Seven Points from the 2014 Delta Drought Modeling

Bay-Delta Science Conference

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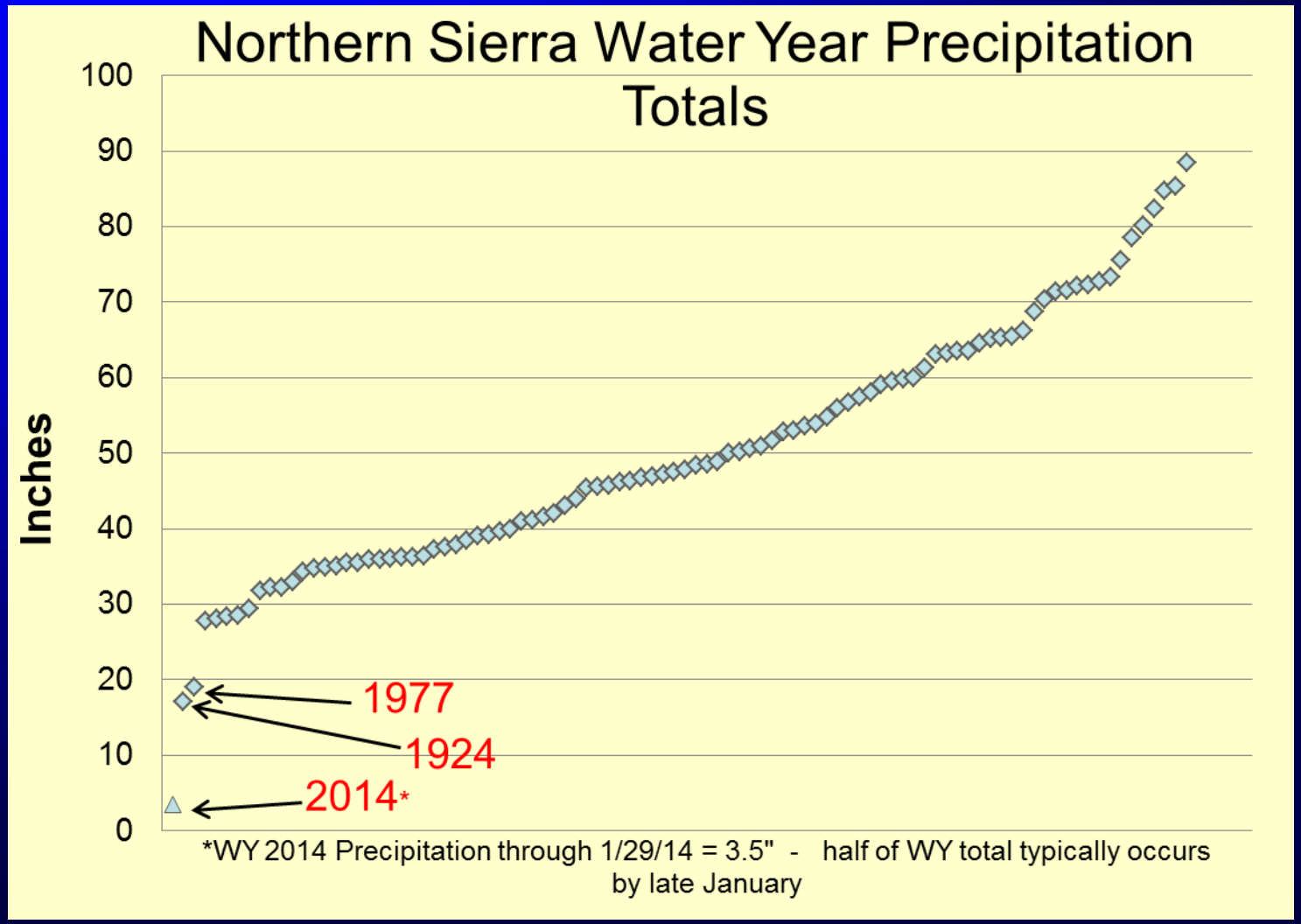
Acknowledgements

- Siqing Liu
- Eli Ateljevich
- Bryant Giorgi
- Francis Chung

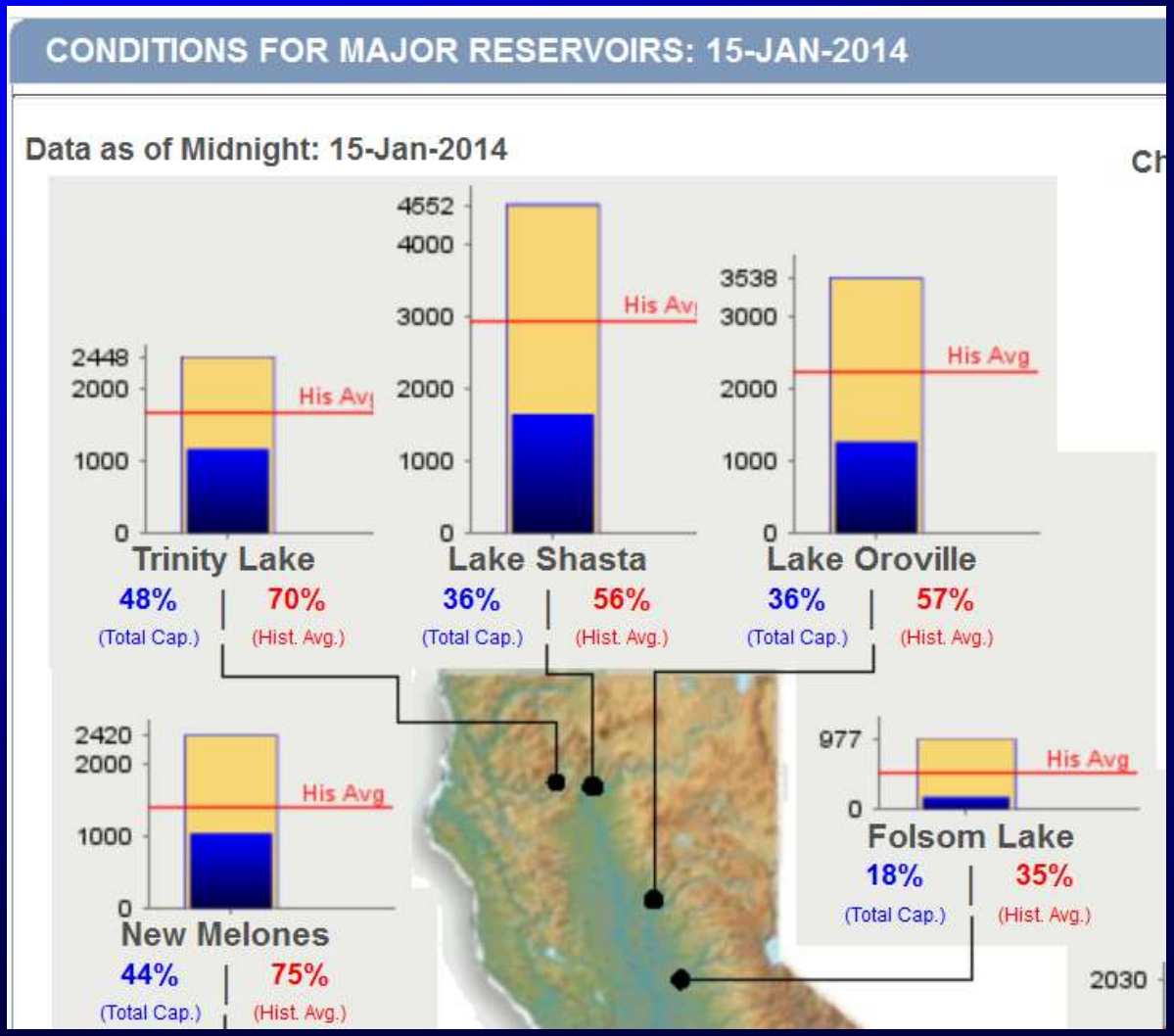
- Delta Modeling Section
- Operations and Maintenance OCO
- RMA

Background – Precipitation 2014



Courtesy of Tracy Hinojosa

Background – Major Reservoir Storage January 2014



http://cdec.water.ca.gov/cdecapp/resapp/getResGraphsMain.action

Background – Processes and Tools Used to Model Drought Conditions

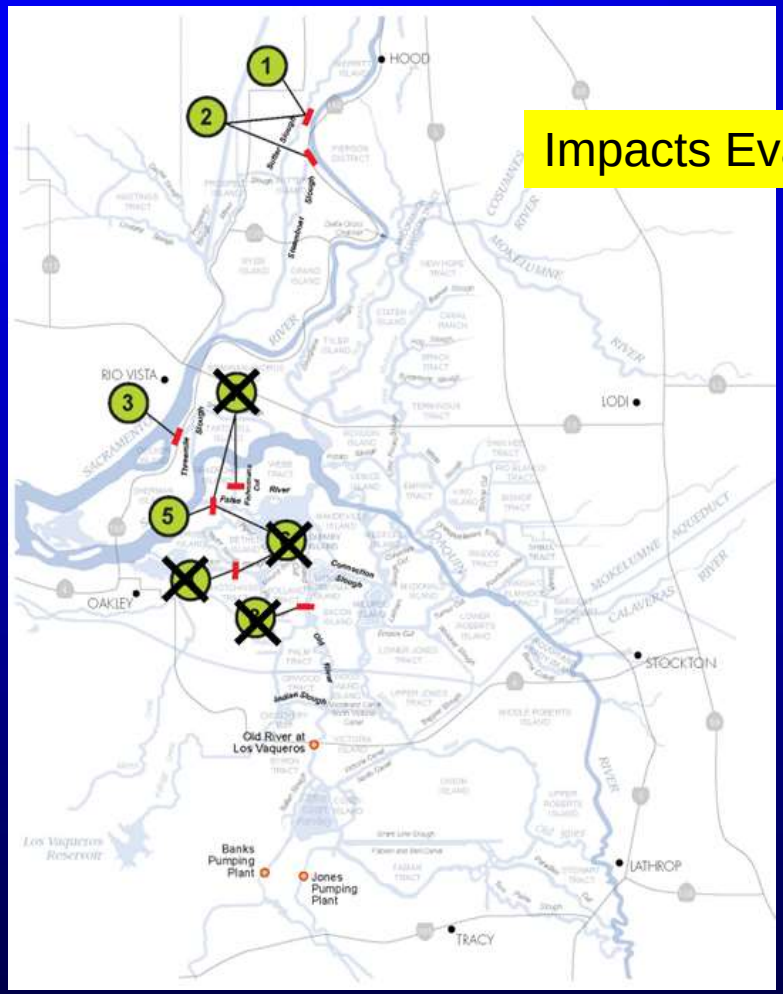
DSM2/SELFE Historical Simulation
- Historical Flows, Exports, etc..
- Is the baseline and starting point for Forecasts

DSM2/SELFE Forecast Simulation
- Receives initial conditions from historical Delta model simulation
- Receives boundary flow conditions from DCO
- Provides forecasted salinity, velocities and water levels in the Delta.

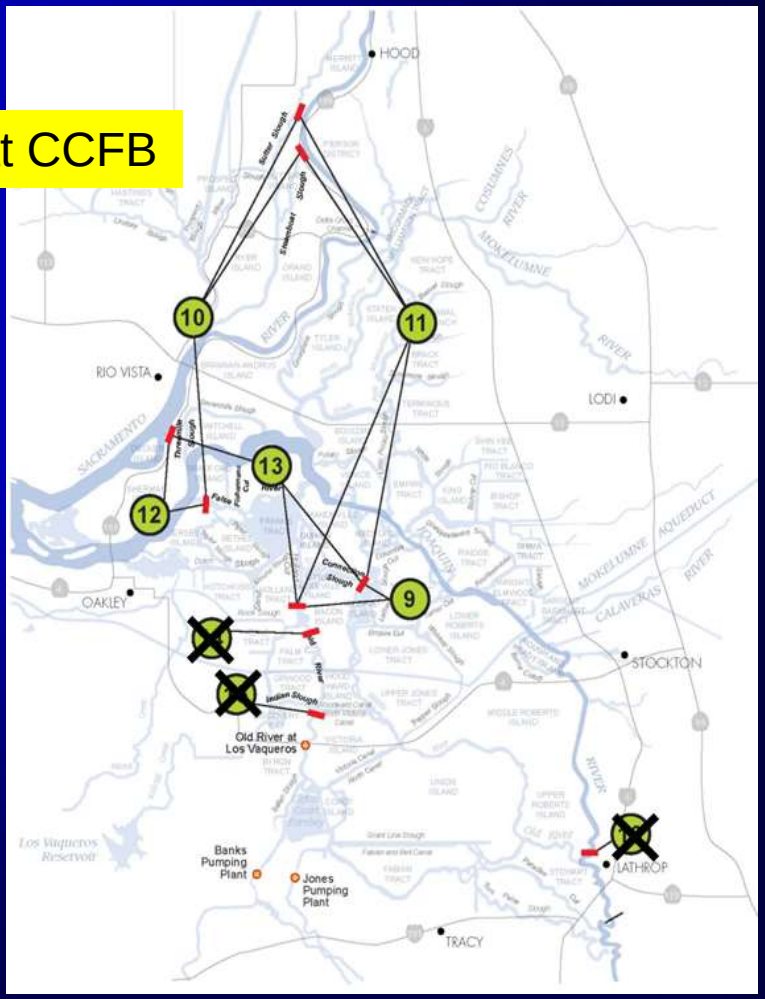
Delta Coordination Operations Model, DCO
(DWR Operations)
- Hydrology Data (DWR Flood Management)
- Contractor Delivery Requests (DWR State Water Project Analysis Office)
- Provides Forecasted Delta Inflows and Exports to Delta Model

Background – Select Delta Water Quality Locations

Utilize the Old Studies!

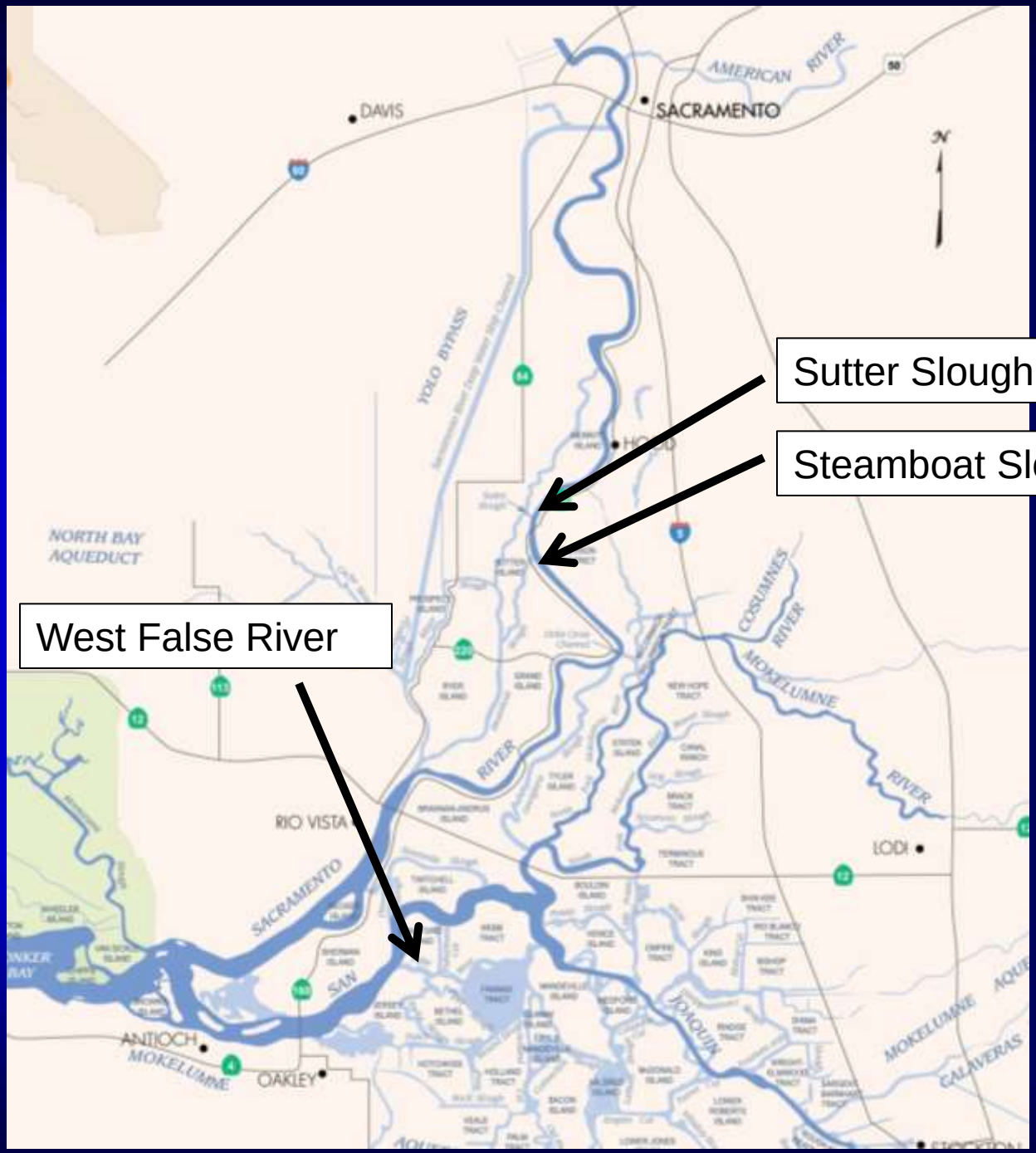


Impacts Evaluated at CCFB



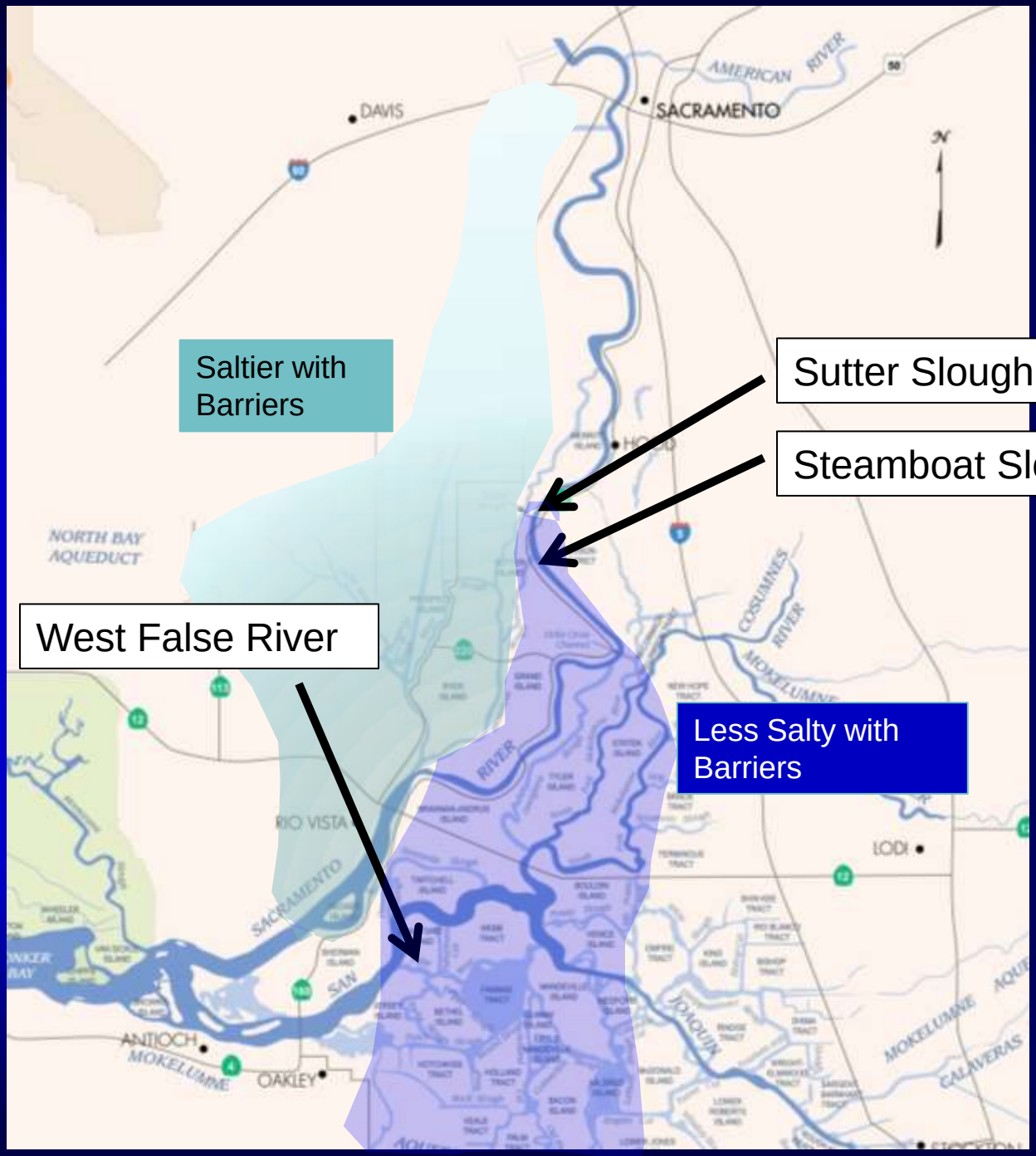
1

Proposed Emergency Barrier Locations

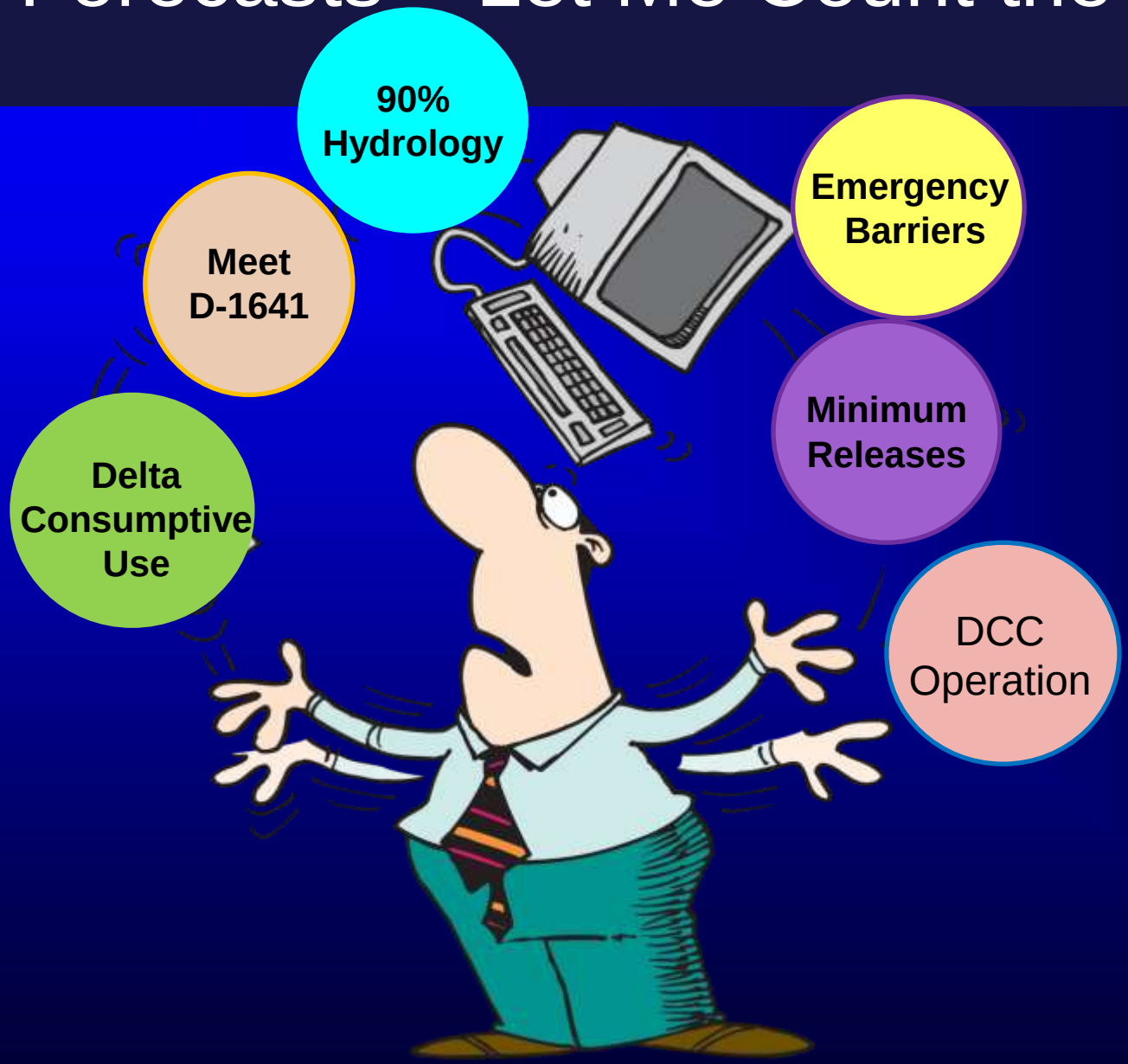


1

General Pattern of Salinity Impacts



2 Forecasts – Let Me Count the Ways



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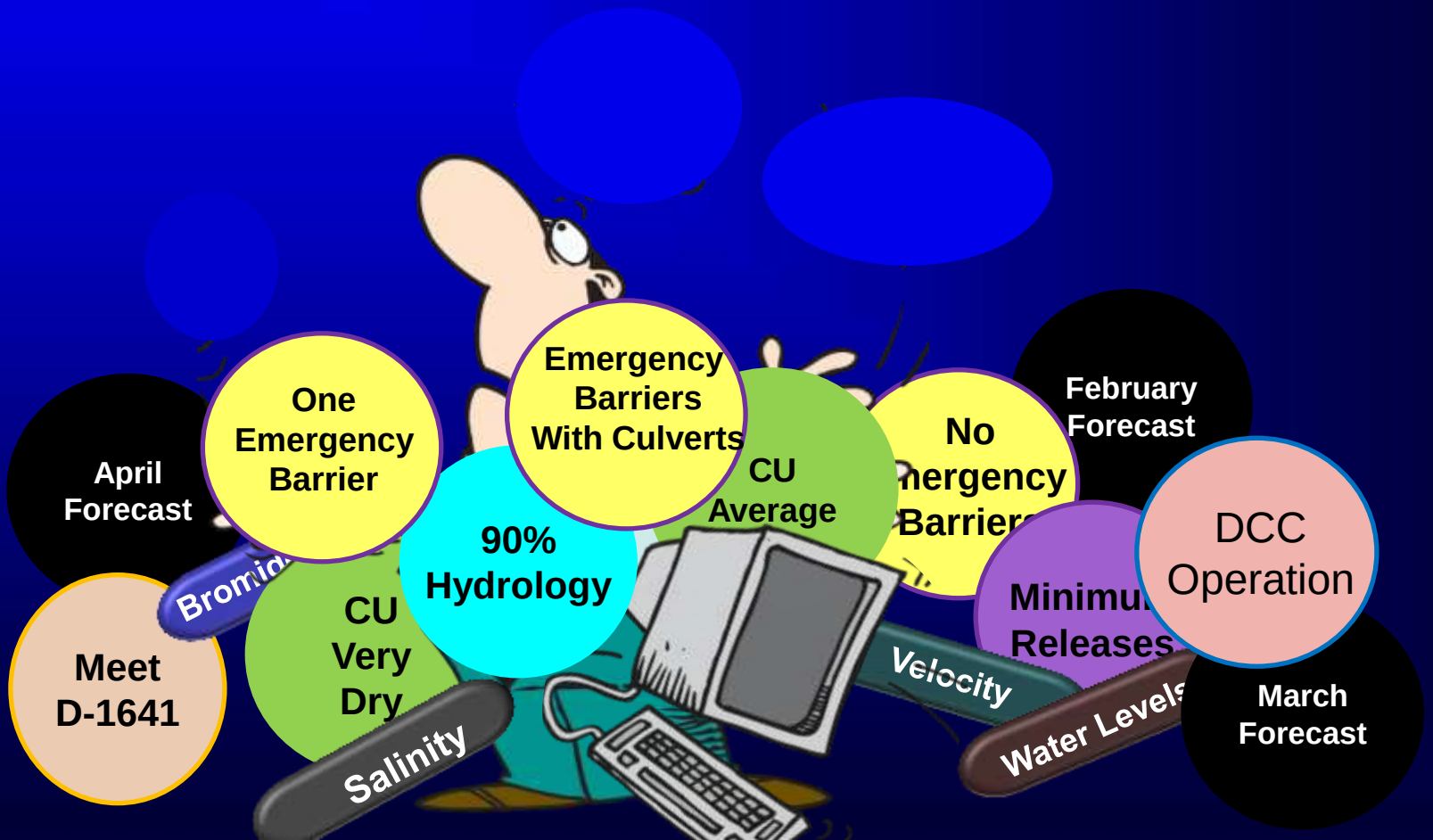
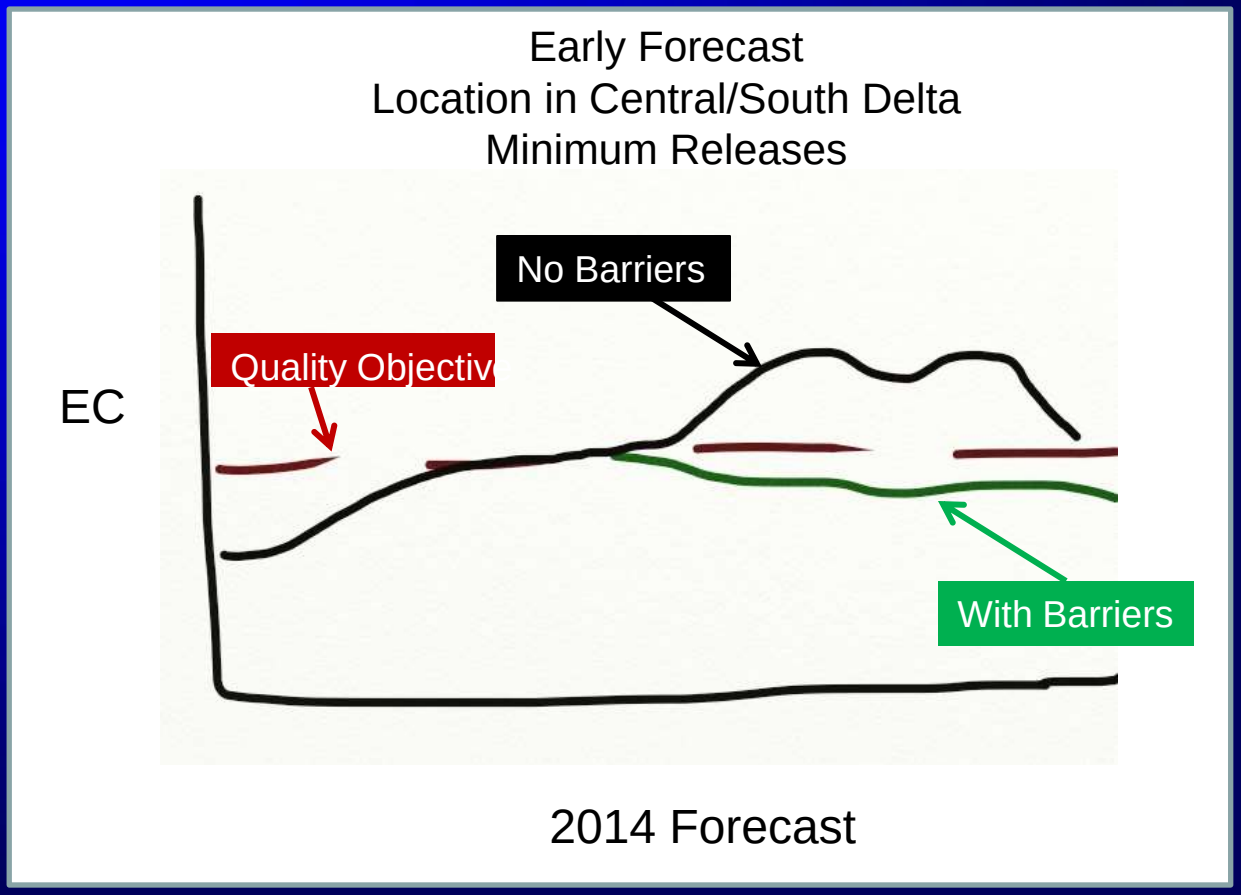


2 Forecasts – Let Me Count the Ways

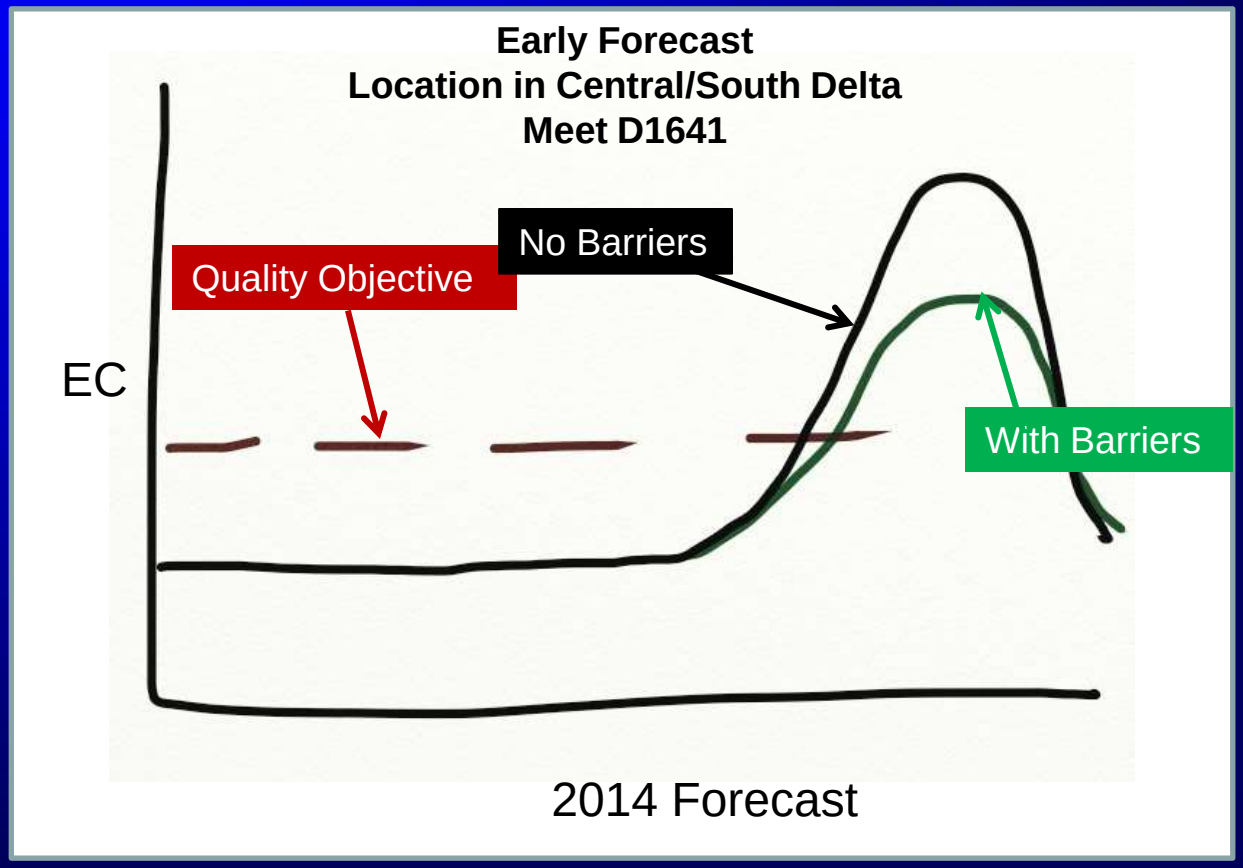
Minimum Releases



Minimum Releases – Release Storage over Time

2 Forecasts – Let Me Count the Ways

Meet D-1641

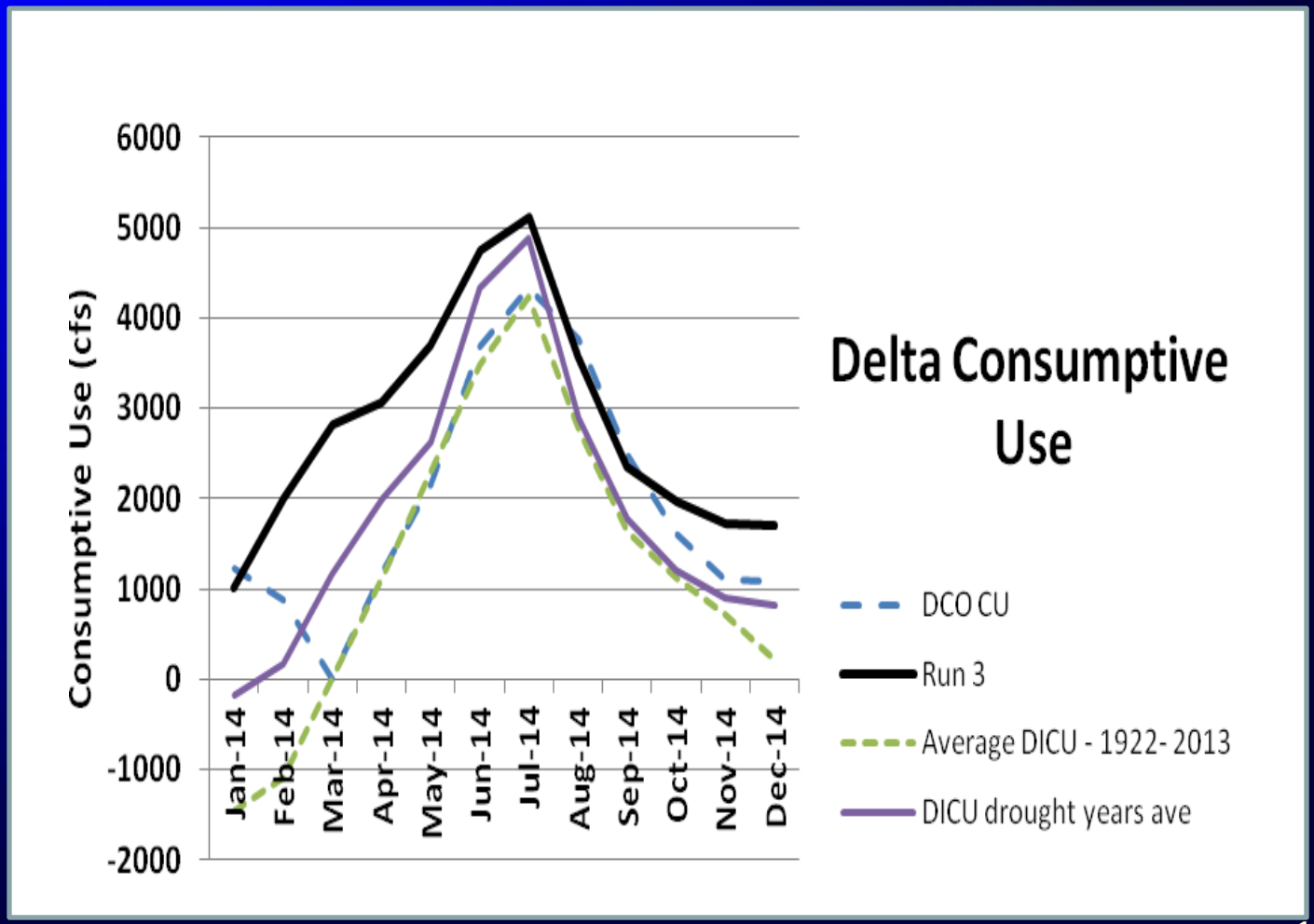


Meet WQ Objectives Until Run Out of Reservoir Storage

3 Will the Real Consumptive Use Please Stand Up

Delta Consumptive Use

- CU Has Large Impact in Drought
- Also Uncertainty



3 Will the Real Consumptive Use Please Stand Up

Simple Flow Balance Example

Inflows	- Exports	- In Delta Use	= Net Delta Outflow Index
8500	- 1500	- 4500	= 2500

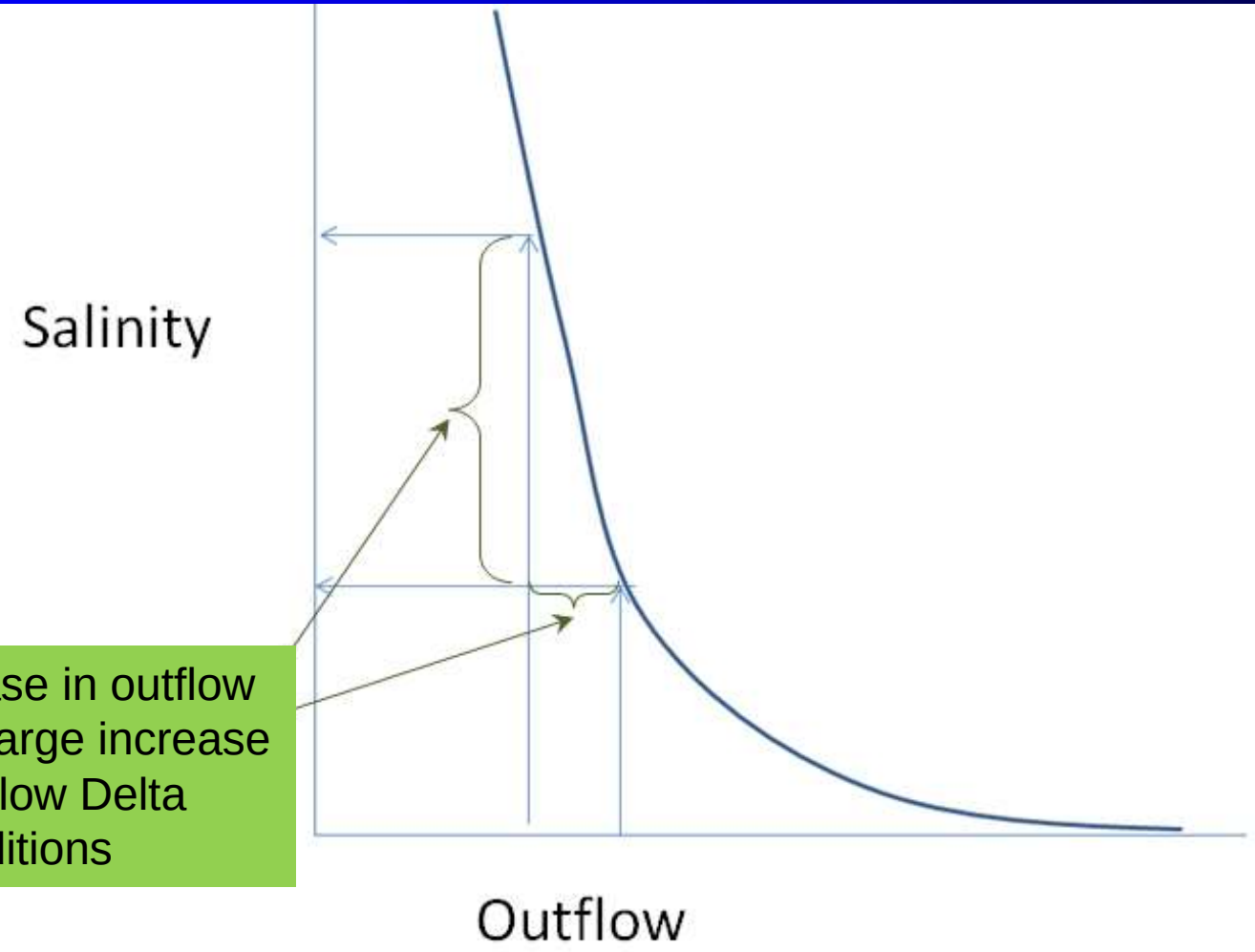
A Difference of 1000 cfs can have a huge impact on salinity intrusion

CU Matters!

4 Extreme Drought is a Stretch For Delta Models

Models Not Calibrated for Extreme Drought – Outside of Historical Record

4 Extreme Drought is a Stretch For Delta Models

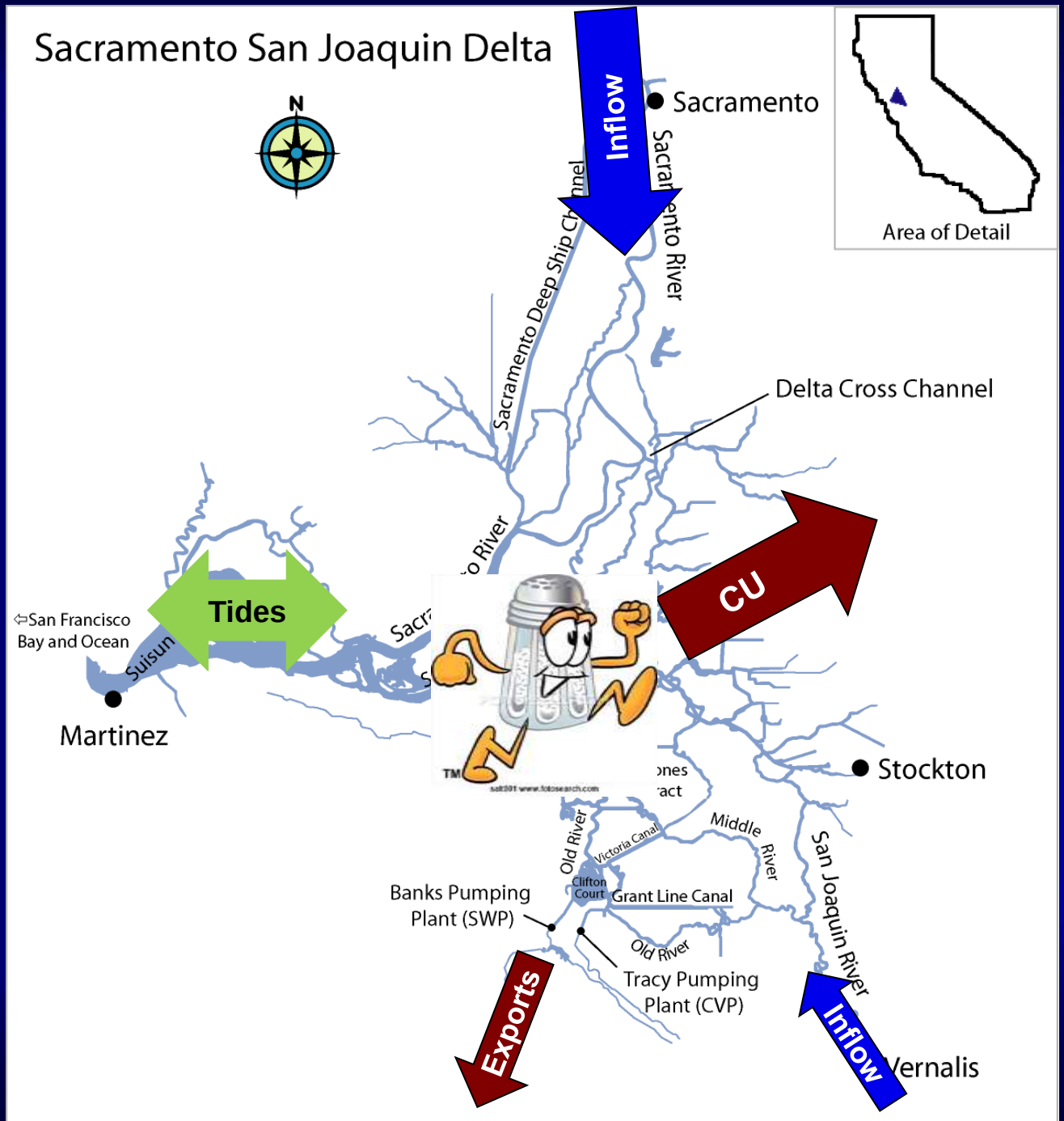


Small increase in outflow results in a large increase in salinity in low Delta outflow conditions

How Bad Can it Be?

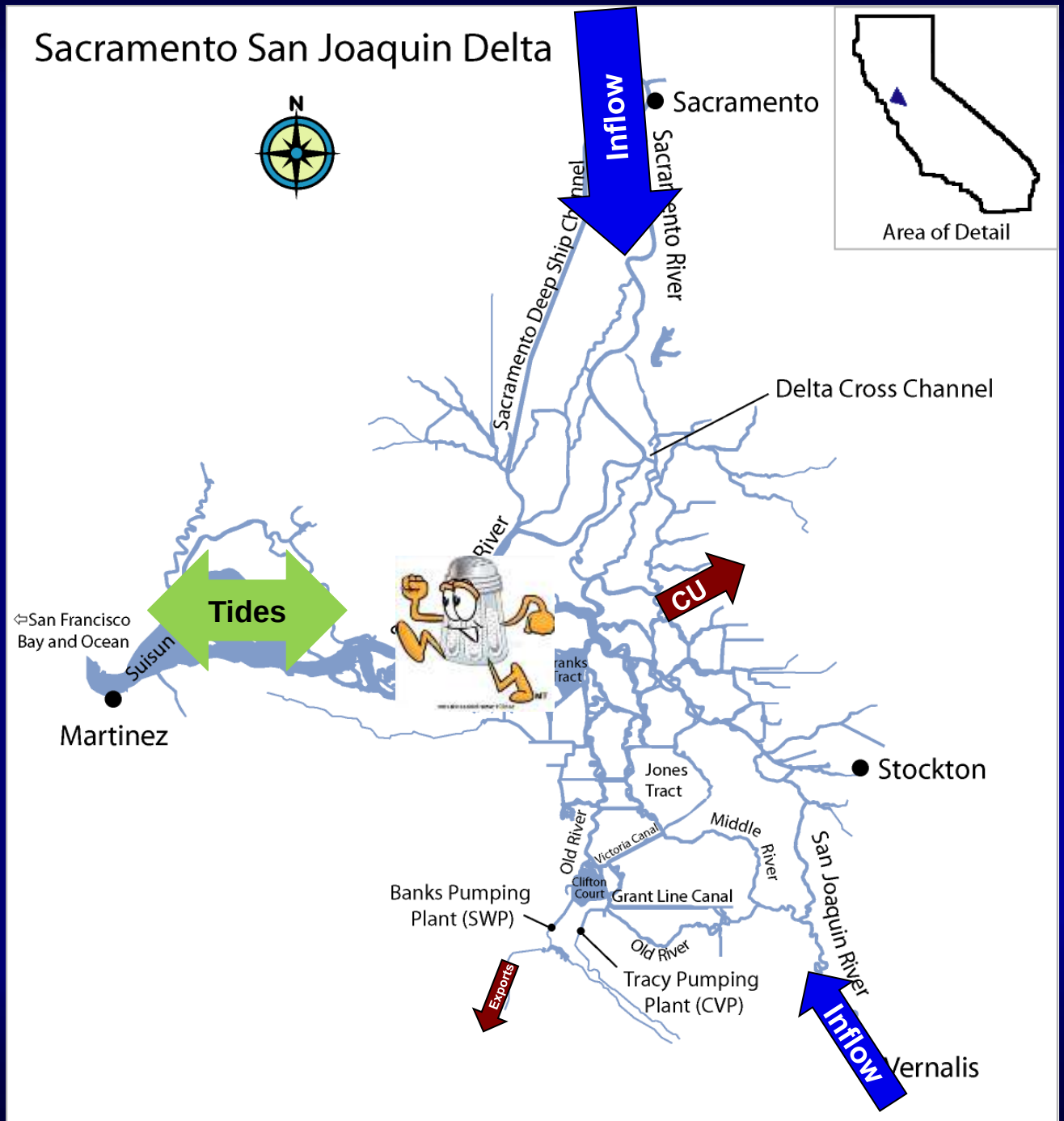
Will the Delta Reach Some Equilibrium Salinity?

5

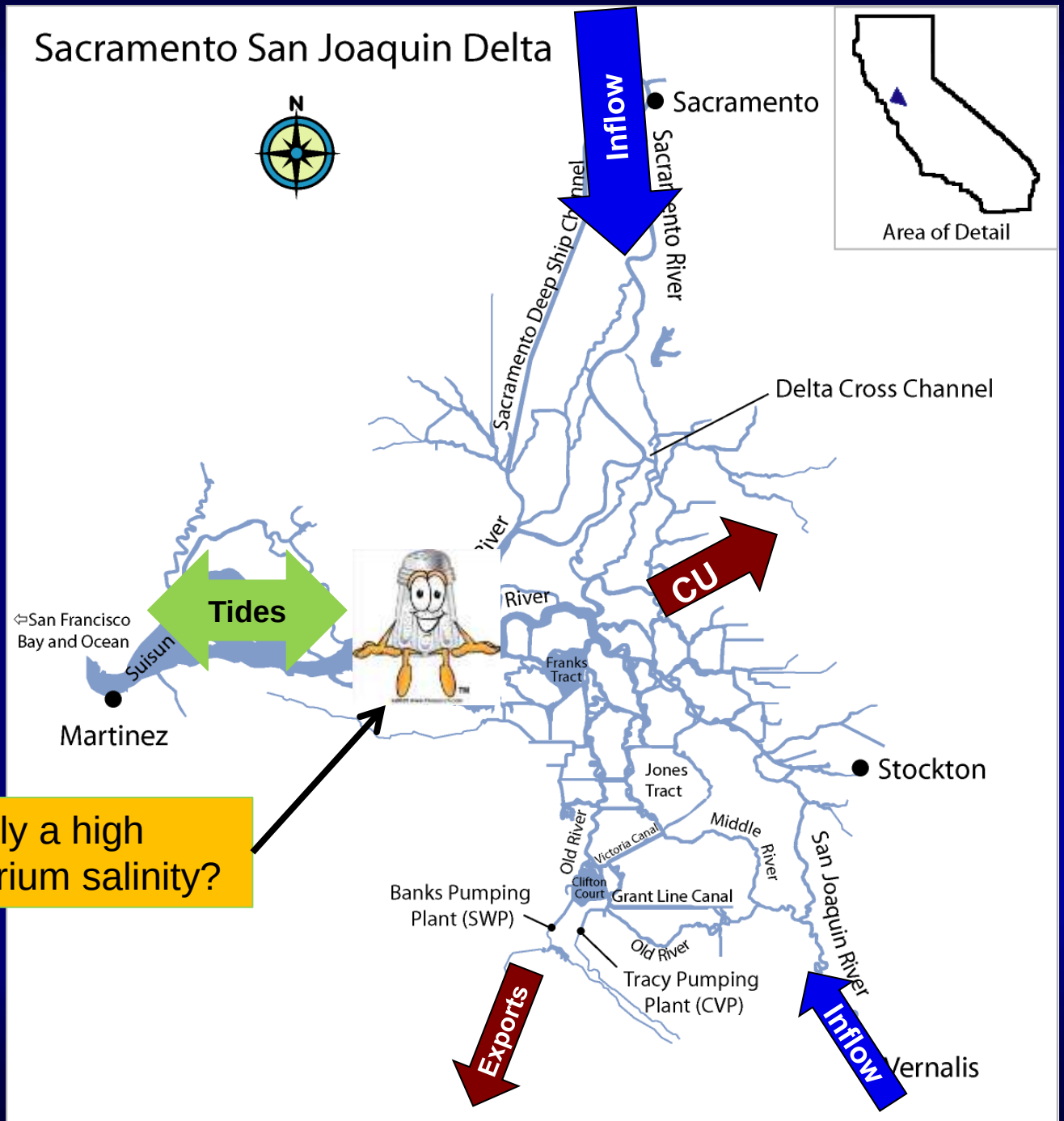


Courtesy of Jamie Anderson

5

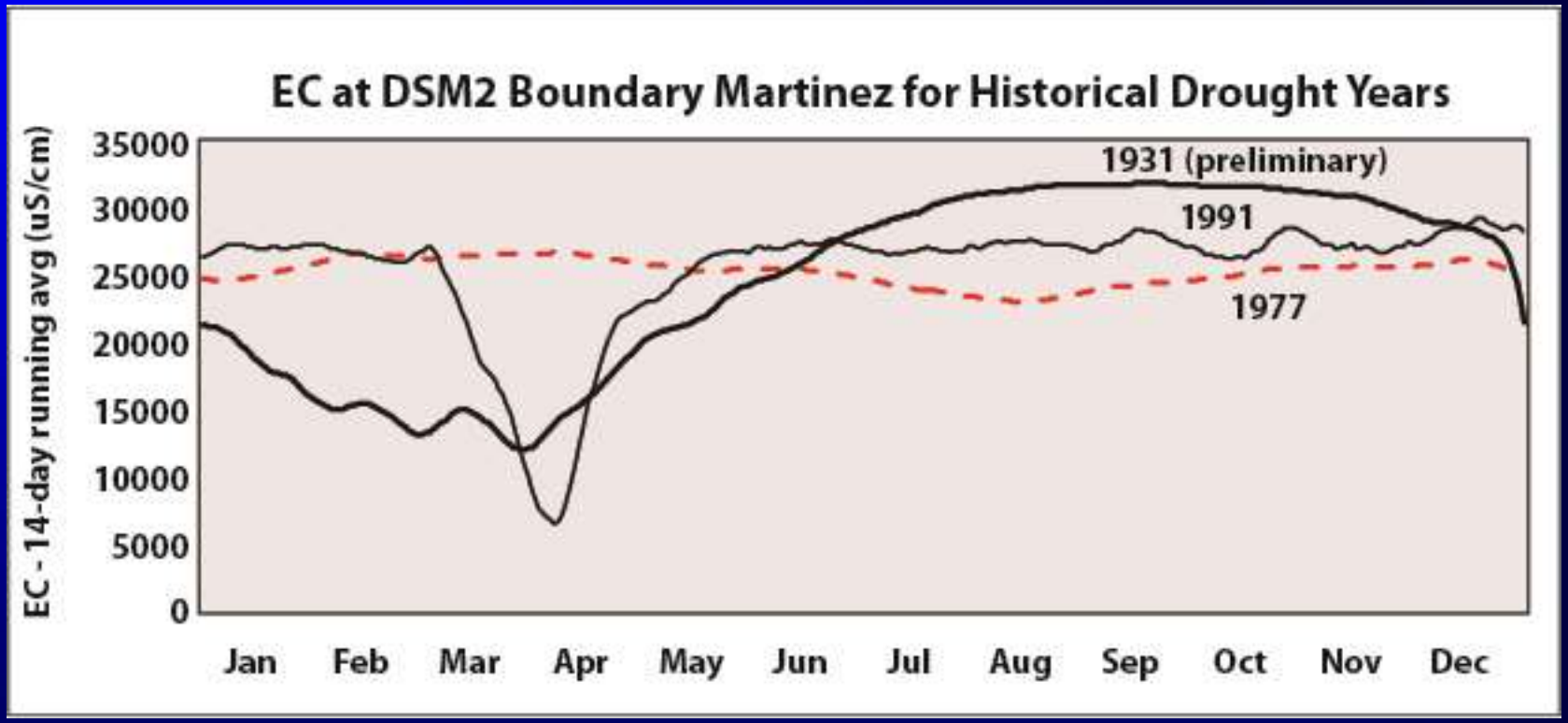

Sacramento San Joaquin Delta
N
Inflow
Sacramento
Sacramento River
Sacramento Deep Ship Channel
Area of Detail
Delta Cross Channel
CU
Tides
San Francisco Bay and Ocean
Suisun
Martinez
Stockton
Jones Tract
Old River
Victoria Canal
Middle River
San Joaquin River
Clifton Court
Grant Line Canal
Banks Pumping Plant (SWP)
Old River
Tracy Pumping Plant (CVP)
Exports
Inflow
Vernalis

5



Possibly a high equilibrium salinity?

How Bad Can it Be?

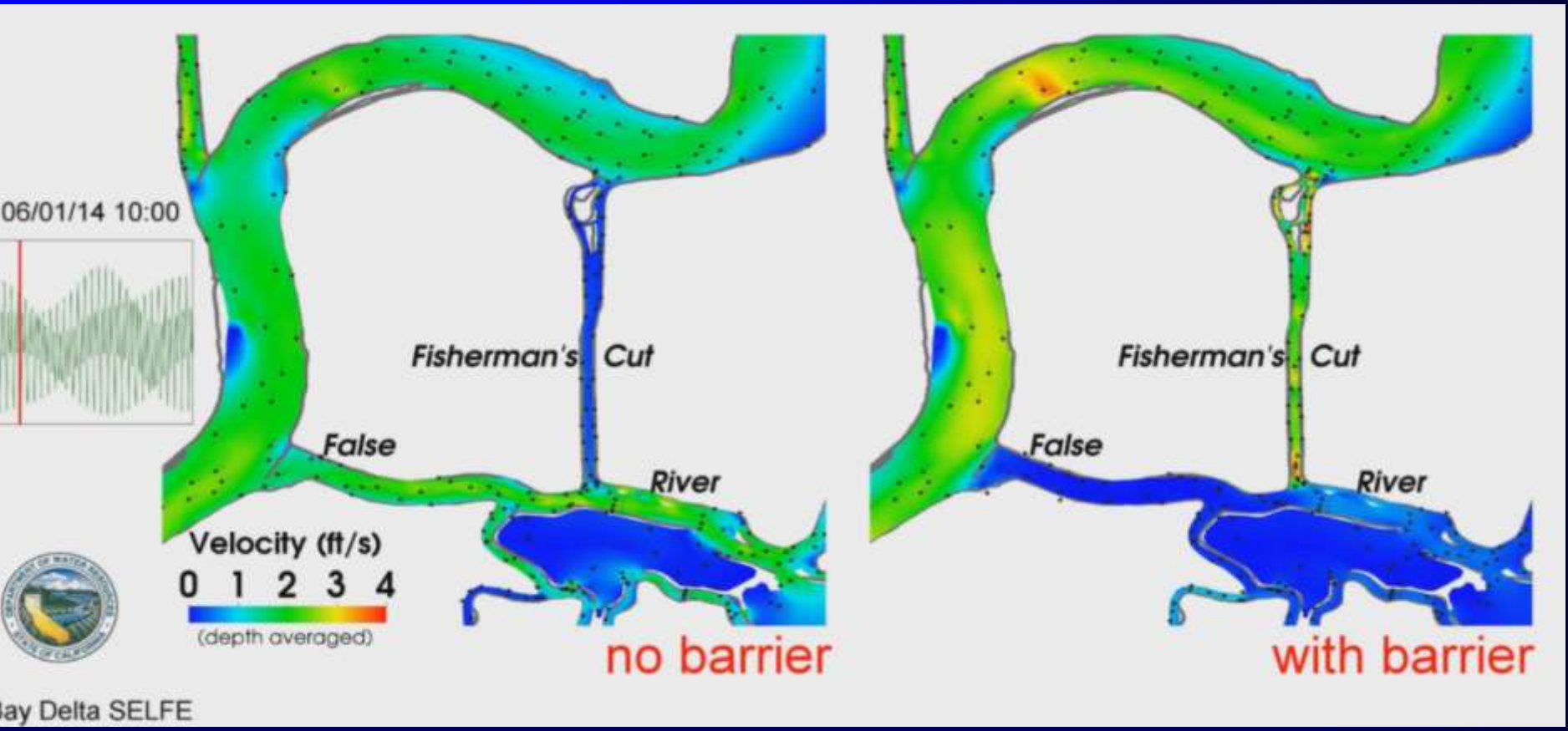


6 It’s Not Just Salinity

- Fish Spawning and Migration
- Water Levels Near Barrier Sites
- Bromide and Organic Carbon
- Velocities

Lots of Model Output to Analyze

6 It's Not Just Salinity



7 Quality Versus Quantity

Changing Goals as Precipitation Occurred

- "Good to the Last Drop"

Using the Barriers, Can we Meet Most of the D1641 Water Quality Objectives Through the Summer?

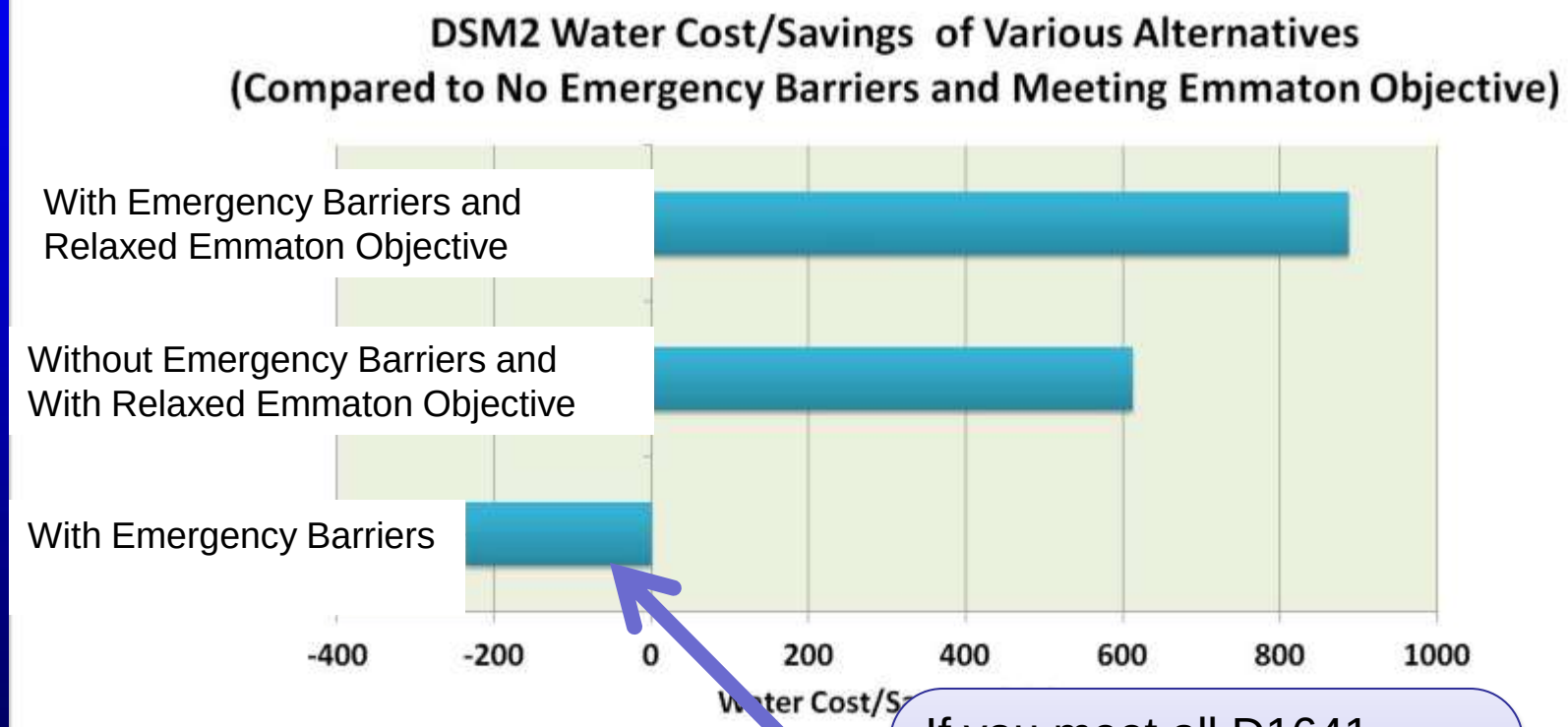
- "We Just Want to Pump You Up??"

Using the Barriers, How Much Water Can We Save for Later Uses?

Quality Versus Quantity

How much water do the Barriers Save?

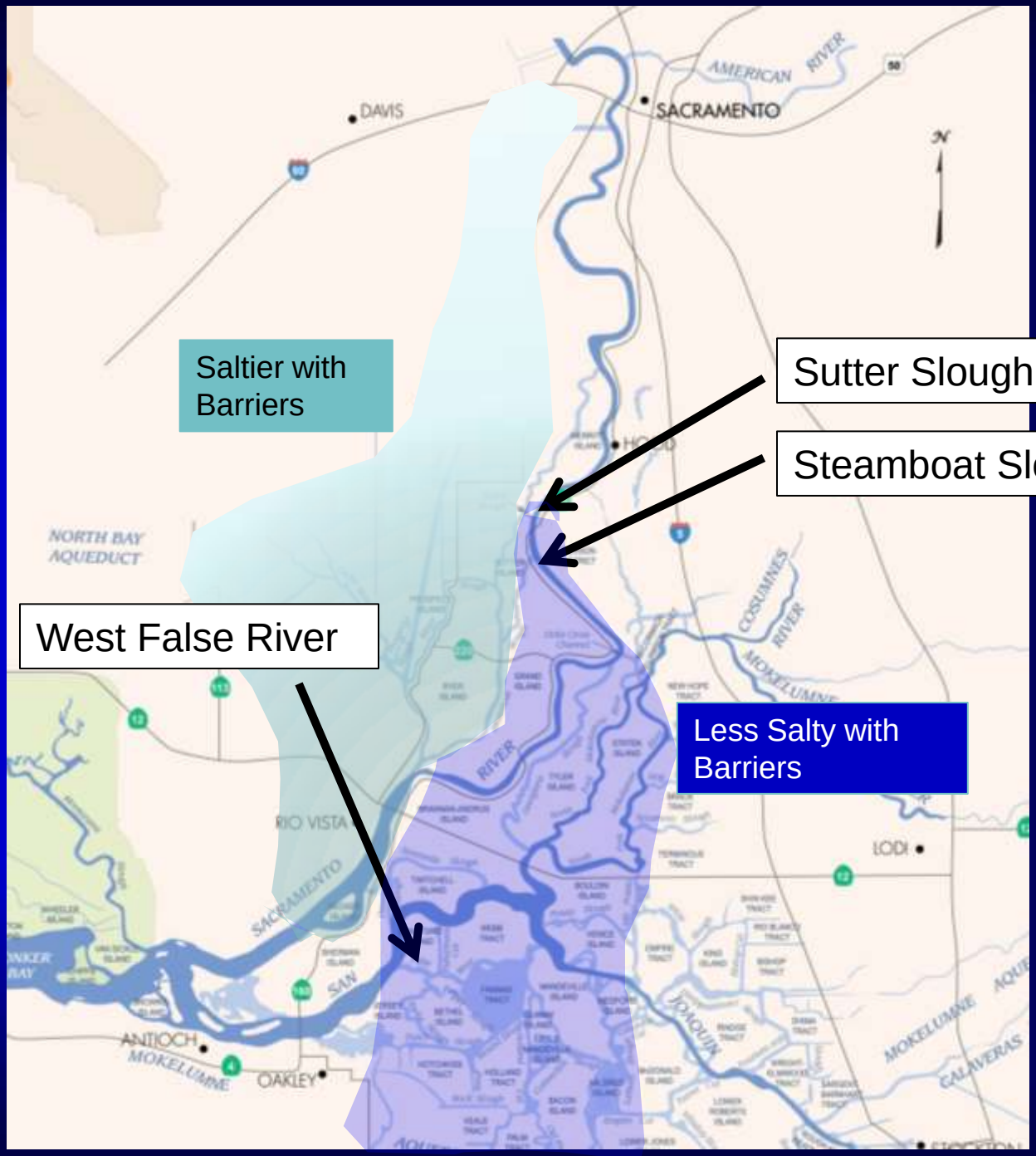
Quality Versus Quantity



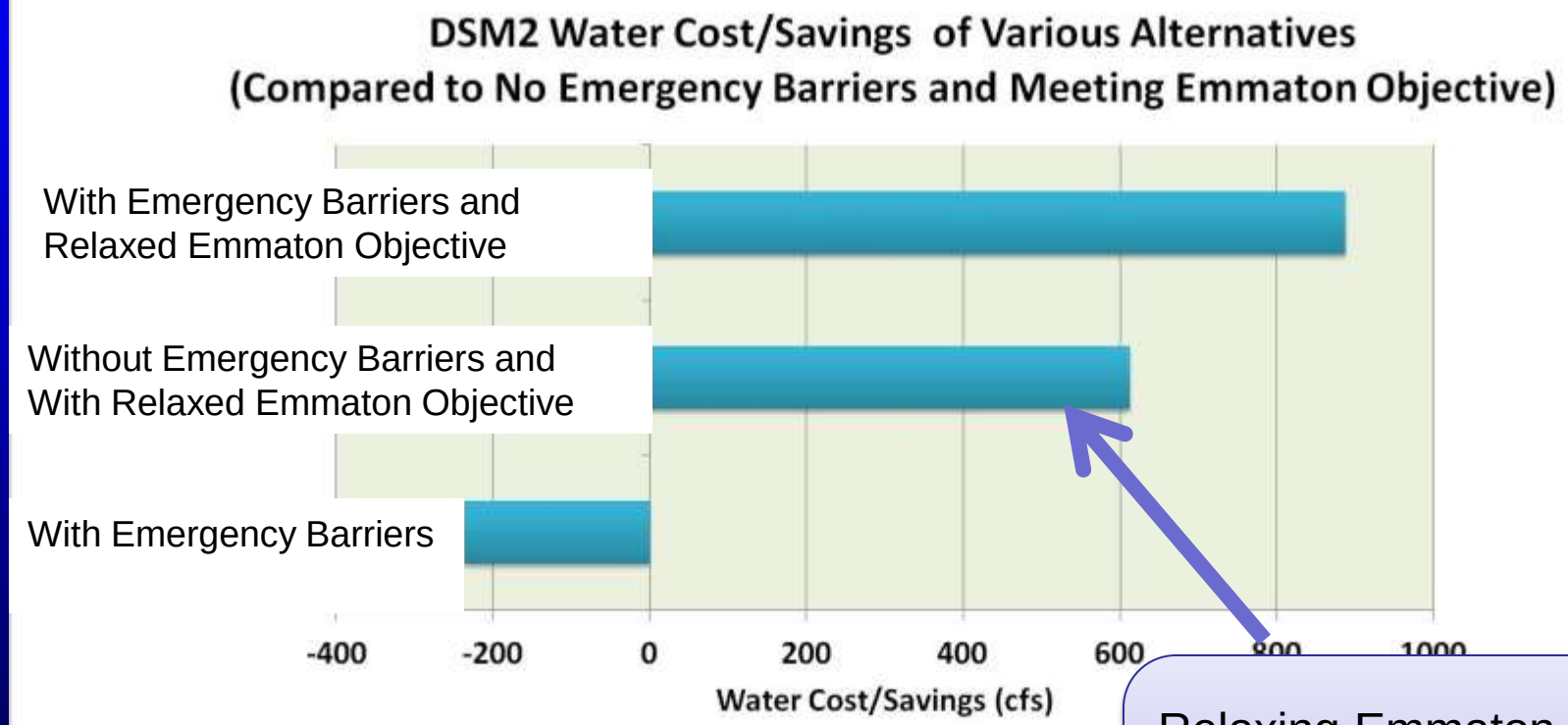
If you meet all D1641 objectives – Including Emmaton – There is a water cost with the barriers

7

General Pattern of Salinity Impacts

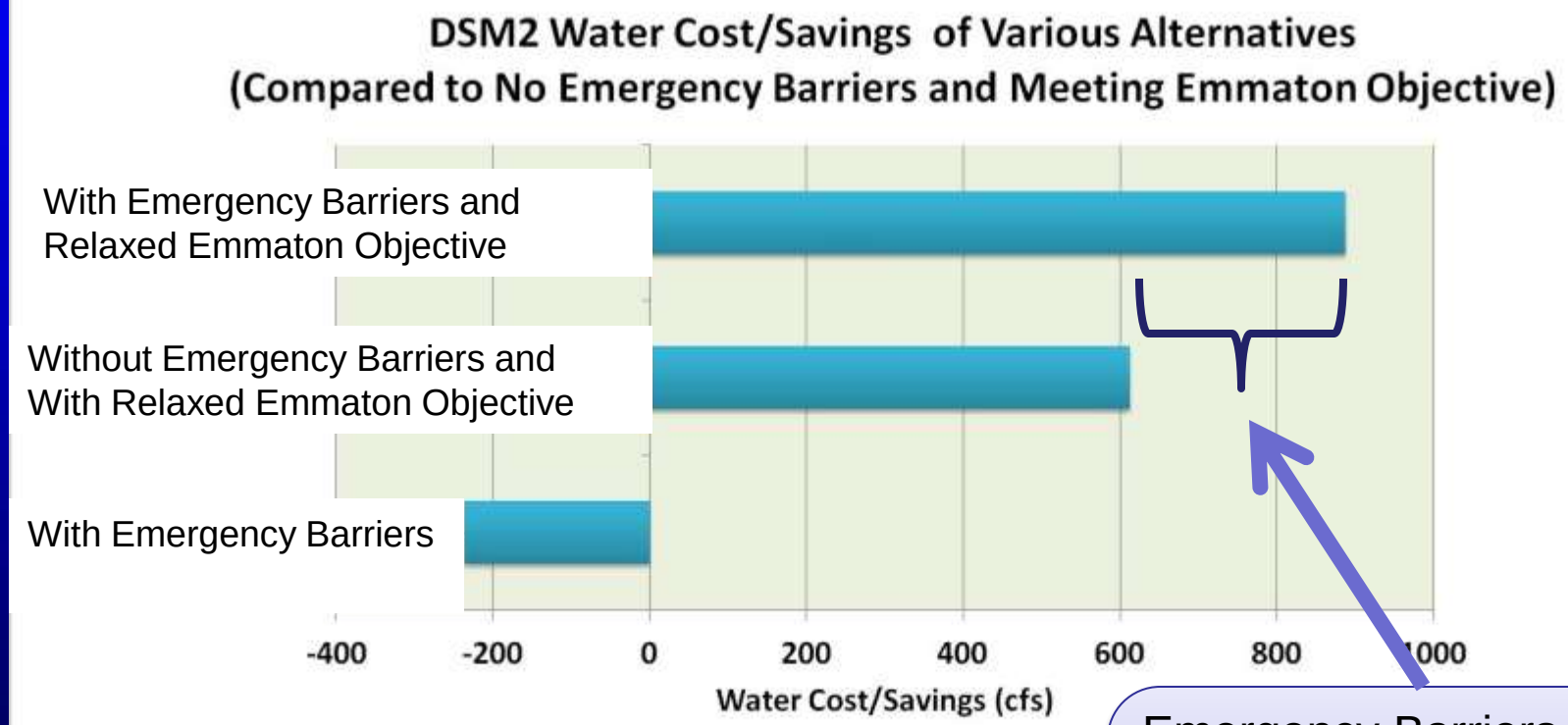


Quality Versus Quantity



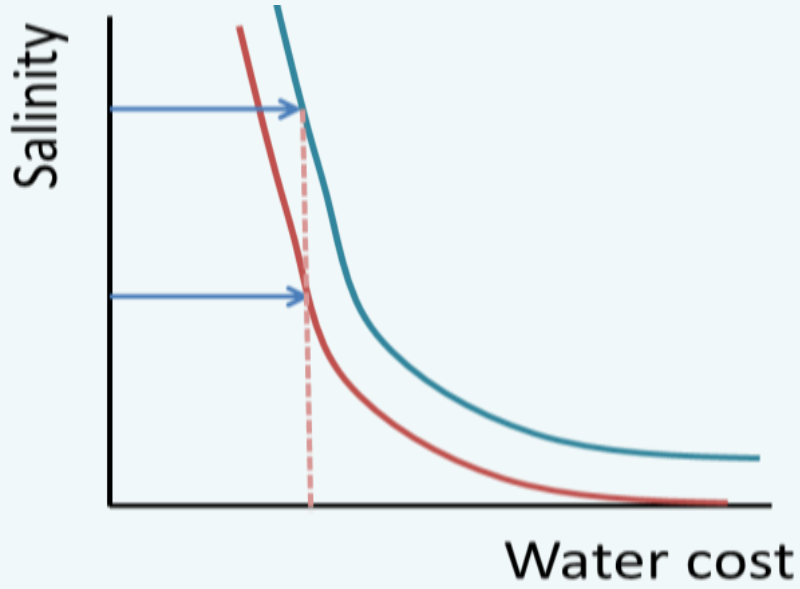
Relaxing Emmaton Objective Results in a Positive Water Savings

Quality Versus Quantity

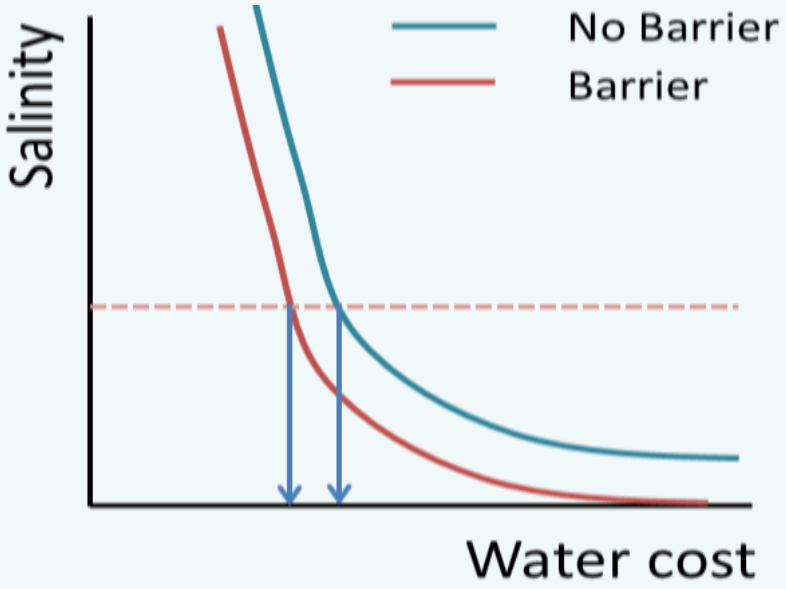


Emergency Barriers add approximately 270 cfs with a Relaxed Emmaton Objective.

Quality Versus Quantity



Large salinity change for fixed flow pattern



Small water cost savings for fixed salinity constraint

Water Cost Savings and Salinity Relationship – courtesy of Eli Ateljevich

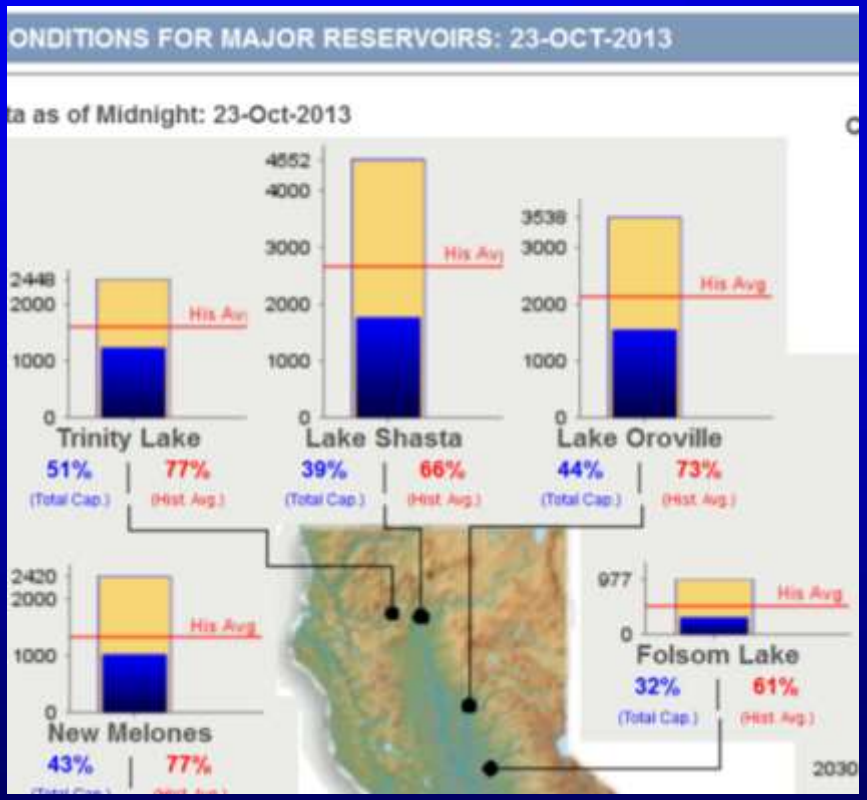
Current Modeling Related to Drought

- Forecasts
- Modeling for Negative Declaration
- Working with RMA on Model Differences
- Evaluating Historical Dry Years – 1920s onward
- Attempting to Determine Net Delta Outflow from Observed Data using Tidal Analysis/Statistical Tools

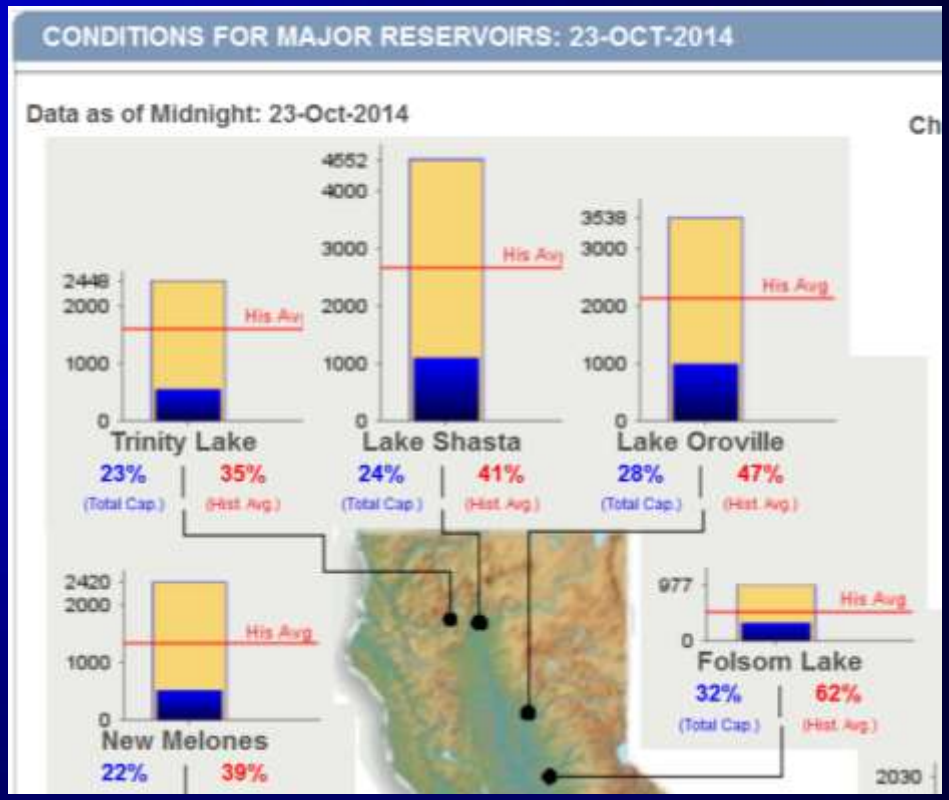
Current Modeling Related to Drought (cont)

- Improving DSM2 Model Boundary Extension
- Recalibrating G-Model (Martinez Boundary Condition for DSM2)
- Evaluating Historical Consumptive Use Data including Well Usage
- Reviewing How Well DSM2 Modeled 2014

Will Next Year Be Another Dry Year?



October 2013



October 2014

http://cdec.water.ca.gov/cdecapp/resapp/getResGraphsMain.action

Thanks!

Tara@water.ca.gov

http://baydeltaoffice.water.ca.gov/modeling/

Further Acknowledgements

Work/Task	Name(s)	DWR Office/Division
Delta Coordinated Operations (DCO) Modeling	Amritpal Sandhu, Tracy Pettit	Operations and Maintenance
Modeling for 2009 Emergency Barriers Report	Subir Saha	Bay-Delta Office
DSM2 Forecasts – DCO Minimum Releases, Early February Forecast	Bryant Giorgi, James Edwards, Dan Yamanaka, Tracy Hinojosa	Operations and Maintenance
DSM2 Forecasts – DCO Minimum Releases, Early February Forecast With and Without Barriers	Siqing Liu	Bay-Delta Office
Delta Island Consumptive Use	Lan Liang, Bob Suits	Bay-Delta Office
Flow balance on South Delta Area	Aaron Miller, Ming-Yen Tu	Operations and Maintenance, Bay Delta Office
Net Delta Outflow Analysis using USGS Flow Stations	Rueen-Fang Wang, Eli Ateljevich	Bay-Delta Office
DSM2 Forecasts – DCO Minimum Releases, February 20 Forecast With and Without Barriers	Siqing Liu	Bay-Delta Office
DSM2 Forecasts – DCO Meet Delta Water Quality Objectives Until Storage Water is Unavailable, February 20 Forecast	Bryant Giorgi	Operations and Maintenance
DSM2 Quality Assurance/Quality Control and Analysis of RMA, DSM2 and SELFE Result Differences	Nicky Sandhu, Bob Suits, Eli Ateljevich	Bay-Delta Office
Historical Data Analysis	Bob Suits, Joey Zhou	Bay-Delta Office
DSM2 Forecast, March 21 Forecast With and Without Barriers	Siqing Liu	Bay-Delta Office

Further Acknowledgements (cont)

Work/Task	Name(s)	DWR Office/Division
SELFE Simulation using March 21st Forecast	Eli Ateljevich, Kijin Nam, Rueen-Fang Wang, Inez Ferreira, Jon Shu	Bay-Delta Office
SELFE Animations	Jon Shu	Bay-Delta Office
Full Delta Graphics Tool Modification	Subir Saha	Bay-Delta Office
Specific Location Graphics Tools	Ming-Yen Tu	Bay-Delta Office
Presentation Graphics	Jamie Anderson	Bay-Delta Office
Water Cost Savings Analysis	Eli Ateljevich	Bay-Delta Office
RMA Bay-Delta Forecasts	John DeGeorge, Richard Rachiele, Stacie Grinbergs	Resource Management Associates, Inc

Extra Slides

Quality Versus Quantity

Net Delta Outflow Needed to Meet D-1641 Objectives for Various Alternatives

Objective	Without Emergency Barriers	Emergency Barriers	NDO Difference(positive indicates water savings with barriers)
Emmaton	3657 cfs	3893 cfs	-236 cfs
Relaxed	3045 cfs	2769 cfs	
NDO Difference (positive indicates water savings with relaxed objectives)	612 cfs	1124 cfs	

If you meet all D1641 Objectives – Including Emmaton – There is a water cost with the barriers