

STATE OF CALIFORNIA

The Resources Agency

Department of Water Resources

DIVISION OF OPERATIONS AND MAINTENANCE

STATE WATER PROJECT  
ANNUAL  
REPORT OF OPERATIONS

1977

## FOREWORD

This is the fourth in a series of annual reports summarizing the water and power operation of the California State Water Project.<sup>1/</sup>

Since January 1965, a "State Water Project, Report of Operations" has been published monthly. These reports are limited to tabulations of daily and monthly data on reservoirs, pumping and generation plant operation, plus data on water quality and water deliveries. The monthly report will continue to provide daily and monthly information to State Water Service Contractors, public agencies, and others.

This annual report summarizes Project facilities in operation during 1977; operational constraints and outages; special drought activities; and significant operations and maintenance events within the five field divisions. Operational data are in the form of annual summaries. Where relevant for comparison, the current and past year's data are shown in charts and tables. Corrections, and revisions to the data published in the monthly "State Water Project, Report of Operations" are included.

The history, planning, and description of the State Water Project Facilities are detailed in "California State Water Project, Bulletin No. 200, Volumes I-IV" published by the Department of Water Resources.

<sup>1/</sup> Annual publications of the Department of Water Resources on the State Water Project activities include: (1) State Water Project, Annual Report of Operations, 1977; (2) The California State Water Project - 1977 Activities and Future Management Plans, Bulletin 132-78; (3) The Continuing California Drought, August 1977; and (4) The 1976-1977 California Drought, A Review, May 1978.

TABLE OF CONTENTS

Foreword . . . . . iii

Table of Contents . . . . . iv

Organization, Division of Operations & Maintenance . . . . . viii

Map of Field Division Boundaries . . . . . ix

Map of Project Facilities . . . . . x

Highlights of 1977 Operation . . . . . 1

Project Status in 1977 . . . . . 5

Special Drought Activities . . . . . 8

Chart A, CVP-SWP Coordinated Operation . . . . . 14

Table A, Sacramento Basin & Sacramento-San Joaquin Delta Operation . . 15

Chart B, Water Quality Objectives & Pertinent Conditions . . . . . 17

Table B, CVP-SWP Coordinated Operation Delta Outflow Index 1977 . . . 18

Figure 1, Drought Mitigative Facilities . . . . . 21

Figure 2, Effects of Mitigative Facilities on Chlorides . . . . . 23

Project Operation . . . . . 27

Conversion Factors . . . . . 47

Graphical Displays of Project Operations

    Project Deliveries . . . . . 48

    Project Deliveries - Yearly Totals . . . . . 49

    Project Gross Power Generation . . . . . 50

    Project Power Operations . . . . . 51

    Gross Generation at Hyatt and Thermalito Powerplants . . . . . 52

    Project Reservoirs . . . . . 53

    Map of Water Quality Monitoring Stations . . . . . 54

    Isometric Plot of Chlorides at Emmaton . . . . . 55

    Isometric Plot of Chlorides at Delta Stations . . . . . 56

    Isometric Plot of Monthly EC at SWP Locations . . . . . 57

Tabular Data

Section I - Project Deliveries

Water Deliveries . . . . . I-1

Section II - Summary of California Aqueduct Operation

Summary of California Aqueduct Operation (8 pages) . . . . . II-1

Section III - Pumping Plants

Project Pumping Plants . . . . . III-1

Section IV - Joint San Luis Facilities

Monthly Operations Summary, State-Federal Joint San  
Luis Facilities. . . . . IV-1

Section V - Operation of Reservoirs

Oroville Field Division:

Upper Feather Area Lakes, Monthly Operation. . . . . V-1

Lake Oroville, Monthly Operation (Table) . . . . . V-2

Lake Oroville Operation (Graph). . . . . V-3

Operation of Lake Oroville for Flood Control . . . . . V-4

Lake Oroville Isotherms. . . . . V-5

Oroville-Thermalito Complex, Monthly Storage . . . . . V-6

Delta Field Division:

Clifton Court Forebay, Monthly Operation . . . . . V-7

Lake Del Valle, Monthly Operation. . . . . V-8

San Luis Field Division:

O'Neill Forebay, Monthly Operation . . . . . V-9

San Luis Reservoir, Monthly Operation (Table). . . . . V-10

San Luis Reservoir Operation (Graph) . . . . . V-11

Southern Field Division:

Pyramid Lake, Monthly Operation (Table). . . . . V-12

Pyramid Lake Operation (Graph) . . . . . V-13

Elderberry Forebay, Monthly Operation . . . . . V-14

Castaic Lake, Monthly Operation (Table) . . . . . V-15

Castaic Lake Operation (Graph). . . . . V-16

Silverwood Lake, Monthly Operation (Table). . . . . V-17

Silverwood Lake Operation (Graph) . . . . . V-18

Lake Perris, Monthly Operation (Table). . . . . V-19

Lake Perris Operation (Graph) . . . . . V-20

Section VI - Power Supply and Use

Operation of Edward Hyatt and Thermalito Powerplants. . . . . VI-1

Project Power Supply. . . . . VI-2

Project Power Use . . . . . VI-3

Section VII - Water Quality

Water Quality, Thermalito Afterbay at Feather River Outlet. . . . VII-1

Water Quality, Putah South Canal Terminal Reservoir  
(inflow to North Bay Aqueduct). . . . . VII-2

Water Quality, California Aqueduct at Delta Pumping Plant . . . . VII-3

Water Quality, South Bay Aqueduct Terminal Reservoir. . . . . VII-4

Water Quality, California Aqueduct Entrance to O'Neill Forebay. . VII-5

Water Quality, California Aqueduct at Check 13. . . . . VII-6

Water Quality, California Aqueduct near Kettleman City. . . . . VII-7

Water Quality, Coastal Branch at Check 5. . . . . VII-8

Water Quality, California Aqueduct at Check 29. . . . . VII-9

Water Quality, California Aqueduct at Tehachapi Afterbay. . . . . VII-10

Water Quality, Pyramid Lake at Entrance to Angeles Tunnel . . . . VII-11

Water Quality, Castaic Lake at Outlet Works . . . . . VII-12

Water Quality, California Aqueduct at Pearblossom Pumping Plant . VII-13

Water Quality, California Aqueduct at Inlet to Mojave Siphon. . . VII-14

Water Quality, Silverwood Lake at Outlet to Mojave River. . . . . VII-15

Section VII - Water Quality (contd)

Water Quality, Silverwood Lake at Inlet to San Bernardino Tunnel. . . . .	VII-16
Water Quality, Devil Canyon Afterbay. . . . .	VII-17
Water Quality, Lake Perris at Inlet . . . . .	VII-18
Water Quality, Pesticides in California Aqueduct. . . . .	VII-19

ORGANIZATION OF  
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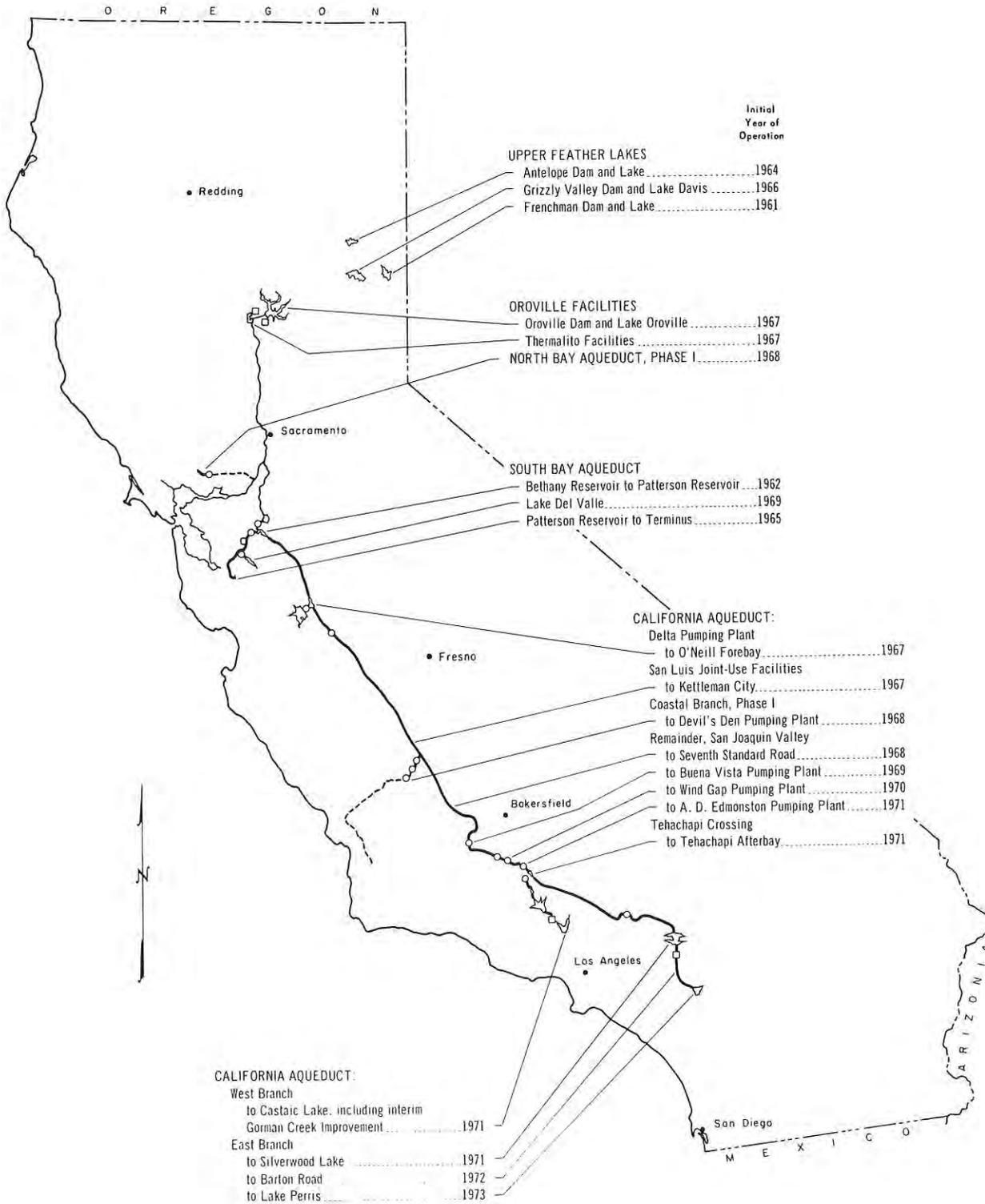
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# FIELD DIVISION BOUNDARIES



# PROJECT FACILITIES



## HIGHLIGHTS OF 1977 OPERATION

### Water Conditions

The 1976-77 water year (October 1, 1976 through September 30, 1977) was the driest in 130 years of record. State-wide, natural runoff during the water year was 24 percent of normal. The water content of the State's snowpack averaged only 25 percent of normal on April 1, normally time of maximum accumulation. Except for the Trinity and Feather River basins, the April 1, 1977 snowpack water content was the lowest of record for any river basin in the State. Following the dry year 1975-76, which was the fourth driest water year of record, 1977 became the most critical year since operation of the Project began in 1962.

As in 1976, the State's weather scene in 1977 was dominated by a similar but more pronounced persistent high-pressure ridge in the atmosphere off the California Coast. The storm track was displaced northwest of its usual winter path over the State. Only for two brief periods was there a breakthrough into the stagnant high-pressure ridge. The first was at the end of December 1976, extending into the first few days of January 1977; the second was around February 20. During August, a tropical storm off the coast of Mexico developed into a hurricane given the name "Doreen". Although "Doreen" soon weakened to a tropical storm category, the resultant precipitation affected a large portion of Southern California.

In the Feather River basin measurements describing water conditions established new record of lows during the 1976-77 water year. These included:

- Precipitation - 20 percent of normal, a new record low for almost every reporting station in the basin.
- Snowpack Water Content - 21 percent of normal, the second lowest value since record began in 1930.
- Basin Unimpaired Runoff - 24 percent of normal, lowest of record.
- Inflow into Lake Oroville - 1 209 608 cubic dekametres (980,631 acre-feet), lowest of record.

A summary of California water conditions during the 1976-77 water year is published in DWR Bulletin 202-77 "Water Conditions and Flood Events in California, Water Year 1976-77". Data on climate and surface water flows are published in DWR Bulletin 130-77, "Hydrologic Data: 1977-Volume I-VI".

#### Water Deliveries

The continuation of the 1976 drought caused 1977 to become the first year the Project was not able to deliver all requested entitlement water to State Water Project Contractors. Agricultural contractor requests were reduced 60 percent and the urban contractors' requests were reduced 10 percent. No surplus or preconsolidation water deliveries were made. In addition, deliveries to water users in the Feather River Service Area were reduced up to 50 percent, depending on the individual agency's contract.

Water delivered from Project facilities to State Water Contractors and non-contractors totaled 1 176 500 cubic dekametres (953,790 acre-feet) during 1977, or about 48 percent of the water delivered to State Water Contractors only in 1976. Of this total, 20 010 cubic dekametres (16,222 acre-feet) was local supply regulated

for delivery, and 38 313 cubic dekametres (31,060 acre-feet) was U. S. Bureau of Reclamation water delivered to Federal Cross Valley Canal customers.

Major rescheduling of the limited water supply available for delivery by the Project was made possible by exchange agreements with the Metropolitan Water District of Southern California (MWD). The agreements provided for MWD to use more Colorado River water and relinquish an equal amount of Project water for use in Northern California. Details of these agreements and the allocation of the exchange water to water users are presented in Bulletin 132-78 "The California State Water Project 1977 Activities and Future Management Plans".

Delivery of U. S. Bureau of Reclamation water to Federal contractors served from the San Luis Joint Facilities totaled 398 844 cubic dekametres (323,344 acre-feet), down 76 percent from 1976 deliveries.

Water delivered from Project facilities to satisfy prior water rights within the Feather River Area, totaled 704 016 cubic dekametres (570,737 acre-feet). This total was 37 percent less than delivered during 1976. An additional 22 559 cubic dekametres (18,289 acre-feet) of natural flow was released through the Project's southern reservoirs or about 11 percent below the natural flow released from these reservoirs in 1976.

Table I-1 is a summary of water deliveries for Project facilities by years to individual agencies.

The record dry conditions and the resulting adjustment in operations were reflected in reservoir fluctuations. Maximum storage was generally recorded very early in the year and decreased thereafter.

Lake Oroville reached its maximum storage of the year, 2 010 373 cubic dekametres (1,629,812 acre-feet), on January 2. Storage decrease during the year exclusive of upper reservoirs totaled 850 354 cubic dekametres (689,383 acre-feet). Minimum storage, 1 038 834 cubic dekametres (882,395 acre-feet), occurred on September 7, the lowest since initial filling in 1968. Maximum daily inflow reached 36 716 cubic dekametres (29,766 acre-feet) on December 15. Maximum release from the Oroville-Thermalito Complex down the Feather River was  $96 \text{ m}^3/\text{s}$  (3,390 cfs) on April 29.

The State's share of San Luis Reservoir storage was at a maximum, 812 425 cubic dekametres (658,634 acre-feet), on March 28. State's minimum storage, 211 490 cubic dekametres (171,455 acre-feet), was reached on November 22. On August 20, 92 518 cubic dekametres (75,000 acre-feet) of State water in San Luis Reservoir was transferred to the U. S. Bureau of Reclamation as a loan. This loan was repayed on November 30, with the transfer of a like amount of Bureau water in San Luis Reservoir to the State.

Castaic Lake storage was at its maximum 198 492 cubic dekametres (160,918 acre-feet), at the beginning of the year. Minimum storage was recorded at 62 731 cubic dekametres (50,856 acre-feet) on December 26. There was no Project water delivered to Castaic Lake after February, thus all deliveries thereafter were made from storage. Releases of natural inflow from Castaic Lagoon were limited to subsurface flows during the year.

At Lake Perris no attempt was made to maintain storage during the year. Except for the latter part of December, inflow was the result of regulation at the Devil Canyon Powerplant afterbay.

Maximum storage was recorded on January 7, 104 447 cubic dekametres (84,675 acre-feet). Minimum storage was reached December 16, 89 927 cubic dekametres (72,904 acre-feet).

#### Project Generation

Because of the low storage in Lake Oroville gross generation at the Edward Hyatt and Thermalito Powerplants totaled only 731 million kilowatthours during 1977, lowest of record, excluding 1968 when Lake Oroville was filling. The gross generation total includes water pumped and later released for generation, 204 380 cubic dekametres (165,691 acre-feet) through the Hyatt pumps and 232 590 cubic dekametres (188,561 acre-feet) through the Thermalito pumps. Table VI-1, summarizes by month, the Edward Hyatt and Thermalito Powerplants operation.

Total energy generated at Project's three recovery power plants, San Luis (State only), Castaic and Devil Canyon, was 227.24 million kilowatthours, lowest total for any year since Devil Canyon became operational in 1972. Table VI-2 summarizes by month, generation at San Luis, Castaic and Devil Canyon Powerplants.

#### PROJECT STATUS IN 1977

The State Water Project conserves water for distribution to much of California's population and irrigated agriculture. It also provides generation of electric power, flood control, water quality control, new recreational opportunities, and enhancement of sport fisheries and wildlife habitat.

The initial Project facilities to become operational were Frenchman Dam and Lake in the Upper Feather River region and the South Bay Aqueduct in the San Francisco Bay Area in 1962. In 1973,

construction of the "Initial Facilities" of the Project were completed. This provided for operation of the entire Project facilities from Plumas County in the north to Riverside County in the south.

During 1977, water was delivered from Project facilities to: 21 State Water Contractors; five non-contractors; five U. S. Bureau of Reclamation customers along the San Luis Joint Facilities in addition to nine agencies served Federal water via the Cross Valley Canal; and eight local agencies receiving water to satisfy prior water rights.

Project facilities in operation during 1977 included: 20 reservoirs with a gross capacity of 8 371 810 cubic dekametres (6,787,037 acre-feet); five power plants with a gross output capacity of 1,354 megawatts; 17 pumping plants housing 112 units with a total motor rating of 2,138 megawatts; and 869 kilometres (540 miles) of aqueduct. Operational data are shown in Sections I-VII.

#### Outages

Outages of Project facilities in chronological order were:

January 8, a two-day shutdown was ordered on the East and West Branches of the California Aqueduct, in the Southern Field Division. The shutdown resulted from a snowstorm causing primary power failures and making some control sites inaccessible so that fuel for the emergency equipment could not be replaced. No curtailment of water deliveries were experienced because of the shutdown.

October 19, the Gorman Creek Improvement Channel was out of service for 31 days to permit construction of the Pyramid Powerhouse bypass channel.

November 16, pumping was suspended from Wheeler Ridge Pumping Plant south for eight days due to a mysterious fish kill of striped bass in the pool immediately above the plant. Water quality samples showed no contamination in the pool.

December 21, pumping was suspended for four days at Buena Vista, Wheeler Ridge, Wind Gap and A. D. Edmonston Pumping Plants due to damage caused by high winds in the area.

### Limitations

Operational restraints imposed on segments of the State Water Project resulting from construction, modifications, maintenance or revised operating capacities included:

January 1 - March 2, Pearblossom Pumping Plant was limited to a maximum pumping rate of  $21 \text{ m}^3/\text{s}$  (925 cfs). The cross connection was removed between the discharge lines, for installation of two new units, No. 1 and 2, thus making unit 3 unavailable also.

January 1 - March 21, Federal water customers', served from the Cross Valley Canal, deliveries were subject to being discontinued during periods when the U. S. Bureau of Reclamation failed to provide its share of water for water quality protection of the Sacramento-San Joaquin Delta. Deliveries were discontinued twice during this period.

March 3 - August 9, Castaic Outlet Works low intake slide gate was out of service. Several daily outages of the Outlet Works were required for repairs.

June 6 - December 1, the Quail Lake maximum water elevation was restricted to 1004.62 metres (3,296.00 feet). This restriction was to allow work on the Quail Lake Outlet structure.

July 25 - December 31, units of the Hyatt and Thermalito Powerplants were restricted to block loading because of low water levels in Lake Oroville.

August 15 - December 31, Hyatt Powerplant units 2, 4, and 6 (pump/generators) were available for emergency generation only because of unstable hydraulic conditions at low heads.

September 29 - December 12, Elderberry Forebay Outlet Works was out of service for repair and upgrading. During this period releases from Elderberry Forebay could have been made into Castaic Lake through the Elderberry Spillway if some emergency had required the passage of water.

December 23 - December 31, Gorman Creek Improvement Channel flow was restricted to  $11 \text{ m}^3/\text{s}$  (400 cfs) due to an undermined area of the channel.

#### SPECIAL DROUGHT ACTIVITIES

In an effort to aid water users affected by the two-year drought, many special activities were undertaken in 1977. The following is a summary of those special drought-related activities that affected the operation of Project facilities and those regular operations specifically modified due to the drought conditions.

The most pronounced of the special events affecting Project operations, was the exchange agreements entered into for the Metropolitan Water District of Southern California (MWD) to use more Colorado River water and thus relinquish its Project water to northern users. Augmenting this action, three other southern water contractors also relinquished all or part of their 1977 entitlement water. Bulletin 132-78 "The California State Water Project 1977

Activities and Future Management Plans" details these actions. These arrangements permitted a substantial modification of water deliveries, especially for agricultural contractors; made Project water available on an emergency basis for delivery to noncontractors; and provided for some carryover storage as a hedge against the drought continuing in 1978.

#### Canadian Entitlement Power Sale

Because of the drought-caused reductions of Project water deliveries, the Department sold 85 megawatts of Canadian Entitlement power between June 10 and December 1977. Under this special agreement with the Pacific Gas and Electric Company (PGandE), the Department also sold San Luis Powerplant peaking capacity. The San Luis peaking capacity was only used in September when PGandE called for generation after fully committing its resources. PGandE later provided energy to pump back into San Luis Reservoir all water released during the generation operation.

#### Special Operations for Fishery at Oroville

The agreement and stipulation which was required for the FPC license for the Oroville Complex provides certain limits in the temperature of water delivered to the fish hatchery and objective limits for the River. Because of the low level in Oroville Reservoir, the configuration of the penstock intake, and the depth of the naturally occurring warm water above the thermocline, it became apparent that in the autumn, Project water released through normal methods would be far warmer than the stipulated temperatures and, therefore, would have an adverse effect on salmon spawning. The actions taken to overcome this problem are described below. A

detailed discussion of the problem and remedial actions is included in a memorandum report titled "Report on Cold Water Operation of Oroville Facilities, Autumn 1977".

Initially to assist spring run salmon, two cold water holding ponds were developed and maintained from August 25 through September 16. The ponds, converted waste water evaporation ponds, were located on the hillside above the Hyatt switchyard and below the Palermo Canal. A continuous flow of 28 litres per second (one cfs) was passed through the ponds from the Palermo Canal. About 200 adult spring run salmon were held in the ponds until the water temperature through the Feather River Fish Hatchery dropped below  $14^{\circ}\text{C}$  ( $57^{\circ}\text{F}$ ), after which they were transferred to the hatchery and the operation discontinued. Project costs were reimbursed by the Department of Fish and Game through a Federal drought-related grant.

To reduce water temperature and maintain it within required limits for the Feather River Fish Hatchery, releases were made from Lake Oroville through the Oroville Dam River outlet valve system, thus bypassing the Hyatt Powerplant units, between September 12 and November 5. Releases through the river outlet valve system during this period totaled 58 613 cubic dekametres (47,518 acre-feet). Maximum release rate was  $48 \text{ m}^3/\text{s}$  (1,700 cfs). Project costs to perform this operation, including the cost of electrical energy foregone, was paid by the Department of Fish and Game with funds from a Federal drought-related grant.

To enhance spawning conditions in the low flow section of the Feather River between the Fish Barrier Dam and the Thermalito Afterbay River outlet, releases through the Thermalito Diversion

Dam were increased between October 4 and November 15. The releases which bypassed the Thermalito Powerplant, were increased from the normal  $11 \text{ m}^3/\text{s}$  (400 cfs) to  $22 \text{ m}^3/\text{s}$  (800 cfs) between October 4 and November 10 and then reduced to  $17 \text{ m}^3/\text{s}$  (600 cfs) until November 15. After that time, releases were reduced back to the normal  $11 \text{ m}^3/\text{s}$  (400 cfs). The operation did not increase total releases from the Oroville Complex to the Feather River. Through a Federal drought-related grant, the Department of Fish and Game, who requested the operation, repaid the Project for the electrical energy foregone.

During the cold water operation, September 15–November 15, releases from the Oroville Complex to the Feather River were maintained at minimum fishery requirements to hold power losses to a minimum. Project's share of water required to maintain Delta water quality was assured by the U. S. Bureau of Reclamation in an agreement whereby any Project deficiencies were to be made up by additional releases from Bureau reservoirs.

The fish ladder at the Feather River Fish Hatchery was temporarily closed to approaching salmon on November 21. The Feather River Fish Hatchery was the only hatchery in Northern California with cold water, and thus became the main recipient of the salmon run. Steelhead were transferred from the Nimbus Fish Hatchery on the American River where warm water was causing a high mortality rate among fingerlings. Also, adult migrating salmon were trapped at the Red Bluff Diversion Dam on the Sacramento River and transported to the Feather River Fish Hatchery. Although extra incubator trays were borrowed from the Coleman and Moccasin Creek Hatcheries to bring the hatchery capacity to 26 million, the

incubators were filled and the ladder had to be closed. After the incubators were cleared of dead eggs and surviving sac fry were consolidated, the ladder was reopened. Despite the emergency nature of the enlargement, the hatchery successfully produced these fish to plantable size. Costs for the increased operation were covered by the Department of Fish and Game with funds from a Federal drought-related grant.

#### Sacramento-San Joaquin Delta Operations

Flows in Sacramento-San Joaquin Delta were controlled by releases from Sacramento Valley, upstream Central Valley Project (CVP) and State Water Project (SWP) reservoirs, during most of 1977. Consequently for coordinated operations the status of "balanced water conditions" was continued through December 24. They were originally declared on February 1, 1976. "Balanced water conditions" occur when it is agreed by USBR and DWR that the releases of water from upstream CVP and Project reservoirs, plus other inflows, approximately equal the water supply needed to meet Sacramento Valley in-basin use, including water quality objectives and exports.

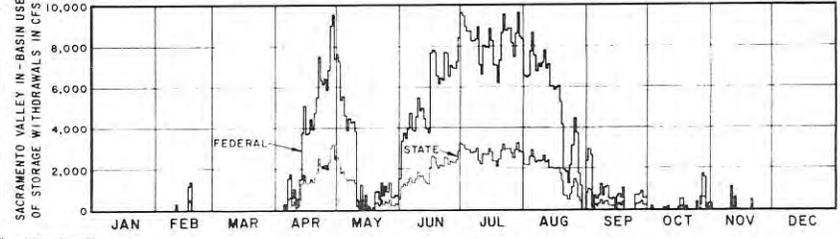
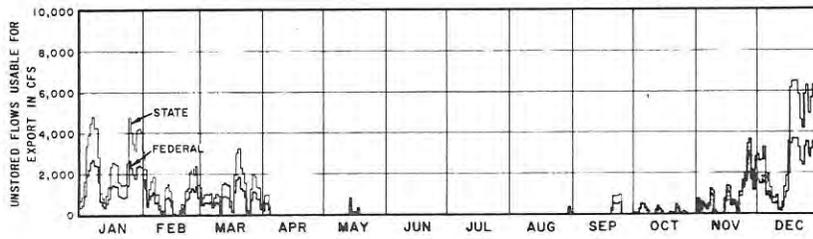
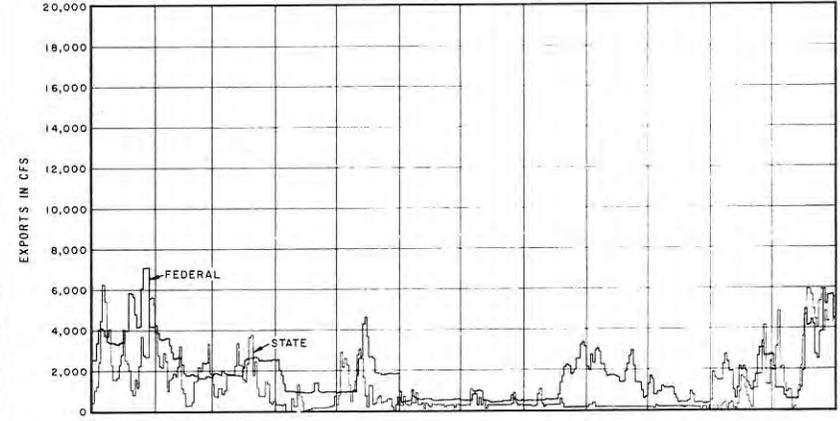
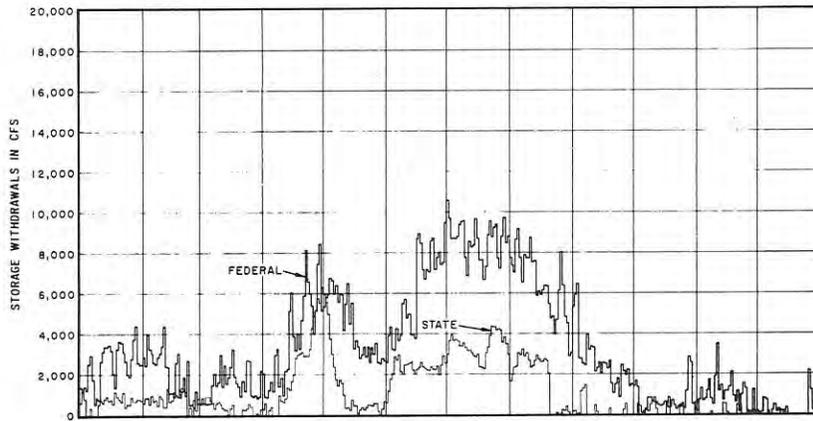
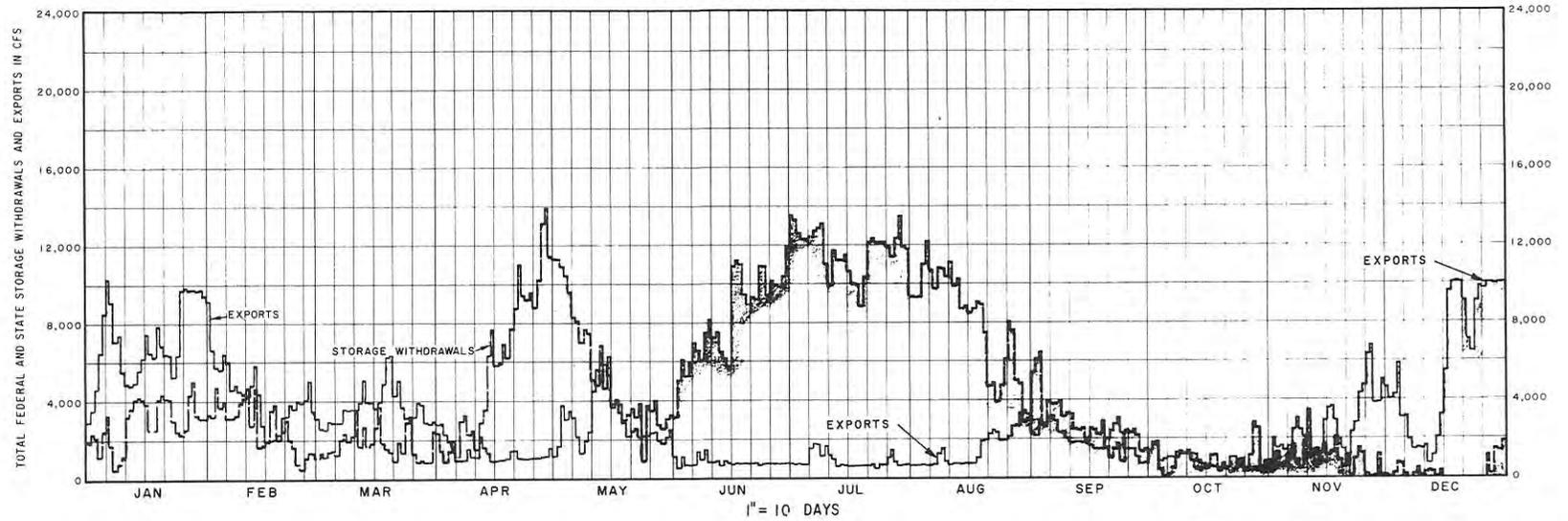
Coordinated operations in the Delta between the CVP and Project were complicated by not only the low water supply but also the difference in water quality objectives each project tried to maintain in the Delta. The operating identities, having gained almost a year's experience working with such complications, maintained balanced water conditions throughout the year by operating on a daily basis. The division of the water between the agencies was based on the draft agreement, "Supplemental Agreement Between

the United States of America and the State of California for Coordinated Operations of the Central Valley Project and the State Water Project", dated May 13, 1971. By a letter dated December 13, 1976, both agencies had agreed to operate during 1977 as if this coordination agreement had been executed except for agreed-upon specific modifications. Chart A, page 14 shows CVP-SWP Delta coordinated operations.

Table A, page 15, shows by months, the routing of water released from CVP-SWP upstream reservoirs to the Sacramento, Feather, and American Rivers. The water flowing to the ocean, represented by the Delta outflow index, provides a hydraulic barrier of fresh water to the more saline water of Suisun Bay to maintain Delta water quality at required levels. Any water in excess of that needed for in-basin use (including Delta consumptive use and the Delta outflow index) was available for State or Bureau export from the Delta in accordance with the terms in the Coordination Agreement. In 1977, the SWP exports from the Delta totaled 955 992 dekametres (775,024 acre-feet) and the CVP exports totaled 1 583 548 dekametres (1,283,784 acre-feet). The minor differences between these values and the totals shown in Table A are the result of rounding in the table.

During 1977, the Project was operated to maintain Delta water quality objectives established by the State Water Resources Control Board. These objectives were twice modified by the Board during the year. The initial objectives established in the Water Quality Control Plan for the Sacramento-San Joaquin Delta and San Francisco Bay Basins (Basin Plans) were modified with the Board's adoption of the Interim Water Quality Control Plan on February 8.

1977 CHART A CVP - SWP COORDINATED OPERATION



1" = 20 DAYS

TABLE A  
SACRAMENTO BASIN AND SACRAMENTO-SAN JOAQUIN DELTA  
OPERATION FOR 1977  
(thousands of acre-feet except as noted)

MONTH	UPSTREAM RESERVOIR RELEASE			Sacramento River In-basin Use <sup>2/</sup>	DELTA INFLOW			Delta Consumptive Use <sup>4/</sup>	DELTA USES		DELTA EXPORTS		
	Keswick <sup>1/</sup>	Oroville <sup>1/</sup>	Nimbus <sup>1/</sup>		Sacramento River at <sup>3/</sup> Sacramento	San Joaquin River at <sup>3/</sup> Vernalis	Total Delta Inflow		Thousands of Acre-feet	Average cfs	Total Exports	Exported by State-DWR	Exported by Federal-USBR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Jan.	336	74	52	137	600	69	669	-56	291	4,737	435	172	263
Feb.	303	67	38	65	473	47	520	-37	314	5,653	240	103	137
Mar.	325	60	18	20	423	33	456	-10	228	3,704	229	95	134
Apr.	431	139	17	-218	369	11	380	63	234	3,927	81	14	67
May	482	69	32	-118	466	22	488	121	178	2,887	181	67	114
June	509	78	68	-292	364	6	370	191	126	2,126	46	17	29
July	662	126	56	-377	467	5	472	268	141	2,295	51	20	31
Aug.	554	98	53	-279	426	6	432	252	78	1,262	92	15	77
Sept.	302	76	31	-24	384	9	393	174	98	1,653	121	9	112
Oct.	206	55	16	-6	271	13	284	118	112	1,814	52	8	44
Nov.	271	54	16	62	403	24	427	55	208	3,497	162	51	111
Dec.	172	55	17	468	707	30	737	2	367	5,975	368	202	166
Total	4,553	951	414	-562	5,353	275	5,628	1,141	2,375		2,058	773	1,285

<sup>1/</sup> Releases to river adjusted to the Delta

<sup>2/</sup> Positive values show accretions; negative values show depletions.

<sup>3/</sup> Col. 5 and 6 are based on daily 6:00 a.m. readings. Cols. 1, 2, 3, 12, and 13 are based on measured total daily flows.

<sup>4/</sup> From Consumptive Use Table dated April 9, 1969.

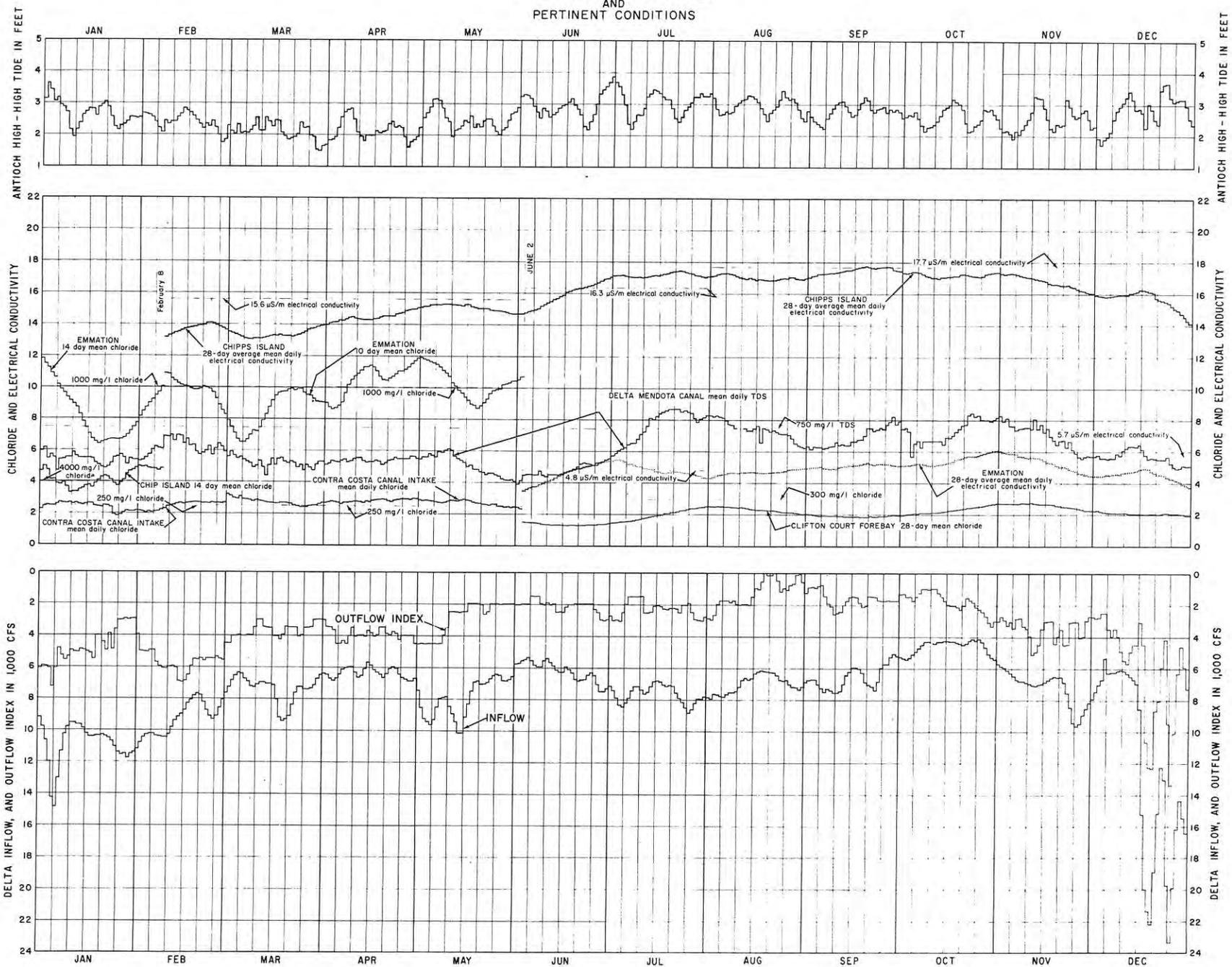
1000 acre-feet = 1.2335 cubic hectometres

1000 cubic feet per second = 28.317 cubic metres per second

The Interim Plan was superseded on June 2 by the Board's "Emergency Regulation Order". This emergency regulation was to have terminated no later than December 31, 1977, but with some modifications was extended in mid-December into 1978. Chart B, page 17, "Water Quality Objectives and Pertinent Conditions, 1977" shows plots of some of the controlling objectives and corresponding recorded daily values. As might be expected from the critical nature of the year and the number of changes of criteria by the Board, difficulty was encountered from time-to-time in meeting all criteria. A detailed discussion of the criteria and the record of achievement in meeting them is presented in Appendix E to Bulletin 132-78.

The U. S. Bureau of Reclamation's Delta operations were directed to providing water of sufficient quality to meet a total dissolved solids (TDS) target of 800 milligrams per litre (mg/l) at the Mendota Pool. To meet this, the TDS at the Tracy pumps was not to exceed 750 mg/l. Chart B, page 17 shows daily mean values of the TDS at the head of the Delta Mendota Canal reflecting water quality at the Tracy pumps. Recognizing plans to provide physical barriers to assist in the control of saline problems the USBR, on August 19, 1977 in an agreement with the Department of Water Resources, dedicated to the Delta through 1977, water necessary to meet 750 mg/l TDS at the Tracy Pumping Plant based on unchanged Delta configuration. The USBR also agreed that in the event of any change in the Delta configuration, it would dedicate to the Delta through 1977, the lesser of (1) water which would have been required to meet 750 mg/l TDS at Tracy without barriers, or (2) that required to meet 1700 mg/l chlorides at Emmaton. Table B, page 18 is a

CHART B  
 WATER QUALITY OBJECTIVES  
 AND  
 PERTINENT CONDITIONS



17

TABLE B  
CVP - SWP COORDINATED OPERATION  
DELTA OUTFLOW INDEX 1977

DAY	JANUARY		FEBRUARY		MARCH		APRIL		MAY 2/		JUNE 2/		JULY 2/		AUGUST		SEPTEMBER		OCTOBER 2/		NOVEMBER 2/		DECEMBER 2/		
	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	Actual	Excess 1/	
1	6,048		3,924		4,484	484	3,010		4,490	990	2,001		2,721		2,855		1,261		1,369		3,007		2,757		
2	5,931		5,004		4,508	508	3,458		4,489		2,007		3,009		2,951		928		1,319		2,951		2,716		
3	5,963		5,026		4,023		3,495		4,517	17/500	1,977		2,987		2,662		839		1,513		2,954		2,789		
4	6,054		5,066		4,013		3,677		4,494		1,983		3,022		1,996		940		1,509		3,260		2,493		
5	7,276		4,977		3,997		4,551	51/500	4,497	497	1,999		2,488	488	1,743		806		1,739		3,023		2,492		
6	6,081		4,984		4,008		4,502		4,404	494	1,497		1,997		1,764		742		1,496		3,420		3,488	-988	
7	4,853		5,743	743	4,005		4,325		4,509	9/1000	1,532		1,496		1,751		1,485		1,254		2,823		3,995	-498	
8	5,282		5,977	977	3,973		4,505	5/325	4,506	6/1000	1,503		1,505		1,826		1,912		984		2,808		3,468		
9	5,575		6,127		3,989		4,002	2/500	3,987	987	1,990		1,504		1,737		2,073		988		3,344		3,981		
10	5,055		6,122		3,519		3,519		3,490	490	2,008		1,493		1,985		2,568		1,007		3,492		4,909		
11	4,984		6,000		3,025		4,005	5/1000	2,488		1,920		1,483		1,999		2,509		981		3,975		5,489		
12	5,046		5,998		3,009		3,995	995	2,476		2,005		2,546		2,000		2,457		984		5,109		5,679		
13	5,075		6,031		3,436		3,294		2,502		1,988		2,493		1,949		2,013		1,259		4,995		5,072		
14	4,882		6,895		3,526		4,016	16/1000	2,540		2,497		2,447		2,447	500	1,792		1,506		4,466		4,499		
15	4,988		6,989		3,568		3,715	715	2,499		2,487		2,095		1,482		1,540		1,774		3,493		4,448		
16	5,089		6,866		4,004		3,838	838	2,477		2,526		2,056		993		1,481		1,990		3,018		3,085		
17	5,153		6,518		4,015		4,023	23/1000	1,983		2,193		2,106		1,006		1,520		2,010		3,005		4,457		
18	5,509		5,979	979	4,261	261/500	3,987	987	1,985		2,013		2,278		518		1,852		2,026		3,494		10,634		
19	4,014		5,507	507	3,983	483	3,496	996	1,988		2,003		2,300		-98		2,103		2,175		4,404		12,220		
20	4,003		5,568	568	3,457		3,487	487	1,974		1,979		2,218		140		2,051		2,268		3,987		12,307		
21	4,447	447	5,477	477	3,488		3,896	396	2,032		1,990		2,003		132		1,460		2,007		3,515		8,866		
22	4,962	962	5,609	609	3,480		3,972	472	2,639	639	1,974		2,271	271	-41		1,500		1,550		1,508		8,044		
23	3,914		5,497	497	3,501		3,775	275	2,499	499	1,996		2,510	500	448		1,514		1,708		3,446		5,953		
24	4,877		5,480	480	4,032	32/500	3,864	364	1,999		1,993		2,008		1,198		1,735		1,820		2,883		4,165		
25	3,656		5,490	490	3,981	481	4,256	756	1,995		1,989		2,006		953		1,748		2,140		3,044		9,187		
26	3,073		5,383	383	3,540		3,988	488	1,994		2,303		1,934		1,039		1,765		2,256		3,034		13,300		
27	3,027		5,491	491	3,517		3,987	487	2,004		2,502		2,472		794		1,778		2,409		4,009		10,380		
28	2,992		4,551	551	3,473		3,986	486	1,998		2,996		2,914		642		1,782		2,708		3,978		6,345		
29	3,033				3,032		3,999	499	1,991		3,004		2,995		95		1,738		3,108		2,999		4,552		
30	2,997				2,988		4,499	999	1,998		2,930		2,999		33		1,746		3,365		2,718		5,947		
31	2,998				2,992				1,988				2,778		570				3,009				7,288		
TOTAL	146,837	1,409	158,279	12,752	114,827	2,956	117,814	15,559	89,508	7,096	63,775	0	71,134	1,259	39,123	500	49,578	0	56,240	0	104,921	0	185,221	-1,486	
AVERAGE	4,737	45	5,653	455	3,704	95	3,927	519	2,887	229	2,126	0	2,295	41	1,262	16	1,653	0	1,814	0	3,497	0	5,975	-48	
MAXIMUM	7,276	962	6,989	1,497	4,508	508	4,551	1,000	4,517	1,000	3,004	0	3,022	500	2,951	500	2,568	0	3,365	0	5,109	0	13,399	0	
MINIMUM	2,992	0	3,924	0	2,988	0	3,010	0	1,974	0	1,497	0	1,483	0	-98	0	742	0	981	0	2,718	0	2,492	-988	
TOTAL TN																									
ACRE-FEET	291,251	2,795	313,946	25,294	227,759	5,863	233,684	30,861	177,539	14,075	126,498	0	141,094	2,497	77,600	992	98,338	0	111,552	0	208,111	0	367,386	-2,947	

Values in cfs - days except where noted  
 1/ Excess outflow is that part of the Outflow Index provided by SWP not shared with CVP  
 2/ SWP assumed excess outflow (+ or -)  
 3/ 11/222 where 11 = USBR added adjustment for outflow above target and 222 = SWP adjustment for target outflow only

ANNUAL

Total Delta Outflow Index		1,197,257 cfs-days	EXCESS 1/
		2,374,758 acre-feet	40,645 cfs-days
			79,430 acre-feet
Delta Outflow Index	Average	3,280 cfs-days	110 cfs-days
	Maximum	13,399 cfs-days	1,407 cfs-days
	Minimum	-98 cfs-days	-988 cfs-days

1

tabulation of the daily computed "Delta outflow index" and that portion of the Delta outflow index not shared by the U. S. Bureau of Reclamation.

As part of the 1977 Sacramento-San Joaquin Delta operations, a series of rock barriers and other facilities were built to reduce the releases of stored water by: (1) reducing salinity intrusion into the Delta; (2) increasing water circulation in selected channels; (3) reducing chloride levels at selected points; (4) increasing protection for the fishery resources; and (5) providing alternate sources of water for Delta water users. The report "The 1976-77 California Drought; A Review", details the construction and operation of these facilities beyond the following summaries. It was estimated that these facilities saved about 296 040 cubic dekametres (240,000 acre-feet) while Delta protection was maintained.

#### Rock and Indian Slough Barriers

To improve water quality at the Contra Costa Canal Intake, two barriers were constructed to isolate the intake channel from the Delta. The contract for these barriers was let on February 23 with the Indian Slough (also known as Werner Cut) Barrier being completed on March 18 and Rock Slough Barrier completed on March 29. Until June 10, the delivery of the first water from Middle River, water in the intake channel was replenished by tidal pumping through tide gates in the Indian Slough Barrier. To provide a better quality of water to the Contra Costa Canal, the Middle River Pumping Plant was constructed in cooperation with the East Bay Municipal Utility District (EBMUD). Using one barrel of EBMUD's Mokelumne Aqueduct, water was conveyed from the plant to the isolated intake channel for diversion into the Contra Costa Canal. Federal emergency drought funds were made

available in connection with this construction. Figure 1, page 21, shows the location of these facilities and the top graph of Figure 2, page 23, shows the chlorides within the isolated intake channel in comparison with the chlorides at its regular source, Old River.

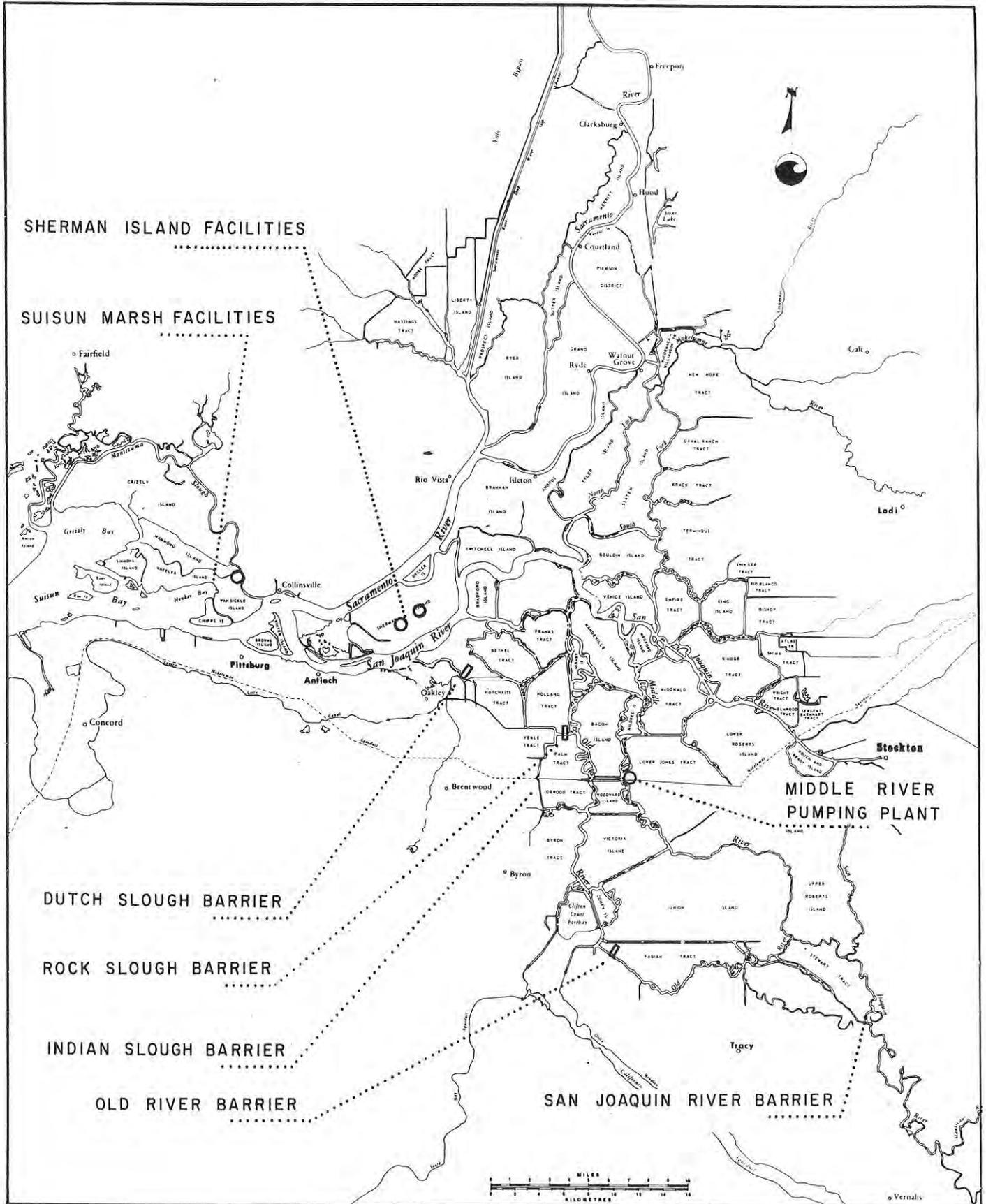
#### South Delta Barriers

To protect the southern Delta agricultural areas from local conditions of poor quality water, two barriers were built. The contract for the first, in the San Joaquin River near Mossdale (see Figure 1, page 21), was let on June 27 and completed on August 23. This barrier was breached in August and removed in February 1978 without being repaired. Prior to being breached, the San Joaquin River barrier stabilized and raised the water level, particularly at low tide, and allowed water users south of Paradise Cut to pump at a constant rate regardless of the tidal stage. The contract for the second rock barrier, in Old River east of Clifton Court (see Figure 1, page 21), was let on July 8 and completed on August 11. This second barrier allowed eastward flow during rising tide, but retarded flow during lowering tide, thereby increasing water circulation in Old River. Federal drought emergency funds were made available for the construction of these facilities also.

#### Old River Closure

The rock barrier installation at the head of Old River (see Figure 1, page 21), was completed on October 27 and removed December 2. The Old River barrier is installed each year to aid the fall migration of salmon to spawning areas upstream of Stockton in keeping with the March 10, 1969 Memorandum of Understanding between the U. S. Bureau of Reclamation, Department of Water Resources, and the Department

Figure 1  
 DROUGHT MITIGATIVE FACILITIES CONSTRUCTED BY DWR  
 SACRAMENTO – SAN JOAQUIN DELTA 1977

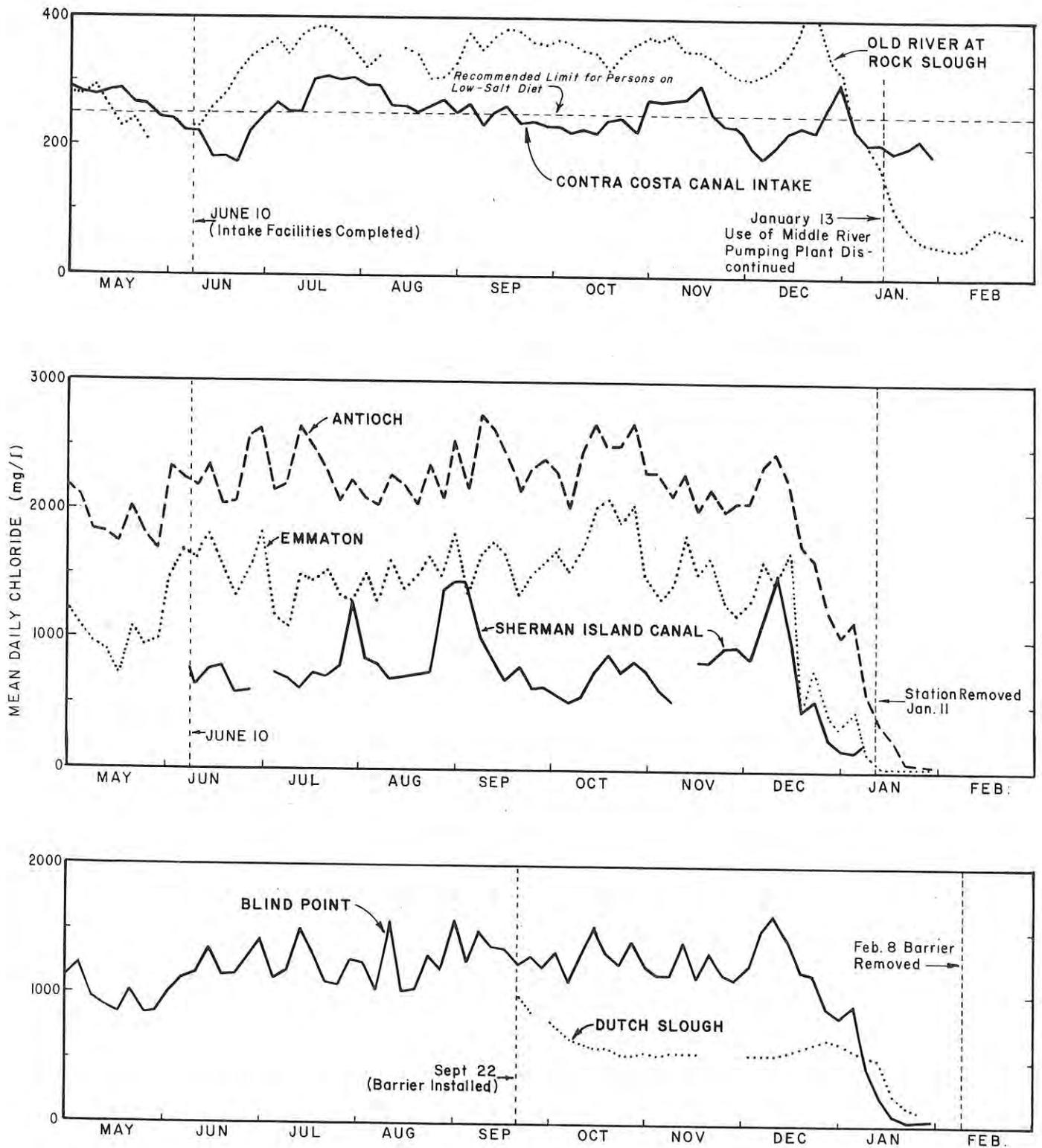


of Fish and Game to maintain and rebuild salmon stock in the San Joaquin River. The barrier's prime functions are to increase the dissolved oxygen level in the lower San Joaquin River and to provide "attraction flow" to the Central Delta. Although this facility is installed annually, this year the timing and duration of the closure was primarily dictated by the drought conditions.

#### Sherman Island Facilities

An agreement, dated March 11, 1977, between the Department of Water Resources, Reclamation District No. 341 (Sherman Island), and the North Delta Water Agency, provided that the Emmaton quality criteria (1,000 mg/l chloride, January to August; 1,400 mg/l chloride, August to January) would be relaxed, and the existing Sherman Island irrigation system altered to provide better quality water for farms on the Island than would be available east of Emmaton. To provide the alterations, an existing drain pump on the eastern portion of the Island was altered to allow it to siphon water from Three Mile Slough into a deepened existing drainage ditch. Pumps were installed in the drain to deliver the water into the Central Canal and also additional pumps were installed in the west end of the Central Canal to lift some of the water into Mayberry Slough. About 38 230 cubic metres (50,000 cubic yards) of material was excavated from existing ditches to allow flows to be reversed for the operation. The State loaned and installed two 566 litre-per-second (20 cfs) pumps to pump water into the Central Canal and two 283 litre-per-second (10 cfs) submersible pumps to pump water into Mayberry Slough. Construction began in March 1977, and the system became operational in May 1977. In June 1977, chloride levels were approximately 600 mg/l in the

Figure 2  
EFFECT OF MITIGATIVE FACILITIES UPON CHLORIDES IN DELTA DURING 1977-78



Central Canal and 1 600 mg/l at Emmaton. Figure 2, page 23 includes a comparison of mean daily chlorides measured at Emmaton and in the Sherman Island Canal. The cost of the facilities totaled \$110,000 which was shared by the State (California Water Fund - \$25,000) and the Federal Drought Emergency Act (\$85,000).

#### West Delta Barriers

During May, the Department proposed to construct three barriers in the western Delta at: Dutch Slough, Fisherman's Cut, and False River. The facilities were designed to reduce salinity intrusion to the central and southern Delta and conserve stored water. The Dutch Slough Barrier was the only barrier constructed (see Figure 1, page 21). It was completed on September 22, 1977, and removed on January 13, 1978. During January 1978, plans to construct the other two barriers were cancelled. Again Federal emergency drought funds were provided.

The Dutch Slough Barrier, with siphon and flapgates, allowed westward flow at ebb tide and prevented eastward flow. Higher salinity water was diverted away from Dutch and Sand Sloughs into False River and the San Joaquin River. The third graph in Figure 2, page 23 compares mean daily chlorides at Dutch Slough to those at Blind Point.

#### Suisun Marsh

During the spring an alternative water supply was provided to certain duck club owners on Simons and Wheeler Islands. Water was brought from Montezuma Slough through existing culverts and controlled levee breaches for distribution to the area duck clubs. The water from Montezuma Slough had a much lower salinity level

than the water around the Suisun Bay. The lower salinity water was needed for production of alkali bullrush seed, a primary waterfowl food item. The arrangement was satisfactory to all parties and during the fall of 1977, several breaches were replaced with culverts and slide gates so that the operation could be repeated if necessary.

#### Drought Activities - California Aqueduct

To provide emergency water to the San Francisco Bay Area, principally Marin County, a turnout was constructed on the South Bay Aqueduct for releasing Project water into the City of San Francisco's San Antonio Reservoir. Of the 9 826 **cubic dekametres** (7,966 acre-feet) released from the turnout between April 5 and December 31, 4 159 cubic dekametres (3,372 acre-feet) went to the San Francisco Water District and 5 663 cubic dekametres (4,594 acre-feet) went to Marin Municipal Water District.

Another special drought action in the Delta Field Division was the blending of South Bay Aqueduct water pumped from the Delta with releases from Lake Del Valle. This blending, to improve the quality of water being delivered, was started August 19 to accommodate South Bay Aqueduct's water contractors. Normally releases from Lake Del Valle are not started until after Labor Day to maintain a maximum recreation pool through the heavy use period.

Specific drought activities in the San Luis Field Division included the delivery of 5 612 cubic dekametres (4,550 acre-feet) of Devils Den Water District's entitlement water to South Lake Farms via Westlands Water District distribution system. In addition, within the division, there was transported to areas of use 3 184 cubic dekametres (2,581 acre-feet) of ground water pumped

into the San Luis Canal. Also, 1 243 cubic dekametres (1,008 acre-feet) of Tulare Lake Basin Water Storage District's entitlement water was delivered to Westlands Water District's turnouts for use on Schwarts Farms, Inc., lands. Although provided as an accommodation during the drought, the Project was reimbursed for all additional costs these activities incurred.

In the San Joaquin Field Division, 2 902 cubic dekametres (2,353 acre-feet) of ground water was conveyed through the California Aqueduct for the Wheeler Ridge-Maricopa Water Storage District. This conveyance was a drought emergency arrangement where, by agreement, the Wheeler Ridge-Maricopa Water Storage District was allowed to pump ground water into the Aqueduct at one point and take delivery of it at another.

In accordance with the Wheeling Agreement of September 2, 1975, deliveries of Federal water through the Cross Valley Canal were interrupted twice during the early spring. The Wheeling Agreement provides that the State Water Project will discontinue conveying Federal water whenever the U. S. Bureau of Reclamation fails to provide its share of water for protection of the Delta. The discontinuance created difficulties for certain of the agricultural interests. On March 21, agreement was reached with the Federal water customers assuring them of a definite schedule of deliveries. During the year a total of 2 773 cubic dekametres (2,248 acre-feet) of water was not delivered. This represents about 7 percent of the volume scheduled for the year.

## PROJECT OPERATION

For the first time in the history of the Project, deliveries of requested entitlement water to State Water Contractors were reduced in accordance with provisions of the water supply contracts. The reduction for agricultural users was 60 percent and 10 percent for all other water contractors. Agencies in the Feather River Service Area having a water rights settlement with the State were decreased 50 percent, the maximum allowed under those contracts.

Project water delivered including entitlement, carryover, exchange and purchased water totaled 1 126 537 cubic dekametres (913,285 acre-feet). This total represented a 53 percent decrease from the volume of entitlement and surplus water delivered during 1976. In addition, local water delivered from Project facilities totaled 23 282 cubic dekametres (18,875 acre-feet), down 7 percent from that delivered in 1976.

Project and local water delivered to each of the major service areas during 1977 compared to 1976 deliveries were:

<u>Service Area</u>	<u>1977 Deliveries</u> <u>Cubic dekametres</u> <u>(acre-feet)</u>	<u>Percent Change</u> <u>From 1976 Deliveries</u>
Feather River	9 620 (7,799)	-38
San Francisco Bay	155 428 (126,006)	-25
San Joaquin Valley	666 641 (540,117)	-51
Southern California	318 537 (258,238)	-63
Total	1 139 673 (932,160)	-53

No preconsolidation repayment water was delivered in 1977, since it would have come from surplus water supplies.

A table showing water deliveries by year and totals to date for individual State Water Contractors, is presented in Section I.

Water deliveries to U. S. Bureau of Reclamation customers from the Joint Facilities totaled 398 845 cubic dekametres (323,344 acre-feet), a reduction of 76 percent from 1976 deliveries. In addition, 38 313 dekametres (31,060 acre-feet) of U. S. Bureau of Reclamation water was wheeled to the Cross Valley Canal in compliance with the three-party (the United States, the State, and nine water agencies) contract, down 65 percent from that wheeled in 1976.

Water delivered from the Oroville-Thermalito Complex to satisfy prior water rights totaled 681 485 cubic dekametres (552,481 acre-feet) a decrease of 40 percent from 1976 deliveries. Natural flow passed through Project's southern reservoirs to satisfy prior water rights, amounted to 22 559 cubic dekametres (18,289 acre-feet) a reduction of 11 percent from the 1976 total.

#### Oroville Field Division

##### Upper Feather River Reservoirs

The upper Feather River reservoirs did not fill or spill during the year. Maximum storage attained in each of the three reservoirs this year established a new record for the lowest maximum storage recorded.

Upper Feather River Reservoirs

Storage  
in  
Dekametres (acre-feet)

<u>Reservoir</u>	<u>Maximum</u>	<u>% of Capacity</u>	<u>Date</u>	<u>Minimum</u>	<u>% of Capacity</u>	<u>Date</u>
Antelope Lake <sup>1/</sup>	4 844 (3,927)	17	12/31	1 310 (1,062)	5	1/1
Frenchman Lake	18 559 (15,046)	27	5/24	9 473 (7,680)	14	11/5-6&19
Lake Davis <sup>2/</sup>	73 604 (59,671)	71	4/9-10&13	41 035 (33,267)	39	11/19-20

<sup>1/</sup> Antelope was drained in the fall of 1976.

<sup>2/</sup> Between June 8 and August 19, releases from Lake Davis were increased to provide 18 051 cubic dekametres (14,634 acre-feet) of water to help maintain Lake Oroville storage above the minimum power pool.

A graph depicting monthly storage values of the three upper Feather River reservoirs can be found on page 53. Monthly operations are presented in Section V, page 1.

Lake Oroville

Lake Oroville's maximum storage, 2 010 373 cubic dekametres (1,629,812 acre-feet), was recorded on January 2. Minimum storage in Lake Oroville, 1 088 434 cubic dekametres (882,395 acre-feet), was reached on September 7. Both maximum and minimum storages established new records. The maximum was the earliest and lowest and the minimum was the lowest recorded since initial filling of Lake Oroville in 1969. Maximum computed inflow rate into Lake Oroville reported for the year occurred between 0200 and 0400 hours on December 15, and averaged 624 m<sup>3</sup>/s (22,025 cfs). Lake Oroville storage is delineated on page 53, and in Section V. Monthly operations are also presented in Section V.

Ponderosa Dam releases into Lake Oroville from South Fork Feather River totaled 8 276 cubic dekametres (6,709 acre-feet). Lake Wilenor water released into Lake Oroville totaled 629 cubic dekametres (510 acre-feet). Thermalito Irrigation District deliveries totaled 516 cubic dekametres (418 acre-feet).

The surface water temperature in Lake Oroville reached a high of 26.7°C (80°F) on June 29, 1977. Minimum temperature recorded was 7.2°C (45°F) on January 19. Monthly Lake Oroville isotherms are delineated in Section V.

#### Complex Releases

Releases to satisfy prior water rights to Sutter/Butte Canal, Pacific Gas and Electric Company Lateral, Western Canal, Richvale Canal, and Palermo Canal totaled 691 401 cubic dekametres (560,520 acre-feet) and reached a peak rate of 84.4 m<sup>3</sup>/s (2,981 cfs) on April 28. Releases to the Feather River totaled 1 172 168 cubic dekametres (950,278 acre-feet), with a peak rate of 96 m<sup>3</sup>/s (3,390 cfs) on April 29. End-of-month water surface elevations and storage values are presented in Section V, for Thermalito Diversion Pool, Forebay and Afterbay.

#### Hyatt-Thermalito Powerplants

Gross generation at the Hyatt-Thermalito (Oroville) Complex during the year totaled 740,018 megawatt hours. Energy consumed for the year's pumped storage operation totaled 124,803 megawatt hours. A graph showing the Hyatt-Thermalito monthly distribution of gross generation is presented on page 52. Monthly operations are tabulated in Section VI.

## Annual Inspection

The annual inspection critique for the Oroville Field Division was held May 12. Mr. Howard H. Eastin, Chief, Division of Operations and Maintenance, conducted the critique with Mr. Phil J. Johns, Chief, Oroville Field Division, representing the Field Division. Mr. Samuel B. Nelson represented the California Water Commission.

## Activities, Outages, and Limitations

Other activities, events, outages, and limitations affecting or influencing operations of the Oroville Field Division are presented in chronological order.

March 18, the Frenchman Dam outlet Howell-Burger valve was reinstalled after being completely overhauled. New stainless steel valve sleeves were also installed in the inlet.

July 25, utilization of the Oroville Complex automatic generation control was discontinued and the units were restricted to block loading. Monitoring of unit performance indicated that there was a net swing range of only about 100 MW available with all units at both plants on line. The low net swing range was due to relatively excessive high minimum loading on some units, upper limits dictated by excessive thrust bearing stress, and roughness in midrange. To compensate for these conditions, the operator was required to intervene on the automatic dispatch control to adjust unit operating limits. Consequently control was semi-manual.

August 15, Hyatt Units 2, 4 and 6 (pump/generators) were placed on reserve shutdown status. Through December the units were only available for emergency generation. This emergency restriction resulted from the unstable hydraulic conditions experienced in these machines at lower heads.

September 7 through November 30, work was completed on the fourth stage of repairs on the Edward Hyatt Powerplant penstock intake. This work included the fabrication and installation of replacement trashracks and the installation of stabilizer assemblies below elevation 225.25 metres (739.0 feet).

### Delta Field Division

#### Water Deliveries

Water deliveries in the North San Joaquin Divisions of the California Aqueduct, totaled 4 157 cubic dekametres (3,370 acre-feet) all to Oak Flat Water District. This total was some 58 percent less than last year's deliveries to the Oak Flat Water District.

Total water deliveries, including regulation of local supply from the North and South Bay Aqueduct, totaled 158 483 cubic dekametres (128,482 acre-feet) a decrease of 27 percent from 1976 deliveries. Of this total, some 13 529 cubic dekametres (10,968 acre-feet) were from exchange water of the Metropolitan Water District of Southern California. Annual water deliveries to each contractor are summarized in Section I.

#### Delta Exports

Total Project water pumped from the Delta this year, excluding mitigation water, was 955 912 cubic dekametres (775,024 acre-feet), a reduction of 48 percent from that pumped in 1976. This total includes 953 525 cubic dekametres (773,024 acre-feet) pumped at the Delta Pumping Plant and 2 467 cubic dekametres (2,000 acre-feet) pumped at the Contra Costa Pumping Plant for Pacific Gas and Electric Company under a drought emergency exchange agreement.

## Delta Pumping Plant

Pumping at the Delta Pumping Plant totaled 1 035 151 cubic dekametres (839,198 acre-feet), the lowest yearly total since 1971. Of this year's total, 79 159 cubic dekametres (64,174 acre-feet) were pumped for the U. S. Bureau of Reclamation. Weekly pumping rates varied from 1 691 cubic dekametres (1,371 acre-feet) (April 18-24) to 92 921 cubic dekametres (75,331 acre-feet) (December 19-25).

All water pumped for the U. S. Bureau of Reclamation at the Delta Pumping Plant was conveyed through the California Aqueduct to O'Neill Forebay. Of the total, 4 800 cubic dekametres (3,891 acre-feet) were pumped in February and March for delivery to U. S. Bureau of Reclamation's Cross Valley Canal customers. In January and December, a total of 67 078 cubic dekametres (54,380 acre-feet) was pumped utilizing excess Project capacity during periods when water was available in the Delta and Bureau's pumping was limited by the Delta-Mendota Canal capacity between the Tracy and O'Neill Pumping Plants. In May, 6 482 cubic dekametres (5,255 acre-feet) were pumped to make up capacity lost by the Bureau earlier when the Bureau had reduced pumping at Tracy to increase Delta outflow during critical periods. In September, 799 cubic dekametres (648 acre-feet) were pumped during a one-day outage of units at the Tracy Pumping Plant. All pumping at the Delta Pumping Plant for the U. S. Bureau of Reclamation was done during periods when the Bureau was providing its share of water to maintain the then existing water quality objectives in the Delta established by the State Water Resources Control Board. Also, the U. S. Bureau of Reclamation provided all power required for pumping its water at the Delta Pumping Plant.

## South Bay Aqueduct

Pumping at the South Bay Aqueduct Pumping Plant totaled 151 026 cubic dekametres (122,437 acre-feet), a reduction of 25 percent from last year. Of this total 9 826 cubic dekametres (7,976 acre-feet) were released into San Francisco Water District's San Antonio Reservoir for the drought emergency.

Lake Del Valle's minimum storage was recorded on the first of the year at 30 710 cubic dekametres (24,897 acre-feet). Pumping into Lake Del Valle from the South Bay Aqueduct totaled 19 796 cubic dekametres (16,049 acre-feet). Maximum storage was first recorded on May 19, at 48 988 cubic dekametres (39,715 acre-feet). Releases and evaporation reduced storage to 32 810 cubic dekametres (26,599 acre-feet) on December 7 and 10. Late December inflow increased year-end storage to 33 144 cubic dekametres (26,870 acre-feet).

## Annual Inspection

This year's critique of the annual inspection of the Delta Field Division was held June 10. Mr. Howard H. Eastin, Chief, Division of Operations and Maintenance, conducted the critique with Mr. Charles F. Tarbox, Chief, Delta Field Division, representing the Field Division. Mr. Samuel B. Nelson represented the California Water Commission at this inspection.

## Activities, Outages, and Limitations

Other activities, events, outages, and limitations affecting or influencing operations in the Delta Field Division in chronological order were:

Drought conditions were the prime limitations on pumping at the Delta Pumping Plant during 1977. Between April 1 and mid-November, pumping was generally limited to South Bay Aqueduct and North San Joaquin water demands except during short periods of freshets.

On August 30, Delta Pumping Plant Unit 2, one of the plant's two smaller units, was taken out of service and remained out of service for the balance of the year. New stainless steel impellers were ordered to replace existing impellers in both small units.

In December the American Canyon County Water District took its first deliveries from their newly installed turnout in the terminal tank of the North Bay Aqueduct, MP 42.24.

### San Luis Field Division

#### San Luis Reservoir

The maximum storage in San Luis Reservoir during the year was 1 490 919 cubic dekametres (1,208,690 acre-feet) on April 4-6, while the minimum was 249 994 cubic dekametres (201,049 acre-feet) on November 7. These storages were the lowest of record since the initial filling. A graph showing the yearly storage fluctuations of San Luis Reservoir is presented in Section V.

Water pumped into San Luis Reservoir totaled 1 152 131 cubic dekametres (934,034 acre-feet) of which 532 838 cubic dekametres (431,964 acre-feet) or 46 percent was State water. Water released to O'Neill Forebay amounted to 1 410 718 cubic dekametres (1,143,671 acre-feet) with the State's share totaling 534 990 cubic dekametres (433,717 acre-feet) or 38 percent. As of midnight December 31, 1977, San Luis Reservoir storage was 694 718 cubic dekametres (563,209 acre-feet) of which 74 percent or 515 388 cubic dekametres (417,826 acre-feet) was State water. Monthly operations of O'Neill Forebay and San Luis Reservoir are presented in tables in Section V.

The only water exchange in San Luis Reservoir and O'Neill Forebay this year was the 92 512 cubic dekametres (75,000 acre-feet) loaned to the U. S. Bureau of Reclamation as part of an agreement between the parties providing for certain operating conditions in the Delta for the remainder of 1977. The water was transferred to the U. S. Bureau of Reclamation on August 20 and repaid November 30.

Between September 6 and 7, 4 594 cubic dekametres (3,724 acre-feet) were released from San Luis Reservoir storage to provide generation for Pacific Gas and Electric Company (PGandE). This generation was in accordance with this year's agreement for the sale of Canadian entitlement capacity and San Luis generation capacity entered into with PGandE. The generation was called for after PGandE committed its available resources. By September 10, the pump-back operation had been completed with the return to San Luis Reservoir storage of all water used by PGandE for generation. PGandE provided the energy for the pumping.

Water delivered to Federal customers from the Joint Facilities totaled 398 845 cubic dekametres (323,344 acre-feet), down over 76 percent from 1976 deliveries. Of this total, 5 467 cubic dekametres (4,432 acre-feet) were Phase I water for construction. This does not include 302 cubic dekametres (245 acre-feet) for Federal share of mitigation water delivered to the Department of Fish and Game. Also not included is 60 cubic dekametres (49 acre-feet) of Federal share to the Department of Parks and Recreation. In addition, 36 647 cubic dekametres (29,710 acre-feet) of Federal water was conveyed through the Joint Facilities for delivery by the San Joaquin Field Division to the Cross Valley Canal.

Deliveries in the Division included 5 612 cubic dekametres (4,550 acre-feet) of Devils Den Water District's entitlement water conveyed to South Lake Farms through the Westlands Water District distribution system. As noted under special drought activities, 3 184 cubic dekametres (2,581 acre-feet) of ground water was pumped into the San Luis Canal and transported to areas of use. By agreement this amount was reduced 10 percent to account for losses. In addition 1 243 cubic dekametres (1,008 acre-feet) of Tulare Lake Basin Storage District's entitlement water was delivered to Westlands Water District's turnouts for use on Schwartz Farms, Inc., lands. Water deliveries from the Joint Facilities to Federal customers were made from 173 turnouts (58 permanent and 115 temporary).

State deliveries in the Division included 368 cubic dekametres (298 acre-feet) to the Department of Fish and Game and 75 cubic dekametres (61 acre-feet) to the Department of Parks and Recreation.

#### Mitigation Water

Project's share of mitigation water totaled 1 375 cubic dekametres (1,115 acre-feet). Most of this year's mitigation water was conveyed to the parties (California Department of Fish and Game, Grassland Water District, and William Affonso) through the Delta-Mendota Canal, although for the first time the California Department of Fish and Game also took deliveries from the San Luis Canal. Conveying of mitigation water through U. S. Bureau of Reclamation facilities provides an overall saving to both agencies. The Project provided the U. S. Bureau of Reclamation electrical energy for pumping its share of the mitigation water at their Tracy and O'Neill Pumping Plants as well as that through the Dos Amigos Pumping Plant.

## Annual Inspection

The annual inspection critique of the San Luis Field Division was held September 23. Mr. Howard H. Eastin, Chief, Division of Operations and Maintenance, conducted the critique with Mr. Jack Arnold, Field Division Chief, San Luis Field Division, representing the Field Division. Representatives from the U. S. Bureau of Reclamation included: Messrs. Dave Coleman, Chief, Central Valley Operations Coordinating Office; and E. R. Klinke, Chief, Power O & M Branch. Messrs. Samuel B. Nelson and Thomas K. Beard represented the California Water Commission.

## Inflow of Flood Waters

December 29, a release of 2.8 m<sup>3</sup>/s (100 cfs) from the Gale Avenue impoundment area into Pool 20, began at 0800 hours. This release continued until 0745 hours on December 31.

## San Joaquin Field Division

### Water Deliveries

Water delivered to State Water Contractors in the San Joaquin Field Division totaled 648 709 cubic dekametres (525,909 acre-feet), a reduction of 52 percent from 1976 water deliveries. In addition, 38 313 cubic dekametres (31,060 acre-feet) of U. S. Bureau of Reclamation water was conveyed from Check 21 for delivery to Federal customers through the Cross Valley Canal turnout. This water delivered to Federal customers was down 65 percent from 1976 deliveries.

Since no preconsolidation repayment water was delivered in 1977, as there were no surplus water supplies, the amount left to be delivered by 1985, under the 1964 contracts, remained:

J. G. Boswell - 105 310 cubic dekametres (85,927 acre-feet)

Belridge Oil Company - 73 920 cubic dekametres (58,927 acre-feet).

A table showing water deliveries by year and totals to date for individual State Water Contractors, is presented in Section 1.

In addition to regular deliveries, 2 902 cubic dekametres (2,353 acre-feet) of ground water was conveyed through the California Aqueduct for the Wheeler Ridge-Maricopa Water Storage District.

#### Annual Inspection

The annual inspection critique of the San Joaquin Field Division was held October 28. Mr. Howard H. Eastin, Chief, Division of Operations and Maintenance, conducted the critique with Mr. Merle Bashor, Chief, San Joaquin Field Division, representing the Field Division.

#### Activities, Outages and Limitations

This year's reduction in pumping requirements provided an opportunity for the San Joaquin Field Division personnel to complete certain reconditioning and improvements.

1. At the A. D. Edmonston Pumping Plant, seven units were taken out of service through the year for reconditioning. This includes Unit 2, which was out of service all year for rewedging the motor stators and repairing the cavitation on the first-stage impeller.

2. At Wind Gap, Wheeler Ridge, and Buena Vista Pumping Plants protective measures were completed on all units which included the tack welding of the nose cone to the runner and repositioning and securing the lower wearing rings.

3. Installation was initiated on the automated turnout assemblies to enable remote control of certain of the turnouts from the Area Control Center.

On November 16, a mysterious kill of striped bass was experienced in Pool 35, immediately upstream of the Wheeler Ridge

Pumping Plant. Pumping was suspended for about a week. Water quality samples showed no contamination in the pool. Operation was returned to normal without evidence of further fish kill.

On December 20 and 21, winds in excess of 161 kilometres per hour (100 miles per hour) were experienced in the Bakersfield and Arvin areas. The dirt and dust residue from the winds affected almost every facility within the Division including those in buildings and resulted in extensive cleanup activities for months. During the winds, weeds plugged the Pastoria Siphon trashracks causing the A. D. Edmonston Pumping Plant to reduce from a six to three unit operation. An "A" phase conductor broke loose from the lightning arrestor relaying the Edmonston-Pastoria 220 kV line. Later, inspection by Southern California Edison, revealed one line structure down and another damaged.

The Buena Vista and Wheeler Ridge Pumping Plants were also temporarily de-energized due to power transformer problems related to the high winds. Rain gutter damage occurred at Buena Vista, Wheeler Ridge, and A. D. Edmonston Pumping Plants. The rollup doors were damaged at A. D. Edmonston and Wind Gap Pumping Plants. The roof was damaged at the Wheeler Ridge Pumping Plant.

#### New Turnout Construction Completions Included

Lost Hills No. 5, Lost Hills Water Storage District

M.P. 202.05; and

Wheeler Ridge-Maricopa No. 14, Wheeler Ridge-Maricopa Water Storage District, M. P. 291.26.

### Southern Field Division

Effective March 1, the Project discontinued pumping of water over the Tehachapi Mountains for the Metropolitan Water District in accordance with a letter agreement between the Department and the Metropolitan Water District of Southern California dated February 24, 1977. Consequently, releases to the West Branch were halted (releases down Gorman Creek Improvement had been zero since February 7) and flows in the East Branch reduced. Total Project water pumped over the Tehachapi Mountains to the Southern Field Division amounted to 199 800 cubic dekametres (161,978 acre-feet) or 26 percent of the 1976 amount. Of this total approximately 51 percent was pumped in January and February.

Project water delivered to Silverwood Lake during the year totaled 113 719 cubic dekametres (92,192 acre-feet). Water conveyed to Lake Perris totaled 7 065 cubic dekametres (5,728 acre-feet). Measured outflow totaled 3 591 cubic dekametres (2,911 acre-feet), consisting mostly of the seepage collected and delivered to Metropolitan Water District of Southern California.

Between September 14 and September 19, 586 cubic dekametres (475 acre-feet) of water from Lake Perris storage was used to fill the connecting aqueducts between Lake Perris and facilities of the Metropolitan Water District of Southern California. Lake Perris storage was used because of an outage of the Colorado River Aqueduct. Except for the seepage water described above, this was the only water delivered to the Metropolitan Water District of Southern California from the East Branch after February. Also it was the first substantial delivery from Lake Perris.

A summary of operations for the reservoirs in the following tabulation is presented in Section V.

Reservoir Capacity <sup>1/</sup>	Reservoir Storages Dekametres (acre-feet)			
	Beginning Dec. 31, 1976	Ending Dec. 31, 1977	Maximum Date	Minimum Date
Pyramid Lake 209 574 (169,902)	204 989 (166,185)	206 941 (167,767)	209 574 6/6 (169,902)	201 400 10/25 (163,275)
Elderberry Fby. 34 823 (28,231)	19 280 (15,630)	27 852 (22,580)	31 886 1/25 (25,850)	17 933 11/7 (14,538)
Combination Pyramid Lake & Elderberry Fby. 232 062 <sup>2/</sup> (188,133)	224 268 (181,815)	234 793 (190,347)	234 895 12/31(190,430)	223 613 12/18 (181,283)
Castaic Lake 393 794 (319,250)	198 492 (160,918)	62 959 (51,041)	198 492 12/31(160,918) 1976	62 731 12/26 (50,856)
Silverwood Lake 90 084 (73,031)	67 405 (54,645)	52 411 (42,490)	72 590 5/17 (58,849)	51 659 12/30 (41,880)
Lake Perris 156 458 (127,841)	104 178 (84,457)	97 720 (79,222)	104 447 1/7 (84,675)	89 927 12/16 (72,904)

<sup>1/</sup> Maximum operating storage.

<sup>2/</sup> Provides for 12 335 cubic dekametres (10,000 acre-feet) of storage space for Los Angeles Department of Water and Power's pumpback operation.

## Water Deliveries

Water deliveries to State Water Contractors in the Southern Field Division totaled 319 692 cubic dekametres (259,175 acre-feet) of which 155 800 cubic dekametres (126,307 acre-feet), 49 percent, were delivered in January and February. Of this year's water deliveries in the Southern Field Division, 47 percent were made to West Branch contractors compared to 61 percent in 1976.

Water from local inflow released from Project facilities in the Southern Field Division to satisfy water rights totaled 25 458 cubic dekametres (20,639 acre-feet), up 8 percent from the 1976 total. End-of-year storage of local inflow in Southern Field Division reservoirs totaled 461 cubic dekametres (374 acre-feet).

Project water to Pyramid Lake totaled only 36 224 cubic dekametres (29,367 acre-feet). Outflows from the Pyramid Lake-Elderberry Forebay system were limited to releases down Piru Creek during the 10-month period March through December. Although water releases were scheduled from Pyramid Lake storage through the Castaic Powerplant during the 10-month period, all water was retained in the system to accommodate LADWP's pumpback operations.

Project water released to Castaic Lake during January and February, totaled 15 283 cubic dekametres (12,390 acre-feet) and zero for the remainder of the year. To maintain releases with the low lake level, the low intake of the Castaic Outlet Works was activated. Downstream releases from the Castaic Lagoon were limited to subsurface flows.

## Annual Inspection

The critique of this year's annual inspection of the Southern Field Division was held November 18. Mr. Howard H. Eastin, Chief, Division of Operations and Maintenance, conducted the critique and Mr. William Burke, Acting Chief, Southern Field Division, represented the Field Division. Mr. Scott E. Franklin represented the California Water Commission along with ex-member Mr. Samuel B. Nelson.

## Activities, Outages, and Limitations

Between January 8 and 10, the East and West Branches were shut down when access became limited during the heaviest snowfall experienced in Antelope Valley since operation began in 1972. The storm, which began January 6, caused primary power failures resulting in a drain on the fuel for the emergency equipment, especially at inaccessible sites. When it was estimated that the emergency fuel supply was nearing exhaustion at the inaccessible sites, the shut down was ordered. There was no curtailment of water deliveries because of the storm and primary power was restored to all check structures by January 14.

May 7, Castaic Powerplant Unit 4 was declared operational. Originally scheduled to be on-line by the first of the year, Unit 4 was delayed to allow for a redesign of the thrust bearings. The redesign was the result of the bearing problems experienced with Unit 3 where the bearings had to be repaired three times in as many months.

March 3, the low intake slide gate of the Castaic Outlet Works failed to open. All eight 38.1 millimetres (1½ inch) stainless steel bolts on the gate stem failed because of stress corrosion. After extensive investigation and repairs the gate was returned to service August 10.

March 3 and March 7, were the dates of initial pumping by Pearblossom Pumping Plant Units 1 and 2, respectively. Units were declared operational after being tested.

During the period June 6 to December 31, a restriction was placed on Quail Lake maximum water surface elevation of 1004.62 metres (3,296.0 feet), or 5.79 metres (19.0 feet) below the normal operating level. This restriction was to allow work on the Quail Lake Outlet structure.

August 15, Mr. Joseph H. Sherrard transferred from Chief, Southern Field Division, to Chief, Water Management Branch, Northern District. Messrs. Melvin T. Branter, William Burke, and Herbert S. Cohn rotated as Acting Chief of the Division for 60-day periods.

During the period September 29 through December 12, Elderberry Forebay Outlet Works was closed to flow at the request of the Los Angeles Department of Water and Power to allow its contractor to repair and upgrade the Outlet Works and Service Spillway. The contingency Plan in the event of an emergency was to increase the storage in Elderberry Forebay and allow water to flow into Castaic Lake through the Elderberry Spillway.

The Gorman Creek Improvement Channel was out of service from October 19 to December 14, to allow construction of the Pyramid Powerhouse bypass channel.

Closure tests were conducted on the Angeles Tunnel gate control on November 16 to verify signals from the Project and Los Angeles Department of Water and Power's Castaic plant. During the test, the gate opened in both directions as designed.

A flow restriction of  $11 \text{ m}^3/\text{s}$  (400 cfs) was placed on the Gorman Creek Improvement Channel between December 23 through December 31 due to some undermined areas in the channel.

During the last week of December, winds from 65 to 70 kilometres per hour (40 to 45 miles per hour) (with gusts up to 135 kilometres per hour (85 miles per hour)) were experienced at Project facilities. Water was blown out of the Aqueduct on the East Branch and Devil Canyon Powerplant lost sections of its roof.

During the year, installation of demand meter equipment was completed at all Southern Field Division plants. This system, when completed in all field division plants, will be used to provide the Project's total power demand at half-hour intervals. This will enhance dispatching of Project power needs.

Turnout completion this year was limited to the Antelope Valley-East Kern Water Agency's Fairmont Turnout, M.P. 323.60.

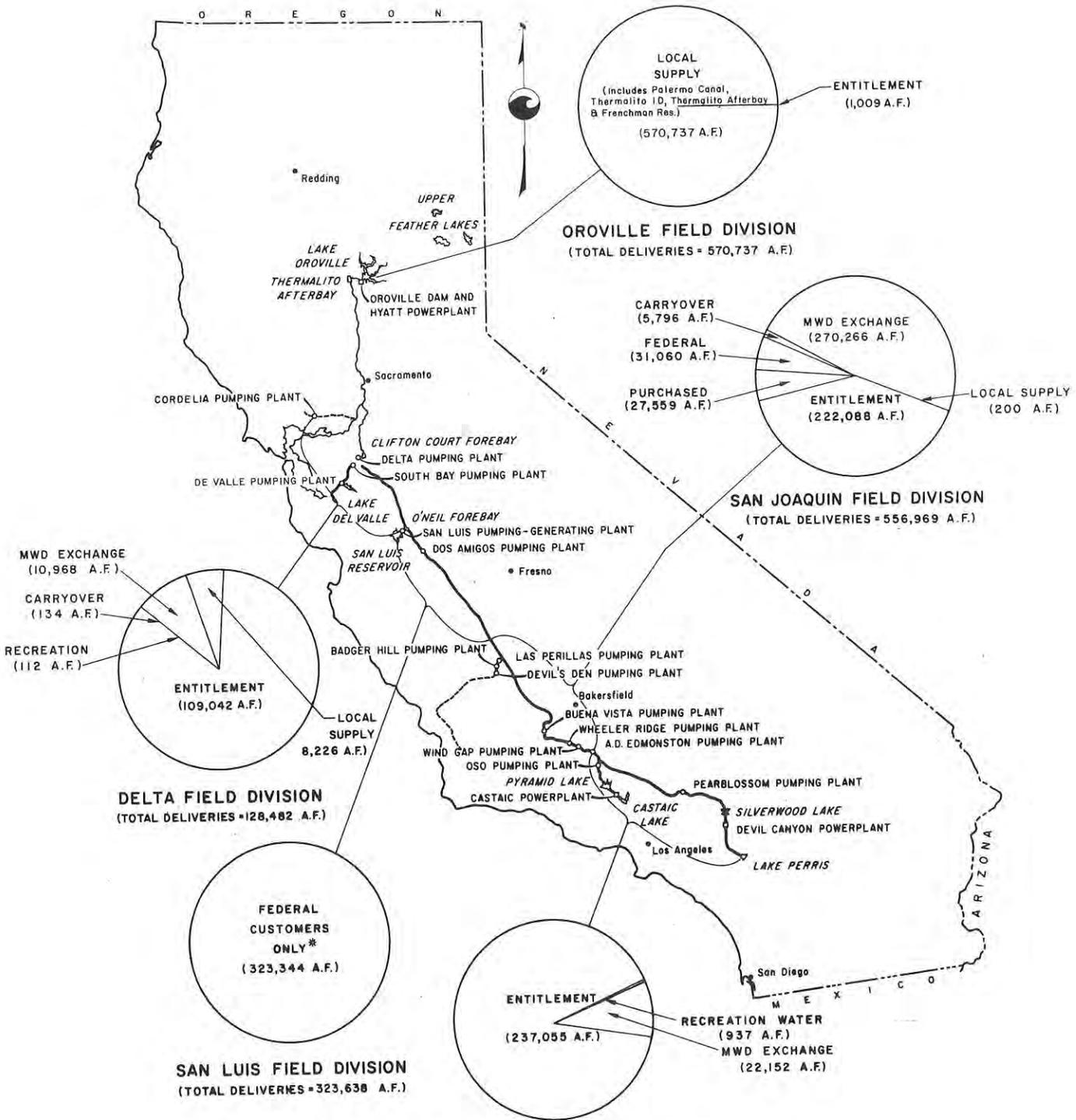
## CONVERSION FACTORS

### English to Metric System of Measurement

<u>Quantity</u>	<u>English unit</u>	<u>Multiply by</u>	<u>To get metric equivalent</u>
Length	inches (in)	25.4	millimetres (mm)
		.0254	metres (m)
	feet (ft)	.3048	metres (m)
	miles (mi)	1.6093	kilometres (km)
Area	square inches (in <sup>2</sup> )	$6.4516 \times 10^{-4}$	square metres (m <sup>2</sup> )
	square feet (ft <sup>2</sup> )	.092903	square metres (m <sup>2</sup> )
	acres	4046.9	square metres (m <sup>2</sup> )
		.40469	hectares (ha)
		.40469	square hectometres (hm <sup>2</sup> )
		.0040469	square kilometres (km <sup>2</sup> )
	square miles (mi <sup>2</sup> )	2.590	square kilometres (km <sup>2</sup> )
Volume	gallons (gal)	3.7854	litres (l)
		.0037854	cubic metres (m <sup>3</sup> )
	million gallons (10 <sup>6</sup> gal)	3785.4	cubic metres (m <sup>3</sup> )
	cubic feet (ft <sup>3</sup> )	.028317	cubic metres (m <sup>3</sup> )
	cubic yards (yd <sup>3</sup> )	.76455	cubic metres (m <sup>3</sup> )
	acre-feet (ac-ft)	1233.5	cubic metres (m <sup>3</sup> )
		.0012335	cubic hectometres (hm <sup>3</sup> )
		$1.233 \times 10^{-6}$	cubic kilometres (km <sup>3</sup> )
Volume/Time (Flow)	cubic feet per second (ft <sup>3</sup> /s)	28.317	litres per second (l/s)
		.028317	cubic metres per second (m <sup>3</sup> /s)
	gallons per minute (gal/min)	.06309	litres per second (l/s)
		$6.309 \times 10^{-5}$	cubic metres per second (m <sup>3</sup> /s)
	million gallons per day (mgd)	.043813	cubic metres per second (m <sup>3</sup> /s)
Mass	pounds (lb)	.45359	kilograms (kg)
	tons (short, 2,000 lb)	.90718	tonne (t)
		907.18	kilograms (kg)
Power	horsepower (hp)	0.7460	kilowatts (kW)
Pressure	pounds per square inch (psi)	6894.8	pascal (Pa)
Temperature	Degrees Fahrenheit (°F)	$\frac{tF - 32}{1.8} = tC$	Degrees Celsius (°C)

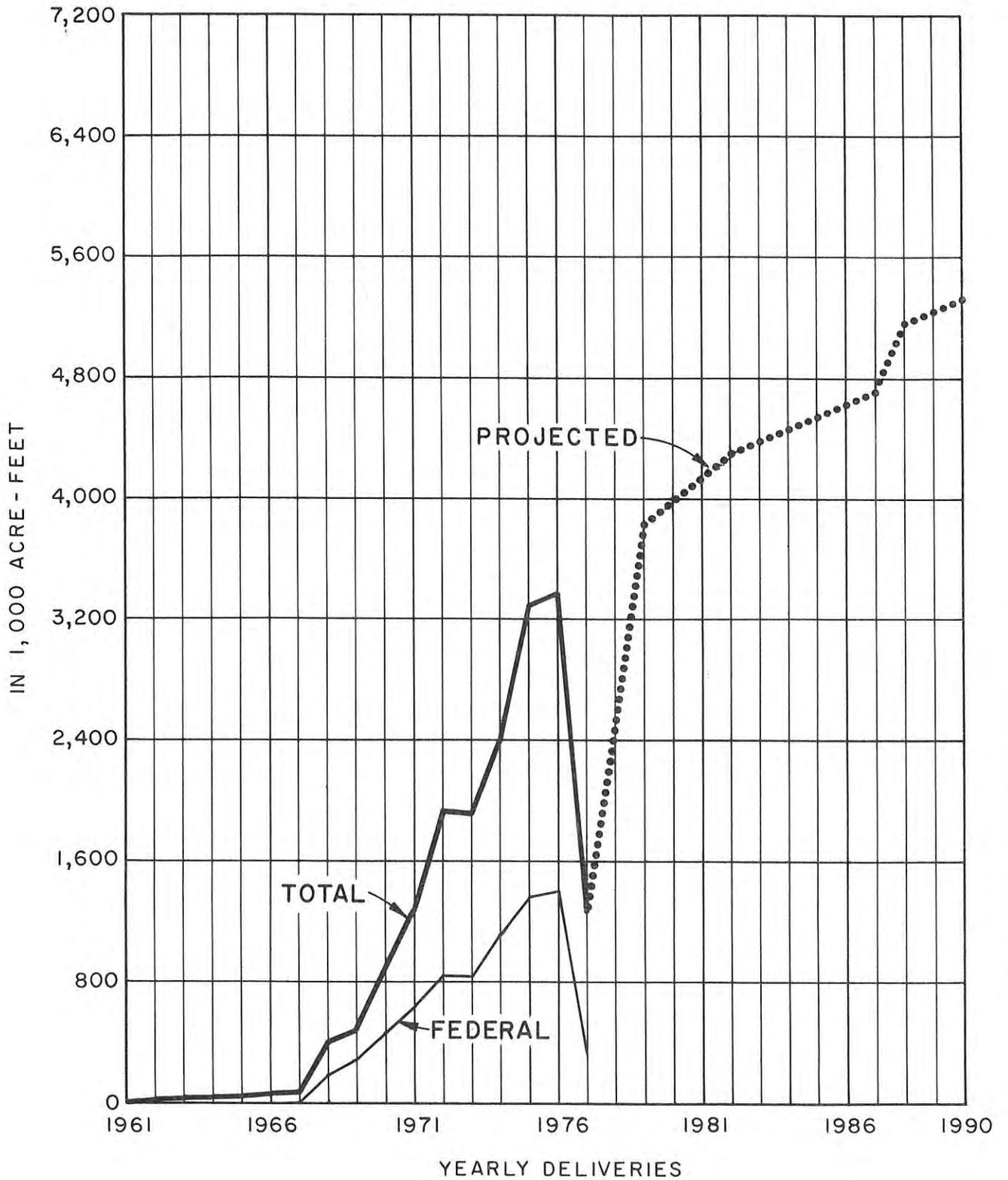
# PROJECT DELIVERIES

1977



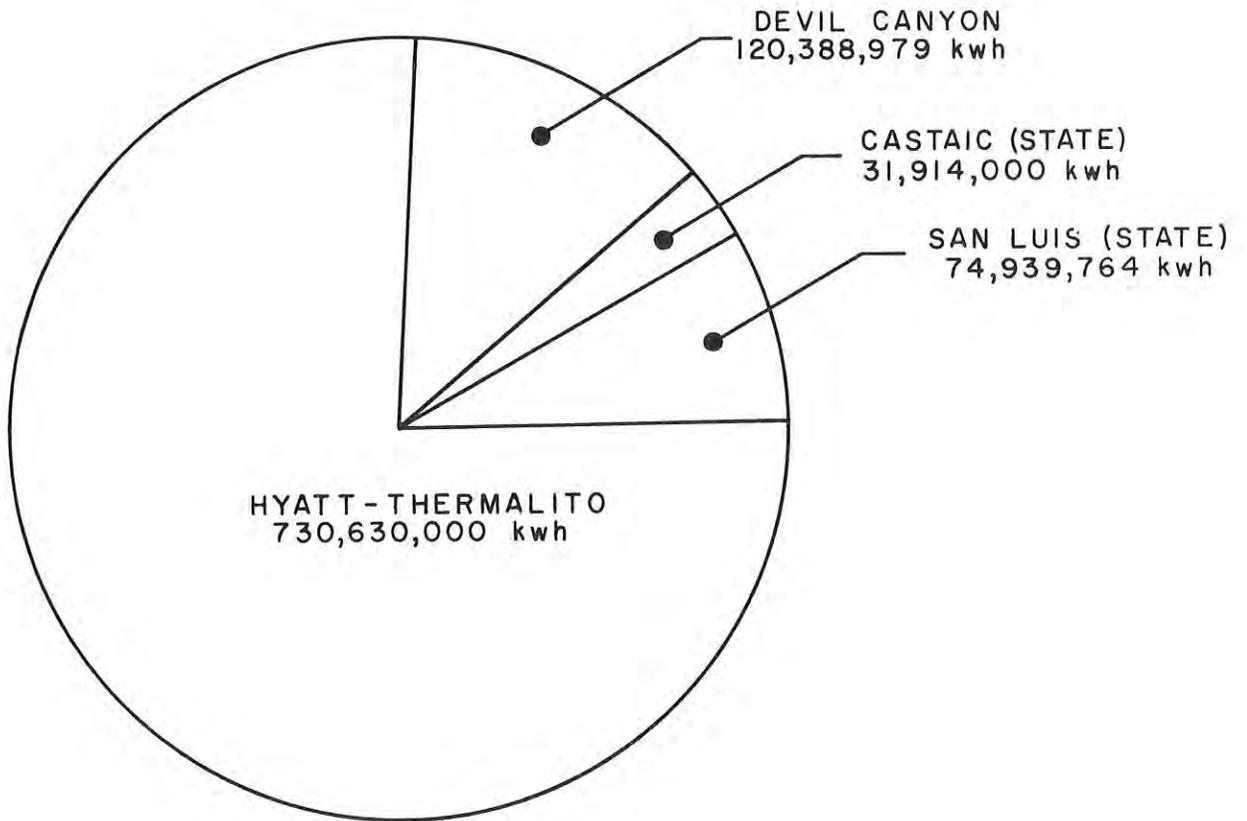
\*EXCEPTION = 294 A.F. FOR PARKS & RECREATION, FISH & GAME.

# PROJECT DELIVERIES - YEARLY TOTALS



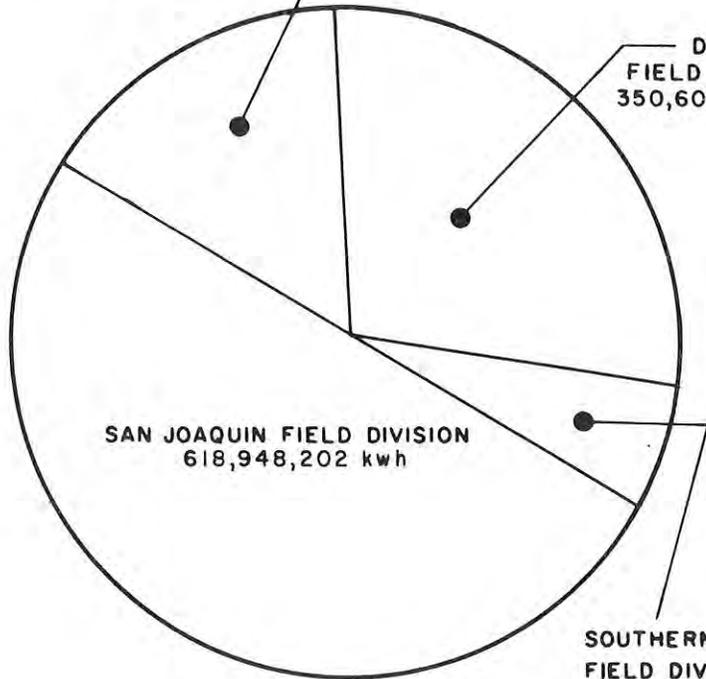
Excludes Thermalito Afterbay and includes Federal deliveries

PROJECT GROSS POWER GENERATION  
1977



**PROJECT POWER OPERATIONS 1/**  
**(STATE ONLY)**  
**1977**

SAN LUIS FIELD DIVISION  
195,471,771 kwh



**ENERGY USED\***

**PUMPING PLANTS**

**DELTA FIELD DIVISION**

1. CORDELIA
2. DELTA
3. SOUTH BAY
4. DEL VALLE

**SAN LUIS FIELD DIVISION**

1. SAN LUIS
2. DOS AMIGOS

**SAN JOAQUIN FIELD DIVISION**

1. LAS PERILLAS
2. BADGER HILL
3. BUENA VISTA
4. WHEELER RIDGE
5. WIND GAP
6. A. D. EDMONSTON

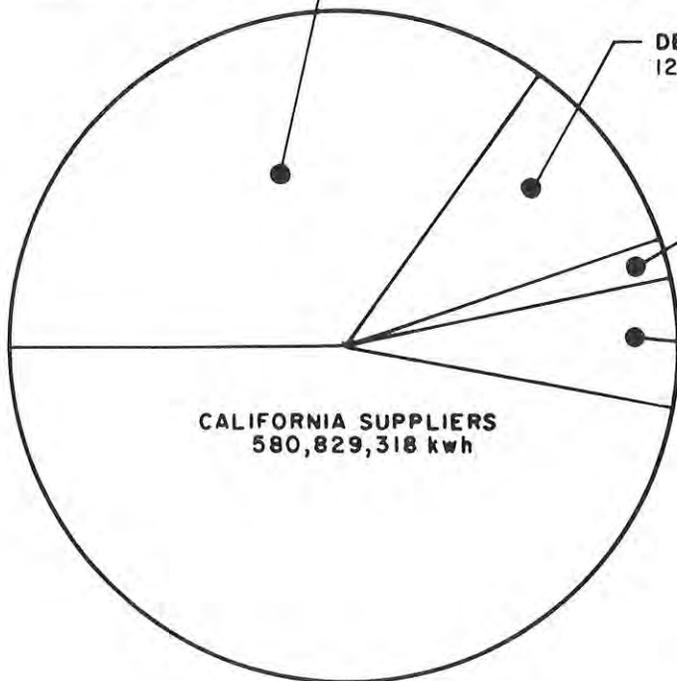
**SOUTHERN FIELD DIVISION**

1. OSO
2. PEARBLOSSOM

\* Not included are Devil Canyon Powerplant station service and states share of power to pump waterfowl mitigation water at Tracy Pumping Plant

CANADIAN ENTITLEMENT  
432,311,730 kwh

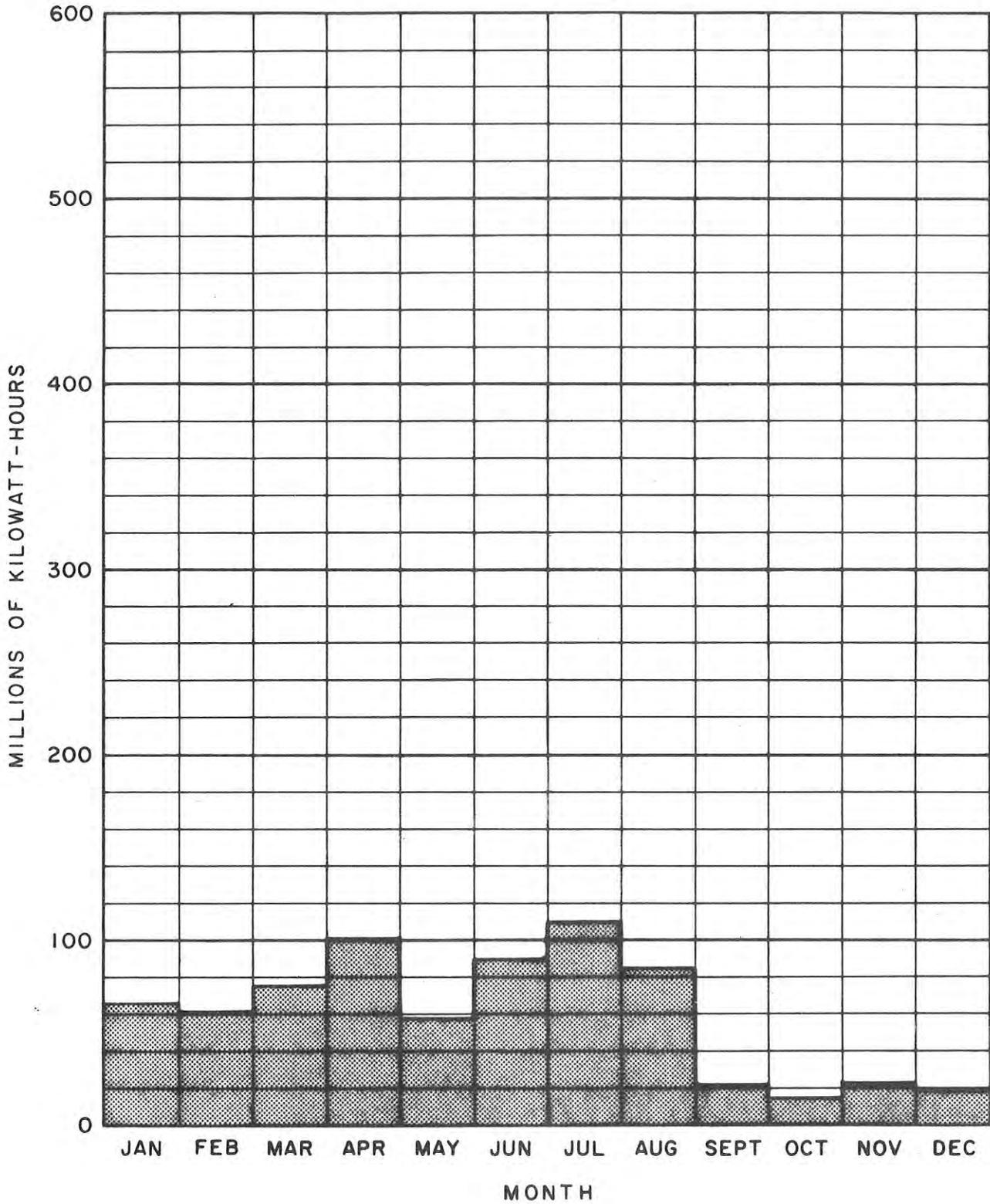
NORTHWEST DUMP  
0 kwh



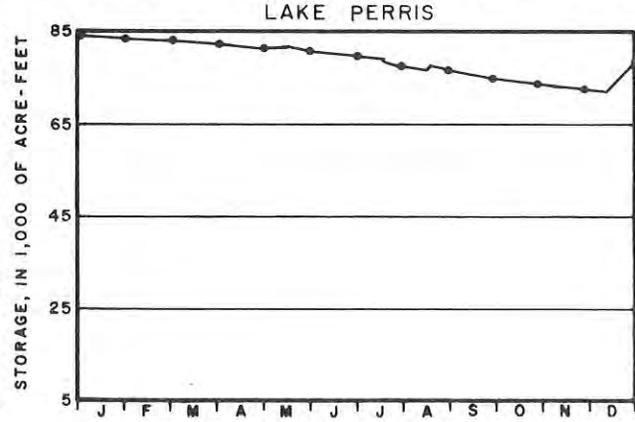
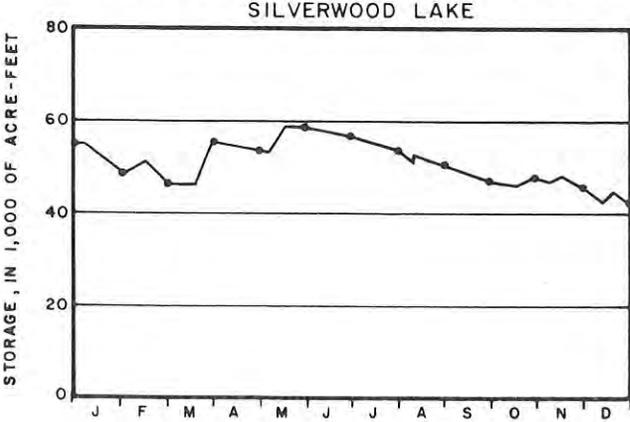
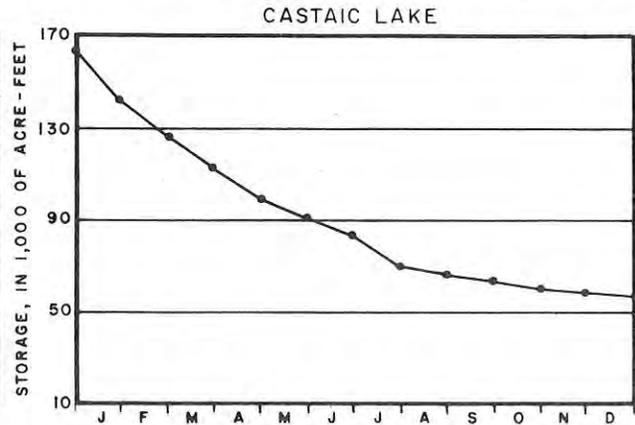
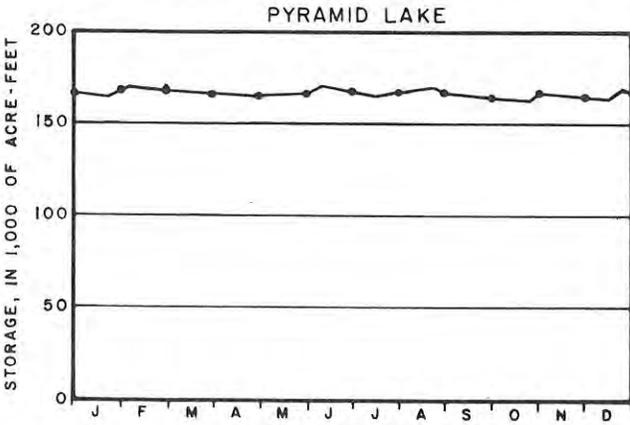
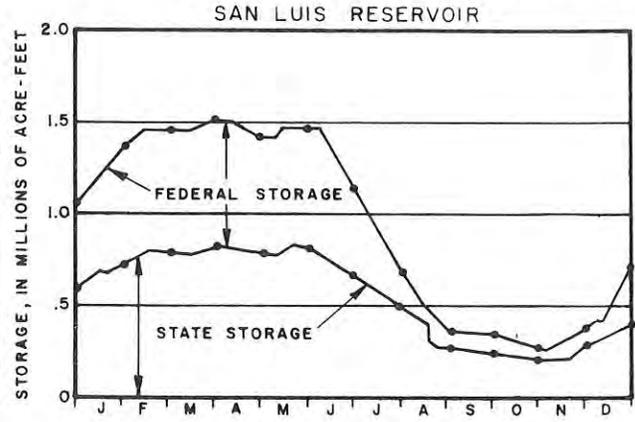
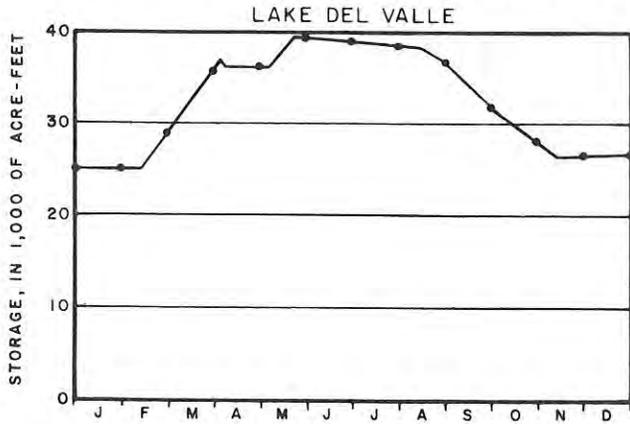
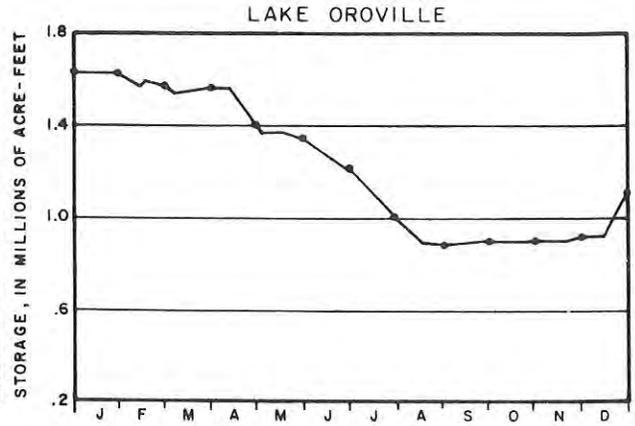
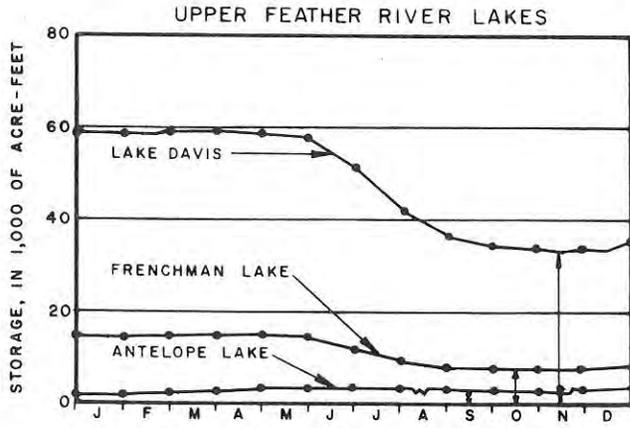
**ENERGY SOURCES**

1/ HYATT-THERMALITO NOT INCLUDED.

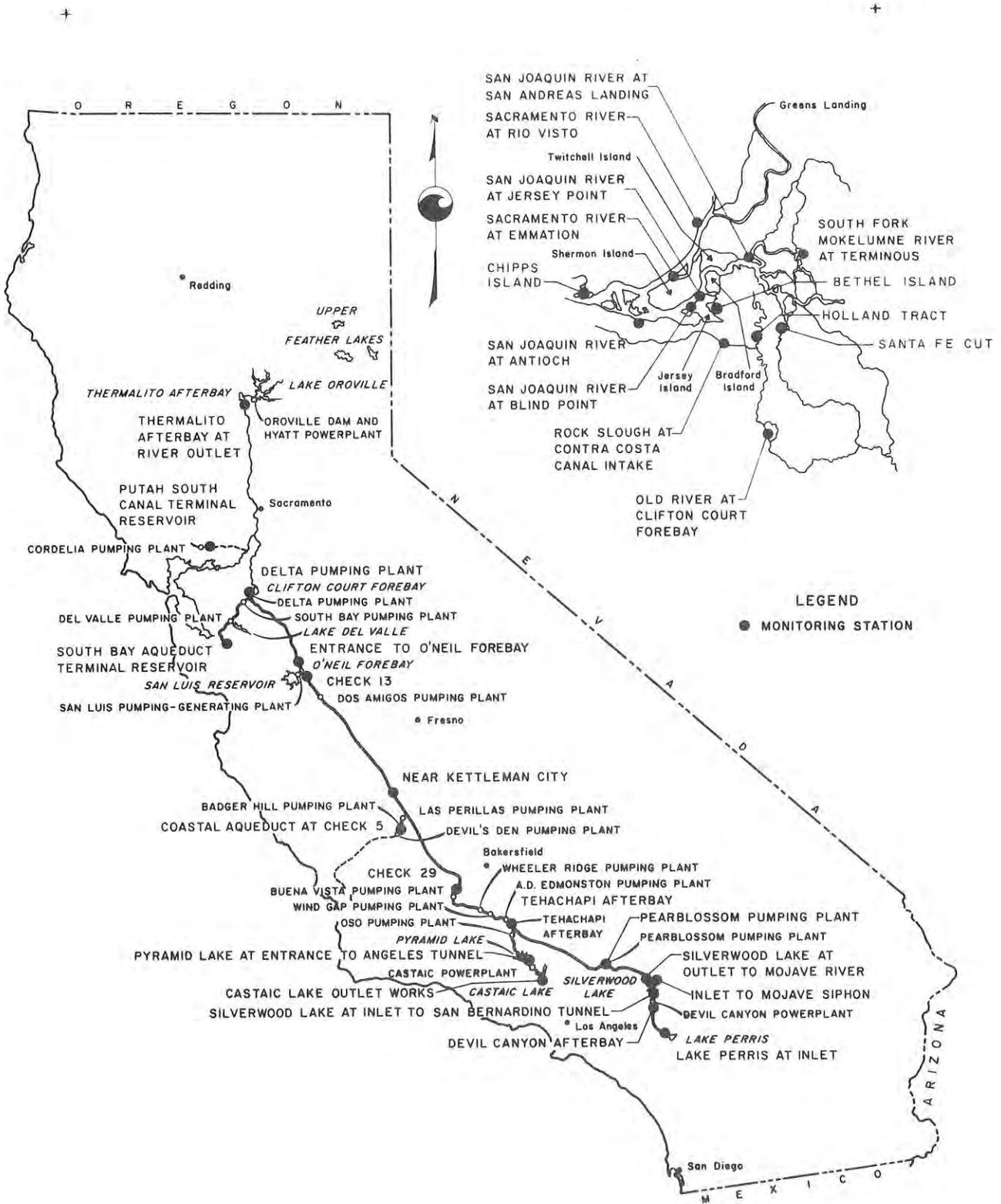
# GROSS GENERATION AT HYATT AND THERMALITO POWERPLANTS 1977

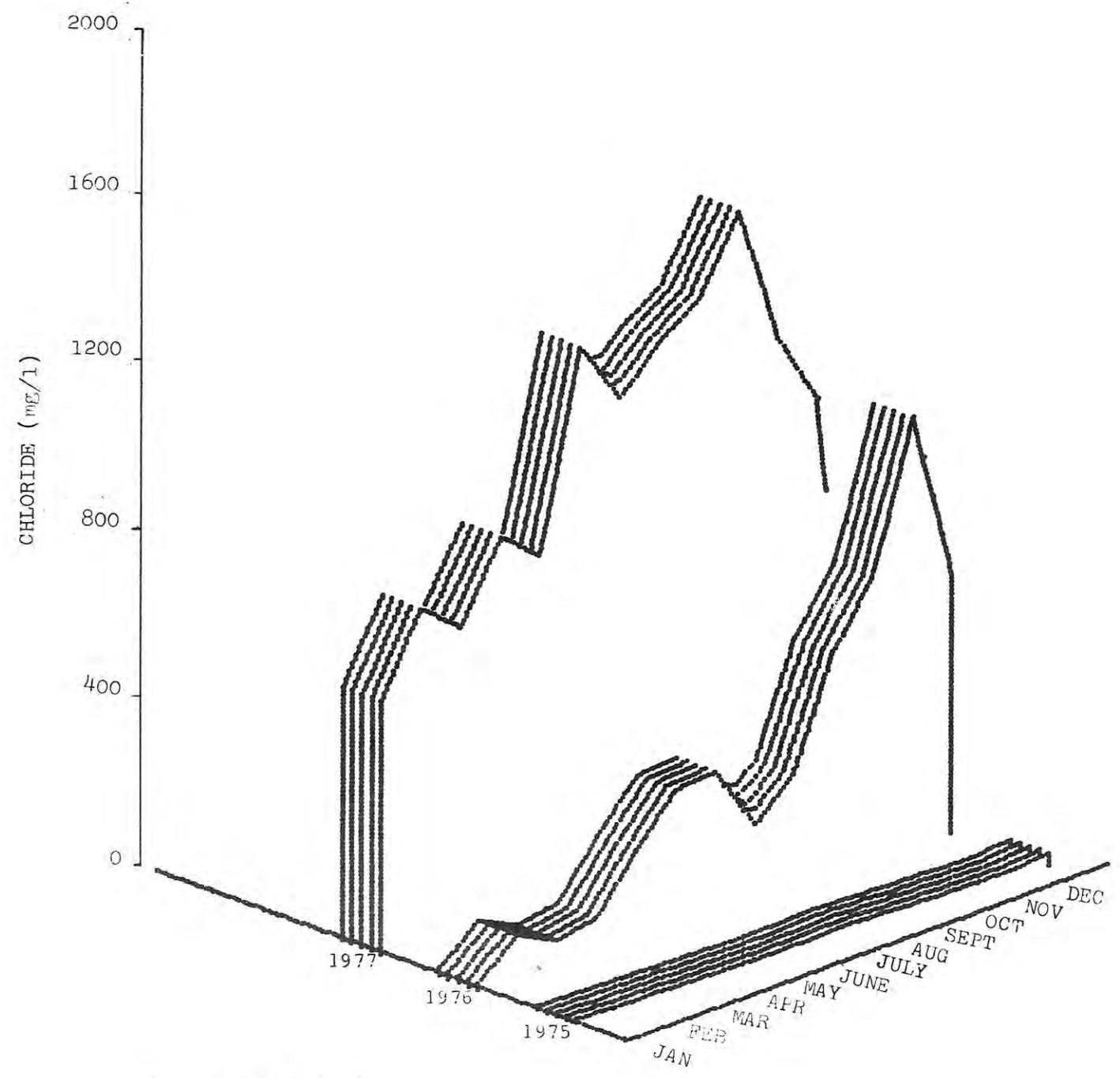


# PROJECT RESERVOIRS 1977

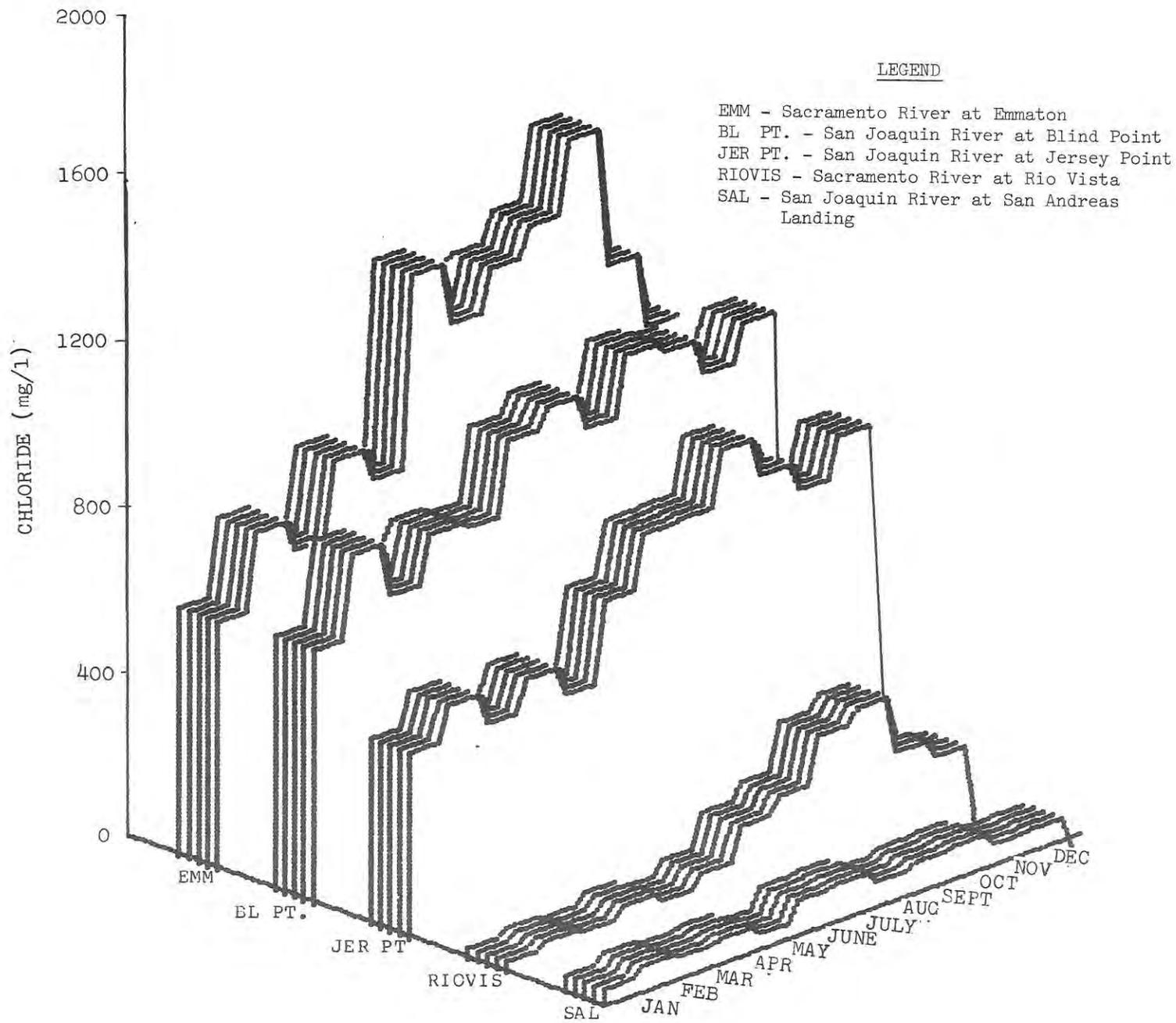


# WATER QUALITY MONITORING STATIONS

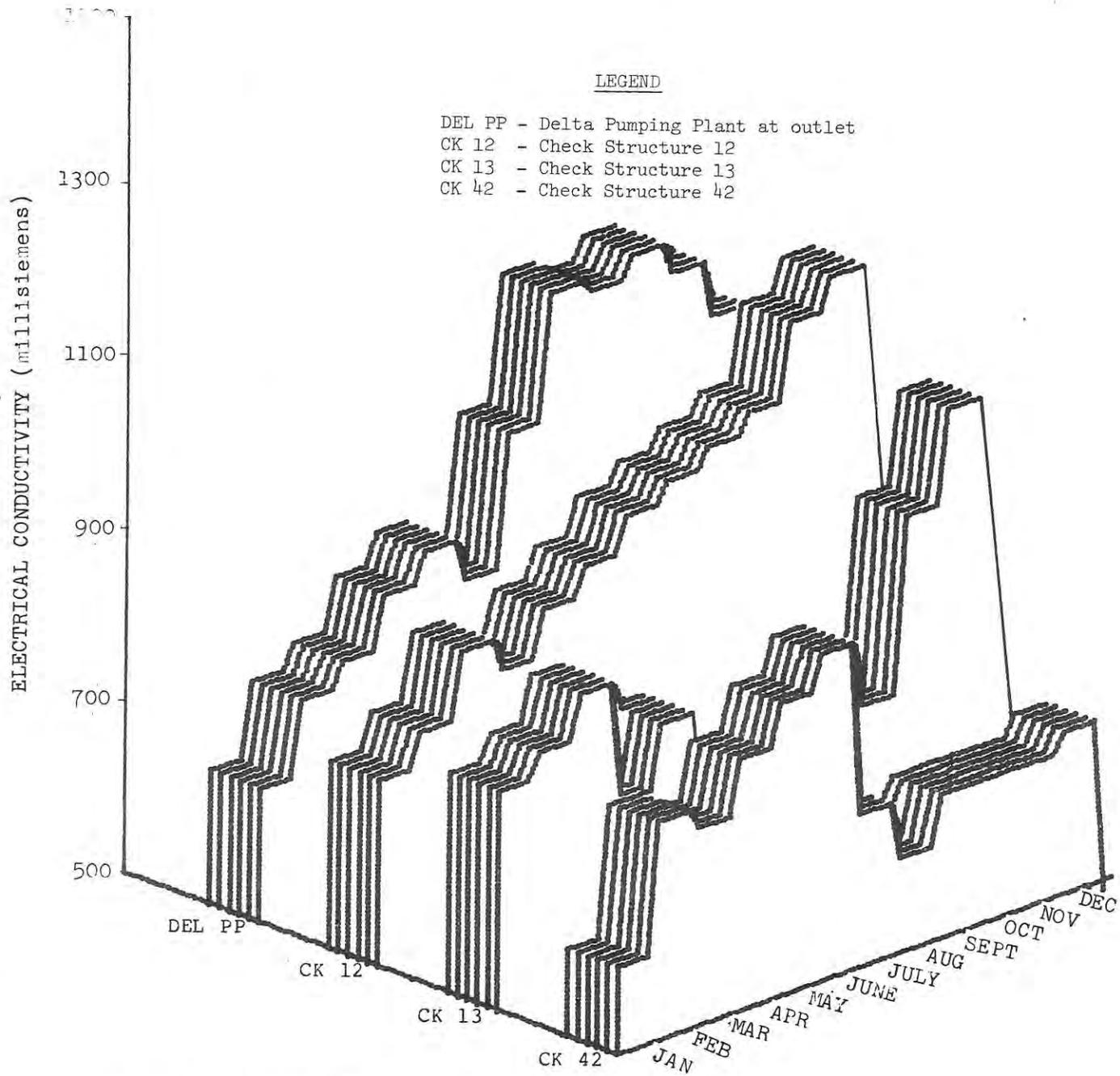




isometric plot of  
mg Cl AT EMPIATON  
1975, 1976, 1977.



isometric plot of  
1977 mm CL (mg/l)  
DELTA STATIONS



isometric plot of  
1977 MONTHLY EC  
SWP LOCATIONS



PROJECT  
DELIVERIES

AGENCY	WATER DELIVERIES* (in acre-feet)																
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977 <sup>B/</sup>	TOTAL
<b>OROVILLE FIELD DIVISION</b>																	
East Chance Creek W. D.	9,383	9,811	11,596	10,079	13,015	8,380	13,563	10,137	13,855	10,119	14,432	12,971	16,090	18,602	11,437	6,372	189,842
Plumas County F.C. & W.C.D.									70	64	505	679	648	405	382	303	3,056
County of Butte										192	186	53	127	253	527	706	2,044
Thermalito I.D.													393	413	234	418	1,458
<b>DELTA FIELD DIVISION</b>																	
Sage County F.C. & W.C.D.							1,214	2,687	3,618	2,521	3,647	3,792	4,870	6,840	7,122	8,226	44,537
Alameda County W.D. <sup>1/</sup>	8,412	10,914	19,238	16,407	14,864	12,882	24,817	6,818	20,607	11,652	27,786	7,900	1,433	8,725	26,643	20,644	239,742
Alameda County F.C. & W.C.D., Zone 7 <sup>1/</sup>	494	1,731	1,673	2,605	5,511	4,780	6,133	6,635	9,249	14,777	14,141	13,041	14,416	16,320	20,983	12,940	145,429
Pleasanton Township W.D.										674							674
Santa Clara Valley W.D.				15,014	34,538	39,101	70,105	62,264	80,311	87,606	100,266	91,081	90,934	106,470	112,705	76,220	966,615
Maris M.W.D. <sup>1/</sup>																4,594	4,594
San Francisco W.D. <sup>1/</sup>																	3,372
Skyloada M.W.D. <sup>1/</sup>																	10
Oak Flat W.D.							3,084	3,016	5,911	7,212	8,166	4,227	6,942	7,152	7,952	3,370	57,032
Mustang W.D.									1,176	1,438	1,642						4,256
Tracy Golf & Country Club													11				11
Dept. of Parks & Recreation (Lake Del Valle)															141	112	253
<b>SAN LEUIS FIELD DIVISION</b>																	
Dept. of Parks and Recreation (State's share)											15	15	10	19	23	61	143
Dept. of Fish and Game (State's share)																72	370
Federal Customers						1,100	185,393	290,761	468,951	633,269	846,687	845,774	1,121,747	1,361,573	1,337,137	323,638 <sup>2/</sup>	7,416,030
<b>SAN JOAQUIN FIELD DIVISION</b>																	
Tulare Lake Basin W.S.D.	25,100	7,081	0	115,826	252,542	111,552	137,978	214,706	112,717	44,522	1,022,024						
Empire West Side I.D.	1,978	56	3,942	5,990	5,795	5,814	4,539	6,448	6,457	2,355	43,374						
County of Kings	900	100	0	3,700	1,400	1,500	1,500	1,600	1,600	1,530	13,830						
Hacienda W.D.			2,842	9,578	6,659	5,851	8,500	5,272	7,517	7,620	57,675						
Kern County W.A.	127,384	141,265	204,634	360,151	490,781	505,243	646,433	821,400	881,400	432,837	4,611,768						
Dudley Ridge W.D.	26,360	31,375	40,407	41,053	42,443	35,249	66,781	81,110	72,343 <sup>1/</sup>	28,918	466,039						
Devil's Den W.D.	7,382	9,970	11,739	12,490	13,905	13,522	13,828	18,195	17,427	11,911	130,369						
J. G. Boswell Company <sup>3/</sup>					7,113	25,542	4,358	2,500	0	6,712	46,225						
Belridge Oil Co. (formerly Buena Vista W.S.D.) <sup>2/</sup>					8,241	19,250	5,945	7,840	6,797	0	48,073						
Green Valley W.D.								1,741	2,217	0	3,958						
Federal, USNR (U.S. Fish & Wildlife Service)												11,700	0	0	0	0	11,700
Federal, USNR (Cross Valley Canal)														88,300	31,060	119,360	
<b>SOUTHERN FIELD DIVISION</b>																	
Antelope Valley-East Kern W.A.											53	20	1,259	8,068	27,782	33354	70536
Metropolitan W.D. of So. California											71,938	159,883	277,715	526,958	618,541 <sup>1/</sup>	189,755	1,844,700
Littlerock Creek I.D.											338	370	467	876	589	111	2,751
Mejave W.A.											55	0	14	0	0	80	149
Desert W.A.													9,000	10,000	11,000	12,000	42,000
Coachella Valley County W.D.													5,800	6,400	7,600	0	26,800
Crestline-Lake Arrowhead W.A.											464	461	627	825	1,002	1,109	4,488
San Geronimo Pass W.A.																	0
San Gabriel Valley M.W.D.													612	5,450	6,071	8,996	21,129
San Bernardino Valley M.W.D.											1,275	32,426	16,605	13,865	12,273	24,833	101,277
Department of Parks and Recreation													44	613	937 <sup>2/</sup>	1,664	
Piru Creek Fish Enhancement													1,362	1,553	0	0	2,915

\* Does not include Thermalito Afterbay deliveries of prior water right entitlements.  
 1/ Includes regulated delivery of local supply.  
 2/ Includes 245 acre-feet for State Department of Fish and Game and 49 acre-feet to State Department of Parks and Recreation.  
 3/ Of this amount, 10,500 acre-feet was acquired by exchange agreement with Metropolitan W.D.B.C.  
 4/ Does not include amount shown in footnote 3.  
 5/ Includes: Reach 24, 111 acre-feet; Reach 28J, 469 acre-feet; and Reach 30, 357 acre-feet.  
 6/ Includes Exchange and 1976 Carryover Water.  
 7/ Exchange water only.  
 8/ Repayment of preconsolidation water.  
 9/ Repayment of local supply from Kings River.



SUMMARY OF  
CALIFORNIA AQUEDUCT  
OPERATION

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

Description	January	February	March	April	May	June
<b>DELTA FIELD DIVISION</b>						
<b>North Bay Aqueduct</b>						
Pumped at Cordelia Pumping Plant	771	657	659	515	747	829
Storage Change	3	-5	2	0	-10	8
Operational Losses (-), Gains (+)	0	0	0	0	0	0
Delivered to Napa Co. FC&WCD	768	662	657	515	757	821
American Canyon Co. W.D.	--	--	--	--	--	--
<b>California Aqueduct</b>						
Pumped at Delta Pumping Plant	205,112	106,116	96,573	14,214	72,301	17,114
South Bay Diversion (So. Bay P.P.)	5,838	9,814	13,843	10,481	14,759	13,486
Storage Change	-137	-36	702	-955	1,237	-689
Operational Losses (-), Gains (+)	-143	-214	-431	-631	-782	-749
Delivered to Contracting Agencies	20	0	425	435	155	412
Outflow at Check 12	199,248	96,124	81,172	3,622	55,368	3,156
<b>South Bay Aqueduct</b>						
Pumped at South Bay P.P.	5,838	9,814	13,843	10,481	14,759	13,486
Inflow from Lake Del Valle	0	0	0	200	0	0
Storage Change	0	0	0	0	0	0
Operational Losses (-), Gains (+)	-12	-11	-10	-12	-10	-13
Outflow, Del Valle Pumping Plant	0	3,689	7,255	1,237	3,527	0
Delivered to Contracting Agencies:						
Project Water	5,357	5,607	6,578	8,646	10,263	12,539
<sup>1/</sup> Exchange Water to Other Agencies	0	0	0	786	959	934
<sup>2/</sup> Del Valle Inflow Exchanged and Released from Aqueduct	207	59	0	0	0	0
<sup>2/</sup> Del Valle Stored Water Exchanged and Released from Aqueduct	262	448	0	0	0	0
Lake Del Valle Operation						
End of Month Storage	24,927	28,610	35,591	36,367	39,574	39,181
Storage Change	30	3,683	6,981	776	3,207	-393
<b>SAN LUIS FIELD DIVISION</b>						
<b>O'Neill Forebay Operation</b>						
End of Month Storage	52,602	53,811	53,596	43,777	47,204	49,423
Storage Change	6,292	1,209	-215	-9,819	3,427	2,219
Inflow, California Aqueduct	199,248	96,124	81,172	3,622	55,368	3,156
Inflow, O'Neill P-G Plant	205,353	61,737	43,590	8,402	51,341	377
Inflow, San Luis P-G Plant	18	0	4,475	74,019	4,548	266,706
Delivered to Federal Customers*	351	379	1,085	821	221	958
Outflow, O'Neill P-G Plant	0	442	11,488	35,623	6,639	118,968
Outflow, San Luis P-G Plant	271,177	71,827	48,493	5,779	48,073	0
Operational Losses (-), Gains (+)	12,823	5,845	5,575	1,043	3,853	1,455
Outflow, Dos Amigos P.P.	139,622	89,849	73,961	54,682	56,750	149,549
<b>San Luis Reservoir Operation</b>						
End of Month Storage	1,100,328	1,165,701	1,203,584	1,133,015	1,169,178	905,233
Storage Change	250,652	65,373	37,883	-70,569	36,163	-263,945
Inflow, San Luis P-G Plant	271,177	71,827	48,493	5,779	48,073	0
Operational Losses (-), Gains (+)	-20,507	-6,454	-6,135	-2,329	-7,362	2,761
Outflow, San Luis P-G Plant	18	0	4,475	74,019	4,548	266,706
<b>California Aqueduct (Pools 14 thru 21)</b>						
Inflow, Dos Amigos P.P. (State)	55,452	55,938	49,266	36,120	43,990	99,138
Inflow, Dos Amigos P.P. (Federal)	84,170	33,911	24,695	18,562	12,760	50,411
Storage Change	-64	-1,954	260	77	373	19
Delivered to Federal Customers*	82,214	27,973	21,372	14,648	9,035	41,380
Operational Losses (-), Gains (+)	-4,269	-5,652	-5,192	-4,302	-6,762	-7,319
Outflow, Check 21 (State)	53,088	54,472	45,821	32,966	39,163	93,000
<sup>3/</sup> Outflow, Check 21 (Federal)	0	3,406	580	1,412	328	6,080

<sup>1/</sup> This water was delivered to Marin MWD, San Francisco WD, and Skyllonda W.D.

<sup>2/</sup> Includes only water delivered from Aqueduct.

<sup>3/</sup> To Cross Valley Canal.

\* Federal deliveries in San Luis F.D. include water for Fish and Game, and Phase I construction. Also included is water to Devil's Den W.D. and Tulare Lake Basin WSD lands within Federal service area.

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

July	August	September	October	November	December	Total	Description
							<u>DELTA FIELD DIVISION</u>
							North Bay Aqueduct
567	764	831	890	637	355	8,222	Pumped at Cordelia Pumping Plant
-4	-4	2	3	1	-2	-6	Storage Change
0	0	0	0	0	0	0	Operational Losses (-), Gains (+)
571	768	829	887	636	339	8,210	Delivered to Napa Co. FC&WCD
--	--	--	--	--	18	18	American Canyon Co. W.D.
							California Aqueduct
20,353	15,422	9,182	7,779	51,274	223,758	839,198	Pumped at Delta Pumping Plant
13,705	11,665	7,696	7,711	6,529	6,910	122,437	South Bay Diversion (So. Bay P.P.)
1,334	916	-9	-507	456	2,588	4,900	Storage Change
-968	-1,061	-565	-495	-431	-265	-6,735	Operational Losses (-), Gains (+)
850	434	282	80	277	0	3,370	Delivered to Contracting Agencies
3,496	1,346	648	0	43,581	213,995	701,756	Outflow at Check 12
							South Bay Aqueduct
13,705	11,665	7,696	7,711	6,529	6,910	122,437	Pumped at South Bay P.P.
0	1,660	4,684	3,465	1,513	0	11,522	Inflow from Lake Del Valle
0	0	0	0	0	0	0	Storage Change
-12	-10	-10	-10	-10	-10	-130	Operational Losses (-), Gains (+)
0	341	0	0	0	0	16,049	Outflow, Del Valle Pumping Plant
12,728	12,024	11,931	10,813	6,797	5,515	108,798	Delivered to Contracting Agencies:
965	950	439	353	1,235	1,355	7,976	Project Water
0	0	0	0	0	30	296	Exchange Water to Other Agencies <u>1/</u>
0	0	0	0	0	0	710	Del Valle Inflow Exchanged and <u>2/</u>
							Released from Aqueduct
							Del Valle Stored Water Exchanged <u>2/</u>
							and Released from Aqueduct
38,659	36,842	32,019	28,250	26,642	26,870	---	Lake Del Valle Operation
-522	-1,817	-4,823	-3,769	-1,608	228	1,973	End of Month Storage
							Storage Change
							<u>SAN LUIS FIELD DIVISION</u>
							O'Neill Forebay Operation
36,972	40,837	39,576	39,174	45,549	54,647	---	End of Month Storage
-12,451	3,865	-1,261	-402	6,375	9,098	8,337	Storage Change
3,496	1,346	648	0	43,581	213,995	701,756	Inflow, California Aqueduct
0	10,045	34,117	4,735	82,399	130,908	633,004	Inflow, O'Neill P-G Plant
358,852	261,363	102,446	69,957	1,287	0	1,143,671	Inflow, San Luis P-G Plant
1,550	1,315	272	84	205	201	7,442	Delivered to Federal Customers*
172,285	113,127	9,318	46,715	1,131	0	515,736	Outflow, O'Neill P-G Plant
0	0	92,405	0	99,108	297,172	934,034	Outflow, San Luis P-G Plant
-1,847	2,527	4,903	2,520	3,199	17,699	59,595	Operational Losses (-). Gains (+)
119,117	156,974	41,380	30,815	23,647	56,131	1,072,477	Outflow, Dos Amigos P.P.
							San Luis Reservoir Operation
552,297	292,948	274,178	202,802	292,884	563,209	---	End of Month Storage
-352,936	-259,349	-18,770	-71,376	90,082	270,325	-286,467	Storage Change
0	0	92,405	0	99,108	297,172	934,034	Inflow, San Luis P-G Plant
5,916	2,014	-8,729	-1,419	-7,739	-26,847	-76,830	Operational Losses (-), Gains (+)
358,852	261,363	102,446	69,957	1,287	0	1,143,671	Outflow, San Luis P-G Plant
							California Aqueduct (Pools 14 thru 21)
135,217	115,860	27,585	23,595	15,668	37,970	695,799	Inflow, Dos Amigos P.P. (State)
63,900	41,114	13,795	7,220	7,979	18,161	376,678	Inflow, Dos Amigos P.P. (Federal)
-29	627	-1,646	977	-1,394	2,726	-28	Storage Change
56,168	35,445	5,795	5,273	6,636	16,064	322,003	Delivered To Federal Customers*
-1,015	-2,940	-3,790	-4,071	-2,522	-3,005	-50,839	Operational Losses (-), Gains (+)
132,179	113,534	26,167	18,151	15,421	34,120	658,083	Outflow, Check 21 (State)
7,711	2,698	6,001	1,494	0	0	29,710	Outflow, Check 21 (Federal) <u>3/</u>

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

Description	January	February	March	April	May	June
<b>SAN JOAQUIN FIELD DIVISION</b>						
California Aqueduct, Check 21 to Buena Vista Pumping Plant						
Inflow, Check 21 (State)	53,088	54,472	45,821	32,966	39,163	93,000
Inflow, Check 21 (Federal)	0	3,406	580	1,412	328	6,080
Delivered to State Contracting Agencies <sup>1/</sup>	6,034	10,732	26,065	18,245	18,353	58,697
Delivered for Repayment of Preconsolidation Water	0	0	0	0	0	0
Delivered to Federal Customers (Cross Valley Canal)	0	3,406	580	1,412	328	7,430
Coastal Br. Diversion (Las Per. P.P.)	4,604	4,451	5,201	8,694	7,945	15,547
Storage Change	-64	-79	-93	423	331	-560
Operational Losses (-), Gains (+)	4,396	4,602	4,762	3,005	2,579	4,848
Outflow, Buena Vista P.P.	46,910	43,970	19,410	8,609	15,113	22,814
California Aqueduct, Buena Vista P.P. to Wheeler Ridge P.P.						
Inflow, Buena Vista P.P.	46,910	43,970	19,410	8,609	15,113	22,814
Delivered to Contracting Agencies	3,311	4,753	5,311	3,686	3,562	11,783
Storage Change	14	-173	199	-301	172	-88
Operational Losses (-), Gains (+)	-979	-1,195	-405	-605	-476	-1,654
Outflow, Wheeler Ridge P.P.	42,606	38,195	13,495	4,619	10,903	9,465
California Aqueduct, Wheeler Ridge P.P. to Wind Gap P.P.						
Inflow, Wheeler Ridge P.P.	42,606	38,195	13,495	4,619	10,903	9,465
Delivered to Contracting Agencies	13	81	339	921	990	3,495
Storage Change	4	-42	39	14	-36	39
Operational Losses (-), Gains (+)	369	-4	238	-184	11	435
Outflow, Wind Gap P.P.	42,958	38,152	13,355	3,500	9,960	6,366
California Aqueduct, Wind Gap P.P. to A. D. Edmonston P.P.						
Inflow, Wind Gap P.P.	42,958	38,152	13,355	3,500	9,960	6,366
Delivered to Contracting Agencies	8	183	471	591	587	886
Storage Change	44	-59	-30	-385	371	-261
Operational Losses (-), Gains (+)	336	798	116	225	156	89
Outflow, A. D. Edmonston P.P.	43,242	38,826	13,030	3,519	9,158	5,830
Coastal Branch, California Aqueduct						
Inflow, Las Perillas P.P.	4,604	4,451	5,201	8,694	7,945	15,547
Delivered to Contracting Agencies <sup>2/</sup>	4,300	4,149	4,749	8,298	7,510	14,283
Storage Change	22	-12	5	-4	-12	5
Operational Losses (-), Gains (+)	-282	-314	-447	-400	-447	-1,259
<b>SOUTHERN FIELD DIVISION</b>						
California Aqueduct, A.D. Edmonston P.P. to Junction of West Branch						
Inflow, A. D. Edmonston P.P.	43,242	38,826	13,030	3,519	9,158	5,830
Storage Change	-3	9	4	-36	23	-37
Operational Losses (-), Gains (+)	8	7	-6	-8	-5	-7
Outflow, West Branch	13,433	6,216	142	-84	246	-76
Outflow, East Branch	29,820	32,608	12,878	3,631	8,884	5,936
California Aqueduct, Junction of West Br. to Pearblossom P.P.						
Inflow	29,820	32,608	12,878	3,631	8,884	5,936
Delivered to Contracting Agencies	143	202	750	3,202	2,193	5,145
Storage Change	5	-14	-139	-117	315	-285
Operational Losses (-), Gains (+)	571	461	-421	-546	-381	-664
Outflow, Pearblossom P.P.	30,243	32,881	11,846	0	5,995	412

<sup>1/</sup> Not included is 1,008 acre-feet of Tulare Lake Basin W.S.D.'s water delivered to their lands within Federal service area. Also, not included is 200 acre-feet delivered to Dudley Ridge W.D. from the Kaweah River.

<sup>2/</sup> Not included is 4,550 acre-feet of Devil's Den W.D.'s water delivered to their lands within Federal service area.

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

July	August	September	October	November	December	Total	Description
							<u>SAN JOAQUIN FIELD DIVISION</u>
							California Aqueduct, Check 21 to Buena Vista Pumping Plant
132,179	113,534	26,167	18,151	15,421	34,120	658,082	Inflow, Check 21 (State)
7,711	2,698	6,001	1,494	0	0	29,710	Inflow, Check 21 (Federal)
82,334	78,940	13,756	8,577	9,031	15,684	346,448	Delivered to State Contracting Agencies <u>1</u> /
0	0	0	0	0	0	0	Delivered for Repayment of Preconsolidation Water
7,711	2,698	6,001	1,494	0	0	31,060	Delivered to Federal Customers (Cross Valley Canal)
22,366	11,813	4,468	2,500	1,572	6,185	95,346	Coastal Br. Diversion (Las Per. P.P.)
-819	1,141	-71	-224	353	953	1,291	Storage Change
1,562	2,881	2,879	1,923	1,488	4,289	39,214	Operational Losses (-), Gains (+)
29,860	24,521	10,893	9,221	5,953	15,587	252,861	Outflow, Buena Vista P.P.
							California Aqueduct, Buena Vista P.P. To Wheeler Ridge P.P.
29,860	24,521	10,893	9,221	5,953	15,587	252,861	Inflow, Buena Vista P.P.
14,973	11,457	3,219	1,044	965	163	64,227	Delivered to Contracting Agencies
57	73	95	-67	168	-219	-70	Storage Change
-303	-961	-478	-1,143	-588	-41	-8,828	Operational Losses (-), Gains (+)
14,527	12,030	7,101	7,101	4,232	15,602	179,876	Outflow, Wheeler Ridge P.P.
							California Aqueduct, Wheeler Ridge P.P. to Wind Gap P.P.
14,527	12,030	7,101	7,101	4,232	15,602	179,876	Inflow, Wheeler Ridge P.P.
4,275	3,559	815	210	73	42	14,813	Delivered to Contracting Agencies
-34	-3	30	-8	33	-84	-48	Storage Change
-341	-41	-289	-153	-66	-740	-765	Operational Losses (-), Gains (+)
9,945	8,433	5,967	6,746	4,060	14,904	164,346	Outflow, Wind Gap P.P.
							California Aqueduct, Wind Gap P.P. to A.D. Edmonston P.P.
9,945	8,433	5,967	6,746	4,060	14,904	164,346	Inflow, Wind Gap P.P.
845	895	342	197	80	9	5,094	Delivered to Contracting Agencies
122	125	43	-43	122	-74	-14	Storage Change
-154	356	254	308	191	37	2,712	Operational Losses (-), Gains (+)
8,824	7,769	5,836	6,889	4,049	15,006	161,978	Outflow, A.D. Edmonston P.P.
							Coastal Branch, California Aqueduct
22,366	11,813	4,468	2,500	1,572	6,185	95,346	Inflow, Las Perillas P.P.
20,633	11,207	4,495	2,504	1,450	5,991	89,569	Delivered to Contracting Agencies <u>2</u> /
40	-34	18	-2	-15	2	13	Storage Change
-1,693	-640	45	2	-137	-192	-5,764	Operational Losses (-), Gains (+)
							<u>SOUTHERN FIELD DIVISION</u>
							California Aqueduct, A.D. Edmonston P.P. to Junction of West Branch
8,824	7,769	5,836	6,889	4,049	15,006	161,978	Inflow, A.D. Edmonston P.P.
46	-25	9	22	-6	3	9	Storage Change
-8	-7	-4	-7	-3	2	-38	Operational Losses (-), Gains (+)
163	-55	39	90	-10	8,189	28,293	Outflow, West Branch
8,607	7,842	5,784	6,770	4,062	6,816	133,638	Outflow, East Branch
							California Aqueduct, Junction of West Br. to Pearblossom P.P.
8,607	7,842	5,784	6,770	4,062	6,816	133,638	Inflow
7,377	6,225	5,679	2,235	251	63	33,465	Delivered to Contracting Agencies
171	160	-179	-40	206	-244	-161	Storage Change
-956	-890	-272	-481	-165	180	-3,564	Operational Losses (-), Gains (+)
103	567	12	4,094	3,440	7,177	96,770	Outflow, Pearblossom P.P.

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

Description	January	February	March	April	May	June
<u>SOUTHERN FIELD DIVISION (Cont.)</u>						
California Aqueduct, Pearblossom P.P. to Silverwood Lake						
Inflow, Pearblossom P.P.	30,243	32,881	11,846	0	5,995	412
<u>1/</u> Deliveries (Exchange of natural inflow)	633	288	356	275	741	396
Storage Change	12	37	-88	-658	185	-174
Operational Losses (-), Gains (+)	-72	-79	-98	-115	-89	-127
Outflow to Silverwood Lake	29,526	32,477	11,480	268	4,980	63
Silverwood Lake Operation						
End of Month Storage	48,810	46,288	55,141	53,906	58,592	56,684
Storage Change	-5,835	-2,522	8,853	-1,235	4,686	-1,908
Inflow, Project	29,526	32,477	11,480	268	4,980	63
Inflow, Natural	911	284	363	276	1,929	201
Delivered to Contracting Agencies	82	81	55	93	58	94
Outflow, Natural Inflow Released	113	0	0	0	758	233
Outflow, Project Water at San Bernardino Tunnel	36,174	34,667	2,966	1,181	1,916	1,508
Operational Losses (-), Gains (+)	97	-535	31	-505	509	-337
California Aqueduct, Silverwood Lake to Lake Perris						
Inflow, San Bernardino Tunnel	36,174	34,667	2,966	1,181	1,916	1,508
Delivered to Contracting Agencies	35,715	35,089	3,763	1,167	1,956	1,487
Storage Change	-1	0	1	14	0	-4
Operational Losses (-), Gains (+)	-1	-1	-1	-2	-2	-4
Outflow to Lake Perris	459	-423	-799	-2	-42	21
Lake Perris Operation						
End of Month Storage	84,161	83,687	82,861	81,979	81,509	80,419
Storage Change	-296	-474	-826	882	-470	-1,090
Inflow	459	-423	-799	-2	-42	21
Delivered to Contracting Agencies	164	145	179	209	198	199
Operational Losses (-), Gains (+)	-591	94	152	-671	-230	-912
Outflow	0	0	0	0	0	0
West Branch California Aqueduct Tehachapi Afterbay to Oso P.P.						
Inflow	13,433	6,216	142	-84	246	-76
Storage Change	-9	27	12	-109	70	-112
Delivered to Contracting Agencies	0	0	0	0	0	0
Operational Losses (-), Gains (+)	25	21	-19	-25	-15	-22
Outflow, Oso Pumping Plant	13,467	6,210	111	0	161	14
West Branch California Aqueduct Oso P.P. to Pyramid Lake						
Inflow, Oso P.P.	13,467	6,210	111	0	161	14
Storage Change	-388	378	44	-220	106	-3,271
Delivered to Contracting Agencies	0	0	0	0	0	0
Operational Losses (-), Gains (+)	-101	-74	-67	-151	-55	-184
Outflow to Pyramid Lake	13,754	5,758	0	69	0	3,101

1/ Includes deliveries to Mojave W.A. as follows: Jan. 22 ac-ft; July 5 ac-ft; Aug. 35 ac-ft, Oct. 18 ac-ft.

2/ Measured surface seepage.

3/ Includes 14 ac-ft of measured surface seepage.

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

July	August	September	October	November	December	Total	Description
							<u>SOUTHERN FIELD DIVISION (Cont.)</u>
							California Aqueduct, Pearblossom P.P. to Silverwood Lake
103	567	12	4,094	3,440	7,177	96,770	Inflow, Pearblossom P.P.
64	45	41	40	35	244	3,158	Deliveries (Exchange of natural inflow)
-320	373	-151	944	89	99	348	Storage Change
-216	-35	-118	-25	-24	-74	-1,072	Operational Losses (-), Gains (+)
143	114	4	3,085	3,292	6,760	92,192	Outflow to Silverwood Lake
							Silverwood Lake Operation
54,031	51,053	47,647	47,969	46,032	42,490	--	End of Month Storage
-2,653	-2,978	-3,406	322	-1,937	-3,542	-12,155	Storage Change
143	114	4	3,085	3,292	6,760	92,192	Inflow, Project
22	10	41	22	35	1,478	5,572	Inflow, Natural
137	135	138	132	103	112	1,220	Delivered to Contracting Agencies
0	0	0	11 <sup>2</sup> / <sub>1</sub>	12 <sup>2</sup> / <sub>1</sub>	1,223 <sup>3</sup> / <sub>1</sub>	2,350	Outflow, Natural Inflow Released
2,026	2,791	3,048	2,284	4,859	11,033	104,453	Outflow, Project Water at San Bernardino Tunnel
-655	-176	-265	-358	-290	588	-1,896	Operational Losses (-), Gains (+)
							California Aqueduct, Silverwood Lake To Lake Perris
2,026	2,791	3,048	2,284	4,859	11,033	104,453	Inflow, San Bernardino Tunnel
1,990	2,685	3,059	2,167	4,737	4,880	98,695	Delivered to Contracting Agencies
0	3	0	-9	-2	1	3	Storage Change
-4	-4	-2	-3	-2	-1	-27	Operational Losses (-), Gains (+)
32	99	-13	123	122	6,151	5,728	Outflow to Lake Perris
							Lake Perris Operation
78,335	77,208	75,441	74,272	73,278	79,222	--	End of Month Storage
-2,084	-1,127	-1,767	-1,169	-994	5,944	-5,235	Storage Change
32	99	-13	123	122	6,151	5,728	Inflow
345	213	672	205	198	184	2,911	Delivered to Contracting Agencies
-1,771	-1,013	-1,082	-1,087	-918	-23	-8,052	Operational Losses (-), Gains (+)
0	0	0	0	0	0	0	Outflow
							West Branch California Aqueduct Tehachapi Afterbay to Oso P.P.
163	-55	39	90	-10	8,189	28,293	Inflow
140	-76	27	69	-19	10	30	Storage Change
0	0	0	0	0	0	0	Delivered to Contracting Agencies
-23	-21	-12	-21	-9	7	-114	Operational Losses (-), Gains (+)
0	0	0	0	0	8,186	28,293	Outflow, Oso Pumping Plant
							West Branch California Aqueduct Oso P.P. to Pyramid Lake
0	0	0	0	0	8,186	28,149	Inflow, Oso P.P.
-173	-291	-74	-66	-24	1,581	-2,398	Storage Change
0	0	0	0	0	0	0	Delivered to Contracting Agencies
-173	-147	-74	-66	-24	-64	-1,180	Operational Losses (-), Gains (+)
0	144	0	0	0	6,541	29,367	Outflow to Pyramid Lake

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

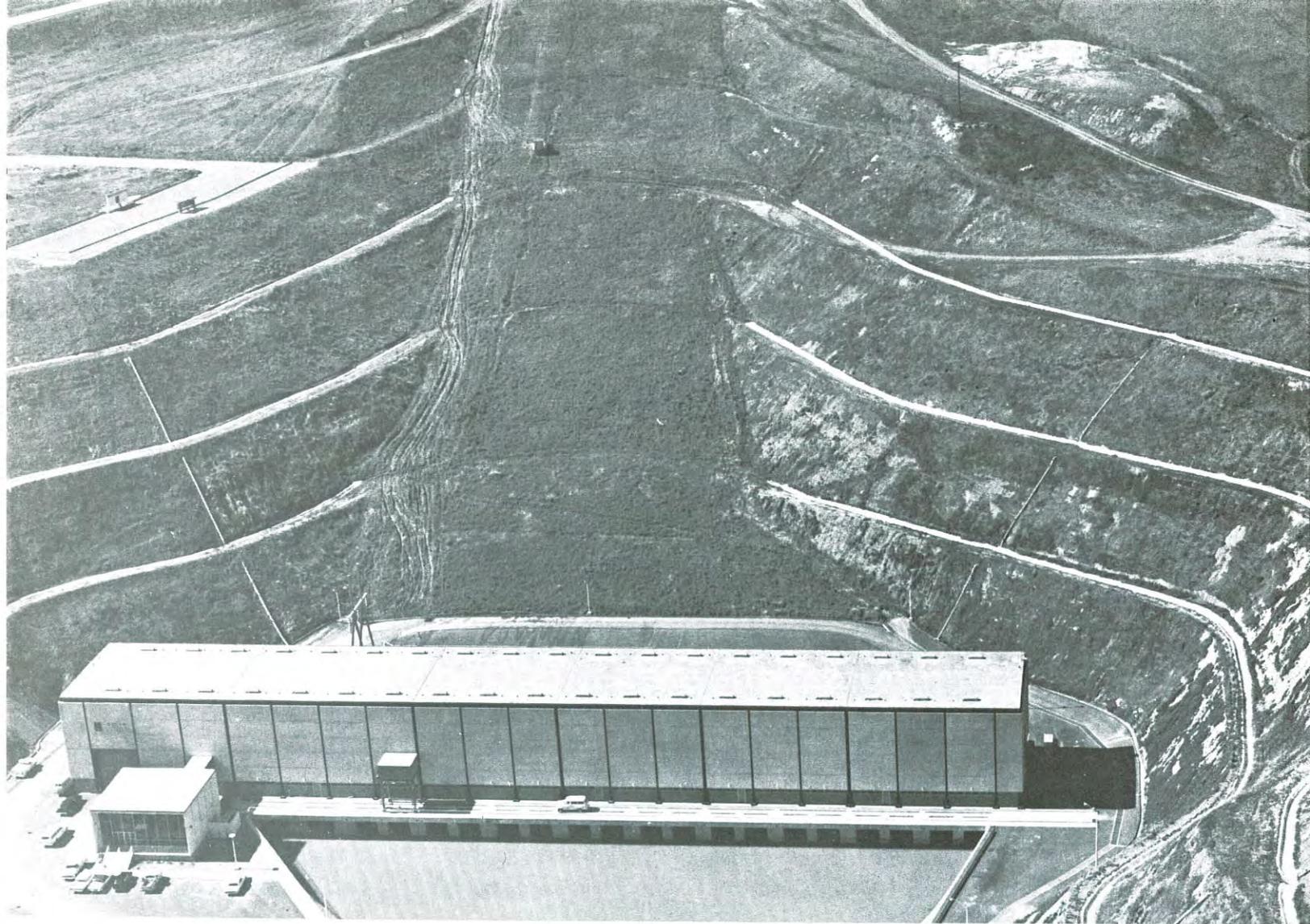
(Amounts in Acre-feet)

Description	January	February	March	April	May	June
<u>SOUTHERN FIELD DIVISION (Cont.)</u>						
Pyramid Lake Operation						
End of Month Storage	167,460	166,822	166,439	166,057	167,077	167,588
Storage Change	1,275	-638	-383	-382	1,020	511
Inflow, Project	13,754	5,758	0	69	0	3,101
Inflow, Natural (from local runoff)	1,235	774	803	584	1,670	378
Inflow, Pumpback from Elderb. Forebay	3,471	0	200	0	0	0
Operational Losses (-), Gains (+)	-266	-501	-913	-371	255	-1,185
Outflow, Angeles Tunnel to Elderb. Fby.	14,599	4,656	190	424	556	1,170
Outflow, Natural Inflow Released to Piru Creek	2,360	2,013	283	240	349	613
Elderberry Forebay Operation						
End of Month Storage	19,805	18,965	19,041	19,498	20,269	21,413
Storage Change	4,175	-840	76	457	771	1,144
Inflow, Project thru Castaic P-G Plant	14,599	4,656	190	424	556	1,170
Inflow, Natural	155	30	51	22	213	7
Operational Losses (-), Gains (+)	17	-76	35	11	2	-33
Outflow, Pumpback to Pyramid Lake	3,471	0	200	0	0	0
Outflow, Project Water Released to Castaic Lake	6,970	5,420	0	0	0	0
Outflow, Natural Inflow Released to Castaic Lake	155	30	0	0	0	0
Castaic Lake Operation						
End of Month Storage	136,800	120,693	108,400	93,716	86,490	77,166
Storage Change	-24,118	-16,107	-12,203	-14,774	-7,226	-9,324
Inflow, Project	6,970	5,420	0	0	0	0
Inflow, Natural	160	76	86	68	253	26
Inflow, Natural Released from Elderberry Forebay	155	30	0	0	0	0
Delivered to Contracting Agencies	32,539	22,177	12,504	14,596	7,764	8,619
Operational Losses (-), Gains (+)	1,159	547	461	-16	561	-556
Outflow, Castaic Afterbay	23	3	246	230	276	175
Castaic Lagoon Operation						
Inflow	23	3	246	230	276	175
Change in Storage	-107	-251	-47	-87	7	-114
Operational Losses (-), Gains (+)	-58	-46	-61	-68	-63	-105
Outflow, Subsurface	72	208	232	249	206	184
Outflow, Surface	0	0	0	0	0	0

SUMMARY OF CALIFORNIA AQUEDUCT OPERATION  
1977

(Amounts in Acre-feet)

July	August	September	October	November	December	Total	Description
							<u>SOUTHERN FIELD DIVISION (Cont.)</u>
							Pyramid Lake Operation
167,588	167,332	165,295	167,077	166,822	167,767	--	End of Month Storage
0	-256	-2,037	1,782	-255	945	1,582	Storage Change
0	144	0	0	0	6,541	29,367	Inflow, Project
87	94	86	102	178	2,400	8,391	Inflow, Natural, (from local runoff)
4,898	1,976	0	4,312	1,476	134	16,467	Inflow, Pumpback from Elderb. Forebay
-774	-961	-508	-1,394	-783	251	-7,110	Operational Losses (-), Gains (+)
3,261	533	685	579	847	7,357	34,877	Outflow, Angeles Tunnel
950	956	930	659	279	1,024	10,656	Outflow, Natural Inflow Released to Piru Creek
							Elderberry Forebay Operation
19,766	18,477	19,155	15,388	14,774	22,580	--	End of Month Storage
-1,647	-1,289	678	-3,767	-614	7,806	6,950	Storage Change
3,261	553	685	579	847	7,357	34,877	Inflow, Project thru Castaic P-G Plant
0	0	0	0	0	440	918	Inflow, Natural
-10	134	-7	-34	15	143	197	Operational Losses (-), Gains (+)
4,898	1,976	0	4,312	1,476	134	16,467	Outflow, Pumpback to Pyramid Lake
0	0	0	0	0	0	12,390	Outflow, Project Water Released to Castaic Lake
0	0	0	0	0	0	185	Outflow, Natural Inflow Released to Castaic Lake
							Castaic Lake Operation
64,446	60,717	58,457	53,876	53,040	51,041	--	End of Month Storage
-12,720	-3,729	-2,260	-2,581	-2,836	-1,999	-109,877	Storage Change
0	0	0	0	0	0	12,390	Inflow, Project
6	0	4	5	8	200	892	Inflow, Natural
0	0	0	0	0	0	185	Inflow, Natural Release from Elderberry Forebay
12,338	3,246	1,547	2,353	2,583	2,538	122,804	Delivered to Contracting Agencies
-128	-135	-450	-233	-261	339	1,288	Operational Losses (-), Gains (+)
260	348	267	0	0	0	1,828	Outflow, Castaic Afterbay
							Castaic Lagoon Operation
260	348	267	0	0	0	1,828	Inflow
-158	61	-2	-298	-267	-58	-1,321	Change in Storage
-130	-111	-93	-86	-79	-44	-944	Operational Losses (-), Gains (+)
288	176	176	212	188	14	2,205	Outflow, Subsurface
0	0	0	0	0	0	0	Outflow, Surface



PUMPING  
PLANTS

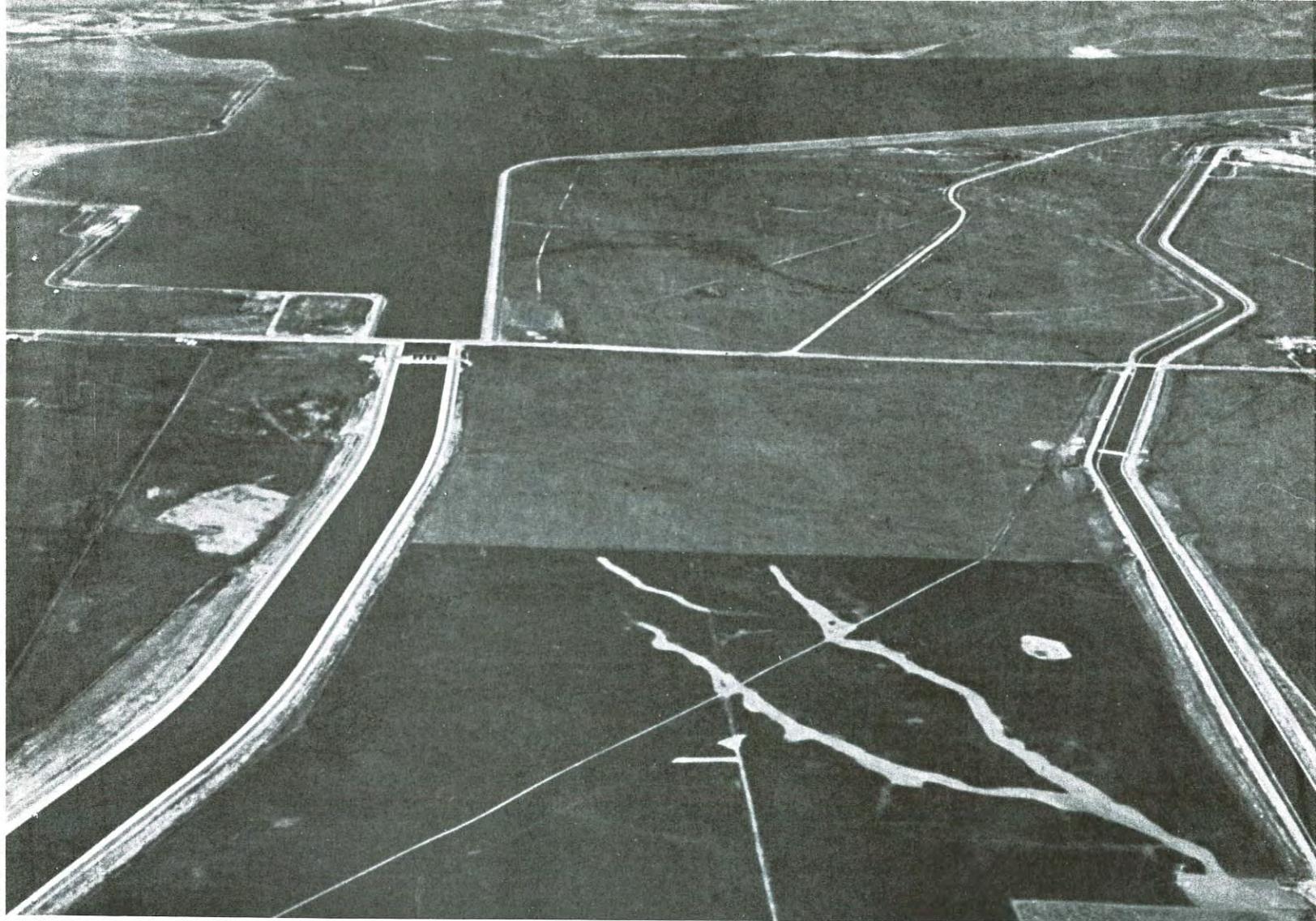
PROJECT PUMPING PLANTS 1/  
1977

Amounts in acre-feet

Pumping Plant	January	February	March	April	May	June	July	August	September	October	November	December	Total
Hyatt	51,783	38,505	74,778	0	625	0	0	0	0	0	0	0	165,691
Thermalito	61,518	39,329	87,150	0	564	0	0	0	0	0	0	0	188,561
Cordelia	771	657	659	515	747	829	567	764	831	890	637	355	8,222
Delta State	172,370	103,367	95,431	14,214	67,046	17,114	20,353	15,422	8,534	7,779	51,274	202,120	775,024
Federal	32,742	2,749	1,142	0	5,255	0	0	0	648	0	0	21,638	64,174
South Bay	5,838	9,814	13,843	10,481	14,759	13,486	13,705	11,665	7,696	7,711	6,529	6,910	122,437
Del Valle	0	3,689	7,255	1,237	3,527	0	0	341	0	0	0	0	16,049
<u>1/</u> San Luis State	125,579	36,720	42,357	0	34,901	0	0	0	3,774	0	30,700	157,933	431,964
Federal	145,598	35,107	6,136	5,779	13,172	0	0	0	88,631	0	68,408	139,239	502,070
<u>2/0'</u> Neill (USBR) Federal	205,353	61,737	43,590	8,402	51,341	377	0	10,045	34,117	4,735	82,399	130,908	633,004
State	0	0	0	0	0	0	0	0	0	0	0	0	0
<u>1/</u> Dos Amigos State	55,452	55,938	49,266	36,120	43,990	99,138	135,217	115,860	27,585	23,595	15,668	37,970	695,799
Federal	84,170	33,911	24,695	18,562	12,760	50,411	63,900	41,114	13,795	7,220	7,979	18,161	376,678
Las Perillas	4,604	4,451	5,201	8,694	7,945	15,547	22,366	11,813	4,468	2,500	1,572	6,185	95,346
Badger Hill	4,596	4,451	5,205	8,675	7,835	15,581	22,000	11,767	4,490	2,500	1,584	6,143	94,827
Buena Vista	46,910	43,970	19,410	8,609	15,113	22,814	29,860	24,521	10,893	9,221	5,953	15,587	252,861
Wheeler Ridge	42,606	38,195	13,495	4,619	10,903	9,465	14,527	12,030	7,101	7,101	4,232	15,602	179,876
Wind Gap	42,958	38,152	13,355	3,500	9,960	6,366	9,945	8,433	5,967	6,746	4,060	14,904	164,346
A. D. Edmonston	43,242	38,826	13,030	3,519	9,158	5,830	8,824	7,769	5,836	6,889	4,049	15,006	161,978
Oso	13,467	6,210	111	0	161	14	0	0	0	0	0	8,186	28,149
Castaic	3,471	0	200	0	0	0	4,898	1,976	0	4,312	1,476	134	16,467
Pearblossom	30,243	32,881	11,846	0	5,995	412	103	567	12	4,094	3,440	7,177	96,770

1/ Joint State-Federal Facility

2/ O'Neill Pumping Plant is a federal USBR facility



## JOINT SAN LUIS FACILITIES

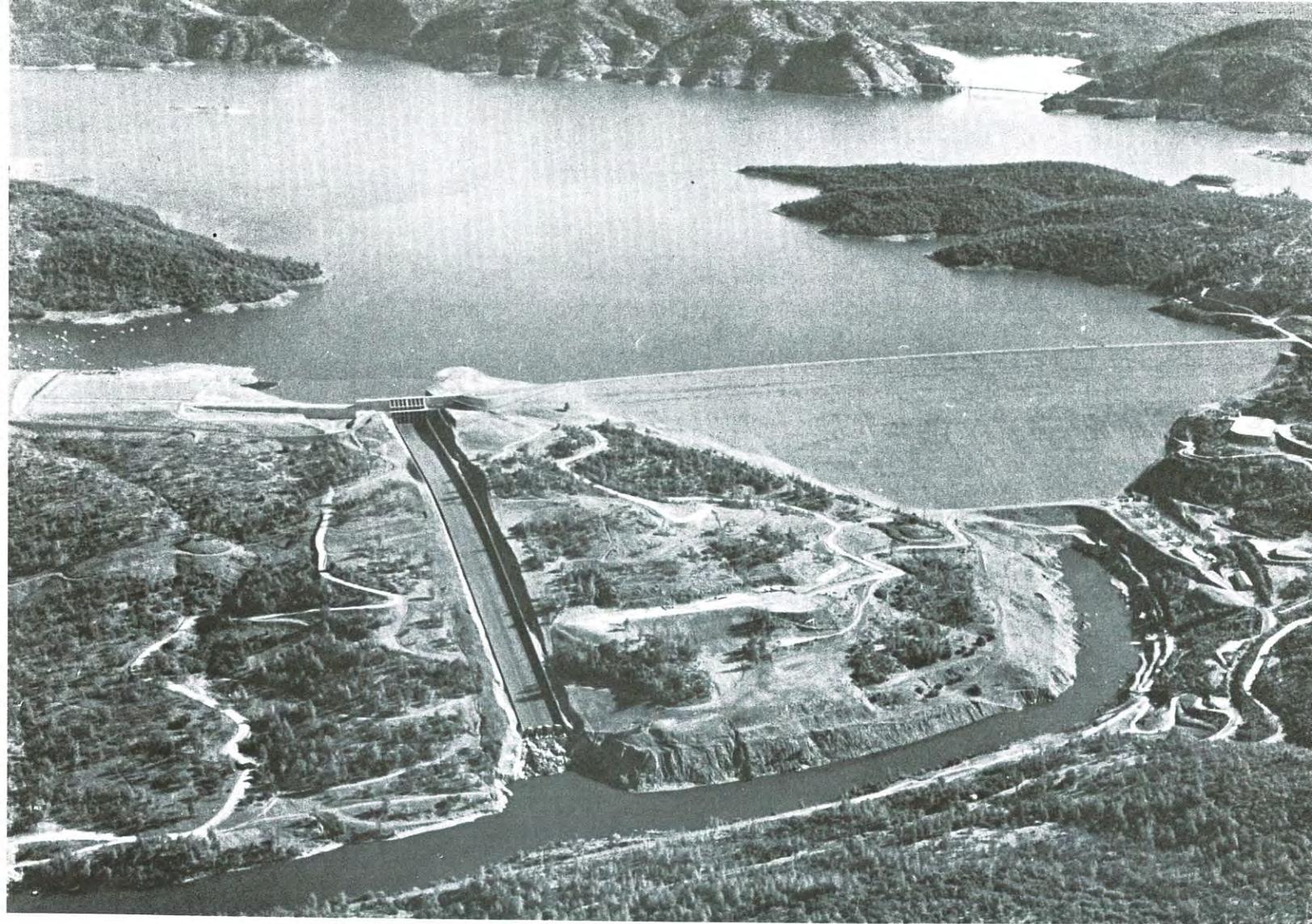
MONTHLY OPERATIONS SUMMARY  
STATE-FEDERAL JOINT SAN LUIS FACILITIES

19 77

Amounts in acre-feet unless noted.

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Check 12	State	166506	93375	80030	3622	50113	3156	3496	1346	0	0	43581	192357	637582
	Federal	32742	2749	1142	0	5255	0	0	0	648	0	0	21638	64174
	Total	199248	96124	81172	3622	55368	3156	3496	1346	648	0	43581	213995	701756
O'Neill Pumping and Generating Plant Amount Pumped	State	0	0	0	0	0	0	0	0	0	0	0	0	0
	Federal	205353	61737	43590	8402	51341	377	0	10045	34117	4735	82399	130908	633004
	Total	205353	61737	43590	8402	51341	377	0	10045	34117	4735	82399	130908	633004
Released for Generation	State	0	0	0	0	0	0	0	0	0	0	0	0	0
	Federal	0	442	11488	35623	6639	118968	172285	113127	9318	46715	1131	0	515736
	Total	0	422	11488	35623	6639	118968	172285	113127	9318	46715	1131	0	515736
O'Neill Forebay End-of-Month Storage	State	31820	35653	27125	28218	3024	27359	30818	22136	21518	20277	20125	26313	xxxx
	Federal	20782	18158	26471	15559	44180	22064	6154	18701	18058	18897	25424	28334	XXXX XXXX
	Total	52602	53811	53596	43777	47204	49423	36972	40837	39576	39174	45549	54647	XXXX
San Luis Reservoir End-of-Month Storage	State	586118	619286	658269	623971	653358	535360	402418	224084	195839	174081	274659	417826	xxxx
	Federal	514212	546415	545315	509044	515820	369873	149879	68864	78339	28711	18225	145383	XXXX XXXX
	Total	1100328	1165701	1203584	1133015	1169178	905233	552297	292948	274178	202802	292884	563209	XXXX
San Luis Pumping and Generating Plant Amount Pumped	State	125579	36720	42357	0	34901	0	0	0	3774	0	30700	157933	431964
	Federal	145598	35107	6136	5779	13172	0	0	0	88631	0	68408	139239	502070
	Total	271177	71827	48493	5779	48073	0	0	0	92405	0	99108	297172	934034
Released for Generation	State	18	0	0	33017	1465	119517	136196	104442	17218	20968	876	0	433717
	Federal	0	0	4475	41002	3083	147189	222656	156921	85228	48989	411	0	709954
	Total	18	0	4475	74019	4548	266706	358852	261363	102446	69957	1287	0	1143671
Dos Amigos Pumping Plant Amount Pumped	State	55452	55938	49266	36120	43990	99138	135217	115860	27585	23595	15668	37970	695799
	Federal	84170	33911	24695	18562	12760	50411	63900	41114	13795	7220	7979	18161	376678
	Total	139622	89849	73961	54682	56750	149549	199117	156974	41380	30815	23647	56131	1072477

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OPERATION  
OF  
RESERVOIRS

**UPPER FEATHER AREA LAKES**  
MONTHLY OPERATION

1977

(From preliminary records)

Month	Lake Storage			Outflow						Inflow	
	Water Surface Elevation in feet	Storage	Storage Change	Regulated		Release		Spill	Estimated Evaporation and Seepage	Total Outflow	Computed or Estimated
				Streamflow Maint.	Water Supply Contract	Water Right Entitlement	Total Regulated Release				
	1	2	3	4	5	6	7	8	9	10	11

**ANTELOPE LAKE**

Capacity 22,566 ac-ft

Jan	4960.19E	1,370	308	0	0	0	0	0	10	10	318
Feb	4963.62E	1,969	599	0	0	0	0	0	14	14	613
Mar	4966.56	2,604	635	0	0	0	0	0	26	26	661
Apr	4969.53	3,395	791	0	0	66	66	0	56	122	913
May	4969.80	3,475	80	0	0	615	615	0	96	711	791
June	4969.88	3,499	24	0	0	307	307	0	161	468	492
July	4969.27E	3,320	-179	0	0	79	79	0	152	231	52
Aug	4968.67E	3,150	-170	0	0	61	61	0	113	174	4
Sept	4968.23E	3,030	-120	0	0	60	60	0	68	128	8
Oct	4968.21E	3,024	-6	0	0	25	25	0	18	43	37
Nov	4968.73E	3,167	143	60	0	0	60	0	43	103	246
Dec	4971.26	3,927	760	61	0	0	61	0	32	93	853
Tot	--	--	2,865	121	0	1,213	1,334	0	789	2,123	4,988

**FRENCHMAN LAKE**

Capacity 55,477 ac-ft

Jan	5551.07E	14,477	205	105	0	0	105	0	48	153	358
Feb	5551.53	14,794	317	187	0	0	187	0	48	235	552
Mar	5551.82	14,997	203	121	0	170	290	0	48	375	578
Apr	5551.74	14,941	-56	112	30	44	186	0	140	326	270
May	5551.00	14,429	-512	68	671	0	739	0	231	970	458
June	5546.52	11,594	-2,835	0	2,748	0	2,748	0	334	3,082	247
July	5542.83E	9,594	-2,000	0	1,548	0	1,548	0	474	2,022	22
Aug	5539.60	8,041	-1,553	2	1,223	0	1,225	0	343	1,568	15
Sept	5538.87E	7,715	-326	7	152	0	159	0	200	359	33
Oct	5538.85E	7,706	-9	20	0	0	20	0	70	90	81
Nov	5538.99	7,768	62	44	0	0	44	0	70	114	176
Dec	5539.90	8,178	410	133	0	0	133	0	49	182	592
Tot	--	--	-6,094	799	6,372	214	7,385	0	2,091	9,476	3,382

**LAKE DAVIS**

Capacity 84,371 ac-ft

Jan	5768.00	58,709	395	307	6	0	313	0	230	543	938
Feb	5768.14	59,172	463	278	3	0	281	0	231	512	975
Mar	5768.18	59,305	133	587	2	0	589	0	398	987	1,120
Apr	5768.00	58,709	-596	722	28	111	861	0	664	1,525	929
May	5767.74	57,855	-854	430	13	430	873	0	1,086	1,959	1,105
June	5765.67	51,306	-6,549	5,072	68	416	5,556	0	1,687	7,243	694
July	5762.35	41,747	-9,559	6,665	59	430	7,154	0	2,422	9,576	17
Aug	5760.12	35,972	-5,775	3,717	60	430	4,207	0	1,578	5,785	10
Sept	5759.56	34,603	-1,369	238	32	132	402	0	987	1,389	20
Oct	5759.18	33,693	-910	246	22	50	318	0	622	940	30
Nov	5759.13	33,574	-119	243	5	1	249	0	379	628	509
Dec	5759.92	35,479	1,905	252	5	0	257	0	264	521	2,426
Tot	--	--	-22,835	18,757	303	2,000	16,060	0	10,548	31,608	8,773

LAKE ORCVILLE  
MONTHLY OPERATION

Capacity 3,537,577 acre-feet

Amounts in acre-feet unless noted

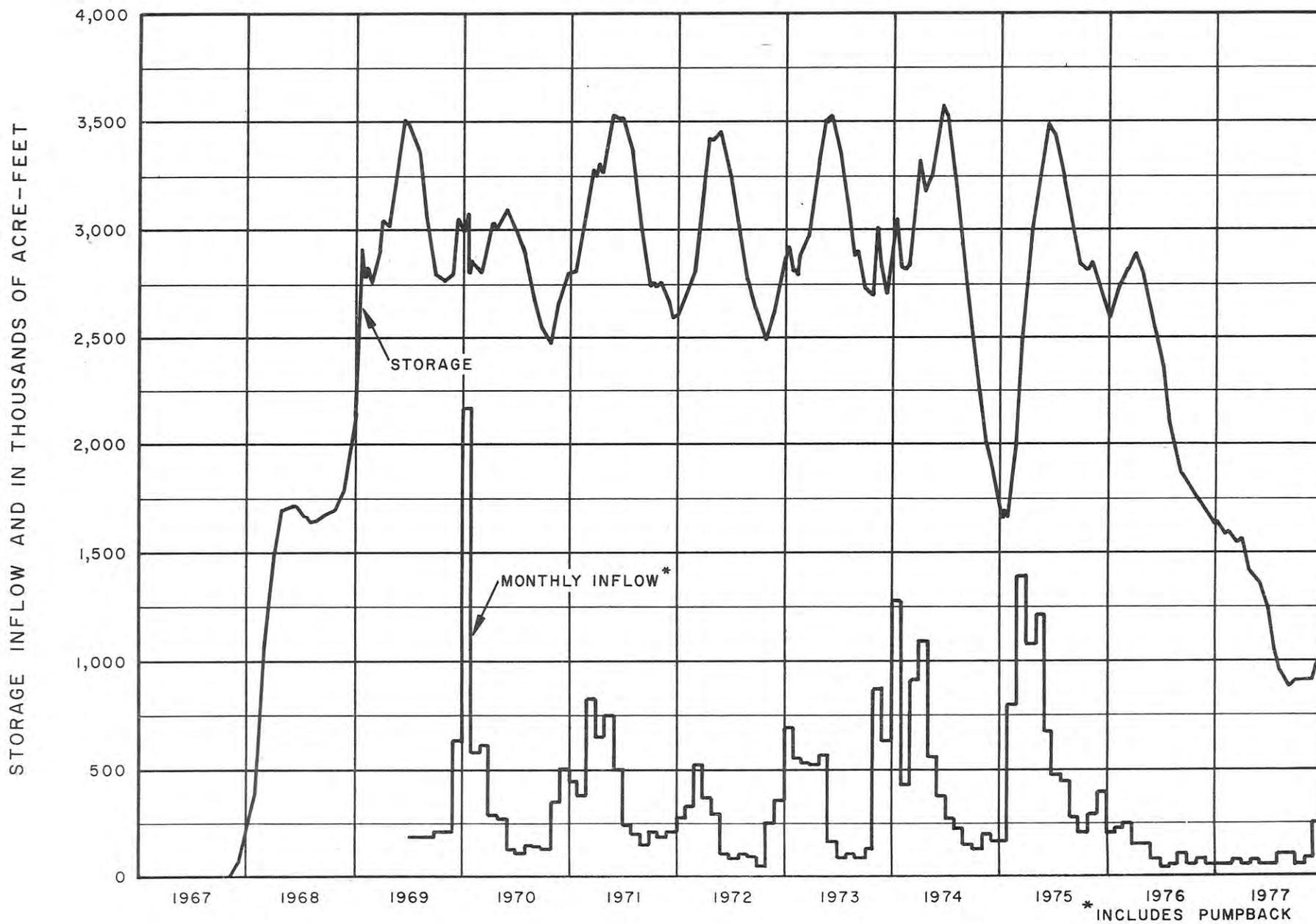
MONTH	YEAR	WATER SURFACE ELEVATION IN FEET	STORAGE	STORAGE CHANGE	OUTFLOW						TOTAL INFLOW	
					POWER	PALERMO CANAL	SPILLWAY LEAKAGE	EVAPORATION	SPILL	TOTAL OUTFLOW	PUMPBACK	INFLOW*
JAN	1977	742.20	1,605,898	-21,356	123,605	260	0	691	0	124,556	51,783	51,417
	1976	840.20	2,679,041	96,295	105,260	308	244	1,525	0	107,337	0	203,632
FEB	1977	738.47	1,572,411	-33,487	120,065	146	0	1,451	0	121,662	38,505	49,670
	1976	845.73	2,751,482	72,441	145,547	260	173	1,702	0	147,682	0	220,123
MAR	1977	737.58	1,564,494	-7,917	154,850	105	0	2,055	0	157,010	74,778	74,315
	1976	854.12	2,863,994	112,512	142,015	322	232	3,268	0	145,837	0	258,349
APR	1977	719.17	1,406,826	-157,668	213,780	784	0	3,657	0	218,221	0	60,553
	1976	845.73	2,751,482	-112,512	254,284	532	222	3,634	0	258,672	0	146,160
MAY	1977	712.61	1,353,410	-53,416	122,728	790	0	2,752	0	126,270	625	72,229
	1976	836.61	2,632,703	-118,779	258,653	1,424	161	7,132	0	267,370	24,106	124,485
JUN	1977	693.13	1,202,953	-150,457	191,043	1,242	0	4,873	0	197,158	0	46,701
	1976	819.71	2,422,062	-210,641	272,321	1,515	86	8,420	0	282,342	8,297	63,404
JUL	1977	663.46	996,872	-206,081	242,113	1,277	0	5,454	0	248,844	0	42,763
	1976	792.96	2,113,333	-308,729	336,234	1,521	12	8,386	0	346,153	0	37,424
AUG	1977	646.68	891,820	-105,052	197,801	1,297	0	4,373	0	203,471	0	98,419
	1976	775.47	1,927,214	-185,573	227,023	1,389	0	5,978	0	234,390	0	48,817
SEP	1977	650.52	915,160	23,340	56,896	1,061	0	3,219	15,932	77,108	0	100,448
	1976	765.64	1,827,949	-99,265	184,741	1,294	0	5,236	0	191,271	0	92,006
OCT	1977	648.91	905,324	-9,836	40,105	661	0	2,514	27,787	71,067	0	61,231
	1976	756.95	1,743,280	-84,669	130,913	974	0	4,567	0	136,454	0	51,785
NOV	1977	650.94	917,738	12,444	60,413	278	0	1,262	3,799	65,752	0	78,196
	1976	750.94	1,686,340	-56,940	129,895	542	0	1,928	0	132,365	13,085	62,340
DEC	1977	681.64	1,119,917	202,179	50,682	148	0	680	0	51,510	0	253,689
	1976	744.55	1,627,254	-59,086	103,010	350	0	1,828	0	105,188	5,611	40,491
TOTAL	1977	--	--	-507,307	1,574,081	8,049	0	32,981	47,518	1,662,629	165,691	989,631
	1976	--	--	-954,946	2,289,896	10,431	1,130	53,604	0	2,355,061	51,099	1,349,016

\* Computed inflow excluding pumpback.

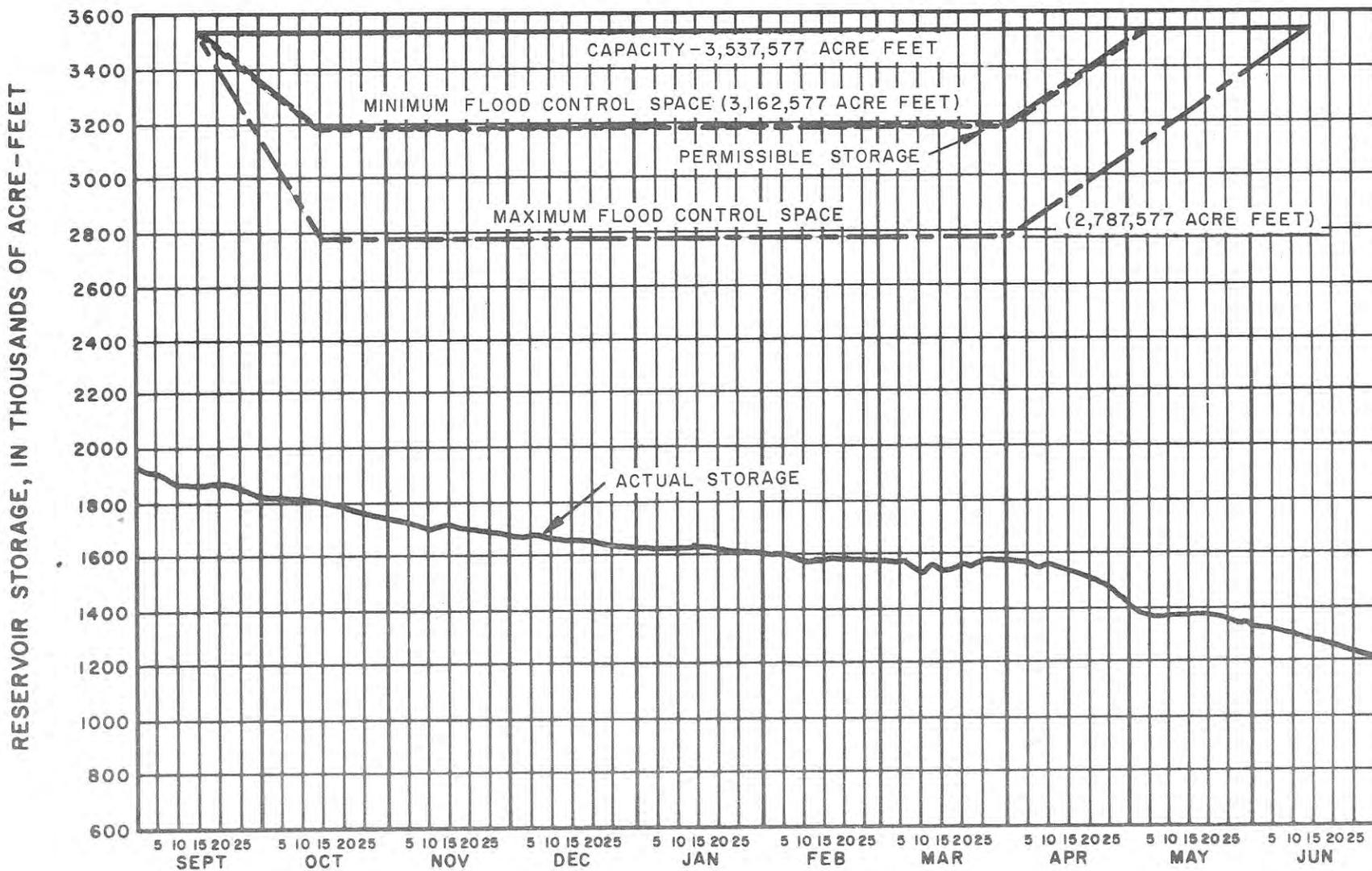
1/ Includes Wicket Gate leakage. 2/ From River Outlet valve.

\*\* Water level recorder adjusted downward 0.05 foot, August 2, 1976.

LAKE OROVILLE OPERATION  
CAPACITY = 3,537,577 A. F.

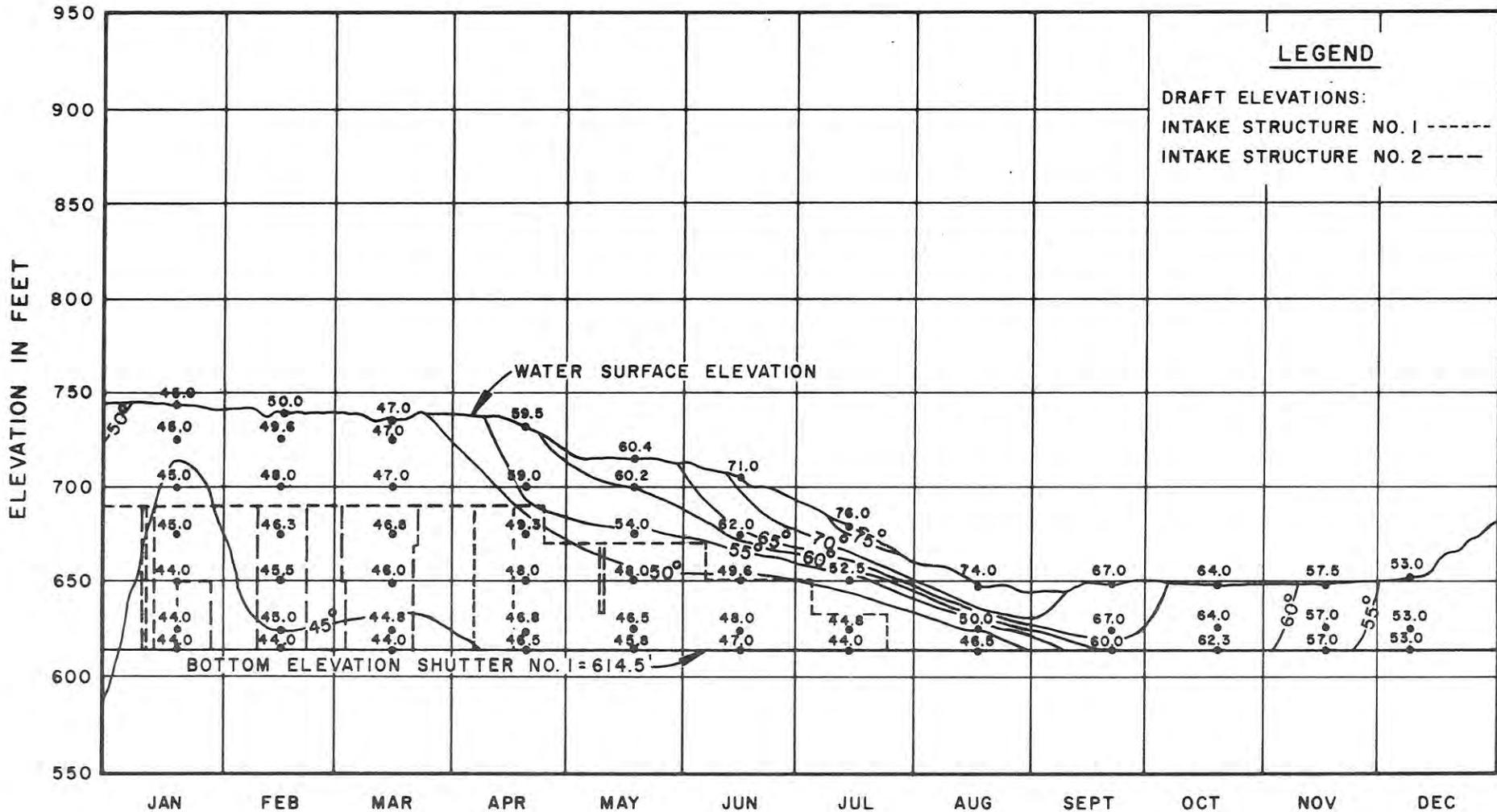


# OPERATION OF LAKE OROVILLE FOR FLOOD CONTROL 1976-77



LAKE OROVILLE  
ISOTHERMS - 1977  
( IN DEGREES FAHRENHEIT )

5-A



OROVILLE-THERMALITO COMPLEX  
MONTHLY STORAGE  
1977

Elevation in feet, storage in acre-feet

Month	Year	Thermalito Diversion Dam Pool		Thermalito Forebay		Thermalito Afterbay	
		Elevation	Storage	Elevation	Storage	Elevation	Storage
Jan.	1977	223.62	12,910	224.18	11,256	124.85	17,210
	1976	223.92	13,006	223.70	10,960	125.61	19,143
Feb.	1977	224.10	13,063	224.10	11,206	127.14	23,318
	1976	222.56	12,575	222.66	10,329	125.74	19,483
Mar.	1977	223.26	12,796	223.24	10,679	125.20	18,088
	1976	223.99	13,028	223.90	11,083	128.47	27,257
Apr.	1977	223.11	12,748	223.14	10,618	129.35	30,024
	1976	223.70	12,935	223.49	10,715	131.57	37,568
May	1977	223.19	12,774	223.22	10,667	126.17	20,627
	1976	224.00	13,031	223.90	11,083	123.80	14,690
June	1977	224.32	13,134	224.28	11,318	126.59	21,773
	1976	223.77	12,958	224.27	11,311	127.45	24,210
July	1977	223.30	12,808	223.34	10,740	128.40	27,043
	1976	223.48	12,866	223.48	10,825	127.21	23,518
Aug.	1977	223.22	12,783	223.40	10,776	130.86	35,069
	1976	222.93	12,692	223.28	10,703	128.70	27,968
Sep.	1977	223.59	12,900	223.62	10,911	124.36	16,012
	1976	223.44	12,853	223.46	10,813	129.65	30,997
Oct.	1977	222.34	12,506	220.00	10,173	123.48	13,957
	1976	222.74	12,632	222.74	10,377	124.13	15,463
Nov.	1977	223.08	12,739	223.00	10,534	124.45	16,229
	1976	223.37	12,831	223.46	10,813	125.36	18,496
Dec.	1977	222.34	12,506	222.46	10,209	124.85	17,210
	1976	224.21	13,098	224.16	11,243	124.01	15,180

CLIFTON COURT FOREBAY  
MONTHLY OPERATION  
1977

In acre-feet, except elevation, which is in feet.

Month	Year	Water Surface Elevation	End of Month Storage	Storage Change	Inflow
Jan.	1977	-2.27	13,386	-2,231	202,881
	1976	-0.11	18,026	-1,637	254,498
Feb.	1977	-1.92	14,137	751	109,441
	1976	-0.15	17,940	-86	176,429
Mar.	1977	0.62	19,599	5,462	105,892
	1976	-2.01	13,944	-3,996	228,286
Apr.	1977	-1.06	15,983	-3,616	16,653
	1976	-1.22	15,639	1,695	33,935
May	1977	0.20	18,693	2,710	80,518
	1976	0.65	19,663	4,024	53,414
June	1977	-0.96	16,198	-2,495	22,913
	1976	-2.23	13,472	-6,191	19,925
July	1977	-0.01	18,240	2,042	31,357
	1976	0.69	19,749	6,277	35,312
Aug.	1977	1.02	20,439	2,199	26,131
	1976	-1.08	15,940	-3,809	133,821
Sep.	1977	-0.57	17,036	-3,403	9,947
	1976	1.28	21,022	5,082	219,479
Oct.	1977	-0.28	17,661	625	10,325
	1976	-0.58	17,015	-4,007	80,718
Nov.	1977	0.49	19,318	1,657	52,977
	1976	-0.86	16,412	-603	93,071
Dec.	1977	0.28	18,867	-451	218,386
	1976	-1.23	15,617	-795	66,996
Total	1977	-	-	3,250	887,421
	1976	-	-	-4,046	1,395,884

LAKE DEL VALLE  
MONTHLY OPERATION  
1977

Amounts in acre-feet unless noted

MONTH	ELEVATION (feet)	STORAGE IN LAKE	STORAGE CHANGE	INFLOW		OUTFLOW				PRECIPI- TATION (Inches)
				NATURAL	SOUTH BAY AQUEDUCT	SOUTH BAY AQUEDUCT	ARROYO VALLE	<u>1/</u> RECREATION	EVAPOR- ATION	
JAN.	678.30	24,927	30	207	0	0	0	144 <sup>2/</sup>	33	1.18
FEB.	685.25	28,610	3,683	59	3,689	0	0	3	62	1.16
MAR.	696.67	35,591	6,981	-142	7,255	0	0	4	128	1.14
APR.	697.84	36,367	776	0	1,237	200	0	6	255	.09
MAY	702.52	39,574	3,207	-103	3,527	0	0	8	209	.94
JUNE	701.96	39,181	-393	-9	0	0	0	10	374	0
JULY	701.21	38,659	-522	-30	0	0	0	16	476	.12
AUG.	698.55	36,842	-1,814	-84	341	1,660	0	21	393	0
SEPT.	691.05	32,019	-4,823	176	0	4,684	0	22	293	.15
OCT.	684.61	28,250	-3,769	-80	0	3,465	0	9	214	.41
NOV.	681.65	26,642	-1,608	20	0	1,513	0	7	108	.88
DEC.	682.08	26,870	228	282	0	0	0	4	50	3.31
TOTAL	--	--	1,973	296	16,049	11,522	0	254	2,596	9.38

1/ To East Bay Regional Park District

2/ Total accumulated usage from 1/1/76 thru 2/1/77

O'NEILL FOREBAY  
MONTHLY OPERATION

In acre-feet unless noted

Month	Year	Reservoir Storage			Inflow			Outflow				Gains (+) Loss (-)
		Water Surface Elevation in ft.	Storage	Monthly Storage Change	O'Neill Pumping	San Luis Generation	Calif. Aqueduct Check 12	O'Neill Generation	San Luis Pumping	Dos Amigos Pumping	Deliveries	
January	1977	223.58	52,602	6,292	205,353	18	199,248	0	271,177	139,622	351	12,823
	1976	220.29	43,907	-7,942	171,454	12,731	242,997	0	76,904	355,279	548	-2,393
February	1977	224.03	53,811	1,209	61,737	0	96,124	442	71,827	89,849	200	5,666
	1976	220.70	44,976	1,069	159,248	5,790	160,805	0	106,639	225,044	1,163	8,072
March	1977	223.95	53,596	-215	43,590	4,475	81,172	11,488	48,493	73,961	1,082	5,572
	1976	219.52	41,917	-3,059	159,703	26,411	208,275	0	110,034	293,560	1,029	7,175
April	1977	220.24	43,777	-9,819	8,402	74,019	3,622	35,623	5,779	54,682	821	1,043
	1976	221.81	47,887	5,970	126,466	92,810	11,142	795	18,309	200,101	953	-4,290
May	1977	221.55	47,204	3,427	51,341	4,548	55,368	6,639	48,073	56,750	221	3,853
	1976	218.29	38,797	-9,090	68,031	172,200	24,319	22	0	270,748	1,211	-1,659
June	1977	222.39	49,423	2,219	377	266,706	3,156	118,968	0	149,549	958	1,455
	1976	219.34	41,454	2,657	28,620	408,384	644	40,224	0	386,480	1,300	-6,987
July	1977	217.55	36,972	-12,451	0	358,852	3,496	172,285	0	199,117	1,550	-1,847
	1976	218.44	39,174	-2,280	1,490 <sup>1/</sup>	580,728	-162 <sup>2/</sup>	66,727	0	502,143	1,695	-13,771
August	1977	219.10	40,837	3,865	10,045	261,363	1,346	113,127	0	156,974	1,315	2,527
	1976	220.70	50,243	11,069	64,657 <sup>2/</sup>	228,853	11,937	0	16,396	372,706	920	-4,356
September	1977	218.60	39,576	-1,261	34,117	102,446	648	9,318	92,405	41,380	272	4,903
	1976	223.07	51,232	989	143,966	0	192,927	0	200,955	151,961	683	17,695
October	1977	218.44	39,174	-402	4,735	69,957	0	46,715	0	30,815	84	2,520
	1976	222.16	48,812	-2,420	104,902	0	74,585	0	136,601	46,461	134	1,289
November	1977	220.92	45,549	6,375	82,399	1,287	43,581	1,131	99,108	23,647	205	3,199
	1976	221.30	46,547	-2,265	141,296	0	85,335	0	140,280	90,533	275	2,192
December	1977	224.34	54,647	9,098	130,908	0	213,995	0	297,172	56,131	201	17,699
	1976	221.21	46,310	-237	87,667	98,482	58,782	0	7,458	232,991	591	-4,128
Total	1977			8,337	633,004	1,143,671	701,756	515,736	934,034	1,072,477	7,260	59,413
	1976			-5,539	1,257,500	1,626,389	1,171,586	107,768	813,576	3,128,007	10,502 <sup>4/</sup>	-1,161

1/ Pumped for State

2/ Of this amount 41,500 acre-feet was State's share.

3/ This amount was "backed into" aqueduct at Check No. 12 and was added as negative inflow.

4/ Total includes 130 acre-feet delivered to California Department of Fish and Game for wildlife habitat area below dam.

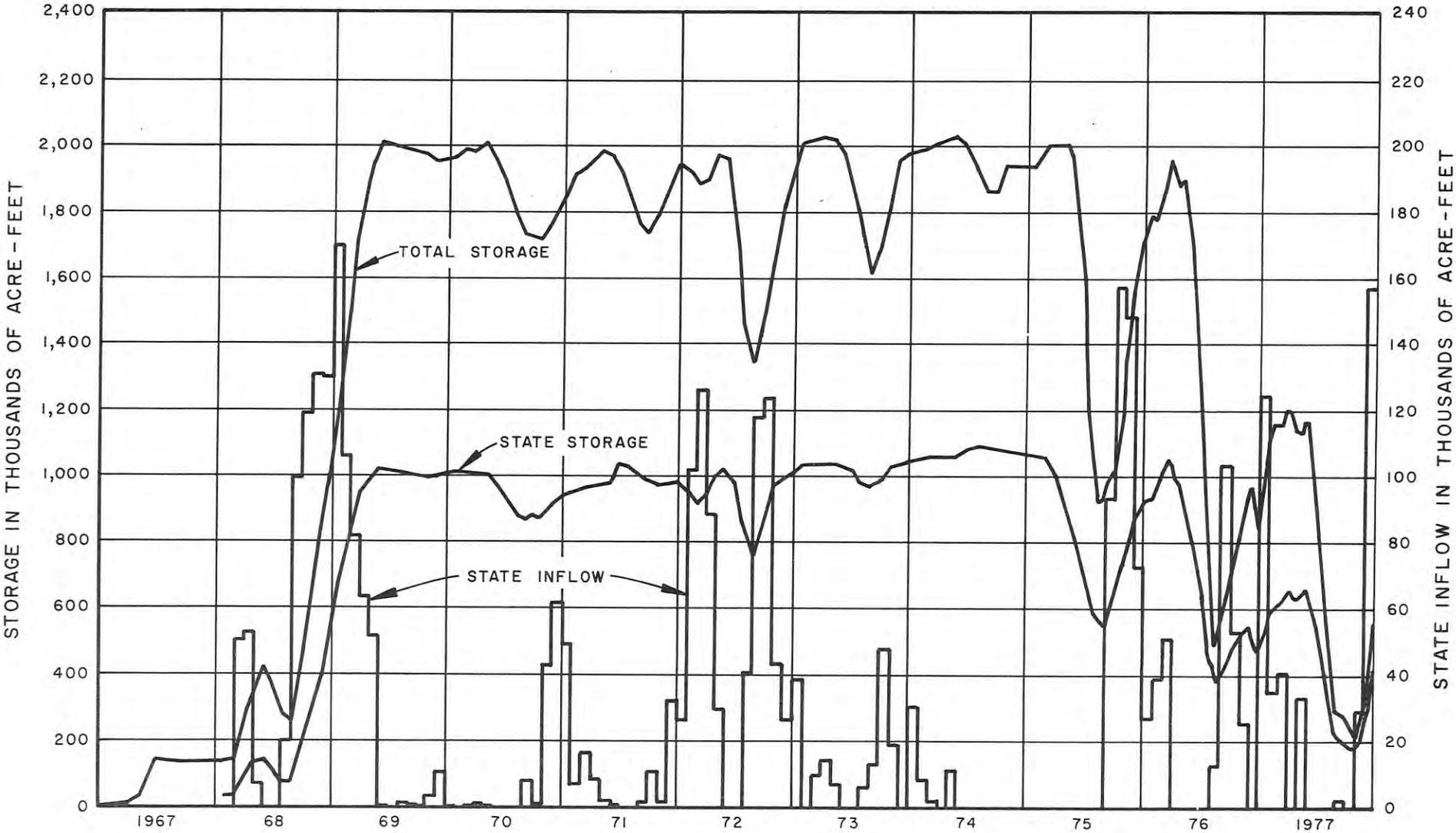
1977 SAN LUIS RESERVOIR MONTHLY OPERATION

In acre-feet unless noted

Month	Year	Reservoir Storage			Inflow	Outflow			Gain (+) Loss (-) (Computed)	Evaporation	Prec. In Inches
		Water Surface Elevation in feet	Storage	Monthly Storage Change	San Luis P-G Plant Pumping	San Luis P-G Plant Generation	Pacheco Tunnel (Future Facility)				
January	1977	462.65	1,100,328	250,652	271,177	18			20,507	631	0.83
	1976	522.87	1,777,719	55,144	76,904	12,731			-9,029	1,857	0.17
February	1977	468.92	1,165,701	65,373	71,827	0			-6,454	1,916	0.22
	1976	529.98	1,864,721	87,002	106,639	5,790			-13,847	2,426	0.75
March	1977	472.50	1,203,584	37,883	48,493	4,475			-6,135	4,764	0.55
	1976	535.78	1,936,802	72,081	110,034	26,411			-11,542	5,716	0.77
April	1977	465.80	1,133,015	-70,569	5,779	74,019			-2,329	8,258	0.00
	1976	529.57	1,859,666	-77,136	18,309	92,810			-2,635	7,567	0.43
May	1977	469.25	1,169,178	36,163	48,073	4,548			-7,362	7,014	1.39
	1976	515.12	1,684,544	-175,122	0	172,200			-2,922	12,496	0.00
June	1977	443.16	905,233	-263,945	0	266,706			2,761	10,840	0.24
	1976	479.55	1,279,350	-405,194	0	408,384			3,190	12,425	0.16
July	1977	403.66	552,297	-352,936	0	358,852			5,916	11,363	0.00
	1976	422.16	709,888	-569,462	0	580,728			11,266	-13,274	0.00
August	1977	368.06	292,948	-259,349	0	261,363			2,014	7,450	0.00
	1976	397.08	499,889	-209,999	16,396	228,853			2,458	6,946	0.72
Sept.	1977	365.08	274,178	-18,770	92,405	102,446			-8,729	4,913	0.18
	1976	418.53	677,813	177,924	200,955	0			-23,031	5,984	2.07
October	1977	352.91	202,802	-71,376	0	69,957			-1,419	3,050	0.05
	1976	432.96	808,347	130,534	136,601	0			-6,067	3,724	0.69
November	1977	368.05	292,884	90,082	99,108	1,287			-7,739	1,571	0.20
	1976	446.73	940,028	131,681	140,280	0			-8,599	1,444	0.97
December	1977	405.00	563,209	270,325	297,172	0			-26,847	871	2.59
	1976	437.36	849,676	-90,352	7,458	98,482			672	1,135	0.90
Total	1977			-286,467	934,034	1,143,671			-35,816	62,641	6.25
	1976			-872,899	813,576	1,626,389			-60,086	74,994	7.63

SAN LUIS RESERVOIR OPERATION  
CAPACITY = 2,038,771 A.F.

II - Δ



PYRAMID LAKE  
MONTHLY OPERATION

1977

Amounts in acre-feet unless noted

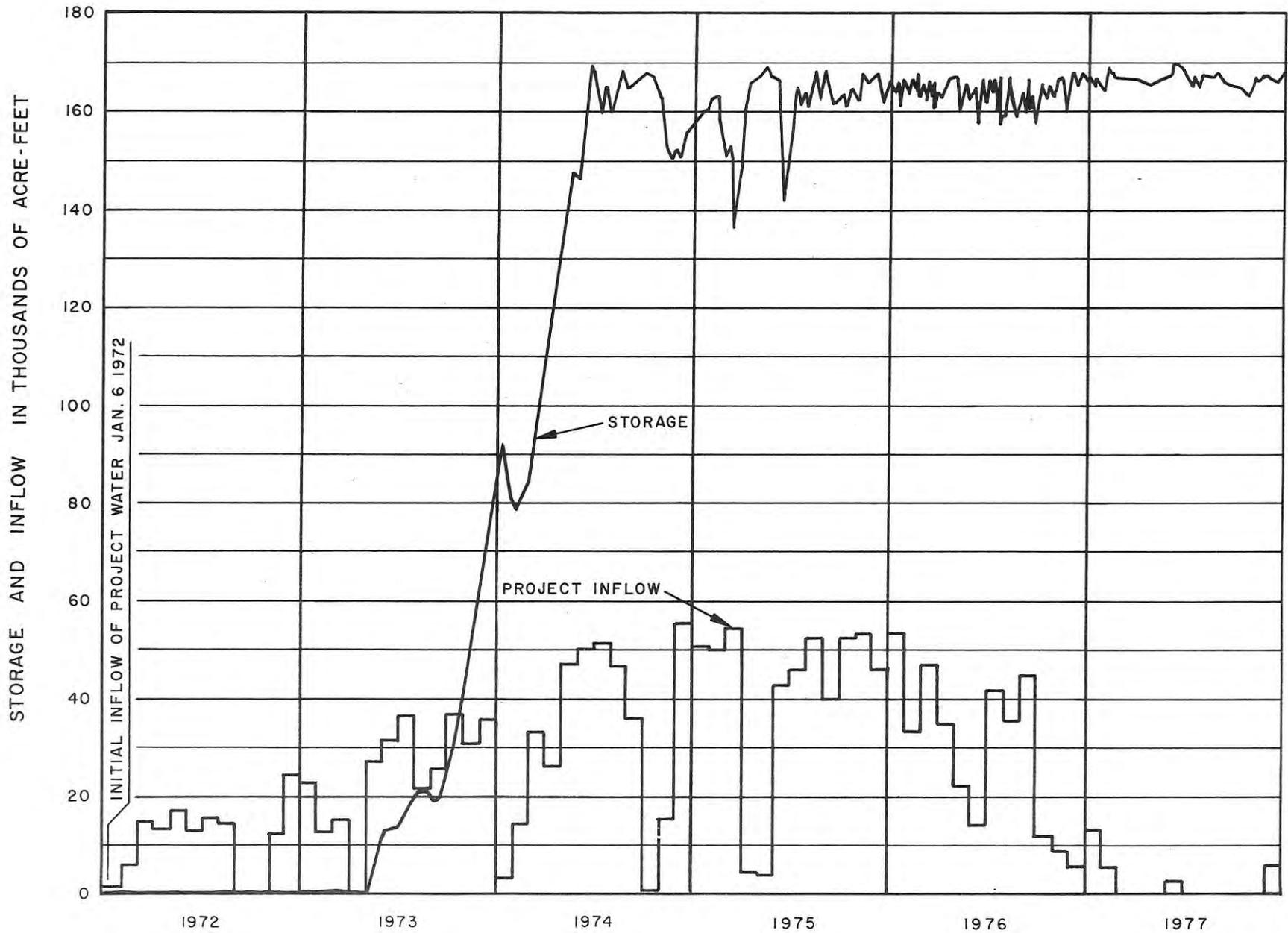
(From Preliminary Records)

MONTH	WATER SURFACE ELEVATION	TOTAL STORAGE <u>1/</u>	STORAGE CHANGE	INFLOW			OUTFLOW			COMPUTED LOSSES (-) GAINS (+)		
				NATURAL	PROJECT		ANGELES TUNNEL	TO PIRU CREEK				
					GORMAN CREEK	PUMPBACK <u>2/</u>		NATURAL INFLOW RELEASE <u>3/</u>				
JAN	2,576.1	(2,998) 167,460	1,275	1,235	13,754	3,471	14,599	2,360				-226
FEB	2,575.6	(1,759) 166,822	-638	774	5,758	0	4,656	2,013				-501
MAR	2,575.3	(2,279) 166,439	-383	803	0	200	190	283				-913
APR	2,575.0	(2,623) 166,057	-382	584	69	0	424	240				-371
MAY	2,575.8	(3,944) 167,077	1,020	1,670	0	0	556	349				255
JUN	2,576.2	(3,709) 167,588	511	378	3,101	0	1,170	613				-1,185
JUL	2,576.2	(2,846) 167,588	0	87	0	4,898	3,261	950				-774
AUG	2,576.0	(1,984) 167,332	-256	94	144	1,976	553	956				-961
SEP	2,574.4	(1,140) 165,295	-2,037	86	0	0	685	930				-508
OCT	2,575.8	(583) 167,077	1,782	102	0	4,312	579	659				-1,394
NOV	2,575.6	(482) 166,822	-255	178	0	1,476	847	279				-783
DEC	2,576.34	(1,858) 167,767	945	2,400	6,541	134	7,357	1,024				251
TOTAL			1,582	8,391	29,367	16,467	34,877	10,656				-7,110

1/ Natural inflow storage shares shown in brackets

2/ Pumpback by Los Angeles Department of Water and Power (LADWP) from Elderberry Forebay thru Castaic Powerplant.

PYRAMID LAKE OPERATION  
CAPACITY : 171,196 ACRE - FEET



ELDERBERRY FOREBAY  
MONTHLY OPERATION

1977

Amounts in acre-feet unless noted

(From Preliminary Records)

MONTH	WATER SURFACE ELEVATION IN FEET	TOTAL STORAGE <u>2/</u>	STORAGE CHANGE	INFLOW		OUTFLOW			COMPUTED LOSSES (-) GAINS (+)
				CASTAIC P.P. GENERATION	NATURAL	TO CASTAIC LAKE		PUMP-BACK TO PYRAMID LAKE. <u>1/</u>	
						NATURAL	PROJECT		
JAN	1,510.0	19,805	4,175	14,599	155	155	6,970	3,471	17
FEB	1,507.8	18,965	-840	4,656	30	30	5,420	0	-76
MAR	1,508.0	(51) 19,041	76	190	51	0	0	200	35
APR	1,509.2	(73) 19,498	457	424	22	0	0	0	11
MAY	1,511.2	(286) 20,269	771	556	213	0	0	0	2
JUN	1,514.1	(293) 21,413	1,144	1,170	7	0	0	0	-33
JUL	1,509.9	(293) 19,766	-1,647	3,261	0	0	0	4,898	-10
AUG	1,506.5	(293) 18,477	-1,289	553	0	0	0	1,976	134
SEP	1,508.3	(293) 19,155	678	685	0	0	0	0	-7
OCT	1,497.9	(293) 15,388	-3,767	579	0	0	0	4,312	-34
NOV	1,496.9	(293) 14,774	-614	847	0	0	0	1,476	15
DEC	1,517.0	(733) 22,580	7,806	7,357	440	0	0	134	143
TOTAL			6,950	34,877	918	185	12,390	16,467	197

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

2/ Natural inflow share not yet released to Castaic Lake shown in brackets.

**CASTAIC LAKE  
MONTHLY OPERATION**

1977

Amount in acre-feet unless noted

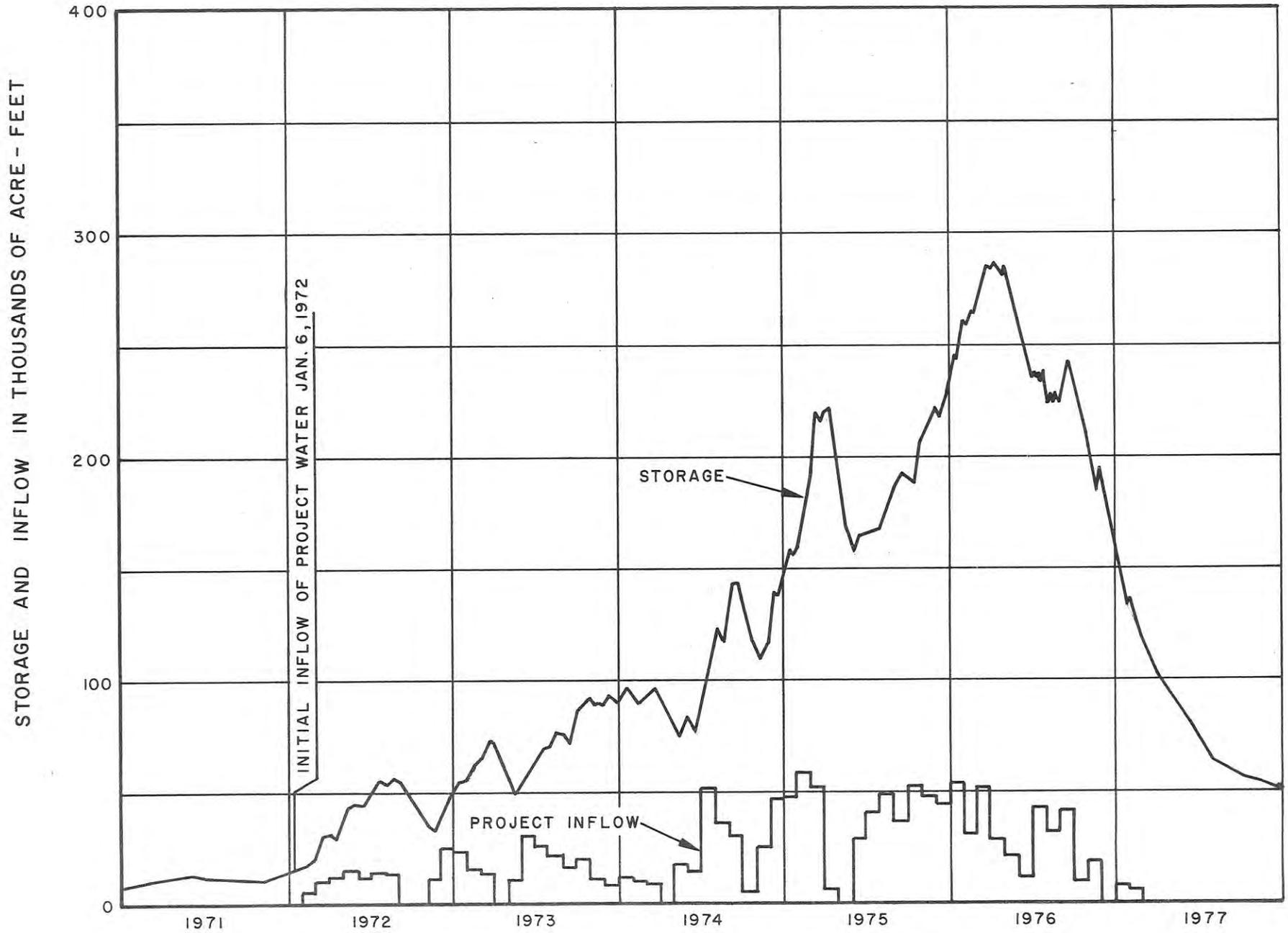
(From Preliminary Records)

MONTH	WATER SURFACE ELEVATION IN FEET	TOTAL STORAGE <u>1/</u>	STORAGE CHANGE	INFLOW			OUTFLOW		DISPOSITION OF NATURAL INFLOW		COMPUTED LOSSES (-) GAINS (+)
				NATURAL	FROM ELDERBERRY FOREBAY		DELIVERIES	RELEASED TO CASTAIC AFTERBAY	RELEASED FROM CASTAIC AFTERBAY		
					NATURAL	PROJECT			SURFACE	SUB-SURFACE	
JAN	1,411.6	(-704) 136,800	-24,118	160	155	6,970	32,539	23	0	72	1,159
FEB	1,399.8	(-806) 120,693	-16,107	76	30	5,420	22,177	3	0	208	547
MAR	1,390.3	(-952) 108,490	-12,203	86	0	0	12,504	246	0	232	461
APR	1,378.0	(-1,133) 93,716	-14,774	68	0	0	14,596	230	0	249	-16
MAY	1,371.6	(-1,086) 86,490	-7,226	253	0	0	7,764	276	0	206	561
JUN	1,362.9	(-1,244) 77,166	-9,324	26	0	0	8,619	175	0	184	-556
JUL	1,349.95	(-1,526) 64,446	-12,720	6	0	0	12,338	260	0	288	-128
AUG	1,345.8	(-1,702) 60,717	-3,729	0	0	0	3,246	348	0	176	-135
SEP	1,343.2	(-1,874) 58,457	-2,260	4	0	0	1,547	267	0	176	-450
OCT	1,340.17	(-2,081) 53,876	-2,581	5	0	0	2,353	0	0	212	-233
NOV	1,336.76	(-2,261) 53,040	-2,836	8	0	0	2,583	0	0	188	-261
DEC	1,334.3	(-2,075) 51,041	-1,999	200	0	0	2,538	0	0	14	339
TOTAL			-109,877	892	185	12,390	122,804	1,828	0	2,205	1,288

1/ Natural inflow storage shares shown in brackets.

CASTAIC LAKE OPERATION  
CAPACITY 323,702 ACRE-FEET

9T - Δ



**SILVERWOOD LAKE  
MONTHLY OPERATION**

1977

Amounts in acre-feet unless noted

(From Preliminary Records)

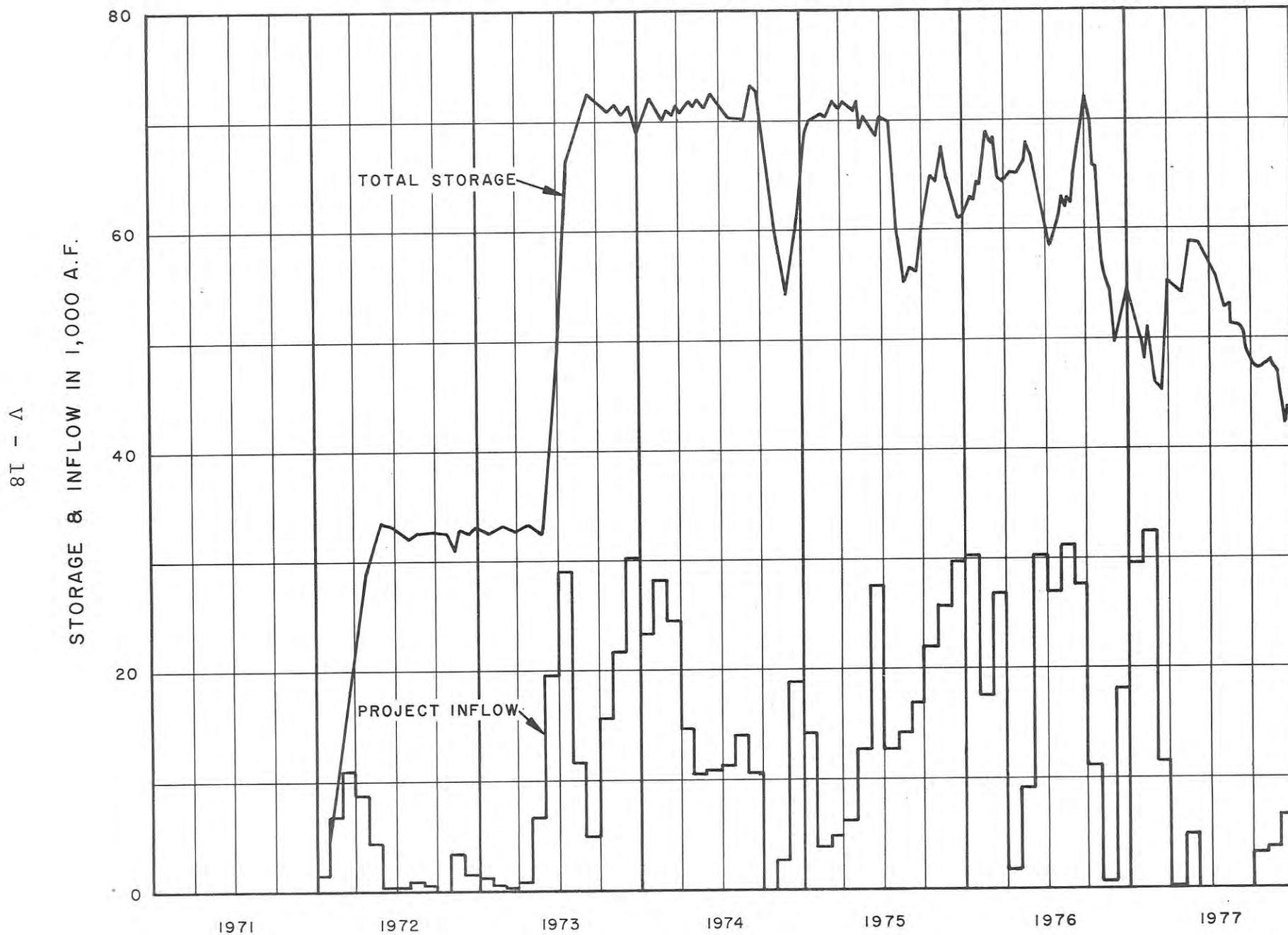
MONTH	WATER SURFACE ELEVATION IN FEET	STORAGE <u>1/</u>	STORAGE CHANGE	INFLOW		OUTFLOW			COMPUTED LOSSES	EXCHANGE OF NATURAL INFLOW <u>2/</u>
				NATURAL	PROJECT	SAN BERNARDINO TUNNEL	AT TURNOUT (CLAWA)	NATURAL INFLOW TO MOJAVE RIVER		
JAN	3,324.01	(31) 48,810	-5,835	911	29,526	36,174	82	113	97	724
FEB	3,321.8	(27) 46,288	-2,522	284	32,477	34,667	81	0	-535	288
MAR	3,333.0	(34) 55,141	8,853	363	11,480	2,966	55	0	31	356
APR	3,331.5	(35) 53,906	-1,235	276	268	1,181	93	0	-505	275
MAY	3,337.1	(465) 58,592	4,686	1,929	4,980	1,916	58	758	509	1,499
JUN	3,334.85	(37) 56,684	-1,908	201	63	1,508	94	233	-337	629
JUL	3,331.65	(0) 54,031	-2,653	22	143	2,026	137	0	-655	59
AUG	3,327.96	(0) 51,053	-2,978	10	114	2,791	135	0	-176	10
SEP	3,323.59	(0) 47,647	-3,406	41	4	3,048	138	0	-265	41
OCT	3,324.01	(-11) 47,969	322	22	3,084	2,284	132	11 <sup>3/</sup>	-358	22
NOV	3,321.46	(-23) 46,032	-1,937	35	3,292	4,859	103	12 <sup>3/</sup>	-290	47
DEC	3,316.65	(-12) 42,490	-3,542	1,478	6,760	11,033	112	1,223 <sup>4/</sup>	588	1,467
TOTAL			-12,155	5,572	92,192	104,453	1,220	2,350	-1,896	5,428

<sup>1/</sup> Natural inflow storage shares are shown in brackets.

<sup>2/</sup> Releases made from Mojave Siphon to Los Flores Ranch Co. and to Mojave River from outlet to Mojave W.A. in exchange for natural inflow stored in lake.

<sup>3/</sup> Measured Surface Seepage      <sup>4/</sup> Includes 14AF of measured surface seepage.

SILVERWOOD LAKE OPERATION  
CAPACITY = 74,970 A.F.



**LAKE PERRIS  
MONTHLY OPERATION**

1977

Amounts in acre-feet unless noted

(From Preliminary Records)

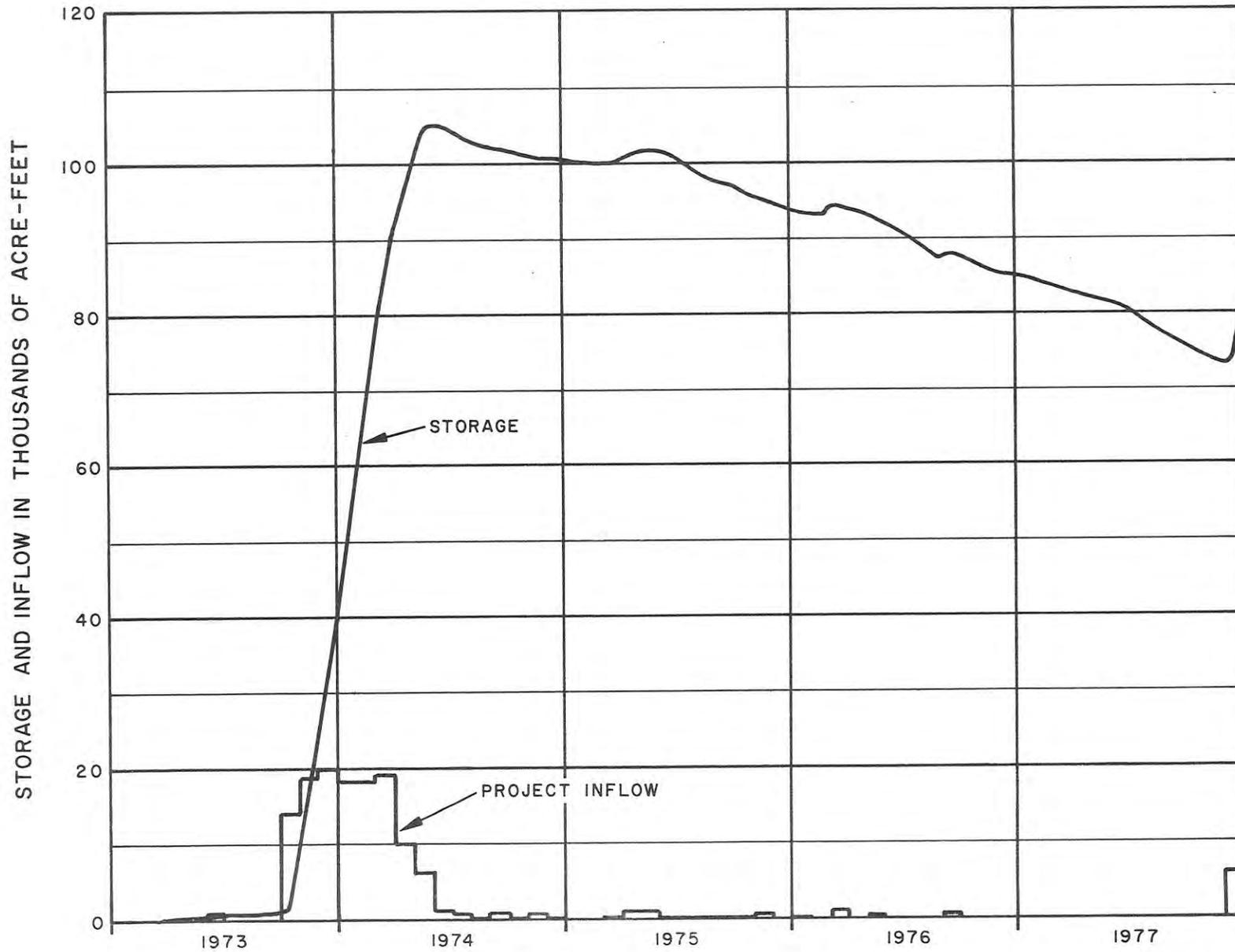
MONTH	WATER SURFACE ELEVATION IN FEET	TOTAL STORAGE	STORAGE CHANGE	INFLOW*	OUTFLOW	COMPUTED LOSSES (-) GAINS (+)
JAN	1,568.02	84,161	-296	459	164	-591
FEB	1,567.78	83,687	-474	-423	145	94
MAR	1,567.36	82,861	-826	-799	179	152
APR	1,566.91	81,979	-882	-2	209	-671
MAY	1,566.67	81,509	-470	-42	198	-230
JUN	1,566.11	80,419	-1,090	21	199	-912
JUL	1,565.03	78,335	-2,084	32	345	-1,771
AUG	1,564.44	77,208	-1,127	99	213	-1,013
SEP	1,563.51	75,441	-1,767	-13	672	-1,108
OCT	1,562.89	74,272	-1,169	123	205	-1,087
NOV	1,562.36	73,278	-994	122	198	-918
DEC	1,565.49	79,222	5,944	6,151	184	-23
TOTAL			-5,235	5,728	2,911	8,052

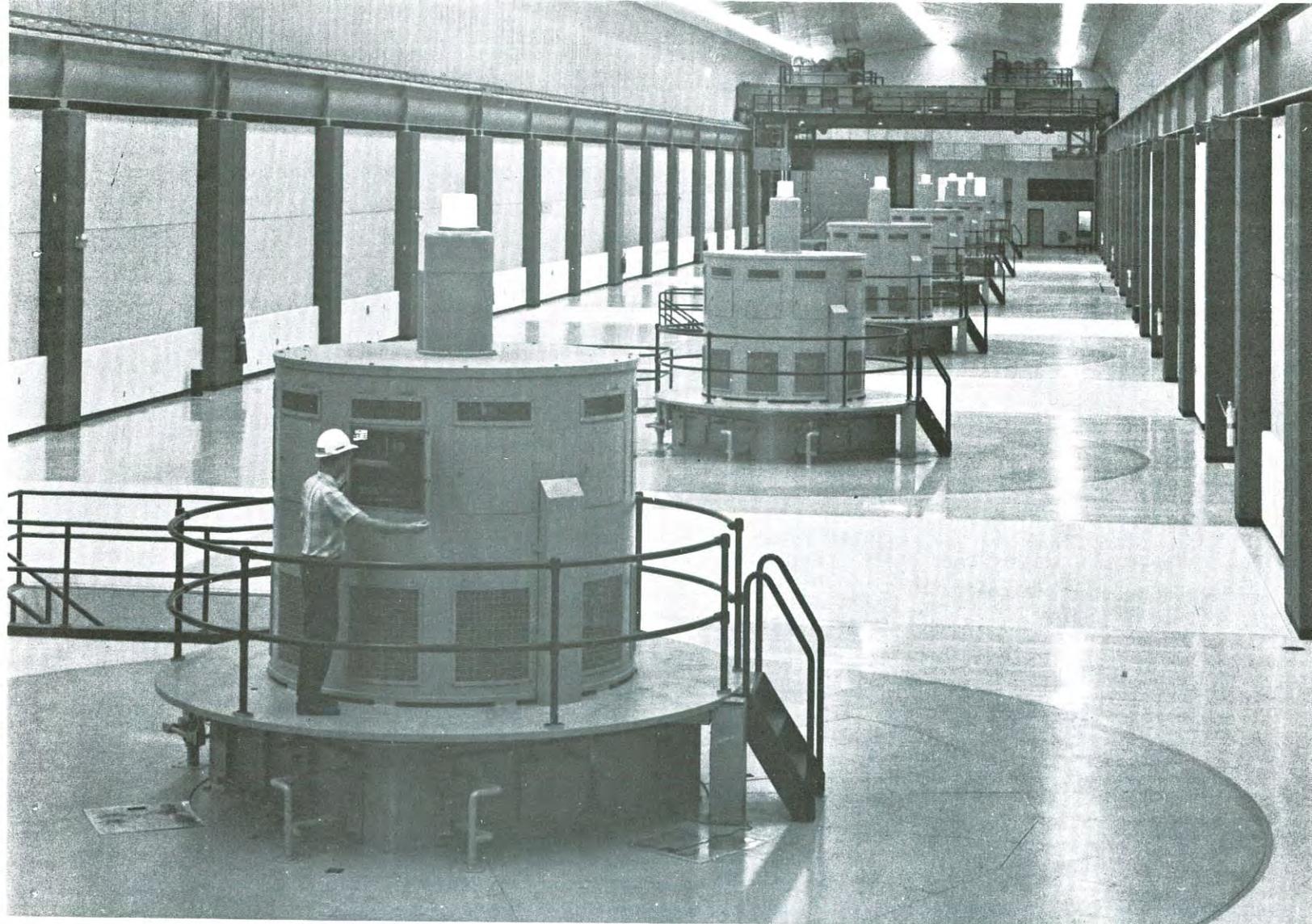
\* Inflow (computed) = Devil Canyon Powerplant release (meters read @ 2400 hrs) minus D.C. Afterbay minus D.C. Afterbay deliveries (meters read @ 0800 hrs) minus Afterbay losses plus/minus Afterbay change in storage. Time lag in reading meters sometimes causes negative values.

# LAKE PERRIS OPERATION

CAPACITY 131,452 ACRE-FEET

V - - 20



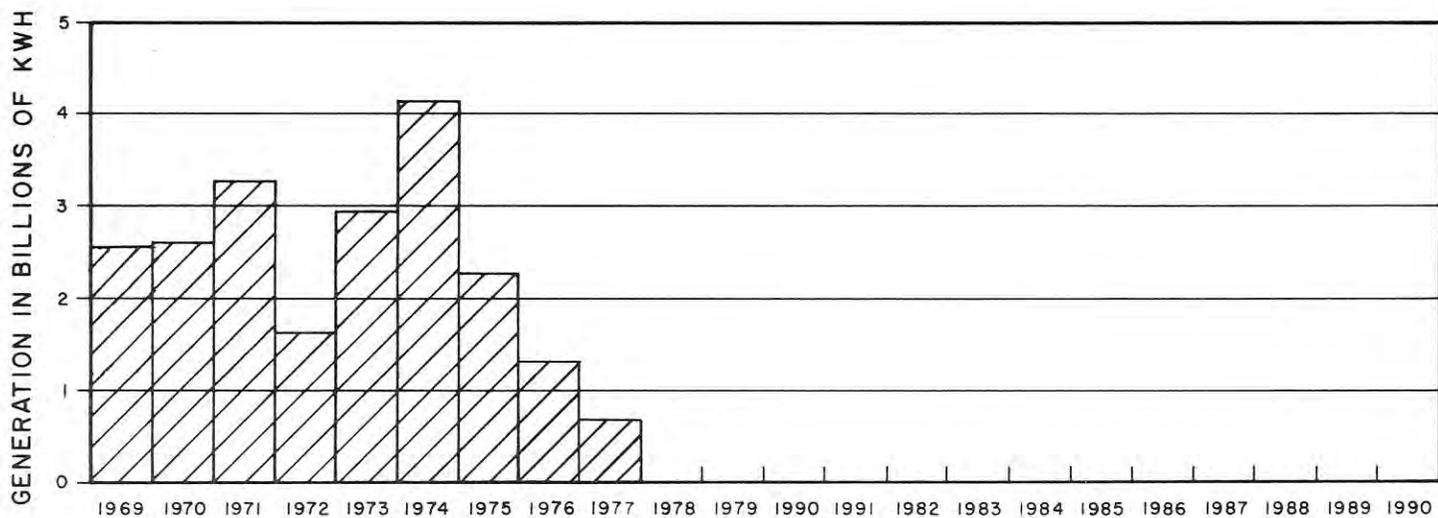


## POWER SUPPLY & USE

# OPERATION OF EDWARD HYATT & THERMALITO POWERPLANTS 1977

ENERGY IN MILLIONS OF KWH

OPERATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
ENERGY GENERATED BY EDWARD HYATT AND THERMALITO POWERPLANTS													
GROSS GENERATION	63.05	60.20	75.49	107.79	58.07	91.66	110.9J	84.58	21.82	14.37	22.95	19.75	730.63
POWERPLANT USE AND PUMPBACK REQUIREMENTS	40.40	29.92	58.41	.86	1.50	.60	1.24	.71	2.61	1.63	1.56	.97	140.41
DELIVERED TO CALIFORNIA POWER POOL COMPANIES	22.65	30.28	17.08	106.93	56.57	91.06	109.66	83.87	19.21	12.74	21.39	18.78	590.22



PROJECT POWER SUPPLY  
1977

(in kilowatt hours)

2 - IA

Source	January	February	March	April	May	June	July	August	September	October	November	December	Total
San Luis Generation													
State	3,000	0	0	7,121,683	311,167	24,579,832	23,980,141	14,903,836	1,640,539	2,311,081	88,485	0	74,939,764
USBR	0	0	948,000	8,882,317	654,833	29,858,599	39,382,859	22,625,164	10,365,078	5,499,919	41,515	0	118,258,284
Total	3,000	0	948,000	16,004,000	966,000	54,438,431	63,363,000	37,529,000	12,005,617	7,811,000	130,000	0	193,198,048
Castaic	15,000,000	5,760,000	3,192,000	0	840,000	840,000	0	18,000	0	0	0	6,264,000	31,914,000
Devil Canyon	42,802,233	41,015,687	3,098,921	1,175,126	2,255,484	1,667,921	2,046,994	2,691,418	3,108,398	2,312,345	5,373,358	12,841,094	120,388,979
Northwest Dump	0	0	0	0	0	0	0	0	0	0	0	0	0
Canadian Entitlement	37,514,474	33,637,684	37,694,304	35,222,659	36,438,548	34,330,967	37,187,700	35,828,710	36,250,310	36,519,287	35,294,332	36,392,755	432,311,730
Suppliers	179,749,305	138,308,799	76,271,968	0	42,718,678	519,441	16,310,477	14,622,456	1,746,832	156,000	1,978,704	108,446,658	580,829,318

PROJECT POWER USE  
1977

(In kilowatt hours)

PUMPING PLANT	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cordelia	398,141	349,850	346,377	281,438	388,293	441,775	303,292	396,835	427,403	466,577	327,346	175,674	4,303,001
Tracy State	1,014,600 <sup>1/</sup>	0	0	0	0	0	0	0	0	0	0	0	1,014,600
Delta State	52,352,266	31,632,690	29,890,519	4,780,018	20,975,189	5,685,908	6,418,330	4,818,566	2,920,774	2,486,380	15,689,252	60,880,398	238,530,290
USBR	10,019,052	841,194	349,452	0	1,608,030	0	0	0	200,880	0	0	6,707,780	19,726,388
South Bay	4,938,331	8,755,901	12,160,192	9,164,775	13,227,092	11,565,682	11,763,344	10,112,435	6,636,327	6,476,436	5,566,717	5,963,226	106,330,458
Del Valle	15,540	294,964	597,104	115,954	297,082	12,568	13,274	34,530	12,340	14,549	19,120	16,846	1,443,871
San Luis State	33,688,926	10,223,425	12,041,857	2,619	9,678,227	1,572	3,667	1,048	0	18,335	5,282,767	29,943,869	100,886,312
USBR	39,016,074	9,826,575	1,765,143	1,663,381	3,713,773	1,428	3,333	952	15,238,234	16,665	11,676,233	26,369,131	109,290,922
Dos Amigos State	6,830,772	7,676,984	6,639,522	4,688,562	5,875,711	13,770,361	18,207,112	15,937,155	3,738,809	3,287,512	2,361,262	5,571,697	94,585,459
USBR	11,765,228	4,310,016	3,181,478	2,920,438	1,817,289	6,585,098	9,015,888	5,602,845	1,977,191	1,222,488	1,161,738	2,341,303	51,901,000
Las Perillas	349,162	326,195	374,651	622,673	563,413	1,109,836	1,610,432	856,839	336,177	203,021	140,388	470,982	6,963,769
Badger Hill	887,728	822,715	981,363	1,660,244	1,534,087	3,033,201	4,231,509	2,314,490	842,483	476,831	313,802	1,238,387	21,156,840
Buena Vista	11,694,840	10,959,819	4,890,437	2,292,392	3,900,706	5,720,065	7,488,482	6,149,433	2,910,974	2,496,161	1,739,307	4,017,145	64,349,761
Wheeler Ridge	12,568,132	11,214,529	4,162,693	1,455,487	3,187,517	2,932,807	4,191,803	3,609,608	2,125,011	2,139,566	1,462,765	4,795,830	53,845,748
Wind Gap	27,974,464	25,281,712	8,616,484	2,503,438	6,375,034	4,337,352	6,375,034	5,734,620	4,220,913	4,686,669	2,852,755	9,664,435	108,622,910
A. D. Edmonston	97,592,487	86,932,939	29,097,686	7,994,661	20,526,833	13,036,340	19,662,545	17,429,802	13,180,388	15,629,203	9,219,069	33,707,221	364,009,174
Oso	3,700,283	1,706,959	16,845	5,615	44,920	0	0	0	0	0	0	2,206,694	7,681,316
Pearblossom	21,063,340	22,543,488	8,312,703	293,616	4,365,733	577,605	370,630	669,059	240,669	3,119,069	2,681,051	5,323,596	69,560,559
Devil Canyon (Station Service)	154,600	118,300	111,800	94,100	97,300	102,300	138,500	136,700	132,800	113,200	120,200	125,400	1,445,200

<sup>1/</sup> Pay back for mitigation water.



## WATER QUALITY

WATER QUALITY  
THERMALITO AFTERBAY AT FEATHER RIVER OUTLET

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	62	66	64	58	59	72	64	69	95	88	82	74	71
Total Hardness (mg/l)	b	47	42	43	42	43	44	47	47	58	49	48	56	47
Chlorides (mg/l)	b	2.0	1.2	2.2	1.4	1.5	2.2	2.4	2.2	1.0	2.2	2.9	2.0	1.9
Sulfates (mg/l)	b	4.1	1.6	2.3	4.8	2.3	2.1	3.0	3.6	3.3	2.8	3.0	4.4	3.1
Sodium (%)	b	21	21	22	21	23	22	19	21	17	22	21	17	21
Boron (mg/l)	b	0.1	0.0	--	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	.04
pH	c	7.4	7.3	7.3	7.6	7.8	7.3	7.6	7.5	7.6	7.5	7.5	7.4	7.4
Electrical Conductivity (Micromhos)	b	107	105	104	107	110	113	117	127	110	129	124	128	115
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/20	8/17	9/21	10/19	11/16	12/21	

I-11A

b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.

WATER QUALITY  
 PUTAH SOUTH CANAL TERMINAL RESERVOIR  
 (INFLOW TO NORTH BAY AQUEDUCT)

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	200	197	195	187	189	192	189	195	202	206	202	172	194
Total Hardness (mg/l)	b	173	162	167	162	164	164	162	163	185	166	166	138	164
Chlorides (mg/l)	b	8.1	7.3	7.3	6.3	6.6	6.1	--	6.3	5.7	7.8	7.1	7.3	6.4
Sulfates (mg/l)	b	24	20	21	23	20	14	21	4.4	21	12	22	20	19
Sodium (%)	b	13	13	14	11	14	13	12	12	10	14	13	14	13
Boron (mg/l)	b	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2
pH	c	8.4	8.6	8.8	8.7	8.8	8.8	8.5	8.7	8.6	8.6	8.7	8.0	8.6
Electrical Conductivity (Micromhos)	b	357	330	353	330 <sup>c</sup>	348	349	353	352	354	360	366	315	347
Sampling Date		1/18	2/15	3/15	4/19	5/17	6/15	7/19	8/16	9/20	10/18	11/15	12/20	

b - Laboratory analysis of monthly samples.  
 c - Field analysis of monthly samples.

WATER QUALITY  
CALIFORNIA AQUEDUCT AT DELTA PUMPING PLANT

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	406	460	477	513	535	504	598	720	698	726	690	645	582
Total Hardness (mg/l)	a	129	146	150	150	150	125	150	160	158	165	170	162	165
Chlorides (mg/l)	a	120	149	158	182	197	177	233	304	299	302	285	262	222
Sulfates (mg/l)	a	44	57	62	60	60	55	60	66	65	70	65	67	61
Sodium (mg/l)	a	79	99	103	114	123	114	145	178	170	175	167	157	135
Sodium (%)	a	57	60	60	62	64	67	68	71	70	70	68	68	65
Elect. Cond. (Micromhos)	a	692	799	835	910	954	894	1085	1266	1249	1281	1236	1156	1030
Elect. Cond. (Micromhos)	b	777	913	851	936	985	870	1140	1250	1250	1300	1320	1250	1070
pH	c	8.2	8.1	8.2	8.4	8.4	8.1	7.6	8.0	7.9	8.1	8.1	7.8	8.0
Boron (mg/l)	b	0.2	0.2	0.1	0.3	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.2	0.3
Fluoride (mg/l)	b	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00
Hexavalent Chromium (mg/l)	b									0.00				0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.04	0.02
Manganese (mg/l)	b	0.04	0.04	0.01	0.03	0.02	0.01	0.04	0.02	0.01	0.00	0.06	0.05	0.03
Magnesium (mg/l)	b	24	23	22	24	25	22	27	30	29	31	32	30	27
Copper (mg/l)	b	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01
Calcium (mg/l)	b	23	24	20	17	19	13	13	12	17	17	19	23	18
Zinc (mg/l)	b	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Phenol (mg/l)	b		0.001							0.006				0.000
Color (units)	b	8	25	25	8	10	20	8	25	15	10	15	18	16
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/20	8/17	9/21	10/19	11/16	12/21	

a - Weighted averages resulting from flow and correlation with continuous electrical conductivity.

b - Laboratory analysis of monthly samples.

c - Field analysis of monthly samples.

d - Sampling performed twice annually.

WATER QUALITY  
SOUTH BAY AQUEDUCT TERMINAL RESERVOIR

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	433	525 <sup>b</sup>	472	506 <sup>b</sup>	539	507 <sup>b</sup>	629 <sup>b</sup>	708 <sup>b</sup>	573	602	660	651	567
Total Hardness (mg/l)	a	136	155 <sup>b</sup>	150	145 <sup>b</sup>	150	124 <sup>b</sup>	144 <sup>b</sup>	151 <sup>b</sup>	160	173	175	172	153
Chlorides (mg/l)	a	127	173 <sup>b</sup>	156	187 <sup>b</sup>	200	183 <sup>b</sup>	237 <sup>b</sup>	290 <sup>b</sup>	232	232	255	265	211
Sulfates (mg/l)	a	50	66 <sup>b</sup>	62	60 <sup>b</sup>	60	50 <sup>b</sup>	61 <sup>b</sup>	68 <sup>b</sup>	60	63	65	67	61
Sodium (mg/l)	a	85	111 <sup>b</sup>	102	126 <sup>b</sup>	124	118 <sup>b</sup>	149 <sup>b</sup>	181 <sup>b</sup>	136	135	153	155	131
Sodium (%)	a	58	61 <sup>b</sup>	60	65 <sup>b</sup>	64	67 <sup>b</sup>	69 <sup>b</sup>	72 <sup>b</sup>	65	63	66	69	65
Elect. Cond. (Micromhos)	a	734	--	825	--	962	--	--	--	1037	1065	1164	1163	993
Elect. Cond. (Micromhos)	b	783	905	878	919	981	879	1032	1243	1060	1080	1100	1170	1003
pH	c	8.5	7.9	8.5	8.5	8.4	8.8	7.6	8.2	8.0	7.9	8.3	8.5	8.2
Boron (mg/l)	b	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.4	0.3	0.2
Fluoride (mg/l)	b	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00
Hexavalent Chromium (mg/l)	b d									0.00				0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.03	0.03	0.02	0.04	0.01	0.00	0.01	0.00	0.12	0.00	0.02	0.02	0.03
Manganese (mg/l)	b	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.02	0.01
Magnesium (mg/l)	b	20	23	23	24	24	23	28	28	27	27	29	30	26
Copper (mg/l)	b	0.02	0.01	0.01	0.02	0.01	0.01	0.04	0.01	0.01	0.00	0.01	0.01	0.01
Calcium (mg/l)	b	25	24	20	19	18	11	12	14	24	22	24	22	20
Zinc (mg/l)	b	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.03	0.02	0.00	0.02	0.02	0.01
Phenol (mg/l)	b d		0.004							0.000				0.002
Color (units)	b	25	20	20	20	10	10	10	25	15	8	12	15	14
Sampling Date		1/18	2/15	3/15	4/19	5/17	6/14	7/19	8/16	9/20	10/18	11/15	21/20	

- a - Weighted averages resulting from flow and correlation with continuous electrical conductivity.  
 b - Laboratory analysis of monthly samples.  
 c - Field analysis on monthly samples.  
 d - Sampling performed twice annually.

WATER QUALITY  
CALIFORNIA AQUEDUCT ENTRANCE TO O'NEILL FOREBAY

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	445	471	518	474b	526	545	551b	578b	660b	627b	687	725	620
Total Hardness (mg/l)	a	145	148	150	145b	150	145	149b	157b	172b	162b	170	172	155
Chlorides (mg/l)	a	137	154	178	168b	191	202	218b	219b	254b	247b	283	307	213
Sulfates (mg/l)	a	55	57	65	60b	60	60	60b	63b	53b	62b	65	71b	61
Sodium (mg/l)	a	88	101	113	113b	119	128	135b	136b	150b	150b	165	194	133
Sodium (%)	a	57	60	62	63b	63	66	66b	65b	65b	67b	68	71	64
Elect. Cond. (micromhos)	a	768	817	913	--	935	978	--	--	--	--	1229	1275	988
Elect. Cond. (micromhos)	b	783	866	904	867	991	997	1030	1060	1090	1120	1050	1260	1002
pH	c	8.0	8.2	8.4	9.3	8.0	8.9	8.5	9.3	9.6	7.7	9.5	8.1	8.6
Boron (mg/l)	b	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2
Fluoride (mg/l)	b	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.02	0.00	0.00
Hexavalent Chromium (mg/l)	b d									0.00	0.00			0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.02	0.03	0.02	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.03	0.04	0.01
Manganese (mg/l)	b	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.01
Magnesium (mg/l)	b	22	22	22	22	25	27	25	25	27	26	26	30	25
Copper (mg/l)	b	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00
Calcium (mg/l)	b	25	25	22	22	18	15	19	21	25	22	27	23	21
Zinc (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Phenol (mg/l)	b d		0.002							0.000				0.001
Color (units)	b	8.0	20	20	15	10	--	10	15	8	2	8	15	11
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/20	8/17	9/21	10/19	11/16	12/21	

a - Weighted average resulting from flow and correlation with continuous electrical conductivity

b - Laboratory analysis of monthly samples.

c - Field analysis of monthly samples.

d - Sampling performed twice annually.

WATER QUALITY  
CALIFORNIA AQUEDUCT AT CHECK 13

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	463	482	517	416	470	361	331	336	450	428	578	667	458
Total Hardness (mg/l)	a	160	168	170	153	163	126	123	122	145	140	180	190	153
Chlorides (mg/l)	a	130	147	165	120	148	105	95	95	130	135	210	245	144
Sulfates (mg/l)	a	70	78	80	65	78	49	45	47	61	54	75	92	66
Sodium (mg/l)	a	96	100	108	87	98	76	69	68	88	90	125	152	96
Sodium (%)	a	57	57	58	55	57	57	55	55	57	58	60	58	57
Elect. Cond. (micromhos)	a	814	851	915	742	833	653	611	612	749	762	1014	1147	809
Elect. Cond. (micromhos)	b	885	895	941	736	991	626	622	628	722	760	1090	1110	834
pH	c	7.4	7.9	7.7	8.2	10.4	8.3	8.1	8.2	8.2	8.1	7.6	7.4	8.1
Boron (mg/l)	b	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.2
Fluoride (mg/l)	b	0.2	0.3	0.2	--	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.01	0.00
Hexavalent Chromium (mg/l)	b d									0.00				0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01
Manganese (mg/l)	b	0.02	0.02	0.02	0.03	0.00	0.02	0.02	0.01	0.02	0.00	0.01	0.03	0.02
Magnesium (mg/l)	b	27	24	28	20	27	18	16	18	20	19	30	32	23
Copper (mg/l)	b	0.04	0.02	0.04	0.02	0.01	0.03	0.02	0.01	0.01	0.00	0.01	0.01	0.02
Calcium (mg/l)	b	26	26	19	23	19	19	23	22	26	24	27	25	23
Zinc (mg/l)	b	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.01
Phenol (mg/l)	b d		0.001							0.000				0.001
Color (units)	b	25	20	20	15	10	8	8	10	8	8	12	20	12
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/20	8/17	9/21	10/19	11/16	12/21	

- a - Weighted average resulting from flow and correlation with continuous electrical conductivity.
- b - Laboratory analysis of monthly samples.
- c - Field analysis of monthly samples.
- d - Sampling performed twice annually.

9-IIA

WATER QUALITY  
CALIFORNIA AQUEDUCT NEAR KETTLEMAN CITY

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	465	473	526	526	394	431	349	342	391	443	480b	540	447
Total Hardness (mg/l)	a	161	163	170	165	148	136	125	124	137	143	147b	168	149
Chlorides (mg/l)	a	136	143	170	175	115	133	100	97	110	139	157b	176	138
Sulfates (mg/l)	a	70	76	80	75	59	60	50	50	59	65	67b	86	66
Sodium (mg/l)	a	97	98	110	113	84	91	71	70	75	95	106b	119	94
Sodium (%)	a	57	57	59	60	55	59	55	55	54	59	61b	59	58
Elect. Cond. (micromhos)	a	817	834	930	932	714	769	633	622	659	791	--	958	787
Elect. Cond. (micromhos)	b	863	824	960 <sup>c</sup>	936	659	808	627	635	657	835	856	1190	821
pH	c	7.9	7.9	8.5	8.7	8.7	8.3	8.6	8.4	8.7	8.6	8.6	8.4	8.4
Boron (mg/l)	b	0.2	0.3	0.4	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.2
Fluoride (mg/l)	b	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
Hexavalent Chromium(mg/l)	b d									0.00				0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.01	0.01	0.03	0.01	0.00	0.01	0.18	0.01	0.00	0.00	0.01	0.01	0.02
Manganese (mg/l)	b	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Magnesium (mg/l)	b	24	21	--	25	19	22	18	17	19	21	22	32	22
Copper (mg/l)	b	0.05	0.03	0.01	0.01	0.02	0.03	0.05	0.01	0.01	0.00	0.01	0.01	0.02
Calcium (mg/l)	b	30	28	--	21	20	20	21	22	27	24	23	28	24
Zinc (mg/l)	b	0.02	0.04	0.01	0.01	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.01	0.01
Phenol (mg/l)	b d		0.001							0.000				0.000
Color (units)	b	25	20	20	20	5	8	8	10	5	2	8	10	12
Sampling Date		1/18	2/16	3/16	4/20	5/18	6/15	7/20	8/17	9/21	10/19	11/16	12/21	

a - Weighted average resulting from flow and correlation with continuous electrical conductivity.  
 b - Laboratory analysis of monthly samples.  
 c - Field analysis of monthly samples.  
 d - Sampling performed twice annually.

VII-7

WATER QUALITY  
COASTAL BRANCH AQUEDUCT AT CHECK 5

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	381	433	479	486	368	386	326	342	382	442	462	490	415
Total Hardness (mg/l)	a	144	156	168	167	135	130	121	124	133	142	145	160	144
Chlorides (mg/l)	a	109	132	150	155	107	115	92	97	107	137	148	146	125
Sulfates (mg/l)	a	54	68	80	75	51	55	43	50	50	65	67	76b	61
Sodium (mg/l)	a	82	92	100	102	78	82	69	70	74	94	100	107	88
Sodium (%)	a	56	56	57	57	56	58	55	55	55	59	60	59	57
Elect. Cond. (micromhos)	a	689	778	851	862	667	695	595	623	643	788	821	887	741
Elect. Cond. (micromhos)	b	745	825	865b	945	678	988	631	633	668	833	788	927	794
pH	c	7.2	7.6	8.6	9.3	8.8	7.6	7.5	7.7	7.6	8.4	8.9	7.3	8.0
Boron (mg/l)	b	0.3	0.2	0.4	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2
Fluoride (mg/l)	b	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00
Hexavalent Chromium(mg/l)	b		0.00							0.00				0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.01	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Manganese (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Magnesium (mg/l)	b	23	21	27	25	9.1	26	16	16	19	21	20	26	21
Copper (mg/l)	b	0.02	0.04	0.01	0.03	0.03	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.02
Calcium (mg/l)	b	25	29	25	21	21	21	24	24	27	23	25	30	25
Zinc (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.02	0.01	0.00
Phenol (mg/l)	b									0.000				0.00
Color (units)	b		0.0002											--
Sampling Date		1/18	2/16	3/15	4/19	5/17	6/15	7/19	8/17	9/20	10/18	11/15	12/20	

8-IIA

- a - Weighted average resulting from flow and correlation with continuous electrical conductivity.
- b - Laboratory analysis of monthly samples.
- c - Field analysis of monthly samples.
- d - Sampling performed twice annually.

WATER QUALITY  
CALIFORNIA AQUEDUCT AT CHECK 29

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	371	455	470	525	491	421	344	351	382	374	427	470	423
Total Hardness (mg/l)	a	138	160	159	165	170	134	125	127	133	133	140	156	145
Chlorides (mg/l)	a	104	138	144	175	156	129	99	101	107	101	130	147	128
Sulfates (mg/l)	a	53	73	76	75	78	60	50	50	50	58	63	74	63
Sodium (mg/l)	a	75	95	98	113	103	89	71	74	74	78	90	102	89
Sodium (%)	a	54	56	57	60	57	59	55	56	55	56	58	58	57
Elect. Cond. (micromhos)	a	662	810	834	930	871	753	626	637	642	665	762	842	753
Elect. Cond. (micromhos)	b	686	827	822	969	923	810	610	632	646	676	827	844	773
pH	c	7.1	7.1	8.8	9.2	8.1	8.2	7.6	7.7	8.6	7.7	8.2	8.1	8.0
Boron (mg/l)	b	0.3	0.2	0.3	0.3	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2
Fluoride (mg/l)	b	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00
Hexavalent Chromium (mg/l)	b		0.00							0.00				0.00
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.00	0.01	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.42	0.04
Manganese (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Magnesium (mg/l)	b	18	23	22	23	27	22	16	17	19	18	21	24	21
Copper (mg/l)	b	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.03	0.01
Calcium (mg/l)	b	28	26	26	29	18	20	24	22	25	24	24	28	25
Zinc (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.01	0.00
Phenol (mg/l)	b									0.000				0.000
Color (units)	b	10	20	20	20	5	5	10	12	8	5	10	8	11
Sampling Date		1/18	2/16	3/15	4/19	5/17	6/15	7/19	8/17	9/20	10/18	11/15	12/20	

a - Weighted averages resulting from flow and correlation with continuous electrical conductivity.  
 b - Laboratory analysis of monthly samples.  
 c - Field analysis of monthly samples.  
 d - Sampling performed twice annually.

6-III A

WATER QUALITY  
CALIFORNIA AQUEDUCT AT TEHACHAPI AFTERBAY

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	355	450	442	486	515	543b	392b	+	427b	370b	458b	386	439
Total Hardness (mg/l)	a	132	160	154	167	167	169b	134b		138b	145b	152b	147	151
Chlorides (mg/l)	a	98	138	127	155	171	198b	140b		104b	109b	105b	128	134
Sulfates (mg/l)	a	47	73	76	75	80	73b	59b		54b	75b	90b	82	71
Sodium (mg/l)	a	72	96	92	100	113	122b	87b		73b	82b	84b	85	91
Sodium (%)	a	54	57	57	57	60	60b	57b		53b	55b	54b	56	61
Elect. Cond. (micromhos)	a	625	812	783	863	923	--	--		--	--	--	746	792
Elect. Cond. (micromhos)	b	585	858	839	898	974	974	726		644	716	717	877	801
pH	c	8.6	8.5	8.9	8.7	8.2	8.7	8.8		8.6	8.6	8.5	8.6	8.6
Boron (mg/l)	b	0.2	0.3	0.3	0.3	0.3	0.3	0.2		0.2	0.3	0.34	0.25	0.3
Fluoride (mg/l)	b	0.2	0.3	0.2	0.2	0.2	0.3	0.1		0.1	0.2	0.2	0.2	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00*		0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--		0.00	0.00	0.00	0.00	0.00
Hexavalent Chromium(mg/l)	b													
Arsenic (mg/l)	d													
	b	0.00	0.00	0.00	0.00	0.00	0.00	--		0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.02	0.02	0.01	0.01	0.01	0.01	0.06		0.00	0.01	0.01	0.01	0.01
Manganese (mg/l)	b	0.00	0.06	0.00	0.02	0.00	0.00	0.00		0.01	0.00	0.01	0.01	0.01
Magnesium (mg/l)	b	16	24	24	23	25	24	18		17	17	17	20	20
Copper (mg/l)	b	0.01	0.00	0.00	0.01	0.00	0.00	0.00		0.00	0.00	0.01	0.01	0.00
Calcium (mg/l)	b	24	30	30	29	32	28	20		27	29	32	28	28
Zinc (mg/l)	b	0.03	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Phenol (mg/l)	b													
	a													
Color (units)	b	5	13	10	6	5	5	5			3	3		6
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/11		9/21	10/19	11/15	12/20	

07-11A

a - Weighted averages resulting from flow and correlation with continuous electrical conductivity.  
 b - Laboratory analysis of monthly samples. \* Minor elements sampled on 7/20.  
 c - Field analysis of monthly samples. + Analysis not received.  
 d - Sampling performed twice annually.

WATER QUALITY  
PYRAMID LAKE AT ENTRANCE TO ANGELES TUNNEL

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	262	275	253	273	315	298	325	330	376	309	--	252	297
Total Hardness (mg/l)	b	122	129	129	128	128	130	142	145	142	144	--	139	134
Chlorides (mg/l)	b	62	63	66	66	66	66	74	78	74	77	--	68	69
Sulfates (mg/l)	b	45	45	48	49	51	55	60	61	61	63	--	61	54
Sodium (mg/l)	b	47	47	47	53	53	49	57	59	61	60	--	54	53
Sodium (%)	b	45	44	44	47	47	44	46	46	47	47	--	45	46
Boron (mg/l)	b	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.3	--	0.27	0.3
pH	c	8.1	8.0	8.4	9.1	9.3	9.2	8.7	8.6	8.8	8.4	8.8		8.6
Elect. Cond. (micromhos)	b	491	492	506	501	508	524	569	570	573	605	--	569	537
Fluoride (mg/l)	b	0.3	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	--	0.3	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Hexavalent Chromium (mg/l)	b													
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Iron (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.00	0.00		0.00
Manganese (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01		0.00
Magnesium (mg/l)	b	15	16	15	14	14	14	17	17	15	16	--	15	15
Copper (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Calcium (mg/l)	b	24	25	27	28	28	29	29	30	32	31	--	31	28
Zinc (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Phenol (mg/l)	b													
Color (units)	b	4	5	2	2	5	2	5	3	--	3	3		3
Sampling Date		1/18	2/15	3/15	4/22	5/17	6/7	7/19	8/2	9/20	10/18	11/18	12/28	

II-11A

b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

WATER QUALITY  
CASTAIC LAKE AT OUTLET WORKS

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	272	286	261	307	282	301	348	371	406	319	347	275	315
Total Hardness (mg/l)	b	144	148	152	155	158	162	184	193	204	195	193	213	175
Chlorides (mg/l)	b	46	46	48	47	48	48	52	55	52	54	49	52	50
Sulfates (mg/l)	b	66	66	70	76	80	87	106	108	112	108	120	115	93
Sodium (mg/l)	b	38	38	38	41	41	39	44	46	48	44	46	46	42
Sodium (%)	b	36	35	35	36	36	34	34	34	35	33	34	32	35
Boron (mg/l)	b	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.3	0.2	0.24	0.2
pH	c	7.8	8.1	8.3	8.7	8.7	8.8	8.4	--	8.4	8.5	8.5	8.4	8.4
Elect. Cond. (micromhos)	b	478	474	491	502	516	532	580	601	615	629	617	670	559
Fluoride (mg/l)	b	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.3	0.4	0.3
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00	0.00	0.00
Hexavalent Chromium (mg/l)	b													
Arsenic (mg/l)	d													
	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.03	0.01	0.00	0.00	0.01
Manganese (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
Magnesium (mg/l)	b	15	14	15	14	14	15	18	19	18	17	17	19	16
Copper (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00
Calcium (mg/l)	b	33	36	36	39	40	40	44	46	52	50	49	54	43
Zinc (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
Phenol (mg/l)	b													
	d													
	b													
Color (units)	b	5	5	2	4	7	4	5	3	--	3	3		4
Sampling Date		1/17	2/14	3/14	4/19	5/16	6/6	7/18	8/1	9/19	10/17	11/14	12/1 <sup>o</sup>	

b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

WATER QUALITY  
CALIFORNIA AQUEDUCT AT PEARBLOSSOM PUMPING PLANT

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	327	518	448b	472b	549b	580b	716b	*	859b	368b	440b	383b	515
Total Hardness (mg/l)	a	125	176	170b	162b	173b	182b	194b		238b	134b	144b	147b	168
Chlorides (mg/l)	a	89	162	150b	153b	194b	208b	273b		307b	118b	109b	110b	170
Sulfates (mg/l)	a	47	83	82b	76b	87b	89b	100b		115b	61b	81b	82b	82
Sodium (mg/l)	a	69	108	96b	104b	127b	134b	178b		195b	82b	84b	86b	115
Sodium (%)	a	55	57	55b	58b	61b	61b	66b		63b	56b	55b	55b	58
Elect. Cond. (micromhos)	a	593	916	--	--	--	--	--		--	--	--	--	755
Elect. Cond. (micromhos)	b	541	892	839	845	988	1064	1180		1427	709	693	700	898
pH	c	9.0	9.2	9.8	9.0	8.8	9.3	9.7		9.5	8.8	9.2	8.4	9.1
Boron (mg/l)	b	0.2	0.3	0.3	0.3	0.3	0.4	0.4		0.4	0.3	0.3	0.24	0.03
Fluoride (mg/l)	b	0.2	0.2	0.2	0.2	0.1	0.1	0.2		0.3	0.1	0.1	0.3	0.02
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00		0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--		0.00	0.00	0.00		0.00
Hexavalent Chromium(mg/l)	b													
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--		0.00	0.00	0.00		0.00
Iron (mg/l)	b	0.01	0.01	0.01	0.02	0.01	0.01	0.01		0.00	0.01	0.01		0.01
Manganese (mg/l)	b	0.00	4.30	0.02	0.01	0.00	0.00	0.00		0.00	0.00	0.01		0.4
Magnesium (mg/l)	b	15	25	23	21	25	26	29		35	18	18	18	23
Copper (mg/l)	b	0.00	0.01	0.01	0.01	0.01	0.01	0.00		0.00	0.00	0.01		0.01
Calcium (mg/l)	b	22	31	30	30	28	30	30		37	24	28	29	29
Zinc (mg/l)	b	0.02	0.01	0.00	0.00	0.01	0.00	0.00		0.00	0.01	0.00		0.01
Phenol (mg/l)	b													
Color (units)	b	5	5	17	17	3	12	8		--	3	3	3	8
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/20		9/21	10/19	11/15	12/20	

a - Weighted averages resulting from flow and correlation with continuous electrical conductivity.  
 b - Laboratory analysis of monthly samples.  
 c - Field analysis of monthly samples.  
 d - Sampling performed twice annually.

\* Analysis not received

VII-13

WATER QUALITY  
CALIFORNIA AQUEDUCT AT INLET TO MOJAVE SIPHON  
1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	a	324	491 b	437 b	490 b	527b	583b	785b	935b	1005b	845b	372b	391b	599
Total Hardness (mg/l)	a	123	177 b	170 b	157 b	176b	184b	226b	232b	326b	230b	144b	150b	191
Chlorides (mg/l)	a	90	161 b	153 b	153 b	188b	218b	278b	318b	387b	327b	109b	105b	207
Sulfates (mg/l)	a	42	81 b	78 b	74 b	92b	98b	116b	131b	145b	116b	74b	87b	95
Sodium (mg/l)	a	68	104 b	96 b	100 b	126b	142b	178b	203b	249b	204b	82b	86b	137
Sodium (%)	a	55	55 b	55 b	58 b	60	62b	62b	65b	61b	65b	55b	55b	59
Elect. Cond. (micromhos)	a	586	-	--	--	--	--	--	--	--	--	--	--	--
Elect. Cond. (micromhos)	b	541	905	839	825	988	1098	1330	1470	1846	1525	720	758	1070
pH	c	9.3	9.0	10.1	8.3	8.3	8.8	8.8	--	9.2	9.6	7.7	8.6	8.8
Boron (mg/l)	b	0.2	0.3	0.3	0.3	0.4	0.4	0.6	0.6	1.08	0.5	0.2	0.19	0.4
Fluoride (mg/l)	b	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.4	0.2	0.2	0.4	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00	0.00	0.00
Hexavalent Chromium(mg/l)	b													
Arsenic (mg/l)	d													
	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00	0.00	0.00
Iron (mg/l)	b	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Manganese (mg/l)	b	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Magnesium (mg/l)	b	15	23	23	21	24	27	34	33	43	34	18	17	26
Copper (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00
Calcium (mg/l)	b	24	33	30	28	31	29	35	39	60	36	0.00	32	34
Zinc (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Phenol (mg/l)	b													
	d													
Color (units)	b	5	5	7	5	5	7	8	--	--	5	3		7
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15	7/19	8/2	9/21	10/19	11/17	12/20	

a - Weighted averages resulting from flow and correlation with continuous electrical conductivity.  
b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

WATER QUALITY  
SILVERWOOD LAKE AT OUTLET TO MOJAVE RIVER

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	281	361	338	415	382	405	476	469	473	411	494	421	411
Total Hardness (mg/l)	b	115	142	152	148	151	153	155	158	161	160	160	160	151
Chlorides (mg/l)	b	79	113	121	125	128	141	134	139	132	142	140	134	127
Sulfates (mg/l)	b	41	54	59	63	64	65	66	67	65	66	67	68	62
Sodium (mg/l)	b	58	76	79	86	86	91	90	90	87	94	94	92	85
Sodium (%)	b	53	53	53	55	55	56	55	55	53	55	55	55	54
Boron (mg/l)	b	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.1	0.3	0.4	0.27	0.3
pH	c	8.4	9.1	8.7	9.5	7.2	9.3	8.8	8.8	7.7	8.6	8.4		8.5
Elect. Cond. (micromhos)	b	540	683	716	732	747	750	760	773	773	835	810	812	744
Fluoride (mg/l)	b	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.3	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Hexavalent Chromium(mg/l)	b													
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Iron (mg/l)	b	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00		0.00
Manganese (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01		0.00
Magnesium (mg/l)	b	14	18	20	19	19	20	20	20	19	20	20	20	19
Copper (mg/l)	b	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00		0.00
Calcium (mg/l)	b	23	27	28	28	29	29	29	30	33	31	32	31	29
Zinc (mg/l)	b	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00		0.00
Phenol (mg/l)	b													
Color (units)	b	5	3	4	7	7	8	8	8	--	3	3		6
Sampling Date		1/17	2/14	3/15	4/20	5/19	6/28	7/19	8/2	9/20	10/17	11/14	12/19	

b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

VII-15

WATER QUALITY  
SILVERWOOD LAKE AT INLET TO SAN BERNARDINO TUNNEL

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	269	310	380	415	360	409	510	466	473	406	481	379	405
Total Hardness (mg/l)	b	115	129	150	147	144	146	155	157	161	162	159	156	148
Chlorides (mg/l)	b	75	91	120	124	119	136	134	139	132	149	142	136	125
Sulfates (mg/l)	b	39	45	59	62	61	64	66	67	65	64	68	66	61
Sodium (mg/l)	b	55	63	79	85	82	88	90	90	88	94	96	94	84
Sodium (%)	b	50	51	53	55	55	56	50	55	54	55	56	56	54
Boron (mg/l)	b	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.3	0.2	0.3	0.4	0.27	0.3
pH	c	8.4	9.0	9.1	9.1b	9.1	9.2	8.8	9.0	7.7	8.5	8.1		8.7
Elect. Cond. (micromhos)	b	518	587	709	732	708	745	756	771	773	816	806	812	728
Fluoride (mg/l)	b	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.3	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Hexavalent Chromium (mg/l)	b													
Arsenic (mg/l)	b d	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Iron (mg/l)	b	0.00	0.01	0.08	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01		0.01
Manganese (mg/l)	b	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01		0.00
Magnesium (mg/l)	b	14	15	20	18	18	18	20	20	19	20	20	19	18
Copper (mg/l)	b	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01		0.00
Calcium (mg/l)	b	23	27	27	29	28	29	29	29	33	32	31	31	29
Zinc (mg/l)	b	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.01		0.00
Phenol (mg/l)	b													
Color (units)	b d	5	5	4	7	7	5	8	8	--	3	3		6
Sampling Date		1/17	2/14	3/15	4/20	5/19	6/28	7/19	8/2	9/20	10/17	11/14	12/19	

b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

VII-16

WATER QUALITY  
DEVIL CANYON AFTERBAY

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	297	340	364	410	362	384	*	*	487	434	436	384	390
Total Hardness (mg/l)	b	115	135	154	151	143	149			158	158	161	160	148
Chlorides (mg/l)	b	76	101	120	123	115	119			129	139	141	135	120
Sulfates (mg/l)	b	39	49	59	62	59	62			64	67	68	65	59
Sodium (mg/l)	b	56	70	77	84	79	80			86	94	94	135	86
Sodium (%)	b	51	52	52	54	54	54			54	56	55	55	54
Boron (mg/l)	b	0.2	0.2	0.3	0.2	0.3	0.2			0.3	0.3	0.3	0.24	0.3
pH	c	8.2	9.0	8.5	8.5	8.7	8.4			8.2	8.3	8.6	8.2	8.4
Elect. Cond. (micromhos)	b	525	637	709	722	691	720			764	816	813	809	721
Fluoride (mg/l)	b	0.2	0.2	0.3	0.1	0.1	0.1			0.1	0.1	0.1	0.3	0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00		0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00		0.00
Hexavalent Chromium (mg/l)	b													
Arsenic (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00		0.00
Iron (mg/l)	b	0.01	0.00	0.00	0.01	0.01	0.00			0.00	0.01	0.00		0.00
Manganese (mg/l)	b	0.01	0.10	0.00	0.00	0.00	0.00			0.02	0.00	0.01		0.01
Magnesium (mg/l)	b	14	17	21	19	17	18			19	19	22	20	19
Copper (mg/l)	b	0.01	0.00	0.00	0.01	0.00	0.00			0.00	0.00	0.01		0.00
Calcium (mg/l)	b	23	26	27	29	29	30			32	32	28	31	29
Zinc (mg/l)	b	0.00	0.01	0.00	0.02	0.00	0.00			0.00	0.01	0.00		0.00
Phenol (mg/l)	b													
Color (units)	b	5	6	5	4	7	4			--	5	3		5
Sampling Date		1/19	2/16	3/16	4/20	5/18	6/15			9/21	10/19	11/16	12/20	

b - Laboratory analysis of monthly samples  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

\* Analysis not received

VI-17

WATER QUALITY  
LAKE PERRIS AT INLET

1977

Constituents		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
Total Dissolved Solids (mg/l)	b	302	291	280	309	276	315	295	316	365	321	360	*	312
Total Hardness (mg/l)	b	137	139	144	138	142	144	142	144	143	144	147		142
Chlorides (mg/l)	b	68	68	69	68	69	71	70	74	72	76	75		71
Sulfates (mg/l)	b	48	46	47	46	46	46	48	47	44	45	47		46
Sodium (mg/l)	b	55	54	53	56	56	56	58	60	60	59	59		57
Sodium (%)	b	46	45	44	47	46	45	46	47	47	47	46		46
Boron (mg/l)	b	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.3		0.2
pH	c	8.4	8.8	8.4	8.7	8.3	9.9	8.7	8.7	8.6	8.8	8.4		87
Elect. Cond. (micromhos)	b	549	548	546	543	554	554	561	555	573	602	581		561
Fluoride (mg/l)	b	0.3	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1		0.2
Lead (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Selenium (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Hexavalent Chromium (mg/l)	b													
Arsenic (mg/l)	d b	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.00	0.00	0.00		0.00
Iron (mg/l)	b	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00		0.00
Manganese (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.01		0.01
Magnesium (mg/l)	b	15	15	16	14	15	15	16	16	14	15	15		15
Copper (mg/l)	b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00		0.00
Calcium (mg/l)	b	30	31	31	32	32	33	30	31	34	33	34		32
Zinc (mg/l)	b	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Phenol (mg/l)	b d													
Color (units)	b	4	5	1	3	1	3	5	0	--	3	3		3
Sampling Date		1/18	2/15	3/16	4/19	5/17	6/13	7/18	8/2	9/20	10/18	11/15		

b - Laboratory analysis of monthly samples.  
c - Field analysis of monthly samples.  
d - Sampling performed twice annually.

\* Data not received

WATER QUALITY  
PESTICIDES IN CALIFORNIA AQUEDUCT  
(Parts per Billion)

1977

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Delta Pumping Plant Chlorinated Hydrocarbons Organic Phosphorous Herbicides	0 0	0 0	.03	0	0	.12a 0	.14a .03	.07a .03	.02a 0	0	0 0	.04
South Bay Aqueduct - Santa Clara Terminal Tank Chlorinated Hydrocarbons Organic Phosphorous	0	0	0	.04	0	0 .02	.10a .02	0 0	0 0	0	.01a	
Entrance to O'Neill Forebay (Check 12) Chlorinated Hydrocarbons Organic Phosphorous	0	0	.03	.03	0 .01	0/.01a .02	0 .04/.02a	0 .01a	.03 0	0	0	
Discharge from O'Neill P.P. Chlorinated Hydrocarbons Organic Phosphorous	0	.03a	.01a	0	0	0	0	0	0.2 0	0	.02	0
Pole Line Road Chlorinated Hydrocarbons Organic Phosphorous	0	0	0	0	0	0	0	0	0.3 0	0	0	0
Near Kettleman City (Check 21) Chlorinated Hydrocarbons Organic Phosphorous Herbicides	0 0.12	0 0	.01a	0	0	0	0	0	0 .01	0	0	0 .06
Near Buena Vista P.P. (Check 29) Chlorinated Hydrocarbons Organic Phosphorous	0	0 0	.01a		.01a	0	0	0	0	0	0	0
Tehachapi Afterbay Chlorinated Hydrocarbons Organic Phosphorous/Herbicides	0/0	0/0	0	0	.02/.08a 0	.02 .02/.11a	0 .01	0 .02	0 0	0	0	
Pearblossom Pumping Plant Chlorinated Hydrocarbons Organic Phosphorous Herbicides	0 0	0 0	0	0	.03 0 .12a	.01 .04 .11a	.01 .01 .12a	.39 .02	.09a .04	0		
Inlet to Mojave Siphon (Check 62) Chlorinated Hydrocarbons Organic Phosphorous Herbicides	0 0	0 0	0	0	.07 0 .11a	.01 .05 .14a	.01 .01 .10a		.02 0	0		

VI-11A

a) Combinations of C,P, and N types.

C - Chlorinated Hydrocarbons  
P - Organic Phosphorous  
N - Organic Nitrogen