Challenges of Instream Flow: Effects on all Beneficial Uses

Delta Conservancy Workshop
December 2, 2014

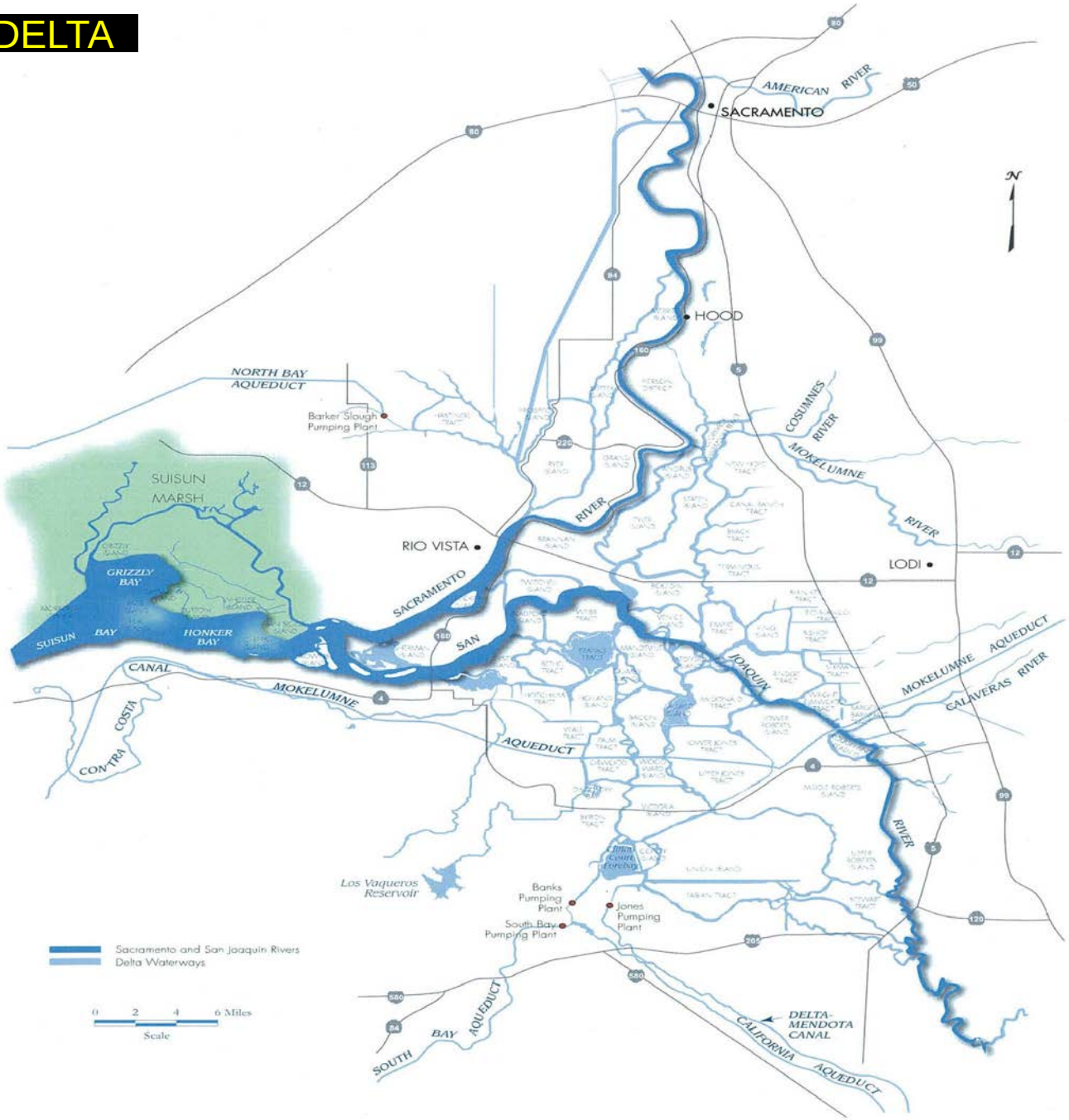
John Herrick, Counsel & Manager
South Delta Water Agency


Obligatory Egret Picture

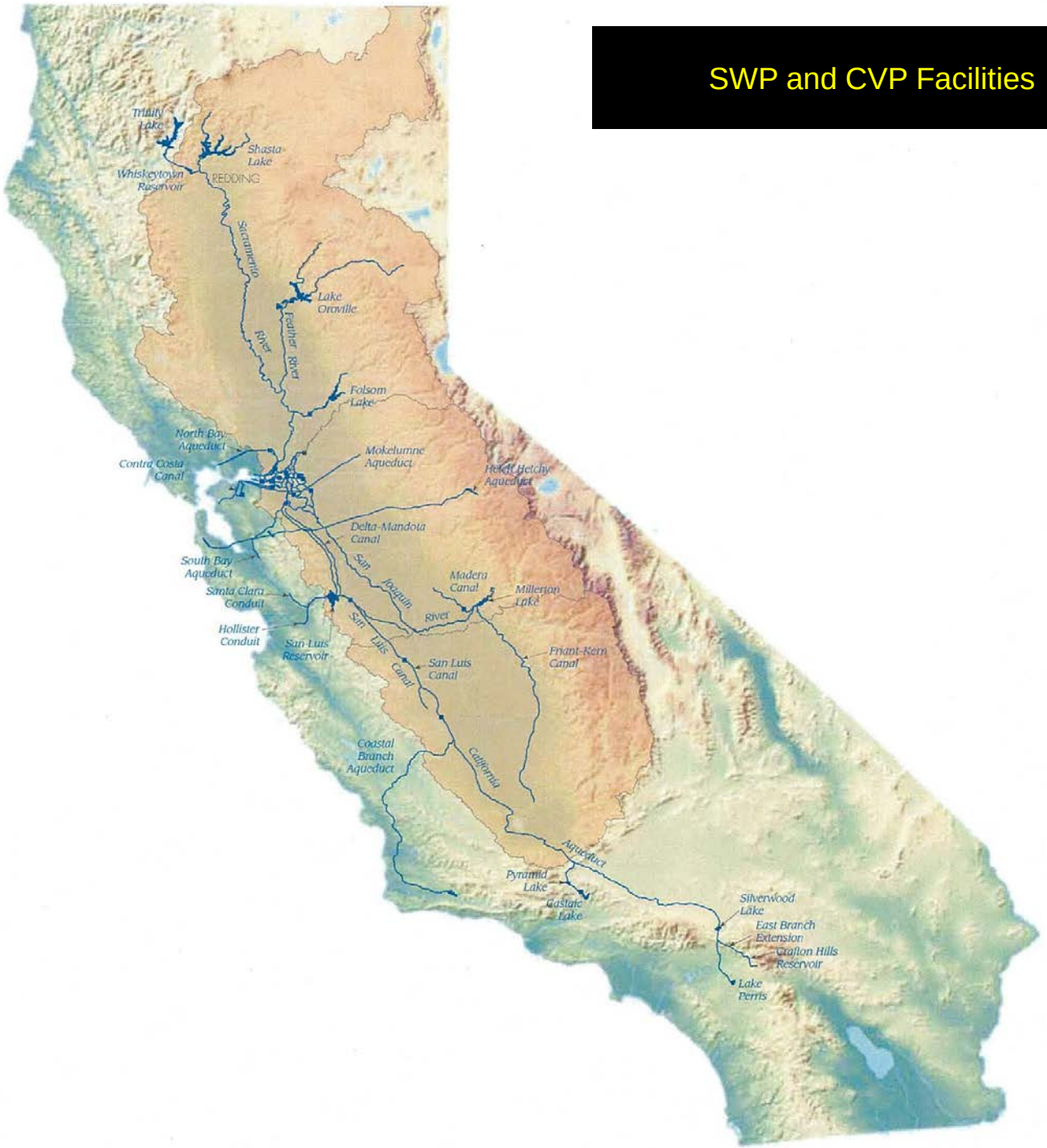
The Delta is fed by two main rivers, the Sacramento which flows from the north and the San Joaquin which flows from the south.

Other rivers and streams feed these tributaries and the Delta itself.

DELTA


SACRAMENTO
AMERICAN RIVER
HOOD
NORTH BAY AQUEDUCT
Barker Slough Pumping Plant
SUISUN MARSH
GRIZZLY BAY
SUISUN BAY
HONKER BAY
RIO VISTA
SACRAMENTO RIVER
SAN JOAQUIN RIVER
COSUMNES RIVER
MOKELUMNE RIVER
LODI
MOKELUMNE AQUEDUCT
CALAVERAS RIVER
CANAL
MOKELUMNE AQUEDUCT
CONTRA COSTA
Los Vaqueros Reservoir
Banks Pumping Plant
Jones Pumping Plant
South Bay Pumping Plant
SOUTH BAY AQUEDUCT
DELTA-MENDOTA CANAL
CALIFORNIA AQUEDUCT
Sacramento and San Joaquin Rivers
Delta Waterways
0 2 4 6 Miles
Scale

SWP and CVP Facilities



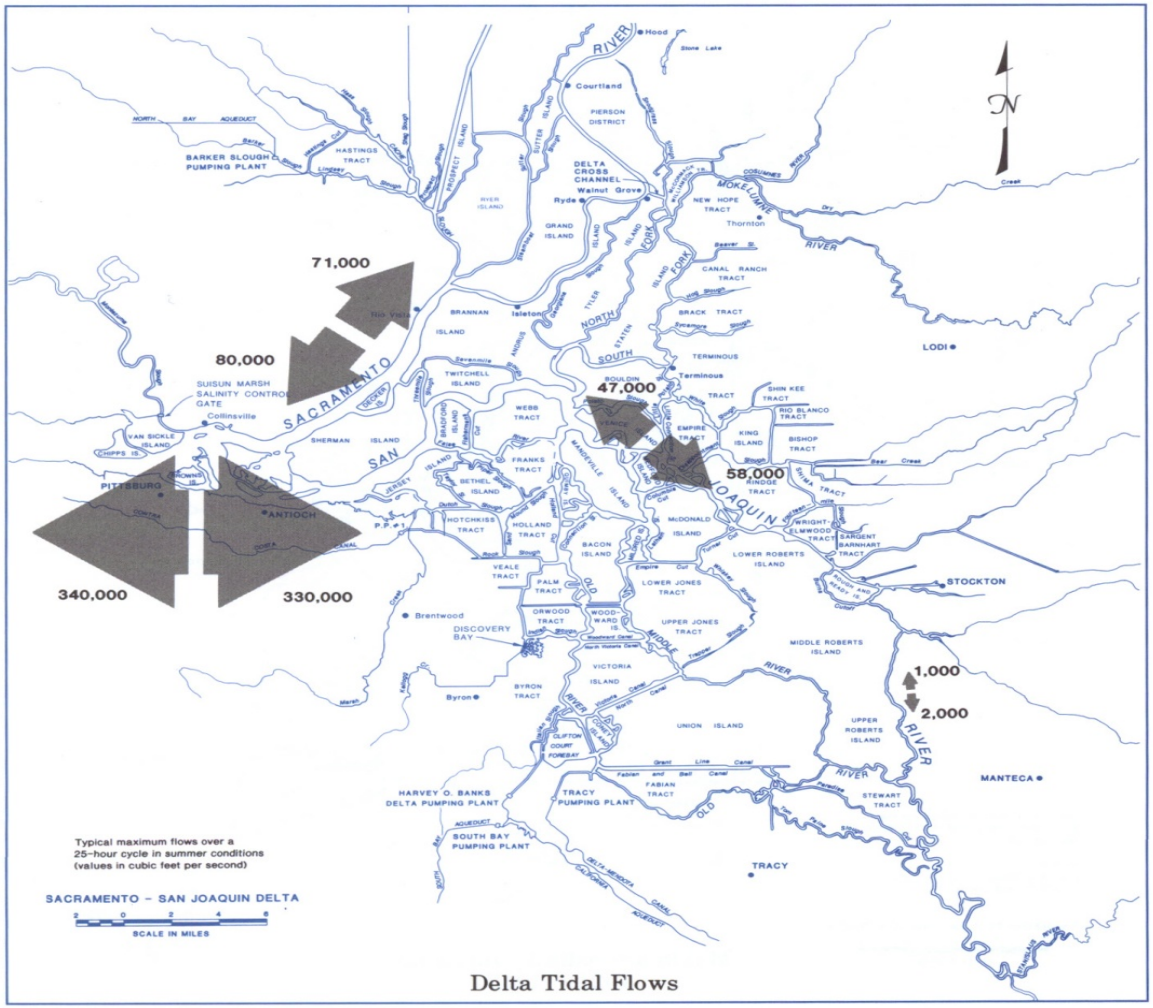
Twice daily, the tidal cycle pushes water upstream into the Delta. During the ebb tides, the levels decrease as the flow returns to a downstream direction.

The tidal range is typically 3 - 5 feet.

It is important no note that the incoming tide does not mean ocean water reaches all the way into the Delta. Ocean salts mixing with the Delta water do get dispersed and enter the Delta.

Delta Tidal Flows and Levels

The Sacramento-San Joaquin Delta is at sea level. Water levels vary greatly during each tidal cycle, from less than a foot on the San Joaquin River near Interstate 5 to more than five feet near Pittsburg. During the tidal cycle, flows can also vary in direction and amount. For example and as shown on the map below, the flow near Pittsburg during a typical summer tidal cycle can vary from 330,000 cfs upstream to 340,000 cfs downstream. The "net" summer Delta outflow is a very small amount of the total water movement, generally 5,000 to 10,000 cfs.



Delta Tidal Flows

Sacramento-San Joaquin Delta Atlas

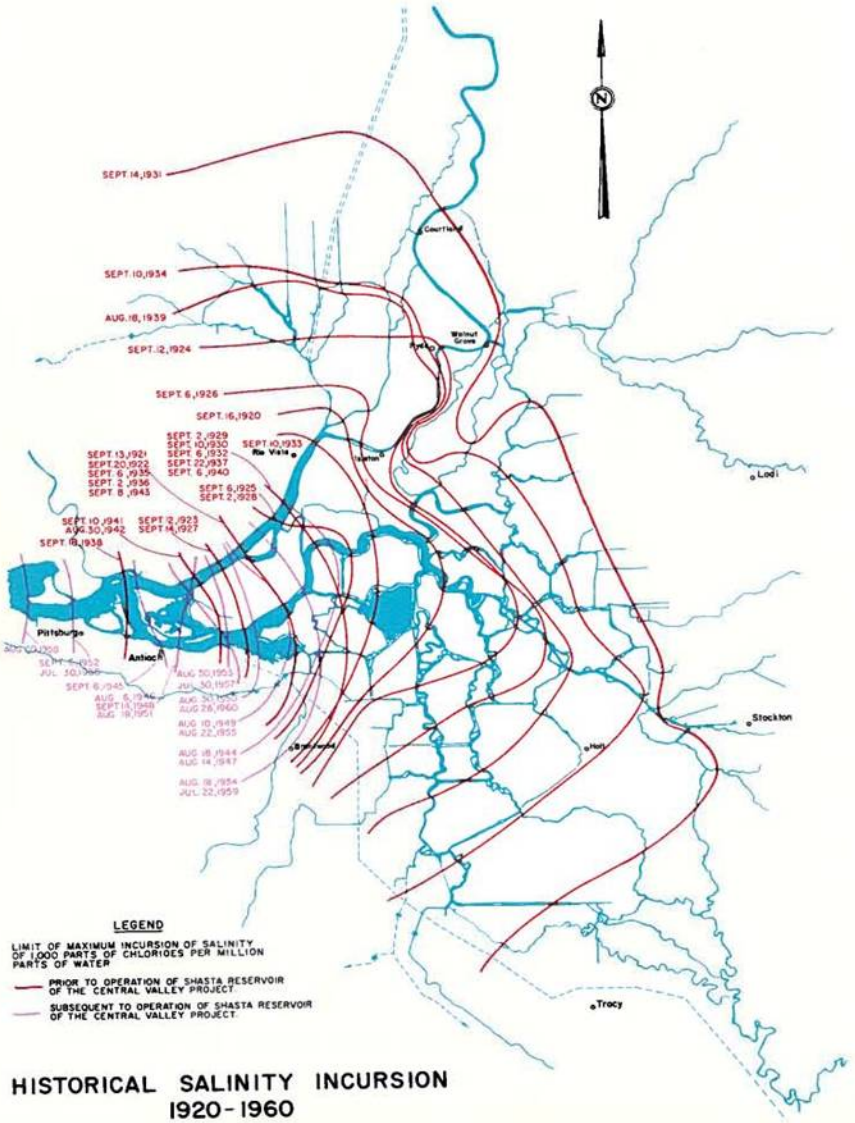
Historically, the two main rivers provided the Delta estuary with inflow during every month in every year. Of course, in drier times inflows during the late summer and fall were much smaller than at other times.

Contrary to common understanding, fresh water flows continued to enter the Delta from the north and the south.

This was because large marsh areas upstream filled with spring runoff and slowly drained back into the rivers as spring ended and summer began.

Even in the worst drought years (pre-project) the southern Delta water quality remained useable as the inflow continued to provide good quality water and acted as a buffer against intruding ocean salinity.

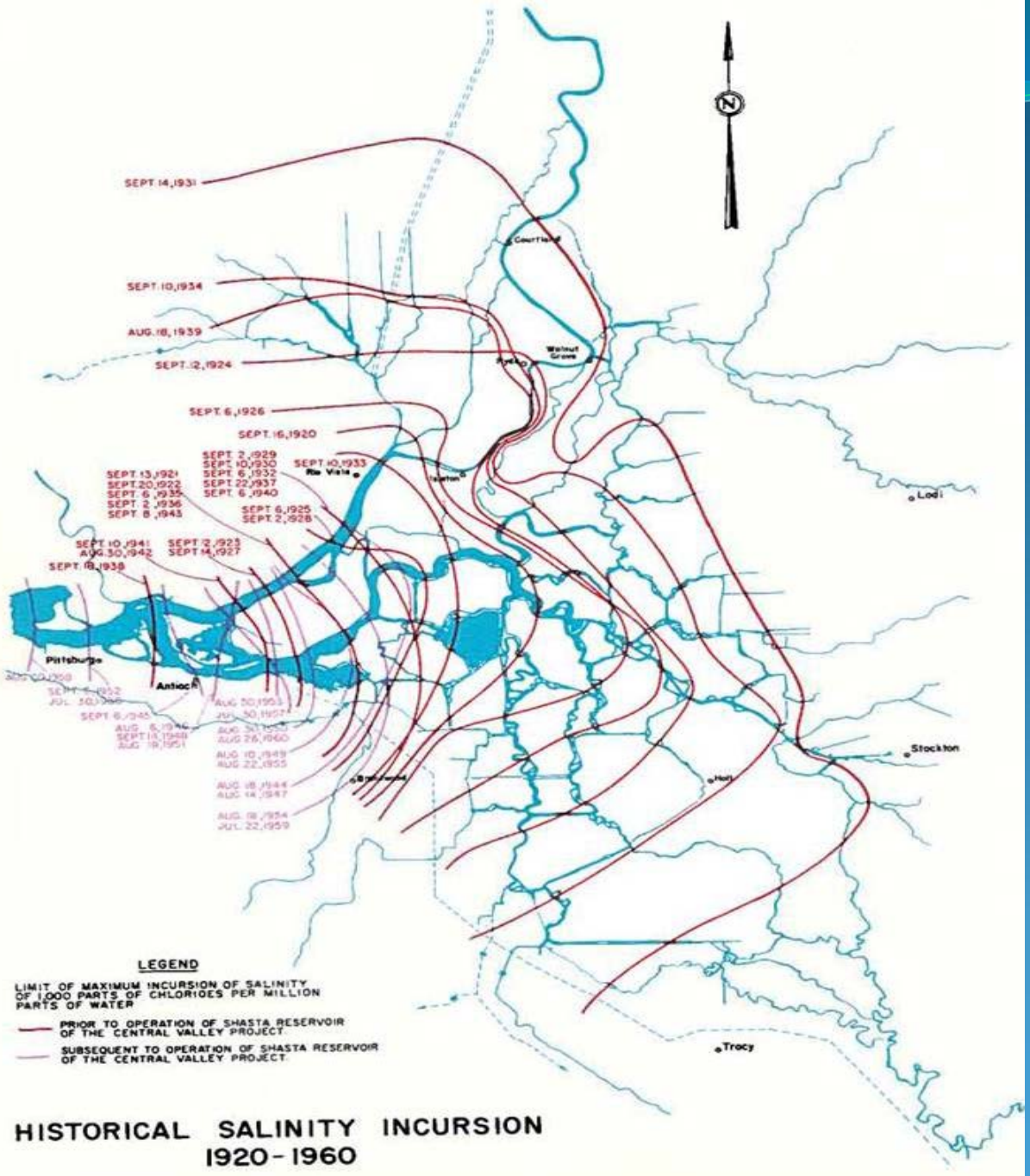
Delta Problems — salinity incursion and water supplies



HISTORICAL SALINITY INCURSION
1920-1960

Salinity incursion into the Delta results from the flooding and ebbing of ocean tides through the San Francisco Bay and Delta system during periods when the fresh water outflow from the Delta is insufficient to repel the saline water. The natural fresh water outflow from the Central Valley was historically inadequate to repel salinity during summer months of some years. The first known record of salinity encroachment into the Delta was reported by Cmdr. Ringgold, U. S. Navy, in August 1841, whose party found the water at the site of the present city of Antioch very brackish and unfit for drinking. Since that time, and particularly after the turn of the century, with expanding upstream water use salinity incursion has become an increasingly greater problem in Delta water supplies. The maximum recorded extent of salinity incursion happened in 1931, when ocean salts reached Stockton. Since 1944 extensive incursion has been repulsed much of the time by fresh water releases from Central Valley Project storage in Shasta and Folsom Reservoirs. Without such releases, saline water would have spread through about 90 percent of the Delta channels in 1955 and 1959. Although upstream uses might not have reached present levels in the absence of the Central Valley Project, salinity problems would still have been very serious during most years.

Further increase in water use in areas tributary to the Delta will worsen the salinity incursion problem and complicate the already complex water rights situation. To maintain and expand the economy of the Delta, it will be necessary to provide an adequate supply of good quality water and protect the lands from the effects of salinity incursion. In 1959 the State Legislature directed that water shall not be diverted from the Delta for use elsewhere unless adequate supplies for the Delta are first provided.



HISTORICAL SALINITY INCURSION
1920 - 1960

What are instream flows supposed to accomplish?

The Protection of Beneficial Uses.

Quality and Quantity of Inflows

The construction and operation of the Friant Dam by the federal Central Valley Project on the upper San Joaquin intentionally severed the upper portions of the River, except in times of high or flood flows.


Sacramento
Cosumnes
Sutter Cr.
Mokelumne
Stanislaus
Calaveras
Pittsburg
Stockton
Manteca
San Francisco
Old
Don Pedro Reservoir
Tuolumne
Modesto
San Joaquin
Turlock
Merced
Merced
Mariposa Cr.
San Joaquin
Fresno
Millerton Lake
Madera
Clovis
Fresno
Kings
St. Johns
Kaweah
Hanford
Visalia
Lake Kaweah
Tulare
Tule
Kern
South Fork
White
Porterville
Tulare Lakebed
Poso Cr.
Lake Isabella
Kern
Bakersfield
Buena Vista Lake
Kern Lake
About 450 miles (724 km) across

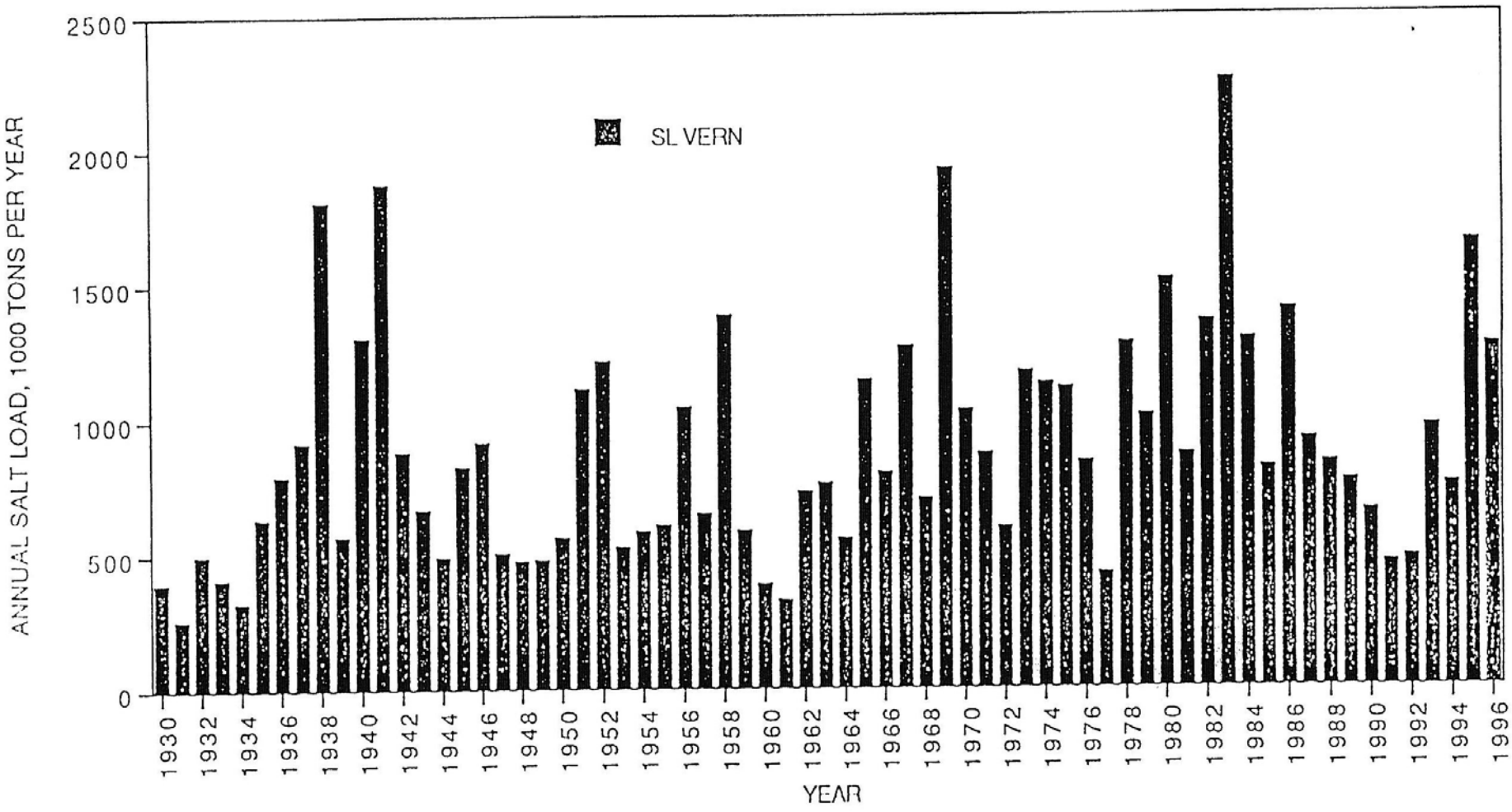
Table V-21

SUMMARY OF REDUCTIONS IN RUNOFF OF SAN JOAQUIN RIVER AT VERNALIS FROM PRE-CVP TO POST-CVP

YEAR TYPE & PERIOD	EFFECT OF ALL POST-CVP UPSTREAM DEVELOPMENT ON RUNOFF AT VERNALIS		EFFECT OF CVP ON RUNOFF AT VERNALIS		
	Reduction in Runoff KAF[1]	Post 1947 Reduction as Percent of Pre-1944 Actual Runoff	Reduction in Runoff KAF[1]	Reduction at Vernalis as Percent of Pre-1944 Flow	Reduction at Vernalis as Percent of Post-1947 Flow
DRY					
April-Sept	206- 417	49-67[2]	6- 7	1.4- 1.6	3.0- 3.6
Full Year	294- 519	25-44	93- 138	8 - 12	10 - 14
BELOW NORMAL					
April-Sept	1064-1177	60-68[2]	386- 428	22 - 24[2]	55 - 61
Full Year	1219	44[2]	543	- 20[2]	35
ABOVE NORMAL					
April-Sept	1406-1732	47-57	440- 704	14 - 23	40 - 64
Full Year	1400-1721	28-34	768-1076	15 - 21	25 - 36
WET					
April-Sept	1002-1760	19-32	554- 965	10 - 18	15 - 26
Full Year	1168-2916	13-32	771-2014	9 - 22	12 - 31
AVERAGE OF ALL YEARS[3]					
April-Sept	920-1272	44-56	347-526	12 - 17	28 - 39
Full Year	1020-1594	28-39	544-943	13 - 19	21 - 29

[1] Range of estimates by all methods of analysis. See Tables V-2 through V-17
[2] Pre-CVP "actual" is assumed to be post-1947 actual plus pre-1944 to post-1947 loss
[3] Assumes that each year class occupies one-quarter of period

The CVP also increased irrigation of saline San Joaquin Valley soils while at the same time delivering to that area millions of tons of ocean salts exported from the Delta.



ANNUAL SALT LOAD
SAN JOAQUIN RIVER NEAR VERNALIS, 1930 TO 1996

Figure 4

CENTRAL VALLEY REGIONAL
WATER QUALITY CONTROL BOARD

Salinity in the Central Valley

An Overview

May 2006

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

Table 3. Annual salt load from mass emissions and Delta exports through the Sacramento-San Joaquin Delta system

	Min	Max	Mean	1985 to 1994 Mean	2001 to 2004 Mean	Period of Record / Notes
Mass Emissions	Annual Salt Load (thousand tons/year)					
Sacramento River	730	3,049	1,945	1,521	1,748	1959 to 2004[1]
Yolo Bypass	0	2,392	405	169	179	1959 to 2004[1], assume EC=100
San Joaquin River	263	2,557	922	749	742	1959 to 2004[2]
Delta Outflow						
Delta Exports	Annual Salt Load (thousand tons/year)					
California Aqueduct (SWP)	983	1,022	1,004		1,004	2001 to 2004[3]
Delta Mendota Canal (CVP)	631	1,003	900		884	2001 to 2004[3]
North Bay Aqueduct	2	6	4	3	6	1959 to 2004[1], assume EC=Sac River
Contra Costa Canal	37	46	41		41	1959 to 2004[1], assume EC=SWP

[1]Source: DayFlow; [2]Source: USGS, 2006; [3]Source: DWR, 2006c

Note: Blanks in the above table represent data that must be compiled by future efforts, if possible

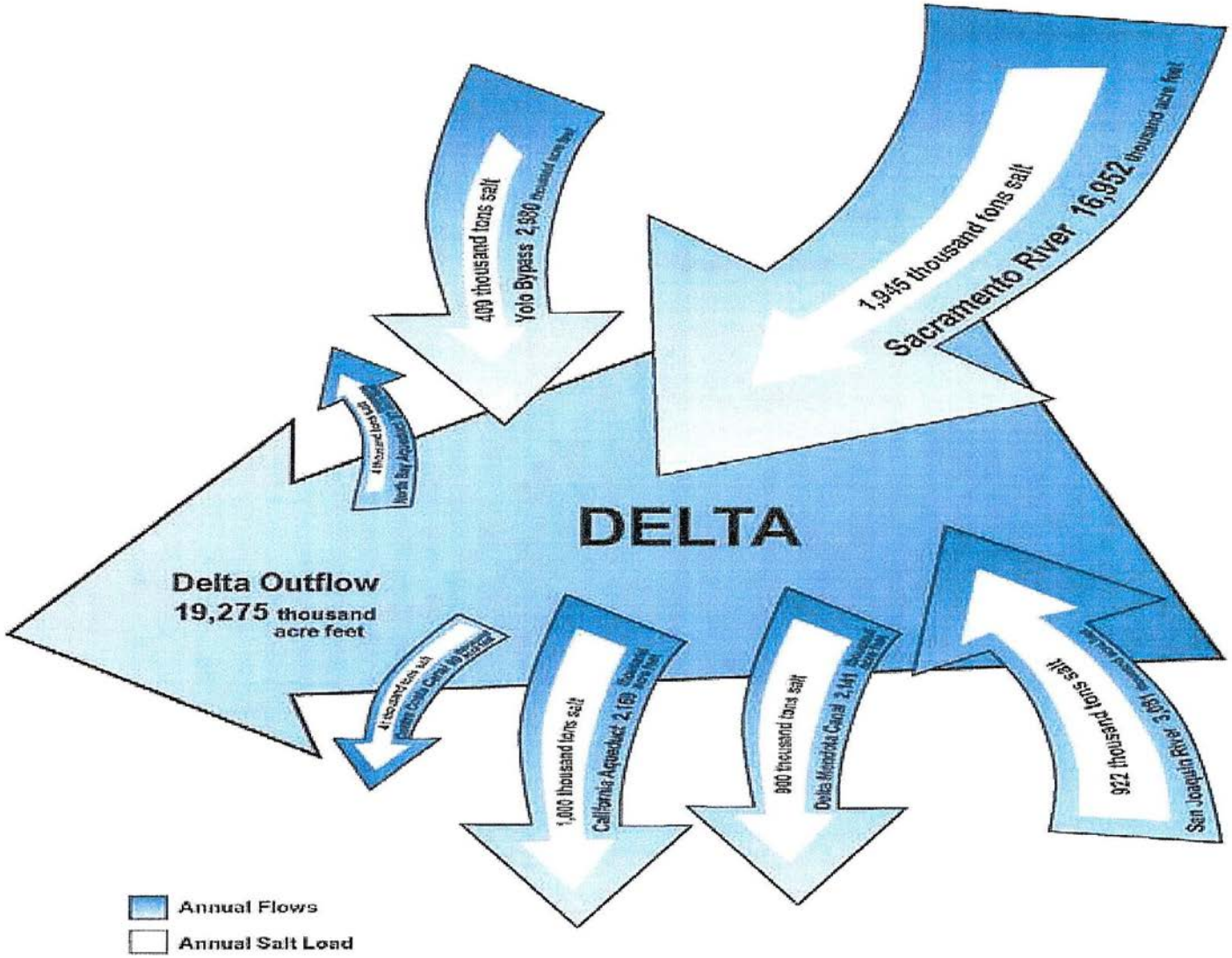


Figure 3. Mass emissions and Delta exports in the Sacramento-San Joaquin Delta system

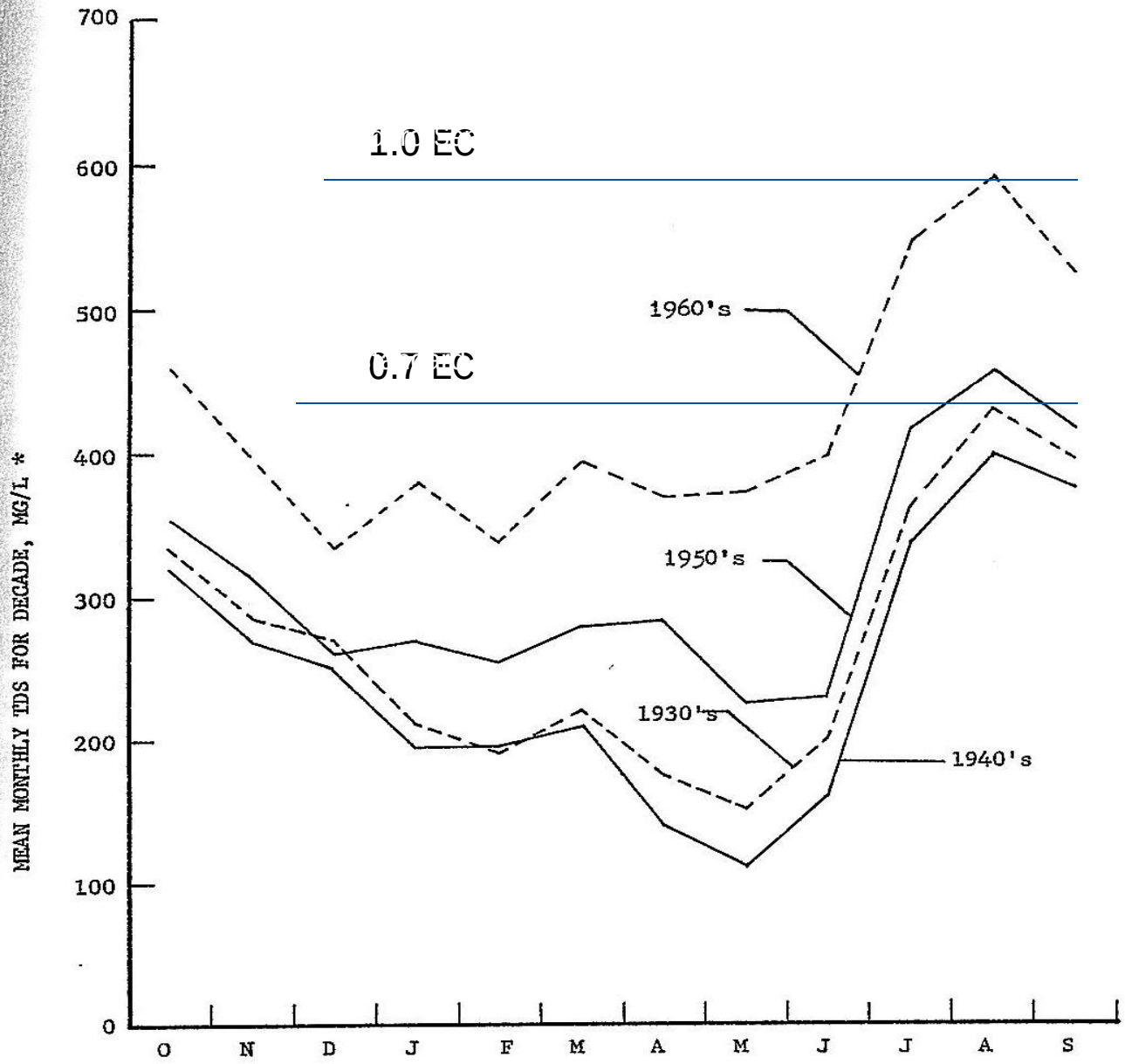


Figure VI-27 MEAN MONTHLY TDS AT VERNALIS BY DECADES 1930-1969

* Estimated by chloride load-flow regressions for 30's and 40's.

Report of the Effects of the CVP Upon the Southern Delta Water Supply Sacramento-San Joaquin River Delta, California June 1980

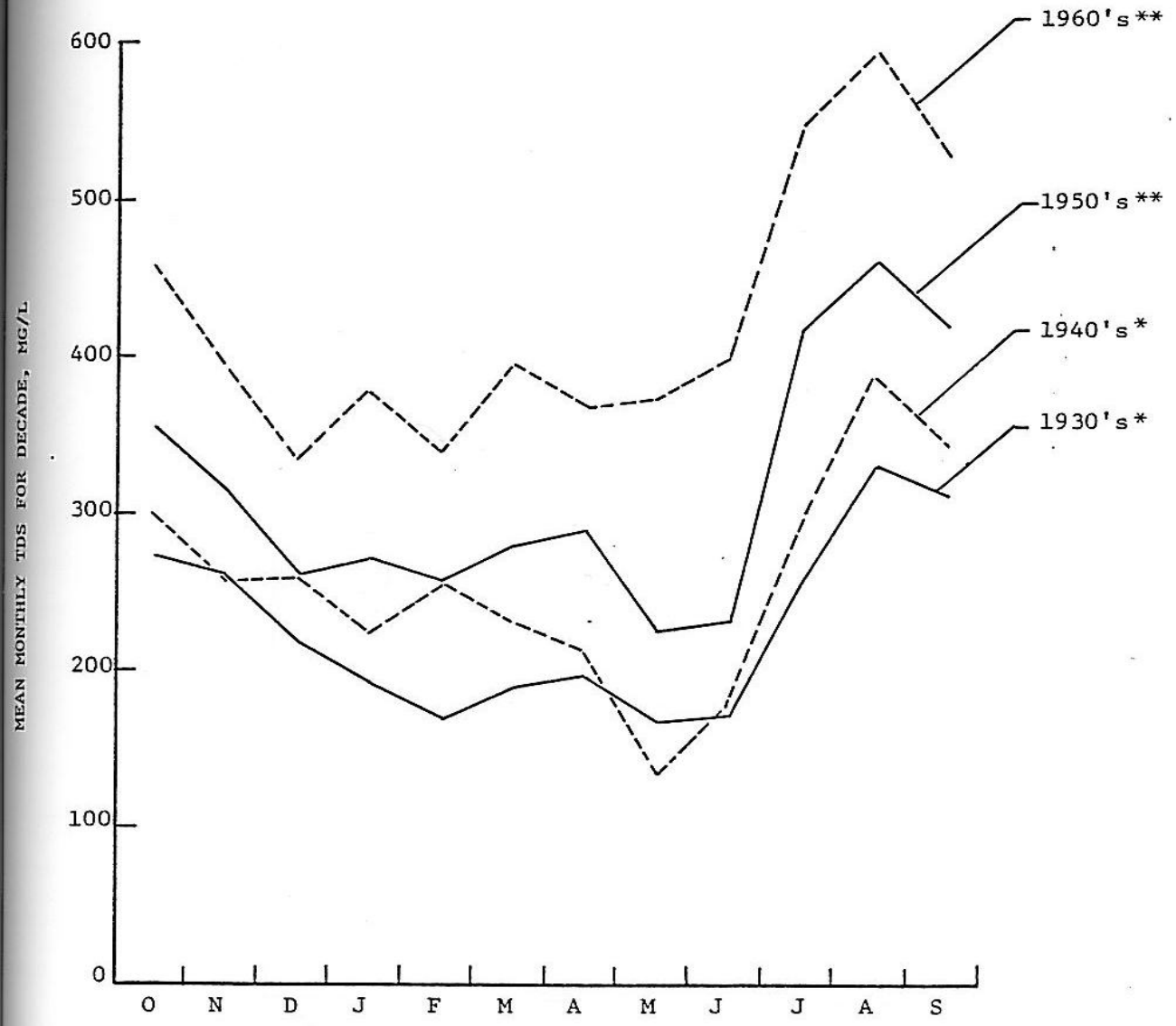


Figure VI-25 MEAN MONTHLY TDS AT VERNALIS BY DECADES 1930-1969
*Based on Mossdale chloride data
**Based on actual observations

Report of the Effects of the CVP Upon the Southern Delta Water Supply Sacramento-San Joaquin River Delta, California June 1980

Vernalis EC from 12/15/13 to 4/1/14 was from .78 EC to 1.0

Roughly double what it was pre-project.

The water quality objective for the protection of agricultural beneficial uses measured at Old River at Tracy Blvd. Bridge was exceeded continuously from 1/1/14 to 11/15/14.

The huge addition of foreign salts to the San Joaquin River adversely affects downstream and in-Delta uses and current standards are not mitigating these impacts.

Fishery Flows that do not Protect Fish

Fishery flows, besides creating habitat, are to either help transport fish smolts out to the ocean, or provide olfactory clues to attract fish back to their spawning streams.

REVISED
Water Right Decision 1641

In the Matter of:

Implementation of Water Quality Objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary;

A Petition to Change Points of Diversion of the Central Valley Project and the State Water Project in the Southern Delta; and

A Petition to Change Places of Use and Purposes of Use of the Central Valley Project

Adopted December 29, 1999

Revised March 15, 2000
in accordance with Order WR 2000-02

STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

IT IS FURTHER ORDERED that Licenses 990, 2684, 2685, 6047, 11395, and 11396 (Applications 1221, 1222, 1224, 10572, 16186, and 16187, respectively) of the Merced Irrigation District, Licenses 7856 and 7860 (Applications 10872 and 13310, respectively) of the Oakdale and South San Joaquin Irrigation Districts, and Licenses 5417 and 11058 (Applications 1233 and 14127, respectively)* of the Turlock and Modesto Irrigation Districts shall be amended by adding the following conditions which shall expire on December 31, 2011 or at such time as the San Joaquin River Agreement (SJRA) is terminated, whichever occurs first.

1. In addition to all other places of use authorized by this license, the reach of river between Licensee's point of diversion and Vernalis on the San Joaquin River is added as a place of use.

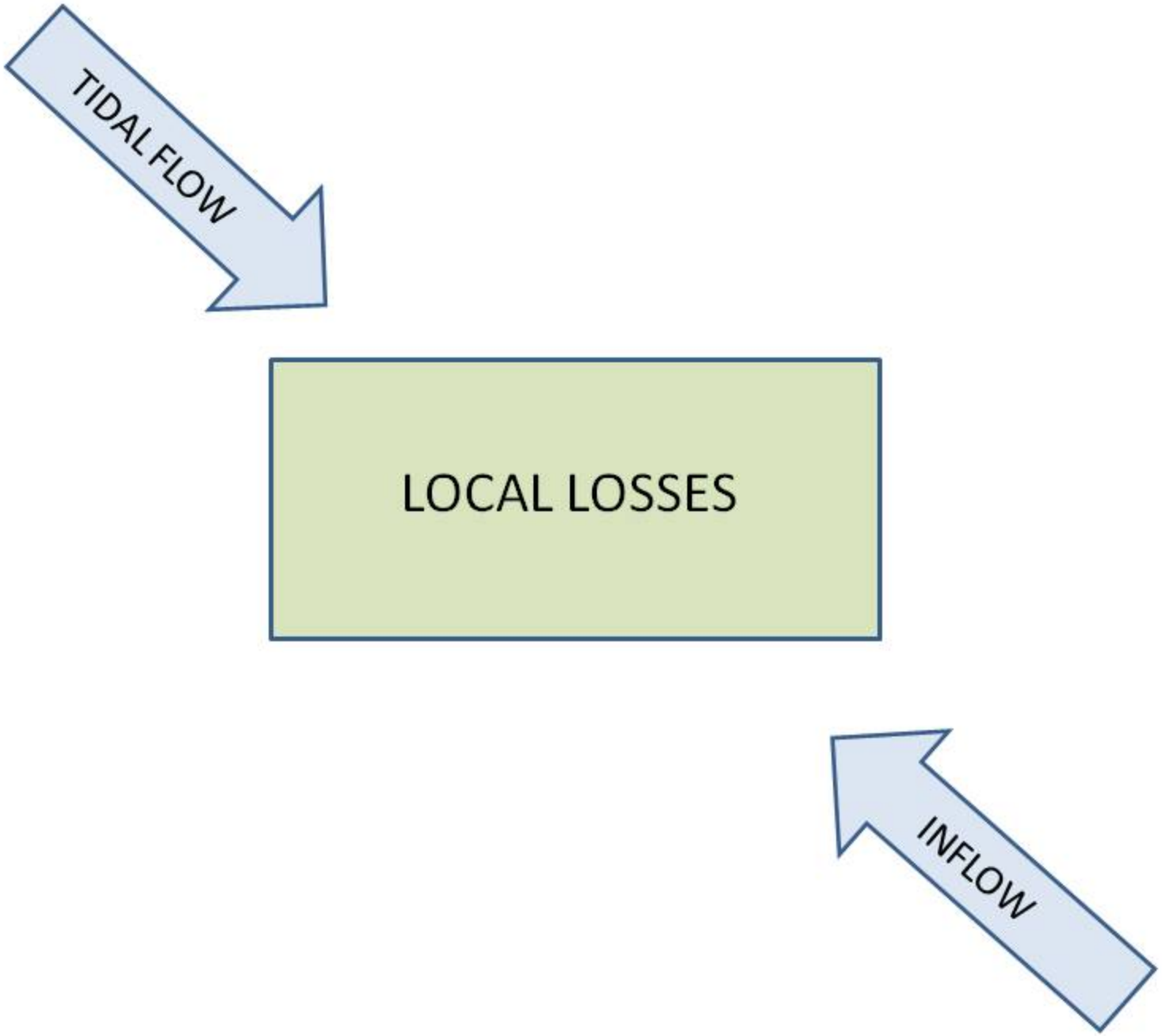
2. In addition to all other purposes of use authorized by this license, the purposes of use shall include Fish and Wildlife Enhancement.

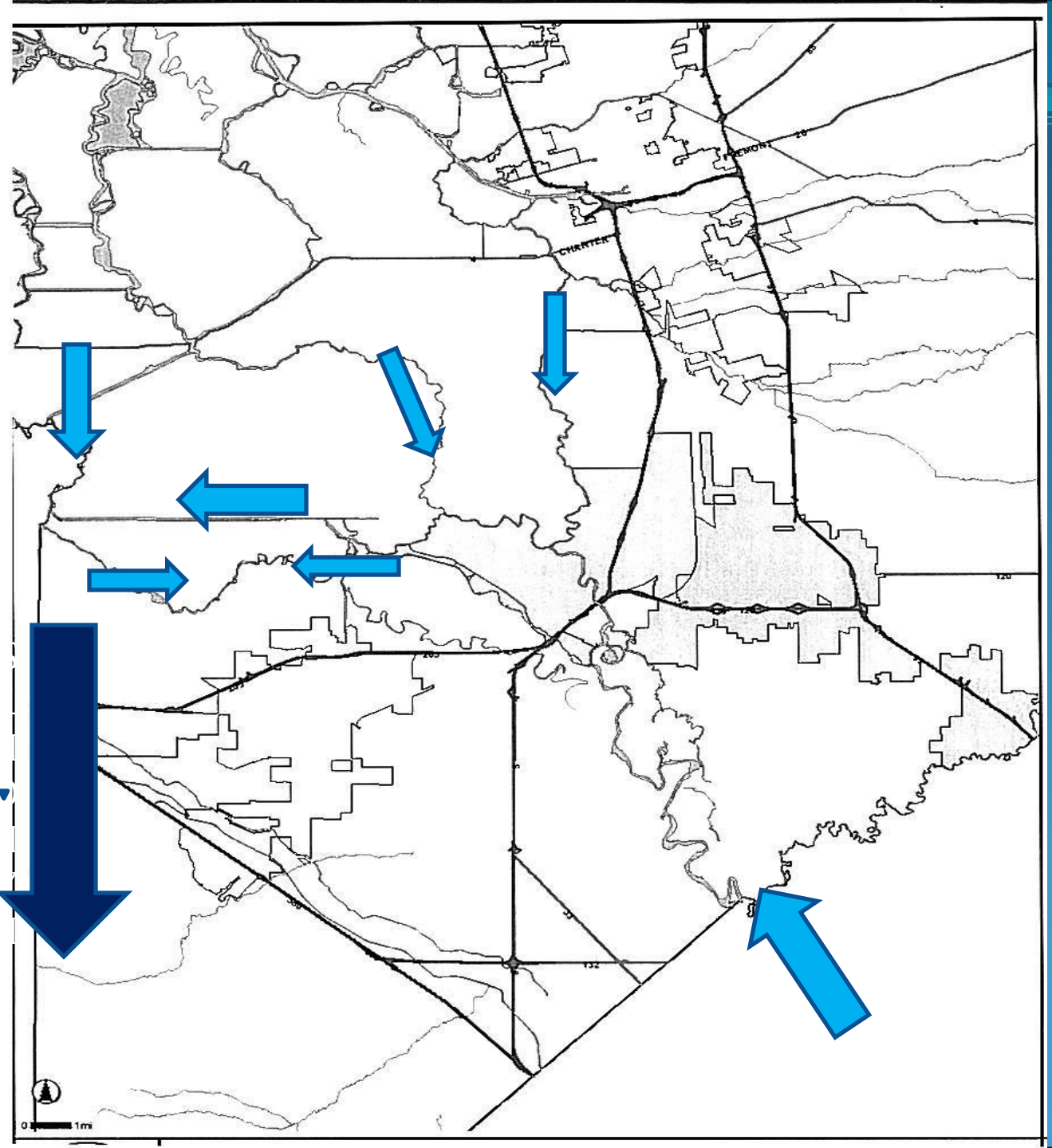
3. The flows provided by Licensee pursuant to the SJRA will satisfy any responsibility of Licensee to meet the objectives in Tables 1, 2, and 3, attached. When the SJRA expires or is terminated, the Board will give notice and will commence a proceeding to determine the responsibility of Licensee to meet the objectives.

4. Except as provided below, while the SJRA is in effect, Licensee shall meet the following target flows for the protection of fish and wildlife beneficial uses on the San Joaquin River

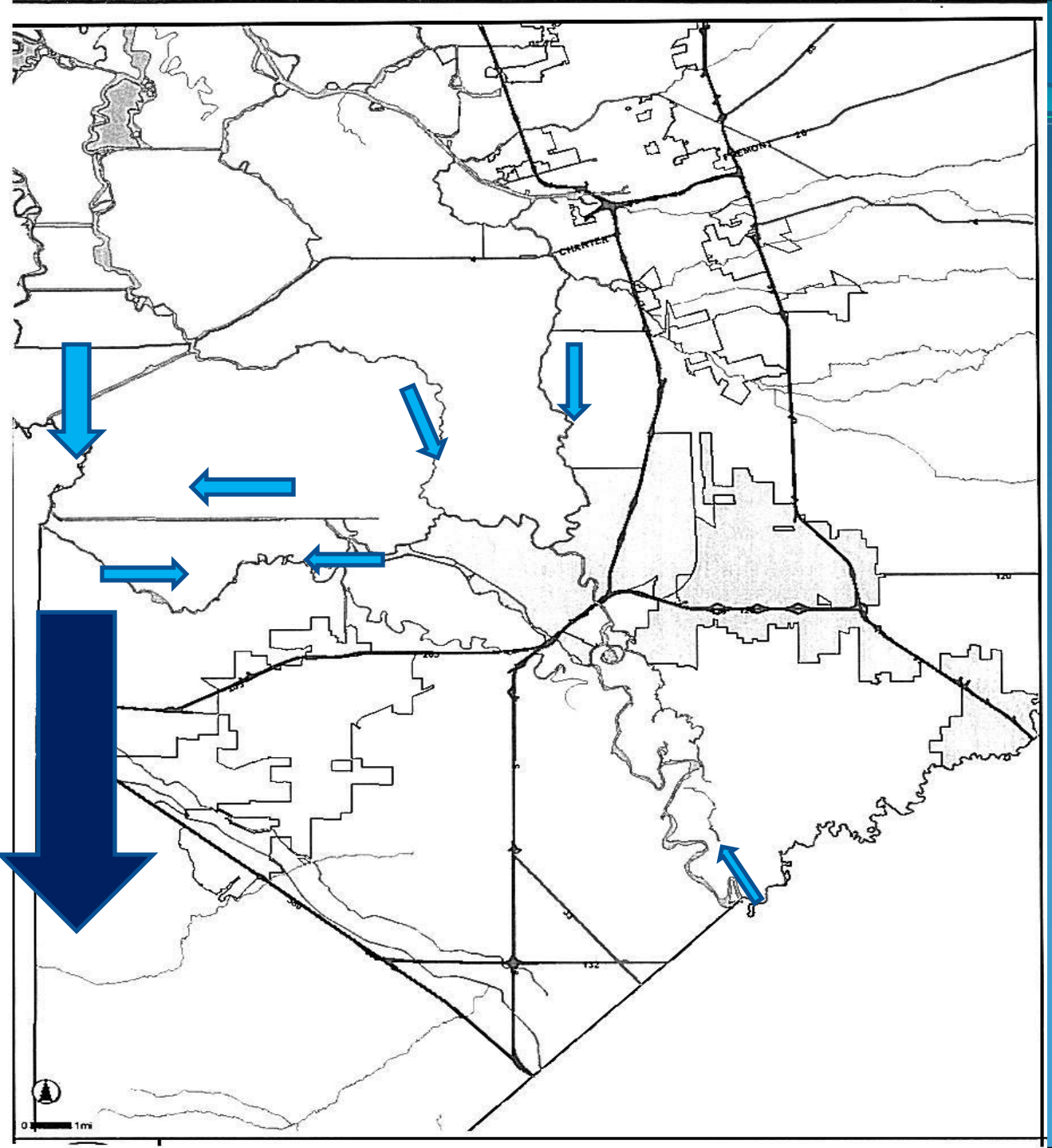
Absent export pumps, flows in southern Delta channels were a function of inflow, net loss, and tidal action.

As inflows decreased, the amount of net loss (evaporation and evapo-transpiration) determined how much of if the San Joaquin River reached the Bay.


TIDAL FLOW
LOCAL LOSSES
INFLOW

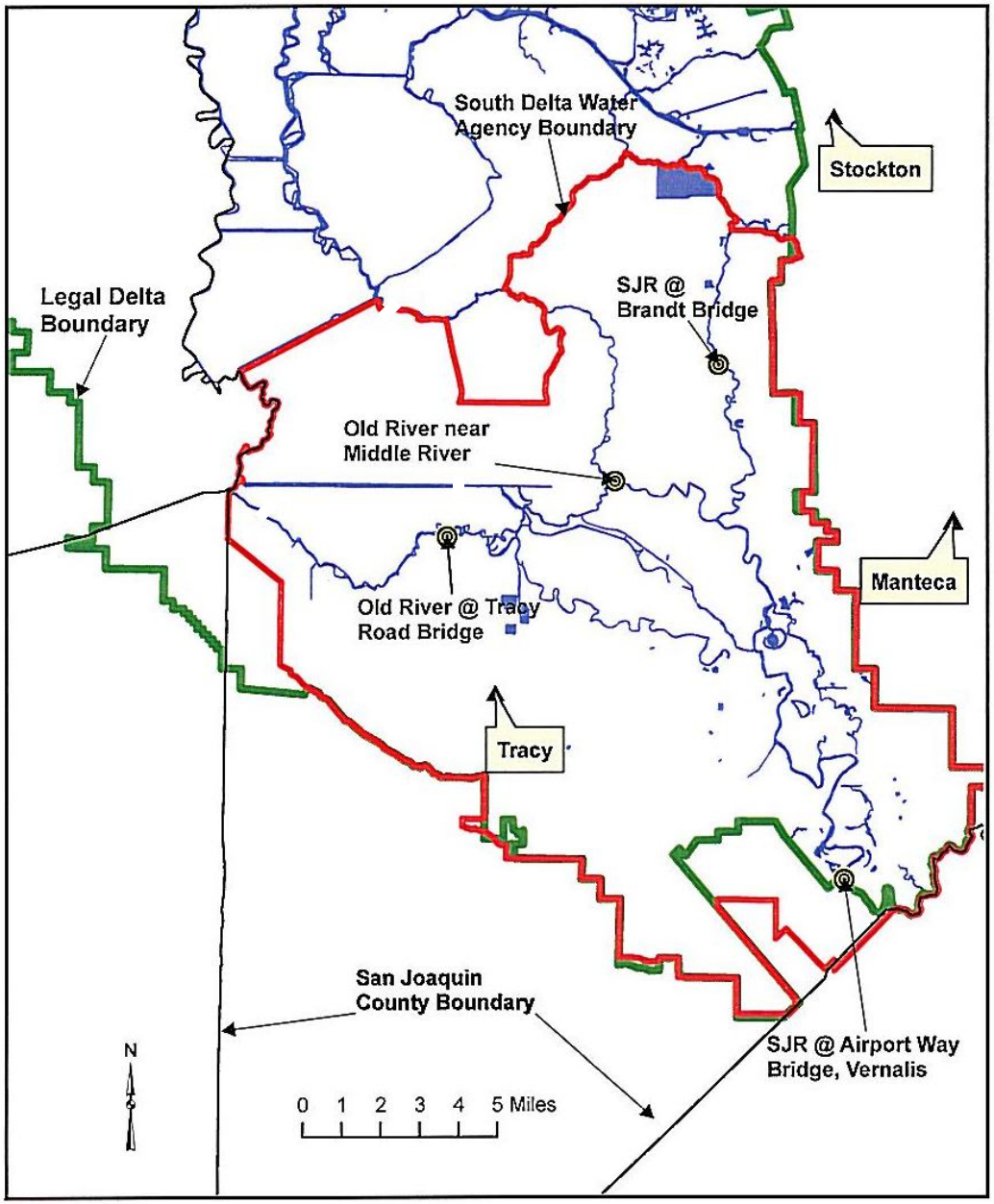


When the San Joaquin River enters the Delta, it flows are subject to tidal influence and the changes in flow resulting from the export projects.



During a typical year, SJ River flow is many times less than the tidal flow and almost always less than exports.

Figure 1.1. Map of southern Delta showing boundary of the South Delta Water Agency and salinity compliance stations.



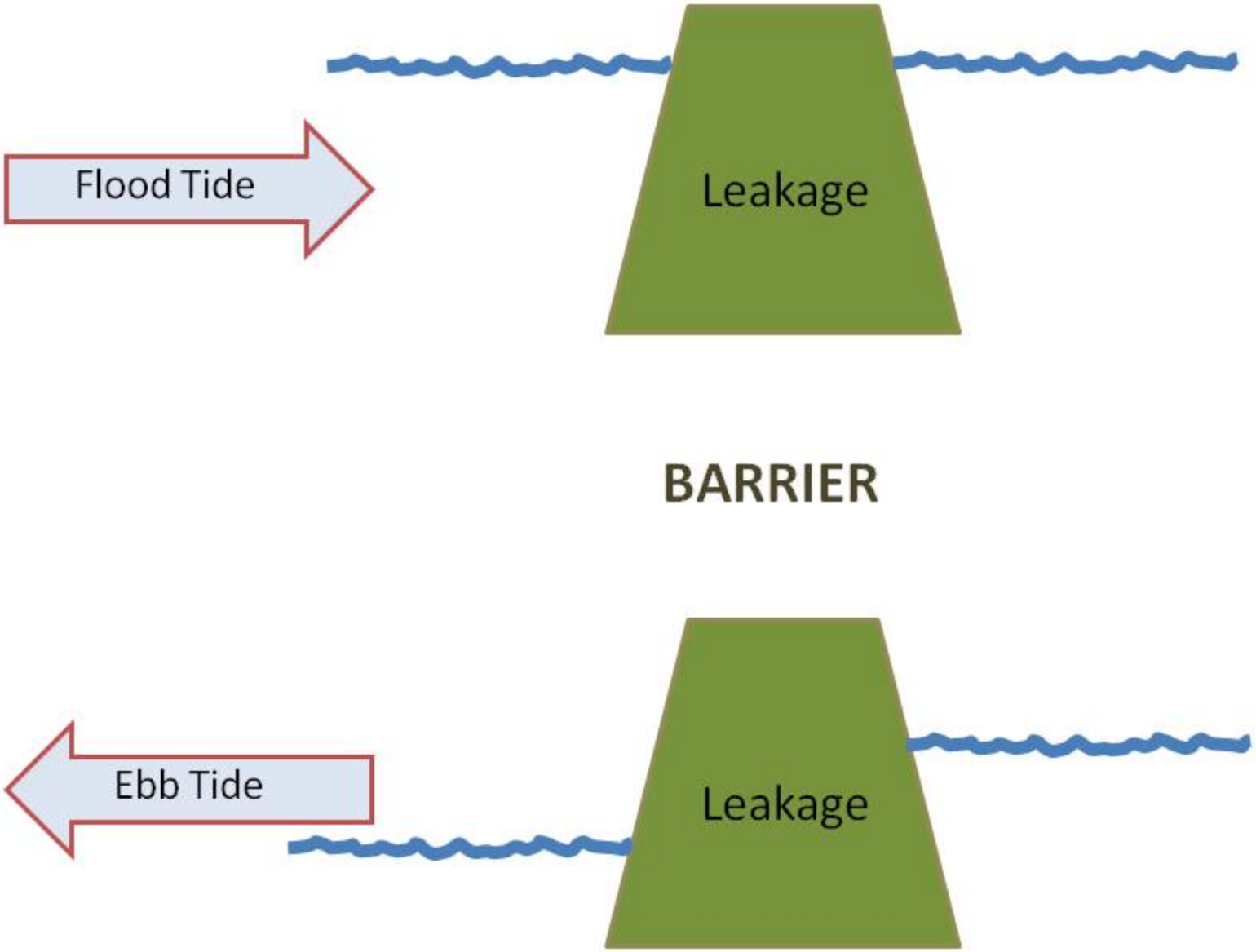

Flood Tide
Leakage
BARRIER
Ebb Tide
Leakage

Figure A5

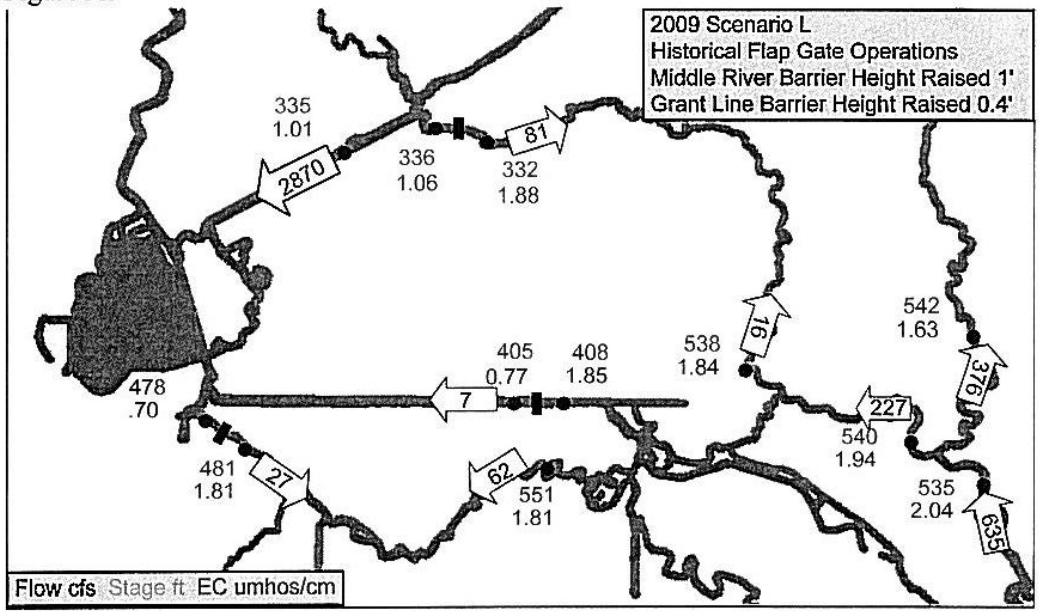
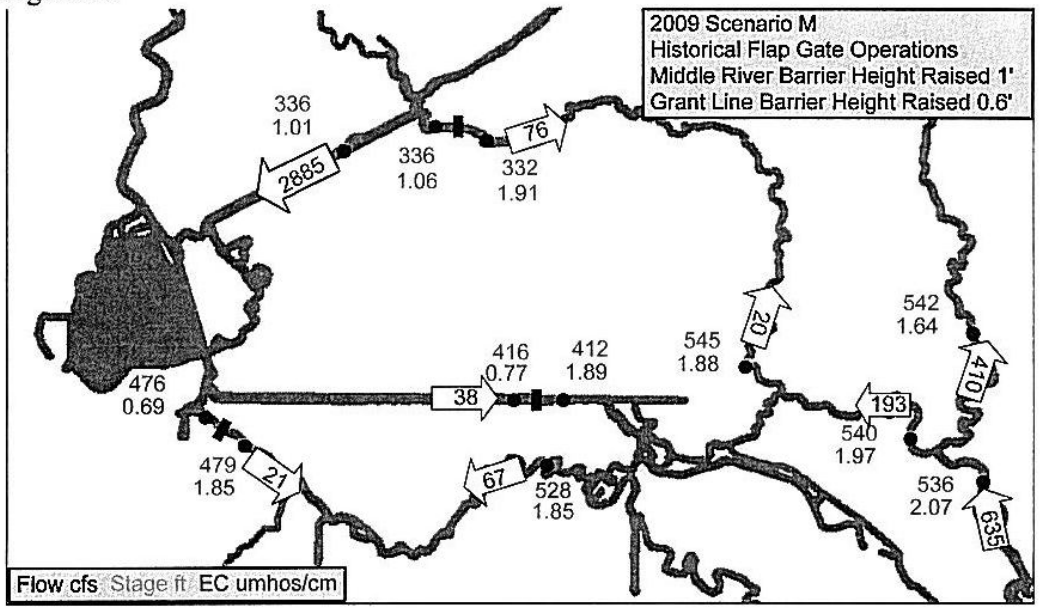


Figure A6



DWR barrier ops modeling

In most months in most years, the San Joaquin River does not connect with the Bay.

Hence fishery flows on the San Joaquin do not transport fish out to the ocean and attraction flows do not guide incoming migrants into the tributaries.

Regulatory Consistency

In 2009 DWR and USBR Petitioned the SWRCB to relax the X2/Outflow standard.

In 2013 DWR and USBR Petitioned the SWRCB to relax the Western Delta Ag Standard and the cold water standard.

In 2014 DWR and USBR Petitioned the SWRCB to relax numerous flow standards.

STATE OF CALIFORNIA
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
STATE WATER RESOURCES CONTROL BOARD

In the Matter of Specified License and Permits[1] of the Department of Water Resources and U.S. Bureau of Reclamation for the State Water Project and Central Valley Project

OCTOBER 7, 2014 ORDER MODIFYING AN ORDER THAT APPROVED A TEMPORARY URGENCY CHANGE IN LICENSE AND PERMIT TERMS AND CONDITIONS REQUIRING COMPLIANCE WITH DELTA WATER QUALITY OBJECTIVES IN RESPONSE TO DROUGHT CONDITIONS

BY THE EXECUTIVE DIRECTOR

1.0 INTRODUCTION

On September 26, 2014, the United States Bureau of Reclamation (Reclamation) submitted a request to temporarily modify requirements in its water right permits to meet San Joaquin River flow requirements at Airport Way Bridge, Vernalis, during October 2014, in response to drought conditions. This request is to make additional changes associated with the Temporary Urgency Change Petition (TUCP) filed on January 29, 2014, by the Department of Water Resources (DWR) and Reclamation (collectively, Petitioners) pursuant to Water Code section 1435 et seq. In the TUCP, Petitioners sought to temporarily modify requirements in their water right permits and license for the State Water Project (SWP) and Central Valley Project (CVP) (collectively Projects) for 180 days in response to drought conditions. On January 31, 2014, the Executive Director conditionally approved the TUCP. That Order was modified by the Executive Director on February 7, 2014, February 28, 2014, March 18, 2014, April 9, 2014, April 11, 2014, April 18, 2014, and May 2, 2014.[2] On May 2, the Executive Director also granted Petitioners' request for renewal of the TUCP Order for another 180 days. On September 24, 2014, the State Water Resources Control Board (State Water Board) considered and denied petitions for

[1] The petition was filed for Permits 16478, 16479, 16481, 16482 and 16483 (Applications 5630, 14443, 14445A, 17512 and 17514A, respectively) of the Department of Water Resources for the State Water Project and License 1986 and Permits 11315, 11316, 11885, 11886, 11887, 11967, 11968, 11969, 11970, 11971, 11972, 11973, 12364, 12721, 12722, 12723, 12725, 12726, 12727, 12860, 15735, 16597, 20245, and 16600 (Applications 23, 234, 1465, 5638, 13370, 13371, 5628, 15374, 15375, 15376, 16767, 16768, 17374, 17376, 5626, 9363, 9364, 9366, 9367, 9368, 15764, 22316, 14858A, 14858B, and 19304, respectively) of the United States Bureau of Reclamation for the Central Valley Project. However, the request to modify the October San Joaquin River flow requirement only applies to Reclamation's permits that include this condition - Permits 16597 and 16600 (Applications 14858A and 19304, respectively).

[2] The Executive Director's January 31, 2014, Order Approving a Temporary Urgency Change Petition and subsequent modifications thereto, are referred to as the "TUCP Order."

During every dry period, the SWRCB relaxes or does not enforce minimum fishery standards.

Do we need to insure minimum flows for fish during dry times as part of our protection and recovery of various species?

QUESTIONS?