SWP/CVP Operations and Delta Salinity Control

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California Department of Water Resources

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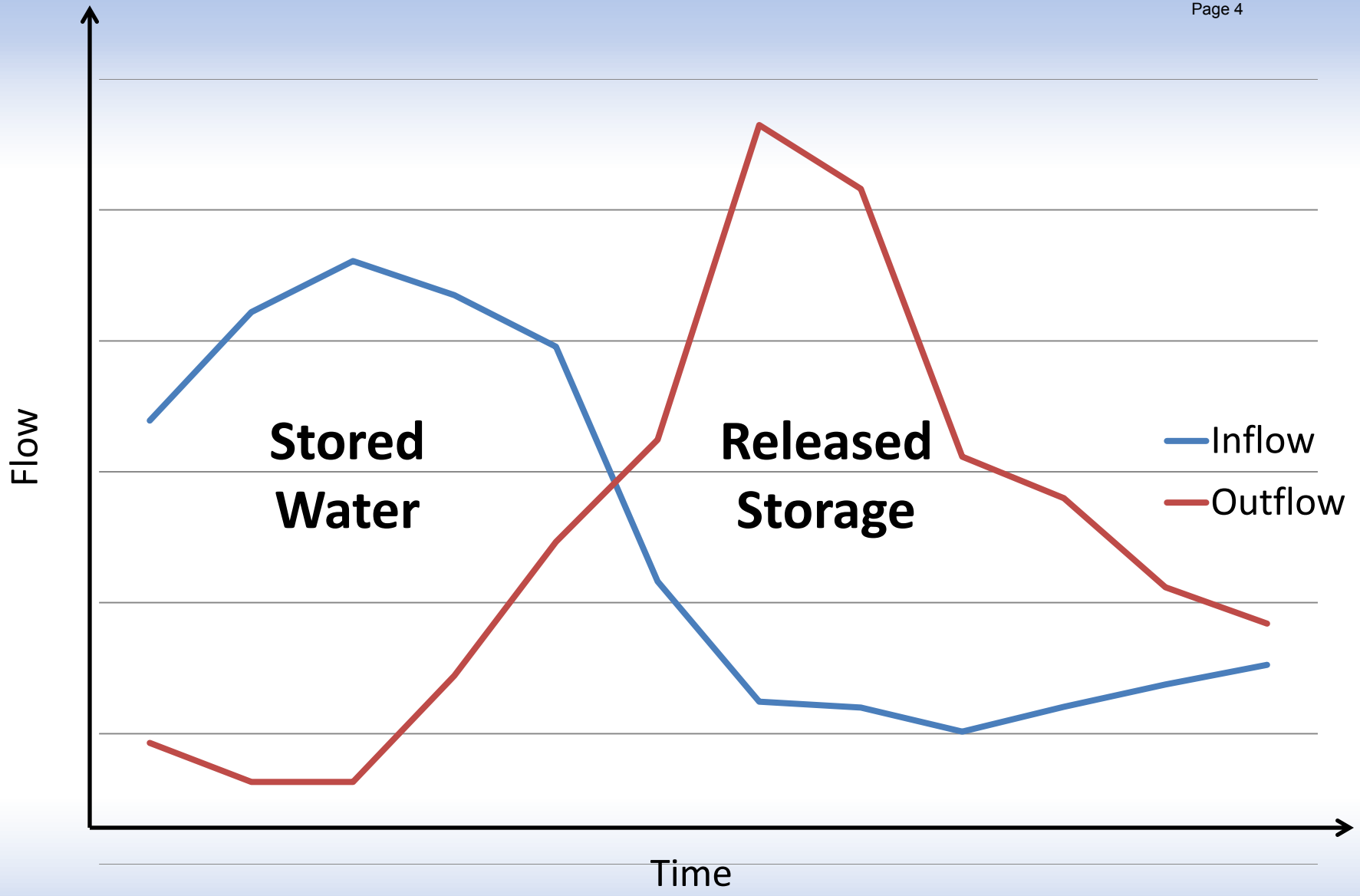
- Why do the Projects Manage Delta Salinity?
- What are the Salinity Requirements?
- How do the Projects Manage Delta Salinity?
- Unique Challenges this Year
- Potential Challenges for 2015

CVP/SWP Water Projects


Flow
Stored Water
Released Storage
Inflow
Outflow
Time

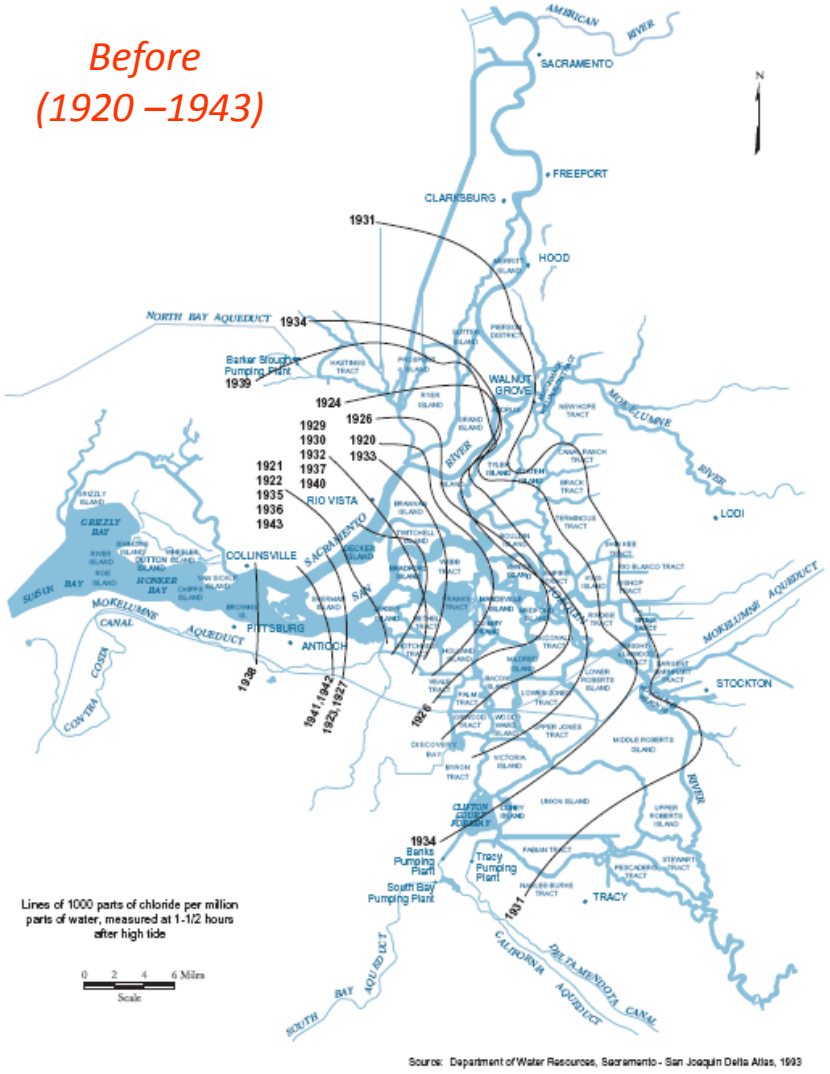
Purpose of Managed Hydrology

- Connect Water Supply with Water Demand
- Create Through-Delta Fresh Water Corridor
- Meet Flow/Salinity/Temperature Standards

Salinity Intrusion Before and After Managed Upstream Reservoirs

Before (1920 –1943)

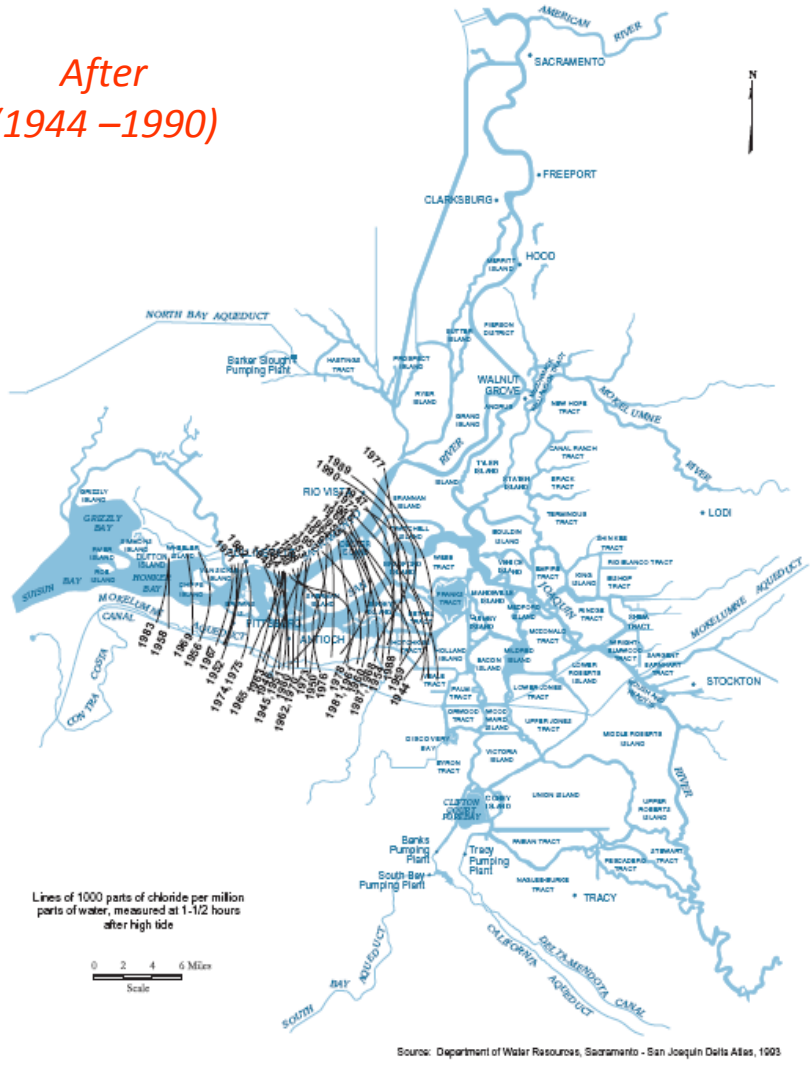
Figure 4-26 Maximum Salinity Intrusion, 1921-1943



Source: Department of Water Resources, Sacramento - San Joaquin Delta Atlas, 1993

After (1944 –1990)

Figure 4-27 Maximum Salinity Intrusion, 1944-1990

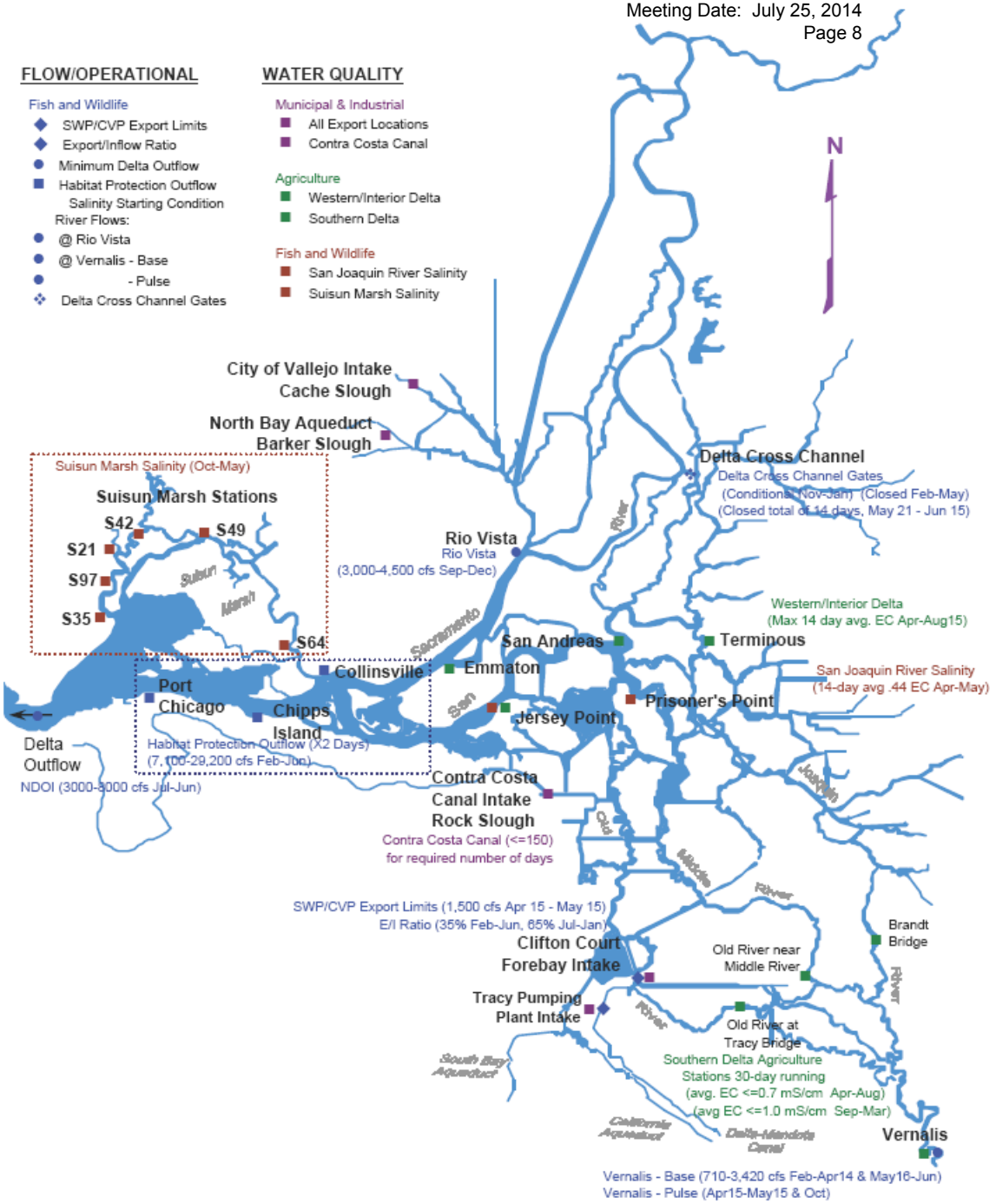


Source: Department of Water Resources, Sacramento - San Joaquin Delta Atlas, 1993

Delta Salinity Standards

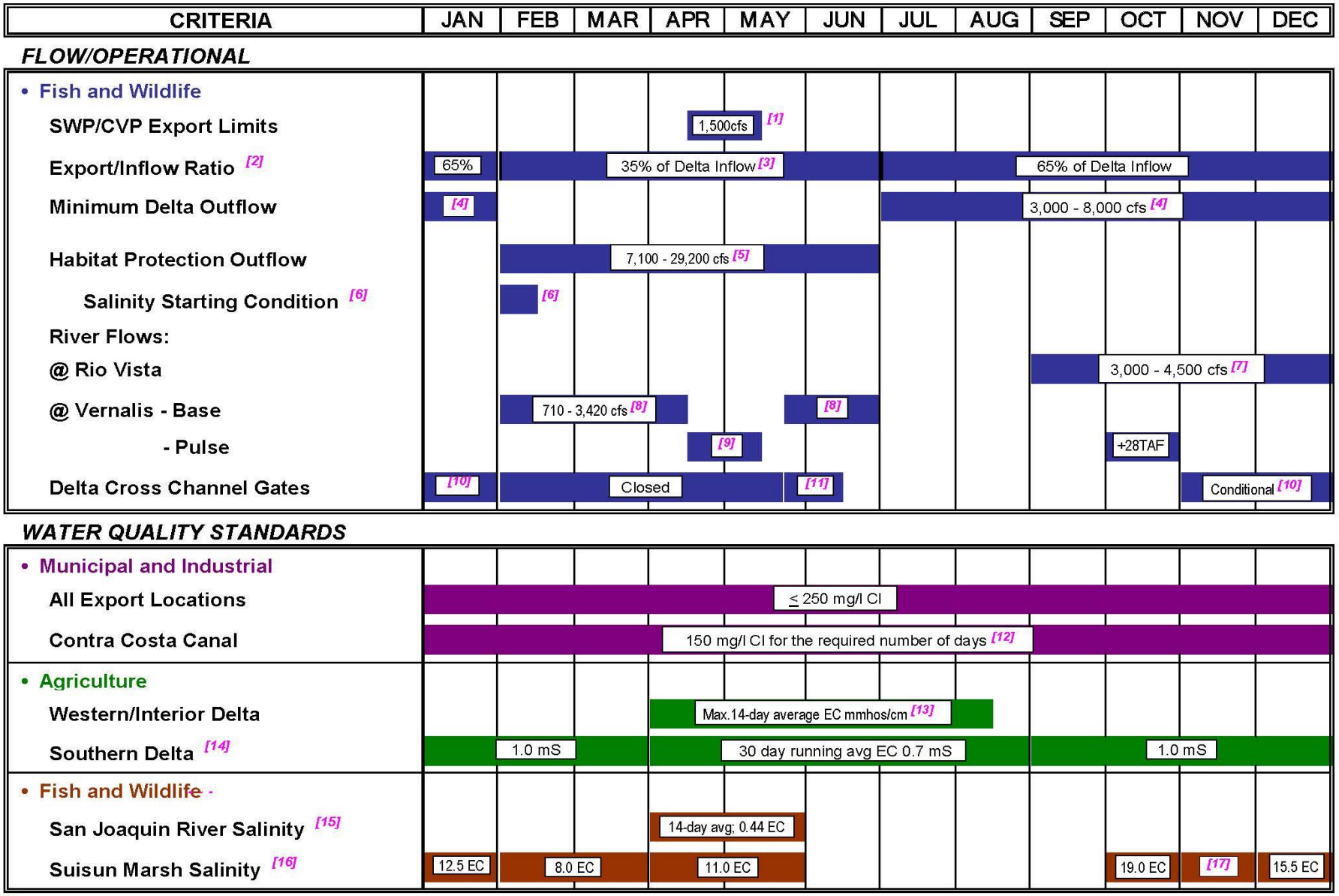
- To protect beneficial uses in the Delta, the State Water Resources Control Board issues a Water Quality Control Plan, then ties DWR's and USBR's water rights to those objectives.

D-1641 Bay-Delta Standards Locations



Bay-Delta Standards

Contained in D-1641



[#] See Footnotes

Footnotes

[1] Maximum 3-day running average of combined export rate (cfs) which includes Tracy Pumping Plant and Clifton Court Forebay Inflow less Byron-Bethany pumping.

Year Type	All
Apr15 - May15*	The greater of 1,500 or 100% of 3-day avg. Vernalis flow

* This time period may need to be adjusted to coincide with fish migration. Maximum export rate may be varied by CalFed Op's group.

[2] The maximum percentage of average Delta inflow (use 3-day average for balanced conditions with storage withdrawal, otherwise use 14-day average) diverted at Clifton Court Forebay (excluding Byron-Bethany pumping) and Tracy Pumping Plant using a 3-day average. (These percentages may be adjusted upward or downward depending on biological conditions, providing there is no net water cost.)

[3] The maximum percent Delta inflow diverted for Feb may vary depending on the January 8RI.

Jan 8RI	Feb exp. limit
≤ 1.0 MAF	45%
between 1.0 & 1.5 MAF	35%-45%
> 1.5 MAF	35%

[4] Minimum monthly average Delta outflow (cfs). If monthly standard ≤ 5,000 cfs, then the 7-day average must be within 1,000 cfs of standard; if monthly standard > 5,000 cfs, then the 7-day average must be ≥ 80% of standard.

Year Type	All	W	AN	BN	D	C
Jan	4,500*					
Jul		8,000	8,000	6,500	5,000	4,000
Aug		4,000	4,000	4,000	3,500	3,000
Sep	3,000					
Oct		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

* Increase to 6,000 if the Dec 8RI is greater than 800 TAF

[5] Minimum 3-day running average of daily Delta outflow of 7,100 cfs OR: either the daily average or 14-day running average EC at Collinsville is less than 2.64 mmhos/cm (This standard for March may be relaxed if the Feb 8RI is less than 500 TAF. The standard does not apply in May and June if the May estimate of the SRI IS < 8.1 MAF at the 90% exceedence level in which case a minimum 14-day running average flow of 4,000 cfs is required.) For additional Delta outflow objectives, see **TABLE A**.

[6] February starting salinity: If Jan 8RI > 900 TAF, then the daily or 14-day running average EC @ Collinsville must be ≤ 2.64 mmhos/cm for at least one day between Feb 1-14. If Jan 8RI is between 650 TAF and 900 TAF, then the CalFed Op's group will determine if this requirement must be met.

[7] Rio Vista minimum monthly average flow rate in cfs (the 7-day running average shall not be less than 1,000 below the monthly objective).

Year Type	All	W	AN	BN	D	C
Sep	3,000					
Oct		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

[8] BASE Vernalis minimum monthly average flow rate in cfs (the 7-day running average shall not be less than 20% below the objective). Take the higher objective if X2 is required to be west of Chipps Island.

Year Type	All	W	AN	BN	D	C
Feb-Apr14 and May16-Jun		2,130 or 3,420	2,130 or 3,420	1,420 or 2,280	1,420 or 2,280	710 or 1,140

[9] PULSE Vernalis minimum monthly average flow rate in cfs. Take the higher objective if X2 is required to be at or west of Chipps Island.

Year Type	All	W	AN	BN	D	C
Apr15 - May15		7,330 or 8,620	5,730 or 7,020	4,620 or 5,480	4,020 or 4,880	3,110 or 3,540
Oct	1,000*					

* Up to an additional 28 TAF pulse/attraction flow to bring flows up to a monthly average of 2,000 cfs except for a critical year following a critical year. Time period based on real-time monitoring and determined by CalFed Op's group.

[10] For the Nov-Jan period, Delta Cross Channel gates may be closed for up to a total of 45 days.

[11] For the May 21-June 15 period, close Delta Cross Channel gates for a total of 14 days per CALFED Op's group. During the period the Delta cross channel gates may close 4 consecutive days each week, excluding weekends.

[12] Minimum # of days that the mean daily chlorides ≤ 150 mg/l must be provided in intervals of not less than 2 weeks duration. Standard applies at Contra Costa Canal Intake or Antioch Water Works Intake.

Year Type	W	AN	BN	D	C
# Days	240	190	175	165	155

[13] The maximum 14-day running average of mean daily EC (mmhos/cm) depends on water year type.

	WESTERN DELTA				INTERIOR DELTA			
	Sac River @ Emmaton		SJR@ Jersey Point		Mokelumne R@ Terminous		SJR@ San Andreas	
Year Type	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *
W	Aug 15		Aug 15		Aug 15		Aug 15	
AN	Jul 1	0.63	Aug 15		Aug 15		Aug 15	
BN	Jun 20	1.14	Jun 20	0.74	Aug 15		Aug 15	
D	Jun 15	1.67	Jun 15	1.35	Aug 15		Jun 25	0.58
C		2.78		2.20		0.54		0.87

* When no date is shown, EC limit continues from April 1.

[14] As per D-1641, for San Joaquin River at Vernalis: however, the April through August maximum 30- day running average EC for San Joaquin River at Brandt Bridge,Old River near Middle River, and Old River at Tracy Road Bridge shall be 1.0 EC until April 1, 2005 when the value will be 0.7 EC.

[15] Compliance will be determined between Jersey Point & Prisoners Point. Does not apply in critical years or in May when the May 90% forecast of SRI ≤ 8.1 MAF.

[16] During deficiency period, the maximum monthly average mhtEC at Western Suisun Marsh stations as per SMPA is:

Month	mhtEC
Oct	19.0
Nov	16.5
Dec-Mar	15.6
Apr	14.0
May	12.5

[17] In November, maximum monthly average mhtEC = 16.5 for Western Marsh stations and maximum monthly average mhtEC = 15.5 for Eastern Marsh stations in all periods types.

TABLE A

Number of Days When Max. Daily Average Electrical Conductivity of 2.64 mmhos/cm Must Be Maintained at Chipps Island and Port Chicago. (This can also be met with a maximum 14-day running average EC of 2.64 mmhos/cm, or 3-day running average Delta outflows of 11,400 cfs and 29,200 cfs, respectively.) Port Chicago Standard is triggered only when the 14-day average EC for the last day of the previous month is 2.64 mmhos/cm or less. PMI is previous month's 8RI. If salinity/flow objectives are met for a greater number of days than required for any month, the excess days shall be applied towards the following month's requirement. The number of day's for values of the PMI between those specified below shall be determined by linear interpolation.

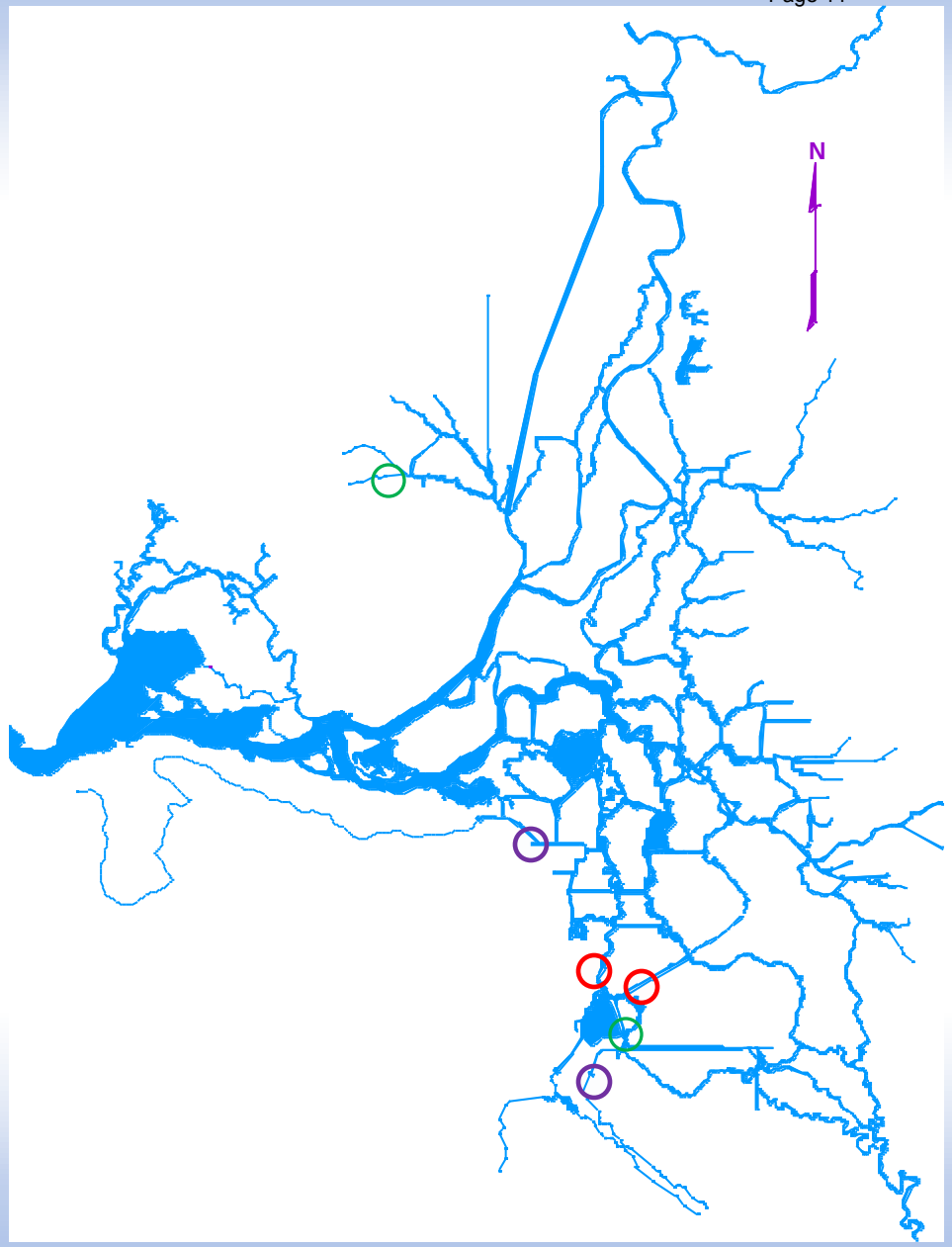
PMI	Chipps Island (Chipps Island Station D10)				
(TAF)	FEB	MAR	APR	MAY	JUN
≤ 500	0	0	0	0	0
750	0	0	0	0	0
1000	28*	12	2	0	0
1250	28	31	6	0	0
1500	28	31	13	0	0
1750	28	31	20	0	0
2000	28	31	25	1	0
2250	28	31	27	3	0
2500	28	31	29	11	1
2750	28	31	29	20	2
3000	28	31	30	27	4
3250	28	31	30	29	8
3500	28	31	30	30	13
3750	28	31	30	31	18
4000	28	31	30	31	23
4250	28	31	30	31	25
4500	28	31	30	31	27
4750	28	31	30	31	28
5000	28	31	30	31	29
5250	28	31	30	31	29
≥ 5500	28	31	30	31	30

*When 800 TAF < PMI < 1000 TAF, the number of days is determined by linear interpolation between 0 and 28 days.

PMI	Port Chicago (continuous recorder at Port Chicago)				
(TAF)	FEB	MAR	APR	MAY	JUN
0	0	0	0	0	0
250	1	0	0	0	0
500	4	1	0	0	0
750	8	2	0	0	0
1000	12	4	0	0	0
1250	15	6	1	0	0
1500	18	9	1	0	0
1750	20	12	2	0	0
2000	21	15	4	0	0
2250	22	17	5	1	0
2500	23	19	8	1	0
2750	24	21	10	2	0
3000	25	23	12	4	0
3250	25	24	14	6	0
3500	25	25	16	9	0
3750	26	26	18	12	0
4000	26	27	20	15	0
4250	26	27	21	18	1
4500	26	28	23	21	2
4750	27	28	24	23	3
5000	27	28	25	25	4
5250	27	29	25	26	6
5500	27	29	26	28	9
5750	27	29	27	28	13
6000	27	29	27	29	16
6250	27	30	27	29	19
6500	27	30	28	30	22
6750	27	30	28	30	24
7000	27	30	28	30	26
7250	27	30	28	30	27
7500	27	30	29	30	28
7750	27	30	29	31	28
8000	27	30	29	31	29
8250	28	30	29	31	29
8500	28	30	29	31	29
8750	28	30	29	31	30
9000	28	30	29	31	30
9250	28	30	29	31	30
9500	28	31	29	31	30
9750	28	31	29	31	30
10000	28	31	30	31	30
> 10000	28	31	30	31	30

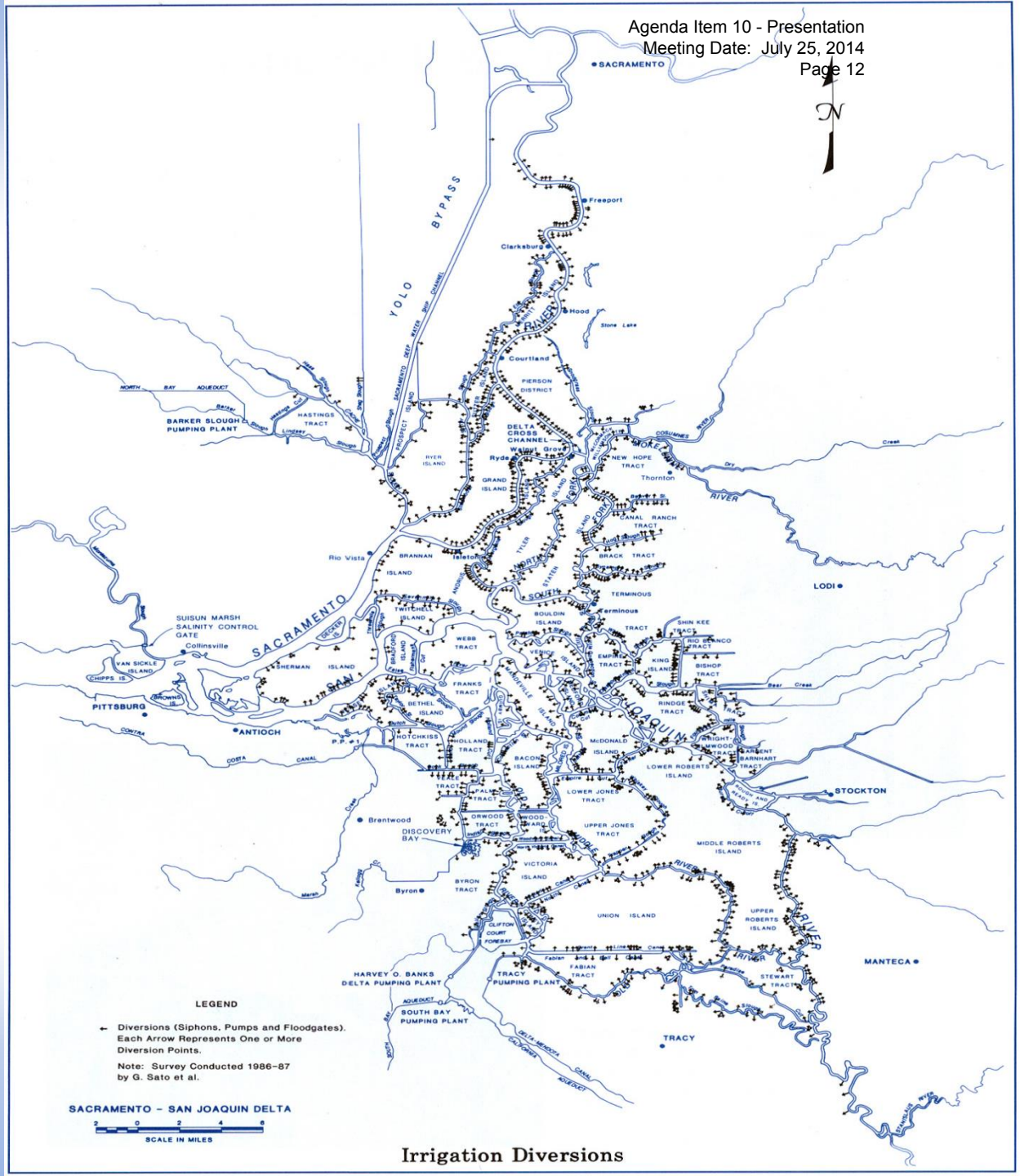
Major Diversions:

- **State Water Project (CCFB, NBA)**
- **Central Valley Project (Jones, RS)**
- **Contra Costa Water District (Old River PP, AIP)**



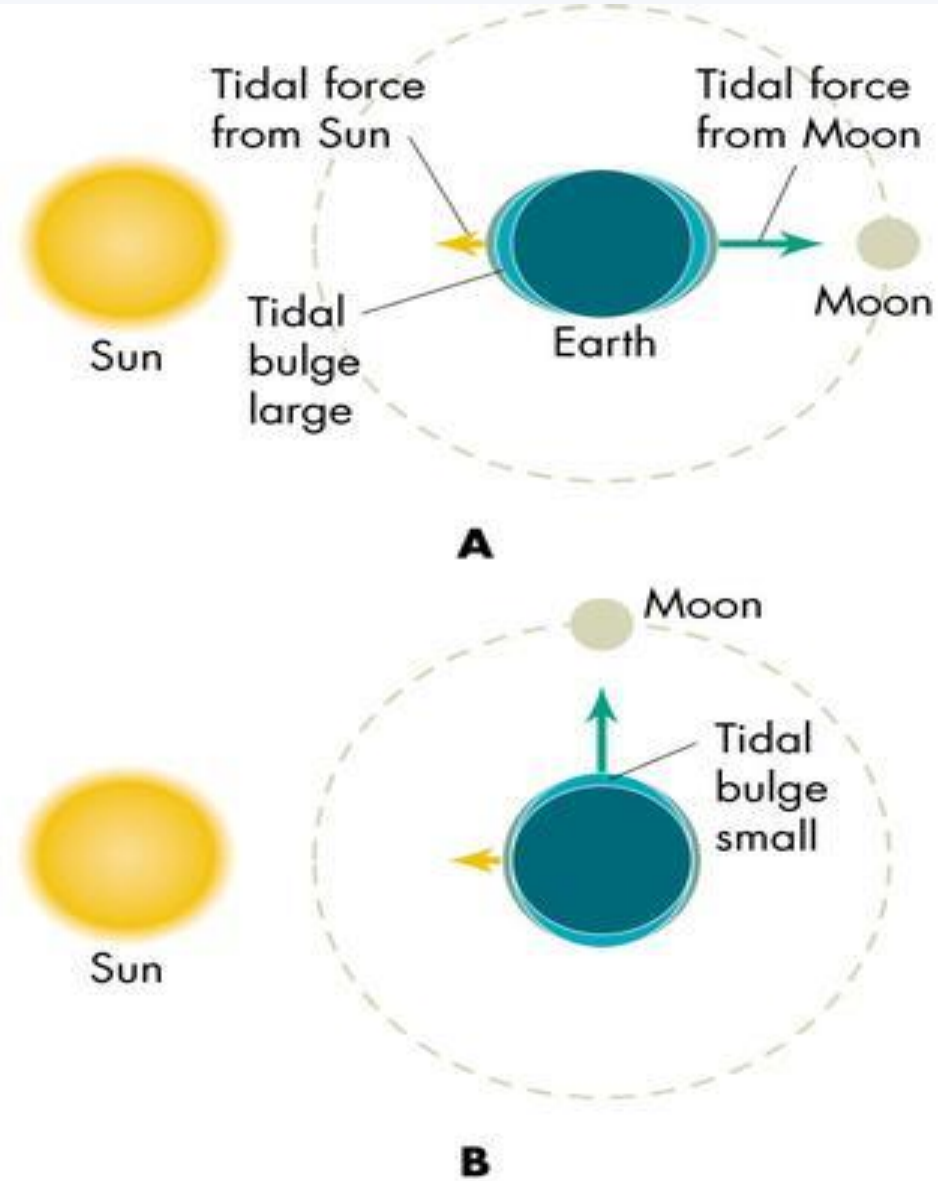
Local Diversions

Over 1800 agricultural diversions throughout the region.

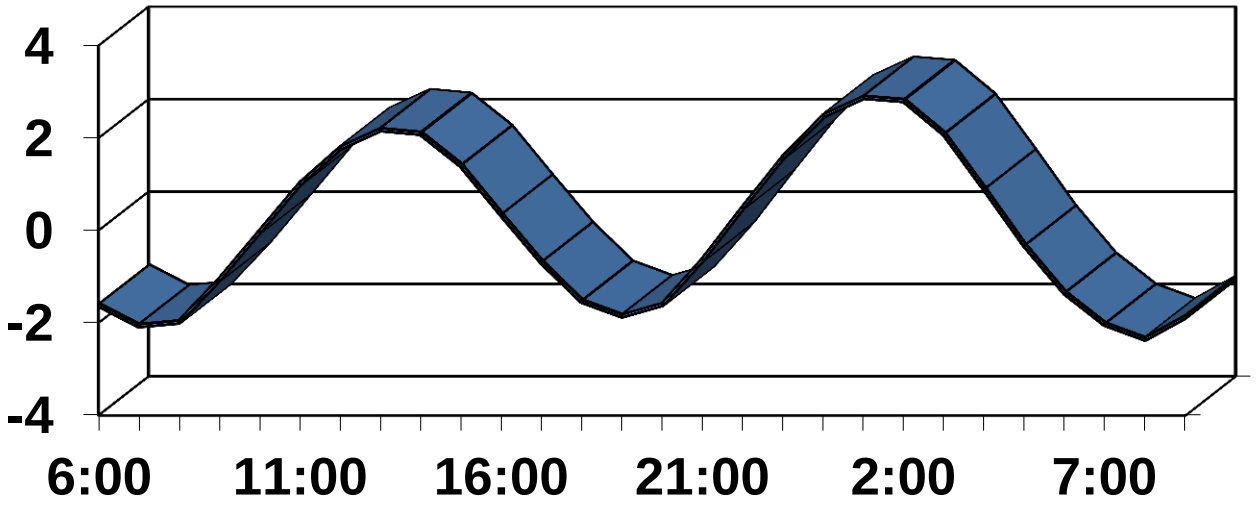


Challenges?

Astronomical Tides

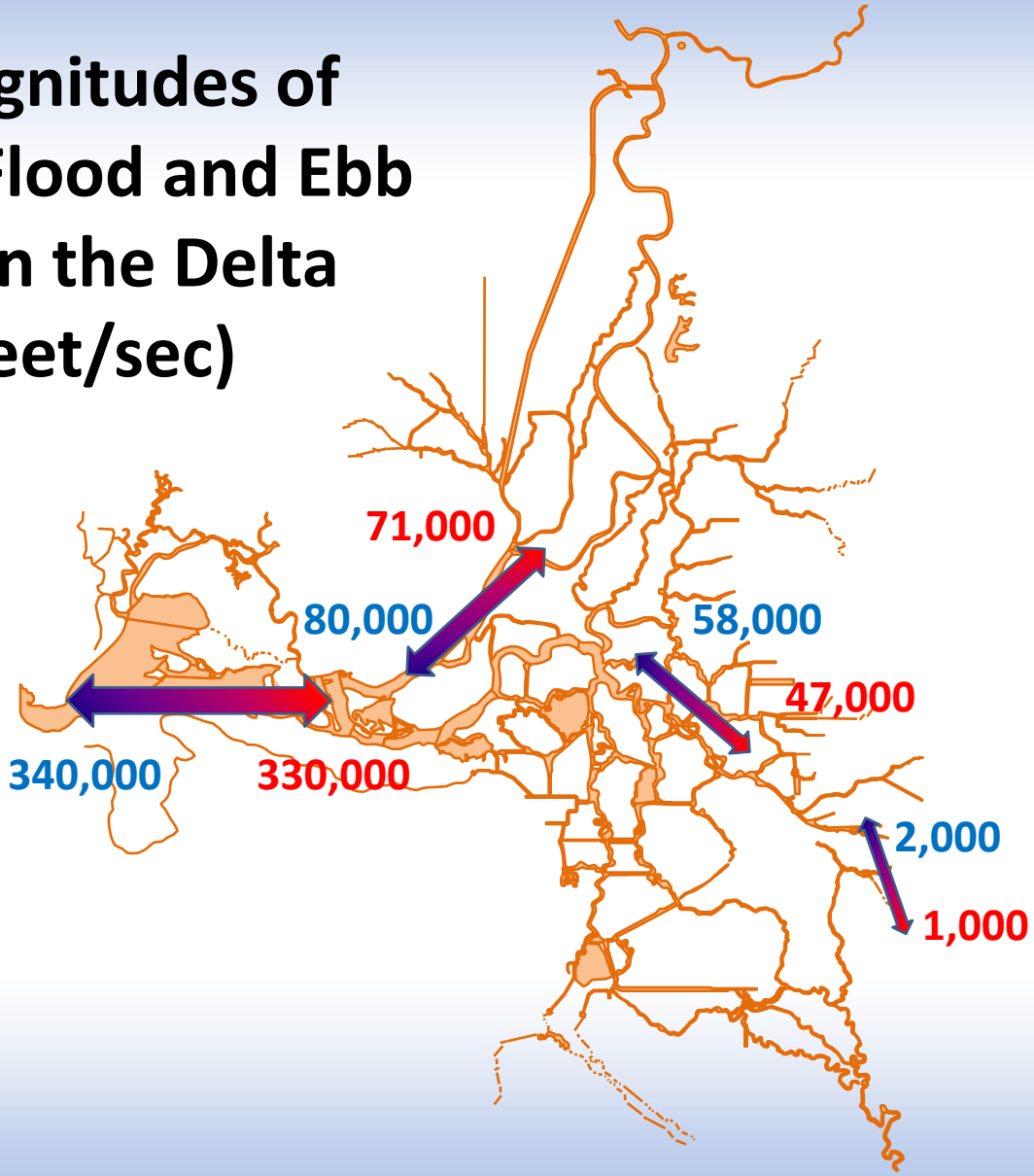


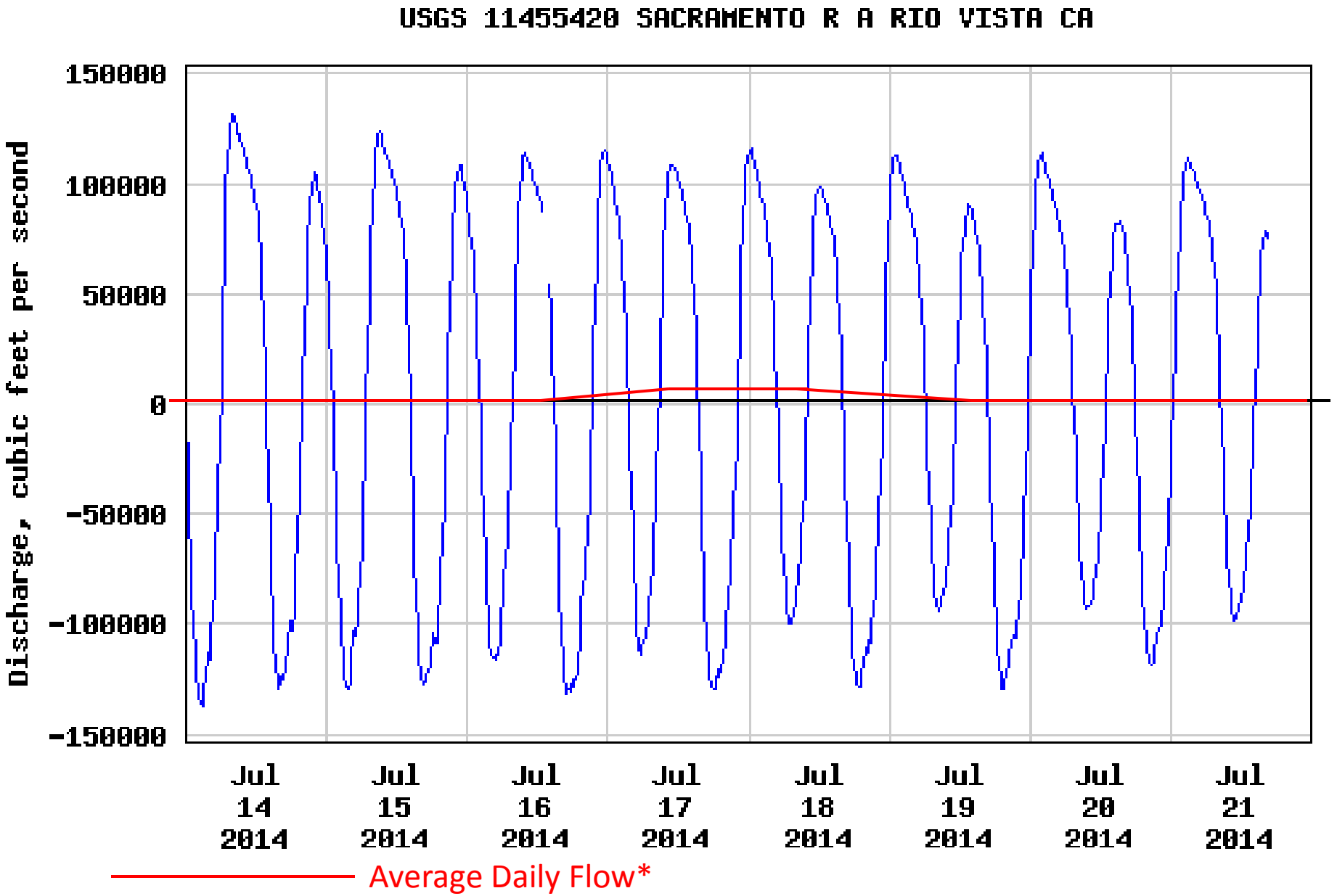
Daily Tidal Cycle



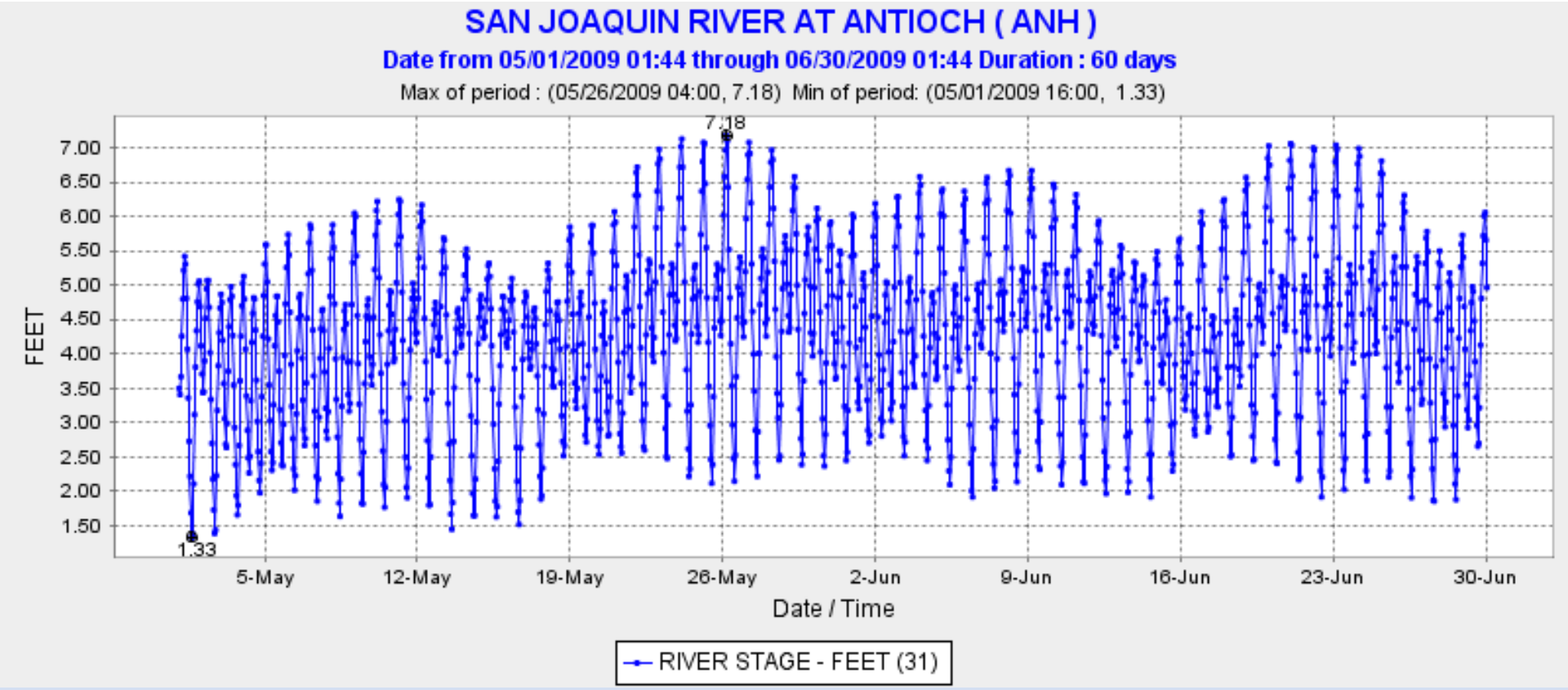
Stage at Martinez

Typical Magnitudes of Semidiurnal Flood and Ebb Tides within the Delta (cubic feet/sec)

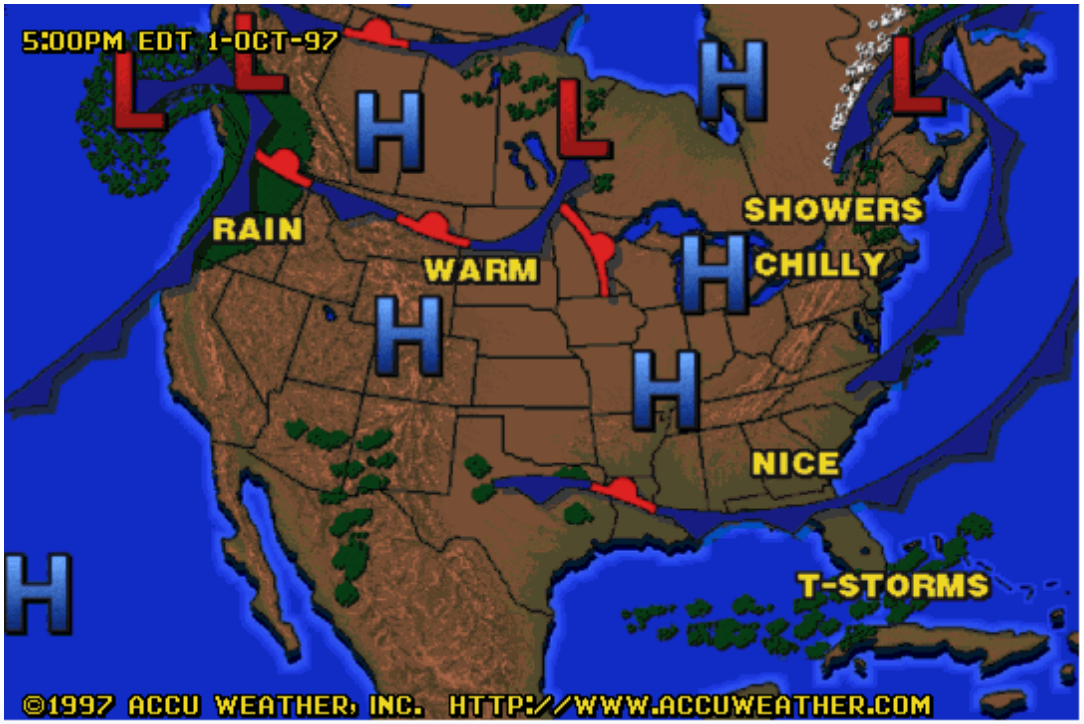



USGS 11455420 SACRAMENTO R A RIO VISTA CA
Discharge, cubic feet per second
150000
100000
50000
0
-50000
-100000
-150000
Jul 14 2014
Jul 15 2014
Jul 16 2014
Jul 17 2014
Jul 18 2014
Jul 19 2014
Jul 20 2014
Jul 21 2014
Average Daily Flow*
*Approximate values added to underlying graph
Graph courtesy of the U.S. Geological Survey

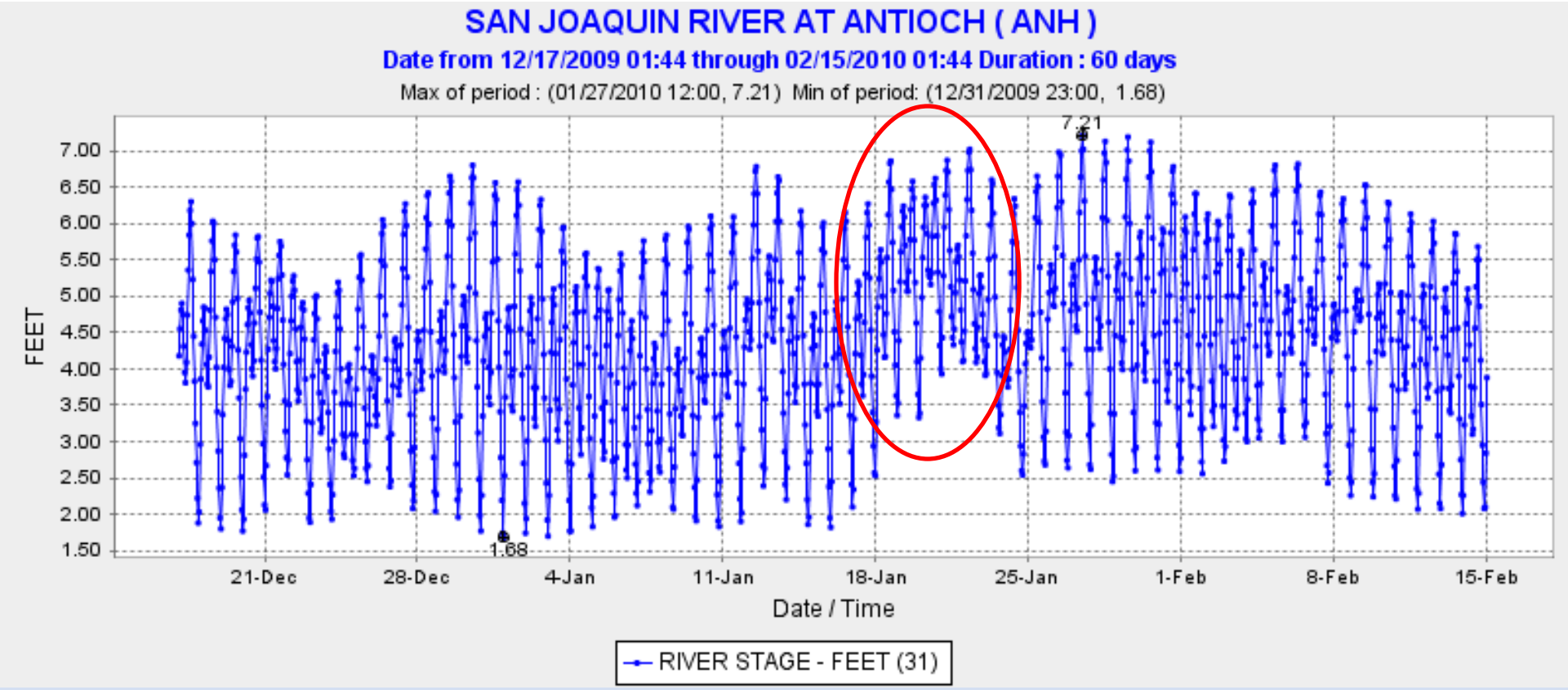
Overlay of Monthly Spring/Neap Cycle



Wind and Barometric Pressure

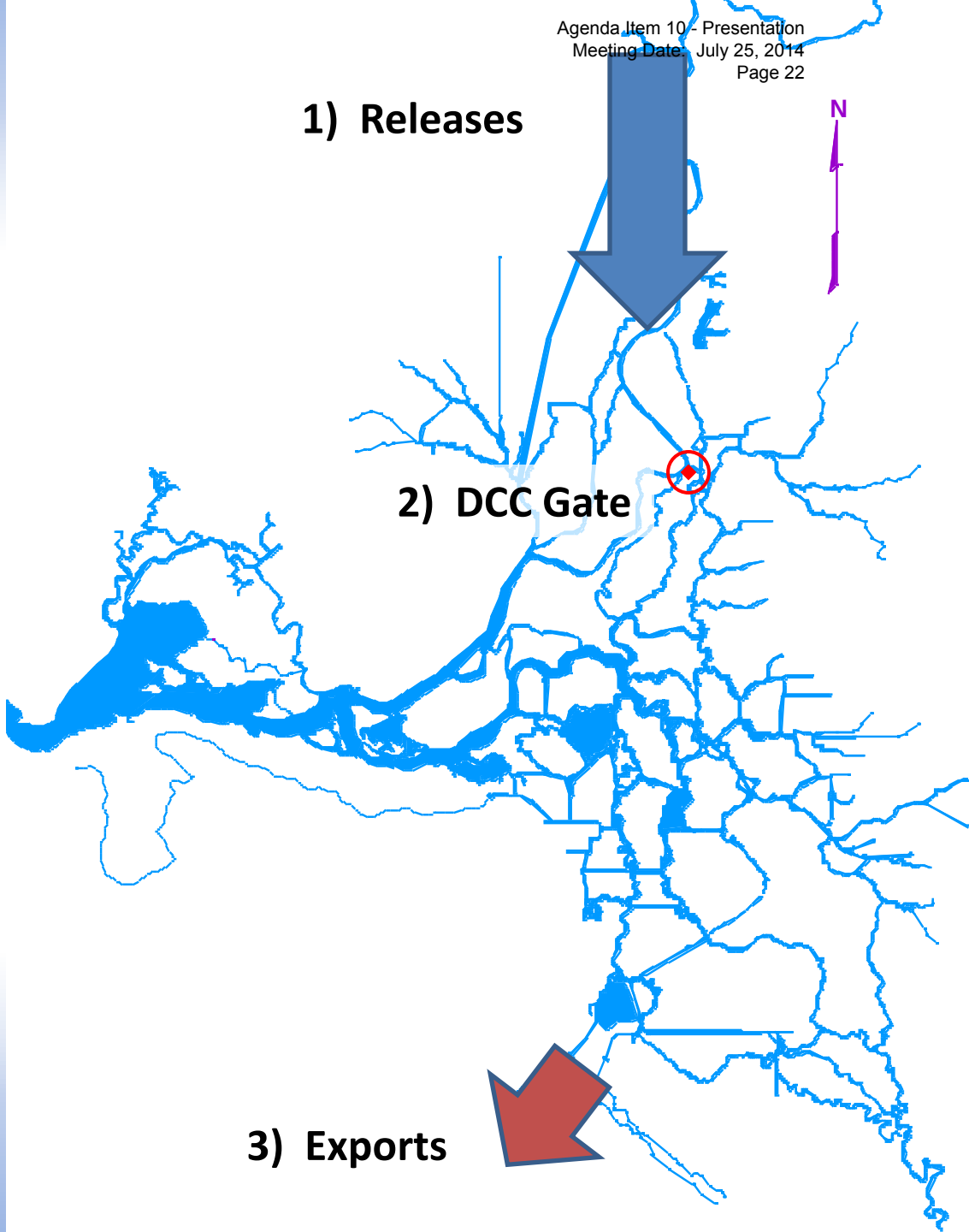


Meteorological Events can Change a Neap Tide into a Spring Tide



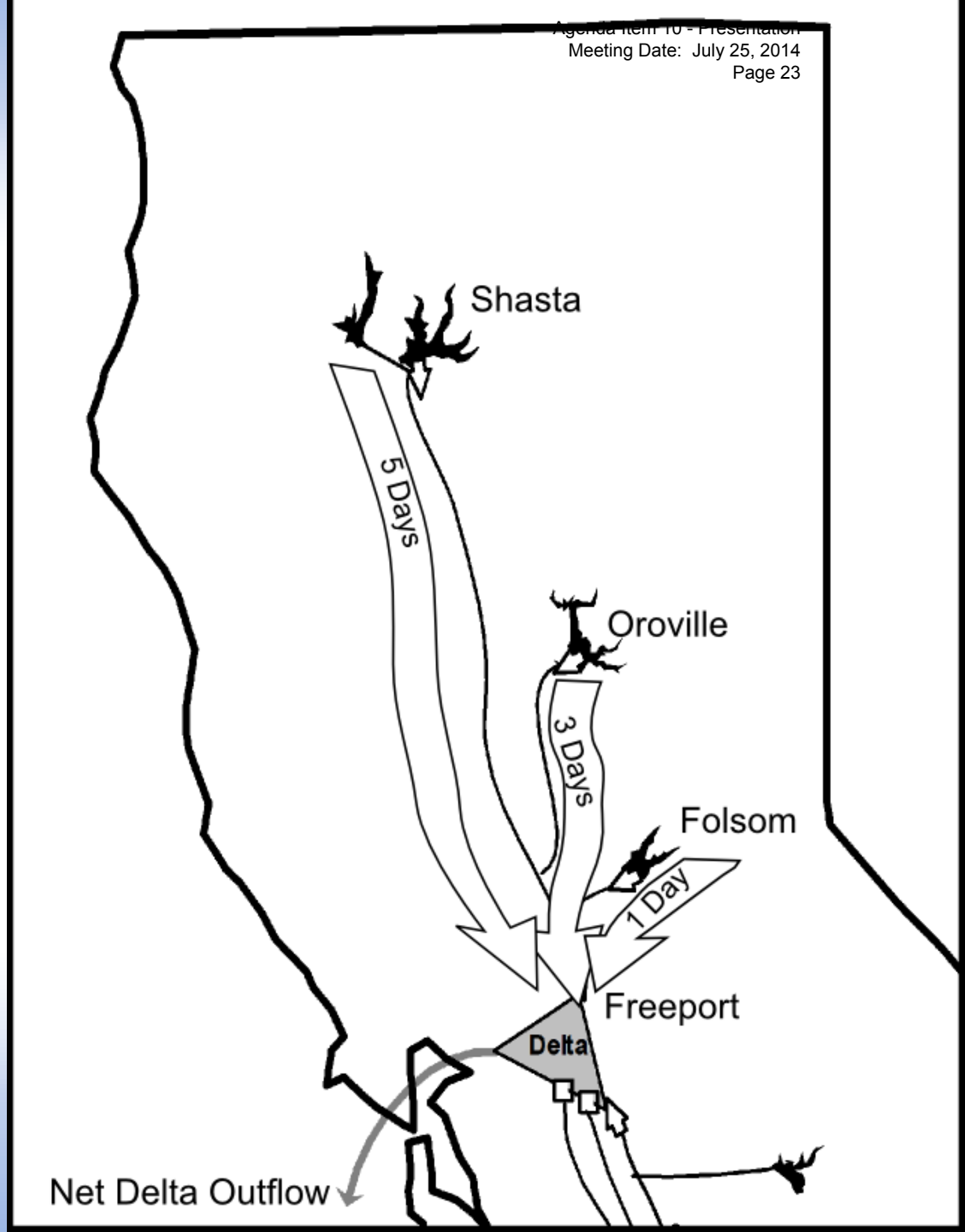
How Do We Manage?

The Projects have 3 "knobs" to turn



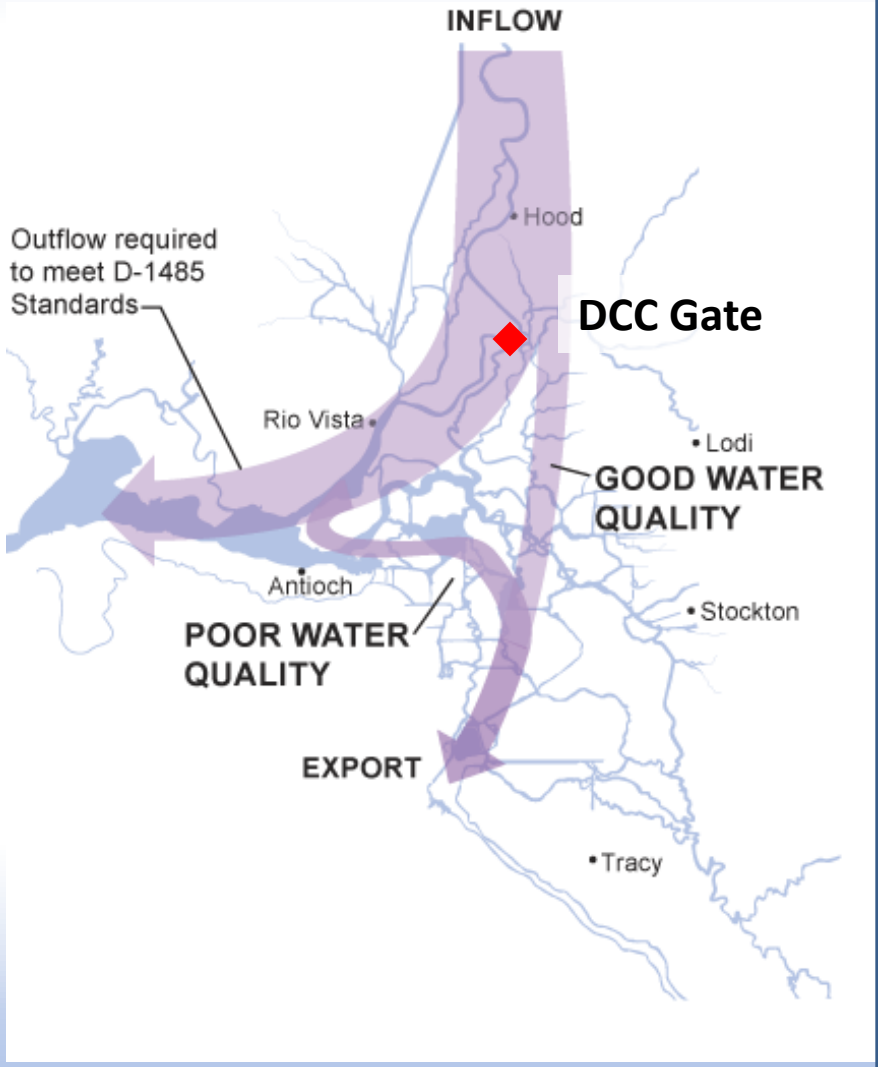
1) Releases:

Travel Times Present a Challenge

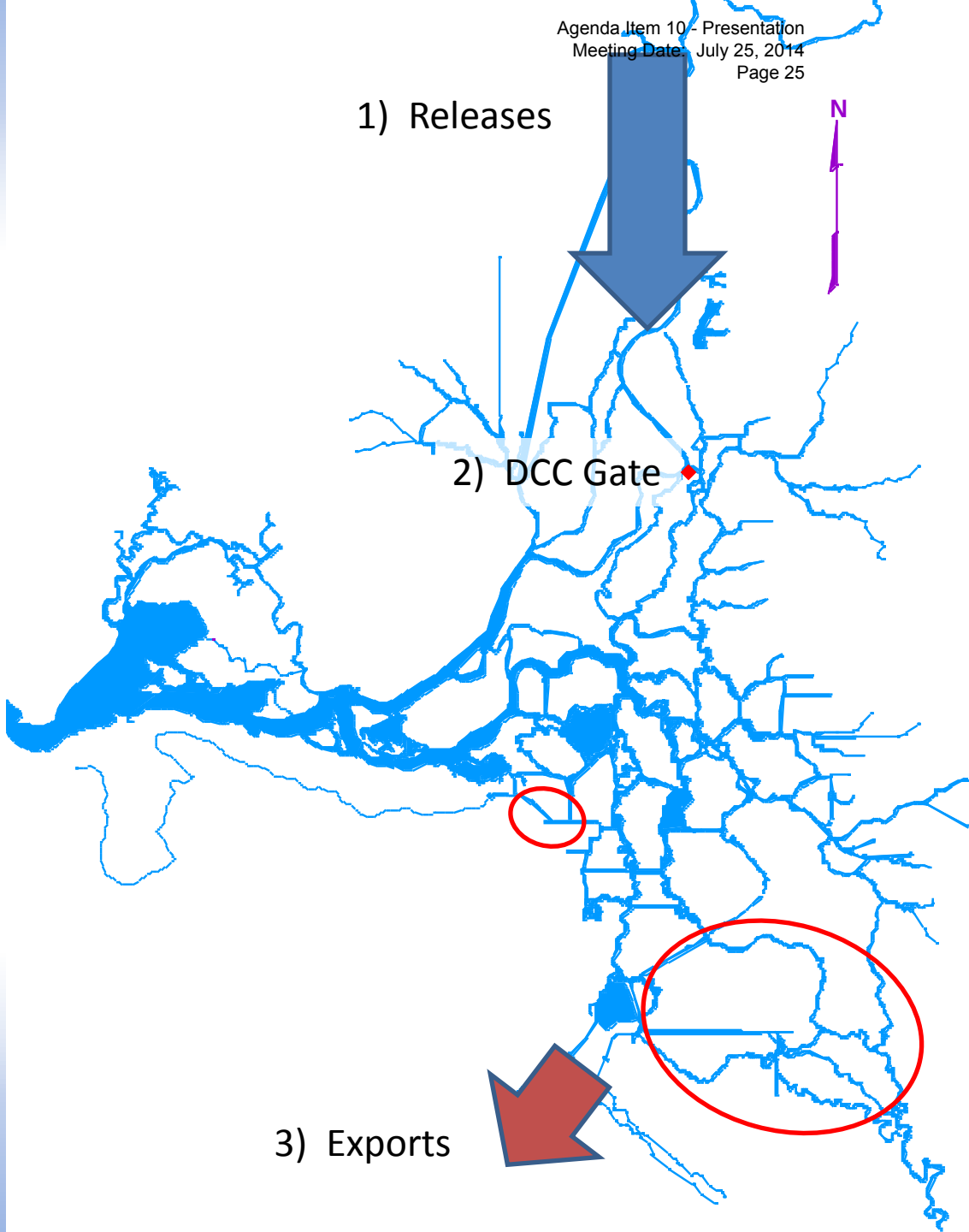


2) Delta Cross Channel Gates:

May Conflict with Fish Migration

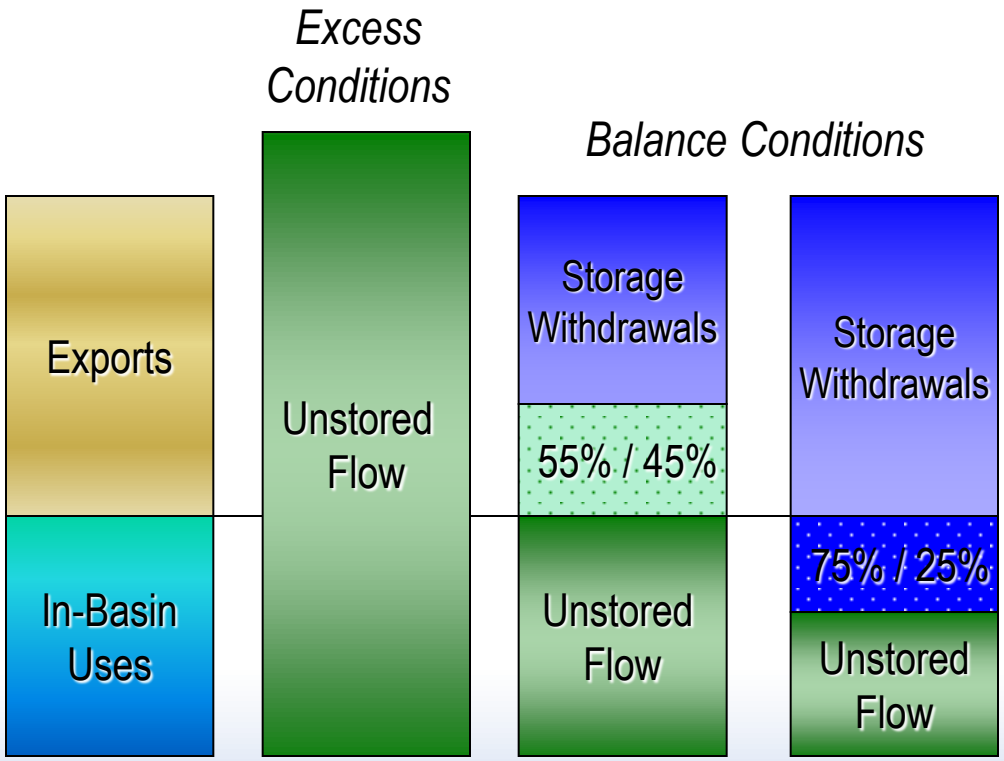


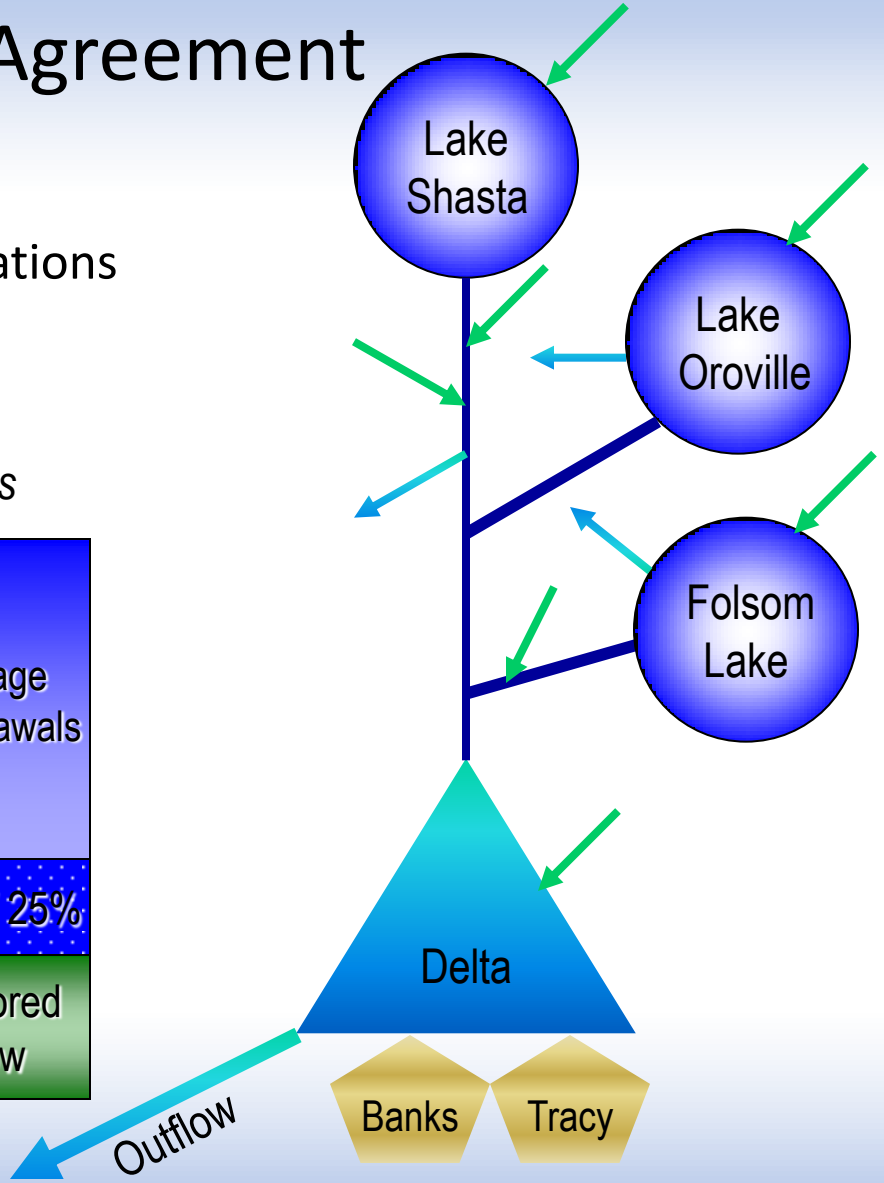
Knobs don't work well for all locations at all times



CVP/SWP Coordinated Operations Agreement (COA)

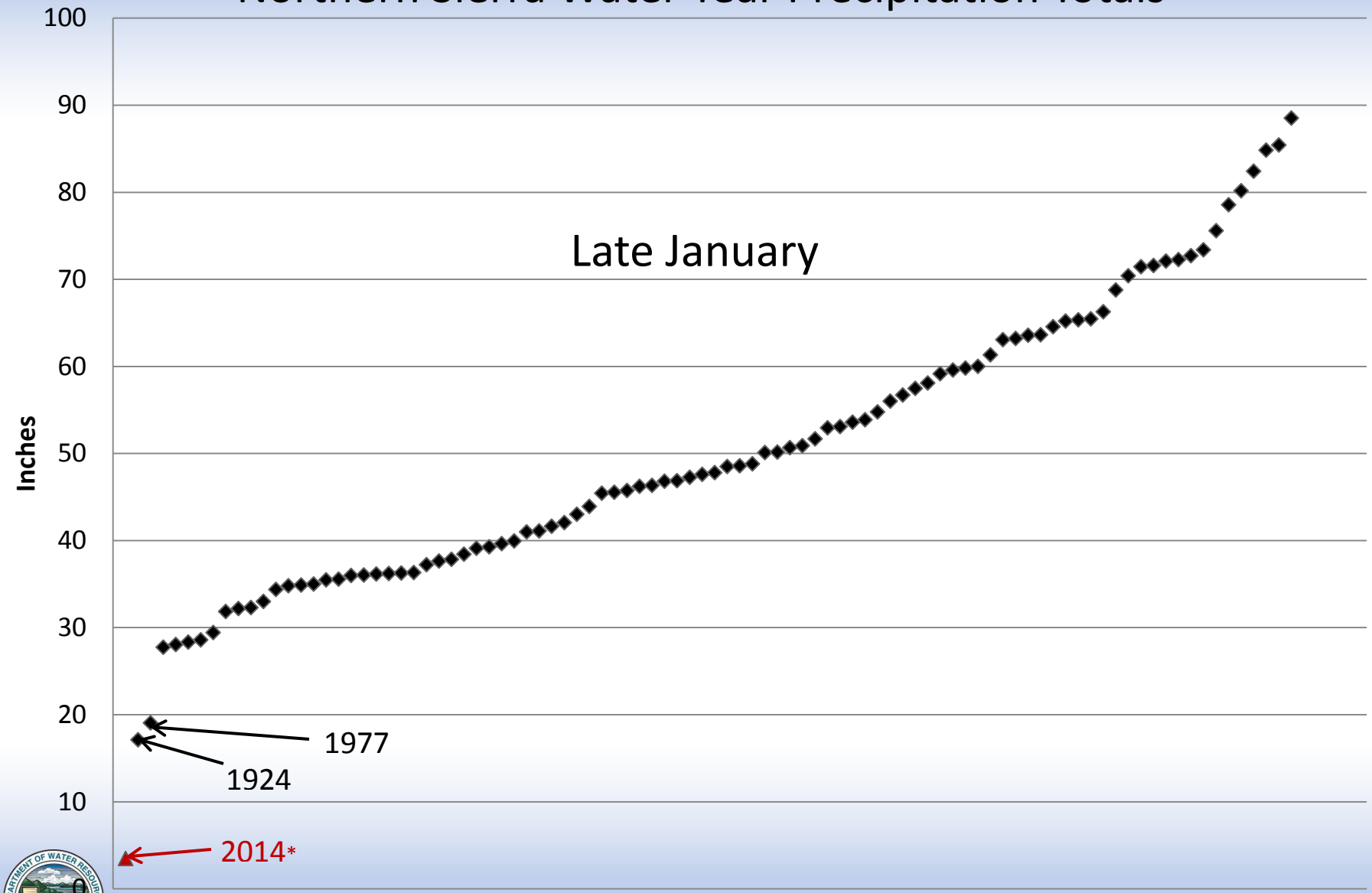
- Defines Share of Benefits and Obligations





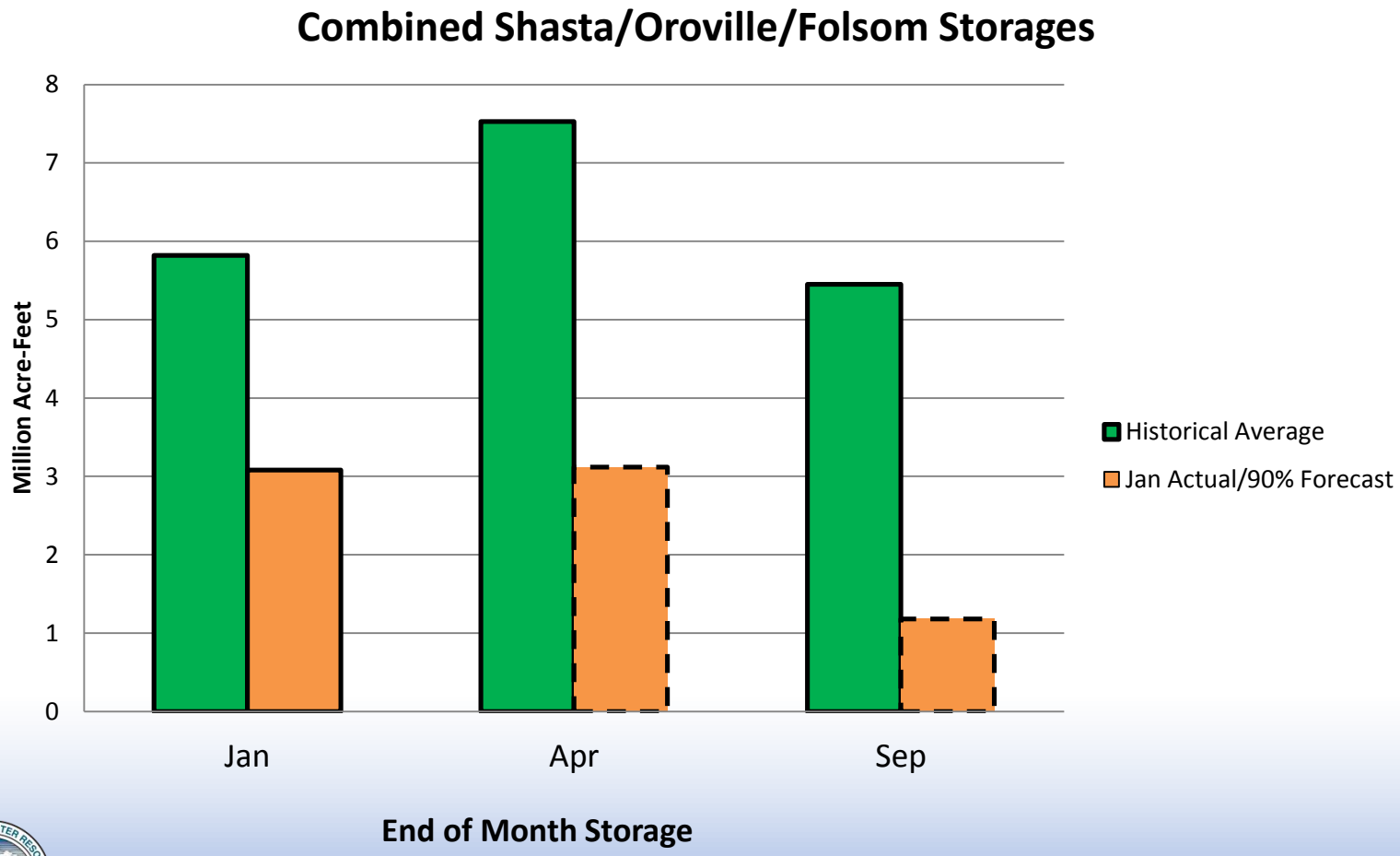
January 2014

Northern Sierra Water Year Precipitation Totals



*WY 2014 Precipitation through 1/29/14 = 3.5" - half of WY total typically occurs by late January

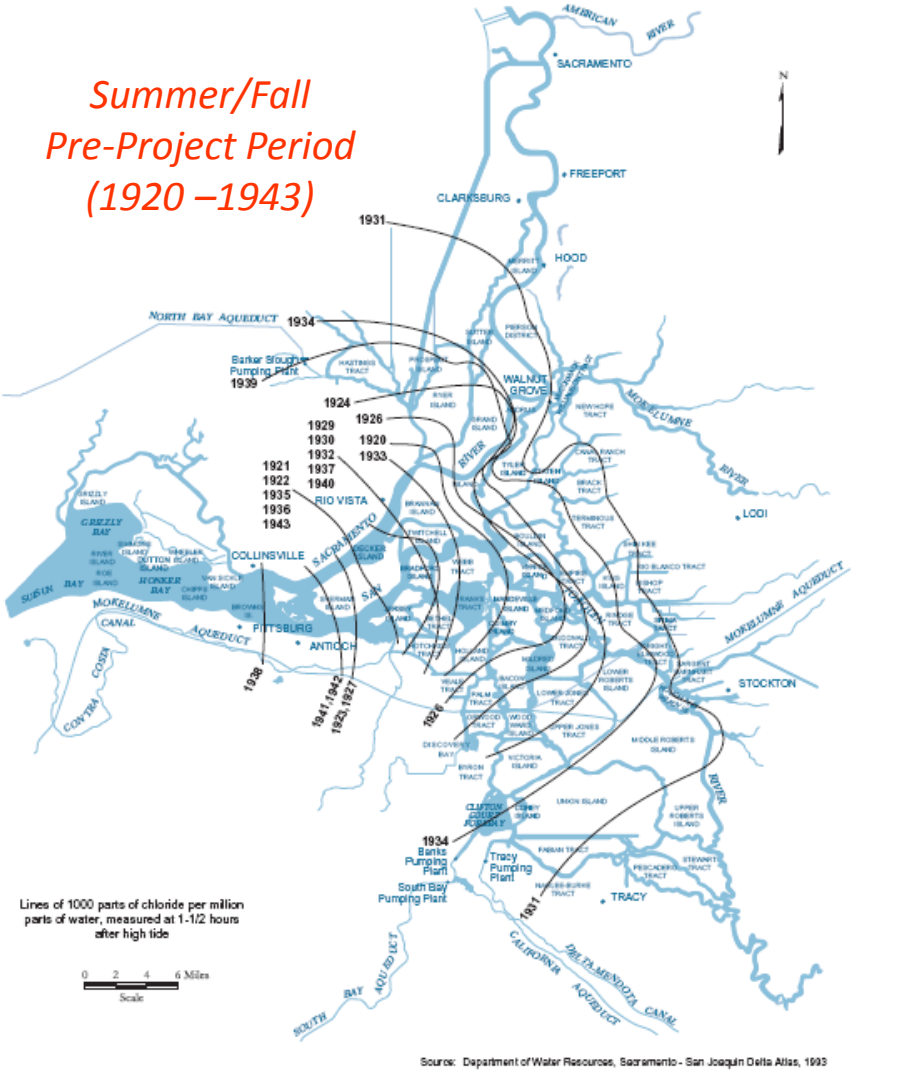
Insufficient Storage Gains in the Winter/Spring for Salinity Control in the Summer/Fall



Continued Dry Conditions
Loss of Delta Salinity Control

Summer/Fall
Pre-Project Period
(1920 –1943)

Figure 4-26 Maximum Salinity Intrusion, 1921-1943



Preparing for the Worst

- Allocation Reductions

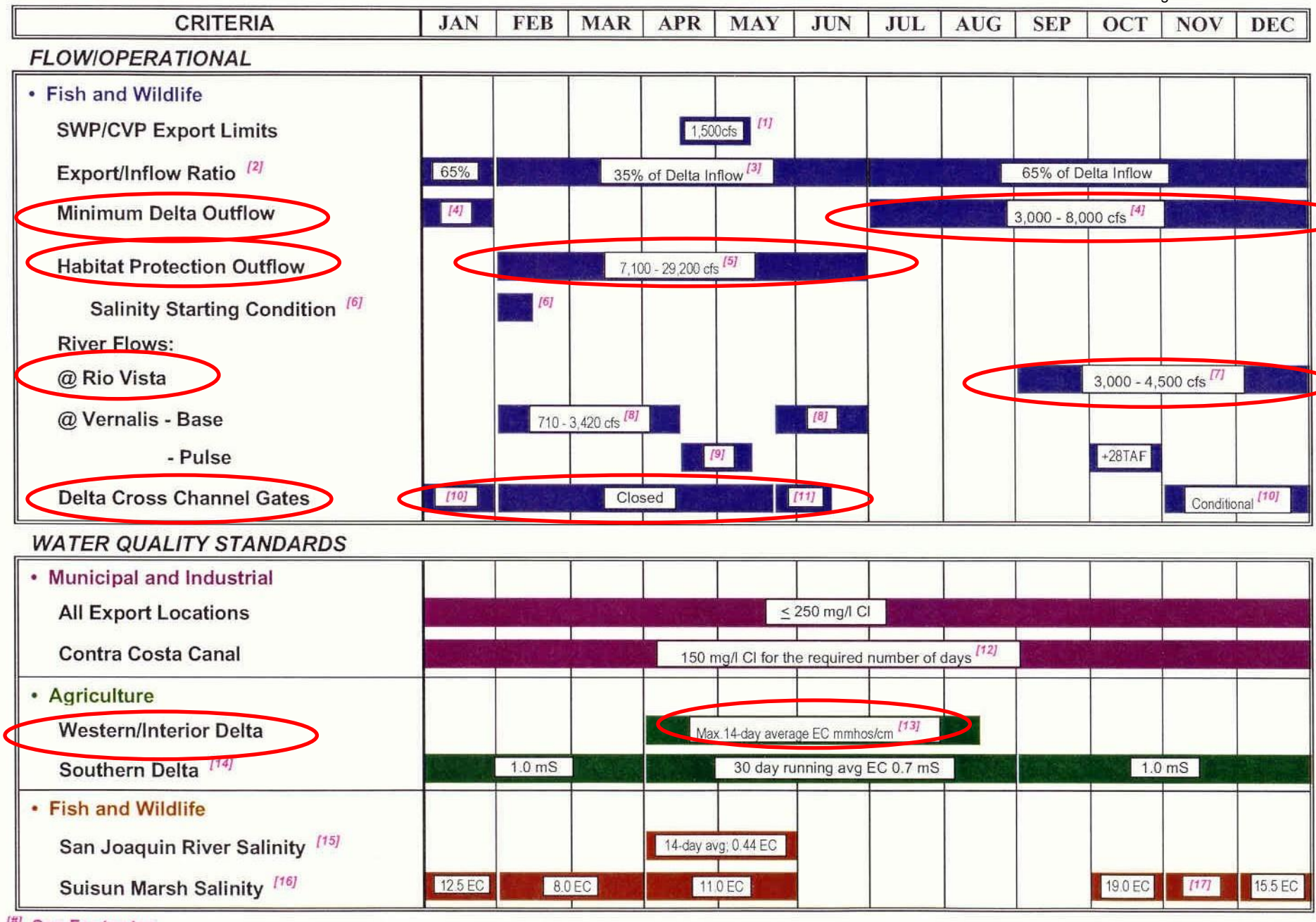
- Petition the Water Board to Modify Delta Standards

- Plan for Emergency Drought Rock Barriers

DRAFT

Bay-Delta Standards

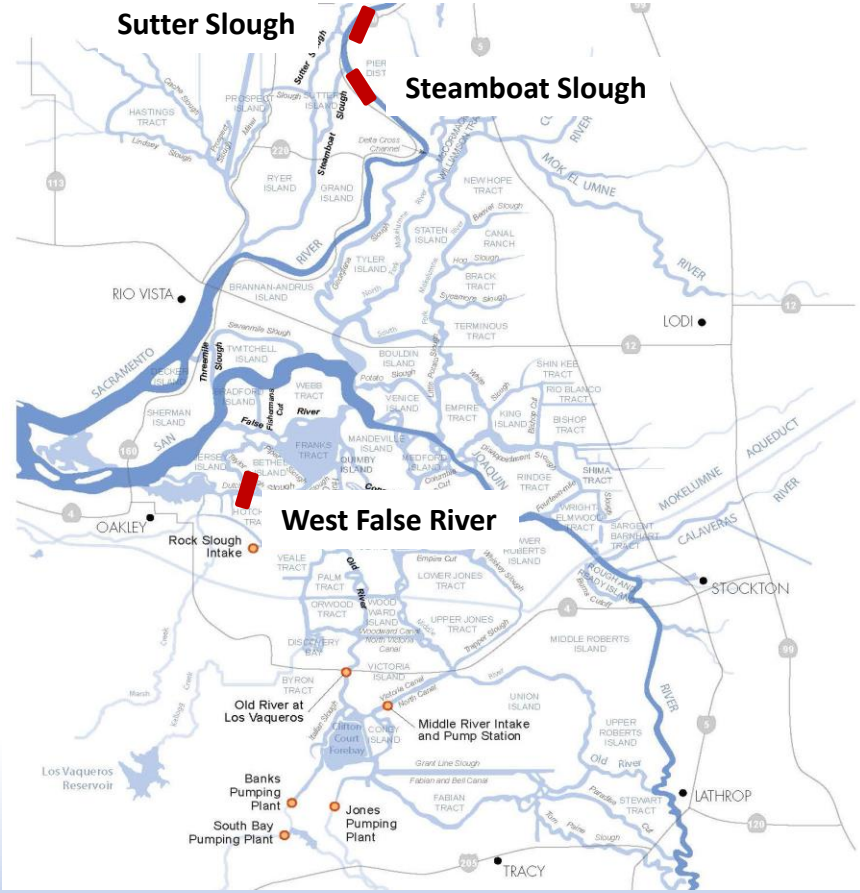
Contained in D-1641



[#] See Footnotes

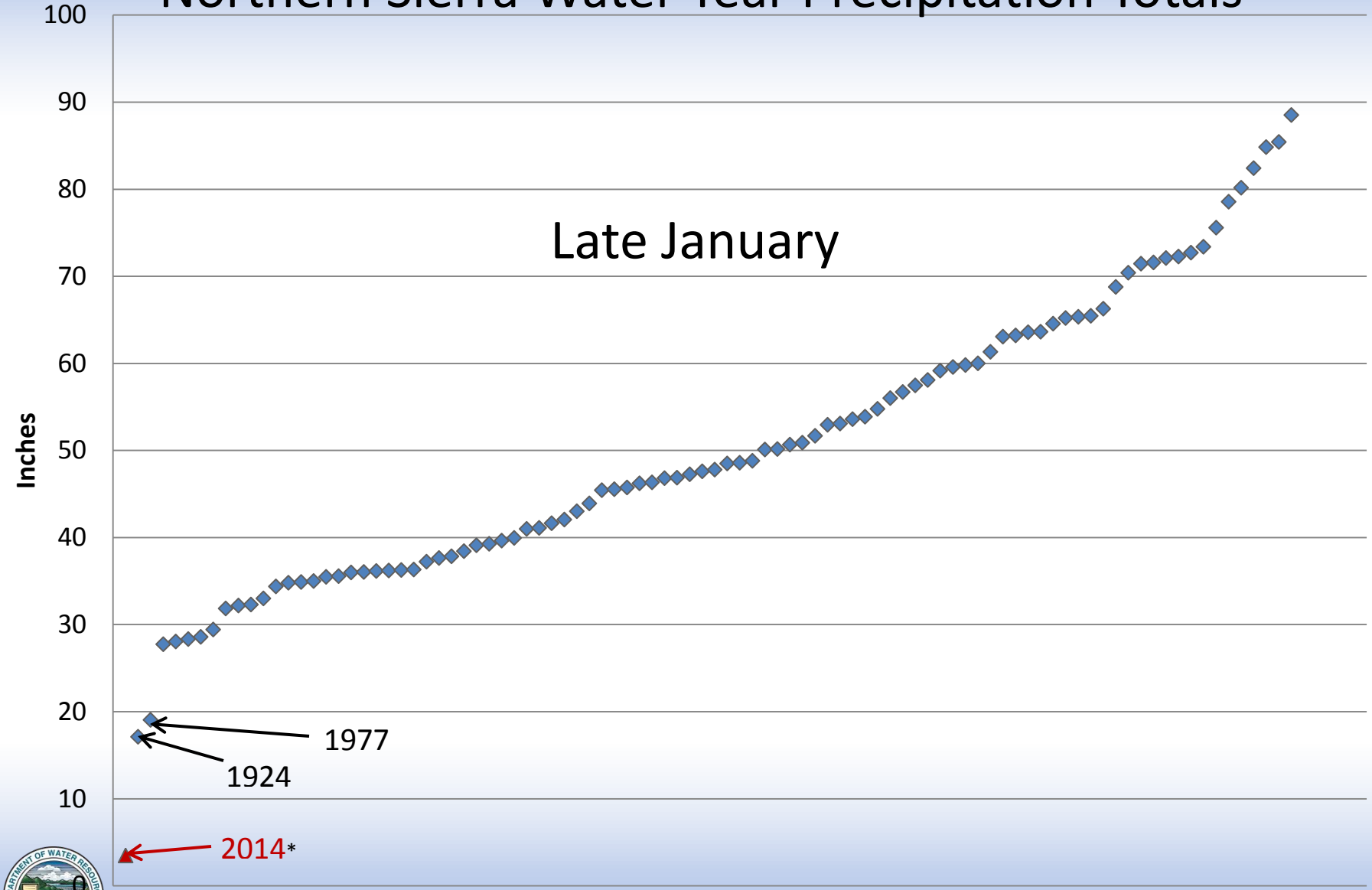
Emergency Drought Barriers

- Temporary rock barriers
- Permits required
- Agency consultations
- Limit Saltwater Intrusion



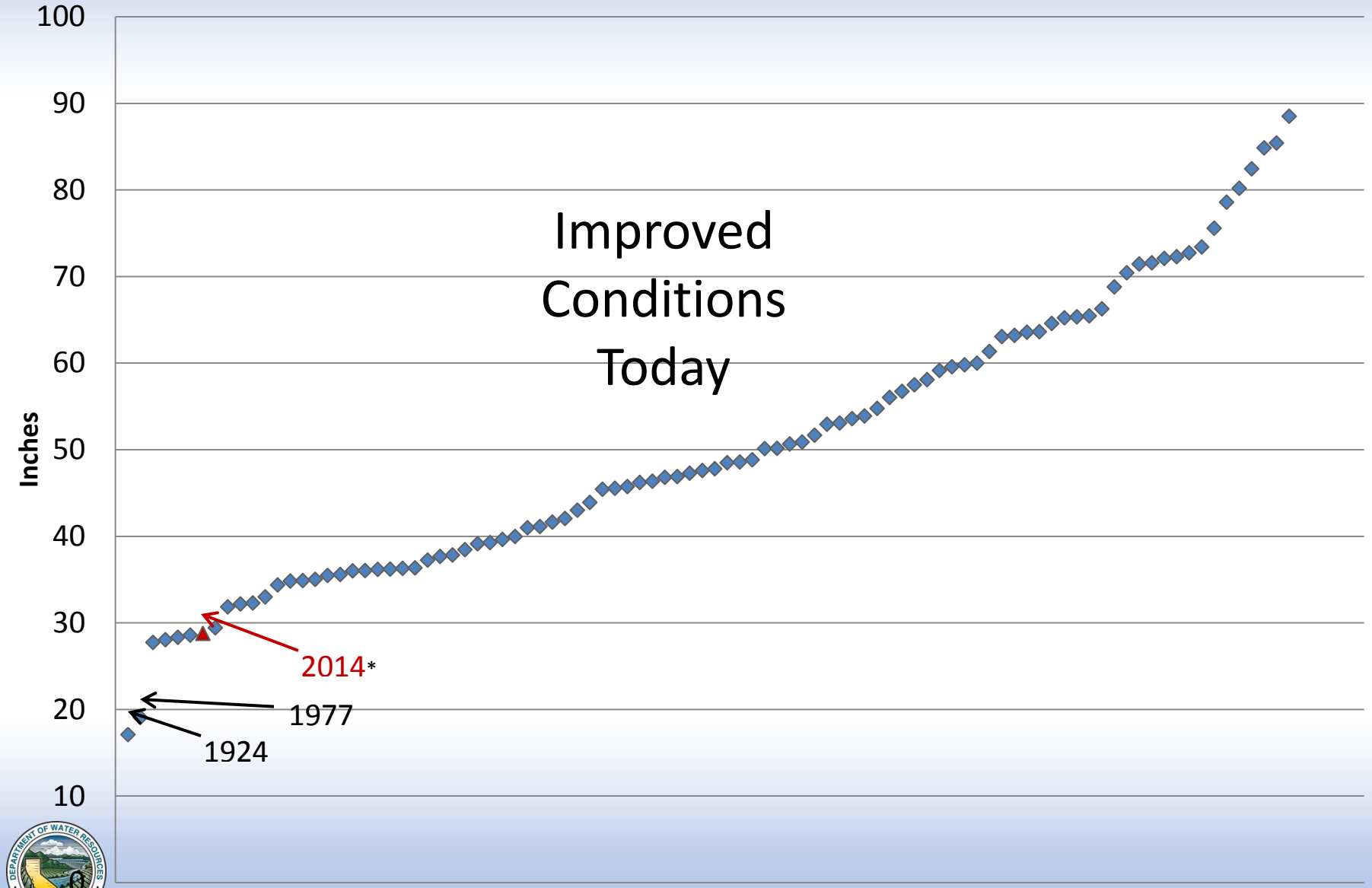
February/March Improvements

Northern Sierra Water Year Precipitation Totals

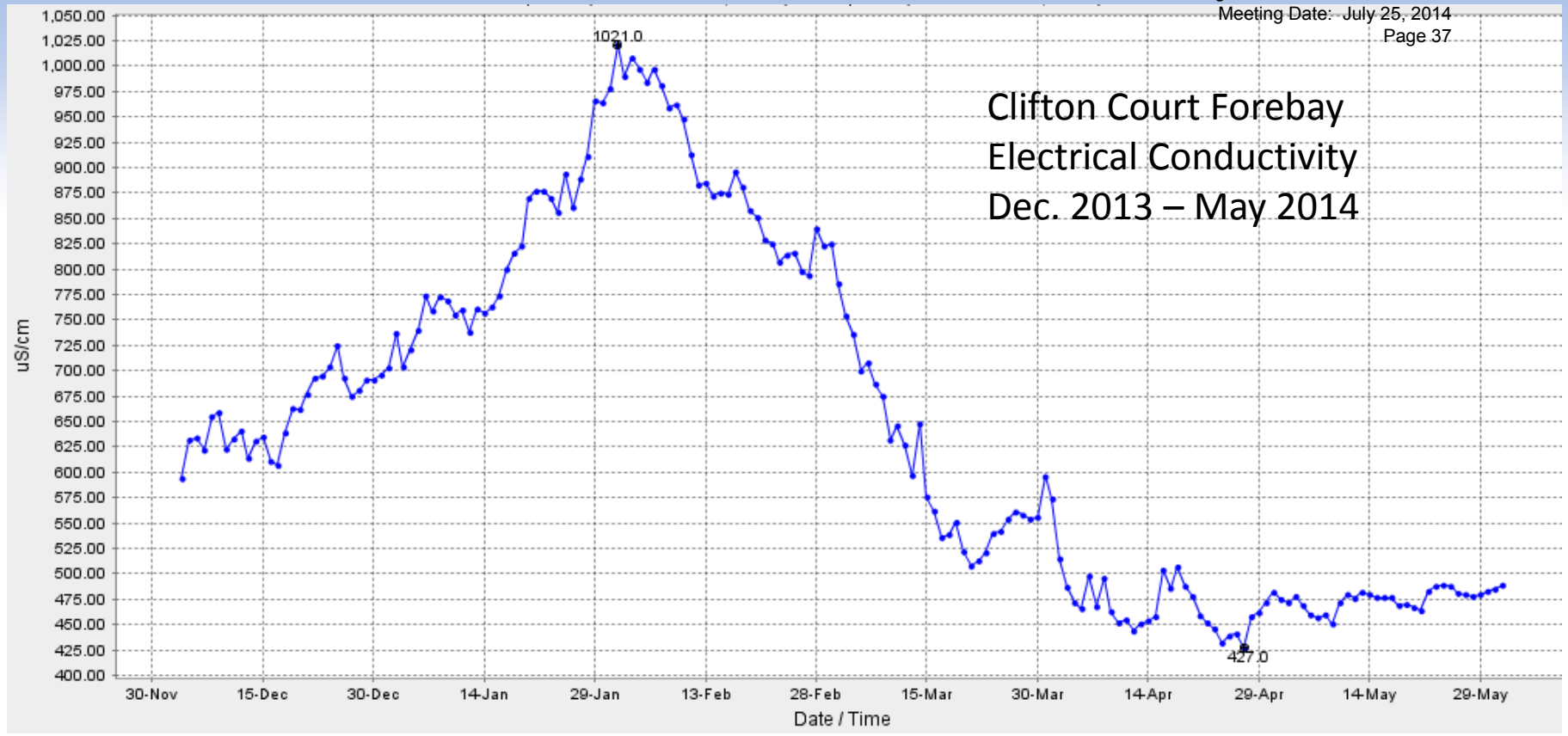


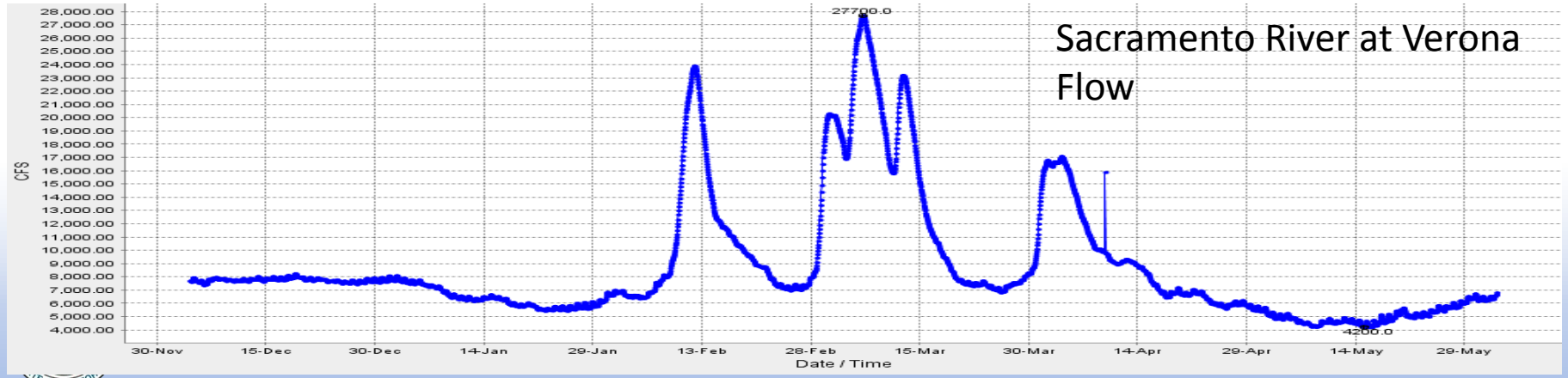
*WY 2014 Precipitation through 1/29/14 = 3.5" - half of WY total typically occurs by late January

Northern Sierra Water Year Precipitation Totals



*WY 2014 with forecasted precipitation through 6/1/14 = 28.8"


Clifton Court Forebay
Electrical Conductivity
Dec. 2013 – May 2014
uS/cm
1,050.00
1,025.00
1,000.00
975.00
950.00
925.00
900.00
875.00
850.00
825.00
800.00
775.00
750.00
725.00
700.00
675.00
650.00
625.00
600.00
575.00
550.00
525.00
500.00
475.00
450.00
425.00
400.00
1021.0
427.0
30-Nov
15-Dec
30-Dec
14-Jan
29-Jan
13-Feb
28-Feb
15-Mar
30-Mar
14-Apr
29-Apr
14-May
29-May
Date / Time


Sacramento River at Verona
Flow
CFS
28,000.00
27,000.00
26,000.00
25,000.00
24,000.00
23,000.00
22,000.00
21,000.00
20,000.00
19,000.00
18,000.00
17,000.00
16,000.00
15,000.00
14,000.00
13,000.00
12,000.00
11,000.00
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8,000.00
7,000.00
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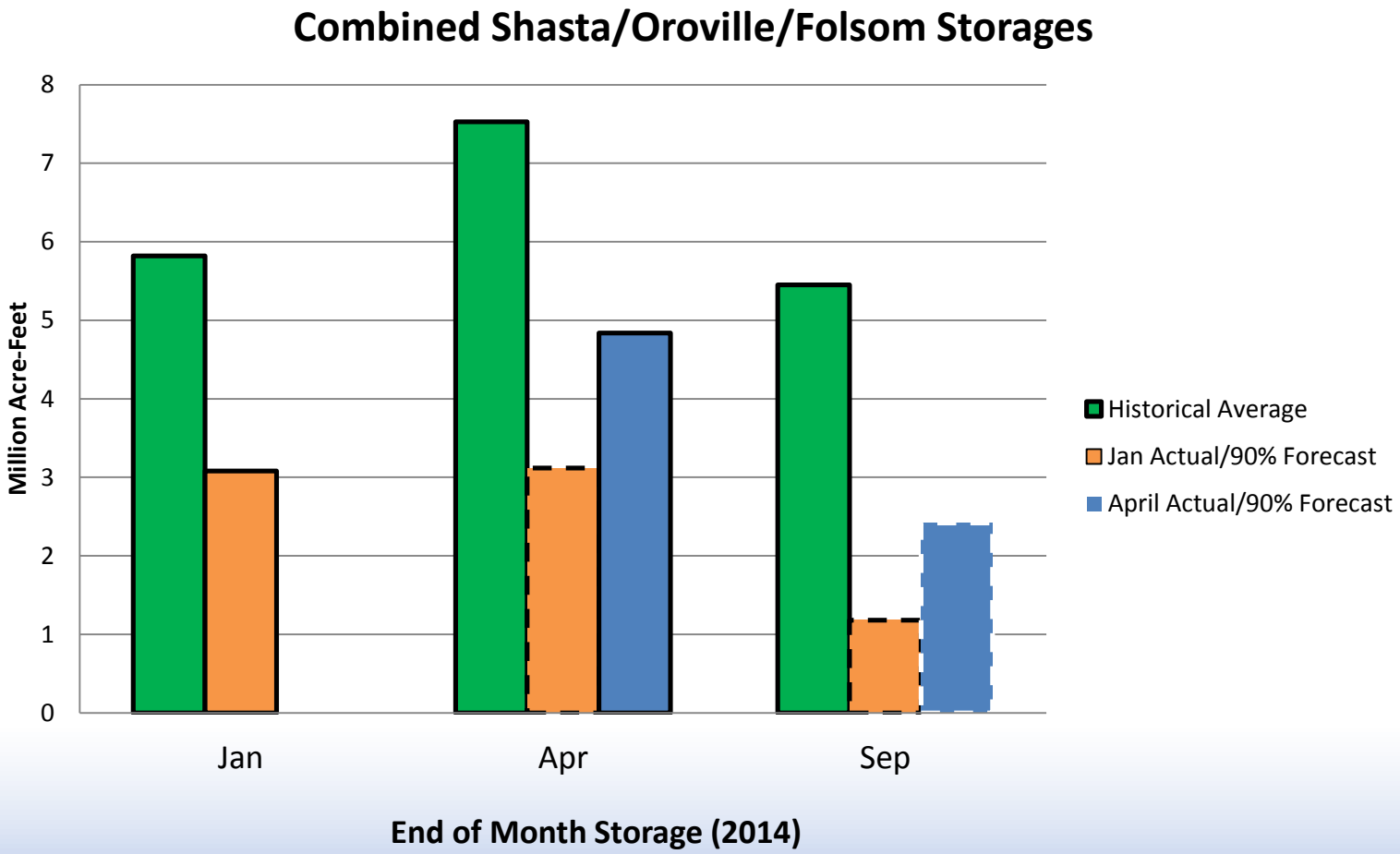
5,000.00
4,000.00
27700.0
4200.0
30-Nov
15-Dec
30-Dec
14-Jan
29-Jan
13-Feb
28-Feb
15-Mar
30-Mar
14-Apr
29-Apr
14-May
29-May
Date / Time

Improved Storage



Improved Conditions

- Some Increased Supply
- Scaled Back Requests for Modified Delta Standards
- Emergency Drought Barrier Installation on Hold

Possible Drought Actions for 2015

- Reduced Project Deliveries
- Modified Delta Flow/Salinity Standards
- State Water Board Curtailments
- Drought Barrier Installation