“The San Francisco Bay-Delta is an ecosystem in crisis.”

-Felicia Marcus, Former President, State Water Board

The Tuolumne River

From Yosemite to San Francisco Bay

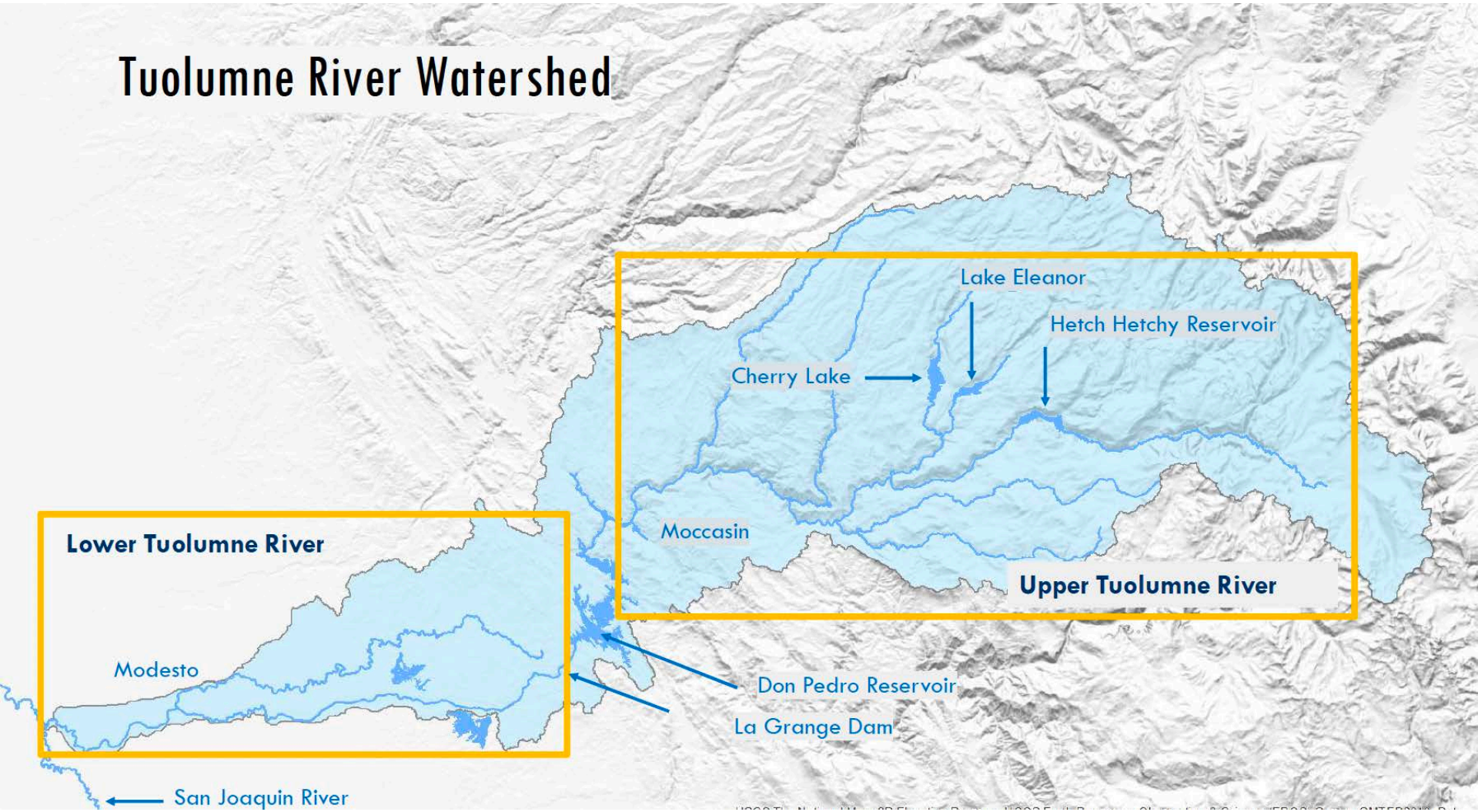
The Tuolumne River


To Sacramento
Sacramento/San Joaquin Delta
San Joaquin River
SF
LA
49
Sonora
Clavey River
Hetch Hetchy Reservoir
Tuolumne River
120
Yosemite National Park
Mt Lyell
Mt Dana
San Francisco
San Francisco Bay
Don Pedro Reservoir
132
Modesto
Tuolumne River
To Los Angeles
N


Hetch Hetchy
Regional Water System
SAN FRANCISCO
SAN FRANCISCO BAY
PENINSULA
SERVICE AREA
SUNOL VALLEY
SAN JOAQUIN
BAY DIVISION
HAYWARD
PALO ALTO
SAN JOSE
HALF MOON BAY
TUOLUMNE RIVER
YOSEMITE NATIONAL PARK
STANISLAUS NATIONAL FOREST
San Andreas Fault
Hayward Fault
Calaveras Fault

Most of Our Water Comes from Sierra Snowmelt

Tuolumne River Watershed



Salmon are a “keystone” species



Supporting other species throughout their life stages

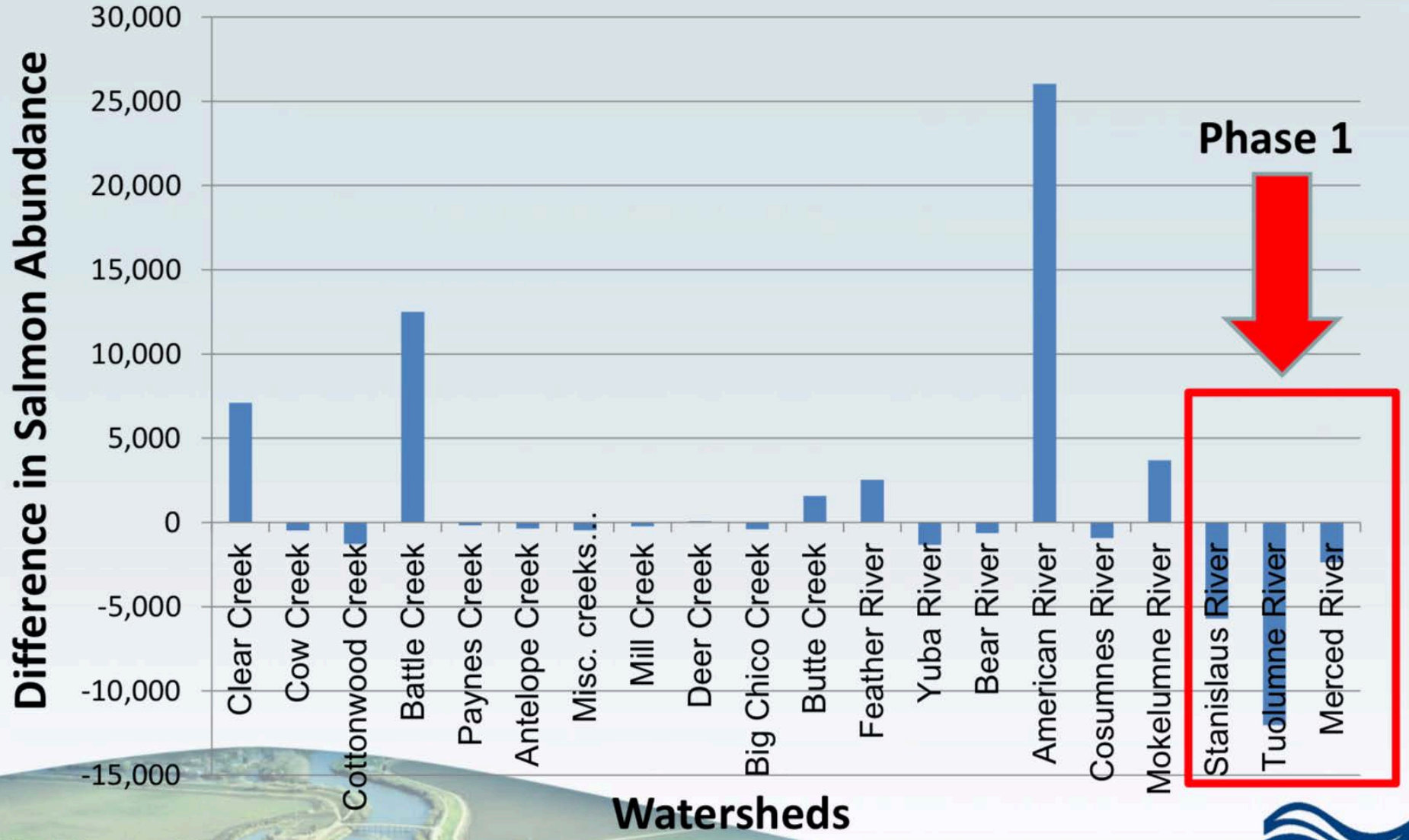


More than 100 species depend on salmon


Salmon are the modern day canary in the coalmine

In an average year, only 21% of the Tuolumne reaches the San Joaquin River

Difference in Adult Fall-run Chinook Salmon Natural Production (1992 to 2011 average minus 1967 to 1991 average)



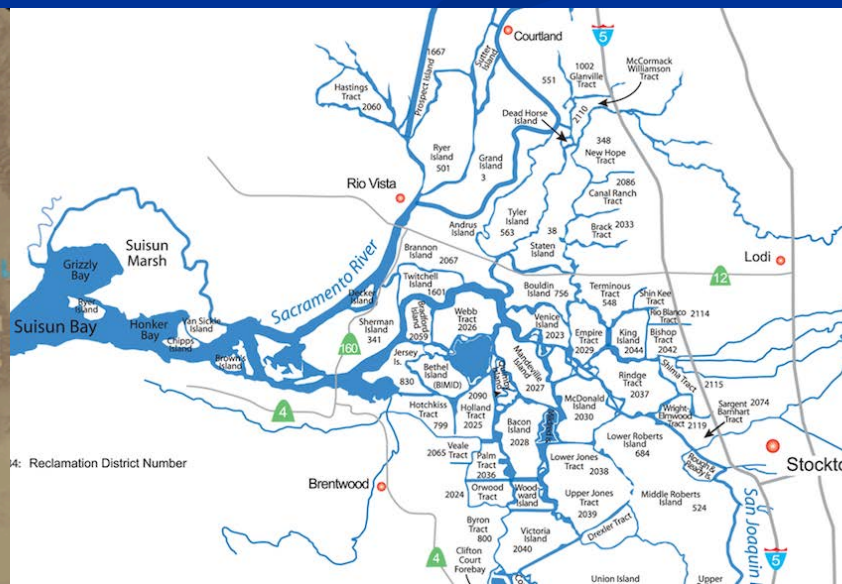
SED Figure 19-1
Corrected Tuolumne River

California Water Boards

Bay Delta Water Quality Control Plan

Managed by the State Water Resources Control Board – Our water experts

Half of California's water drains out through the San Joaquin and Sacramento Rivers into the Bay-Delta.



The Delta and its tributaries provide for remarkable biological diversity





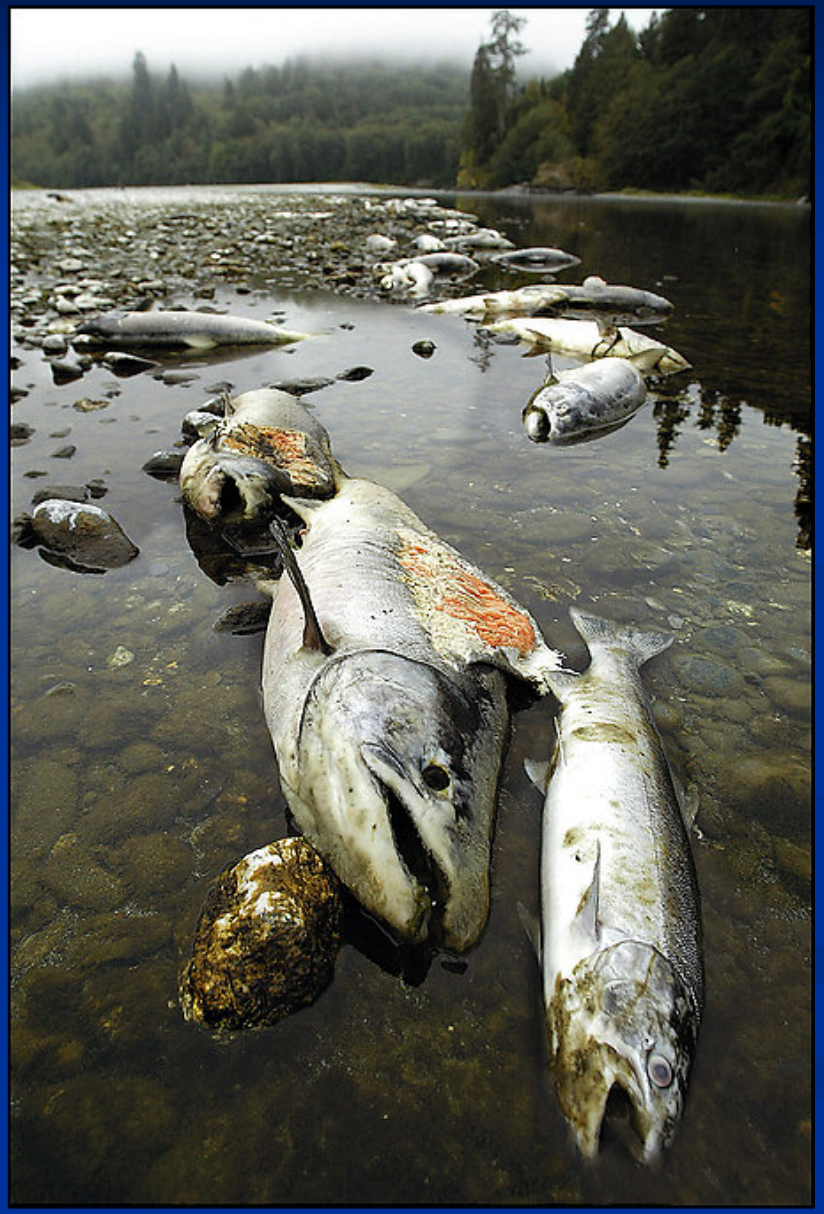

Habitat for more than 500 species of fish and wildlife.

A major stopover for the Pacific Flyway

Historically, more than a million salmon spawned in Central Valley rivers each year

Agriculture and development have transformed the Delta and its tributaries

Low flows impact temperature and water quality



Low flows hinder fish migration

Both to and from their natal streams to the ocean.

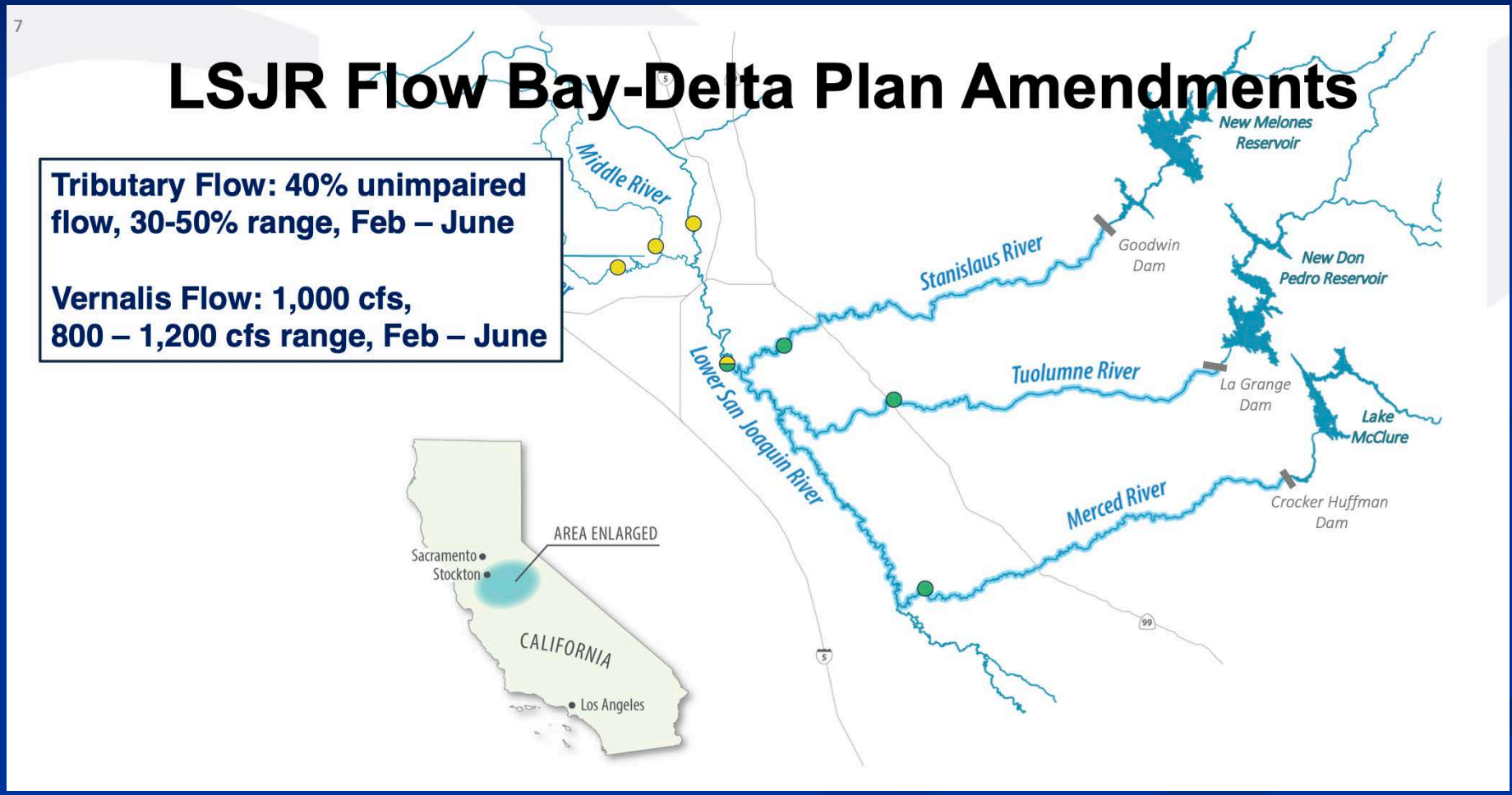
Floodplains are rarely inundated

Non-native species thrive under low flow conditions

Slow-moving, warm water has led to toxic algae blooms in the Delta


SALMON
MEAN BUSINESS
Protect Salmon Protect Jobs

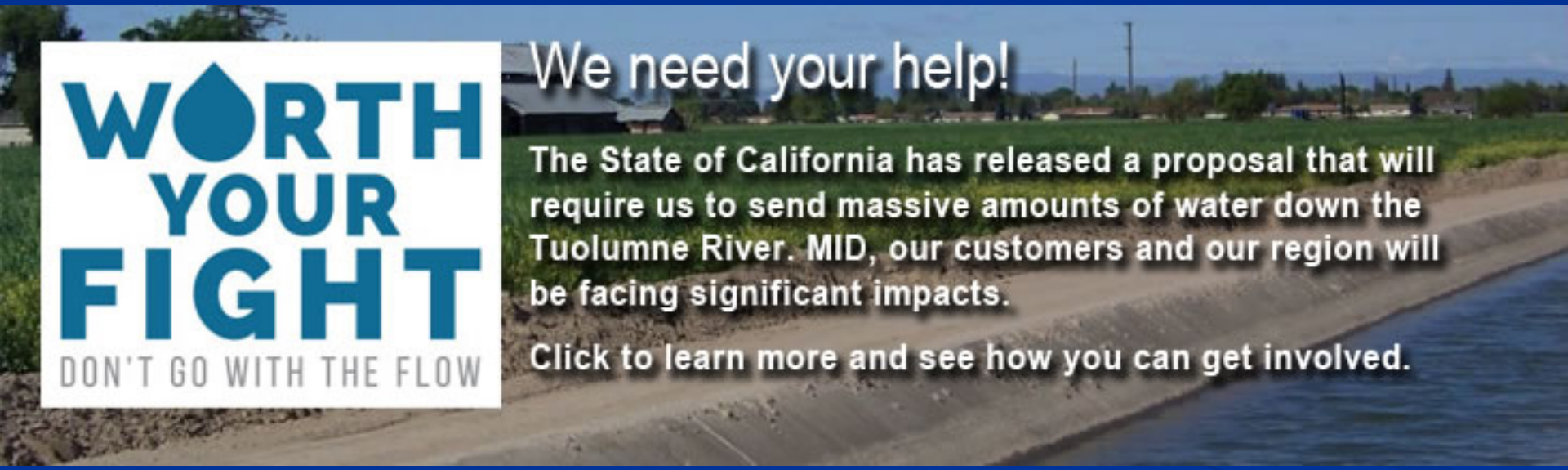
The Plan established 40% of unimpaired flow between February and June



Current Flow Averages

Stanislaus: 40% Tuolumne: 21% Merced: 26%

The agricultural irrigation districts sued the State Water Board



And the SFPUC joined them

BAWSCA sued as well

Are “Voluntary Agreements” a better alternative?

No! They do little to address:

Water temperature
Floodplain habitat
Juvenile fish outmigration
Toxic algae blooms
Bay-Delta salinity balance


BREAKING NEWS:
STUDY FINDS FISH NEED WATER!
PRESS

NMFS peer review debunked the TRVA

The Chinook salmon population model is useful but not usable by all stakeholders; and the *O. mykiss* population model is neither useful nor usable.

The [Chinook] model is not a full life cycle, which hampers its utility for evaluating potential benefits of management actions to the overall population.

A shortage of habitat quantity, including spawning habitat and gravel availability, is not a limitation on the population at abundance levels that are of concern. Thus, gravel augmentation would not significantly improve population performance.

The Chinook salmon production model cannot identify the number of predators that would need to be removed or how much of a reduction in consumption would be required to achieve a significant increase in smolt-to smolt survival. The response from predator control is assumed, not predicted.

It bears noting that the model, as developed, found water temperatures to be the major environmental factor driving juvenile *O. mykiss* productivity downstream of the dam. Flows released below La Grange Dam are apparently the major factor affecting water temperatures.

The model, as configured, indicates that the status of the Chinook salmon population is extremely precarious and bold actions will be needed to prevent extirpation. This need, according to the model, would best be met by very substantial increases in flow releases during spring (the period of active smolt outmigration from the river).

Can we meet the State's coequal goals of ensuring a reliable water supply AND restoring the Bay-Delta ecosystem?

Drought of Record Repeat

(With Bay Delta Plan flows in place)

Year	Demand (MGD)	Rationing (%)	Storage Reduction (TAF)	Water in Storage (TAF)
=1986				1,517
=1987	198	0	450	1,067
=1988	198	0	319	748
=1989	198	0	42	706
=1990	198	0	289	417
=1991	198	0	97	320
=1992	198	0	242	**78**

If the worst drought on record were to repeat, and the Bay Delta Plan flows were in place, the SFPUC could manage the drought without requiring any rationing or developing any new water supplies.

The SFPUC's Design Drought

Hetch Hetchy Regional Water System

San Francisco Water Supply Planning

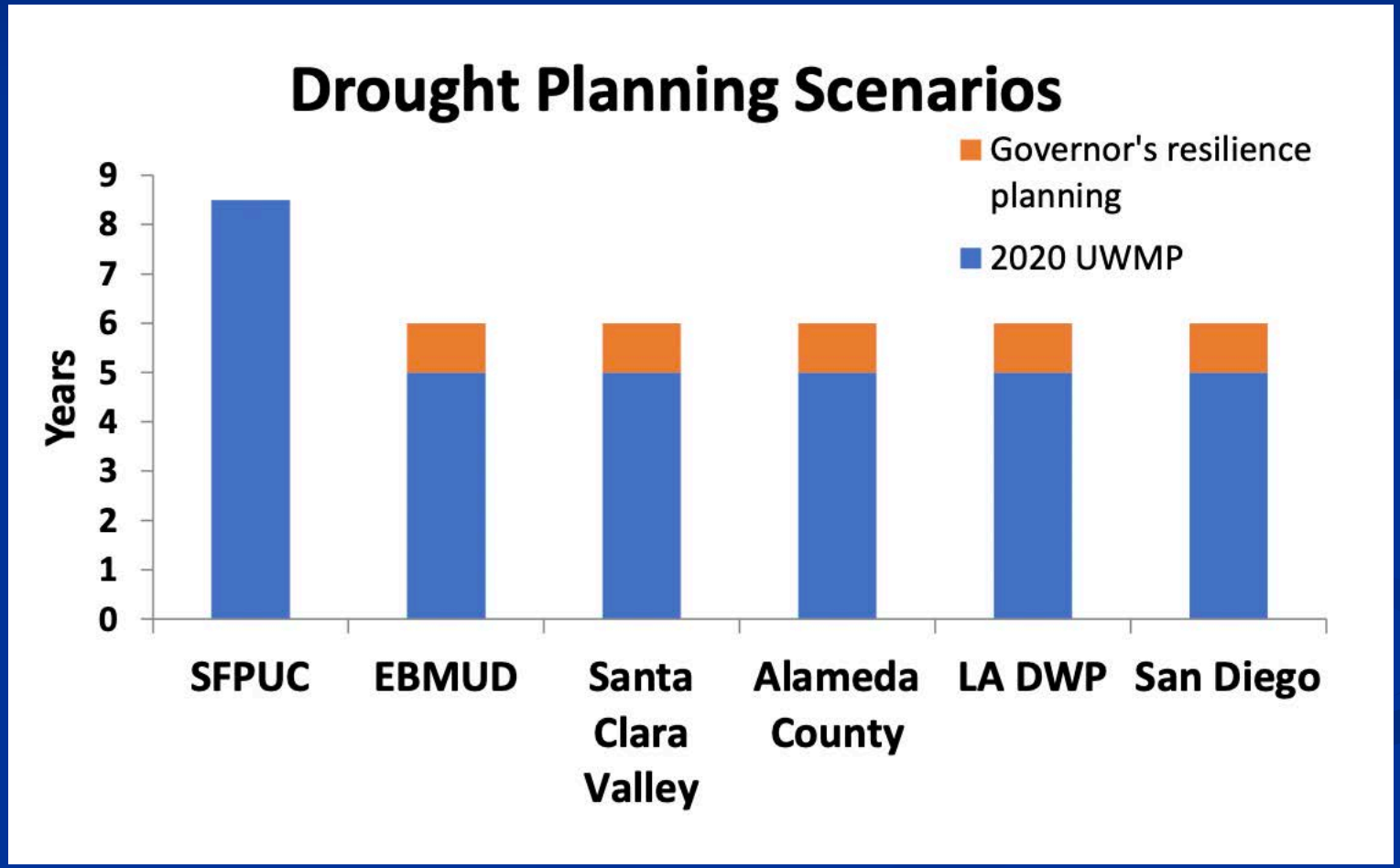
- Our Level of Service objective for water supply (used since 1994 and adopted in 2008) is to **survive a specific 8.5-year drought planning scenario (1987-92 followed by 1976-77) with no more than 20% rationing** from a **total system demand of 265 MGD**.

Source: SFPUC

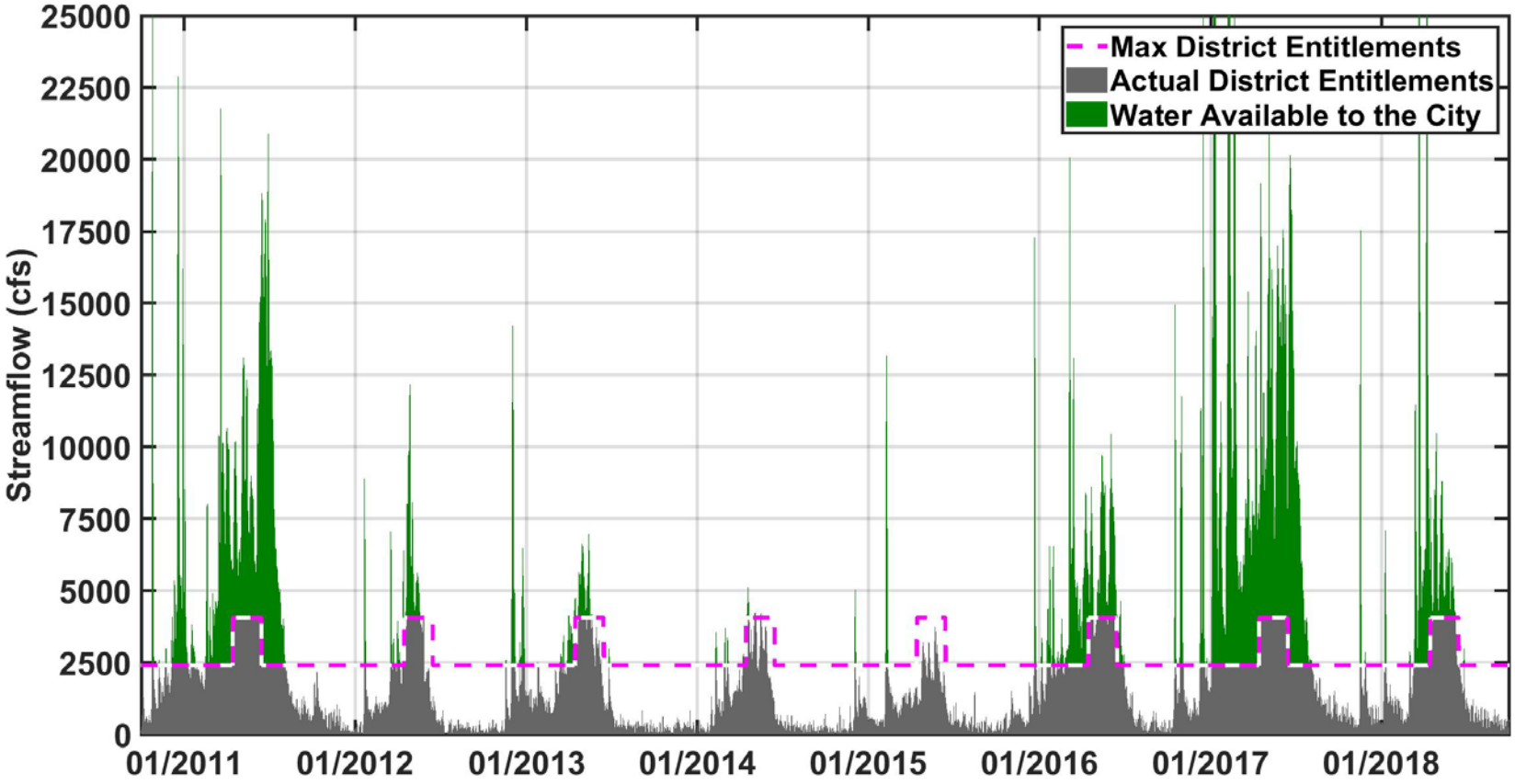
It was created in response to the 1987-92 (6-year) drought – the worst on record. It assumes a much, much worse drought.

It also assumes very high demand, opposite of the trend.

The SFPUC has the longest drought scenario of California's major water districts

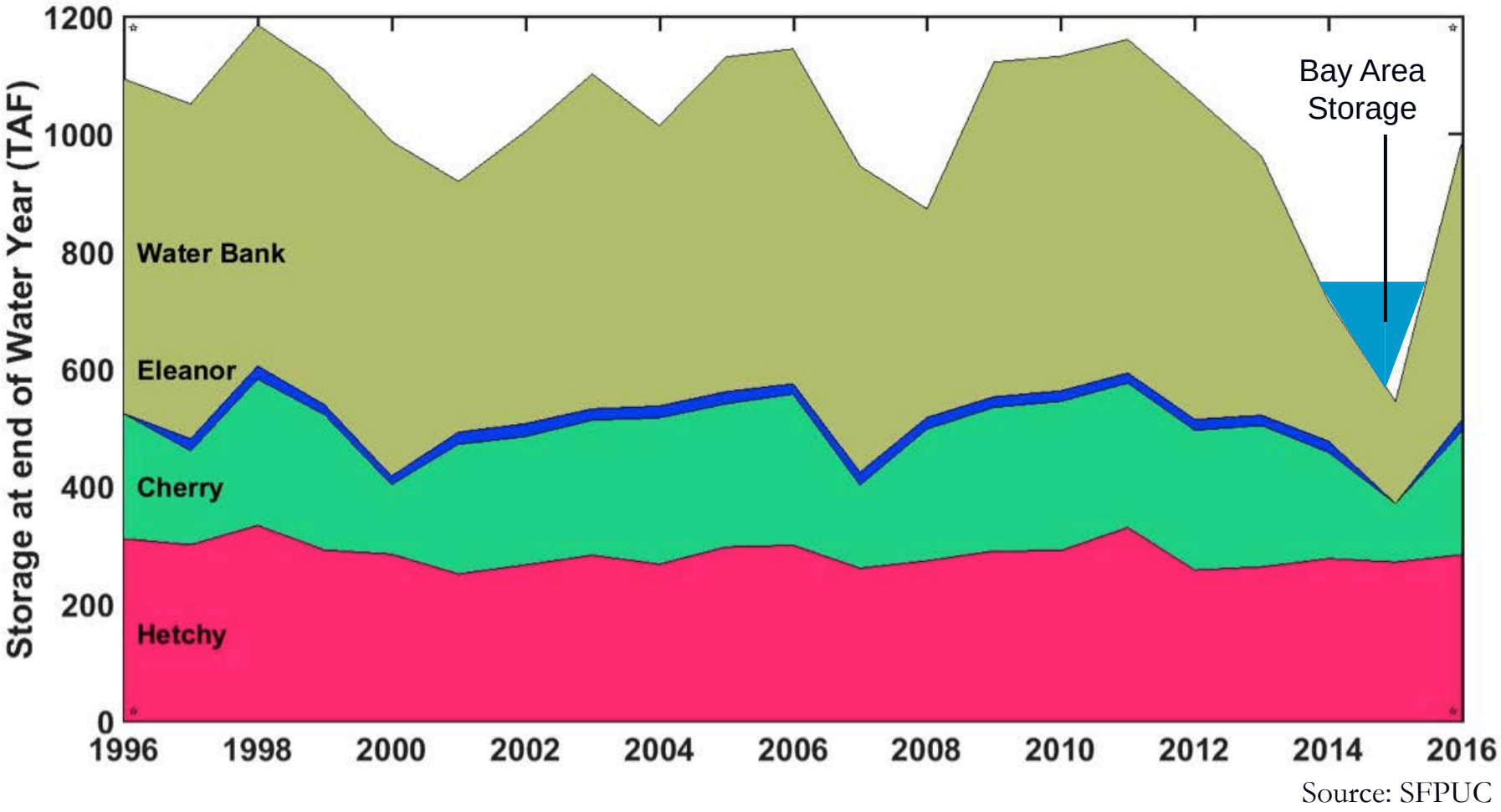


Tuolumne River Water Entitlements



The SFPUC's water rights are poor in dry years,
but exceptional in normal and wet years.

SFPUC Tuolumne Storage



Source: SFPUC

At the height of the 2012-15 drought, the SFPUC had enough water to last three years. (Bay Area storage not included.)

THE Water Research FOUNDATION

PROJECT NO.
4703

Long Term Vulnerability Assessment and Adaptation Plan for the San Francisco Public Utilities Commission Water Enterprise - Phase I

San Francisco Water Power Sewer

“According to climate projections and expert elicitations, there is a central tendency of warming of + 2°C and + 4°C by 2040 and 2070 (Representative Concentration Pathway [RCP] 8.5), respectively, with no clear direction of change in mean annual precipitation over the planning horizon.”

Source: LTVA, p. xxii

Drought Return Periods

How likely are droughts to occur?

Table 5-1. Effect of Precipitation and Temperature Change on the Return Periods Associated with the Severity of the Historic Droughts.

Return periods are round off to the nearest 5 years.

Threshold [TAF]	Drought Event	Changes in Precipitation			Changes in Temperature [°C]		
		0%	-10%	-20%	0	+2	+4
269	1976-1977	100	45	25	100	105	130
	1987-1992	420	120	45	420	495	675
	2012-2015	180	70	35	180	200	260

Source: LTVA, p. 157

Numbers represent how many years might be expected to pass between droughts as severe as those listed.

The LTVA did not include a return period for the Design Drought.

Hydrological Drought Frequency Analysis for the Upper Tuolumne River

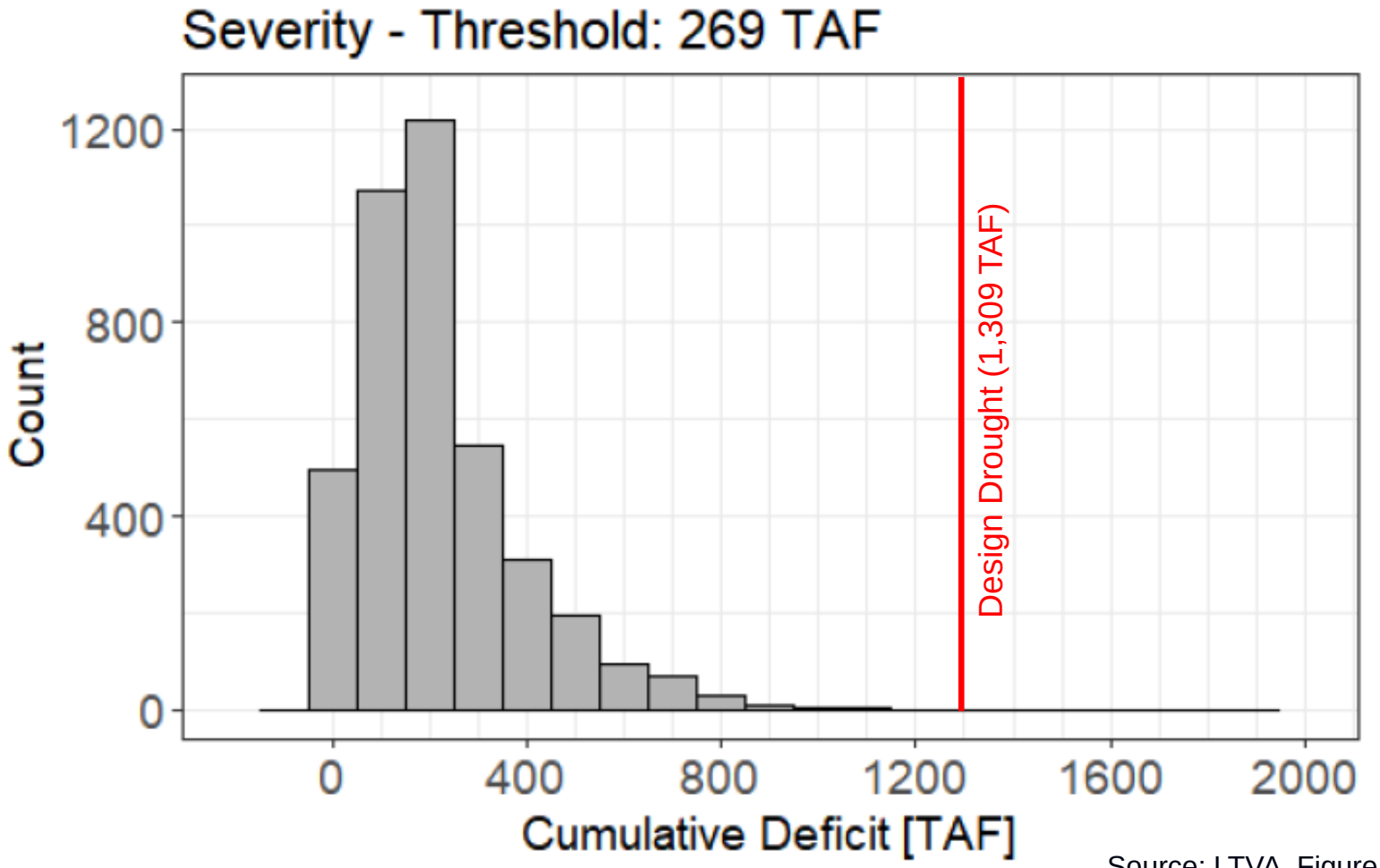
December 8th, 2020

Return periods of historical drought

Drought Event	Deficit (TAF)	Duration (Year)	Return Period (Year) (best estimate and 95% confidence interval)		
			Deficit	Duration	Deficit and Duration
1976-77	517	2	217 (188; 255)	30 (29; 31)	316 (273; 371)
1987-92	797	6	1,456 (1,031; 2,140)	486 (422; 563)	20,406 (14,589; 29,851)
2012-16	752	4	1,093 (820; 1,520)	121 (110; 133)	4,250 (3,190; 5,899)
Design Drought	1,309	8	25,293 (12,940; 56,679)	1,954 (1,620; 2,376)	1,371,578 (720,390; 2,997,390)

Source: “Hydrological Drought Frequency Analysis for the Upper Tuolumne River,” 12/8/2020

The LTVA's most severe drought used less than 1,200 TAF of storage



Source: LTVA, Figure 3-29

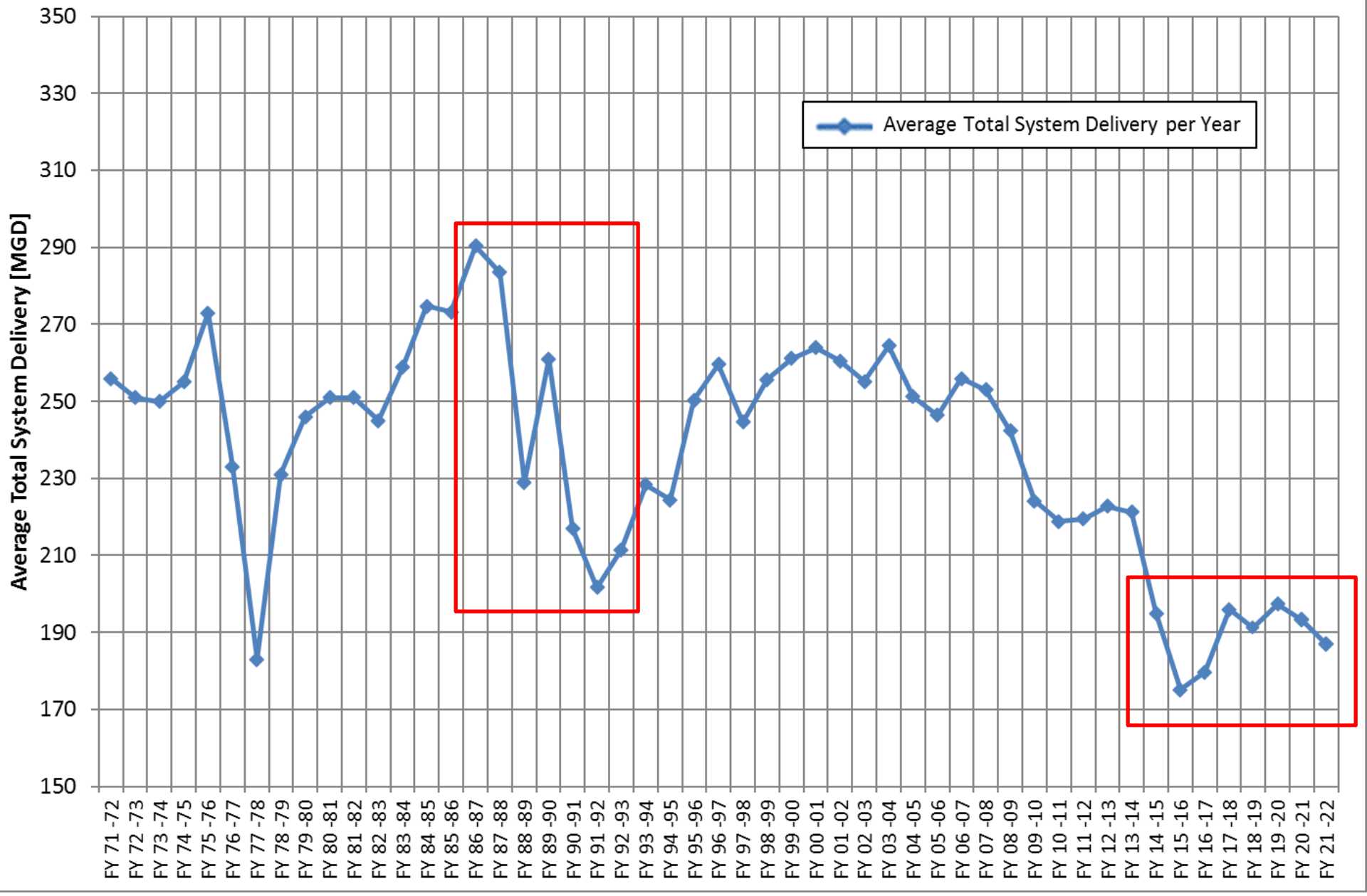
An Assessment of Urban Water Demand Forecasts in California

(The Pacific Institute, August 2020)

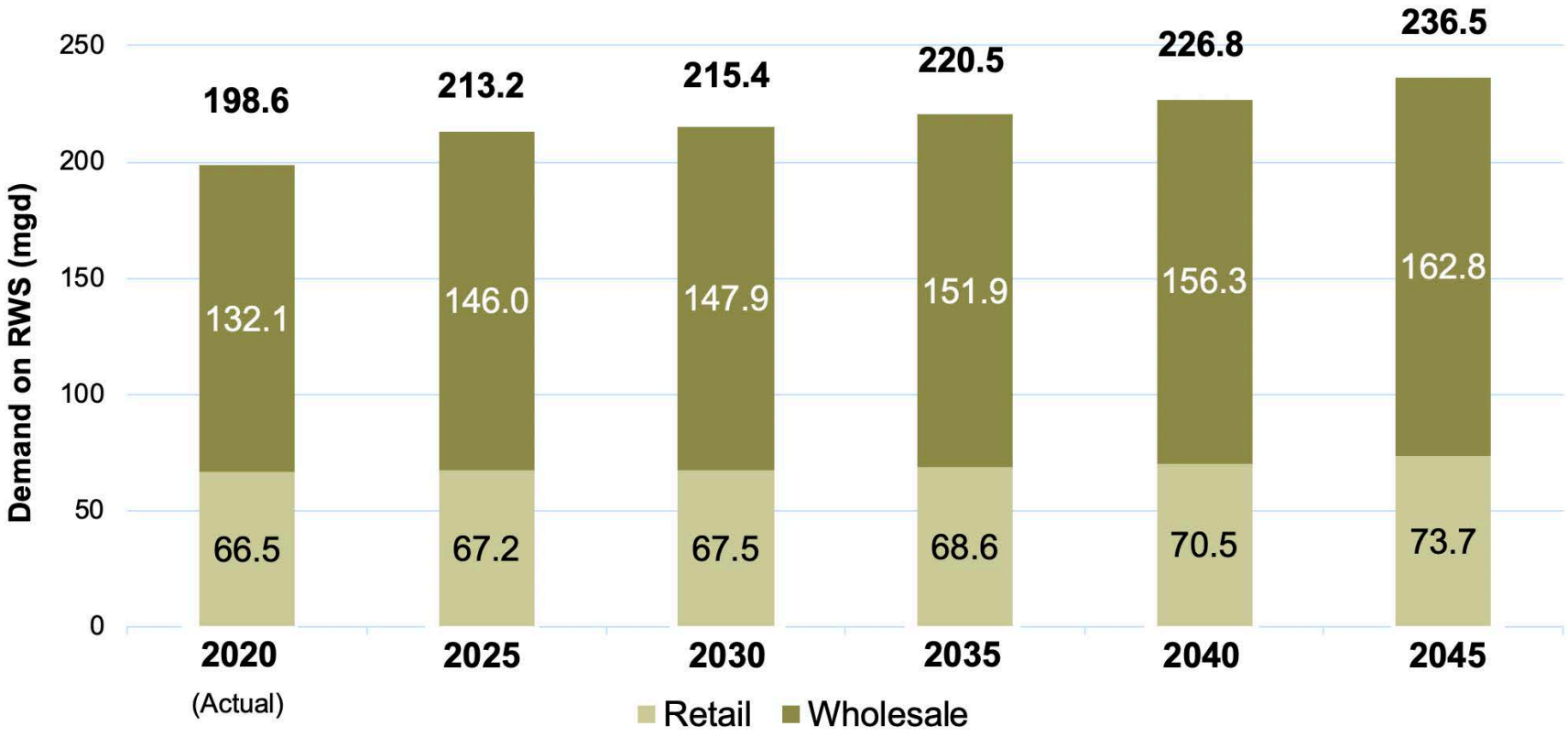
Table 3. Percent Change in Total Demand, Per Capita Demand, and Population Between 2000 and 2015

Water Supplier	Per Capita Demand	Population	Total Demand
East Bay Municipal Utilities District	-17%	9%	-9%
Eastern Municipal Water District	-39%	84%	12%
City of Fresno*	-22%	11%	-14%
Irvine Ranch Water District	-33%	43%	-3%
City of Long Beach	-25%	4%	-22%
Los Angeles Department of Water and Power	-25%	4%	-22%
City of Sacramento	-47%	18%	-38%
City of San Diego	-16%	3%	-14%
San Francisco Public Utilities Commission	-30%	8%	-25%
San Jose Water Company	-31%	1%	-30%
All Water Suppliers	-25%	9%	-18%

SFPUC Average Total System Delivery per Year
Fiscal Years 1971 - 2022



Total 2020 UWMP Projected Demands on the Regional Water System



Source: SFPUC, July 16, 2021

Water Sales Volumes
Historical and Projected

Source: SFPUC, January 7, 2022

“Water Enterprise and Finance Bureau Water Demand Projections”

Water Enterprise

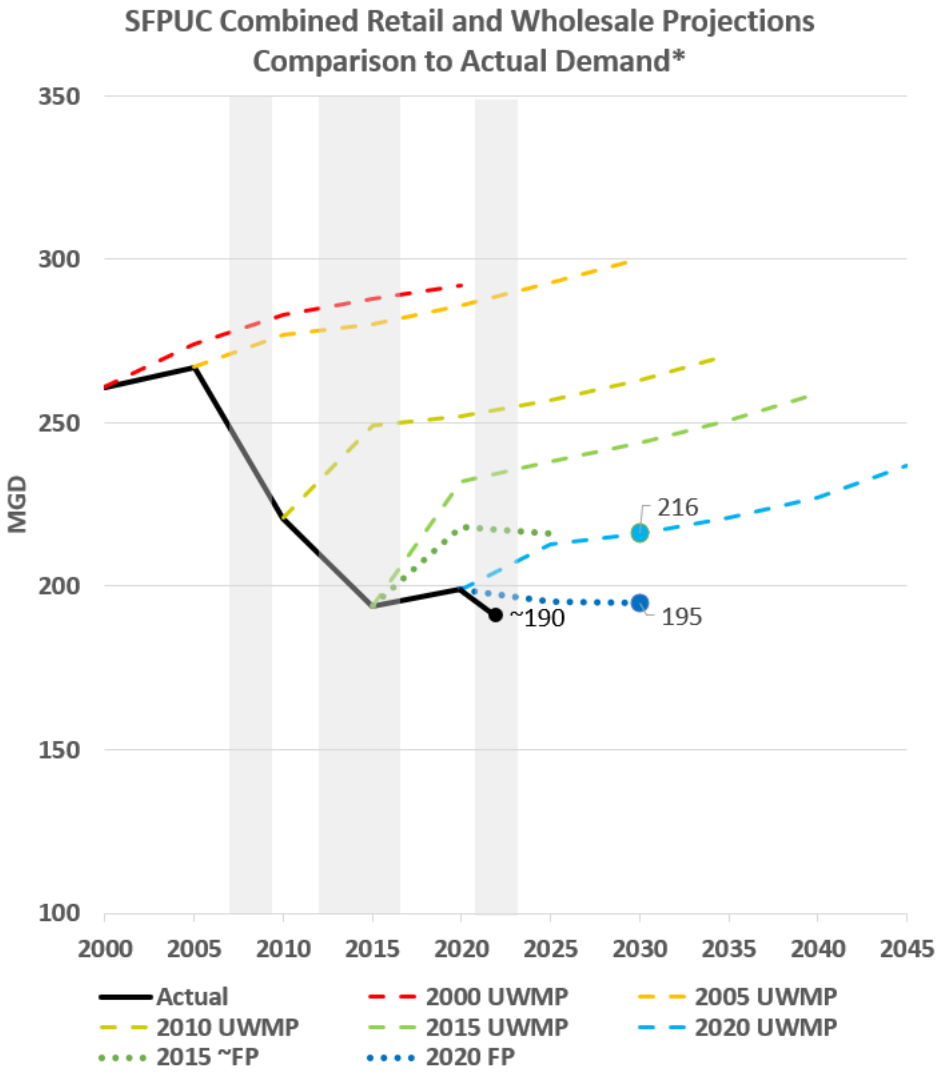
"…**the projections represent an outside bound of whatever demand will occur in the next 25 years**...These demands will likely always be greater than actual demands because not all developments materialize, or they materialize slower than projected.”

Finance Bureau

"By contrast, for the purpose of financial planning and for short term water system management, we estimate the demand that we are likely to experience. **For budgeting and rate setting we use demand projections that are as close to actual as we can make them**.”

Source: SFPUC, July 5, 2022

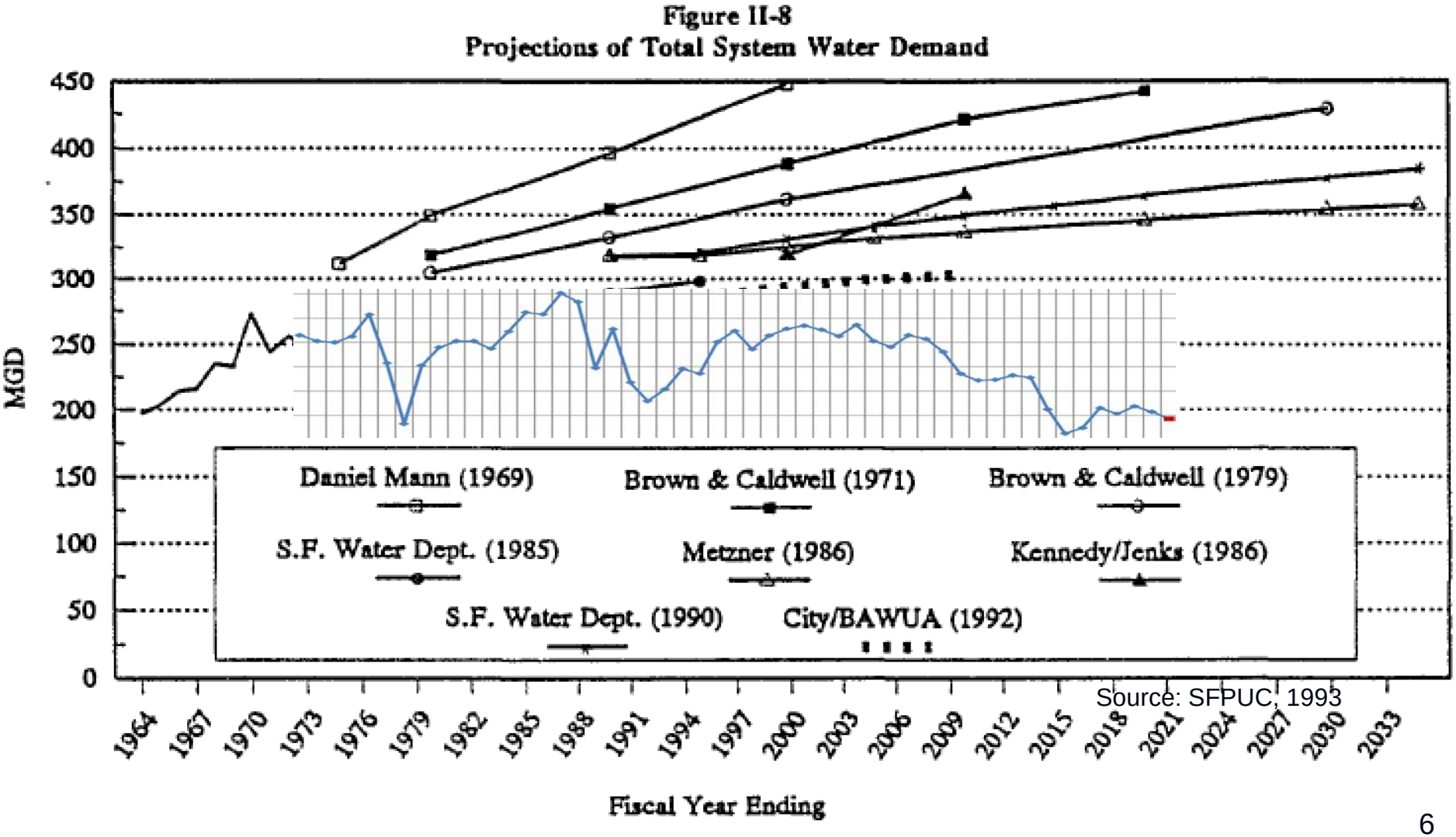
Combined Demand Projections Comparison



*Comparison is between the UWMP projections (dashed lines) and the finance department sales projections (dotted lines) where 6 mgd of projected water loss (non-revenue) has been added to the finance department figures. 2015 finance department projections were visually estimated from the charts in General Manager Herrera's letter to commissioners dated July 5, 2022.

Sources: Data = SFPUC; Graph = TRT

The SFPUC Planned for Much Higher Demand



Source: SFPUC, 1993

The SFPUC has a whole lot of storage! Enough to last more than six years.

Reservoirs	Capacity (Acre-Feet)
Tuolumne Reservoirs	660,973
Don Pedro Water Bank	570,000
Bay Area Reservoirs	227,711
Total Storage	**1,458,684**

In an average year, the SFPUC is entitled to enough water to last more than three years.

San Francisco Chronicle

BAY AREA

San Francisco declares water shortage emergency, asks city users to conserve 5%

Julie Johnson

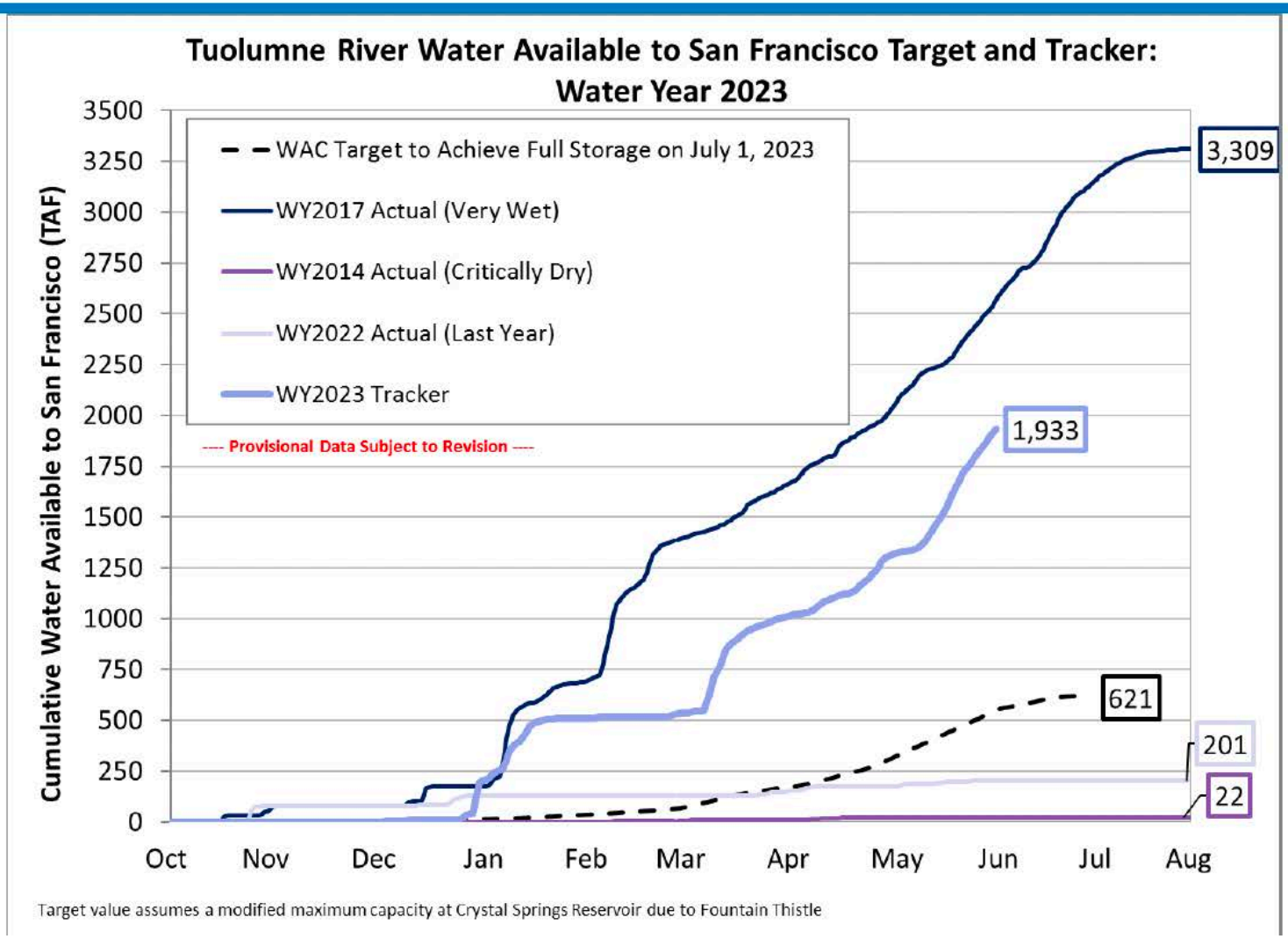
Nov. 23, 2021

December 6, 2021 Reservoir Storage

Reservoir	Current Storage[1,2,3] (AF)	Maximum Storage[4] (AF)	Available Capacity (AF)	Percent of Maximum Storage	Normal Percent of Maximum Storage[5]
Tuolumne System					
Hetch Hetchy	263,600	340,830	77,230	77.3%	**71.8%**
Cherry	241,900	268,800	26,900	90.0%	-
Eleanor	16,450	21,495	5,045	76.5%	-
Water Bank	337,192	570,000	232,808	59.2%	**98.5%**
Total Tuolumne Storage	**859,142**	**1,201,125**	**341,983**	**71.5%**	-
Local System					
Calaveras	54,905	96,670	41,765	56.8%	-
San Antonio	48,525	53,266	4,741	91.1%	-
Crystal Springs	52,973	58,309	5,336	90.8%	-
San Andreas	15,960	19,027	3,067	83.9%	-
Pilarcitos	2,159	3,030	871	71.3%	-
Total Local Storage	**174,522**	**230,302**	**55,780**	**75.8%**	-
Total System Storage	1,033,664	1,431,427	397,763	**72.2%**	**80.2%**
Total without water bank	696,472	861,427	164,955	**80.9%**	-

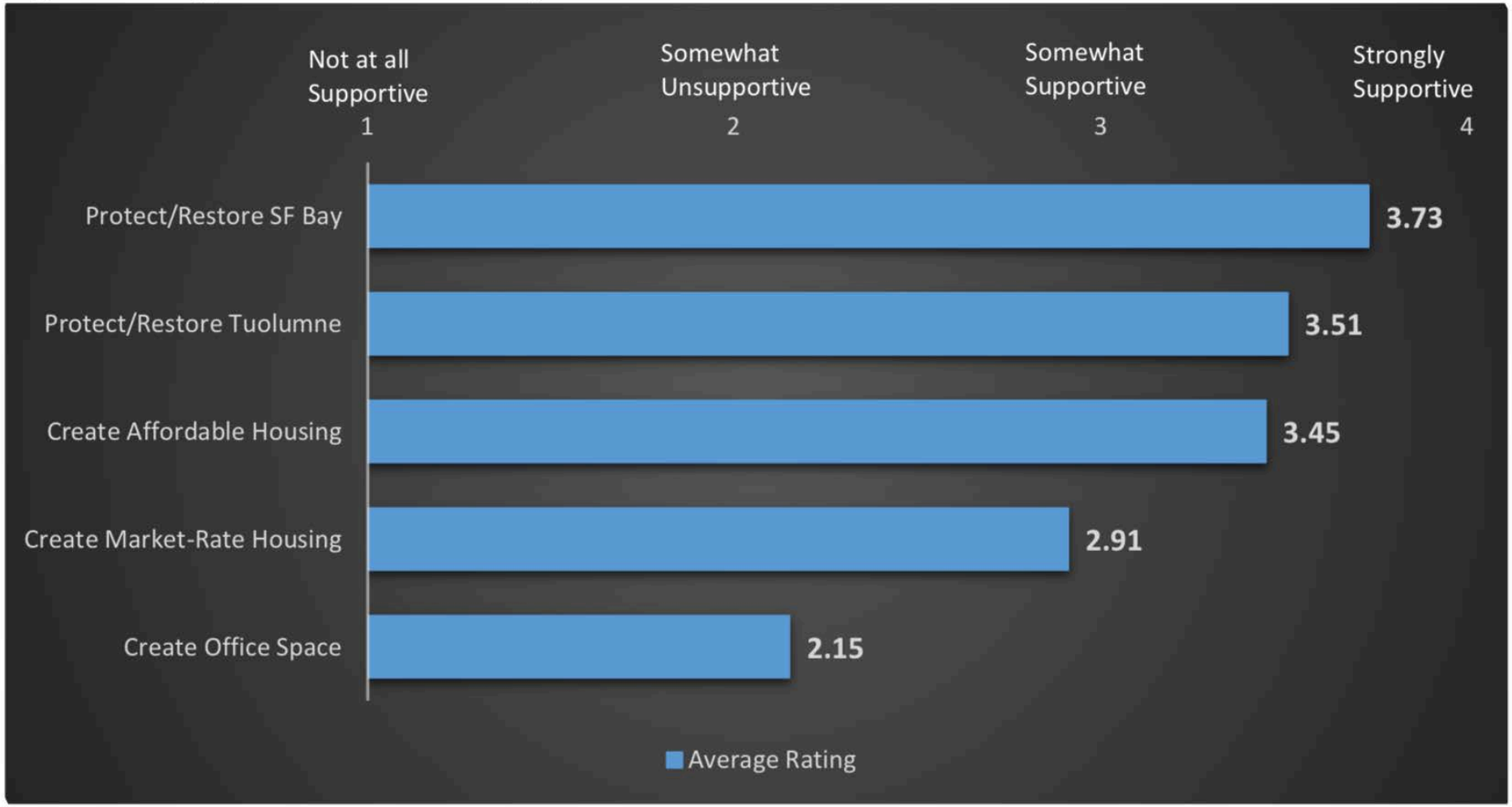
Hetch Hetchy Regional Water System

Tuolumne River Water Available to the City



97% support for San Francisco Bay

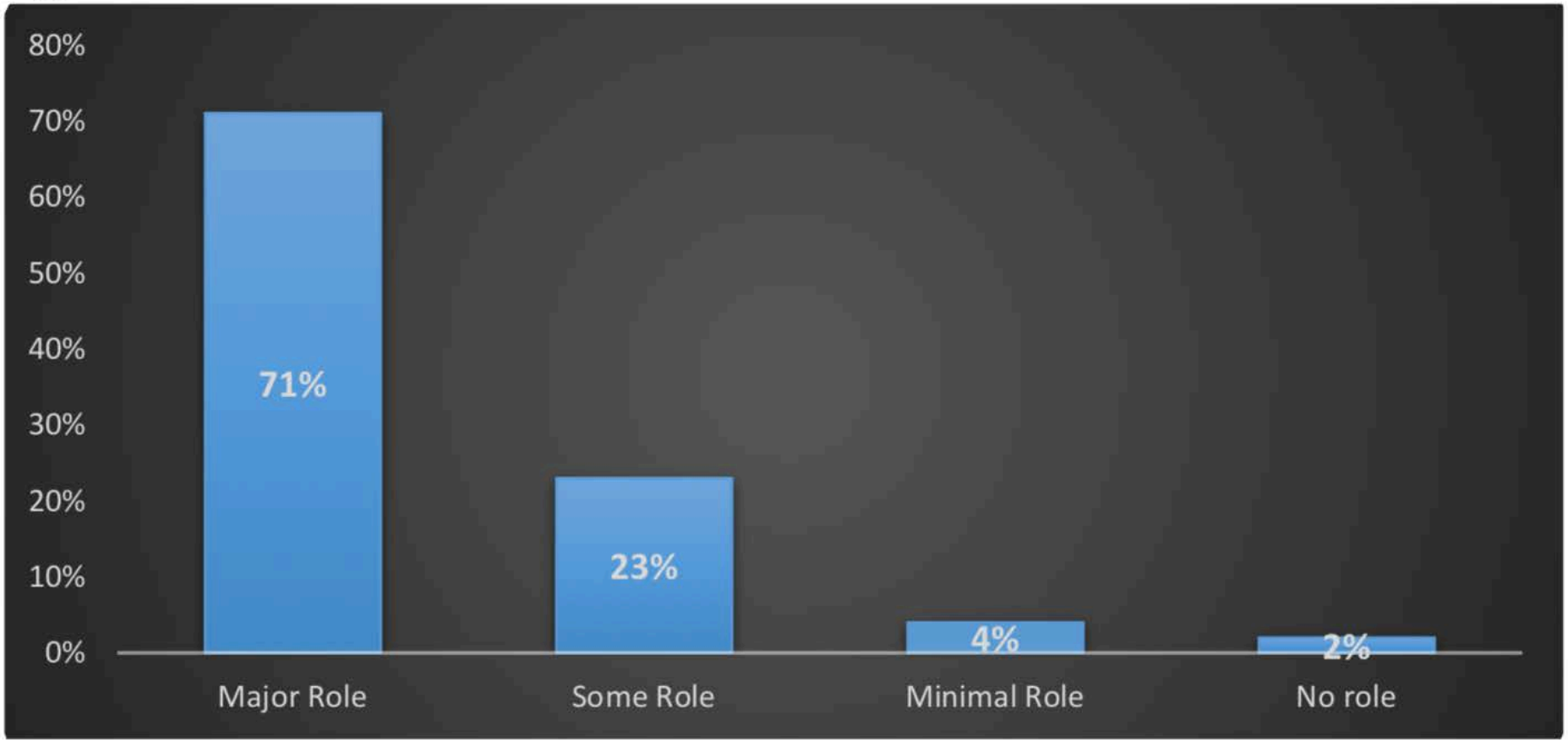
Figure 6. Support for Potential City-Wide Measures



92% support for the Tuolumne River

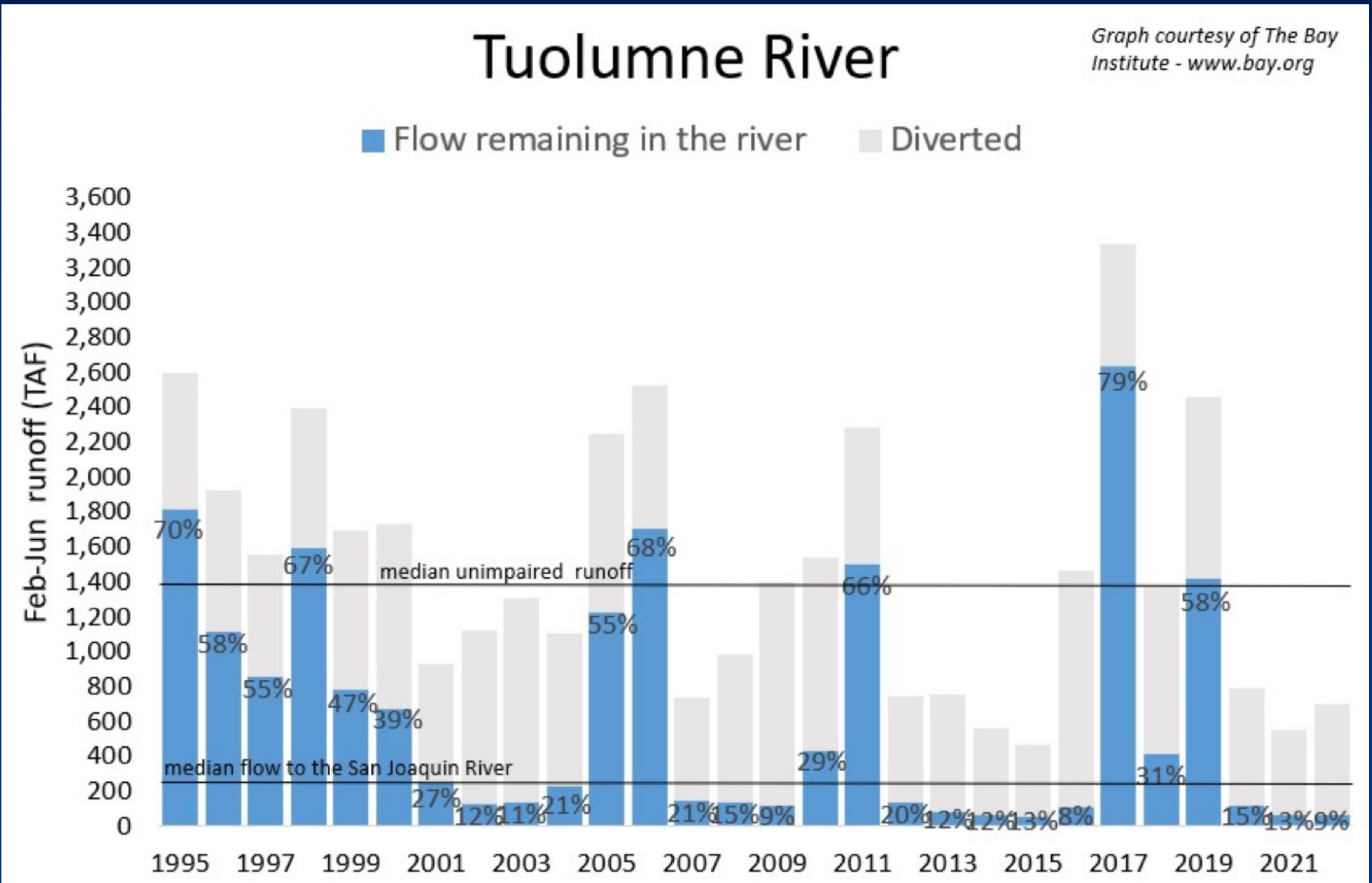
Environmental protection is an extremely strong motivator to conserve water

Figure 3. Role of Environmental Concerns in Water Conservation Efforts



Conserved water was just impounded

Current policy devastates the River in dry years



VII. Bay-Delta Plan with Alternative Water Supply Projects, Modified Rationing Policy and Modified Design Drought

- Base Conditions
- Includes SFPUC contribution to the Bay-Delta Plan displayed in the graph as a reduction in Firm Yield, assuming the flow requirement is 40% of unimpaired flow at La Grange from February through June. Current FERC flow requirements are assumed for the rest of the year.
- SFPUC contributions are calculated according to the 4th Agreement and assuming continuation of the 1995 side agreement.
- Includes a total of 35 MGD of new water supply projects, as described on slide 12 for scenario V
- Yield values are estimated using a 7.5-year design drought
- Includes 6.5 years of rationing at 20% in the 7.5-year design drought sequence.

SFPUC Water Supply and Demand Worksheet Results
All values are in million gallons per day (MGD)

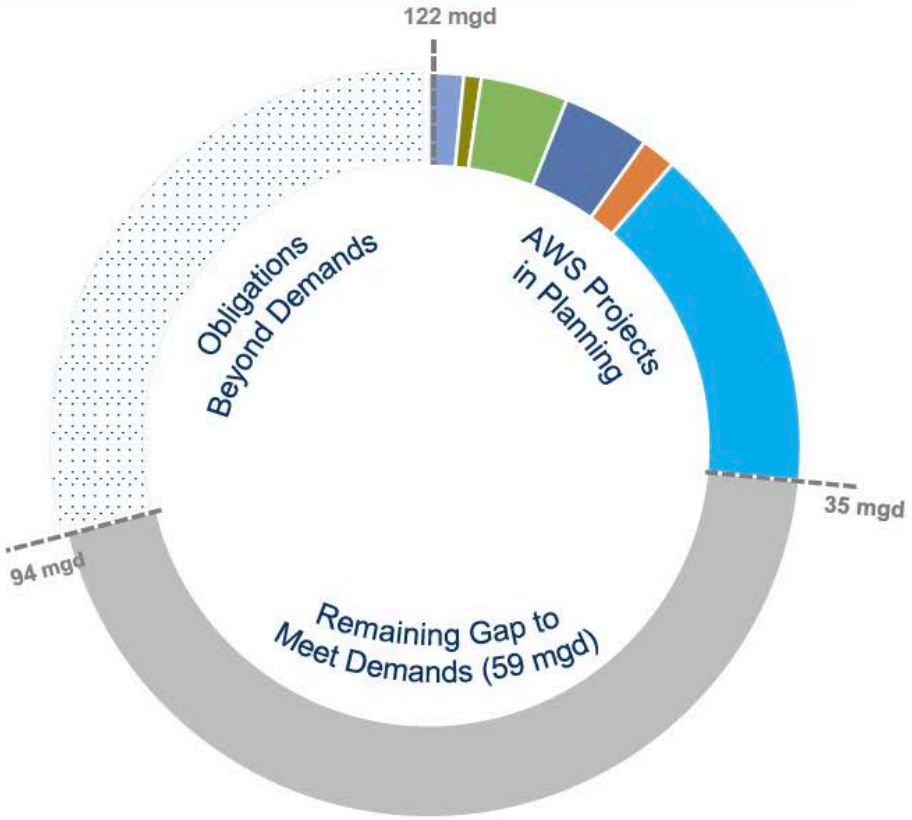
	FY 2019-20	2025	2030	2035	2040	2045
Total Yield:	299	192	196	196	238	238
RWS Demand:	198	213	215	220	227	236
Lower Tuolumne Contribution:	NA	101	101	101	101	101
Surplus or Deficit:	100	-21	-19	-24	12	2

Source: SFPUC, March 26, 2021

Hetch Hetchy Regional Water System

Projected Gap in Meeting Demands

- Dry year water supply need is 94 mgd (to meet projected purchase requests) to 122 mgd (to meet obligations)
- AWS projects in planning currently total up to ~ 35 mgd
- Remaining gap of at least **59 mgd** after AWS project implementation to meet projected purchase requests



Source: Alternative Water Supply, September 15, 2022

In an absolute worst-case scenario we could purchase irrigation water

Conclusions

- We can meet the State's co-equal goals of ensuring a reliable water supply AND restoring the Bay-Delta ecosystem.
- By removing a year from the Design Drought and using reasonable demand projections, we won't need to worry about excessive rationing or the need to overinvest in expensive alternative water supplies.
- C/CAG can help lead the way toward a sustainable regional water policy.