tuolumne Public Power Agency	8,000
Turlock Irrigation District	2,190
Category Total:	**428,449**
Rural Electric Cooperatives	
Plumas-Sierra Rural Electric Cooperative	17,900
Category Total:	**17,900**
Irrigation and Water Districts	
Arvin-Edison Water Storage District	30,000
Banta-Carbona Irrigation District	3,700
Broadview Water District	500
Byron-Bethany Irrigation District	2,200
Cawelo Water District	3,500
East Contra Costa Irrigation District	2,000
East Contra Costa Irrigation District	500
Eastside Power Authority	1,914
Glenn-Colusa Irrigation District	3,343
James Irrigation District	638

TABLE 3.5-3
Western Customers by Agency and Sub-agency Type and Associated Firm Power

Customers by Agency and Sub-agency Types	Long-term Firm (kW)
Kern-Tulare Water District	638
Lower Tule River Irrigation District	914
Patterson Water District	2,000
Provident/Princeton Irrigation District	750
Rag Gulch Water District	500
Reclamation District 2035	1,600
San Juan Water District	1,000
San Luis Water District (Fittje)	3,250
San Luis Water District (Kalijian)	3,400
Santa Clara Valley Water District	638
Sonoma County Water Agency	6,000
West Side Irrigation District	2,000
West Stanislaus Irrigation District	5,200
Westlands Water District	16,391
Westlands Water District 6-1	1,850
Westlands Water District 7-1	3,200
Category Total:	**97,626**
Railroads and Railways	
Bay Area Rapid Transit District	4,000
Category Total:	**4,000**
Economic Development	
Merced Irrigation District	3,724
Pittsburg Power Company	3,869
Category Total:	**7,593**
Grand Total:	**1,267,890**

The forecast of hourly market-clearing power prices also includes a forecast of hourly loads across the many subareas of WECC. A database of power generation available for operation in these areas is developed and updated along with the operating restrictions, heat rates, and fuel cost that need to be reflected in an analysis regarding operating the plants. The key transmission path constraints that may limit the ability to move power from one subarea of WECC to another from hour to hour are also maintained in the database. (See Power Resources Technical Appendix C.)

Choosing a Year for Analysis. The year 2005 was selected as an appropriate level of development for the analysis. The power generation overbuild situation is forecast to level out or be reduced by that time because loads are forecast to grow, and little new power generation is assumed to be added after 2003. Beyond 2005, it is more difficult to predict just when and how much new generation will be built.

Choosing a Topology for Analysis. The transmission across the WECC system was then defined in order to assess the ability to move electricity between subregions. As can be seen, on the topology map on Figure 3.5-6, the WECC is divided into 14 zones. The lines on the topology map reflect the ability of the transmission system to move power between the zones. The numbers on the lines indicate the maximum amount of power, in MW, that such line (path) can move in the indicated direction.

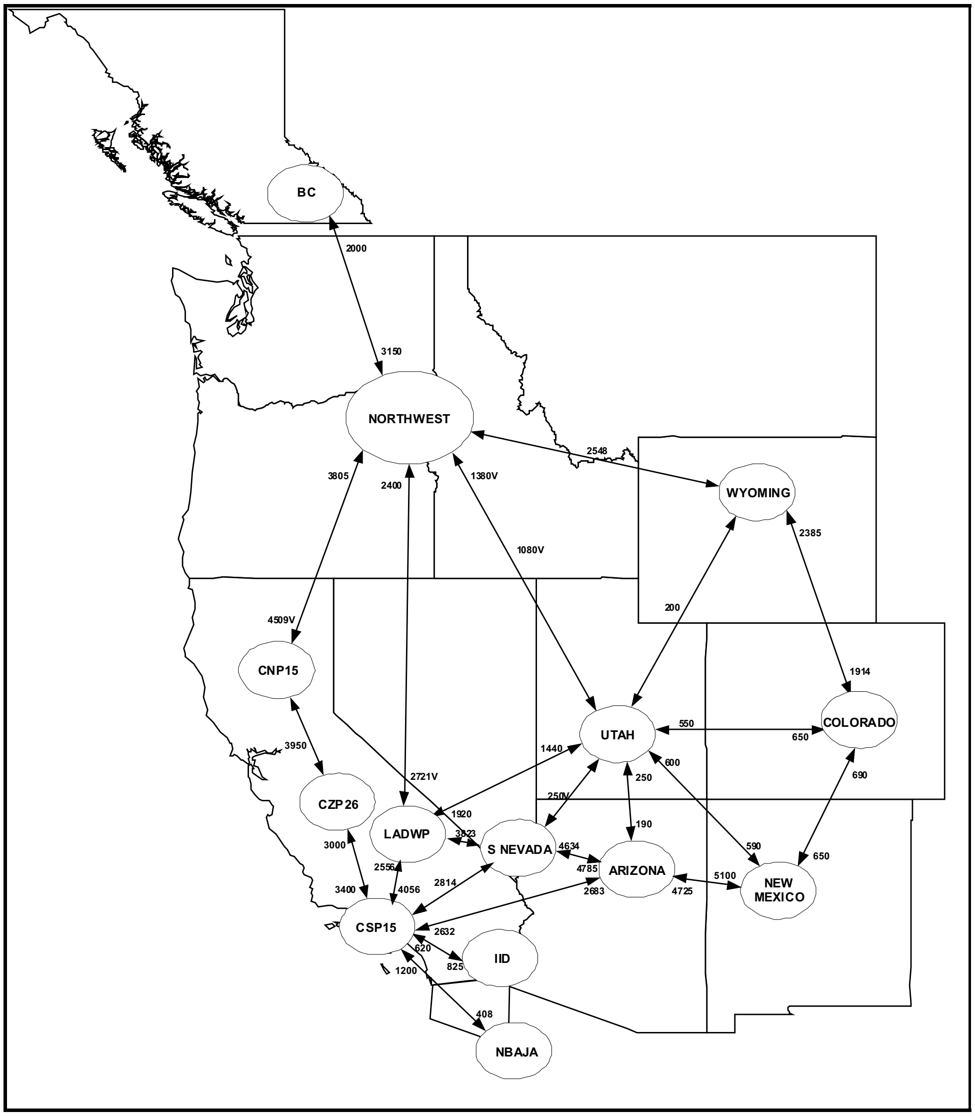


FIGURE 3.5-7
WECC Zones

This 14-zone topology provides a reasonable representation of major transmission constraints in WECC and can be used for market-clearing price formation analysis. Following definition of price and load forecasts and the transmission system, the MARKETSYM model was used to determine hourly dispatch of power generation against loads across WECC in the year 2005. The analysis is repeated for each of the alternatives.

<u>How the Model Computes Hourly Market Clearing Prices</u>. The MARKETSYM model runs assume that there is no transmission constraint within a zone. In each hour being analyzed, the model first determines the load for the hour in one of the zones, and then determines which generating plants located in that zone must be operated to meet the load. The plants with the lowest bid price[13] are operated first. After the model orders power generation resources within the first zone, it then conducts the same analysis in each of the remaining zones. Then the model assesses low-cost resource that may not be running in one zone while a higher cost resource is operating in a different zone. If so, the model will attempt to move power generation between zones, if there is sufficient transmission capacity. The model continues to assess re-dispatch opportunities until all the zones reflect the same marginal cost or transmission constraints prohibit additional economic re-dispatch of power. At this point, the model can determine the market-clearing price in each zone for that hour. This operation is conducted for every hour of the model year.

<u>Determining Hourly Amounts of CVP Generation</u>. Monthly estimates of power generation at each of the CVP hydroelectric facilities were derived from CALSIM output. For each of the generators, it was assumed there was a minimum amount of power generation that would be needed to operate in every hour and a maximum capacity that could be operated in any hour. Monthly generation was disaggregated into hourly estimates given physical limitations and environmental constraints of the system. The remaining generation was shaped to reflect the hourly shape of loads in the ISO control area. The maximum power generation in any hour could not exceed the maximum capacity of that generator/system.

These hourly operations were then used for a stochastic analysis that assessed the effects of the alternatives against potential volatility. Deterministic, or static, analyses were also conducted to assess specific water conditions in the CVP. Deterministic analyses were conducted for the average condition (1922-1993) and for a representative wet year (1958) and a representative dry year (1937). On a yearly average, the generation at the CVP projects under 1958 water conditions is about 161 percent of the generation that would be

[13] WECC markets are currently bilateral markets. Sellers offer their power at a price they are willing to sell. In general, sellers will need to cover at least their operating cost from a sale or they will simply shut down. Sellers also need to cover additional amounts to cover fixed costs. Competition generally keeps sellers from making excessively high bids. The supply demand situation in the year 2005 is such that sellers will not be able to extrapolate monopoly prices. Henwood's bid price algorithm reflects competitive limits on bid prices. In the absence of competition, FERC has indicated they will impose some kind of price mitigation regulation.

expected to occur under average water conditions. On a yearly average, the generation at the CVP projects under 1937 water conditions is about 75 percent of the generation that would be expected to occur under average water conditions.

Taking Volatility into Account. Several key inputs needed in the modeling database are subject to weather-induced volatility. For example, the CVP Powerplants will generate different amounts of power, depending on how much rainfall occurs in any year. CALSIM output representing CVP power generation amounts under each of the alternatives will vary depending on rainfall conditions. This analysis considered 72 different annual generation levels for each CVP Powerplant for each of the alternatives, corresponding to historical rainfall levels over a 72-year history.

In addition to variations in CVP power generation levels caused by weather, other key inputs impacted by weather are as follows:

- Hydrogeneration levels in other parts of WECC
- Loads across WECC
- Natural gas prices that fuel natural gas priced generation

In December of 2000 when the ROD for the Trinity River Fishery Restoration was issued, WECC was in the midst of a severe drought, especially with regard to hydrogeneration affected by Pacific Northwest rainfall conditions. It was determined that the power impact analysis should reflect the possibility that such conditions could recur.

In order to assess future volatility, a stochastic analysis was conducted. In other words, each of the alternatives was analyzed at a 2005 level of development 72 times, representing the variability of the hydrologic period of record. At the same time, random Monte-Carlo draws for the key inputs described above, and also for forced outages, were included to reflect variable hourly loads in the 14 zones of WECC for a number of parameters that influence price. Historical correlation between these zonal load variations were reflected in the analysis. A single Monte-Carlo draw was conducted for each water year and applied to all alternatives. Monte-Carlo draws are a statistical method for generating a sample of simulated data. Monte-Carlo draws are used to generate large numbers of possible outcomes. Monte-Carlo draws for Pacific Northwest hydropower were also reflected in the 73 iterations based on historical volatility in these power generation amounts. Correlation between CVP hydropower and Pacific Northwest hydropower was reflected in the analysis based on historical correlations of these levels[14]. Additionally, a deterministic run was analyzed, which more closely replicates recent generation experience without volatility (these data are presented in Table 3.5-4 at the end of this section).

Calculating the Value of CVP Power. The analysis then reflects an expected value of CVP power under each alternative. Value of the CVP power is calculated as CVP power generation levels (net of pumping load requirements) multiplied by the market-clearing price of power in the Northern California zone[15].

Ancillary Services. Power projects such as those owned by CVP have value not only from their ability to produce power, but also from their ability to provide ancillary services. Ancillary services are products needed for the power grid to be operated reliably. There are five typical kinds of ancillary services:

- Spinning Reserve - The portion of unloaded synchronized generation capacity that is immediately responsive to system frequency and that is capable of being loaded in 10 minutes, and that is capable of running for at least 2 hours.
- Non-spinning Reserve - The portion of offline generating capacity that is capable of being synchronized and ramping to a specified load in 10 minutes (or load that is capable of being interrupted in 10 minutes) and that is capable of running (or being interrupted) for at least 2 hours.
- Regulation Up and Regulation Down – The service provided either by Generating Units certified by the ISO as equipped and capable of responding to the ISO's direct digital control signals, or by System Resources that have been certified by the ISO as capable of delivering such service to the ISO Control Area in an upward or downward direction to match, on a real-time basis, demand and resource, consistent with established NERC and WECC operating criteria. Regulation covers both the increase or decrease in output of generation. Regulation Up and Regulation

[14] This analysis assumes that weather induced changes to CVP power generation is correlated to other Northern California hydrogeneration levels. That is, dry conditions in the CVP system likely occur in the same years as dry conditions exist in other California hydro resources. Hydrogeneration amounts in WECC outside of Northern California and the Pacific Northwest are small in comparison to Northern California and Pacific Northwest hydrogeneration levels. The analysis has included these hydrogeneration amounts at their average value in all cases.

[15] In making this calculation, project generation on heavy load hours for each month were valued at the average of all heavy load market-clearing prices for that month. Similarly, project generation on light load hours for each month was valued at the average of all light-load hour market-clearing prices for that month. This approach was taken for two reasons. First, much of the power bought and sold in WECC is packaged as "standard products," with a standard product being a flat heavy-load hour delivery for a day and a flat light-load hour delivery for a day. It is possible that the hourly load-shaping algorithm used here may overstate the amount of power that can be shaped due to issues regarding re-regulating reservoirs that exist on the CVP system. It is not practicable to capture all these limitations in this kind of analysis. The somewhat overly optimistic hourly shaping algorthim is offset by the somewhat pessimistic average pricing approach to reflect a reasonable estimation of the value of project generation.

Down are distinct capacity products, with separately stated requirements and Market Clearing Prices in each settlement period.

- Replacement Reserve – Generating capacity that is dedicated to the ISO, capable of starting up if not already operating, being synchronized to the grid, and ramping to a specific load point within a 60-minute period, the output of which can be continuously maintained for a 2-hour period.

Regulation Up and Regulation Down receive the highest prices of the ancillary services described here. However, Henwood assumes that CVP will not allow its generators to be automatically controlled by the ISO's direct digital control signals. Therefore, CVP projects would not realize these prices.

Spinning Reserve is the next highest value of the ancillary services. Henwood assumes that CVP projects could be offered as spinning reserve units to the ISO to the full extent of their capability less the then-current operating level. In general, the alternative that results in less hydrogeneration would result in more sales of spinning reserve[16]. Given the assumption of all unused capacity being sold as spinning reserve, there is nothing else left to sell to the remaining lower value ancillary services markets.

Air Emissions. Power modeling output can be used to measure sulfur oxide (SO_2), oxides of nitrogen (NO_x) and CO_2 emissions by powerplant for every hour. CVP project power generation does not create air emissions. When more hydroelectric power is available, air emissions from fossil fuel generators decrease, and vice versa. This analysis includes calculations of the expected levels of total WECC-wide SO_2, NO_x, and CO_2 emissions for the year 2005 under each of the alternatives studied. Results are available in Power Resources Technical Appendix C.

Reliability. As a measure of the effect on reliability of power supply in WECC of the alternatives, the analysis included calculations of the expected level of load that would not be served under the stochastic analysis in WECC. In other words, power generation is expected to be adequate to meet load in all hours of 2005 under "normal" conditions. Normal conditions do not reflect higher than normal loads caused by hotter than normal temperatures, drought conditions, or forced outages for maintenance.

The Monte-Carlo-driven stochastic analysis presented here results in some situations where load is higher than normal and resource availability is lower than normal. Therefore, it is possible that certain

[16] The exception is the Maximum Flow Alternative, which provides no water to the J.F. Carr and Spring Creek projects. With no water, these projects can provide no ancillary services.

areas of WECC may have difficulty meeting load in all hours of the year. This analysis evaluates unserved energy associated with any hour of any iteration for each of the alternatives studied. A comparison of expected levels of unserved energy will provide an indication of impacts to reliability associated with each alternative.

Historical operations of the TRD include bypasses of the Trinity Powerplant to achieve downstream temperature benefits. Such operations were noted in the NOAA Fisheries BO on the original Draft EIS/EIR and were subsequently rejected in Judge Wanger's ruling. However, because bypass operations are a potential facet of current operations, it is assumed that bypasses could occur under any of the alternatives considered in this document.

Consistent with the methodology outlined in the Powerplant Bypass Thematic Response in the Final EIS/EIR, bypasses were considered to be a possible operation during periods of low storage in Trinity Reservoir. Accordingly, each alternative was evaluated for the percentage of time modeled operations drew storage below 750,000 acre-feet in June-September of any year, or below 1,000,000 acre-feet in October of any year. An annual value of bypassed energy is presented for each alternative based on the modeled amount of energy that would have otherwise been produced at the powerplant. During periods of future power emergencies such as those seen in the California Power Crisis described earlier in this section, Reclamation would consider foregoing powerplant bypasses in order to generate power for short periods of time to avoid power system failures. However, such considerations would be on a case-by-case basis. In part, because of the very conservative approach to identifying potential bypass operations and the possibility that Reclamation would forego bypasses for short periods to avoid system-wide blackouts, it is assumed that the effects on powerplant reliability would be negligible.

<u>Significance Criteria</u>. Alternatives were analyzed for their impacts on hydropower generation, reliability, and value relative to the No Action condition. Long-term reductions in generation and reliability could require individual customers to either purchase additional power through the open power markets or construct new power facilities. Because natural gas plants are increasingly an economic and relatively clean source of fossil fuel power, it seems likely that elimination of some power from the TRD system would result in greater natural gas power generation somewhere in the Western United States, for ultimate consumption in California. It is therefore likely that air pollution from natural gas power generation would increase to a degree. The location of the resulting emissions, however, is impossible to predict. The powerplants at issue would

be subject to increasingly stringent air quality laws, such as the Clean Air Act; and the powerplants themselves would be required to operate pursuant to the terms of their permits, which necessarily require some level of pollution reduction.

To assess the severity of the impacts, the following significance criteria were developed:

- A 50-MW reduction in dry-year capability available for sale to preference power customers in January, February, March, June, July, August, September, or December (the months typically most sensitive to reduced capacity). Capability is defined as the amount of CVP capacity that can be sustained (given flow constraints) that efficiently supplies electricity to meet demands.
- A reduction of 5 percent or more in the annual energy available for sale to preference power customers in the average year.
- A reduction of 5 percent or more in the average energy available for sale to preference power customers during any month in the average year.
- Any decrease in CVP power that results in a cost increase of $0.50 per MWh for either an average preference power customer or a high-allocation preference power customer.

No Action. Under the No Action Alternative, the CVP power generation facilities would be operated in a manner similar to the operations discussed under Affected Environment and consistent with the criteria defined in the current draft CVP-OCAP. Predicted power generation and value, as modeled MARKETSYM, is presented in Table 3.5-4 at the end of this section. Under this operation, MARKETSYM estimates the value of net power generated by the CVP system for use by preference power customers as $122,800,000 per year. It is important to note that this is the value of net CVP generation, not revenue from sales of net CVP generation.

Under the No Action Alternative, Trinity County PUD would continue to receive benefits from the TRD in accordance with its status as a First Preference Power Customer. Modeled results indicate that Trinity County would be eligible for approximately 325 GWh per year from the TRD, almost four times current annual energy use (80 to 85 GWh). Based on the market analysis prepared for the Supplemental EIS/EIR, the value of Trinity County's First Preference Power purchases is approximately $3,100,000 per year. Actual costs for First Preference Power received by Trinity County PUD would be established by Western based, in part, on the amount of custom services purchased and allocations of CVPIA restoration charges to power customers. Both of which are beyond the scope of this analysis.

Under the No Action Alternative, bypass operations would be considered in 15 percent of the modeled months June-October over the period of record. Annual average value of generation would be reduced by $581,000 per year if every potential bypass were realized.

Revised Mechanical. Average annual CVP power generation under this alternative would be reduced. This alternative would reduce the amount of power generated by the TRD, resulting in a decrease in the value of net power available for use by preference power customers of $4,200,000 annually compared to No Action. If ancillary services are included in the value of the CVP, the net change is a reduction of $3,400,000 annually compared to No Action. This alternative was not analyzed in the original Draft EIS/EIR.

MARKETSYM output identified significant impacts of the Revised Mechanical Alternative. In the average year, CVP energy available for sale would be reduced by 3.6 percent compared to No Action, a less than significant impact. However, energy available for sale in average months would be reduced by more than 5 percent in 3 out of 12 months, which would constitute a significant impact.

Based on the MARKETSYM analysis, there is no impact to overall system reliability under this alternative, in either the CNP 15 node or the overall WECC.

Modeled projects of energy production at the TRD facilities is still well in excess of 83,000 MWh, which means that wholesale purchases will likely not be necessary.

Based on average energy purchases of 83,000 MWh per year, under the Revised Mechanical Alternative, Trinity County PUD would continue to receive benefits from the TRD in accordance with its status as a First Preference Power Customer. Modeled results indicate that Trinity County PUD would be eligible for approximately 299 GWh per year from the TRD, over three times current annual energy use (80 to 85 GWh). Actual costs for First Preference Power received by Trinity County would be established by Western through its regular rate-setting process, and would depend, in part, on the types of custom services Trinity County PUD would purchase from Western and future allocations of the CVPIA restoration fund, both of which are beyond the scope of this analysis.

Under the Revised Mechanical Alternative, bypass operations would be considered in 16 percent of the modeled months June-October over the period of record, an increase of 1 percent compared to No Action. Annual average value of generation would be reduced by $604,000 per year if every potential bypass were realized, $23,000 more than No Action.

The change in cost per unit of electricity for the average Western customer under the Revised Mechanical Alternative would be $.16, while the change for the high-allocation customer would be $.94.

Flow Evaluation. Average annual CVP power generation under this alternative would be reduced. This alternative would reduce the amount of power generated by the TRD, resulting in a decrease in the value of net power available for use by preference power customers of $8,800,000 annually compared to No Action. If ancillary services are included in the value of the CVP, the net change is a reduction of $7,200,000 annually compared to No Action. In the original Draft EIS/EIR, using different methodology, the Flow Evaluation Alternative was estimated to reduce net value to preference power customers by $5,600,000 annually.

MARKETSYM output identified several significant impacts of the Flow Evaluation Alternative. In the average year, CVP energy available for sale would be reduced by 7.3 percent compared to No Action. Energy available for sale in average months would be reduced by more than 5 percent in 9 out of 12 months.

Based on the MARKETSYM analysis, there is no impact to overall system reliability under this alternative, in either the CNP 15 node or the overall WECC.

Under the Flow Evaluation Alternative, Trinity County PUD would continue to receive benefits from the TRD in accordance with its status as a First Preference Power Customer. Modeled results indicate that Trinity County PUD would be eligible for approximately 260 GWh per year from the TRD, over three times current annual energy use (80 to 85 GWh). Actual costs for First Preference Power received by Trinity County would be established by Western through its regular rate-setting process and would depend, in part, on the types of custom services Trinity PUD would purchase from Western and future allocations of the CVPIA restoration fund, both of which are beyond the scope of this analysis.

Under the Flow Evaluation Alternative, bypass operations would be considered in 14 percent of the modeled months June through October over the period of record, a decrease of 1 percent compared to No Action. Annual average value of generation would be reduced by $408,000 per year if every potential bypass were realized, $173,000 less than No Action both because bypasses would occur less frequently and fewer GWh would be lost when bypasses did occur (802 GWh under 70 Percent Inflow compared to 1,141 GWh under No Action).

The change in cost per unit of electricity for the average Western customer under the Flow Evaluation Alternative would be $.33, while the change for the high-allocation customer would be $1.99.

Modified Percent Inflow. Average annual CVP power generation under this alternative would be reduced. This alternative would reduce the amount of power generated by the TRD, resulting in a decrease in the value of net power available for use by preference power customers of $7,800,000 annually compared to No Action. If ancillary services are included in the value of the CVP, the net change is a reduction of $6,800,000 annually compared to No Action. This alternative was not analyzed in the original Draft EIS/EIR.

MARKETSYM output identified several significant impacts of the Modified Percent Inflow Alternative. In the average year, energy available for sale would be reduced by 7 percent compared to No Action. Energy available for sale in average months would be reduced by more than 5 percent in 8 out of 12 months.

Based on the MARKETSYM analysis, there is no impact to overall system reliability under this alternative, in either the CNP 15 node or the overall WECC.

Under the Modified Percent Inflow Alternative, Trinity County PUD would continue to receive benefits from the TRD in accordance with its status as a First Preference Power Customer. Modeled results indicate that Trinity County PUD would be eligible for approximately 285 GWh per year from the TRD, over three times current annual energy use (80 to 85 GWh). Actual costs for First Preference Power received by Trinity County would be established by Western through its regular rate-setting process and would depend, in part, on the types of custom services Trinity PUD would purchase from Western and future allocations of the CVPIA restoration fund, both of which are beyond the scope of this analysis.

Under the Modified Percent Inflow Alternative, bypass operations would be considered in 16 percent of the modeled months June-October over the period of record, an increase of 1 percent compared to No Action. Annual average value of generation would be reduced by $547,000 per year if every potential bypass were realized, $34,000 less than No Action because fewer GWh would be lost (1,074 GWh under Modified Percent Inflow compared to 1,141 GWh under No Action).

The change in cost per unit of electricity for the average Western customer under the Modified Percent Inflow Alternative would be $.29, while the change for the high-allocation customer would be $1.76.

70 Percent Inflow Alternative. Average annual CVP power generation under this alternative would be reduced. This alternative would reduce the amount of power generated by the TRD, resulting in a decrease in the value of net power available for use by preference power customers of $21,700,000 annually compared to No Action. If ancillary services are included in the value of the CVP, the net change is a reduction of $19,400,000 annually compared to No Action. This alternative was not analyzed in the original Draft EIS/EIR.

MARKETSYM output identified several significant impacts of the Revised Mechanical Alternative. Compared to No Action, dry-year capacity would be reduced by more than 50 MW during off-peak hours in July and August. In the average year, CVP energy available for sale would be reduced by 17.3 percent compared to No Action. Energy available for sale in average months would be reduced by more than 5 percent in 9 out of 12 months, which would also constitute a significant impact.

Based on the MARKETSYM analysis, there is no impact to overall system reliability under this alternative, in either the CNP 15 node or the overall WECC.

Under the 70 Percent Inflow Alternative, Trinity County PUD would continue to receive benefits from the TRD in accordance with its status as a First Preference Power Customer. Modeled results indicate that Trinity County PUD would be eligible for approximately 182 GWh per year from the TRD, over twice its current annual energy use (80 to 85 GWh). Actual costs for First Preference Power received by Trinity County would be established by Western through its regular rate-setting process, and would depend, in part, on the types of custom services Trinity County PUD would purchase from Western and future allocations of the CVPIA restoration fund, both of which are beyond the scope of this analysis.

Under the 70 Percent Inflow Alternative, bypass operations would be considered in 19 percent of the modeled months June-October over the period of record, an increase of 3 percent compared to No Action. Annual average value of generation would be reduced by $449,000 per year if every potential bypass were realized, $132,000 less than No Action because fewer GWh would be lost (886 GWh under 70 percent Inflow compared to 1,141 GWh under No Action).

The change in cost per unit of electricity for the average Western customer under the Modified Percent Inflow Alternative would be $.81, while the change for the high-allocation customer would be $4.89.

Maximum Flow. Reductions in power generation under the Maximum Flow Alternative reflect the elimination of Trinity River diversions to the Sacramento River. The alternative would substantially reduce the amount of electricity generated by the TRD, resulting in a decrease in the value of net power available for use by preference power customers of $32,600,000 compared to the No Action condition. This is an estimate of the cost of power customers would pay to replace CVP hydro, on average, each year. If ancillary services are also valued, the impact increases to $45,100,000, because it is assumed that the TRD components are not available to serve as spinning reserve. However, this is unlikely to be the case under emergency conditions because of mitigation measures described below. In the original Draft EIS/EIR, using different methodology, this reduction was estimated as $26,000,000 annually.

MARKETSYM output identified several significant impacts resulting from the alternative. Compared to No Action, dry-year capacity would be reduced by more than 50 MW, both on-peak and off-peak in July and August, largely due to the elimination of generation at the J.F. Carr Powerhouse and reduction of generation at Spring Creek Powerplant. Likewise, on average, CVP energy available for sale would be reduced by 26 percent compared to No Action. Energy available for sale in average months would be reduced by more than 5 percent in 9 out of 12 months compared to No Action.

Based on the MARKETSYM analysis, there is no impact to overall system reliability under this alternative, in either the CNP 15 node or the overall WECC.

Under the Maximum Flow Alternative, Trinity County PUD would continue to receive benefits from the TRD in accordance with its status as a First Preference Power Customer. Modeled results indicate that Trinity County PUD would be eligible for approximately 91 GWh per year from the TRD, just over its current annual energy use (80 to 85 GWh). Actual costs for First Preference Power received by Trinity County would be established by Western through its regular rate-setting process and would depend, in part, on the types of custom services Trinity County PUD would purchase from Western and future allocations of the CVPIA restoration fund, both of which are beyond the scope of this analysis.

Under the Maximum Flow Alternative, bypass operations would be considered in 56 percent of the modeled months June-October over the period of record, an increase of 41 percent compared to No Action. Annual average value of generation would be reduced by $1,130,000 per year if every potential bypass were realized, $549,000 more than No Action.

The change in cost per unit of electricity for the average Western customer under the Modified Percent Inflow Alternative would be $1.21, while the change for the high-allocation customer would be $7.34.

Existing Conditions versus Proposed Action. In general, power operations of the CVP under existing conditions (i.e., 2000) are similar to the No Action Alternative (i.e., 2020). The major difference between the two is the amount of project load served under existing conditions is approximately 138 GWh greater than under No Action. This reduces the net generation available for sale, thus reducing the value of current operations by $2,800,000 compared to the future operations under No Action. Consequently, the reduction in project value to preference customers between the Proposed Action and existing conditions is $6,000,000 less than existing conditions per year. Taking ancillary services into account, the reduction is $4,500,000 per year.

Based on the MARKETSYM analysis, there is no impact to overall system reliability under this alternative, in either the CNP 15 node or the overall WECC.

Mitigation.

Operating criteria would be established to allow Western to respond to various emergency situations in accordance with their obligations to the North American Electric Reliability Council. This commitment would also provide for exemptions to a given alternative's operating criteria during search and rescue situations, special studies and monitoring, dam and powerplant maintenance, and spinning reserves. Such exemptions for responding to various emergency situations would be consistent with the Presidential Memorandum, dated August 3, 2000, directing federal agencies to work with California to develop procedures governing the use of backup power generation in power shortage emergencies.

Potentially significant power-related impacts could occur as a result of decreased surface-water supplies associated with the Revised Mechanical, Flow Evaluation, Modified Percent Inflow, 70 Percent Inflow, and Maximum Flow Alternatives. Although water supply changes were not considered an impact, the development of additional water supplies to meet demands would lessen the associated impacts. Conceptually, any additional water supply or demand reduction would free up water for use by other, competing uses, including power production. Numerous demand- and supply-related programs are currently being studied across California, many of which are being addressed through the ongoing CALFED and CVPIA programs and planning processes. Although none of these actions would be directly implemented as part of the alternatives discussed in this Supplemental EIR/EIS, each could assist in offsetting impacts resulting from decreased Trinity River exports.

Power-related benefits associated with such programs would only occur if operations were conducted to provide increased power generation; otherwise, implementation of such programs could negatively affect power resources.

Examples of actions being assessed in the CALFED and CVPIA planning processes include:

- Develop and implement additional groundwater and/or surface-water storage. Such programs could include the construction of new surface reservoirs and groundwater storage facilities, as well as expansion of existing facilities. Potential locations include sites throughout the Sacramento and San Joaquin Valley watersheds, the Trinity River Basin, and the Delta.
- Purchase long- and/or short-term water supplies from willing sellers (both in-basin and out-of-basin) through actions including, but not limited to, temporary or permanent land fallowing.
- Facilitate willing buyer/willing seller inter- and intra-basin water transfers that derive water supplies from activities such as conservation, crop modification, land fallowing, land retirement, groundwater substitution, and reservoir re-operation.
- Promote and/or provide incentive for additional water conservation to reduce demand.
- Decrease demand through purchasing and/or promoting the temporary fallowing of agricultural lands.
- Increase water supplies by promoting additional water recycling.
- Develop or construct power generation facilities for use by CVP customers.
- Purchase replacement power resources to offset losses of CVP generation.
- Modify the current CVP Cost Allocation policy to ensure that costs allocated to CVP preference power customers are reduced in an amount equal to the cost of acquiring replacement power.

TABLE 3.5-4
Predicted Power Generation and Value as Modeled MARKETSYM

Results of Case:	No Action		Revised Mechanical		Flow Evaluation		Modified Percent Inflow		70 Percent Inflow		Maximum Flow		Existing Conditions	
1 Market Clearing Prices	**$/MWh**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**	
+2 SD	43.53		0.0		0.1		0.1		0.2		0.5		-0.1	
Mean	35.09		0.1		0.1		0.1		0.3		0.4		0.0	
-2 SD	27.99		0.0		0.1		0.1		0.4		0.5		0.0	
2 Expected Monthly Net Energy	**MWh**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**	
Jan	142,609		-4.3		17.8		-17.4		-18.3		-4.5		-16.1	
Feb	206,674		-2.0		-5.2		-5.1		2.1		5.9		-3.3	
Mar	181,222		-2.4		-2.2		-10.4		7.0		-1.0		-9.2	
Apr	288,740		0.3		-0.5		-24.5		5.3		-3.1		-22.2	
May	471,487		-2.0		-4.4		-4.4		-10.7		-13.8		-1.4	
Jun	463,883		-5.5		-10.1		-3.5		-15.8		-24.0		0.7	
Jul	554,085		-1.3		-7.0		-1.2		-19.4		-37.7		1.1	
Aug	392,956		-1.8		-6.6		-1.9		-19.2		-51.3		0.5	
Sep	303,585		-2.4		-14.2		-8.8		-34.9		-43.0		3.1	
Oct	225,999		-15.8		-17.3		-13.3		-41.0		-38.9		1.4	
Nov	98,160		-10.9		-36.4		-19.8		-31.6		-57.4		-2.0	
Dec	162,089		-4.8		-8.9		5.5		-46.4		-32.8		-1.7	
	3,491,490		-3.6		-7.3		-7.0		-17.3		-26.3		-2.8	
3 Expected Annual Net Energy	**MWh**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**	
On-Peak	2,722,291		-3.3%		-6.7%		-3.4%		-15.5%		-22.7%		0.9%	
Off-Peak	769,199		-4.6%		-9.5%		-19.6%		-23.9%		-39.2%		-16.0%	
Total	3,491,490		-3.6%		-7.3%		-7.0%		-17.3%		-26.3%		-2.8%	
4 Expected a MW of July and August Capacity Based on Reclamation Generation	**MW**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**		**% Change**	
On-Peak	601		-1.5%		-4.9%		-2.5%		-15.3%		-30.0%		0.0%	
Off-Peak	240		-3.3%		-9.6%		-5.4%		-21.5%		-34.4%		-0.2%	
5 Reclamation Expected Monthly and Annual Loads and Resources, MWh	**Generation**	**Load**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**
Jan	260,007	117,398	-6,680	-532	-7,595	-33,006	-4,935	19,903	-13,237	12,797	-23,649	-17,252	3,161	26,080
Feb	289,404	82,729	-5,111	-955	-7,734	3,077	-5,822	4,676	1,210	-3,154	-3,219	-15,386	1,536	8,319
Mar	305,146	123,925	-5,613	-1,262	-7,248	-3,329	-5,031	13,743	-12,632	-25,236	-12,882	-11,025	1,382	18,091
Apr	344,021	55,281	-3,552	-4,346	-1,005	405	-1,610	69,055	9,149	-6,139	-2,463	6,616	6,009	70,077
May	504,005	32,517	-5,815	3,839	-16,257	4,369	-10,928	9,913	-44,825	5,473	-60,213	4,776	2,777	9,563
Jun	553,318	89,434	-16,608	9,041	-28,286	18,627	-17,144	-878	-65,030	8,045	-98,539	12,792	6,906	3,671
Jul	697,260	143,174	-14,879	-7,865	-38,639	69	-21,711	-14,817	-112,654	-5,285	-191,184	17,815	4,403	-1,771
Aug	554,938	161,982	-10,192	-3,091	-39,586	-13,732	-19,975	-12,439	-100,904	-25,455	-199,732	1,990	-4,791	-6,603
Sep	410,099	106,514	-9,411	-2,169	-53,561	-10,385	-28,340	-1,691	-130,496	-24,522	-188,253	-57,742	7,645	-1,719
Oct	283,365	57,366	-17,120	18,488	-40,993	-1,943	-28,374	1,684	-78,836	13,854	-121,392	-33,517	5,328	2,181
Nov	199,241	101,081	-8,096	2,595	-23,241	12,488	-16,922	2,560	-45,480	-14,452	-63,336	-7,023	2,890	4,820
Dec	256,743	94,655	-5,303	2,411	-14,670	-243	-8,950	-17,919	-38,744	36,391	-59,967	-6,871	2,886	5,606
Annual	4,657,546	1,166,056	-108,378	16,153	-278,815	-23,602	-169,742	73,791	-632,479	-27,685	-1,024,828	-104,826	40,133	138,315
6 Reclamation Expected Monthly and Annual Loads and Resources, MWh (based on a deterministic assessment)	**Generation**	**Load**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**

TABLE 3.5-4
Predicted Power Generation and Value as Modeled MARKETSYM

Results of Case:	No Action		Revised Mechanical		Flow Evaluation		Modified Percent Inflow		70 Percent Inflow		Maximum Flow		Existing Conditions	
Jan	291,061	123,012	-2,455	5,188	-23,342	-3,006	-8,115	-2,448	-5,040	-1,625	-6,492	-1,187	-17,739	2,632
Feb	313,620	110,575	-14,158	2,165	-1,413	-10,189	-7,941	286	-5,911	-1,781	-5,236	-2,176	1,245	-2,109
Mar	322,289	103,269	-4,779	1,037	-11,884	-14,162	-7,237	-985	-5,104	-2,349	-6,137	-729	-13,168	-6,959
Apr	358,713	52,856	-1,957	-229	2,042	-4,727	-993	482	-1,415	220	-6,288	-163	10,794	-1,277
May	513,016	53,056	-5,885	-854	-56,826	-8,396	-7,846	-2,166	-7,991	-1,155	-6,331	-938	-42,478	-2,130
Jun	563,970	90,476	-6,787	3,012	-98,124	-12,728	-28,317	-3,643	-16,850	-1,842	-18,276	-1,310	-64,737	-3,801
Jul	693,652	149,308	-3,876	7,444	-193,068	-30,999	-39,189	-9,251	-22,194	-6,948	-13,802	-5,163	-112,658	-15,023
Aug	554,911	140,269	-9,845	1,522	-200,127	-22,708	-40,639	-4,284	-21,048	-4,489	-10,878	-2,052	-102,163	-8,532
Sep	416,940	108,724	-1,479	1,009	-188,464	-10,764	-53,600	-1,804	-29,473	-733	-9,490	-546	-131,176	-5,757
Oct	288,485	94,601	-538	46	-123,969	-7,409	-41,130	-3,296	-28,003	-2,829	-17,134	-404	-79,915	-8,831
Nov	214,714	105,625	-12,466	236	-65,014	-9,525	-23,121	-2,035	-16,748	-2,459	-8,003	-628	-47,300	-7,656
Dec	271,033	123,813	-13,733	-3,288	-62,876	-14,516	-15,793	-4,886	-9,670	-2,965	-5,631	-1,698	-41,422	-7,805
Annual	4,802,403	1,255,582	-77,958	17,289	-1,023,063	-149,130	-273,920	-34,030	-169,446	-28,955	-114,149	-16,994	-640,717	-67,428
7 Reclamation Net Value (based on Net Energy), $	**2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**	
Jan	5,562,001		-233,068		890,565		-847,350		-1,024,649		-226,633		-749,648	
Feb	6,899,260		-144,548		-342,469		-315,441		130,028		417,018		-182,634	
Mar	6,062,268		-146,390		-135,514		-609,075		414,949		-77,548		-543,120	
Apr	8,828,167		57,752		-21,645		-2,030,507		479,692		-315,696		-1,819,059	
May	14,424,587		-279,535		-607,091		-618,232		-1,491,585		-1,918,174		-181,582	
Jun	15,192,841		-789,358		-1,443,279		-525,378		-2,289,950		-3,516,773		98,237	
Jul	20,509,625		-236,201		-1,370,413		-250,026		-3,857,282		-7,341,958		201,781	
Aug	14,980,450		-248,381		-961,156		-275,670		-2,775,407		-7,517,197		58,831	
Sep	12,322,829		-278,223		-1,672,152		-991,385		-4,190,738		-5,033,749		348,943	
Oct	7,896,463		-1,198,208		-1,307,584		-1,028,491		-3,138,980		-2,957,070		107,477	
Nov	3,746,575		-387,282		-1,296,423		-702,382		-1,107,978		-2,071,484		-52,625	
Dec	6,376,967		-297,536		-562,109		395,011		-2,852,034		-2,066,448		-71,771	
Annual	**122,802,033**		**-4,180,978**		**-8,829,268**		**-7,798,926**		**-21,703,932**		**-32,625,713**		**-2,785,171**	
8 Reclamation Net Value (based on Net Energy), $ (deterministic assessment)	**2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**		**Change in 2003 U.S. ($)**	
Jan	$13,591,768		-$586,978		-$4,502,830		-$150,978		-$71,543		-$126,857		-$2,438,741	
Feb	$8,710,297		-$712,125		-$654,680		-$291,317		-$158,675		-$122,519		$168,794	
Mar	$9,970,199		-$353,702		-$1,098,638		-$195,495		-$86,645		-$155,960		-$102,347	
Apr	$13,315,976		-$6,747,820		-$1,162,042		-$31,484		$59,302		-$131,828		$546,755	
May	$19,078,234		-$515,550		-$2,567,787		$309,515		$126,703		$111,445		-$659,208	
Jun	$18,548,357		-$197,331		-$3,509,378		-$407,973		-$256,057		-$310,772		-$1,189,602	
Jul	$24,010,111		$445,511		-$6,141,877		-$864,540		-$466,113		-$245,500		-$2,983,722	
Aug	$19,439,764		$254,460		-$7,158,787		-$1,297,190		-$579,766		-$326,741		-$3,259,051	
Sep	$13,990,002		$156,535		-$7,139,566		-$1,949,949		-$1,057,278		-$345,227		-$4,548,066	
Oct	$9,201,531		-$7,060		-$4,754,280		-$186,436		-$783,843		-$522,248		-$2,205,930	
Nov	$6,284,399		-$864,501		-$3,117,609		-$791,888		-$530,325		-$273,105		-$1,460,837	
Dec	$10,173,007		-$1,161,057		-$4,201,699		-$415,303		-$240,655		-$148,839		-$1,176,572	
Annual	$166,313,646		-$4,189,619		-$46,009,173		-$7,273,038		-$4,044,895		-$2,598,150		-$19,308,527	

TABLE 3.5-4
Predicted Power Generation and Value as Modeled MARKETSYM

Results of Case:	No Action	Revised Mechanical	Flow Evaluation	Modified Percent Inflow	70 Percent Inflow	Maximum Flow	Existing Conditions
9 Change in Cost per Unit of Electricity for Western customers, $/MWh		**Change in 2003 U.S. ($)**	**Change in 2003 U.S. ($)**	**Change in 2003 U.S. ($)**	**Change in 2003 U.S. ($)**	**Change in 2003 U.S. ($)**	**Change in 2003 U.S. ($)**
Average Customer (14 percent of load)	--	**.16**	**.33**	**.29**	**.81**	1.21	**.10**
High-allocation Customer (85 percent of load)	--	**.94**	**1.99**	**1.76**	**4.89**	7.34	**.63**
10 Reliability as Measured by E.N.S. in CNP15	**MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**	**Change in MWh**
Annual	0	0	0	0	0	0	0
11 Reliability as Measured by E.N.S. in WECC							
Annual	4,599	0	0	0	0	0	0

SECTION 4.0

Other Impacts and Commitments

This chapter discusses the cumulative and growth-inducing impacts that may occur because of other related programs and activities. Several of these related programs are being implemented. Others are currently undergoing planning the preparation of environmental documentation. This chapter also discusses irreversible and irretrievable resource commitments, and compares short-term impacts versus long-term environmental benefits. Table 4-1 provides a summary of commitments, mitigation, and significant unavoidable impacts for the alternatives.

4.1 Cumulative Impacts

Cumulative impacts are the impacts on the environment that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or entity undertakes such other actions. It is recognized that the proposed action may be implemented in an interactive manner with other concurrent projects. In addition, these other projects may affect the impacts of the proposed action. The cumulative analysis addresses impacts associated with several related actions including the following:

Cumulative impacts are the impacts on the environment that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions.

- ESA consultation for the CVP-OCAP
- CALFED Bay-Delta Program
- Changes in federal farm support programs
- Changes to fisheries management
- Changes in Trinity River Basin Consumptive Water Use
- Five Counties Salmonid Conservation Program
- TMDL
- Lower Klamath Restoration Partnership
- Changes in California Forest Practice Rules
- Sacramento Valley Water Management Agency (SVWMA) (Phase 8)
- EWA

- Intertie proposed action
- Freeport Regional Water Project
- South Delta Improvement Project

Many other water resource activities are planned in California. These activities include water transfer actions and conveyance facilities in the Central Valley and central and southern coastal areas, and wetlands and other habitat restoration projects in the Central Valley. However, the cumulative impact of these programs on the proposed action would be minimal. The following actions are described at length because, in some instances, they could potentially change the level of impacts to the natural or human environment from that which has been described in previous chapters. Because of the uncertainty as to how, when, and to what degree each of these programs and activities will be implemented, this analysis identifies only the primary issues associated with each.

4.1.1 ESA Consultation for CVP-OCAP

As noted previously in this document, ESA and CESA consultation and compliance for this program is being conducted in conjunction with ESA and CESA consultation for CVP-OCAP. However, CVP-OCAP includes consideration programs and projects that were not included under the impact analysis conducted for the action alternatives because final details regarding CVP-OCAP were complex and subject to substantial delays. Notably, CVP-OCAP includes the following additions that were not included in the Supplemental EIS/EIR impact analysis:

- Implementation of CVPIA 3406(b)(2) as defined in May 2003.
- Refinement in modeling assumptions governing EWA assumptions.
- Inclusion of Napa draft propositions, including Freeport Regional Water Project, treatment of two-thirds of North Bay Aqueduct diversions as export, Delta Mendota Canal California Aqueduct Intertie, SWP conveyance of 100,000 acre-feet of CVP water to SWP to meet COA in-basin requirements. Shift of 35,000 taf of Placer County Water Agency demand from the Sacramento River to the American River.
- Modification of Cross Valley Canal operations to reflect changes in CVPIA (3406(b)(2).

Therefore, in terms of ESA compliance, the Preferred Alternative is one of many factors influencing endangered species, whereas in the impact analysis in Chapter 3.0, assumptions regarding CVP and SWP operations were held constant across alternatives, with the exception

TABLE 4-1
Comparison of Impacts on Water Resources

Parameter		Hydrologic Conditions	Existing Conditions	No Action	Preferred Flow	Cumulative
Trinity Reservoir Elevation (feet)	30-May	Dry	2,261	2,261	2,258	2,251
		Wet	2,363	2,363	2,356	2,355
		Average	2,328	2,328	2,319	2,317
	30-Sep	Dry	2,203	2,205	2,213	2,199
		Wet	2,327	2,327	2,321	2,321
		Average	2,286	2,286	2,281	2,276
Shasta Reservoir Elevation (feet)	30-May	Dry	988	987	984	977
		Wet	1,060	1,060	1,059	1,058
		Average	1,042	1,043	1,040	1,037
	30-Sep	Dry	919	914	912	901
		Wet	1,012	1,012	1,010	1,008
		Average	988	987	982	979
San Luis Reservoir Elevation (feet)	30-May	Dry	514	518	588	788
		Wet	565	566	561	658
		Average	568	527	528	602
	30-Sep	Dry	459	397	462	467
		Wet	499	407	408	495
		Average	417	404	410	420
Trinity River Exports (taf/year)		Dry	524	525	380	393
		Wet	1,027	1,024	670	635
		Average	769	773	541	540
Trinity Reservoir Storage (taf)	30-Sep	Dry	673	693	712	641
		Wet	1,816	1,814	1,743	1,740
		Average	1,403	1,403	1,321	1,289
Shasta Reservoir Storage (taf)	30-Sep	Dry	1,540	1,506	1,455	1,341
		Wet	3,117	3,120	3,080	3,046
		Average	2,692	2,680	2,585	2,529
San Luis Reservoir Storage (taf)	30-Sep	Dry	570	541	587	627
		Wet	726	684	685	705

TABLE 4-1
Comparison of Impacts on Water Resources

Parameter	Hydrologic Conditions	Existing Conditions	No Action	Preferred Flow	Cumulative
	Average	568	554	555	547
CVP Deliveries North of Delta (taf/year)	Dry	2,200	2,422	2,385	2,459
	Wet	2,566	2,878	2,871	2,924
	Average	2,448	2,730	2,712	2,765
CVP Deliveries South of Delta (taf/year)	Dry	1,725	1,767	1,617	1,628
	Wet	3,052	3,037	2,981	3,177
	Average	2,631	2,598	2,539	2,623
Exports, Tracy Pumping Plant (taf/year)	Dry	1,640	1,688	1,605	1,607
	Wet	2,562	2,584	2,553	2,673
	Average	2,337	2,333	2,281	2,314
Exports, Banks Pumping Plant (taf/year)	Dry	1,754	1,863	1,837	1,952
	Wet	3,620	3,791	3,794	3,927
	Average	3,012	3,109	3,095	3,185
Exports, Tracy and Banks Pumping Plants (taf/year)	Dry	3,395	3,551	3,442	3,559
	Wet	6,181	6,375	6,347	6,600
	Average	5,349	5,441	5,376	5,499
Delta Inflow (taf/year)	Dry	11,564	11,635	11,481	11,347
	Wet	28,379	28,231	27,896	27,894
	Average	21,274	21,214	21,010	20,934
Delta Outflow (taf/year)	Dry	6,605	6,551	6,605	6,358
	Wet	20,686	20,440	20,145	19,879
	Average	14,501	14,399	14,276	14,040
Trinity River Releases (taf/year)	Critically dry	341	341	370	368
	Dry	341	341	454	454
	Normal	341	341	648	648
	Wet	341	341	702	702
	Extremely wet	341	341	817	817

of the various levels of release into the Trinity River. Notably, the preferred alternative as described in this document is carried through the various CVP-OCAP documents and analyses as the future condition subject to review by responsible resource agencies.

CVP-OCAP is defined as the action proposed by Reclamation and DWR to operate the CVP and SWP to divert, store, and convey CVP and SWP water consistent with applicable law. The CVP and the SWP are two major inter-basin water storage and delivery systems that divert water from the southern portion of the Delta. Both projects include major reservoirs north of the Delta and transport water via natural watercourses and canal systems to areas south and west of the Delta.

The CVP also includes facilities and operations on the Stanislaus and San Joaquin Rivers. ESA consultation for CVP-OCAP includes consideration of the following listed species:

- Winter-run Chinook salmon
- Spring-run Chinook salmon
- Central Valley steelhead
- Delta smelt
- Coho salmon

Further, a separate consultation is also underway addressing the effects of operating the CVP and SWP on wildlife and plant species that are listed, or proposed for listing, under the federal ESA. These species include the following:

- Bald eagle
- California clapper rail
- Salt marsh harvest mouse
- Riparian brush rabbit
- Riparian woodrat
- California red-legged frog
- Giant garter snake
- Valley elderberry longhorn beetle
- Suisun thistle
- Soft bird's-beak

Separate consultation is also underway for wildlife species that are listed, or proposed for listing, under CESA that are not formally addressed in other consultations. These species include the following:

- Bank swallow
- Swainson's hawk
- Western yellow-billed cuckoo

As previously noted, CVP-OCAP includes actions and programs that were not included in the base assumptions defined in Chapter 2.0 and evaluated in Chapter 3.0. The differences between assumptions used for analysis in Chapter 3.0 and those used for CVP-OCAP are outlined in Table 4.2.

TABLE 4-2
Comparison of Modeling Assumptions Used in Supplemental EIS/EIR and CVP-OCAP Analyses

	Supplemental EIS/EIR Existing Conditions	Supplemental EIS/EIR Alternative Analyses	CVP-OCAP Analyses
Level of Development			
DWR 160-98	2001	2020	2020
South of Delta Water Demand			
Contra Costa Water District	143 TAF/year	151 TAF/year	158 TAF/year
State Water Project (including North Bay Aqueduct)	3.0-4.1 MAF/year	3.0-4.1 MAF/year	3.3-4.1 MAF/year
Facilities			
Freeport Regional Water Project	None	None	Included with modified operations on the Mokelumne River
Banks Pumping Capacity	6,680 cfs	6,680 cfs	8,500 cfs
Tracy Pumping Capacity	4,200 cfs with deliveries upstream of Delta-Mendota Canal constriction	4,200 cfs with deliveries upstream of Delta-Mendota Canal constriction	4,600 cfs with intertie

Future actions associated with terms and conditions required during the ESA consultation process and as further development of programs described in the CVP-OCAP project description have the potential to affect the cumulative condition.

4.1.2 CALFED Bay-Delta Program

In the August 28, 2000 CALFED ROD, state and federal agencies committed to implementing a long-term solution to problems affecting the Delta. The CALFED program includes efforts to address water quality and reliability, water storage options that include groundwater banking and offstream surface-water storage, and several water conveyance alternatives in the Delta. The CALFED process is intended to improve the Bay-Delta ecosystem and water quality, which would lead to increased salmon populations in Central Valley streams.

Future actions associated with CALFED have the potential to affect the cumulative condition.

4.1.3 Changes in Federal Farm Support Programs

The 2002 Farm Bill updated the way federal farm subsidies are determined. However, there remains some uncertainty about how the U.S. Department of Agriculture (USDA) would treat lands that are part of a grower's base acreage, yet fallowed if CVP water supplies are reduced. For this Supplemental EIS/EIR, it was assumed that USDA would remove such lands from the grower's base acreage and reduce their federal subsidies accordingly, resulting in a savings to the federal treasury.

In contrast, if growers who fallow their land because of water supply reductions continue to receive farm program payments associated with that land, then no savings would accrue to the federal treasury. However, net revenues to the farmers would increase. This may lead to greater participation in the Central Valley water transfer market, which may lead to a lower cost for water. Either or both of these impacts could increase the amount of water available for water acquisition. This would then increase water supply reliability of agricultural or municipal users. The water also could be acquired to increase instream flow releases. The Farm Bill also includes provisions relating to trade, nutrition programs, rural development, forestry and energy, among other provisions, all of which have the potential to affect physical change on the environment.

4.1.4 Changes to Fisheries Management

Artificial propagation of game fish, including west coast anadromous fish, has been an important tool in fishery management. Numerous federal, state, and local fish hatcheries and rearing facilities have made successful and substantial contributions to the size of anadromous fish populations. Most of these programs are well funded by their respective agencies, including the TRSSH, which has undergone a major rehabilitation to improve water quality and production facilities. Increased hatchery production could increase the number of salmon in the ocean and, therefore, increase the number of returning fish to all streams, including the Trinity River. However, concerns have been raised about the propagation of hatchery fish that are not subject to natural selection during reproduction and rearing, which may lead to competitive disadvantages for natural fish when hatchery fish are released en masse. Hatchery-raised fish may also reduce genetic variability and lead to genetic abnormalities or predisposition that are transferred to natural stock. Hatchery-raised fish may also be more subject to disease.

Salmon spend over two-thirds of their life cycle in the ocean. During this stage of their lives, they are difficult to study. Both sport and commercial harvests appear to have a major role in returning fish populations. However, until harvest impacts can be discerned from natural phenomena of the sea (e.g., changes to temperature, upwellings, currents, and food availability), there is no exact method to assess the impacts of ocean fisheries. NOAA Fisheries has made advances in resolving some of these issues and will continue to address these concerns, leading to improved management of ocean fisheries. The preferred alternative focuses on restoring natural fish production and, as such, is projected to increase the number of fish produced and available for harvest accordingly.

4.1.5 Changes in Trinity River Basin Beneficial Water Use

The 1955 authorizing legislation for the TRD and the 1959 contract between Reclamation and Humboldt County require that not less than 50,000 acre-feet of water be released annually from the TRD and made available to Humboldt County and downstream water users. As water is released pursuant to that legislation and contract for beneficial use downstream of Lewiston Dam, it could reduce TRD exports and power generation above that are identified in this Supplemental EIS/EIR. The resultant impacts would be influenced by the timing and amount of releases and associated decreased exports. The mandate to release water in this context precedes enactment of NEPA and affords no discretion to the Secretary.

4.1.6 Five Counties Salmonid Conservation Program

The Five Counties Salmonid Conservation Program (5C) is a conservation strategy formed by the Counties of Del Norte, Humboldt, Mendocino, Trinity, and Siskiyou (located in Northwestern California), in response to the 1997 listing of the coho salmon as threatened.

The goal of the program was to seek opportunities to contribute to the long-term recovery of salmon and steelhead in Northern California. The objectives were as follows:

- Evaluate options for improving county plans, policies, and practices to provide or improve salmonid habitat
- Identify areas where counties might be vulnerable to challenges under the ESA
- Upgrade training programs and monitoring and reporting procedures

The mission of 5C is "to strive to protect the economic and social resources of Northwestern California by providing for the conservation and restoration of salmonid populations to healthy and sustainable levels and to base decisions on watershed rather than county boundaries." Specific environmental and economic 5C objectives include the following:

- Identifying potential problem sites through systematic inventories of fish passage barriers and potential erosion sources on county roads
- Improving county policies and road maintenance practices
- Increasing the amount of salmonid habitat by replacing inadequate stream crossings with structures that provide full passage
- Protecting riparian habitat corridors through education and incentive
- Developing model regulations only where other means can not be found to address land use activities regulated by the counties
- Securing various grant program funding
- Devising methods to streamline permitting procedures (ESA, Clean Water Act, and California Fish and Game Code)

Funding sources include NOAA Fisheries, For Sake of the Salmon, CDFG, State Water Resources Control Board, California Resources Agency, California Coastal Conservancy, National Fish and Wildlife Foundation, American Rivers, and Trinity County Resources Advisory Committee.

Work accomplished to date includes a University of California Cooperative Extension review of current land use activities, prioritization of watersheds by local fisheries biologists, completion of a Migration Barrier Inventory of county roads in each county, Implementation of 34 migration barrier removal projects on county roads which have restored over 100 miles of habitat for coho and Chinook salmon, cutthroat trout, and steelhead. The 5C has completed a sediment source inventory on over 1,700 miles of County roads. Based on that inventory, sediment reduction projects have been completed in individual counties. The program has completed its final draft of "A Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California Watersheds," which has been officially adopted by Del Norte and Trinity Counties. This manual will serve as a guide and framework for implementing improved road maintenance practices on county roads. The 5C also holds annual water quality and fish habitat training workshops for county roads staff, county land use planners, and policy makers.

The 5C is assisting in the long-term improvement of water quality and fish habitat in the Trinity and Klamath rivers.

4.1.7 Total Maximum Daily Load

The South Fork Trinity, Mainstem Trinity, and Klamath Rivers are listed on the State of California's Clean Water Act (CWA) Section 303(d) Impaired Waterbodies list (303(d) list). The 303(d) list describes waters that do not fully support all beneficial uses or are not meeting water quality objectives. The South Fork Trinity and Mainstem Trinity Rivers are identified as impaired by sediment, with the South Fork Trinity River also impaired by temperature. The Klamath River is identified as impaired by nutrients, temperature, and dissolved oxygen. For such water bodies, the CWA requires the development of TMDL allocations for the pollutants of concern. A TMDL allocation must estimate the TMDL, with seasonal variations and a margin of safety, for all suitable pollutants and thermal loads, at a level that would assure protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife.

Because of a stipulated dismissal of a lawsuit by numerous environmental and fishery groups against the EPA, the EPA completed the South Fork Trinity River TMDL in December 1998. The Trinity River TMDL was completed in 2001, but implementation is still pending. The Klamath River TMDL is scheduled for completion sometime in 2004. Implementation of the respective TMDLs will require incorporation into the NCRWQCB's "*Water Quality Control Plan for the North Coast Region*" (Basin Plan) through an amendment process. To date, only the TMDL for the Garcia River has been incorporated into the Basin Plan. There is no current schedule for inclusion of the South Fork Trinity or Mainstem Trinity TMDL into the Basin Plan. However, ultimate completion and adoption of TMDL's for the South Fork Trinity, Mainstem Trinity, and Klamath Rivers could assist in the long-term improvement of water quality and fish habitat in the Trinity and Klamath Rivers.

4.1.8 Lower Klamath Restoration Partnership

The Yurok Tribe is participating in a major Lower Klamath Restoration Partnership (LKRP), a program to reduce sediment yields and improve fish habitat in the lower Klamath River and its tributaries. The LKRP is a cooperative effort between the Yurok Tribe, Simpson Timber Company, California State Coastal Conservancy, and Northern California Indian Development Council. The LKRP is undertaking a holistic approach to ecosystem management, which focuses on the protection, restoration, and management of the entire basin rather than focusing on the enhancement of single, isolated projects. This process involves a prioritization of watersheds to be restored based on geomorphology, road densities, management history, in-stream habitat, and biological surveys. All road systems and landslides within priority watersheds are assessed, followed by implementation of restoration projects to solve the major erosion problems within the watershed. During the summer of 1999, five excavators and five bulldozers were working to repair priority erosion problems that were previously identified as priority projects by assessment efforts.

4.1.9 Changes in California Forest Practice Rules

The California Board of Forestry, which is a nine-member, governor-appointed body, is responsible for promulgation and adoption of rules and regulations that affect the harvest of timber from private lands within California. The listing of coho salmon as threatened or endangered throughout California and the CWA 303(d) listing of several north coast streams (see TMDL above), has resulted in changes to the Forest Practice Rules (FPR) to better protect impaired water bodies, including salmon and steelhead populations and their habitat. The rule changes are a result of a scientific panel's review of the FPR, which identified serious deficiencies in the FPRs in terms of protection for aquatic ecosystems, riparian ecosystems, and watersheds. California's coho recovery plan contains additional recommendations changes in FPR's. It is anticipated that the rule changes will complement current efforts to restore aquatic ecosystems, fish habitat, and watershed health in the Trinity River Basin and elsewhere by reducing sediment input to streams and rivers. Additional changes may occur as a result of the State Coho Recovery Plan.

4.1.10 Sacramento Valley Water Management Agreement (Phase 8)

Over the past several years, the SWRCB has been engaged in seven phases of proceedings regarding the responsibility for meeting the flow-related water quality standards for the Delta established in the 1995 Delta Water Quality Control Plan, resulting in Decision 1641. The flow-related standards provide requirements for the amounts of water flowing out from the Delta into the San Francisco Bay to maintain quality parameters within the Delta. The SWRCB hearings have focused on which users should provide this water, and Phase 8 of these proceedings focused on the water users in the Sacramento Valley. Senior water rights holders and water users throughout the Sacramento Valley felt that water releases for Delta water quality could infringe upon their water rights.

In response, DWR, Reclamation, Sacramento Valley water interests, and export water users entered the SVWMA in April 2001, providing an alternative to the Phase 8 proceedings. The SVWMA establishes a process by which local parties are to develop and implement various local water management projects that will increase water supplies cumulatively, meeting both in-basin demands and the Delta water quality requirements set forth in the Delta Water Quality Control Plan. SVWMA proponents plan to implement the SVWMA in water year 2003. In 2005, Phase 8 upstream users are to provide 185,000 acre-feet of water to meet water quality standards through implementation of conjunctive management projects. Current preparations are underway for an EIR/EIS for the program.

The agreement includes a series of work plans that are to be implemented over an 8-year period. Currently, the short-term work plan consists of over 50 locally managed, publicly funded projects. These projects incorporate the following benefits:

- Facilitation of groundwater management and planning
- Water conservation and efficiency through facility improvements
- Fish passage improvements
- Provisions for water transfers and exchanges
- Flood protection
- Conjunctive water management opportunities
- Environmental improvements

An offstream storage project north of the Delta is a key component of the long-term plan. This storage is intended to provide additional water quality benefits to the Delta and provide additional storage space with other environmental benefits.

SVWMA could contribute to the cumulative condition in normal, dry, and critical water years. Signatories to SVWMA would initially seek water during below normal, dry, and critically dry years from reservoirs, groundwater pumping, and groundwater substitution opportunities upstream from the Delta. As future projects are further defined and implemented, physical effects on the cumulative condition are likely.

4.1.11 Environmental Water Account

The CALFED ROD describes the EWA as a cooperative management program intended to provide protection to fish in the Bay-Delta through environmentally beneficial operations of SWP and CVP facilities. Beneficial operations are intended to occur with no uncompensated cost to water users. For further explanation, see CVP-OCAP BA (Appendix G). EWA will expire in 2004, and will be subject to review and adjusted to best meet the needs of future years. Future operations and changes to EWA have the potential to affect the cumulative condition.

4.1.12 Intertie Proposed Action

A proposed intertie between the SWP and CVP facilities at or near Tracy, California could affect the cumulative condition. Currently, the CVP facility has a maximum pumping capacity of 4,600 cfs. The canal downstream from the pump narrows at the final pools, reducing the maximum capacity that can be delivered to O'Neill Forebay to 4,200 cfs. An intertie would be built between the project facilities to accommodate the additional 400 cfs that cannot be moved through the final pool of the canal. The canal would potentially increase export capacity for the programs. For example, if the CVP allocations to its contractors were less than 100 percent, unused capacity in the intertie could provide additional capacity for the EWA to move water through the Delta, assuming that the CVP is not using the capacity for its own purposes. This capacity would typically be available during summer months, but the exact amounts are unknown.

4.1.13 Freeport Regional Water Project

The Freeport Regional Water Project will be a new facility that will divert up to a maximum of about 300 cfs from the Sacramento River near Freeport for Sacramento County and East Bay Municipal Utility District. East Bay Municipal Utility District will divert water pursuant to its amended contract with Reclamation. Sacramento County will divert using its water rights and its CVP contract supply. Diversions will result in some reduction in Delta export supply for both the CVP and SWP contractors. Future operations of this project have the potential to affect the cumulative condition.

4.1.14 South Delta Improvement Project

The CALFED ROD identifies the South Delta Improvements Project (SDIP) as a way to improve the use of the Delta for conveyance purposes. The intention of the SDIP is to increase conveyance capacity at the SWP Delta export facility to meet water supply demands in the Export Service Area. The SDIP includes several projects intended to maximize diversion capability into Clifton Court Forebay, while providing an adequate water supply for the South Delta Water Agency and reducing the effects of SWP exports on aquatic resources. The major components of the SDIP are as follows:

- Increasing the maximum allowable diversion capacity at the SWP Clifton Court Forebay to 8,500 cfs
- Dredging a portion of Old River to improve conveyance capacity
- Constructing permanent operable barriers to improve water supply reliability and water quality
- Dredging local channels to reduce the frequency of barrier operations and to accommodate improvements to existing agriculture

- Constructing a permanent operable fish control structure at the Head of Old River to improve conditions for salmon migrating up and down the San Joaquin River

CALFED agencies determined that the objectives outlined in the PEIS/EIR could not be met without some of these South Delta improvements (DWR and Reclamation, 2002).

4.1.15 Cumulative Impacts Analysis

ESA consultations for this program are occurring through the more comprehensive CVP-OCAP consultation. Modeling results for the CVP-OCAP consultation represent the updated cumulative condition for the Supplemental EIS/EIR because they include reasonably foreseeable programs and projects as determined jointly by the federal and state agencies responsible for operating the CVP and SWP. The Cumulative Impacts analysis for this Supplemental EIS/EIR focuses on changes to water resource operations, and the resulting impacts to the primary ESA issues associated with the Trinity River Program, winter-run Chinook salmon in the Sacramento River, and Delta smelt.

The following modifications were included in the CVP-OCAP modeling assumptions, compared to the Supplemental EIS/EIR modeling results presented in Chapter 3.0 of this Supplemental EIS/EIR:

- Implementation of the May 2003 CVPIA 3406(b)(2) decision
- Modification of Cross Valley Canal operations to reflect changes in CVPIA 3406(b)(2) accounting.
- Refinement of EWA logic
- Inclusion of Napa draft propositions for 2020 LOD studies, including the following:
  - Consideration of East Bay Municipal Utilities District as a Delta exporter
  - Treatment of two-thirds of North Bay Aqueduct diversions as an export
  - Delta Mendota Canal/California Aqueduct intertie
  - SWP conveyance of 100 taf of refuge water annually
  - Provision of 75 taf of CVP water to SWP to meet COA in-basin requirements
- Shift of 35 taf of Placer County Water Agency demand from the Sacramento River to the American River

For a complete description of the operation, facility, and modeling assumptions used in the CVP-OCAP consultation, see Appendix G. Table 4-3 outlines the CVP contract allocations assumed for the Existing Conditions, No Action/Preferred Alternative, and Cumulative Impacts conditions.

TABLE 4-3
CVP Contract Allocation Assumed to be used in Existing Conditions, No Action, Preferred Alternative, and Cumulative Impacts Scenarios

CVP Water Users	Existing Conditions (simulated 2001 levels) (taf)	No Action & Preferred Alternative (simulated 2020 levels) (taf)	Cumulative Impacts (simulated 2020 levels) (taf)
North of the Delta			
Agricultural Water Service Contractors	390	390	390
Sacramento River Water Rights Settlement Contractors	2,230	2,230	2,230
Municipal Water Rights	205	376	400
Municipal Water Service Contractors	260	340	510
Refuge Water Supplies	108	108	108
South of the Delta			
Agricultural Water Service Contractors	1,950	1,950	1,950
San Joaquin River Exchange Contractors	880	880	880
Municipal Water Service Contractors	154	154	154
Refuge Water Supplies	290	290	290
CVP Contracts on the Stanislaus River	160	160	160

The models on which 2020 projections were based take account for “probable future projects.” This approach satisfies the separate CEQA obligation to address cumulative impacts.

Between 2001 and the year 2020, projected annual CVP M&I water service contracts and water rights demands are assumed to increase by approximately 251,000 acre-feet. The cumulative condition assumes an additional 194,000 acre-feet CVP M&I water demands. Annual SWP entitlements are projected to remain between 3.0 and 4.1 maf through the year 2020, increasing to 3.3 to 4.1 maf under the cumulative condition.

Potential changes to reservoir storage levels and water deliveries were modeled using CALSIM. Updates to the cumulative condition are presented here as an update to the cumulative analysis in the

2000 EIS/EIR. Results presented here are generally consistent with data used to develop conclusions for the cumulative analysis presented in the 2000 EIS/EIR, but provide an update on foreseeable projects.

Water Resources. Table 4-3 outlines the comparative changes in water resources between Existing Conditions, No Action, Preferred Flow, and the Cumulative condition. Additionally graphic representations of key water resource characteristics are presented on Figures 4-1 through 4-5

The primary change to system operations is described in Table 4-1, under the parameter "Trinity River Exports." As shown, the No Action Alternative and the Existing Condition scenario have very similar export characteristics, in large part because their minimum releases to the Trinity River are exactly the same (340,000 acre-feet). For the Preferred Alternative, instream releases are increased, resulting in less water available, on average, for export; 773,000 acre-feet under No Action compared to 541,000 acre-feet under the Preferred Alternative. Increased dry year demand in the Cumulative condition results in slightly higher diversions in the dry period as the CVP system attempts to meet increased demand outlined in Table 4-3.

The increased demand in the dry period is also evident in the parameter "Trinity Reservoir Storage," where the Trinity Reservoir end of year storage is drawn down by approximately 50,000 acre-feet in the dry period compared to the Preferred Alternative. A similar effect is demonstrated at Shasta Reservoir, with the Cumulative condition resulting in lower end-of-year storage in the dry period (1.3 maf) than the Preferred Alternative (1.5 maf), in large part due to increased demand. Trinity and Shasta Reservoir storage frequencies are presented on Figures 4-1 and 4-2. The change in release schedule to the Sacramento River is also described by lower flow in the Sacramento River. The timing and magnitude of this reduction is described on Figure 4-4, displaying flow in the Sacramento River below Keswick Dam the reregulating dam below Shasta Reservoir.

For all alternatives, the dry period includes some months where Shasta Reservoir drops to levels very close to theoretical minimum levels where structural concerns relating to "vortex" operations might mandate emergency changes to operations. Vortex operations refer to conditions whereby air might run through the dam intake-outlet structures, possibly resulting in catastrophic failure. Concerns about vortex operations are exacerbated in the Cumulative condition, where drawdowns are expected to occur more frequently. Secondary effects of reduced storage and flow are described below under Fishery Resources.

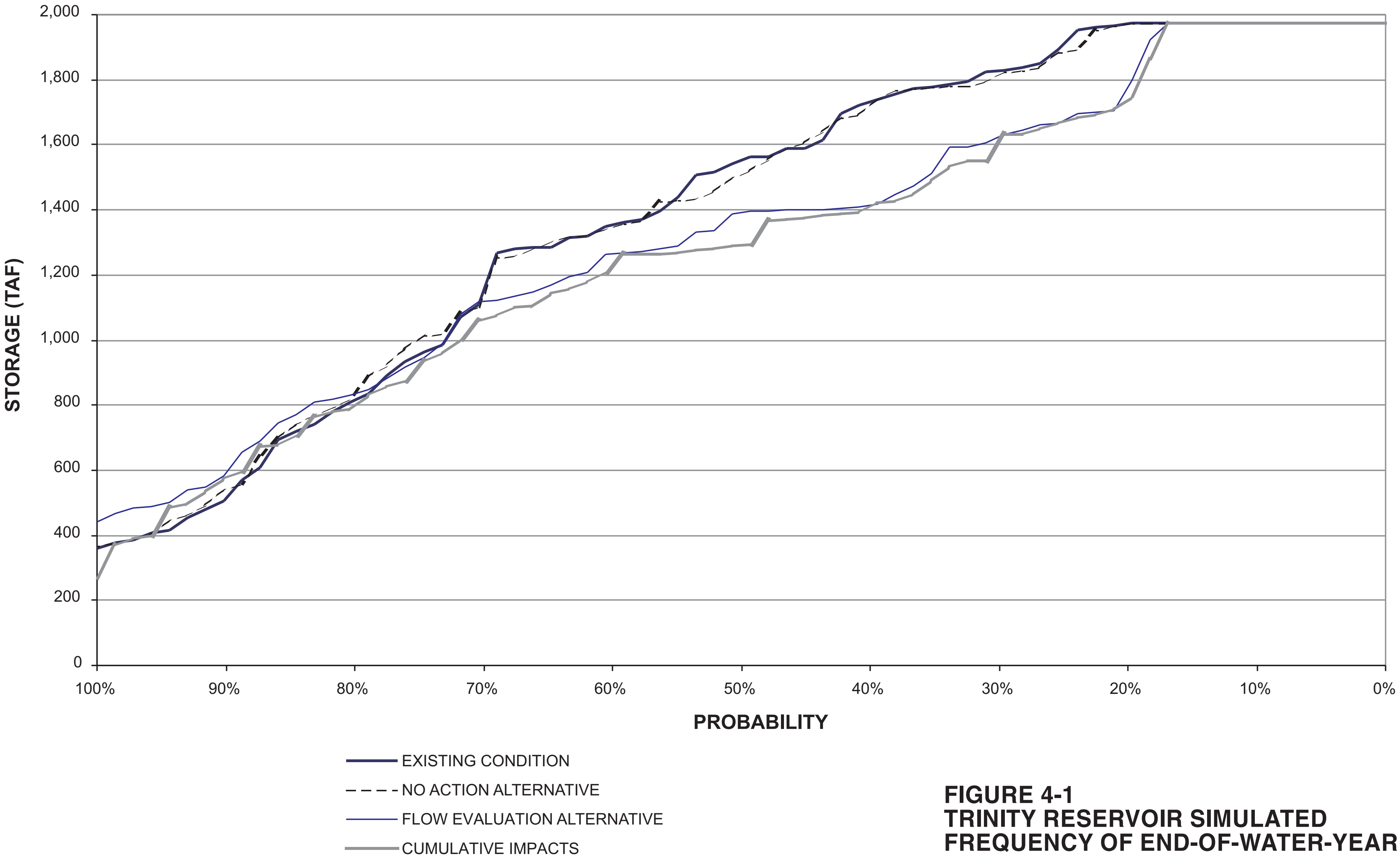


FIGURE 4-1
TRINITY RESERVOIR SIMULATED FREQUENCY OF END-OF-WATER-YEAR STORAGE, WATER YEARS 1922-1990
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

W022004007RDD_991 (4/5/04)

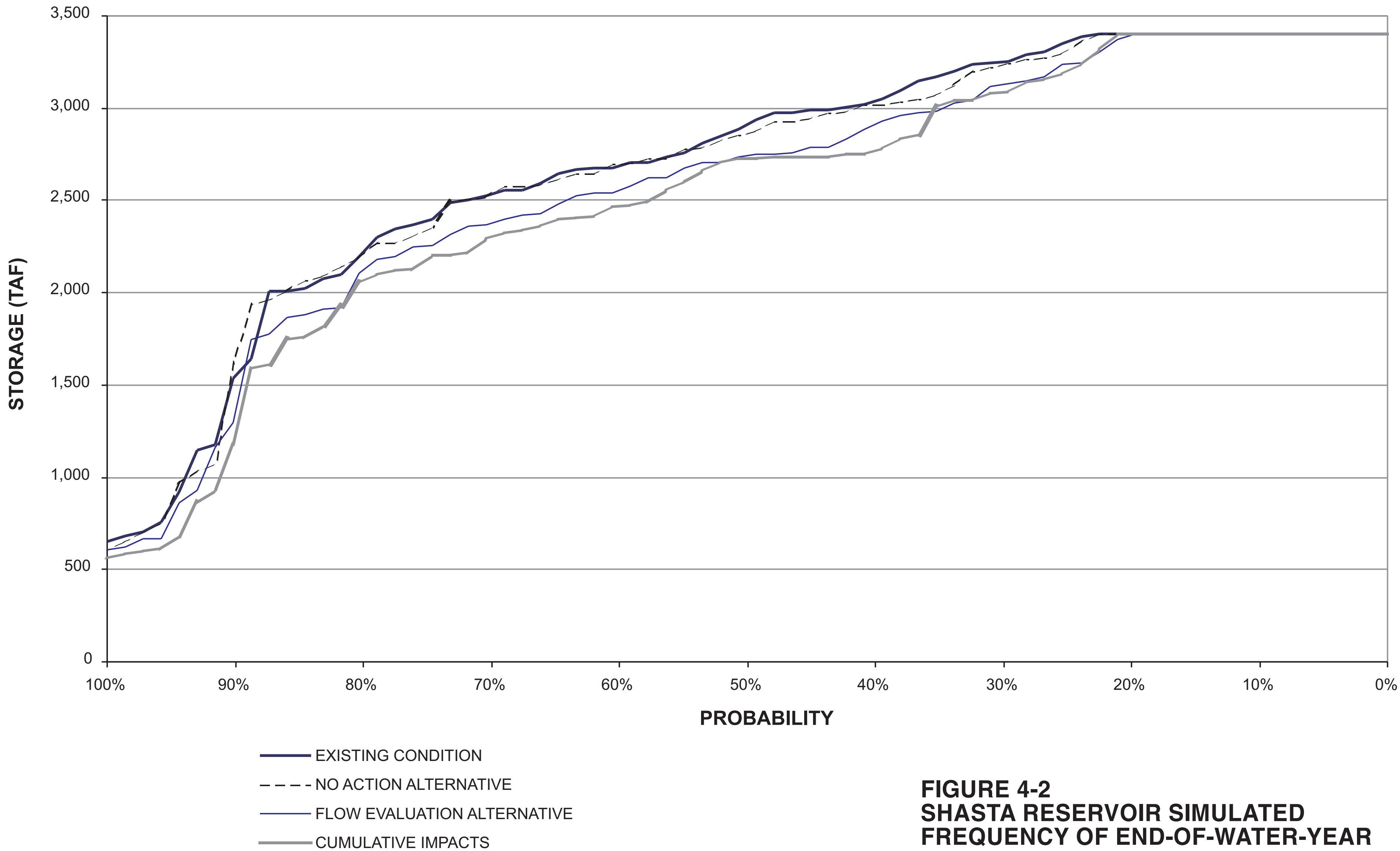
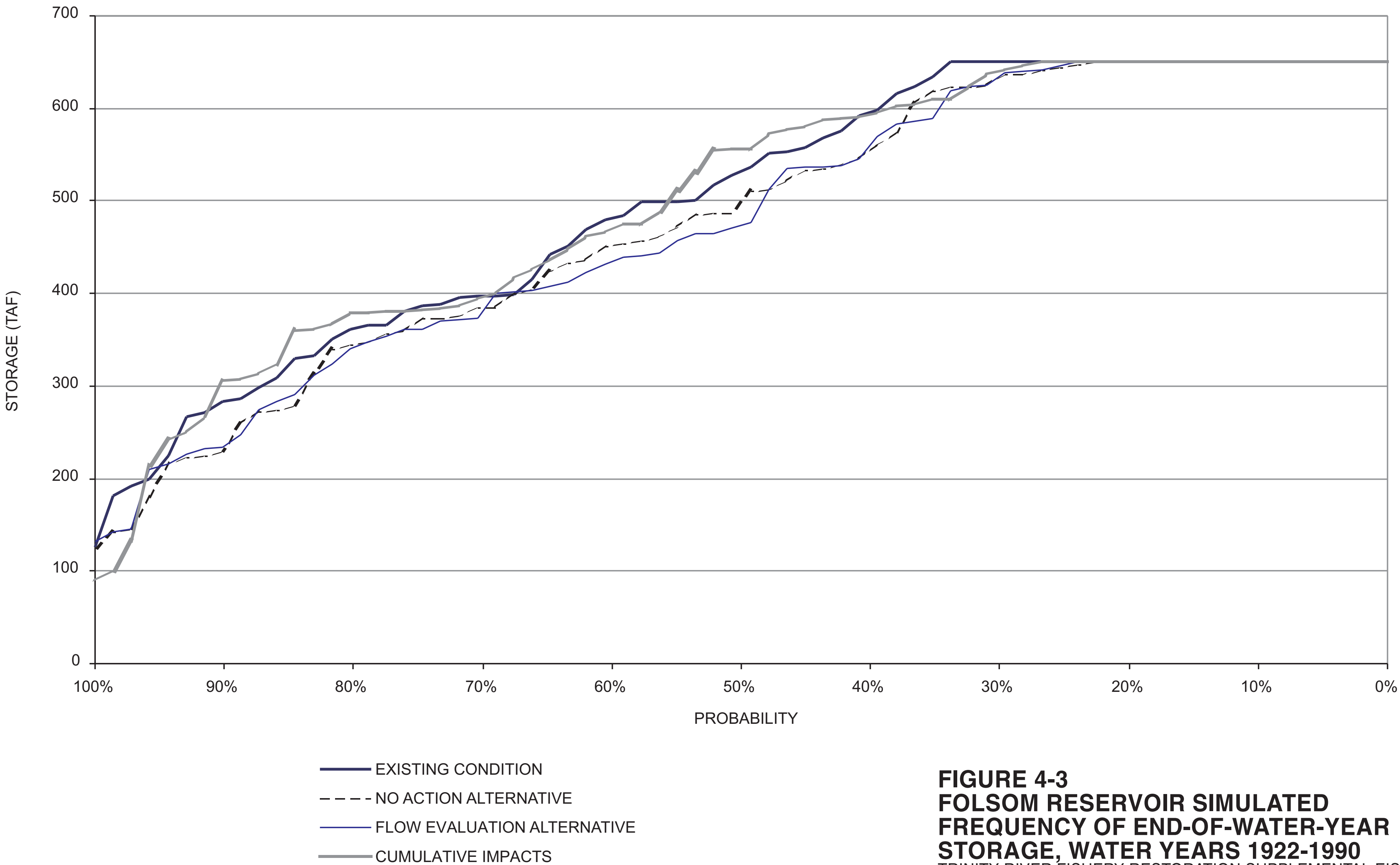


FIGURE 4-2
SHASTA RESERVOIR SIMULATED FREQUENCY OF END-OF-WATER-YEAR STORAGE, WATER YEARS 1922-1990
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

W022004007RDD_992 (4/5/04)



W022004007RDD_993 (4/5/04)

FIGURE 4-3
FOLSOM RESERVOIR SIMULATED FREQUENCY OF END-OF-WATER-YEAR STORAGE, WATER YEARS 1922-1990
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

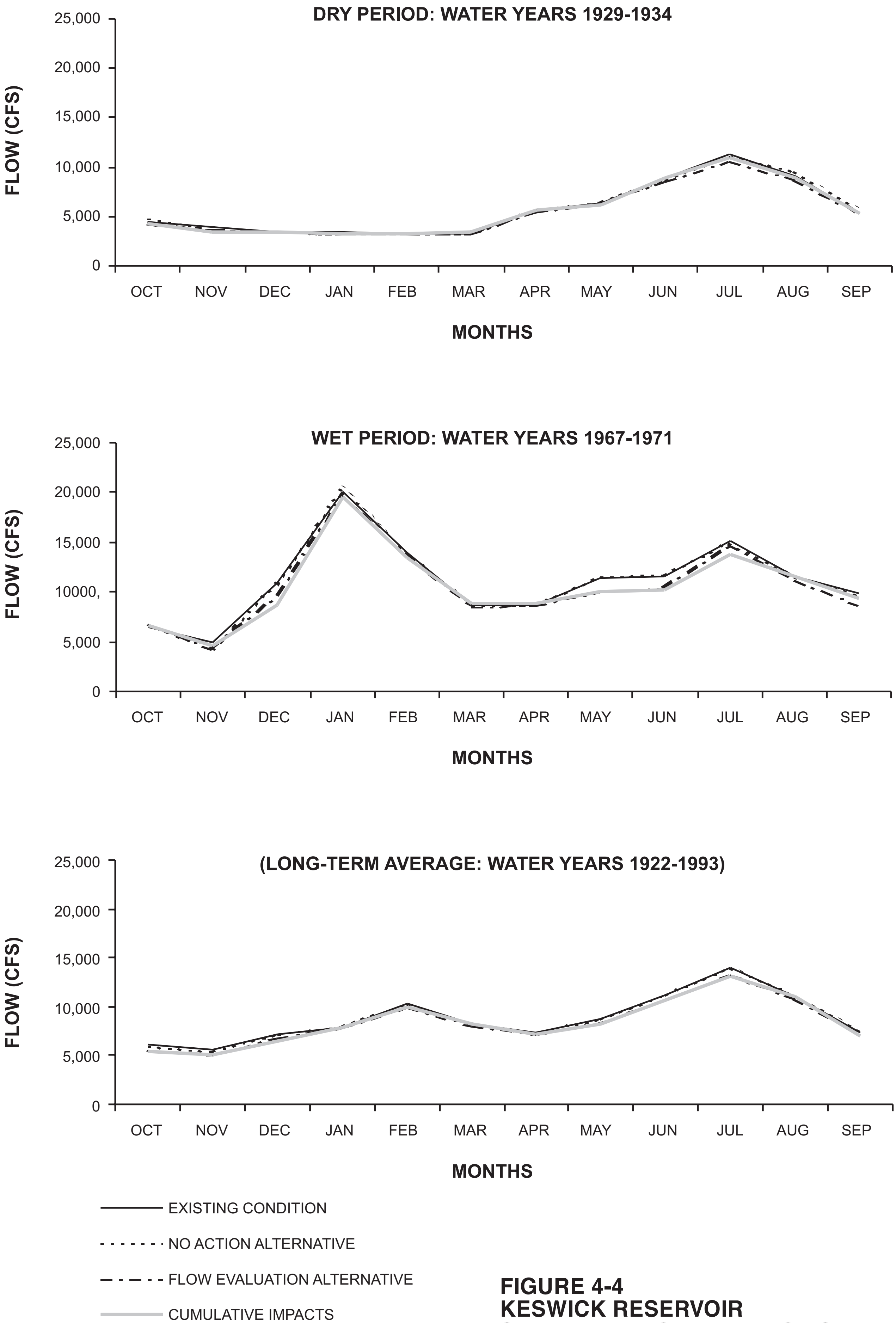


FIGURE 4-4
KESWICK RESERVOIR
SIMULATED MONTHLY FLOWS
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

W022004007RDD_994 (4/5/04)

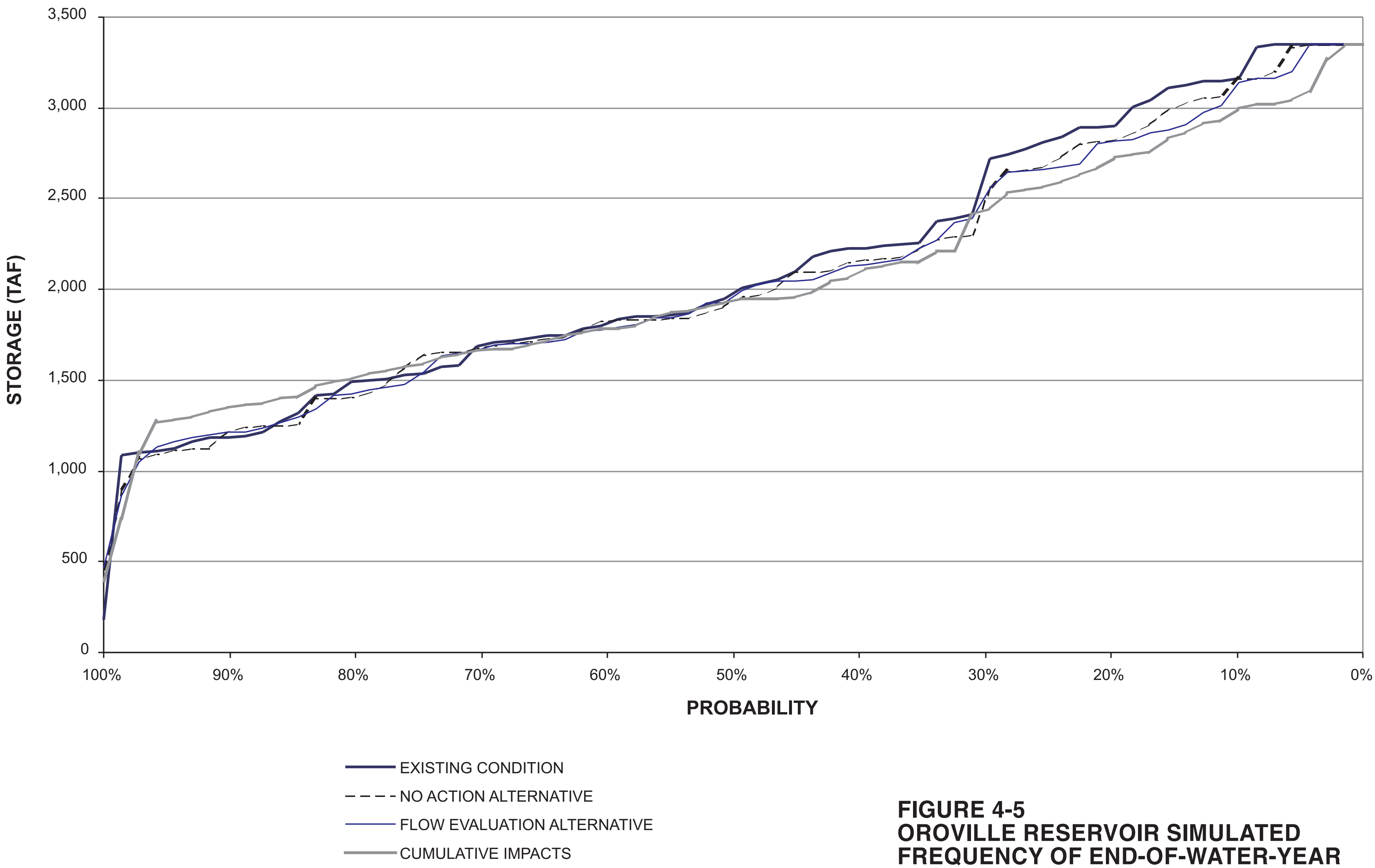


FIGURE 4-5
OROVILLE RESERVOIR SIMULATED FREQUENCY OF END-OF-WATER-YEAR STORAGE, WATER YEARS 1922-1990
TRINITY RIVER FISHERY RESTORATION SUPPLEMENTAL EIS/EIR

W022004007RDD_995 (4/5/04)

CVP Water Deliveries North of the Delta. Deliveries to agricultural and M&I water service contractors north of the Delta are a function of CVP available water supply. As shown in Table 4-1 under the parameter "CVP deliveries North of Delta," deliveries increase from Existing Conditions to the future conditions described in the other alternatives, on average increasing from approximately 2.4 maf to 2.7 maf to 2.8 maf under No Action, Preferred Alternative and the Cumulative condition. Changes in demand due to the Freeport Regional Water Project, increases for the CCWD and Sacramento County are included in this parameter.

CVP Water Deliveries South of the Delta. Deliveries to agricultural and M&I water service contractors south of the Delta are a function of available CVP water supply and the amount of water exported through the Delta. As shown in Table 4-1, under the parameter "CVP Deliveries South of Delta," dry period deliveries are reduced under the Preferred Alternative and Cumulative condition, compared to Existing Conditions and No Action. However, the Cumulative condition, due to the Napa provisions, increases deliveries in the wet period over all scenarios described in Table 4-1. On average, deliveries under the Cumulative condition are similar to existing conditions, although fluctuations between dry year and wet year deliveries may be greater.

The change in CVP deliveries south of the Delta is also reflected in the changes in modeled exports through the Banks Pumping Plant where annual diversions are expected to be greater than Existing Conditions in the dry period, wet period, and on average. In part, this increase also attributes to a decrease in Delta outflow. Secondary effects of reduced Delta outflow are described below under Fishery Resources.

Issue-specific Cumulative Impact Analysis. The previous EIS/EIR identified potentially significant cumulative impacts that are anticipated as a result of implementing the Preferred Alternative in relation to past, present, and reasonably foreseeable projects. The discussion identified those areas in which the impacts of the Preferred Alternative, when viewed against the backdrop of these other projects, would cause an incremental impact that is "cumulatively considerable" within the meaning of CEQA. Impacts discussed within issue areas, which were not included in the previous EIS/EIR, were omitted because the incremental impact of the Preferred Alternative was considered to be "de minimus" (CEQA Guidelines §§15130). A "de minimus contribution means that the environmental conditions would essentially be the same whether or not the proposed project is implemented" (CEQA Guidelines §§15130). This Supplemental EIS/EIR focuses on the impacts to Fishery Resources for the following two reasons:

1. The Cumulative condition uses the same set of assumptions as described in the ESA consultation for CVP-OCAP, which includes in-depth discussion of impacts to Fishery Resources.
2. The operational changes described in the Cumulative condition include effects to Fishery Resources that are "cumulatively considerable."

Fishery Resources. Implementation of the Preferred Alternative is expected to result in a cumulatively beneficial impact in terms of increased anadromous fish production within the Trinity River Basin. As described in Chapter 3.0, this increase in fish production would result in beneficial recreational impacts, and increased modeled adverse impacts to anadromous fish within the Sacramento River would be expected to occur with regard to increased losses of early life-stages (eggs and sac-fry) of some runs of Sacramento River Chinook salmon compared to the No Action Alternative and existing conditions. These impacts are attributable to a slight anticipated mortality of Chinook salmon eggs and sac-fry from increases of Sacramento River water temperature.

Trinity River Fisheries. Compared to the No Action Alternative, the implementation of the Preferred Alternative, in relation to the cumulative condition, would result in substantially restoring the diverse fish habitats necessary for the restoration and maintenance of anadromous fishery resources in the Trinity River Basin. The watershed protection component of the Preferred Alternative would accelerate and enhance habitat improvement and salmonid production through mechanical restoration. These improvements would be beneficial effects and substantially assist in the restoration of anadromous salmonid populations in the Trinity River. Increased populations would result in a greater number of fish being available for harvest.

The assumed increase in fish available for ocean commercial harvest would be a beneficial effect for the Northern/Central Oregon, KMZ-Oregon, KMZ-California, and Mendocino Regions.

Similar to the comparison to the No Action Alternative, the cumulative effects scenario would result in substantially restoring the diverse fish habitats necessary for the restoration and maintenance of anadromous fishery resources in the Trinity River Basin as compared to existing conditions. (As discussed in Section 3.4 Fishery Resources, while some habitat degradation is assumed to occur under the No Action condition, the majority of such degradation is assumed to have already occurred and, therefore, fishery habitats for existing conditions and the No Action Alternative are similar.) The watershed protection component of the Preferred Alternative would accelerate and enhance habitat improvements and salmonid production through mechanical restoration. Compared to existing conditions, these improvements would be beneficial effects and would substantially assist in the restoration of anadromous salmonid populations in the Trinity River. The increased availability of fish for ocean commercial harvest for the Northern/Central Oregon, KMZ-Oregon, KMZ-California, and Mendocino Regions would be a beneficial effect.

Sacramento River Fisheries. This impact assessment focuses on the following two aspects of implementation of the Preferred Alternative:

1. Temperature impacts affecting winter-run and spring-run Chinook salmon mortality in the Sacramento River
2. Changes in X2 position that affect the relative amount of habitat available for Delta smelt

Winter-run and spring-run Chinook salmon are the subject of review in the ESA consultation for CVP-OCAP, as are Delta smelt. These impacts are considered separately.

Elevated instream water temperature can cause mortality in winter-run and spring-run Chinook salmon. As described in Chapter 3.0, the selection of downstream temperature targets can change the number of days that suitable temperatures may be provided for salmon. Essentially, the further downstream the temperature target is set, the fewer number of days it is possible to meet that target. However, targets that are further downstream are desirable because they provide more total habitat than upstream targets. Balancing the interplay between total habitat and time that the habitat is available has become a major operational effort since the publication of the 1993 Winter-run Chinook BO.

As stated in Chapter 3.0, the year-to-year downstream temperature target tends to be Bend Bridge, depending on water year type and carryover storage. In years when temperature compliance is forecast to be unachievable at the downstream targets, it is moved upstream until a target is set that is believed to be achievable through the management period. However, as stated in the CVP-OCAP BA, the proposed target is Balls Ferry, a location approximately 10 miles upstream of Bend Bridge, with downstream targets to be considered as additional water is determined to be available. The effects of these operations on winter-run and spring-run Chinook mortality, classified by water year type (Sacramento Index), is displayed in Tables 4-4 and 4-5.

TABLE 4-4
Comparative Levels of Mortality for Winter-run Chinook Salmon in the Sacramento River with the Bend Bridge and Balls Ferry Temperature Targets (Separated by Sacramento River Index)

		Existing Conditions		No Action		Preferred Alternative		Cumulative	
		Bend Bridge	Balls Ferry	Bend Bridge	Balls Ferry	Bend Bridge	Balls Ferry	Bend Bridge	Balls Ferry
Wet	Average	0.2	0.9	0.2	0.9	0.3	1.1	0.3	1.2
	Median	0.2	0.8	0.2	0.8	0.3	1.0	0.3	1.1
	Maximum	0.6	2.3	0.6	2.3	0.6	2.3	0.6	2.4
	Minimum	0.1	0.2	0.1	0.2	0.1	0.3	0.1	0.3
Above Normal	Average	0.3	1.7	0.3	1.7	0.3	1.9	0.3	2.1
	Median	0.2	1.7	0.2	1.7	0.2	2.0	0.2	1.9
	Maximum	1.1	3.0	1.1	3.1	1.1	3.5	1.1	4.0
	Minimum	0.1	0.4	0.1	0.4	0.1	0.4	0.1	0.4
Below Normal	Average	0.6	2.2	0.7	2.3	1.2	2.5	1.8	3.2
	Median	0.2	46.9	0.2	1.9	0.3	2.3	0.3	2.2
	Maximum	2.2	51.9	3.2	6.4	9.0	6.5	16.4	10.3
	Minimum	0.1	45.2	0.1	0.6	0.1	0.6	0.1	0.6
Dry	Average	2.9	4.3	3.5	4.7	2.8	3.9	5.2	4.6
	Median	0.2	1.8	0.2	1.9	0.4	2.1	0.4	2.1
	Maximum	37.3	26.6	46.2	31.1	35.7	28.0	69.7	39.5
	Minimum	0.1	0.6	0.1	0.8	0.1	0.7	0.1	0.8
Critical	Average	45.6	36.1	45.9	36.0	50.1	38.1	55.0	46.1
	Median	23.4	10.3	58.9	24.6	59.8	25.5	85.6	58.4
	Maximum	99.4	85.8	100.0	93.6	100.0	96.1	100.0	100.0
	Minimum	0.4	0.6	0.4	0.6	0.2	1.0	0.3	0.8

TABLE 4-5
Comparative Levels of Mortality for Spring-run Chinook Salmon in the Sacramento River with the Bend Bridge and Balls Ferry Temperature Targets (Separated by Sacramento River Index)

		Existing Conditions		No Action		Preferred Alternative		Cumulative	
		Bend Bridge	Balls Ferry	Bend Bridge	Balls Ferry	Bend Bridge	Balls Ferry	Bend Bridge	Balls Ferry
Wet	Average	5.3	5.9	5.7	5.9	8.2	6.9	8.3	6.7
	Median	4.8	5.6	5.1	5.8	6.3	7.2	6.4	6.9
	Maximum	12.7	8.9	14.8	8.2	35.0	10.4	27.8	10.3
	Minimum	1.9	2.9	2.0	3.1	2.9	3.1	2.5	3.1
Above Normal	Average	4.7	6.1	4.8	6.1	8.4	6.4	8.0	6.3
	Median	4.5	5.7	4.5	5.8	6.7	6.0	5.3	6.2
	Maximum	8.8	8.4	9.1	8.6	18.4	9.5	16.0	9.3
	Minimum	1.8	4.1	1.6	4.0	1.9	4.4	2.0	4.0
Below Normal	Average	19.2	10.9	19.6	12.6	29.3	17.2	32.6	20.8
	Median	6.1	44.8	6.4	6.4	12.0	7.5	15.5	7.4
	Maximum	85.8	47.9	92.7	58.3	98.4	82.1	98.7	98.3
	Minimum	1.1	39.8	1.1	2.7	2.2	2.8	2.3	2.8
Dry	Average	22.4	12.5	24.1	12.7	40.9	17.4	48.7	21.9
	Median	15.5	6.5	14.8	5.9	31.9	7.8	40.4	7.8
	Maximum	99.8	99.8	99.9	99.8	99.9	99.9	99.9	99.9
	Minimum	0.4	2.6	0.4	2.5	0.4	2.5	0.4	2.7
Critical	Average	86.1	73.7	81.2	64.5	87.8	78.3	89.6	83.0
	Median	99.3	96.5	96.5	96.3	99.0	96.5	98.9	98.7
	Maximum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Minimum	20.5	7.6	19.4	6.2	22.2	11.1	26.2	12.8

As shown in Tables 4-4 and 4-5, mortality for both winter-run and spring-run Chinook salmon is highly variable, and can be influenced by management of the temperature target in the Sacramento River. The greatest influence of temperature target management is in Critically Dry years for both winter-run and spring-run Chinook salmon, although severe mortality (up to 100 percent in a given year) remains a possibility. Management of the temperature compliance point also outlines tradeoffs inherent in system operation. Use of the upstream temperature target (Balls Ferry) tend to benefit spring-run Chinook salmon in all water year types, but can slightly increase mortality of winter-run Chinook salmon in wetter years. This is likely a result of the relative distribution of spawners in the river. Existing Conditions tend to result in the lowest mortality for winter-run Chinook salmon for all year types, regardless of temperature compliance point.

Incremental increases in winter-run mortality occur in the Preferred Alternative compared to Existing Conditions and No Action, with a potentially significant impact occurring in Critically Dry water years. However, as noted in Chapter 3.0, this significant impact can be reduced to less than significant through the management of upstream targets in the Critically Dry water years. Compared to the Preferred Alternative, the cumulative condition results in incremental increases in winter-run Chinook salmon mortality, notably in the Dry and Critically Dry water years. However, this impact is reduced through the use of upstream temperature targets in Dry and Critically Dry water years. Regardless, the incremental effect of the cumulative condition is considered cumulatively considerable. Effects on spring-run Chinook salmon show similar trends as those for winter-run, with the exception that the upstream temperature target reduces mortality in all cases. The final analysis of cumulative effects on both winter-run and spring run Chinook salmon will be published in the CVP-OCAP BO.

A common surrogate parameter for Delta smelt habitat is relative salinity in the Delta, often measured as X2. The X2 criteria refer to the measurement of upstream movement of water with 2 ppt concentration of salt. The X2 is measured as km from the Golden Gate Bridge. Higher X2 values indicate salt water intrusion into the Delta. For Delta smelt, X2 is important because it represents suitable nursery habitat. Nursery habitat is required during the February through June timeframe. However, other factors that relate to habitat include depth of water and vegetation. Honker Bay, located just west of Chipps Island (73 km from the Golden Gate Bridge) is considered high-quality nursery habitat for Delta smelt. Generally, there is little benefit in terms of Delta smelt habitat from having extremely low X2 values because areas to the west, like San Pablo Bay, do not provide quality habitat. Table 4-6 presents average X2 position, by month for the various conditions considered here. As shown in Table 4-6, relative values of X2 are very similar, although there is a slight trend towards upstream values (approximately 0.1 to 0.2 km) moving from Existing Conditions to the Cumulative condition.

TABLE 4-6
Comparative X2 Positions, Averaged by Month

Month	Existing Conditions	No Action	Preferred Alternative	Cumulative
October	85.5	86.0	86.3	86.5
November	84.3	84.6	84.9	85.5
December	82.0	82.0	82.4	82.2
January	76.7	76.8	76.9	77.6
February	71.2	71.3	71.4	71.6
March	66.1	66.2	66.2	66.4
April	65.6	65.7	65.8	65.9
May	67.6	67.7	67.7	67.8
June	70.4	70.5	70.6	70.3
July	75.0	75.1	75.1	75.2
August	79.2	79.3	79.3	79.2
September	84.4	84.4	84.4	83.7

Table 4-7 presents the relative exceedances between scenarios. For this discussion, exceedances are defined as changes in X2 position, in any month between February and June greater than 0.5 km. For example, if the CALSIM modeling for the No Action Alternative results in a value of 75.6 for February of 1930, and 75.0 for February 1930, in the Existing Conditions, it would be reported in Table 4-7 as an upstream exceedance month.

TABLE 4-7
Relative X2 Exceedances of more than 0.5 km February through June over the Modeled Period

Alternative	Existing Conditions versus No Action	No Action versus Preferred Alternative	Existing Condition versus Preferred Alternative	Cumulative versus Preferred Alternative
Total Months with Upstream[a] Change of 0.5 km	28	35	26	94
Total Months with Downstream[b] Change of 0.5 km	41	29	13	44

[a]An upstream change is considered a negative impact on Delta Smelt habitat
[b]A downstream change is considered a positive impact on Delta Smelt habitat

As shown in Table 4-7, X2 changes in the various scenarios occur in both the upstream and downstream direction. Compared to Existing

Conditions, exceedances tend towards the downstream direction, resulting in benefits to total nursery habitat for Delta smelt. The Preferred Alternative results in both upstream and downstream exceedances of the 0.5 km threshold; however, as noted in Chapter 3.0, the incremental change in rearing habitat is not significant, especially after consideration of the relative value of habitat (i.e, Honker Bay-type habitat versus San Pablo Bay-type habitat). Compared to the Preferred Alternative, the Cumulative condition results in more occurrences of upstream exceedances. This effect is considered cumulatively considerable, and is the subject of ESA consultation through the CVP-OCAP process.

SECTION 5.0
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Technical Appendices

Continue...