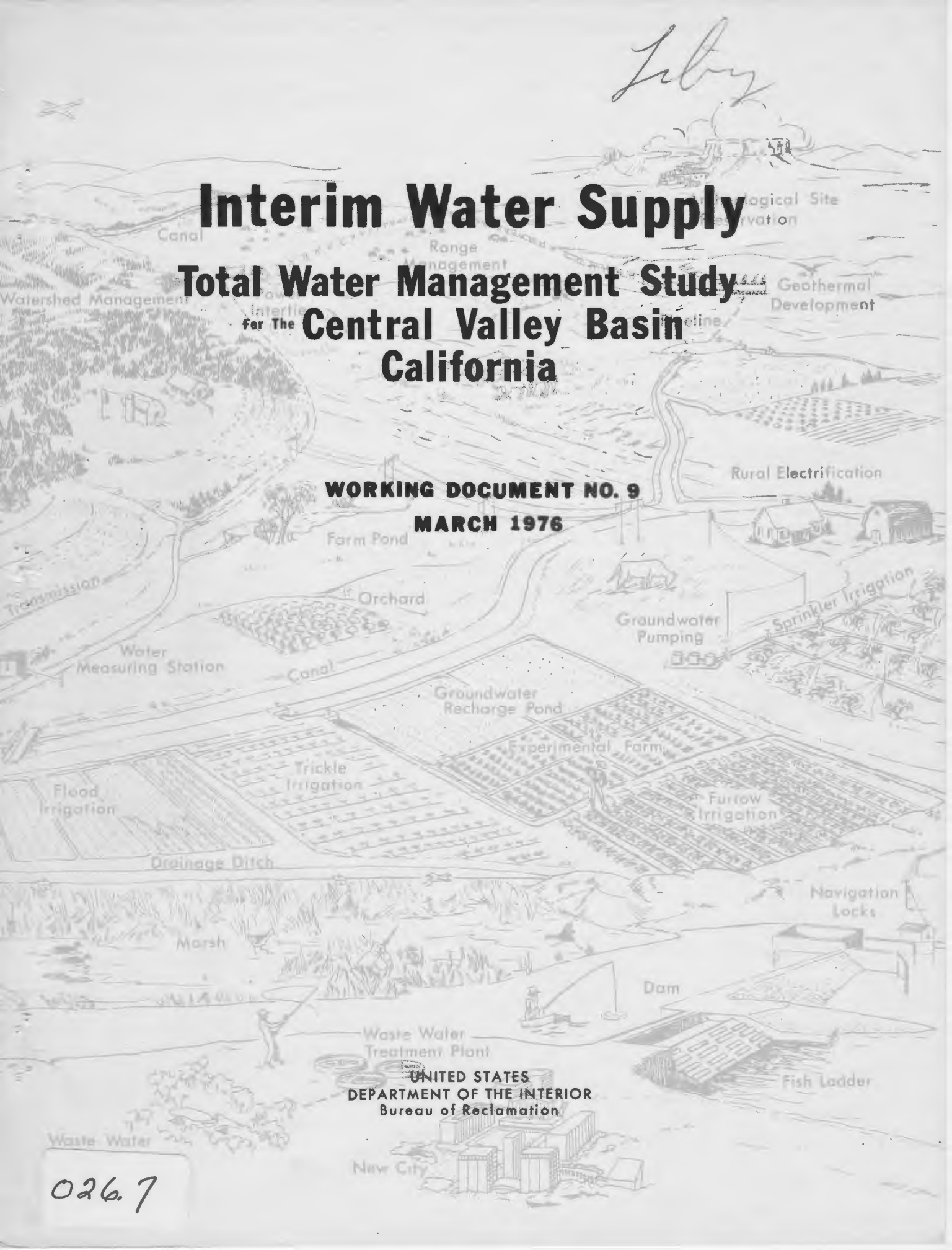
Interim Water Supply

Total Water Management Study
for The Central Valley Basin
California

WORKING DOCUMENT NO. 9

MARCH 1976



UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

026.7

TOTAL WATER MANAGEMENT STUDY
FOR THE
CENTRAL VALLEY BASIN, CALIFORNIA

INTERIM WATER SUPPLY

WORKING DOCUMENT NO. 9

March 1976

THIS REPORT WAS PREPARED PURSUANT TO FEDERAL RECLAMATION LAWS (ACT OF JUNE 17, 1902, 32 STAT. 388 AND ACTS AMENDATORY THEREOF OR SUPPLEMENTARY THERETO). PUBLICATION OF THE FINDINGS AND RECOMMENDATIONS HEREIN SHOULD NOT BE CONSTRUED AS REPRESENTING EITHER THE APPROVAL OR DISAPPROVAL OF THE SECRETARY OF THE INTERIOR. THE PURPOSE OF THIS REPORT IS TO PROVIDE INFORMATION AND ALTERNATIVES FOR FURTHER CONSIDERATION BY THE BUREAU OF RECLAMATION, THE SECRETARY OF THE INTERIOR, AND OTHER FEDERAL AGENCIES.

BUREAU OF RECLAMATION

MID-PACIFIC REGION

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FIGURE 1


OREGON
CALIFORNIA
NEVADA
MILES
0 20 40 60
N
CLAIR ENGLE LAKE
LEWISTON LAKE
WHISKEYTOWN LAKE
CLEAR CREEK SOUTH UNIT
SHASTA LAKE
KESWICK
COW CREEK UNIT
Redding
Trinity
Pit
Red Bluff
RED BLUFF DIVERSION
CORNING CANAL
ORLAND PROJECT
BLACK BUTTE LAKE (CE)
STONY CANAL
STONY GORGE
Stony Cr.
EAST PARK
TEHAMA-COLUSA CANAL
CLEAR LAKE
Cache
Putah Cr.
LAKE BERRYESSA
LAKE SOLANO
SOLANO PROJECT
PUTAH SOUTH CANAL
DELTA CROSS CHANNEL
CONTRA COSTA CANAL
San Francisco
TRACY PUMPING PLANT
SOUTH BAY AQUEDUCT (STATE)
San Jose
CALIFORNIA AQUEDUCT (STATE)
DELTA-MENDOTA CANAL
SAN LUIS (FEDERAL-STATE)
SAN FELIPE DIVISION (AUTHORIZED)
Hollister
DOS AMIGOS PUMPING PLANT (FEDERAL-STATE)
SAN LUIS CANAL (FEDERAL-STATE)
COALINGA CANAL
CENTRAL VALLEY BASIN BOUNDARY
CALIFORNIA AQUEDUCT (STATE)
Bakersfield
BUENA VISTA LAKE
ISABELLA LAKE (CE)
Kern
LAKE ALMANOR
SACRAMENTO
Chico
LAKE OROVILLE (STATE)
Oroville
Yuba
Feather
MARYSVILLE LAKE (CE)
Bear
American
LAKE TAHOE
SUGAR PINE
AUBURN
LAKE NATOMA
FOLSOM LAKE
JENKINSON LAKE
COUNTY LINE
Cosumnes
Mokelumne
FOLSOM SOUTH CANAL
CAMANCHE
PARDEE
Stanislaus
NEW HOGAN LAKE (CE)
Calaveras
NEW MELONES LAKE (CE & USBR)
GOODWIN DAM
Tuolumne
Stockton
DON PEDRO
Merced
LAKE McCLURE
SAN JOAQUIN
KESTERSON
Chowchilla
BUCHANAN (CE)
HIDDEN (CE)
MADERA CANAL
MILLERTON LAKE
Fresno
PINE FLAT LAKE (CE)
Kings
FRIANT-KERN CANAL
SAN LUIS DRAIN
LAKE KAWEAH (CE)
Kaweah
LAKE SUCCESS (CE)
Tule
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL VALLEY PROJECT

INTRODUCTION

With the buildup in use of Central Valley Project (CVP) water as presently projected, anticipated demands for project water supplies are not expected to exceed supplies available until sometime after the year 2000. The amount of supply available after meeting CVP demands during the buildup period is the interim water supply.

The interim project supply could be made available at the Delta, on a firm basis, and would be available even in the driest year, including a recurrence of a period as severe as the critical dry period which occurred in the Central Valley from 1928 through 1934.

This document demonstrates the projected buildup in use of project water for CVP services; the interim quantities of project water available after satisfaction of water requirements within CVP service areas; and some of the present and potential uses for project interim water supply.

The availability of the interim supplies is predicated on an outflow of 2,500 cubic feet per second for Sacramento-San Joaquin Delta. To maintain satisfactory quality at the Tracy Pumping Plant, a Peripheral Canal or alternative Delta facilities may be required by about 1985. If such facilities are not available, a portion of the interim supply would be required for outflow to maintain minimum water quality at the pumps.

CENTRAL VALLEY PROJECT

The Central Valley Project is a multipurpose project, which consists of a series of storage, conveyance, and power facilities in operation, under construction, or planned, to make optimum use of the water supplies developed and controlled by those facilities.

The main existing storage reservoirs are Shasta, Clair Engle, Whiskeytown, Millerton, Black Butte, Folsom, and San Luis. Others currently under construction are Auburn and New Melones; Marysville is authorized but construction has not yet started. Minor reservoirs that will soon be in operation are Hidden and Buchanan in the San Joaquin Valley.

Project functions are: Flood control, power, navigation, recreation, fish and wildlife conservation, provision of firm or dependable water supplies for agriculture and municipal and

industrial (M&I) uses, and drainage of agricultural land. Water quality maintenance, although--with the exception of New Melones--not an authorized function of the Central Valley Project, is provided to the extent possible through the operation of the project.

The types of services provided by the Central Valley Project vary in time and location, and in many instances, the same water is used for more than one purpose.

For example, water stored and released from Shasta to meet a navigation demand can also serve several purposes enroute. The water, as stored in Shasta, is used for fish and recreation purposes prior to release. As it leaves the reservoir, the water generates power and then maintains the fishery in the upper reaches of the Sacramento River. In the river's middle reaches, the same water provides recreation, helps satisfy the navigation flow requirement, and then is diverted for export. Return flows from upstream diversions reenter the system and become available for further project use, possibly to meet a later Delta export requirement.

Shasta, Folsom, Millerton, and Black Butte Reservoirs are operated to control floods. Auburn, New Melones, and Marysville, when operational, will also be operated for flood control. Storage space is provided in the reservoirs during the winter and spring months when the danger of flooding is present. Releases within the capability of the downstream channels are made through the powerplants, outlet works, and spillways. The balance of the inflow is stored in the reservoirs until capacity is available in the downstream channels to permit the release of floodflows, or held in the conservation pool, within the operations of the flood control parameters established by the Corps of Engineers, to optimize power production.

In the operation of the Central Valley Project, each reservoir upstream of the Delta must meet the demands which can be met only from that reservoir. Below the confluence of the Sacramento and American Rivers on the edge of the Delta, there is, however, considerable flexibility in operating to meet the requirements which physically can be served from either the Shasta-Trinity complex or the American River facilities (Folsom and Auburn). Service is likely to be by various combinations of supplies. The Bureau's share of Delta demands can be commonly met at various times and in varying proportions from the Shasta-Trinity system, and from the American River facilities.

American River facilities may, at times, have a greater amount of excess storage (in excess of the amount necessary to meet those demands which can only be met from the American River) than the Shasta-Trinity complex. To make maximum use of American River water, close operational coordination is essential. When Folsom has ample water supplies, it can meet an increased share of common requirements, thus relieving the demands on the Shasta-Trinity system. American River water which might otherwise have spilled and been lost to the Central Valley Project can be utilized, permitting water to be stored in the Shasta-Trinity system for future use. This coordination of water operations between the Shasta-Trinity complex and the American River has certain limitations. For example, the capacities of Clear Creek and Spring Creek Tunnels limit the amount of water that can be brought from the Trinity River to the Sacramento Valley in a given period of time.

The future Marysville Reservoir will provide a supply that can also be integrated with the Central Valley Project and used to meet Delta requirements.

In the San Joaquin Valley, San Luis is integrated with the Shasta-Trinity complex and American River reservoirs.

Millerton Lake, on the San Joaquin River near Fresno, is operated locally to serve the Friant Division which includes the Madera and Friant-Kern Canal service areas. To provide a maximum water supply to those areas, the Bureau has relieved Millerton Lake of the need to satisfy the water rights entitlements of water users along the San Joaquin River below Mendota Pool. For these water rights by an exchange contract, the Bureau provides a substitute supply of water made available in the Delta and delivered through the Delta-Mendota Canal. When the Delta-Mendota Canal cannot deliver this substitute supply, water is released from Millerton Lake, thus depriving the Friant Division service areas of overland gravity supplies.

New Melones, Hidden, and Buchanan Reservoirs, which are Corps of Engineers projects under construction, will upon completion be financially integrated into the Central Valley Project. Their water supplies will not be operationally integrated into the Central Valley Project but will be used to meet projected local demands.

WATER SUPPLY

The water supply of the Central Valley Project, for purposes of this document, is estimated to be 11,407,000 acre-feet annually, as shown on table 1.

Table 1. CVP water supply available[a]

Facility or service area	Supply (acre-feet)
Central Valley Project[b]	9,250,000
Existing facilities	(8,932,000)
Authorized facilities (Auburn)	(318,000)
Other reservoirs	532,800
Existing facilities	82,000
Sly Park	(23,000)
Black Butte*	(59,000)
Authorized facilites	450,800
New Melones*	(245,000)
Marysville*	(155,000)
Hidden*	(24,000)
Buchanan*	(24,000)
Sugar Pine	(2,800)
Other service areas	1,624,000
Existing facilities	1,624,000
Placer County water rights	(120,000)
Friant Division[c]	(1,504,000)
TOTAL	11,407,000
SUMMARY	
Existing facilities	10,638,000
Authorized facilities	768,800
TOTAL	11,407,000

* Corps of Engineers projects authorized as part of CVP.

[a] Available from existing and authorized CVP facilities plus Peripheral Canal and overland facilities to provide suitable quality water for the Contra Costa Canal ("Rock Slough criteria").

[b] Without Millerton, Sly Park, Sugar Pine, or Corps of Engineers projects listed.

[c] Includes class 2 water of 659,000 acre-feet which is the projected average available during the 40-year contract period. (Class 2 availability can range from 0 to 1,402,800 acre-feet per year. The mean availability has been projected at 47 percent (1,402,800 x .47 = 659,000)).

Introduction

The water supply or firm yield of the Central Valley Project is determined by the use of simulated operation studies. These studies, made on a monthly basis, consider the inflow and storage in each CVP reservoir in relation to the obligations to be met by the total Central Valley Project.

Trinity, Shasta, Folsom, Auburn, Whiskeytown, and San Luis Reservoirs are operated in an integrated manner under the following assumptions:

1. That the Central Valley Project water customers and service to its other multipurpose functions be protected against a recurrence of a period as severe as the critical dry period (1928-34).

2. That CVP reservoirs are assumed full at the beginning and nearly empty at the end of this critical period.

3. That deficiencies in agricultural supplies up to 100 percent of 1 year's supply (25 percent for 4 years) be assessed during the 7 years of the critical period.

4. That releases from CVP reservoirs maintain a daily average of 5,000 cubic feet per second at the navigation control point on the Sacramento River between Colusa and Knights Landing during normal years, and 4,000 cubic feet per second daily average in critically dry years. After the year 1985 navigation flows be maintained at 4,000 cubic feet per second in normal years and 3,000 cubic feet per second in critical years.

5. That existing agreements for fish and wildlife requirements below all CVP reservoirs be maintained with permissible deficiencies during critically dry years.

6. That a Delta outflow of 2,500 cubic feet per second be maintained. This is assumed to be sufficient to maintain the quality of the water at the Tracy Pumping Plant.

7. That all inbasin reasonable uses, including those of the Delta, would be given priority before meeting Delta exports.

8. That in CVP reservoirs with powerplants, any interim water supply available that is not under contract be used to maximize power production.

9. That, whenever possible, recreation pool levels be maintained as high as possible.

While the yields of the other CVP reservoirs shown on table 1 are based on the protection against the recurrence of a period as severe as the critical dry period, they are measured against local conditions and are independent of any basinwide integration. The average annual water supply of 1,504,000 acre-feet available within the Friant Division includes a class 2 supply of 659,000 acre-feet. This class 2 supply is the average available during the contract period, notwithstanding the fact that little or no class 2 water would be available during several of the years in a critical dry period.

The supply to meet Delta requirements has not been included in table 1. In a joint memorandum dated April 9, 1969, the State and the Bureau for the purposes of current and future planning studies and operations by both agencies adopted the following Delta water requirements:

	Amount (acre-feet/yr)
Delta Lowlands channel depletion	1,266,000
Delta Uplands net use	340,000
Total	1,606,000

SUPPLY UNDER CONTRACT

Agreements or contracts for project water have been executed with numerous individuals and water service entities throughout the Central Valley Basin. These agreements or contracts recognize any prior rights which are entitlements to water held prior to the construction of the various units of the Central Valley Project.

Contracts with water users holding prior rights show the amount of project or pay water, and also the prior right or free water. Prior right water is included in the supply under contract to assure that CVP operation makes the water available, since the water supplies are dependent on project operation. The Bureau of Reclamation now has under agreement or contract these amounts of water:

	Prior rights	Total under contract including prior rights
	(acre-feet)	
Sacramento Valley	1,813,163	2,598,781
American River	344,000	833,166
Sacramento-San Joaquin Delta Export	877,635	3,204,062
San Joaquin Valley	- 0 -	1,575,000
Total	3,034,798	8,211,009

In the Sacramento Valley another 500,000 acre-feet not shown under contract represents the existing and potential uses of water along the Sacramento River and its various bypasses and drains by those diverters who are not a part of the Sacramento River diverters contracting program. This water use is made possible, in part, by recovery of return flows from Bureau customers in the summer months.

The amount shown under contract for the San Joaquin Valley includes the average contractual obligation of the Friant water users to class 2 water. Depending upon the annual hydrologic conditions within the San Joaquin River watershed, the amount available could range from zero to a maximum of 1,402,800 acre-feet, with the average available 659,000 acre-feet.

Table 2 shows by service area the quantities of CVP supply for which agreements or contracts have been executed with the various water users, and the use during calendar year 1974.

Table 2. CVP supply obligated by long-term contract, calendar year 1974 water use, and anticipated demand for CVP water (acre-feet)

	SACRAMENTO VALLEY	Supply under long-term contract (1975)	Use, calendar year 1974	Anticipated demand for water[a]
1.	Clear Creek South	17,400	4,225	31,000
2.	Cow Creek South	24,000	6,550	24,000
3.	City of Redding	6,140[b]	882	6,140
4.	Feather Water District	20,000	19,827	20,000
5.	Spring Creek Conduit & others	4,775	525	1,625
6.	Toyon Pipeline	3,960	882	3,960
7.	Shasta area	5,000	102	5,000
8.	Sacramento River diverters	2,292,236	2,431,974	2,933,500
	Project water	(374,073)	(349,225)[c]	(378,000)
	Base supply	(1,813,163)	(1,550,484)[d]	(1,950,500)
	Bypasses and riparian	-	(500,000)	(500,000)
	Wildlife refuges	(105,000)	(32,265)	(105,000)
9.	Sacramento Canals	225,100	46,115	705,000
	Corning Canal	(44,900)	(29,241)	(108,000)
	Tehama-Colusa Canal	(171,200)	(14,769)	(400,000)
	West Sacramento Valley Canal	-	-	(148,000)
	Losses	(9,000)	(2,105)	(49,000)
10.	Stony Creek diverters	170	502	170
	Subtotal	2,598,781	2,511,584	3,733,545

a Includes supply under contract.

b City of Redding also receives water under a Sacramento River Diverter contract - 3,150 acre-feet, project supply, 17,850 acre-feet, base supply.

c Includes 983 acre-feet of project water used by the city of Redding.

d Includes 5,006 acre-feet of base supply used by the city of Redding.

Table 2 (continued)

	AMERICAN RIVER	Supply under long-term contract (1975)	Use calendar year 1974	Anticipated demand for water
1.	El Dorado County	6,166	4,460	6,166
2.	El Dorado County Water Rights	-	-	103,834
3.	San Juan Suburban	11,200	4,786	11,200
4.	City of Roseville	40,000	6,423	40,000
5.	North Fork, Natomas Ditch, and Folsom Prison et al	69,000	61,697	69,000
6.	Placer County	117,000	-	117,000
7.	Placer County Water Rights	120,000	-	120,000
8.	Malby	-	-	25,000
9.	City of Sacramento	230,000[a]	35,369	230,000
10.	Folsom South Canal	237,000	-	965,000
	SMUD	(75,000)[b]	3,729	(75,000)[c]
	EBMUD	(150,000)	-	(150,000)
	Irrigation	-	-	(620,000)
	M&I	-	-	(80,000)
	Losses	(12,000)[c]	-	(40,000)
11.	Foresthill Divide	2,800	-	2,800
	Subtotal	833,166	116,464	1,690,000

a Total contractual obligation is 245,000 acre-feet (project water, 90,000 acre-feet; water rights, 155,000 acre-feet). 15,000 acre-feet is to be delivered to SMUD via the Folsom South Canal and 20,000 acre-feet are available from return flows below Nimbus Dam.

b Includes 15,000 acre-feet of city of Sacramento water rights water to be conveyed to SMUD's Rancho Seco facilities.

c Losses shown are those associated with the SMUD and EBMUD supplies only.

Table 2 (continued)

	DELTA	Supply under long-term contract (1975)	Use calendar year 1974	Anticipated demand for water
1.	Delta-Mendota Canal	1,504,862	1,552,078	1,675,000
	DMC water	(438,227)[a]	(514,037)[b]	(608,365)
	Exchange contracts	(840,000)	(836,699)	(840,000)
	Schedule II	(37,635)	(35,813)	(37,635)
	Grasslands	(50,000)	(66,139)	(50,000)
	State of California	(19,000)	(21,390)	(19,000)
	Losses	(120,000)	(78,000)	(120,000)
2.	Contra Costa Canal	195,000	72,949	195,000
	Schedule A	(86,000)	(72,000)	(86,000)
	Schedule B	(39,000)	(949)	(39,000)
	Schedule C	(70,000)	(0)	(70,000)
3.	San Luis Canal	1,475,200	1,176,747	1,475,200
	San Luis irrigation	(1,176,000)[c]	1,110,931	(1,176,000)
	San Luis interim	(207,000)	(0)	(207,000)
	Miscellaneous	(5,700)	(1,440)	(5,700)
	M&I	(27,500)	(9,376)	(27,500)
	Losses[d]	(59,000)	(55,000)	(59,000)
4.	San Felipe Unit	-	-	216,000
5.	Cross Valley Canal	-	-	128,300
6.	Mid-Valley Canal	-	-	650,000
	Subtotal	3,175,062	2,801,774	4,339,500
	Subtotal - Sacramento and American Rivers, Sacramento-San Joaquin Delta	6,607,009	5,429,822	9,763,045

a Includes only long-term contracts. A number of entities have enlarged their areas and are using additional water from the uncontracted supply each and every year.

b Water is delivered to various individuals and entities pursuant to amendatory and temporary contracts.

c Includes an amendatory contract with Westlands Water District for an additional 317,000 acre-feet which has been submitted to the Congress for approval.

d Includes San Luis evaporation (Federal share).

Table 2 (continued)

	SAN JOAQUIN VALLEY	Supply under long-term contract (1975)	Use, calendar year 1974	Anticipated demand for water
1.	Friant Division	1,504,000	2,013,842	1,504,000
	Class I	(800,000)	(800,000)	(800,000)
	Class 2	(659,000)[a]	(1,163,030)[b]	(659,000)
	Losses	(45,000)	(50,812)	(45,000)
2.	Hidden Project	24,000	-	24,000
3.	Buchanan Project	24,000	-	24,000
4.	Sly Park Unit	23,000	23,602	23,000
5.	New Melones Project	-	-	210,000[c]
	Subtotal	1,575,000	2,037,444	1,785,000
	Total	8,182,009	7,467,266	11,548,045

a Projected average class 2 water entitlement with a maximum of 1,402,800 acre-feet entitlement during 40-year contract period.

b Includes temporary contracts.

c Demand assumed to be within Stanislaus, Tuolumne, Calaveras, and San Joaquin Counties.

PROJECTIONS OF WATER DEMANDS

TOTAL DEMAND

The amounts under executed agreement or contract and the additional commitments for Central Valley Project water within those service areas in which the conveyance facilities are available or authorized are:

	Acre-feet
Under agreement or contract	8,182,009
Additional commitments:	
Sacramento Valley	1,134,764
American River	856,834
Sacramento-San Joaquin Delta Export	1,164,438
San Joaquin Valley	210,000
Total anticipated demand	11,548,045

A detailed breakdown on the anticipated demands by service area is presented in table 2. These include both the amount under contract and the additional commitments not yet under contract.

In determining water requirements both for agricultural and for municipal and industrial uses, the representative districts or agencies are contacted. All legal water rights of these entities are recognized. Methods used by the Bureau of Reclamation to determine water requirements are explained further in the sections on irrigation demand, and municipal and industrial demand.

IRRIGATION DEMAND

The Bureau of Reclamation determines the irrigation water requirements, in general, to be satisfied by the project in the following manner:

1. The land is classified to determine the arable acreage, taking into account factors such as soil texture, depth of soil profile, the presence or absence of hardpan, permeability of the soil, chemical and fertility levels, topography, and drainage problems. Arable lands are those lands suitable for irrigation which can repay the costs of development, including the distribution system. Roads and rights-of-way are subtracted to determine

the irrigable acreage. The acreage devoted to farm buildings, service roads, and other nonagricultural uses is then deducted to arrive at the productive acreage, which is used in establishing the irrigation water demand.

2. Estimates are made of the kinds of agricultural crops which can be grown on the lands, and of the acreage of each crop which is likely to be grown under full development. In addition to land classification, factors taken into account in estimating future crop patterns include trends in cropping, livestock production, crop rotation practices, and future marketing conditions.

3. A determination is made of the annual water requirement for each crop in acre-feet per acre. This determination takes into account the permeability of the soil, temperature, humidity, wind movement, length of growing season, and the leaf structure and exposure of the plant. Water use data in similar areas, climatic data, and variations in cultural and irrigation practices are considered. Additional amounts of water may be needed to maintain salt balance due to the chemical reaction of soluble salts in the irrigation water and soluble salts in the irrigated soils. Water may also be needed for frost protection. These water quantities are included in crop requirement.

4. The farm delivery demand, or amount of water required, is determined by multiplying the acreage of each crop to be grown in the service area under full development by the water requirement for that crop.

5. The amount of usable nonproject water available to the service area is evaluated. This evaluation takes into account the geologic formations, the permeability of the underground strata, the sources and extents of both surface and underground flows of water, and the underground aquifer capacity for long-term regulation. The safe yield of the ground-water basin is estimated, since ground-water storage is an important source of water which should not be overdrawn, or conversely, underutilized.

6. From the total annual irrigation water requirement, i.e., the farm delivery demand and distribution system losses, the annual quantity of nonproject water available is deducted to determine the annual quantity of project water required to serve the agricultural area.

In this manner the amount of supplemental water required from the project for a specific area in order to permit full development, without exceeding locally available surface and ground-water supplies, can be determined.

MUNICIPAL AND INDUSTRIAL DEMAND

The supplemental water requirements for municipal uses are based on population projections and the annual per capita requirement for water.

In making population projections many factors are taken into consideration, such as geographic location, transportation available, economic opportunities, and the historic growth rate. Per capita requirements for water will vary, depending on such factors as climatic conditions, amount of available nonproject water supplies, anticipated domestic use both inside and outside of residences, anticipated number of commercial or business establishments, and anticipated public uses such as schools, hospitals, parks, and fire protection.

Water requirements for industrial uses are based on projections of industry types and demands. Some industries recycle their supplies, and while they may divert a substantial amount of water, will consumptively use little. A cannery is considered a consumptive water using industry, a virtually nonconsumptive industry is a paper mill.

BUILDUP IN USE OF PROJECT WATER

A number of factors influence the anticipated rate of buildup in the use of project water. Some of them are:

1. Funds for construction of the necessary project facilities and distribution systems are not always appropriated in a manner permitting an ideal construction schedule, thereby affecting the capability of providing the project supplies as well as the initial dates of delivery.

2. Projections of agricultural use of project water generally reflect a 15-year buildup after the initial year of delivery, to allow for the development of the local facilities and the change in agricultural practices.

3. Buildups projected in the municipal and industrial use are generally related to the population projections for the specific area and projections of industrial development.

4. Some of the buildups are premised upon negotiated minimums incorporated in various contracts, to insure an increasing obligation on the part of the contractors to pay for certain increasing quantities of water during the initial period of the contracts.

5. Initial dates of service are predicated upon the projected completion dates of the various project facilities.

The projected buildups in use of water within the various CVP service areas from 1975 to 2030 are presented in table 3. The individual service area buildups include both irrigation and municipal and industrial quantities. Predictions of the initial year of delivery, or of availability of water in the case of reservoirs, are:

Year	Facility
1976	Tehama-Colusa Canal
	Cross Valley Canal
	Hidden Dam and Reservoir
	Buchanan Dam and Reservoir
1979	New Melones Dam and Reservoir
1980	Folsom South Canal (Reaches 3-5)
	Foresthill Divide Unit
1981	San Felipe Unit
1985	Malby Unit
	Mid-Valley Canal
	Auburn Dam and Reservoir
	Peripheral Canal
1986	Marysville Dam and Reservoir
2000	West Sacramento Canal

Present facilities of the Central Valley Project are capable of providing present and near-term future needs.

Table 3. Central Valley Project demand buildup
(1,000 acre-feet)

Buildup in use of project water

SACRAMENTO BASIN SERVICE AREAS	1975	1980	1985	1990	2000	2010	2020	Ultimate
SACRAMENTO VALLEY								
Shasta Area & Toyon Pipeline	2	2	3	3	4	5	5	9
City of Redding & Spring Creek Cond.	4	6	7	9	10	11	11	11
Clear Creek South	4	13	17	17	17	17	17	31
Sac'to Canals & Cow Creek	58	197	361	477	576	653	729	729
Feather River W.D.	20	20	20	20	20	20	20	20
Sacramento Water Users	2,723	2,730	2,736	2,742	2,755	2,767	2,780	2,934
Subtotal	2,811	2,968	3,144	3,268	3,382	3,473	3,562	3,734
AMERICAN RIVER								
Foresthill Divide	0	2	2	2	2	3	3	3
No. Fork, Natomas, Folsom Prison	69	69	69	69	69	69	69	69
San Juan Suburb & Roseville	13	17	23	27	43	51	51	51
City of Sacramento	56	68	80	92	123	156	194	230
El Dorado County	4	6	6	6	6	6	6	6
El Dorado County Water Rights	13	18	21	26	47	104	104	104
Placer County Project Water	0	0	0	0	35	117	117	117
Placer County Water Rights	15	20	25	30	55	120	120	120
Malby	0	0	2	7	17	25	25	25
Subtotal	160	200	228	259	397	651	689	725
EXPORT SERVICE AREAS								
AMERICAN RIVER								
Folsom-South Canal at Nimbus	32	130	351	550	875	875	875	875
Subtotal	32	130	351	550	875	875	875	875
DELTA								
Exchange, Schedule 2, and DMC Losses	997	997	997	997	997	998	998	998
DMC Irrigation & Grasslands	507	664	665	666	672	677	677	677
Contra Costa Canal	105	135	172	188	195	195	195	195
San Luis Unit	1,255	1,448	1,465	1,470	1,475	1,475	1,475	1,475
San Felipe	0	0	77	119	152	178	196	216
Cross Valley	0	128	128	128	128	128	128	128
Folsom So. Svc Area from Delta	0	0	0	0	1	80	90	90
Mid-Valley Canal	0	0	650	650	650	650	650	650
Subtotal	2,864	3,372	4,154	4,218	4,270	4,381	4,409	4,429
SAN JOAQUIN VALLEY								
Friant Division	1,504	1,504	1,504	1,504	1,504	1,504	1,504	1,504
Hidden Project	11	24	24	24	24	24	24	24
Buchanan Project	24	24	24	24	24	24	24	24
Sly Park Unit	23	23	23	23	23	23	23	23
New Melones Project	0	0	32	82	200	210	210	210
Subtotal	1,562	1,575	1,607	1,657	1,775	1,785	1,785	1,785
TOTAL DEMAND	7,429	8,245	9,484	9,952	10,699	11,165	11,320	11,548

INTERIM SUPPLY AVAILABLE

The main CVP storage facilities, including Shasta, Trinity, Whiskeytown, Folsom, Auburn, San Luis, Black Butte, and New Melones are now or will be operational by 1985. Full use of the water to meet firm CVP contractual requirements may not be made until about 35 years later. The supply and the demand are depicted in figure 2. The quantities of interim water which are available during the buildup period are shown in table 4.

The interim inbasin supply is the total supply available to the respective service areas in which the demands have not built up. If, for example, in the year 1990, there is a supply of 200,000 acre-feet, and a demand in the Sacramento Valley for 100,000 acre-feet, an interim supply of 100,000 acre-feet would be available for use within the Sacramento Valley. However, if that interim supply were to be used in the Delta, a quantity less than 100,000 acre-feet would be available. This Delta equivalent supply is explained as follows:

A primary use of water in the Sacramento Valley upstream of the Delta contributes a return flow to the system, which can be reused to meet downstream needs. A primary use of water in the Delta for export or water quality enhancement would generate no return flow to the system, and consequently no reuse.

Using a return flow rate in the Sacramento Valley of 35 percent, the primary use of 100,000 acre-feet there would contribute 35,000 acre-feet of return flow for reuse downstream. The net effect on the system would be a depletion of 65,000 acre-feet. Transferring the primary use of water to the Delta would produce the same depletionary effect on the system, but only 65,000 acre-feet would be available in the Delta and no return flow would be recaptured for further use.

The interim inbasin supply and the Delta equivalent supply are shown in table 4.

Figure 2

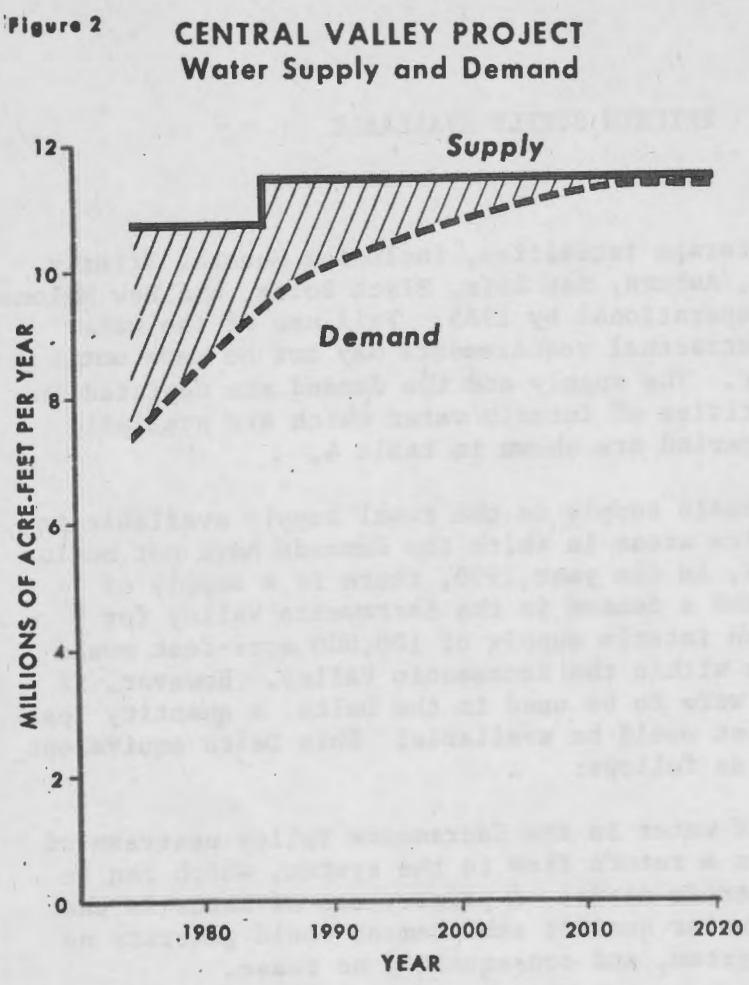


Table 4. CVP supply, demand, and interim supply available

Year	Supply[a]	Demand	Interim supply available	
			Inbasin	Delta equivalent
		(1,000 acre-feet)		
1975	10,689	7,429	3,260	1,805
1980	10,689	8,245	2,444	1,451
1985	11,407	9,484	1,923	1,201
1990	11,407	9,952	1,455	893
2000	11,407	10,699	708	368
2010	11,407	11,165	242	157
2020	11,407	11,320	87	57

[a] Based on 2,500 cubic feet per second allowance for Delta outflow.

DELTA WATER QUALITY ENHANCEMENT

CVP interim water supplies are presently being used for the enhancement of water quality conditions in the Sacramento-San Joaquin Delta.

The State of California has adopted standards which are set forth in its State Water Quality Control Policy of 1967, Resolution 68-17, and Resolution 73-16. These standards protect municipal and industrial water for Contra Costa County, internal irrigation uses in the Delta, and striped bass spawning. The standards, approved by the Environmental Protection Agency (EPA), in most instances represent an enhancement over historical conditions.

In recent years the standards have been more than maintained, due in part to releases from CVP reservoirs. The Bureau will continue to use CVP interim water for this purpose as long as it does not interfere with the satisfaction of the authorized services of the Central Valley Project.

In the event of a critically dry period and competing needs for CVP water, the stringent State adopted and federally approved (EPA) standards would not be met, and would not have to be met as supported by a recent legal opinion by the Solicitor of the Department of the Interior. The Solicitor has examined the effect of the Federal Water Pollution Control Act. He concluded that the act did not impose any increased obligation on the Central Valley Project to meet State water quality standards. The purpose of the 1972 amendment to the Pollution Control Act (P.L. 92-500) was to impose limitations on Federal agencies regarding the discharge of pollutants from effluent sources. The act did not effect a blanket repeal of the Reclamation laws in favor of State programs for the repulsion of saltwater intrusion.

Estimates of CVP firm and interim supply used in this document are premised on this assumption: With Peripheral Canal and overland facilities to provide suitable quality water for Contra Costa Canal ("Rock Slough criteria"), a Delta outflow averaging 2,500 cubic feet per second will be necessary to maintain the quality of water at Tracy Pumping Plant. This outflow will maintain the quality stipulated in the November 19, 1965, standards, with 1,000 p/m chlorides at Emmaton and Jersey Point. The determination of the firm water supply yield of the Central Valley Project in previous studies was based on an assumed Delta outflow of 1,800 cubic feet per second, which was then assumed to be adequate to maintain 1,000 p/m chlorides at Emmaton and Jersey Point. Any outflow requirements in excess of 1,800 cubic feet per second might have to be satisfied by storage releases from CVP reservoirs. To accommodate those requirements would mean either reducing service to contracts and commitments with a corresponding reduction to interim water supplies, or

retaining the same firm yield and taking larger deficiencies in critical years in both irrigation and municipal and industrial uses in future contracts. The current Bureau policy is to allow for greater deficiencies in critical years.

Even with the 2,500-cubic-foot-per-second outflow, because of the export of water by the State Water Project at Clifton Court Forebay, the desired quality of water in the vicinity of Tracy pumps can no longer be provided in the absence of a Peripheral Canal or other alternative facilities. To maintain the desired quality would require an outflow of about 3,600 cubic feet per second for a limited combined Central Valley Project and State Water Project export of 11,000 cubic feet per second. The impact on firm yield, if the Central Valley Project were to share in the responsibility for providing this outflow, assuming a 60 percent share, could be about 500,000 acre-feet per year by as early as 1985.

The implementation of more stringent water quality standards, such as those outlined in Decision 1379 or the State adopted standards as approved by EPA, could impose additional demands upon the Central Valley Project and the State Water Project.

Water supply studies indicate that varying additional amounts of water in excess of 2,500 cubic feet per second would be needed under either water quality standards, depending on assumptions as to what facilities might be constructed in the Delta. Estimates of the additional outflows needed annually if the CVP share is assumed to be 60 percent are as follows:

	D-1379 standards		State adopted/ EPA approved standards	
	Normal year	Average critical period	Normal year	Average critical period
	(millions of acre-feet)			
Present facilities	2.2	1.9	2.0	1.7
No Peripheral Canal/with overland facilities[a]	1.4	1.2	0.9	0.8
With Peripheral Canal/no overland facilities	1.6	1.4	1.1	1.0
With Peripheral Canal/with overland facilities	1.1	1.0	0.3	0.2

[a] Assumes Contra Costa Canal meets Antioch M&I criteria and overland replacement to satisfy Rock Slough criteria. D-1379 case also includes overland facilities to meet Blind Point criteria.

Delta Water Quality Enhancement

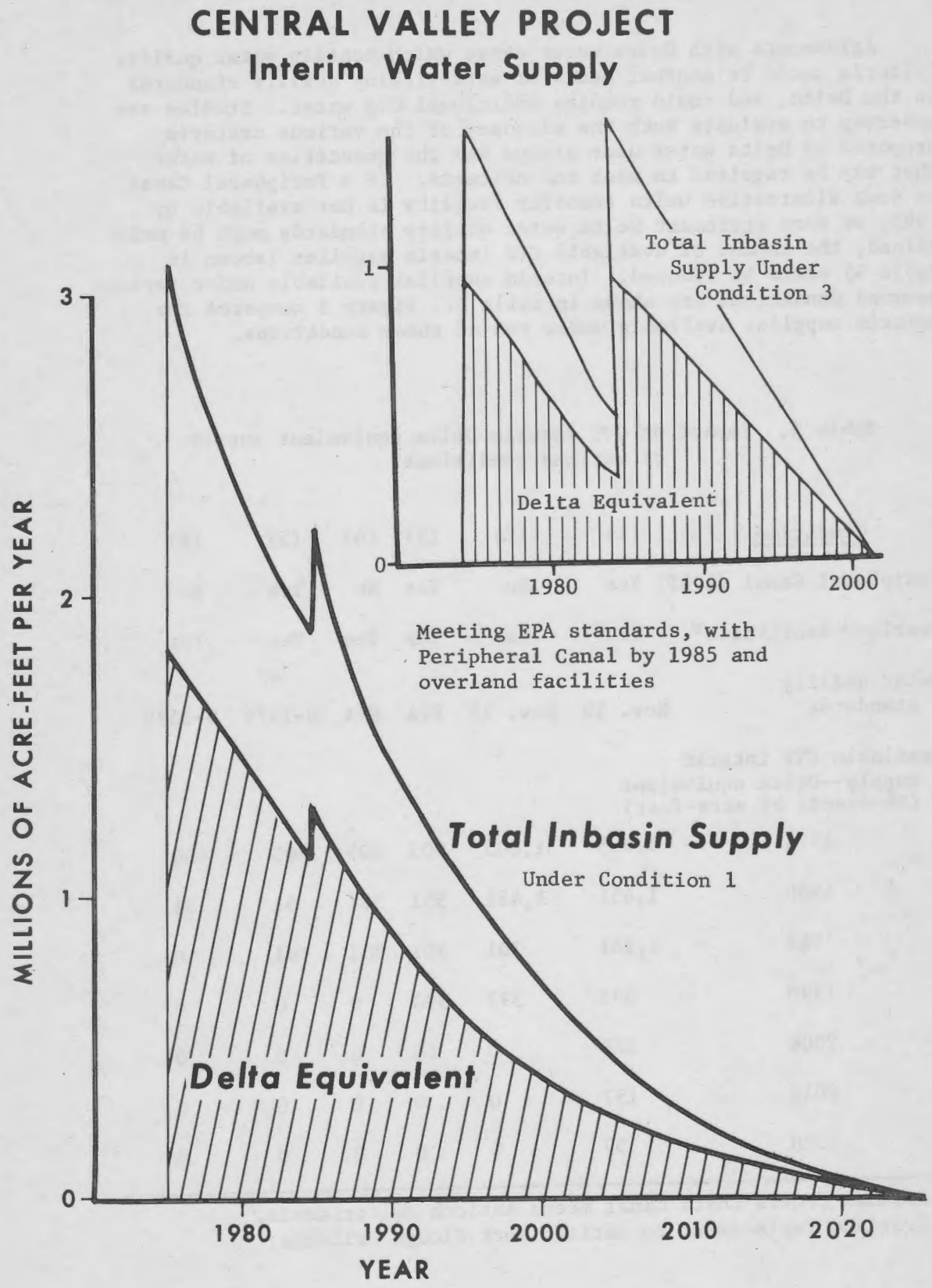
Agreements with Delta water users which contain water quality criteria could be another means of establishing quality standards in the Delta, and could require additional CVP water. Studies are underway to evaluate both the adequacy of the various criteria proposed by Delta water user groups and the quantities of water that may be required to meet the criteria. If a Peripheral Canal or some alternative Delta transfer facility is not available by 1985, or more stringent Delta water quality standards must be maintained, the amount of available CVP interim supplies (shown in table 4) would be reduced. Interim supplies available under various assumed conditions are shown in table 5. Figure 3 compares the interim supplies available under two of those conditions.

Table 5. Impact on CVP interim Delta equivalent supply of various conditions

Condition	(1)	(2)	(3)	(4)	(5)	(6)
Peripheral Canal (1985)	Yes	No	Yes	No	Yes	No
Overland facilities[a]	Yes	Yes	Yes	Yes	Yes	Yes
Water quality standards	Nov. 19	Nov. 19	EPA	EPA	D-1379	D-1379
Available CVP interim supply--Delta equivalent (thousands of acre-feet)						
1975	1,805	1,805	905	905	405	405
1980	1,451	1,451	551	551	51	51
1985	1,201	701	901	301	101	0
1990	893	393	593	0	0	0
2000	368	0	68	0	0	0
2010	157	0	0	0	0	0
2020	57	0	0	0	0	0

[a] Assumes Contra Costa Canal meets Antioch M&I criteria. Overland replacement to satisfy Rock Slough criteria.

Figure 3


CENTRAL VALLEY PROJECT
Interim Water Supply
Total Inbasin Supply Under Condition 3
Delta Equivalent
1
0
1980
1990
2000
Meeting EPA standards, with Peripheral Canal by 1985 and overland facilities
Total Inbasin Supply
Under Condition 1
Delta Equivalent
MILLIONS OF ACRE-FEET PER YEAR
3
2
1
0
1980
1990
2000
2010
2020
YEAR

PRESENT USES FOR INTERIM SUPPLY

Present as well as potential uses for CVP interim water supplies can be met only until such time as those supplies are needed to satisfy the buildups in CVP contracts and commitments.

Some of the water being released from CVP reservoirs is not covered by an existing contract or long-term agreement, but is being put to beneficial use. These uses include water quality enhancement discussed in the previous part, power production, irrigation, maintenance of riverflows and reservoir levels, and fishery enhancement.

HYDROPOWER PRODUCTION

The production of electric power at CVP hydroelectric plants, although not the primary operating objective of CVP reservoirs, is an essential project benefit. In the day-to-day project operation for scheduling water deliveries, every effort is made to maximize power production.

The power production of the CVP hydroelectric plants consists of electric energy generation and dependable capacity. Projections of dependable capacity, which assume that the interim supplies will be available for power production, show that the present dependable capacity (880 MW in 1975 and 925 MW in 1973) will decrease to around 700 MW in 1995. These projections do not include the addition of New Melones, Auburn, and Marysville Powerplants.

The marketing of the interim water supplies will not have any appreciable effect on electric generation. The dependable capacity will be reduced because the heads of the reservoirs will be drawn down to lower levels, reducing the capability of the hydroelectric plants. In other words, approximately the same total quantity of energy will be produced but the capability to meet short-term peaks will be reduced.

WESTLANDS WATER DISTRICT

An amendatory contract is presently being negotiated with Westlands Water District which includes a firm water supply of 1,150,000 acre-feet per year with provisions for an additional interim amount of approximately 200,000 acre-feet per year. This interim supply for irrigation can be provided until the East Side water customers are able to take delivery of the supply committed to them. They will be served by the potential Mid-Valley Canal.

RESERVOIR RECREATION

Recreation was not specifically authorized initially as an intended purpose of the Central Valley Project. After construction of the initial features of the project, however, the excellent recreation opportunities became apparent.

During the recreation season, every attempt is made to maintain the reservoir recreation pools at levels as high as possible.

AMERICAN RIVER FISH AND RECREATION FLOWS

The accomplishments of the Central Valley Project and, more specifically, the commitments made to American River service areas are predicated on the flows required by the present agreement with California Department of Fish and Game for flow maintenance in the American River.

In April 1972 the State Water Resources Control Board issued its Decision 1400 (D-1400) purporting to establish minimum flow requirements for fish and recreation on the American River below Nimbus Dam. The flows described in D-1400 require about 747,000 acre-feet more water annually than the existing agreement with Fish and Game.

Service area water use for existing contracts and future commitments is expected to build up slowly, making an interim supply available for the American River system.

Flows in the American River below Nimbus Dam are, at present, generally being maintained at an amount greater than required by D-1400. The larger flows could be maintained from Folsom and later by the combination of Auburn and Folsom until such time as the water is required to meet contractual commitments, especially diversions from Nimbus Dam to the Folsom South service area.

The Bureau is presently studying the feasibility of a Hood-Clay Pump Connection which could permit higher flows in the American River to be maintained beyond the time when they will be required for the increasing demands in the Folsom South service area. Water from the American River flowing past the point of normal diversion to the Folsom South Canal would enter the Sacramento River and be recaptured by a pumping plant near Hood. The water would be delivered through the Hood-Clay Pump to the Folsom South Canal, facilitating dual use of the releases from Folsom and Auburn. Development of such an alternative is dependent upon its feasibility, and ultimately, upon congressional authorization.

TRINITY RIVER FISH RELEASES

The Bureau of Reclamation and the California Department of Fish and Game on March 27, 1959, entered into a memorandum operating agreement for streamflow maintenance for the protection, preservation, and enhancement of fish and wildlife, and the recreation resources of the Trinity River as affected by Lewiston and Trinity Dams. The agreement provides that the Bureau release from Lewiston Reservoir these quantities of water down the natural channel of the Trinity River:

Period	Quantity (ft^3/s)
December 1-August 31	150
September 1-October 14	200
October 15-November 14	250
November 15-November 30	200

This schedule was modified slightly in 1968, but the amount of water required, 120,500 acre-feet per year, was not changed.

The fishery of the Trinity River has apparently declined in recent years. As part of a program to reverse this apparent decline, the California Department of Fish and Game recommended additional releases be made. In 1974 the Bureau entered into a 3-year agreement with Fish and Game to release an additional 125,000 acre-feet of water annually to the Trinity River.

This use of interim CVP water supplies for this purpose reduces the energy generation of the project. However, depending on the results of the 3-year test, any loss of power revenues could be offset by an increase in fishery benefits.

Should additional releases to the Trinity River prove to be a beneficial use of project water, CVP interim water supplies could continue to be used for this purpose.

POTENTIAL USES FOR INTERIM SUPPLY

Potential uses of interim water currently being considered as an ongoing part of Reclamation planning activities are irrigation in the San Joaquin Valley, supplemental supplies for the State Water Project, and temporary use of New Melones Project water in areas outside the Stanislaus River Basin.

IRRIGATION

Areas in the San Joaquin Valley such as the Pleasant Valley Water District have indicated an interest in obtaining an interim supply of water. The key limitation in providing such service is conveyance capacity from the Delta. It might be possible either to enter into an agreement with the State whereby the Bureau of Reclamation would pay for conveyance of this water through the California Aqueduct, or to purchase capacity in the aqueduct in order to deliver the interim water.

STATE PROJECT WATER

The State Water Project presently has executed contracts requiring about 4,500,000 acre-feet of water (deliveries plus losses). Should a period as severe as the critical dry period (1928-34) reoccur, the State Water Project would have a water supply of only about 3,580,000 acre-feet with an assumed Delta outflow of 2,500 cubic feet per second.

The State must comply with the stringent D-1379 water quality standards which require additional Delta outflow that could, at the present time, be provided only from CVP interim water supplies. Barring construction of any new project features, the State supply may possibly be augmented by the purchase of CVP interim water until the water is required to meet CVP contracts and commitments.

NEW MELONES PROJECT

Although there is an apparent need for New Melones water in the Stanislaus River Basin, a supply could be available before it is required inbasin to satisfy consumptive use requirements. This supply could be used on an interim basis for other purposes.

The New Melones Project was originally authorized by the Flood Control Act, approved December 22, 1944. Public Law 87-874, dated October 23, 1962, modified the original plan substantially in accordance with the recommendations of the Chief of Engineers

in House Document 453. One of the provisions included in P.L. 87-874 follows:

> ". . . that before initiating any diversions of water from the Stanislaus River Basin in connection with the operation of the Central Valley Project, the Secretary of the Interior shall determine the quantity of water required to satisfy all existing and anticipated future needs within the basin and the diversions shall at all times be subordinate to the quantities so determined . . . ."

Preliminary indications are that the ultimate water needs of the basin which includes parts of Stanislaus, San Joaquin, Tuolumne, and Calaveras Counties, may be greater than the estimated water supply that will become available upon completion of New Melones Dam and Reservoir. However, the use of this supply within the basin is dependent upon the development of the necessary conveyance facilities and contracting with local entities.

The South Delta Water Agency has expressed an interest in contracting for water from New Melones to maintain water quality and positive flow conditions in their area. The Central Delta Water Agency has shown a similar interest.

Another potential use of the New Melones interim water supply could be for the maintenance of white-water recreation on the Stanislaus River below the damsite.

CONCLUSIONS AND RECOMMENDATIONS

Comparison of CVP water supplies and the buildup estimated for the use of those supplies to meet contracts and commitments indicates that an interim supply is available for about the next 35 years. Availability of this interim supply is based on a series of assumptions, which are:

1. Facilities completed and in operation by the year 1985 will include Auburn, Marysville, and New Melones Reservoirs; the Peripheral Canal, and the Mid-Valley Canal.

2. The Central Valley Project will be operated to protect against the occurrence of a hydrologic period as severe as the critical dry period (1928-34).

3. The Central Valley Project demand will build up at the rate projected.

4. A Delta outflow of 2,500 cubic feet per second will be sufficient to maintain the quality of water at the Tracy Pumping Plant.

CONCLUSIONS

Generally the present uses of CVP interim water supplies are for:

1. Power production at CVP hydroelectric powerplants.

2. Enhancement of water quality conditions in the Sacramento-San Joaquin Delta.

3. Sale of additional water to Westlands Water District.

4. Maintenance of higher levels in CVP reservoirs during the summer recreation season.

5. Fish and recreation flows in the American River below Nimbus.

6. Fishery releases to the Trinity River below Lewiston.

RECOMMENDATIONS

It is recommended that present uses of interim water be continued.

It is also recommended that active consideration be given to the marketing of CVP interim water supplies for such purposes as use in the San Joaquin Valley by the Pleasant Valley Water District and others; to augment supplies of the State Water Project, if possible, enabling it to meet contract commitments; and to improve water quality conditions in the San Joaquin River and southern Delta.

The impacts of these potential new uses should be evaluated with respect to the present uses such as recreation, power as it affects project repayment, and the ability to provide Trinity River releases. The new uses of interim water can then be implemented if justified.

Acre-foot - A term commonly used in measuring volumes of water stored or used. Equal to the quantity of water required to cover 1 acre to a depth of 1 foot. (Approximately 2 acre-feet = 1 cubic foot per second for 1 day.)

Water Year - The 12-month period from October 1 through September 30. The water year is designated by the calendar year in which it ends. The basic intent is to include all of one winter's precipitation in one period.

Class 1 Water Supply - Water controlled in and provided by Millerton Lake to Friant Division water users on a firm basis. Available in all but critically dry years when there may be some shortage.

Class 2 Water Supply - Water controlled in and provided by Millerton Lake to Friant Division water users on an intermittent basis. Amount available depends on the type of year. Availability varies with large quantities in very wet years to none in critically dry years.

Normal Year - Any year in which the normal multipurpose functions of the Central Valley Project can be satisfied without taking shortages or deficiencies.

Deficiency - A tolerable reduction in service to a demand in critically dry years so that more water can be marketed in normal years. Deficiencies are taken in most irrigation demands and in navigation requirements along the Sacramento River and some agreed fishery releases. They are estimated to be 100 percent of 1-year demand spread over a critically dry period or approximately 25 percent in any one critically dry year.

Critically Dry Year - A critical year, as defined in the May 1956 contract for the exchange of water and in water rights settlement contracts in the Sacramento Basin, is said to exist if:

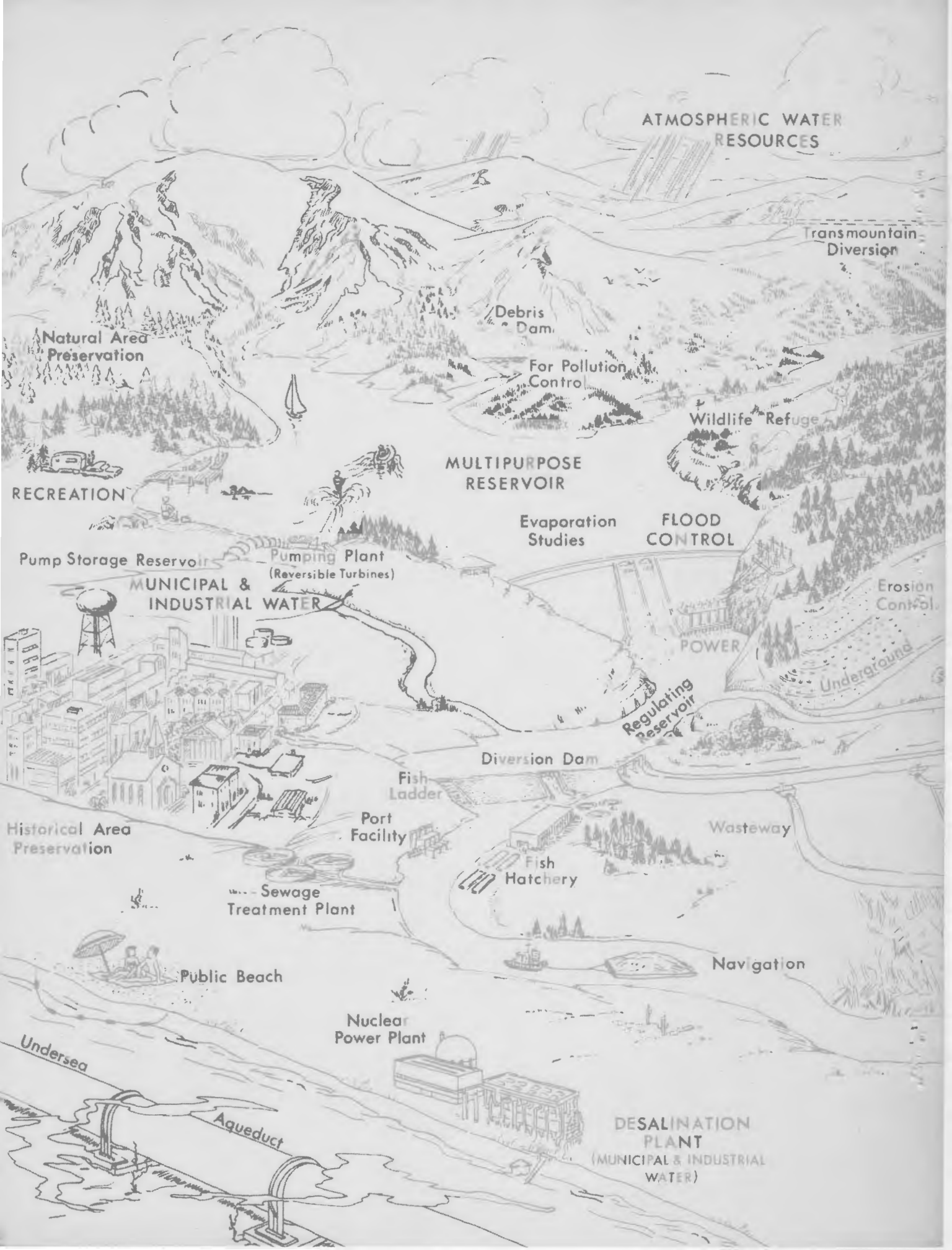
1. The forecasted full natural inflow to Shasta Lake for the current water year (October 1 of the preceding calendar year through September 30 of the current calendar year), as such forecast is made by the United States, on or before February 15, and reviewed as frequently thereafter as conditions and information warrant, is equal to or less than 3,200,000 acre-feet, or

2. The total accumulated actual deficiencies of inflow below 4 million acre-feet in the immediately prior water year or series of successive water years, each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the current water year, exceed 800,000 acre-feet. The full natural inflow to Shasta Lake includes adjustments to eliminate the effect of any major construction above Shasta Lake, which materially alters the present regimen of the contributory stream systems.

Carryover Storage - The maximum amount of usable water stored in a reservoir to meet demands for a critically dry period.

Reservoir Capacity - Total storage space in a reservoir below a designated elevation.

Reservoir Yield - Amount of water supply available from a reservoir in a normal year that would not be available in the absence of the reservoir. Derived from both controllable runoff to the reservoir and carryover storage available for a critically dry period.


ATMOSPHERIC WATER RESOURCES
Transmountain Diversion
Debris Dam
For Pollution Control
Natural Area Preservation
Wildlife Refuge
MULTIPURPOSE RESERVOIR
RECREATION
Evaporation Studies
FLOOD CONTROL
Pump Storage Reservoir
Pumping Plant (Reversible Turbines)
MUNICIPAL & INDUSTRIAL WATER
Erosion Control
POWER
Underground
Regulating Reservoir
Diversion Dam
Fish Ladder
Port Facility
Historical Area Preservation
Wasteway
Fish Hatchery
Sewage Treatment Plant
Navigation
Public Beach
Nuclear Power Plant
Undersea Aqueduct
DESALINATION PLANT (MUNICIPAL & INDUSTRIAL WATER)