Water Right Decision 1644

In the Matter of:

Fishery Resources and Water Right Issues of the Lower Yuba River

Involving Water Right Permits 15026,
15027, and 15030 Issued on
Applications 5632, 15204, and 15574
of Yuba County Water Agency,

Licenses 3984 and 3985 Issued on
Applications 9927 and 12371 of
Cordua Irrigation District

License 4443 Issued on
Application 9899 of Hallwood
Irrigation District, and

Other Water Diversions by Various
Parties Under Claim of Riparian Rights,
Pre-1914 Appropriative Rights,
and Contractual Rights.

Adopted March 1, 2001

STATE WATER RESOURCES CONTROL BOARD

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

DECISION 1644

In the Matter of
FISHERY RESOURCES AND WATER RIGHT ISSUES OF THE LOWER YUBA RIVER
Involving Water Right Permits 15026, 15027, and 15030 Issued on Applications 5632, 15204, and 15574 of Yuba County Water Agency,

Licenses 3984 and 3985 Issued on Applications 9927 and 12371 of Cordua Irrigation District

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Other Water Diversions by Various Parties Under Claim of Riparian Rights, Pre-1914 Appropriative Rights, and Contractual Rights.

SOURCE: Yuba River Tributary to Feather River

COUNTY: Yuba

DECISION REGARDING PROTECTION OF FISHERY RESOURCES AND OTHER ISSUES RELATING TO DIVERSION AND USE OF WATER FROM THE LOWER YUBA RIVER

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CITING THE RECORD[1]

Citations to the hearing record are indicated as follows:

Citation to Reporter's Transcript:
Citations to the Reporters Transcript are indicated by "R.T." followed by a Roman numeral for the volume of the transcript where applicable, followed by the beginning page and line number and the ending page and line number.

Example: (R.T.V, 10:5-11:2.)

Citations for the transcript for the hearing in the year 2000 are preceded by an S.

Example: (S-R.T. 10:5-11:2.)

Citation to Exhibits:

Citations to exhibits in the evidentiary hearing record are designated by the name or abbreviation for the party submitting the exhibit, followed by the exhibit number, followed by the page number or other location of the cited information in the exhibit.

Example: Yuba County Water Agency Exh. 4, page 3 would be cited as (YCWA 4, p. 3.)

Citations for exhibits introduced at the hearing in the year 2000 are preceded by an S.

Example: (S-YCWA 4, p. 3.)

[1] Citations the hearing record are provided solely for ease of reference. There is often other supporting evidence in the record that is not specifically cited in the decision.

Abbreviations used for the parties or sources of information:

Brophy	Brophy Water District
Browns Valley	Browns Valley Water District
Cook	Mr. Walter Cook
Cordua	Cordua Irrigation District
CSPA	California Sportfishing Protection Alliance
DWR	California Department of Water Resources
DFG	California Department of Fish and Game
Hallwood	Hallwood Irrigation Co.
NMFS	National Marine Fisheries Service
PG&E	Pacific Gas & Electric Co.
Ramirez	Ramirez Water District
Sierra	Sierra Club, Motherlode Chapter
South Yuba	South Yuba Water District
SYRCL	South Yuba River Citizens League
SWRCB	State Water Resources Control Board
USFWS	U. S. Fish and Wildlife Service[1]
YCWA	Yuba County Water Agency
YG	YG Development Co., Western Aggregates, Inc., and Western Water Co.

[1] In the resumed hearing in 2000, the exhibits presented by witnesses for the U. S. Fish and Wildlife Service were submitted as exhibits of the Department of the Interior, abbreviated as DOI.

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SOURCE: Yuba River Tributary to Feather River

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DECISION REGARDING PROTECTION OF FISHERY RESOURCES AND OTHER ISSUES RELATING TO DIVERSION AND USE OF WATER FROM THE LOWER YUBA RIVER

BY THE BOARD:

1.0 INTRODUCTION

This decision is the result of an extensive review and lengthy evidentiary hearing process that began following the State Water Resources Control Board's (SWRCB) receipt of a complaint on February 23, 1988, regarding fishery protection and water right issues on the lower Yuba River. The complaint was filed by a coalition of fishery groups referred to as the United Groups. The complainants' main contention is that the instream flow requirements specified in Yuba County

Water Agency's (YCWA) water right permits and the existing fish screening facilities do not provide an adequate level of protection for fishery resources in the lower Yuba River. The complainants also raised questions about the adequacy of several parties' water rights. The Division of Water Rights investigated the issues raised in the complaint, but did not finalize its report until August 1991, after receiving the Lower Yuba River Fisheries Management Plan (DFG Plan) prepared by the California Department of Fish and Game (DFG).

The DFG Lower Yuba River Fisheries Management Plan was prepared pursuant to the Streamflow Protection Standards Act (Public Resources Code section 10001 et seq.). By letter dated May 8, 1991, DFG requested that the SWRCB revise existing streamflow and temperature requirements on the lower Yuba River in accordance with the recommendations set forth in the DFG Plan. Following receipt of the DFG Plan, the SWRCB scheduled a water right hearing to begin on November 13, 1991. YCWA filed suit in federal court to enjoin the SWRCB from considering revisions to the water temperature and instream flow requirements specified in its water right permits. The court denied the request for a preliminary injunction, but the suit resulted in postponing the water right hearing until February 10, 1992.

In 1992, the SWRCB held 14 days of hearing to receive testimony and other evidence regarding fishery issues in the lower Yuba River and other issues raised in the United Groups complaint. Following the close of the hearing, parties were allowed to submit legal briefs or closing statements. A draft decision was prepared for the SWRCB's consideration, but was not acted upon by the SWRCB. Copies of the draft decision dated April 28, 1996, were distributed to hearing participants and other interested parties on February 10, 1999.

The SWRCB scheduled a subsequent hearing for September 1999, to receive relevant new evidence not previously available. At the request of DFG and YCWA, the subsequent hearing was postponed in order to provide the parties an opportunity to reach a proposed settlement regarding interim flows and further studies to be undertaken. Following notification by DFG and YCWA that they could not reach agreement on a settlement proposal, the SWRCB conducted 13 additional

days of hearing from February 22 to May 17, 2000. Parties were allowed until July 10, 2000, to submit legal briefs and written closing statements. A revised draft decision dated November 7, 2000, was distributed to the parties to the hearing and other interested persons. The SWRCB heard comments on the November 7 draft at public meetings on December 4, 2000, and January 11, 2001. This decision includes substantial revisions based on the SWRCB's consideration of issues raised in oral and written comments on the draft decision dated November 7, 2000.

The subjects addressed in this decision are complex and the evidentiary record is extensive.[2] Based on the evidentiary record and applicable law, this decision establishes revised instream flow requirements in the lower Yuba River and requires specified actions to provide suitable water temperatures for anadromous fish and reduce fish losses at water diversion facilities. However, due to evidence that it is not always feasible to provide water of suitable temperatures for protection of chinook salmon and steelhead, this decision does not establish mandatory water temperature requirements beyond the requirements previously agreed to in a 1965 agreement between YCWA and DFG. The order also requires a number of actions to help ensure that water diversions from the lower Yuba River are made pursuant to valid water rights.

The historic flows in the lower Yuba River have generally substantially exceeded the minimum flow requirements specified in the 1965 agreement between YCWA and DFG and have helped maintain current fish populations in the river.[3] In most months, the revised flow standards established in this decision will not require an increase over the average flows that have been present historically, but will require higher flows than the minimum levels specified in the 1965 agreement.[4] In view of the increasing demands for water from the lower Yuba River, the

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[2] The record for this proceeding includes the record from both the 1992 hearing and the 2000 hearing.

[3] Section 6.3 of this decision discusses fishery population trends following construction of New Bullards Bar Dam in 1969.

[4] As discussed in Section 6.4 of this decision, the instream flow requirements currently specified in YCWA's water right permits for irrigation and other uses were based upon a 1962 agreement between YCWA and DFG. That agreement was superseded by a later agreement in 1965, but the water right permits were not amended to reflect the later agreement.

importance of theYuba River fishery, and continuing disputes over the quantity and timing of flows needed for protection of fish, it is imperative that the minimum instream flow requirements in YCWA's permits be revised to assure protection of fishery resources in the years ahead.

As explained in our findings below, the SWRCB concludes that the water resources of the lower Yuba River area are sufficient to protect public trust resources while continuing to meet reasonable water demands for agriculture and other uses. The SWRCB retains continuing authority to revise the requirements established in this decision in the event changed conditions warrant further action in the future.[5]

2.0 PARTICIPANTS IN EVIDENTIARY HEARING

Seventeen parties participated in the evidentiary portion of the water right hearing and presented evidence on a broad range of issues including: (1) operation of the Yuba River Development Project, (2) present and projected water demands, (3) water temperature and flow requirements for protection of fish, (4) the presence and effectiveness of fish screens at water diversions facilities, and (5) the basis and extent of water rights held by various parties.

In 1992, DFG appeared in support of the recommendations in its Lower Yuba River Fisheries Management Plan and other recommendations based upon subsequent work. DFG presented testimony from DFG staff and private consultants who had conducted the studies on which many of the DFG recommendations are based. Although several parties took issue with various recommendations in the Fisheries Management Plan, no other party presented comprehensive recommendations for protection of the Yuba River fishery at the 1992 hearing. At the subsequent hearing in 2000, DFG presented testimony that the flow requirements in the 1996 SWRCB Draft Decision are the minimum that should be adopted immediately, with additional provisions governing flow fluctuations. DFG also presented revised water temperature recommendations based on the need to protect all lifestages of fall and spring-run chinook salmon and steelhead, and

[5] The possibility of establishing water temperature requirements in the future is addressed in Section 6.6.5 below.

based on a heightened concern about spring-run chinook salmon following its listing as a threatened species under the California Endangered Species Act.

The U.S. Fish and Wildlife Service (USFWS) presented testimony in 1992 supporting adoption of the DFG recommendations. USFWS witnesses expressed concern that DFG flows may be insufficient at some times of the year, but they did not present alternative flow recommendations. In 2000, the USFWS presented testimony that the minimum flow requirements in the 1996 Draft Decision represent an appreciable improvement over the present minimum flow requirements, but urged the SWRCB to implement the minimum flow requirements in their Anadromous Fish Restoration Program Working Paper, which are consistent with the flows in the DFG Fisheries Management Plan.

The National Marine Fisheries Service (NMFS) presented testimony at the hearing in 2000 that Central Valley steelhead and Central Valley spring-run chinook salmon are currently designated as threatened species under the federal Endangered Species Act. NMFS recommended that the minimum flow provisions of the 1996 Draft Decision be adopted immediately and recommended additional provisions regarding spawning flows for spring-run chinook salmon, lower maximum water temperature requirements, restrictions on flow fluctuations, and Chinook salmon outmigration studies.

The California Sportfishing Protection Alliance (CSPA), one of the organizations composing the United Groups which filed the complaint against YCWA in 1988, presented testimony generally in support of the DFG recommendations, but preferred more stringent requirements and argued that the SWRCB should consider public trust needs in the Sacramento-San Joaquin Delta when considering modifications to YCWA's permits.

YCWA presented evidence on numerous issues including operation of the Yuba River Development Project, present and anticipated water requirements within the YCWA service area, estimated economic effects of adopting the DFG recommendations, and various aspects of lower

Yuba River fishery requirements. YCWA questioned specific aspects of DFG's recommendations, but did not present alternative flow or temperature recommendations at the time of the 1992 hearing. Following review of the SWRCB's 1996 Draft Decision and additional work by environmental and engineering consultants, YCWA presented testimony in 2000 recommending adoption of alternative flow requirements.

Additional evidence regarding fish and wildlife issues, water rights, and water use within Yuba County was presented by Browns Valley Water District (Browns Valley), Cordua Irrigation District (Cordua), South Yuba Water District (South Yuba), Brophy Water District (Brophy), Ramirez Water District (Ramirez), YG Development, Western Aggregates, Inc., and Western Water Company. The water districts and other entities receiving water from YCWA share a general concern that their water supplies not be adversely affected by measures taken to protect lower Yuba River fisheries.

Pacific Gas and Electric Company (PG&E) presented evidence at the 1992 hearing regarding fishery issues and hydroelectric power production on the lower Yuba River.[6] The Department of Water Resources (DWR) presented evidence in 1992 on potential long-term transfers of water from YCWA to DWR.[7] Walter Cook, the South Yuba River Citizens League (SYRCL), and the Mother Lode Chapter of the Sierra Club presented evidence in support of adopting additional requirements for protection of fishery and other public trust values of the lower Yuba River.

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[6] PG&E participated in the 1992 hearing, but not at the continuation of the hearing in 2000.

[7] DWR presented evidence in the 1992 hearing, but its participation as a party in the 2000 hearing was limited to addressing preliminary issues regarding the scope of the proceeding and a pending petition by YCWA to change the place of use and related conditions in its permits. The YCWA change petition is not the subject of this order.

3.0 BACKGROUND

3.1 Yuba River Watershed

The Yuba River is the fourth largest river in the Sacramento River Basin. The river provides water for agriculture, domestic use, hydroelectric power generation, and recreation, in addition to supporting numerous species of fish including salmon, steelhead and American shad. The focus of the hearing was the lower Yuba River, i.e., the 24-mile section of the river between Englebright Dam and the confluence with the Feather River south of Marysville. Figure 1 shows major features within the Yuba River watershed.

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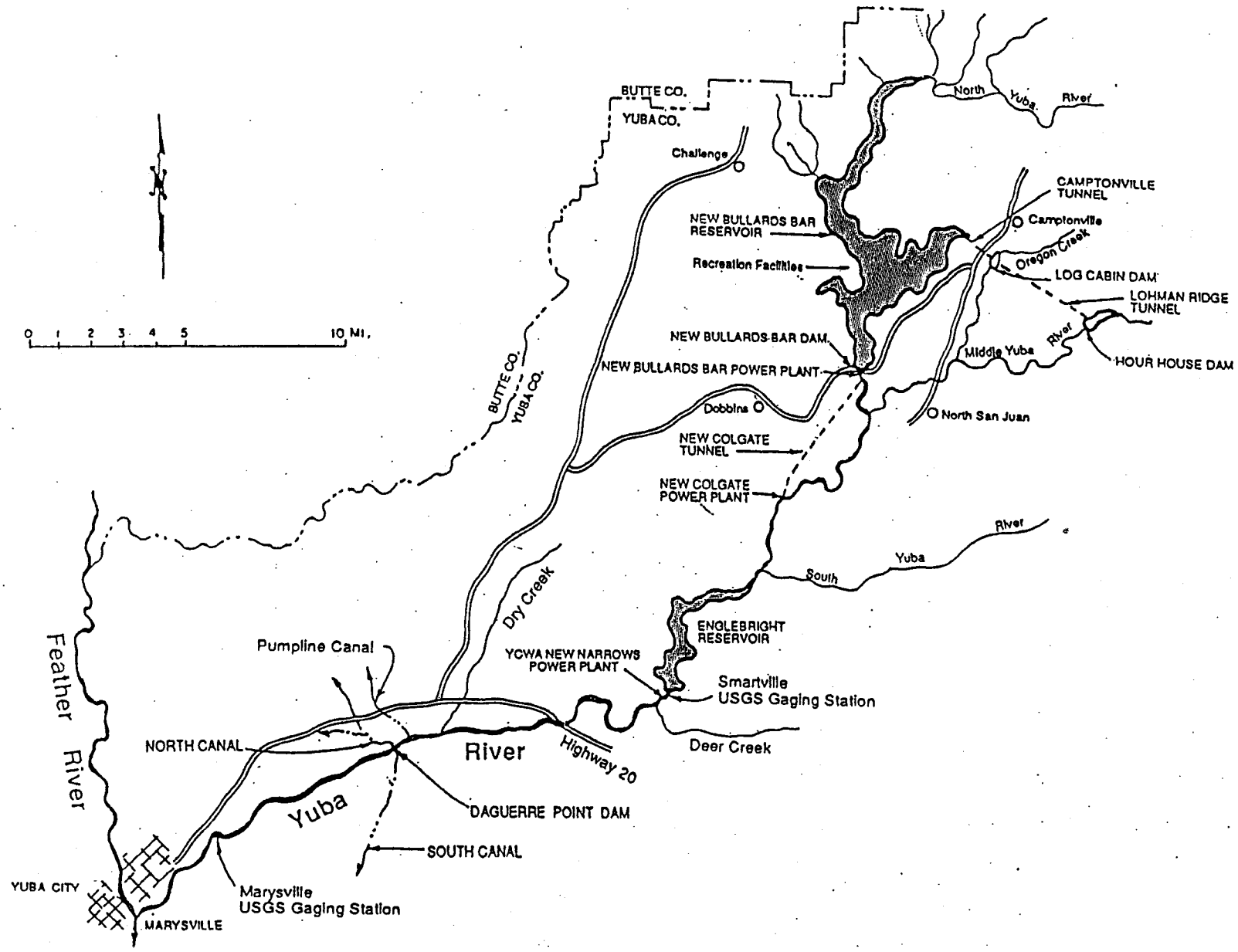

FIGURE 1
Yuba River Development Project

3.1.1 Surface Water Supplies

The Yuba River watershed drains an area of approximately 1,350 square miles that has an average unimpaired runoff of approximately 2.4 million acre-feet. Annual unimpaired runoff has varied from a low of 369,300 acre-feet to a high of 4,926,000 acre-feet. (YCWA 2, p. 2.) The estimated unimpaired flow at Smartville for 63 years of record is shown in DFG Exhibit 26, included as Table IV-3 of the 1994 staff analysis.[8] (DFG 26, p. 19.) The United States Geological Survey (USGS) maintains gages located near Smartville and near Marysville. Table 1 below shows the median of historic recorded flows at each of those gaging stations for the years specified.

TABLE 1

MEDIAN FLOW OF HISTORICALLY RECORDED FLOWS IN LOWER YUBA RIVER (CFS)

YEAR 1941-1997	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Median Flow at USGS #1141800 (Smartville)	1490	2450	2810	3350	3030	1570	864	710	608	634	670	996
YEAR 1943-1997	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Median Flow at USGS #1142100 (Marysville)	1670	3000	3320	3290	2570	1180	458	372	403	443	596	918

Flows in the lower Yuba River are significantly affected by the operation of New Bullards Bar Reservoir which has a storage capacity of 966,000 acre-feet and Englebright Reservoir which has a capacity of 67,000 acre-feet. Historic storage levels in New Bullards Bar and Englebright Reservoirs are shown in Figure IV-2 of the 1994 staff analysis.

[8] State Water Resources Control Board, Division of Water Rights "Staff Analysis of the Hearing Record: Fishery Resources and Water Right Issues on the Lower Yuba River," July 1994, (hereafter referred to as "1994 staff analysis.")

Deer Creek flows into the Yuba River about 1.2 miles below Englebright Dam. On average, Deer Creek contributes about 170,000 acre-feet per annum to the lower Yuba River. ((S-YCWA 13, p. 2.) Lake Wildwood is located on Deer Creek about four miles upstream from the Yuba River. YCWA presented testimony that the inflow of warm water released when Lake Wildwood is drawn down for maintenance occurs at a time when it is difficult to achieve DFG's recommended water temperatures in the lower Yuba River. (YCWA 2, p. 24.) No data were submitted to establish the extent of this problem.[9]

Dry Creek flows into the Yuba River about 10 miles downstream of Englebright Dam. The flow in Dry Creek is regulated to a large extent by Brown's Valley Irrigation District's operation of Merle Collins Reservoir (57,000 acre-feet capacity) located on Dry Creek about eight miles upstream of the confluence with the Yuba River.

3.1.2 Groundwater Supplies

The Yuba Groundwater Basin is hydraulically divided by the lower Yuba River into the Yuba-North Basin and the Yuba-South Basin. The Yuba-North Basin provides about forty percent and the Yuba-South Basin provides about sixty percent of the total groundwater storage capacity of the Yuba Groundwater Basin. Because of sufficient surface water supplies, significant groundwater pumping capacity has not been developed to meet irrigation demands in the Yuba-North Basin. Conversely, because surface water supplies were limited in the Yuba-South Basin until the development of the South Yuba Canal in the mid-1980s, significant groundwater pumping capacity has been developed in this area.[10] (S-YCWA 17, p. 1.) Only limited groundwater is available in the foothills and mountainous area of eastern Yuba County.

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[9] The order at the conclusion of this decision directs SWRCB staff to meet with representatives of the Lake Wildwood Association, DFG, and YCWA to determine ways of operating Lake Wildwood to avoid adversely impacting water temperature in the lower Yuba River.

[10] The Yuba-South Basin is bounded by the Yuba River on the north, the Feather River on the west, the Bear River on the south, and the groundwater basin boundary on the east.

In 1992, YCWA presented evidence that groundwater accounts for about 31 percent or 130,000 acre-feet of irrigation water use in the county. (YCWA 45, p. 2-2.) YCWA also submitted evidence showing that at least 385 wells located in the YCWA service area provide water for irrigation. In 1984, those wells provided about 200,000 acre-feet of water at a unit cost of between $17 and $36 per acre-foot. (YCWA 16, Table 3.) In recent years, YCWA has been providing surface water to areas previously served by groundwater, thereby decreasing demands on the groundwater basin. In 1991 and 1994, however, water users within YCWA increased their use of groundwater in order to allow YCWA to transfer surface water to the State Water Bank. Groundwater extractions were 82,018 acre-feet in 1991 and 26,033 acre-feet in 1994. (YCWA 2, p. 12; S-YCWA 15A, Table 10; S-YCWA 27.)

The communities of Marysville, Linda, Olivehurst, and Wheatland rely totally on groundwater for their municipal water supplies. (YCWA 2, p. 12.) No evidence was submitted that any municipality intends to discontinue its use of groundwater as the primary source of supply. YCWA presented testimony that additional development in the foothills would require more surface water because limited groundwater is available in those areas.

Data developed by DWR indicate that, from 1950 to 1980, excessive pumping of groundwater created localized decreases in the groundwater levels (cones of depression) beneath Ramirez Water District, Brophy Water District, and South Yuba Water District. (YCWA 2, fig. 8-E.) Before surface water deliveries from YCWA began in 1983, these districts relied entirely on groundwater. (YCWA 2, p. 12.)

Figure 9A of YCWA Exhibit 2 illustrates the effect of surface water deliveries on groundwater elevations. The figure shows the groundwater elevation in a representative well located in the southern cone of depression within the Brophy Water District. As indicated by the exhibit, the groundwater level fell 120 feet between 1948 and 1982. YCWA began delivery of surface water to Brophy Water District in 1983 and to South Yuba Water District in 1986. Since that time, the

water table has risen approximately 65 feet. The recovery of the groundwater level in recent years resulted from importation of surface water for irrigation and reduction in groundwater pumping. Figure 2 below graphically depicts the groundwater storage in the Yuba-South Basin area for water years 1960 to 1998. (S-YCWA 17, pp. 6-7; Figure 4.)

FIGURE 2
ESTIMATED GROUNDWATER STORAGE
IN THE YUBA-SOUTH BASIN AREA (1960-1998)
(Based on 200,000 acre-feet storage in 1960)

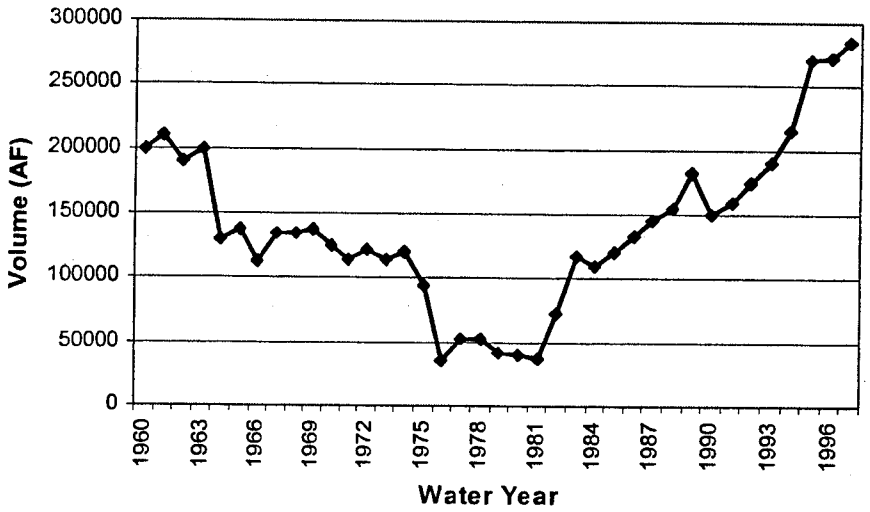

Figure 2 illustrates that, since Brophy Water District and South Yuba Water District began receiving surface water, there has been a net gain of groundwater storage in the Yuba-South Basin area. The decrease in groundwater storage in 1991 resulted from an increase in groundwater pumping undertaken to allow for transfer of surface water to the State Water Bank. (See Section 7.1.) The Yuba-South Basin's annual groundwater recharge rate was estimated to be 15,100 acre-feet per annum in years corresponding to a drying period in the long-term hydrologic cycle (1982-1990) and 21,200 acre-feet per annum in years corresponding to a wetter period in the long-term hydrologic cycle (1991-1998). (S-YCWA 17, pp. 9-11.)

YCWA presented a study of the opportunities for substituting groundwater for surface water in the Yuba-South Basin. The study estimates that the cost of pumping groundwater in the Yuba-South Basin is currently $14 to $18 per acre-foot including variable operation and maintenance costs, and that these costs rise $1.20 to $1.60 per acre-foot for each 10 feet increase in pumping lift. (S-YWCA 17, p. 11.) Based on information from the 1992 hearing, the YCWA consultants estimated that the annual fixed cost of maintaining pumping capacity is an additional $11.30 per acre-foot. The YCWA study concluded that during drought periods, agricultural water users in a portion of the YCWA service area could pump groundwater as a substitute for reduced surface water supplies. The YCWA study recognizes that "when operated conjunctively with surface water, groundwater storage can be used to increase YCWA's service reliability." (S-YCWA 17, pp. 2 and 11.)

Due to the higher cost of using groundwater, surface water has been the preferred source of supply for irrigation in the YCWA service area when available. The record establishes that significant quantities of groundwater are available for use in a conjunctive use program, particularly in the Yuba-South Basin area where the groundwater pumping capacity and rising groundwater levels are present.

3.2 Summary of Water Rights and Diversion Facilities

YCWA is the largest water right holder on the Yuba River. Various water districts, irrigation districts, water companies and individuals contract with YCWA for delivery of water. Some of the parties that receive water from YCWA also have their own appropriative or riparian rights for diversion of water.[11] For the reasons explained in Section 9.7 below, this decision does not address water right issues involving diversions on the upper reaches of the Yuba River.

YCWA diverts water for consumptive uses under Water Right Permits 15026, 15027, and 15030. The permits authorize diversion of water to storage at New Bullards Bar Reservoir and direct

[11] Table II-1 of the 1994 staff analysis provides a summary of water right claimants and their respective claims.

diversion of water for consumptive use at downstream locations. YCWA's permits authorize direct diversion at a total rate of 1,550 cubic feet per second (cfs) from the lower Yuba River from September 1 to June 30 for irrigation and other uses, and diversion to storage in New Bullards Bar Reservoir of 961,300 acre-feet from October 1 to June 30.

In addition to providing water for consumptive use, water is released for power generation at the Colgate Powerhouse and at the Narrows 1 and Narrows 2 Powerhouses. (See Figure 1.) Hydroelectric power is generated at those locations under authorization from the Federal Energy Regulatory Commission (FERC) and eight water right licenses issued by the State. The October 18, 1991 supplemental hearing notice clarified that the current proceeding addresses diversions under YCWA's consumptive use permits, but does not involve consideration of amendment of YCWA's water right licenses for hydroelectric power production.

Water diverted under YCWA's water right permits is delivered to Browns Valley, Cordua, Hallwood, Ramirez, Brophy, and South Yuba. Browns Valley receives water at the Pumpline Diversion Facility located nine-tenths of a mile upstream of Daguerre Point Dam. Cordua, Hallwood, and Ramirez receive water via the Hallwood-Cordua Canal (North Canal) from the north side of the Yuba River just upstream of the north abutment of Daguerre Point Dam. Brophy and South Yuba receive water via the South Yuba Canal (South Canal) from the south side of the Yuba River just upstream of the abutment of the Daguerre Point Dam. The location of these diversion facilities is shown in Figure 1.

In addition, YCWA began serving water to the Dry Creek Mutual Water Company in 1998. Several private parties pump water from the lower Yuba River downstream of Daguerre Point Dam in an area known as the Dantoni Area. The basis and extent of the water rights held by the various water districts and other parties who receive water from YCWA or divert water from the lower Yuba River are addressed below in Sections 10.0 through 10.9.

3.3 Operation of Yuba River Development Project

The Yuba River Development Project is a multiple-use project utilized for flood control, generation of hydroelectric power, irrigation, recreation, and protection of fish and wildlife. The key component of the project is New Bullards Bar Reservoir, completed in 1970, which has a storage capacity of 966,000 acre-feet. Englebright Dam and Daguerre Point Dam were not constructed by YCWA as part of the Yuba River Development Project, but are used by YCWA in delivering water for project purposes.

Englebright Reservoir is located on the Yuba River about six miles downstream of New Bullards Bar Reservoir and about 26 miles east of Marysville. The dam was completed by the California Debris Commission (a division of the U.S. Army Corps of Engineers) in 1941 as a debris barrier. Englebright Reservoir serves as the afterbay for YCWA's New Colgate Powerhouse and the forebay for power generation at the Narrows 1 and Narrows 2 Powerhouses. PG&E has direct diversion rights to 700 cfs and storage rights to divert 45,000 acre-feet per year from October 1 through March 1 for power generation at Narrows 1 Powerhouse. (Application 8794, License 6388.)

Daguerre Point Dam was constructed in 1906 by the California Debris Commission to prevent debris from reaching the navigable channels of the Feather and Sacramento Rivers. The dam is still owned and operated by the U.S. Army Corps of Engineers. The dam currently provides no significant storage capacity due to siltation, but the dam serves to raise the water elevation in the immediate upstream area and thereby enables diversion of water into the three major canals through which YCWA delivers water for offstream use. Water is diverted at Daguerre Point Dam to water districts located both north and south of the Yuba River. There are extensive dredger tailings in the vicinity of Daguerre Point Dam in an area commonly referred to as the Yuba Goldfields.

The operation of the Yuba River Development Project is subject to provisions of various permits, licenses and contracts including water right permits and licenses administered by the SWRCB,

Federal Power License 2246, the 1966 Power Purchase Contract with PG&E, a 1965 contract with the Department of Fish and Game concerning instream flows, and a 1966 contract with the Department of Water Resources under the Davis-Grunsky Act. (YCWA 2, pp. 3 and 4.) YCWA determines project operations based on a year-to-year analysis. (R.T. VII, 132:13-132:14.) Several of the uses served by the project are addressed below in Sections 3.3.1 through 3.3.7.

3.3.1 Hydroelectric Power

YCWA operates the Yuba River Development Project to generate hydroelectric power pursuant to the provisions of Federal Power License 2246 administered by the Federal Energy Regulatory Commission (FERC), its water right licenses for power production, and the 1966 Power Purchase Contract between YCWA and PG&E. Most water released from New Bullards Bar Reservoir flows through the Colgate Powerhouse into Englebright Reservoir. The Colgate Powerhouse operates as a peaking facility which may be run at full capacity for a few hours each day. (YCWA 18, p. 10.) There is a fish bypass requirement of 5 cfs to be released into the Yuba River below New Bullards Bar.

Englebright Reservoir serves as an afterbay for the Colgate Powerhouse and a forebay for Narrows 1 and Narrows 2 Powerhouses. Narrows 1 Powerhouse is operated pursuant to a federal power license held by PG&E and Narrows 2 Powerhouse is operated pursuant to a federal power license held by YCWA. The operation of Narrows 1 and 2 Powerhouses depends upon the water level, or "head," in Englebright Reservoir and the amount of water being released. The two powerhouses have a combined capacity of 4,100 cfs.

The 1966 YCWA/PG&E Power Purchase Contract contains criteria governing operation of the Yuba River Development Project. Appendix C of the contract defines minimum monthly quota for generation of power at the Colgate Power Plant and critical end-of-month storage levels in New Bullards Bar Reservoir. The operational criteria specified in the contract can be modified by mutual agreement of PG&E and YCWA. (YCWA 2, p. 10.)

Since the mid-1980s, the Yuba River Development Project has been operated to reduce winter energy production when storage or forecasted runoff is low in order to conserve water for power generation during summer months. (YCWA 14, p. 3: R.T. V, 114:6-114:25; YCWA 36.) This practice allows for generation of more hydroelectric power during the summer months when it is more valuable. (S-YCWA 11, p. 6.) In addition, New Bullards Bar Reservoir storage frequently has been maintained above the minimum storage levels. Recent operating practices have not followed all of the criteria specified in the Power Purchase Contract.

In 1993, FERC issued a new license (Project No. 1403-004) to PG&E for the operation of the Narrows 1 Powerhouse. The SWRCB may take official notice of the FERC order pursuant to section 648.2 of title 23 of the California Code of Regulations. Table 2 shows the minimum required flows under Article 402 of PG&E's federal power license.

TABLE 2

YUBA RIVER FLOWS AT SMARTVILLE AS SPECIFIED IN FEDERAL POWER LICENSE 1403

OPERATING PERIOD	REQUIRED FLOW AT SMARTVILLE GAGE(CFS)
October 1 - March 31	700
April 1 - April 30	1,000
May 1 - May 31	2,000
June 1 - June 30	1,500
July 1 - September 30	450

The flow standards specified by FERC are numerically equal to the flows recommended by DFG in the Fisheries Management Plan. However, DFG recommends that the minimum flows be maintained at the Marysville gage rather than the Smartville gage as required in the FERC order. The FERC license allows for reductions in the specified flows under certain conditions. (February 11, 1993, FERC Order on Project No. 1403-004, pp. 23-25.) Therefore, it is difficult to determine the impact of the new FERC license requirements on flows in the lower Yuba River. However, the FERC order cites an analysis that indicates: (1) PG&E can substantially increase the

frequency of meeting DFG recommended flows in April, May, and June; (2) flows in the winter months frequently exceed the specified flows; and (3) release of water for irrigation during the summer would exceed the minimum flow requirements. (February 11, 1993, FERC Order on Project No. 1403-004, pp. 7 and 8.)

Under the YCWA/PG&E Power Purchase Contract, PG&E pays YCWA $8 million per year for all power generated. (YCWA 6, p. 2.)[12] This annual payment is not contingent on the amount of power produced in any given year. PG&E will receive all the hydroelectric power generated by the Project at the prices specified in the 1966 Power Purchase Contract until 2016. Therefore, any reduction in the economic value of power produced until the year 2016 is a direct cost to PG&E rather than to YCWA. After 2016, changes in the value of hydroelectric power due to changes in instream flow requirements would affect YCWA. (S-YCWA 11, p. 7.)

Legislation passed in 1996 created a deregulated market for electricity in California beginning in 1998 under which the wholesale price of electricity varies on an hourly basis. (Public Utilities Code §§ 330 to 397.) The SWRCB takes official notice of the fact that the recent electrical energy market in California has been in a state of turmoil. (Cal. Code Regs., tit. 14, § 648.2; Evidence Code § 451(f).) Therefore any prediction of the effect on hydroelectric revenue due to changes in instream flow requirements would be highly speculative. (See also S-YCWA-12, p. 7.)

3.3.2 Flow and Temperature Requirements Currently Applicable to Yuba River Development Project

YCWA currently operates its facilities to meet the instream flows specified in the 1965 agreement with DFG which requires flows in the lower Yuba River immediately below Daguerre Point Dam as specified in Table 3 below. (S-YCWA 13, p. 3.)

[12] The money received from PG&E is used to pay off the Series A revenue bonds that were used to finance the majority of YCWA's project development costs. The Series A bonds are expected to be retired in 2015. (YCWA 8, p. 7.)

TABLE 3

FLOWS SPECIFIED IN 1965 DFG/YCWA AGREEMENT

TIME PERIOD	FLOW REQUIREMENT BELOW DAGUERRE POINT DAM (CFS)
January 1 - June 30	245
July 1 - September 30	70
October 1 - December 31	400

Releases required by the 1965 Agreement are subject to reductions in critical dry years, which are defined as those years for which the DWR April 1 forecast predicts that annual unimpaired flow in the lower Yuba River at Smartville will be 50 percent or less of normal. The water release curtailments for critical dry years are release reductions of 15, 20, and 30 percent when Yuba River unimpaired flow forecasts are, respectively, 50, 45, and 40 percent or less of normal. The critical year provision is effective from the time of the forecast until April 1 of the following year. However, in no event may water releases be reduced to less than 70 cfs. (DFG 26, pp. 187-188.)

The 1965 agreement with DFG also provides that:

> "The AGENCY [YCWA] shall so locate and operate the power intake and outlet works of New Bullards Bar Dam so as to provide water temperatures of the releases from New Bullards Bar Dam comparable to or better than present values with regard to fishery resources." (DFG 26, p. 190.)

In 1966, YCWA received a $4.4 million grant from DWR under the Davis-Grunsky Act to assist in the construction of the Yuba River Development Project. The grant provided funds for fishery enhancement and recreational facilities. Section 21 of the grant contract specifies conditions relating to flow and temperature standards for protection of the lower Yuba River fishery. The contract requires that from October 1 through March 31 YCWA must:

> ". . . regulate the water releases through the multi-level intake facility in the dam (New Bullards Bar) so as to provide, to the maximum extent possible, water temperatures between 46 degrees Fahrenheit and 56 degrees Fahrenheit in the spawning area and shall make all reasonable efforts to maintain a constant temperature of 52 degrees Fahrenheit in the spawning area." (CSPA Exhibit AA, pp. 39-42.)

The reservoir control gates at New Bullards Bar Dam provide the ability to release water from different levels at the dam, from near the surface elevation at elevation 1,956 feet to a low-level outlet at elevation 1,638 feet. (S-YCWA-18, p. 7.) In 1992, YCWA presented testimony that it had operated the multi-level outlet as directed by DFG, releasing cooler water from the low level outlet in September and warmer water from the high level outlet in April. (R.T. V, 72:9-72:17.) YCWA presented testimony in 2000, however, that under revised operational procedures which were established by the Water Temperature Advisory Committee in 1993, the low level outlet at New Bullards Bar Dam has been used for water releases throughout the year since 1993. (S-YCWA 11, pp. 2-3; S-YCWA 18, p. 7; S-R.T. 1349:12-1349:13.)[13] YCWA also presented testimony that it may be extremely difficult to meet the proposed DFG daily temperature standards for the lower Yuba River. (R.T. V, 90:16-90:20.) As discussed in Section 6.6 below, YCWA recently submitted a proposal for funding for a project that would allow for release of water from the lower level of Englebright Reservoir. If constructed, the project may allow for reducing the temperature of releases from Englebright Reservoir by from 2 to 6 degrees Fahrenheit from May through October. (S-SWRCB 12.)

3.3.3 Flood Control

New Bullards Bar Reservoir is operated in accordance with a 1966 contract with the U. S. Army Corps of Engineers (Corps of Engineers) that requires YCWA to maintain required flood control storage space in the reservoir. (YCWA 2, p. 3.) In accordance with the 1966 contract, the Corps of Engineers provided $12.6 million toward construction of New Bullards Bar Reservoir. (YCWA 2, p. 10.) Englebright Reservoir has a gross storage capacity of 67,000 acre-feet and a

[13] The Water Temperature Advisory Committee was formed in 1993 with representatives of YCWA, DFG, and USFWS.

usable storage capacity of 45,000 acre-feet. There presently is no low level outlet. Englebright Reservoir is drawn down in the fall to provide additional flood protection. (YCWA 2, p. 6.) The reservoir is operated jointly by YCWA and PG&E under terms of the YCWA's 1966 contract with the Corps of Engineers. (YCWA 2, p. 5; YCWA 3, p. 14.)

3.3.4 Irrigation

YCWA currently supplies water to the Hallwood, Cordua, Ramirez, Browns Valley, Brophy, South Yuba, Naumes, Inc., Wilbur Ranches, and Dry Creek Mutual Water Company. (S-YCWA 27.) Some of the YCWA contracts allow for delivery of less water in dry years, based on the percentage of normal run-off forecast by DWR. (YCWA 14, Table 2.) For example, if the DWR forecast shows that runoff will be less than 40 percent of normal, YCWA can impose up to a 50 percent deficiency in water deliveries to Cordua Irrigation District, Hallwood Irrigation District, and the Dantoni area, including water delivered for fall flooding of rice fields.

In addition to water deliveries under existing contracts, YCWA has plans to deliver water to the Wheatland Water District and an area referred to as the "Wheatland Detachments," neither of which yet has a water distribution system or water service contract with YCWA. (S-YCWA 15, p. 7.) YCWA's water demand for irrigation is addressed further in Section 7.1 below.

3.3.5 Recreation

In addition to storing and releasing water for other uses, New Bullards Bar Reservoir and Englebright Reservoir are used for boating, fishing, and camping. There was general testimony that recreational use is enhanced by keeping the reservoirs as full as possible, particularly in the summer, but no detailed evidence was presented regarding operational criteria for recreational uses at either reservoir.

3.3.6 Use of Water Outside of YCWA Service Area

In addition to uses within the Yuba River watershed, water from the Yuba River serves important uses downstream. Prior to initiation of a series of short-term water transfers beginning in 1987, the

water released from New Bullards Bar Reservoir that was not used in the YCWA service area flowed from the Yuba River into the Feather River, then into the Sacramento River, and then into the Sacramento-San Joaquin River Delta (Delta). As with water reaching the Delta from other tributaries, flow from the Yuba River was available for satisfying other water rights or meeting Delta outflow requirements.

In the late 1980s, YCWA made water available to water users outside of Yuba County in accordance with statutory provisions encouraging water transfers. Water Code section 109 sets forth legislative policy encouraging voluntary water transfers where consistent with the public welfare of the place of export and the place of import. When applicable statutory requirements are met, the SWRCB has supported the concept of utilizing water transfers as an effective method of meeting water needs throughout the State, particularly during drought conditions.

Between 1987 and 1991, the SWRCB approved all 12 requests for water transfers which were submitted by YCWA in accordance with Water Code section 1725 et seq.[14] The SWRCB approved transfer of a total of 822,700 acre-feet of water, of which approximately 725,700 acre-feet was delivered to a variety of water users. These transfers resulted in approximately $30 million in revenue to YCWA. In most instances, YCWA and DFG were able to agree on terms to prevent unreasonable effects on fish and wildlife that were included as conditions of the orders approving the temporary transfers. Since 1992, hydrologic conditions have been relatively wet and YCWA has participated in only two out of county transfers, one in 1994 and another in 1997. YCWA has received inquiries about potential transfers from several other water districts. (S-YCWA 11, p. 9.)

3.4 Relation of Present Proceeding to Previous Temporary Water Transfers

The present proceeding was initiated to consider the recommendations of the DFG Fisheries Management Plan and to address other issues raised by the 1988 United Groups complaint. The

[14] The quantities of water, the parties involved, and the SWRCB orders approving the transfers are summarized in Table I-1 of the 1994 Staff Analysis.

fishery study on which many of the DFG recommendations are based was initiated in 1986 prior to the YCWA water transfers approved by the SWRCB. This proceeding is not directed at consideration of proposed future water transfers or reconsideration of previously approved transfers. Rather, this proceeding addresses measures necessary to protect fisheries in the lower Yuba River on an ongoing basis.[15]

Nevertheless, representatives of YCWA have attempted to tie this proceeding to YCWA's past water transfers and have suggested that the SWRCB has been critical of YCWA for having engaged in water transfers. (e.g., R.T. IV, 26:4-26:12.) In view of the potential importance of water transfers for meeting water needs throughout the state, we believe it is imperative to avoid any misconception regarding SWRCB support of water transfers meeting statutory requirements. The SWRCB approved all 14 requests for water transfers submitted by YCWA. The SWRCB's position has been that consideration of fish and wildlife effects of temporary transfers should focus on the effects of the particular transfer in question. (SWRCB Order WR 88-12, p. 14.) Prior to the proceedings leading to this decision, correspondence from YCWA indicates the agency was in agreement with the standard used by the SWRCB in evaluating effects of proposed water transfers on fish and wildlife. (SWRCB 1, letter dated July 12, 1989 from attorney Paul Bartkiewicz to Walt Pettit.)[16]

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[15] Although transfers of water outside the place of use presently authorized in YCWA's permits were not the subject of this hearing, the SWRCB acknowledges that establishing well- supported instream flow requirements as a requirement of YCWA's permits could help expedite processing of any future petitions for water transfers under YCWA's permits.

[16] Prior to the start of the 1992 hearing, YCWA is on record expressing its appreciation for SWRCB staff's expeditious processing of two water transfer petitions. (Staff 1, letter dated May 1, 1989 from Paul Bartkiewicz to Dave Cornelius.) During the SWRCB's consideration of a YCWA water transfer proposal in 1991, several parties urged the SWRCB to apply the flow requirements of the DFG Fisheries Management Plan. YCWA responded that it would not be appropriate to consider those issues when the SWRCB had previously indicated that long-term flows in the Yuba River would be examined in a publicly noticed hearing. (SWRCB 1, letter dated July 30, 1991 from attorney Alan Lilly to Bert Parkinson of the SWRCB Division of Water Rights.) Thus, prior to this proceeding, YCWA appeared to recognize the distinction between addressing issues related to temporary water transfers and addressing issues related to long-term flow requirements in the lower Yuba River.

In summary, the record demonstrates that the concern regarding protection of the lower Yuba River fishery predates SWRCB actions on temporary water transfers by YCWA. The SWRCB supports the concept of water transfers and has approved all temporary water transfer proposals presented by YCWA. The SWRCB is also on record, however, as recognizing the need to address long-term measures needed to protect fishery resources in the lower Yuba River. Our commitment to address long-term Yuba River fishery issues in the context of this proceeding was appropriately cited by YCWA as reason not to address those issues in the context of previous proceedings on temporary water transfers. In view of the SWRCB's record of support for temporary water transfers, there is no basis for any suggestion that the present proceedings were initiated due to opposition to water transfers.

4.0 STATUTORY PROVISIONS REGARDING PROTECTION OF FISHERY RESOURCES

Congress and the California Legislature have enacted several state and federal statutes that are particularly relevant to consideration of fishery protection measures on the lower Yuba River. State statutes include Fish and Game Code section 5937; the Streamflow Protection Standards Act; the Salmon, Steelhead Trout and Anadromous Fisheries Program Act; and the California Endangered Species Act. Key federal statutes are the Central Valley Project Improvement Act and the Federal Endangered Species Act. Those statutes are described below.

4.1 Fish and Game Code Section 5937

The basic statutory requirement for release of water from a dam to protect downstream fish is set forth in Fish and Game Code section 5937 which provides, in pertinent part:

> "The owner of a dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through a dam to keep in good condition any fish that may be planted or exist below the dam."

4.2 Streamflow Protection Standards Act

The DFG Lower Yuba River Fisheries Management Plan was prepared in response to the Streamflow Protection Standards Act (Public Resources Code § 10000 et seq., enacted in 1982). The act directs DFG to identify streams and watercourses throughout the state for which minimum flow levels need to be established to assure the continued viability of stream-related fish and wildlife resources. (Public Resources Code § 10001.) In developing minimum flow requirements, DFG is directed to consult with state officials, local governments, and any private individuals or groups deemed advisable. DFG is directed to transmit its proposed requirements to the SWRCB. (Public Resources Code § 10002.)

Water Code section 1257.5 directs the SWRCB to consider the flow requirements proposed by DFG when acting upon applications to appropriate water and authorizes the SWRCB to "establish such streamflow requirements as it deems necessary to protect fish and wildlife as conditions in permits and licenses." Either on its own motion or at the request of the SWRCB, DFG may review streamflow requirements and propose modifications of those requirements. (Public Resources Code § 10003.) DFG's recommendations should also be considered by the SWRCB in the exercise of its continuing authority to supervise the diversion and use of water in order to protect public trust resources. (See Section 5.2 below.)

4.3 Salmon, Steelhead Trout and Anadromous Fisheries Program Act

Legislative policy with respect to protection of anadromous fisheries is set forth in the Salmon, Steelhead Trout, and Anadromous Fisheries Program Act enacted in 1988. The Act emphasizes the importance of protecting and increasing the naturally spawning salmon and steelhead trout of the State in order to provide a valuable public resource, a large statewide economic benefit, and employment opportunities not otherwise available. (Fish and Game Code § 6901.) The act establishes state policy to "significantly increase the natural production of salmon and steelhead trout by the end of this century." (Fish and Game Code § 6902(a).) The act also declares that "existing natural salmon and steelhead trout habitat shall not be diminished further without offsetting the impacts of the lost habitat." (Fish and Game Code § 6902(c).) In establishing

fishery protection flows for the lower Yuba River, the SWRCB is obligated to consider the Legislature's policy regarding the importance of protecting salmon and steelhead trout and increasing natural production of those fish.

DFG presented evidence that the lower Yuba River is one of the most important locations in the state for natural production of chinook salmon. (R.T. I, 53:1-54:22.) The flows in the lower Yuba River have generally been significantly higher than the minimum levels specified in the 1965 agreement between YCWA and DFG. To allow flows to be reduced to the levels specified in the 1965 agreement would be contrary to the Legislature's declared policy of maintaining and improving salmon habitat. (Fish and Game Code §§ 6901(g) and 6902(c).)[17]

Pursuant to the Salmon, Steelhead Trout and Anadromous Fisheries Program Act, DFG developed the Steelhead Restoration and Management Plan for California in 1996. (S-DFG 29.) That plan recommends management of the Yuba River as a wild steelhead fishery, with no hatchery stocking. The plan also recommends that DFG continue to seek adequate flows, temperatures and other restoration measures included in the 1991 Yuba River Fisheries Management Plan. (DFG 26.)

4.4 California Endangered Species Act

The California Endangered Species Act (CESA) establishes various requirements and protections regarding species listed as threatened or endangered under State Law. (Fish and Game Code §§ 2050-2068.) The exercise of authority by state agencies in actions involving threatened or endangered species is governed by Fish and Game Code section 2055 which provides:

> "The Legislature further finds and declares that it is the policy of this state that all state agencies, boards, and commissions shall seek to conserve endangered species and threatened species and shall utilize their authority in furtherance of the purposes of [CESA]."

[17] Section 6.4 of this decision addresses the inadequacy of the 1965 agreement flows for fishery protection.

Sacramento spring-run chinook salmon, which occur in the lower Yuba River, were listed as a threatened species on February 5, 1999 under the CESA. (S-DFG 1, pp. 1-2; S-DFG 13, p. 1; S-R.T. 1944:23-1945:1; S-R.T. 1961:24-1962:4.) Thus, in exercising authority over water rights in the lower Yuba River, the California Endangered Species Act requires the SWRCB to seek to conserve spring-run chinook salmon.

4.5 Federal Endangered Species Act

The federal Endangered Species Act (ESA) is designed to preserve endangered and threatened species by protecting individuals of the species and their habitat, and by implementing measures to promote their recovery. Under the ESA, an endangered species is defined as one that is in danger of extinction in all or a significant part of its range, and a threatened species is one that is likely to become endangered in the near future. (16 U.S.C. § 1532.)

In 1997, NMFS completed a status review of chinook salmon in the west coast states and concluded that Central Valley spring-run chinook salmon are in danger of extinction or are likely to become endangered in the near future. (S-NMFS 2, p. 251.) NMFS cited habitat problems as the most important ongoing risk. The general degradation of conditions in the Sacramento River Basin (including elevated water temperatures, agricultural and municipal diversions and returns, restricted and regulated flows, entrainment of migrating fish into unscreened or poorly screened diversions, and the poor quality and quantity of remaining habitat) were cited as severely impacting juvenile rearing habitat and migration corridors. (S-NMFS 2, p. 251.) On September 16, 1999, NMFS designated Central Valley spring-run chinook salmon as a threatened species under the ESA. (S-NMFS 1a, p. 2; S-NMFS 4; S-R.T. 123:15-123:17.)[18]

In 1996, NMFS completed a status review of steelhead trout in Washington, Idaho, Oregon, and California and concluded that Central Valley steelhead are presently in danger of extinction.

[18] On September 16, 1999, NMFS determined that listing Central Valley fall-run and late fall-run chinook salmon as threatened or endangered species was not warranted at this time, but designated these runs as candidate species under the federal ESA. (S-NMFS 4, p. 50394.)

(S-NMFS 5, p. 169.) Habitat concerns cited include widespread degradation, destruction, and blockage of freshwater habitats within the region. (S-NMFS 5, p. 169.) On March 19, 1998, NMFS designated Central Valley steelhead as a threatened species under provisions of the ESA. (S-NMFS 1a, pp. 2-3; S-NMFS 7; S-R.T. 123:21-123:23.)

NMFS designated critical habitat for Central Valley spring-run chinook salmon and Central Valley steelhead on February 16, 2000. The designated area includes the lower Yuba River from Englebright Dam to the confluence with the Feather River. (S-NMFS 13; S-R.T. 123:18-123:20; S-R.T. 123:24–124:2.) Flow quality and quantity are considered constituent elements of critical habitat. (S-R.T. 124:3-124:5.)

Section 9 of the ESA prohibits certain activities that directly or indirectly affect endangered species. (16 U.S.C. § 1538.) The prohibitions apply to all individuals, organizations, and agencies subject to U.S. jurisdiction. (16 U.S.C. § 1532 (13).) Section 4(d) of the ESA provides that regulations for conservation of threatened species may include any or all of the prohibitions applicable to threatened species. NMFS intends to issue protective regulations pursuant to Section 4(d) for Central Valley spring-run chinook. (S-NMFS-4, p. 50413.) On December 30, 1999, NMFS issued a proposed rule identifying the regulations NMFS believes necessary and advisable to conserve Central Valley steelhead trout that occur in the lower Yuba River. (S-DFG-37.) On July 10, 2000, NMFS issued a final Section 4(d) rule applicable to take of Central Valley steelhead. (50 CFR Part 223 Vol. 65 No.132, pp. 42422-42481.)

In the final rule, NMFS defined categories of activities very likely to injure or kill salmonids and result in a violation of the take prohibitions provided in the rule. Types of activities defined in the rule that occur on the lower Yuba River include: (1) constructing or maintaining barriers that eliminate or impede a listed species' access to habitat or ability to migrate; (2) removing water or otherwise altering streamflow when it significantly impairs spawning, migration, feeding or other essential behavior patterns; (3) constructing or operating dams or water diversion structures with inadequate fish screens or fish passage facilities in a listed species' habitat; and (4) altering lands

or waters in a manner that promotes unusual concentrations of predators. The rule states that persons or entities who conclude that their activity is likely to injure or kill protected fish are encouraged to immediately adjust that activity to avoid take and seek NMFS' authorization for incidental take under: (1) an ESA section 10 incidental take permit, (2) an ESA section 7 consultation, or (3) a limit on the take prohibitions provided in the rule.

YCWA and SYWD presented testimony suggesting that, in the Feather River basin, spring-run chinook salmon are not genetically distinct from fall-run chinook salmon. (S-SYWD 6; S-R.T. 933:6-933:17; S-R.T. 2881:16-2884:23.) A DFG witness responded that the conclusion about the genetic characteristics of fall-run and spring-run chinook salmon in the Yuba River referred to by YCWA and SYWD was based on results of a preliminary study that has not been peer-reviewed. (S-R.T. 2168:11-2170:3.) DFG also noted that during the federal ESA status review, NMFS concluded that spring-run chinook salmon in the Feather River were genetically distinct from fall-run chinook. (S-R.T. 2141:14-214120; S-R.T. 2170:4-2170:17.)

The classification of species and designation of critical habitat under the state and federal Endangered Species Acts are not within the jurisdiction of the SWRCB. Unless the designations of threatened species or critical habitat are revised or overturned, the SWRCB will give appropriate consideration to the status of Central Valley spring-run chinook salmon and Central Valley steelhead as threatened species and the inclusion of the lower Yuba River in the critical habitat designations.

5.0 AUTHORITY OF STATE WATER RESOURCES CONTROL BOARD

The State Water Resources Control Board has broad authority to establish minimum flows and take other measures needed for protection of fisheries and other public trust resources. That authority is provided by article X, section 2 of the California Constitution, Water Code sections 100 and 275, the public trust doctrine as articulated by the California Supreme Court in *National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419 [189 Cal. Rptr. 346], and Water Code sections 1243 and 1253.

5.1 Reasonableness Doctrine

Article X, section 2 of the California Constitution and Water Code section 100 prohibit the waste, unreasonable use, unreasonable method of use or unreasonable method of diversion of water. Water Code section 275 directs the SWRCB to take all appropriate proceedings or actions to prevent violations of the reasonable use standard. The limitations of article X, section 2 of the California Constitution apply to all water users of the state and serve as a limitation on every water right and every method of diversion. *(Peabody v. Vallejo* (1935) 2 Cal.2d 351, 367, 372 [40 P. 2d, 486, 491, 498-499].) The SWRCB's jurisdiction to regulate water diversion and use in accordance with article X, section 2 extends to pre-1914 rights. (*Imperial Irrigation District v. State Water Resources Control Board* (1986) 186 Cal.App.3d 1160 [231 Cal.Rptr. 283].)

Article X, section 2 of the California Constitution provides that the general welfare requires that the State's water resources be put to beneficial use to the fullest extent to which they are capable. Therefore, in determining the reasonableness of a particular use of water or method of diversion, other competing water demands and beneficial uses of water must be considered. A particular water use or method of diversion may be determined to be unreasonable based on its impact on fish, wildlife, or other instream beneficial uses. (*Environmental Defense Fund, Inc. v. East Bay Municipal Utility District* (1980) 26 Cal.3d 183, [161 Cal.Rptr. 466].)

5.2 Public Trust Doctrine

Under the public trust doctrine, the State retains ongoing supervisory control over navigable waters and the lands beneath those waters. The purpose of the public trust is to protect navigation, fishing, recreation, fish and wildlife habitat, and aesthetics. (*National Audubon Society v. State Water Resources Control Board, supra,* 33 Cal.3d at 434-435, 437 [189 Cal. Rptr. at 356, 358]; cert. denied, 464 U.S. 977.) Fish and Game Code section 5937 is a legislative expression concerning the public trust doctrine that should be taken into account when the SWRCB acts under its public trust authority. (See *California Trout, Inc. v. State Water Resources Control Board* (1989) 207 Cal.App.3d 585, 626, 631 [255 Cal. Rptr. 209, 212].)

In applying the public trust doctrine, the State has the power to reconsider past water allocations even if the State considered public trust impacts in its original water allocation decision. Thus, the fact that minimum flow requirements were included as conditions of YCWA's water right permits does not prevent the SWRCB from reevaluating the subject of fishery protection based on more recent evidence and changed conditions. The State has the duty of continuing supervision over the taking and use of appropriated water and an affirmative duty to protect public trust uses whenever feasible. (*National Audubon Society v. Superior Court, supra,* 33 Cal.3d at 445-448 [189 Cal.Rptr. at 363-366].)

YCWA recognizes that the SWRCB may reconsider past water right decisions that were made after consideration of public trust values if a past decision was incorrect in light of current knowledge or is inconsistent with current needs. (YCWA closing brief, p. 14.) However, YCWA argues that "[n]either the public trust doctrine nor Fish and Game Code section 5937 authorizes the [SWRCB] to require Yuba to release water stored in New Bullards Bar Reservoir to augment flows that would otherwise occur in the lower Yuba River, to attempt to mitigate the adverse impacts of Englebright Dam." (YCWA closing brief, p. 17.)

For the reasons discussed below, the SWRCB concludes that in the present case, as in several prior cases, application of the public trust doctrine requires amendment of YCWA's water right permits to establish instream flow requirements that involve release of water from storage during some periods. The instream flow requirements and other provisions of this decision will protect fish and fish habitat in the lower Yuba River and will partially mitigate for the ongoing adverse effects of Englebright Dam, Daguerre Point Dam, and ongoing diversions of water under YCWA's permits.

Englebright Dam and Daguerre Point Dam were incorporated into the design of, and are integral parts of, YCWA's Yuba River Development Project. Englebright Reservoir is jointly operated by YCWA and PG&E. (YCWA 2, p. 5, YCWA 3, p. 14.) The reservoir is operated as an afterbay for YCWA's Colgate Powerhouse and a forebay for YCWA's Narrows 2 Powerhouse and PG&E's Narrows 1 Powerhouse. Englebright Reservoir receives the widely fluctuating releases of water

back into the Yuba River from the Colgate Powerhouse and allows YCWA to regulate its release of water for downstream irrigation deliveries. (YCWA 2, p. 5.)

Current operations of the Yuba River Development Project are dependent upon the continued presence of Englebright Reservoir which allows YCWA to regulate releases for downstream diversion at the three major diversion canals located near Daguerre Point Dam. Daguerre Point Dam serves as a diversion dam for the majority of the irrigation diversions under YCWA's permits. (YCWA 2, p. 5.) Thus, although YCWA did not build Englebright Dam or Daguerre Point Dam, YCWA is involved in the ongoing operation of Englebright Reservoir, and both dams are integral parts of the project authorized by YCWA's water rights.

The impacts of Englebright Dam and Daguerre Point Dam on Yuba River fisheries are not limited to past injuries at the time of construction. Rather, the impacts of the dams are more accurately viewed as a continuing harm to the fishery. As long as the dams continue to block or impede free passage of anadromous fish, they continue to harm anadromous fisheries by preventing or impeding migration to upstream areas that provide spawning and rearing habitat formerly utilized by salmon and steelhead. Due to the dams and reservoirs on the Yuba River, fish that would otherwise be able to migrate to upstream habitat are now dependent on maintenance of suitable conditions downstream.

The extent to which a project developer may be required to provide mitigation for adverse effects on public trust resources caused by unrelated prior projects need not be decided in the present case. In this instance, YCWA benefits from, and participates in, the ongoing operation of previously constructed facilities that eliminate or reduce access to suitable upstream habitat for anadromous fish. Moreover, although the record shows that overall fish populations have stabilized or slightly increased following YCWA's construction of New Bullards Bar Dam, the record is also clear that diversion of water under YCWA permits has resulted, and is continuing to result, in the loss of thousands of young salmonids annually. (See Sections 6.7 through 6.7.4.)

Full restoration of the Yuba River fishery and fish habitat to pre-development conditions would require removal of Englebright Dam and other facilities and a substantial reduction in water diversions. Due to the role of dams and diversion facilities in making water available for consumptive uses and hydropower production, restoration of pre-development fishery conditions on the Yuba River is not feasible. However, as is the case on many California rivers with major reservoirs, the release of stored water into the lower Yuba River helps provide conditions downstream of the reservoirs that serve to replace, in part, the fishery habitat that would otherwise be available upstream.[19] (See, e.g., SWRCB WR 90-5 at p. 18 [discussing the effect of Shasta and Keswick dams], SWRCB Order WR 86-9 at p. 11 [discussing applicability of the public trust doctrine to require releases from a reservoir to protect downstream fisheries where dams and diversions have modified the watercourse].)

Due to factual differences regarding public trust resources and competing uses of water in different situations, the effect of the public trust doctrine differs in each situation in which it is applied.[20] In the present situation, where anadromous fish and fish populations are influenced by a variety of factors and where projects operated by YCWA have had both beneficial and harmful effects on fish in the lower Yuba River, it would be unreasonable to charge YCWA with full restoration of conditions that benefited the fisheries that once existed on the Yuba River. However, it is reasonable to require YCWA to regulate its diversions and releases of water in a manner that

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[19] The 1993 FERC order applicable to PG&E's Narrows 1 project, discussed in Section 3.3.1 above, requires PG&E to release up to 45,000 acre-feet of stored water in order to meet the instream flow requirements established by FERC for protection of fish downstream of Englebright Dam. (February 11, 1993, FERC Order on Project No. 1403-004.) As explained in Section 6.5.9 below, this decision establishes minimum instream flow requirements to be measured at the Marysville gage. Thus, the flow requirements established in this decision will ensure that a larger portion of the water released for fish by PG&E remains in the river downstream of YCWA's points of diversion near Daguerre Point Dam. During periods when the combination of natural flow and any water released from storage by PG&E is not sufficient to meet the requirements of this decision, then YCWA will have to supplement flow from those sources with storage releases from New Bullards Bar.

[20] See Gregory S. Weber, *Articulating the Public Trust: Text, Near Text and Context,* 27 Arizona Law Review 1155, 1241. In explaining why it is unlikely that the courts will develop a specific set of "rules" for application of the public trust doctrine, the author stresses that each diversion presents different water use alternatives and each ecosystem presents unique trust characteristics thereby making it likely that the decision in each case will depend upon circumstances unique to that case.

protects the remaining fish and fish habitat to the extent feasible. Sections 8.0 through 8.4 below discuss the effects of the revised instream flow requirements on YCWA's use of water for other purposes.[21] Section 8.3.2 addresses the relationship between the revised instream flow requirements and generation of hydroelectric power. As discussed in 8.3.2, the SWRCB concludes that in view of the current power shortages in California, the public interest in maintaining flexibility for hydroelectric power generation justifies deferring the effective date of the long-term instream flow requirements established in this decision for a period of five years. During that period, this decision requires compliance with lower instream flow requirements on an interim basis. This decision provides a reasonable balance and protection of competing uses, including public trust uses, in accordance with the physical solution doctrine and the mandate of article X, section 2 of the California Constitution to maximize reasonable and beneficial uses of water.[22]

5.3 Water Code Sections 1243 and 1253

Water Code section 1243 provides:

> "The use of water for recreation and preservation and enhancement of fish and wildlife resources is a beneficial use of water. In determining the amount of water available for appropriation for other beneficial uses, the board shall take into account, whenever it is in the public interest, the amounts of water required for recreation and the preservation and enhancement of fish and wildlife resources."

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[21] Protection of public trust resources in other instances has had a relatively greater effect on the availability of water for competing uses. Protection of fish and other public trust resources in the Mono Basin, for example, is expected to result in an estimated reduction in diversions to the City of Los Angeles by a long-term average of approximately 43,700 acre-feet per year. (SWRCB Decision 1631, p. 164.) In Marin County, revised instream flow requirements for protection of fish in Lagunitas Creek reduced the amount of water available for diversion for municipal use in Marin Municipal Water District by between 1,650 and 2,000 acre-feet per year in a water short area where the cost of replacement water ranged from $350 to $1,800 per acre-foot. (SWRCB Order WR 95-17, pp.102-105.)

[22] The physical solution doctrine is based upon the constitutional goal of promoting maximum beneficial use of the State's water resources. Previous SWRCB decisions discuss application of the physical solution doctrine as a basis for establishing a flow regime for protection of fish in which the required release of water from a reservoir at a particular time may exceed the rate of inflow to the reservoir. (See Decision 1631, p. 10 and Water Right Order, WR 90-16.)

Water Code section 1253 states:

> "The board shall allow the appropriation for beneficial purposes of unappropriated water under such terms and conditions as in its judgment will best develop, conserve, and utilize in the public interest the water sought to be appropriated."

As discussed in Sections 5.1 and 5.2 above, the state has continuing authority to regulate water use under the public trust doctrine and the reasonable use provisions of the California Constitution. In addition to other applicable statutes, exercise of the SWRCB's continuing authority over water diversion and use is guided by the legislative directives of Water Code sections 1243 and 1253.

6.0 PROTECTION OF FISHERY RESOURCES IN THE LOWER YUBA RIVER

6.1 Anadromous Fish Occurring in the Lower Yuba River

As discussed in Section 4.3 above, the California Legislature has established the state policy in support of protection and restoration of natural stocks of chinook salmon and steelhead. (Fish and Game Code § 6900 et seq.) In the lower Yuba River, the primary species of concern identified by DFG, USFWS, and the NMFS are fall and spring-run chinook salmon and steelhead trout. (DFG 26, p. 1; R.T. I, 187:17-187:25; R.T. II, 63:5-63:15; R.T. III, 94:18-95:3; S-NMFS 1A; S-DOI 7; S-DFG 1; S-DFG 13; S-DFG 27; S-R.T. 123:15-124:2; S-R.T. 252:18-253:21; S-R.T. 1952:19-1953:4.) Fall-run chinook salmon are the most abundant anadromous fish in the lower Yuba River and support significant sport and commercial fisheries. (DFG 26, p. 7.) The Central Valley fall-run chinook salmon is identified as a candidate species under the federal Endangered Species Act. (S-NMFS 4, p. 50394.) Central Valley spring-run chinook salmon, which occur in the lower Yuba River, have been listed as a threatened species under both the state and federal Endangered Species Acts, due to significant population declines throughout its range. (S-NMFS 1a; S-NMFS 4; S-DFG 13, p. 1.) Central Valley steelhead trout, which occur in the lower Yuba River, have been listed as threatened under the federal Endangered Species Act, also due to significant population declines. (S-NMFS 1a, S-NMFS 7.) In addition, DFG is concerned with protection of the American shad fishery in the lower Yuba River. (DFG 26, p. 1.)

New Bullards Bar and Englebright reservoirs also support significant fishery resources. In accordance with Legislative directives and policy of the Fish and Game Commission, however, DFG places a greater emphasis on protection of anadromous species in the lower Yuba River than on protection of the reservoir fisheries. (R.T. II, 168:18:169:24.) Figure 3 shows the reaches of the lower Yuba River used by anadromous fish, as defined in the DFG anadromous fish studies. Figure 4 identifies periods during the year when the various species of anadromous fish are present, and Figure 5 shows the sections of the river used during the various life stages of each species. Anadromous fish occurring in the lower Yuba River include fall-run chinook salmon, late fall-run chinook salmon, spring-run chinook salmon, steelhead, and American shad. The life history of each of these species is summarized below.

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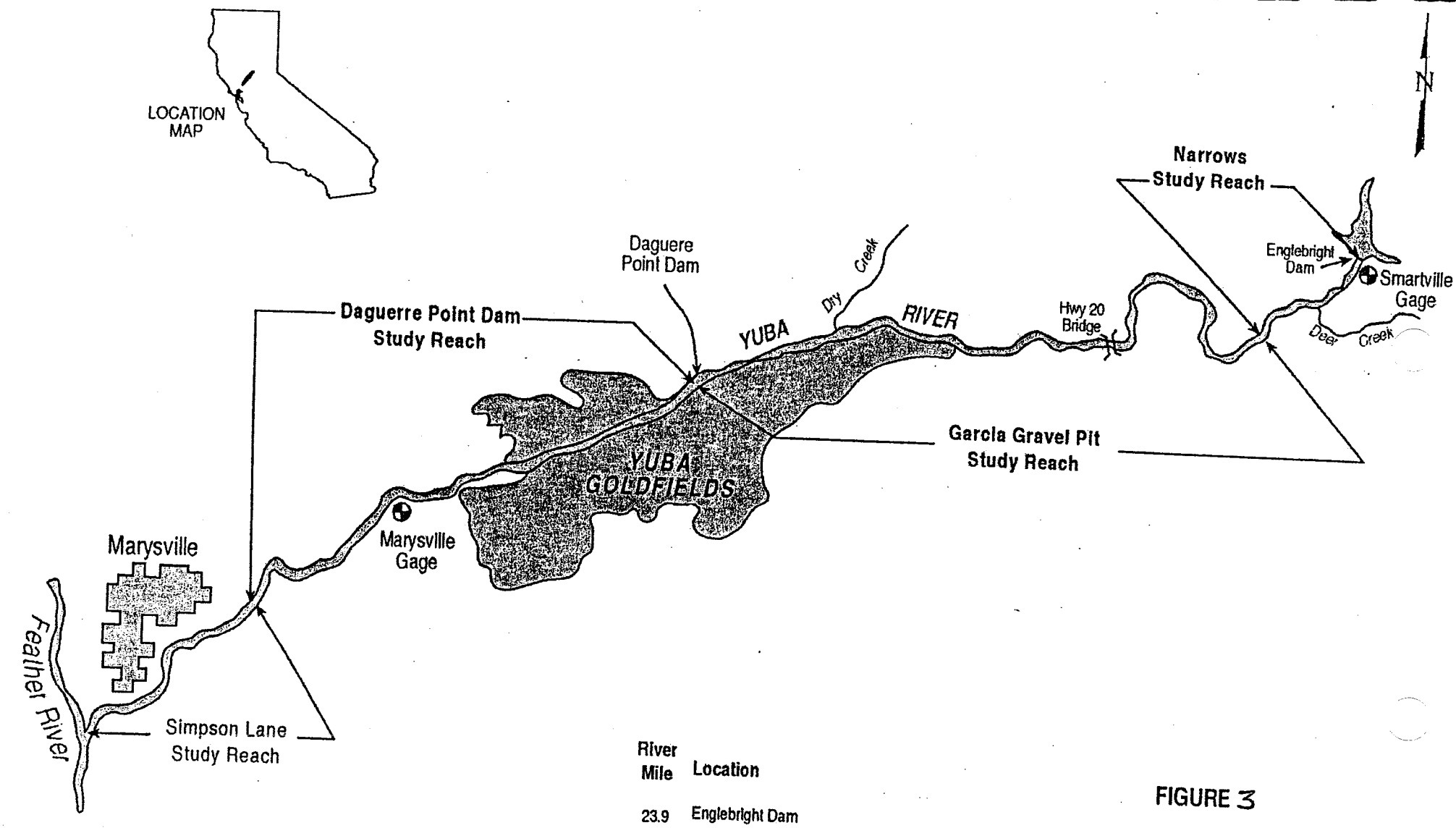


River Mile	Location
23.9	Englebright Dam
22.7	Deer Creek Confluence
18.0	Highway 20 Bridge
13.6	Dry Creek Confluence
11.6	Daguerre Point Dam
6.2	USGS Gage near Marysville
0.0	Feather River Confluence

LEGEND
USGS GAGING STATIONS

1 0 1 mile
SCALE

FIGURE 3

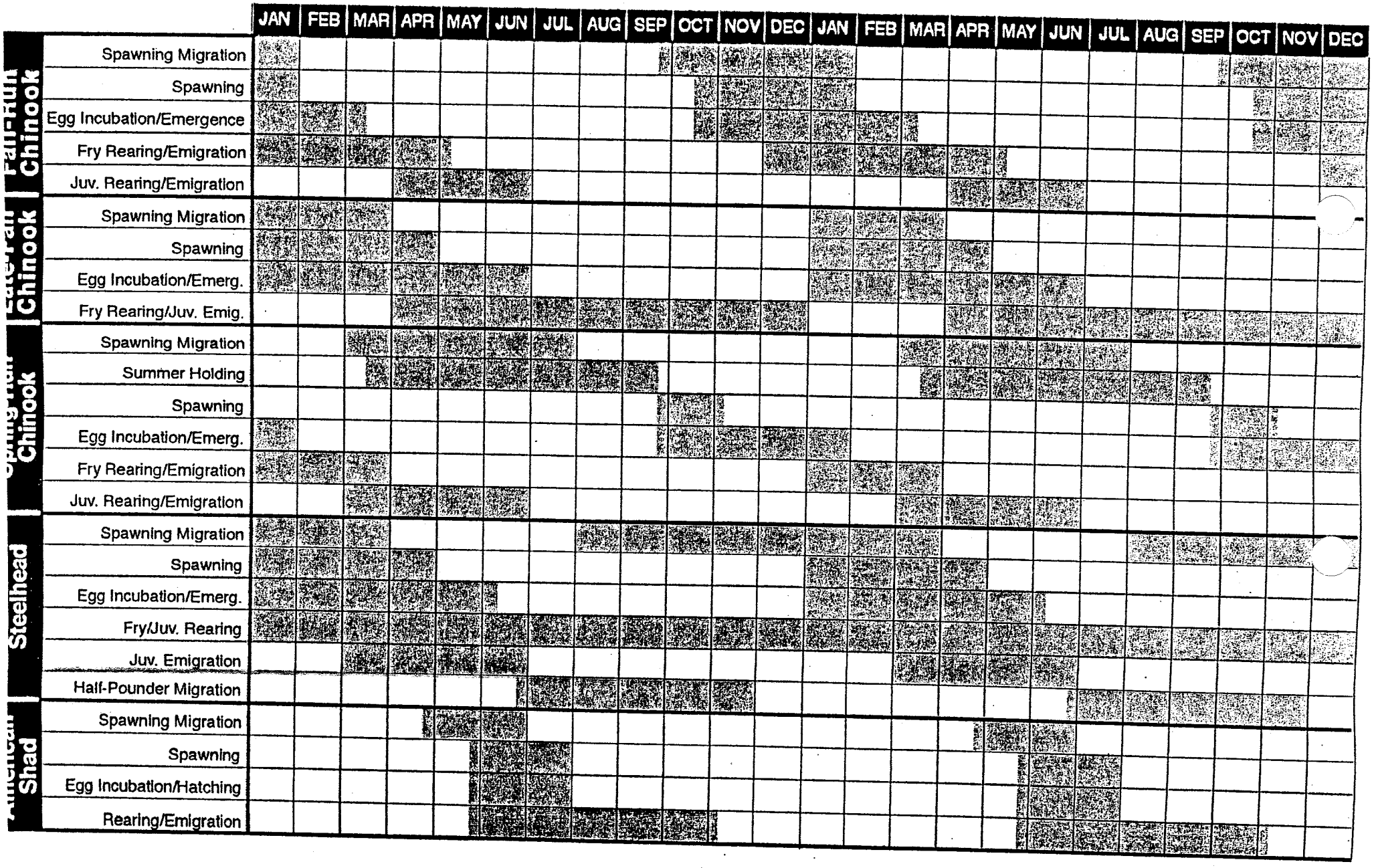
STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
DIVISION OF WATER RIGHTS

LOWER YUBA RIVER

FIGURE 7

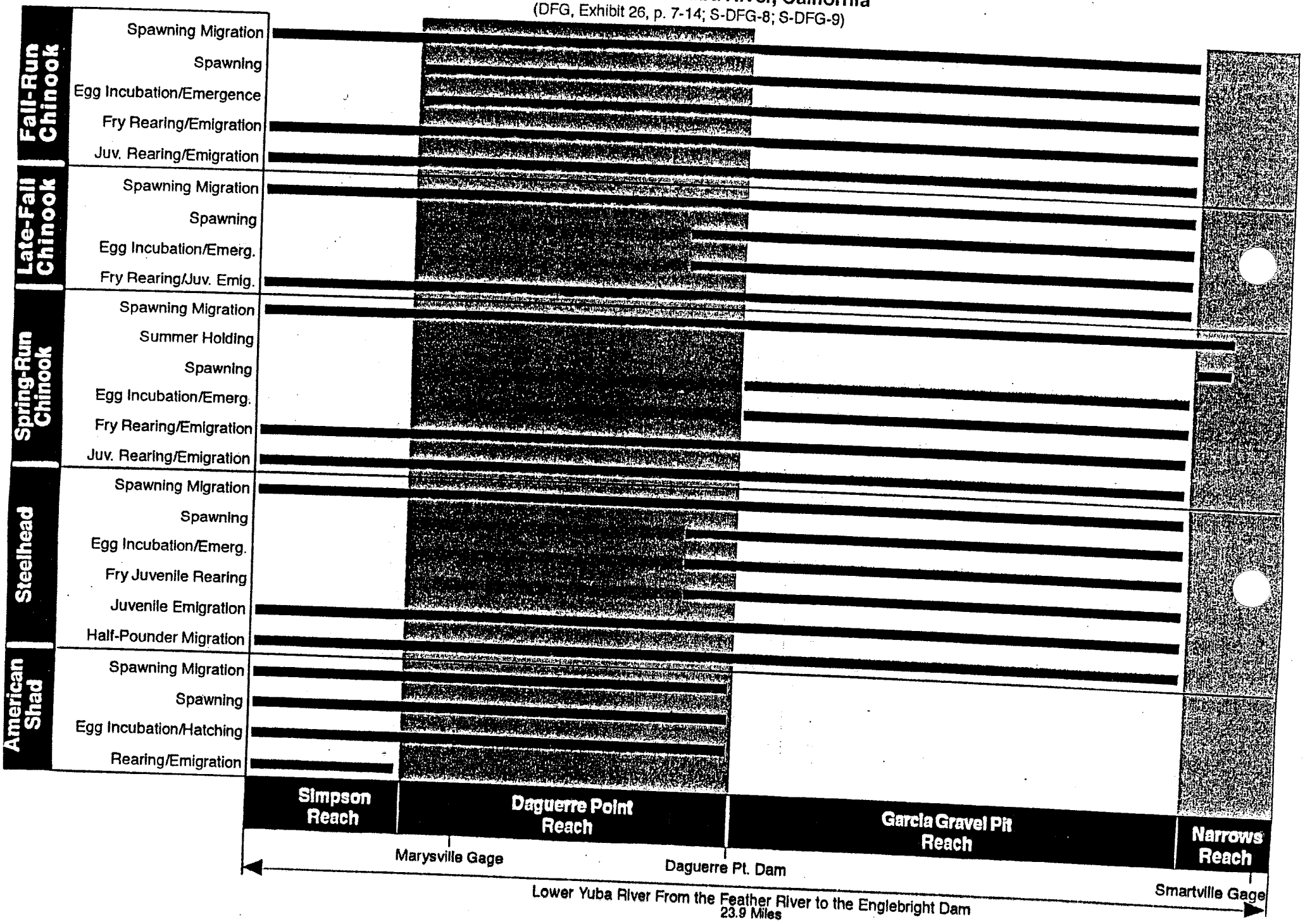
Periods During the Year When Various Species of Anadromous Fish are Present in the Lower Yuba River, California

(DFG, Exhibit 26, p.10, YCWA Exhibit 20, p. 3-8 and 3-9)



Locations Occupied by the Various Life Stages of Anadromous Fish Found in the Lower Yuba River, California

(DFG, Exhibit 26, p. 7-14; S-DFG-8; S-DFG-9)



6.1.1 Fall-Run Chinook Salmon

Fall-run chinook salmon are the most abundant anadromous fish in the lower Yuba River. Central Valley fall-run chinook salmon support significant sport and commercial fisheries. The Sacramento River system, of which the Yuba River is a part, has historically been an important spawning area for fall-run chinook salmon. In the past, the Yuba River supported up to 15 percent of the annual run of fall chinook in the Sacramento River system. (DFG 26, p. 7.)

Fall-run adults typically migrate into the lower Yuba River from late September through January, with peak adult migration occurring in late October and November. Low flows and high water temperatures may delay upstream migration and spawning in the lower Yuba River. (DFG 26, p. 7; S-YCWA 51; S-R.T. 2635:23-2638:13.) Spawning can begin as early as October 1. (R.T. I, 129:9-129:16; S-YCWA 51.) Normally, spawning begins in mid-October with peak spawning during November and December. (DFG 26, pp. 7 and 62.) During spawning, salmon construct redds (nests) in the gravel where they deposit their eggs. Eggs incubate in the gravel into February, followed by hatching and emergence of fry into March. (DFG 26, p. 9.) Fry may emigrate within a few weeks of emergence while others may rear in-river as late as June before emigrating as smolts. (DFG 26, p. 9; YCWA 20, Fig. 3-4: R.T. II, 16:7-17:4; R.T. III, 20:14-24:5; R.T. VIII, 57:13-59:14.)

Spawning habitat occurs from the lower end of the Narrows Reach downstream to about two and one-half miles below the Marysville gage. (DFG 26, pp. 62, 65-66.) Generally, about 60 percent of the fall-run chinook salmon spawn between the Highway 20 bridge and Daguerre Point Dam, but from 1975 to 1979, most spawning occurred downstream of Daguerre Point Dam. (DFG 26, p. 7; R.T. I, 60:5-60:6; YCWA 80, DFG November 18, 1980 memo.) Fry utilize all reaches of the lower Yuba River downstream of the Narrows Reach for rearing. The largest concentration appears to be upstream of Daguerre Point Dam in the Garcia Gravel Pit Reach. (DFG 26, p. 26.)

6.1.2 Late Fall-Run Chinook Salmon

Although late fall-run chinook salmon occur primarily in the upper Sacramento River, incidental populations are known to occur in the lower Yuba River. (R.T. II, 245:8-245:20; R.T. III, 24:7-24:20; USFWS 7, p. 5.) Adult late fall-run chinook salmon migrate into fresh water from January into March. Spawning and egg incubation occur from January into June. Fry emigration, juvenile rearing and juvenile emigration occur from April into December. (R.T. II, 245:8-245:20; USFWS 7, p. 5.) Spawning and nursery areas preferred by late fall-run chinook salmon are expected to be similar to steelhead since both species enter the river about the same time and rearing occurs through the summer. Some spawning activity has been observed in the Yuba Goldfields area downstream of Daguerre Point Dam. (USFWS 7, p. 5.)

6.1.3 Spring-Run Chinook Salmon

Adult spring-run chinook salmon migrate into the lower Yuba River from March through June or July (DFG 26, p. 10; S-R.T. 1949:11-1949:12.) Peak migrations occur in May and June. (DFG 26, p. 11.) Adults spend the summer in deep pools in the Narrows Reach and spawn primarily from late September through early November. (DFG 26, p. 11.) In recent years, spring-run spawning has been observed to begin approximately the second week of September. (S-DFG 8; S-DFG 9; S-R.T. 1949:17-1949:19.) Spawning occurs within the Garcia Gravel Pit Reach, downstream to Daguerre Point Dam. Most spawning occurs in the upper end of the reach, above the Highway 20 Bridge. (S-DFG 8; S-DFG 9.) Fry emergence begins in November and extends through January. Some fry emigrate within a few weeks of emergence while others may remain until June when they emigrate as juveniles. (DFG 26, p. 11.) Rearing occurs from the upper end of the Garcia Gravel Pit Reach downstream to the mouth of the lower Yuba River. (DFG 26, pp. 26, 62-66.)

6.1.4 Steelhead

The lower Yuba River supports natural production of steelhead and is managed by DFG as a naturally sustained population. DFG's 1996 Steelhead Restoration and Management Plan for California (1996) states that the Yuba River supports "essentially the only wild steelhead fishery

remaining in the Central Valley." (S-DFG 29, p. 47.) Adult steelhead migration into the lower Yuba River begins as early as August and may extend through March. Peak migration occurs from October through February and spawning occurs from January through April. Emergence of fry from the gravel extends into early June and the young fish remain in the river from one to three years prior to emigrating as "yearlings." Emigration of yearlings occurs from March into June. (DFG 26, pp. 11 and 12.) In addition to migration of adults into the lower Yuba River, "half pounder" steelhead are known to migrate into the river from late June into the winter months. (DFG 26, p. 12.) A "half pounder" is a steelhead that returns from the ocean before it is sexually mature. The best spawning habitat for steelhead occurs in the Daguerre Point Dam and Garcia Gravel Pit Reaches. (DFG 26, p. 153.) Side channels may also provide spawning habitat. (R.T. III, 120:17-121:13.) Rearing occurs from the Garcia Gravel Pit Reach downstream to Marysville. (DFG 26, p. 63.)

6.1.5 American Shad

American shad typically begin migrating into the Feather River system and the Yuba River from late April through June. (R.T. I, 183:20-184:14; YCWA 20, pp. 3-8 to 3-9; YCWA 73, p. 41.) Spawning occurs downstream of Daguerre Point Dam because the fish ladders at the dam are impassable to American shad. (R.T. I, 80:21-80:25.) Spawning typically occurs from late May through July. Shad spawn in schools near the water surface, usually at night. Shad eggs are semi-buoyant and non-adhesive. They drift downstream with the current until they gradually sink to the bottom. Incubation takes three to six days and newly hatched larvae may be rapidly transported downstream. (DFG 26, pp. 13 and 14.) Few juvenile American shad are seen in the lower Yuba River after October. (R.T. II, 59:20-60:16.)

6.2 Factors Affecting Anadromous Fish Populations in the Lower Yuba River

Based on information in the DFG Fisheries Management Plan (DFG 26), the USFWS Draft Restoration Plan for the Anadromous Fish Restoration Program (S-DOI-4), and other studies and analyses, DFG, USFWS, NMFS, and other parties have recommended revision of permit requirements governing: (1) minimum flows in the lower Yuba River, (2) rate of streamflow

fluctuations, (3) water temperature, and (4) screening of water diversion facilities. The evidence and our conclusions regarding these subjects are addressed in this decision. The DFG Fisheries Management Plan and the USFWS Draft Restoration Plan also identify a number of other fishery protection and enhancement measures that can more appropriately be implemented by the actions of other agencies. (DFG 26; S-DOI 4.)

In addition to the subjects addressed by provisions of this decision, YCWA and SYWD identified a number of out-of-basin environmental factors that could affect fish populations in the lower Yuba River including: (1) ocean commercial and sport fishing; (2) fishery hatchery practices; (3) flows, temperatures, and diversions in the Feather and Sacramento Rivers; (4) Sacramento-San Joaquin Delta water temperatures and water exports; (5) dam construction on other streams tributary to the Sacramento-San Joaquin Delta; and (6) introduction of exotic species of fish. (SYWD 20, pp. 16-18; YCWA 20, pp. [2-13]-[2-22]; R.T. VIII, 37:17-50:6; R.T. X, 205:10-207:19; S-YCWA 19, pp. [3-12]–[3-14]; S-R.T. 589:9-590:6.) Modification or regulation of out-of-basin factors goes beyond the issues under consideration in this proceeding and, in some cases, beyond the jurisdiction of the SWRCB. Many of the issues associated with water diversions and flows in the Sacramento-San Joaquin Delta fishery are under consideration by the SWRCB in a separate proceeding.

6.3 Status of Anadromous Fish Populations in the Lower Yuba River

Fall-Run Chinook Salmon: DFG projected that, following construction of New Bullards Bar, average annual spawning runs of adult fall-run chinook salmon would increase from around 13,000 to 38,000. However, spawning information from 1953 to 1989 presented in 1992 indicated that post-project populations of fall-run chinook salmon remained at approximately 13,000 adults. (DFG 26, p. 7; R.T. I, 235:18-235:24, 237:22-238:8.)

YCWA presented testimony in 2000 that the average fall-run spawning escapement in the lower Yuba River was higher in the post-New Bullards Bar Reservoir period (1972-1999) than in the pre-project period (1953-1971). (S-YCWA 19, p. 3-9; S-YCWA 43; S-R.T. 572:20-573:23.)

However, no evidence was presented on the statistical significance of this population increase. (S-R.T. 2707:16-2709:22.) In addition, DFG presented testimony that the rate of increase in the fall-run population prior to operation of New Bullards Bar (1953-1971) was actually higher than the rate of increase in the post-project period (1972-1999). (S-DFG 41; S-R.T. 2436:3–2437:11.)

Due to concerns over population declines of Central Valley fall-run chinook in the Sacramento-San Joaquin River system as a whole, the species has been designated as a candidate species under the federal Endangered Species Act. (S-NMFS 4, p. 50394.)

Late Fall-Run Chinook Salmon: Small numbers of late fall-run chinook are known to spawn in the lower Yuba River. (R.T. II, 245:8 – 245:20; R.T. III, p. 24:9-24:21; USFWS 7, p. 5.) However, no population estimates exist for late fall-run chinook for either the pre- or post-New Bullards Bar Reservoir periods. (R.T. III, 24:7-24:20.)

Spring-Run Chinook Salmon: Historically, spring-run chinook salmon were the dominant race of salmon in the Yuba River. The combination of fish passage problems at Englebright Reservoir and Daguerre Point Dam, together with water temperature problems downstream of Englebright Reservoir during spawning periods, led to the virtual disappearance of spring-run chinook salmon by 1959. (DFG 26, p. 9; R.T. I, 236:5-236:23; YCWA 20, p. 2-12; R.T. VIII, 23:6-23:23.)

The restoration of fish passage at Daguerre Point Dam allowed reestablishment of small numbers of spring-run chinook in the lower Yuba River. In addition, the cooler summer water temperatures resulting from construction of New Bullards Bar Reservoir may have improved habitat for spring-run in the lower Yuba River. In 2000, YCWA presented testimony that flows and water temperature conditions following construction of the reservoir have contributed to the recovery of spring-run chinook salmon. (S-YCWA 19, p. 3-12; S-R.T. 646:2-646:11.)

In 1992, USFWS presented testimony that the estimated population of spring-run chinook salmon spawners in the lower Yuba River at that time was approximately 1,000. (R.T. III, 110:1-111:12.)

In 2000, DFG presented testimony that, based on their best professional judgment, DFG personnel estimated spring-run chinook salmon populations during the 1980's to number several hundred fish. (S-DFG 15, p. VI-20; S-R.T. 1962:21-1962:23.) However, there have been no accurate surveys of spring-run chinook salmon in the lower Yuba River and the current population size and population trends are unknown. (S-R.T. 2145:17-21.)

Spring-run chinook salmon populations in the mainstream Sacramento River and its tributaries are generally at low levels, which led to designation of Central Valley spring-run chinook salmon as threatened under both the federal Endangered Species Act and the California Endangered Species Act. (S-NMFS 2; S-NMFS 3; S-NMFS 4; S-DFG 13, S-DFG 15, S-DFG 17 to S-DFG 24; S-R.T. 1962:24-1963:4.)

Steelhead: Prior to construction of New Bullards Bar Reservoir in 1969, high water temperatures in the lower Yuba River limited steelhead populations to approximately 200 adults. (DFG 26, p. 11; YCWA 20, p. 2-12; PG&E 2, p. 6.) In 1992, DFG and YCWA presented limited data that recent populations of steelhead may have increased since the completion of New Bullards Bar. (DFG 26, p. 11; YCWA 69 and 70.) In 2000, YCWA presented testimony that flows and water temperature conditions following construction of the reservoir have contributed to the recovery of steelhead. (S-R.T. 646:2-646:11.) The steelhead run size in the Yuba River in 1984 was estimated to be about 2,000 fish. (S-DFG 29, p. 47.) However, no definitive population estimates exist for steelhead in the lower Yuba River and the current status of the population is unknown. (DFG 26, p. 11; S-R.T. 2248:23 – 2251:25.) Steelhead stocks of the Central Valley are generally at low levels which led to designation of steelhead as threatened under the federal Endangered Species Act in 1998. (S-NMFS 5; S-NMFS 6; S-NMFS 7; S-DFG 27; S-DFG 29; S-DFG 30.)

American Shad: American shad were introduced into the Sacramento River from the East coast in 1871 and quickly became established in the San Joaquin and Sacramento River Systems. American shad populations are now found in the upper Sacramento, American, Feather, and Yuba rivers. (R.T. II, 240:15-243:10.) Shad populations in the lower Yuba River in 1968 and 1969

were estimated to range from 30,000 to 40,000 adults. (DFG 26, p. 13.) During 1976, 1977, 1981, 1987, and 1988, when mean flows in May ranged between 166 cfs and 367 cfs, there were no significant shad runs up the Yuba River. Better shad runs have occurred during years with higher flows during May. (YCWA 20 p. 3-22; CSPA Exhibit CC.)

Summary: Daguerre Point Dam interferes with migration of anadromous fish and Engelbright Dam blocks upstream passage entirely. Both dams were present prior to construction of New Bullards Bar, but YCWA makes use of both facilities as part of its ongoing operations. Due to the loss of anadromous fish habitat upstream of Englebright Reservoir, maintenance of the remaining habitat in the lower Yuba river is particularly important. Although the cooler water at upstream locations is no longer accessible to anadromous fish, the multi-level outlet at New Bullards Bar Dam was built to increase the ability to provide cool water in the lower Yuba River. (See Sections 6.6 through 6.6.5.) The record indicates that overall populations of fall-run chinook salmon have not changed significantly since construction of New Bullards Bar Reservoir. The reservoir may have improved habitat for spring-run chinook salmon and steelhead in the lower Yuba River, but the population effects are unknown. As discussed in Section 6.5.7 below, the number of American shad entering the Yuba River to spawn is related to the ratio between flows in the Yuba and Feather Rivers during the late April through June upstream migration period.

6.4 Adequacy of Existing Streamflow and Temperature Requirements

The minimum flows currently specified in Water Right Permits 15026, 15027, and 15030 are based on a 1962 agreement between YCWA and DFG. The 1962 agreement was superseded by a later agreement between the same two agencies signed in 1965. (DFG 26, p. 185.) Although YCWA's water right licenses covering hydropower generation were amended to include the 1965 agreement flows, its water right permits for consumptive use were not amended to reflect the 1965 agreement. Prior to entering the 1965 agreement, DFG initiated studies in 1960 to determine the minimum flows necessary to protect salmon in the lower Yuba River, but the studies were never completed. (R.T. XIII, 68:1-71:10, 78:19-79:17.) DFG presented evidence that production of

anadromous fish in the lower Yuba River has been limited by flow and water temperature criteria specified in the 1965 agreement. (DFG 26, pp. 7-14; R.T. I, 40:18-40:25 and 60:23-60:25.)

The adequacy of the 1965 agreement flows was also questioned by the USFWS who presented written testimony that the flow regimes identified in the 1965 agreement "would likely provide poor habitat for chinook salmon reproduction and the population would decline measurably." (USFWS 8, p. 3.) A USFWS fisheries biologist expressed concern about future flow conditions on the lower Yuba River and testified that if project operations were to strictly adhere to the minimum flow regime prescribed by the 1965 agreement, "the resulting habitat conditions would be extremely detrimental to all anadromous salmonid populations in the Yuba River." (R.T. III, 95:9-95:21, 105:5-105:23.)

The Department of Interior's Anadromous Fish Restoration Program (AFRP) identified flows needed in the lower Yuba River and other Central Valley streams to achieve the federal government's fish restoration goals. (S-DOI 7, p. 1.) The AFRP "Working Paper on Restoration Needs" (May 1995) identified flows for the lower Yuba River that are consistent with flows recommended by DFG's 1992 Lower Yuba River Management Plan. (DFG 26, pp. 107-114; S-DOI 3, pp. [3-Xc-12]–[3-Xc-17]; S-DOI 7, pp. 1-2; S-R.T. 248:19-249:9.) The 1997 Revised Draft Restoration Plan for the Anadromous Fish Restoration Program identifies several restoration actions for the lower Yuba River, including supplementing instream flows to improve habitat and water temperature conditions, reducing flow fluctuations, and improving fish screening and fish passage facilities. (S-DOI 4.) The goal of the AFRP is to increase natural production of a anadromous fish in Central Valley streams to double their 1967-1991 levels. (S-DOI 3; S-DOI 4, p. 4.)

CSPA presented evidence that a DFG biologist questioned the adequacy of the 1965 agreement flows prior to execution of the agreement. His concern was reduced, however, due to the expectation that actual project operations would provide substantially more flow than required by the agreement. Peak releases for power were expected to exceed 2,000 cfs starting April 1 under

terms of the power contract between PG&E and YCWA. The DFG biologist continued to be concerned, however, about the adequacy of the 245 cfs minimum flow requirement during the rearing and emigration period for juvenile salmon. (R.T. XIII, 72:2-76:17; CSPA Exhibit A, DFG memo dated December, 17, 1965.)

CSPA also presented testimony by a former DFG fishery scientist who worked on the incomplete DFG study in 1960 and 1961. The witness testified that the flows in the 1965 agreement did not take American shad into consideration and that the specified flows were "woefully" inadequate for salmon. (R.T. XIII, 76:19-80:15.) In 2000, YCWA presented testimony that the lower Yuba River fall-run chinook salmon and resident native and introduced fish resources are currently in "good condition." (S-YCWA 19, p. 5-2; S-R.T. 644:15-645:18.) However, average flows in the lower Yuba River since completion of New Bullards Bar in 1970 have generally been substantially in excess of the minimum flows specified in the 1965 agreement between YCWA and DFG. Therefore, historic fishery data provide no basis for concluding that the minimum flows required under the 1965 agreement would be adequate to keep fall-run chinook salmon in good condition. As indicated by their status under the endangered species acts, the spring-run chinook salmon and steelhead populations are not considered to be in good condition.

There was no expert testimony presented by any party that a flow regime that strictly adhered to the requirements of the 1965 Agreement would provide suitable protection for lower Yuba River fisheries. The instream flow recommendations in the DFG Fisheries Management Plan are much higher than the minimum flows required in the 1965 Agreement. In 2000, YCWA also proposed significantly higher instream flow releases for fishery purposes than are required in the 1965 Agreement. (S-YCWA 19, p. 4-1.)

6.5 Instream Flows for Protection of Fishery Resources

Chinook salmon, steelhead trout, and American shad populations in the lower Yuba River depend on adequate flows downstream of Englebright Reservoir and Daguerre Point Dam to provide habitat for adult attraction and passage, spawning, egg incubation, juvenile rearing, and

emigration. The quantity and timing of flows needed for these purposes are evaluated in Sections 6.5.1 through 6.5.9 below.

6.5.1 Physical Habitat Needs (IFIM/PHABSIM Model)

To evaluate and quantify the relationship between fish habitat and flow, DFG initiated a study in 1986 utilizing the USFWS's computer based Instream Flow Incremental Methodology/Physical Habitat Simulation Model (IFIM/PHABSIM). (DFG 26, pp. 65-70; R.T. I, 100:6-103:15.) The IFIM/PHABSIM modeling process is used to identify the incremental relationship between streamflow and habitat. The method combines information on habitat preference and stream hydraulics to develop a streamflow-habitat relationship index called Weighted Usable Area (WUA). Changes in WUA generally represent changes in the availability of aquatic habitat, provided other factors such as water temperature and food supply are adequate. DFG used the IFIM/PHABSIM methodology to determine the relationship between habitat and streamflow for the various life stages of chinook salmon and steelhead in the lower Yuba River. The IFIM/PHABSIM methodology was not used to develop similar information for American shad. (DFG 26, p. 80.)

Field studies were conducted in the lower Yuba River to develop microhabitat use criteria for various life stages of chinook salmon, steelhead trout, and American shad. Sufficient data were collected through direct observation to describe habitat use for fry, juvenile, and spawning adult chinook salmon. Insufficient numbers of steelhead and American shad were observed to allow development of habitat criteria for these species. (DFG 26, pp. 31-44.) DFG did not develop WUA discharge relationships for American shad. (DFG 26, p. 80.) Microhabitat use criteria for steelhead lifestages were based on published data. (DFG 26, p. 41.) With the results of the PHABSIM analysis, DFG attempted to identify flows that would be feasible and would provide adequate habitat for each lifestage of chinook salmon and steelhead. (R.T. I, 48:9-48:18.)

6.5.2 Results of the DFG IFIM/PHABSIM Study

Fall-Run Chinook Salmon: The period from mid-October into March is characterized by fall-run chinook salmon spawning, egg incubation, fry emergence and fry rearing. The IFIM results for total spawning habitat presented by DFG show that a flow of 700 cfs in the Garcia Gravel Pit Reach above Daguerre Point Dam maximizes total spawning habitat in that reach. (DFG 26, p. 133, Table II-4a.) The DFG data also show that maximum spawning habitat in the reach of the river below Daguerre Point Dam would be provided by a flow of approximately 450 to 500 cfs. (DFG 26, p. 133, Table II-4a.)

Fall-run chinook fry rearing occurs from December into May. Fry are common in run/glide, shallow pool, deep pool and riffle habitat. (DFG 26, p. 29.) The greatest concentration of the habitat types used for rearing is in the Garcia Gravel Pit Reach, the Daguerre Point Dam Reach and the Simpson Lane Reach. (DFG 26, p. 68.) Maximum fry rearing habitat in these three reaches would occur at a flow of 100 cfs, provided that water temperature and other requirements are met. (DFG 26, p. 131, Table II-2a.)

Fall-run chinook juvenile rearing occurs from April into June. (DFG 26, p. 29.) The greatest concentration of juvenile rearing habitat is in the Garcia Gravel Pit Reach, followed by the Daguerre Point Dam Reach and the Simpson Lane Reach. (DFG 26, p. 68.) The maximum habitat for juvenile rearing in the lower Yuba River would be provided at a flow of 150 to 200 cfs. (DFG 26, p. 132, Table II-3a.)

Late Fall-Run Chinook Salmon: Late fall-run chinook salmon have a similar life history to fall-run chinook salmon and steelhead. Although late fall-run chinook habitat was not modeled, it is reasonable to assume that the flow recommendations based on the IFIM/PHABSIM model results for fall-run chinook salmon and steelhead would also benefit late fall-run chinook salmon.

Spring-Run Chinook Salmon: DFG assumed that the IFIM/PHABSIM model results for fall-run chinook salmon are applicable to spring-run chinook salmon. (DFG 26, p. 71.) Spring-run

chinook salmon spawning, egg incubation and fry emergence occurs from late September through January. Spawning occurs from late September to early November within the Garcia Gravel Pit Reach, downstream to Daguerre Point Dam. (S-DFG 8; S-DFG 9.) Fry and juvenile rearing occur from the upper end of the Garcia Gravel Pit Reach downstream to the mouth of the lower Yuba River. Fry rearing occurs from January through March; juvenile rearing occurs from March through June. (DFG 26, pp. 7-14, 26, 62-66.)

A flow of 700 cfs in the Garcia Gravel Pit Reach above Daguerre Point Dam maximizes total spawning habitat in that reach. (DFG 26, p. 133, Table II-4a.) Maximum fry rearing habitat in the Garcia Gravel Pit, Daguerre Point Dam, and Simpson Lane reaches would occur at a flow of 100 cfs, provided that water temperature and other requirements are met. (DFG 26, p. 131, Table II-2a.) Maximum habitat for juvenile rearing in these reaches would be provided at a flow of 150 to 200 cfs. (DFG 26, p. 132, Table II-3a.)

Steelhead: Steelhead spawning, egg incubation, and fry emergence occurs from January into early June. A flow of 700 cfs would provide maximum spawning habitat in the reach above Daguerre Point Dam while a flow of 500 cfs would provide maximum habitat below Daguerre Point Dam. (DFG 26, p. 153, Table III-4a.)

Steelhead fry and juvenile rearing occurs throughout the year in all habitat types. (DFG 26, pp. 28 and 29.) Species distribution data for January and May indicate that young steelhead concentrate in the Garcia Gravel Pit Reach with lower numbers also observed in the Daguerre Point Dam Reach. (DFG 26, p. 26.) Flows of 100 cfs and 350 cfs would provide maximum fry and juvenile rearing habitat respectively in the Garcia Gravel Pit reach, provided water temperature and other requirements are met. (DFG 26, p. 151, Table III-2a and p. 152, Table III-3a.) Fry and juvenile rearing habitat in the Daguerre Point Reach would be maximized by flows of 150 and 250 cfs respectively. (DFG 26, p. 151, Table III-2a and p. 152, Table III-3a.)

American Shad: The IFIM/PHABSIM study was not used to establish a habitat streamflow relationship for American shad. American shad spawning occurs in the Daguerre Point Dam and Simpson Lane Reaches from late May through July. Egg incubation and rearing of fry and juvenile shad occurs in the Simpson Lane Reach from late May into November.

6.5.3 YCWA Evaluations of Instream Flow Study Relationships

In 1992, YCWA presented evidence questioning DFG's interpretation of the IFIM/PHABSIM model results. (YCWA 20, p. 3-3 and Appendix A.) YCWA described DFG's use of the model results as "fatally flawed" because DFG did not consider seasonal effects of tributary inflow from Dry Creek and Deer Creek or irrigation diversions at Daguerre Point Dam. YCWA reevaluated the model results and concluded that maximum habitat for the various life stages of salmon would be achieved with different streamflows above and below Daguerre Point Dam. YCWA's use of habitat curves also differed from the approach taken by DFG. In 2000, YCWA provided additional testimony on flow-habitat relationships for chinook salmon and steelhead. (S-YCWA 19, pp. [3-26]–[3-29].) Despite the different approaches, however, YCWA's approach led to the conclusion that maximum habitat is available at essentially the same streamflows shown by the DFG analysis. (See Table 4 below.)

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TABLE 4

COMPARISON OF STREAMFLOWS NEEDED TO PROVIDE MAXIMUM HABITAT FOR CHINOOK SALMON (CFS)

LIFE STAGE	GARCIA GRAVEL PIT REACH			DAGUERRE POINT DAM REACH		
	DFG*	YCWA** (1992)	YCWA*** (2000)	DFG*	YCWA** (1992)	YCWA*** (2000)
Spawning	700	700	700-800	450	400-550	450-525
Fry	100	100	100-150	100	100	100-150
Juvenile	150	150	150-250	200	200	150-250

Table Notes:
*DFG 26, pp. 131-133
**YCWA 20, p. 3-3 and Appendix A, presented in 1992
***S-YCWA 19, pp. [3-26] to [3-29], presented in 2000

Although there is little difference in the available habitat results developed by YCWA and DFG, the YCWA approach demonstrates the benefits of separately examining the fishery habitat available in the reaches above and below Daguerre Point Dam. Data in Table 4 above show that, for some life stages, optimum habitat would be provided at different flows in the sections of the river above and below the dam. (YCWA 20, p. 3-3 and Appendix A; S-YCWA 19, pp. [3-26]–[3-29].)

6.5.4 Minimum Streamflow Recommendations in 1992

In 1992, DFG presented comprehensive flow recommendations for fishery protection in the lower Yuba River that were supported by USFWS, CSPA, and Walter Cook. (R.T. III, 97:13-97:22; 105:19-106:3; R.T. III, 173:19-174:11; R.T. XIV, 179:1-179:13; R.T. XIII, 80:3-81:4; R.T. XII, 76:2-76:9.) DFG's recommended flows for protection of salmon, steelhead, and American shad in normal and wet years are shown in Table 5 below.

TABLE 5

DFG'S RECOMMENDED MINIMUM MEAN DAILY STREAMFLOWS FOR NORMAL AND WET YEARS (1992)

Time Period	Flow at Marysville Gage (cfs)
October 1 - March 31	700
April 1 - April 30	1,000
May 1 - May 31	2,000
June 1 - June 30	1,500
July 1 - September 30	450

The above recommendations were based partially on the IFIM analysis and partially on other factors including: juvenile salmon emigration flows, American shad attraction flows, water temperature concerns, historic flow patterns, and professional judgment. In dry years, DFG recommended that reductions in the flows specified above be done "equitably" with the same percentage reductions in instream flows and diversions for offstream uses. DFG recommended that such reductions be based on water available to permanent contracts existing on January 1, 1990. Under the DFG recommendation, diversions based on post January 1, 1990 contractual obligations would be reduced to zero before reductions in fishery flows would occur. (DFG 26, pp. xiii and 113; R.T. II, 176:1-177:13.)

DFG defined a dry year as less than 50 percent of the 50-year average unimpaired runoff in acre-feet at Smartville for the current water year as published annually in the May 1 Report of Water Conditions in California by the California Department of Water Resources. For the 63-year period of estimated unimpaired streamflows at Smartville (1921 through 1983), ten years would be classified as "dry" using the criteria proposed by DFG. (DFG 26, p. 22.)

6.5.5 1996 SWRCB Draft Decision Instream Flow Requirements

In 1996, SWRCB staff completed a Draft Decision that proposed new instream flow requirements for the protection of fish for the lower Yuba River. Flow requirements in the 1996 Draft Decision are shown in Tables 6 and 7 below. For purposes of the Draft Decision, "dry year" criteria were defined as recommended by DFG in 1992.

TABLE 6

SWRCB 1996 DRAFT DECISION MINIMUM AVERAGE DAILY STREAMFLOW REQUIREMENTS IN THE LOWER YUBA RIVER FOR NORMAL AND WET YEARS (cfs)

Period	Marysville Gage	Smartville Gage
October 15 - April 20	500	700
April 21 – April 30	1,000	-
May 1 – May 31	2,000	-
June 1	1,400	
June 2	980	-
June 3 – June 30	800	-
July 1	560	-
July 2	390	-
July 3 – October 14	250	-

TABLE 7

SWRCB 1996 DRAFT DECISION MINIMUM AVERAGE DAILY STREAMFLOW REQUIREMENTS IN THE LOWER YUBA RIVER FOR DRY YEARS (cfs)

Period	Marysville Gage	Smartville Gage
October 15 - April 20	500	700
April 21 – April 30	1,000	-
May 1 – May 31	1,100	-
June 1 – June 30	800	-
July 1	560	-
July 2	390	-
July 3 - October 14	250	-

6.5.6 Minimum Streamflow Recommendations in 2000

In 2000, DFG presented testimony that adoption of the 1996 SWRCB Draft Decision would provide a significant improvement in flows, water temperatures, and resultant habitat conditions for anadromous fish in the lower Yuba River compared to the requirements in the 1965 agreement. DFG also presented testimony that the recommendations in the Draft Decision are the minimum that should be implemented immediately, with additional provisions for water temperatures, and flow fluctuations and reductions. (S-DFG 1, p. 1; S-R.T. 1944:19-1944:23.)

NMFS recommended that the minimum flow provisions of the 1996 Draft Decision be adopted immediately, with additional provisions for spring-run chinook spawning flows, outmigration studies, water temperatures, and flow fluctuations and reductions. (S-NMFS 1A, pp. 5-8; S-R.T. 125:19-127:23.)

USFWS presented testimony that the minimum flow requirements in the 1996 Draft Decision represent appreciable improvement and that the SWRCB has adequate information to adopt the Draft Decision immediately. (S-R.T. 245:20-22.) However, the USFWS urged the SWRCB to implement the flows in the Anadromous Fish Restoration Program Working Paper which are consistent with the flows in the 1991 Fisheries Management Plan. (S-DOI 3; S-DOI 7; S-DOI 8; S-R.T. 245:23-251:13.)

CSPA recommended higher instream flow requirements for the lower Yuba River based on an analysis of the required flows in the lower American River and a comparison between the unimpaired runoff of the American and Yuba River Basins. (S-CSPA 2.)

In 2000, YCWA proposed minimum instream flow requirements, based on consideration of fishery needs, hydrology, and consumptive use needs. (S-YCWA 19, p. 4-1.) YCWA's proposed minimum instream flow requirements are 5-day running averages, with instantaneous flows never to be less than 90% of the applicable requirement. The water year types identified in YCWA's

proposal are defined by the Yuba River Index described in Exhibit S-YCWA 14. YCWA's proposed instream flows are shown in Table 8 below.

TABLE 8

INSTREAM FLOW REQUIREMENTS PROPOSED BY YCWA FOR THE LOWER YUBA RIVER (2000)

Time Period	Wet & Above Normal Years (cfs)		Below Normal Years (cfs)		Dry Years (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sep 15-Oct 14	700	250	550	250	500	250
Oct 15-Apr 20	700	500	700	500	600	400
Apr 21-Apr 30	--	1,000	--	900	--	400
May 1-May 31	--	1,500	--	1,500	--	500
Jun 1	--	1,050	--	1,050	--	400
Jun 2-Jun 30	--	800	--	800	--	400
Jul 1	--	560	--	560	--	280
Jul 2	--	390	--	390	--	250
Jul 3-Sep 14	--	250	--	250	--	250
Time Period	**Critical Years (cfs)**					
	Smartville Gage	Marysville Gage				
Sep 15-Oct 14	400	150				
Oct 15-Apr 20	600	400				
Apr 21	--	280				
Apr 22-Apr 30	--	270				
May 1-May 31	--	270				
Jun 1	--	195				
Jun 2	--	140				
Jun 3-Sep 14	--	100				

6.5.7 Analysis of Flows for Fishery Purposes Based on Physical Habitat Requirements

6.5.7.1 Instream Flows in Below Normal, Above Normal, and Wet Water Years

Extensive evidence regarding flows needed for fishery protection in the lower Yuba River was presented during the course of the hearing. As shown in Table 4, there is general consensus on streamflows needed to provide optimum habitat for chinook salmon and steelhead in the lower Yuba River.

In order to account for annual variations in hydrology, we concur with the use of the Yuba River Index developed by YCWA for use in establishing instream flow requirements for the lower Yuba River. (S-YCWA 14.) In analyzing instream flow requirements, consideration must be given to the locations of gaging facilities in relation to fishery habitat needs. There are USGS gages at Smartville and Marysville, but there are no flow measurement gages immediately above and below Daguerre Point Dam. Unmeasured accretions from the Yuba Goldfields augment flows measured at the Marysville gage several miles downstream of Daguerre Point Dam. (YCWA 2, p. 33.) Therefore, if flow measurement at the Marysville gage is relied on to protect habitat throughout the reach between Daguerre Point Dam and Marysville, the flow requirement at Marysville should be set at the upper end of the range of desirable flows. Our conclusions regarding fishery flow requirements for each period of the year are summarized below.

September 15 through mid-April: The primary fishery activities during this period are:

- Spring-run chinook spawning (mid-September through early November)
- Fall-run chinook upstream migration and spawning (late September through January)
- Late fall-run chinook upstream migration and spawning (January through April)
- Steelhead spawning (January through April)
- Egg incubation, fry emergence, fry rearing, and emigration (all chinook runs and steelhead)

The IFIM model results show that salmon and steelhead spawning habitat is maximized with flows in the Garcia Gravel Pit reach of 700 to 800 cfs, while spawning habitat below Daguerre Point Dam is maximized at lower flows of 500 cfs for steelhead and 400 to 550 cfs for chinook salmon. (Table 3.)

Providing adequate spawning, egg incubation, and rearing habitat for spring-run chinook is essential for the protection and recovery of the species within the range of its designated critical habitat. Spring-run chinook spawning begins in mid-September, but occurs only in the Garcia Gravel Pit Reach above Daguerre Point Dam. (S-DFG 8; S-DFG 9; S-R.T. 1949:17-19.) To

provide adequate habitat for spring-run chinook spawning and egg incubation in this reach, the NMFS recommended a minimum flow of 700 cfs at Englebright Dam beginning the second week of September in all water year types. (S-NMFS 1A, p. 6.) Instream flows proposed by YCWA are 700 cfs in above normal and wet years and 550 cfs in below normal years from September 15 to October 14 in the Garcia Gravel Pit Reach. (S-YCWA 19, p. 4-1.) Based on the evidence presented on the importance of providing adequate habitat for spring-run chinook spawning and egg incubation for recovery of the run, we conclude that a minimum flow of 700 cfs at the Smartville gage should be provided beginning on September 15. For the reasons discussed below, a minimum flow of 700 cfs should be maintained through April 20.

DFG recommended that a flow of 700 cfs also be provided for fall-run chinook spawning beginning October 1 of each year throughout the Garcia Gravel Pit and Daguerre Point Dam reaches. However, the record indicates that fall-run chinook normally do not begin spawning until about October 15. In addition, in the Garcia Gravel Pit Reach, a flow of 700 cfs provides maximum chinook salmon spawning habitat. A flow of 500 cfs provides maximum habitat below Daguerre Point Dam. Therefore, we conclude that flows for fall-run chinook spawning should begin on October 15 rather than on October 1. Beginning October 15, a flow of 700 cfs should be continued in the Garcia Gravel Pit Reach and a flow of 500 cfs should be provided in the Daguerre Point Dam reach. These flows are the same as those recommended by YCWA in below normal, above normal, and wet water years.

Steelhead spawning occurs from January through April in the Garcia Gravel Pit and Daguerre Point Dam reaches. Steelhead spawning habitat is maximized with flows in the Garcia Gravel Pit reach of 700 cfs; spawning habitat below Daguerre Point Dam is maximized with flows of 500 cfs. (DFG-26, p. 153, Table III-4a.) These flows, provided beginning on October 15 for fall-run chinook, should be continued through the steelhead spawning period.

DFG places a higher priority on providing salmonid spawning habitat and maintaining stable flows throughout the egg incubation and early rearing periods than on providing the maximum quantity

of rearing habitat for fry and juveniles. (DFG 26, pp. 81-83.) No evidence was presented that the total quantity of physical rearing habitat for fry and juvenile salmonids is a limiting factor in the lower Yuba River. The flows described above maximize spawning habitat for chinook salmon and steelhead. IFIM study results show that those flows will also benefit incubating salmon and steelhead eggs, but may not provide maximum physical rearing habitat for salmon and steelhead fry and juveniles. (DFG 26, pp. 131, 133, 151 and 153.)

DFG also presented evidence on the importance of maintaining sufficient flows to prevent dewatering of redds and to prevent stranding of juvenile fish. (DFG 26, pp. 81-82.) Chinook salmon redds and nursery habitat for fry commonly occur in shallow water along the edges of the river. Braided side channels provide habitat for spawning steelhead and rearing chinook salmon fry. (R.T. VIII, 120:17-121:13.) Maintaining relatively constant flows through mid-April serves to prevent these habitat areas from being dewatered. Fry and juvenile fish have the option of seeking more suitable rearing habitat downstream and the majority of salmon fry commonly emigrate or redistribute themselves within a few weeks of emergence. (R.T. II, 16:7-17:4; R.T. III, 20:14-24:5; 57:13-58:4.) Eggs in the gravel, however, are much more vulnerable to flow reductions.

Based on the evidence discussed above for the mid-September through mid-April period, we conclude that providing adequate habitat for fall and spring-run chinook salmon and steelhead spawning, and maintaining stable flows through at least the early rearing period for these species, is more important than providing maximum physical habitat for fry and juvenile lifestages. Therefore, we conclude that the minimum flows for fishery protection purposes during September 15 through October 14 of below normal, above normal, and wet water years should be 700 cfs at the Smartville gage and 250 cfs at the Marysville gage. (The 250 cfs requirement will be a continuation of the previous July 3 through September 14 flow requirement, described in detail below.) From October 15 through April 20 of the succeeding year, minimum flows should be 700 cfs at Smartville and 500 cfs downstream of Daguerre Point Dam, measured at the Marysville gage.

Mid-April through June: The primary fishery activities during this period are:

- Spring-run chinook juvenile rearing and emigration (outmigration of young fish), and adult upstream migration and holding[23] (April through June)
- Fall and late fall-run chinook juvenile rearing and emigration (April through June)
- Steelhead egg incubation, juvenile rearing and emigration (April through June)
- American shad upstream migration, spawning, and early rearing (late April through June)

The primary fishery consideration in the April through June period is to provide adequate flows for juvenile chinook salmon and steelhead emigration. No specific studies of flows needed for steelhead or chinook salmon emigration have been conducted in the lower Yuba River. (R.T. I, 212:25-215:15.) The results of the IFIM/PHABSIM analysis are not directly applicable to establishing flows during the spring emigration period.

DFG based its recommended flows of 1,000, 2,000 and 1,500 cfs at the Marysville gage during April, May, and June, respectively, on flow needs for emigration of yearling steelhead and juvenile chinook salmon (fall, late fall, and spring runs), maintenance of preferred water temperatures at the Marysville gage for various life stages of chinook salmon, and attraction and spawning of American shad. (DFG 26, pp. 82-83; R.T. II, 23:1-23:7.)

In the 1995 AFRP Working Paper, the USFWS made the same flow recommendations as DFG for April, May, and June, with the objective of improving conditions for juvenile salmonid rearing and emigration. (S-DOI 3; p. 3-Xc-16.) USFWS presented evidence that lack of suitable juvenile rearing and emigration conditions are factors that currently limit salmonid production in the lower Yuba River. Maintaining appropriate rearing and emigration flows would increase annual

[23] Following their upstream migration, adult spring-run chinook spend the summer (hold) in deep pools in the Narrows Reach until spawning in late September through early November.

salmonid production by decreasing juvenile mortality due to predation, thermal stress, and stranding. (S-DOI 3; p. 3-Xc-16.)

In 2000, NMFS recommended a study of the timing of smolt emigration and flow needs for the period April 1-June 30. The recommended study would include a variable spring interim flow schedule of 800, 1,500, and 2,000 cfs for a ten-year period. Migration rates at various flows, efficacy and potential water savings of pulsed flows and temporal variation in downstream movement would be investigated. (S-NMFS 1A, pp. 6-7; S-R.T. 126:9-126:25.)

Although a smolt emigration study would provide additional data on flow needs for chinook salmon emigration in the April through June period, the present record is sufficient to justify requiring minimum instream flows in the April through June period that balance the needs of all lifestages of target species in the lower Yuba River. As discussed below, the overall record supports establishing somewhat lower minimum flow requirements than recommended by DFG and USFWS for the April through June period.

The DFG flow recommendation of 1000 cfs during April is intended to increase survival of fall-run juvenile chinook salmon. However, the record indicates that emigration of juvenile chinook salmon from the lower Yuba River begins in late April, peaks in May, and is normally complete by the second week in June. (R.T. VIII, 124:3-127:3; R.T. XIV 168:13-169:11; YCWA 20, pp. 3-23; YCWA 80; YCWA 68, Figure 3-4, pp. 3-27.)

Since emigration does not normally begin until the last week of April, flows for juvenile salmon migration need not begin until that time. In addition, survival of emigrating juveniles may decline during June due to increased water temperature downstream of the Yuba River. Therefore, flows to protect juvenile salmon during downstream migration should occur before June.

The minimum flow requirements established in this decision for April through June are expected to provide adequate conditions for upstream migrating adult spring-run chinook salmon. DFG

presented testimony that the flow requirements in the 1996 Draft Decision for March through June are adequate to attract ascending spring-run adults into the lower Yuba River. (S-DFG 1, p. 2.) DFG presented evidence that American shad adults typically begin migrating into the Feather River system and the Yuba River from late April through June. (R.T. I, 183:20-184:14.) Attraction of American shad into the lower Yuba River is related to the proportion of flow in the Yuba River to the flow in the Feather River at the confluence. DFG presented testimony that the Yuba River should contribute at least one third of the combined Yuba/Feather River flows in order to attract adult American shad into the Yuba River. (R.T. I, 75:19-76:13.) Failure to provide sufficient attraction flows would reduce the overall spawning habitat utilized by American shad.

Creel census data was collected by DFG from 1981 to1983 and 1985 to 1987 to define the distribution of the American shad spawning population in the Sacramento River Basin in relation to streamflow and other factors. (CSPA, Exhibit CC.) When flows at the mouth of the Yuba River ranged from 200 to 400 cfs in the spring months, the American shad fishery in the lower Yuba River was almost non-existent. At flows ranging from 4,000 to 11,000 cfs, the fishery was excellent. (CSPA, Exhibit CC.) Field investigations of Yuba River American shad conducted by Jones and Stokes Associates in 1990 indicated that a flow of 300 cfs in the first half of May did not attract large numbers of shad into the lower river. Anglers were first observed in the lower river following an increase in discharge to 1,000 cfs in mid-May; with these flows continuing through the end of June, large numbers of shad and high angling success occurred below Daguerre Point Dam beginning the first week of June. (CSPA, Exhibit CC; YCWA 73, pp. 3-2 and 4-1.) We conclude that a minimum flow of 1,500 cfs in May, provided to protect chinook salmon and steelhead, would also provide adequate attraction and spawning flows for American shad in the lower river.

When lower Yuba River flows exceeded the 33 percent contribution to joint Yuba/Feather River flows during May, flows as low as 800 cfs during June appeared sufficient to continue attracting adult American shad into the lower Yuba River and to maintain suitable water temperatures for

American shad spawning. (CSPA, Exhibit CC.) Therefore, we conclude that a minimum flow requirement of 800 cfs during June is adequate for protection of American shad.

YCWA, South Yuba, and PG&E presented testimony in 1992 that the flows recommended by DFG for April through June may be detrimental to fry and juvenile chinook salmon rearing. As support for this contention, YCWA cited data from the Hallwood-Cordua fish screen that showed fewer entrained salmon at higher flow, and DFG beach seining data that showed fewer young salmon were caught during high flow years. (YCWA 20, Figs. 3-1 to 3-4; YCWA 21, p. 18; YCWA 80 and 84.)

The evidence does not establish, however, that increased flows in the spring months are harmful to juvenile chinook salmon or that fewer juvenile salmon are present in the river at higher flows. To the contrary, the USFWS analysis of the Hallwood-Cordua fish screen records indicates that the number of juvenile salmon entrained is related to the percent of total streamflow diverted, and not to the abundance of juvenile salmon in the river. (USFWS 17, pp. 3-15; R.T. VIII, 78:1-78-20; R.T. XIV, 162:8-165:4.) Thus, higher flows would serve to promote survival of juvenile salmon. Similarly, the beach seining data cited by YCWA and South Yuba does not establish the number of juvenile salmon in the river at a particular flow. Rather, as shown in evidence presented by YCWA and USFWS, beach seining is less likely to catch representative numbers or sizes of juvenile salmon during high flow years. (YCWA 80, p. 2; USFWS 18, p. 2; R.T. VIII, 131:7-135:85; 144:3-149:9.)

Testimony presented by YCWA and South Yuba suggests that increased flows in the spring months, April through June, may decrease water temperatures and result in slower growth of juvenile chinook salmon and delayed emigration from the lower Yuba River. Witnesses for YCWA and South Yuba testified that delayed emigration would result in lower survival of fish as they migrated through the lower Sacramento River and Delta where elevated temperatures may occur in the late spring. (S-SOUTH YUBA 2, pp. 21-24; S-YCWA 19, pp. [3-16]–[3-17]; S-YCWA 42; S-R.T. 798:15-799:5; S-R.T. 991:15-992:10; S-R.T. 2611:23-2613:22;

S-R.T. 2860:5–2863:22; S-R.T. 2869:12-2875:24.) As supporting evidence, YCWA and South Yuba presented data that indicate that the timing of juvenile chinook emigration was later in years with higher spring flows in the lower Yuba River. (S-YCWA 19, pp. [3-16]-[3-18]; S-YCWA 42; S-R.T. 590:23-591:16.)

Substantial evidence in the record indicates, however, that the spring flows adopted in this decision will not result in delayed emigration or lower survival of emigrating juvenile chinook. The relationship between timing of juvenile chinook salmon emigration and spring flows in the lower Yuba River presented by YCWA may not be valid due to the sampling method used for juvenile chinook. Sampling data were obtained from the Hallwood-Cordua fish screen trap. Testimony presented by DFG, YCWA, and South Yuba indicates that this trap was not operated over consistent time periods each year. (S-R.T. 1011:9-1016:17; S-R.T. 1236:20-1237:16; S-R.T. 2235:9-2238:3.) Therefore, use of the data for comparison of emigration timing between years may not be valid.

Evidence in the record also indicates that water temperatures in the lower Yuba River change very little in response to changes in streamflow. Relationships developed by YCWA to predict water temperature changes in the lower Yuba River show that a 1,000 cfs change in flow at Marysville during April or May would result in less than a one degree Fahrenheit change in water temperature at Marysville. (S-YCWA-18, p. 18.) The spring flows in this decision would therefore have an insignificant effect on spring water temperatures compared to recent historical conditions, and would not be expected to significantly reduce growth rates or delay emigration of juvenile salmonids.

In addition, the record indicates that there are no studies that support the theory that survival of juvenile chinook salmon from the lower Yuba River is lower in years with high spring flows. (S-South Yuba 2, p. 24; S-R.T. 2238:7-2238:21.) To the contrary, evidence presented by YCWA and USFWS shows that growth and production of juvenile chinook salmon in the lower Yuba River have been good during high flow years. (YCWA 80; USFWS 18: and R.T. XIV, 175:19-

176:2.) As discussed earlier, USFWS presented testimony that high, extended spring flows significantly increase the overall success of outmigrating chinook in returning to spawn as adults. (R.T. 2312:7-2312:19.) Adult spawning escapements of fall-run chinook salmon in the Central Valley are positively correlated to increased flow during their spring smolt outmigration period. (S-DOI 9.)

South Yuba also argued that outmigration of chinook salmon smolts is stimulated by changes in flow and that maintaining stable flows throughout the spring outmigration period may result in delayed migration. (S-South Yuba 2, pp. 14-18.) However, USFWS witnesses testified that a sustained flow throughout the chinook salmon and steelhead spring outmigration period would likely result in better survival than a shorter duration pulse flow. USFWS presented testimony that providing sustained flows that allow fish to outmigrate when they are physiologically ready to migrate is more effective than providing shorter duration pulse flows that may or may not match the timing of physiological readiness. (S-R.T. 358:9-359:21.)

July through September 14: The primary fishery activities during this period are:

- Steelhead juvenile and yearling rearing (July through September)
- Steelhead adult upstream migration (August and September),
- Late fall-run chinook salmon juvenile rearing (July through September),
- Spring-run chinook salmon upstream migration and holding (July through September),

Based on historical unimpaired flows, DFG recommended a minimum flow of 450 cfs at the Marysville gage from July through September for the protection of steelhead rearing in the Daguerre Point Dam reach. (DFG 26, p. 109.) Flows upstream of Daguerre Point Dam would be higher due to water releases from Englebright Reservoir for irrigation. (R.T. I, 116:12-116:16; 131:6-131:9; DFG 26, p. 110.)

A flow of 450 cfs, as recommended by DFG, exceeds the 250 cfs that would provide maximum weighted useable area for juvenile steelhead, but DFG contends that the higher flows will be

needed to maintain water temperature within a range suitable for rearing steelhead. (DFG 26, p. 109.) Observations by a field biologist, however, indicate that streamflows in the range of 250 cfs have been suitable for maintaining juvenile steelhead habitat in the Daguerre Point Dam reach from July through September. (YCWA 76, p. 8; YCWA 20, pp. E-12 and E-13; PG&E 2, pp. 4 and 5; R.T. VIII, 77:2-77:15.) Based on their similar life histories, it is reasonable to assume that the habitat needs of late fall-run chinook salmon will also be met at a flow of 250 cfs.

A flow of 250 cfs should also be sufficient to provide adequate passage for steelhead and spring-run chinook salmon that migrate upstream during this period. IFIM/PHABSIM model results indicate that a minimum flow of 175 cfs is needed for adequate passage of adult chinook salmon over shallow riffles in the lower Yuba River. (DFG 26, pp. 93 to 95; R.T. I, 103:17-104:12; R.T. I, 187:20-189:19 and 196:1-196:6.) Based on the evidence discussed above, we conclude that the minimum flow requirement for July through September 14 should be 250 cfs, measured at the Marysville Gage. The subject of suitable water temperatures is addressed in Section 6.6 below.

6.5.7.2 Instream Flows in Dry and Critical Water Years

Extensive evidence was presented on the impact of instream flows required in the 1996 Draft Decision on water available for consumptive use, particularly in dry and critical water year types. (S-YCWA 16.) As in all Central Valley rivers, flows in the lower Yuba River are highly variable on an annual basis. Based on the evidence of flows needed for fishery protection and competing demands for water for offstream uses, we believe it is reasonable during certain time periods to reduce the minimum flow requirements in dry and critical water years.

In the DFG instream flow recommendations, a dry year was defined as less than 50 percent of the 50 year average impaired runoff in acre-feet at Smartville as published annually in the Department of Water Resources May 1 Report of Water Conditions in California. (DFG 26, pp. 112-113.) In 2000, YCWA presented a revised water year classification system for the lower Yuba River, the Yuba River Index. (S-YCWA 14.) We concur with the use of the more detailed classification system presented by YCWA and have separated flow requirements in this decision into the five

water year types defined by the index. (Appendix 1.) In addition, this decision establishes an extreme critical year classification based on criteria used in the Yuba River Index.

The Yuba River Index is based on the estimated unimpaired flow at Smartville for each water year, as published in California Department of Water Resources Bulletin 120. Flow requirements for each water year under this decision are based on the April 1 forecast of the unimpaired flow at Smartville for the water year, which includes hydrologic conditions to date plus forecasts of runoff for the remainder of the year, assuming normal precipitation for the remainder of the year. Requirements established on April 1 would remain in effect through March 31 of the following year.

Providing adequate spawning, egg incubation, and early rearing habitat for spring-run chinook salmon from September 15 through October 14 in the Garcia Gravel Pit Reach is essential for the protection and recovery of the run. As discussed in section 6.5.7, a flow that supports optimum habitat for spring-run spawning (700 cfs) should be provided in below normal, above normal, and wet water years. However, under unimpaired conditions, flows at Smartville in September and October of dry and critical years frequently were less than 700 cfs. (DFG 26, pp. 18-21.) YCWA proposed flows of 500 and 400 cfs, respectively, in dry and critical water years from September 15 through October 14 at the Smartville gage. (S-YCWA-19, p. 4-1.) In view of the lower flows under unimpaired conditions, we believe that the flows proposed by YCWA for September 15 to October 14 will provide reasonable protection for spring-run spawning and early rearing, while preserving a substantial quantity of water for other purposes.

Mimimum flows of 700 cfs at the Smartville gage and 500 cfs at the Marysville gage for the October 15 through April 20 period were established to provide optimum habitat for fall and spring run chinook salmon and steelhead spawning, egg incubation and rearing. To conserve water in dry and critical years, we believe it is reasonable to reduce this flow requirement to 600 cfs and 400 cfs, at the Smartville and Marysville gages, respectively. The IFIM studies show that these minimum flows should provide at least 98 percent of optimum habitat for chinook salmon

spawning and rearing, and at least 94 percent of optimum habitat for steelhead spawning and rearing.

Testimony provided by YCWA suggests that flows in the range of 1,100 cfs during the last two weeks of May in 1990 were sufficient to improve the American shad fishery compared to the previous dry years. (YCWA 73, pp. 3-2 and 4-1.) A flow of 1,100 cfs at Marysville during May, however, may result in lower survival of emigrating juvenile chinook salmon and steelhead than would occur at 1,500 cfs. To minimize impacts on chinook salmon and steelhead but conserve water for other purposes, we believe it is reasonable to reduce the flow requirement in May to 1,100 cfs in critical water years, as measured at the Marysville gage.

The 1996 SWRCB Draft Decision included a lower flow requirement of 1,100 cfs in May in dry water years, defined as less than 50 percent of the 50 year average impaired runoff in acre-feet at Smartville. Even with this lower flow requirement, however, operations modeling conducted by the SWRCB showed that instream flow requirements in the 1996 Draft Decision would have severe impacts on water deliveries at Daguerre Point Dam in some critical water years. (S-SWRCB 1; S-SWRCB 3, Table A-22.) Over the 71 year period of record, 50 percent deficiencies in deliveries were modeled in water years 1924, 1931, 1934, 1976, and 1977 at the present level of demands. Deficiencies of this magnitude (over 155,000 acre feet) are too great to be made up with conjunctive use of groundwater in a single season without adverse effects on the groundwater basin.

Analysis of those years where severe deficiencies occurred shows that the Yuba River Index, calculated using unimpaired flow data (DFG-26, p. 19) and YCWA methodology (S-YCWA 14), was less than 540,000 acre-feet (540 TAF). To reduce impacts to water deliveries in the spring months of those extremely critical years, we believe it is reasonable to reduce the required instream flows from April 21 through June 30 to 500 cfs, measured at the Marysville gage. The 500 cfs flow requirement will apply only in those years when the Yuba River Index is predicted to be less than 540 TAF.

A minimum flow of 500 cfs in the spring months of extreme critical years may result in lower survival of emigrating juvenile chinook salmon and steelhead, and reduced spawning and rearing success of American shad, than with the higher minimum spring flows in other water year types. However, extreme critical water years occur rarely, in fewer than 10 percent of water years. Minimum flows of 500 cfs will provide higher minimum flows than are now required and promote a reasonable balance between fishery protection and consumptive water uses in extreme critical water years.

6.5.8 Flow Fluctuations and Reductions

Fluctuations and reductions in streamflow can cause dewatering of salmonid redds and stranding of fry and juvenile fish. (DFG 26, pp. xiii and 113; R.T. I, 132:3-132:9.) For purposes of this decision, daily streamflow fluctuations are considered to be changes in flow that occur on a regular daily basis which are generally associated with daily operations of hydroelectric power generation or deliveries to water diverters. Streamflow reductions are considered to be planned reductions in flow for more than a day such as those associated with changes in instream flow requirements, reservoir flood reservation requirements, deliveries to offstream diverters, water transfers and downstream salinity intrusion control. Changes in flow that occur due to storm events are not considered to be fluctuations or reductions subject to regulation as a condition of a water right permit or license.

Provisions of 1965 Agreement: The 1965 agreement provides that daily streamflow fluctuations during the period of October 16 through March 31 shall not cause releases to vary by more than 15 percent from the scheduled uniform releases and that flow variance shall be minimized where possible. During January 16 through October 15, project flow releases from Englebright Reservoir for start-up, shutdown, and operation of the Narrows Power Plant may not fluctuate more than 500 cfs per hour and hourly releases are to be as gradual as possible. Flow reductions between October 15 and October 31 must be no more than 35 percent of the flow during the preceding seven day period, and the reduction in average flow from November 1 to November 30 must be no

more than 15 percent of the average flow during the preceding seven day period. Fluctuations in streamflow are to be measured at the USGS gaging station below Englebright Dam.

Although various lifestages of salmon, steelhead and American shad are present in the lower Yuba River throughout the year, the 1965 agreement regulates changes in flow only during certain months. For the Yuba River downstream of Englebright Reservoir, the agreement contains no requirements governing flow reductions between December 1 and January 15 when salmon and steelhead eggs are incubating and fry are present. The agreement also does not include flow fluctuation limitations from April 1 through October 15 when salmon and steelhead rearing occurs and American shad spawning occurs.

Analysis of the Evidence on Criteria for Flow Fluctuation and Reduction: DFG's Fisheries Management Plan includes revised recommendations for regulation of daily flow fluctuations and flow reductions. (DFG 26, pp. xiii-xv.) The evidence presented does not demonstrate that the existing 15 percent daily streamflow fluctuation limitation is inadequate, except for the fact that it presently is not in effect throughout the year. Extending the present 15 percent daily streamflow fluctuation limitation to scheduled releases throughout the year would provide additional protection against stranding fish and dewatering eggs.

In 1992, DFG proposed weekly flow fluctuation limitations of plus or minus 200 cfs during May and plus or minus 150 cfs during June to promote American shad spawning and angler success. (DFG 26, p. 114; R.T. I, 77:1-77:17; R.T. II, 33:4-37:8.) Studies on the Feather River indicate that flow fluctuations resulting in water temperature changes of plus or minus three degrees Fahrenheit can affect American shad spawning activity. (DFG 26, p. 80; R.T. I, 77:6-77:17; R.T. II, 33:4-37:8.) The magnitude of flow change that will result in a three degrees Fahrenheit change in water temperature, however, is not known with certainty. Therefore, there is insufficient evidence to adopt the 150 cfs and 200 cfs limitation on weekly streamflow fluctuations proposed by DFG.

DFG also recommended that daily streamflow reductions should not exceed more than 30 percent of existing flows. For example, streamflow reductions between May and June during a normal or wet water year would be accomplished by reducing the minimum flow on a gradual basis by no more than 30 percent every 24 hours. Thus, the 2,000 cfs minimum flow in May could be gradually reduced ("ramped" down) by as much as 600 cfs during the first day of flow reductions. Applying the same streamflow reduction criteria on a year-round basis is reasonable due to the presence of various life stages of anadromous fish susceptible to flow fluctuations throughout the year.

To further reduce impacts to spawning salmon and steelhead, DFG proposed additional criteria in 1992 for October through March to prevent redd dewatering and stranding of fall-run chinook salmon and steelhead fry. In 2000, DFG recommended that flows occurring on September 1 should be maintained thereafter to prevent dewatering of redds, and loss of incubating eggs and emerging spring-run chinook salmon. (S-DFG 1, p. 4; S-R.T. 1957:5-1957:11.) DFG recommends that flow reductions of no more than 300 cfs should occur after September 1. (S-DFG 1, p. 4.)

YCWA conducted an analysis which utilized transect data from DFG's IFIM/PHABSIM study to determine the effect of flow reductions on redd dewatering and fry stranding. The analysis indicates that about one percent of the redds present above and below Daguerre Point Dam at a particular time are likely to be stranded when flows drop from 1,000 cfs to 700 cfs. About three and one half percent would be stranded when flows drop from 1,200 cfs to 700 cfs, and about ten percent would be stranded by a flow reduction from 1,500 to 700 cfs. (YCWA 20, pp. C-1 to C-6.)

Field evaluation data on the effects of a flow reduction of 2,000 cfs to about 850 cfs during October 1990 as measured in the Yuba River at Marysville show that the YCWA analysis would provide a reasonable basis on which to establish flow reduction requirements. (Testimony

presented during the January 1, 1992, SWRCB hearing on streamflows and temporary flow requirements in the lower Yuba River, R.T. from January 1, 1992, 138:8-139:5.)

Spring-run chinook salmon spawning begins in mid-September, while most fall-run chinook salmon and steelhead spawning and egg incubation occurs in October and subsequent months. The information in the YCWA dewatering analysis indicates that establishing a limit of 45 percent on flow reductions from September 15 through the end of October would result in protecting at least 90 percent of the redds present in September and October against dewatering. Establishing a limit of 35 percent on flow reductions from November through March, when fall-run chinook salmon and steelhead spawning are at a peak, would result in protecting at least 95 percent of the redds present during that period.

In addition to the flow reduction criteria identified above, establishing a flow reduction limitation of 30 percent during any 24-hour period would reduce stranding of fry. Due to the importance of minimizing dewatering of redds and fish stranding, YCWA should be required to consult with DFG and USFWS and to conduct field monitoring to verify that the specified flow reduction criteria provide adequate protection against dewatering and stranding.

In 2000, DFG recommended that no flow reductions of more than 300 cfs should occur after September 1, for the protection of spring-run eggs and fry. DFG based that recommendation on verbal information from YCWA, that a 100 cfs flow change results in approximately a 2-inch water surface elevation change. Spring-run spawning occurs at depths of 0.5 feet to over 3 feet, with an average depth of 1.85 feet. Due to the observed shallow depth (6 inches) of spring-run redds, DFG concluded that flow changes of greater than 300 cfs would impact spring-run redds, incubating eggs and emerging fry. (S-DFG 1, p. 3.)

We find that the verbal information that DFG received from YCWA on the relationship of flow changes to changes in water surface elevation is not sufficient to justify further limitations on flow fluctuations. Changes in water surface elevation depend on many factors, including the initial flow

rate and channel morphology at a particular location. The relationship between flow and water surface elevation referred to by DFG is not supported by YCWA's previous analysis of the IFIM data. YCWA's previous, more detailed analysis appears to provide more accurate information on the incremental change in water surface elevation with changes in flow. Therefore, we conclude that limiting flow reductions to 300 cfs after September 1 would be overly protective. Other limitations on flow reductions established in this decision should provide adequate protection for spring-run spawning and egg incubation. Similarly, we find that the NMFS recommendation that any reductions or fluctuations in flow during the spawning and egg incubation period of the listed salmonids should be prohibited is overly protective and would not be feasible in the course of real-time project operations.

The flow fluctuation criteria proposed by YCWA were intended to apply only to YCWA-controlled releases for project purposes. (S-YCWA 19, p. 4-2.) YCWA did not intend these criteria to apply to releases made for flood control purposes, releases of uncontrolled inflows into Englebright Reservoir, uncontrolled spills, or releases made for out-of-county water transfers that would be subject to independent environmental review. We concur that the criteria cannot apply when flood control releases are made, uncontrolled inflows into Englebright Reservoir are bypassed, or uncontrolled spills occur. However, since the purpose of the fluctuation criteria is the protection of anadromous salmonid resources in the lower Yuba River, the flow fluctuation criteria should apply to releases for all other purposes whenever releases are under the control of the project operator.

During the 2000 hearing, YCWA presented testimony that minimum instream flow requirements should be measured on 5-day running averages, with the instantaneous flow never to be less than 90 percent of the applicable requirement. Measuring minimum flow requirements in that manner would allow YCWA to avoid having to release substantial amounts of additional water to ensure that it is meeting the minimum flows. (S-YCWA 11, p. 5.) No party presented any evidence that this proposal would adversely affect fish and the SWRCB concludes that, in this instance, it is a reasonable method of measuring compliance with the minimum instream flow requirements.

6.5.9 Summary of Flow Requirements for Fishery Protection

The relationship between competing demands for water from the lower Yuba River and the requirements established for protection of lower Yuba River fishery resources is addressed in Section 8 through 8.4 of this decision. Appendix 5 of this decision contains graphs showing the instream flow recommendations of the DFG Fisheries Management Plan, YCWA's instream flow recommendations at the 2000 hearing, and the minimum instream flow requirements established in this decision for each water-year type. Based on the findings above, the SWRCB's conclusions regarding flow requirements for fishery protection purposes in the lower Yuba River can be summarized as follows:

1. The minimum average daily streamflows needed for protection of fish in the lower Yuba River are specified in Table 9 below. The minimum requirements should be maintained based on a 5-day running average of daily streamflows with instantaneous flows never less than 90 percent of the applicable requirement. From September 15 to April 20, flows should be measured at the Smartville and Marysville gages. During the remainder of the year, minimum flows should be measured at the Marysville gage. Although gaging requirements during some periods will be only at Marysville, the SWRCB's intent is that the flows specified below also be maintained immediately downstream of Daguerre Point Dam.

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TABLE 9

MINIMUM AVERAGE DAILY STREAMFLOW REQUIREMENTS IN THE LOWER YUBA RIVER

Periods	Wet, Above Normal & Below Normal Years (cfs)		Dry Years (cfs)		Critical Years (cfs)		Extreme Critical Years (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sept. 15 - Oct 14	700	250	500	250	400	250	400	250
Oct 15 - Apr 20	700	500	600	400	600	400	600	400
Apr 21 - Apr 30	--	1,000	--	1,000	--	1,000	--	500
May 1 - May 31	--	1,500	--	1,500	--	1,100	--	500
Jun 1	--	1,050	--	1,050	--	800	--	500
Jun 2	--	800	--	800	--	800	--	500
Jun 3 - Jun 30	--	800	--	800	--	800	--	500
Jul 1	--	560	--	560	--	560	--	500
Jul 2	--	390	--	390	--	390	--	390
Jul 3 - Sept. 14	--	250	--	250	--	250	--	250

* "Extreme Critical" year classification is defined as: Equal to or less than 540 TAF on the Yuba River Index scale.

2. For purposes of this decision, wet, above normal, below normal, dry and critical water year types are as defined in the Yuba River Index. (S-YCWA 14.) Extreme critical water years are defined as years when the Yuba River Index is predicted to be less than 540 TAF. Determination of water year classification shall be made on April 1 of each year, in accordance with the forecast of unimpaired flow of the Yuba River at Smartville published in California Department of Water Resources Bulletin 120. The year type for the preceding water year will remain in effect until April 1 when the current year forecast is available.

3. Flow fluctuation criteria identified in paragraphs 3 through 6 herein should apply whenever releases are under the control of the project operator. These criteria shall not apply to releases made for flood control purposes, bypasses of uncontrolled inflows into Englebright Reservoir, or uncontrolled spills. YCWA's permits should be amended to provide that daily streamflow releases below Englebright Dam shall not vary by more than 15 percent of the scheduled release except during periods when flows are beyond control of the project operator. Project releases or bypasses that increase streamflow downstream of Englebright Dam should not exceed a rate of change of more than 500 cfs per hour.

4. To prevent stranding of fry, project releases or bypasses that reduce streamflow downstream of Englebright Dam shall be gradual and, during any 24-hour period, should not be reduced below 70 percent of the prior day's flow release or bypass flow.

5. To prevent dewatering of salmon redds during the period from September 15 to October 31, YCWA's permits should be amended to provide that flows may not be reduced below 55 percent of the maximum release that has occurred during the period of September 15 to October 31, or the minimum streamflow requirement that would otherwise apply, whichever is greater.

6. To prevent dewatering of salmon redds between November 1 to March 31, YCWA's permits should be amended to provide that releases from Englebright Reservoir may not be reduced below the minimum release or bypass established under paragraph 5 above, or 65 percent of the maximum flow release that has occurred during the period from November 1 to March 31, or the minimum streamflow requirement that would otherwise apply, whichever is greater.

7. To ensure that salmon and steelhead redds and fry are adequately protected from dewatering or stranding, YCWA should be required to conduct further field monitoring of the effects of flow fluctuations in conjunction with DFG and USFWS for a period of time agreed to by DFG and USFWS. If YCWA, DFG, and USFWS cannot reach an agreement regarding the appropriate period of time for this monitoring, then YCWA may request the Chief of the Division of Water Rights to determine an appropriate time period. Summary reports of said monitoring covering the year ending the previous September 30 should be submitted annually to the SWRCB by December 31, and a final report should be submitted within one year of completion of the study.

8. Daily streamflow fluctuations and/or streamflow reductions are to be monitored at the Smartville gage. YCWA's permits should be amended to provide for construction of any

gages necessary to measure and verify compliance with the minimum flow and flow fluctuation requirements of this decision.

9. In accordance with the criteria discussed in Section 8.4 below, the instream flow requirements established in this decision are subject to temporary modification based on projected deficiencies in the amount of surface water available for offstream uses.

6.6 Water Temperature Requirements for the Protection of Fishery Resources

Maintaining suitable water temperatures for anadromous fish is an essential element of providing habitat to maintain fish in good condition. Improvement of water temperature conditions in the lower Yuba River for salmon, steelhead, and American shad was one of the intended purposes of the New Bullards Bar Reservoir project. (R.T. IV, 251:7-253:23; R.T. V, 40:7-40:13.) In 1966, YCWA received a grant from the Department of Water Resources under the Davis-Grunsky Act to construct an adjustable subsurface intake structure at New Bullards Bar Reservoir to allow for releasing water from different depths in order to provide "to the maximum extent feasible" water between 46 degrees Fahrenheit and 56 degrees Fahrenheit in the lower Yuba River during October 1 through March 31. (CSPA AA, pp. 39-42.) The reservoir outlet control gates at the dam provide the ability to release water from different levels, from near the surface at elevation 1,956 feet to a low-level outlet at elevation 1,638 feet. (S-YCWA 18, p. 7.)

Section 3.3 of YCWA's 1965 agreement with DFG provides that YCWA is to operate the facilities at New Bullards Bar Dam "so as to provide water temperatures comparable to or better than present values with regard to fishery resources." (DFG 26, p. 190.) Since completion of New Bullards Bar Reservoir in 1969, water temperatures downstream of Daguerre Point Dam near Marysville have generally been: (a) warmer from around mid-March to mid-June, (b) cooler from around mid-June to mid-December, and (c) about the same from mid-December to mid-March,

compared to pre-New Bullards Bar conditions. (DFG 26, pp. 46 and 47; R.T. I, 92:15-92:24; S-YCWA 19, p. 3-9.)[24]

In 2000, YCWA presented testimony that, under the operational procedures that it began in 1993, the low-level outlet at New Bullards Bar Dam is used for water releases throughout the year. (S-YCWA 11, pp. 2-3; S-YCWA 18, p. 7; S-R.T. 1349:12-1349:13.) A Temperature Advisory Committee, convened by YCWA with representatives from the DFG and the USFWS, established these criteria in 1993 after review of relevant data including reservoir temperature profiles and termperature modeling data. (S-YCWA 18, p. 7; S-R.T. 1349:14-1349:23.)

In 1999, YCWA submitted a proposal for Proposition 204 funding for the Narrows II Powerhouse Intake Extension Project. (S-SWRCB 12; S-R.T. 1520:4-1520:23.) The project would extend the intake of the powerhouse to allow the cooler water that is present at lower levels of Englebright Reservoir to flow through the Narrows II Powerhouse and into the lower Yuba River. Construction of the project would allow water temperatures at the powerhouse release to be lowered by an estimated 2 to 6 degrees Fahrenheit from May through October. (S-SWRCB 12.)

6.6.1 Water Temperature Requirements for Anadromous Fish

DFG presented testimony that water temperature is the primary factor influencing growth and survival of chinook salmon, steelhead and American shad in the lower Yuba River. (R.T. I, 88:10-90:2.) YCWA and South Yuba also presented testimony on the effects of water temperature on growth and survival of salmonids. (YCWA 20, 68 and 80; South Yuba 20 and 21.)

Water temperatures preferred by chinook salmon, steelhead and American shad in the lower Yuba River vary with the time of year, life stage and species. (DFG 26, pp. 41-43 and 47-63; R.T. I, 93:16-94:8.) When water temperature is above the preferred range, mortality rates increase,

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[24] YCWA introduced evidence that between completion of New Bullards Bar Reservoir in 1969 and 1993, DFG directed YCWA to release water as warm as possible from New Bullards Bar Reservoir starting in April of each year and to release as cool water as possible starting in September of each year. (S-YCWA 11, p. 2.)

growth rate is reduced, and susceptibility to disease is increased. (DFG 26, p. 41; South Yuba 21, p. 15; R.T. XI, 7:15-8:25.) When temperature drops below the preferred range, growth rate is reduced and survival can also decrease. (DFG 26, p. 41.) California is at the southern end of the species range for salmon and steelhead, and the streams have a tendency to be warmer than streams in the northern end of the range. Consequently, water temperatures preferred or tolerated by salmon and steelhead in the lower Yuba River may be at the upper end of the preferred temperature range. (R.T. II, 9:7-10:2; R.T. X, 211:18-212:3.)

In 1992, DFG presented evidence regarding water temperature ranges preferred by the various life stages of fall-run and spring-run chinook salmon, steelhead, and American shad. The evidence on preferred water temperatures, shown in Table 10, was developed by DFG based on their review of several water temperature studies.

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TABLE 10

PREFERRED TEMPERATURE RANGES FOR ANADROMOUS FISH (°F)

LIFE STAGE	CHINOOK SALMON		STEELHEAD	AMERICAN SHAD
	FALL-RUN	SPRING-RUN		
Spawning Migration	44.1-57.5	37.9-55.9	46.0-52.0	48.9-66.2
Spawning	41.0-57.0	40.0-57.0	39.0-52.0	59.0-70.0
Egg Incubation and Emergence	41.0-57.9	41.0-57.9	48.0-52.0	57.9-66.0
Fry Rearing	44.6-57.2		55.0-60.1	59.9-69.8
Juvenile Rearing	45.1-58.3		45.1-60.1	59.9-69.8
Adult Holding		≤ 77.0		

No water temperature data were available for spring-run chinook salmon fry and juvenile rearing, but the species are so similar that it is reasonable to assume the temperature preferences are similar to that of fall-run chinook salmon. (DFG 26, p. 44.) Preferred water temperatures of adult spring-run chinook salmon holding in freshwater during the summer months can range from less than 60 degrees Fahrenheit to as high as 77 degrees Fahrenheit. (DFG 26, pp. 9 and 42.) Testimony presented by YCWA in 1992 generally concurred with DFG that the optimum water temperature for spawning salmon ranges from 46 to 56 degrees Fahrenheit. (R.T. IX, 162:5-162:6.)

In 2000, YCWA summarized optimum temperature ranges reported in the fisheries literature for various life stages of chinook salmon, steelhead and American shad. (S-YCWA 19, pp. [3-24]-[3-25].) These temperature ranges were similar to those reported by DFG in 1992. However, YCWA also reported the results of a recent study by Drs. Cech and Myrick of temperature effects on juvenile steelhead and chinook salmon acquired from the Nimbus Fish Hatchery. (S-YCWA 19, pp. [3-25]–[3-26].) YCWA consultants testified that juvenile steelhead and chinook

salmon in the study exhibited higher preferred temperature ranges than reported by other researchers. The YCWA consultants also testified that Nimbus steelhead used in the study preferred temperatures between 17°C and 20°C (62.6° - 68°F), irrespective of food ration level or rearing temperature, and Nimbus chinook salmon reached maximum growth at 19°C (66.2°F). (S-YCWA 19, pp. [3-25]-[3-26].)

DFG biologists dispute that the Cech and Myrick report concludes that 66.2°F was "optimal" for juvenile chinook salmon or juvenile steelhead. (S-DFG 36, p. 25; S-DFG 38, p. 5; S-RT 2443:13-2452:22.) DFG testified that "optimal" temperatures for salmonids occur at preferred temperatures and maximum food conversion efficiencies. (S-DFG 38, p. 2.) The DFG witnesses emphasized that the report states: (1) there were no significant differences between mean or final preferred temperatures of any treatment; (2) there were no significant temperature effects on full ration salmon gross conversion efficiencies; and (3) it is premature to conclude that the optimum temperature for Central Valley steelhead is 19 degrees Centigrade (66.2 degrees Fahrenheit). Thus, DFG concluded that the study did not show higher preferred temperature ranges than reported by other researchers. (S-DFG 38, p. 6; S-RT 2450:1-2451:5.)

6.6.2 Water Temperature Records

In 1992, water temperature data were presented for the 1973 through 1978 period from the U.S. Geological Service (USGS) gages at Smartville (below Englebright Dam) and near Marysville. (DFG 26, pp. 47 and 48.) In 2000, YCWA presented temperature data for the lower Yuba River at the Marysville gage during three periods for which temperature data were available: 1965-1968, 1974-1977, and 1989-1999. YCWA testified that the Yuba River Development Project has been operated differently since the 1976-1977 drought and, thus, temperatures for the 1989-1999 period are more representative of current operations. (S-YCWA 18, pp. 2-3.)

6.6.3 Water Temperature Recommendations

In 1992, DFG presented water temperature recommendations for fisheries protection in the lower Yuba River. The DFG recommendations were supported by the USFWS, CSPA, and Walter Cook. (R.T. III, 173:19-174:11; R.T. XIV, 179:1-179:13; R.T. XIII, 80:3-81:4 and R.T. XII, 76:2-76:9.) The mean daily water temperatures for normal and wet years recommended by DFG in 1992 are shown below in Table 11:

TABLE 11

DFG'S RECOMMENDED MEAN DAILY WATER TEMPERATURE REQUIREMENTS FOR NORMAL AND WET WATER YEARS (°F) (1992)

TIME PERIOD	DAGUERRE POINT DAM	MARYSVILLE
October 1 - March 31	56	57
April 1 – April 30	60	60
May 1 – May 31	--	60
June 1 – June 30	--	65
July 1 – August 31	65	--
Sept 1 – Sept 30	--	65

DFG's 1992 water temperature recommendations were at or above the upper limit of preferred water temperature ranges for salmon and steelhead. DFG explained that the recommended water temperatures for chinook salmon and steelhead represent a compromise between the desired temperatures and the feasibility of providing those temperatures. (R.T. II, 197:11-199:1.) The 60 degrees Fahrenheit recommendation at Marysville during April and May for rearing chinook salmon was made with the recognition that water temperatures upstream of Marysville would be cooler and that American shad would benefit during May. (R.T. III, 8:2-8:15; R.T. III, 7:24-8:6.) In 2000, DFG and NMFS presented revised water temperature recommendations based on the need for protection of all lifestages of spring and fall-run chinook salmon and steelhead in the lower Yuba River, particularly the listed species. DFG presented testimony that the proposed temperature requirements in the 1996 Draft Decision did not adequately address the specific needs of spring-run chinook salmon or steelhead and that the listing of these species makes it imperative

to maintain the water temperatures necessary to protect them. DFG and NMFS recommend establishing the maximum water temperatures shown in Table 12. (S-DFG 1, p. 4; S-NMFS 1A, pp. 7-8; S-R.T. 127:1-127:5; S-R.T. 1956:14-1957:4; S-R.T. 1966:24-1968:4; S-R.T. 1970:20-1971:6.)

TABLE 12
DFG and NMFS REVISED RECOMMENDED WATER TEMPERATURE REQUIREMENTS (°F) (2000)

TIME PERIOD	DAGUERRE POINT DAM	MARYSVILLE GAGE	TARGET SPECIES
Oct. 1 – June 30	56	56	Spring-run, fall-run chinook, steelhead
July 1 – Sept. 30	56	60	Spring-run, fall-run chinook, steelhead

The above recommendations are based primarily on the following lifestage needs. Spring-run chinook adults over-summer in the lower Yuba River from June through September or October and spawn from early September through mid-October. The temperature of 56 degrees Fahrenheit at Daguerre Point Dam would provide protection for these lifestages, based on recent research by USFWS on temperature effects on Sacramento River fall and winter-run chinook. (S-DFG 1, p. 3; S-DFG 10; S-R.T. 1950:19-1951:14; S-R.T. 1956:14-1956:20; S-R.T. 1965:3-1965:23.) Substantial numbers of juvenile steelhead move downstream below Daguerre Point Dam throughout the summer. DFG presented testimony that it is important to provide a water temperature of 60 degrees Fahrenheit below Daguerre Point Dam during the summer for juvenile steelhead rearing. (S-DFG 1, p. 3; S-R.T. 1951:15-1952:2; S-R.T. 1956:25-1957:4.)

6.6.4 Feasibility of Achieving Recommended Water Temperatures

YCWA presented testimony that maintaining the water temperatures in the 1996 Draft Decision, and those recommended by DFG and NMFS in 2000, would not be feasible through operation of the existing project facilities. The channel of the lower Yuba River is relatively wide and flat, with little or no bank shading. The high surface area to flow volume ratio results in rapid increases in water temperature below Englebright Dam. (S-YCWA 18, pp. 3-6.) Under current operational

procedures, the low-level outlet at New Bullards Bar Dam is used for water releases throughout the year. (S-YCWA 18, p. 7; S-R.T. 1349:12-1349:13.) Therefore, the only method of lowering water temperatures at Marysville is to increase releases from New Bullards Bar Reservoir.

YCWA's consultants testified that significant amounts of water in addition to the amounts required to meet the instream flow requirements would need to be released to implement the temperature requirements in the Draft Decision. (S-YCWA 18, pp. 24-25.) Even if releases were capped at the 3,500 cfs release capacity of Yuba's Narrows 2 Powerhouse, evidence presented by YCWA indicates that approximately 164,000 acre-feet per year of additional water would be required to attempt to meet the water temperature requirements. (S-YCWA 18, p. 28.) Using large quantities of water would significantly deplete storage in New Bullards Bar Reservoir and its cold water pool, which would adversely impact subsequent water temperatures, instream flows, and consumptive use deliveries. (S-YCWA 18, p. 46.)

The YCWA analysis shows that the water temperature recommendations made by DFG and NMFS in 2000 would be even more difficult to meet than the temperatures proposed in the 1996 Draft Decision. Required water releases could exceed 3,500 cfs. (S-YCWA 34.) The YCWA analysis indicates that if no cap were placed on water releases, over three million acre feet per year would be needed to attempt to meet the proposed water temperature requirements. (S-YCWA 34 and 35; R.T. 2586:4-2587:4.) If required releases were capped at 3,500 cfs, the YCWA analysis shows the proposed requirements often would not be met (S-YCWA 32), and substantial quantities of additional water, up to 2 million acre-feet per year, would be needed to attempt to meet the requirements. (S-YCWA 33; R.T. 2583:1-2589:3.) These quantities exceed the total average unimpaired flow in the Yuba River Basin. (S-YCWA 19, p. 3-2.) If DFG's proposed temperature requirements were implemented as instantaneous maximums, it would be even less feasible to meet the requirements due to the significant differences between daily mean and maximum water temperatures at Marysville. (S-YCWA 19, p. 3-2.)

6.6.5 *Conclusions Regarding Water Temperature*

The SWRCB recognizes that compliance with requirements to provide suitable water temperatures year-round for all lifestages of chinook salmon and steelhead is not feasible in the lower Yuba River prior to the construction of additional facilities to improve the ability to manage water temperature. However, maintenance of suitable water temperatures should be given a high priority when feasible. Based on the findings and conclusions above, the SWRCB concludes that YCWA should be required to make reasonable efforts, as described below, to operate the Yuba River Development Project to maintain suitable water temperatures in the lower Yuba River for fall, late fall, and spring-run chinook salmon and steelhead.

YCWA should be required to consult with a Temperature Advisory Committee, including representatives from SWRCB, SYRCL, CSPA, DFG, USFWS, and NMFS, on a regular basis from May through October of each year. Consultations with the Temperature Advisory Committee should include current operations for temperature control in order to provide suitable habitat for anadromous fish. YCWA should make changes to project operations for temperature control as recommended by the Temperature Advisory Committee on a real-time basis, unless YCWA determines that the Committee's recommendation is infeasible and notifies the Chief of the Division of Water Rights of the reasons for that determination within 14 days.

Prior to April 1 of each year, YCWA should prepare an annual operations plan for water temperature control in consultation with the Temperature Advisory Committee. The plan should specify actions to be taken to maintain suitable water temperatures for anadromous fish. The plan should include operations for the subsequent May through October period. The plan should be submitted to the Chief of the Division of Water Rights for review by April 1 of each year.

YCWA should monitor water temperatures on a continuous basis at the Smartville Gage, Daguerre Point Dam, and the Marysville Gage. YCWA should operate and maintain gages at these locations as needed for reliable measurement of water temperature. YCWA should prepare an annual report that summarizes the results of water temperature monitoring for the previous water year at the

specified locations and describes operations to minimize water temperature impacts on anadromous fish. The monitoring report covering the previous water year should be submitted to the Chief of the Division of Water Rights by December 31 of each year.

This decision directs the YCWA to diligently pursue development of the Narrows II Powerhouse Intake Extension Project at Englebright Dam, in coordination with the USFWS, the DFG, and NMFS. YCWA should submit a report to the Chief of the Division of Water Rights on the status of its application for funding and the progress of project development every six months from the date of this decision through the completion of project construction. Following construction, the Narrows II Powerhouse Intake Extension at Englebright Dam should be operated in conjunction with the multi-level outlet structure at New Bullards Bar Dam to minimize water temperature impacts on anadromous fish in the lower Yuba River. The effects of project operations should be monitored and, in consultation with the Temperature Advisory Committee, modifications should be made on a real-time basis to minimize adverse fishery impacts.

The SWRCB will retain continuing authority over the establishment of water temperature requirements for the lower Yuba River. Following construction of the Narrows II Powerhouse Intake Extension Project at Englebright Dam and subsequent monitoring of water temperatures, the SWRCB may establish water temperature requirements for protection of fishery resources.

6.7 Requirements for Fish Passage Facilities and Fish Screens

YCWA currently supplies water to the Hallwood Irrigation Company, Cordua Irrigation District, Ramirez Water District, Browns Valley Irrigation District, Brophy Water District, South Yuba Water District, Naumes, Inc., Wilbur Ranches, and Dry Creek Mutual Water Company. (S-YCWA 27.) Daguerre Point Dam is currently operated by the Corps of Engineers. Water is diverted at the dam to supply water to districts located both north and south of the Yuba River. Three major diversion facilities are located at or just upstream of the Daguerre Point Dam: (1) the Browns Valley Pumpline Diversion Facility, (2) the South Yuba/Brophy Water District South Canal, and (3) the North Canal that serves Hallwood, Cordua and Ramirez. Diverters using these facilities divert under their own water rights, purchase water from YCWA, or both. Most water

diverted from the lower Yuba River for irrigation is delivered from March through mid-October. In addition, an average of 41,790 acre-feet has been diverted in recent years (1987-1999) from October 15 through December for the purposes of rice straw decomposition and waterfowl habitat. (S-YCWA 27.)

The North Canal (also referred to as the Hallwood-Cordua Diversion) is a gravity flow diversion structure located on the north bank of Daguerre Point Dam, with a present diversion rate of up to 625 cfs. The Browns Valley Pumpline Diversion Facility uses a pump with a present diversion capacity of 80.2 cfs, located on the north bank of the Yuba River about nine-tenths of a mile upstream of Daguerre Point Dam. The South Canal is a gravity flow diversion with a present capacity of 380 cfs located on the south bank of the river, just upstream of Daguerre Point Dam. South Yuba and Brophy plan to expand the capacity of the South Canal to 700 cfs.

The potential for loss of juvenile chinook salmon and steelhead to impingement, entrainment and predation at the diversion facilities is significant. In 2000, DFG presented evidence that 437,770 fish were salvaged in a single season at the Hallwood-Cordua Diversion, with up to 40,000 juvenile fish salvaged in a single day. (S-DFG 1, p. 2.) This is consistent with testimony presented by YCWA in 1992 regarding salvage of juvenile salmon at that location. (YCWA 80.)

The number of chinook salmon entrained at a diversion facility is related to the percent of flow diverted. (R.T. II, 233:9-233:19; R.T. III, 178:1-78:20 and 87:12-88:1; R.T. XIX, 162:8-165:4.) An analysis of the daily North Canal fish screen trap records for 1972 to 1991 by the USFWS shows that the number of juvenile salmonids entering the trap is directly related to the percent of streamflow diverted. (USFWS 17; R.T. XIV, 162:8-165:4.) DFG also presented testimony indicating that the number of emigrating salmonid juveniles trapped at the North Canal fish screen went down significantly when flows at Marysville were above 2,000 cfs. (R.T. III, 78:1-78:20.) The present combined diversion rate of the three diversion facilities near Daguerre Point Dam is 1,085 cfs. Under the flows required by the 1965 Agreement, water diversions at those three facilities could potentially be as high as 82 percent of total streamflow during the April and May

emigration period for spring and fall-run chinook salmon and steelhead. A significant number of juvenile salmonids could be lost due to diversions of such a high percentage of total flow. (R.T. II, 233:19-234:9 and 239:11-239:15; R.T. III, 74:23-75:20 and 187:12-188:1.) In addition, the total quantity of water diverted and the instantaneous diversion capacity are both expected to increase due to increased demands in the future. (S-YCWA-15.) Therefore, the potential loss of fish at the major diversion facilities remains a significant problem.

The recent listings of Central Valley steelhead under the federal ESA, and Central Valley spring-run chinook salmon under both the state and federal endangered species acts, increase the importance of minimizing entrainment losses at these diversion facilities. Section 9 of the federal ESA prohibits certain activities that directly or indirectly affect endangered species. Under Section 4(d) of the ESA, the Secretary of Commerce is required to adopt regulations deemed necessary and advisable for the conservation of species listed as threatened, which may include extending any or all of the prohibitions of Section 9 to threatened species. On July 10, 2000, NMFS issued a final Section 4(d) rule governing the take of Central Valley steelhead. The NMFS rule defines "constructing or operating dams or water diversion structures with inadequate fish screens or fish passage facilities in a listed species' habitat" as a type of activity that is very likely to injure or kill salmonids and result in a prohibited take of the protected species.

Loss of fish at the diversion facilities could be significantly reduced by installation of fish screens that meet the criteria established by NMFS and DFG. NMFS and DFG have established standard fish screen design criteria for the protection of juvenile chinook salmon and steelhead. (S-DFG 34; S-DFG 34, Attachment A; S-BVID 12 and 13.) Funding for construction of fish screens in the Sacramento River basin is available through the Anadromous Fish Screening Program authorized by the Central Valley Project Improvement Act, the CALFED program, and bond funds provided under Proposition 204. (S-R.T. 367:24-368:8; S-R.T. 1973:4-1973:11; S-R.T. 2197:23-2198:3.) The current condition of fish passage facilities and fish screens and the need for improvements are addressed in Sections 6.7.1 through 6.7.4 below.

6.7.1 Daguerre Point Dam

Fish passage facilities at Daguerre Point Dam include two fish ladders, one on the north and one on the south end of the dam. DFG presented testimony that operation of the existing ladders at times inhibits upstream migration of adult fall-run chinook salmon, spring-run chinook salmon, steelhead, and potentially late fall-run chinook salmon. (S-R.T. 1957:17-1957:24; S-R.T. 2007:11-2008:24.) DFG also presented testimony that adult fall-run chinook may be delayed in their upstream migration in the fall months, resulting in illegal take in the vicinity of the dam. (S-R.T. 2007:20-2007:24.) The Corps of Engineers past operational criteria required that the ladders be physically closed when water elevations reached 130, or when flows were slightly less than 10,000 cfs. This standard resulted in periodic ladder closures during the fall through the spring, potentially impacting passage of fall-run chinook and/or steelhead. Testimony indicated that, at times, the ladder has been closed for weeks or a month at a time. (S-R.T. 2007:25-2008:12.)

DFG presented testimony that over the last approximately ten years, from July 1989 through December 1999, the north and south ladders have obstructed passage to some extent, either through gate closures or insufficient ladder exit openings, for a period of 766 days on the north ladder and 425 days on the south ladder. These were primarily during times when spring-run chinook or steelhead are expected to be present. (S-DFG 11 and 12; S-R.T. 2008:17-2008:24.) A witness for SYRCL testified that SYRCL has received numerous phone calls from the public over the last two and a half years regarding badly maintained or closed fish ladders at Daguerre Point Dam. (S-R.T. 405:11-405:25.)

DFG has requested the Corps of Engineers to address the fish ladder problems at Daguerre Point Dam. The Corps of Engineers currently maintains the ladders open when flows exceed elevation 130 and they have improved debris removal efforts. (S-R.T. 2121:22-2122:14.) NMFS has initiated consultation with the Corps of Engineers under Section 7 of the ESA regarding activities on the Yuba River, including fish passage facilities at Daguerre Point Dam. (S-RT 205:11-206:9.)

The USFWS Anadromous Fish Restoration Program includes evaluation and improvement of fish passage at Daguerre Point Dam as a restoration action in its revised draft restoration plan. (S-R.T. 258:24-259:17.) In 1996, USFWS funded the Corps of Engineers to initiate an evaluation of fish passage improvement at Daguerre Point Dam. (S-R.T. 261:4-262:3; S-R.T. 2122:15-2122:17.)

The Corps of Engineers is not a party to this proceeding. Although the SWRCB lacks authority in this proceeding to require the Corps of Engineers to improve fish passage at Daguerre Point Dam, the SWRCB strongly encourages USFWS, the Corps of Engineers, DFG, NMFS, and other appropriate parties, to cooperate in development of a project to improve fish passage at Daguerre Point Dam.

6.7.2 Browns Valley Pumpline Diversion Facility

Browns Valley Irrigation District presented testimony in 2000 that a state-of-the-art fish screen has been installed at the Browns Valley Pumpline Diversion that meets the current NMFS and DFG screening criteria for protection of chinook salmon and steelhead. (S-BVID 1, pp. 4-9; S-BVID 5 through 15]; S-R.T. 1788:6-1791:18; S-R.T. 1822:10-1822:16; S-R.T. 1827:10-1827:16.) Funding for design and construction of the screen was obtained from DWR, the U.S. Bureau of Reclamation's CVPIA Anadromous Fish Screen Program, the California Urban Water Agencies Category III Account, PG&E, and YCWA. BVID contributed manpower and equipment to the construction and assumed the obligation to operate and maintain the fish screen. (S-BVID1, p. 4.) The screen became operational in April of 1999 and has operated for a full year to design specifications. (S-R.T. 1790:10-1790:21.) USFWS witnesses testified that the screen was built to DFG and NMFS criteria and that such screens are generally very effective. (S-R.T. 364:6-365:12.)

The SWRCB concludes that the new fish screen at the Browns Valley Pumpline Diversion Facility provides adequate protection for juvenile salmonids. Browns Valley Irrigation District should continue to operate and maintain the new fish screen in compliance with NMFS and DFG criteria.

6.7.3 South Canal Rock Gabion

The South Canal diversion facility diverts water from the Yuba River through a diversion channel into an old dredger pond on the south side of the river. A "leaky levee" rock gabion fish screen was constructed across the dredger pond in 1985 in accordance with an agreement with DFG. Water passes through the rock levee into the other side of the dredger pond where it is diverted into the South Canal for delivery to South Yuba and Brophy Water Districts. Imbedded within the rock levee is a fine mesh plastic screen designed to prevent fry or juvenile salmonids from passing through the levee. A portion of the water diverted from the river reenters the river through a return channel at the downstream end of the dredger pond.[25] The amount of water diverted at the South Canal has steadily increased. In 1991, YCWA delivered about 89,000 acre-feet to Brophy and South Yuba.

Questions about adverse effects of the South Canal diversion facilities on fish concern the effectiveness of the rock levee in preventing loss of fish, as well as questions about the effect of the dredger pond and return channel on fish survival. Testimony was presented in 1992 that similar rock levee fish barriers have proven ineffective in other locations. (USFWS 8, p. 4; R.T. I, 109:18-109:24; R.T. II, 80:7-81:12; RT III, 96:14-96:20 and 135:11-138:1.) In 2000, a NMFS biologist testified that the rock levee at the South Yuba-Brophy diversion does not meet NMFS screening criteria. (S-R.T. 143:2-143:4; S-R.T. 198:22-199:4.) A DFG biologist testified that the rock levee at the South Yuba-Brophy diversion is considered an alternative fish screen, and that no alternative methods have come close to achieving the standards that the agencies have established for state-of-the-art fish screens. (S-R.T. 1975:1-1976:8; S-R.T. 2004:12-2005:4.)

Evidence was also introduced on the effects of the physical configuration of the dredger pond and the return channel on survival of fish diverted from the Yuba River. The construction of the rock barrier across the large dredger pond resulted in a relatively wide, deep pool directly in front of the rock barrier. The pool reduces the water velocity in the bypass channel which disorients juvenile

[25] Figure 7 of YCWA Exhibit 2 is a photograph showing the South Canal diversion.

salmon and delays their downstream migration. The pool also results in increased water temperature that is detrimental to salmon, and in increased fish mortality due to predation in the pool in front of the rock levee fish screen. (South Yuba 8, p. 2; R.T. II, 82:7-82:17; DFG 26, p. 99; R.T. I, 108:19-108:25; R.T. II, 108:23-109:12; R.T. III, 139:12-142:10, 150:20-151:15 and 217:16-218:6; S-R.T. 216:23-217:3.)

Water not diverted through the rock levee re-enters the river through a return channel that follows a meandering alignment rather than the relatively straight alignment shown on design plans included in the agreement with DFG. (South Yuba 5, p. 11.) USFWS presented data showing that bypass flows in the return channel were at times less than 10 percent of the water diverted. USFWS recommended that much higher bypass flows be maintained. (USFWS 7, p. 13; USFWS 8, p. 3.) Testimony was also presented that there has been a recurrent problem of blockage of the return channel. (R.T. XII, 93:20-94:19; R.T. XII, 123:16-124:5.) In addition, there is currently no way to prevent water from entering the diversion channel when water is not being diverted into the South Canal for irrigation. (USFWS 8, p. 3.) Therefore, losses at the diversion facilities due to predation and other factors occur even when no water is being diverted for beneficial use. Finally, USFWS presented evidence that deposition and accumulation of gravel and debris in the diversion channel as a result of floods or other events can adversely affect flow and migration of juvenile salmon through the diversion facility. (USFWS 7, p. 12.)

The potential for significant entrainment of juvenile salmonids at the diversion is evident in DFG's rotary screw trap sampling of outmigrating juveniles, started in 1999. Sampling indicates that "vast numbers" of juvenile and recently emerged chinook salmon and steelhead trout are present in the river virtually year-round. (S-DFG 1, p. 2; S-R.T. 1947:15-1948:18; S-R.T. 2005:7-2005:13.) Based on these data and information presented at the 1992 hearings, DFG concluded in 2000 that significant entrainment can and does occur at unscreened and inadequately screened diversions, including the South Yuba-Brophy diversion. (S-DFG 1, p. 2; S-R.T. 1947:15-1948:23.)

Evidence was presented in 1992 and 2000 that fish are entrained from the river into the dredger pond and the South Yuba-Brophy Canal. In April of 1989, the USFWS seined 31 juvenile chinook salmon ranging in size from 46 to 70 millimeter (mm) fork length in the diversion pond area behind the rock gabion fish screen. Several hundred juvenile salmonids were also observed feeding in the same area on May 5, 1989. (USFWS 7, pp. 10-12.)

Fyke net sampling conducted by South Yuba consultants from May to July of 1993 also documents the continued loss of both chinook salmon and steelhead at the rock gabion. The South Yuba consultants collected 17 juvenile chinook salmon over 100 mm in length and two juvenile steelhead, 26 and 33 mm in length, at the outfall of the diversion pipe entering the South Yuba-Brophy Canal. A biological consultant for South Yuba testified that this was a very small number of juvenile steelhead. (S-DFG 35; S-South Yuba 2, pp. 7-11; S-South Yuba 2.2; S-R.T. 1142:7-1143:1.) However, a DFG witness testified that the fyke net used in the study may not have been efficient for small salmonids. (S-R.T.-2481:15-2482:11.) Fish averaging 94 mm in length were used in the net efficiency test. (S-South Yuba-2.2, p. 19.) The fyke net, constructed of 1/8 inch mesh (S-South Yuba 2.2, p. 8.) may not have been efficient for capturing small juvenile salmonids. The number of small juvenile steelhead entering the irrigation canal, therefore, may have been significantly underestimated in the South Yuba sampling.

The USFWS concluded that the salmon collected in 1989 behind the gabion most likely were washed into the pond during early March when river flows exceeded 20,000 cfs and over-topped the gabion structure. (USFWS 7, p. 12.) South Yuba concluded that the large size of juvenile chinook captured indicated that they entered the diversion pond during high flow periods in late January and late March, 1993. (S-DFG 35; S-South Yuba 2, p. 10; S-South Yuba 2.2, p. 15; S-R.T. 1144:18-1145:20.) Flow measurements at Marysville from 1969 to 1989 indicate that flows that overtop the levee (exceeding 20,000 cfs) have occurred numerous times in eight of those 20 years. (USFWS 7, pp. 6 and 12.) South Yuba presented testimony that the smaller steelhead captured in the 1993 study probably passed through the gabion structure. (S-South Yuba 2, p. 11; S-South Yuba 2.2, p. 19; S-R.T.1194:13-1194:23; S-R.T. 1145:21 – 1146:7.) Regardless of the

manner in which fish enter the diversion pond, it appears that fish, including listed species, continue to be lost from the lower Yuba River fishery at the rock gabion. (S-R.T. 1974:20-1974:21.)

South Yuba contends that the diversion pond existed prior to the diversion of water at the South Canal, and that fish could have been washed into the pond at high flows and lost from the river prior to the existence of the diversion facilities. (S-R.T. 3102:7-3102:15.) While this may have occurred, the current rock gabion structure was built as a part of the South Yuba-Brophy diversion system and is intended to serve as a fish protective device to keep fish out of the diversion pond. To address the loss of fish at the South Canal, DFG recommends installation of a fish screen at the South Yuba-Brophy diversion that meets the criteria established by NMFS and DFG for fishery protection. (S-DFG 1, p. 4; S-R.T. 1957:12-1957:16; S-R.T. 2161:5-2161:11.)

In summary, considerable evidence was presented regarding the rock gabion fish screen and effects of other elements of the South Canal diversion facilities on fish survival. The SWRCB concludes that there is ample evidence showing that the continuing diversion of water from the Yuba River through existing facilities at the South Canal has reasonably avoidable adverse impacts on anadromous fish in the Yuba River. To continue the diversions at the South Canal without taking actions to reduce fish loss would be an unreasonable method of diversion with unnecessary harmful effects on public trust resources. The continuing loss of steelhead trout from the lower Yuba River at the South Yuba-Brophy diversion may also violate the ESA section 4(d) rule governing the take of Central Valley steelhead, which identified operation of inadequate fish screens as an activity likely to injure or kill listed salmonids. NMFS testified that once the 4(d) rule was in effect, ESA section 9 prohibitions against take of steelhead would apply. (S-R.T. 143:5-144:5.)

Those parties that supply or divert water at the South Canal have the responsibility to ensure that water diversions at that location do not result in a significant loss of fish. Therefore, in order to prevent unnecessary loss of fish at the South Yuba-Brophy diversion (South Canal), YCWA,

Brophy, and South Yuba, should consult with NMFS, USFWS, and DFG to develop a plan to reduce fish losses and comply with all applicable requirements of the state and federal endangered species acts. If NMFS or DFG determines that a potential incidental take of listed species may result from diversion of water into the South Canal, then YCWA, Brophy, and South Yuba should obtain appropriate authorization for the incidental take. In order to continue diversion of water at the South Canal, the plan to reduce fish losses, and any required incidental take authorization, should be provided to the Chief of the Division of Water Rights by March 31, 2002.

6.7.4 North Canal

The Hallwood-Cordua fish screen located at the North Canal utilizes a V-shaped perforated plate screen constructed, operated and maintained by DFG. A bypass system diverts fish captured by the screen into a collection tank. The collected fish are returned to the river either through a pipeline or by truck. (DFG 26, p. 98.) The design and current operation of the Hallwood-Cordua fish screen results in the loss of significant numbers of fish. Losses also occur due to predation near the face of the screen and upstream in the intake channel. Losses ranged from 19.0 to 50.2 percent for test groups released in 1977 and 1978. (DFG 26, p. 98.) Losses also occur due to the fish trapping facility that returns fish from the diversion canal to the river. (R.T. II, 85:9-85:17.) The long distance between the diversion channel intake, low bypass flows, and excessive handling of the fish stopped by the screen all contribute to the loss of salmonids at the Hallwood-Cordua fish screen. (R.T. I, 109:7-109:14; R.T. II, 84:13-85:17; R.T. XIV, 165:5-166:6; S-R.T. 2003:23-2003:25.)

DFG presented testimony that it has periodically operated the fish screen at the Hallwood-Cordua diversion since 1992 to prevent the unnecessary loss of juvenile chinook salmon and steelhead. Significant numbers of juvenile chinook salmon have been salvaged at the screen. DFG has only operated the screen during the peak fall-run smolt outmigration period in the spring (about April through early to mid-June). Operation is generally dependent on available funds and is often for a much shorter period of time. Water is diverted at the North Canal for a much longer period than the period in which DFG operates the screen. (S-DFG 1, p. 2; S-DFG 4; S-R.T. 1945:22-1946:14.)

DFG presented evidence indicating that significant numbers of juvenile steelhead are entrained and lost at the North Canal diversion. Past observations by DFG personnel indicate that the number of juvenile steelhead entering the diversion was just beginning to increase when operations of the screen were terminated in late May and early June. In 1999 salvage operations were extended through August. The salvage of steelhead entering the diversion steadily increased through July and significant numbers continued to be present in August when DFG ceased operation of the screen. (S-DFG 1, p. 2; S-DFG 5; S-R.T. 1946:15-1947:15; S-R.T. 2000:3-2000:14.)

DFG began an outmigration study of juvenile salmonids in 1999, using a rotary screw trap located in the lower Yuba River near Hallwood Boulevard. DFG reported that significant numbers of juvenile chinook salmon, including spring-run, have been captured. Recently emerged steelhead are present throughout the summer months. Steelhead as small as 24 mm have been observed in July, with 27 and 37 mm fish observed in August and September. It is evident, based on the size and numbers of juvenile steelhead and chinook salmon present throughout the year, that large numbers of fish are vulnerable to entrainment at the Hallwood-Cordua Diversion. DFG concluded that significant entrainment occurs at inadequately screened diversions, including the Hallwood-Cordua diversion. (S-DFG 1, p. 2; S-DFG 7; S-R.T. 1947:15-1948:23; S-R.T. 2000:3-2001:5.)

In addition, DFG presented testimony that the5/32 inch mesh size of the Hallwood-Cordua fish is much larger than the 3/32 inch mesh currently recommended by both DFG and NMFS. (S-R.T. 2004:4-2004:6; S-R.T. 2438:15-2438:17.) The smaller mesh size does not protect recently emerged steelhead fry. (S-R.T. 2003:20-2003:23.) The ineffectiveness of the screen in salvaging fry-size fish is evident when comparing catches at the screen with catches in the rotary screw trap during the same period. In periods when catches of fry-size fish were still high in the rotary screw trap, the fish screen was capturing no fish in that size range. (S-DFG 42; S-R.T. 2437:23-2439:25.) In addition, the approach velocity at approximately 25 percent of the screen area exceeds approach velocities that are currently recommended. (S-R.T. 2004:6-2004:11; S-R.T. 2438:12-2438:15.)

In summary, substantial evidence was presented that significant fish losses occur at the Hallwood-Cordua fish screen, including losses of listed species. DFG recommended installation of a fish screen at the Hallwood-Cordua diversion that meets the criteria established by NMFS and DFG for protection of juvenile chinook salmon and steelhead. (S-DFG 1, p. 4; S-DOI 4; S-R.T. 1957:12-1957:16; S-R.T. 2161:5-2161:11.) The SWRCB concludes that the continuing diversion of water from the Yuba River through existing facilities at the North Canal has reasonably avoidable adverse impacts on anadromous fish in the Yuba River. To continue diversions at the North Canal without taking steps to reduce fish loss would be an unreasonable method of diversion with unnecessary effects on public trust resources. The continuing loss of steelhead trout from the lower Yuba River at the North Canal diversion may violate the ESA section 4(d) rule governing the take of Central Valley steelhead, which identified operation of inadequate fish screens as an activity likely to injure or kill listed salmonids.

Those parties that supply or divert water at the North Canal have the responsibility to ensure that water diversions at that location do not cause a significant loss of fish. Therefore we conclude that, in order to prevent unnecessary loss of fish at the Hallwood-Cordua diversion (North Canal), YCWA, Hallwood, Cordua, and Ramirez should consult with the NMFS, USFWS, and DFG to develop a plan to reduce fish losses resulting from diversion of water into the canal and comply with all applicable requirements of the state and federal endangered species acts. If potential take of listed species is determined by NMFS or DFG to result from diversion of water into the North Canal, YCWA, Hallwood, Cordua, and Ramirez should obtain appropriate authorization for incidental take. In order to continue diversion of water at the Hallwood-Cordua diversion, the plan to reduce fish losses, and any required incidental take authorization, should be provided to the Chief of the Division of Water Rights by March 31, 2002.

6.8 Impacts of Return Flows from the Yuba Goldfields on Fishery Resources

The Yuba Goldfields are composed of approximately 11,000 acres of land adjoining the Yuba River. In 1992, YG Development Co. and Western Aggregates, Inc. owned much of the property

in the Yuba Goldfields area and participated in the hearing at that time. At the most recent hearing in 2000, Western Aggregates, Inc. and Western Water Company participated as claimants to water rights in the Yuba Goldfields area.[26] The ownership interests of the various parties claiming to own land or water rights in the Yuba Goldfields are not well defined from the evidence in the record.

The Yuba Goldfields contain several interconnected dredger ponds that create a meandering channel that discharges into the Yuba River approximately one and one half miles below Daguerre Point Dam. The channel once returned water to the river through a wide, braided channel over a gravel bar which did not attract a significant number of salmon. The present channel configuration returns a more concentrated flow through a narrow channel which attracts upstream migrating salmon into the Goldfields area.

In 1989, the USFWS studied spawning and rearing of anadromous fish in the Yuba Goldfields. The USFWS found that a substantial number of anadromous fish were attracted into the goldfields by flow in the return channel. The fish spawn in the goldfields area, but the resulting offspring have a relatively poor chance of survival due to: (1) fluctuations in water levels which result in dewatering redds and stranding fry, (2) relatively high water temperatures, and (3) extensive predation. (USFWS Exh. 7, pp. 5-10.)

The Yuba Goldfields return channel is the result of substantial alterations in the Yuba Goldfields area adjoining the Yuba River. In 2000, USFWS testified that the AFRP program has completed a feasibility and preliminary engineering study on a permanent barrier to eliminate access of adult salmon to the Yuba Goldfields. The current project design for the Yuba Goldfields Adult Fish Exclusion Barrier is a large graduated rock gabion structure. When complete, the project would be

[26] In a letter dated November 27, 2000, Michael Patrick George, President of Western Water Company, advised the SWRCB that Western Water is a "successor by name change to YG Development Company." Mr. George's written testimony states that Western Water Company's "predecessor companies" were "generally known as Yuba Consolidated Goldfields, Inc." (S-Western Water Company/Western Aggregates, Exhibit 5.)

effective in preventing adult salmon from entering the Yuba Goldfields at all flows, except for hundred-year flow events. Funding for construction has not yet been identified. (S-R.T. 261:21-261:23; S-R.T. 332:17-333:4; S-R.T. 344:4-344:21; S-R.T. 346:13-347:2; S-R.T. 363:6-364:2.)

The existing diversion and use of water in the Yuba Goldfields, including the method by which water is returned to the river, results in adverse impacts on anadromous fish in the Yuba River. Continuation of existing practices after identification of a reasonable way to reduce fish loss would constitute an unreasonable method of diversion and use of water in violation of article X, section 2 of the California Constitution and Water Code section 100.

In order to minimize adverse impacts to anadromous fish in the lower Yuba River, the SWRCB concludes that YG Development Co., Western Water Company and Western Aggregates (or their successors in interest) should be required to consult with YCWA, DFG, USFWS, and NMFS, and work cooperatively on the development of a project to eliminate access of adult salmon to the Yuba Goldfields. This decision requires YG Development Co., Western Water Company and Western Aggregates to submit a report to the Chief of the Division of Water Rights on the progress of project development every six months beginning July 1, 2001 and every six months thereafter until completion of project construction.

7.0 LOWER YUBA RIVER WATER REQUIREMENTS FOR CONSUMPTIVE USES AND WATERFOWL HABITAT WITHIN YUBA COUNTY

In evaluating the feasibility of meeting the instream flow requirements established in this decision for protection of public trust resources, the SWRCB must consider competing demands to divert water from the lower Yuba River for other uses. YCWA's estimates of present and future diversion demands are discussed in Sections 7.1 and 7.2 below.. Sections 7.3 through 7.5 explain the basis for the water demand figures used by the SWRCB in analyzing the feasibility of meeting the instream flow requirements established in this decision.

7.1 Present Level of Demand Estimated by YCWA

At the hearings in 1992 and 2000, YCWA provided estimates of the quantity of water needed from the lower Yuba River to meet the existing level of demand within YCWA's service area. (YCWA 13, p. 4; S-YCWA 15, p. 2, 7-11; S-YCWA 15A.) In 1992, YCWA estimated that its existing level of demand was 295,750 acre-feet during normal years and 302,850 acre-feet during dry years.[27] At the hearing in 2000, consultants for YCWA presented an updated estimate of 308, 412 acre-feet per year as the average present level of demand. Using the five water year types identified in the Yuba River Index (S-YCWA 14), YCWA estimated that the "present level of demand" is 305,298 acre-feet in wet and above normal years, and 311,081 acre-feet in below normal, dry, and critical years. As in 1992, YCWA's estimates of the present level of demand were based on multiplying an estimated water requirement per acre for a given crop by the estimated number of acres of that crop planted in the area served by YCWA and adding approximately 10 percent to cover conveyance losses. (S-YCWA 15, p.2.)[28] YCWA's current water demand estimates also include an allowance of 1.0 acre-foot per acre for 90 percent of the net rice acreage in the service area. The additional 1.0 acre-foot per acre is for fall flooding of rice fields to aid in decomposition of rice stubble and to provide waterfowl habitat. (S-YCWA 15, p. 3.)

In order to compare YCWA's "present level of demand" estimates with actual water diversions, SWRCB staff requested YCWA to provide data on recorded historic surface water diversions from the lower Yuba River for the period 1987 to 1999 by entities under contract with YCWA.

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[27] YCWA's values for existing agricultural water demand presented in 1992 were developed using 1984 data related to land use, estimated values for applied water for various crops, and estimated conveyance losses. (YCWA 45, pp. 4-1 to 4-8.) YCWA presented testimony that this methodology was used to determine water demand because YCWA did not have complete records for contractual sales or water deliveries. (R.T. VI, 141:19-142:15.) YWCA's 1992 estimates of agricultural water demand include additional quantities of water for irrigation following critical dry winters. (YWCA 13, p. 4.)

[28] YCWA's most recent estimates of irrigation demand reflect an assumed reduction in demand of 0.4 acre-foot per acre for non-rice and non-pasture crops in above normal and wet years due to differences in soil moisture, precipitation, and other factors. (S-YCWA 15, p. 9.)

(S-R.T. 1490:11-1490:13.)[29] Appendix 2, Table2-1 shows the quantities of water delivered to each entity served by YCWA from 1987 through 1999 for irrigation (S-YCWA 27) and estimated demands for fall flooding and waterflow habitat deliveries. Table 13 below shows a comparison of YCWA's estimated present level of demand in 2000 with reported historic water deliveries for the period 1987 to 1999. (S-YCWA 15A, Table 10.)[30] In 1991 and 1994, water users within YCWA's service area increased their use of groundwater in order to allow YCWA to transfer surface water to areas outside of Yuba County. The increased use of groundwater offset a like amount of surface water that would have been used in the YCWA service area. Therefore, the quantities of pumped groundwater shown in the table for 1991 and 1994 are included in the column for total reported historic diversions for 1991 and 1994.

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[29] The 1987 to 1999 period was selected as most representative of present conditions. Diversions to the South Yuba Canal began in 1986. Deliveries to Dry Creek Mutual Water Company did not begin until 1998. Dry Creek Mutual received 1,402 acre-feet in 1998 and 3,976 acre-feet in 1999. (S-YCWA-15A, p. 11.)

[30] The figures for annual historical diversions shown in Table 13 are from Exhibit S-YCWA 15A which was introduced during the 2000 hearing as a correction of figures presented in Exhibit S-YCWA 15. The figures in Table 13 for average "total reported historic diversions" for wet and above average years and for below normal, dry and critical years have been revised to correct an apparent arithmetical error in Table 10 of Exhibit S-YCWA 15A.

TABLE 13

YCWA'S HISTORIC AND ESTIMATED PRESENT LEVEL OF DEMAND FOR DIVERSIONS FROM THE LOWER YUBA RIVER (ACRE-FEET)

WATER YEAR	WATER YEAR TYPE	REPORTED HISTORIC SURFACE WATER DIVERSIONS	PUMPED GROUNDWATER USED FOR IN BASIN IRRIGATION	TOTAL REPORTED HISTORIC DIVERSIONS INCLUDING GROUNDWATER PUMPED TO ENABLE WATER TRANSFERS	ESTIMATE OF PRESENT DIVERSION DEMAND STATED IN YCWA's 2000 ANALYSIS
1987	C	252,805	-	252,805	311,081
1988	C	226,752	-	226,752	311,081
1989	BN	248,908	-	248,908	311,081
1990	D	280,001	-	280,001	311,081
1991	C	194,710	82,018	276,729	311,081
1992	C	249,766	-	249,766	311,081
1993	AB	239,774	-	239,774	305,298
1994	C	238,954	26,033	264,987	311,081
1995	W	240,247	-	240,247	305,298
1996	W	262,551	-	262,551	305,298
1997	W	292,355	-	292,355	305,298
1998	W	233,054	-	233,054	305,298
1999	W	301,554	-	301,554	305,298
AVERAGE	--------	**250,879**	--------	**259,191**	**308,412**
AVERAGE (W, AB)	--------	**261,588**	--------	**261,588**	**305,298**
AVERAGE (BN, D, C)	--------	**241,699**	--------	**257,134**	**311,081**

W = Wet; AB = Above Normal; BN = Below Normal; D = Dry; C = Critical

As indicated in Table 13, YCWA's estimated "present level of demand" in 2000 exceeds the average of reported diversions for 1987-1999 by an average of 49,221 acre-feet per annum. During wet and above normal water year types, YCWA's 2000 estimated present level of demand exceeds the average of reported diversions by 45,520 acre-feet per annum. During below normal, dry and critical water year, YCWA's 2000 estimates exceed the average of reported diversions by 52,574 acre-feet per annum.

Although, YCWA estimates that it has a present demand of 305,298 acre-feet per year in wet and above normal years, the only year in which reported historic diversions have exceeded 300,000 acre-feet was in 1999. Reported deliveries for waterfowl habitat in 1999 reached a record level of 62,543 acre-feet, well in excess of the 39,162 acre-feet diverted for waterfowl habitat in the previous year or the 34,000 acre-feet per annum that YCWA's consultants used as a reasonable figure in developing their estimate of YCWA's overall water demand. (S-YCWA 27; YCWA 45, p. 4.) Diversion of 34,000 acre-feet of water for waterfowl habitat in 1999, rather than the 62,543 acre-feet reported, would have reduced YCWA's total diversions for water year 1999 to approximately 273,011 acre-feet.

Due to the many variables involved, estimating the water demand from the lower Yuba River is a difficult task. In the absence of actual water delivery data, the estimates of present water demand developed by YCWA's consultants could be used to provide a rough estimate of the present level of demand for surface water from the lower Yuba River. However, when data on actual water deliveries for recent years is available, examination of that data provides a better understanding of the actual present level of demand.[31] Relying on overly high estimates of the level of demand for offstream water deliveries may result in forecasting delivery deficiencies that are more frequent and more severe than would actually occur as a result of meeting the instream flow requirements established in this decision. The water demand figures applied by the SWRCB in evaluating the feasibility of meeting the instream flow requirements established in this decision are discussed in Section 7.3 below.

7.2 Full-Development Level of Demand Estimated by YCWA

At the hearing in 2000, YCWA's consultants predicted that in the future, under "full-development conditions," YCWA will have an average demand of 347,136 acre-feet per annum for irrigation and waterfowl habitat purposes and an additional 30,000 acre-feet for municipal and industrial uses. (S-YCWA 15, pp. 1, 7-9.) YCWA's "full development level of demand" for all purposes

[31] There is no evidence in the record that water deliveries by YCWA were curtailed due to insufficient water to meet demand in the YCWA service area.

was estimated to be an average of 377,136 acre-feet per annum.[32] The major difference between YCWA's estimate of its current and full development level of demand for irrigation and waterfowl habitat purposes is that the full development estimate includes YCWA's proposal to provide water to the Wheatland Water District and the Wheatland Water District "detachments." (S-YCWA 15, p. 7.) YCWA's estimated future demand for serving Wheatland Water District and its detachments is an average of 40,855 acre-feet per year, none of which is currently delivered. (S-YCWA 15, p. 8.) Thus, the sum of 40,855 acre-feet to be delivered to the Wheatland area plus 30,000 acre-feet for potential municipal and industrial uses would result in a projected increase in average annual demand of 70,855 acre-feet per year.

As YCWA's report on Lower Yuba River Diversion Requirements indicates, the timing for attaining the full-development of demand is uncertain. (S-YCWA 15, pp. 2, 7.) The Wheatland Water District and the Wheatland Water District detachments are located in the southern portion of the county in an area that does not yet have a water distribution system and does not presently have a water service contract with YCWA. (S-YCWA 15, p. 7.) At the hearing in 1992, YCWA presented testimony that the construction of a canal to serve these areas was expected to occur in about five years. (R.T. V, 156:21-156:24.) Evidence presented in 2000 indicates that the distribution system is still in the planning stages. (S-YCWA 11, p. 13.)

The continuing absence of water supply contracts and a water distribution system eight years later leads the SWRCB to conclude that the proposed delivery of 40,855 acre-feet of water to the Wheatland area projected by YCWA remains uncertain. In most years there would be sufficient surface water available from the lower Yuba River to meet YCMA's present level of demand plus the projected water demands in the Wheatland area. However, in a few years, irrigation in the Wheatland area will continue to be dependent upon use of groundwater unless the demand

[32] For dry, critical and below normal water years, YCWA estimates its full development level of demand for all purposes at 381, 936 acre-feet. For above normal and wet years, YCWA estimates that its full development level of demand will be 375, 688 acre-feet.

for surface water in other areas of the YCWA service area is reduced through a conjunctive use program or increased water conservation.

The three major urban areas in Yuba County (Marysville, Linda-Olivehurst, and Wheatland) all rely on groundwater. (YCWA 2, p. 12.) Although municipal and industrial uses are authorized under YCWA's permits, YCWA had not diverted any water from the Yuba River for municipal use in Yuba County at the time of the 1992 hearing. At that time, YCWA estimated that new urban demand for water from the lower Yuba River would range from 30,000 to 50,000 AFA within the next 50 years. (YCWA 13, p. 5.) YCWA's Report on Lower Yuba River Diversion Requirements presented at the supplemental hearing in 2000 estimates that 30,000 acre-feet per year will be needed for municipal and industrial uses. (S-YCWA 15, p. 9.)

Although 30,000 acre-feet for municipal and industrial uses was included in YCWA's estimate of the full-development level of demand to be served from the lower Yuba River, YCWA's consultants stated that "[p]rojected future M&I diversion requirements for Yuba River water below New Bullards Bar Reservoir cannot be defined with the same level of confidence as the projected irrigation diversion requirement." (S-YCWA 15, p. 8.) The Report on Lower Yuba River Diversion Requirements mentions several factors that could influence the amount of water needed for future municipal use, but does not clearly describe the basis for the projected increase in water demand for municipal and industrial use.

Based on the evidence in the record, we conclude that the need for lower Yuba River water for irrigation in the Wheatland area and for additional municipal and industrial uses in Yuba County has not been established. To the contrary, the estimates of future water demand for those purposes appear nearly as speculative in 2000 as at the earlier hearing in 1992.[33] In evaluating

[33] The uncertainty in estimates of future water demand in the YCWA service area is evident when comparing YCWA's estimates of future water demand for irrigation and waterfowl habitat at the 1992 hearing with its revised estimates at the 2000 hearing. In 1984, for example YCWA's consultants estimated that the future demand for water from the lower Yuba River for irrigation and waterfowl habitat would be 368,540 acre-feet per year. (YCWA 45, (continued next page)

the feasibility of the instream flow requirements established in this decision, we conclude it is more reasonable to use the water demand figures described in Section 7.3 below based on recent historical water use for irrigation and a reasonable allocation for waterfowl habitat.

The SWRCB recognizes that there will be new uses of water in Yuba County in the future, but we believe that a large portion of those uses can be met through more efficient use of existing water supplies or with water from other sources.[34]

YCWA's comments on the Draft Decision dated November 7, 2000, stress YCWA's intentions to provide 16,743 acre-feet of water annually to the Dry Creek Mutual Water Company and to provide 40,855 acre-feet of water annually to Wheatland Water District and the Wheatland Water District Detachments. Section 8.4 of this decision discusses the procedure by which YCWA can request a temporary modification of applicable instream flow requirements if the projected deficiencies of surface water deliveries for offstream uses in a specific year exceed 20 percent of the projected demand for that year. The criteria for determining YCWA's overall "projected demand" for a particular year include provisions for estimating the projected water demand for use in the Dry Creek and Wheatland areas. The record remains unclear as to when and if the projected demands for surface water in the Wheatland and Dry Creek areas will be reached. However, under the provision discussed in Section 8.4, YCWA may request temporary modification of the instream flow requirements in years in which YCWA would be unable to meet 80 percent of its overall demand, including the projected demands in a specific year in the Wheatland and Dry Creek areas.

p. 4-8.) By the time of the hearing in 2000, the YCWA estimate for those purposes was revised downward to 347,136 acre-feet per year. (S-YCWA 15, p. 8.)

[34] A 1990 report prepared for YCWA recognizes that, in addition to water from the lower Yuba River, future water supply needs in Yuba County may be met from a combination of sources including the Feather River, Bear River, groundwater supplies and improved efficiency in water application. (YCWA 45, pp. 2-3 and 4-8.)

7.3 Factors Affecting Water Requirements for Irrigation

Irrigation demand depends on many factors, including cropping patterns. In the YCWA service area, the amount of land planted in rice has a particularly significant effect on total irrigation water requirements. The quantity of water required for rice irrigation is affected by several factors including the acreage planted, the applied water rate, and herbicide regulations. YCWA submitted data that indicates less water is used when crops are irrigated with groundwater rather than surface water. For example, YCWA assumes an applied water rate of 4.5 acre-feet per acre for rice irrigation using groundwater rather than 5.7 acre-feet per acre for rice irrigation with surface water. (YCWA 45, Table 5.)[35] The higher cost to pump groundwater may result in more efficient water use. Using the lower applied water rate for irrigation of a projected 35,876 acres of rice (S-YCWA 15, p. 8) would reduce estimated irrigation water demand by approximately 43,000 acre-feet per year.

Another factor influencing water demand for rice irrigation is regulation of allowable levels of herbicides in agricultural return flow water. A 1990 report prepared by YCWA's consultants states that more stringent limits on rice herbicides in return flow affect the detention periods for water used for growing rice. Due to the general trend toward reductions in organic chemicals allowed in return flows, YCWA's consultant predicted that the applied water rate for rice would tend to be reduced in the future. (YCWA 45, p. 4-3.) YCWA's full development level of demand estimates, however, continue to be based upon an assumed duty of water for rice of 5.7 acre-feet per acre. (S-YCWA 15, Appendix A.)

In general, the amount of surface water required for irrigation is a function of water use efficiency. A 1990 study prepared by YCWA's consultants indicates that approximately 34 percent of the water estimated to be needed for irrigation in Yuba County would be available for recovery or reuse, or would flow into the Feather River or Bear River. (YCWA 45, pp. 2-1 and 2-2.) The study goes on to state that return flow rates in some areas are so high that "[s]ome

[35] YCWA has estimated that conveyance losses for surface water deliveries are approximately 10 percent. Therefore, it is reasonable to assume that approximately 5.0 acre-feet of surface water would be needed to deliver 4.5 acre-feet to the place of use.

of this return flow would need to be pumped from groundwater to prevent water logging." (YCWA 45, p. 4-7.)

The study on present and future water requirements submitted by YCWA in 1992 acknowledges that improved efficiency in water application and conjunctive use of groundwater storage and surface water storage should be explored as a "means of increasing the regulated water supply in Yuba County while fully meeting local requirements." (YCWA 45, p. 2-3.) Although YCWA has acknowledged a potential role for conjunctive use (S-YCWA 17), it did not include any water that may be available from a conjunctive use program in developing the estimates of "lower Yuba River diversion requirements" presented in Exhibit 15. Assistance in implementing more efficient water management practices is available to YCWA from the Department of Water Resources pursuant to Water Code section 10904.

At the time of the hearing in 1992, YCWA sold water to member districts for as low as one dollar per acre-foot. (R.T. IV, 61:10-61:12.) Testimony presented at the hearing in 2000 established that YCWA bills water districts in its service area a fixed amount based regardless of the amount of water they actually receive. (S-R.T. 1517:18-1517:23.) YCWA's full-development level of demand projections were based on the assumption "that the cost of water from YCWA would be very low and not be a limitation on the use of surface water for irrigation." (YCWA 45, p. 1-3.) In view of the chronic water shortages in many areas of the state, we do not believe it is reasonable for a large water purveyor to deliver large quantities of water for irrigation under a pricing system that provides no economic incentive to conserve.

Even under the existing pricing system, there have been some notable water conservation measures undertaken in the area receiving water from YCWA. During the 2000 hearing, representatives of water districts testified about water conservation measures undertaken by farmers in their districts. These measures include drip irrigation for orchards, laser leveling of rice fields and reuse of water drained from rice fields for additional irrigation. (S-R.T. 1667:13-1670:3; 1686:15-1688:5; 1813:25-1815:22; 1817:21-1818:15; 3011:23-31012:19.) Browns Valley presented testimony that it had spent over $2,000,000 replacing unlined canals with closed pipelines. (S-Browns Valley 1,

p. 3.) Water conservation measures undertaken by Browns Valley have enabled that district to reduce conveyance losses and serve many new customers with little change in the total amount of water diverted. (S-R.T. 1813:25-1815:22; 1817:21-1818:15.)

7.4 Water Requirements for Waterfowl Habitat

Flooding rice fields in the fall months of October, November and December promotes decomposition of rice stubble and provides waterfowl habitat. Dr. Frederic Reid, Director of Conservation Planning for Ducks Unlimited in Western North America, presented testimony that waterbird species prefer a water depth of under 10-inches in flooded rice fields and that the best management practice for rice straw decomposition is to keep rice stubble moist or very shallowly flooded. (S-Cordua 1, p.1-2.) YCWA has not established a goal of providing a specific number of acres of waterfowl habitat. (S-R.T. 1509:17-1509:25.) YCWA's consultants estimated the seasonal water requirement for fall flooding based on an application of 1.0 acre-feet of water per acre to 90 percent of the rice acreage. (YCWA 45, p. 4-7; S-YCWA 15, last page of Appendix A.) In 1992, YCWA estimated that total seasonal demand for flooding waterfowl habitat was 25,500 acre-feet of water and would increase at full development to 34,000 acre-feet. (YCWA 45, p. 4-7.)

Based on the crop acreage information presented in Appendix A of Exhibit S-YCWA 15, YCWA estimates that a total of 35,876 acres of rice will receive water deliveries from YCWA at full development. Using an application rate of 1.0 acre-foot per acre for 90 percent of the acreage planted in rice, and adding 10 percent to cover conveyance losses, would result in an estimated full development level of demand for waterfowl habitat of 35,516 acre-feet per annum. However, YCWA's water delivery data show that the average quantity of water delivered for waterfowl habitat for the period 1987 through 1999 was 41,790 acre-feet per year, with up to a maximum of 62,543 acre-feet delivered for waterfowl habitat in 1999. (S-YCWA 27.)

The reason for the discrepancy between the estimated water demand and the substantially greater quantities of water reportedly delivered for waterfowl habitat in some years is not clear from the

record. The SWRCB acknowledges that testimony was presented that use of water for waterfowl habitat can exceed 1.0 acre-foot per acre. In view of the expert testimony of Dr. Frederic Reid (S-Cordua 1, pp.1 and 2), however, the SWRCB concludes that the reasonable use of water for waterfowl habitat should not exceed an average of 1.0 acre-foot per acre as assumed in the water demand analysis prepared by the YCWA consultants, plus 10 percent for conveyance losses. The quantity of water needed for waterfowl habitat could actually be substantially less if rice fields were flooded sequentially using the water drained off of one field to flood another field as discussed by Dr. Reid. (S-R.T. 1320:3-1321:4.) Dr. Reid's testimony indicates that, in a dry year, flooding 7,000 acres of rice and 3,000 acres of seasonal and semi-permanent wetlands in the District 10 area of Yuba County would be a realistic goal for providing waterfowl habitat. (S-R.T. 1311:3-1314:6.)

7.5 Summary and Conclusions Regarding Water Demand from the Lower Yuba River in the YCWA Service Area

Water delivery records show that the historical water demand for irrigation in recent years has been much lower than YCWA's estimates of the present level of demand for irrigation. Conversely, the amount of water delivered for waterfowl habitat in many years has been greater than is justified based on the evidence in the record and the reasonable use limitations of article 10, section 2 of the California Constitution. YCWA's estimates of both the present and full development level of demand for surface water from the lower Yuba River do not appear to account for any significant water savings due to water conservation measures, nor do the YCWA estimates account for reduction in the use of surface water due to development of an ongoing conjunctive use program. As discussed in Section 7.2 above, YCWA's projected increases in demand for surface water from the lower Yuba River are very speculative.

To evaluate the potential effects of the flow requirements established in this decision on YCWA's water deliveries for other purposes, the SWRCB utilized the model discussed in Section 8.1 below. In view of the problems with the water demand estimates developed by YCWA, the SWRCB concludes that it is more reasonable to use a water demand estimate based on recent historic water deliveries for irrigation plus a reasonable additional amount of water for

waterfowl habitat and rice straw decomposition. Table 14 below shows historic irrigation water deliveries for water years 1987 through 1999 plus an additional amount of 35,516 acre-feet per year for waterfowl habitat purposes. The adjusted historic deliveries are shown graphically on Figure 6.

TABLE 14

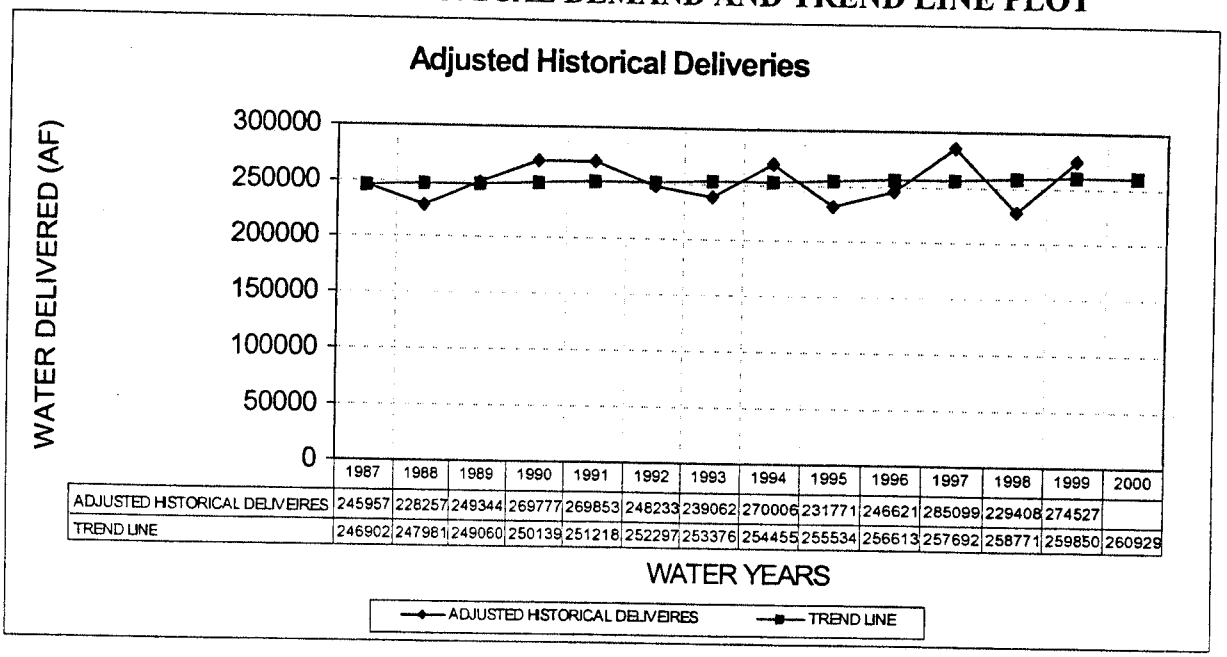
ADJUSTED HISTORIC WATER DEMAND FROM LOWER YUBA RIVER

WATER YEAR	WATER YEAR TYPE	HISTORIC IRRIGATION DELIVERIES * (AC-FT)	ALLOCATION FOR WATERFOWL HABITAT DELIVERIES** (AC-FT)	TOTAL ADJUSTED HISTORIC DIVERSION DEMAND (AC-FT)
1987	C	210,441	35,516	245,957
1988	C	192,741	35,516	228,257
1989	BN	213,828	35,516	249,344
1990	D	234,261	35,516	269,777
1991	C	234,337	35,516	269,853
1992	C	212,717	35,516	248,233
1993	AB	203,546	35,516	239,062
1994	C	234,490	35,516	270,006
1995	W	196,255	35,516	231,771
1996	W	211,105	35,516	246,621
1997	W	249,583	35,516	285,099
1998	W	193,892	35,516	229,408
1999	W	239,011	35,516	274,527
AVE.	——	——	——	**252,916**
AVE. (BN,D,C)	——	——	——	**254,489**
AVE. (W,AN)	——	——	——	**251,081**
MIN.	——	——	——	**228,257**
MAX	——	——	——	**285,099**
MEDIAN	——	——	——	**248,233**
AVE. (5 HIGHEST YEARS)	——	——	——	**273,847**

**Historic irrigation deliveries are from S-YCWA 27. The reported amounts include groundwater pumped to allow for surface water transfers to State Water Bank in 1991 (82,018 acre-feet) and in 1994 (26,033 acre-feet).*

*** The allocation for waterfowl habitat deliveries is based on flooding 90 percent of estimated rice acreage at a rate of 1 acre-foot per acre plus 10 percent for conveyance losses.*

FIGURE 6
ADJUSTED HISTORICAL DEMAND AND TREND LINE PLOT



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
ADJUSTED HISTORICAL DELIVEIRES	245957	228257	249344	269777	269853	248233	239062	270006	231771	246621	285099	229408	274527	
TREND LINE	246902	247981	249060	250139	251218	252297	253376	254455	255534	256613	257692	258771	259850	260929

Note: A simple linear regression was used for the development of the trend line: (The R squared value equals 0.0493.)

Based on the information summarized in Table 14 and Figure 6 above, we conclude that, for modeling purposes, it is reasonable to take the average of the five highest years of adjusted historic demand as an estimate of YCWA's present level of demand for water from the lower Yuba River. As shown in Table 14, that figure is 273,847 acre-feet per year.[36] Because delivery data is available for a limited number of years and deliveries do not vary significantly by water year type, it is reasonable to use an average demand figure for all years without regard to water year types.[37] The method by which the estimated annual water demand was distributed into monthly diversion demands for use in modeling is described in Appendix 2. The effects of establishing the instream flow requirements specified in this decision on water deliveries for other purposes are discussed in Sections 8.0 through 8.5 below.

8.0 EFFECTS OF REVISED INSTREAM FLOW REQUIREMENTS ON OTHER USES OF WATER

Preceding sections of this decision address measures needed for fishery protection and the estimated quantities of water needed to meet current and projected water demands for other purposes. Due to substantial differences in hydrologic conditions and water demands each year, it is impossible to identify with certainty the effects that alternative instream flow requirements may have on water available for competing uses in future years. Although computer models are subject to inherent limitations due to inaccurate or incomplete input data and other factors, well-designed computer models of a river basin can provide the best means of evaluating what is likely to occur over a period of years under different scenarios. As discussed in Sections 8.1 through 8.5 below, in this instance, the SWRCB has utilized the Yuba River Basin Model, developed by consultants for YCWA, to help evaluate effects of alternative instream flow requirements on the use of water for other purposes.

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[36] The average present level of demand would be expected to be somewhat lower due to the fact that the estimate of 273,847 acre-feet per year is based on the five highest years of irrigation deliveries and the fact that the figures for waterfowl habitat demand include acreage in the Wheatland area that does not yet receive water from YCWA.

[37] Based on the figures in Table 14, the average adjusted historic diversion demand for below normal, dry and critical water years is approximately one percent more than in wet and above normal years. However, the two years with the highest demand are both classified as wet.

8.1 The Yuba River Basin Model

Consultants for YCWA have developed a model of the Yuba River Basin that can be used to simulate operation of the Yuba River Development Project under various conditions.[38] YCWA's Yuba River Basin Model is a monthly model that simulates the operations of major water facilities in the Yuba River Basin. YCWA consultants collaborated with one of the original authors of the Corps of Engineers HEC-5 program to develop an enhanced model that allows for more accurate representations of flow and storage dependent diversions on the lower Yuba River. (S-YCWA 13, p.11.) The original operational parameters and criteria for the Yuba River Basin Model were obtained from DWR's HEC-3 model of the Yuba River Basin. (S-YCWA 13, pp. 8-9.) YCWA's consultants have periodically modified the Yuba River Basin Model through collaborative efforts with DWR staff to improve the model as additional hydrology data become available.

On June 14, 1999, the SWRCB staff held a pre-hearing technical workshop. The purpose of the technical workshop was to provide SWRCB staff, staff from DWR's Modeling Support Branch, YCWA consultants, and others an opportunity to discuss hydrologic modeling of the Yuba River Basin to be done by DWR staff at the request of the SWRCB. (S-SWRCB 4; S-SWRCB 5.) In order to allow for evaluating the effects of alternative instream flow scenarios, the SWRCB requested and received the Yuba River Basin model inputs from YCWA's consultants and purchased a copy of the modified HEC-5 software licensed from William Eichert. (S-SWRCB 6.)[39]

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[38] The model developed for YCWA utilizes a HEC-5 general- purpose program developed by the Hydrologic Center of the U. S. Army Corps of Engineers. The HEC-5 program simulates the operation of flood control and water water storage and conveyance systems, through calculations made by a period-by-period, upstream-to-downstream procedure. (S-YCWA 13, p. 9.)

[39] At the time of the 1992 hearing, YCWA's consultant had developed an operational model for the lower Yuba River and introduced testimony about predicted effects of the proposed instream flow and water temperature requirements recommended by DFG. However, the model was not introduced into the record or otherwise made available to the SWRCB for use in evaluating the evidence presented at the 1992 hearing and preparing the 1996 Draft Decision. The SWRCB's purchase of the updated model in 1999 enabled it to be used in evaluating the record for this decision.

DWR's Modeling Support Branch examined the Yuba River Basin Model and compared the inputs used in the model with Yuba River system hydrology developed by the DWR Hydrologic Unit. Following installation and testing of the model, DWR's Modeling Support Branch staff concluded that the modified Yuba River Basin Model can be used as a tool to evaluate water supply impacts of alternative operating scenarios. (S-SWRCB 1; S-SWRCB 3.) In using the Yuba River Basin Model to simulate the effects of the flows specified in the 1996 Draft Decision, the DWR Modeling Support Branch staff reached results that are very similar to those reached by the YCWA consultants.

8.2 Alternatives Evaluated and Modeling Assumptions

For purposes of comparison, the Yuba River Basin Model was used to evaluate the effects of operating the Yuba River Development Project to meet three alternative instream flow scenarios: (1) flows under the 1965 agreement between DFG and YCWA; (2) the instream flow recommendations presented by YCWA at the hearing in 2000; and (3) the instream flow requirements established in this decision. The evaluation of each alternative also reflects the operational constraints under which the project operates as described in detail by YCWA. (S-YCWA 13.) Other assumptions used in the modeling are discussed below.

8.2.1 Water Year Classifications and Hydrologic Data

Five water-year type classifications (i.e., wet, above normal, below normal, dry and critical) as defined in YCWA's Yuba River Index (YRI), were used in evaluating the results under each of the three alternatives. (S-YCWA 14.) The YRI follows the principles of the Sacramento Valley Index and the San Joaquin River Index and is based on the unimpaired runoff of the Yuba River for the period 1921 to 1994. The YRI is defined by three components in a 50-30-20 proportion: (1) the current year's April through July Yuba River unimpaired runoff (50%); (2) the current year's October through March Yuba River unimpaired runoff (30%); and (3) the previous year's index (20%). (S-YCWA 14, p. 7.) The YRI's five water-year classifications, quantified in thousands of acre-feet (TAF) are defined as follows (S-YCWA 14, Appendix A):

Wet:	Equal to or less than 1,230 TAF
Above Normal:	Greater than 990 TAF and less than 1,230 TAF
Below Normal:	Equal to or less than 990 TAF and greater than 790 TAF
Dry:	Equal to or less than 790 TAF and greater than 630 TAF
Critical:	Equal to or less than 630 TAF

The evaluation of the instream flows established in this decision utilizes a modified version of the YRI in which an "Extreme Critical" year classification is added for water years in which the YRI is equal to or less than 540 TAF. For purposes of evaluating the effects of the alternative instream flow scenarios, the flows were modeled for a 71-year period based on the hydrologic records of the Yuba River Basin for the period of 1922 through 1992.

8.2.2 Power Generation Operational Criteria

As discussed in Section 3.3.1 above, since the mid-1980's, the operational criteria specified in the 1965 YCWA/PG&E Power Purchase Contract have been modified annually by mutual agreement of PG&E and YCWA to reduce winter energy production when storage or forecasted runoff is low, thus conserving water for power generation during the summer months when electricity is more valuable and increasing the amount of water remaining available for summer irrigation. Therefore, in evaluating the effects of alternative instream flow scenarios, the SWRCB assumes that the current operational criteria for power generation would continue. Those operational criteria were adopted from studies conducted by YCWA's consultants. The monthly storage levels and evaporation rates used in the Yuba River Basin Model for simulation of power generation were defined by YCWA. (S-YCWA 13, p. 33, Table 26.)

8.2.3 Demand Level

For purposes of evaluating the effects of the different instream flow alternatives, the modeling simulations described in this decision used the average annual demand level discussed in section 7.5 above. The annual demand was distributed on a monthly basis based on YCWA's monthly pattern of distribution as described in Appendix 2.

8.3 Results of Modeling Simulations

Appendix 3 contains the simulation output for the three alternative instream flow scenarios using the Yuba River Basin Model. The effects of the three instream flow alternatives on YCWA water deliveries for offstream purposes, power generation and uses of water for other purposes are discussed in Sections 8.3.1 through 8.4 below.

8.3.1 Effects of Different Alternatives on Water Deliveries for Offstream Uses

The estimated effects of the three instream flow alternatives on average monthly and yearly water deliveries for offstream purposes at Daguerre Point Diversion Dam for the 71-year period of record are summarized in Table 15 below:

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TABLE 15

ESTIMATED AVERAGE DELIVERIES AT DAGUERRE POINT DAM FOR OFFSTREAM PURPOSES COMPARATIVE SUMMARY (ACRE-FEET)

MONTH	ESTIMATED YCWA DIVERSION DEMAND ON LOWER YUBA RIVER	ESTIMATED DELIVERIES UNDER 1965 YCWA/DFG AGREEMENT	ESTIMATED DELIVERIES UNDER YCWA PROPOSED FLOW REQUIREMENTS	ESTIMATED DELIVERIES UNDER FLOW REQUIREMENTS ESTABLISHED IN THIS DECISION
January	352	352	352	-345
February	352	352	352	345
March	2,648	2,648	2,648	2,596
April	16,242	16,242	16,242	15,922
May	53,088	53,088	53,088	52,041
June	49,001	49,001	49,001	48,035
July	57,541	57,541	57,541	56,406
August	48,304	48,304	48,304	47,352
September	15,815	15,815	15,815	15,503
October	16,727	16,727	16,727	16,397
November	9,191	9,191	9,191	9,010
December	4,586	4,586	4,586	4,496
TOTAL	273,847	273,847	273,847	268,447

As the figures in Table 15 indicate, YCWA would be able to fully meet estimated annual diversion requirements of 273,847 acre-feet per annum with no deficiencies under the existing flow requirements of the 1965 agreement or under the instream flow requirements recommended by YCWA.[40] The simulated average annual deficiency under the flow requirements established in this decision would be 5,400 acre-feet out of an estimated average annual demand for surface

[40] As discussed previously, however, neither YCWA nor any of the fishery agencies now suggest that operation to meet the minimum flows specified in the 1965 agreement would provide adequate protection of fish. The YCWA flow recommendations would reduce instream flows from the desirable levels discussed in Sections 6.5 through 6.5.9. The effects of the YCWA flow recommendations on water available for diversion for offstream purposes were evaluated solely for purposes of comparison with the effects of the instream flow requirements established in this decision.

water from the lower Yuba River of 273,847 acre-feet.[41] The numbers in Table C-5 of Appendix 3 indicate that in 58 years of the 71-year period that was modeled, YCWA could comply with the instream flow requirements established in this decision and meet its demand for offstream uses without any deficiencies. The simulated average annual deficiencies for each of the six water year types under the modified Yuba River Index and the instream flow requirements adopted in this decision are shown in Table 16 below.

TABLE 16

SIMULATED AVERAGE ANNUAL DELIVERIES FOR OFFSTREAM USES BY WATER YEAR TYPE

WATER-YEAR TYPE 1922 - 1992 (number of years)	AVERAGE ANNUAL DELIVERY (AF)	AVERAGE ANNUAL DEMAND (AF)*	AVERAGE DEFICIENCY (Percent of Demand)	**AVERAGE DEFICIENCY (AF)**
Wet (24)	273,847	273,847	0.00	0
Above Normal (14)	271,912	273,847	0.7	1,935
Below Normal (15)	273,283	273,847	0.2	564
Dry (8)	260,348	273,847	4.9	13,499
Critical (3)	249,848	273,847	8.8	23,999
Extreme Critical (7)	249,869	273,847	8.8	23,978

**Section 7.9 and Appendix 2 of this decision explain the basis for using the 273,847 acre-feet as the average annual demand in all water year types.*

A more detailed summary of the impacts during each water-year type is provided in Tables 17 through 22 below. As the numbers in the tables indicate, there are some years even in the dry, critical, and extreme critical year classifications in which no deficiencies occurred. Presumably, the difference in deficiencies among similar water year types under the YRI classification is due to variations in the hydrology that are not fully accounted for by the YRI criteria.

[41] This decision uses the term "deficiency" to refer to that portion of the estimated YCWA water demand for offstream uses that cannot be supplied with surface water from the lower Yuba River based on modeling simulations using YCWA's Yuba River Basin Model. As used in this decision, the term does not imply an actual physical shortage of water that is not available from other sources.

TABLE 17

SIMULATED DELIVERIES FOR OFFSTREAM USES
WET WATER-YEARS

WATER YEAR	TOTAL ANNUAL DELIVERIES (AF)	TOTAL ANNUAL DEMAND (AF)	DELIVERY DEFICIENCY (Percent of Demand)	DELIVERY DEFICIENCY (AF)
1922	273,847	273,847	0	0
1927	273,847	273,847	0	0
1938	273,847	273,847	0	0
1941	273,847	273,847	0	0
1942	273,847	273,847	0	0
1943	273,847	273,847	0	0
1951	273,847	273,847	0	0
1952	273,847	273,847	0	0
1953	273,847	273,847	0	0
1956	273,847	273,847	0	0
1958	273,847	273,847	0	0
1963	273,847	273,847	0	0
1965	273,847	273,847	0	0
1967	273,847	273,847	0	0
1969	273,847	273,847	0	0
1970	273,847	273,847	0	0
1971	273,847	273,847	0	0
1974	273,847	273,847	0	0
1975	273,847	273,847	0	0
1980	273,847	273,847	0	0
1982	273,847	273,847	0	0
1983	273,847	273,847	0	0
1984	273,847	273,847	0	0
1986	273,847	273,847	0	0
Average	273,847	273,847	0	0

TABLE 18

SIMULATED DELIVERIES FOR OFFSTREAM USES ABOVE-NORMAL WATER-YEARS

WATER YEAR	TOTAL ANNUAL DELIVERIES (AF)	TOTAL ANNUAL DEMAND (AF)	DELIVERY DEFICIENCY (Percent of Demand)	DELIVERY DEFICIENCY (AF)
1923	273,847	273,847	0	0
1928	273,847	273,847	0	0
1935	273,847	273,847	0	0
1936	273,847	273,847	0	0
1937	273,847	273,847	0	0
1940	261,997	273,847	4.3	11,850
1945	273,847	273,847	0	0
1946	273,847	273,847	0	0
1948	273,847	273,847	0	0
1950	273,847	273,847	0	0
1954	273,847	273,847	0	0
1957	273,847	273,847	0	0
1973	273,847	273,847	0	0
1978	258,612	273,847	5.6	15,235
Average	271,912	273,847	0.7	1,935

TABLE 19

SIMULATED DELIVERIES FOR OFFSTREAM USES BELOW-NORMAL WATER-YEARS

WATER YEAR	TOTAL ANNUAL DELIVERIES (AF)	TOTAL ANNUAL DEMAND (AF)	DELIVERY DEFICIENCY (Percent of Demand)	DELIVERY DEFICIENCY (AF)
1925	268,769	273,847	1.9	5,078
1926	273,847	273,847	0	0
1930	273,154	273,847	0.6	1,693
1932	273,847	273,847	0	0
1944	273,847	273,847	0	0
1949	273,847	273,847	0	0
1960	272,154	273,847	0.6	1,693
1962	273,847	273,847	0	0
1964	273,847	273,847	0	0
1966	273,847	273,847	0	0
1968	273,847	273,847	0	0
1972	273,847	273,847	0	0
1979	273,847	273,847	0	0
1985	273,847	273,847	0	0
1989	273,847	273,847	0	0
Average	273,283	273,847	0.2	564

TABLE 20

SIMULATED DELIVERIES FOR OFFSTREAM USES
DRY WATER-YEARS

WATER YEAR	TOTAL ANNUAL DELIVERIES (AF)	TOTAL ANNUAL DEMAND (AF)	DEFICIENCY (Percent of Demand)	DEFICIENCY (AF)
1929	261,847	273,847	4.4	12,000
1933	273,847	273,847	0	0
1939	189,850	273,847	30.7 **(see note)**	83,997 **(see note)**
1947	273,847	273,847	0	0
1955	273,847	273,847	0	0
1959	261,847	273,847	4.4	12,000
1981	273,847	273,847	0	0
1990	273,847	273,847	0	0
Average	260,348	273,847	4.9	13,499

Note: Pursuant to the "Deficiency Clause" described under Section 8.4 of this decision, any year in which the projected deficiency in offstream deliveries would exceed 20% of projected demand, the permittee may ask for a temporary modification of instream flow requirements. Under the provisions of the "Deficiency Clause" described in Section 8.4, the maximum deficiency at the present level of demand would be limited to 54,769 acre-feet, or 20% of present demand.

TABLE 21

SIMULATED DELIVERIES FOR OFFSTREAM USES
CRITICAL WATER-YEAR

WATER YEAR	TOTAL ANNUAL DELIVERIES (AF)	TOTAL ANNUAL DEMAND (AF)	DELIVERY DEFICIENCY (Percent of Demand)	DELIVERY DEFICIENCY (AF)
1961	273,847	273,847	0	0
1987	201,850	273,847	26.3 **(see note)**	71,997 **(see note)**
1991	273,847	273,847	0	0
Average	249,848	273,847	8.8	23,999

Note: Pursuant to the "Deficiency Clause" described under Section 8.4 of this decision, any year in which the projected deficiency in offstream deliveries would exceed 20% of projected demand, the permittee may ask for a temporary modification of instream flow requirements. Under the provisions of the "Deficiency Clause" described in Section 8.4, the maximum deficiency at the present level of demand would be limited to 54,769 acre-feet, or 20% of present demand.

TABLE 22

SIMULATED DELIVERIES FOR OFFSTREAM USES
EXTREME CRITICAL WATER-YEAR

WATER YEAR	TOTAL ANNUAL DELIVERIES (AF)	TOTAL ANNUAL DEMAND (AF)	DELIVERY DEFICIENCY (Percent of Demand)	DELIVERY DEFICIENCY (AF)
1924	237,848	273,847	13.1	35,999
1931	273,847	273,847	0	0
1934	273,847	273,847	0	0
1976	261,847	273,847	4.4	12,000
1977	164,158	273,847	40.1**(see note)**	109,689 **(see note)**
1988	263,690	273,847	3.7	10,157
1992	273,847	273,847	0	0
Average	249,869	273,847	8.8	23,978

Note: Pursuant to the "Deficiency Clause" described under Section 8.4 of this decision, any year in which the projected deficiency in offstream deliveries would exceed 20% of projected demand, the permittee may ask for a temporary modification of instream flow requirements. Under the provisions of the "Deficiency Clause" described in Section 8.4, the maximum deficiency at the present level of demand would be limited to 54,769 acre-feet or 20% of present demand.

The figures in Tables 15 through 22 above show that the instream flow requirements adopted in this decision will have no impact on YCWA water deliveries in many years. In three years of the 71-year period of record that was modeled, the flow requirements established in this decision could lead to deficiencies ranging from 26 percent to 40 percent unless a provision is made for adjusting the instream flow requirements in the few years where large deficiencies would otherwise occur. Section 8.4 below discusses the Deficiency Clause that will be operable in those years when the projected deficiency in deliveries for offstream uses would otherwise exceed 20 percent.

As discussed in Section 3.1, YCWA estimates the annual groundwater recharge rate in the Yuba-South Basin to be between 15,100 acre-feet and 21,200 acre-feet depending upon variable hydrologic conditions. The estimated groundwater recharge rate substantially exceeds the average annual surface water deficiency of 6,364 acre-feet that is estimated to occur using the instream flow requirements in this decision. In view of the Deficiency Clause discussed in

Section 8.4, the impact of the flow requirements established in this decision on offstream water deliveries will always be less than the additional 82,018 acre-feet of groundwater that YCWA water users pumped in 1991 to enable a water transfer to outside the YCWA service area. (See Section 3.1.2 above.) Thus, the record indicates that any deficiencies in surface water supplies that may occur due to the instream flow requirements established in this decision could be offset through implementation of a groundwater conjunctive use program[42] Deficiencies in the amount of water available for offstream use could also be offset through increased water conservation measures. Despite successful water conservation measures in some instances, the record establishes that water users in the YCWA service area could adopt additional reasonable but more stringent water conservation measures.[43] In addition, YCWA's contracts provide for imposing deficiencies upon its contractors under specified conditions. The specific means of dealing with any potential deficiencies in surface water supplies from the lower Yuba River is a decision for YCWA and water users within its service area.

8.3.2 Effects of Different Alternatives on Hydroelectric Power Production

Under the terms of YCWA/PG&E Power Purchase Contract, PG&E pays YCWA $8 million per year for all power that is generated at YCWA facilities. (YCWA 6, p.2..) The payment is not dependent upon the amount of power produced. Consequently, any reduction in the economic value of power produced until 2016 would represent a cost to PG&E, rather than to YCWA.

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[42] In addition to the direct costs of pumping groundwater, Brophy presented testimony that maintaining standby groundwater pumping capability can result in additional annual costs of approximately $36.25 per acre even if no groundwater is pumped. (S-Brophy 1, p. 4.) These costs would be incurred whether the standby pumping capability is maintained in order to allow groundwater pumping needed to meet demands within Yuba County or to make surface water available for use in other areas of the state as proposed by YCWA.

[43] For example, the water demand figures used in this analysis for waterfowl habitat are based on an assumed duty of water of one acre-foot per acre for 90 percent of the rice acreage in the YCWA service area, plus 10 percent for conveyance losses. Yet the testimony establishes that flooding successive rice fields sequentially would require less water and is more desirable from the standpoint of providing waterfowl habitat. (S-R.T.1313:15 -1314:22; 1320:21-1321:4.) As discussed in Section 7.3, the record also indicates that rice can be grown with less water per acre when there is an incentive to conserve as was the case when groundwater was used more widely in the YCWA service area.

In contrast to many other situations where power production is at issue, virtually all of the water released to provide instream flows in the lower Yuba River passes through the YCWA and PG&E powerplants by the time it enters the river downstream of Englebright Dam. Therefore, variations in the instream flow requirements for protection of fish in the lower Yuba River would be expected to have minimal impact on the net quantity of power produced. A change in the release schedule toward greater releases in spring months and reduced releases in July, August, and September, however, would be expected to result in a shift in power production to different periods and a reduction in the value of the power produced. (R.T. VI, 60:16-61:4.) Adherence to the schedule specified in the Power Purchase Contract would also result in higher releases earlier in the year and reduced releases in July, August, and September.[44]

The flow requirements established in this decision apply to the reach of the lower Yuba River downstream of Englebright Reservoir, and therefore, would not directly impact on the use of the Colgate Powerhouse as a daily peaking facility which can produce power during the periods of each day when the demand and economic value of the power produced is greatest. The quantity of power to be generated at Colgate Powerhouse under each of the three alternatives is shown in Appendix 4. The relatively small difference in the amount of power generated under the alternative proposed by YCWA and the alternative based on the instream flows requirements adopted in this decision, when averaged over all water-year types, is due in part to the similarity of the different instream flow alternatives for wet and above normal years, and in part due to influence of other operational criteria.

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[44] In recent years YCWA and PG&E have agreed to deviate from the release schedule called for in the 1966 Power Purchase Contract. The Yuba River Development Project has always been operated for multiple purposes, including fishery protection, and virtually any change in the operation of the project for any reason can affect power revenues. Releases of water from New Bullards Bar can also affect the timing of water releases by the State Water Project (SWP) and the Central Valley Project (CVP) for meeting Delta outflow requirements. (R.T. XII, 19:4-19:18.) Therefore, any power production impacts associated with changing instream flows in the lower Yuba River may be partially offset due to related changes in releases at SWP and CVP facilities. Although this point is recognized on page 16 of the letter dated November 27, 2000, submitted by PG&E, the evidentiary record is insufficient to determine the extent of the changes at other power production facilities.

YCWA's Yuba River Development Project historically has been operated for many purposes of which power production is one. Strict conformance with the provisions of the Power Purchase Contract would not maximize generation of power during periods of highest demand. In view of the multiple purposes for which the project was developed, the importance of the Yuba River fishery, and legal requirements for protection of that fishery where feasible, the SWRCB ordinarily would not defer requiring compliance with the new requirements due to the effects on hydroelectric power production discussed above.

However, in view of the critical electrical power situation in California at the present time, and the need to maintain flexibility in powerplant operations to avoid serious electricity shortages, we conclude that it is appropriate in this instance to defer imposition of the long-term instream flow requirements established by this decision for a period of approximately five years, until April 21, 2006.[45] In the interim, this decision requires YCWA to comply with the instream flow requirements set forth in the order at the end of this decision. The interim flow requirements are similar to the flows specified in YCWA's instream flow proposal presented at the 2000 hearing.[46] (See Section 6.5.6 above.) Operation in accordance with the interim instream flows will allow more flexibility in releasing water from power generation during months of high demand. With the exception of the provision for lower interim flows, the other provisions of this decision are not deferred.

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[45] The SWRCB takes official notice of the fact that, on January 17, 2001, Governor Davis proclaimed a State of Emergency to exist due to the energy shortage in California. (Cal. Code Regs. tit 23, Section 648.2.) The SWRCB also takes official notice that on February 8, 2001, the Governor issued several Executive Orders to expedite application processing and construction of new powerplants and to increase electrical generating capacity in California. (Executive Orders D-22-01, D-23-01, D-24-01, D-25-01, and D-26-01.

[46] The interim flow requirements specified in the order at the end of this decision differ from the flows recommended by YCWA for June of critical years and for October 1 through October 14 of critical years. The interim flows for those periods of critical years were increased from the YCWA proposal based upon the higher flow requirements that currently apply under the 1965 DFG/YCWA agreement.

8.3.3 *Effects of Revised Instream Flow Requirements on Recreation, Wildlife, Riparian Vegetation and Waterfowl Habitat*

Increased minimum flow requirements in the lower Yuba River could affect recreation along the river and at New Bullards Bar and Englebright Reservoirs. Water-related recreation in the lower Yuba River area includes fishing, canoeing, rafting, snorkeling, bird watching, photography, hiking and camping. (R.T. VII, 67:6-69:5; R.T. XIV, 16:5-21:25; Cook Exhibits J-4, L-3, M-5 through M-8, and T.) In years when instream flows approach the minimum required under the 1965 agreement, interest in canoeing and rafting declines. (R.T. XII, 69:6-70:2.) There was testimony that the flows proposed by DFG will improve recreational opportunities. (R.T. XIV, 12:5-12:17 and 15:8-15:13.) The flows established in this decision are lower than proposed by DFG, but substantially higher than the flows specified in the 1965 agreement. We conclude that the increased flows established in this decision will benefit recreational use of the lower Yuba River.

In 1992, YCWA presented testimony that New Bullards Bar provides important recreational resources and recommended that studies be done to evaluate potential adverse impacts of the DFG recommendations on recreation at New Bullards Bar. (R.T. IX, 123:1-123:20.) No such studies were introduced into the record during the hearing in 2000. The evidence presented by YCWA in 1992 indicates that recreation at New Bullards Bar actually increased during the 1987-1992 drought as other reservoirs in the area were drawn down. (YCWA 19, pp. 13 and 14.) Thus, the reduction in reservoir storage levels during that period due to temporary water transfers and associated instream flow requirements does not appear to have had a significant adverse effect on recreation. The testimony of the recreation specialist presented by YCWA did not address recreation at Englebright Reservoir or the lower Yuba River. (R.T. IX, 123:17-123:20.)

Wildlife-related issues addressed in the proceeding include effects of higher flow requirements on bald eagles, riparian vegetation and waterfowl habitat. Bald eagles are known to occur at New Bullards Bar Reservoir throughout the year, and along the lower Yuba River during fall and winter. (R.T. IX, 121:19-122:10; R.T. XIV, 11:15-11:20 and 20:3-20:10.) YCWA's wildlife

expert testified in 1992 that he was not aware of any problems with bald eagles at New Bullards Bar Reservoir due to water level fluctuations in recent years, and that he had no evidence to indicate the flows proposed by DFG would adversely affect bald eagles. (R.T. IX, 129:11-131:3.)

The riparian plant community adjoining the lower Yuba River can benefit wildlife and fisheries. (DFG 26, p. 101.) Since completion of New Bullards Bar, the riparian community has expanded under streamflow conditions that have generally been higher than required under the 1965 agreement. (DFG 26, p. 102-103; YCWA 20, pp. 2-9 to 3-10.) The flows established by this decision are within the recent historic range of flows and are not expected to adversely affect the riparian plant community.

There was extensive testimony about the beneficial use of water from the lower Yuba River for winter flooding of rice fields to promote rice straw decomposition and to provide waterfowl habitat. As discussed in Section 8.3.1, the instream flow requirements established in this decision will leave sufficient water available from surface and groundwater sources to meet YCWA's water demands for offstream uses, including waterfowl habitat. In some years, the water applied for waterfowl habitat may be reduced, but there is no evidence that the instream flow requirements established in this decision would prevent Yuba County water users from maintaining sufficient waterfowl habitat

8.4 Temporary Modification of Instream Flow Requirements Based on Projected Surface Water Deficiencies

As discussed in preceding sections, the record shows that YCWA will have sufficient water available to comply with the instream flow requirements established in this decision and to fully meet reasonable demands for surface water deliveries in most years. However, computer simulations show that in 3 years of the 71-year period of record, YCWA would experience deficiencies in excess of 20 percent of its present level of demand. As the demand for water

increases, deficiencies in the amount of surface water available to meet offstream demands would be expected to increase.

In view of the need for water for fishery protection and the availability of water from other sources, the SWRCB believes it is reasonable to expect YCWA to meet a significant portion of expected surface water deficiencies through conjunctive use programs, increased water conservation or other approaches. However, in the relatively few dry, critical or extreme critical years in which computer simulations indicate that large deficiencies may occur, the SWRCB believes that it is reasonable to allow for a temporary reduction in instream flow requirements in order to prevent deficiencies in the amount of water available for offstream uses from exceeding 20 percent of the projected demand for that year.

Therefore, among the amendments to YCWA's water right permits specified in this decision is a condition that allows YCWA to file a request with the Chief of the Division of Water Rights for a temporary reduction in the instream flow requirements applicable to its permits. The condition allows for filing the request in dry, critical, and extreme critical years (based on the Yuba River Index) if YCWA's projected deficiency for surface water deliveries within the YCWA service area for the calendar year exceeds 20 percent of projected demand. For purposes of the permit condition, "projected demand" for the calendar year is based upon the sum of the following:

1. Permittee's projected demand for surface water deliveries to Dry Creek Mutual Water Company (Dry Creek) for the current year, not to exceed 16,743 acre-feet;

2. Permittee's projected demand for surface water deliveries to Wheatland Water District and Wheatland Water District Detachments (Wheatland) for the current year, not to exceed 40,855 acre-feet; and

3. Permittee's projected demand for surface water deliveries for the remainder of permittee's authorized place of use within the permittee's service area (excluding Dry Creek and Wheatland) for the current year, not to exceed 273,847 acre-feet.

In order to allow the SWRCB to evaluate the nature and extent of any projected deficiencies, the new permit condition provides that the projected demand figures must specify YCWA's surface water deliveries to each water district or other recipient that have occurred during the calendar year as of the date of the request and YCWA's projected demand for surface water deliveries for the remainder of the current calendar year. The request must include documented data on actual surface water deliveries to Dry Creek and Wheatland for the past three years (if applicable) and expected surface water demand for Dry Creek and Wheatland for the current calendar year.

The permit condition also provides that if YCWA files a request to reduce instream flow requirements, then it shall develop an alternative instream flow proposal, following notification to and consultation with DFG, that would allow for meeting up to 80 percent of YCWA's projected demand for the current year. The alternative instream flow proposal must be included with YCWA's request and must propose instream flows to remain in effect from the date of approval by the Division Chief for the remainder of the calendar year. Any request for a temporary reduction in instream flow requirements must be submitted by April 7 of the year for which the reduction is requested, in order to facilitate action by the Division Chief upon the request prior to April 21 of each year.

Following review of any request submitted by YCWA and other relevant information, the permit condition provides that the Division Chief has the authority to approve a temporary reduction in the instream flow requirements for the period of April 21 through October 31 (or a portion thereof) of the year in which the flow reduction request is submitted. The Division Chief may approve a temporary reduction of instream flow requirements, as requested by YCWA or as otherwise justified by the available information, but the condition provides that, in no event, shall the temporary instream flow requirements be approved that are less than proposed in YCWA's request or less than the instream flows specified in the table set forth in paragraph 1(c) of the first term added to YCWA's permits by the order portion of this decision.

The term also provides for notification to DFG of action upon the request for a temporary reduction of applicable instream flow requirements and provides that the Division Chief's action shall be subject to reconsideration by the SWRCB. Finally, the condition includes appropriate reporting requirements regarding actual water deliveries, any curtailments in requested deliveries, and instream flows at Marysville for the year during which any reduced flow requirements are in effect. This condition is included in the permit as a means of balancing the need for instream flows for protection of fish with the need for water to serve offstream uses in YCWA's service area

8.5 Summary of Effects of Revised Instream Flow Requirements

YCWA introduced substantial evidence regarding the effects of establishing the instream flow requirements proposed in the 1996 Draft Decision. The instream flow requirements established in this decision are similar to the 1996 Draft Decision, but are substantially lower during the spring months of extreme critical years. Much of the evidence YCWA presented regarding potential water supply deficiencies and related effects was based on excessively high estimates of YCWA's water demands. For the reasons discussed in Section 7.5 above, we conclude that a more reasonable estimate of YCWA's present demand for surface water from the lower Yuba River is 273,847 acre-feet per year. As the findings above explain, any deficiencies that may result from operating to meet the instream flow requirements established in this decision are expected to be significantly less than predicted by YCWA and any adverse effects would be reduced accordingly.

Due to the limitations in computer modeling and inevitable yearly variations in many factors, the analysis developed through use of YCWA's Yuba River Basin Model cannot be treated as a precise forecast of what will occur in any particular year. However, the record establishes that the modeling simulations provide a reasonable estimate of the probable effects of maintaining the instream flows required by this decision. In our opinion, the evidentiary record and the foregoing analysis establish that maintaining the instream flow requirements specified in this

decision is feasible[47] and will provide substantial protection and benefits for fishery resources in the lower Yuba River. In most years, YCWA will have sufficient surface water available from the lower Yuba River to meet all its reasonable offstream demands. In some years, water users will need to utilize groundwater to offset deficiencies in the surface water supply or employ additional water conservation measures to reduce water use. The Deficiency Clause discussed in Section 8.4 will limit deficiencies to no more than 20 percent at YCWA's present level of demand.

9.0 LEGAL ISSUES RELATED TO FISHERY PROTECTION MEASURES

Statutory provisions regarding protection of fishery resources are reviewed in Sections 4.0 through 4.3 above. The subject of the SWRCB's legal authority to regulate water diversions to protect fish and other public trust uses, and to ensure compliance with the reasonable use and diversion mandates of Article X, Section 2 of the California Constitution, is discussed in Sections 5.0 through 5.3 above. A number of other legal issues were raised at the hearing or in legal briefs submitted following the hearing in 1992 and in 2000. Sections 9.1 through 9.8 below address legal issues raised by parties to the proceeding that are not addressed elsewhere in this decision.

9.1 Preparation of Department of Fish and Game Fisheries Management Plan

The DFG Lower Yuba River Fisheries Management Plan (DFG 1) was prepared in response to the Streamflow Protection Standards Act enacted in 1982. (Public Resources Code § 10000 et seq.). The act directs DFG to identify streams and watercourses throughout the state for which minimum flow levels need to be established to assure the continued viability of stream-related fish and wildlife resources. (Public Resources Code § 10001.) In developing the requirements,

[47] In addition to information derived using the Yuba River Basin Model, the SWRCB believes that it is significant that throughout the 1987 to 1992 drought, YCWA was able to: (1) supply all existing demand without imposing any deficiencies as allowed for under its contracts, (2) maintain a minimum of 500,000 AF (or roughly 50 percent of capacity) in New Bullards Bar Reservoir, (3) provide 725,000 AF of water to other areas of the state, and (4) maintain instream flows in the Yuba River which were frequently much higher than the minimum flows required under the 1965 agreement and, during substantial periods of time, higher than the flows established in this decision.

DFG is directed to consult with state officials, all affected local governments, and any private individuals, groups or organizations deemed advisable. DFG is directed to transmit its proposed requirements to the SWRCB. (Public Resources Code § 10002.)

Water Code section 1257.5 provides that the SWRCB shall consider the proposed requirements when acting upon applications to appropriate water. Section 1257.5 also provides that the Board "may establish such streamflow requirements as it deems necessary to protect fish and wildlife as conditions in permits and licenses." Either on its own motion or at the request of the SWRCB, DFG "may review any streamflow requirement and may propose any revision or modification thereof." (Public Resources Code § 10003.)

YCWA alleges that DFG failed to comply with statutory requirements governing preparation of the fishery management plan because DFG failed to consult with YCWA. The record shows, however, that DFG repeatedly was in contact with YCWA with regard to specific fishery issues and development of the fishery management plan. (e.g., YCWA 38, including attached proposed "Memorandum of Understanding" SWRCB 1e, letter dated October 12, 1990, from Donn Wilson to Peter F. Bontadelli; and SWRCB 1e, letter dated March 20, 1990, from Donn Wilson to W. Don Maughan.) The fact that the two agencies were unable to reach an accord simply shows that the consultations did not lead to a mutually agreeable proposal.

The DFG recommendations are based on several years of technical study and analysis. Much of the information developed in that process is highly relevant to the issues before the SWRCB. Although the requirements established by this decision do not adopt the DFG recommendations in their entirety, the DFG Fisheries Management Plan is the most comprehensive fishery study done on the Lower Yuba River. As such, the report provides relevant evidence that was appropriately considered in developing this decision.

YCWA's post-hearing briefs argue that DFG plan does not address economic and other implications of adopting DFG's recommendations. As a result, YCWA argues, DFG failed to

meet "its" burden of proof and, therefore, YCWA's permits should not be amended. This argument appears to reflect a basic misconception of the scope and nature of the proceeding. In this decision, the SWRCB is applying its own authority, not DFG's, based on evidence in the entire record, not just evidence in the DFG plan.

By the time of the resumed hearing in February 2000, if not before, there was a widespread consensus that, if the Yuba River Development Project were operated all times just to meet the minimum flow requirements specified in the 1965 agreement, then there would not be sufficient flows to keep fish in good condition. Moreover, YCWA's water right permits contain earlier flow requirements that both DFG and YCWA recognize were superseded by the flows in the 1965 agreement. In the absence of any meaningful instream flow requirements in the permit, the task before the SWRCB is to exercise its ongoing authority and responsibility to protect public trust resources where feasible in accordance with applicable law.[48] Due to the number and complexity of issues involved, no single party was expected to offer evidence on all issues addressed in this decision. Numerous parties presented evidence on many issues. Taken as a whole, the extensive evidentiary record forms a solid basis for this decision.

YCWA also takes issue with the language in the Fisheries Management Plan about "optimizing" fishery habitat, arguing first that DFG has not established that its recommendations would "optimize" fishery habitat, and, second, that there is no legal basis for requiring that fishery conditions be "optimized." It is unclear from the record what DFG meant by "optimizing" habitat. Due to the variety of species and lifestages present in the lower Yuba River, DFG had to balance desirable habitat conditions of different species and lifestages to come up with proposed flows representing what it considered to be an "optimum" proposal.

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[48] The initial hearing in 1992 was conducted in response to a complaint and in response to DFG's request to consider the recommendations in the Fisheries Management Plan. Based on the evidence in the present record regarding the importance of Yuba River fishery resources (including threatened species) and the absence of adequate conditions in YCWA's permits to protect those resources, the SWRCB would be justified in proceeding in this matter even if there were no pending complaint.

The DFG plan proposes that potential water shortages in dry years be distributed between reductions in instream flows and reductions in consumptive use. This approach indicates that DFG did not intend to "optimize" fishery conditions at the expense of all other uses. In addition, we note that DFG's temperature recommendations are at the upper end of the desired temperature range for the species under consideration, which indicates that DFG considered the available water supply in developing its recommendations. The USFWS criticism of the DFG plan for not considering the potential fishery benefits of higher flow levels also indicates that the DFG plan was not based on a single purpose intent of "optimizing" fishery habitat.

Regardless of what DFG may have intended by the term "optimizing," the fishery protection measures established by the SWRCB in this decision do not represent an attempt to create some hypothetical optimal fishery habitat without consideration of other factors. Rather, the requirements of this decision take into account the evidence presented on fishery needs, competing water demands, project operations, and applicable legal requirements.

9.2 Effect of Federal Court Rulings Regarding Preemption of State Regulatory Authority Over Federally Licensed Hydropower Projects

In addition to the water right permits for irrigation, municipal use, recreation and fishery enhancement which are the subject of the present proceeding, YCWA holds separate water right licenses, and a federal power license, authorizing generation of hydropower at the Colgate Powerhouse and Narrows Powerhouse No. 2. Citing the Supreme Court ruling in the *"Rock Creek"* case (*California v. Federal Energy Regulatory Commission* (1990) 495 U.S. 490 [110 S. Ct. 2024]), YCWA filed suit in federal court arguing that the State was preempted from setting instream flow or temperature standards which differ from the requirements specified in YCWA's federal power license. YCWA requested a preliminary injunction to prevent the SWRCB from "considering or imposing" flow or temperature standards that differ from the requirements in the power license.

In an order dated January 29, 1992, Judge Edward Garcia ruled that YCWA had little chance of success on the merits and denied YCWA's request for a preliminary injunction. Judge Garcia's ruling stressed that the water rights under consideration in the present proceeding are distinct from YCWA's water right licenses for generation of hydropower. The *Rock Creek* decision addressed state water right authority over single-purpose hydroelectric projects. It did not address the state's authority over diversion or use of water for irrigation, municipal, or other uses as part of a multiple purpose project involving hydropower production.

In the present case, the "supplemental notice of public hearing" dated October 18, 1991, specifically excluded YCWA's water right licenses for production of hydroelectric power production from consideration at the SWRCB hearing. As explained in the original hearing notice dated September 12, 1991, and the supplemental notice hearing, the focus of the proceeding, with respect to the diversion of water by YCWA, was on diversions under Water Right Permits 15026, 15027, and 15030 for irrigation, domestic, industrial, recreation, fish and wildlife, and flood control uses.

The position of YCWA and PG&E,[49] as expressed at the hearing and in post-hearing legal briefs, appears to be that the existence of a federal power license for the hydroelectric power aspects of a multiple-use project somehow shields the project operator's diversion of water for other purposes from state regulation to protect fish and wildlife. The SWRCB recognizes that under the *Rock Creek* decision, the Federal Energy Regulatory Commission (FERC) has preemptive authority to establish the instream flow requirements that apply to the use of water for power production. If YCWA proposed to divert water only for power production purposes as authorized by its FERC license and by its state water right licenses for power production, then it might have a basis for arguing that the state would not have the authority to adopt water right

[49] PG&E participated in the 1992 hearing, but did not participate in the hearing in 2000 or file a brief following the hearing.

permit conditions establishing instream flow requirements more restrictive than the federal requirements.[50]

Section 27 of the Federal Power Act specifies that state authority over irrigation, municipal use, or other similar uses is not preempted. (16 U.S.C. § 821; see *Rock Creek*, 495 U.S. 490, 398 [110 S.Ct. 2024, 2029] [holding that this section preserves state authority to regulate irrigation, municipal use, and other uses of the same nature, and does not preserve state authority to regulate use for hydropower generation].) In *County of Amador* v. *El Dorado County Water Agency* (1999) 76 Cal.App.4th 931 [91 Cal.Rptr.2d 66], the Court of Appeal held that the Federal Power Act does not preempt state laws concerning environmental impacts of operation of FERC licensed multiple purpose water development projects to the extent that those laws are applied to use of the project for consumptive use purposes such as irrigation or municipal use. Thus, if a water user diverts water for irrigation or other non-power purposes, as in the present case, that diversion of water remains fully subject to regulation by the State, including appropriate conditions for protection of fish and wildlife.

Both PG&E and YCWA cite *Escondido Mutual Water Co. v. FERC* (1982) 692 F. 2d 1223, for the proposition that FERC has jurisdiction over the non-power production aspects of a multiple-purpose project for which a federal power license has been issued. The Escondido decision, however, says nothing about preemption of state law. The fact that FERC has jurisdiction over a project does not prevent the State from exercising its independent jurisdiction to regulate diversions of water for non-power production purposes.

The logical conclusion of PG&E's and YCWA's argument regarding the extent of federal preemption would be that the existence of a federal power license for any aspect of a multi-purpose project would shield all other aspects of the project, and all other uses of water by the project, from having to comply with any provisions of state law beyond protection of prior

[50] The state also may impose instream flow requirements as part of its water quality certification for FERC licensing or FERC license renewal. (*PUD No. 1* v. *Washington Department of Ecology* (1994) 511 U.S. 700 [114 S.Ct. 1900].)

rights.[51] As the price for the exemption from state regulation that YCWA seeks, its diversion of water for competing non-power production purposes would be subject to regulation by the federal government. The result would be a major shift in the responsibility for regulation of California's water resources away from the State and toward the federal government. We believe that, not only would such a change be contrary to law, but that a shift toward exclusive federal regulation of competing non-power production uses would be contrary to the interests of California water users.

The FERC relicensing order for PG&E's Narrows 1 Powerplant establishes instream flow requirements at Smartville in order to protect fishery habitat. Diversion of water near Daguerre Point Dam for consumptive use in the YCWA service area, however, could substantially reduce flows between Daguerre Point Dam and the confluence of the Yuba River with the Feather River. For the SWRCB to condition YCWA's water right permits for consumptive use on YCWA maintaining appropriate instream flows below Daguerre Point Dam would serve to compliment FERC's objective of providing sufficient water for instream uses. In addition, the findings and conclusions in this decision will be utilized by the SWRCB in commenting on hydropower applications before FERC and in exercising the State's water quality certification authority. (See *Jefferson County PUD v. Ecology Dept. of Washington* (1994) 511 U. S. 700 [114 S. Ct. 1900].)

9.3 Provisions of SWRCB Regulations Governing Release of Stored Water for Protection of Public Trust Purposes

The SWRCB's authority to modify water right permit terms to protect public trust uses of water is addressed in subdivision (a) of section 784, title 23, California Code of Regulations, as follows:

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[51] No parties to the proceeding have suggested that the State lacks authority to protect holders of prior rights against diversions by junior appropriators.

"In exercising its discretionary authority respecting applications to appropriate water, including prescribing or modifying permit terms and conditions, the board may require releases of water diverted and stored whenever such releases are determined by the board to be in the public interest or are needed to protect public trust uses of water, if such requirement is reasonable under Article X, Section 2 of the California Constitution." (Emphasis added.)

Subdivision (b) of section 784 provides that notwithstanding subdivision (a), where construction has commenced or the permittee has undertaken a substantial financial commitment for construction, the SWRCB will not require a release or bypass of water authorized to be appropriated unless the permittee agrees or unless the Board expressly reserved jurisdiction to require such bypass or release at the time of issuing the permit. Subdivision (b) goes on to state, however, that the specified restrictions on exercise of the SWRCB's authority "shall not apply to the continuing authority of the board to regulate appropriations of water so as to conform with Section 780 of this subchapter or to revoke permits . . . ."

Section 780 of title 23 of the California Code of Regulations requires that all permits issued by the SWRCB shall include a prescribed condition providing that the permit is subject to the Board's continuing authority to protect public trust uses. Permits 15026, 15027, and 15030 include a prior version of the present "continuing authority term" specified in section 780 of the regulations. The permit term in Permits 15026, 15027, and 15030 provides that all rights and privileges under the permit (and any subsequent license) including method of diversion, method of use, and quantity of water diverted are subject to the continuing authority of the Board to protect public trust uses and to prevent waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion.

Mandatory releases of stored water for protection of public trust uses are subject to subdivisions (c) and (d) of section 784 which provide:

"(c) Before requiring releases of water pursuant to subsection (a) of this section over the objection of the applicant or permittee, the board will hold a hearing and make findings with respect thereto. The hearing will be limited to a consideration of (1) the basis for any recommendation of the Department of Fish and Game

pursuant to Water Code Section 1243; (2) whether such releases are necessary to maintain or enhance beneficial uses or to meet water quality objectives in the relevant water quality control plan; (3) the probable effects of releases upon the applicant's proposed project; (4) evidence to assist in the preparation of dry and critical year relief provisions related to releases; and (5) any other issues which may be relevant to the appropriateness of a release requirement.

"(d) The quantity of water to be released from storage shall be reduced in dry and critical years as defined by the board on a basis determined by the board to be equitable after considering and balancing the effect of reduced quantity upon downstream conditions and upon permittee's project."

In this instance, SWRCB proceedings complied with the applicable procedural requirements of subdivision (c) above. In addition, this decision establishes lower instream flow requirements for dry and critical years based on equitable considerations and balancing of the effects on instream conditions and the other non-power purposes of permittee's project. In exercising our continuing authority over the water rights amended by this decision, the SWRCB concludes that the limitations established by this decision are reasonable and consistent with article X, section 2 of the California Constitution, consistent with the public interest, and necessary to preserve and restore uses protected by the public trust.

9.4 Compensation for Potential Loss of Revenue

YCWA's legal brief suggests that any potential loss of revenue from power generation may be compensable in money damages as a taking of YCWA's property rights. This suggestion is incorrect for several reasons. First, the argument ignores the fact that the property rights for which YCWA believes compensation may be due are the water right permits which it received from the State. The property rights represented by YCWA's water right permits are defined by the Water Code and applicable court decisions.

As discussed in Section 5.2 above, the California Supreme Court addressed the subject of modification of appropriative water rights in *National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419 [658 P.2d 709, 189 Cal. Rptr. 346] cert. denied, 464 U.S. 977. The Court concluded that appropriative water rights were subject to modification in order to protect public

trust uses. In addition, it has long been established that all water rights in California are subject to regulation as necessary to comply with the constitutional mandate to avoid wasteful or unreasonable uses, methods of use, or methods of diversion, and to maximize the beneficial use of water. (California Constitution, art. X, § 2; *Gin S. Chow v. City of Santa Barbara* (1933) 217 Cal. 673 [22 P.2d 5].) These limitations "inhere in the title" of the property right YCWA obtained when it accepted a permit from the SWRCB; applying these limitations cannot constitute a taking because YCWA acquired its right subject to these limitations. (See *Lucas v. South Carolina Coastal Council* (1992) 505 U.S. 1003, 1029 [112 S.Ct. 2886, 2900].)

Water Code section 1391 provides that every permit issued shall include a list of enumerated conditions and the statement that any appropriator to whom a permit is issued takes it subject to the conditions expressed in the permit. Water Code section 1392 states that every permittee who accepts a permit does so "under the condition precedent that no value whatsoever in excess of the amount paid to the State therefore shall at any time be assigned or claimed for any permit" if purchased or condemned by the State. YCWA's water right permits include conditions setting forth the provisions of sections 1391 and 1392. In addition, YCWA's permits include the standard permit condition providing that the rights under the permit are subject to the continuing authority of the Board to impose further limitations on the permit in order to protect public trust uses. (See Section 9.3 above.)

In summary, the law is clear that the property interests in the water right permits held by YCWA are defined by state law, that those property interests are subject to modification or additional regulation under state law, that YCWA's permits expressly provide that they are subject to modification for protection of public trust resources, and that the maximum compensation which YCWA could claim if the State were to condemn or otherwise acquire all rights represented by the permits is the amount paid to the State for the permits. Compliance with the instream flow requirements of this decision is necessary to comply with section 5937 of the Fish and Game Code, a provision of law that was in effect at the time YCWA first received its water right permits.

Finally, we note that YCWA's contract with PG&E does not call for scheduling water releases to maximize revenue from power production. Anytime that YCWA changes its operations in any manner, whether for scheduling deliveries of irrigation water or some other reason, that change could have some marginal effect on power production. Moreover, YCWA's contract with PG&E indicates that the payment YCWA receives from PG&E for power production is not dependent upon maximizing the amount, or economic value, of power produced. Rather, the contract calls for YCWA to receive a flat rate from PG&E through the year 2016. Consequently, any diminution in the value of YCWA's rights to generate hydropower that may occur as a result of this decision is speculative and is insubstantial in comparison to the value of the remaining right.[52] Depending upon FERC's action at the time YCWA's power facilities are up for relicensing in 2016, the requirements established in this decision may have no impact whatsoever on YCWA's revenue from power production.

9.5 Impairment of Contract Provisions of State and Federal Constitutions Are Not Applicable

YCWA contends that the federal and state constitutions prohibit the SWRCB from adopting instream flow and temperature requirements that differ from the provisions of YCWA's 1965 agreement with DFG. YCWA bases this argument on provisions of the state and federal constitutions that prohibit the State from passing a law that impairs the obligation of contracts. (United States Constitution, art. I, § 10; California Constitution, art. I, § 9.) YCWA's argument ignores established case law that the impairment of contract clauses of the state and federal constitutions do not apply as between the State and its political subdivisions. (*Trenton v. New Jersey* (1923) 262 U.S. 182 [43 S.Ct. 534]; *Alameda County v. Janssen* (1940) 16 Cal.2d 276 [106 P.2d 11]; *State v. Marin Municipal Water District* (1941) 17 Cal.2d 699 [111 P.2d 651].)

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[52] We also note that the United State Supreme Court has held that a political subdivision cannot invoke the Takings Clause as a limitation on the power of the state. (Trenton v. New Jersey (1923) 262 U.S. 182 [43 S. Ct. 534].)

We also note that acceptance of YCWA's impairment of contract argument would effectively eliminate any ongoing authority of the State under article X, section 2 of the California Constitution or the public trust doctrine. Water Code section 174 provides that the adjudicatory and regulatory authority of the State in the field of water resources shall be vested with the SWRCB. Water Code section 275 charges the SWRCB with the responsibility of taking all appropriate actions to prevent waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water. As the agency charged by the Legislature with exercising the State's authority over water resources, the SWRCB cannot be divested of its authority or obligations by virtue of an agreement between YCWA and another state agency.

9.6 Applicability of California Environmental Quality Act to Provisions of this Decision

Although fishery enhancement was one of the original purposes of the Yuba River Development Project, YCWA argues that an environmental impact report (EIR) is required before any of the proposals in the DFG Fishery Management Plan could be added as conditions to YCWA's water right permits. (YCWA's 1992 Closing Brief, p. 52.) YCWA's most recent brief argues that an EIR would be required prior to adoption of the 1996 Draft Decision because provisions of that decision would have significant adverse environmental impacts. (YCWA's 2000 Closing Brief, p. 7.) The closing brief of South Yuba and Cordua following the hearing in 2000 also argues that an EIR is required prior to adoption of a decision by the SWRCB. For the reasons discussed below, however, the instream flow requirements and other provisions of this decision are not subject to the requirements of the California Environmental Quality Act. (Public Resources Code § 21000 et seq.)

9.6.1 Ongoing Project Exemption

The 1966 Contract Between the State of California Department of Water Resources and Yuba County Water Agency For Recreation and Fish Enhancement Grants Under the Davis-Grunsky Act, and testimony presented at the hearing, establish that fishery enhancement was one of the original purposes of the Yuba River Development Project. (CSPAA Exh. AA; R.T. V, 14:12-

14:15.) Water right permits were issued to YCWA in 1966, and construction of New Bullards Bar Reservoir was completed in April 1970.

In accordance with Public Resources Code section 21169 and section 15261 of title 14 of the California Code of Regulations, projects being carried out by a public agency prior to November 23, 1970 are exempt from CEQA. In *Nacimiento Regional Water Management Advisory Committee v. Monterey County Regional Agency* (1993) 15 Cal.App.4th 201 [19 Cal.Rptr.2d 1], the California Court of Appeal held that varying the amounts of water released from a reservoir in order to meet competing interests is part of an ongoing project and is therefore exempt from CEQA.

In this instance, the flows and water temperatures present on the lower Yuba River since the construction of New Bullards Bar are dependent primarily upon hydrologic conditions and annual operational decisions based on meeting competing project objectives, including fishery needs. Fishery enhancement was one of the original project objectives, and the flow requirements specified in this decision are well within the historic range of what has existed on the lower Yuba River since 1970. Therefore, we conclude that regulating releases to the lower Yuba River to meet the instream flow requirements specified in this decision qualifies as an ongoing project that is exempt from CEQA.[53] Similarly, continuing to meet with the Water Temperature Advisory Committee and attempting to provide water at temperatures beneficial to fish also falls within the ongoing project exemption.

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[53] YCWA's most recent brief argues that while its operation of the Yuba River Development Project is exempt from CEQA, any requirements imposed by the SWRCB are not exempt. We believe that a more reasonable application of the ongoing project exemption looks at the action being taken, not the agency requiring the action. For purposes of CEQA, a "project" ordinarily means the activity that occurs and may affect the environment, such as construction or operation of a facility, not the governmental decisions that require or authorize that activity. [See Cal. Code Regs., tit. 14, § 15378, subd. (c) ["The term 'project' refers to the activity that is being approved . . . . The term 'project' does not mean each separate governmental approval."]. See also id. § 15378, subd. (d) [distinguishing situations where the project is adoption of a generally applicable regulatory plan or rule from those where the project is the activity subject to regulatory oversight or approval].) It would be nonsensical to argue that YCWA is free to vary the flow releases to the lower Yuba River in a manner harmful to the fish without preparing an EIR, but that the SWRCB must prepare an EIR before it can require YCWA to maintain instream flows at a level that protects downstream fish.

9.6.2 Categorical Exemptions for Flow Requirements

Pursuant to Public Resources Code section 21084 and section 15300 of title 14 of the California Code of Regulations, the California Resources Agency has established certain classes of projects that have been determined not to have a significant effect on the environment and which, therefore, are categorically exempt from the preparation of environmental documents under CEQA. The instream flow requirements established in this decision meet the criteria for categorical exemptions under sections 15301, 15307 and 15308 of title 14 of the California Code of Regulations.

Section 15301 provides that the "Class 1" categorical exemptions consist of "operation, repair, maintenance or minor alteration of existing public or private structures and facilities...involving negligible or no expansion of use beyond that previously existing." Among the specific activities listed as examples of Class 1 exemptions are maintenance of fish screens, wildlife habitat areas, and streamflows to protect fish and wildlife.

Section 15307 describes "Class 7" actions that are categorically exempt from CEQA as follows:

> "Class 7 consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment. Examples include but are not limited to wildlife preservation activities of the State Department of Fish and Game. Construction activities are not included in this exemption."

Similarly, section 15308 describes "Class 8" actions that are categorically exempt as follows:

> "Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Construction activities and relaxation of standards allowing environmental degradation are not included in this exemption."

In summary, even in the absence of the ongoing project exemption, establishing the flow requirements specified in this decision would be categorically exempt from CEQA under sections 15301, 15307, and 15308 as set forth above.

Section 15300.2(c) of title 14 provides that a categorical exemption shall not be used where there is a reasonable possibility that an activity will have a significant effect on the environment due to unusual circumstances. Public Resources Code section 21068 defines significant effect on the environment as a substantial or potentially substantial adverse change in the environment. Meeting the requirements established in this decision will require release of considerably less water than would be required under the DFG proposal and will leave adequate water available for other uses in Yuba County.[54] The evidence also establishes that the flows established in this decision are well within the range of flows that have occurred since the construction of New Bullards Bar. In summary, there is no evidence of unusual circumstances that would result in the flow requirements established in this decision having a significant adverse effect on the environment.[55] Consequently, the categorical exemption provisions discussed above would apply.

9.6.3 Improvements to Fish Screens and Water Diversion Facilities

The extent of environmental review associated with improving fish screens and related water diversion facilities in order to reduce fish losses is dependent upon the nature of the improvements proposed in the plans to be prepared by YCWA and other parties diverting water from the lower Yuba River. The preparation of feasibility and planning studies for future actions that have not been approved or funded does not require preparation of an EIR or negative

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[54] As discussed at length above, potentially significant deficiencies in the amount of water available to meet other needs referred to in evidence presented by YCWA are the result of over estimating the need for water from the lower Yuba River in the YCWA service area and failing to fully account for conjunctive use opportunities and readily available water conservation measures.

[55] For determining if an action will have a significant adverse effect on the environment for purposes of CEQA, the baseline or point of reference consists of the existing physical conditions. (14 Cal. Code of Regs. §15125(c); *Environmental Information and Planning Council v. County of El Dorado* (1982) 131 Cal.App.3d 350.)

declaration, but does require consideration of environmental factors. (Cal. Code Regs. tit. 14 § 15262.)

As mentioned above, the "Class 1" categorical exemption under section 15301 of title 14 applies to maintenance of fish screens. (Cal. Code Regs. tit. 14 § 15301 (i).) In addition, "Class 2" categorical exemptions under section 15302 are defined to consist of "replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced . . . ." (Cal. Code Regs. tit.14 § 15302.)

A case-by-case determination of the applicability of the categorical exemptions authorized by sections 15301 and 15302 can be made after the agencies responsible for diversion of water at the North Canal and South Canal prepare and submit their plans for improving the diversion facilities to reduce loss of fish. If the plans indicate that proposed improvements to a particular facility will require environmental documentation under CEQA, the type of environmental document and the schedule for preparing it can be established at that time. Following completion of any required environmental documents, the SWRCB will determine what specific actions should be required to reduce loss of fish at the major lower Yuba River diversion facilities. This procedure is in accordance with the process followed with regard to the stream channel restoration requirements for streams in the Mono Lake Basin. (SWRCB Decision 1631 (1994).)

9.7 Focus of SWRCB Proceeding on Water Diversions and Instream Needs in LowerYuba River Area

The focus of the water right hearing was on instream flow needs of the lower Yuba River downstream of Englebright Dam and on various issues relating to the adequacy of water rights of parties that divert water from the lower Yuba River. As discussed below, various parties suggested that the scope of the proceeding should have been expanded to include other geographical areas and/or water users.

YCWA argued that the SWRCB should evaluate diversions by water users located upstream of New Bullards Bar Reservoir (e.g., Nevada Irrigation District, Oroville Wyandotte Irrigation District, and Pacific Gas and Electric Company) and the potential obligations of those water users to bypass flow to protect fish in the lower Yuba River. YCWA also argued that the SWRCB has to consider the beneficial effects of out-of-basin water transfers before determining the in-basin instream flow needs of the lower Yuba River.

CSPA and Walter Cook argued that the SWRCB should consider the benefits to public trust uses within the stretch of the Yuba River between New Bullards Bar Reservoir and Englebright Dam. CSPA also argued that the SWRCB should consider the benefits to public trust uses within the Bay/Delta system that would result from higher instream flows in the lower Yuba River.

As discussed below, there are several reasons for focusing on instream flow needs of the lower Yuba River and water diversions by YCWA and others along the lower Yuba River rather than addressing upstream water diversions, speculating as to future out-of-basin demands for Yuba River water, or attempting to define the responsibility of Yuba River toward Delta outflow needs in the context of this proceeding.

Consideration of Additional In-Basin Factors: The main reason for focusing on the lower Yuba River is that the DFG Fisheries Management Plan presents technical data and recommendations for protection of fishery resources of the lower Yuba River. The plan did not evaluate the fishery needs of the Yuba River between New Bullards Bar Reservoir and Englebright Lake. Although evidence was presented that the flow in that stretch of the river has been extremely low, the record is insufficient to evaluate the instream flow needs of that portion of the river.

The fact that there are water diversions from upper reaches of the Yuba River under earlier priority rights does not prevent the SWRCB from determining appropriate conditions to be included in YCWA's water right permits for protection of public trust resources in the lower

Yuba River. The SWRCB was not required to conduct a statutory adjudication of all rights within the watershed when it initially established the instream flow requirements in YCWA's permits, nor is it required to adjudicate all water rights within the basin in order to revise those requirements. In the case of those projects that divert water from the upper Yuba River solely for production of hydropower under a license from FERC, the SWRCB's jurisdiction to independently establish instream flow requirements as a condition of a water right permit has been preempted by federal law.

New Bullards Bar Reservoir has a capacity of nearly one million acre-feet which is substantially larger than the combined storage of all the upstream reservoirs. The storage and release of water from New Bullards Bar Reservoir for consumptive uses significantly modifies the streamflow of the lower Yuba River. In addition, fishery enhancement was one of the original purposes of the Yuba River Development Project. Consequently, it is reasonable for the SWRCB to determine appropriate instream flow and temperature conditions to be included in YCWA's water right permits without attempting to adjudicate all prior rights of senior upstream appropriators.

Consideration of Out-Of-Basin Needs and Delta Outflow Requirements: There was considerable evidence presented that water from the Yuba River has been put to beneficial use in other regions of the state with large economic benefits. For example, Dr. Timothy Quinn of Metropolitan Water District of Southern California urged that the SWRCB consider competing uses of water in developing a management plan for the lower Yuba River fisheries, including beneficial uses in Southern California and other areas that receive water by transfer. (R.T. IV, 155:14-155:21.) Dr. Quinn's written testimony states that an acre-foot of water in an urban area "supports more than $300,000 in economic activities in some industries in contrast to the $150 to $400 output produced per acre-foot of water used for irrigation in the Central Valley." Dr. Quinn's written testimony also states that the unreliability of water supplies have forced some water sensitive industries to implement water conservation measures that cost from $5,000 to $10,000 per acre foot of water saved. (YCWA 24, p. 3.)

Similar testimony on the benefits which water from the Yuba River has had in other areas of the state was presented by George Baumli, General Manager of the State Water Contractors (YCWA 22, p. 4); Thomas Clark, General Manager of the Kern County Water Agency (YCWA, 28, p. 1); Frank Cotton, Supervising Engineer for the Santa Clara Valley Water District (YCWA, 30, p. 6); and John Lindblad, Public Works Director of the City of Napa. (YCWA, 32, p. 7.) In addition, water transfers to DWR have provided water to the State Water Bank, enhanced Delta outflow and provided protection of public trust uses in other areas. (YCWA 29.) None of the witnesses from agencies receiving Yuba River water via transfers from YCWA, however, had reviewed the flow releases proposed in the DFG Fisheries Management Plan. (R.T. IV, 162:8-165:11.) Without having reviewed the DFG report, the various agencies who have received water via transfers from YCWA were not in a position to comment on the merits of the DFG recommendations with respect to protection of fisheries or with respect to the effect of those recommendations on the availability of water to their agencies.

By the same token, the evidence was insufficient to evaluate the potential benefits of Yuba River flows on the Bay-Delta estuary. The DFG Fisheries Management Plan focuses on the fishery needs of the lower Yuba River rather than fishery requirements in the Delta. The SWRCB's Bay-Delta proceedings provide the appropriate forum to address the contribution of water from the Yuba River toward protecting public trust resources in the Delta.

Determining the effect of increased flow requirements in the lower Yuba River on the availability of water for uses outside the Yuba River Basin would be a complex undertaking involving consideration of SWP and CVP operation, water demand by SWP and CVP customers and others, the availability of water from other sources, and numerous other factors which vary considerably with time. The only significant amount of water from the Yuba River Basin that would definitely not be available for beneficial use by other water users is the water that is consumptively used within Yuba County or the water that flows through the Delta during periods of water surplus.

In summary, the focus of this proceeding has been on evaluation of the in-basin needs of water for fishery protection in the lower Yuba River in view of the competing demands for water for other purposes within Yuba County. Evaluation of future out-of-basin demands for Yuba River water, whether for transfer to other water users (as urged by YCWA) or for Delta outflow (as urged by CSPA), would be very speculative and beyond the scope of the present hearing record. Future water transfer proposals can be brought before the SWRCB in accordance with applicable statutory procedures. The question of Delta outflow and revised water quality standards for the Bay-Delta estuaries is the subject of separate proceedings. It was appropriate for the present proceeding to focus on the in-basin demands for water in the lower Yuba River area.

9.8 The SWRCB Proceedings Have Provided Due Process to All Parties

The brief filed by South Yuba and Cordua following the hearing in 2000 argues that, in view of the change in the hearing officer and membership of the SWRCB between the initial hearing and the most recent hearing, due process requires an entirely new hearing following completion of an EIR on the DFG Fisheries Management Plan.[56] Although this decision is based on evidence presented by DFG and other parties, the decision does not adopt the flow or temperature recommendations in the DFG plan or many other recommendations in the plan. The applicability of CEQA to the provisions of this decision is addressed in Sections 9.6 through 9.6.3 above.

Most of the 1992 hearing was presided over by former SWRCB Chairman Don Maughan who left the SWRCB due to health considerations prior to adoption of a decision. In cases where the original hearing officer is no longer available, due process does not require disregarding a previously complied hearing record. (*Keith v. San Bernardino County Retirement Board* (1990) 222 Cal. App. 3d 411 [271 Cal. Rptr. 649].) Due to changes in conditions since 1992, the SWRCB held a subsequent hearing that involved 13 additional hearing days. The transcripts and exhibits from the first hearing were incorporated into the record of the second hearing. Prior to

[56] Counsel for South Yuba and Cordua raised a similar objection prior to the start of the hearing in February of 2000. (S-R.T. 46:9-50:6.)

completion and distribution of a proposed decision following the hearing in 2000, SWRCB staff consulted with the Hearing Officer repeatedly and the SWRCB met in closed session on two occasions with the hearing staff to deliberate on a proposed decision as authorized by Government Code section 11126(c)(3). Following the closed session deliberations, the SWRCB distributed a proposed decision to all parties to the proceeding and provided an opportunity for oral and written comment on the proposed decision prior to adoption of a final decision. Water Code section 183 provides in relevant part:

> "Any hearing or investigation by the Board may be conducted by any member upon authorization of the board, and he shall have the powers granted to the board by this section, but any final action shall be taken by a majority of all members of the board at a meeting duly called and held." (Emphasis added.)

In this instance, as in most other instances, water right hearings before the SWRCB have been held before a single hearing officer, with other Board Members attending as their schedules allow. The record shows that parties to the hearing were provided a full opportunity to present evidence, cross-examine other parties' witnesses and present rebuttal evidence. Although the hearing notice directed parties to focus on "new information" not available in 1992, a review of the transcript shows that the Hearing Officer allowed the parties considerable latitude in presenting information they considered to be relevant.[57] The entire Board has had ample opportunity to review the record and deliberate prior to adoption of this decision in accordance with applicable statutory procedures.

[57] For example, the record shows that, near the end of a lengthy hearing, counsel for South Yuba and Cordua was allowed to personally testify as a rebuttal witness regarding physical conditions in 1982, prior to construction of the South Yuba/Brophy Canal, even though it was unclear what evidence in the record he was attempting to rebut. (S-R.T. 3097:14-3013:15.) Other parties were also allowed considerable latitude in presentation of their cases.

10.0 ISSUES RAISED CONCERNING BASIS AND EXTENT OF WATER RIGHTS HELD BY VARIOUS DIVERTERS

The hearing notice listed a number of issues regarding the basis of water rights held by various diverters and restrictions which apply to the exercise of those rights. These subjects are addressed in Sections 10.1 through 10.9 below.

10.1 Diligence in the Development and Use of Water by YCWA

One of the issues listed in the hearing notice was whether YCWA had demonstrated diligence in developing and using water in accordance with the conditions contained in Permits 15026, 15027, and 15030. The three permits contain conditions requiring that: (1) construction work begin before June 1, 1967, (2) construction work be completed by December 1, 1973, and (3) application of water to the proposed uses be completed by December 1, 2010.

Water Code section 1395 requires that construction work and utilization of water for beneficial purposes shall be prosecuted with due diligence in accordance with applicable statutes, regulations and the terms of the permit. Section 841 of title 23 of the California Code of Regulations provides:

> "In determining the period of time to be allowed to build diversion works and apply the water to full beneficial use, the particular conditions surrounding each case will govern. In every case the matter must be pressed with due diligence considering the size of the project and the obstacles to be overcome."

Section 842 of title 23 allows the SWRCB to grant time extensions to complete construction or apply water to full beneficial use. Construction of New Bullards Bar dam was initiated in June 1966 and completed in April 1970. For a variety of reasons, substantial revisions have been made to the diversion canals and other facilities from what was originally proposed. (YCWA 2, p. 13.) YCWA presented testimony relating to the on-going development of the project and the schedule for construction of major diversion canals. (YCWA 13, pp. 8 and 9.)

The record shows that YCWA has complied with the time schedule relating to construction of New Bullards Bar Reservoir which is the major component of the Yuba River Development Project. In view of the fact that YCWA is not required to complete application of water to beneficial use until the year 2010, the requirement to complete construction prior to December 1, 1973 should not be construed to apply to all proposed diversion and distribution facilities. We conclude that YCWA's actions to date comply with the statutory requirement of reasonable diligence in the developing the project authorized by its permits.

10.2 Amendments in Points of Diversion and Rediversion Specified in YCWA Water Right Permits

Permits 15026, 15027 and 15030 originally specified a number of points of diversion and rediversion. In 1973, the SWRCB entered an order allowing changes in points of diversion and rediversion, purpose of use, and the total quantity of water diverted under YCWA's consumptive use permits. Points of diversion previously identified as the New Colgate Diversion Dam and the Irrigation Diversion Weir were replaced with the proposed Marysville Afterbay Dam which was designated as a new point of diversion and rediversion. The location of the Marysville Afterbay Dam was specified as being on the Yuba River "within the SW¼ of the SW¼ of Section 29, T16N, R5E, MDB&M (precise location to be determined at the time of construction)."

In 1988, the SWRCB approved addition of a new point of rediversion specified as: "The Pumpline Diversion Facility located south 1,800 feet and west 1,300 feet from the NE corner of Section 29, T16N, R5E, MDB&M being within the SE¼ of the NE¼ of Section 29." The order adding the Pumpline Diversion Facility as a point of rediversion to YCWA's permits provided that YCWA shall not divert water from that facility until it has installed fish screening devices satisfactory to DFG.

At present, YCWA's authorized points of diversion and rediversion on the lower Yuba River under its consumptive use permits are: (1) the location specified for the proposed Marysville

Afterbay Dam, and (2) the location specified for the Pumpline Diversion Facility. Although the Marysville Afterbay Dam has not been built, the existing Daguerre Point Dam is located within the authorized location for that facility. The axis of the Daguerre Point Dam is defined by California Co-ordinates N56054, E215846. (YCWA 2, p. 22.)

A point of diversion or rediversion is identified as the structure or device that controls the diversion of water out of the natural channel. Points of original diversion may also be points of rediversion. In the case of a pump in the stream channel, the pump structure would be identified as the point of diversion. The Browns Valley diversion structure meets this criterion and is an identified point of diversion/rediversion in YCWA's permits. Water users in the Dantoni area below Daguerre Point Dam divert water supplied under contract with YCWA, but their points of diversion or rediversion have not been identified in YCWA's permits.

In the case of a dam that creates a backwater area that is used to divert water, the dam constitutes the control structure and the midpoint of the dam, where it crosses the stream, is identified as the point of diversion or rediversion. Diversions to the North and South Canals are controlled by Daguerre Point Dam, which would be considered as the point of diversion or rediversion for these canals. Daguerre Point Dam exists at substantially the same location that the proposed Marysville Dam was to have been constructed. Therefore, although not precisely defined when the permit was issued, the location of the present point of diversion has not changed significantly from the original planned location. A broadly defined point of diversion, that encompasses Daguerre Point Dam, is identified in YCWA's permits.

YCWA delivers contract water to Brophy and South Yuba via the South Canal located near the south abutment of Daguerre Point Dam. Water is diverted from the Yuba River through a rock barrier fish screen. A gated control structure and pipeline, are located behind the fish screen. These facilities convey the water through an embankment into the Yuba Goldfields property. Water emerging from the pipeline runs through a series of interconnected dredger ponds and channels to the south edge of the Goldfields property. Additional flow accrues to the channel as

it crosses the porous dredger material of the Goldfields property. The flow in the canal is measured at gage located one mile down the canal from the Meadow Pond at the southern edge of the Goldfields. At this gage, a control structure and continuous recording device measure the quantity of water taken into the South Canal.

Daguerre Point Dam causes the lower Yuba River to surcharge the porous dredger material of the Goldfields adjacent to the dam and to flow into the South Canal. Therefore, Daguerre Point Dam is considered the point of diversion and rediversion and the at Meadow Pond is regarded as the headworks for the taking of water.

Brophy Water District diverts water from the South Canal into Reeds Creek for subsequent rediversion into several lateral canals in the Brophy service area. Water destined for South Yuba continues down the South Canal from which it is diverted at various locations to serve South Yuba's customers.

In summary, the evidence indicates that changes in points of diversion and rediversion are required for diversion of water to offstream uses supplied by YCWA. YCWA's Permits 15026, 15027, and 15030 (Applications 5632, 15204, and 15574) should be amended to more accurately describe Daguerre Point Dam as an authorized point of diversion and rediversion. The description of the point of diversion/rediversion located on the lower Yuba River within the SW¼ of the SW¼ of Section 29, T16N, R5E, MDB&M should be administratively corrected to read as follows:

> "Daguerre Point Dam, located within the SW¼ of the SW¼ of Section 29, T16N, R5E, MDB&M and having the following California Co-ordinates N56054, E2157846."

In addition, YCWA should be directed to file petitions with the SWRCB to add points of diversion/rediversion to its permits to authorize the diversion of water from the lower Yuba River to serve diverters in the Dantoni area.

10.3 Water Rights Held by Browns Valley Irrigation District

Browns Valley Irrigation District (Browns Valley) is located on the north side of the Yuba River. The district encompasses an area up to the Butte County line, extending from near Daguerre Point on the west to Smartville on the east. Browns Valley claims a pre-1914 appropriative water right to divert up to 47.2 cfs from the North Fork Yuba River based on a March 21, 1890, filing of a notice of appropriation.

Because the pre-1914 right was not perfected prior to the effective date of the Water Commission Act of 1913, Browns Valley applied to the State Water Commission for a certificate recognizing its pre-1914 appropriative right. Certificate No. 8 "Certificate Prescribing Time for Complete Application of Water to Proposed Use" under Application 12-1986 was issued to Browns Valley by the State Water Commission on April 14, 1921. (Browns Valley 2, p. 1.) The certificate established October 1921 as the date by which water appropriated for agricultural use under the pre-1914 claim must be applied to a beneficial use. Browns Valley later requested time extensions to fully place water to beneficial use. Full beneficial use was acknowledged by the State Water Commission by letter dated April 1, 1929. (Staff 1, App. 12-1986.)

The water use claimed by Browns Valley under the pre-1914 right is for agricultural use. No season of diversion is specified in the certificate. Browns Valley presented testimony that water has been used on a year-round basis. (R.T. IX, 16:8-16:22.) As summarized in Table XI-3 of the staff analysis, Division of Water Rights records on Application 12-1986 for 1907 to 1921 indicate that some water was used on a year-round basis, but that less water was used from November through March of each year. In addition, Browns Valley submitted information by letter dated March 26, 1929, to document complete development of its pre-1914 right. The information submitted shows diversions only for the months of April through October. (Staff 1, App. 12-1986, Letter dated March 26, 1929.)

Based on the quantity of water reportedly diverted during the period of time that Browns Valley confirmed beneficial use under Application 12-1986, Browns Valley's pre-1914 water rights for

diversion of water from the North Fork Yuba River and the Yuba River would be no greater than shown in Table 23 below:

TABLE 23

BROWNS VALLEY MAXIMUM AVERAGE MONTHLY DIVERSIONS UNDER CLAIM OF PRE-1914 WATER RIGHT

Period	Amount (cfs)	Amount (AF)	Year of Maximum Diversion
January	10.0	614	1926
February	7.3	419	1920
March	9.0	552	1926
April – October	47.2	20,000	1928
November	35.0	2,079	1924
December	13.0	798	1926
TOTAL		24,462	

Following completion of New Bullards Bar in 1970, the headworks of Browns Valley Canal was inundated by the reservoir and Browns Valley needed to relocate its point of diversion. About 5,500 acre-feet of water were diverted directly from the Colgate Powerhouse Penstock and provided to the Browns Valley service area through the upper portion of the Browns Valley Canal. (Browns Valley 2, p. 2.) Browns Valley also developed the Pumpline Diversion Facility on the lower Yuba River about 0.9 mile upstream of Daguerre Point Dam to provide water to the lower portion of the Browns Valley service area. The facility has the capacity to pump up to 80.2 cfs from the Yuba River into the Pumpline Canal serving the lower portion of the Browns Valley service area. Water Code section 1706 allows the holder of a pre-1914 appropriative right to change the point of diversion if others are not injured by such change, but does not authorize changes in the amount of water diverted or the season of diversion.

Prior to 1987, a continuous record of flows diverted into the Browns Valley Canal was not maintained. (R.T. IX, 5:7-6:20 and 7:23-8:5.) Records submitted by Browns Valley at the hearing in 1992 indicate that, in recent years, Browns Valley had not exceeded the rates of

diversion in Table 23 above except for the month of July 1990, when the average diversion rate for the month was 47.95 cfs.

Browns Valley does not hold any post-1914 appropriative water rights on the Yuba River. In addition to the pre-1914 right described above, however, Browns Valley has a contractual right to receive up to 9,500 acre-feet of YCWA water under terms of an amended contract signed with YCWA on June 4, 1992. The contract provides that the monthly rate of supply and the annual quantity of water may be adjusted upon the mutual consent of both parties. As of the time of the hearing, Browns Valley had not requested YCWA to provide contract waters. Any diversion of water in excess of the rate and quantity authorized under Browns Valley's pre-1914 appropriative right should be covered by a water supply contract with YCWA.

Although Browns Valley filed a Statement of Water Diversion and Use on December 12, 1998, the statement does not provide all the information required under Water Code section 5103. In order to maintain proper documentation regarding the exercise of Browns Valley's pre-1914 right, Browns Valley should maintain a continuous record of its water diversions and provide complete monthly and annual water diversion information on all future Supplemental Statements of Water Diversion and Use. The Supplemental Statements of Water Diversion and Use should identify diversions under its pre-1914 appropriative right and diversions under its contract with YCWA.[58]

10.4 Diversion of Water by Brophy Water District and South Yuba Water District

Brophy Water District (Brophy) and South Yuba Water District (South Yuba) are located south of the Yuba River. Prior to completion of a surface water conveyance and delivery system in 1985, groundwater was the only source of water for Brophy and South Yuba. (Brophy 1, p. 1; South Yuba 24, p. 1/19.) All water from the lower Yuba River that presently is used by Brophy and South Yuba is delivered through the South Canal under contract with YCWA. Brophy's

[58] SWRCB Decision 1600 held that the right to use a large quantity of water carries with it the responsibility to account for its use accurately. (SWRCB Decision 1600, p. 37.)

contract with YCWA provides for a total allocation of 75,647 acre-feet composed of a "base allocation" and a "supplemental allocation." (S-YCWA 15, Appendix A.) South Yuba's contract with YCWA provides a total allocation (base and supplemental) of 43,330 acre-feet. (S-YCWA 15, Appendix A.)

In addition to receiving water diverted under YCWA's rights, Brophy and South Yuba were also co-applicants on petitions for assignment of Water Right Applications 5632A and 20714 which were initiated under the "state filing" provisions of Water Code section 10500 et seq. The petitions for assignment were withdrawn on February 28, 1994. At present, Brophy's and South Yuba's only rights to divert water from the lower Yuba River are pursuant to their contracts with YCWA and subject to the conditions of YCWA's permits.

Reeds Creek is a seasonal stream that runs southwesterly through Brophy and South Yuba. During periods when seasonal runoff is present in Reeds Creek, Brophy may also be diverting the natural flow of Reeds Creek into the lateral canals of their distribution system. Brophy introduced evidence that water use on the parcels of property riparian to Reeds Creek is sufficient to account for any natural flow from Reeds Creek that is diverted for irrigation. (S-Brophy 2 and 3.)

10.5 Water Rights Held By Cordua Irrigation District

Coruda Irrigation District (Cordua) is located on the north side of the lower Yuba River, west of Daguerre Point and Browns Valley. Cordua diverts water from the north side of the Yuba River near the Daguerre Point Dam. The water is diverted through a headworks into the North Canal shared by Cordua, Hallwood, and Ramirez.

Cordua claims a pre-1914 appropriative water right for diversion from the lower Yuba River based on a 1909 filing for 10,000 miners inches of water under four inches of pressure (200 cfs) for irrigation, domestic use, and power generation. Cordua claims a second pre-1914 right based on the 1874 filing of James P. Stall for 2,500 inches of water under four inches of pressure

(50 cfs) for irrigation, stockwatering, and "various other uses." Information from Application 9927 indicates that the pre-1914 water rights were not developed beyond the 75 cfs capacity of a 4,000-foot flume. Following issuance of permits on Applications 9927 and 12371, the 4,000-foot flume section was replaced and approximately seven miles of the canal system was widened.

Upon completion, the Cordua Canal became capable of transporting 200 cfs of water with one foot of freeboard on the canal. (Staff 1h, Application 9927, Memoranda to file dated January 15, 1941 and July 21, 1952.)

In addition to its pre-1914 rights, Cordua holds Water Right Licenses 3984 and 3985 (Applications 9927 and 12371), which allow for the direct diversion of 40 cfs and 50 cfs, respectively. Both licenses allow diversion from April 1 to November 1 for irrigation and from January 1 through December 31 for domestic use. The authorized place of use is described as 6,935 acres within a gross area of 7,464 acres. (Staff 1h, Applications 9927 and 12371.) The combination of Cordua's pre-1914 rights and its post-1914 licensed rights results in a total diversion right of 165 cfs. It is reasonable to conclude that the diversion season for irrigation under the pre-1914 rights is the same as the April 1 through November 1 season authorized under Cordua's licenses.

Cordua's pre-1914 rights and licensed rights all identify domestic use as a basis for diversion throughout the year. (Cordua 19A, 19A-1; Water Right Licenses 3984 and 3985.) However, Cordua's Report of Licensee for the years 1958 to present state that "water is used for irrigating crops only, although we do provide water for duck ponds during each duck season." The information from Cordua's Reports of Licensee indicates that Cordua's year-round right to divert for domestic purposes has been lost through more than five years non-use. (Water Code § 1241.)

Cordua presented written testimony that water is being diverted to flood rice land for wildlife habitat "utilizing its pre-1914 rights conducted under Water Code section 1706 as a changed

season and propose of use which is made without harm to any party and utilizing Agency [YCWA] rights from the Yuba River Development Project." (Cordua 19, p. 3.) The first documentation of using water for wildlife habitat, however, is found in Cordua's 1949 Progress Report by Permittee under Application 9927 which states: "We have now started to serve water for duck ponds for the coming duck season." (Emphasis added.) Water for duck pond filling is indicated on all subsequent reports submitted to the SWRCB.

Water Code section 1706 allows for persons holding pre-1914 appropriative rights to change the point of diversion, place of use, or purpose of use if others are not injured by the change, but the statute does not authorize increases in the amount of water diverted or changes in the season of diversion. In this instance, Cordua did not start diverting water for duck pond use until 1949 or about 35 years after enactment of the Water Commission Act of 1914. Therefore, Cordua's diversion of water for duck ponds in the fall must be undertaken pursuant to a post-1914 appropriative right or its water supply contract with YCWA.

If diversion of water for duck pond use occurs outside of the season of diversion authorized in Cordua's licenses, then it must be undertaken pursuant to Cordua's contract with YCWA. Cordua presented written testimony that its contract with YCWA was amended recently to allow water not utilized in any month to be carried forward to a subsequent month in the same water year. (Cordua 19, p. 2.) However, a copy of the contract was not offered into evidence.

The authorized place of use under Licenses 3984 and 3985 is defined as 6,935 acres within a gross area of 7,464 acres. (Staff 1h, Applications 9927 and 12371.) Cordua presented written testimony that it now serves approximately 10,000 acres and the 1989 Report of Licensee states that 13,389 acres were served in 1987. (Cordua 19, p. 1; Staff 1h, Application 9927, 1989 Report of Licensee.) The water diverted by Cordua under its pre-1914 rights, post-1914 rights and contract rights is commingled in the diversion system and served throughout the district. Therefore, Cordua should file a petition to amend its place of use to accurately describe its full existing service area.

Cordua has installed a gage and maintains a continuous record of the flows diverted from the Yuba River at Daguerre Point Dam. Cordua also maintains a Parshall flume in the Cordua Canal to measure the percentages of the diverted flow going to Cordua and Ramirez. Water is ordered from YCWA 24 hours in advance. (Cordua 19, p. 3.) Despite the ability to gage and record the quantity of water going to each district, Cordua's Reports of Licensee submitted to the SWRCB since 1954 have not identified the monthly or annual quantities of water diverted from the river. In order to provide accurate and complete information on water diversions and use, Cordua should continue to maintain a continuous record of water diversions. The record should be available to the SWRCB and to other interested parties upon request of the SWRCB. In addition, all future Reports of Licensee should include monthly and annual water diversion information.

In order to document and provide an ongoing record of diversions under its pre-1914 rights, Cordua should file a Statement of Water Diversion and Use in accordance with Water Code section 5100 et seq, together with appropriate documentation to substantiate any claimed pre-1914 diversion rights from the Yuba River. Information on monthly and annual water diversions relevant to Cordua's claim of pre-1914 right should be provided on all future triennial Supplemental Statements of Water Diversion and Use.

10.6 Water Rights Held By Hallwood Irrigation Company

Hallwood Irrigation Company (Hallwood) holds Water Right License 4443 (Application 9899) which allows direct diversion of 100 cfs from the north side of the Yuba River at Daguerre Point Dam from April 1 to November 1 of each year for irrigation of 7,400 acres within a gross area of 8,000 acres. (Staff 1g, License 4443.) Water Right Application 9899 also makes reference to a claim of "old rights" to divert 150 cfs, but neither a season of diversion nor a purpose of use is specified. (Staff 1g, Application 9899.)

In 1980, Hallwood signed a contract with YCWA that refers to diversion of up to 275 cfs by Hallwood, up to a maximum amount of 78,000 acre-feet per year. In addition to providing for

diversion by Hallwood of water covered by YCWA's rights, the contract refers to diversion of 100 cfs under License 4443 and 175 cfs under Hallwood's claim of a pre-1914 water right. The 175 cfs which the contract refers to as covered by a pre-1914 water right exceeds Hallwood's previous claim of "old rights" to divert 150 cfs. The season of diversion for water covered by the contract is April through October. There is nothing in the contract or elsewhere in the record indicating that water that is not utilized in any month may be diverted in a subsequent month. (Staff 1g, Contract between YCWA and Hallwood dated December 30, 1980.)

Hallwood's claim of "old rights" appears to refer to a claim of pre-1914 appropriative rights, but a Statement of Water Diversion and Use has not been filed to substantiate Hallwood's claim. The record indicates that any pre-1914 rights which Hallwood may be able to establish would be for no more than diversion of 150 cfs based on a filing of 7,000 miners inches of water by F. D. Groh and Byron Jakes in 1909. In the absence of documentation to substantiate a different season of diversion, it is reasonable to assume that the season of diversion under any pre-1914 rights held by Hallwood would be the same as the April 1 through November 1 season of diversion specified in Hallwood's licensed right.

In order to properly document and report water diversions under License 4443, Hallwood's claim of pre-1914 right, and Hallwood's contractual rights with YCWA, Hallwood should maintain a continuous record of water diversions which should be made available to the SWRCB and to other parties upon request of the SWRCB. Hallwood should provide complete information on monthly and annual water diversions under License 4443 in all future triennial Reports of Licensee.

In accordance with Water Code section 5100 et seq., Hallwood should file a Statement of Water Diversion and Use together with appropriate documentation to substantiate its claim to a pre-1914 right to divert from the Yuba River. Hallwood should also provide complete information on monthly and annual water diversions under its claim of a pre-1914 right on all future triennial Supplemental Statements of Water Diversion and Use.

Hallwood's diversions of water from the Yuba River from April 1 through November 1 should be limited to the diversion season specified in License 4443 and in its 1980 water supply contract with YCWA. Diversion of water during other months would require acquisition of additional water rights or amendment of Hallwood's contract with YCWA.

10.7 Diversion of Water By Ramirez Water District

The Ramirez Water District (Ramirez) is located north of Cordua bordering Butte County. Ramirez diverts water from the lower Yuba River into the North Canal shared with Cordua and Hallwood. Ramirez holds no water rights of its own but purchases water from YCWA under contract. The contract allows Ramirez to purchase a base water supply of 14,790 acre-feet per year and a supplemental supply of 10,311 acre-feet per year. (S-YCWA 15, Appendix A.) All diversion and use of water from the Yuba River by Ramirez is subject to the conditions contained in YCWA's water right permits.

10.8 Water Use in the Dantoni Area

Several water users divert from the lower Yuba River downstream of Daguerre Point Dam in an area on the south side of the river referred to as the Dantoni area. Information regarding water diversions in the Dantoni area comes from the Statements of Water Diversion and Use filed with the SWRCB and from YCWA reports relating to water demands. (YCWA 45, Tables A-2 and A-7; Statements 315, 316, 317, and 7900 filed by Nuames Inc.; and Statement of 2208 filed by Quinco Corp.) All of the Statements of Water Diversion and Use claim riparian rights.

In addition to water diverted under claim of riparian right, YCWA provides water to Nuames Inc. and Dorothy Wilbut under contract. (R.T. VI, 24:15-24:19.) YCWA estimates that 2,620 acre-feet of groundwater and 7,180 acre-feet of surface water are used to irrigate approximately 2,750 acres of orchard within the Dantoni area. (YCWA 45, Tables A-2 and A-7.)

In accordance with Water Code section 5100 et seq., water users in the Dantoni area should file Statements of Water Diversion and Use to substantiate their claimed basis of right. The water

users should provide complete information on monthly and annual water diversions on all future triennial Supplemental Statements of Water Diversion and Use. Prior to entering into new contracts or continuing to deliver water under existing contracts, YCWA should identify the points of diversion of the Dantoni area users to which it delivers water and petition to have those points of diversion added to its existing permits. (See Section 10.2 above.)

10.9 Western Water Company, Western Aggregates, Inc. and YG Development Company

Evidence was presented at the hearing in 1992 that YG Development Co. and Western Aggregates, Inc. (YG) own several thousand acres of land on the south bank of the lower Yuba River. (YG 1, p. 1.) The area is referred to as the Yuba Goldfields and it consists mainly of "dredger tailings" left over from gold mining operations. In some areas, the dredger tailings reach depths of 125 feet. (Staff 1a, Statement of Water Diversion and Use 8291.) In 2000, a representative of Western Water Company testified that his company had obtained an undefined portion of the water rights that attach to the Yuba Goldfields. (S-R.T. 1924:18- 1930:25.)

Prior to the dredging operations, the Yuba River Channel ran to the south of Daguerre Point, through the center of the YG land. (R.T. IX, 51:1-51:6.) The dredging operations disturbed much of YG's land and ultimately resulted in relocating the Yuba River to its present day course along the northern boundary of the Yuba Goldfields property.

Water Rights: YG claims both riparian and pre-1914 appropriative water rights. (YG Exh. 1, p. 1.) Yuba Goldfields, Inc. (prior owner of the land now owned by YG) filed Statement of Water Diversion and Use 8291 in 1974. The statement claims a water right for the purposes of domestic, agricultural, and recreational use, dredging for precious metals (mining) and fish culture. The season of use appears to be all year long, but the quantity of water is not specified in the statement. (Staff 1a, Statement 8291.)

YG presented testimony that water was diverted for continuous use for as many as 10 dredges on the property from 1904 through 1960. From 1969 to 1973, no record of use was maintained. From 1973 through 1978, water was used only intermittently for mining operations. The dredge in operation in 1992 has been in continuous operation since 1978. It uses a minimum of 25,000 gallons per minute (55 cfs). The water is used in a sluicing operation and then discharged back into a pond (YG 1, p. 3.) Water is also pumped from the ponds for irrigation of between 200 and 500 acres of grain crops on the YG property. (YG 1, p. 3; R.T. IX, 48:18, 53:2-54:12.) YG does not purchase water from YCWA.

YG's water rights were defined by a Superior Court judgment entered in 1929. The judgment concludes that YG's predecessor had been engaged in gold mining on riparian property for a period of 20 years and that YG's predecessor was then using 20.6 cfs. In addition, the court found that YG's predecessor "is now developing" the irrigable portions of its property and was entitled to 5,905 acre-feet, as against the plaintiff, to be diverted in accordance with a defined monthly diversion schedule with an allowance for reasonable ditch losses.

The effect of the 1929 judgment was to define YG's predecessor's pre-1914 rights and to establish the riparian status of the YG property. The judgment refers to the priority of the "appropriations" made by YG's predecessor and enjoins a competing water user from interfering with YG's predecessor's rights to divert up to 20.6 cfs for dredging under a pre-1914 right. There is some evidence in the record that this right may have since been reduced by five or more years of reduced use, but there is insufficient evidence to reach a conclusion regarding the present extent of YG's pre-1914 right.[59] In order to document present and future use of water under its pre-1914 right, YG and any of its successors in interest who claim to have a water right should provide complete monthly and annual water diversion information on all future triennial Supplemental Statements of Water Diversion and Use.

[59] Although there is some incidental loss, the SWRCB considers diversion of water for use in dredging to be a non-consumptive use of water when most of the water reenters the watercourse shortly after being used.

Conveyance of Water Across YG Property to Brophy and South Yuba: The United Groups complaint questioned whether YG's predecessor had sold or transferred water to YCWA, Brophy, or South Yuba without a valid basis of right. In 1982, YG's predecessor, Yuba Natural Resources, Inc., entered into a contract with Brophy which provided for Brophy to purchase and transport water across land owned by Yuba Natural Resources, Inc. In 1983, Yuba Natural Resources, Inc. entered into a similar contract with South Yuba. As discussed above, the pre-1914 rights for dredging that attach to the YG property were for what is primarily a non-consumptive use of water. The riparian rights attaching to the property are for use only on the particular riparian parcel of property to which they attach. Therefore, it is not clear what rights YG's predecessor had that would have authorized it to deliver water to either Brophy or South Yuba as called for in the contracts.

YCWA presented testimony that in 1991, it purchased conveyance rights across the Yuba Goldfields. (YCWA 2, p. 13.) There is substantial seepage of water into the canal as it crosses the goldfields, but YCWA accounts for the additional water as Yuba River water diverted under YCWA's rights. (YCWA 2, p. 3.) The water measurement gage on the South Canal near the Hammonton-Smartville Road is the billing point for water delivered under YCWA's rights to Brophy and South Yuba. (R.T. VII, 164:3-164:24.) The evidence indicates that, under the current arrangement, YG has granted YCWA the right to convey water across its property and YCWA provides water to Brophy and South Yuba that is diverted under YCWA's water right permits.

11.0 CONCLUSION

The minimum flows presently specified in Water Right Permits 15026, 15027, and 15030 are based on a 1962 agreement between YCWA and DFG. The 1962 agreement was superseded by a later agreement between the same two agencies signed in 1965, but the water right permits were not amended accordingly. The historic flows in the lower Yuba River usually have exceeded the flows specified in the 1965 agreement. If the flows were reduced to the levels specified in the 1965 agreement, the habitat available to salmon, steelhead, and American shad

would be substantially reduced, contrary to the policy of the Salmon, Steelhead and Anadromous Fisheries Program Act (Fish and Game Code § 6900, et seq.), the California Endangered Species Act (Fish and Game Code §§ 2050-2116) and the Federal Endangered Species Act (16 U.S.C. §§ 1531-1544.) The minimum flows specified in the 1965 agreement are not sufficient to keep fish in good condition as required by Fish and Game Code section 5937.

There presently is much more information available concerning lower Yuba River fishery resources than was available in 1962 or 1965. The revised instream flow requirements established in this decision are supported by extensive evidence in the record and will provide increased protection for the fishery resources of the lower Yuba River. If future studies establish the need for refinements in the requirements adopted in this decision, the SWRCB may do so under its continuing authority.

The instream flow requirements established by this decision will require substantially less water than would be needed to meet the recommendations of the 1991 DFG Fisheries Management Plan. The evidence shows that there is sufficient water available to meet the revised requirements while continuing to meet existing demands for other reasonable and beneficial uses of water within Yuba County. YCWA's estimates of water supply deficiencies were based on computer modeling using estimates of YCWA's present and ultimate water demand. The evidence shows that the present level of demand for water from the lower Yuba River in the YCWA service area is less than estimated by YCWA and that the future level of demand is likely to be considerably less than the YCWA estimates.

Implementation of expanded water conservation programs can help minimize future increases in overall water demand. Increased water conservation and water management efforts, including a conjunctive use program of groundwater and surface water supplies, should allow YCWA to comply with the revised conditions of its permits while meeting reasonable future water demands in its service area. In addition to establishing different instream flow requirements for different water-year types, this order contains a Deficiency Clause allowing for temporary changes in the

flow requirements in years in which surface water supply would be insufficient to supply 80 percent of projected demand. The SWRCB retains continuing authority to reconsider the subject of instream flow requirements in the event changed conditions make it infeasible to comply with the requirements specified in this decision.

The record establishes that the water temperatures in the lower Yuba River often are higher than is desirable for protection of chinook salmon and steelhead. However, the record also establishes that, with the existing facilities, YCWA does not always have the ability to provide cooler water at the temperatures recommended by the fishery agencies. YCWA has applied for funding to construct the Narrows II Powerhouse Intake Extension Project that would provide a low level outlet at Englebright Reservoir to enable release of cooler water. Construction of that project that would increase YCWA's ability to release water in the lower Yuba River meeting the temperature recommendations of state and federal resource agencies.

This decision directs YCWA to diligently pursue development of the Narrows II Powerhouse Extension Project and to submit a progress report to the Chief of the Division of Water Rights every six months until the project is complete. This decision also directs YCWA to participate on an ongoing basis in a Temperature Advisory Committee with representatives of specified resource agencies and environmental groups to determine the most desirable and feasible means of operating to provide water at temperatures suitable for the fisheries in the lower Yuba River. The decision requires YCWA to file an annual operations plan and monitoring report with the Division of Water Rights and to advise the Chief of the Division of Water Rights if YCWA believes it is not feasible to operate in accordance with the recommendations of the Temperature Advisory Committee. The decision retains continuing authority over YCWA to establish water temperature requirements at a future time following notice and opportunity for hearing.

The record also establishes that there are unnecessary and reasonably avoidable losses of fish due to water diversions into the South Canal and the North Canal. The specific causes and magnitude of the losses, as well as the appropriate corrective actions, vary with each facility. In

each case, however, YCWA and the parties diverting water at that site should be required to study the problem in consultation with the appropriate resource agencies and prepare a plan for a corrective action to reduce fish loss in accordance with the provisions of this decision.

All water rights in California are subject to continuing regulation in order to comply with the constitutional mandate to maximize the reasonable and beneficial use of water and to avoid wasteful or unreasonable uses, methods of uses, or methods of diversion. (California Constitution, art. X, § 2; Water Code §§ 100 and 275.) The revised permit conditions and other requirements set forth in this decision are appropriate to the situation under consideration and are needed in order to comply with applicable constitutional and statutory requirements regarding reasonable use and methods of diversion.

In addition, the California Supreme Court decision in *National Audubon Society v. Superior Court*, *supra*, requires this Board to consider the impact of water diversions on public trust resources and to protect those resources where feasible. The fishery protection measures established in this decision constitute a physically and financially feasible means of protecting public trust resources of the lower Yuba River while continuing to provide sufficient water for other beneficial uses.

Finally, this decision addresses a number of questions concerning the adequacy of water rights held by various diverters and actions needed to ensure that future water diversions are undertaken in accordance with applicable law. Our findings on these issues are set forth in Sections 10.0 through 10.9 above.

As discussed in Sections 5.0 through 5.3 above, the SWRCB may exercise its continuing authority over the water diversions addressed in this order pursuant to the public trust doctrine, applicable provisions of the Water Code, and article X, section 2 of the California Constitution. In the event that YCWA and other parties to this proceeding reach a proposed settlement

agreement within 60 days of the date of this decision, the SWRCB will consider revision of the provisions of the order below in view of the proposed settlement.

ORDER

IT IS HEREBY ORDERED that the specified water right permits and licenses below are amended as shown and that the identified permittees, licensees and other water users comply with the directives set forth below:

Yuba County Water Agency

Permits 15026, 15027, and 15030 of Yuba County Water Agency are amended to include the following terms:

1. For the protection of fish and other public trust resources in the lower Yuba River, permittee shall release or bypass sufficient water to maintain the following instream flows in the lower Yuba River The minimum flow requirements shall be maintained as measured by a 5-day running average of average daily streamflows with instantaneous flows never less than 90 percent of the specificed flow requirements.

    a. Beginning April 21 of 2006, streamflow shall be maintained at or above the flows specified in the following table as measured at the USGS gaging installations at Marysville and Smartville:

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Long-Term Instream Flow Requirments

Periods	Wet, Above Normal & Below Normal Years (cfs)		Dry Years (cfs)		Critical Years (cfs)		Extreme Critical Years* (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sept. 15 - Oct 14	700	250	500	250	400	250	400	250
Oct 15 - Apr 20	700	500	600	400	600	400	600	400
Apr 21 - Apr 30	--	1,000	--	1,000	--	1,000	--	500
May 1 - May 31	--	1,500	--	1,500	--	1,100	--	500
Jun 1	--	1,050	--	1,050	--	800	--	500
Jun 2	--	800	--	800	--	800	--	500
Jun 3 - Jun 30	--	800	--	800	--	800	--	500
Jul 1	--	560	--	560	--	560	--	500
Jul 2	--	390	--	390	--	390	--	390
Jul 3 - Sept. 14	--	250	--	250	--	250	--	250

* "Extreme Critical" year classification is defined as: Equal to or less than 540 TAF on the Yuba River Index scale.

b. For purposes of this order, wet, above normal, below normal, dry and critical water year types in the table above are as defined in the Yuba River Index. (See Appendix 1.) Extreme critical water years are defined as years when the Yuba River Index is predicted to be less than 540 thousand acre-feet. Determination of water year classifications shall be made on April 1 of each year, in accordance with the forecast of unimpaired flow of the Yuba River at Smartville published in California Department of Water Resources Bulletin 120. The year type for the preceding water year shall remain in effect until April 1 when the current year forecast is available.

c. In order to avoid potential aggravation of the electrical energy crisis in California present in early 2001, the flows specified above in part "a." of this term shall come into effect on April 21, 2006. In the interim period, streamflow shall be maintained at or above the flows specified in the following table as measured at the USGS gaging installations at Marysville and Smartville.

Interim Instream Flow Requirements

Period	Wet & Above Normal Years (cfs)		Below Normal Years (cfs)		Dry Years (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sep 15-Oct 14	700	250	550	250	500	250
Oct 15-Apr 20	700	500	700	500	600	400
Apr 21-Apr 30	--	1,000	--	900	--	400
May 1-May 31	--	1,500	--	1,500	--	500
Jun 1	--	1,050	--	1,050	--	400
Jun 2-Jun 30	--	800	--	800	--	400
Jul 1	--	560	--	560	--	280
Jul 2	--	390	--	390	--	250
Jul 3-Sep 14	--	250	--	250	--	250
Period	Critical Years (cfs)					
	Smartville Gage	Marysville Gage				
Sep 15-Oct 1	400	150				
Oct 1-Oct 14	400	250				
Oct 15-Apr 20	600	400				
Apr 21	--	280				
Apr 22-Apr 30	--	270				
May 1-May 31	--	270				
Jun 1-July 2	--	(See Note)				
July 3-Sep 14	--	100				

Table Note: The interim instream flow requirements for June 1-30 of critical years shall be 245 cfs pursuant to the provisions of the agreement between Yuba County Water Agency and the Department of Fish and Game dated September 2, 1965, except if a lower flow is allowed pursuant to the provisions of the 1965 agreement. The minimum flow on July 1 shall be 70 percent of the flow on June 30, and the minimum flow on July 2 shall be 70 percent of the flow on July 1.

2. To minimize water temperature impacts on anadromous fish and other public trust resources in the lower Yuba River, permittee shall comply with the following terms and conditions:

   a. Permittee shall diligently pursue development of the Narrows II Powerhouse Intake Extension Project at Englebright Dam, in coordination with the Department of Fish and Game, the United States Fish and Wildlife Service and the National Marine Fisheries Service. Permittee shall submit proposals for project funding and prepare all appropriate

CEQA documentation for project development in a timely manner. Permittee shall submit proposals for project funding and prepare all appropriate CEQA documentation for project development in a timely manner. Permitttee shall submit a report to the Chief of the Division of Water Rights on the status of its application for funding and the progress of project development every six months from the date of this Order through the completion of project construction.

b. Permittee shall coordinate operation of available temperature control devices to minimize temperature impacts on anadromous fishery resources in the lower Yuba River. Permittee shall consult with the Temperature Advisory Committee (composed of representatives from the SWRCB, the Department of Fish and Game, the United States Fish and Wildlife Service, the National Marine Fisheries Service, the California Sportfishing Protection Alliance and the South Yuba River Citizens League) on a regular basis during the temperature control season (May through October). Permittee shall monitor water temperature effects of project operations and report to the Advisory Committee on a regular basis. Permittee shall discuss with the Committee current operations for temperature control and variances from the temperatures needed to provide suitable habitat for anadromous fish. Permittee shall make changes to project operations for temperature control as recommended by the Temperature Advisory Committee on a real-time basis, unless Permittee informs the Chief of the Division of Water Rights within 14 days that the Committee recommendation is infeasible and explains the basis for that conclusion.

c. Prior to April 1 of each year, permittee shall prepare an annual operations plan for water temperature control in consultation with the Temperature Advisory Committee. The plan shall specify actions to be taken to maintain suitable water temperatures for anadromous fish in the subsequent May through October period. The plan shall be submitted to the Chief of the Division of Water Rights for approval by April 1 of each year, and shall describe proposed operations for the subsequent May through October period.

d. Permittee shall install and operate automated temperature monitoring equipment and record water temperatures on an hourly basis at the Smartville Gage, Daguerre Point Dam, and the Marysville Gage. Permittee shall prepare an annual monitoring report that summarizes the results of water temperature monitoring for the previous water year at the above-described locations and describes operations to minimize water temperature impacts on anadromous fish. The monitoring report covering the previous water year ending September 30 shall be submitted to the Chief of the Division of Water Rights by December 31 of each year.

e. The SWRCB retains continuing authority over this permit to establish water temperature requirements for the lower Yuba River for the protection of fishery resources following notice and opportunity for hearing.

3. With the exception of emergencies, flood flows, bypasses of uncontrolled flows into Englebright Reservoir, uncontrolled spilling, or uncontrolled flows of tributary streams downstream of Englebright Dam, permittee shall make reasonable efforts to operate New Bullards Bar Reservoir and Englebright Reservoir to avoid fluctuations in the flow of the lower Yuba River downstream of Englebright Dam. Daily changes in project operations affecting releases or bypasses of flow from Englebright Dam shall be continuously measured at the USGS gage at Smartville and shall be made in accordance with the following conditions:

a. Project releases or bypasses that increase streamflow downstream of Englebright Dam shall not exceed a rate of change of more than 500 cfs per hour.

b. Project releases or bypasses that reduce streamflow downstream of Englebright Dam shall be gradual and, over the course of any 24-hour period, shall not be reduced below 70 percent of the prior day's flow release or bypass flow.

c. Once the daily project release or bypass level is achieved, daily fluctuations in the streamflow level downstream of Englebright Dam due to changes in project operations shall not vary up or down by more than 15 percent.

d. During the period from September 15 to October 31, permittee shall not reduce the flow downstream of Englebright Dam to less than 55 percent of the maximum release or bypass level that has occurred during that September 15 to October 31 period or the minimum streamflow requirement that would otherwise apply, whichever is greater.

e. During the period from November 1 to March 31, permittee shall not reduce the flow downstream of Englebright Dam to less than the minimum streamflow release or bypass established under (d) above; or 65 percent of the maximum flow release or bypass that has occurred during that November 1 to March 31 period; or the minimum streamflow requirement that would otherwise apply, whichever is greater.

4. By July 1, 2001, permittee shall submit, for approval of the Chief of the Division of Water Rights, a report specifying the types and locations of gages that are capable of continuously measuring flows and temperatures required by the conditions of this permit. The report shall include a construction schedule for installation of any additional gages which may be needed to continuously measure flows and temperatures at the locations specified in this permit. No water shall be diverted under this permit unless permittee installs the devices in accordance with the plan and construction schedule as approved by the Chief of the Division of Water Rights. Permittee shall ensure that said devices are properly maintained.

5. Permittee shall maintain a continuous record of the daily instream flows at the Smartville and Marysville Gages sufficient to document compliance with the terms of this permit. Permittee shall also maintain hourly records of water temperatures at Marysville, Smartville and

Daguerre Point Dam. Permittee shall make flow and temperature records available to the SWRCB and to other interested parties upon request of the SWRCB.

6. Permittee shall submit a report by December 31 of each year that verifies permittee's compliance with all permit conditions for the previous water year ending September 30. The report shall be submitted to the Division of Water Rights in a format designated by the Chief of the Division of Water Rights.

7. By July 1, 2001, permittee shall submit for approval of the Chief of the Division of Water Rights a plan that describes the scope and duration of studies to be conducted to verify that salmon and steelhead redds and fry are being adequately protected from dewatering or stranding. Permittee shall consult with the Department of Fish and Game, the United States Fish and Wildlife Service, and the National Marine Fisheries Service regarding the development and scope of the plan. Following approval of the plan, the studies shall be conducted in accordance with the schedule specified in the plan. Pending completion of the studies, summary reports shall be submitted annually to the Division of Water Rights by December 31 and a final report with recommendations should be submitted within one year of the completion of the study.

8. Permittee, in conjunction with the water districts or other water users receiving water from the Hallwood-Cordua Canal (North Canal) and the South Yuba-Brophy Canal (South Canal), shall consult with the Department of Fish and Game, the National Marine Fisheries Service, and the United States Fish and Wildlife Service to develop plans to reduce fish losses resulting from diversion of water into the canals. The plan shall identify proposed sources of funding, including any money available under state or federal grants. Conditions of the plans shall result in compliance with all applicable requirements of the state and federal endangered species acts. If the Department of Fish and Game or the National Marine Fisheries Service determines that a potential take of listed species will result from diversion of water into the canals, permittee shall obtain appropriate authorization for incidental take. In order to continue

diversion of water at the Hallwood-Cordua and South Yuba-Brophy canals, the plans to reduce fish losses and any required incidental take authorization shall be provided to the Chief of the Division of Water Rights by March 31, 2002. The Chief of the Division of Water Rights shall review the adequacy of the plans for protection of fish and the schedule for implementing the proposed actions. If the plans are not adequate, they shall be revised in accordance with the direction of the Chief of the Division of Water Rights.

9. This permit does not authorize any act that results in the taking of a threatened or endangered species or any act which is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code § 2050 et seq) or the federal Endangered Species Act (16 U.S.C. § 1531 et seq.). If a "take" will result from any act authorized under this permit, permittee shall obtain authorization for incidental take. Permittee shall be responsible for meeting all requirements of the applicable Endangered Species Act for diversion of water under this permit and related actions.

10. If the forecasted Yuba River Index (YRI) on April 1 is less than or equal to 790 TAF, permittee may file a request with the Chief of the Division of Water Rights (Division Chief) for a temporary reduction in the instream flow requirements applicable to this permit, if permittee estimates that it will have deficiencies of more than 20 percent of projected demand for surface water deliveries within the YCWA service area for the calendar year.

    For the purpose of this permit term, "projected demand" for the calendar year shall be based upon the sum of the following:

    (1) Permittee's projected demand for surface water deliveries to Dry Creek Mutual Water Company (Dry Creek) for the current year, not to exceed 16,743 acre-feet;

    (2) Permittee's projected demand for surface water deliveries to Wheatland Water District and Wheatland Water District Detachments (Wheatland) for the current year, not to exceed 40,855 acre-feet; and

(3) Permittee's projected demand for surface water deliveries for the remainder of permittee's authorized place of use within the permittee's service area (excluding Dry Creek and Wheatland) for the current year, not to exceed 273,847 acre-feet.

The projected demand figures shall specify permittee's surface water deliveries to each water district or other recipient that have occurred during the calendar year as of the date of permittee's request and permittee's projected demand for surface water deliveries for the remainder of the current calendar year. Permittee's request shall include documented data on actual surface water deliveries by permittee to Dry Creek and Wheatland for the past three years (if applicable) and expected surface water demand for Dry Creek and Wheatland for the current calendar year.

If permittee files a request to reduce instream flow requirements pursuant to this permit term, permittee shall develop an alternative instream flow proposal, following notification to and consultation with the Department of Fish and Game (DFG), that would allow permittee to meet up to 80 percent of its projected demand for the current year. The alternative instream flow proposal shall be included with permittee's request and shall propose instream flows to remain in effect from the date of approval by the Division Chief for the remainder of the calendar year. Any request for a temporary reduction in instream flow requirements shall be submitted by April 7 of the year for which the reduction is requested, in order to facilitate action by the Division Chief upon the request prior to April 21 of each year.

Following review of the request submitted by permittee and other relevant information, the Division Chief shall have the authority to approve a temporary reduction in the instream flow requirements for the period of April 21 through December 31 (or a portion thereof) of the year in which the flow reduction request is submitted. The Division Chief may approve a temporary reduction of instream flow requirements, as requested by permittee or as otherwise justified by the available information, but in no event shall the temporary instream flow requirements approved pursuant to this permit term be less than proposed in permittee's request or less than the instream flows required under part c of the condition added as Term 1of this order. The

Division Chief shall notify permittee and DFG of the Division Chief's action upon the request for a temporary reduction of applicable instream flow requirements. The Division Chief's action upon a request for temporary reduction of instream flow requirements shall be subject to reconsideration by the State Water Resources Control Board.

If a temporary reduction in instream flow requirements is approved, permittee shall submit a report to the Division Chief that accounts for actual surface water deliveries, any curtailments of requested surface water deliveries to customers in Yuba County, and instream flows in the Yuba River at Marysville for the year during which any reduced flow requirements are in effect. The report shall be submitted by February 1 of the following year.

11. Permittee shall maintain a continuous record showing the quantities of water diverted from the lower Yuba River under Permits 15026, 15027 and 15030 at all points of diversion and rediversion. Such records shall be available to the SWRCB and to other interested parties upon request of the SWRCB.

In addition to the new terms specified above, Permits 15026, 15027 and 15030 are amended as follows:

1. Paragraph 2 of Permits 15026, 15027 and 15030 titled "Location of Point(s) of Diversion," shall be corrected to describe the point of diversion/rediversion located on the lower Yuba River within the SW¼ of the SW¼ of Section 29, T16N, R5E, MDB&M as follows:

   "Daguerre Point Dam, located within the SW¼ of the SW¼ of Section 29, T16N, R5E, MDB&M and having the following California Co-ordinates: N56054, E2157846."

2. Permit term 20 of Permit 15026, permit term 19 of Permit 15027, and permit term 19 of Permit 15030 are deleted from said permits.

In addition to the above terms amending Yuba County Water Agency's permits, it is further ordered that:

1. Yuba County Water Agency shall file and diligently pursue petitions for change with the SWRCB, requesting the addition of points of diversion/rediversion to serve diverters within the permitted place of use in the Dantoni area. The petition shall be filed within one year of the date of this order.

2. Prior to the submittal of the petition(s) for change to add points of diversion/rediversion, Yuba County Water Agency shall consult with the Department of Fish and Game and conduct an evaluation of fish losses from diversions in the Dantoni area. The results of the evaluation, along with proposed alternatives and recommendations for any reasonable improvements that could be made to reduce fish losses at these points of diversion and the parties responsible for implementing the improvements shall be submitted to the SWRCB along with the petitions for change.

Browns Valley Irrigation District

It is further ordered that:

1. Browns Valley Irrigation District shall operate and maintain the fish screen at the Pumpline Diversion Facility to meet current Department of Fish and Game and National Marine Fisheries Service screening criteria for juvenile salmonids. If the screen is not operated and maintained to meet the Department of Fish and Game and National Marine Fisheries Service criteria, the SWRCB may exercise its continuing authority to require additional measures for the protection of fish at the Browns Valley Pumpline Diversion Facility.

2. If Browns Valley Irrigation District intends to divert water from the Yuba River in excess of the quantities specified in Table 23 of the findings of this order plus the quantity provided by the 1981 contract with Yuba County Water Agency, Browns Valley Irrigation District shall

either apply for a water right permit from the SWRCB, or amend the contract with Yuba County Water Agency to allow Browns Valley Irrigation District to divert additional water under Yuba County Water Agency's existing rights. Diversion of water not covered by a pre-1914 water right, water right permit, or contract with Yuba County Water Agency may be construed a trespass pursuant to section 1052 et seq. of the Water Code.

3. Browns Valley Irrigation District shall provide complete monthly and annual water diversion information on all future triennial Supplemental Statements of Water Diversion and Use submitted pursuant to Water Code section 5103.

Cordua Irrigation District

It is further ordered that Licenses 3984 and 3985 of Cordua Irrigation District are amended to include the following terms:

1. Licensee, in conjunction with Yuba County Water Agency, Hallwood Irrigation Company, and Ramirez Water District shall consult with the Department of Fish Game, the National Marine Fisheries Service and the United States Fish and Wildlife Service to develop a plan to reduce fish losses resulting from diversion of water at the Hallwood-Cordua Canal (North Canal). The plan shall identify proposed sources of funding, including any money available under state or federal grants. Conditions of the plan shall result in compliance with all applicable requirements of the state and federal endangered species acts. If the Department of Fish Game or the National Marine Fisheries Service determines that a potential take of listed species will result from diversion of water, licensee shall obtain appropriate authorization for incidental take. In order to continue diversion of water at the Hallwood-Cordua Canal, the plan to reduce fish losses and any required incidental take authorization shall be provided to the Chief of the Division of Water Rights by March 31, 2002. The Chief of the Division of Water Rights shall review the adequacy of the plan for protection of fish and the schedules for implementing the proposed actions. If the plan is not adequate, it shall be revised in accordance with the direction of the Chief of the Division of Water Rights.

2. Licensee shall provide complete monthly and annual water diversion information relevant to License 3984 and License 3985 on all future triennial Reports of Licensee. Reports of licensee shall specify the monthly and annual quantities of water diverted under each license.

In addition to the above terms amending Cordua Irrigation District's Licenses 3984 and 3985, it is further ordered that:

1. Prior to July 1, 2001, Licensee shall file a petition with the SWRCB requesting a change in the licensed place of use defined under Licenses 3984 and 3985 to accurately reflect licensee's service area.

2. Prior to July 1, 2001, Licensee shall file a Statement of Water Diversion and Use in accordance with Water Code section 5100 et seq., together with appropriate documentation to substantiate the claimed pre-1914 diversion right from the Yuba River. Licensee shall provide complete monthly and annual water diversion information relevant to said Statement on all future triennial Supplemental Statements of Water Diversion and Use.

Hallwood Irrigation Company

It is further ordered that License 4443 of Hallwood Irrigation Company is amended to include the following terms:

1. Licensee, in conjunction with Yuba County Water Agency, Cordua Irrigation District, and Ramirez Water District shall consult with the Department of Fish and Game, the National Marine Fisheries Service, and the United States Fish and Wildlife Service to develop a plan to reduce fish losses resulting from diversion of water at the Hallwood-Cordua Canal (North Canal). The plan shall identify proposed sources of funding, including any money available under state or federal grants. Conditions of the plan shall result in compliance with all applicable requirements of the state and federal endangered species acts. If the Department of

Fish and Game or the National Marine Fisheries Service determines that a potential take of listed species will result from diversion of water, licensee shall obtain appropriate authorization for incidental take. In order to continue diversion of water at the Hallwood-Cordua Canal, the plan to reduce fish losses and any required incidental take authorization shall be provided to the Chief of the Division of Water Rights by March 31, 2002. The Chief of the Division of Water Rights shall review the adequacy of the plan for protection of fish and the schedules for implementing the proposed actions. If the plan is not adequate, it shall be revised in accordance with the direction of the Chief of the Division of Water Rights.

2. Licensee shall provide complete monthly and annual water diversion information relevant to License 4443 on all future triennial Reports of Licensee. Reports of licensee shall specify the monthly and annual quantities of water diverted under this license.

In addition to the above terms amending Hallwood Irrigation Company License 4443, it is further ordered that:

1. Prior to July 1, 2001, Hallwood Irrigation Company shall file a Statement of Water Diversion and Use in accordance with Water Code section 5100 et seq., together with appropriate documentation to substantiate the claimed pre-1914 diversion right from the Yuba River. Hallwood should provide complete monthly and annual water diversion information relevant to said Statement on all future triennial Supplemental Statements of Water Diversion and Use.

2. Hallwood Irrigation Company shall be limited to the diversion season specified in water right License 4443 and the 1980 contract with Yuba County Water Agency, both of which allow diversion between April 1 and November 1 of each year. If Hallwood Irrigation Company desires to extend its diversion season, it shall either apply for a water right permit with the SWRCB, or amend the contract with Yuba County Water Agency to allow diversion during

other months. Diversion of water in the absence of the required documentation may be considered a trespass pursuant to section 1052 et. seq. of the Water Code.

Ramirez Water District

It is further ordered that:

1. Ramirez Water District, in conjunction with Yuba County Water Agency, Cordua Irrigation District, and Hallwood Irrigation Company shall consult with the Department of Fish and Game, the National Marine Fisheries Service, and the United States Fish and Wildlife Service to develop a plan to reduce fish losses resulting from diversion of water at the Hallwood-Cordua Canal (North Canal). The plan shall identify proposed sources of funding, including any money available under state or federal grants. Conditions of the plan shall result in compliance with all applicable requirements of the state and federal endangered species acts. If the Department of Fish and Game or the National Marine Fisheries Service determines that a potential take of listed species will result from diversion of water, appropriate authorization for incidental take shall be obtained. In order to continue diversion of water at the Hallwood-Cordua Canal, the plan to reduce fish losses and any required incidental take authorization shall be provided to the Chief of the Division of Water Rights by March 31, 2002. The Chief of the Division of Water Rights shall review the adequacy of the plan for protection of fish and the schedules for implementing the proposed actions. If the plan is not adequate, it shall be revised in accordance with the direction of the Chief of the Division of Water Rights.

South Yuba Water District

It is further ordered that:

1. South Yuba Water District, in conjunction with Yuba County Water Agency and Brophy Water District, shall consult with the Department of Fish and Game, the National Marine Fisheries Service, and the United States Fish and Wildlife Service to develop a plan to reduce

fish losses resulting from diversion of water into the South Yuba-Brophy Canal (South Canal). The plan shall identify proposed sources of funding, including any money available under state or federal grants. Conditions of the plan shall result in compliance with all applicable requirements of the state and federal endangered species acts. If the Department of Fish and Game or the National Marine Fisheries Service determines that a potential take of a listed species will result from diversion of water, permittee shall obtain appropriate authorization for incidental take. In order to continue diversion of water at the South Yuba-Brophy Canal, the plan to reduce fish losses and any required incidental take authorization shall be provided to the Chief of the Division of Water Rights by March 31, 2002. The Chief of the Division of Water Rights shall review the adequacy of the plan for protection of fish and the schedule for implementing the proposed actions. If the plan is not adequate, it shall be revised in accordance with the direction of the Chief of the Division of Water Rights.

Brophy Water District

It is further ordered that:

1. Brophy Water District, in conjunction with Yuba County Water Agency and South Yuba Water District, shall consult with the Department of Fish and Game, the National Marine Fisheries Service, and the United States Fish and Wildlife Service to develop a plan to reduce fish losses resulting from diversion of water into the South Yuba-Brophy Canal (South Canal). The plan shall identify proposed sources of funding, including any money available under state or federal grants. Conditions of the plan shall result in compliance with all applicable requirements of the state and federal endangered species acts. If the Department of Fish and Game or the National Marine Fisheries Service determines that a potential take of listed species will result from diversion of water, permittee shall obtain appropriate authorization for incidental take. In order to continue diversion of water at the South Yuba-Brophy Canal, the plan to reduce fish losses and any required incidental take authorization shall be provided to the Chief of the Division of Water Rights by December 31, 2001. The Chief of the Division of Water Rights shall review the adequacy of the plan for protection of fish and the schedule for

implementing the proposed actions. If the plan is not adequate, it shall be revised in accordance with the direction of the Chief of the Division of Water Rights.

Western Water Company, Western Aggregates, Inc., and YG Development Company

It is further ordered that:

1. Western Water Company, Western Aggregates, Inc., and YG Development Company shall provide complete monthly and annual water diversion information relevant to Statement 8291 on all future triennial Supplemental Statements of Water Diversion and Use.

2. Western Water Company, Western Aggregates, Inc. and YG Development Company. shall consult with the Department of Fish and Game, the National Marine Fisheries Service, and the United States Fish and Wildlife Service and work cooperatively to develop a project to eliminate access of adult salmon to the Yuba Goldfields through the Yuba Goldfields return channel. Western Water Company, Western Aggregates, Inc. and YG Development Co. shall submit a report to the Chief of the Division of Water Rights on the progress of project development beginning July 1, 2001 and continuing every six months thereafter until completion of project construction.

Lake Wildwood Association

It is further ordered that:

1. The Chief of the Division of Water Rights, or his designee, is directed to meet with representatives from the Department of Fish and Game, Lake Wildwood Association and Yuba County Water Agency to discuss ways that the Lake Wildwood Association could change the operations of Lake Wildwood to reduce potential water temperature impacts to the Yuba River. Possible modifications to the operation of Lake Wildwood could include:

   a. Releasing water either earlier or later in the year.

b. Releasing water to coincide with higher releases or bypass of water from Englebright Dam.

c. Releasing a lesser quantity of water over a longer time.

d. Using other vegetation removal methods at Lake Wildwood.

If those discussions do not result in development of a voluntary, mutually-acceptable solution, the Division of Water Rights is directed to conduct an investigation of the reasonableness of the Lake Wildwood Association's water use operations pursuant to Water Code sections 100 and 275, section 855 et seq. of title 23 of the California Code of Regulations (Misuse of Water), and the SWRCB's continuing authority over Water Right License 10779.

Compliance

It is further ordered that, in the event any of the actions specified in this order are not taken within the time specified in this order or such extension of time as may be allowed for good cause by the Chief of the Division of Water Rights, the Chief of the Division of Water Rights is directed to pursue appropriate enforcement action.

Upon showing of good cause, the Chief of the Division of Water Rights shall have the authority to extend the time for submission of the plans to reduce fish losses at diversion facilities as required under prior provisions of this order.

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Further Action

The State Water Resources Control Board will schedule a meeting on May 3, 2001, at 9:00 a.m., to consider any proposed settlement agreement that may be negotiated among some or all of the parties to this proceeding and to hear a progress report on any settlement negotiations.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify that the foregoing is a full and correct copy of a decision duly and regularly adopted at a meeting of the State Water Resources Control Board held on March 1, 2001.

AYE: Arthur G. Baggett, Jr.
Mary Jane Forster
John W. Brown
Peter S. Silva

NO: None

ABSENT: None

ABSTAIN: None

Maureen Marché
Administrative Assistant to the Board

APPENDICES

APPENDIX 1

FIGURE 1

DEFINITION OF YUBA RIVER INDEX

The water year hydrologic classification for the Yuba River shall be determined by the following equation:

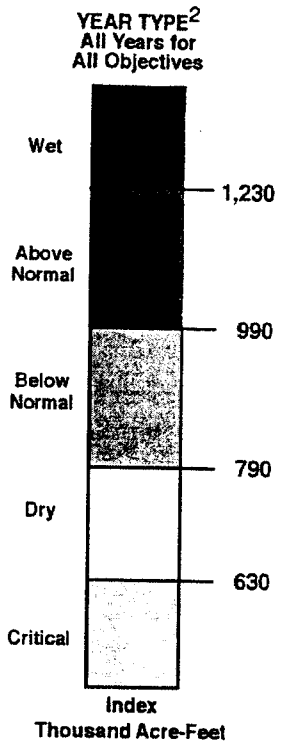
$$\text{INDEX} = 0.5\,X + 0.3\,Y + 0.2\,Z$$

Where **X** = Current year's April-July Yuba River unimpaired runoff

Y = Current year's October-March Yuba River unimpaired runoff

Z = Previous year's index.[1]

The Yuba River unimpaired runoff for the current water year (October 1 of the preceding calendar year through September 30 of the current calendar year), as published in California Department of Water Resources Bulletin 120, is a forecast of the unimpaired flow of the Yuba River at Smartville. Preliminary determinations of a year's classification shall be made in February, March, and April, with the final determination in May. These preliminary determinations shall be based on hydrologic conditions to date plus forecasts of future runoff, assuming normal precipitation for the remainder of the water year.



Classification	Index Thousand Acre-Feet (TAF)
Wet	Equal to or greater than 1,230
Above Normal	Greater than 990 and less than 1,230
Below Normal	Equal to or less than 990 and greater than 790
Dry	Equal to or less than 790 and greater than 630
Critical	Equal to or less than 630

[1] A cap of 1,400 TAF is imposed on the previous year's index to account for required flood control reservoir releases during wet years.

[2] The year type for the preceding water year will remain in effect until the initial forecast of unimpaired runoff for the current year is available.

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APPENDIX 2

Offstream Use Water Demand For Use In Computer Modeling Simulations

The evaluation of the effects of revised instream flow requirements to YCWA's ability to deliver water for offstream uses requires an analysis of historic recorded water delivery data provided by YCWA (S-YCWA 27) and consideration of evidence in the record regarding best management practices for fall flooding. The information in the following table and figure were used in determining the most reasonable level of demand for computer modeling purposes.

APPENDIX TABLE 2-1
Level of Demand for Modeling Purposes
Supporting Data

WATER YEAR	WATER YEAR TYPE	REPORTED HISTORIC IRRIGATION DELIVERIES* (S-YCWA 27) (AF)	ESTIMATED FALL FLOODING/ WATERFOWL HABITAT DELIVERIES (AF)	TOTAL ADJUSTED HISTORIC DIVERSION DEMAND FOR MODELING PURPOSES (AF)
1987	C	210,441	35,516	245,957
1988	C	192,741	35,516	228,257
1989	BN	213,828	35,516	249,344
1990	D	234,261	35,516	269,777
1991	C	234,337	35,516	269,853
1992	C	212,717	35,516	248,233
1993	AB	203,546	35,516	239,062
1994	C	234,490	35,516	270,006
1995	W	196,255	35,516	231,771
1996	W	211,105	35,516	246,621
1997	W	249,583	35,516	285,099
1998	W	193,892	35,516	229,408
1999	W	239,011	35,516	274,527
AVE.	———	———	———	**252,916**
AVE. (BN,D,C)	———	———	———	**254,489**
AVE. (W,AN)	———	———	———	**251,081**
MIN.	———	———	———	**228,257**
MAX	———	———	———	**285,099**
MEDIAN	———	———	———	**248,233**
AVE. (5 HIGHEST YEARS)	———	———	———	**273,847**

*** Includes amounts pumped from groundwater to allow for transfer of surface water to the State Water Bank (82,018 acre-feet in 1991 and 26,033 acre-feet in 1994)**

The estimated fall flooding/waterfowl habitat deliveries data summarized in the above table were derived from YCWA's 1999 estimated summary of irrigation diversion

requirements for the full development levels of demand (S-YCWA-15, p. 8, Table 7) and related "fall flooding" testimony presented by YCWA and Cordua Irrigation District. (YCWA 45, pp.4-5; S-YCWA 15, Appendix A, p. 9 of 7 (columar description #7); S-Cordua 1, pp. 1-2.) Based on that information, the following table shows the estimated annual amount of water needed for rice straw decomposition and waterfowl habitat at YCWA's full development level of demand.

APPENDIX TABLE 2-2
Estimated Full Development Demands for
Waterfowl Habitat and Rice Straw Decomposition

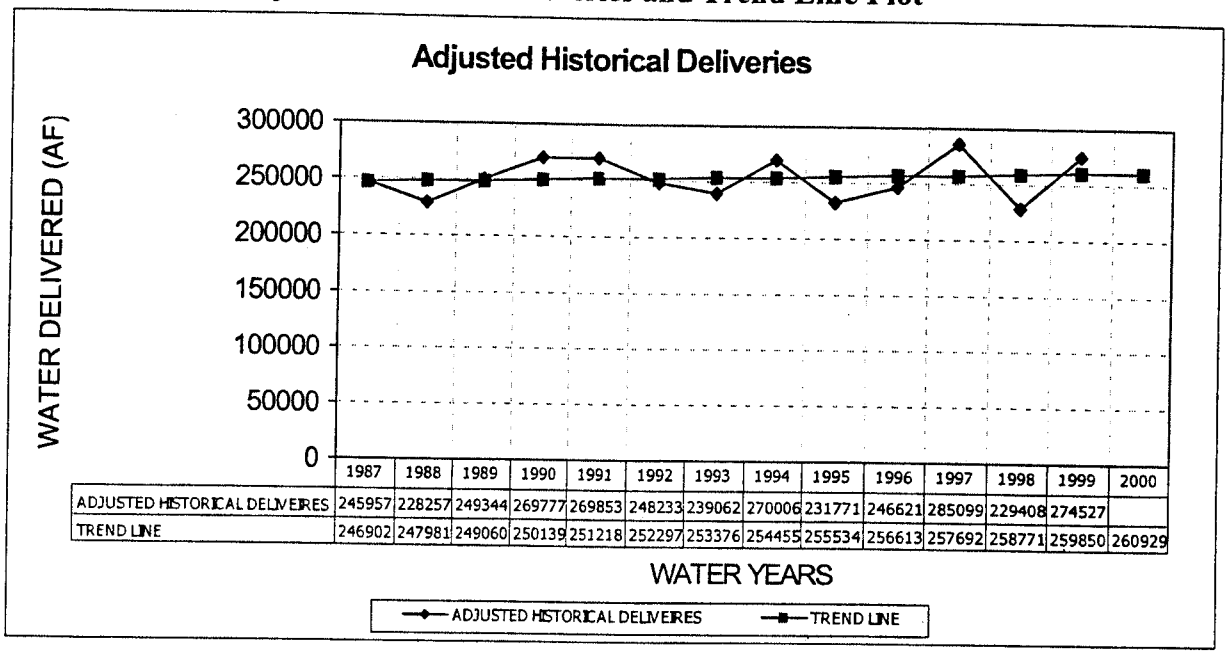
DISTRICT	NET RICE CROP ACREAGE (ACRES) (S-YCWA-15, p.8, Table 7)	FALL FLOODING - WATERFOWL HABITAT ANNUAL DEMAND* (AF)
Brophy	7,700	7,623
Browns Valley	4,400	4,356
Cordua	8,000	7,920
Dantoni Area	0	0
Dry Creek	465	461
Hallwood	4,400	4,356
Ramirez	4,776	4,727
South Yuba	5,268	5,215
Wheatland	530	524
Wheatland Detached	337	333
TOTALS	**35,876**	**35,516**

*** Fall Flooding Demand equals 90% of the net rice acreage at full development times 1.1 acre-feet of applied water (1.0 acre-feet per acre plus 10% added to account for conveyance losses). (S-YCWA 15, Appendix A; S-Cordua 1)**

The following figure illustrates the total adjusted historic diversion demand for the data summarized in Appendix Table 2-1 and the corresponding "trend-line" for the plotted data. As the figure shows, five out of the 13 years plotted lie over the plotted trend-line. These five highest years of deliveries (1990, 1991, 1994, 1997, and 1999) were averaged to obtain the estimated level of demand used for modeling purposes. As Appendix Table 2-1 indicates, the average of the five highest years of deliveries equals 273,847 acre-feet.

The figures in Appendix Table 2-1 show that estimated average demand in below normal, dry and critical years was approximately one percent higher than in wet and above normal. However, the two years of highest demand were both wet years. In view of the small number of years involved and the small effect of water year type on diversion demand, the computer modeling simulations used in developing the SWRCB's decision used a single water demand figure of 273, 847 acre-feet, as the estimated demand for offstream uses in all water year types.

APPENDIX FIGURE 2-1
Adjusted Historical Deliveries and Trend Line Plot



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
ADJUSTED HISTORICAL DELIVERES	245957	228257	249344	269777	269853	248233	239062	270006	231771	246621	285099	229408	274527	
TREND LINE	246902	247981	249060	250139	251218	252297	253376	254455	255534	256613	257692	258771	259850	260929

The following Appendix Table 2-3 provides the average monthly diversion demand for all water year types that were used for modeling the effects of fishery protection measures on YCWA's ability to deliver water for offstream uses. The monthly values were calculated based on YCWA's estimated pattern of delivery distribution for the present level of demand. (S-YCWA 15A, p. 10, Table 8.)

APPENDIX TABLE 2-3
Present Level of Diversion Requirement Used For Modeling Purposes
(All Water Year Types)

Unit	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
AF	16,727	9,191	4,586	352	352	2,648	16,242	53,088	49,001	57,541	48,304	15,815	273,847

APPENDIX 3

MODELING STUDIES RESULTS

TABLE A-1 Total Outflow from New Bullar ar Reservoir
YCWA/DFG 1965 AGRE NT
Study : a) presen level demand; b) current PG&E practice; c) current minimum flow requirements; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	509	463	327	472	1311	1226	2544	6796	5791	3024	1712	889
1923	543	379	2178	1412	820	267	2215	2668	2082	2415	1669	954
1924	514	437	360	602	283	445	341	973	994	1008	860	320
1925	326	274	263	260	2074	2175	1889	2124	1245	2050	1617	886
1926	557	428	394	567	2489	928	2041	968	1035	1093	1543	855
1927	507	2438	1690	1994	5663	4024	4038	3444	3425	2633	1595	918
1928	556	865	1164	1611	1247	5657	2782	1754	1033	2062	1577	892
1929	570	419	410	631	284	255	261	720	922	992	1072	838
1930	505	387	1709	1525	1689	1626	1154	972	1090	2025	1605	908
1931	612	349	521	517	289	256	303	943	972	1008	855	326
1932	390	274	262	257	1223	1207	1256	3255	2931	2201	1654	843
1933	579	466	480	634	424	258	262	423	851	1497	1543	855
1934	444	349	267	1016	1064	687	430	988	994	1003	855	324
1935	483	267	290	612	1182	589	4235	3678	2662	2153	1627	868
1936	545	490	543	1877	2711	3432	3421	2742	2136	2272	1648	914
1937	579	495	532	673	285	253	2115	3576	1949	2133	1606	847
1938	531	384	2976	1847	2013	6163	4677	6584	4780	3067	1786	935
1939	532	497	539	587	283	254	258	897	917	951	855	332
1940	437	336	375	2538	3944	6496	3029	2190	1363	2048	1624	919
1941	543	421	2043	2764	3852	3974	2624	4500	2511	2881	1755	1000
1942	556	408	2959	3014	5014	2475	3506	3870	3725	2973	1775	910
1943	576	1072	2540	3479	3228	5871	2972	1756	1881	2271	1722	937
1944	572	502	485	577	283	253	258	1873	1471	2088	1627	875
1945	562	396	1332	921	2626	1743	1140	2665	1881	2217	1674	910
1946	523	766	2644	3459	1401	1079	2235	2494	1458	2169	1691	893
1947	589	364	771	743	1170	1360	500	1025	970	972	1531	877
1948	497	500	568	1583	443	253	2035	3150	3124	2325	1756	918
1949	593	500	256	602	284	254	1540	1914	1142	2011	1613	892
1950	597	426	511	640	2515	1405	2733	2738	2245	2234	1699	907
1951	510	4075	6925	3698	3938	2678	1752	1888	1309	2171	1671	893
1952	475	809	2868	2044	3122	2855	5358	7438	5066	3966	2030	1066
1953	602	451	255	3436	3011	784	2305	2554	3576	3159	1847	950
1954	587	369	415	1005	2012	2325	3058	1451	1026	2089	1627	895
1955	464	402	323	702	404	288	301	1324	1472	2126	1641	883
1956	589	409	8135	6990	3263	2881	1670	3854	3042	2498	1865	1016
1957	459	406	543	527	2487	2262	466	2762	1966	2236	1725	946
1958	523	443	1188	1590	5508	3608	3905	6095	3621	2834	1877	1251
1959	602	429	499	826	1476	595	289	980	967	977	1173	944
1960	569	496	528	397	2146	2738	904	867	1040	2114	1674	880
1961	570	399	391	631	473	252	257	759	944	1926	1620	871
1962	530	388	329	436	2075	1627	2618	1780	1991	2164	1708	950
1963	2822	1355	2373	2321	4612	1996	3501	4085	1994	2380	1847	1066
1964	530	1461	682	919	822	253	258	1003	1369	2117	1701	929
1965	587	413	10355	6469	3653	1406	2993	2609	2501	2493	1931	1062
1966	592	359	507	916	635	941	1848	960	1008	1742	1598	899
1967	626	466	2421	2517	3133	2670	1149	5066	5189	3556	1920	1011
1968	536	405	417	871	2862	2227	257	828	1020	1569	1633	772
1969	510	440	1034	7093	3577	2590	3240	5208	3304	2747	1739	964
1970	584	446	2935	10589	3385	2616	257	705	1224	2170	1674	883
1971	576	1425	2454	2308	1832	2392	1819	4206	2832	3209	1905	1147
1972	592	474	408	1213	1383	2138	948	1396	1319	2099	1755	1051
1973	503	974	1967	2810	3386	2870	1520	3053	1420	2171	1714	1077
1974	500	3200	3427	6826	3521	5596	3569	3327	2892	2778	1851	971
1975	575	437	457	525	2139	2584	972	4128	3955	2929	1851	1046
1976	587	580	612	621	290	341	353	901	828	852	717	265
1977	413	266	329	429	287	297	408	906	848	907	823	283
1978	452	294	274	832	1899	3896	2687	2720	2720	2540	1838	1213
1979	554	442	470	424	1070	1517	947	2897	1420	2134	1694	958
1980	500	683	913	7369	6456	3179	1482	1812	2091	2487	1754	898
1981	430	473	530	288	1333	626	257	958	909	919	1437	863
1982	438	3447	7898	3585	7153	4424	7225	4740	2753	2663	1835	1404
1983	573	1685	3199	2694	4880	9348	2990	5197	5774	4113	2126	1209
1984	441	2648	7813	3516	3416	2149	612	1583	1634	2261	1746	1024
1985	452	1254	866	647	743	253	848	933	1012	1348	1608	944
1986	433	392	754	2373	12183	7330	1133	940	1304	2189	1688	1211
1987	410	500	555	665	340	624	348	911	924	942	822	297
1988	478	291	698	1304	728	253	303	877	877	922	823	314
1989	451	477	474	730	1174	6702	2745	934	1218	2062	1689	1006
1990	549	414	495	910	545	891	370	765	804	1506	1689	902
1991	554	441	571	738	534	257	260	820	909	1495	1661	895
1992	554	441	571	738	534	257	260	820	909	1488	1661	895
AVG.	558	719	1525	1872	2233	2118	1764	2376	1980	2096	1596	884

TABLE A-2 New Bullards Bar Reservoir End-of-month Storage
YCWA/DFG 1965 AGREEM
Study : a) pre level demand; b) current PG&E practice; c) cu minimum flow requirements; d) YRI
(AF)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	561358	548404	586356	623906	720000	790000	890000	966000	966000	840000	750000	705000
1923	681634	685208	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1924	685183	667846	670097	650073	696599	700454	742722	713818	658805	598208	545740	531741
1925	525771	535507	581157	622850	796000	790000	890000	966000	950000	840000	750000	705000
1926	679976	670822	674363	670320	730198	790000	890000	927494	899579	840000	750000	705000
1927	686374	705000	705000	705000	796000	796000	896000	966000	966000	840000	750000	705000
1928	679714	705000	705000	705000	720000	796000	890000	966000	950000	840000	750000	705000
1929	676847	666743	662848	643440	668248	721005	800273	870409	864800	811940	750000	705000
1930	678804	661239	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1931	667872	666518	640277	634341	646221	701941	740914	716246	669819	609014	558877	544091
1932	530981	532510	609700	677902	720000	790000	890000	966000	950000	840000	750000	705000
1933	674721	654655	635396	613294	607533	665868	757767	866547	919195	840000	750000	705000
1934	685514	675431	705000	705000	720000	790000	837794	814409	770314	712734	663263	648744
1935	625712	642275	659107	705000	720000	790000	896000	966000	950000	840000	750000	705000
1936	683258	671246	661570	705000	796000	790000	890000	966000	950000	840000	750000	705000
1937	676601	655384	635756	606461	668873	776382	890000	966000	950000	840000	750000	705000
1938	679695	705000	736930	705000	768577	796000	896000	966000	966000	840000	750000	705000
1939	686758	680097	674720	664468	670647	756206	873641	870539	829926	774897	722562	705000
1940	687409	677470	671293	705000	796000	796000	890000	966000	950000	840000	750000	705000
1941	682442	689525	705000	729164	796000	796000	890000	966000	950000	840000	750000	705000
1942	685510	694375	705000	796000	796000	790000	896000	966000	966000	840000	750000	705000
1943	679085	705000	705000	796000	794452	796000	890000	966000	950000	840000	750000	705000
1944	681629	665513	654180	650330	686546	771940	877101	966000	950000	840000	750000	705000
1945	679616	705000	705000	705000	796000	790000	890000	966000	950000	840000	750000	705000
1946	690244	705000	796000	721769	720000	790000	890000	966000	950000	840000	750000	705000
1947	679598	705000	705000	687175	720000	790000	890000	900302	883203	835042	750000	705000
1948	705000	700825	687386	705000	716241	744513	890000	966000	950000	840000	750000	705000
1949	678306	669569	674492	656432	663201	749613	890000	966000	950000	840000	750000	705000
1950	674436	662548	643777	705000	720000	790000	890000	966000	950000	840000	750000	705000
1951	705000	796000	796000	796000	796000	790000	890000	966000	950000	840000	750000	705000
1952	701918	705000	705000	705000	796000	794115	896000	966000	966000	840000	750000	705000
1953	678576	666567	700424	796000	720000	790000	890000	966000	966000	840000	750000	705000
1954	684415	695006	701549	705000	720000	790000	890000	966000	950000	840000	750000	705000
1955	680353	675600	705000	705000	720000	771958	862848	966000	950000	840000	750000	705000
1956	676710	672018	796000	796000	796000	790000	890000	966000	950000	840000	750000	705000
1957	700259	697812	690276	687641	720000	790000	890000	966000	950000	840000	750000	705000
1958	696633	702517	705000	705000	796000	796000	896000	966000	966000	840000	750000	705000
1959	676562	665625	650358	705000	720000	790000	881576	893597	862352	813434	750000	705000
1960	677388	653166	627729	646205	720000	790000	890000	956261	950000	840000	750000	705000
1961	675370	675855	687632	664773	720000	788882	884716	952946	944687	840000	750000	705000
1962	682202	669532	690348	688820	777113	790000	890000	966000	950000	840000	750000	705000
1963	737090	705000	705000	705000	796000	790000	896000	966000	950000	840000	750000	705000
1964	689814	705000	705000	705000	720000	770856	881388	966000	950000	840000	750000	705000
1965	696579	705000	796000	796000	748924	790000	890000	966000	950000	840000	750000	705000
1966	683197	705000	705000	705000	720000	790000	890000	966000	933889	840000	750000	705000
1967	674829	705000	705000	741091	720000	790000	890000	966000	966000	840000	750000	705000
1968	690003	679146	692889	705000	782257	790000	890000	944818	925587	840000	750000	705000
1969	686712	705000	705000	796000	796000	790000	896000	966000	966000	840000	750000	705000
1970	690955	684886	705000	796000	776241	790000	872907	959084	950000	840000	750000	705000
1971	691585	705000	705000	705000	720000	790000	890000	966000	966000	840000	750000	705000
1972	690741	690115	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1973	702624	705000	705000	796000	796000	790000	890000	966000	950000	840000	750000	705000
1974	703914	796000	796000	796000	720000	796000	896000	966000	950000	840000	750000	705000
1975	687696	684514	682763	693963	720000	790000	890000	966000	966000	840000	750000	705000
1976	705000	705000	705000	690187	710811	756631	795299	797000	759515	711088	673316	662579
1977	643592	635118	622138	608095	604550	602352	596536	573906	533227	478958	430500	416372
1978	392618	388378	466120	705000	720000	796000	890000	966000	950000	840000	750000	705000
1979	683596	675956	664249	705000	720000	790000	890000	966000	950000	840000	750000	705000
1980	703638	705000	705000	796000	796000	790000	890000	966000	950000	840000	750000	705000
1981	686687	672977	678915	705000	720000	790000	889456	911177	880852	833597	750000	705000
1982	704314	796000	796000	796000	796000	796000	896000	966000	950000	840000	750000	705000
1983	705000	705000	728138	710121	796000	796000	890000	966000	966000	840000	750000	705000
1984	705000	796000	796000	773165	725654	790000	890000	966000	950000	840000	750000	705000
1985	694176	705000	705000	703343	720000	782914	890000	937842	910086	840000	750000	705000
1986	686789	693810	705000	705000	796000	796000	890000	966000	950000	840000	750000	705000
1987	696716	683272	667166	657348	720000	790000	851400	843440	802427	752634	707547	695008
1988	672790	665990	705000	705000	720000	765195	816031	815581	788344	742955	696359	682060
1989	659137	705000	705000	705000	720000	796000	890000	966000	950000	840000	750000	705000
1990	705000	704454	695870	705000	720000	790000	877688	894650	918216	840000	750000	705000
1991	674207	664402	634996	603243	590770	727250	844862	912667	914509	840000	750000	705000
1992	674207	664402	634996	603243	590346	726824	844436	912242	914089	840000	750000	705000
AVG.	675262	680617	689971	704580	732282	777928	872949	934070	919372	820204	735890	694375

TABLE A-3 Total Energy Production at New E[illegible]ds Bar Reservoir
YCWA/DFG 1965 AGREEMEN[illegible]
Study: a) present level demand; b) current PG&E practice; c) current minimum flow requirements; d) YRI
(MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	35968	31493	23074	33646	85674	89870	183252	269514	260820	226564	126084	62857
1923	39457	26611	158345	102832	53991	19587	159542	202019	153188	181961	122916	67451
1924	37381	30599	26038	43436	19161	32356	24094	71076	69766	72224	60691	21643
1925	22715	18500	18500	18500	136513	160220	136021	160839	91604	154454	119086	62645
1926	40466	29997	28518	41022	163602	68060	147027	73058	75675	81925	113634	60454
1927	36849	171506	123034	145212	237781	264848	259348	254271	246131	198674	117465	64907
1928	40412	60833	84732	117323	85011	263520	200541	132801	76005	155359	116139	63069
1929	41392	29343	29624	45458	18500	18500	18500	53544	66839	73807	78811	59253
1930	36690	27051	123909	111061	111201	119190	83148	73592	80199	152570	118202	64200
1931	44406	24419	37510	37117	18759	18500	21367	68894	68351	72385	60607	22131
1932	27247	18500	18500	18500	83245	88498	90497	242219	214950	165834	121811	59606
1933	42007	32547	34529	45385	27336	18500	18500	31290	62068	112426	113634	60454
1934	32266	24458	19376	73996	70054	50369	30763	73321	70844	73350	62046	22565
1935	34682	18500	20894	44359	77823	43186	259166	269514	195837	162217	119822	61373
1936	39578	34353	39243	136070	185731	246334	240317	207603	157161	171184	121369	64624
1937	42044	34606	38272	48141	18500	18500	152123	263282	143402	160709	118275	59889
1938	38546	26993	216036	134801	132975	264368	259348	269514	260820	229352	131536	66108
1939	38650	34891	39048	42443	18500	18500	18500	67223	66196	70205	62602	23400
1940	31775	23596	27157	184189	246273	264848	216678	165806	100286	154319	119601	64977
1941	39449	29575	148555	201610	238162	264848	189108	269514	184753	216826	129297	70702
1942	40413	28687	214371	219234	239217	182311	245581	269514	260820	223223	130770	64341
1943	41807	75341	184923	247797	211311	264821	213117	132927	138399	171109	126866	66250
1944	41571	35166	35002	41561	19161	18500	18500	141695	108232	157318	119822	61868
1945	40818	27814	96965	67079	173725	128351	82093	201789	138399	167040	123285	64341
1946	38028	53928	193635	246852	92331	79079	161000	188811	107276	163422	124537	63140
1947	42801	25613	56115	54032	76953	99706	36012	77268	70663	72656	112749	62009
1948	36167	35242	41298	115131	30206	18500	145797	235543	227243	175179	129325	64907
1949	43087	35029	18500	43487	18500	18500	110427	144915	84025	151515	118791	63069
1950	43359	29813	36823	46291	165567	102983	196810	207328	165181	168321	125172	64129
1951	37114	254765	264848	264682	239217	197210	126208	142965	96313	163573	123064	63140
1952	34571	57017	208697	148853	211402	210287	259291	269514	260820	269514	149511	75367
1953	43714	31588	18500	245132	198073	57478	166048	193341	256181	235276	136029	67168
1954	42648	25945	30206	73171	132428	170379	218358	109859	75490	157393	119822	63281
1955	33701	28191	23425	51132	26603	21069	21595	100066	108306	160182	120854	62433
1956	42787	28661	262681	264848	220866	211933	120268	269514	222091	188216	137355	71833
1957	33402	28603	39481	38267	163522	165798	33592	209108	144653	168472	127087	66886
1958	38052	31212	86511	115794	237781	258233	259348	269514	259390	213839	138239	88441
1959	43688	30038	35997	59781	97178	43626	20768	73764	70233	72676	86266	66744
1960	41336	34636	37905	28502	145560	200670	65134	65595	76489	159278	123285	62221
1961	41388	27967	28358	45689	31038	18500	18500	57427	69347	145073	119307	61585
1962	38497	27203	23854	31665	137002	119660	188534	134809	146493	163046	125789	67168
1963	205890	95698	172771	168983	237781	146984	245223	269514	146713	179323	136029	75367
1964	38536	102826	49634	66933	56031	18500	18500	75881	100727	159504	125274	65684
1965	42701	29059	263257	264848	235476	103252	214288	197535	184003	187839	142217	75084
1966	42993	25233	36891	66715	41811	68982	133089	72684	74107	131022	117686	63564
1967	45438	32759	176307	183681	204204	195663	82788	269514	260820	260858	141407	71469
1968	38967	28408	30270	63387	195857	163864	18510	62579	74792	117907	120264	54588
1969	37105	30946	75266	263257	231288	190761	229627	269514	238727	207275	128073	68158
1970	42499	31343	212619	263257	219703	192437	18500	53282	90048	163498	123285	62433
1971	41902	100294	178690	168068	120612	175312	130977	269514	208632	238472	140347	81091
1972	43043	33293	29644	88341	94284	156665	68254	105719	97048	158147	129252	74307
1973	36647	68637	143221	205825	220049	211193	109491	229242	104480	163588	126231	76144
1974	36432	223360	246149	264848	226491	263520	250192	246945	212419	209317	136324	68653
1975	41833	30664	33155	38117	140718	189418	69982	269514	260820	220314	136369	73953
1976	42721	40876	44536	45176	19750	24907	25081	66373	58938	62282	52116	18500
1977	29745	18500	23586	30650	18500	21142	28095	64200	57610	62820	56130	18500
1978	30341	18993	18500	58951	124999	263520	193689	205919	200142	191381	135366	85756
1979	40270	30972	33997	30720	70449	111198	68218	218959	104480	160785	124758	67734
1980	36395	48139	66455	263257	247761	230823	106748	137184	153850	187387	129178	63493
1981	31245	33146	38384	20924	87764	45888	18500	72259	66292	68689	105781	61020
1982	31882	237898	264848	256645	239217	264848	259348	269514	202579	200651	135145	99255
1983	41701	118745	229752	196539	237862	264848	214253	269514	260820	269514	156583	85473
1984	32090	187692	264848	251269	228238	157567	44088	119882	120225	170356	128589	72398
1985	32878	88318	63032	47118	48928	18500	61039	70473	74122	101132	118423	66744
1986	31488	27565	54837	172787	237781	264848	81667	71169	95945	164945	124316	85614
1987	29804	35146	40151	48004	22315	45752	24950	67923	66318	69263	60033	20894
1988	34634	20339	50656	94968	49622	18500	21583	64946	62649	67682	60021	22036
1989	32644	33431	34488	53170	77296	263520	197858	70702	89617	155359	124390	71126
1990	39954	29190	36040	66205	35886	65310	26610	57545	58741	113096	124390	63776
1991	40216	30866	41114	52767	34315	18500	18500	61597	66455	112206	122327	63281
1992	40216	30866	41114	52767	35533	18500	18500	61591	66451	111688	122327	63281
AVG.	40467	49916	87144	111581	125873	128097	118493	155709	135064	156323	117383	62423

TABLE A-4 Total Delivery at Daguerre Point Dam
YCWA/DFG 1965 AGREEMENT
Study: a) present level demand; b) current PG&E practice; c) current minimum flow requirements; d) YRI
(AF)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1923	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1924	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1925	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1926	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1927	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1928	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1929	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1930	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1931	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1932	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1933	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1934	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1935	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1936	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1937	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1938	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1939	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1940	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1941	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1942	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1943	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1944	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1945	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1946	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1947	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1948	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1949	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1950	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1951	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1952	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1953	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1954	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1955	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1956	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1957	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1958	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1959	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1960	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1961	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1962	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1963	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1964	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1965	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1966	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1967	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1968	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1969	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1970	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1971	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1972	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1973	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1974	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1975	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1976	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1977	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1978	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1979	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1980	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1981	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1982	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1983	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1984	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1985	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1986	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1987	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1988	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1989	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1990	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1991	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1992	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
AVG.	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847

LE A-5 Total Deliveries and Deficiencies at Da re Point Diversion Dam
YCWA/DFG 1965 AGREEMENT
Study 1: a) present level demand; b) current PG&E practice; c) current minimum flow requirements; d) YRI

Water Year	Year Type (YRI)	Total Annual Delivery (ac-ft)	Total Annual Demand (ac-ft)	Deficiency, Percent of Demand %	Deficiency, Volume (ac-ft)
1922	W	273847	273847	0.0%	0
1923	AN	273847	273847	0.0%	0
1924	C	273847	273847	0.0%	0
1925	BN	273847	273847	0.0%	0
1926	BN	273847	273847	0.0%	0
1927	W	273847	273847	0.0%	0
1928	AN	273847	273847	0.0%	0
1929	D	273847	273847	0.0%	0
1930	BN	273847	273847	0.0%	0
1931	C	273847	273847	0.0%	0
1932	BN	273847	273847	0.0%	0
1933	D	273847	273847	0.0%	0
1934	C	273847	273847	0.0%	0
1935	AN	273847	273847	0.0%	0
1936	AN	273847	273847	0.0%	0
1937	AN	273847	273847	0.0%	0
1938	W	273847	273847	0.0%	0
1939	D	273847	273847	0.0%	0
1940	AN	273847	273847	0.0%	0
1941	W	273847	273847	0.0%	0
1942	W	273847	273847	0.0%	0
1943	W	273847	273847	0.0%	0
1944	BN	273847	273847	0.0%	0
1945	AN	273847	273847	0.0%	0
1946	AN	273847	273847	0.0%	0
1947	D	273847	273847	0.0%	0
1948	AN	273847	273847	0.0%	0
1949	BN	273847	273847	0.0%	0
1950	AN	273847	273847	0.0%	0
1951	W	273847	273847	0.0%	0
1952	W	273847	273847	0.0%	0
1953	W	273847	273847	0.0%	0
1954	AN	273847	273847	0.0%	0
1955	D	273847	273847	0.0%	0
1956	W	273847	273847	0.0%	0
1957	AN	273847	273847	0.0%	0
1958	W	273847	273847	0.0%	0
1959	D	273847	273847	0.0%	0
1960	BN	273847	273847	0.0%	0
1961	C	273847	273847	0.0%	0
1962	BN	273847	273847	0.0%	0
1963	W	273847	273847	0.0%	0
1964	BN	273847	273847	0.0%	0
1965	W	273847	273847	0.0%	0
1966	BN	273847	273847	0.0%	0
1967	W	273847	273847	0.0%	0
1968	BN	273847	273847	0.0%	0
1969	W	273847	273847	0.0%	0
1970	W	273847	273847	0.0%	0
1971	W	273847	273847	0.0%	0
1972	BN	273847	273847	0.0%	0
1973	AN	273847	273847	0.0%	0
1974	W	273847	273847	0.0%	0
1975	W	273847	273847	0.0%	0
1976	C	273847	273847	0.0%	0
1977	C	273847	273847	0.0%	0
1978	AN	273847	273847	0.0%	0
1979	BN	273847	273847	0.0%	0
1980	W	273847	273847	0.0%	0
1981	D	273847	273847	0.0%	0
1982	W	273847	273847	0.0%	0
1983	W	273847	273847	0.0%	0
1984	W	273847	273847	0.0%	0
1985	BN	273847	273847	0.0%	0
1986	W	273847	273847	0.0%	0
1987	C	273847	273847	0.0%	0
1988	C	273847	273847	0.0%	0
1989	BN	273847	273847	0.0%	0
1990	D	273847	273847	0.0%	0
1991	C	273847	273847	0.0%	0
1992	C	273847	273847	0.0%	0
AVG.		273847	273847	0.0%	0

TABLE A-6 Flow in Yuba River ( ) rysville
YCWA/DFG 1965 AGREEI
Study: a) present level demand; b) current PG&E practice; c) current minimum flow requirements; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	464	505	764	960	2992	2552	4184	9677	8666	2225	1003	676
1923	428	599	3505	2231	1412	860	3196	2822	1683	1581	953	755
1924	415	498	620	915	1102	640	184	189	181	77	77	77
1925	291	404	755	768	5215	3037	2437	2015	542	1187	871	658
1926	421	514	638	951	4791	1791	2984	289	313	194	771	612
1927	415	3592	2403	2960	10088	5761	5701	5190	4146	1776	856	709
1928	424	1348	1689	2350	2062	9336	3886	2490	345	1202	822	657
1929	416	562	647	857	786	997	601	321	230	87	294	588
1930	332	344	2864	2371	2822	2934	1545	335	399	1138	842	683
1931	418	565	565	952	704	889	193	190	189	77	77	77
1932	291	371	823	840	2213	2512	2375	3632	3190	1344	929	594
1933	421	483	616	925	665	941	884	225	243	600	777	608
1934	353	381	775	1682	1901	1391	221	228	229	79	77	77
1935	332	502	506	1228	1923	1482	7155	4279	2476	1293	901	628
1936	415	478	603	4047	6772	4213	3918	3347	1915	1395	910	687
1937	421	466	627	899	2628	2132	3177	3944	1312	1250	863	591
1938	418	1006	5287	2382	5954	10061	6044	9710	6869	2272	1057	736
1939	416	478	557	931	738	1341	300	230	192	79	79	95
1940	291	291	369	4548	7038	9403	4209	3048	639	1157	886	687
1941	415	547	3070	4933	6489	5680	3775	6048	2386	2061	1051	814
1942	415	548	4423	5026	8122	3362	5115	5125	4973	2145	1092	730
1943	417	1451	3389	6404	4694	8907	4325	2388	1333	1443	1044	748
1944	421	474	633	935	1634	1453	499	1392	807	1179	880	645
1945	415	929	1711	1166	5357	2668	1552	2767	1243	1328	979	687
1946	422	1165	5246	4514	2087	2071	2707	2805	762	1297	948	650
1947	421	702	1158	819	1961	2680	701	287	291	122	777	648
1948	426	480	564	2321	662	1298	3984	3357	3214	1445	991	670
1949	437	480	975	897	964	2058	2330	1411	389	1138	841	666
1950	415	511	630	2222	4707	2635	3608	3207	1907	1382	955	671
1951	430	7409	11088	6060	5539	3864	2799	2744	586	1324	921	646
1952	422	1168	4273	4765	6153	5104	7288	11286	7727	3447	1280	849
1953	422	508	1094	6129	3397	1870	2994	2607	4835	2289	1097	716
1954	421	594	625	2159	3334	3867	3917	1135	336	1189	859	647
1955	416	559	891	1355	958	672	260	1267	845	1200	870	634
1956	415	560	14341	11370	4980	3716	1861	5521	3671	1691	1120	800
1957	417	502	558	990	4052	3754	720	3509	1697	1354	964	718
1958	417	514	1748	2542	8888	5970	6798	8344	5215	1973	1132	1023
1959	425	505	588	1701	3128	1069	270	278	283	122	401	731
1960	415	466	569	1050	4527	4095	1072	281	354	1214	903	630
1961	416	611	597	853	1277	1113	356	237	245	1007	849	618
1962	353	427	586	798	5246	2844	3139	1248	1494	1306	984	709
1963	4819	1471	3008	3219	7103	2981	5831	6129	1616	1579	1138	844
1964	425	2341	863	1899	1313	744	477	487	743	1291	950	686
1965	415	682	17044	10251	4506	1820	4437	3592	2718	1673	1239	859
1966	415	653	1024	1770	1253	1628	2252	372	315	868	874	665
1967	415	1051	3575	5032	4083	4381	2502	6210	7749	3005	1260	810
1968	428	571	683	1676	4740	3065	378	272	283	825	909	583
1969	418	673	1732	12349	6453	3913	4594	8241	4499	1964	1078	770
1970	430	525	4180	16405	4716	3879	277	294	567	1370	972	673
1971	421	1995	4305	3833	2593	4175	2414	4692	4175	2412	1240	934
1972	422	501	1293	1830	2545	3076	1406	965	705	1295	1021	867
1973	419	1521	2605	5559	5897	4543	1832	3645	743	1354	1004	891
1974	418	5291	5277	9622	4483	8957	5127	4303	3130	2024	1203	807
1975	429	516	664	967	4260	4632	1761	4735	5185	2206	1258	982
1976	729	1043	638	872	764	677	193	201	209	87	79	125
1977	291	319	368	618	522	426	179	179	189	77	77	89
1978	291	327	840	4270	2813	5973	3888	3123	3385	1704	1133	1054
1979	418	560	612	1158	2633	2947	1289	3054	725	1293	969	729
1980	421	815	1563	11479	9822	4720	1795	2403	2124	1684	1063	763
1981	429	481	608	1092	1809	1690	278	270	245	119	710	635
1982	353	5747	11560	5546	10479	6893	11840	7259	3263	1869	1149	1289
1983	588	2438	4640	5275	8456	14252	4377	7260	9457	4406	1449	1042
1984	482	5330	11781	4618	4730	3224	957	2331	1185	1436	1034	841
1985	418	2035	1158	865	1684	1059	1283	277	312	514	891	796
1986	420	644	1104	3145	21081	11190	1886	1622	778	1359	982	1032
1987	433	473	573	937	1146	1495	207	201	193	82	79	79
1988	293	315	1198	2191	1067	490	193	200	189	85	79	79
1989	293	1042	817	1181	1638	10573	3233	643	567	1240	995	809
1990	747	551	569	1615	1266	1610	388	264	279	684	997	723
1991	415	508	561	835	695	2187	421	273	286	702	926	669
1992	416	511	561	835	696	2188	421	273	286	690	926	669
AVG.	477	1062	2377	3137	3876	3555	2526	2721	1894	1276	869	671

TABLE A-7 Shortage in Required flow in Yuba River at Marysville
YCWA/DFG 1965 AGREEMENT
Study: a) pr( )level demand; b) current PG&E practice; c) c( ) minimum flow requirements; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
AVG.	0	0	0	0	0	0	0	0	0	0	0	0

TABLE A-8 Outflow from Englebright Reservoir
YCWA/DFG 1965 AGREEM
Study: a) present leve and; b) current PG&E practice; c) current mini flow requirements; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	716	617	617	815	2471	2102	3784	9960	9340	3122	1759	921
1923	683	617	3178	2008	1248	737	3103	3604	2463	2486	1712	1016
1924	679	628	617	815	886	617	427	1045	1001	1011	862	341
1925	490	485	642	636	4404	2799	2495	2805	1335	2096	1648	921
1926	685	617	617	815	4235	1604	2890	1119	1109	1115	1553	876
1927	651	3308	2239	2670	8774	5155	5549	5915	4880	2678	1617	954
1928	679	1284	1573	2151	1822	8352	3934	3289	1130	2110	1584	920
1929	684	617	617	815	667	845	708	1128	1026	1020	1076	852
1930	601	495	2543	2138	2509	2604	1658	1152	1189	2047	1623	946
1931	687	617	620	815	617	767	428	1042	1009	1011	860	340
1932	534	453	671	683	1937	2185	2234	4230	3958	2252	1689	858
1933	689	618	617	815	617	788	928	930	1025	1533	1559	871
1934	594	524	638	1525	1699	1257	467	1070	1045	1013	860	341
1935	597	507	494	1058	1714	1238	6549	4927	3247	2201	1660	891
1936	678	617	617	3360	5522	4002	3992	4147	2698	2305	1671	949
1937	687	617	617	815	1753	1462	2964	4667	2094	2160	1625	857
1938	669	819	4516	2183	4241	8508	5750	10377	7643	3176	1818	980
1939	680	623	617	815	635	1131	528	1066	1006	1008	862	358
1940	559	445	432	3918	6193	8586	4160	3871	1430	2070	1647	951
1941	667	617	2737	4235	5637	5099	3511	6715	3170	2962	1809	1055
1942	682	623	3991	4486	7137	3073	4759	5656	5742	3048	1847	971
1943	684	1392	3210	5570	4245	7908	4341	3187	2108	2347	1799	989
1944	690	617	617	815	1280	1162	610	2213	1598	2112	1662	908
1945	674	833	1668	1112	4651	2436	1652	3572	2024	2241	1737	950
1946	661	1118	4621	4245	1902	1830	2804	3627	1550	2209	1710	916
1947	692	688	1125	815	1790	2426	875	1126	1088	1053	1558	911
1948	624	617	627	2132	617	1092	3768	4057	4015	2373	1775	936
1949	709	617	733	815	748	1482	2340	2219	1187	2049	1625	930
1950	687	617	644	1728	4108	2332	3615	3996	2698	2290	1719	937
1951	651	6717	10245	5220	5030	3442	2932	3442	1376	2230	1685	912
1952	629	1114	3855	3791	5019	4245	6867	11797	8463	4357	2044	1096
1953	694	623	865	5512	3312	1597	3006	3320	5602	3200	1861	978
1954	692	617	617	1799	2959	3498	3891	1947	1128	2104	1643	913
1955	668	617	755	1190	822	617	432	1983	1630	2135	1654	900
1956	687	617	12576	9829	4311	3429	1989	6237	4448	2587	1884	1048
1957	633	623	617	815	3668	3441	841	4037	2472	2266	1745	984
1958	658	623	1548	2231	7930	5166	5917	9067	5993	2881	1896	1281
1959	697	623	621	1407	2676	971	476	1110	1074	1053	1185	995
1960	682	617	618	815	3896	3783	1239	1093	1145	2129	1688	896
1961	684	617	617	815	1102	949	546	1056	1041	1943	1634	884
1962	625	524	524	693	4235	2466	3257	2059	2273	2214	1745	975
1963	4369	1569	2888	2949	6537	2625	5191	6748	2387	2477	1895	1092
1964	671	2181	885	1676	1210	656	648	1313	1532	2213	1733	952
1965	687	660	15853	9072	4245	1700	4192	4366	3498	2575	1997	1104
1966	687	632	954	1560	1100	1498	2393	1193	1108	1798	1652	929
1967	687	931	3261	4235	3822	3813	2133	6736	8483	3901	2009	1055
1968	681	633	617	1436	4241	2849	525	1076	1081	1722	1671	839
1969	653	676	1510	10746	5287	3427	4335	8897	5266	2856	1825	1005
1970	692	627	3807	15174	4245	3430	431	1109	1349	2270	1728	919
1971	690	1895	3874	3452	2412	3746	2453	5465	4952	3313	1995	1181
1972	693	620	1102	1713	2307	2975	1541	1795	1494	2215	1803	1128
1973	651	1378	2442	4635	4907	3903	1903	4455	1524	2253	1761	1139
1974	648	4753	4778	8796	4118	7828	4790	5076	3929	2918	1951	1044
1975	688	620	617	815	3578	4057	1682	5412	5947	3094	1999	1205
1976	884	1036	673	815	617	617	432	1033	993	998	846	375
1977	556	449	432	571	455	432	437	1031	994	1000	857	348
1978	558	432	656	3167	2501	5321	3604	3848	4169	2608	1890	1295
1979	681	620	617	918	2142	2557	1388	3819	1515	2199	1742	992
1980	648	869	1394	10620	8853	4217	1897	3210	2910	2586	1820	997
1981	672	620	617	874	1703	1471	491	1104	1035	1044	1488	899
1982	575	5331	10846	4869	9529	6040	10734	7951	4040	2763	1903	1521
1983	755	2222	4241	4245	7028	12452	3988	7762	10225	5297	2199	1280
1984	692	4879	10829	4245	4251	2877	1058	3116	1963	2338	1795	1087
1985	636	1855	1134	815	1414	851	1418	1102	1105	1439	1668	1048
1986	643	617	1036	2892	18910	10199	2005	2419	1563	2261	1737	1278
1987	665	622	629	815	933	1292	444	1035	1004	1008	857	338
1988	565	435	1055	1943	984	476	393	1030	994	1008	856	338
1989	558	926	776	1052	1501	9598	3332	1449	1345	2144	1751	1070
1990	904	627	619	1369	1073	1445	610	1012	1051	1604	1769	979
1991	676	617	617	815	617	1565	542	1071	1067	1600	1700	927
1992	676	617	617	815	617	1565	542	1071	1067	1588	1700	927
AVG.	716	1072	2187	2761	3382	3136	2503	3473	2677	2187	1637	927

TABLE A-9 Flow in Yuba River at Smartv
YCWA/DFG 1965 AGREEMENT
Study: a) present level demand; b) current PG&E practice; c) current minimum flow requirements; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	729	642	735	904	2795	2431	4222	10337	9410	3138	1781	939
1923	693	689	3409	2143	1348	828	3316	3633	2486	2506	1733	1016
1924	679	642	664	872	1009	657	433	1045	1002	1011	862	341
1925	526	523	741	717	4886	2966	2619	2834	1352	2116	1651	921
1926	686	648	669	890	4567	1733	3101	1131	1126	1125	1553	876
1927	669	3551	2379	2844	9608	5599	5829	5993	4912	2696	1638	972
1928	689	1405	1681	2271	1967	8981	4075	3316	1150	2130	1604	920
1929	685	669	672	843	742	960	798	1140	1041	1020	1077	852
1930	601	495	2765	2279	2697	2824	1746	1170	1205	2067	1624	946
1931	688	672	629	891	672	865	439	1043	1009	1011	860	340
1932	547	490	791	779	2104	2402	2470	4376	3979	2272	1709	858
1933	690	627	657	874	648	904	1048	1012	1041	1533	1559	871
1934	609	527	751	1621	1822	1358	474	1083	1049	1013	860	341
1935	599	584	539	1162	1841	1408	7065	5035	3269	2221	1681	891
1936	680	625	645	3760	6285	4178	4122	4174	2716	2326	1692	950
1937	688	617	658	864	2272	1882	3268	4744	2113	2181	1646	857
1938	677	1007	5014	2303	5373	9590	6125	10493	7660	3195	1839	997
1939	683	627	625	878	697	1278	539	1078	1007	1008	862	359
1940	560	445	437	4281	6695	9135	4363	3885	1452	2091	1668	951
1941	676	664	2966	4650	6174	5526	3865	6836	3189	2981	1828	1073
1942	682	668	4277	4808	7762	3301	5175	5877	5757	3068	1866	989
1943	686	1506	3358	6064	4529	8618	4509	3214	2124	2366	1818	1007
1944	691	621	664	882	1492	1359	705	2224	1615	2113	1662	908
1945	679	967	1737	1148	5071	2599	1741	3594	2046	2262	1757	950
1946	679	1223	5030	4406	2016	1999	2904	3640	1572	2230	1731	916
1947	693	775	1186	822	1895	2601	920	1140	1104	1053	1559	911
1948	659	624	631	2241	648	1239	4055	4144	4034	2376	1776	936
1949	709	626	907	867	880	1847	2480	2237	1205	2069	1626	930
1950	687	647	676	2013	4465	2537	3765	4026	2722	2310	1740	937
1951	678	7202	10794	5793	5381	3766	3015	3542	1397	2250	1706	912
1952	663	1223	4145	4368	5788	4853	7321	12019	8495	4380	2065	1115
1953	694	645	1031	5878	3365	1786	3159	3395	5619	3220	1882	982
1954	693	687	664	2010	3183	3742	4067	1965	1144	2125	1644	913
1955	670	669	870	1291	906	671	493	2052	1646	2136	1655	900
1956	687	672	13666	10872	4770	3658	2075	6325	4465	2607	1905	1066
1957	665	641	625	911	3896	3651	931	4235	2486	2287	1749	984
1958	674	648	1696	2418	8498	5720	6684	9147	6009	2901	1917	1289
1959	697	644	645	1572	2947	1055	499	1123	1091	1053	1186	995
1960	682	618	631	945	4272	3993	1295	1111	1162	2150	1688	896
1961	685	689	649	841	1209	1071	585	1067	1058	1943	1634	884
1962	625	552	593	758	4834	2715	3336	2077	2297	2234	1766	975
1963	4780	1603	3002	3111	6888	2900	5796	6899	2402	2497	1916	1110
1964	686	2350	917	1811	1274	735	693	1324	1548	2217	1733	952
1965	687	752	16597	9849	4429	1821	4532	4409	3516	2594	2016	1122
1966	687	721	1039	1687	1194	1599	2458	1204	1125	1799	1652	929
1967	687	1079	3489	4708	3979	4229	2557	6946	8520	3918	2029	1074
1968	692	685	690	1581	4539	3002	585	1093	1098	1740	1691	839
1969	672	755	1680	11722	6074	3784	4687	9019	5282	2874	1845	1024
1970	702	657	4057	15928	4571	3767	498	1124	1368	2288	1747	934
1971	691	2031	4172	3680	2523	4033	2598	5513	4969	3333	2014	1198
1972	694	638	1246	1786	2452	3057	1617	1807	1511	2220	1803	1128
1973	671	1539	2581	5183	5557	4358	2024	4474	1542	2272	1781	1149
1974	670	5144	5115	9327	4372	8626	5193	5119	3953	2934	1970	1061
1975	698	650	680	903	3982	4421	1889	5509	5961	3109	2017	1221
1976	954	1130	693	852	703	678	441	1046	1008	1000	846	376
1977	556	461	435	603	494	454	437	1031	995	1000	857	348
1978	558	456	795	3819	2689	5764	3971	3924	4188	2627	1910	1310
1979	682	669	656	1058	2436	2813	1483	3862	1531	2219	1746	992
1980	672	920	1531	11129	9468	4594	2001	3233	2930	2604	1840	1014
1981	683	627	649	999	1770	1626	516	1117	1053	1044	1488	899
1982	599	5652	11310	5297	10175	6653	11653	8049	4056	2782	1923	1537
1983	813	2429	4520	4909	7992	13700	4426	7990	10240	5316	2218	1298
1984	723	5224	11467	4505	4581	3150	1163	3153	1981	2357	1814	1100
1985	666	2036	1192	848	1577	1000	1484	1114	1122	1440	1668	1049
1986	664	711	1120	3045	20270	10904	2097	2449	1583	2280	1757	1293
1987	681	625	638	880	1062	1437	451	1048	1006	1008	857	338
1988	565	452	1167	2093	1037	502	436	1042	995	1008	856	338
1989	558	1070	842	1132	1586	10198	3427	1467	1368	2163	1770	1070
1990	972	670	633	1506	1191	1568	627	1080	1065	1605	1769	979
1991	676	642	626	830	658	1950	622	1092	1082	1618	1700	927
1992	677	645	626	830	659	1951	622	1092	1082	1606	1700	927
AVG.	733	1151	2339	2991	3693	3430	2685	3532	2694	2201	1648	933

TABLE A-10 Required Carryover Storage at New Bullards Bar Reservoir
YCWA/DFG 1965 AGREEMENT
Study: a) presen(demand; b) current PG&E practice; c) curre(imum flow requirements; d) YRI

Year	Ac-ft
1922	488000
1923	488000
1924	347000
1925	488000
1926	488000
1927	488000
1928	488000
1929	488000
1930	488000
1931	321000
1932	488000
1933	488000
1934	311000
1935	488000
1936	488000
1937	488000
1938	488000
1939	488000
1940	488000
1941	488000
1942	488000
1943	488000
1944	488000
1945	488000
1946	488000
1947	488000
1948	488000
1949	488000
1950	488000
1951	488000
1952	488000
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1954	488000
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1960	488000
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1962	488000
1963	488000
1964	488000
1965	488000
1966	488000
1967	488000
1968	488000
1969	488000
1970	488000
1971	488000
1972	488000
1973	488000
1974	488000
1975	488000
1976	475000
1977	311000
1978	488000
1979	488000
1980	488000
1981	488000
1982	488000
1983	488000
1984	488000
1985	488000
1986	488000
1987	488000
1988	311000
1989	488000
1990	488000
1991	488000
1992	488000
AVG.	476000

TABLE B-1 Total Outflow from New Bullards Bar Reservoir
YCWA's PROPOSED INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	700	546	311	287	1235	1226	2544	6796	6061	2766	1712	889
1923	582	413	2107	1412	820	267	2215	2668	2082	2415	1669	954
1924	554	526	415	449	283	517	533	1076	927	1039	891	378
1925	334	366	266	262	2845	940	1889	2124	1593	1715	1617	886
1926	544	502	444	396	2743	762	2041	2255	1613	1193	1033	505
1927	494	1338	1690	1994	7032	2886	4038	3347	3695	2375	1595	918
1928	595	825	1164	1611	1247	5755	2682	1754	1569	1547	1577	892
1929	605	472	457	513	284	255	261	1033	1132	1177	1039	512
1930	519	509	1215	1525	1689	1626	1154	2207	1581	1191	1024	623
1931	599	400	609	345	336	256	495	1046	905	1039	886	384
1932	398	399	264	259	725	1207	1256	3255	2931	2201	1654	843
1933	566	558	542	479	495	258	262	723	1048	1190	1314	855
1934	437	440	255	947	1064	687	596	1065	901	1034	886	382
1935	450	300	368	272	1182	589	4336	3581	2662	2153	1627	868
1936	584	585	613	1677	4032	2197	3421	2742	2136	2272	1648	914
1937	616	597	589	533	286	254	2061	3576	1949	2133	1606	847
1938	576	337	3496	1328	2888	5471	4677	6487	5051	2809	1786	935
1939	569	595	630	428	305	254	425	1236	1153	1136	1039	499
1940	492	508	549	814	5266	5358	2928	2190	1620	1801	1624	919
1941	586	480	1943	3157	4786	2836	2523	4500	2511	2881	1755	1000
1942	593	469	2864	4494	4745	1240	3607	3773	3995	2715	1775	910
1943	611	1036	2540	4960	2931	4758	2871	1756	1881	2271	1722	937
1944	606	600	540	414	283	253	417	2049	1559	1658	1627	875
1945	549	409	1332	921	3995	507	1140	2665	1881	2217	1674	910
1946	570	718	4124	2252	1099	1079	2235	2494	1592	2040	1691	893
1947	621	331	771	650	1273	1360	500	1287	1129	1157	1019	788
1948	497	493	560	1599	412	253	2065	3150	3124	2325	1756	918
1949	625	593	256	454	284	254	1568	2163	1643	1284	1613	892
1950	584	502	581	510	2515	1405	2733	2738	2245	2234	1699	907
1951	559	5554	6926	3698	3668	1442	1752	1888	1618	1874	1671	893
1952	538	744	2868	2044	4443	1686	5390	7341	5337	3708	2030	1066
1953	634	532	256	4806	1373	784	2305	2554	3847	2901	1847	950
1954	619	405	470	884	2012	2325	3058	2003	1578	1207	1435	895
1955	514	456	255	668	404	336	460	1123	1472	2126	1641	883
1956	520	358	9734	6990	3003	1646	1670	3854	3042	2498	1865	1016
1957	515	494	637	335	2440	2262	466	2762	1966	2236	1725	946
1958	570	524	1064	1590	6877	2470	3905	5998	3892	2576	1877	1251
1959	634	513	577	635	1476	595	448	1242	1126	1162	1041	474
1960	500	495	509	258	2216	2738	904	2154	1550	1207	1041	652
1961	557	430	461	519	501	252	276	823	838	1947	1620	871
1962	476	452	353	295	3225	698	2618	2101	1663	2164	1708	950
1963	3344	816	2373	2321	5981	760	3602	3988	1994	2380	1847	1066
1964	573	1417	682	919	822	253	462	2125	1521	1121	1248	929
1965	574	426	11836	6470	2536	936	2993	2609	2501	2493	1931	1062
1966	624	357	477	916	635	941	1848	2151	1586	1170	996	498
1967	613	307	2421	3104	2483	2670	1149	5066	5460	3298	1920	1011
1968	576	458	446	751	3945	1215	549	2115	1598	1082	1017	455
1969	497	433	358	8573	3308	1355	3341	5111	3574	2489	1739	964
1970	616	522	2830	12069	2760	1702	684	1992	1519	1109	987	659
1971	610	1390	2454	2308	1832	2392	1819	4206	3103	2951	1905	1147
1972	624	557	295	1213	1383	2138	948	2124	1504	1205	1755	1051
1973	490	988	1967	4290	3117	1634	1520	3053	1568	2028	1714	1077
1974	552	4676	3428	6826	1883	5693	3569	3230	2892	2778	1851	971
1975	610	512	499	341	2177	2584	972	4128	4225	2671	1851	1046
1976	587	580	639	498	306	382	545	1004	761	883	748	277
1977	421	422	508	443	410	459	600	1009	781	938	854	327
1978	462	452	282	266	1013	3994	2587	2720	2720	2540	1838	1213
1979	594	495	533	269	1070	1517	947	2897	1585	1975	1694	958
1980	487	697	913	8849	6196	1944	1482	1812	2091	2487	1754	898
1981	480	567	597	255	1139	626	408	1258	1106	1104	990	498
1982	431	4967	7899	3586	6884	3286	7225	4642	2753	2663	1835	1404
1983	573	1685	3575	2401	6156	8210	2889	5197	6045	3855	2126	1209
1984	444	4174	7813	3145	2330	2057	612	1583	1634	2261	1746	1024
1985	508	1196	866	620	773	253	848	2220	1590	1143	982	410
1986	424	404	353	2292	13552	6192	1032	940	1419	2078	1688	1211
1987	466	602	644	504	282	594	540	1014	857	973	853	355
1988	486	456	256	1240	728	368	495	980	810	953	854	372
1989	459	265	254	695	1174	6799	2644	1904	1531	1143	1352	1006
1990	549	477	583	762	545	891	529	1027	963	1104	1525	902
1991	485	417	557	524	493	255	259	846	765	1961	1661	895
1992	438	417	557	524	493	255	259	846	765	2003	1661	895
AVG.	581	816	1584	1896	2326	1751	1804	2583	2131	1921	1506	841

TABLE B-2 New Bullards Bar Reservoir End-of-month Storage
YCWA's PROPOSED INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI
(AF)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	549619	531770	570718	619640	720000	790000	890000	966000	950000	840000	750000	705000
1923	679238	680830	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1924	682726	660075	658958	648338	694859	694275	725132	689924	638958	576521	522182	504758
1925	498321	502588	548087	589633	720000	790000	890000	966000	929403	840000	750000	705000
1926	680775	667257	667735	674201	720000	790000	890000	848480	786501	721022	662626	638644
1927	620935	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1928	677318	705000	705000	705000	720000	790000	890000	966000	918311	840000	750000	705000
1929	674697	661480	654707	642551	667356	720111	799379	850279	832217	768056	708228	682720
1930	655704	630849	705000	705000	720000	790000	890000	890281	845844	787255	733018	705000
1931	668670	664321	632680	637316	646581	702302	729855	698875	656477	593811	541792	523575
1932	509992	504081	581142	649255	720000	790000	890000	966000	950000	840000	750000	705000
1933	675520	649959	626900	614325	604619	662945	754842	845188	886158	825918	750000	705000
1934	685944	670457	700754	705000	720000	790000	827920	799814	761279	701819	650478	632538
1935	611563	626145	638196	705000	720000	790000	890000	966000	950000	840000	750000	705000
1936	680862	663239	649272	705000	720000	790000	890000	966000	950000	840000	750000	705000
1937	674328	647056	623937	603248	665650	773156	890000	966000	950000	840000	750000	705000
1938	676930	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1939	684484	672034	661076	660598	665572	751125	858632	834713	780125	713865	650393	623062
1940	602238	582125	565298	705000	720000	790000	890000	966000	934805	840000	750000	705000
1941	679801	683414	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1942	683236	688514	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1943	676934	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1944	679540	657635	642934	649102	685315	770707	866398	944572	923583	840000	750000	705000
1945	680415	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1946	687357	705000	705000	705000	720000	790000	890000	966000	942085	840000	750000	705000
1947	677632	705000	705000	692886	720000	790000	890000	884201	857674	798198	744699	705000
1948	705000	701280	688342	705000	718015	746289	890000	966000	950000	840000	750000	705000
1949	676340	662111	667011	658047	664820	751234	890000	950746	905253	840000	750000	705000
1950	675234	658863	635800	705000	720000	790000	890000	966000	950000	840000	750000	705000
1951	701979	705000	705000	705000	720000	790000	890000	966000	931731	840000	750000	705000
1952	698047	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1953	676610	659823	693659	705000	720000	790000	890000	966000	950000	840000	750000	705000
1954	682449	690939	694112	705000	720000	790000	890000	932156	883916	828219	750000	705000
1955	677282	669357	702915	705000	720000	768980	850415	966000	950000	840000	750000	705000
1956	680949	679326	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1957	696818	689177	675876	685044	720000	790000	890000	966000	950000	840000	750000	705000
1958	693746	694852	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1959	674596	658703	638652	705000	720000	790000	872119	868048	827391	767176	711970	694995
1960	671623	647414	623158	650202	720000	790000	890000	877338	841482	787404	736384	705000
1961	676169	674848	682331	666353	720000	788882	883603	947920	945990	840000	750000	705000
1962	685519	669078	688426	695560	720000	790000	890000	946345	950000	840000	750000	705000
1963	705000	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1964	687173	705000	705000	705000	720000	770856	869246	885080	860787	812126	750000	705000
1965	697378	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1966	681231	703162	705000	705000	720000	790000	890000	893027	827204	768617	715752	694689
1967	665336	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1968	687546	673517	685489	705000	720000	790000	872613	848490	795439	740032	688110	662127
1969	644714	663432	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1970	688989	678440	705000	705000	720000	790000	847517	854752	828879	784287	736610	705000
1971	689496	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1972	688775	683193	705000	705000	720000	790000	890000	921429	894993	840000	750000	705000
1973	703423	705000	705000	705000	720000	790000	890000	966000	941219	840000	750000	705000
1974	700719	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1975	685546	677884	673593	696103	720000	790000	890000	966000	950000	840000	750000	705000
1976	705000	705000	703311	696054	715745	759026	786273	781658	748190	697890	658255	646789
1977	627338	609601	585668	570792	560449	548301	531100	502195	465597	409534	359302	342725
1978	318468	304865	382114	655778	720000	790000	890000	966000	950000	840000	750000	705000
1979	681139	670327	654759	705000	720000	790000	890000	966000	940256	840000	750000	705000
1980	704437	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1981	683615	664295	666127	694228	720000	790000	880495	883815	841821	783278	727245	704001
1982	703746	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1983	705000	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1984	704791	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1985	690736	705000	705000	705000	720000	782914	890000	858860	797145	739905	688561	675464
1986	657857	664222	700050	705000	720000	790000	890000	966000	943200	840000	750000	705000
1987	693275	673774	652210	652289	718164	790000	839979	825701	788701	737042	690089	674139
1988	651467	634846	701060	705000	720000	758135	797560	790800	767597	720360	671920	654225
1989	630860	689328	702808	705000	720000	790000	890000	906577	872692	819284	750000	705000
1990	705000	700745	686762	705000	720000	790000	868231	869100	883358	829929	750000	705000
1991	678446	670105	641566	622960	612753	749286	866940	933100	943226	840000	750000	705000
1992	681334	672990	644450	625843	615320	751859	869520	935661	945758	840000	750000	705000
AVG.	667253	666822	672502	685639	708102	776343	868983	917452	893877	805515	726727	687809

TABLE B-3 Total Energy Production at New Bu[illegible]s Bar Reservoir
YCWA's PROPOSED INSTREAM [illegible]S
Study: a) pres[illegible] level demand; b) current PG&E practice; c) YCW[illegible] proposed minimum flows; d) YRI
(MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	49367	36937	21831	20418	80620	89870	183252	269514	260820	208413	126084	62857
1923	42280	28930	153097	102832	53991	19587	159542	202019	153188	181961	122916	67451
1924	40278	36818	29940	32360	19161	37580	37595	78388	64751	74103	62463	25376
1925	23085	24493	18500	18500	185181	68891	136021	160839	117053	128934	119086	62645
1926	39525	35124	32088	28651	180147	55866	147027	168914	115570	87456	75025	35163
1927	35388	93488	123034	145212	236581	211218	258983	248057	260820	178947	117465	64907
1928	43234	57988	84732	117323	85011	263415	193145	132801	115162	116142	116139	63069
1929	43923	32980	32959	36930	18500	18500	18500	76630	81569	86805	75994	36007
1930	37520	35434	87791	111061	111201	119190	83148	166165	114579	88160	75122	44000
1931	43466	27935	43790	24767	21820	18500	34902	76277	63426	74376	62508	25926
1932	27636	26753	18500	18500	49207	88498	90497	242219	214950	165834	121811	59606
1933	41067	38984	38919	34270	31908	18500	18500	53327	75959	88855	96696	60454
1934	31758	30813	18500	68949	70054	50369	42600	78812	64118	75521	64129	26526
1935	32205	20753	26394	19667	77823	43186	258983	263641	195837	162217	119822	61373
1936	42402	40918	44190	121408	245031	160983	240317	207603	157161	171184	121369	64624
1937	44720	41674	42266	38072	18500	18500	148170	263282	143402	160709	118275	59889
1938	41802	23721	247260	96716	189866	263415	258983	269514	260820	211653	131536	66108
1939	41330	41675	45518	30896	19900	18500	30387	92104	82422	83205	75304	34624
1940	35122	34939	38788	58410	245031	263415	210214	165806	119058	135481	119601	64977
1941	42562	33639	141235	226851	236581	207883	181719	269514	184753	216826	129297	70702
1942	43092	32898	208170	261667	236581	90874	252468	269514	260820	204569	130770	64341
1943	44339	72784	184923	261667	192341	263415	206603	132927	138399	171109	126866	66250
1944	44031	41936	38877	29789	19161	18500	29887	154689	114363	124600	119822	61868
1945	39877	28760	96965	67079	236581	37177	82093	201789	138399	167040	123285	64341
1946	41434	50498	261667	163992	72358	79079	161000	188811	117055	153594	124537	63140
1947	45116	23286	56115	47307	83744	99706	36012	96837	81864	85871	74831	55699
1948	36167	34704	40712	116274	28106	18500	147964	235543	227243	175179	129325	64907
1949	45402	41452	18500	32785	18500	18500	112400	163594	120421	96238	118791	63069
1950	42419	35072	41801	36873	165567	102983	196810	207328	165181	168321	125172	64129
1951	40686	253175	261667	261538	234565	105700	126208	142965	118882	140913	123064	63140
1952	39147	52422	208697	148853	245031	123592	258983	269514	260820	269514	149511	75367
1953	46028	37177	18500	261453	90397	57478	166048	193341	260820	218154	136029	67168
1954	44964	28410	34153	64333	132428	170379	218358	151331	115267	90133	105646	63281
1955	37321	31898	18500	48656	26603	24611	32930	84768	108306	160182	120854	62433
1956	37794	25076	261032	261667	203456	120608	120268	269514	222091	188216	137355	71833
1957	37470	34707	46185	24291	160421	165798	33592	209108	144653	168472	127087	66886
1958	41463	36827	77398	115794	236581	181007	258983	269514	260820	194094	138239	88441
1959	46002	35836	41525	45939	97178	43626	32174	93105	81224	85635	76137	33405
1960	36281	34581	36488	18500	150337	200670	65134	161907	112114	89279	76357	46024
1961	40447	30092	33397	37573	32910	18500	19844	62240	61542	146690	119307	61585
1962	34586	31651	25579	21447	208739	51175	188534	158884	122163	163046	125789	67168
1963	238198	57507	172771	168983	236581	55719	252111	269514	146713	179323	136029	75367
1964	41651	99674	49634	66933	56031	18500	33109	159496	110377	83350	91756	65684
1965	41758	30005	261667	261667	166984	68599	214288	197535	184003	187839	142217	75084
1966	45309	25073	34710	66715	41811	68982	133089	161948	114779	86274	72859	35078
1967	44398	21530	176307	223536	163468	195663	82788	269514	260820	243784	141407	71469
1968	41865	32124	32317	54588	245031	89035	39485	158129	114601	79433	74111	31834
1969	35825	30194	25942	261667	213411	99283	235539	269514	255748	187538	128073	68158
1970	44817	36602	205604	261667	181676	124735	49041	148626	109483	81878	72360	46503
1971	44365	97801	178690	168068	120612	175312	130977	269514	225923	221463	140347	81091
1972	45361	39113	21442	88341	94284	156665	68254	160306	109903	90232	129252	74307
1973	35703	69586	143221	261667	202824	119771	109491	229242	115331	152685	126231	76144
1974	40210	253154	243235	261667	123953	263415	249845	240660	212419	209317	136324	68653
1975	44368	35920	36091	24750	143271	189418	69982	269514	260820	201253	136369	73953
1976	42721	40876	46532	36254	20864	27935	38719	73845	54079	64446	54200	19329
1977	30214	29199	36108	31324	26099	32242	40602	70069	51968	63636	56927	20781
1978	30154	28324	18500	18500	66386	263415	186297	205919	200142	191381	135366	85756
1979	43165	34682	38477	19508	70449	111198	68218	218959	116520	148690	124758	67734
1980	35450	49087	66455	261667	245031	142446	106748	137184	153850	187387	129178	63493
1981	34869	39710	43121	18500	74946	45888	29321	94533	80058	81673	72539	35151
1982	31369	253205	261667	253597	236581	236275	258983	269514	202579	200651	135145	99255
1983	41701	118745	252855	174848	236581	263415	207749	269514	260820	269514	156583	85473
1984	32337	253223	261667	226066	158872	150772	44088	119882	120225	170356	128589	72398
1985	36939	84217	63032	45160	50896	18500	61039	166495	114217	83903	71604	28739
1986	30639	28181	25595	166873	236581	263415	74352	71169	104353	156498	124316	85614
1987	33869	42245	46457	36311	18500	43559	38667	75350	61290	71407	62165	24878
1988	35052	31722	18500	90280	49622	26893	35205	72222	57662	69762	62072	25962
1989	33017	18500	18500	50568	77296	263415	190463	143548	111505	85164	99469	71126
1990	39954	33576	42374	55374	35886	65310	38005	76945	69941	82457	112267	63776
1991	35222	29173	40150	37585	31832	18500	18500	63833	56117	147705	122327	63281
1992	31818	29192	40175	37609	32950	18500	18500	63856	56137	150846	122327	63281
AVG.	42043	52245	87352	104360	122634	107669	121158	171817	143243	143486	110656	59297

TABLE B-4 Total Delivery at Daguerre Poi m
YCWA's PROPOSED INSTREAM FLO
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI
(AF)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1923	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1924	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1925	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1926	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1927	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1928	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1929	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1930	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1931	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1932	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1933	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1934	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1935	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1936	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1937	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1938	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1939	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1940	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1941	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1942	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1943	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1944	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1945	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1946	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1947	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1948	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1949	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1950	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1951	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1952	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1953	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1954	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1955	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1956	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1957	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1958	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1959	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1960	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1961	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1962	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1963	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1964	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1965	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1966	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1967	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1968	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1969	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1970	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1971	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1972	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1973	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1974	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1975	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1976	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1977	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1978	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1979	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1980	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1981	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1982	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1983	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1984	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1985	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1986	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1987	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1988	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1989	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1990	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1991	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1992	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
AVG.	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847

TABLE B-5 Total Deliveries and Deficiencies at Daguerre Point Diversion Dam
YCWA's PROPOSED INSTREAM FLO
Study: a) presen demand; b) current PG&E practice; c) YCWA osed minimum flows; d) YRI

Water Year	Year Type (YRI)	Total Annual Delivery (ac-ft)	Total Annual Demand (ac-ft)	Deficiency, Percent of Demand %	Deficiency, Volume (ac-ft)
1922	W	273847	273847	0.0%	0
1923	AN	273847	273847	0.0%	0
1924	C	273847	273847	0.0%	0
1925	BN	273847	273847	0.0%	0
1926	BN	273847	273847	0.0%	0
1927	W	273847	273847	0.0%	0
1928	AN	273847	273847	0.0%	0
1929	D	273847	273847	0.0%	0
1930	BN	273847	273847	0.0%	0
1931	C	273847	273847	0.0%	0
1932	BN	273847	273847	0.0%	0
1933	D	273847	273847	0.0%	0
1934	C	273847	273847	0.0%	0
1935	AN	273847	273847	0.0%	0
1936	AN	273847	273847	0.0%	0
1937	AN	273847	273847	0.0%	0
1938	W	273847	273847	0.0%	0
1939	D	273847	273847	0.0%	0
1940	AN	273847	273847	0.0%	0
1941	W	273847	273847	0.0%	0
1942	W	273847	273847	0.0%	0
1943	W	273847	273847	0.0%	0
1944	BN	273847	273847	0.0%	0
1945	AN	273847	273847	0.0%	0
1946	AN	273847	273847	0.0%	0
1947	D	273847	273847	0.0%	0
1948	AN	273847	273847	0.0%	0
1949	BN	273847	273847	0.0%	0
1950	AN	273847	273847	0.0%	0
1951	W	273847	273847	0.0%	0
1952	W	273847	273847	0.0%	0
1953	W	273847	273847	0.0%	0
1954	AN	273847	273847	0.0%	0
1955	D	273847	273847	0.0%	0
1956	W	273847	273847	0.0%	0
1957	AN	273847	273847	0.0%	0
1958	W	273847	273847	0.0%	0
1959	D	273847	273847	0.0%	0
1960	BN	273847	273847	0.0%	0
1961	C	273847	273847	0.0%	0
1962	BN	273847	273847	0.0%	0
1963	W	273847	273847	0.0%	0
1964	BN	273847	273847	0.0%	0
1965	W	273847	273847	0.0%	0
1966	BN	273847	273847	0.0%	0
1967	W	273847	273847	0.0%	0
1968	BN	273847	273847	0.0%	0
1969	W	273847	273847	0.0%	0
1970	W	273847	273847	0.0%	0
1971	W	273847	273847	0.0%	0
1972	BN	273847	273847	0.0%	0
1973	AN	273847	273847	0.0%	0
1974	W	273847	273847	0.0%	0
1975	W	273847	273847	0.0%	0
1976	C	273847	273847	0.0%	0
1977	C	273847	273847	0.0%	0
1978	AN	273847	273847	0.0%	0
1979	BN	273847	273847	0.0%	0
1980	W	273847	273847	0.0%	0
1981	D	273847	273847	0.0%	0
1982	W	273847	273847	0.0%	0
1983	W	273847	273847	0.0%	0
1984	W	273847	273847	0.0%	0
1985	BN	273847	273847	0.0%	0
1986	W	273847	273847	0.0%	0
1987	C	273847	273847	0.0%	0
1988	C	273847	273847	0.0%	0
1989	BN	273847	273847	0.0%	0
1990	D	273847	273847	0.0%	0
1991	C	273847	273847	0.0%	0
1992	C	273847	273847	0.0%	0
AVG.		273847	273847	0.0%	0

TABLE B-6 Flow in Yuba River a[illegible]ysville
YCWA's PROPOSED INSTREA[illegible]WS
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	655	587	748	775	2915	2552	4184	9677	8936	1967	1003	676
1923	467	632	3434	2231	1412	860	3196	2822	1683	1581	953	755
1924	455	587	675	762	1103	712	376	292	114	108	108	135
1925	299	496	758	770	5986	1802	2437	2015	890	852	871	658
1926	408	588	688	780	5044	1625	2984	1576	891	294	261	261
1927	402	2493	2403	2960	11456	4623	5701	5093	4416	1517	856	709
1928	463	1307	1689	2350	2062	9433	3785	2490	881	687	822	657
1929	451	615	694	739	786	998	601	634	440	272	261	261
1930	346	466	2370	2371	2822	2934	1545	1570	890	304	261	398
1931	405	615	653	780	751	889	385	293	122	108	108	135
1932	299	496	825	842	1715	2512	2375	3632	3190	1344	929	594
1933	408	576	678	770	736	941	885	525	440	292	548	608
1934	346	472	763	1613	1901	1391	387	305	136	110	108	135
1935	299	535	584	888	1923	1482	7256	4182	2476	1293	901	628
1936	454	572	673	3847	8093	2977	3918	3347	1915	1395	910	687
1937	458	568	684	759	2628	2132	3123	3944	1312	1250	863	591
1938	463	959	5806	1862	6829	9369	6044	9613	7139	2013	1057	736
1939	453	575	648	772	760	1341	467	569	428	264	263	261
1940	346	463	543	2825	8359	8265	4108	3048	896	910	886	687
1941	458	605	2971	5326	7423	4542	3674	6048	2386	2061	1051	814
1942	452	608	4328	6506	7852	2126	5216	5028	5244	1887	1092	730
1943	452	1415	3389	7884	4397	7794	4224	2388	1333	1443	1044	748
1944	455	572	688	772	1634	1453	658	1568	895	750	880	645
1945	402	942	1711	1166	6726	1432	1552	2767	1243	1328	979	687
1946	469	1116	6727	3307	1785	2071	2707	2805	896	1168	948	650
1947	453	669	1158	726	2064	2680	701	549	450	307	264	559
1948	426	473	556	2336	631	1298	4014	3357	3214	1445	991	670
1949	469	573	975	749	964	2058	2357	1660	890	411	841	666
1950	402	586	700	2093	4707	2635	3608	3207	1907	1382	955	671
1951	479	8888	11088	6060	5270	2628	2799	2744	895	1027	921	646
1952	485	1103	4273	4765	7474	3935	7319	11189	7998	3188	1280	849
1953	454	588	1094	7499	1759	1870	2994	2607	5106	2031	1097	716
1954	453	629	680	2038	3334	3867	3917	1687	888	307	667	647
1955	466	612	824	1321	958	720	419	1065	845	1200	870	634
1956	346	508	15940	11370	4720	2481	1861	5521	3671	1691	1120	800
1957	473	589	652	798	4006	3754	720	3509	1697	1354	964	718
1958	464	594	1624	2542	10256	4832	6798	8247	5486	1714	1132	1023
1959	457	588	666	1511	3128	1069	429	540	442	307	268	261
1960	346	465	550	911	4596	4095	1072	1568	863	307	271	401
1961	403	642	667	741	1305	1113	375	301	139	1028	849	618
1962	299	490	610	657	6396	1915	3139	1569	1165	1306	984	709
1963	5341	931	3008	3219	8471	1745	5932	6032	1616	1579	1138	844
1964	468	2297	863	1899	1313	744	681	1609	895	295	497	686
1965	402	696	18524	10251	3389	1350	4437	3592	2718	1673	1239	859
1966	447	651	994	1770	1253	1628	2252	1563	893	296	272	263
1967	402	892	3575	5619	3433	4381	2502	6210	8019	2746	1260	810
1968	468	624	712	1556	5823	2053	670	1559	861	338	293	266
1969	405	667	1056	13830	6184	2677	4695	8143	4769	1706	1078	770
1970	462	600	4075	17885	4091	2965	704	1581	862	309	286	448
1971	455	1960	4305	3833	2593	4175	2414	4692	4446	2154	1240	934
1972	454	585	1181	1830	2545	3076	1406	1692	890	401	1021	867
1973	406	1534	2605	7039	5628	3308	1832	3645	892	1211	1004	891
1974	470	6767	5278	9623	2845	9054	5127	4206	3130	2024	1203	807
1975	464	591	706	783	4299	4632	1761	4735	5456	1947	1258	982
1976	729	1043	665	749	780	718	385	304	142	118	110	137
1977	299	475	547	632	645	588	371	282	122	108	108	135
1978	299	485	849	3704	1927	6071	3787	3123	3385	1704	1133	1054
1979	458	613	675	1004	2633	2947	1289	3054	890	1135	969	729
1980	408	829	1563	12960	9562	3485	1795	2403	2124	1684	1063	763
1981	479	576	675	1059	1615	1690	428	570	442	304	263	270
1982	346	7267	11561	5547	10210	5755	11841	7161	3263	1869	1149	1289
1983	588	2438	5016	4982	9732	13114	4276	7260	9728	4147	1449	1042
1984	486	6857	11782	4247	3643	3132	957	2331	1185	1436	1034	841
1985	474	1977	1158	838	1714	1059	1283	1564	890	309	266	261
1986	411	655	703	3064	22450	10052	1785	1622	893	1249	982	1032
1987	488	575	662	776	1088	1465	399	304	126	113	110	137
1988	301	480	756	2127	1067	605	385	303	122	116	110	137
1989	301	831	598	1145	1638	10670	3132	1613	880	321	659	809
1990	747	613	657	1467	1266	1610	547	526	438	281	834	723
1991	346	483	546	621	654	2186	420	299	142	1168	926	669
1992	300	486	547	621	654	2186	420	299	142	1205	926	669
AVG.	501	1160	2437	3161	3969	3188	2567	2927	2045	1101	779	628

TABLE B-7 Shortage in Required flow in Yu[illegible]er at Marysville
YCWA's PROPOSED INSTREAM [illegible]WS
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
AVG.	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B-8 Outflow from Englebrig[illegible] Reservoir
YCWA's PROPOSED INSTREA[illegible]WS
Study: a) p[illegible]nt level demand; b) current PG&E practice; c) Y[illegible]A proposed minimum flows; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	907	699	601	630	2394	2102	3784	9960	9611	2863	1759	921
1923	722	650	3107	2008	1248	737	3103	3604	2463	2486	1712	1016
1924	719	718	672	662	886	689	619	1148	934	1042	893	399
1925	498	577	644	638	5175	1563	2495	2805	1683	1761	1648	921
1926	672	690	667	644	4489	1439	2890	2406	1687	1215	1043	525
1927	638	2209	2239	2670	10142	4017	5549	5818	5150	2419	1617	954
1928	718	1243	1573	2151	1822	8450	3834	3289	1665	1595	1584	920
1929	719	669	664	697	667	845	708	1441	1236	1205	1044	525
1930	615	617	2049	2138	2509	2604	1658	2387	1679	1213	1043	661
1931	674	667	707	643	664	767	620	1145	942	1042	891	398
1932	542	578	673	685	1439	2185	2234	4230	3958	2252	1689	858
1933	676	710	679	660	688	788	928	1230	1222	1225	1330	871
1934	587	615	626	1456	1699	1257	633	1147	952	1044	891	399
1935	564	540	572	718	1714	1238	6649	4830	3247	2201	1660	891
1936	717	711	687	3160	6844	2767	3992	4147	2698	2305	1671	949
1937	724	719	674	675	1753	1462	2910	4667	2094	2160	1625	857
1938	714	772	5036	1664	5115	7816	5750	10280	7913	2917	1818	980
1939	717	720	708	656	657	1131	695	1405	1242	1193	1046	525
1940	614	617	606	2195	7515	7448	4060	3871	1687	1823	1647	951
1941	710	675	2637	4628	6571	3961	3410	6715	3170	2962	1809	1055
1942	719	683	3896	5967	6868	1838	4860	5559	6012	2789	1847	971
1943	719	1356	3210	7051	3948	6795	4240	3187	2108	2347	1799	989
1944	724	714	672	652	1280	1163	770	2389	1687	1683	1662	908
1945	661	846	1668	1112	6020	1200	1652	3572	2024	2241	1737	950
1946	708	1070	6101	3038	1600	1830	2804	3627	1683	2081	1710	916
1947	724	655	1125	722	1893	2426	875	1388	1247	1238	1046	822
1948	624	609	619	2147	586	1092	3798	4057	4015	2373	1775	936
1949	741	709	733	667	748	1482	2367	2468	1688	1322	1625	930
1950	674	692	714	1598	4108	2332	3615	3996	2698	2290	1719	937
1951	700	8196	10246	5220	4761	2207	2932	3442	1684	1933	1685	912
1952	692	1049	3855	3791	6341	3076	6899	11700	8734	4099	2044	1096
1953	726	703	865	6882	1674	1597	3006	3320	5873	2941	1861	978
1954	724	652	672	1678	2959	3498	3891	2500	1679	1222	1451	913
1955	718	670	688	1156	822	665	591	1781	1630	2135	1654	900
1956	618	565	14175	9829	4051	2194	1989	6237	4448	2587	1884	1048
1957	689	710	711	623	3622	3441	841	4037	2472	2266	1745	984
1958	705	703	1423	2231	9298	4028	5917	8970	6263	2622	1896	1281
1959	729	706	699	1216	2676	971	635	1372	1233	1238	1053	525
1960	613	617	598	676	3966	3783	1239	2380	1654	1222	1055	667
1961	671	647	687	703	1130	949	565	1120	935	1964	1634	884
1962	571	587	548	552	5385	1537	3257	2380	1945	2214	1745	975
1963	4891	1030	2888	2949	7906	1390	5292	6651	2387	2477	1895	1092
1964	714	2137	885	1676	1210	656	852	2435	1684	1217	1280	952
1965	674	674	17333	9072	3128	1230	4192	4366	3498	2575	1997	1104
1966	719	630	924	1560	1100	1498	2393	2384	1686	1227	1050	527
1967	674	771	3261	4822	3172	3813	2133	6736	8753	3643	2009	1055
1968	721	686	646	1316	5323	1837	818	2363	1659	1235	1055	521
1969	640	669	834	12227	5018	2192	4435	8800	5537	2597	1825	1005
1970	724	702	3702	16655	3620	2516	857	2396	1644	1209	1041	694
1971	724	1860	3874	3452	2412	3746	2453	5465	5223	3054	1995	1181
1972	725	703	990	1713	2307	2975	1541	2522	1679	1321	1803	1128
1973	638	1391	2442	6116	4638	2667	1903	4455	1672	2110	1761	1139
1974	700	6229	4779	8797	2480	7926	4790	4978	3929	2918	1951	1044
1975	723	695	658	631	3617	4057	1682	5412	6217	2835	1999	1205
1976	884	1036	701	692	633	658	624	1136	926	1029	877	388
1977	564	605	610	585	578	594	629	1134	927	1031	888	394
1978	566	590	665	2601	1615	5418	3503	3848	4169	2608	1890	1295
1979	721	673	680	764	2142	2557	1388	3819	1679	2041	1742	992
1980	635	882	1394	12101	8593	2982	1897	3210	2910	2586	1820	997
1981	722	714	684	841	1509	1471	642	1404	1232	1229	1041	534
1982	568	6851	10847	4869	9259	4902	10735	7854	4040	2763	1903	1521
1983	755	2222	4617	3952	8305	11314	3887	7762	10495	5039	2199	1280
1984	695	6405	10830	3874	3164	2785	1058	3116	1963	2338	1795	1087
1985	692	1798	1134	788	1444	851	1418	2389	1683	1233	1043	514
1986	634	628	636	2812	20278	9061	1904	2419	1678	2151	1737	1278
1987	721	724	717	654	875	1263	636	1138	937	1039	888	396
1988	573	600	613	1879	984	590	585	1133	927	1039	887	396
1989	566	715	557	1016	1501	9695	3231	2419	1658	1225	1415	1070
1990	904	689	707	1220	1073	1445	769	1274	1210	1201	1605	979
1991	607	592	603	601	576	1564	541	1097	923	2066	1700	927
1992	560	592	603	601	575	1563	541	1097	923	2102	1700	927
AVG.	740	1170	2247	2785	3476	2769	2544	3679	2828	2012	1547	883

TABLE B-9 Flow in Yuba River at [illegible]rtville
YCWA's PROPOSED INSTREAM [illegible]WS
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	920	724	719	719	2718	2431	4222	10337	9680	2880	1781	939
1923	732	722	3338	2143	1348	828	3316	3633	2486	2506	1733	1016
1924	719	731	719	719	1010	729	625	1148	935	1042	893	399
1925	534	615	744	719	5657	1731	2619	2834	1700	1781	1651	921
1926	673	722	719	719	4820	1567	3101	2418	1704	1225	1043	525
1927	656	2452	2379	2844	10976	4461	5829	5896	5182	2437	1638	972
1928	728	1364	1681	2271	1967	9078	3974	3316	1686	1615	1604	920
1929	720	722	719	725	742	961	798	1453	1251	1205	1044	525
1930	615	617	2271	2279	2697	2824	1746	2405	1696	1233	1043	661
1931	675	722	717	719	719	865	631	1146	942	1042	891	398
1932	555	615	793	781	1606	2402	2470	4376	3979	2272	1709	858
1933	677	720	719	719	719	904	1049	1312	1238	1225	1330	871
1934	602	618	739	1552	1822	1358	640	1160	956	1044	891	399
1935	566	617	617	822	1841	1408	7166	4938	3269	2221	1681	891
1936	719	719	715	3560	7606	2942	4122	4174	2716	2326	1692	950
1937	725	719	715	724	2272	1882	3214	4744	2113	2181	1646	857
1938	722	960	5533	1783	6248	8898	6125	10396	7930	2936	1839	997
1939	720	724	716	719	719	1278	706	1417	1243	1193	1046	525
1940	615	617	611	2558	8016	7997	4262	3885	1709	1844	1668	951
1941	719	722	2867	5043	7108	4388	3764	6836	3189	2981	1828	1073
1942	719	728	4182	6288	7492	2065	5276	5780	6028	2810	1866	989
1943	721	1470	3358	7544	4232	7505	4408	3214	2124	2366	1818	1007
1944	725	719	719	719	1492	1359	864	2400	1703	1684	1662	908
1945	666	980	1737	1148	6440	1363	1741	3594	2046	2262	1757	950
1946	726	1174	6511	3199	1714	1999	2904	3640	1706	2101	1731	916
1947	725	742	1186	729	1998	2601	920	1402	1263	1238	1046	822
1948	659	617	623	2256	617	1239	4085	4144	4034	2376	1776	936
1949	741	719	907	719	880	1847	2507	2486	1706	1342	1626	930
1950	674	722	746	1884	4465	2537	3765	4026	2722	2310	1740	937
1951	727	8681	10794	5793	5112	2530	3015	3542	1706	1953	1706	912
1952	726	1158	4145	4368	7109	3684	7352	11922	8766	4121	2065	1115
1953	726	725	1031	7248	1727	1786	3159	3395	5890	2962	1882	982
1954	725	722	719	1889	3183	3742	4067	2517	1696	1243	1452	913
1955	720	722	803	1257	906	719	652	1850	1646	2136	1655	900
1956	618	620	15265	10872	4510	2423	2075	6325	4465	2607	1905	1066
1957	721	728	719	719	3850	3651	931	4235	2486	2287	1749	984
1958	721	728	1572	2418	9866	4582	6684	9050	6280	2642	1917	1289
1959	729	727	723	1382	2947	1055	658	1385	1250	1238	1053	525
1960	613	617	612	806	4341	3993	1295	2398	1671	1243	1056	667
1961	672	720	719	729	1237	1071	604	1131	952	1964	1634	884
1962	571	615	617	617	5984	1786	3336	2398	1968	2234	1766	975
1963	5302	1063	3002	3111	8256	1664	5897	6802	2402	2497	1916	1110
1964	729	2306	917	1811	1274	735	897	2446	1700	1221	1280	952
1965	674	766	18077	9849	3312	1351	4532	4409	3516	2594	2016	1122
1966	719	719	1009	1687	1194	1599	2458	2395	1703	1227	1050	527
1967	674	920	3489	5295	3329	4229	2557	6946	8790	3659	2029	1074
1968	732	738	719	1461	5622	1990	877	2380	1676	1253	1075	522
1969	659	749	1004	13203	5805	2548	4788	8921	5552	2616	1845	1024
1970	734	732	3952	17408	3946	2853	925	2411	1663	1227	1061	709
1971	725	1996	4172	3680	2523	4033	2598	5513	5240	3075	2014	1198
1972	726	722	1134	1786	2452	3057	1617	2534	1696	1326	1803	1128
1973	658	1552	2581	6663	5288	3123	2024	4474	1691	2129	1781	1149
1974	722	6620	5116	9328	2734	8723	5193	5022	3953	2934	1970	1061
1975	733	725	722	719	4021	4421	1889	5509	6232	2850	2017	1221
1976	954	1130	720	729	719	719	633	1149	941	1031	877	388
1977	564	617	614	617	617	616	629	1134	928	1031	888	394
1978	566	614	804	3253	1803	5862	3870	3924	4188	2627	1910	1310
1979	722	722	719	904	2436	2813	1483	3862	1696	2061	1746	992
1980	659	934	1531	12610	9208	3359	2001	3233	2930	2604	1840	1014
1981	733	722	716	966	1576	1626	666	1417	1250	1229	1041	534
1982	592	7172	11311	5298	9906	5515	11654	7951	4056	2782	1923	1537
1983	813	2429	4896	4616	9268	12562	4325	7990	10511	5057	2218	1298
1984	727	6751	11468	4134	3494	3058	1163	3153	1981	2357	1814	1100
1985	722	1978	1192	821	1607	1000	1484	2401	1700	1235	1043	514
1986	655	722	719	2964	21639	9766	1996	2449	1698	2170	1757	1293
1987	736	727	727	719	1004	1407	643	1151	939	1039	888	396
1988	573	617	725	2029	1037	617	628	1145	928	1039	887	396
1989	566	859	623	1096	1586	10295	3326	2437	1681	1244	1434	1070
1990	972	732	721	1358	1191	1568	786	1342	1224	1202	1606	979
1991	607	617	611	616	617	1949	621	1118	938	2084	1700	927
1992	561	620	612	616	617	1949	621	1118	938	2121	1700	927
AVG.	757	1248	2399	3015	3786	3063	2725	3738	2846	2026	1558	889

BLE B-10 Required Carryover Storage at Ne ilards Bar
YCWA's PROPOSED INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) YCWA proposed minimum flows; d) YRI

Year	Ac-ft
1922	592000
1923	592000
1924	451000
1925	592000
1926	592000
1927	592000
1928	592000
1929	592000
1930	592000
1931	425000
1932	592000
1933	592000
1934	311000
1935	592000
1936	592000
1937	592000
1938	592000
1939	592000
1940	592000
1941	592000
1942	592000
1943	592000
1944	592000
1945	592000
1946	592000
1947	592000
1948	592000
1949	592000
1950	592000
1951	592000
1952	592000
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1963	592000
1964	592000
1965	592000
1966	592000
1967	592000
1968	592000
1969	592000
1970	592000
1971	592000
1972	592000
1973	592000
1974	592000
1975	592000
1976	579000
1977	311000
1978	592000
1979	592000
1980	592000
1981	592000
1982	592000
1983	592000
1984	592000
1985	592000
1986	592000
1987	592000
1988	311000
1989	592000
1990	592000
1991	592000
1992	592000
AVG.	575606

Table C-1 Total Outflow from New Bullards Bar Reservoir
SWRCB INSTREAM FLOWS
Study: a) nt level demand; b) current PG&E practice; c) SV minimum flow; d) modified YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	706	552	317	293	1241	1232	2550	6802	6067	2772	1718	895
1923	588	419	2113	1418	826	273	2221	2674	2088	2421	1675	960
1924	560	532	421	455	289	523	576	1189	1216	1070	933	470
1925	346	374	274	271	2221	946	1895	2130	1599	1721	1623	892
1926	602	508	450	402	2691	768	2047	2261	1619	1199	1039	511
1927	563	1279	1696	2000	7038	2892	4044	3353	3701	2381	1601	924
1928	601	831	1170	1617	1253	5761	2688	1760	1575	1553	1583	898
1929	611	478	463	519	290	261	276	2021	1516	1150	1006	504
1930	511	515	265	1246	1695	1632	1160	2213	1587	1197	1030	629
1931	652	406	615	351	342	262	579	1288	1317	1211	1045	516
1932	451	405	276	271	292	383	1262	3261	2937	2207	1660	849
1933	620	564	548	485	501	264	268	1754	1473	1210	1035	515
1934	443	446	264	262	882	693	680	1307	1313	1206	1045	514
1935	503	306	374	266	290	259	4321	3587	2668	2159	1633	874
1936	590	591	619	1683	4038	2203	3427	2748	2142	2278	1654	920
1937	622	603	595	539	292	260	2067	3582	1955	2139	1612	853
1938	582	343	3502	1334	2894	5477	4683	6493	5057	2815	1792	941
1939	575	601	636	434	311	260	540	1965	1290	828	771	412
1940	454	514	555	595	5272	5364	2934	2196	1626	1807	1630	925
1941	592	486	1949	3163	4792	2842	2529	4506	2517	2887	1761	1006
1942	599	475	2870	4500	4751	1246	3613	3779	4001	2721	1781	916
1943	617	1042	2546	4966	2937	4764	2877	1762	1887	2277	1728	943
1944	612	606	546	420	289	259	457	2055	1565	1632	1633	881
1945	608	360	1338	927	4001	513	1146	2671	1887	2223	1680	916
1946	576	724	4130	2258	1105	1085	2241	2500	1598	2046	1697	899
1947	627	337	777	656	1279	1366	506	2318	1554	1177	1025	497
1948	421	500	566	544	418	259	2071	3156	3130	2331	1762	924
1949	631	599	262	460	290	260	1574	2169	1649	1290	1619	898
1950	635	508	587	471	2521	1411	2739	2744	2251	2240	1705	913
1951	565	5560	6932	3704	3674	1448	1758	1894	1624	1880	1677	899
1952	544	750	2874	2050	4449	1692	5396	7347	5343	3714	2036	1072
1953	640	538	262	4812	1379	790	2311	2560	3853	2907	1853	956
1954	625	411	476	890	2018	2331	3064	2009	1584	1213	1441	901
1955	520	462	261	674	410	342	671	1672	1523	1358	1647	889
1956	526	364	9740	6996	3009	1652	1676	3860	3048	2504	1871	1022
1957	521	500	643	341	2446	2268	472	2768	1972	2242	1731	952
1958	576	530	1070	1596	6883	2476	3911	6004	3898	2582	1883	1257
1959	640	519	583	641	1482	601	645	2230	1510	1135	1008	466
1960	492	501	515	270	704	2744	910	2160	1556	1213	1047	658
1961	611	436	467	525	454	258	531	1680	1557	1211	1047	524
1962	529	458	359	301	3068	704	2624	2107	1669	2170	1714	956
1963	3350	822	2379	2327	5987	766	3608	3994	2000	2386	1853	1072
1964	579	1423	688	925	828	259	502	2131	1527	1127	1221	935
1965	625	386	11842	6476	2542	942	2999	2615	2507	2499	1937	1068
1966	630	363	483	922	641	947	1854	2157	1592	1176	1002	504
1967	664	270	2424	3110	2489	2676	1155	5072	5466	3304	1926	1017
1968	582	464	452	757	3951	1221	589	2121	1604	1088	1023	461
1969	566	439	268	8579	3314	1361	3347	5117	3580	2495	1745	970
1970	622	528	2836	12075	2766	1708	690	1998	1525	1115	993	665
1971	616	1396	2460	2314	1838	2398	1825	4212	3109	2957	1911	1153
1972	630	563	301	1219	1389	2144	954	2130	1510	1211	1761	1057
1973	561	926	1973	4296	3123	1640	1526	3059	1574	2034	1720	1083
1974	558	4682	3434	6832	1889	5699	3575	3236	2898	2784	1857	977
1975	616	518	505	347	2183	2590	978	4134	4231	2677	1857	1052
1976	593	586	645	504	312	388	615	1203	1132	1008	868	395
1977	460	428	514	449	416	465	561	863	823	689	660	339
1978	427	456	290	274	670	4000	2593	2726	2726	2546	1844	1219
1979	600	501	539	275	1076	1523	953	2903	1591	1981	1700	964
1980	559	634	919	8855	6202	1950	1488	1818	2097	2493	1760	904
1981	486	573	603	261	1145	632	619	2289	1531	1124	996	504
1982	437	3295	7905	3592	6890	3292	7231	4648	2759	2669	1841	1410
1983	579	1691	3581	2407	6162	8216	2895	5203	6051	3861	2132	1215
1984	450	4180	7819	3151	2336	2063	618	1589	1640	2267	1752	1030
1985	514	1202	872	626	779	259	854	2226	1596	1149	988	416
1986	499	410	359	2230	13558	6198	1038	946	1425	2084	1694	1217
1987	472	608	650	510	288	600	713	1612	1329	866	777	407
1988	457	462	266	262	708	374	579	1222	1222	1125	1013	504
1989	512	276	265	263	348	6805	2650	1910	1537	1149	1358	1012
1990	555	483	589	768	551	897	740	2058	1388	1124	965	449
1991	491	423	563	530	499	263	469	1703	1484	1098	1001	496
1992	491	423	563	530	499	263	298	1088	1177	1096	1474	901
AVG.	598	793	1576	1849	2259	1740	1837	2740	2233	1879	1479	828

Table C-2 New Bullards Bar Reservoir End-of- Storage
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flow; d) modified YRI
(AF)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	549619	531770	570718	619640	720000	790000	890000	966000	950000	840000	750000	705000
1923	679238	680830	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1924	682726	660075	658958	648338	694859	694275	722931	681152	613392	549474	492963	470455
1925	463680	467861	513197	554583	720000	790000	890000	966000	929403	840000	750000	705000
1926	677580	664064	664544	671011	720000	790000	890000	848480	786501	721022	662626	638644
1927	617065	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1928	677318	705000	705000	705000	720000	790000	890000	966000	918311	840000	750000	705000
1929	674697	661480	654707	642551	667356	720111	798828	789379	748958	687044	629836	605326
1930	579301	554489	687457	705000	720000	790000	890000	890281	845844	787254	733018	705000
1931	665783	661436	629796	634433	643700	699414	722332	676862	610396	537647	476312	450671
1932	434264	428380	505084	572872	668906	790000	890000	966000	950000	840000	750000	705000
1933	672571	647013	623955	611380	601676	659996	751890	779258	795427	734527	676336	652087
1934	633126	617676	647812	694578	720000	790000	823281	780675	718052	648524	587950	562626
1935	538845	553459	565532	633102	698035	788733	890000	966000	950000	840000	750000	705000
1936	680862	663239	649272	705000	720000	790000	890000	966000	950000	840000	750000	705000
1937	674328	647056	623937	603248	665650	773156	890000	966000	950000	840000	750000	705000
1938	676930	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1939	684484	672034	661076	660598	665572	751125	852149	783803	721536	674717	628185	606428
1940	588336	568273	551450	705000	720000	790000	890000	966000	934805	840000	750000	705000
1941	679801	683414	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1942	683236	688514	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1943	676934	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1944	679540	657635	642934	649102	685315	770707	864376	942564	921599	840000	750000	705000
1945	677159	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1946	687357	705000	705000	705000	720000	790000	890000	966000	942085	840000	750000	705000
1947	677632	705000	705000	692886	720000	790000	890000	821207	769871	709748	656479	634650
1948	639802	636015	623105	705000	718015	746289	890000	966000	950000	840000	750000	705000
1949	676340	662111	667011	658047	664820	751234	890000	950746	905253	840000	750000	705000
1950	672470	656102	633040	705000	720000	790000	890000	966000	950000	840000	750000	705000
1951	701979	705000	705000	705000	720000	790000	890000	966000	931731	840000	750000	705000
1952	698047	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1953	676610	659823	693659	705000	720000	790000	890000	966000	950000	840000	750000	705000
1954	682449	690939	694112	705000	720000	790000	890000	932156	883916	828219	750000	705000
1955	677282	669357	702915	705000	720000	768980	838221	920512	902400	840000	750000	705000
1956	680949	679326	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1957	696818	689177	675876	685044	720000	790000	890000	966000	950000	840000	750000	705000
1958	693746	694852	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1959	674596	658703	638652	705000	720000	790000	860758	796348	733352	675416	622861	606906
1960	584548	560390	536160	562861	720000	790000	890000	877338	841482	787404	736384	705000
1961	673220	671901	679386	663409	720000	788882	868792	880950	837242	777062	722753	698799
1962	676442	660008	679359	686497	720000	790000	890000	946345	950000	840000	750000	705000
1963	705000	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1964	687173	705000	705000	705000	720000	770856	867224	883060	858770	810113	750000	705000
1965	694613	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1966	681231	703162	705000	705000	720000	790000	890000	893027	827204	768617	715752	694689
1967	662571	704800	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1968	687546	673517	685489	705000	720000	790000	870591	846469	793422	738021	686104	660125
1969	638845	657567	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1970	688989	678440	705000	705000	720000	790000	847517	854752	828879	784287	736610	705000
1971	689496	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1972	688775	683193	705000	705000	720000	790000	890000	921429	894993	840000	750000	705000
1973	699429	705000	705000	705000	720000	790000	890000	966000	941219	840000	750000	705000
1974	700719	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1975	685546	677884	673593	696103	720000	790000	890000	966000	950000	840000	750000	705000
1976	705000	705000	703311	696054	715745	759026	782466	765998	710871	653374	606873	588856
1977	567463	549753	525833	510968	500647	488529	474045	454531	415857	375549	337705	320820
1978	299125	285689	362812	636385	720000	790000	890000	966000	950000	840000	750000	705000
1979	681139	670327	654759	705000	720000	790000	890000	966000	940256	840000	750000	705000
1980	700381	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1981	683615	664295	666127	694228	720000	790000	868301	808640	741869	682723	626966	603928
1982	603852	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1983	705000	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1984	704791	705000	705000	705000	720000	790000	890000	966000	950000	840000	750000	705000
1985	690736	705000	705000	705000	720000	782914	890000	858860	797145	739905	688561	675464
1986	653618	659986	695816	705000	720000	790000	890000	966000	943200	840000	750000	705000
1987	693275	673774	652210	652289	718164	790000	830046	779396	714794	670277	628553	609999
1988	589592	573008	639032	703507	720000	758135	792922	771667	724375	667064	609391	584335
1989	558182	616426	629684	658781	720000	790000	890000	906577	872692	819284	750000	705000
1990	705000	700745	686762	705000	720000	790000	856037	793926	783398	729333	684441	666907
1991	640421	632106	603583	584991	574804	711244	816804	830740	799059	749538	700629	679824
1992	653315	644991	616463	597867	587361	723832	839547	891256	877730	828163	750000	705000
AVG.	654396	655663	662242	678667	705220	774471	865480	904682	875455	790061	713342	675585

Table C-3 Total Energy Production at New Bullards Bar Reservoir
SWRCB INSTREAM FLOWS
Study: a) p level demand; b) current PG&E practice; c) SWR himum flow; d) modified YRI
(MWH)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	49367	36937	21831	20418	80620	89870	183252	269514	260820	208413	126084	62857
1923	42280	28930	153097	102832	53991	19587	159542	202019	153188	181961	122916	67451
1924	40278	36818	29940	32360	19161	37580	40199	86121	84207	75346	64449	30857
1925	23257	24348	18500	18500	143567	68891	136021	160839	117053	128934	119086	62645
1926	43288	35099	32065	28631	176314	55866	147027	168914	115570	87456	75025	35163
1927	39885	88908	123034	145212	236581	211218	258983	248057	260820	178947	117465	64907
1928	43234	57988	84732	117323	85011	263415	193145	132801	115162	116142	116139	63069
1929	43923	32980	32959	36930	18500	18500	19157	148439	107307	83448	72122	34426
1930	35873	34758	18500	90156	111201	119190	83148	166165	114579	88160	75122	43999
1931	46862	27917	43762	24751	21806	18500	40379	93300	91193	85130	71989	33730
1932	30216	26148	18500	18500	19161	27532	90497	242219	214950	165834	121811	59606
1933	44538	38958	38893	34248	31887	18500	18500	128294	104516	88320	74923	35548
1934	31392	30457	18500	18500	57664	50369	48152	96008	92637	86975	74250	34711
1935	34886	20343	25897	18500	18500	18500	258944	263641	195837	162217	119822	61373
1936	42402	40918	44190	121408	245031	160983	240317	207603	157161	171184	121369	64624
1937	44720	41674	42266	38072	18500	18500	148170	263282	143402	160709	118275	59889
1938	41802	23721	247260	96716	189866	263415	258983	269514	260820	211653	131536	66108
1939	41330	41675	45518	30896	19900	18500	38146	145040	91037	59826	55070	28044
1940	31866	34745	38631	42190	245031	263415	210214	165806	119058	135481	119601	64977
1941	42562	33639	141235	226851	236581	207883	181719	269514	184753	216826	129297	70702
1942	43092	32898	208170	261667	236581	90874	252468	269514	260820	204569	130770	64341
1943	44339	72784	184923	261667	192341	263415	206603	132927	138399	171109	126866	66250
1944	44031	41936	38877	29789	19161	18500	32316	154646	114331	122151	119822	61868
1945	43712	24905	96965	67079	236581	37177	82093	201789	138399	167040	123285	64341
1946	41434	50498	261667	163992	72358	79079	161000	188811	117055	153594	124537	63140
1947	45116	23286	56115	47307	83744	99706	36012	172706	110341	85653	73870	34150
1948	29776	34351	40132	38859	28106	18500	147964	235543	227243	175179	129325	64907
1949	45402	41452	18500	32785	18500	18500	112400	163594	120421	96238	118791	63069
1950	45673	35049	41775	33618	165567	102983	196810	207328	165181	168321	125172	64129
1951	40686	253175	261667	261538	234565	105700	126208	142965	118882	140913	123064	63140
1952	39147	52422	208697	148853	245031	123592	258983	269514	260820	269514	149511	75367
1953	46028	37177	18500	261453	90397	57478	166048	193341	260820	218154	136029	67168
1954	44964	28410	34153	64333	132428	170379	218358	151331	115267	90133	105646	63281
1955	37321	31898	18500	48656	26603	24611	47526	125099	110864	101353	120854	62433
1956	37794	25076	261032	261667	203456	120608	120268	269514	222091	188216	137355	71833
1957	37470	34707	46185	24291	160421	165798	33592	209108	144653	168472	127087	66886
1958	41463	36827	77398	115794	236581	181007	258983	269514	260820	194094	138239	88441
1959	46002	35836	41525	45939	97178	43626	45843	165123	106789	82202	72102	31803
1960	34580	33855	35659	18500	46890	200670	65134	161907	112114	89279	76357	46024
1961	43919	30072	33376	37549	29422	18500	37699	125614	112176	89016	76239	36544
1962	37939	31588	25529	21404	199546	51175	188534	158884	122163	163046	125789	67168
1963	238198	57507	172771	168983	236581	55719	252111	269514	146713	179323	136029	75367
1964	41651	99674	49634	66933	56031	18500	35539	159423	110326	83312	89340	65684
1965	45024	26729	261667	261667	166984	68599	214288	197535	184003	187839	142217	75084
1966	45309	25073	34710	66715	41811	68982	133089	161948	114779	86274	72859	35078
1967	47643	18500	176068	223536	163468	195663	82788	269514	260820	243784	141407	71469
1968	41865	32124	32317	54588	245031	89035	41919	158056	114548	79412	74091	31820
1969	40328	30155	19014	261667	213411	99283	235539	269514	255748	187538	128073	68158
1970	44817	36602	205604	261667	181676	124735	49041	148626	109483	81878	72360	46503
1971	44365	97801	178690	168068	120612	175312	130977	269514	225923	221463	140347	81091
1972	45361	39113	21442	88341	94284	156665	68254	160306	109903	90232	129252	74307
1973	40425	64841	143221	261667	202824	119771	109491	229242	115331	152685	126231	76144
1974	40210	253154	243235	261667	123953	263415	249845	240660	212419	209317	136324	68653
1975	44368	35920	36091	24750	143271	189418	69982	269514	260820	201253	136369	73953
1976	42721	40876	46532	36254	20864	27935	43258	87933	79727	72629	61800	26804
1977	32111	28730	35479	30776	25641	31674	36908	58584	53568	45733	43122	20979
1978	27252	27943	18500	18500	43411	263415	186297	205919	200142	191381	135366	85756
1979	43165	34682	38477	19508	70449	111198	68218	218959	116520	148690	124758	67734
1980	40245	44274	66455	261667	245031	142446	106748	137184	153850	187387	129178	63493
1981	34869	39710	43121	18500	74946	45888	44008	169858	108429	81509	71313	34433
1982	30696	224837	261667	253597	236581	236275	258983	269514	202579	200651	135145	99255
1983	41701	118745	252855	174848	236581	263415	207749	269514	260820	269514	156583	85473
1984	32337	253223	261667	226066	158872	150772	44088	119882	120225	170356	128589	72398
1985	36939	84217	63032	45160	50896	18500	61039	166495	114217	83903	71604	28739
1986	35608	28155	25571	161816	236581	263415	74352	71169	104353	156498	124316	85614
1987	33869	42245	46457	36311	18500	43559	50569	118570	93766	62504	55470	27718
1988	32074	31249	18500	18500	47848	26893	40742	89470	86201	81370	72271	34250
1989	35752	18500	18500	18500	22437	263415	190463	143548	111505	85164	99469	71126
1990	39954	33576	42374	55374	35886	65310	52660	152206	98452	81932	69814	30998
1991	34930	28930	39814	37255	31521	18500	32860	125859	105827	80235	72650	34431
1992	35029	29013	39928	37376	32729	18500	20764	81023	85183	81367	108081	63281
AVG.	42714	51426	86226	100422	117789	106455	123125	182886	149858	139667	108049	57842

Table C-4 Total Delivery at Daguerre Dam
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flow; d) modified YRI
(AF)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1923	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1924	16727	9191	4586	352	352	2648	13806	45125	41651	48910	41058	13443	237848
1925	14218	7812	3898	299	299	2251	16242	53088	49001	57541	48304	15815	268769
1926	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1927	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1928	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1929	16727	9191	4586	352	352	2648	15430	50434	46551	54664	45889	15024	261847
1930	15891	8731	4357	334	334	2516	16242	53088	49001	57541	48304	15815	272154
1931	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1932	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1933	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1934	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1935	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1936	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1937	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1938	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1939	16727	9191	4586	352	352	2648	10557	34507	31851	37402	31398	10280	189850
1940	10873	5974	2981	229	229	1721	16242	53088	49001	57541	48304	15815	261997
1941	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1942	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1943	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1944	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1945	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1946	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1947	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1948	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1949	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1950	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1951	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1952	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1953	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1954	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1955	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1956	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1957	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1958	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1959	16727	9191	4586	352	352	2648	15430	50434	46551	54664	45889	15024	261847
1960	15891	8731	4357	334	334	2516	16242	53088	49001	57541	48304	15815	272154
1961	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1962	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1963	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1964	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1965	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1966	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1967	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1968	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1969	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1970	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1971	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1972	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1973	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1974	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1975	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1976	16727	9191	4586	352	352	2648	15430	50434	46551	54664	45889	15024	261847
1977	15891	8731	4357	334	334	2516	8933	29198	26951	31648	26567	8698	164158
1978	9200	5055	2522	194	194	1456	16242	53088	49001	57541	48304	15815	258612
1979	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1980	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1981	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1982	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1983	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1984	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1985	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1986	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1987	16727	9191	4586	352	352	2648	11369	37162	34301	40279	33813	11071	201850
1988	11709	6434	3210	246	246	1854	16242	53088	49001	57541	48304	15815	263690
1989	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1990	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1991	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
1992	16727	9191	4586	352	352	2648	16242	53088	49001	57541	48304	15815	273847
AVG.	16397	9010	4496	345	345	2596	15922	52041	48035	56406	47352	15503	268447

T[illegible]-5 Total Deliveries and Deficiencies at Daguerre [illegible] Diversion Dam
SWRCB INSTREAM FLOWS
Study : a) present level demand; b) current PG&E practice; c) SWRCB minimum flows; d) modified YRI

Water Year	Year Type (YRI)	Total Annual Delivery (ac-ft)	Total Annual Demand (ac-ft)	Deficiency, Percent of Demand %	Deficiency, Volume (ac-ft)
1922	W	273847	273847	0.0%	0
1923	AN	273847	273847	0.0%	0
1924	EC	237848	273847	13.1%	35999
1925	BN	268769	273847	1.9%	5078
1926	BN	273847	273847	0.0%	0
1927	W	273847	273847	0.0%	0
1928	AN	273847	273847	0.0%	0
1929	D	261847	273847	4.4%	12000
1930	BN	272154	273847	0.6%	1693
1931	EC	273847	273847	0.0%	0
1932	BN	273847	273847	0.0%	0
1933	D	273847	273847	0.0%	0
1934	EC	273847	273847	0.0%	0
1935	AN	273847	273847	0.0%	0
1936	AN	273847	273847	0.0%	0
1937	AN	273847	273847	0.0%	0
1938	W	273847	273847	0.0%	0
1939	D	189850	273847	30.7%	83997
1940	AN	261997	273847	4.3%	11850
1941	W	273847	273847	0.0%	0
1942	W	273847	273847	0.0%	0
1943	W	273847	273847	0.0%	0
1944	BN	273847	273847	0.0%	0
1945	AN	273847	273847	0.0%	0
1946	AN	273847	273847	0.0%	0
1947	D	273847	273847	0.0%	0
1948	AN	273847	273847	0.0%	0
1949	BN	273847	273847	0.0%	0
1950	AN	273847	273847	0.0%	0
1951	W	273847	273847	0.0%	0
1952	W	273847	273847	0.0%	0
1953	W	273847	273847	0.0%	0
1954	AN	273847	273847	0.0%	0
1955	D	273847	273847	0.0%	0
1956	W	273847	273847	0.0%	0
1957	AN	273847	273847	0.0%	0
1958	W	273847	273847	0.0%	0
1959	D	261847	273847	4.4%	12000
1960	BN	272154	273847	0.6%	1693
1961	C	273847	273847	0.0%	0
1962	BN	273847	273847	0.0%	0
1963	W	273847	273847	0.0%	0
1964	BN	273847	273847	0.0%	0
1965	W	273847	273847	0.0%	0
1966	BN	273847	273847	0.0%	0
1967	W	273847	273847	0.0%	0
1968	BN	273847	273847	0.0%	0
1969	W	273847	273847	0.0%	0
1970	W	273847	273847	0.0%	0
1971	W	273847	273847	0.0%	0
1972	BN	273847	273847	0.0%	0
1973	AN	273847	273847	0.0%	0
1974	W	273847	273847	0.0%	0
1975	W	273847	273847	0.0%	0
1976	EC	261847	273847	4.4%	12000
1977	EC	164158	273847	40.1%	109689
1978	AN	258612	273847	5.6%	15235
1979	BN	273847	273847	0.0%	0
1980	W	273847	273847	0.0%	0
1981	D	273847	273847	0.0%	0
1982	W	273847	273847	0.0%	0
1983	W	273847	273847	0.0%	0
1984	W	273847	273847	0.0%	0
1985	BN	273847	273847	0.0%	0
1986	W	273847	273847	0.0%	0
1987	C	201850	273847	26.3%	71997
1988	EC	263690	273847	3.7%	10157
1989	BN	273847	273847	0.0%	0
1990	D	273847	273847	0.0%	0
1991	C	273847	273847	0.0%	0
1992	EC	273847	273847	0.0%	0
AVG.		268447	273847	0.02	5400

Table C-6 Flow in Yuba River at Mary
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flows; d) modified YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	655	587	748	775	2915	2552	4184	9677	8936	1967	1003	676
1923	467	632	3434	2231	1412	860	3196	2822	1683	1581	953	755
1924	455	587	675	762	1103	712	454	528	520	274	261	261
1925	346	521	772	774	5356	1808	2437	2015	890	852	871	658
1926	460	588	688	780	4987	1625	2984	1576	891	294	261	261
1927	465	2428	2403	2960	11456	4623	5701	5093	4416	1517	856	709
1928	463	1307	1689	2350	2062	9433	3785	2490	881	687	822	657
1929	451	615	694	739	786	998	624	1659	859	286	261	261
1930	346	473	1418	2087	2822	2936	1545	1570	890	304	261	398
1931	452	615	653	780	751	889	463	529	528	274	261	261
1932	346	496	831	847	1276	1682	2375	3632	3190	1344	929	594
1933	456	576	678	770	736	941	885	1550	859	306	263	261
1934	346	472	766	922	1713	1391	465	541	542	276	261	261
1935	346	535	584	876	1024	1146	7235	4182	2476	1293	901	628
1936	454	572	673	3847	8093	2977	3918	3347	1915	1395	910	687
1937	458	568	684	759	2628	2132	3123	3944	1312	1250	863	591
1938	463	959	5806	1862	6829	9369	6044	9613	7139	2013	1057	736
1939	453	575	648	772	760	1341	672	1594	847	278	263	261
1940	396	517	570	2602	8361	8280	4108	3048	896	910	886	687
1941	458	605	2971	5326	7423	4542	3674	6048	2386	2061	1051	814
1942	452	608	4328	6506	7852	2126	5216	5028	5244	1887	1092	730
1943	452	1415	3389	7884	4397	7794	4224	2388	1333	1443	1044	748
1944	455	572	688	772	1634	1453	692	1568	895	718	880	645
1945	454	888	1711	1166	6726	1432	1552	2767	1243	1328	979	687
1946	469	1116	6727	3307	1785	2071	2707	2805	896	1168	948	650
1947	453	669	1158	726	2064	2680	701	1574	869	321	264	261
1948	346	473	556	1275	631	1298	4014	3357	3214	1445	991	670
1949	469	573	975	749	964	2058	2357	1660	890	411	841	666
1950	447	586	700	2048	4707	2635	3608	3207	1907	1382	955	671
1951	479	8888	11088	6060	5270	2628	2799	2744	895	1027	921	646
1952	485	1103	4273	4765	7474	3935	7319	11189	7998	3188	1280	849
1953	454	588	1094	7499	1759	1870	2994	2607	5106	2031	1097	716
1954	453	629	680	2038	3334	3867	3917	1687	888	307	667	647
1955	466	612	824	1321	958	720	624	1608	889	426	870	634
1956	346	508	15940	11370	4720	2481	1861	5521	3671	1691	1120	800
1957	473	589	652	798	4006	3754	720	3509	1697	1354	964	718
1958	464	594	1624	2542	10256	4832	6798	8247	5486	1714	1132	1023
1959	457	588	666	1511	3128	1069	634	1565	861	321	268	261
1960	346	472	554	918	3079	4097	1072	1568	863	307	271	401
1961	451	642	667	741	1252	1113	624	1152	852	286	270	264
1962	346	490	610	657	6233	1915	3139	1569	1165	1306	984	709
1963	5341	931	3008	3219	8471	1745	5932	6032	1616	1579	1138	844
1964	468	2297	863	1899	1313	744	715	1609	895	295	465	686
1965	447	649	18524	10251	3389	1350	4437	3592	2718	1673	1239	859
1966	447	651	994	1770	1253	1628	2252	1563	893	296	272	263
1967	447	848	3571	5619	3433	4381	2502	6210	8019	2746	1260	810
1968	468	624	712	1556	5823	2053	704	1559	861	338	293	266
1969	468	667	960	13830	6184	2677	4695	8143	4769	1706	1078	770
1970	462	600	4075	17885	4091	2965	704	1581	862	309	286	448
1971	455	1960	4305	3833	2593	4175	2414	4692	4446	2154	1240	934
1972	454	585	1181	1830	2545	3076	1406	1692	890	401	1021	867
1973	471	1467	2605	7039	5628	3308	1832	3645	892	1211	1004	891
1974	470	6767	5278	9623	2845	9054	5127	4206	3130	2024	1203	807
1975	464	591	706	783	4299	4632	1761	4735	5456	1947	1258	982
1976	729	1043	665	749	780	718	463	540	548	284	263	263
1977	346	482	551	633	645	590	449	518	528	274	261	261
1978	377	554	885	3709	1581	6090	3787	3123	3385	1704	1133	1054
1979	458	613	675	1004	2633	2947	1289	3054	890	1135	969	729
1980	474	760	1563	12960	9562	3485	1795	2403	2124	1684	1063	763
1981	479	576	675	1059	1615	1690	633	1595	861	318	263	270
1982	346	5589	11561	5547	10210	5755	11841	7161	3263	1869	1149	1289
1983	588	2438	5016	4982	9732	13114	4276	7260	9728	4147	1449	1042
1984	486	6857	11782	4247	3643	3132	957	2331	1185	1436	1034	841
1985	474	1977	1158	838	1714	1059	1283	1564	890	309	266	261
1986	480	655	703	2996	22450	10052	1785	1622	893	1249	982	1032
1987	488	575	662	776	1088	1465	648	1155	839	281	263	263
1988	348	526	782	1145	1044	618	463	539	528	282	263	263
1989	348	835	602	708	806	10670	3132	1613	880	321	659	809
1990	747	613	657	1467	1266	1610	752	1551	857	295	267	263
1991	346	483	546	621	654	2188	624	1150	855	299	261	263
1992	347	486	547	621	654	2188	453	535	548	292	734	669
AVG.	517	1134	2424	3108	3897	3172	2599	3095	2157	1072	762	614

Table C-7 Shortage in Required flow in Yuba Riv( )Marysville
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flows; d) modified YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	0	0	0
1924	0	0	0	0	0	0	0	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0	0	0	0	0	0
1936	0	0	0	0	0	0	0	0	0	0	0	0
1937	0	0	0	0	0	0	0	0	0	0	0	0
1938	0	0	0	0	0	0	0	0	0	0	0	0
1939	0	0	0	0	0	0	0	0	0	0	0	0
1940	0	0	0	0	0	0	0	0	0	0	0	0
1941	0	0	0	0	0	0	0	0	0	0	0	0
1942	0	0	0	0	0	0	0	0	0	0	0	0
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	0	0	0	0	0	0	0	0	0	0	0	0
1947	0	0	0	0	0	0	0	0	0	0	0	0
1948	0	0	0	0	0	0	0	0	0	0	0	0
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
AVG.	0	0	0	0	0	0	0	0	0	0	0	0

Table C-8 Total Outflow from Englebright rvoir
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flows; d) modified YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	907	699	601	630	2394	2102	3784	9960	9611	2863	1759	921
1923	722	650	3107	2008	1248	737	3103	3604	2463	2486	1712	1016
1924	719	718	672	662	886	689	656	1255	1217	1067	929	485
1925	504	579	647	641	4544	1563	2495	2805	1683	1761	1648	921
1926	724	690	667	644	4431	1439	2890	2406	1687	1215	1043	525
1927	700	2144	2239	2670	10142	4017	5549	5818	5150	2419	1617	954
1928	718	1243	1573	2151	1822	8450	3834	3289	1665	1595	1584	920
1929	719	669	664	697	667	845	717	2423	1614	1172	1005	511
1930	601	617	1092	1853	2509	2604	1658	2387	1679	1213	1043	661
1931	721	667	707	643	664	767	698	1381	1348	1208	1044	524
1932	589	578	679	690	1000	1354	2234	4230	3958	2252	1689	858
1933	724	710	679	660	688	788	928	2255	1641	1239	1045	524
1934	587	615	629	765	1511	1257	711	1383	1358	1210	1044	525
1935	611	540	572	706	815	902	6628	4830	3247	2201	1660	891
1936	717	711	687	3160	6844	2767	3992	4147	2698	2305	1671	949
1937	724	719	674	675	1753	1462	2910	4667	2094	2160	1625	857
1938	714	772	5036	1664	5115	7816	5750	10280	7913	2917	1818	980
1939	717	720	708	656	657	1131	804	2128	1373	879	772	432
1940	569	617	606	1970	7515	7448	4060	3871	1687	1823	1647	951
1941	710	675	2637	4628	6571	3961	3410	6715	3170	2962	1809	1055
1942	719	683	3896	5967	6868	1838	4860	5559	6012	2789	1847	971
1943	719	1356	3210	7051	3948	6795	4240	3187	2108	2347	1799	989
1944	724	714	672	652	1280	1163	804	2389	1687	1651	1662	908
1945	713	792	1668	1112	6020	1200	1652	3572	2024	2241	1737	950
1946	708	1070	6101	3038	1600	1830	2804	3627	1683	2081	1710	916
1947	724	655	1125	722	1893	2426	875	2413	1666	1252	1046	524
1948	544	609	619	1086	586	1092	3798	4057	4015	2373	1775	936
1949	741	709	733	667	748	1482	2367	2468	1688	1322	1625	930
1950	719	692	714	1553	4108	2332	3615	3996	2698	2290	1719	937
1951	700	8196	10246	5220	4761	2207	2932	3442	1684	1933	1685	912
1952	692	1049	3855	3791	6341	3076	6899	11700	8734	4099	2044	1096
1953	726	703	865	6882	1674	1597	3006	3320	5873	2941	1861	978
1954	724	652	672	1678	2959	3498	3891	2500	1679	1222	1451	913
1955	718	670	688	1156	822	665	796	2325	1674	1362	1654	900
1956	618	565	14175	9829	4051	2194	1989	6237	4448	2587	1884	1048
1957	689	710	711	623	3622	3441	841	4037	2472	2266	1745	984
1958	705	703	1423	2231	9298	4028	5917	8970	6263	2622	1896	1281
1959	729	706	699	1216	2676	971	826	2354	1611	1205	1014	511
1960	599	617	598	682	2448	3783	1239	2380	1654	1222	1055	667
1961	719	647	687	703	1077	949	814	1971	1648	1222	1055	530
1962	618	587	548	552	5222	1537	3257	2380	1945	2214	1745	975
1963	4891	1030	2888	2949	7906	1390	5292	6651	2387	2477	1895	1092
1964	714	2137	885	1676	1210	656	886	2435	1684	1217	1248	952
1965	719	627	17333	9072	3128	1230	4192	4366	3498	2575	1997	1104
1966	719	630	924	1560	1100	1498	2393	2384	1686	1227	1050	527
1967	719	728	3258	4822	3172	3813	2133	6736	8753	3643	2009	1055
1968	721	686	646	1316	5323	1837	852	2363	1659	1235	1055	521
1969	703	669	739	12227	5018	2192	4435	8800	5537	2597	1825	1005
1970	724	702	3702	16655	3620	2516	857	2396	1644	1209	1041	694
1971	724	1860	3874	3452	2412	3746	2453	5465	5223	3054	1995	1181
1972	725	703	990	1713	2307	2975	1541	2522	1679	1321	1803	1128
1973	703	1324	2442	6116	4638	2667	1903	4455	1672	2110	1761	1139
1974	700	6229	4779	8797	2480	7926	4790	4978	3929	2918	1951	1044
1975	723	695	658	631	3617	4057	1682	5412	6217	2835	1999	1205
1976	884	1036	701	692	633	658	688	1329	1291	1148	991	500
1977	597	605	610	585	578	594	584	982	963	776	688	400
1978	522	590	667	2603	1266	5418	3503	3848	4169	2608	1890	1295
1979	721	673	680	764	2142	2557	1388	3819	1679	2041	1742	992
1980	701	814	1394	12101	8593	2982	1897	3210	2910	2586	1820	997
1981	722	714	684	841	1509	1471	847	2429	1651	1243	1041	534
1982	568	5173	10847	4869	9259	4902	10735	7854	4040	2763	1903	1521
1983	755	2222	4617	3952	8305	11314	3887	7762	10495	5039	2199	1280
1984	695	6405	10830	3874	3164	2785	1058	3116	1963	2338	1795	1087
1985	692	1798	1134	788	1444	851	1418	2389	1683	1233	1043	514
1986	703	628	636	2743	20278	9061	1904	2419	1678	2151	1737	1278
1987	721	724	717	654	875	1263	803	1730	1403	926	806	442
1988	538	600	616	895	958	590	663	1369	1333	1205	1040	522
1989	613	719	561	579	669	9695	3231	2419	1658	1225	1415	1070
1990	904	689	707	1220	1073	1445	974	2299	1629	1215	1039	519
1991	607	592	603	601	576	1566	745	1948	1636	1197	1035	521
1992	607	592	603	601	575	1565	574	1333	1329	1190	1508	927
AVG.	750	1141	2233	2731	3403	2753	2571	3830	2924	1965	1514	864

Table C-9 Flow in Yuba River at Smar
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flows; d) modified YRI
(CFS)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	920	724	719	719	2718	2431	4222	10337	9680	2880	1781	939
1923	732	722	3338	2143	1348	828	3316	3633	2486	2506	1733	1016
1924	719	731	719	719	1010	729	662	1255	1218	1067	929	485
1925	540	617	746	722	5026	1731	2619	2834	1700	1781	1651	921
1926	725	722	719	719	4763	1567	3101	2418	1704	1225	1043	525
1927	719	2387	2379	2844	10976	4461	5829	5896	5182	2437	1638	972
1928	728	1364	1681	2271	1967	9078	3974	3316	1686	1615	1604	920
1929	720	722	719	725	742	961	807	2435	1629	1172	1005	511
1930	601	617	1315	1994	2697	2824	1746	2405	1696	1233	1043	661
1931	722	722	717	719	719	865	709	1382	1348	1208	1044	524
1932	602	615	799	786	1167	1572	2470	4376	3979	2272	1709	858
1933	725	720	719	719	719	904	1049	2337	1657	1239	1045	524
1934	602	618	742	861	1634	1358	718	1396	1362	1210	1044	525
1935	613	617	617	810	942	1072	7145	4938	3269	2221	1681	891
1936	719	719	715	3560	7606	2942	4122	4174	2716	2326	1692	950
1937	725	719	715	724	2272	1882	3214	4744	2113	2181	1646	857
1938	722	960	5533	1783	6248	8898	6125	10396	7930	2936	1839	997
1939	720	724	716	719	719	1278	815	2140	1374	879	772	432
1940	570	617	611	2333	8016	7997	4262	3885	1709	1844	1668	951
1941	719	722	2867	5043	7108	4388	3764	6836	3189	2981	1828	1073
1942	719	728	4182	6288	7492	2065	5276	5780	6028	2810	1866	989
1943	721	1470	3358	7544	4232	7505	4408	3214	2124	2366	1818	1007
1944	725	719	719	719	1492	1359	898	2400	1703	1652	1662	908
1945	718	926	1737	1148	6440	1363	1741	3594	2046	2262	1757	950
1946	726	1174	6511	3199	1714	1999	2904	3640	1706	2101	1731	916
1947	725	742	1186	729	1998	2601	920	2427	1682	1252	1046	524
1948	579	617	623	1195	617	1239	4085	4144	4034	2376	1776	936
1949	741	719	907	719	880	1847	2507	2486	1706	1342	1626	930
1950	719	722	746	1839	4465	2537	3765	4026	2722	2310	1740	937
1951	727	8681	10794	5793	5112	2530	3015	3542	1706	1953	1706	912
1952	726	1158	4145	4368	7109	3684	7352	11922	8766	4121	2065	1115
1953	726	725	1031	7248	1727	1786	3159	3395	5890	2962	1882	982
1954	725	722	719	1889	3183	3742	4067	2517	1696	1243	1452	913
1955	720	722	803	1257	906	719	857	2393	1690	1362	1655	900
1956	618	620	15265	10872	4510	2423	2075	6325	4465	2607	1905	1066
1957	721	728	719	719	3850	3651	931	4235	2486	2287	1749	984
1958	721	728	1572	2418	9866	4582	6684	9050	6280	2642	1917	1289
1959	729	727	723	1382	2947	1055	849	2367	1628	1205	1014	511
1960	599	617	612	812	2824	3993	1295	2398	1671	1243	1056	667
1961	720	720	719	729	1184	1071	853	1982	1665	1222	1055	530
1962	618	615	617	617	5821	1786	3336	2398	1968	2234	1766	975
1963	5302	1063	3002	3111	8256	1664	5897	6802	2402	2497	1916	1110
1964	729	2306	917	1811	1274	735	931	2446	1700	1221	1248	952
1965	719	719	18077	9849	3312	1351	4532	4409	3516	2594	2016	1122
1966	719	719	1009	1687	1194	1599	2458	2395	1703	1227	1050	527
1967	719	876	3485	5295	3329	4229	2557	6946	8790	3659	2029	1074
1968	732	738	719	1461	5622	1990	911	2380	1676	1253	1075	522
1969	722	749	908	13203	5805	2548	4788	8921	5552	2616	1845	1024
1970	734	732	3952	17408	3946	2853	925	2411	1663	1227	1061	709
1971	725	1996	4172	3680	2523	4033	2598	5513	5240	3075	2014	1198
1972	726	722	1134	1786	2452	3057	1617	2534	1696	1326	1803	1128
1973	723	1485	2581	6663	5288	3123	2024	4474	1691	2129	1781	1149
1974	722	6620	5116	9328	2734	8723	5193	5022	3953	2934	1970	1061
1975	733	725	722	719	4021	4421	1889	5509	6232	2850	2017	1221
1976	954	1130	720	729	719	719	697	1342	1306	1150	991	500
1977	597	617	614	617	617	616	584	982	964	776	688	400
1978	522	614	806	3255	1454	5862	3870	3924	4188	2627	1910	1310
1979	722	722	719	904	2436	2813	1483	3862	1696	2061	1746	992
1980	725	865	1531	12610	9208	3359	2001	3233	2930	2604	1840	1014
1981	733	722	716	966	1576	1626	871	2442	1669	1243	1041	534
1982	592	5494	11311	5298	9906	5515	11654	7951	4056	2782	1923	1537
1983	813	2429	4896	4616	9268	12562	4325	7990	10511	5057	2218	1298
1984	727	6751	11468	4134	3494	3058	1163	3153	1981	2357	1814	1100
1985	722	1978	1192	821	1607	1000	1484	2401	1700	1235	1043	514
1986	724	722	719	2896	21639	9766	1996	2449	1698	2170	1757	1293
1987	736	727	727	719	1004	1407	810	1743	1405	926	806	442
1988	538	617	728	1045	1012	617	706	1381	1334	1205	1040	522
1989	613	863	627	659	754	10295	3326	2437	1681	1244	1434	1070
1990	972	732	721	1358	1191	1568	991	2367	1643	1216	1039	519
1991	607	617	611	616	617	1951	825	1969	1651	1215	1035	521
1992	608	620	612	616	617	1951	654	1354	1344	1208	1508	927
AVG.	767	1220	2384	2961	3713	3047	2752	3889	2942	1978	1525	870

Table C-10 Required Carryover Storage at Ne\ ..lards Bar
SWRCB INSTREAM FLOWS
Study: a) present level demand; b) current PG&E practice; c) SWRCB minimum flow; d) modified YRI

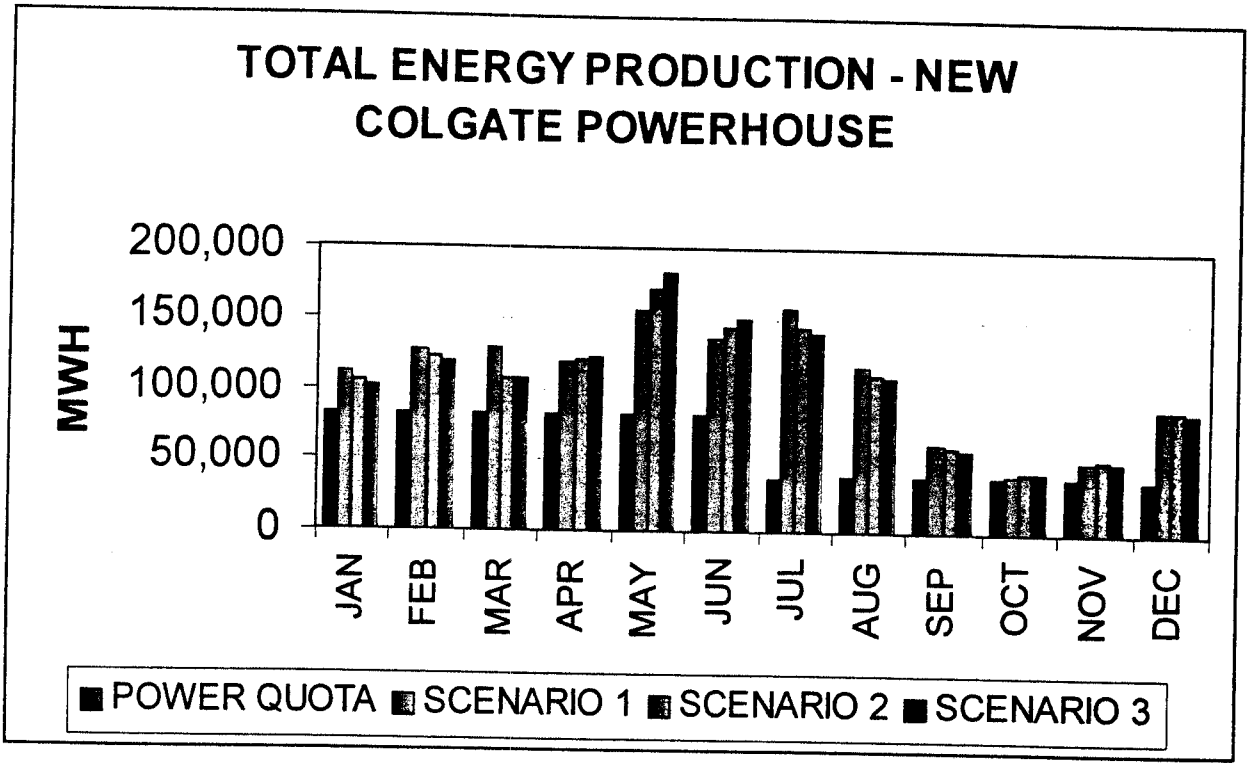
Year	ac-ft
1922	600000
1923	600000
1924	460000
1925	600000
1926	600000
1927	600000
1928	600000
1929	600000
1930	600000
1931	434000
1932	600000
1933	600000
1934	318000
1935	600000
1936	600000
1937	600000
1938	600000
1939	600000
1940	600000
1941	600000
1942	600000
1943	600000
1944	600000
1945	600000
1946	600000
1947	600000
1948	600000
1949	600000
1950	600000
1951	600000
1952	600000
1953	600000
1954	600000
1955	600000
1956	600000
1957	600000
1958	600000
1959	600000
1960	600000
1961	600000
1962	600000
1963	600000
1964	600000
1965	600000
1966	600000
1967	600000
1968	600000
1969	600000
1970	600000
1971	600000
1972	600000
1973	600000
1974	600000
1975	600000
1976	588000
1977	311000
1978	600000
1979	600000
1980	600000
1981	600000
1982	600000
1983	600000
1984	600000
1985	600000
1986	600000
1987	600000
1988	311000
1989	600000
1990	600000
1991	600000
1992	600000
AVG.	583408

APPENDIX 4

ENERGY PRODUCTION EVALUATION

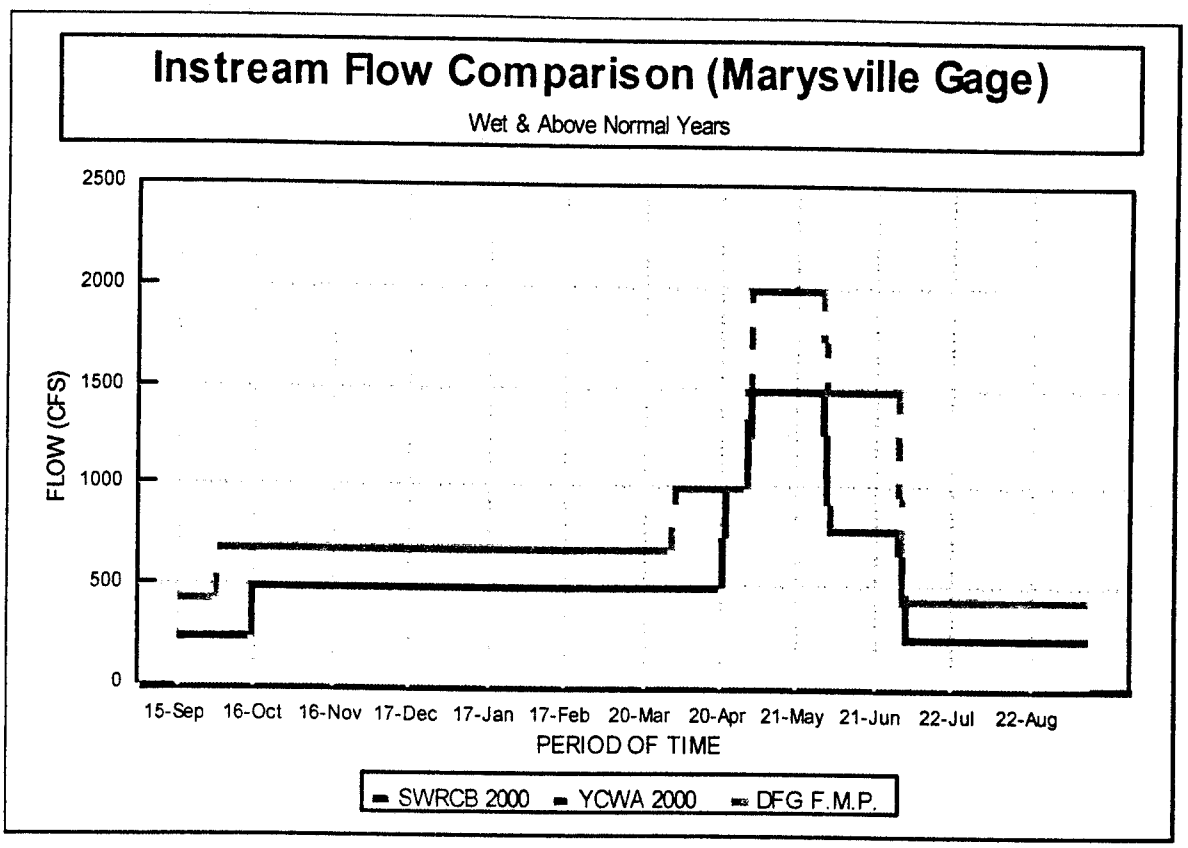
Total E y Production - New Colgate Pow use
Comparative Summary

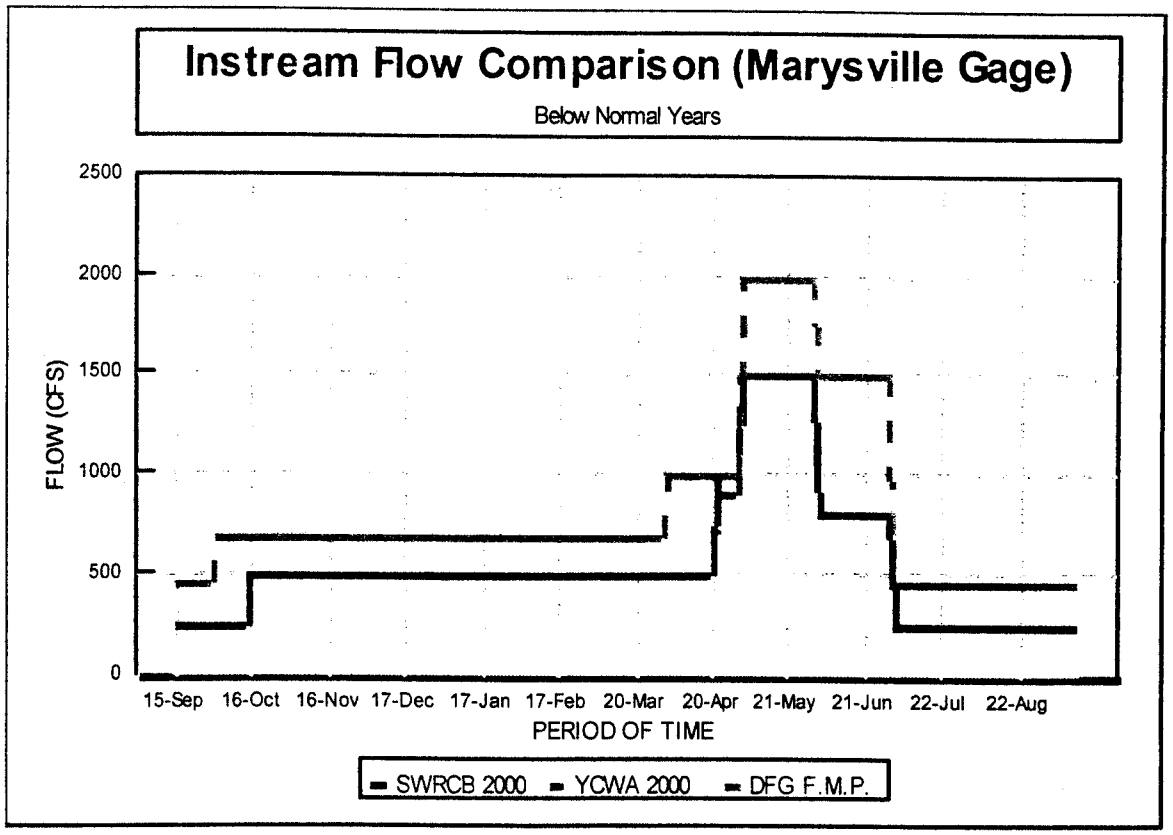
MONTH	MINIMUM QOUTA SCHEDULE (MWH)	SCENARIO 1 1965 YCWA/DFG AGREEMENT {period average} (MWH)	SCENARIO 2 YCWA PROPOSED INSTREAM FLOWS {period average} (MWH)	SCENARIO 3 SWRCB INSTREAM FLOWS {period average} (MWH)
January	81,700	111,581	104,360	100,422
February	81,700	125,873	122,634	117,789
March	81,500	128,097	107,669	106,455
April	81,700	118,493	121,158	123,125
May	82,000	155,709	171,817	182,886
June	82,100	135,064	143,243	149,858
July	37,700	156,323	143,486	139,667
August	38,200	117,383	110,656	108,049
September	38,900	62,423	59,297	57,842
October	39,300	40,467	42,043	42,714
November	39,500	49,916	52,245	51,426
December	37,800	87,144	87,352	86,226
TOTAL	722,100	1,290,439	1,265,962	1,266,460

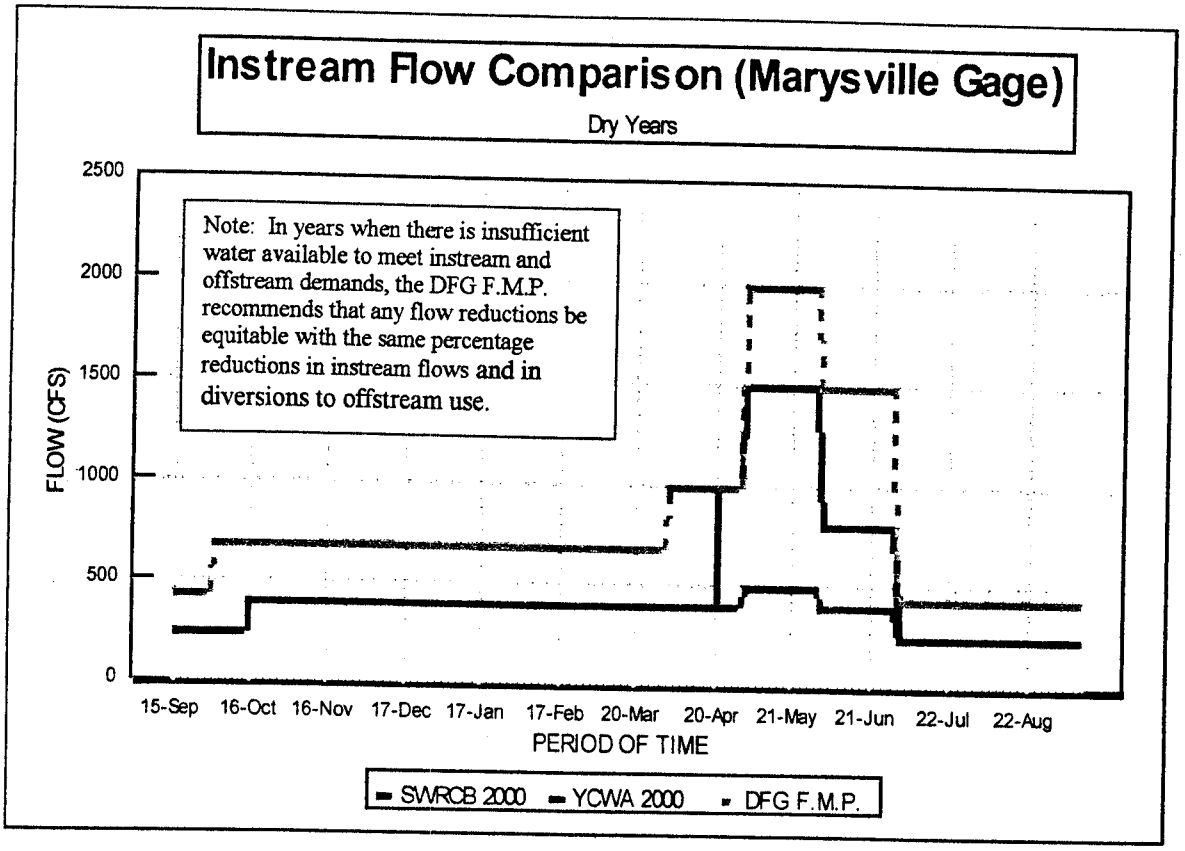


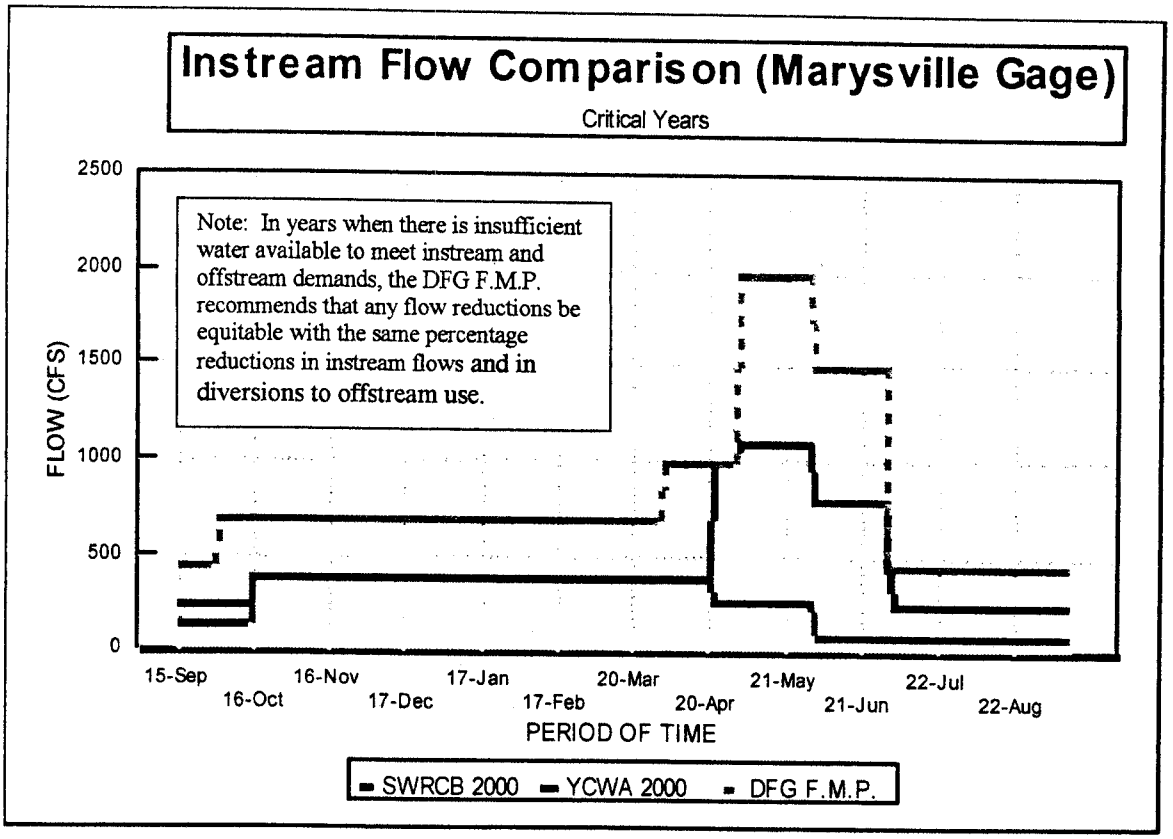
APPENDIX 5

MINIMUM INSTREAM FLOW COMPARISON GRAPHS


Instream Flow Comparison (Marysville Gage)
Wet & Above Normal Years
2500
2000
1500
1000
500
0
FLOW (CFS)
15-Sep
16-Oct
16-Nov
17-Dec
17-Jan
17-Feb
20-Mar
20-Apr
21-May
21-Jun
22-Jul
22-Aug
PERIOD OF TIME
SWRCB 2000
YCWA 2000
DFG F.M.P.


Instream Flow Comparison (Marysville Gage)
Below Normal Years
2500
2000
1500
1000
500
0
FLOW (CFS)
15-Sep
16-Oct
16-Nov
17-Dec
17-Jan
17-Feb
20-Mar
20-Apr
21-May
21-Jun
22-Jul
22-Aug
PERIOD OF TIME
SWRCB 2000
YCWA 2000
DFG F.M.P.


Instream Flow Comparison (Marysville Gage)
Dry Years
Note: In years when there is insufficient water available to meet instream and offstream demands, the DFG F.M.P. recommends that any flow reductions be equitable with the same percentage reductions in instream flows and in diversions to offstream use.
FLOW (CFS)
2500
2000
1500
1000
500
0
15-Sep
16-Oct
16-Nov
17-Dec
17-Jan
17-Feb
20-Mar
20-Apr
21-May
21-Jun
22-Jul
22-Aug
PERIOD OF TIME
SWRCB 2000
YCWA 2000
DFG F.M.P.


Instream Flow Comparison (Marysville Gage)
Critical Years
Note: In years when there is insufficient water available to meet instream and offstream demands, the DFG F.M.P. recommends that any flow reductions be equitable with the same percentage reductions in instream flows and in diversions to offstream use.
FLOW (CFS)
2500
2000
1500
1000
500
0
15-Sep
16-Oct
16-Nov
17-Dec
17-Jan
17-Feb
20-Mar
20-Apr
21-May
21-Jun
22-Jul
22-Aug
PERIOD OF TIME
SWRCB 2000
YCWA 2000
DFG F.M.P.