

State of California  
The Resources Agency

DEPARTMENT OF WATER RESOURCES  
Division of Operations and Maintenance

# **STATE WATER PROJECT ANNUAL REPORT OF OPERATIONS 1991**

**December 1997**

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State of California

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## Glossary

## Abbreviations and Units

The following abbreviations, commonly used throughout this report, are defined here.

AF	acre-feet
Banks	Harvey O. Banks Delta Pumping Plant
California Aqueduct	Governor Edmund G. Brown California Aqueduct
CVP	Central Valley Project
cfs	cubic feet per second
D-1485	Water Rights Decision 1485
DOI	Delta Outflow Index
DWR	Department of Water Resources
DO	dissolved oxygen
EC	electrical conductivity
ft	feet
Kv	kilovolt
KW	kilowatt
KWh	kilowatt-hour
LADWP	Los Angeles Department of Water and Power
MAF	million acre-feet
MW	megawatt
MWh	megawatt-hour
MWDSC	Metropolitan Water District of Southern California
PG&E	Pacific Gas and Electric Company
SCE	Southern California Edison
SDWA	South Delta Water Agency
SRI	Sacramento River Index
SWP	State Water Project
SWRCB	State Water Resources Control Board
USBR	United States Bureau of Reclamation

## ***Introduction***

The 1991 Annual Report of Operations for the SWP is divided into seven parts. The first two parts, "Highlights of 1991 Operation" and "Project Status in 1991," cover conditions and events of statewide significance. The following three sections cover water conditions, water operations, and energy operations in 1991. The sixth part, "Sacramento-San Joaquin Delta Operations," gives special emphasis to Delta operations, a key aspect of the SWP. The last part, "Project Operations by Field Division," provides further detail on operational conditions and activities for each field division as outlined on Map 1.

The report also includes an appendix, tabulating and describing Project operations in 1991.

## *Highlights of 1991 Operation*

During the last five years, 1987 through 1991, Californians have experienced one of the State's driest hydrologic periods. Thanks to water delivery systems now in place, the economic effects of this six-year drought have been somewhat mitigated. Costs of the drought have been high; agricultural land has been fallowed, hydroelectric energy production has declined, groundwater supplies have been depleted, winter-run Chinook salmon and striped bass populations declined significantly, agricultural unemployment rates have risen considerably, and local businesses primarily dependent on agriculture for sales have suffered.

Managing available water supplies during the drought involved activities designed to make the most beneficial use of water available to SWP. DWR initially structured its plans for water conservation, storage, and delivery capabilities according to the concept of a firm yield, or the quantity of water that can be made available on a firm annual basis to municipal and industrial users and to agricultural users during a drought period. Mainly because of escalating costs of large-scale water projects, all facilities necessary to manage water this way had not been built. DWR changed its methods of determining delivery amounts and the concept of firm yield was replaced by the concept of variable yield.

Operating on the basis of a variable yield is designed to make efficient use of available water supplies during a drought. Frequent reevaluation and modifications to delivery capabilities are made as water supplies, hydrologic conditions, reservoir storage levels, and amounts of water needed for environmental protections change. In changing the basis of operations from a firm yield to a variable yield, DWR also changed its activities for water management and developed programs to compensate for the lack of storage facilities. Those programs include transferring, exchanging, loaning, storing, purchasing, and carrying over water for delivery at a later date. Total requests for delivery of entitlement water in 1991 were about 3.5 MAF. SWP sent initial approval letters in November, 1990, reflecting a 65 percent cut in agricultural deliveries and a 15 percent cut in M&I deliveries. These initial approvals totaled about 2.3 MAF.

In 1991, California began its first statewide water transfer program, the Drought Water Bank. Established through Executive Order by Governor Wilson in February 1991, the bank was administered by the department.

Of the 862,040 AF of water transferred to the 1991 water bank, 167,012 AF was used for environmental protection of the Delta.

Water available for sale from the 1991 bank totaled about 695,000 AF, including about 265,000 AF allocated to the SWP for carry-over storage to meet SWP's water requirements in early 1992.

DWR negotiated the transfer of 490,462 AF of water in 1991. This included three transfers of SWP entitlement water, a first delivery of entitlement water to Santa Barbara Flood Control and Water Conservation District, 13 transfers involving non-project contractors, and 14 transfers of water purchased from the 1991 Drought Water Bank.

Programs permitting agencies to exchange, loan, store, and purchase water from the SWP allowed contractors to pump water directly into the California Aqueduct. To preserve water quality, DWR normally does not allow water to be pumped directly into the aqueduct. But because of the severity of the drought, DWR approved the pump-ins after implementing a comprehensive system to check and monitor the quality of water introduced into the aqueduct. Pump-in agreement details are discussed further in this report under "*Water Deliveries and Aqueduct Operations*".

In 1990, eight long-term contractors carried over about 27,000 AF of water, which DWR delivered in 1991. In 1991 seven long-term contractors requested and, DWR approved, 92,000 AF of 1991 entitlement water to be delivered in 1992.

DWR and USBR declared balanced Delta water conditions twice during 1991: from January 1 to March 5, and from April 15 through December 31. This was the eighth consecutive year in which balanced water conditions were declared. Balanced water conditions exist when upstream reservoir storage releases, plus other inflows, approximately equal the water supply needed to (1) satisfy Sacramento Valley and the Sacramento-San Joaquin Delta in-basin needs, including Delta water quality requirements, and (2) meet export needs. During balanced water conditions, DWR and USBR adjust their reservoir storage releases and Delta exports to enable each agency to meet its share of in-basin uses and Delta outflow.

There are nineteen pumping plants along the SWP. These include two State-federal facilities, one federal facility, and sixteen State facilities. Plants used for federal pumping are Banks, O'Neill, Gian-

elli, and Dos Amigos. A list of all project pumping is shown on Table 1.

Energy resources totaled 7,444,990 MWh which includes generation of 3,625,225 MWh of energy at SWP locations and 136,934 MWh of federal generation at Gianelli (see Figure 4). Energy loads of 7,308,056 MWh include sales of 2,090,862 MWh, 4,980,166 MWh used to deliver water to SWP contractors, and 222,333 MWh of losses (see Figure 6).

Water was delivered from SWP facilities to fifty-two agencies totaling 2,225,227 AF. This amount is less than 50% of the total State and federal water deliveries from the SWP in 1990. Total State contractor deliveries were 1,129,627 AF; including 545,016 AF of entitlement water and 584,611 AF of other water; excluding Joint Facilities and prior water right deliveries. See the "*Water Deliveries and Aqueduct Operations*" section for more details on water deliveries.

## *Project Status in 1991*

### *Project Facilities*

The SWP conserves water for distribution to much of California's population and to irrigated agriculture. It also provides flood control, water quality control, electrical power generation, new recreational opportunities, and enhancement of sport and wildlife.

SWP facilities in operation during 1991 included: 28 water storage facilities with a gross capacity of 6,768,792 AF, seven power plants with a total output capacity of 1,686 megawatts (MW); 16 pumping plants housing 112 units with a total motor rating of 2,768 MW; and 537 miles of aqueduct. A detailed description of aqueduct flow is as follows.

The SWP begins with three small lakes on the Feather River tributaries, Lake Davis, Frenchman Lake, and Antelope Lake. The branches and forks of the Feather River flow into Lake Oroville, SWP's principal reservoir with a capacity of about 3.5 MAF. From Oroville, water flows through three hydroelectric powerplants, then down the Feather River and Sacramento River before reaching the Delta. From the northern Delta, water is supplied to Napa and Solano counties through the North Bay Aqueduct. Water is supplied to Alameda and Santa Clara counties through the South Bay Aqueduct. Banks Pumping Plant lifts water into Bethany Reservoir. It is then lifted by the South Bay Pumping Plant into the South Bay Aqueduct. Most of the water from the Bethany Reservoir, however, flows into the California Aqueduct. From O'Neill Forebay, part of the water is pumped through the Gianelli Pumping-Generating Plant for storage in San Luis Reservoir until needed. DWR's share of storage in the reservoir is 1,062,183 AF.

Water not stored in San Luis Reservoir continues its flow south down the valley and is raised 1,069 feet by four pumping plants, Dos Amigos, Buena Vista, Teerink, and Chrisman. In the southern San Joaquin Valley, the Coastal Branch Aqueduct serves agricultural areas west of the California Aqueduct. At the Tehachapi Mountains, Edmonston Pumping Plant raises the water 1,926 feet to enter 8.5 miles of tunnels and siphons. Once the water has crossed the Tehachapi Mountains, it flows through the California Aqueduct into the Antelope Valley. The California Aqueduct then divides into two branches, the East Branch and West Branch. The East Branch carries water through the Antelope Valley into Silverwood Lake. From Silverwood Lake, the water enters the San Bernardino Tunnel and drops 1,418 feet into

Devil Canyon Powerplant, then flows to Lake Perris, SWP's southernmost reservoir. Water in the West Branch flows through the Warne Powerplant into Pyramid Lake. From Pyramid Lake it flows through the Angeles Tunnel and Castaic Powerplant into Castaic Lake, terminus of the West Branch. For the location of facilities cited here, see Map 3.

To collect and store water for deliveries in the future, SWP operates a complex system of 22 dams and reservoirs. Lake Oroville and San Luis Reservoir are the primary conservation facilities. The remaining 20 dams and reservoirs are used primarily to regulate the conserved supply into water delivery patterns designed to fit local needs. Of those 20 the five largest are Lake Del Valle, located in Alameda County near Livermore; and Pyramid Lake, Castaic Lake, Silverwood Lake, and Lake Perris, located near the metropolitan areas of southern California, where water supplies are primarily imported. Information about those reservoirs, including amounts of unimpaired runoff to Lake Oroville and storage levels for SWP's conservation and other storage facilities are summarized in this report.

In 1991, DWR was involved in planning one additional conservation surface reservoir, Los Banos Grandes, and developing a significant groundwater storage program, Kern Water Bank. Los Banos Grandes, authorized by the California Legislature in 1984, is designed to be a primary south-of-the-Delta water storage facility for DWR. To be effective, Los Banos Grandes must be linked with an efficient Delta transfer facility. The facilities, consisting of a dam, an off-stream storage reservoir, several saddle dams, and two pumping-generating plants, will be located in Merced County on Los Banos Creek. The project also will include a pumping-generating system for filling the reservoir from the California Aqueduct and for recovering energy when releases are made.

The Kern Water Bank, a subsurface reservoir, is designed to store SWP water in the ground during wet years. Later, during dry periods, water can be with-drawn by pumping to the California Aqueduct or substituted for entitlement water that ordinarily would be delivered to Kern County. The water bank currently consists of eight separate projects or elements. The initial element, the Kern Fan Element, was proposed by DWR. To build the Kern Fan Element, DWR plans to construct recharge basins and extraction wells and use similar facilities that have been constructed as part of the La Hacienda Groundwater Program. DWR signed a contract for purchasing re-

charged ground-water from La Hacienda, Inc., in 1990. To extract the water, DWR rehabilitated existing wells and constructed conveyance facilities.

### ***Outages and Limitations***

Major outages, construction, and operating limitations of SWP facilities during 1991 were:

#### ***January***

- Assembly of Dos Amigos Pumping Plant Unit No. 6 continued with installation of the thrust bearing.
- Due to continued loss of head, units 1, 2, and 3 at Hyatt were placed on 70 MW restriction on January 3 and Units 2, 4, and 6 were made available for emergency use only.
- The Santa Ana Pipeline was made unavailable on January 18 for draining and inspection. The inspection was completed and the pipeline refilled by January 28.

#### ***February***

- Wheeler Ridge Maricopa Water Storage District received approval from DWR to install pipelines on state right-of-way to allow for pumping local well water into the aqueduct for its own use.
- Heavy rains on February 28 washed out a 2 foot by 10 foot section of berm on the California Aqueduct at mile post 318.30.
- At Hyatt, the number 2 penstock was dewatered on February 7 to replace the turbine shut-off valve seat "O" rings on Units 4, 5, & 6.

#### ***March***

- Hyatt's No. 2 penstock continued to be under clearance for replacement of the turbine shut-off valve seat "O" rings on units 4, 5, and 6.

#### ***April***

- Hyatt No. 2 penstock was returned to service, having been out of service since February 7. Due to rising lake elevation, Hyatt units 2 and 4 were made available only as generators.

#### ***May***

- Work began on the O'Neill Dam modification.
- Hyatt unit No. 3 was out of service for annual maintenance.
- Porter Tunnel was taken out of service on May 5 for pump down and inspection. The tunnel was put back in service on May 8.

- Pipe joints on the Santa Ana Pipeline were excavated to allow the design personnel to complete the design of the "Y" section for the pipeline to the new Devil Canyon Afterbay.

#### ***June***

- Several cracks in the canal liner at mile post 108.3 were drilled and grouted.
- Installation of a radial gate at check 9 was completed.

#### ***July***

- Buckling of a 30-foot section of canal liner at mile post 399.57 necessitated a drawdown of pool 65 for inspection and repair.
- Rotor coupling bolts on Unit No. 1 at Gianelli Plant sheared during startup on July 5. Unit remained out of service throughout 1991.
- Leaks in penstock No. 2 of the Devil Canyon Plant caused it to be drained for repairs.

#### ***August***

- Two Hyatt intake shutters were removed on August 12 for water temperature control.
- Pumping on the East Branch was curtailed to less than 560 cfs due to the drawdown of Pools 48 to 51 to repair damage in Pool 48.
- The USBR approved new pump-in facilities in the San Luis Field Division. Forty-four wells were discharging into the aqueduct to date.

#### ***September***

- The last temperature control shutters were removed from the Hyatt intake penstocks.
- The test excavation sites at the Santa Ana Pipeline were refilled.
- A plant fire at Pearblossom caused a brief outage.
- Kelly Ridge Powerplant was made unavailable for two weeks for annual inspection.

#### ***October***

- Santa Nella Water District repaired a leak in its 30-inch water supply pipe located in the aqueduct bank near Check 13.
- The O'Neill Dam Modification contractor completed excavation of berm foundations and the placement of compacted material.
- Crews grouted and sealed grouting holes at mile post 329 on the California Aqueduct.

### *November*

- A water chiller was rented for use at the Feather River Fish Hatchery to cool water for salmon eggs.
- Pools 65 and 66 were drained for a two week outage to perform liner repair work.

### *December*

- Due to decreasing water temperatures, the chiller at the Feather River fish hatchery was shut down and removed.
- The O'Neill Dam Modification contractor completed contract work.

## *Water Supply Conditions*

In a typical year, California receives about 193 MAF of water as rain or snow. Of this amount, about 107 MAF falls in the northern half of California. However, about 75 percent of the demand for water originates in the southern half of California. About 30 MAF runs off into streams or rivers and eventually flows into the Sacramento-San Joaquin Delta, the primary source of SWP's water supply.

Total runoff in the Sacramento River Basin in northern California has been as little as 5.1 MAF in 1977, and as much as 38 MAF in 1983 (the 50-year average is about 18 MAF). This runoff constitutes the primary SWP water supply.

As drought conditions continued for a fifth year, precipitation at the start of the water year in October and November 1990 was sparse at slightly more than 30 percent of average for both the State and the Sacramento Basin. Statewide precipitation averaged only 28 percent of normal by January 1, the midpoint of the rainy season. By the end of January, the only areas of the State with precipitation over 30 percent of average were the Colorado Desert and South Coast areas. The Sacramento and San Joaquin basins received only 12 and 10 percent of monthly average, respectively. The season totals at the end of January were 23 and 21 percent, respectively. March was a wet month, however, with about three times the average amount of precipitation, rising to 292 percent of normal (the wettest March of record).

Sacramento Basin precipitation was nearly as high at 286 percent of normal.

Statewide precipitation increased to 75 percent of average by April 1, 1991. Nevertheless, the heavy March precipitation was not enough to overcome the effects of successive dry years in many areas of the State, including the vital watersheds within the Sacramento River Basin. The 1990-91 water year ended with statewide precipitation at 76 percent of average statewide, and 65 percent of average in the Sacramento Basin.

The water year classification is used to set water quality and flow requirements for the Delta according to standards included in D-1485. SWP, in cooperation with the CVP, works to ensure those requirements are met by monitoring water quality and modifying releases and exports when necessary. As reported in the May 1, 1991 edition of *Water Conditions in California*, the amount of unimpaired runoff in the Sacramento River basin for the 1990-91 water year was forecast to be 8.7 MAF, or 46 percent of average. Based on the 1990-91 water year forecast, the water year was classified as *"critical"* for fish and wildlife and for agricultural, municipal, and industrial uses. The actual amount of unimpaired run-off recorded for the year was 8.4 MAF or 44 percent of average

## Water Operations

### Reservoir Operations

Lake Oroville and San Luis Reservoir are the two conservation facilities for SWP water supplies. Table 8 and Table 13 summarize the operations of these reservoirs during the 1990 and 1991 calendar years.

Lake Oroville began 1991 with 987,094 AF of storage, 974,443 AF less than it held at the beginning of 1990. Computed inflow peaked in March with a total for the month of 420,962 AF. Storage for January through June was considerably below the same period for 1990. Inflow during July through December that exceeded the inflows for the same period in 1990 brought storages to levels higher than the same period in 1990. Storage in Lake Oroville peaked on June 2 at 1,687,463 AF (48 percent of normal maximum operating capacity) and dropped to 1,265,734 AF (38 percent of normal maximum operating capacity) by December 31. The net effect of operations and water conditions at Lake Oroville resulted in a storage change of 278,640 AF.

At the beginning of 1991, Lake Del Valle held 29,527 AF (74 percent of normal maximum operating capacity). As result of March storms, described above, storage reached maximum levels prompting releases of 3,653 AF to Arroyo Valle. Almost all of Lake Del Valle's natural inflow for the year, 10,583 AF, occurred in the month of March.

At the start of 1991, San Luis Reservoir held 479,478 AF, 24 percent of its normal maximum operating capacity (2,027,835 AF); the SWP held only 5,555 AF of its maximum operating capacity (1,062,180 AF). SWP had borrowed 100,000 AF from CVP in October and November, 1990 and repaid it in March, 1991. SWP storage at the end of 1991 increased to 409,583 AF. End-of-year federal storage was 400,722 AF, for an end-of-year total of 810,305 AF.

Principal SWP southern reservoirs (Pyramid, Castaic, Silverwood, and Perris) have a combined maximum operating storage capacity of 701,320 AF. At the beginning of 1991 the total combined storage of these reservoirs was 530,618 AF (76 percent of maximum operating capacity). At the end of 1991, the total combined storage had increased to 635,762 AF (91 percent of maximum operating capacity) for a storage change of 105,144 AF.

The following tabulation compares normal operating capacity in the principal SWP reservoirs with year-end storage for 1990 and 1991:

Reservoir	Normal Maximum Operating Capacity	End-of-year Storage 1990	End-of-year Storage 1991
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Lake Oroville	3,537,577	987,094	1,265,734
Lake Del Valle	40,000	29,527	24,995
San Luis Reservoir	1,062,000	479,478	810,305
Pyramid Lake	171,200	163,489	144,281
Silverwood Lake	74,970	54,924	71,949
Lake Perris	131,450	105,625	124,055
Castaic Lake	323,700	206,580	295,477
Totals	5,340,897	2,026,717	2,736,796

### Water Deliveries and Aqueduct Operations

Generally, water diverted from the Sacramento-San Joaquin Delta is delivered to SWP storage facilities and to contractors through Banks Pumping Plant and Barker Slough Pumping Plant, for a variety of beneficial uses. In addition to delivering entitlement water to long-term water supply contractors, SWP transports water to other public agencies through exchanges or purchases, provides water for wildlife and recreational uses, and conveys water to meet local water rights agreements. Specific information about water deliveries made to long-term contractors and other agencies during 1991, and from 1962 through 1991, has been organized in Table 2.

In some instances, contractors may delay delivery of entitlement water to another year or request early delivery of entitlement water that normally would be delivered in the future. In 1991, a total of 27,223 AF (27,075 AF of 1990 carryover and 148 AF of advance) of 1991 and 1992 entitlement water was delivered to ten contractors.

Make-up water is allocated to contractors according to Article 12(d) and Article 14(b) of the long-term water supply contracts. No make-up water as defined by Article 12(d) or Article 14(b) was delivered in 1991. Long-term contractors have earned credits for make-up water according to Article 12(d) and Article 14(b) of the long-term contracts. However, the exact amount of those credits had not been fully negotiated by the end of 1991.

Under provisions of their water supply contracts, South Bay and San Joaquin Valley contractors may reduce entitlement water deliveries during years in which above-average amounts of local water are available and increase deliveries by an equal amount in later years. No additional credits for wet-weather water were accumulated during 1991.

For several years, DWR has offered contractors the opportunity to carry over for delivery during the next year a portion of their entitlement water approved for delivery in the current year. The carry-over program was designed to encourage the most effective use of water, and to avoid obligating the contractors to use or lose the water by December 31. Because operational constraints may change from year to year, an agreement in which the conditions of the ap-

proval are listed is signed each year with participating contractors. Contractors were informed of DWR's willingness to consider requests to carry over 1991 entitlement water to January, February, and March 1992. The total amount of 1991 entitlement water carried over for delivery in 1992 was 92,282 AF.

During 1991, SWP provided water service to 52 agencies, including 27 long-term water contractors. SWP facilities were used to convey non-project water for other agencies, including the CVP. In addition, SWP facilities were used to deliver water transfers, water purchased from the newly established Drought Water Bank, and from one agency to another. The 1991 Drought Water Bank was established through Executive Order by Governor Wilson in February 1991. Transfers were accomplished according to agreements negotiated with USBR throughout the year as well as with participants of existing three-party contracts for the use of the Cross Valley Canal.

The Cross Valley Canal in Kern County is a facility used by nine water or irrigation districts and two counties to obtain water from the USBR and convey it via the California Aqueduct. Those districts and counties include Ducor, Hills Valley, Lower Tule River, and Pixley Irrigation districts; Kern-Tulare, Rag Gulch, and Tri-Valley Water districts; and the counties of Fresno and Tulare. All contractors except Ducor Irrigation District received USBR water either through a water exchange with another agency or through deliveries made from the canal. That water was made available by DWR by conveying USBR water through the California Aqueduct directly from the Delta and from storage in San Luis Reservoir.

Total Project (State and federal) deliveries for 1991 totaled 2,225,227 AF. This total includes State contract deliveries of 1,129,627 AF, federal deliveries of 528,323 AF, Oroville Complex diversions of 565,395 AF, and Upper Feather River deliveries of 1,882 AF. Contract deliveries include 545,016 AF of entitlement and entitlement-related water to 27 long-term contractors. In addition, 584,611 AF of other water, including 3,521 AF of unscheduled surplus water was delivered. A graph showing the highest and lowest annual total deliveries from SWP facilities is shown in Figure 1. Amounts of 1991 water deliveries are shown by field division on Map 2, and include entitlement water, permit water, local supply, recreation, purchases, wheeling, and water transfers. Totals by agency are shown in Table 2.

DWR entered into nine "pump-in" agreements with its SWP contractors (primarily with Westlands Water District and Kern County Water Agency) to help alleviate affects of the fifth year of drought. These agreements set forth provisions for the contractors to introduce local groundwater into the Cali-

fornia Aqueduct for use in other reaches of the aqueduct. Those groundwater amounts appear as negative deliveries in the delivery tables of this report. In addition, the agreements allowed the contractors to introduce groundwater into the aqueduct slowly over a period of time and build up a "storage account." An equal quantity of water was returned to the contractors over a period of time to meet peak agricultural demand. The contractors were required to limit aqueduct inflow to certain specified amounts, adhere to strict water quality standards, contribute to evaporation losses, and pay contract development and use-of-facility charges.

In 1991, DWR advanced a total of 124,097 AF (Water typed "SWP Del") of SWP water from project supplies to two contractors in the San Joaquin Valley Area and one contractor in the Delta Field Division for agricultural use. By December 31, 1991, 103,002 AF of water had been repaid by the contractors through a program to return pumped groundwater into the California Aqueduct.

The following table is a breakdown of contract deliveries in 1991:

Entitlement Water		Other Water	
M & I	429,281	Purchased	25,589
Advance	148	General Wheeling	39,349
Ground Water	69,199	Local Supply	10,855
Bypass	15,458	Recreation	4,879
Carryover	27,075	Transfer	4,577
Transfer	4,097	Vallejo Permit	14,322
Benecia	2,984	Unscheduled	3,521
Vallejo	871	91 Drought Bank	344,828
		SWP Del.	124,097
		Local In/Out	3,164
		Exchange	9,430
<b>Total</b>	<b>545,016</b>	<b>Total</b>	<b>696,533</b>
<b>Total Water</b>		<b>1,129,627</b>	

Significant operational activities during 1991 were as follows:

#### January

- Thermalito Afterbay diversions were discontinued for the winter season.
- The Santa Ana Pipeline inspection was completed and filling operations were completed by January 28, when the pipeline was available for future water deliveries to Perris.

#### February

- Pumping into Lake Del Valle from the South Bay Aqueduct totaled 5,775 AF; the highest month since April of 1988.

- The D-1485 water quality standard for mean daily chloride of 250 mg/l at the Contra Costa Canal Intake was exceeded for one day, on February 20.
- Wheeler Ridge-Maricopa Water Storage District received approval from DWR to install pipelines on State right-of-way to allow for pumping of local well water into the California Aqueduct.

### ***March***

- Heavy precipitation was reported in all field divisions of the SWP.
- Excess water conditions were declared by SWP and CVP on March 5, 1991.
- SWP repaid the loan of 100,000 AF of water to USBR which was made in October and November of 1990.
- 16.61 inches of rainfall was recorded at the Oroville Dam gauge, a March record covering data since 1959.
- Flood-water inflow into San Luis Canal totaled 3,365 AF.
- The water quality standard for mean daily chloride of 250 mg/l at the Contra Costa Canal Intake was exceeded March 6 through March 12.
- Wheeler Ridge-Maricopa Water Storage District pumped groundwater from 12 wells into the Aqueduct.

### ***April***

- Four more wells were approved for use by Wheeler Ridge-Maricopa Water Storage District to extract groundwater for pumping into the Aqueduct under the emergency pump-in program.

### ***May***

- The San Antonio turnout modification increased the capacity to 100 cfs and allowed deliveries of 4,518 AF to the City of San Francisco.
- DWR's "pump-in" agreements with SWP contractors continued through May.

### ***June***

- Lake Oroville lost 12 feet in water surface elevation (the first drop since January of this year), dropping to 1.5 million AF of storage.

- DWR's "pump-in" agreements with SWP contractors continued.

### ***July***

- Lake Oroville dropped 14 ft in water surface elevation, finishing the month at about 1.45 MAF of storage.
- In the San Luis Field Division, wells drilled adjacent to the canal liner at Milepost 108.3L were pumped with bentonite grout, successfully stopping a leak.

### ***August***

- Approvals for new pump-in facilities were received from the USBR. Construction of these pump-in facilities began at several sites.
- Forty-four wells discharged into the Aqueduct by the end of August.

### ***September***

- All shutters were removed from Hyatt Powerplant intake No.'s 1 & 2 for temperature control. Water is now taken from the lowest possible elevation in the lake except for the river outlet.
- At the request of the MWD, DWR staff conducted a copper sulfate treatment in the Aqueduct from Check 59 to Check 66 to control aquatic organisms.

### ***October***

- Water deliveries to the San Francisco Water District began on October 15.
- In the San Luis Field Division, two new wells were added to the Non-Project Water Conveyance Project.

### ***November***

- Both intake structures at Hyatt remained without shutters while water temperatures of the Feather River at the Fish Hatchery continued to be a problem.
- A chiller was rented to provide water of cooler temperature to the fish hatchery.

### ***December***

- Both intakes at Hyatt remained without shutters while river water temperatures at the Fish Hatchery improved.
- The rented chiller at the fish hatchery was shut down and returned to the vender.

## *Energy Operations*

### *Energy Resources*

Energy generation from SWP's seven hydroelectric plants (Hyatt, Thermalito, Gianelli, Warne, Castaic, Alamo, and Devil Canyon) during 1991, totaled 1,995,088 MWh, as illustrated in Figure 2.

The SWP receives energy under contract from five small hydroelectric facilities (total capacity of 30 MW) owned and operated by MWDSC. In 1991, these plants furnished 150,561 MWh of energy to the SWP. DWR has exchange arrangements with SCE and LADWP to provide transmission of this energy.

The DWR-SCE Power Contract has been in effect since April 1983. Under this contract, part of the Hyatt Thermalito Power plants' generation and all of the output of Devil Canyon Power Plant and Alamo Power Plant are delivered to SCE. The energy is generally delivered during on-peak periods and a greater amount of energy is returned during off-peak periods to compensate for the higher value of energy during on-peak periods. A total of 803,207 MWh was returned to the SWP along with 2,310,201 MWh of additional energy.

Long term contracted energy purchases, such as TERA Corp. and MWD Hydro are itemized separately in Table 3. Other purchases totaled 1,139,069 MWh from various utilities, such as Montana Power Company and Arizona Public Service Company.

### *Energy Loads*

Energy load data (total energy used by the SWP) is summarized in Table 4, Figure 5, and Figure 6. For the purposes of balancing energy resources and loads, this report itemizes those amounts required to meet SWP supplies and demands from those amounts required to meet total DWR supplies and demands. Besides Project energy loads of 4,980,166 MWh, total DWR energy loads include sales of 2,090,862 MWh, losses of 222,333 MWh, and deviation adjustments of 14,695 MWh.

The San Joaquin Field Division, which includes the largest number of plants and the highest combined lift, accounted for over half of the total Project energy load. The Edmonston Pumping Plant, in the San Joaquin Field Division, used 1,804,215 MWh with peak pumping occurring in June and December. Project energy loads also include amounts that DWR is committed to supplying to agencies such as SCE., LADWP., PG& E., and the Bonneville Power Authority.

In 1991, DWR had contracts with 30 utilities for the sale of excess power. DWR sold power to 12 of these agencies resulting in revenues of over \$48 million. The largest sale was 637,045 MWh to Sacramento Municipal Utility District.

## *Sacramento - San Joaquin Delta Operations*

The Sacramento-San Joaquin Delta, the crossroads of California's water system, provides an estimated one-half of the State's water supply. In addition, the Delta is an estuary, a constantly changing area where tidal and river currents meet, and where salinity is between the extremes of brackish and fresh waters. The estuary provides a habitat for fish and wildlife, including waterfowl on the Pacific Flyway.

Many of the problems facing the Delta today have plagued the area for many years, including, for example, problems with salinity intrusion and oxidation of peat soil. Originally a tidal marsh-land covered with tules, the Delta, during dry summer months, has been subject to intrusions of salty ocean water from the San Francisco Bay.

Today, dams upstream of the Delta, including SWP's Oroville Dam and CVP's Shasta Dam and Folsom Dam, help control the intrusion of salt water by releasing fresh water into the Delta during dry periods in summertime. However, problems with salinity in the Delta still exist and determining responsibility for and correcting the problems is not easy.

Since the project began operating in 1965, DWR has been actively involved in protecting Delta resources. In 1991, DWR reviewed its Delta water management programs in light of the Governor's California water policy. Particular attention is being paid to developing both long-term and interim solutions to solving problems concerning water quality, fisheries, wildlife, wetlands, subsidence, and erosion.

See Chapter 11 of DWR's Bulletin 132-92, "Preserving Delta Resources," and Chapter 12, "Managing Delta Resources," for additional information about DWR's Delta water management programs and the effects of the governor's water policy on those programs.

### *Delta Outflow Index*

Direct measurements of net Delta outflow are impractical because of huge tidal flows. However, since net outflow is one of the primary factors in controlling Delta water quality, a calculated value, known as

the Delta Outflow Index (DOI), has been developed. The DOI represents the daily mean net flow of Delta water past Chipps Island. Table 6 shows the daily DOI for 1991.

Several surface inflows, notably the Cosumnes, Mokelumne, and Calaveras Rivers, and the Yolo Bypass flood control channel, are not included. Furthermore, the precipitation and channel depletion factors in the calculation are based on daily increments of long-term averages, whereas Delta inflow estimates represent mean flows for that entire day. A comparison of Delta Inflow and DOI is plotted on Figure 7. Gross channel depletion is the sum of evapo-transpiration and net increase in soil moisture of Delta lands plus evaporation from Delta channels. The DOI is calculated daily from the sum of Sacramento River inflow, San Joaquin River inflow, and Sacramento Treatment Plant discharge minus the Delta consumptive use estimates and the water exported by the SWP, CVP, and Contra Costa Canal. The Delta consumptive use variable used in the DOI calculation is based on daily increments of long-term averages. Daily inflow estimates are based on either the daily mean of hourly measurements, or on an instantaneous flow measurement that represents the entire day.

The 1991 daily DOI averaged only 5,883 cfs for the year which was similar to the 1990 daily average. The greatest mean monthly and daily DOI's occurred in March, at 17,325 cfs and 40,302 cfs. High flows were generated during the 30 day period of storm and snowmelt inflow (March 6 through April 4). They provided over one quarter of the year's total outflow (563,932 cfs days) and generated the only mean daily flow rates over 10,000 cfs (25 days) of which 10 days flowed at over 20,000 cfs. The lowest monthly DOI occurred in August (3,137 cfs).

D-1485 standards set a minimum DOI at Chipps Island for Striped Bass survival. All DOI and river flow standards were met in 1991.

# Project Operations by Field Division

## Oroville Field Division

### Water Storage

SWP water storage facilities in the Oroville Field Division include Lake Oroville, Thermalito Forebay and Afterbay (Oroville-Thermalito Complex) and the upper Feather River reservoirs Lake Davis, Frenchman Lake, and Antelope Lake.

The Upper Feather River Reservoirs have a combined capacity of 162,000 AF. None of these reservoirs spilled in 1991. Monthly operations for the three upper Feather River reservoirs are presented in Table 7. The table below compares storage capacity with the largest end of month storage for each reservoir for the last five years:

	Antelope	Frenchman	Davis
	(all values in acre-feet)		
Capacity	22,566	55,477	84,371
1991	(May) 22,048	(Apr.) 22,590	(Apr.) 48,902
1990	(May) 22,007	(Apr.) 28,207	(Apr.) 55,713
1989	(May) 23,125	(Apr.) 37,031	(Apr.) 61,015
1988	(Apr.) 16,344	(Apr.) 32,002	(Jan.) 55,043
1987	(May) 19,285	(Apr.) 41,909	(Apr.) 69,815

The total amount of unimpaired runoff to Lake Oroville for the 1990-91 water year totaled only about 2.1 MAF, 47 percent of average. Because of the low storage at the beginning of 1991 and the small amount of runoff, storage peaked at only 1,691,870 AF (or 48 percent of normal maximum operating capacity) on June 2, 1991, and declined to 1,265,734 AF (or 36 percent of normal maximum operating capacity) by December 31, 1991.

Storage during the first half of 1991 remained below levels for the same periods in 1990. However, because water was retained in Oroville when water purchased for the Drought Water Bank was used to fulfill deliveries, storage for the last half of 1991 remained above storage for the same period in 1990.

Lake Oroville's computed inflow is tabulated in Table 8 and plotted along with releases, diversions, and storage withdrawals on Figure 11. A ten-year historical summary of Lake Oroville's storage and inflow is illustrated on Figure 12.

Water temperatures on and below the lake's surface are monitored very closely throughout the year at various locations around the lake. Two intakes to the powerplant have shutters that control the depth from which water enters the plant. Temperatures of water being released can be controlled by adding or removing shutters as necessary. An illustration of

water temperature and intake operation is shown on Figure 14. Further discussions on water temperature operations are detailed in "Water Deliveries and Aqueduct Operations."

### Water Deliveries

Project water stored in the Upper Feather Area Lakes flows into Lake Oroville through the North and Middle Forks of the Feather River. Contract deliveries in 1991 totaled 7,430 AF to two agencies, Last Chance Creek Water District and Plumas County Flood Control and Water Conservation District. Non-project deliveries (prior water rights) were made from Lake Davis and Frenchman Lake totaling 1,882 AF.

Water stored in Lake Oroville is released into the Thermalito Diversion Dam Pool, from which specified quantities are released into both the Feather River and the Thermalito Power Canal. The Power Canal supplies water first to the Thermalito Forebay and then to Thermalito Afterbay. From the Thermalito Afterbay, additional water is released to the Feather River and several local distribution systems used to deliver water to prior water right holders. These deliveries are collectively called the Feather River Service Area (FRSA) diversions and flow through the Sutter-Butte Canal, Richvale Canal, Sunset Pumps, Western Canal Lateral, Western Canal, Tudor Mutual, Garden Highway, Plumas Mutual, and Palermo Canal outlets. FRSA diversions are not considered SWP benefits, as they predate the SWP construction, and would have occurred in the absence of the SWP to the limit of available natural river flows. Nearly all FRSA diversions are for agricultural use. FRSA diversion totaled 556,261 AF in 1991, down nearly 300,000 AF from 1990. FRSA diversions are detailed below:

Sutter Butte Cana	269,132
Richvale Canal	47,312
Sunset Pumps	19,678
Western Canal Lateral	2,762
Western Canal	186,874
Tudor Mutual	2,756
Garden Highway	11,811
Plumas Mutual	9,621
Palermo Canal	6,315
Total In AF	556,261

A comparison of 1990 and 1991 Diversion Dam, Forebay, and Afterbay water surface elevations and storages is presented in Table 9.

## ***Delta Field Division***

### ***Water Storage***

The Delta Field Division consists of the North Bay Aqueduct, the South Bay Aqueduct, and California Aqueduct from Clifton Court Forebay to Check 12. Water is stored at Clifton Court Forebay, Bethany Reservoir, and Lake Del Valle.

Project water flows from the Delta into Clifton Court Forebay through the Clifton Court control gates. A schedule of daily gate operation is published in the “SWP Monthly Report of Operations.” Monthly inflows to Clifton Court Forebay along with corresponding storage changes are shown in Table 12.

Releases from Lake Del Valle usually occur in the fall and are detailed in Table 11. Inflow and storage changes for the last ten years at Lake Del Valle are shown in Figure 15.

### ***Water Deliveries***

The Delta Field Division delivered 218,859 AF of water in 1991. These and other deliveries are summarized in Table 2.

The North Bay Aqueduct system, completed in May 1988, begins in the North Delta at Barker Slough Pumping Plant. From there, water is conveyed by pipeline for 24 miles northwest to contractors in Napa and Solano Counties and to the Cordelia Pumping Plant. Deliveries are made to Solano County water users via turnouts along its length. From the Cordelia Pumping Plant, the North Bay Aqueduct terminates at the Napa Terminal Tank. North Bay Aqueduct supplied 34,057 AF to Napa and Solano Counties in 1991.

Banks Pumping Plant lifts water from Clifton Court Forebay into Bethany Reservoir, and from Bethany Reservoir, the South Bay Pumping Plant lifts water into the South Bay Aqueduct. Through the South Bay Aqueduct water is supplied to Alameda and Santa Clara Counties. The South Bay Aqueduct was first fully operational in 1965.

In 1991, 62,273 AF were delivered to SWP entitlement contractors in the Delta Field Division. This included 54,357 AF of 1991 entitlement deliveries; 4,395 AF of carryover entitlement; and the only delivery of unscheduled water (3,521 AF) during 1991. The unscheduled delivery was made to the Napa and Solano Flood Control and Water Conservation Districts during the March and April "excess" outflow period. Delivery of non-entitlement supply (General

Wheeling) included 39,349 AF of non-SWP transfer water purchased from the YCWA by Napa County Flood Control and Water Conservation District. Delivery of 69,395 AF of 1991 Drought Water Bank supply was conveyed to six agencies, and 14,322 AF of Vallejo Permit Water (local water right) was delivered to Solano Flood Control and Water Conservation District. This Vallejo Permit Water delivery represented the largest increase (from 748 AF in 1990) in non-entitlement supply.

### ***Pumping Plants***

Delta Field Division pumping plants include Barker Slough Pumping Plant and Cordelia Pumping Plant on the North Bay Aqueduct, Banks on the California Aqueduct, and South Bay and Del Valle Pumping Plants on the South Bay Aqueduct. Monthly pumping data is summarized for the year in Table 1.

Banks Pumping Plant was built to accommodate 11 units. Initially, seven pumps were constructed for a total pumping capacity of 6,400 cfs. Construction of the final four pumps was completed in 1990, each with a design capacity of 1,067 cfs for a new total plant capacity of 10,500 cfs but limited by Corp. of Engineers permit to 6,993 cfs. The new pumps were not yet operational in 1991. Export pumping rates are increased on weekends to take advantage of less costly off-peak electricity. This produces sharp peaks in the export rate at 7-day intervals.

There was 51,642 AF of federal pumping at Banks in 1991. Over half was conveyed in January and the rest in October. Federal customers taking delivery of this water include the Cross Valley contractors consisting of nine water or irrigation districts and two counties, all serviced through a California Aqueduct turnout to Kern County Water Agency's Cross Valley Canal. Below is a five-year summary of federal, State, and total pumping at Banks in AF:

PUMPING AT HARVEY O. BANKS DELTA P.P.			
Year	Federal	State	Total
1991	51,642	1,643,819	1,695,461
1990	205,208	2,210,756	2,415,964
1989	373,209	3,409,326	3,782,535
1988	488,027	2,166,266	2,654,293
1987	337,069	1,857,714	2,194,783

## San Luis Field Division

### Water Storage

San Luis Reservoir reached its maximum end of month storage for the year, 1,542,231 AF, in April. Maximum operating storage capacity is 2,027,840 AF. Minimum end of month storage for the year, 569,441 AF, occurred in August. The State's share of San Luis Reservoir end of month storage reached the maximum of 593,428 AF in April, while the minimum of 63,024 AF occurred in January. Table 13 (below) and Figure 16 show San Luis Reservoir operations during 1991. Table 14 shows the monthly operation of O'Neill Forebay during 1991.

### Pumping and Generating Plants

Total pumping in 1991 at Gianelli Pumping-Generating Plant was 1,611,155 AF. Total water released from San Luis Reservoir to O'Neill Forebay (generation) was 1,160,010 AF. Total pumping at Dos Amigos Pumping plant was 1,456,486 AF, less than half of that pumped in 1990. Table 15 summarizes joint-use plant activity on a monthly basis.

### Water Deliveries

SWP water deliveries in the San Luis Field Division during 1991 totaled 504,570 AF. This included federal diversions from the Joint-Use facilities total-

ing 504,257 AF, federal recreation deliveries of 144 AF, and State recreation deliveries of 169 AF. Recreation deliveries went to the DFG and the DPR from the O'Neill Forebay and San Luis Reservoir (Reach 3). Similar deliveries out of Reach 5 totaled 86 AF. The following tabulation details the components of these recreation deliveries:

Deliveries (AF)			
O'Neill Forebay and San Luis Reservoir (Reach 3)			
	DPR	DFG	Total
State	59	65	124
Federal	49	54	103
Sub-total	108	119	227
Pools 16, 17, & 18 (Reach 5)			
	DPR	DFG	Total
State	45	0	45
Federal	36	5	41
Sub-total	81	5	86

The DFG purchased 31,500 AF of 1991 Drought Water which was conveyed to O'Neill Forebay and the Delta-Mendota Canal. It was used for habitat preservation mostly in Los Banos, Volta, and Mendota State Wildlife Management areas.

**Table 13. San Luis Reservoir Monthly Operation  
1991**

(In acre-feet except as noted)

Month	Reservoir Storage			Inflow	Outflow				Gain (+) Loss (-)	Evaporation	Precipitation (in inches)
	Water Surface Elevation (in feet)	Storage	Storage Change		Gianelli P-G Plant Pumping	Gianelli P-G Plant Generation	Pacheco Tunnel	Spill			
JAN	410.75	610,943	131,465	152,419	0	7,934	0	-13,020	1,416	1.13	
FEB	418.96	681,574	70,631	93,770	19,865	4,424	0	1,150	2,251	1.29	
MAR	472.31	1,201,565	519,991	529,074	0	1,037	0	-8,046	4,649	0.57	
APR	503.00	1,542,231	340,666	367,007	7,279	3,270	0	-15,792	8,317	0.04	
MAY	493.40	1,432,612	-109,619	16,799	117,591	5,401	0	-3,426	10,219	1.59	
JUN	461.13	1,084,678	-347,934	8,267	347,727	7,371	0	-1,103	11,399	0.00	
JUL	423.99	726,263	-358,415	5,332	361,013	7,520	0	4,786	11,681	0.00	
AUG	405.32	569,441	-156,822	59,287	204,169	7,111	0	-4,829	8,555	0.00	
SEP	415.76	653,701	84,260	116,145	17,006	3,953	0	-10,926	6,423	0.08	
OCT	425.61	740,880	87,179	123,023	26,404	3,269	0	-6,171	4,299	0.02	
NOV	428.11	763,599	22,719	59,697	30,560	3,472	0	-5,946	1,956	0.13	
DEC	433.17	810,305	46,706	80,335	28,396	3,657	0	-1,576	567	0.43	
<b>TOTAL</b>			330,827	1,611,155	1,160,010	58,419	0	-61,899	71,732	5.28	

## ***San Joaquin Field Division***

### ***Water Deliveries***

There was 1,025,680 AF of SWP inflow past Check 21 into the San Joaquin Field Division in 1991. The State's share was 992,405 AF and the federal share (9,430 AF of which was exchanged between CVC contractors and KCWA) was 33,275 AF. From this inflow, there were deliveries totaling 265,344 AF. There were five SWP water service contractors who took delivery of 241,499 AF. The water types included exchange, entitlement, drought bank, carryover entitlement, SWP advance delivery, and transfer water. KCWA took delivery of 92 percent of the total SWP water delivered within the San Joaquin Field Division. See Map 2 and Table 2 for break down of water deliveries by agency and water type.

Agencies pumped water into SWP facilities to convey non-project water to other agencies. To preserve water quality, the Department normally does not allow water to be pumped directly into the aqueduct. But because of the severity of the drought, the Department approved the pump-ins implementing a comprehensive system to check and monitor the quality of the water introduced into the aqueduct.

The San Joaquin Field Division is the only field division in the SWP where there are no water storage facilities. All deliveries are made from the Aqueduct and are summarized in Appendix I, Table 21.

In addition to SWP deliveries, 23,845 AF of federal deliveries were wheeled through SWP facilities in the San Joaquin Field Division; 17,645 AF delivered to KCWA's Cross Valley Canal for the CVC contractors and 6,200 AF to the Kern Wildlife Refuge. The table below itemizes federal deliveries in the San Joaquin Field Division:

<b>Federal Wheeling</b>	
<b>Agency</b>	<b>Agency Total</b>
Kern National Wildlife Refuge	6,200
Fresno County	365
Kern-Tulare Water District	5,345
Lower Tule River	7,506
Pixley Irrigation District	3,784
Tulare County	645
<b>Total Federal Wheeling</b>	<b>23,845</b>

### ***Pumping Plants***

Pumping plants in the San Joaquin Field Division include Las Perillas and Badger Hill on the Coastal Aqueduct, and Buena Vista, Wheeler Ridge, Wind Gap, and Edmonston on the California Aqueduct. A complete monthly summary of amounts pumped at these plants is shown in Table 1. A summary of energy used to pump at each plant is shown in Table 4. Edmonston pumped 800,837 AF of water into the Southern Field Division in 1991.

## ***Southern Field Division***

### ***Water Storage***

There are four storage reservoirs in the Southern Field Division with a combined storage capacity of 701,320 AF. Combined storage at the beginning of the year was 530,618 AF. End of year combined storage was 635,732 AF. Complete monthly operation tables for reservoirs in the Southern Field Division, along with historical inflow and storage data for the last ten years is summarized in Tables 16, 17, 18, 19, 20, and Figures 17, 18, 19 and 20.

### ***Water Deliveries***

SWP deliveries in the Southern Field Division totaled 668,164 AF to fourteen agencies including 439,826 AF of entitlement deliveries, 215,236 AF of 1991 drought bank water, 4,560 AF of recreation, 3,987 AF of local water, a net "pump in/out" delivery of 3,164 AF, and 1,391 AF of transfer water. Metropolitan Water District of Southern California

received the largest single total delivery for 1991 from the SWP at 606,447 AF.

### ***Pumping and Generating Plants***

Pumping plants in the Southern Field Division include Oso and Castaic on the West Branch, and Pearblossom on the East Branch. A total of 800,837 AF of SWP water was pumped into the Southern Field Division by Edmonston Pumping Plant. A complete monthly summary of amounts pumped is shown on Table 1. A summary of energy used to pump and station service energy at each plant is shown on Table 4.

Generating plants include William E. Warne and Castaic on the West Branch, and Alamo and Devil Canyon on the East Branch. Energy available from each generating plant is summarized in Table 3. Combined generation at all four plants totaled 1,092,807 MWh.

**Table 1. Project Pumping by Plant**

**1991**  
(in acre-feet)

Pumping Plants	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Hyatt*	0	0	19	13,171	52,617	74,293	42,270	0	0	0	0	0	182,370
Thermalito*	0	72,010	63,238	65,801	69,065	97,414	48,124	0	0	0	0	0	415,652
Barker Slough	2,397	2,363	2,664	2,547	2,808	3,439	3,582	2,990	3,419	3,462	2,508	2,547	34,726
Cordelia	1,649	1,674	1,393	1,525	2,366	2,306	2,310	2,158	2,351	2,335	1,910	1,966	23,943
South Bay	18,175	14,376	6,880	11,222	16,760	16,707	17,253	17,415	15,050	15,469	11,952	12,743	174,002
Del Valle	1,628	5,775	796	0	1,296	0	0	0	0	0	0	0	9,495
<b>Banks</b>													
State	153,374	97,884	363,799	269,840	78,745	51,670	44,802	126,068	131,784	183,293	63,966	78,594	1,643,819
Federal	26,679	0	0	0	0	0	0	0	0	24,963	0	0	51,642
Total	180,053	97,884	363,799	269,840	78,745	51,670	44,802	126,068	131,784	208,256	63,966	78,594	1,695,461
<b>Gianelli 1/</b>													
State	75,130	41,843	342,355	256,612	16,799	8,267	5,332	59,287	75,961	93,596	40,097	10,400	1,025,679
Federal	77,289	51,927	186,719	110,395	0	0	0	0	40,184	29,427	19,600	69,935	585,476
Total	152,419	93,770	529,074	367,007	16,799	8,267	5,332	59,287	116,145	123,023	59,697	80,335	1,611,155
<b>O'Neill 2/</b>													
State	0	0	0	0	0	0	0	0	0	0	0	0	0
Federal	89,853	85,201	191,893	128,033	11,772	0	0	1,932	37,185	17,277	60,615	102,083	725,844
Total	89,853	85,201	191,893	128,033	11,772	0	0	1,932	37,185	17,277	60,615	102,083	725,844
<b>Dos Amigos 1/</b>													
State	90,370	63,225	6,089	8,729	90,563	158,124	148,344	116,454	50,491	84,150	73,923	104,453	994,915
Federal	21,341	25,648	16,042	20,606	45,402	112,509	126,640	65,642	7,667	8,933	5,767	5,374	461,571
Total	111,711	88,873	22,131	29,335	135,965	270,633	274,984	182,096	58,158	93,083	79,690	109,827	1,456,486
Las Perillas	1,867	574	272	3,216	10,430	16,968	16,704	9,205	4,070	8,021	2,104	3,081	76,512
Badger Hill	1,867	574	277	3,357	10,688	17,483	17,428	9,584	4,466	8,029	2,167	3,095	79,015
Buena Vista	81,977	46,834	7,636	11,810	75,944	121,686	90,060	88,558	50,230	82,614	79,816	111,523	848,688
Teerink	83,413	46,441	7,967	11,871	72,457	114,657	82,560	81,736	47,268	81,295	79,712	111,940	821,317
Chrisman	82,029	46,658	7,734	11,335	70,212	111,572	79,796	80,909	46,763	80,216	79,372	110,189	806,785
Edmonston	82,851	46,377	7,810	11,430	70,727	111,574	79,496	79,619	45,893	78,902	77,919	108,239	800,837
Oso	24,939	14,678	3,125	6,585	58,128	77,469	43,582	62,221	29,259	33,891	48,790	87,108	489,775
Castaic* 3/	72,410	28,481	17,125	28,560	6,219	9,891	44,914	57,111	50,958	56,788	70,385	58,646	501,488
Pearblossom	57,121	29,135	4,296	3,851	9,645	32,757	33,210	16,363	14,971	42,488	28,654	22,648	295,139

1/ Joint State-federal Facility.

2/ O'Neill Pumping Plant is a Federal facility.

3/ Pumping at Castaic Pumping Plant is by and for the City of Los Angeles.

\* Pumping-generating plants. This table includes only the pumping portion of operations of these plants.

**Table 2. Water Deliveries 1962-1991**

(in acre-feet)

Agency	1962-1986	1987	1988	1989	1990	1991	TOTALS
<b>Oroville Field Division</b>							
Last Chance Creek W.D. (Local Supply)	156,641	9,444	6,988	11,487	7,046	7,010	198,616
Plumas Co. F.C. & W.C.D.	5,723	452	523	486	548	420	8,152
County of Butte	4,870	459	385	300	380	328	6,722
Thermalito I.D. (Local Supply)	14,761	2,338	2,417	2,152	2,272	2,124	26,064
Prior Water Rights Deliveries	15,103,959	836,720	832,786	810,458	860,543	558,143	19,002,609
Yuba City	498	88	303	403	494	265	2,051
<b>Delta Field Division</b>							
Napa CO. F.C. & W.C.D. (Local Supply)	86,861	7,693	7,038	10,153	13,313	10,018	135,076
Alameda Co. W.D. (Local Supply)	416,584	25,475	33,464	26,042	31,703	30,126	563,394
A.C.F.C. & W.C.D., Zone 7 (Local Supply)	331,136	26,397	27,252	28,185	33,975	14,101	461,046
Pleasanton Township W.D.	674	0	0	0	0	0	674
Santa Clara Valley W.D.	1,139,022	94,949	87,961	107,085	120,962	87,253	1,637,232
Marin W.D.	4,594	0	0	0	0	0	4,594
City of San Francisco	4,345	0	0	0	332	51,135	55,812
Skylonda M.W.D.	10	0	0	0	0	0	10
Oak Flat W.D.	108,879	5,880	4,412	6,391	3,212	1,472	130,246
Mustang W.D.	4,256	0	0	0	0	0	4,256
Granite Construction	120	0	0	0	0	0	120
Lake Del Valle ( E.B.R.P.D. )	1,403	137	142	152	168	150	2,152
Orestimba Creek	100	0	0	0	0	0	100
CVP Water	3,279	510	620	473	38	77	4,997
Solano Co. F.C.W.C.D.	1,400	1,550	13,452	17,364	19,879	24,527	78,172
<b>San Luis Field Division</b>							
Dept. Parks & Rec. ( STATE )	566	8	7	64	70	59	774
Dept. Fish & Game ( STATE )	4,882	590	380	429	145	110	6,536
Fed. Customers ( Rec.+ Joint-Use )	18,983,170	1,462,359	1,421,166	1,303,249	992,022	504,401	24,666,367
Fed. Customers (Misc.)	89,059	9,335	149,192	0	0	0	247,586
<b>San Joaquin Field Division</b>							
Tulare Lake Basin W.S.D.	2,019,431	144,290	94,316 8/	181,963	90,312	2,180	2,532,492
Empire West Side I. D.	64,196	4,401	3,475 9/	3,000	3,310	221	78,603
County Of Kings	37,900	4,000	4,000	4,000	2,000	0	51,900
Hacienda W.D.	75,895	0	0	0	0	0	75,895
Kern County Water Agency	13,486,268	1,028,124	1,009,520	1,146,062	862,448 12/	223,928	17,756,350
Kern Water Bank	0	7,501 6/	0	0	0	0	7,501
Dudley Ridge Water District	1,045,010	46,288	47,994	57,049 11/	36,657	14,454	1,247,452
Devils Den Water District	292,218	14,394	11,534	14,645	6,440	716	339,947
J.G. Boswell	117,430	0	0	0	0	0	117,430
Shell Cal Prod.	85,914	0	0	0	0	0	85,914
Green Valley Water District	11,054	0	0	0	0	0	11,054
Federal Wheeling	571,225	137,289	153,211 10/	172,656	74,746	23,845	1,132,972
Wheeler Ridge W.S.D.	92	0	0	0	0	0	92
<b>Southern Field Division</b>							
A.V.E.K. W.A.	512,365	34,089	34,079	45,280	47,206	8,607	681,626
M.W.D. Of S.C.	7,188,963	712,424	902,564	1,156,698	1,396,423	606,447	11,963,519
Littlerock Creek I. D.	5,002	1,085	419	971	1,747	522	9,746
Mojave Water Agency	57,589	17	9	200	0	2,032	59,847
Desert Water Agency	233,300	31,500	34,000	36,500	38,100	11,430	384,830
Coachilla Valley Water District	148,776	19,431	20,652	21,873	23,100	6,930	240,762
Crestline-Lake Arrowhead Water Agency	15,886	1,849	2,006	2,170	1,950	1,561	25,422
San Gabriel Valley M.W.D.	69,365	10,630	8,948	12,839	16,649	5,399	123,830
San Bernardino Valley M.W.D.	162,265	19,075 7/	21,386	20,782	18,831	7,177	249,516
Santa Barbara	0	0	0	0	0	1,240	1,240
Dept. Parks & Rec., L.A. Co. Rec. Dept.	21,642	6,937	4,360	7,490	8,879	4,560	53,868
Piru Creek Fish Enhancement	2,915	0	0	0	0	0	2,915
Castaic Lake Water Agency	63,776	16,167	18,904	21,719	22,139	7,357	150,062
Palmdale Water District	4,654	5,379	1,770	9,009	8,608	3,914	33,334
United Water C.D. (Local Supply)	998	0	0	0	0	0	998
Ventura County FCD	0	0	0	0	4,836	988	5,824
Lilico Pictures	0	0	0	10	0	0	10
<b>Totals</b>	<b>62,760,921</b>	<b>4,729,254</b>	<b>4,961,635</b>	<b>5,239,789</b>	<b>4,751,483</b>	<b>2,225,227</b>	<b>84,668,309</b>

1/ Includes Thermalito Afterbay, Palermo Canal, Upper Feather Lakes deliveries.

2/ Hacienda Water District was annexed by Tulare Lake Basin WSD in 1981.

3/ Includes 1,703 AF transferred to Tulare Lake Basin W.S.D.

4/ Repayment of preconsolidation water.

5/ Includes 6,500 AF to KCWD, 6,500 AF to Lakeside IWD, & 50 AF to Green Valley WD

6/ Advance storage of groundwater, by agreement between KCWA and DWR

7/ Includes 324 AF of Local-Out.

8/ Includes 1,550 AF transferred to Westlands WD (federal).

9/ Includes 300 AF transferred to Tulare Lake BWSD as entitlement.

10/ Includes 3,000 AF transferred to Westlands WD (federal).

11/ Includes 2,500 AF of transferred entitlement water.

12/ Includes 150,000 AF of 1990 Kern Ground water Demo.

**Table 3. Total Energy Resources  
1991**

(in MWh)

Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Hyatt-Thermalito 1/	48,891	23,140	22,068	21,298	123,030	159,435	135,414	73,922	53,706	49,385	33,452	67,414	811,155
Bottle Rock	0	0	0	0	0	0	0	0	0	0	0	0	0
Gianelli													
State	0	2,239	0	-38	12,397	27,614	23,612	10,458	1,866	2,533	5,452	4,993	91,126
Federal	0	1,158	0	1,770	15,677	47,388	44,920	22,979	882	2,160	0	0	136,934
Total	0	3,397	0	1,732	28,074	75,002	68,532	33,437	2,748	4,693	5,452	4,993	228,060
Warne 2/	15,602	8,959	1,713	3,967	33,979	45,963	25,993	37,756	17,605	20,890	28,785	50,878	292,090
Castaic (State Share)	24,552	11,736	504	5,028	53,376	72,288	43,488	54,504	24,792	27,792	64,104	78,408	460,572
Alamo Powerplant	2,266	1,753	296	144	97	2,428	2,518	711	1,495	43	-54	815	12,512
Devil Canyon	46,934	41,675	3,759	3,287	16,923	32,040	33,924	20,930	23,196	43,590	33,616	27,759	327,633
Tera Corp.	27	98	125	321	496	690	783	937	388	162	134	46	4,207
MWD Hydro	14,842	8,855	6,253	5,945	11,388	14,499	16,219	12,927	13,201	17,955	14,138	14,339	150,561
Reid Gardner	154,329	149,878	160,858	20,754	96,161	92,782	97,787	108,950	111,938	126,958	120,157	85,502	1,326,054
Pine Flat	0	0	0	7,791	21,218	68,350	51,598	358	0	0	0	0	149,315
Purchases 3/	119,369	93,190	106,245	112,271	110,959	147,434	110,300	56,042	43,200	58,700	85,756	95,603	1,139,069
Other resources/ Exchanges 4/	315	889	2,451	5,727	47,818	54,363	37,944	28,288	23,635	28,895	2,101	1,135	233,561
SCE Return Additional	114,818	56,485	156,771	170,733	72,209	49,323	105,587	442,078	355,854	323,004	178,137	285,202	2,310,201

1/ Includes Table Mountain and Hyatt out adjusted to Tesla.

2/ Includes station-service energy.

3/ Includes Salt River Project, Portland General Electric, British Columbia Hydro Authority, Nevada Power, Southern California Edison, Bonneville Power Authority, Pacific Gas and Electric, Washington Water & Power Co., Montana Power Company, Western Area Lower Colorado, Idaho Power Co., Arizona Public Service Co., Pacific Power & Light, Puget Sound Power and Light, Eugene Water and Electric Board, Los Angeles Dept. of Water and Power, and Public Service of New Mexico.

4/ Includes Southern California Edison, Western Area Mid-Pacific, Los Angeles Dept. of Water and Power, Bonneville Power Authority, Northern California Power Authority, and Pacific Gas & Electric.

State: 7,308,056

Federal: 136,934

Total Project: 7,444,990

**Table 4. Total Energy Loads**

**1991**

(in MWh)

Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Hyatt-Thermalito Pumpback and Station Service	241	7,948	7,180	15,360	41,435	58,376	32,018	298	210	33	73	226	163,398
North Bay 3/	2,112	672	940	1,139	1,318	1,440	2,546	310	828	3,045	3,080	658	18,088
South Bay	15,006	12,146	5,428	9,282	14,134	14,340	14,701	14,672	12,544	12,852	9,922	10,283	145,310
Del Valle	76	434	74	6	106	4	6	6	7	10	6	7	742
Banks													
State	46,511	29,675	109,445	81,234	23,716	15,794	13,745	37,846	39,699	55,263	19,507	24,165	496,600
Federal	7,922	0	0	0	0	0	0	0	0	7,416	0	0	15,338
Bottlerock 1/	184	172	147	154	117	103	83	89	69	88	123	144	1,473
Gianelli													
State	16,502	11,374	96,583	82,674	6,035	2,668	1,646	12,820	17,217	24,271	11,125	3,452	286,367
Federal	16,381	13,720	52,897	34,953	0	0	0	0	9,093	7,766	5,232	19,207	159,249
Dos Amigos													
State	12,762	7,859	1,327	1,219	11,154	19,878	19,153	14,235	6,883	12,327	10,473	14,502	131,772
Federal	2,408	4,347	1,882	2,773	6,744	15,645	17,235	9,582	810	126	238	0	61,790
Pine Flat 1/	223	212	239	79	0	0	0	199	202	132	200	233	1,719
Las Perillas	146	58	41	254	772	1,249	1,227	671	288	580	156	227	5,669
Badger Hill	348	119	69	679	2,092	3,487	3,413	1,858	811	1,531	385	555	15,347
Buena Vista	20,277	11,571	2,096	3,013	18,533	29,500	21,874	21,464	12,290	20,162	19,442	27,100	207,322
Teerink	23,015	13,043	2,430	3,411	20,152	31,669	22,936	22,636	13,123	22,549	21,973	30,738	227,675
Chrisman	52,626	29,748	5,468	7,853	45,322	70,989	50,867	51,460	29,697	50,657	49,897	69,625	514,209
Edmonston	186,186	104,302	18,636	26,422	157,787	248,833	176,586	178,485	102,876	179,623	177,511	246,968	1,804,215
Oso	7,055	4,229	1,178	2,049	15,876	20,796	11,760	16,773	8,093	9,230	13,259	23,581	133,879
Pearblossom	38,526	19,957	3,327	2,944	6,834	22,361	22,393	11,252	10,303	28,980	19,459	15,718	202,054
Warne 1/	62	87	147	112	31	0	39	11	65	58	43	0	655
Sales 2/	66,076	90,783	154,311	65,094	179,480	158,016	209,481	390,505	322,192	168,452	88,829	197,643	2,090,862
Losses	14,799	18,400	13,472	12,777	12,871	26,076	25,622	20,309	18,299	22,302	16,257	21,149	222,333
Actual Deviation	182	82	1,218	1,807	1,676	1,220	900	1,755	1,302	1,840	2,091	622	14,695
Other Project Loads 4/	39,030	36,024	37,289	39,667	40,608	40,409	54,172	50,207	73,878	85,921	101,967	24,500	623,672

1/ Station Service only.

2/ Includes Sacramento Municipal Utility District, Southern California Edison, Modesto Irrigation District, City of Vernon, Nevada Power, Turlock Irrigation District, Metropolitan Water District, Northern California Power Agency, Pacific Gas and Electric, Azusa-Banning-Colton-Riverside Combine, City of Riverside, and City of Anaheim.

3/ Includes scheduled energy paid back to Pacific Gas and Electric at Barker Slough and Cordelia Pumping Plants.

4/ Includes Southern California Edison, Bonneville Power Authority, Nevada Power, Northern California Power Agency, and South Bay Station Service.

Total State: 7,308,056

Total Federal: 236,377

Total Project: 7,544,433

**Table 5. Sacramento Basin And Sacramento-San Joaquin Delta Operations  
1991**

(in thousands of acre-feet except as noted)

Month	Upstream Reservoir Releases To River			Sacramento River In-Basin Use	Delta Inflow			Consumptive	Delta Uses		Delta Exports		
	Keswick 1/ 6/	Oroville 1/ 6/	Nimbus 6/		Sacramento River at Sacramento 3/	San Joaquin River at Vernalis 4/	Total 5/		Outflow Index		Total	DWR 6/	USBR 6/
				Total				Average CFS					
Jan	269	103	30	187	578	52	643	-56	401	6,523	305	153	152
Feb	226	55	19	164	456	40	507	-37	291	5,237	250	98	152
Mar	152	54	19	1,305	1,578	107	1,697	-10	1,063	17,285	600	364	236
Apr	174	52	20	481	642	70	726	18	306	5,144	446	269	177
May	457	88	43	-91	457	65	534	62	296	4,810	165	79	86
Jun	507	156	135	-241	539	28	578	136	321	5,397	114	52	62
Jul	546	116	183	-254	578	29	620	190	273	4,439	156	45	111
Aug	518	68	160	-157	581	33	626	196	190	3,090	235	126	109
Sep	345	91	86	64	594	38	644	157	230	3,868	252	132	120
Oct	274	94	136	78	576	53	642	110	207	3,365	324	183	141
Nov	253	62	69	46	413	65	490	55	245	4,124	190	64	126
Dec	217	123	113	122	577	56	645	2	436	7,095	200	79	121
<b>Total</b>	<b>3,938</b>	<b>1,062</b>	<b>1,013</b>	<b>1,704</b>	<b>7,569</b>	<b>636</b>	<b>8,352</b>	<b>823</b>	<b>4,259</b>	<b>---</b>	<b>3,237</b>	<b>1,644</b>	<b>1,593</b>

- 1/ Time lagged values (Keswick: 5 days; Oroville: 2 days).
- 2/ Positive values are accretions; negative values are depletions.
- 3/ These values were based on a measured daily average taken from the Sacramento River at Freepport.
- 4/ These values are based on daily 6 a.m. readings.
- 5/ Includes Sacramento County Regional Waste Treatment Plant.
- 6/ Based on measured total daily flow.

**Table 6. Delta Outflow Index  
1991**

(in cfs-days except as noted)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6,667	4,045	6,014	19,967	5,130	5,485	5,085	3,826	1,404	5,116	2,048	4,796
2	6,069	3,425	7,649	15,558	4,593	5,982	4,581	3,074	1,501	4,905	2,634	4,520
3	5,614	4,081	6,034	13,522	3,575	6,540	4,575	3,176	2,365	4,549	2,037	3,985
4	6,632	3,980	4,258	9,844	4,597	6,404	4,061	3,521	3,596	4,530	2,574	4,097
5	6,607	3,749	6,831	7,731	4,255	5,564	4,550	4,089	4,083	5,294	2,739	4,469
6	5,896	4,528	23,374	6,398	4,070	5,937	5,092	4,862	4,093	4,981	3,779	6,114
7	5,583	4,985	29,570	5,602	3,556	5,386	5,402	5,543	4,254	4,547	4,368	6,080
8	5,641	6,385	26,341	4,701	3,585	5,074	5,553	4,829	3,896	4,088	5,019	6,854
9	6,753	8,011	18,508	4,433	3,820	4,959	5,914	4,876	3,193	3,539	5,212	7,238
10	7,470	7,542	12,134	4,274	3,059	5,115	6,081	4,499	2,328	3,179	6,030	7,978
11	8,067	6,492	7,870	5,146	3,303	5,616	5,421	4,116	1,799	3,563	5,359	7,500
12	7,585	7,501	6,109	2,560	2,895	6,185	5,328	3,894	1,824	3,522	4,625	7,574
13	7,563	6,419	3,770	729	3,819	6,419	4,842	3,352	2,569	3,431	4,027	7,456
14	7,057	6,167	6,412	1,198	3,862	6,047	4,584	3,036	3,606	2,546	4,585	7,659
15	6,518	6,023	16,635	2,594	4,765	6,059	4,006	3,518	3,677	2,115	3,560	7,615
16	6,840	6,418	22,983	2,366	5,602	5,738	3,610	3,063	3,623	1,552	3,045	7,566
17	7,549	5,631	19,981	2,508	5,914	5,887	3,555	3,056	3,864	1,547	3,037	8,584
18	7,553	5,064	16,719	2,817	5,897	5,355	3,510	3,064	4,191	1,547	4,480	9,060
19	7,542	4,435	13,421	3,450	6,153	4,992	3,525	2,992	4,990	1,508	3,497	9,421
20	7,194	4,015	11,140	3,997	5,392	4,622	3,329	3,026	5,472	2,125	3,519	8,603
21	7,088	4,582	16,265	3,974	5,490	4,050	4,394	3,017	5,549	2,771	3,831	8,224
22	5,878	5,079	18,323	4,046	6,030	4,461	3,807	2,546	5,741	4,164	4,024	8,252
23	6,051	5,351	19,181	4,272	6,320	4,192	4,352	2,280	5,211	4,250	4,170	8,673
24	6,629	4,585	15,554	3,829	6,243	4,303	4,850	2,090	5,050	3,142	4,266	8,226
25	6,929	4,448	11,130	3,642	5,108	5,308	4,863	2,116	4,551	3,659	5,244	7,482
26	6,664	4,433	22,505	3,256	4,173	5,107	4,271	2,123	4,614	3,565	5,488	7,537
27	6,407	4,874	32,352	3,304	5,089	5,519	4,546	2,252	4,845	4,731	5,547	7,004
28	6,601	5,509	40,302	2,938	5,959	5,535	4,372	1,769	5,859	3,897	5,558	7,400
29	5,457		38,775	3,047	5,902	6,132	3,931	1,588	5,128	2,929	5,564	7,564
30	5,020		32,103	3,901	6,024	5,577	3,667	1,129	4,795	2,267	5,090	7,073
31	4,263		24,839		6,256		3,692	924		2,440		6,549
<b>TOTAL</b>	<b>203,387</b>	<b>147,757</b>	<b>537,082</b>	<b>155,604</b>	<b>150,436</b>	<b>163,550</b>	<b>139,349</b>	<b>97,246</b>	<b>117,671</b>	<b>105,999</b>	<b>124,956</b>	<b>221,153</b>
<b>AVE.</b>	<b>6,561</b>	<b>5,277</b>	<b>17,325</b>	<b>5,187</b>	<b>4,853</b>	<b>5,452</b>	<b>4,495</b>	<b>3,137</b>	<b>3,922</b>	<b>3,419</b>	<b>4,165</b>	<b>7,134</b>
<b>MAX.</b>	<b>8,067</b>	<b>8,011</b>	<b>40,302</b>	<b>19,967</b>	<b>6,320</b>	<b>6,540</b>	<b>6,081</b>	<b>5,543</b>	<b>5,859</b>	<b>5,294</b>	<b>6,030</b>	<b>9,421</b>
<b>MIN.</b>	<b>4,263</b>	<b>3,425</b>	<b>3,770</b>	<b>729</b>	<b>2,895</b>	<b>4,050</b>	<b>3,329</b>	<b>924</b>	<b>1,404</b>	<b>1,508</b>	<b>2,037</b>	<b>3,985</b>
<b>TOTAL IN AF</b>	<b>403,418</b>	<b>293,076</b>	<b>1,065,302</b>	<b>308,641</b>	<b>298,390</b>	<b>324,401</b>	<b>276,399</b>	<b>192,887</b>	<b>233,400</b>	<b>210,249</b>	<b>247,850</b>	<b>438,657</b>

Annual Total = 2,164,190 cfs days  
or 4,292,671 acre-feet

**Table 7. Upper Feather Area Lakes Monthly Operation  
1991**

(in acre-feet except as noted)

Month	Lake Storage			Outflow							Inflow
	Water Surface Elevation (in feet)	Storage*	Storage Change	Regulated Release				Spill	Estimated Evaporation And Seepage	Total Outflow	Computed
				Stream-Flow Maint.	Water Supply Contract	Prior Water Rights	Total Regulated Release				

**Antelope Lake Capacity 22,566 AF**

Jan	4,992.95	15,037	-369	521	0	0	521	0	52	573	204
Feb	4,993.10	15,147	110	278	0	0	278	0	59	337	447
Mar	4,995.26	16,787	1,640	307	0	0	307	0	94	401	2,041
Apr	4,998.56	19,490	2,703	298	0	0	298	0	164	462	3,165
May	5,001.44	22,048	2,558	317	0	0	317	0	282	599	3,157
Jun	5,000.89	21,548	-500	595	0	0	595	0	455	1,050	550
Jul	4,999.77	20,541	-1,007	615	0	0	615	0	702	1,317	310
Aug	4,998.57	19,498	-1,043	615	0	0	615	0	623	1,238	195
Sep	4,997.43	18,537	-961	595	0	0	595	0	485	1,080	119
Oct	4,996.50	17,774	-763	615	0	0	615	0	279	894	131
Nov	4,995.94	17,324	-450	595	0	0	595	0	148	743	293
Dec	4,995.47	16,952	-372	615	0	0	615	0	87	702	330
Total	---	---	1,546	5,966	0	0	5,966	0	3,430	9,396	10,942

**Frenchman Lake Capacity 55,477 AF**

Jan	5,557.49	19,329	25	148	0	0	148	0	56	204	229
Feb	5,557.74	19,536	207	117	0	0	117	0	58	175	382
Mar	5,559.77	21,270	1,734	71	0	418	489	0	104	593	2,327
Apr	5,561.25	22,590	1,320	86	167	0	253	0	179	432	1,752
May	5,560.10	21,560	-1,030	0	2,194	0	2,194	0	298	2,492	1,462
Jun	5,557.35	19,213	-2,347	137	1,963	0	2,100	0	426	2,526	179
Jul	5,554.54	16,986	-2,227	18	1,694	0	1,712	0	556	2,268	41
Aug	5,552.88	15,753	-1,233	42	716	0	758	0	548	1,306	73
Sep	5,552.37	15,386	-367	57	276	0	333	0	250	583	216
Oct	5,552.01	15,130	-256	129	0	0	129	0	213	342	86
Nov	5,551.89	15,045	-85	119	0	0	119	0	112	231	146
Dec	5,551.91	15,060	15	123	0	0	123	0	77	200	215
Total	---	---	-4,244	1,047	7,010	418	8,475	0	2,877	11,352	7,108

**Lake Davis Capacity 84,371 AF**

Jan	5,762.86	43,139	-610	615	38	0	653	0	194	847	237
Feb	5,762.77	42,891	-248	555	18	0	573	0	193	766	518
Mar	5,764.07	46,555	3,664	615	8	0	623	0	343	966	4,630
Apr	5,764.87	48,902	2,347	595	4	0	599	0	590	1,189	3,536
May	5,764.85	48,840	-62	246	16	369	631	0	982	1,613	1,551
Jun	5,764.16	46,816	-2,024	238	67	357	662	0	1,706	2,368	344
Jul	5,763.39	44,616	-2,200	246	80	369	695	0	1,805	2,500	300
Aug	5,762.74	42,809	-1,807	246	71	369	686	0	1,883	2,569	762
Sep	5,762.11	41,099	-1,710	595	53	0	648	0	1,322	1,970	260
Oct	5,761.62	39,801	-1,298	615	41	0	656	0	1,020	1,676	378
Nov	5,761.45	39,350	-451	595	12	0	607	0	279	886	435
Dec	5,761.32	39,014	-336	615	12	0	627	0	169	796	460
Total	---	---	-4,735	5,776	420	1,464	7,660	0	10,486	18,146	13,411

\* At end of month.

**Table 8. Lake Oroville Monthly Operation**

(in acre-feet except as noted)

Capacity 3,537,577 acre-feet

Month	Year	Water Surface Elevation (in feet)	Storage	End Of Month Storage Change	Outflow						Hyatt Pumpback	Computed Inflow 3/
					Hyatt Generation 1/	Palemo Canal	Spillway Leakage 2/	Evaporation	Spill	Total Outflow		
Jan	1991	651.48	921,058	-66,036	113,451	180	0	602	0	114,233	0	48,197
	1990	772.37	1,895,501	6,702	210,354	205	0	652	0	211,211	39,507	178,406
Feb	1991	654.21	937,977	16,919	44,896	164	0	849	0	45,909	0	62,828
	1990	776.26	1,935,355	39,854	149,189	114	0	1,023	0	150,326	71,535	118,645
Mar	1991	708.45	1,320,262	382,285	37,883	22	0	723	0	38,628	19	420,894
	1990	791.00	2,091,865	156,510	187,092	81	0	2,000	0	189,173	47,356	298,327
Apr	1991	741.50	1,599,577	279,315	35,000	0	0	1,925	0	36,925	13,171	303,069
	1990	766.99	1,841,358	-250,507	451,613	646	0	2,920	0	455,179	0	204,672
May	1991	750.76	1,684,654	85,077	230,141	714	0	2,684	0	233,539	52,617	265,999
	1990	755.31	1,727,608	-113,750	318,113	849	0	3,361	0	322,323	43,944	164,629
Jun	1991	738.23	1,570,271	-114,383	297,013	881	0	4,411	0	302,305	74,293	113,629
	1990	751.61	1,692,620	-34,988	239,926	817	0	4,662	0	245,405	64,425	145,992
Jul	1991	724.31	1,449,685	-120,586	262,101	982	0	5,025	0	268,108	42,270	105,252
	1990	723.90	1,446,234	-246,386	350,907	1,010	0	5,602	0	357,519	32,952	78,181
Aug	1991	716.89	1,388,101	-61,584	147,556	994	0	4,302	0	152,852	0	91,268
	1990	691.02	1,187,386	-258,848	346,810	1,100	0	4,580	0	352,490	0	93,642
Sep	1991	718.25	1,399,251	11,150	113,083	1,029	0	4,359	0	118,471	0	129,621
	1990	687.71	1,163,259	-24,127	113,895	1,170	0	3,577	0	118,642	0	94,515
Oct	1991	712.61	1,353,409	-45,842	117,563	845	0	3,428	0	121,836	0	75,994
	1990	689.08	1,173,203	9,944	98,987	1,070	0	2,945	0	103,002	0	112,946
Nov	1991	709.81	1,331,037	-22,372	82,671	281	0	1,195	0	84,147	0	61,775
	1990	686.64	1,155,535	-17,668	93,327	422	0	1,123	0	94,872	0	77,204
Dec	1991	701.45	1,265,734	-65,303	138,999	220	0	619	0	139,838	0	74,535
	1990	661.95	987,094	-168,441	257,633	226	0	575	0	258,434	0	89,993
Total	1991	---	---	278,640	1,620,357	6,312	0	30,122	0	1,656,791	182,370	1,753,061
	1990	---	---	-901,705	2,817,846	7,710	0	33,020	0	2,858,576	299,719	1,657,152

1/ Includes bypass flows

2/ Only occurs when Lake water elevation is greater than or equal to 813.00 and there is no spill.

3/ Does not include pumpback.

**Table 9. Thermalito Forebay Monthly Operation**

Including Diversion Pool And Power Canal

(end of month storage in acre-feet)

Month	Year	Storage 1/	Storage Change	Inflow			Outflow					Losses (-) And Gains (+)
				Lake Oroville Release 2/	Kelly Ridge Generation	Thermalito Pumpback	Thermalito Generation 3/	County of Butte	Thermalito Irrigation District	Releases To River 4/	Hyatt Pumpback	
Jan	1991	20,470	-3,870	113,451	1,471	0	81,012	2	104	38,085	0	411
	1990	23,295	-171	210,354	14,090	40,413	186,252	27	87	39,496	39,507	341
Feb	1991	22,433	1,963	44,896	1,290	72,010	80,098	27	94	34,612	0	-1,402
	1990	24,268	973	149,189	6,722	73,638	125,724	66	82	35,750	71,535	4,581
Mar	1991	24,170	1,737	37,883	12,712	63,238	84,292	167	82	38,833	19	11,297
	1990	23,201	-1,067	187,092	7,516	52,729	166,274	172	108	39,306	52,729	10,185
Apr	1991	22,756	-1,414	35,000	14,180	65,801	67,368	125	119	37,133	13,171	1,521
	1990	22,752	-449	451,613	12,167	0	426,898	17	179	38,133	0	998
May	1991	23,901	1,145	230,141	14,720	69,065	227,492	0	193	38,486	52,617	6,007
	1990	23,456	704	318,113	9,650	47,716	293,768	19	207	38,480	43,944	1,643
Jun	1991	22,659	-1,242	297,013	14,454	97,414	307,126	0	253	37,129	74,293	8,678
	1990	23,446	-10	239,926	14,440	90,351	236,970	5	268	37,260	64,425	-5,799
Jul	1991	24,385	1,726	262,101	14,747	48,124	246,683	0	303	37,712	42,270	3,722
	1990	23,576	130	350,907	14,770	45,577	335,540	9	329	38,920	32,952	-3,374
Aug	1991	23,775	-610	147,556	14,585	0	126,984	0	290	38,528	0	3,051
	1990	23,980	404	346,810	14,910	0	321,552	10	302	38,110	0	-1,342
Sep	1991	23,862	87	113,083	4,123	0	79,673	0	263	37,306	0	123
	1990	22,857	-1,123	113,895	9,050	0	81,872	19	251	36,480	0	-5,446
Oct	1991	24,611	749	117,563	741	0	79,962	0	208	41,489	0	4,104
	1990	24,645	1,788	98,987	793	0	63,488	0	225	37,923	0	3,644
Nov	1991	24,915	304	82,671	14,833	0	60,423	0	117	37,076	0	416
	1990	24,905	260	93,327	14,400	0	71,588	6	128	37,084	0	1,339
Dec	1991	24,565	-350	138,999	1,971	0	109,033	7	98	38,389	0	6,207
	1990	24,340	-565	257,633	4,873	0	231,149	31	124	38,345	0	6,578
Total	1991		225	1,620,357	109,827	415,652	1,550,146	328	2,124	454,778	182,370	44,135
	1990		874	2,817,846	123,381	350,424	2,541,075	381	2,290	455,287	305,092	13,348

1/ Sum of Thermalito Forebay and Diversion Pool.

2/ Sum of releases from Lake Oroville through Hyatt plant, spill, and spillway leakage.

3/ Includes bypass flows.

4/ Sum of Diversion Dam generation plus Feather River Fish Hatchery.

**Table 10. Thermalito Afterbay Monthly Operation**

(end of month storage in acre-feet)

Month	Year	Elevation (in feet)	Storage	Storage Change	Inflow	Outflow						Losses (-) And Gains (+)
					Thermalito Generation 1/	Sutter Butte Canal	Western Canal Lateral	Richvale Canal	Western Canal	River Outlet	Thermalito Pumpback	
Jan	1991	133.82	46,011	12,923	80,658	902	0	290	234	65,156	0	-1,153
	1990	130.95	35,382	3,330	186,252	1,770	8	179	1,080	147,500	40,413	8,028
Feb	1991	129.49	30,478	-15,533	79,886	5,180	0	0	0	20,103	72,010	1,874
	1990	130.55	34,004	-1,378	125,724	0	0	0	0	67,260	73,638	13,796
Mar	1991	132.15	39,668	9,190	84,084	0	0	0	0	14,966	63,238	3,310
	1990	128.88	28,531	-5,473	166,274	1,101	8	0	0	123,473	52,729	5,564
Apr	1991	124.98	17,531	-22,137	67,368	4,060	128	1,336	1,460	14,923	65,801	-1,797
	1990	125.66	19,273	-9,258	426,898	54,570	374	5,821	13,833	353,618	0	-7,940
May	1991	129.05	29,067	11,536	227,373	51,460	441	6,395	33,970	49,893	69,065	-4,613
	1990	131.95	38,938	19,665	293,768	84,440	554	14,040	48,110	90,040	47,716	10,797
Jun	1991	125.81	19,667	-9,400	307,126	49,910	587	7,664	36,820	118,613	97,414	-5,517
	1990	129.90	31,820	-7,118	236,970	81,240	834	17,350	43,380	20,070	90,351	9,137
Jul	1991	132.40	40,590	20,923	246,683	51,300	720	8,585	35,100	78,094	48,124	-3,837
	1990	132.08	39,412	7,592	335,540	99,690	962	20,200	55,550	120,900	45,577	14,931
Aug	1991	133.49	44,723	4,133	126,770	47,690	527	8,021	33,060	29,522	0	-3,816
	1990	131.06	35,765	-3,647	321,552	86,180	556	15,900	42,090	179,600	0	-873
Sep	1991	129.60	30,835	-13,888	79,673	24,640	82	2,631	8,930	54,015	0	-3,264
	1990	132.55	41,148	5,383	81,872	38,810	46	4,010	8,920	28,840	0	4,137
Oct	1991	129.70	31,162	327	79,962	10,740	0	62	11,590	55,643	0	-1,600
	1990	128.21	26,464	-14,684	63,488	33,101	0	2,590	13,799	33,239	0	4,557
Nov	1991	129.40	30,187	-975	60,243	12,940	209	6,827	16,230	25,020	0	8
	1990	133.31	44,028	17,564	71,588	15,230	254	6,161	11,010	24,655	0	3,286
Dec	1991	128.90	28,594	-1,593	109,033	10,310	68	5,500	9,480	84,360	0	-908
	1990	130.28	33,088	-10,940	231,149	13,242	80	4,366	8,073	198,786	0	-17,542
Total	1991			-4,494	1,548,859	269,132	2,762	47,312	186,874	610,309	415,652	-21,313
	1990			1,036	2,541,075	509,374	3,676	90,617	245,845	1,387,981	350,424	47,878

1/ Includes bypass flows.

**Table 11. Lake Del Valle Monthly Operation**

**1991**

(in acre-feet except as noted)

Month	Water* Surface Elevation (in feet)	Storage	Storage Change	Inflow			Outflow				Precipitation (inches)
				Natural	South Bay Aqueduct	South Bay Aqueduct	Recreation 1/	Release to Arroyo Valle	Evaporation	Total	
Jan	688.71	30,609	1,082	-79	1,628	392	8	0	67	467	0.25
Feb	698.05	36,507	5,898	215	5,775	0	5	0	87	92	1.80
Mar	703.60	40,340	3,833	9,313	796	2,521	3	3,653	99	6,276	5.95
Apr	702.58	39,618	-722	749	0	1,276	6	0	189	1,471	0.32
May	704.11	40,704	1,086	56	1,296	0	15	0	251	266	0.36
Jun	701.26	38,695	-2,009	-19	0	1,623	22	0	345	1,990	0.03
Jul	698.61	36,884	-1,811	-3	0	1,363	20	0	425	1,808	0.00
Aug	695.90	35,084	-1,800	-44	0	1,395	21	0	340	1,756	0.42
Sep	690.46	31,660	-3,424	77	0	3,156	21	0	324	3,501	0.02
Oct	683.47	27,622	-4,038	193	0	3,948	16	0	267	4,231	2.00
Nov	678.43	24,990	-2,632	54	0	2,565	6	0	115	2,686	0.23
Dec	678.44	24,995	5	71	0	0	7	0	59	66	1.29
Total	---	---	-4,532	10,583	9,495	18,239	150	3,653	2,568	24,610	12.67

\*At end of month.

1/ To East Bay Regional Park District.

**Table 12. Clifton Court Forebay Monthly Operation**

(elevation in feet, storage in acre-feet)

Month	Year	End-of-Month Water Surface Elevation (ft)	End-of-Month Storage (AF)	Storage Change (AF)	Inflow (AF)
Jan	1991	-0.29	17,639	-2,607	177,349
	1990	0.32	18,952	1,657	390,237
Feb	1991	0.17	18,629	990	99,636
	1990	0.15	18,586	-366	350,691
Mar	1991	0.55	19,448	819	364,784
	1990	-0.60	16,972	-1,614	391,238
Apr	1991	0.05	18,371	-1,077	271,296
	1990	-0.03	18,199	1,227	314,685
May	1991	-0.12	18,005	-366	84,133
	1990	1.76	22,060	3,861	30,768
Jun	1991	0.11	18,500	495	58,579
	1990	1.25	20,958	-1,102	22,926
Jul	1991	1.18	20,807	2,307	53,469
	1990	-1.17	15,747	-5,211	149,662
Aug	1991	-0.42	17,359	-3,448	127,928
	1990	-0.46	17,273	1,526	215,310
Sep	1991	-0.23	17,768	409	136,091
	1990	0.17	18,629	1,356	153,339
Oct	1991	0.81	20,009	2,241	211,911
	1990	0.15	18,586	-43	141,116
Nov	1991	-0.01	18,242	-1,767	61,647
	1990	-1.45	15,145	-3,441	126,242
Dec	1991	-2.29	13,343	-4,899	73,185
	1990	0.92	20,246	5,101	170,933
Total	1991	---	---	-6,903	1,720,008
	1990	---	---	2,951	2,457,147

**Table 13. San Luis Reservoir Monthly Operation**

(in acre-feet except as noted)

Month	Year	Reservoir Storage*			Inflow	Outflow			Gain (+) Loss (-)	Evaporation	Precipitation (in inches)
		Water Surface Elevation (in feet)	Storage	Monthly Storage Change	Gianelli P-G Plant Pumping	Gianelli P-G Plant Generation	Pacheco Tunnel	Spill			
Jan	1991	410.75	610,943	131,465	152,419	0	7,934	0	-13,020	1,097	0.30
	1990	504.09	1,554,851	326,627	341,156	0	3,992	0	-10,537	1,416	1.13
Feb	1991	418.96	681,574	70,631	93,770	19,865	4,424	0	1,150	1,724	1.87
	1990	513.04	1,659,787	104,936	131,833	20,281	3,297	0	-3,319	2,251	1.29
Mar	1991	472.31	1,201,565	519,991	529,074	0	1,037	0	-8,046	2,410	4.64
	1990	527.87	1,838,781	178,994	197,303	0	4,451	0	-13,858	4,649	0.57
Apr	1991	503.00	1,542,231	340,666	367,007	7,279	3,270	0	-15,792	6,327	0.45
	1990	538.55	1,971,565	132,784	171,446	6,048	12,046	0	-20,568	8,317	0.04
May	1991	493.40	1,432,612	-109,619	16,799	117,591	5,401	0	-3,426	8,971	0.18
	1990	514.08	1,672,133	-299,432	833	291,320	9,532	0	587	10,219	1.59
Jun	1991	461.13	1,084,678	-347,934	8,267	347,727	7,371	0	-1,103	10,739	0.00
	1990	471.67	1,194,771	-477,362	10,300	476,929	9,168	0	-1,565	11,399	0.00
Jul	1991	423.99	726,263	-358,415	5,332	361,013	7,520	0	4,786	11,316	0.00
	1990	422.09	709,258	-485,513	0	477,065	12,934	0	4,486	11,681	0.00
Aug	1991	405.32	569,441	-156,822	59,287	204,169	7,111	0	-4,829	7,888	0.07
	1990	395.91	490,766	-218,492	26,372	232,026	11,685	0	-1,153	8,555	0.00
Sep	1991	415.76	653,701	84,260	116,145	17,006	3,953	0	-10,926	7,230	0.00
	1990	395.57	488,128	-2,638	104,777	91,828	8,055	0	-7,532	6,423	0.08
Oct	1991	425.61	740,880	87,179	123,023	26,404	3,269	0	-6,171	5,154	0.27
	1990	375.26	340,198	-147,930	16,333	154,701	7,529	0	-2,033	4,299	0.02
Nov	1991	428.11	763,599	22,719	59,697	30,560	3,472	0	-2,946	2,521	0.26
	1990	375.95	344,850	4,652	68,993	51,553	6,230	0	-6,558	1,956	0.13
Dec	1991	433.17	810,305	46,706	80,335	28,396	3,657	0	-1,576	1,196	1.28
	1990	394.45	479,478	134,628	182,903	22,654	9,567	0	-16,054	567	0.43
Total	1991	---	---	330,827	1,611,155	1,160,010	58,419	0	-61,899	66,573	9.32
	1990	---	---	-748,746	1,252,249	1,824,405	98,486	0	-78,104	71,732	5.28

\* At end of month.

**Table 14. O'Neill Forebay Monthly Operation**

(in acre-feet except as noted)

Month	Year	End-Of-Month Water Surface Elevation (in feet)	End-Of-Month Storage	End-Of-Month Storage Change	Inflow			Outflow				Gain ( + ) Loss ( - )
					O'Neill P-G Plant Pumping	Gianelli P-G Plant Generation	Flow Past Check 12	O'Neill P-G Plant Generation	Gianelli P-G Plant Pumping	Dos Amigos Pumping	Deliveries	
Jan	1991	220.05	43,282	-6,511	89,853	0	162,508	3,541	152,419	111,711	375	9,174
	1990	221.52	47,125	1,600	226,176	0	372,752	0	341,156	255,544	425	-203
Feb	1991	220.38	44,140	858	85,201	19,865	83,004	2,455	93,770	88,873	702	-1,412
	1990	221.08	45,970	-1,155	139,578	20,281	332,338	0	131,833	357,087	2,238	-2,194
Mar	1991	219.66	42,273	-1,867	191,893	0	358,182	1,271	529,074	22,131	213	747
	1990	220.97	45,682	-288	155,004	0	366,940	0	197,303	328,037	2,161	5,269
Apr	1991	218.57	39,498	-2,775	128,033	7,279	259,901	8,457	367,007	29,335	871	7,682
	1990	219.30	41,349	-4,333	144,788	6,048	290,931	0	171,446	283,737	1,900	10,983
May	1991	220.43	44,270	4,772	11,772	117,591	60,780	35,466	16,799	135,965	1,395	4,254
	1990	221.87	48,045	6,696	54,274	291,320	0	10,031	833	322,710	2,524	-2,800
Jun	1991	220.62	44,766	496	0	347,727	32,848	106,644	8,267	270,633	1,675	7,140
	1990	221.25	46,416	-1,629	41,749	476,929	0	41,825	10,300	463,370	2,986	-1,826
Jul	1991	220.50	44,453	-313	0	361,013	26,126	108,102	5,332	274,984	2,344	3,310
	1990	222.28	49,128	2,712	14,170	477,065	129,295	38,455	0	568,697	4,923	-5,743
Aug	1991	223.66	52,813	8,360	1,932	204,169	108,100	69,631	59,287	182,096	2,052	7,225
	1990	221.12	46,075	-3,053	30,641	232,026	188,798	35,856	26,372	393,275	3,346	4,331
Sep	1991	222.42	49,501	-3,312	37,185	17,006	115,900	3,854	116,145	58,158	592	5,346
	1990	221.65	47,467	1,392	97,485	91,828	133,098	0	104,777	217,785	1,560	3,103
Oct	1991	221.40	46,810	-2,691	17,277	26,404	193,392	25,282	123,023	93,083	460	2,084
	1990	221.41	46,836	-631	1,444	154,701	123,912	62,032	16,333	209,278	334	7,289
Nov	1991	220.93	45,577	-1,233	60,615	30,560	51,400	2,152	59,697	79,690	93	-2,176
	1990	222.29	49,155	2,319	65,719	51,553	115,212	1,299	68,993	163,675	369	4,171
Dec	1991	221.99	48,360	2,783	102,083	28,396	66,262	0	80,335	109,827	276	-3,520
	1990	222.53	49,793	638	137,752	22,654	150,928	0	182,903	137,259	188	9,654
Total	1991	---	---	-1,433	725,844	1,160,010	1,518,403	366,855	1,611,155	1,456,486	11,048	39,854
	1990	---	---	4,268	1,108,780	1,824,405	2,204,204	189,498	1,252,249	3,700,454	22,954	32,034

**Table 15. Monthly Operations Summary, State-Federal San Luis Joint-Use Facilities  
1991**

(In acre-feet except as noted)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Check 12													
State	135,829	83,004	358,182	259,901	60,780	32,848	26,126	108,100	115,900	168,429	51,400	66,262	1,466,761
Federa	26,679	0	0	0	0	0	0	0	0	24,963	0	0	51,642
Tota	162,508	83,004	358,182	259,901	60,780	32,848	26,126	108,100	115,900	193,392	51,400	66,262	1,518,403
O'Neill P-G Plant													
Pumping													
State	0	0	0	0	0	0	0	0	0	0	0	0	0
Federa	89,853	85,201	191,893	128,033	11,772	0	0	1,932	37,185	17,277	60,615	102,083	725,844
Tota	89,853	85,201	191,893	128,033	11,772	0	0	1,932	37,185	17,277	60,615	102,083	725,844
Generation													
Federa	3,541	2,455	1,271	8,457	35,466	106,644	108,102	69,631	3,854	25,282	2,152	0	366,855
O'Neill Forebay													
End-Of-Month Storage													
State	22,996	18,047	20,296	13,317	10,021	6,898	5,304	1,558	1,888	8,104	9,210	16,757	---
Federa	20,286	26,093	21,977	26,181	34,249	37,868	39,149	51,255	47,613	38,706	36,367	31,603	---
Tota	43,282	44,140	42,273	39,498	44,270	44,766	44,453	52,813	49,501	46,810	45,577	48,360	---
San Luis Reservoir													
End-Of-Month Storage													
State	63,024	93,908	339,738	593,428	567,398	447,565	331,394	324,104	385,114	460,929	451,446	409,583	---
Federa	547,919	587,666	861,827	948,803	865,214	637,113	394,869	245,337	268,587	279,951	312,153	400,722	---
Tota	610,943	681,574	1,201,565	1,542,231	1,432,612	1,084,678	726,263	569,441	653,701	740,880	763,599	810,305	---
Gianelli P-G Plant													
Pumping													
State	75,130	41,843	342,355	256,612	16,799	8,267	5,332	59,287	75,961	93,596	40,097	10,400	1,025,679
Federa	77,289	51,927	186,719	110,395	0	0	0	0	40,184	29,427	19,600	69,935	585,476
Tota	152,419	93,770	529,074	367,007	16,799	8,267	5,332	59,287	116,145	123,023	59,697	80,335	1,611,155
Generation													
State	0	13,091	0	1/ -164	51,945	127,493	124,136	63,921	11,441	14,387	30,560	28,396	465,534
Federa	0	6,774	0	7,443	65,646	220,234	236,877	140,248	5,565	12,017	0	0	694,804
Tota	0	19,865	0	7,279	117,591	347,727	361,013	204,169	17,006	26,404	30,560	28,396	1,160,010
Pacheco Tunnel Diversion													
Federa	7,934	4,424	1,037	3,270	5,401	7,371	7,520	7,111	3,953	3,269	3,472	3,657	58,419
Dos Amigos P.P.													
Amount Pumpec													
State	90,370	63,225	6,089	8,729	90,563	158,124	148,344	116,454	50,491	84,150	73,923	104,453	994,915
Federa	21,341	25,648	16,042	20,606	45,402	112,509	126,640	65,642	7,667	8,933	5,767	5,374	461,571
Tota	111,711	88,873	22,131	29,335	135,965	270,633	274,984	182,096	58,158	93,083	79,690	109,827	1,456,486

1/ Negative values in State generation indicate a mismatch of scheduled CVP energy and actual energy; adjustments to SWP water shares are made to balance the mismatch.

**Table 16. Pyramid Lake Monthly Operation  
1991**

(in acre-feet except as noted)

Month	End-of month Water Surface Elevation (in feet)	End Of Month Storage	Natural Inflow Storage Shares	Storage Change	Inflow			Outflow				Computed Losses (-) Gains (+)
					Natural	Project		Project		To Piru Creek		
						Warne Power- plant	Castaic Powerplant Pumpback	Castaic Powerplant Generation	Recreation Deliveries (metered water)	Pyramid Diversion 1/	Deliveries 2/	
Jan	2,570.28	160,125	356	-3,364	357	25,041	72,410	99,037	1	326	0	-1,808
Feb	2,575.55	166,757	670	6,632	610	14,428	28,481	36,728	1	296	0	138
Mar	2,576.63	168,138	2,969	1,381	7,882	2,921	17,125	21,759	0	5,583	0	795
Apr	2,574.93	165,958	8,483	-2,180	9,163	6,606	28,560	42,580	1	3,649	0	-279
May	2,571.37	161,483	3,796	-4,475	1,396	57,655	6,219	61,651	3	6,082	0	-2,009
Jun	2,574.90	165,930	1,862	4,447	470	78,264	9,891	78,946	4	2,405	0	-2,823
Jul	2,572.70	163,149	296	-2,781	173	43,459	44,914	87,705	7	1,739	0	-1,876
Aug	2,573.17	163,740	0	591	138	62,704	57,111	115,486	4	434	423	-3,015
Sep	2,573.68	164,384	0	644	177	28,474	50,958	76,276	4	177	653	-1,855
Oct	2,574.09	164,902	0	518	195	34,464	56,788	88,057	3	195	599	-2,075
Nov	2,556.72	143,839	0	-21,063	265	48,970	70,385	138,701	1	265	178	-1,538
Dec	2,557.10	144,281	0	442	623	87,374	58,646	143,155	1	623	988	-1,434
Total	---	---	---	-19,208	21,449	490,360	501,488	990,081	30	21,774	2,841	-17,779

1/ Pumpback by Los Angeles Department of Water and Power (LADWP) from Elderberry Forebay through Castaic powerplant.

2/ Portion of these amounts used to satisfy fishery enhancement agreement.

**Table 17. Elderberry Forebay Monthly Operation\***  
**1991**

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Total Storage	Storage Change	Inflow		Outflow		Pumpback To Pyramid Lake 1/	Computed Losses (-) Gains (+)
				Castaic Powerplant Generation	Natural	To Castaic Lake			
						Natural	Project		
Jan	1,512.67	20,579	-2,146	99,037	0	0	30,004	72,410	1,231
Feb	1,513.46	20,890	311	36,728	56	56	7,936	28,481	0
Mar	1,515.85	21,846	956	21,759	3,049	3,049	4,063	17,125	385
Apr	1,511.01	19,933	-1,913	42,580	596	596	15,695	28,560	-238
May	1,510.20	19,621	-312	61,651	78	78	56,032	6,219	288
Jun	1,513.57	20,933	1,312	78,946	2	2	70,892	9,891	3,149
Jul	1,514.35	21,244	311	87,705	0	0	42,925	44,914	445
Aug	1,522.92	24,806	3,562	115,486	0	0	55,161	57,111	348
Sep	1,512.86	20,654	-4,152	76,276	0	0	29,887	50,958	417
Oct	1,513.16	20,772	118	88,057	0	0	31,257	56,788	106
Nov	1,519.99	23,555	2,783	138,701	0	0	65,248	70,385	-285
Dec	1,522.00	24,409	854	143,155	76	76	83,511	58,646	-144
Total	---	---	1,684	990,081	3,857	3,857	492,611	501,488	5,702

1/ Pumpback by Los Angeles Department of Water and Power (LADWP) thru Castaic Power Plant.

\* Daily pumping and generation at Castaic plant and releases from Elderberry Forebay to Castaic Lake are determined by LADWP, the operator of this facility to meet weekly releases into Castaic Lake scheduled by SWP.

**Table 18. Castaic Lake Monthly Operation  
1991**

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	End-of-Month Storage	Natural Inflow Storage Shares	Storage Change	Inflow			Outflow		Computed Losses (-) Gains (+)	Castaic Lagoon Release of Natural Inflow
					Natural	From Elderberry Forebay		Deliveries 1/	Released to Castaic Lagoon		
						Natural	Project				
Jan	1,149.17	195,006	30	-11,574	19	0	30,004	42,225	0	628	30
Feb	1,432.52	167,916	240	-27,090	154	56	7,936	36,853	0	1,617	102
Mar	1,437.94	176,506	4,112	8,590	2,316	3,049	4,063	1,688	1,493	2,343	0
Apr	1,444.24	186,761	5,215	10,255	507	596	15,695	5,222	0	-1,321	235
May	1,464.42	221,743	5,079	34,982	93	78	56,032	20,745	307	-169	210
Jun	1,491.71	274,082	5,013	52,339	23	2	70,892	13,822	91	-4,665	227
Jul	1,499.22	289,551	4,387	15,469	4	0	42,925	25,871	630	-959	330
Aug	1,509.10	310,669	4,130	21,118	0	0	55,161	32,514	257	-1,272	282
Sep	1,502.37	296,189	3,940	-14,480	0	0	29,887	43,984	190	-193	239
Oct	1,484.73	260,128	2,665	-36,061	0	0	31,257	67,404	0	86	212
Nov	1,486.29	263,213	1,437	3,085	1	0	65,248	61,446	0	-718	319
Dec	1,502.22	295,447	532	32,234	59	76	83,511	50,374	33	-1,005	89
Total	---	---	---	88,867	3,176	3,857	492,611	402,148	3,001	-5,628	2,275

1/ Includes 3,511 AF of Natural Inflow delivered to C.L.W.A.

**Table 19. Silverwood Lake Monthly Operation  
1991**

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	End-of-Month Storage	Natural Inflow Storage Shares 2/	Storage Change	Inflow		Outflow			Computed Losses (-) Gains (+)	Natural Inflow Exchanged or Released 1/
					Natural	Project	San Bernardino Tunnel	CLAWA Turnout	Release of Natural Inflow To Mojave River		
Jan	3,350.94	71,064	-87	16,140	28	56,140	39,535	189	9	-295	0
Feb	3,346.55	66,969	170	-4,095	306	29,600	35,135	134	9	1,277	29
Mar	3,351.67	71,758	1,823	4,789	3,001	4,220	3,842	105	760	2,275	483
Apr	3,352.03	72,102	1,862	344	1,822	2,770	3,061	108	717	-362	958
May	3,345.83	66,310	1,145	-5,792	484	7,770	13,774	91	218	37	878
Jun	3,349.64	69,838	372	3,528	100	27,560	26,183	124	1,615	3,790	636
Jul	3,353.57	73,581	163	3,743	15	30,450	27,695	137	541	1,651	179
Aug	3,351.99	72,063	152	-1,518	0	14,270	16,728	156	11	1,107	0
Sep	3,347.64	67,974	152	-4,089	10	15,140	18,769	147	10	-313	0
Oct	3,353.12	73,147	160	5,173	19	40,430	35,866	144	11	745	0
Nov	3,352.18	72,226	134	-921	6	26,630	27,434	111	10	-2	22
Dec	3,351.87	71,949	206	-277	125	21,180	22,871	107	11	1,407	42
Total	---	---	---	17,025	5,916	276,160	270,893	1,553	3,922	11,317	3,227

1/ Total releases made from Mojave Siphon to Las Flores Ranch Co., in exchange for natural inflow stored in lake, and from Silverwood Lake to Mojave River from outlet for Mojave W.A. The difference between this total column and the natural inflow released to Mojave River equals the Las Flores Ranch.

2/ Account balance of natural inflows and releases.

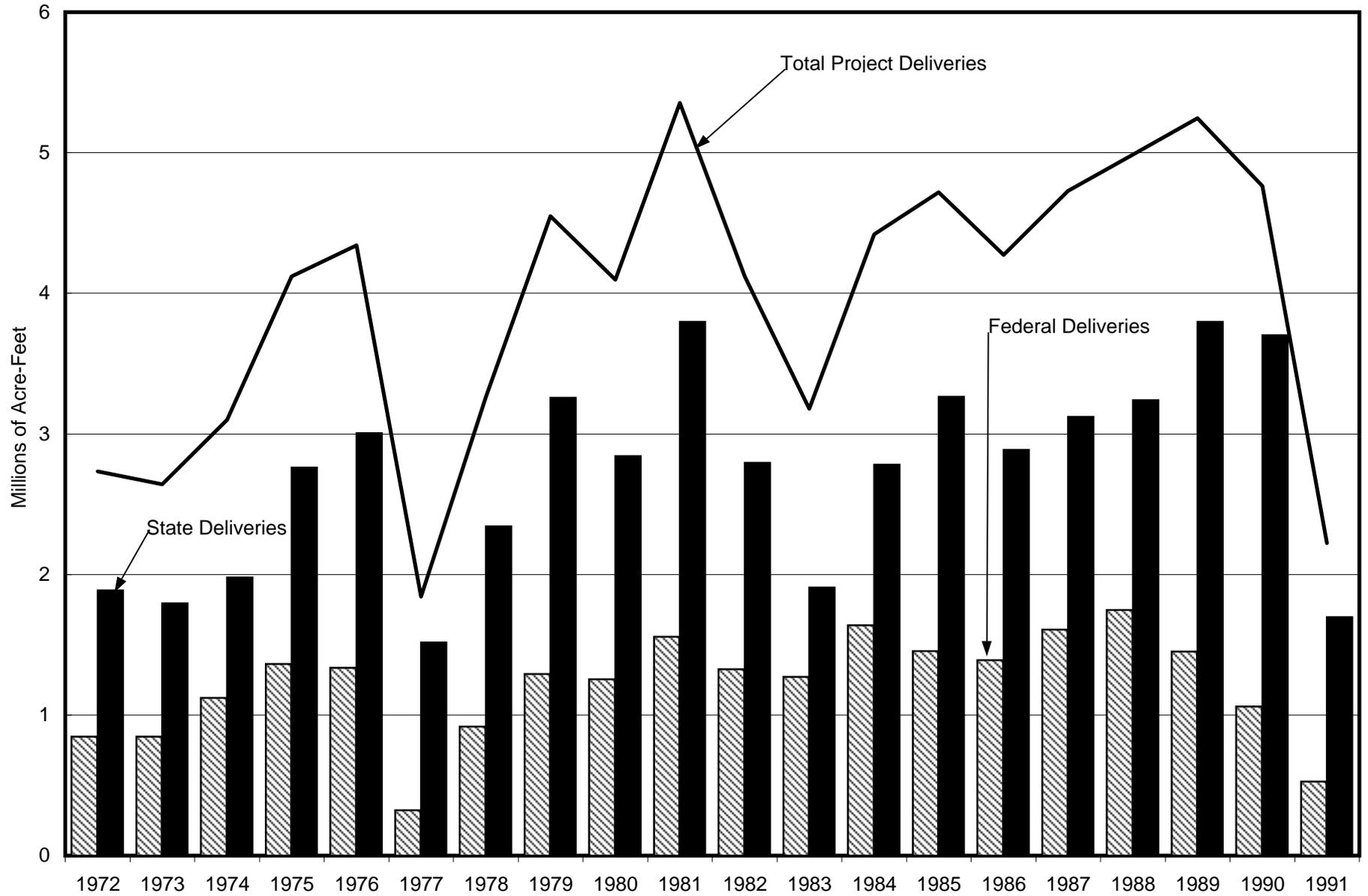
**Table 20. Lake Perris Monthly Operation**

**1991**

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	End-of Month Storage	Storage Change	Inflow	Outflow	Computed Losses (-) Gains (+)
Jan	1,584.10	118,022	12,397	13,976	794	-785
Feb	1,587.04	124,647	6,625	6,949	394	70
Mar	1,587.42	125,514	867	647	435	655
Apr	1,586.97	124,487	-1,027	327	413	-941
May	1,586.43	123,261	-1,226	993	437	-1,782
Jun	1,586.05	122,400	-861	840	420	-1,281
Jul	1,585.69	121,587	-813	276	422	-667
Aug	1,585.25	120,597	-990	671	420	-1,241
Sep	1,584.89	119,788	-809	818	415	-1,212
Oct	1,584.36	118,602	-1,186	858	522	-1,522
Nov	1,584.62	119,184	582	3,067	1,222	-1,263
Dec	1,586.78	124,055	4,871	6,124	404	-849
Total	---	---	18,430	35,546	6,298	-10,818

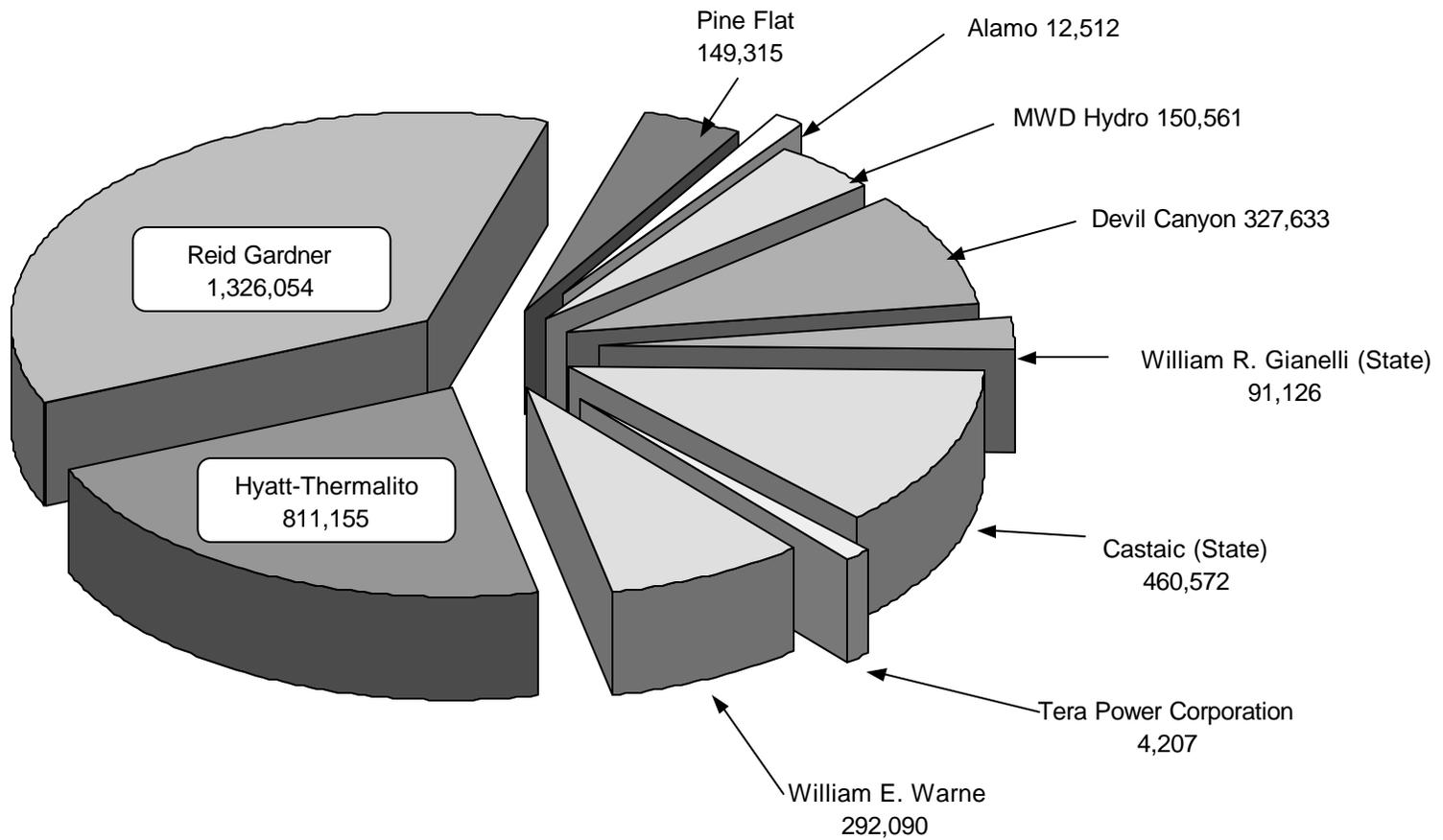
**Figure 1. Total Deliveries from SWP Facilities**  
Annual Totals



**Figure 2. SWP Energy Resources**

(all values in MWh)

**1991**



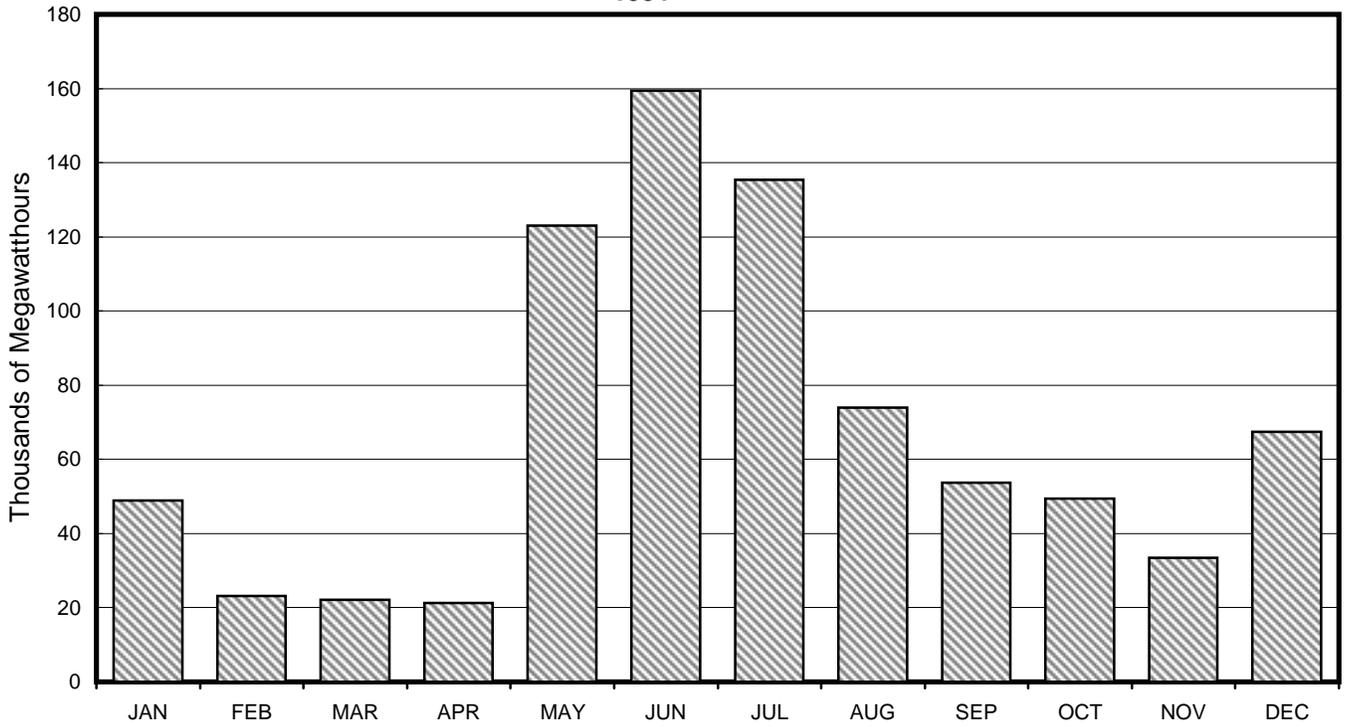
**Total: 3,625,225**

Note: Purchases, Other Sources and SCE Return Additional are not shown here. All values are metered readings at plants and are not adjusted for transmission losses.

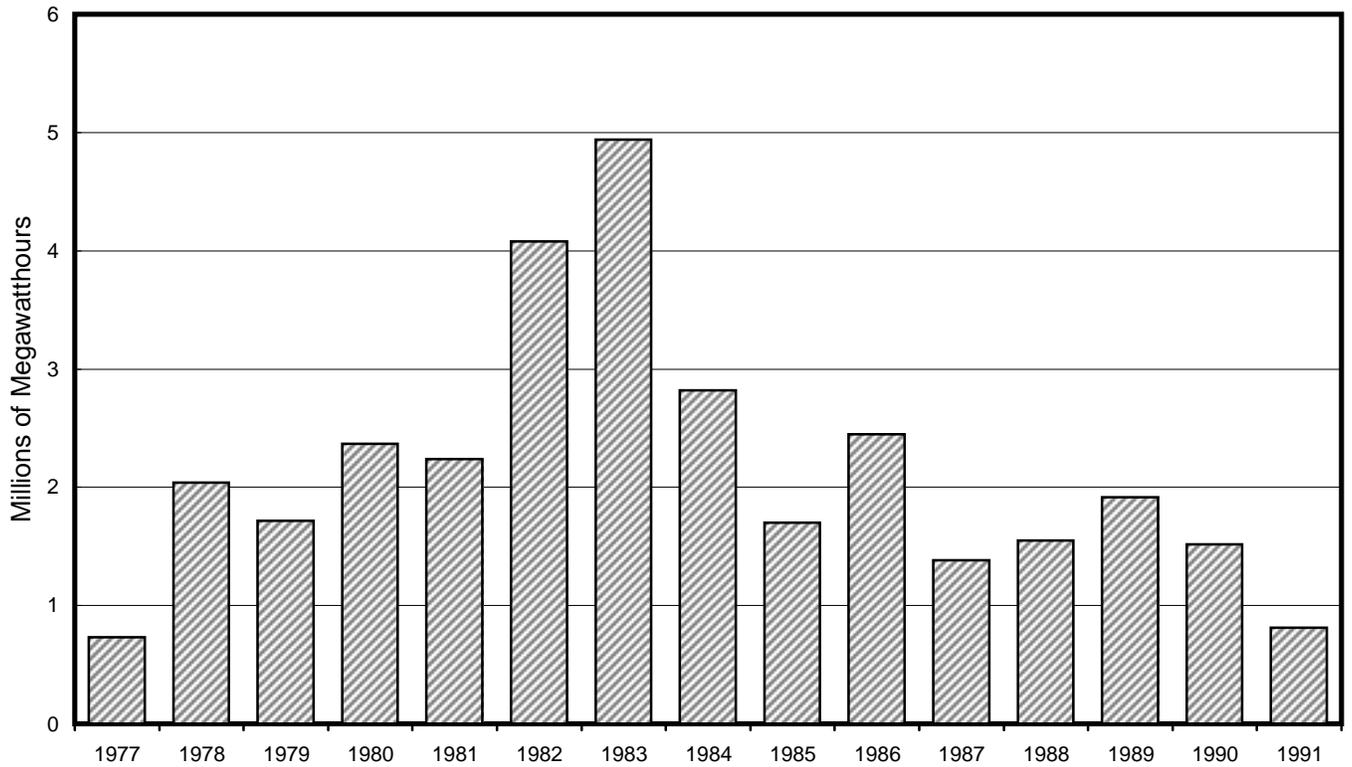
**Figure 3. Operation of Oroville Complex Powerplants**

**Monthly Gross Generation**

**1991**



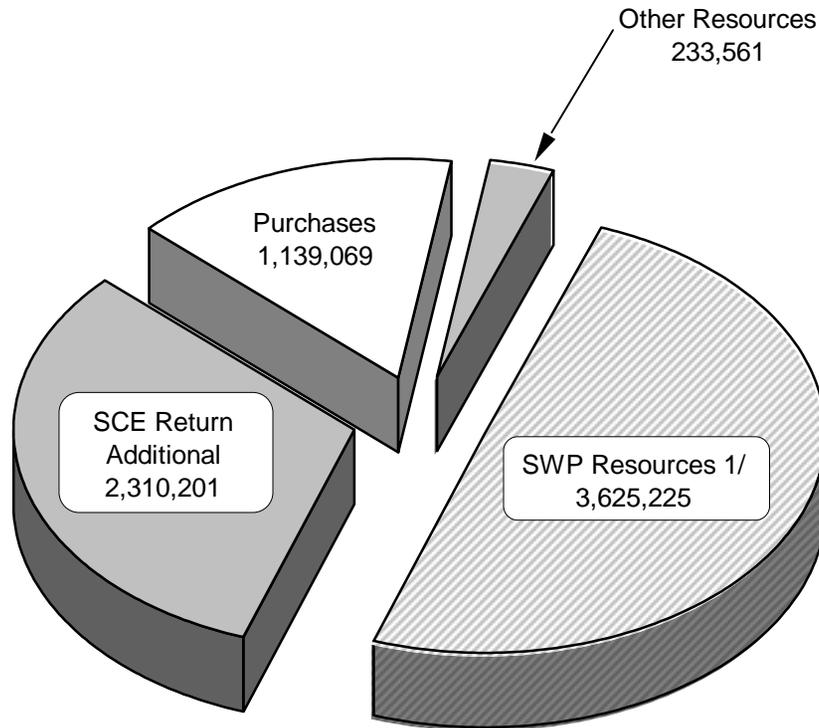
**Annual Gross Generation Summary**



**Figure 4. Total State Energy Resources**

**1991**

(all values in MWh)



**Total: 7,308,056**

<u>Purchases</u>	
Bonneville Power Authority	483,624
Pacific Power and Light	433,940
Montana Power Company	55,702
British Columbia Hydro Authority	43,782
Salt River Project	38,048
Portland General Electric	19,625
Western Area Lower Colorado	16,665
Washington Water and Power Co.	13,971
Los Angeles Dept. of Water and Power	12,316
Puget Sound Power and Light	11,930
Arizona Public Service Company	5,412
Southern California Edison	1,628
Eugene Water and Electric Board	1,600
Pacific Gas and Electric Company	727
Nevada Power	54
Public Service of New Mexico	45
	<hr/>
	1,139,069

<u>Other Resources</u>	
Bonneville Power Authority	118,610
Southern California Edison	97,440
Pacific Gas and Electric Company	12,156
Los Angeles Dept. of Water and Power	2,229
Western Area Mid Pacific	2,216
Northern California Power Authority	910
	<hr/>
	233,561

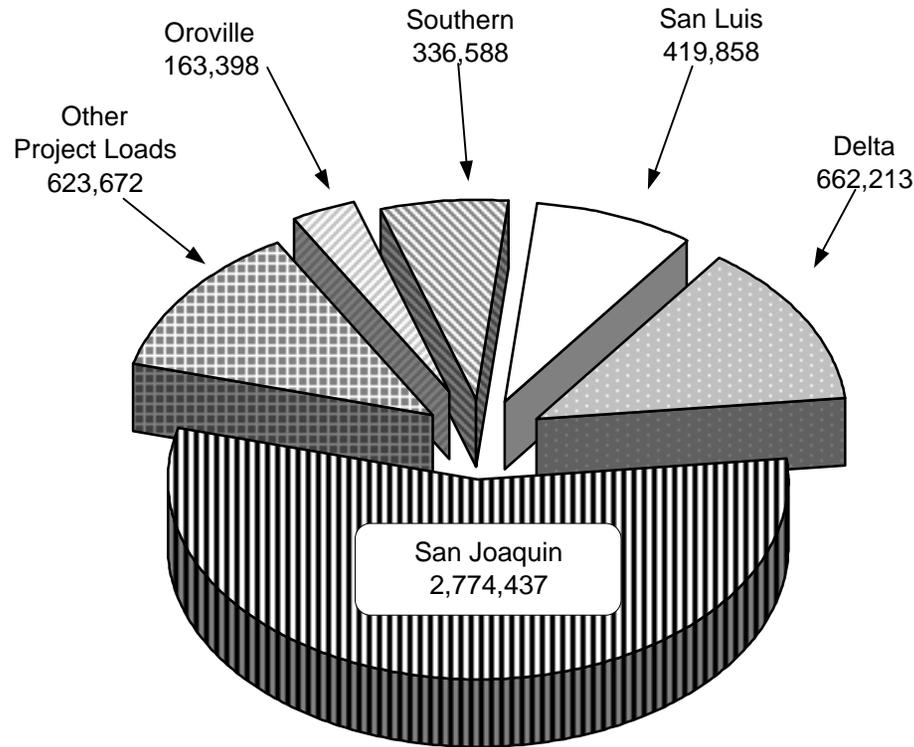
<u>SCE Return Additional</u>	
Total Received from SCE	3,113,408
SCE Hyatt-Thermalito Entitlement	-312,501
SCE Devil Canyon Entitlement	-327,633
SCE Alamo Entitlement	-12,512
MWD Hydro Entitlement	-150,561
	<hr/>
	2,310,201

1/ See Figure 2 for a breakdown of SWP energy resources.

**Figure 5. SWP Energy Loads  
(by field division)**

**1991**

(all values in MWh)



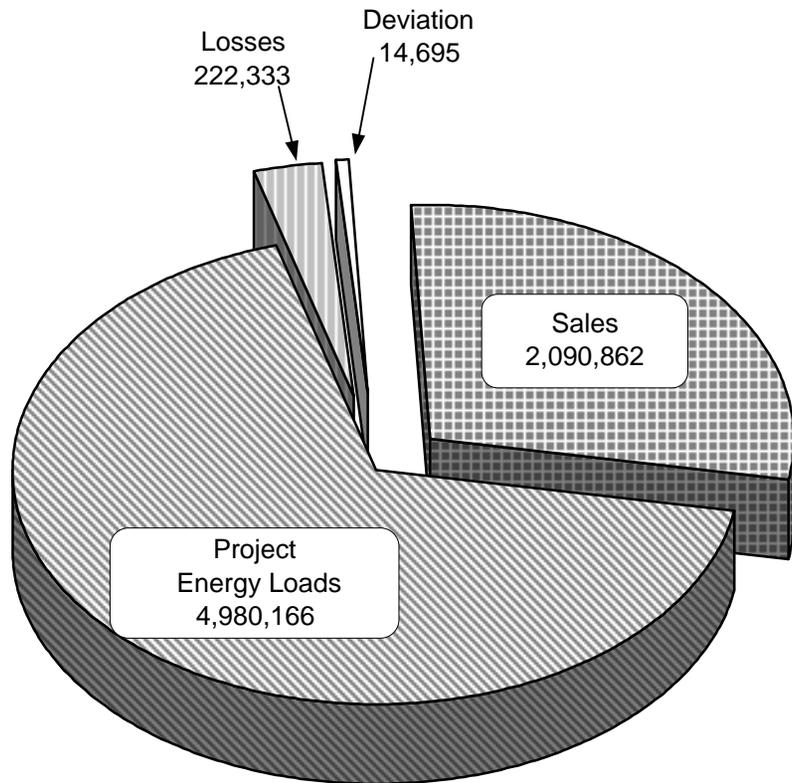
**Total: 4,980,166**

<u>Oroville Field Division</u>	
Hyatt-Thermalito Complex (Pump-back and Station Service)	163,398
<u>Delta Field Division</u>	
North Bay	18,088
South Bay	145,310
Del Valle	742
Harvey O. Banks Delta	496,600
Bottle Rock (Station Service)	1,473
<u>San Luis Field Division</u>	
William R. Gianelli	286,167
Dos Amigos	131,772
Pine Flat (Station Service)	1,719
<u>San Joaquin Field Division</u>	
Las Perillas	5,669
Badger Hill	15,347
Buena Vista	207,322
Wheeler Ridge	227,675
Wind Gap	514,209
A.D.Edmonston	1,804,215
<u>Southern Field Division</u>	
Oso	133,879
Pearblossom	202,054
William E. Warne (Station Service)	655
<u>Other Project Loads</u>	
Southern California Edison	414,024
Bonneville Power Authority	206,110
Nevada Power	2,431
Northern California Power Agency	910
South Bay Station Service	197

### Figure 6. Total Energy Loads

1991

(all values in MWh)



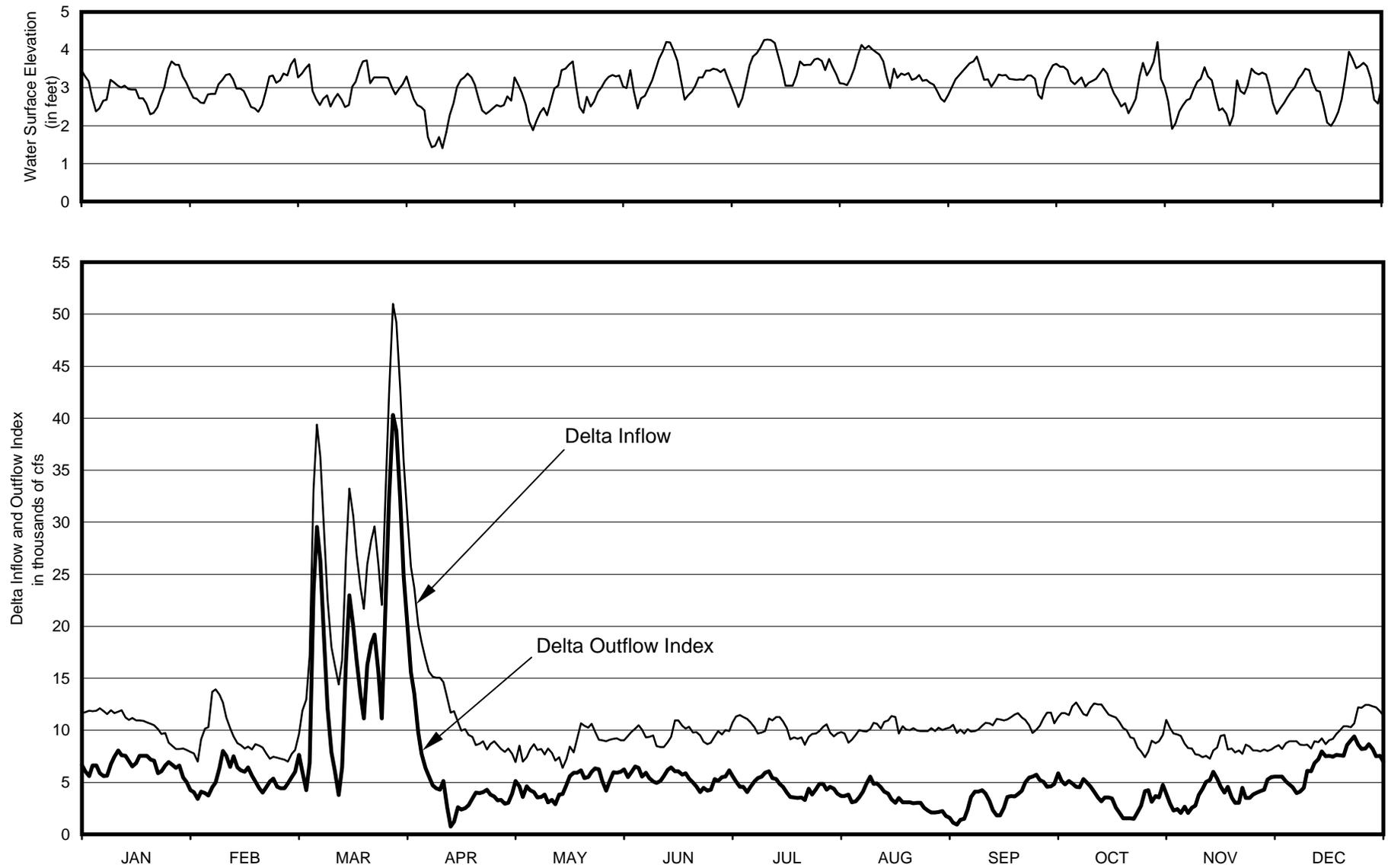
<u>Sales</u>	
Sacramento Municipal Utility District	637,045
Southern California Edison	340,162
Modesto Irrigation District	333,989
City of Vernon	275,002
Nevada Power	198,397
Turlock Irrigation District	151,466
Metropolitan Water District	55,065
Northern California Power Agency	50,791
Pacific Gas and Electric	41,737
Azusa, Banning, Colton, Riverside	5,160
City of Riverside	1,525
City of Anaheim	523

**Total: 7,308,056**

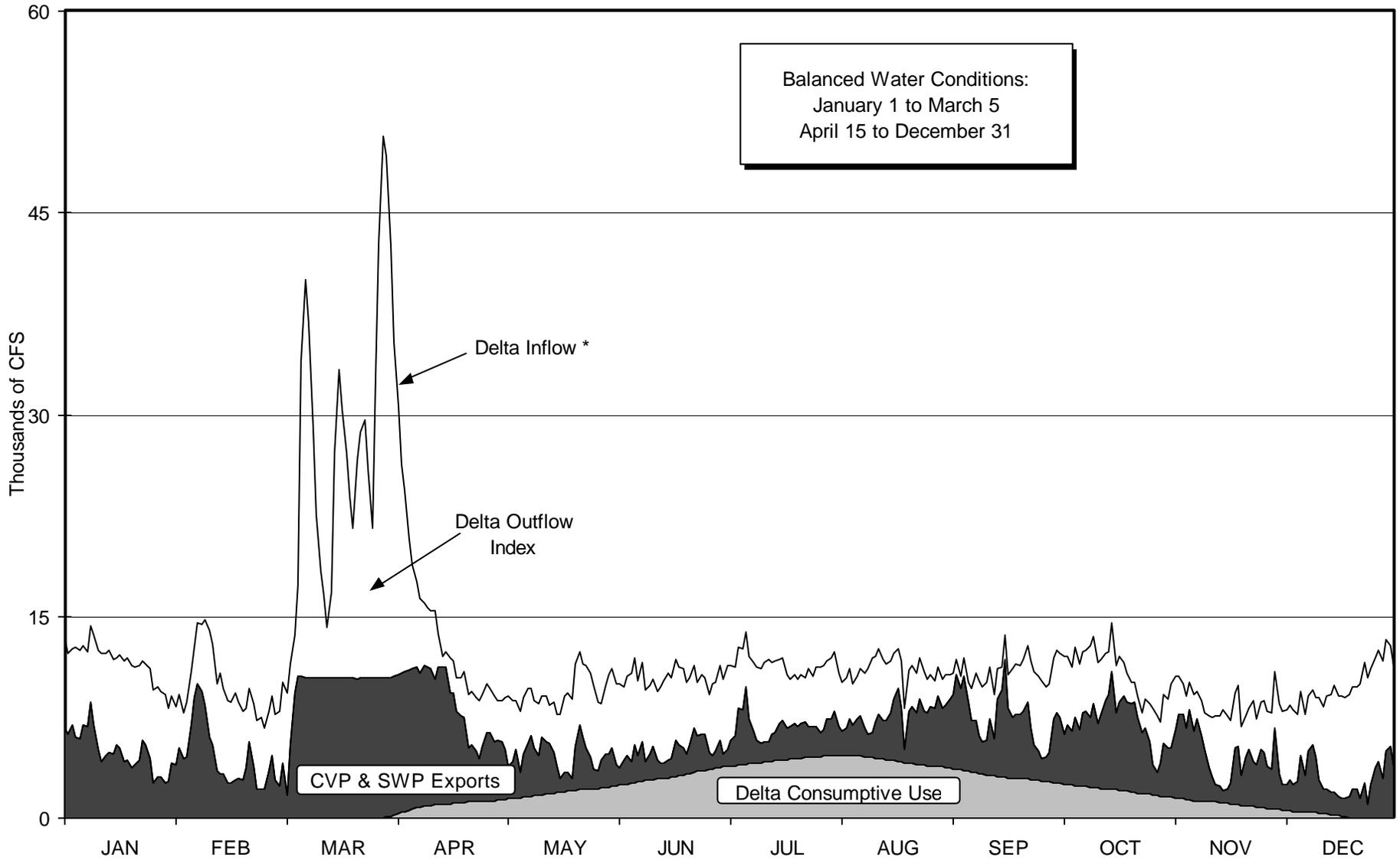
Note: See Figure 5 for breakdown of Project Energy Loads.

Figure 7. Antioch High-High Tide and Delta Inflow, and Outflow Index

1991

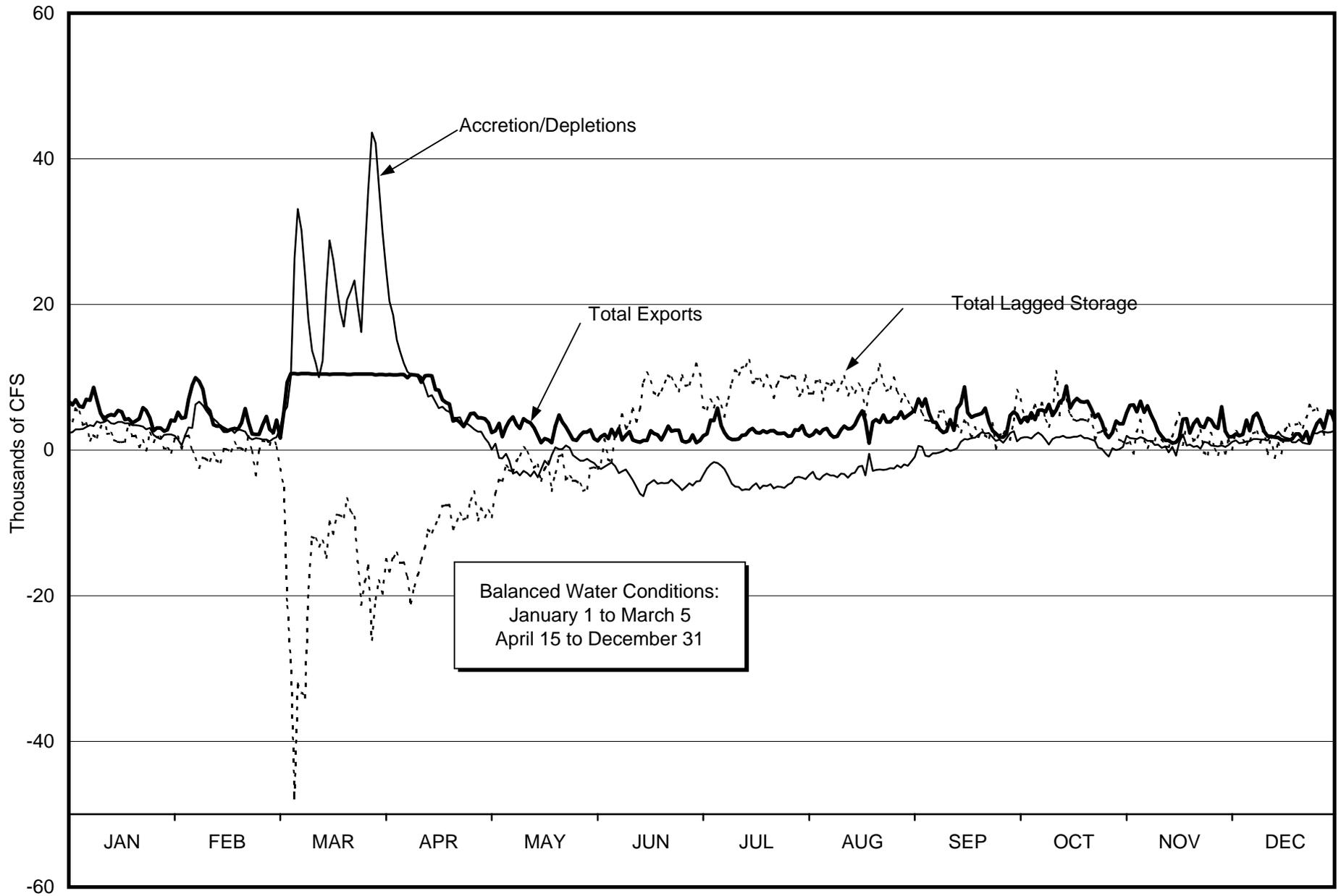


**Figure 8. Coordinated Delta Operations  
1991**

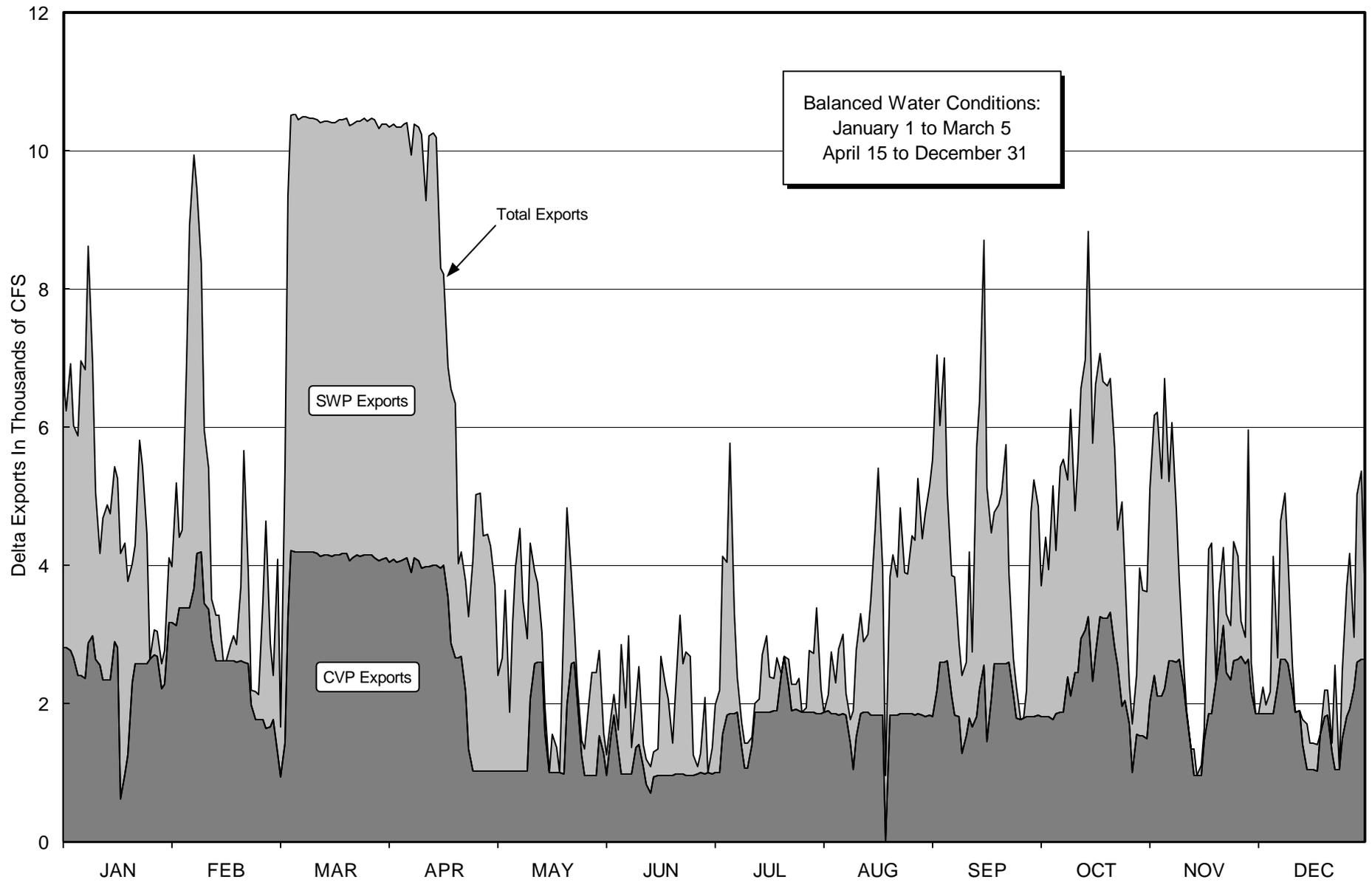


\* Delta inflow = Exports + Outflow + Consumptive use.

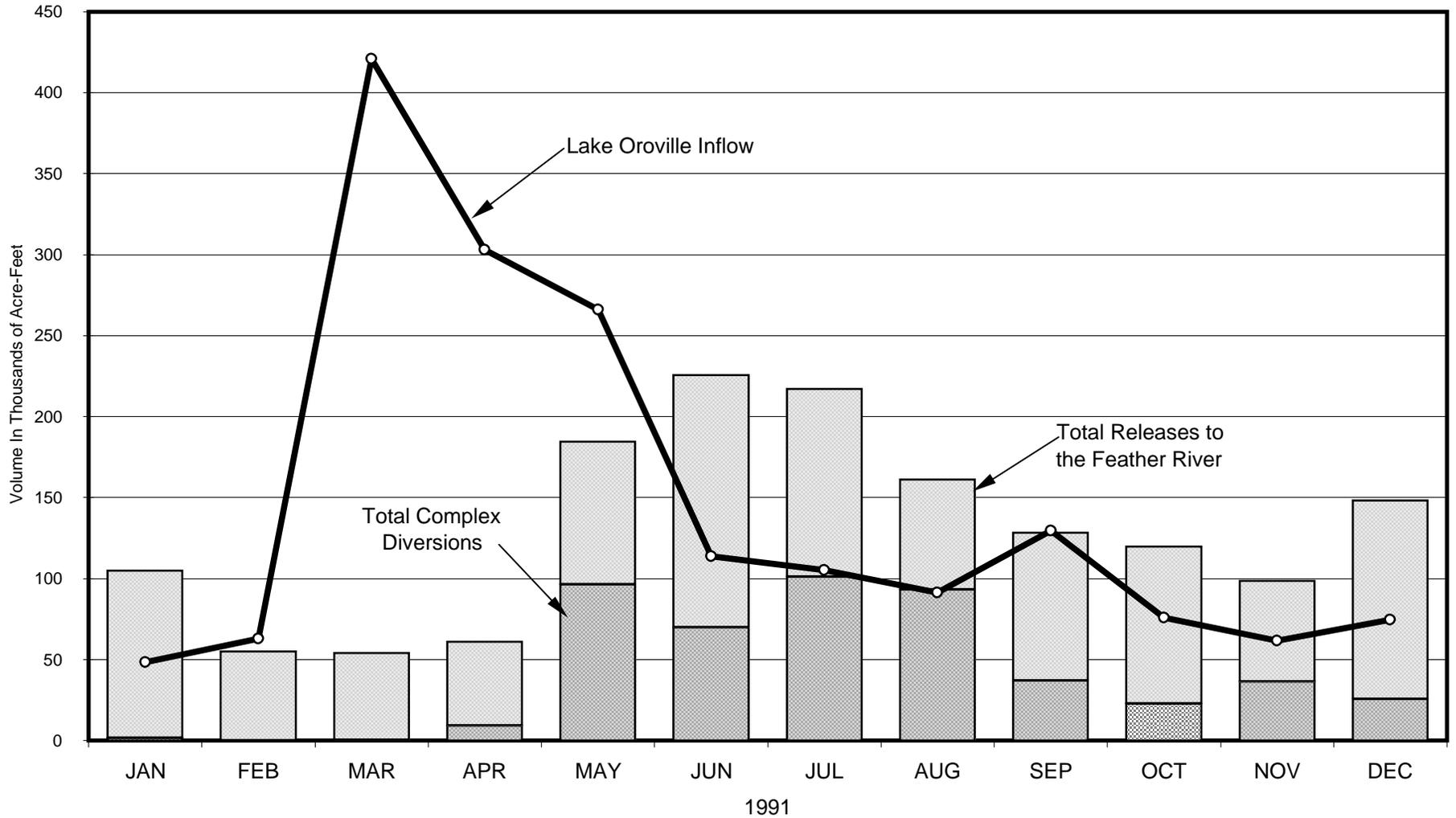
**Figure 9. Coordinated Delta Operations  
Lagged Storage Withdrawals  
1991**



**Figure 10. Coordinated Delta Operations**  
**Delta Exports**  
**1991**

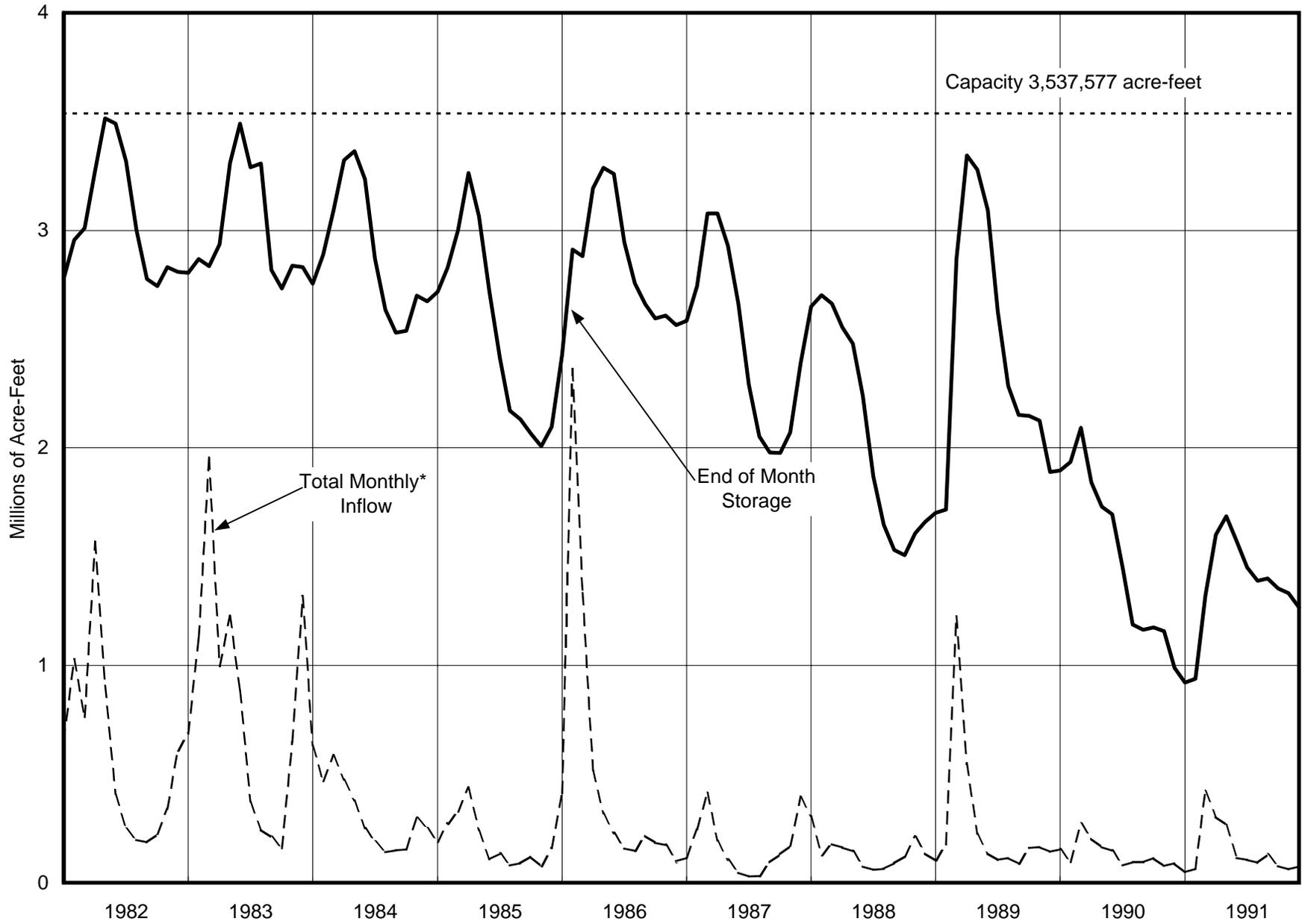


**Figure 11. Oroville-Thermalito Complex**  
 Inflow, Releases, and Diversions  
**1991**



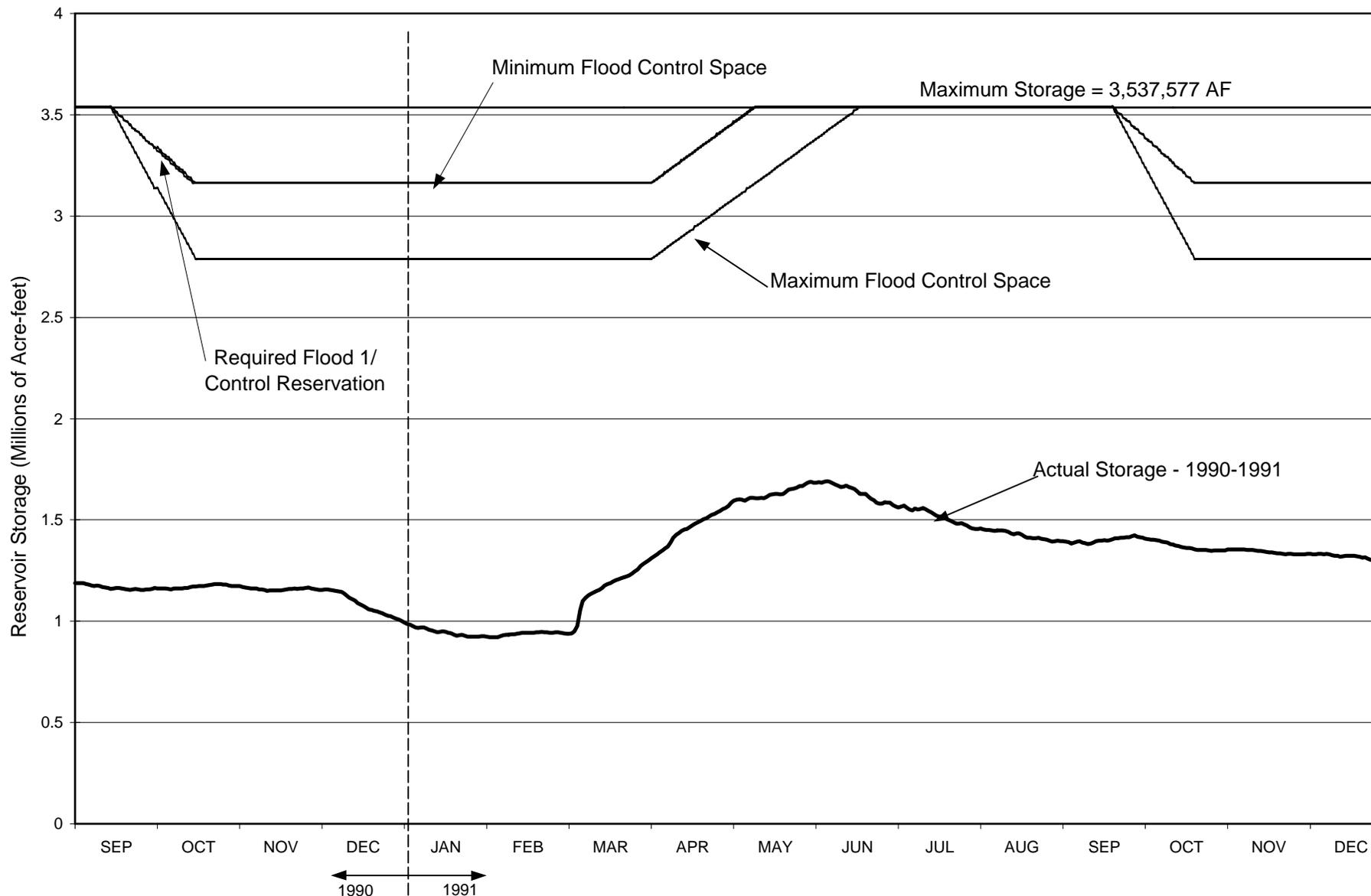
Note: Releases include flows at Fish Barrier dam, fish hatchery, and Afterbay river outlet. Diversions include Butte County, Thermalito Irrigation District, Sutter Butte Canal, Western Lateral, Richvale Canal, Sunset Pumps, and Western Canal. Lengths of bars extending above the Inflow line represent amounts derived from storage.

Figure 12. Lake Oroville Operation



\* Excludes pumpback.

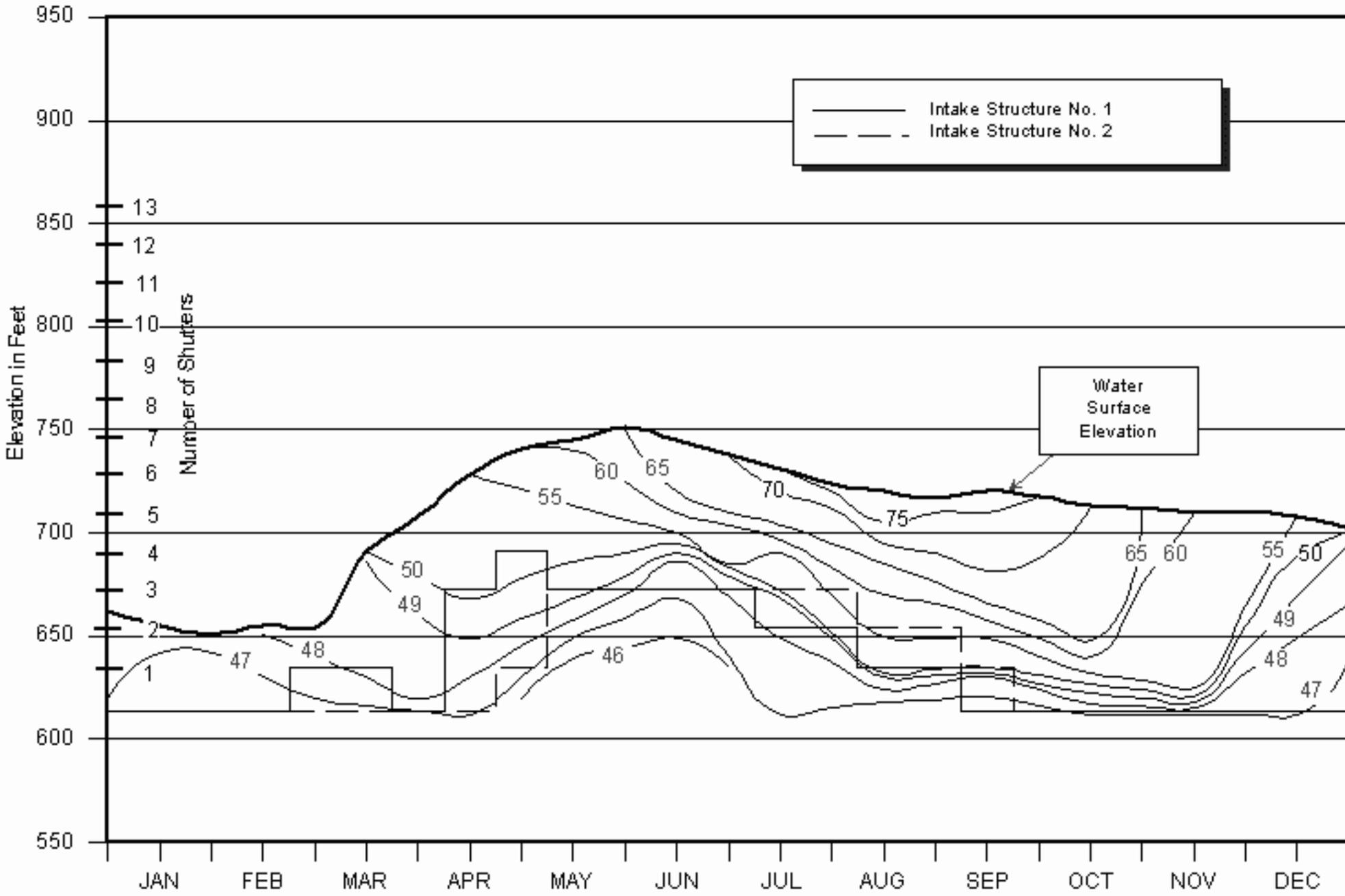
**Figure 13. Operation of Lake Oroville for Flood Control  
1990-1991**



1/ Due to low storage and minimal rainfall, Required Flood Control Reservation was virtually equal to Minimum Flood

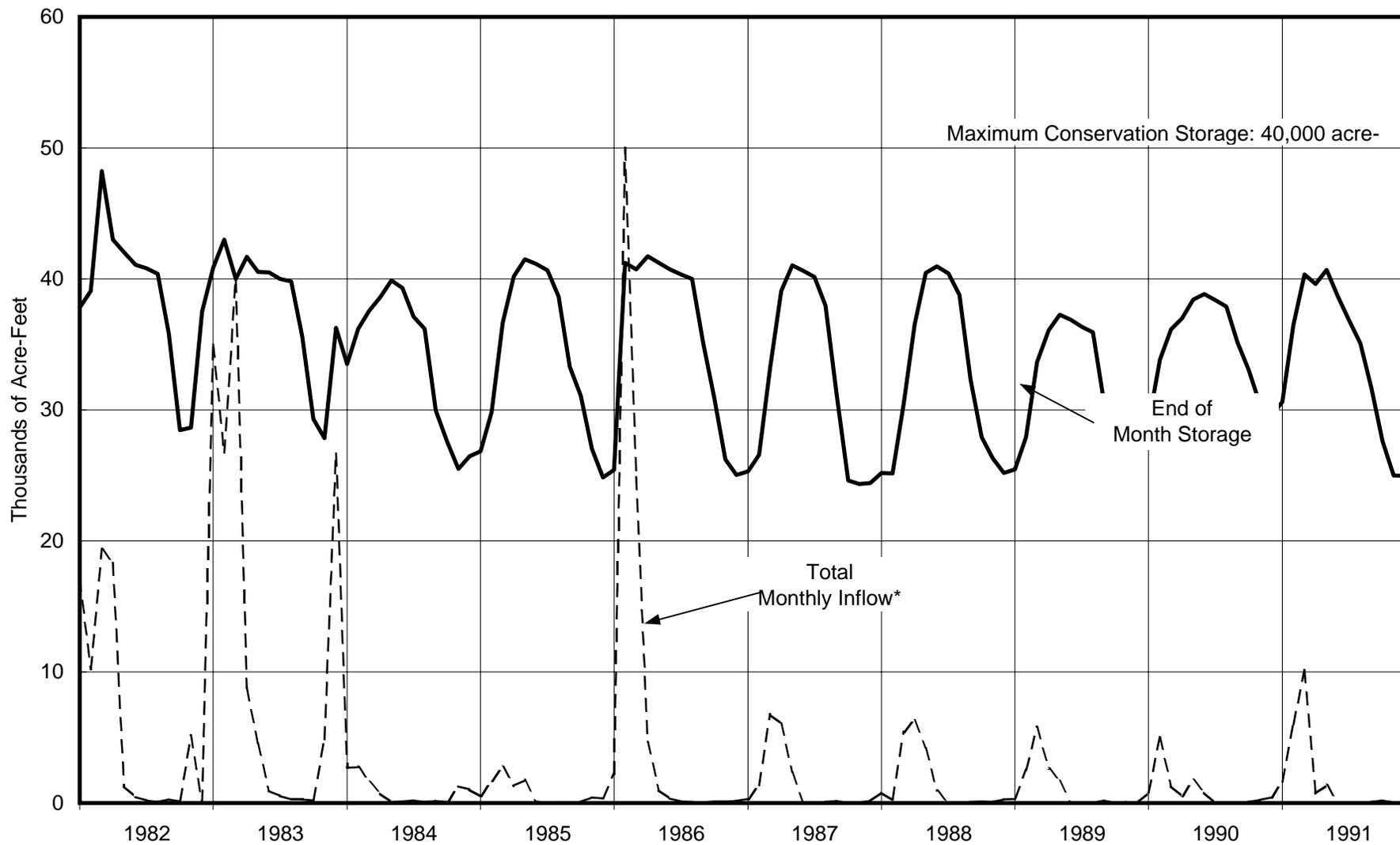
**Figure 14. Lake Oroville Temperatures  
1991**

( isotherms in degrees Farenheit )



Note: Temperature data is obtained once per month and averaged for the rest of the year.

Figure 15. Lake Del Valle Operation



\* Natural and pumped inflows

Figure 16. San Luis Reservoir Operation

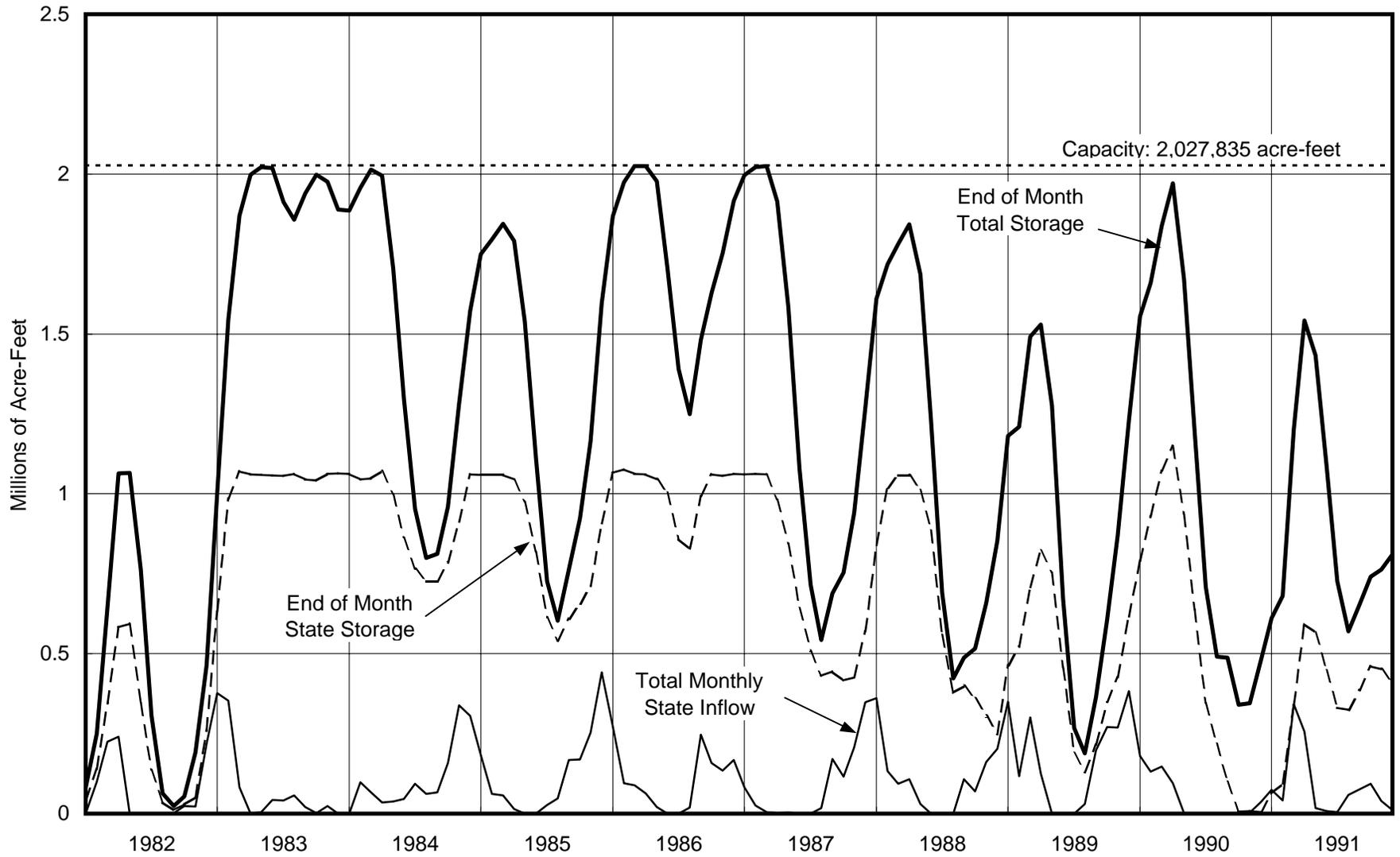
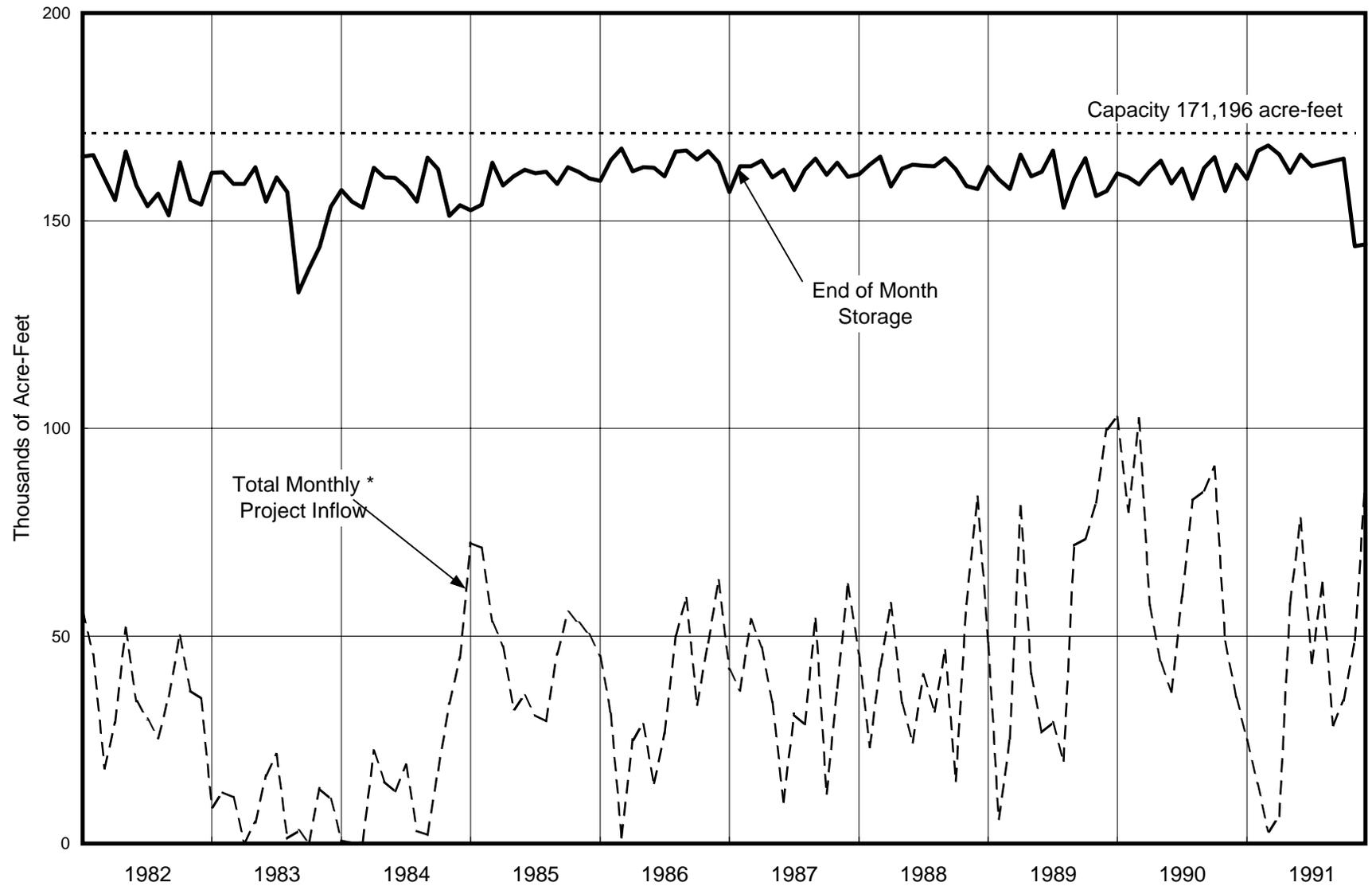


Figure 17. Pyramid Lake Operation



\* Excludes pumpback by LADWP through Castaic

Figure 18. Castaic Lake Operation

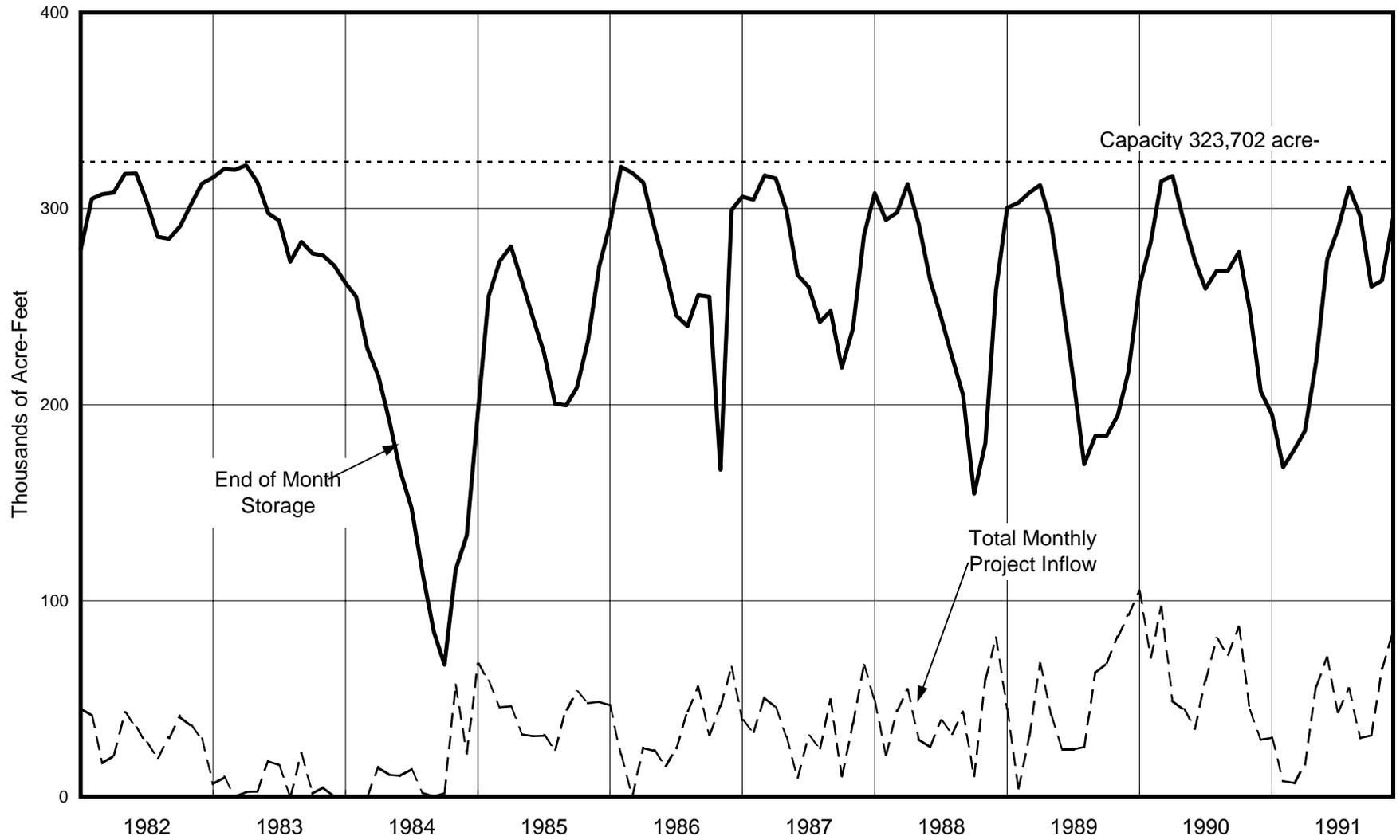


Figure 19. Silverwood Lake Operation

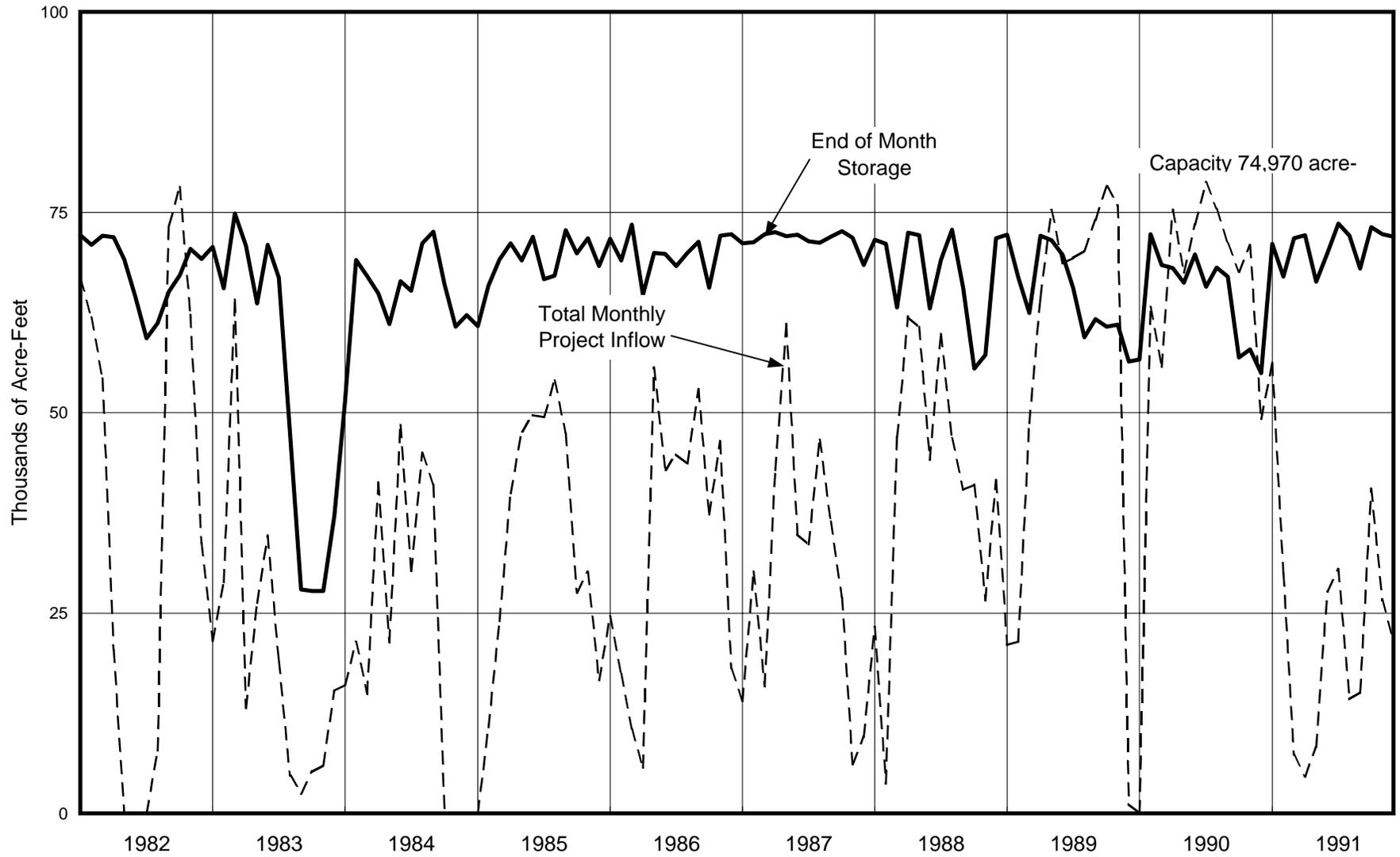
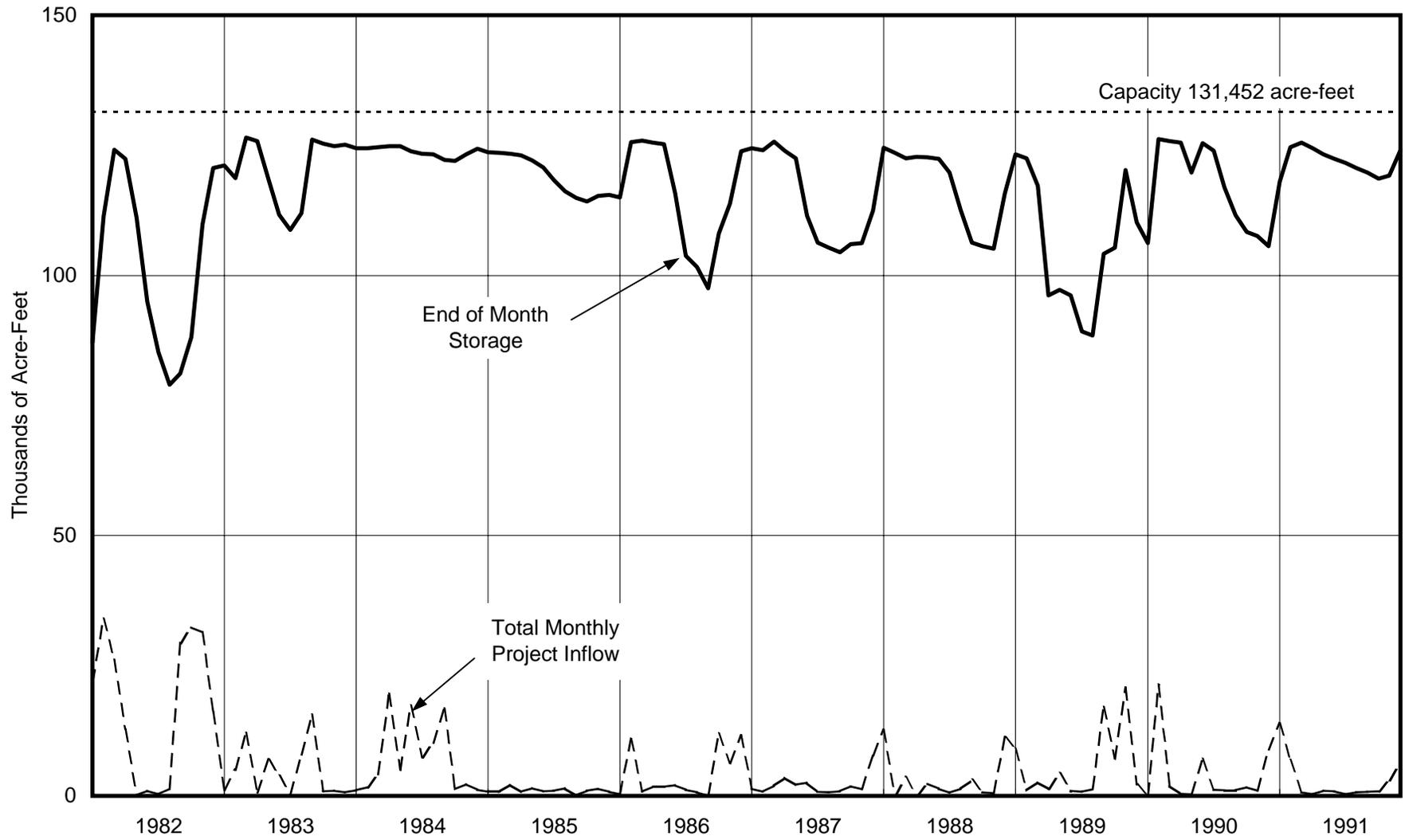


Figure 20. Lake Perris Operation



O R E G O N

● **Redding**

OROVILLE FIELD DIVISION

■ BECKWOURTH O & M SUBCENTER

■ OROVILLE O & M CENTER

● **Sacramento**

■ PROJECT OPERATIONS CENTER

DELTA FIELD DIVISION

■ DELTA O & M CENTER

■ SAN LUIS O & M CENTER

SAN LUIS FIELD DIVISION

● **Fresno**

■ COALINGA O & M SUBCENTER

SAN JOAQUIN FIELD DIVISION

■ LOST HILLS O & M SUBCENTER

● **Bakersfield**

■ SAN JOAQUIN O & M CENTER

SOUTHERN FIELD DIVISION

■ CASTAIC O & M CENTER

■ PEARBLOSSOM O & M SUBCENTER

● **Los Angeles**

● **San Diego**

M E X I C O

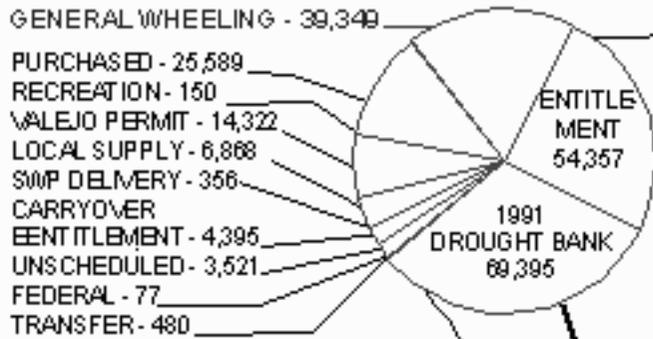
A R I Z O N A

N

# MAP 2 1991 WATER DELIVERIES

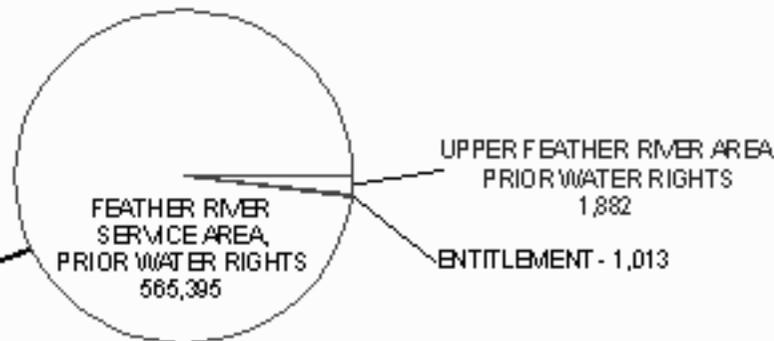
(in acre-feet)

## DELTA FIELD DIVISION (TOTAL DELIVERIES - 218,859)\*

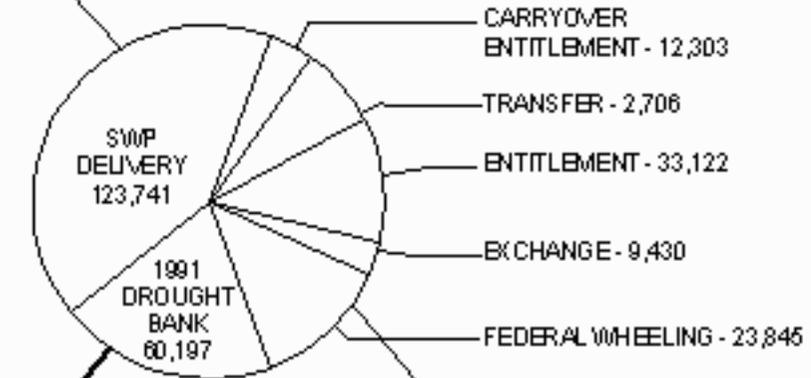


\* DOES NOT REFLECT 356 AF OF PAYBACK INFLOW

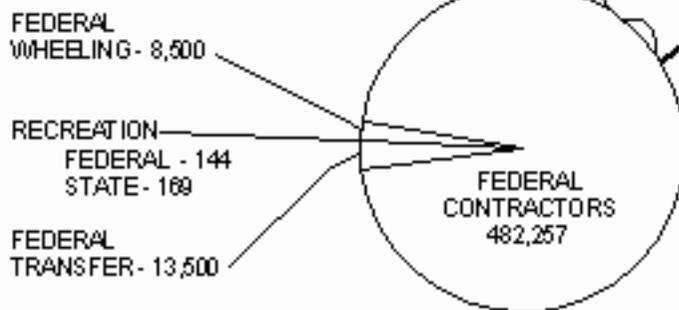
## OROVILLE FIELD DIVISION (TOTAL DELIVERIES - 568,290)



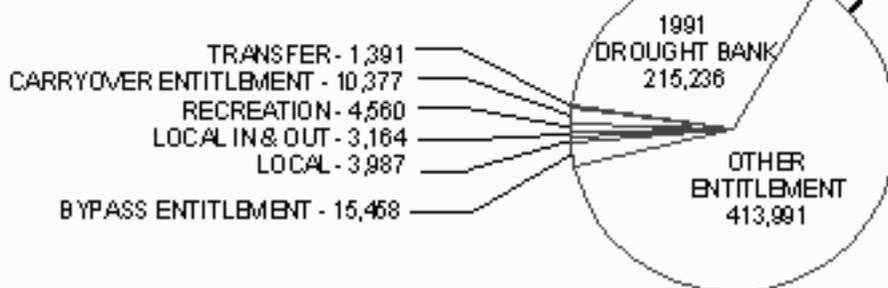
## SAN JOAQUIN FIELD DIVISION (TOTAL DELIVERIES - 265,344)



## SAN LUIS FIELD DIVISION (TOTAL DELIVERIES - 504,570)

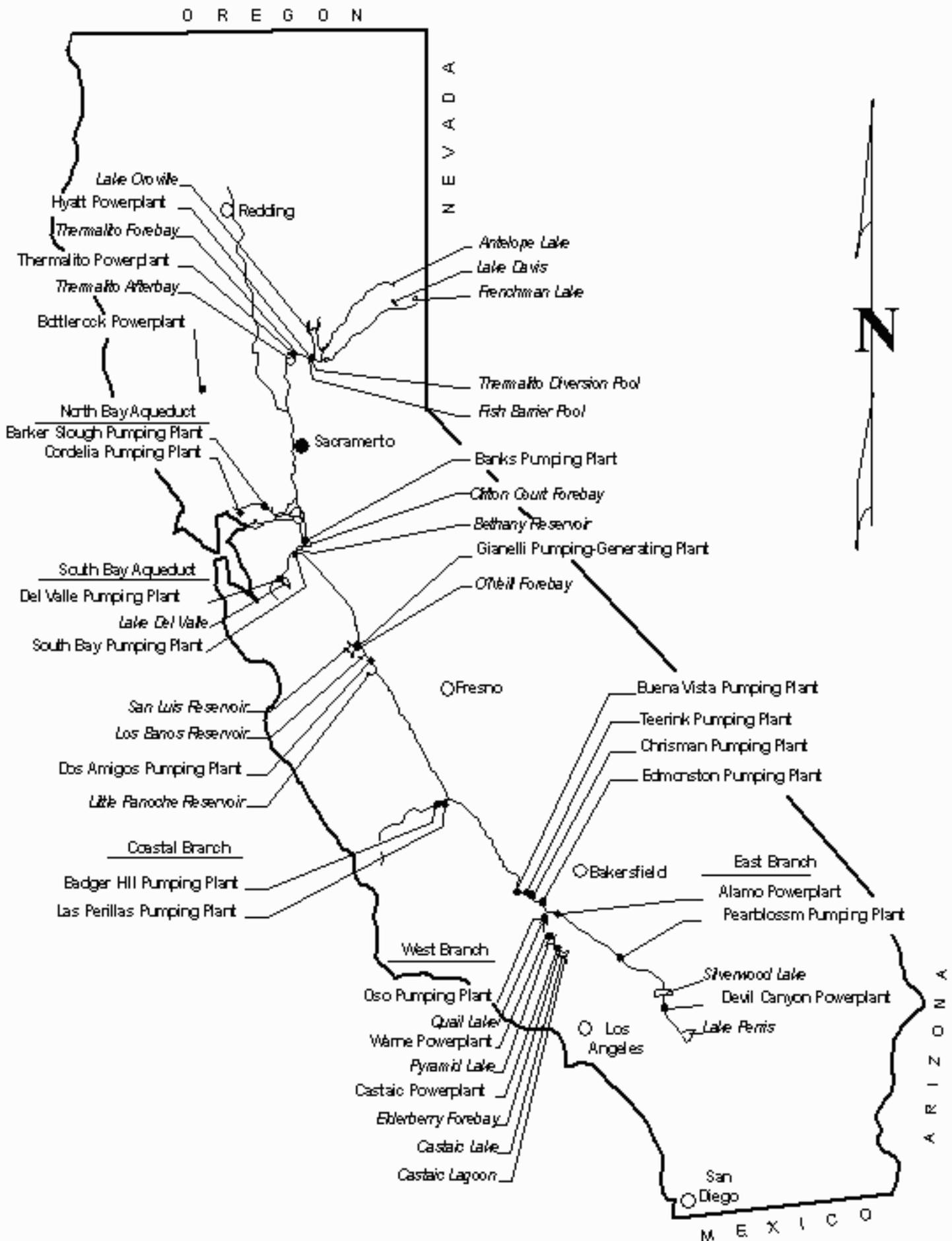


## SOUTHERN FIELD DIVISION (TOTAL DELIVERIES - 668,164)



**TOTAL DELIVERIES**  
**2,225,227**

# Map 3 Project Facilities



**Table 21a. Summary of California Aqueduct Operation  
1991**

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Delta Field Division	Note: North Bay Aqueduct, South Bay Aqueduct, and Lake Del Valle are not within the Edmond G. Brown California Aqueduct, they are shown here for completeness.												
North Bay Aqueduct													
Pumped at Barker Slough Pumping Plant	2,397	2,363	2,664	2,547	2,808	3,439	3,582	2,990	3,419	3,462	2,508	2,547	34,726
Deliveries (Travis & Fairfield/Vacaville)	801	834	1,099	911	306	1,035	1,174	792	950	1,063	576	567	10,108
Pumped at Cordelia Pumping Plant	1,649	1,674	1,393	1,525	2,366	2,306	2,310	2,158	2,351	2,335	1,910	1,966	23,943
Deliveries (Benicia, Vallejo, A.C. 1&2, & Napa)	1,644	1,678	1,395	1,528	2,366	2,308	2,311	2,164	2,352	2,485	1,909	2,297	24,437
Change in Storage, Napa Terminal Tank	5	-4	-2	-3	0	-2	-1	-6	-1	-150	1	-331	-494
Computed Losses (-), Gains (+)	53	145	-172	-111	-136	-98	-98	-40	-118	-64	-22	-14	-675
California Aqueduct	2,445	2,512	2,494	2,439	2,672	3,343	3,485	2,956	3,302	3,548	2,485	2,864	34,545
Pumped at Banks													
Pumping Plant	180,053	97,884	363,799	269,840	78,745	51,670	44,802	126,068	131,784	208,256	63,966	78,594	1,695,461
Pumped at South Bay Pumping Plant	18,175	14,376	6,880	11,222	16,760	16,707	17,253	17,415	15,050	15,469	11,952	12,743	174,002
Delivered to Contracting Agencies	116	31	3	11	302	112	392	70	22	93	10	31	1,193
Inflow (Return delivery)	0	0	0	0	20	86	84	109	57	0	0	0	356
Change in Storage	-276	433	-92	-1,222	66	962	-429	516	493	-439	19	-384	-353
Outflow at Check 12	162,508	83,004	358,182	259,901	60,780	32,848	26,126	108,100	115,900	193,392	51,400	66,262	1,518,403
Computed Losses (-), Gains (+)	470	-40	1,174	72	-857	-1,127	-1,544	-76	-376	259	-585	58	-2,572
South Bay Aqueduct													
Pumped at South Bay Pumping Plant	18,175	14,376	6,880	11,222	16,760	16,707	17,253	17,415	15,050	15,469	11,952	12,743	174,002
Lake Del Valle releases into S. Bay Aq.	392	0	2,521	1,276	0	1,623	1,363	1,395	3,156	3,948	2,565	0	18,239
Outflow (Pumped into Lake Del Valle)	1,628	5,775	796	0	1,296	0	0	0	0	0	0	0	9,495
Outflow, Deliveries	16,929	8,590	8,594	12,489	15,454	18,320	18,606	18,800	18,196	19,397	14,507	12,733	182,615
Computed Losses (-), Gains (+)	-10	-11	-11	-9	-10	-10	-10	-10	-10	-20	-10	-10	-131
Lake Del Valle Operation:	16,929	8,590	8,594	12,489	15,454	18,320	18,606	18,800	18,196	19,397	14,507	12,733	
Natural Inflow/Outflow	-79	215	9,313	749	56	-19	-3	-44	77	193	54	71	10,583
Inflow from S. Bay Aq.	1,628	5,775	796	0	1,296	0	0	0	0	0	0	0	9,495
Releases to S. Bay Aq.	392	0	2,521	1,276	0	1,623	1,363	1,395	3,156	3,948	2,565	0	18,239
Outflow to Arroyo Valle	0	0	3,653	0	0	0	0	0	0	0	0	0	3,653
Delivered to EBRP District	8	5	3	6	15	22	20	21	21	16	6	7	150
End-of-Month Storage (State)	30,609	36,507	40,340	39,618	40,704	38,695	36,884	35,084	31,660	27,622	24,990	24,995	---
Change in Storage	1,082	5,898	3,833	-722	1,086	-2,009	-1,811	-1,800	-3,424	-4,038	-2,632	5	-4,532
Computed Losses (-), Gains (+)	-67	-87	-99	-189	-251	-345	-425	-340	-324	-267	-115	-59	-2,568
San Luis Field Division													
O'Neill Forebay Operation													
End-of-Month Storage	43,282	44,140	42,273	39,498	44,270	44,766	44,453	52,813	49,501	46,810	45,577	48,360	---
Inflow, California Aqueduct	162,508	83,004	358,182	259,901	60,780	32,848	26,126	108,100	115,900	193,392	51,400	66,262	1,518,403
Inflow, O'Neill P.- G. Plant	89,853	85,201	191,893	128,033	11,772	0	0	1,932	37,185	17,277	60,615	102,083	725,844
Inflow, Gianelli P.- G. Plant	0	19,865	0	7,279	117,591	347,727	361,013	204,169	17,006	26,404	30,560	28,396	1,160,010
Delivered to Dept. of Fish and Game (State)	0	0	12	0	0	0	0	0	0	2	4	47	65
Delivered to Dept. of Fish and Game (Fed.)	0	0	9	0	0	0	0	0	0	3	3	39	54
Delivered to Dept. of Parks & Rec. (Fed.)	1	1	1	4	1	8	9	9	6	5	3	1	49
Delivered to Dept. of Parks & Rec. (State)	2	0	1	5	2	9	12	10	9	6	2	1	59
Delivered to Federal Customers	375	702	192	871	1,395	1,675	2,344	2,052	592	455	86	188	10,927
Outflow, O'Neill P.- G. Plant	3,541	2,455	1,271	8,457	35,466	106,644	108,102	69,631	3,854	25,282	2,152	0	366,855
Outflow, Gianelli P.- G. Plant	152,419	93,770	529,074	367,007	16,799	8,267	5,332	59,287	116,145	123,023	59,697	80,335	1,611,155
Outflow, Dos Amigos P.P.	111,711	88,873	22,131	29,335	135,965	270,633	274,984	182,096	58,158	93,083	79,690	109,827	1,456,486
Change in Storage	-6,511	858	-1,867	-2,775	4,772	496	-313	8,360	-3,312	-2,691	-1,233	2,783	-1,433
Computed Losses (-), Gains (+)	9,174	-1,412	747	7,682	4,254	7,140	3,310	7,225	5,346	2,084	-2,176	-3,522	39,852
San Luis Reservoir Operation													
State End-of-Month Storage	63,024	93,908	339,738	593,428	567,398	447,565	331,394	324,104	385,114	460,929	451,446	409,583	---
Total End-of-Month Storage	610,943	681,574	1,201,565	1,542,231	1,432,612	1,084,678	726,263	569,441	653,701	740,880	763,599	810,305	---
Inflow, Gianelli P.- G. Plant	152,419	93,770	529,074	367,007	16,799	8,267	5,332	59,287	116,145	123,023	59,697	80,335	1,611,155
Outflow, Gianelli P.- G. Plant	0	19,865	0	7,279	117,591	347,727	361,013	204,169	17,006	26,404	30,560	28,396	1,160,010
Pacheco Tunnel Diversion	7,934	4,424	1,037	3,270	5,401	7,371	7,520	7,111	3,953	3,269	3,472	3,657	58,419
Change in Storage (Total)	131,465	70,631	519,991	340,666	-109,619	-347,934	-358,415	-156,822	84,260	87,179	22,719	46,706	330,827
Computed Losses (-), Gains (+)	-13,020	1,150	-8,046	-15,792	-3,426	-1,103	4,786	-4,829	-10,926	-6,171	-2,946	-1,576	-61,899

Note: Monthly values may not add up to totals shown because of rounding.

**Table 21b. Summary of California Aqueduct Operation (cont.)  
1991**

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<b>San Luis Field Division (Cont.)</b>													
<b>California Aqueduct (Pools 14 thru 21)</b>													
Inflow, Dos Amigos P.P.(State)	90,370	63,225	6,089	8,729	90,563	158,124	148,344	116,454	50,491	84,150	73,923	104,453	994,915
Inflow, Dos Amigos P.P.(Federal)	21,341	25,648	16,042	20,606	45,402	112,509	126,640	65,642	7,667	8,933	5,767	5,374	461,571
Total Inflow, Dos Amigos P.P.	111,711	88,873	22,131	29,335	135,965	270,633	274,984	182,096	58,158	93,083	79,690	109,827	1,456,486
Flow into Aqueduct	958	908	3,365	3,008	5,306	5,141	6,266	8,914	12,408	13,273	12,624	15,513	87,684
Delivered to Dept. of Fish and Game (State)	0	9	0	0	0	0	0	0	0	29	2	5	45
Delivered to Dept. of Fish and Game (Fed.)	0	8	0	0	0	1	1	0	1	24	2	4	41
Delivered to Federal Customers	20,977	30,531	17,779	21,519	50,205	115,410	125,923	68,995	12,393	11,561 1/	9,627	8,410	493,330
Outflow, Check 21 (State)	91,938	54,170	6,794	8,945	85,656	153,096	147,016	115,136	52,265	88,552	78,343	110,494	992,405
Outflow, Check 21 (Federal)	481	5,037	114	1,099	0	1,600	6,709	5,754	3,213	5,810	2,366	1,092	33,275
Change in Storage	-1,424	880	216	-1,752	1,232	1,104	-435	549	-191	-410	-792	730	-293
Computed Losses (-), Gains (+)	-697	854	-593	-2,532	-4,178	-4,563	-2,036	-576	-2,885	-790	-2,766	-4,605	-25,367
<b>San Joaquin Field Division</b>													
<b>California Aqueduct, Check 21 to Buena Vista Pumping Plant</b>													
Inflow, Check 21 (state)	91,938	54,170	6,794	8,945	85,656	153,096	147,016	115,136	52,265	88,552	78,343	110,494	992,405
Inflow, Check 21 (Federal)	481	5,037	114	1,099	0	1,600	6,709	5,754	3,213	5,810	2,366	1,092	33,275
Total Inflow, Check 21	92,419	59,207	6,908	10,044	85,656	154,696	153,725	120,890	55,478	94,362	80,709	111,586	1,025,680
West Kern Trade, Pumpback	0	0	0	0	397	708	671	592	714	597	117	629	4,425
Delivered to Contracting State Agencies	4,134	4,593	1,660	4,454	10,473	18,698	34,669	19,767	5,826	7,035	2,374	3,114	116,797
Delivered to Federal Customers	481	5,037	114	0	0	1,600	6,709	3,296	360	2,983	2,173	1,092	23,845
Kern Water Bank Preconsol. Return	0	0	2,402	9,811	13,458	8,378	731	2,584	7,398	8,795	7,412	8,258	69,227
Outflow, Buena Vista P.P.	81,977	46,834	7,636	11,810	75,944	121,686	90,060	88,558	50,230	82,614	79,816	111,523	848,688
Coastal Br. Diversion	1,867	574	272	3,216	10,430	16,968	16,704	9,205	4,070	8,021	2,104	3,081	76,512
Change in Storage	-148	155	-1,015	-330	52	479	440	-867	568	-274	-279	-134	-1,354
Computed Losses (-), Gains (+)	-4,108	-2,014	-643	-705	-2,612	-4,351	-6,545	-4,107	-2,536	-3,375	-2,050	-1,797	-34,843
<b>California Aqueduct, Buena Vista P.P. to Teerink Pumping Plant</b>													
Inflow, Buena Vista Pumping Plant	81,977	46,834	7,636	11,810	75,944	121,686	90,060	88,558	50,230	82,614	79,816	111,523	848,688
Delivered to Contracting State Agencies	510	538	207	1,238	3,475	7,413	8,459	7,895	3,569	2,173	960	894	37,331
W.R.M.W.S.D. Pumpback	0	0	676	979	1,077	920	909	1,316	827	1,008	542	416	8,670
Outflow, Teerink Pumping Plant	83,413	46,441	7,967	11,871	72,457	114,657	82,560	81,736	47,268	81,295	79,712	111,940	821,317
Change in Storage	175	-10	-45	-797	568	152	-161	51	27	47	-259	183	-68
Computed Losses (-), Gains (+)	2,121	135	-183	-477	-521	-384	-111	-192	-193	-107	55	1,078	1,221
<b>California Aqueduct, Teerink to Chrisman P.P.</b>													
Inflow, Teerink Pumpingplant	83,413	46,441	7,967	11,871	72,457	114,657	82,560	81,736	47,268	81,295	79,712	111,940	821,317
Delivered to Contracting State Agencies	82	259	27	40	1,539	2,111	2,044	673	81	827	145	156	7,984
Outflow, Chrisman P.P.	82,029	46,658	7,734	11,335	70,212	111,572	79,796	80,909	46,763	80,216	79,372	110,189	806,785
Change in Storage	-51	73	-60	-38	101	-78	-3	3	73	-44	-16	-8	-48
Computed Losses (-), Gains (+)	-1,353	549	-266	-534	-605	-1,052	-723	-151	-351	-296	-211	-1,603	-6,596
<b>California Aqueduct, Chrisman P.P. to Edmonston P.P.</b>													
Inflow, Chrisman P.P.	82,029	46,658	7,734	11,335	70,212	111,572	79,796	80,909	46,763	80,216	79,372	110,189	806,785
Delivered to Contracting State Agencies	0	42	72	75	328	1,216	1,375	1,302	1,015	445	182	292	6,344
Outflow, Edmonston P.P.	82,851	46,377	7,810	11,430	70,727	111,574	79,496	79,619	45,893	78,902	77,919	108,239	800,837
Change in Storage	1	14	-60	14	18	87	-79	-1	-38	47	-51	41	-7
Computed Losses (-), Gains (+)	823	-225	88	184	861	1,305	996	11	107	-822	-1,322	-1,617	389
<b>Coastal Branch, California Aqueduct</b>													
Inflow, Las Perillas P.P.	1,867	574	272	3,216	10,430	16,968	16,704	9,205	4,070	8,021	2,104	3,081	76,512
B.M.W.S.D. Pumpback	0	0	0	137	252	440	484	502	518	0	0	0	2,333
Delivered to Contracting State Agencies	1,639	507	263	2,922	9,961	16,381	15,526	9,027	4,435	7,515	2,093	2,774	73,043
Delivered to Federal Customers	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Storage	24	-27	-13	38	-19	8	-13	12	3	-8	-14	32	24
Computed Losses (-), Gains (+)	-204	-94	-22	-393	-740	-1,019	-1,675	-668	-150	-514	-25	-275	-5,779

1/ Includes 4 ac-ft of Phase 1 water to Lateral 4L.

Note: Monthly values may not add up to totals shown because of rounding.

**Table 21c. Summary of California Aqueduct Operation (cont.)  
1991**

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<b>Southern Field Division</b>													
<b>California Aqueduct, Edmonston P.P. to Junction of West Branch</b>													
Inflow, Edmonston P.P.	82,851	46,377	7,810	11,430	70,727	111,574	79,496	79,619	45,893	78,902	77,919	108,239	800,837
Outflow, West Branch	24,937	14,682	3,111	6,617	58,165	77,539	43,631	62,233	29,299	33,881	48,764	87,053	489,912
Outflow, East Branch	57,915	31,694	4,704	4,802	12,549	34,012	35,849	17,382	16,581	45,025	29,164	21,204	310,881
Change in Storage	6	-3	-1	8	-7	5	3	-5	2	-1	-4	0	3
Computed Losses (-), Gains (+)	7	-4	4	-3	-20	-18	-13	-9	-11	3	5	18	-41
<b>California Aqueduct, Junction of West Branch to Pearblossom P.P.</b>													
Inflow (Aqueduct)	57,915	31,694	4,704	4,802	12,549	34,012	35,849	17,382	16,581	45,025	29,164	21,204	310,881
Delivered to Contracting Agencies	1,692	2,708	389	653	1,337	350	568	1,693	1,547	1,461	821	1/-176	13,043
Outflow, Pearblossom P.P.	57,121	29,135	4,296	3,851	9,645	32,757	33,210	16,363	14,971	42,488	28,654	22,648	295,139
Change in Storage	-407	-449	306	107	109	-416	1,104	-1,365	-753	1,255	53	63	-393
Computed Losses (-), Gains (+)	491	-300	287	-191	-1,458	-1,321	-967	-691	-816	179	364	1,331	-3,092
<b>California Aqueduct, Pearblossom P.P. to Silverwood Lake</b>													
Inflow, Pearblossom P.P.	57,121	29,135	4,296	3,851	9,645	32,757	33,210	16,363	14,971	42,488	28,654	22,648	295,139
Deliveries (Exchange of Natural Inflow)	0	0	0	0	0	0	0	0	0	0	0	0	0
Exchange of Natural Inflow (Los Flores T.O.)	0	29	483	958	878	636	179	0	0	0	22	42	3,227
Outflow to Silverwood Lake	56,140	29,600	4,220	2,770	7,770	27,560	30,450	14,270	15,140	40,430	26,630	21,180	276,160
Change in Storage	71	-142	-195	-64	375	143	-273	-114	-591	327	766	249	552
Computed Losses (-), Gains (+)	-910	352	212	-187	-622	-4,418	-2,854	-2,207	-422	-1,731	-1,236	-1,177	-15,200
<b>Silverwood Lake Operation</b>													
Inflow, Project	56,140	29,600	4,220	2,770	7,770	27,560	30,450	14,270	15,140	40,430	26,630	21,180	276,160
Inflow, Natural	28	306	3,001	1,822	484	100	15	0	10	19	6	125	5,916
Delivered to Contracting Agencies	189	134	105	108	91	124	137	156	147	144	111	107	1,553
Deliveries from Inflow released	3	9	5	4	4	1,508	539	7	7	6	1	1	2,094
Outflow, Natural Inflow Released	6	0	755	713	214	107	2	4	3	5	9	10	1,828
Outflow, Bernardino Tunnel	39,535	35,135	3,842	3,061	13,774	26,183	27,695	16,728	18,769	35,866	27,434	22,871	270,893
Change in storage	16,140	-4,095	4,789	344	-5,792	3,528	3,743	-1,518	-4,089	5,173	-921	-277	17,025
Computed Losses (-), Gains (+)	-295	1,277	2,275	-362	37	3,790	1,651	1,107	-313	745	-2	1,407	11,317
	192	143	110	112	95	1,632	676	163	154	150	112	108	
<b>California Aqueduct, Silverwood Lake to Lake Perris</b>													
Inflow, San Bernardino Tunnel	39,535	35,135	3,842	3,061	13,774	26,183	27,695	16,728	18,769	35,866	27,434	22,871	270,893
Inflow, SBVMWD Pump-in at DC Afterbay	0	0	0	1,982	1,354	302	0	0	0	0	0	0	3,638
Delivered to Contracting Agencies	25,556	28,189	3,193	4,728	14,114	25,643	27,425	16,054	17,946	35,003	24,366	16,750	238,967
Outflow to Lake Perris	13,976	6,949	647	327	993	840	276	671	818	858	3,067	6,124	35,546
Change in Storage	2	-4	1	-14	19	-1	-8	0	2	3	0	-4	-4
Operational Losses (-), Gains (+)	-1	-1	-1	-2	-2	-3	-2	-3	-3	-2	-1	-1	-22
<b>Lake Perris Operation</b>													
Inflow	13,976	6,949	647	327	993	840	276	671	818	858	3,067	6,124	35,546
Delivered to Contracting Agencies	794	394	435	413	437	420	422	420	415	522	1,222	404	6,298
Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Storage	12,397	6,625	867	-1,027	-1,226	-861	-813	-990	-809	-1,186	582	4,871	18,430
Computed Losses (-), Gains (+)	-785	70	655	-941	-1,782	-1,281	-667	-1,241	-1,212	-1,522	-1,263	-849	-10,818

Note: Monthly values may not add up to totals shown because of rounding.

**Table 21d. Summary Of Governor Edmund (cont.)  
1991**

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<b>Southern Field Division (Cont.)</b>													
<b>West Branch California Aqueduct Tehachapi Afterbay to Oso P.P.</b>													
Inflow	24,937	14,682	3,111	6,617	58,165	77,539	43,631	62,233	29,299	33,881	48,764	87,053	489,912
Outflow, Oso Pumping Plant	24,939	14,678	3,125	6,585	58,128	77,469	43,582	62,221	29,259	33,891	48,790	87,108	489,775
Change in Storage	19	-8	-2	24	-23	16	9	-16	6	-3	-11	0	11
Computed Losses (-), Gains (+)	21	-12	12	-8	-60	-54	-40	-28	-34	7	15	55	-126
<b>West Branch California Aqueduct Oso P.P. to Pyramid Lake</b>													
Inflow, Oso P.P.	24,939	14,678	3,125	6,585	58,128	77,469	43,582	62,221	29,259	33,891	48,790	87,108	489,775
Outflow through Warner P.P. to Pyramid Lake	25,041	14,428	2,921	6,606	57,655	78,264	43,459	62,704	28,474	34,464	48,970	87,374	490,360
Change in Storage	-124	301	650	-22	494	-803	559	-493	766	-586	146	-223	665
Operational Losses (-), Gains (+)	-22	51	446	-1	21	-8	436	-10	-19	-13	326	43	1,250
<b>Pyramid Lake Operation</b>													
Inflow, Project	25,041	14,428	2,921	6,606	57,655	78,264	43,459	62,704	28,474	34,464	48,970	87,374	490,360
Inflow, Natural	357	610	7,882	9,163	1,396	470	173	138	177	195	265	623	21,449
Inflow, Pumpback from Elderberry Forebay	72,410	28,481	17,125	28,560	6,219	9,891	44,914	57,111	50,958	56,788	70,385	58,646	501,488
Deliveries (Fish Enhancement)	0	0	0	0	0	0	0	423	653	599	178	0	1,853
Deliveries	0	0	0	0	0	0	0	0	0	0	0	988	988
Delivered to Dept. of Parks and Rec. (State)	1	1	0	1	3	4	7	4	4	3	1	1	30
Outflow, Pyramid Diversion	326	296	5,583	3,649	6,082	2,405	1,739	434	177	195	265	623	21,774
Outflow, Angeles Tunnel	99,037	36,728	21,759	42,580	61,651	78,946	87,705	115,486	76,276	88,057	138,701	143,155	990,081
Change in Storage	-3,364	6,632	1,381	-2,180	-4,475	4,447	-2,781	591	644	518	-21,063	442	-19,208
Computed Losses (-), Gains (+)	-1,808	138	795	-279	-2,009	-2,823	-1,876	-3,015	-1,855	-2,075	-1,538	-1,434	-17,779
<b>Elderberry Forebay Operation</b>													
Inflow, Project through Castaic P-G Plant	99,037	36,728	21,759	42,580	61,651	78,946	87,705	115,486	76,276	88,057	138,701	143,155	990,081
Inflow, Natural	0	56	3,049	596	78	2	0	0	0	0	0	76	3,857
Outflow, Pumpback to Pyramid Lake	72,410	28,481	17,125	28,560	6,219	9,891	44,914	57,111	50,958	56,788	70,385	58,646	501,488
Outflow, Project Water Released to Castaic Lake	30,004	7,992	7,112	16,291	56,110	70,894	42,925	55,161	29,887	31,257	65,248	83,587	496,468
Change in Storage	-2,146	311	956	-1,913	-312	1,312	311	3,562	-4,152	118	2,783	854	1,684
Computed Losses (-), Gains (+)	1,231	0	385	-238	288	3,149	445	348	417	106	-285	-144	5,702
<b>Castaic Lake Operation</b>													
Inflow, Project	30,004	7,992	7,112	16,291	56,110	70,894	42,925	55,161	29,887	31,257	65,248	83,587	496,468
Inflow, Natural	19	154	2,316	507	93	23	4	0	0	0	1	59	3,176
Delivered to Contracting Agencies	42,225	36,853	1,688	5,222	20,745	13,822	25,871	32,514	43,984	67,404	1/ 61,446	50,374	402,148
Outflow, Castaic Afterbay	0	0	1,493	0	307	91	630	257	190	0	0	33	3,001
Change in Storage	-11,574	-27,090	8,590	10,255	34,982	52,339	15,469	21,118	-14,480	-36,061	3,085	32,234	88,867
Computed Losses (-), Gains (+)	628	1,617	2,343	-1,321	-169	-4,665	-959	-1,272	-193	86	-718	-1,005	-5,628
<b>Castaic Lagoon Operation</b>													
Inflow (Includes recreation inflow)	0	0	1,493	0	307	91	630	257	190	0	797	33	3,798
Inflow, Natural	0	0	171	0	0	0	0	0	0	0	0	0	171
Outflow	30	102	0	235	210	227	330	282	239	212	319	89	2,275
Deliveries to Recreation (State)	170	28	113	68	89	101	117	120	125	104	91	64	1,190
Change in Storage	-200	-130	1,551	-303	8	-237	183	-145	-174	-316	387	-120	504
Computed Losses (-), Gains (+)	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: Monthly values may not add up to totals shown because of rounding.

1/ Includes 797 ac-ft of recreation water delivered to Castaic Lagoon (shown as inflow Castaic Lagoon)

## Glossary

**accretion** - the water accumulated and retained within a service area.

**acre-foot (AF)** - a quantity or volume of water covering one acre to a depth of one foot; equal to 43,560 cubic feet or 325,851 gallons.

**active storage capacity** - the total usable reservoir capacity available for seasonal or cyclic water storage. It is gross reservoir capacity minus inactive storage capacity.

**afterbay** - a reservoir that regulates fluctuating discharges from a hydroelectric power plant or a pumping plant.

**alluvium** - a stratified bed of sand, gravel, silt, and clay deposited by flowing water.

**aquifer** - a geologic formation that stores and transmits water and yields significant quantities of water to wells and springs.

**average annual runoff** - the average value of annual runoff amounts for a specified area calculated for a selected period of record that represents average hydrologic conditions.

**balanced water conditions** - exist when upstream reservoir storage releases, plus other inflows, approximately equal the water supply needed to (1) satisfy Sacramento Valley and Sacramento-San Joaquin Delta in-basin needs, including Delta water quality requirements, and (2) meet export needs.

**benthic invertebrates** - aquatic animals without backbones that dwell on or in the bottom sediments of fresh or salt water. Examples: clams, crayfish, and a wide variety of worms.

**biota** - all living organisms of a region, as in a stream or other body of water.

**brackish water** - water containing dissolved minerals in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses. Considerably less saline than sea water.

**carriage water** - the amount of water needed above an increased export so as to not increase salinity in the Delta.

**conjunctive use** - the operation of a ground water basin in combination with a surface water storage and conveyance system. Water is stored in the ground water basin for later use by intentionally recharging the basin during years of above-average water supply.

**Decision 1485 operating criteria (D-1485)** - standards for operating water project facilities under Water Rights Decision 1485 regarding the Sacramento-San Joaquin Delta and Suisun Marsh, adopted by the State Water Resources Control Board, August 1978.

**Delta consumptive use** - the sum of evapotranspiration and changes in soil moisture of Delta lands and evaporation from Delta channels.

**Delta outflow index (DOI)** a calculated approximation of this seaward freshwater outflow as it passes Chippis Island near Pittsburg, beyond the confluence of the Sacramento and San Joaquin Rivers.

**depletion** - the water consumed within a service area and no longer available as a source of supply.

**deviation** - the difference between scheduled and actual energy.

**dissolved organic compounds** - carbon substances dissolved in water.

**drainage basin** - the area of land from which water drains into a river; for example, the Sacramento River Basin, in which all land area drains into the Sacramento River. Also called, "catchment area," "watershed," or "river basin."

**drought condition** - hydrologic conditions during a defined drought period during which rainfall and runoff are much less than average.

**ecology** - the study of the interrelationships of living organisms to one another and to their surroundings.

**ecosystem** - recognizable, relatively homogeneous units, including the organisms they contain, their environment, and all the interactions among them.

**effluent** - waste water or other liquid, partially or completely treated or in its natural state, flowing from a treatment plant.

**environment** - the sum of all external influences and conditions affecting the life and development of an organism or ecological community; the total social and cultural conditions.

**estuary** - the lower course of a river entering the sea influenced by tidal action where the tide meets the river current.

**evapotranspiration (ET)** - the quantity of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces. Quantitatively, it is usually expressed in terms of depth of water per unit area during a specified period of time.

**evapotranspiration of applied water (ETAW)** - the portion of the total evapotranspiration which is provided by irrigation.

**forebay** - a reservoir or pond situated at the intake of a pumping plant or power plant to stabilize water levels; also a storage basin for regulating water for percolation into ground water basins.

**fry** - a recently hatched fish.

**gross reservoir capacity** - the total storage capacity available in a reservoir for all purposes, from the streambed to the normal maximum operating level. Includes dead (or inactive) storage, but excludes surcharge (water temporarily stored above the elevation of the top of the spillway).

**ground water** - water that occurs beneath the land surface and completely fills all pore spaces of the alluvium, soil or rock formation in which it is situated.

**ground water basin** - a ground water reservoir, defined by an overlying land surface and the underlying aquifers that contain water stored in the reservoir.

**ground water overdraft** - the condition of a ground water basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years during which water supply conditions approximate average.

**ground water recharge** - increases in ground water storage by natural conditions or by human activity.

**ground water table** - the upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

**hydraulic barrier** - a barrier developed in the estuary by release of fresh water from upstream reservoirs to prevent intrusion of sea water into the body of fresh water.

**hydrologic balance** - an accounting of all water inflow to, water outflow from, and changes in water storage within a hydrologic unit over a specified period of time.

**hydrologic basin** - the complete drainage area upstream from a given point on a stream.

**hydrologic region** - a study area, consisting of one or more planning subareas.

**joint-use facilities** - specific pumping plants, power plants, canals, and reservoirs in which both State and federal agencies participated in the construction, use, and maintenance.

**land subsidence** - the lowering of the natural land surface in response to earth movements; lowering of fluid pressure (or lowering of ground water level); removal of underlying supporting materials by mining or solution of solids, either artificially or from natural causes; compaction caused by wetting (hydrocompaction); oxidation of organic matter in soils; or added load on the land surface.

**megawatt (MW)** - one million watts.

**milligrams per liter (mg/L)** - the weight in milligrams of any substance dissolved in one liter of liquid; nearly the same as parts per million.

**natural flow** - the flow past a specified point on a natural stream that is unaffected by stream diversion, storage, import, export, return flow, or change in use caused by modification in land use.

**percolation** - the downward movement of water throughout the soil or alluvium to a ground water table.

**permeability** - the capability of soil or other geologic formations to transmit water.

**phytoplankton** - minute plants, usually algae, that live suspended in bodies of water and that drift about because they cannot move by themselves or because they are too small or too weak to swim effectively against a current.

**pollution (of water)** - the alteration of the physical, chemical, or biological properties of water by the introduction of any substance into water that adversely affects any beneficial use of water.

**prior water right** - a water designation used for water delivered based on its use prior to SWP construction.

**pumping-generating plant** - a plant at which the turbine-driven generators can also be used as motor-driven pumps.

**recharge basin** - a surface facility, often a large pond, used to increase the percolation of surface water into a ground water basin.

**riparian vegetation** - vegetation growing on the banks of a stream or other body of water.

**runoff** - the total volume of surface flow from an area during a specified time.

**Sacramento River index** - the sum of the Sacramento Valley's unimpaired runoff at the following four locations: Sacramento River near Red Bluff; total Feather River inflow to Lake Oroville; Yuba River at Smartville; and total American River inflow to Folsom Lake.

**salinity** - generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity, or osmotic pressure. See **total dissolved solids**.

**salinity intrusion** - the movement of salt water into a body of fresh water. It can occur in either surface water or ground water bodies.

**salt-water barrier** - a physical facility or method of operation designed to prevent the intrusion of salt water into a body of fresh water.

**sediment** - soil or mineral material transported by water and deposited in streams or other bodies of water.

**seepage** - the gradual movement of a fluid into, through, or from a porous medium.

**service area** - the geographical land area served by a distribution system of a water agency.

**snow water content** - a calculated or measured amount of water contained in packed snow based on its depth and density.

**spawning** - the depositing and fertilizing of eggs (roe) by fish and other aquatic life.

**streamflow** - the rate of water flow past a specified point in a channel.

**surplus water** - developed water supplies in excess of contract entitlement or apportioned water.

**total dissolved solids (TDS)** - a quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter. See **salinity**.

**transpiration** - an essential physiological process in which plant tissues give off water vapor to the atmosphere.

**unimpaired runoff** - represents the natural water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds.

**waste water** - the water, liquid waste, or drainage from a community, industry, or institution.

**water conservation** - reduction in applied water due to more efficient water use.

**water quality** - used to describe the chemical, physical, and biological characteristics of water, usually in regard to its suitability for a particular purpose or use.

**water right** - a legally protected right to take possession of water occurring in a natural waterway and to divert that water for beneficial use.

**water table** - see **ground water table**.

**water year** - a continuous 12-month period for which hydrologic records are compiled and summarized. In California, it begins on October 1 and ends September 30 of the following year.

**watershed** - see **drainage basin**.