Top ~~Ten~~ Seven Insights from the 2014 Delta Drought Modeling

Municipal Water Quality Investigations Annual Meeting
July 30, 2014

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Chief , Delta Modeling Section

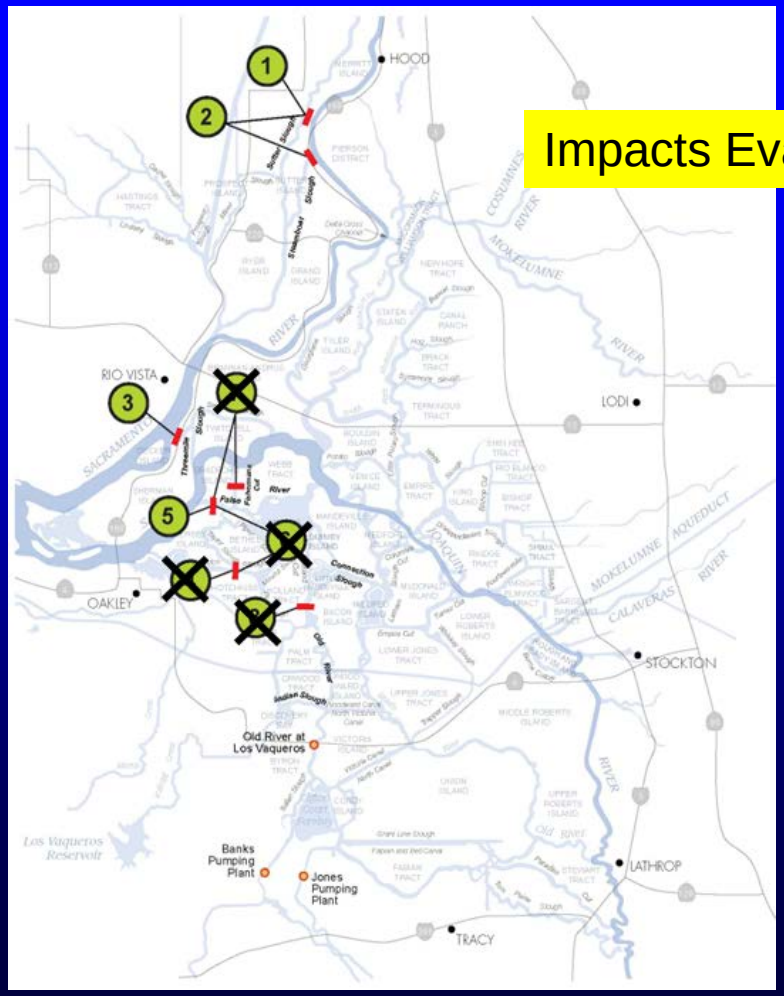
Acknowledgements

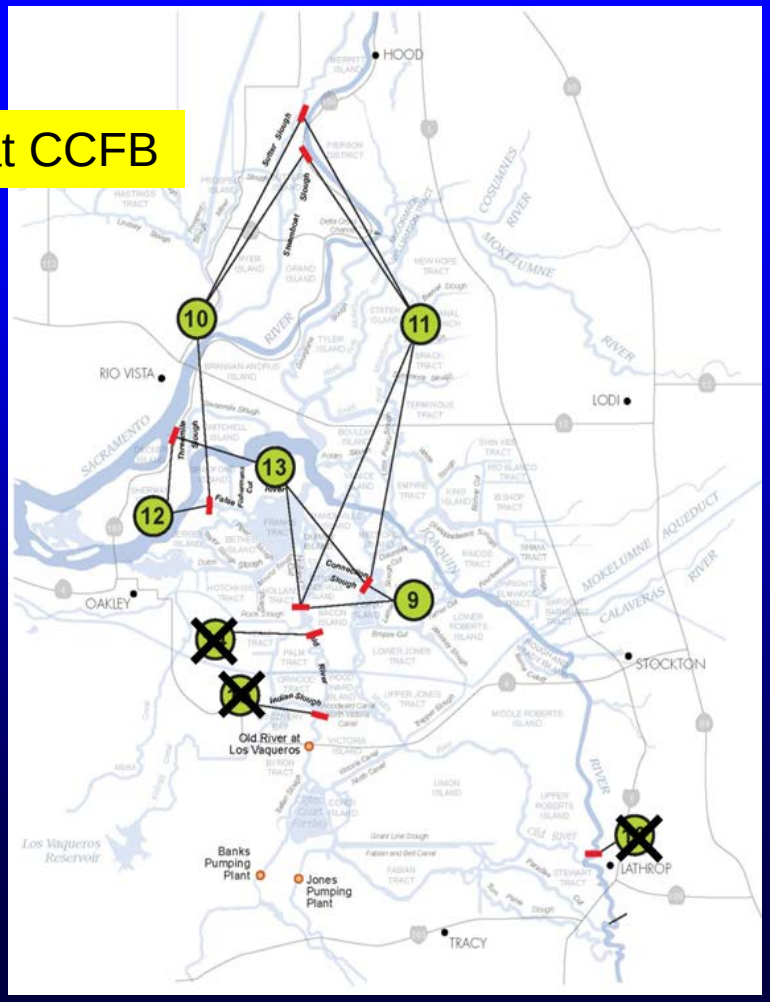
- Siqing Liu
- Eli Atejevich
- Bryant Giorgi

- Delta Modeling Section
- Operations and Maintenance OCO
- RMA

1 Don’t Throw Away the Old Studies!

Impacts Evaluated at CCFB





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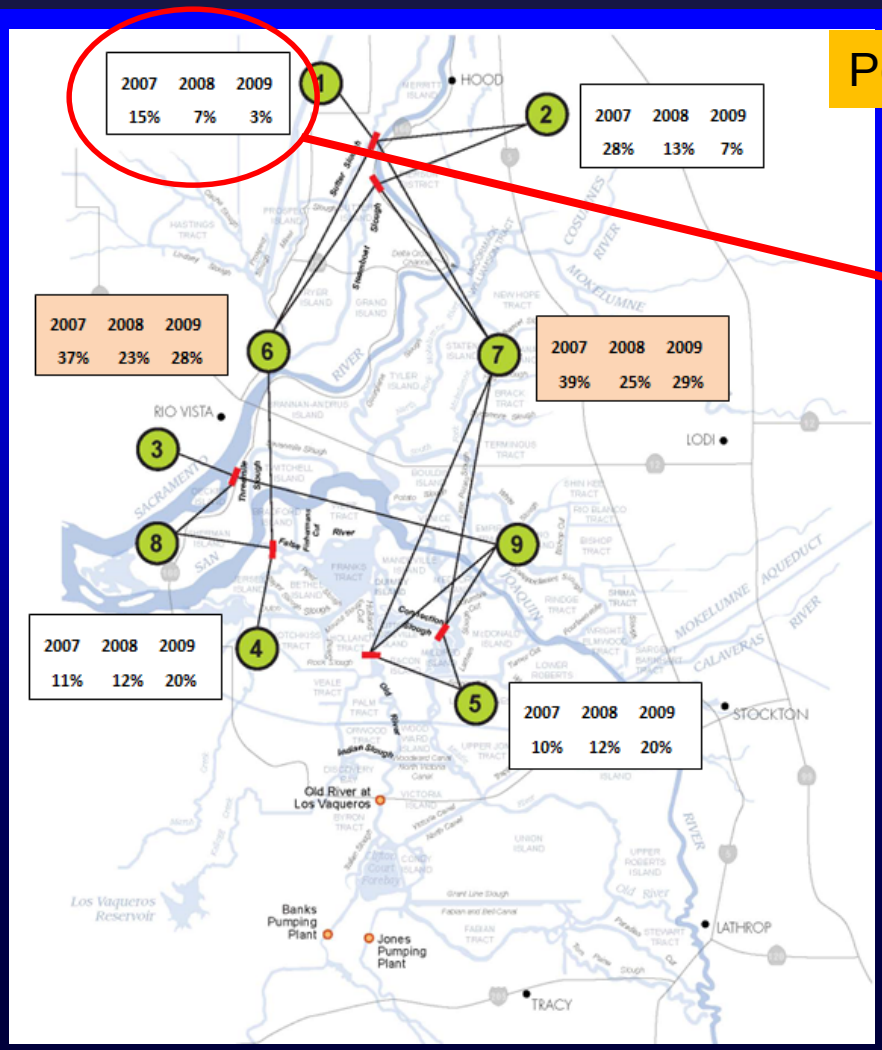


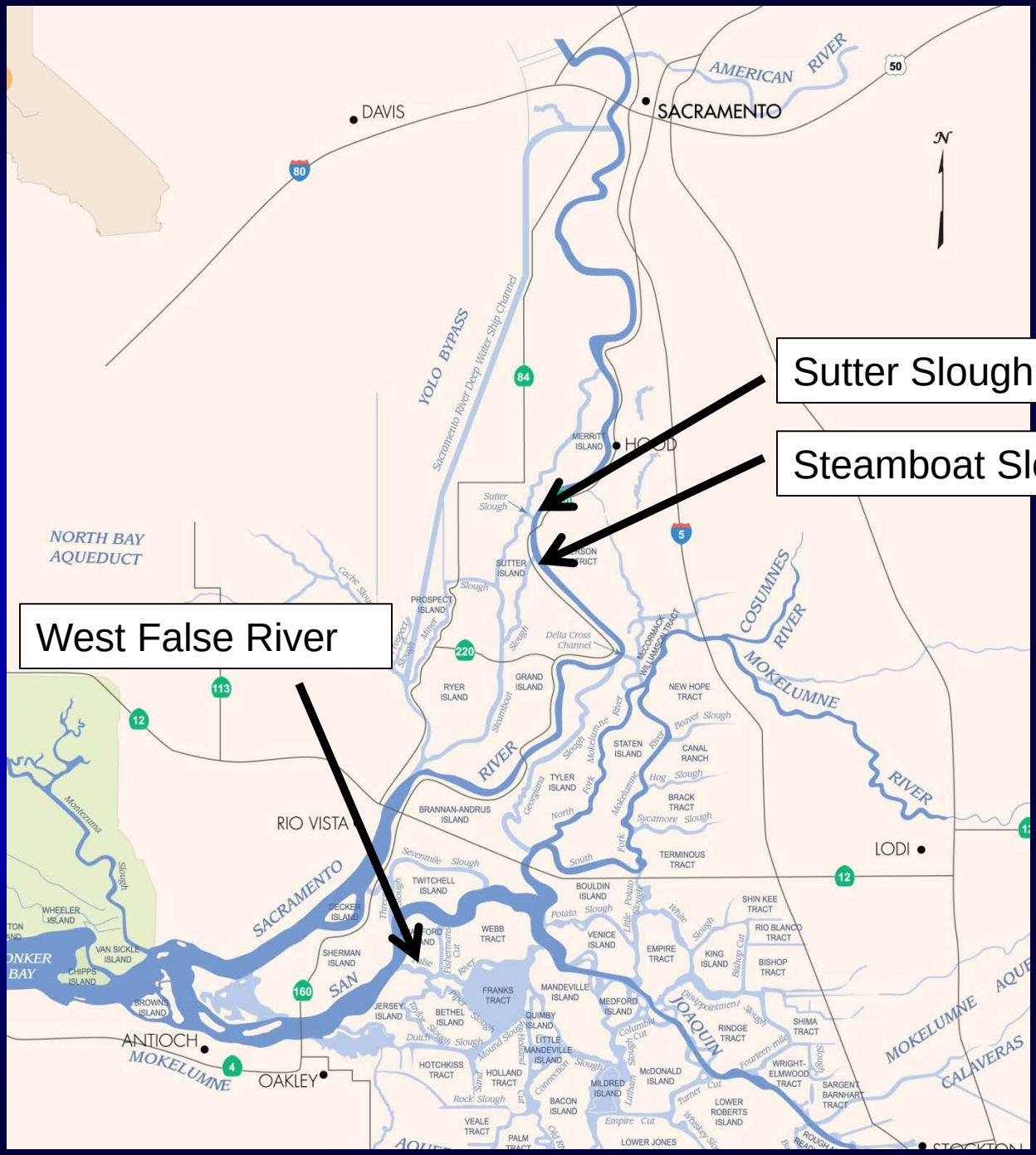
Percentage Salinity Improvement at CCFB

2007	2008	2009
15%	7%	3%

Checked Impacts with 2014 Forecast

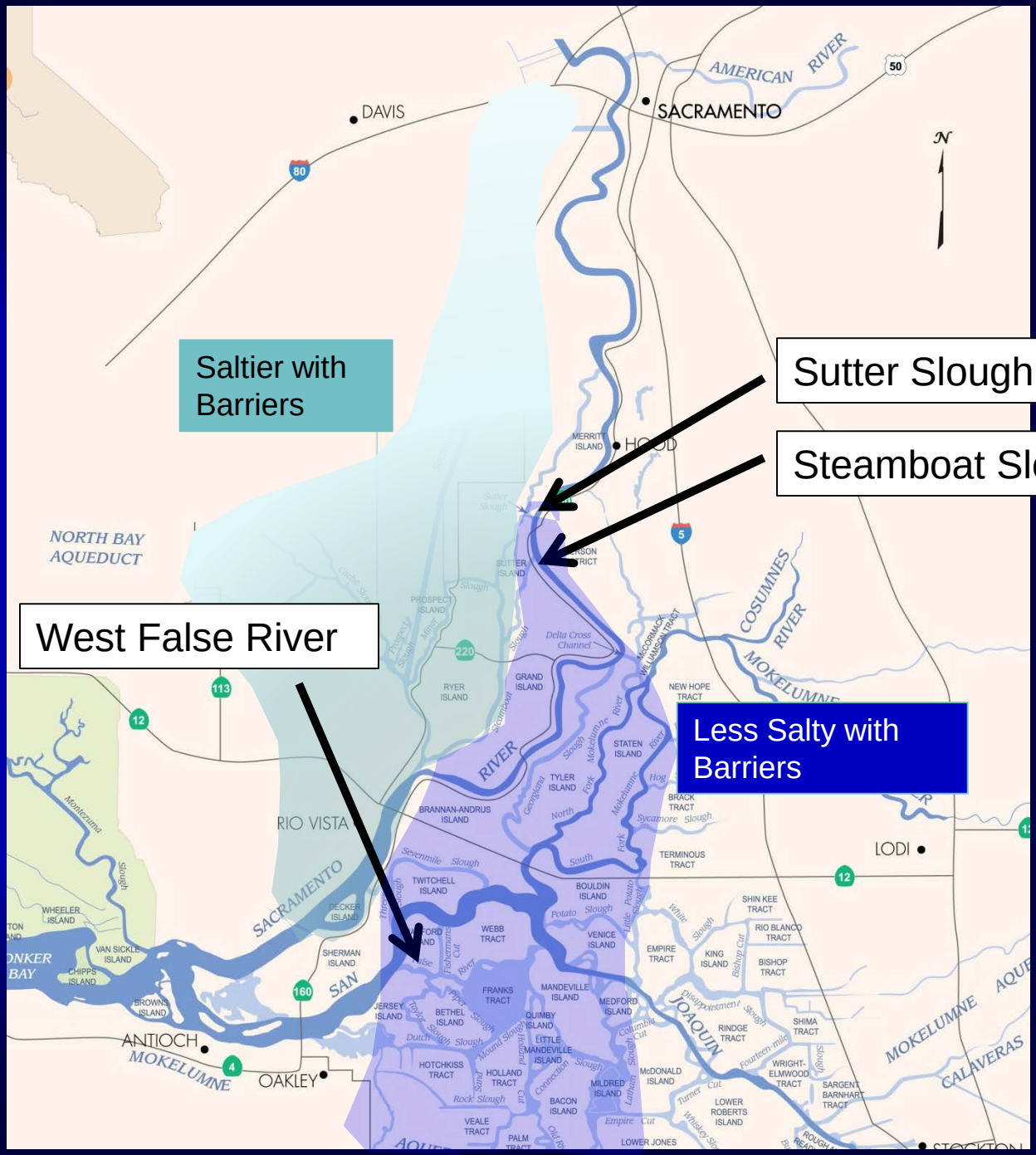
1

Proposed Emergency Barrier Locations



1

General Pattern of Salinity Impacts



2 Forecasts – Let Me Count the Ways

2 Forecasts – Let Me Count the Ways

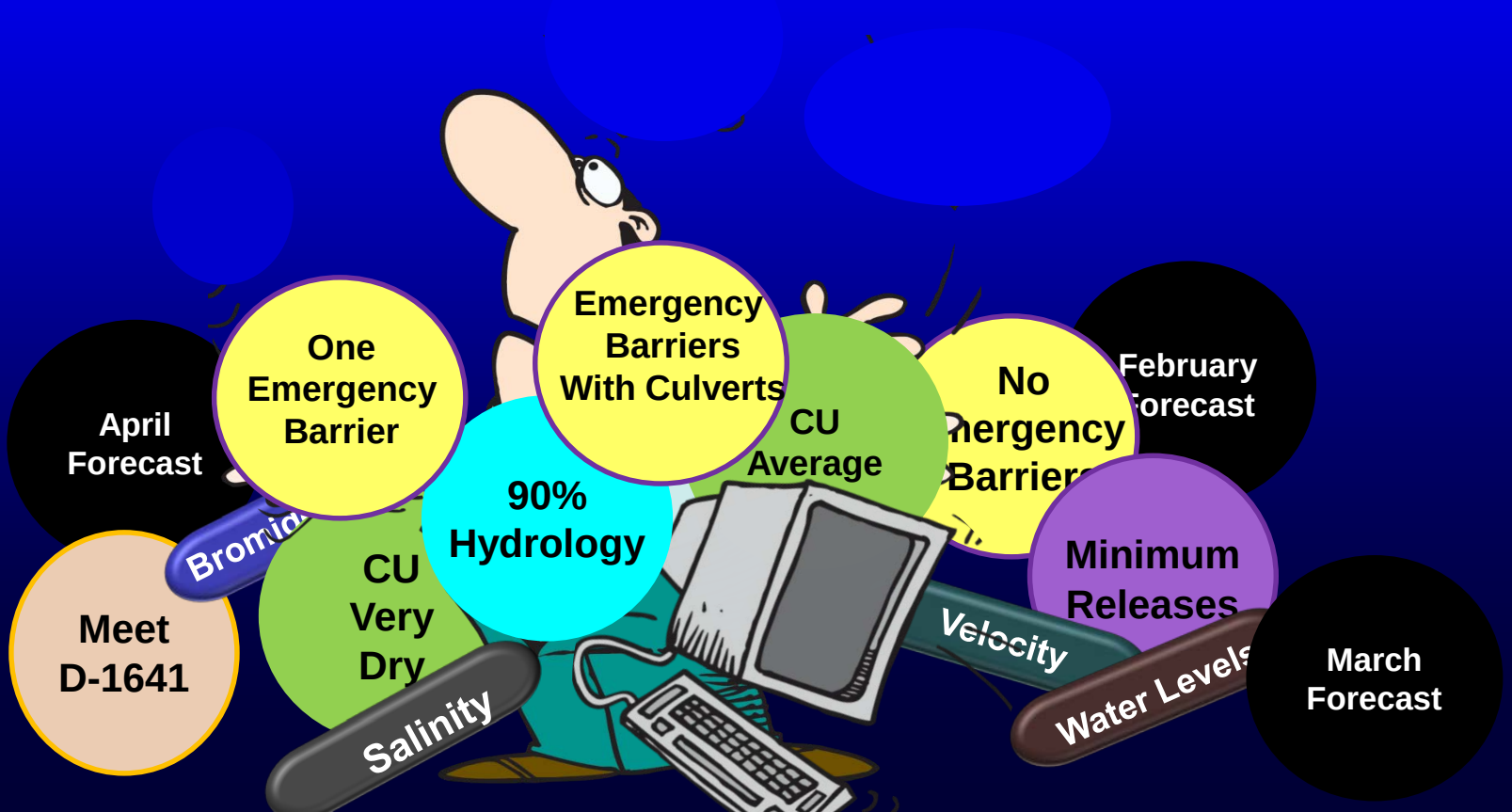
Modeling Forecasts Don't Predict the Future!

- Precipitation Changes
- Operations/Uses will vary

Review Results knowing the Assumptions in the Modeling Runs.

2 Forecasts – Let Me Count the Ways

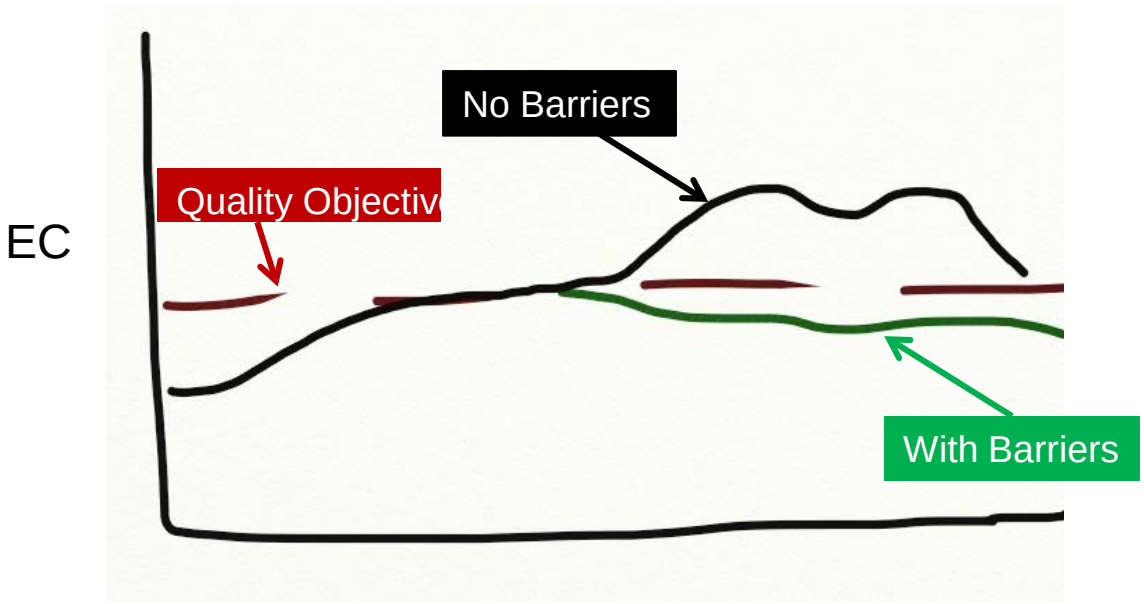
2 Forecasts – Let Me Count the Ways



2 Forecasts – Let Me Count the Ways

Minimum Releases

Early Forecast
Location in Central/South Delta
Minimum Releases

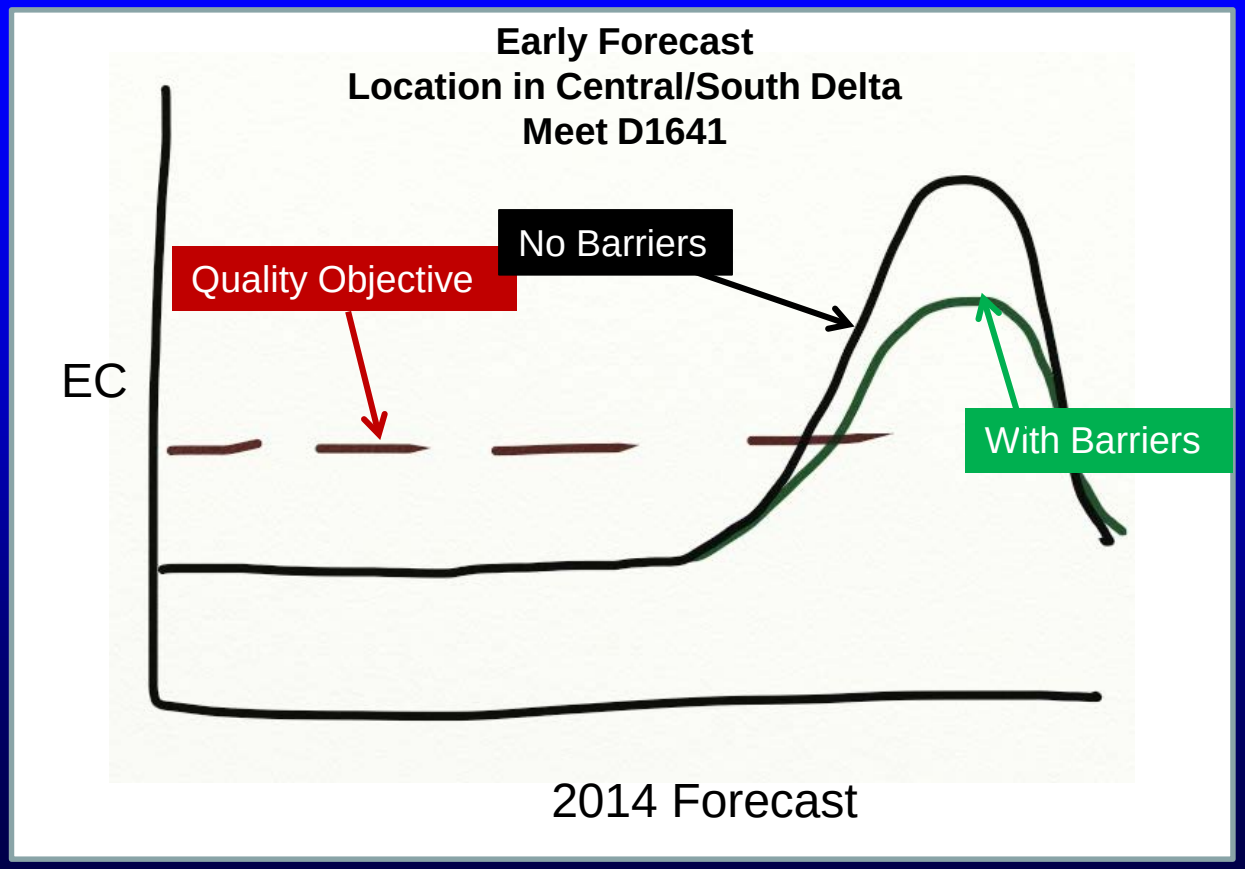


2014 Forecast

Minimum Releases – Release Storage over Time

2 Forecasts – Let Me Count the Ways

Meet D-1641

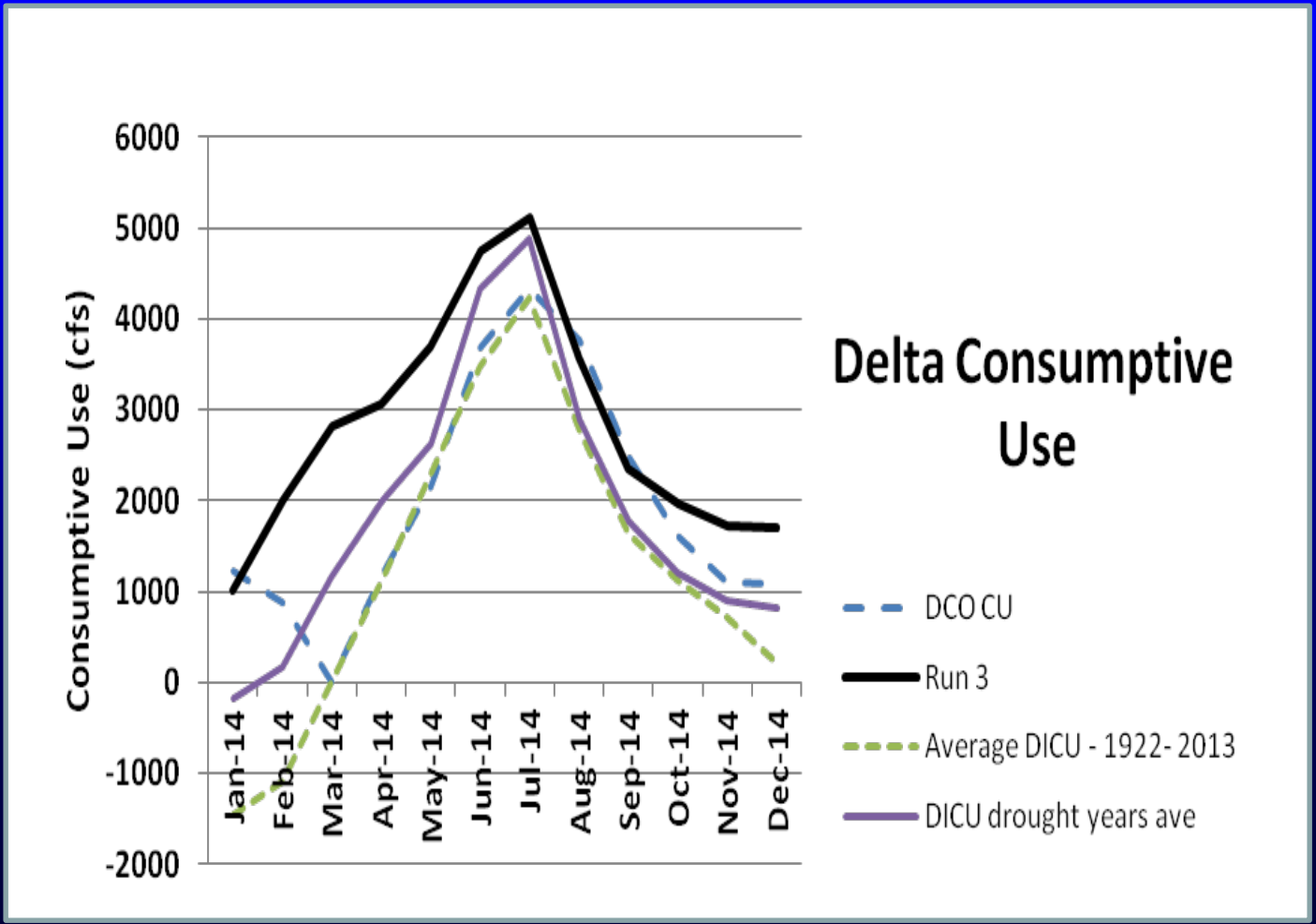


Meet WQ Objectives Until Run Out of Reservoir Storage

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

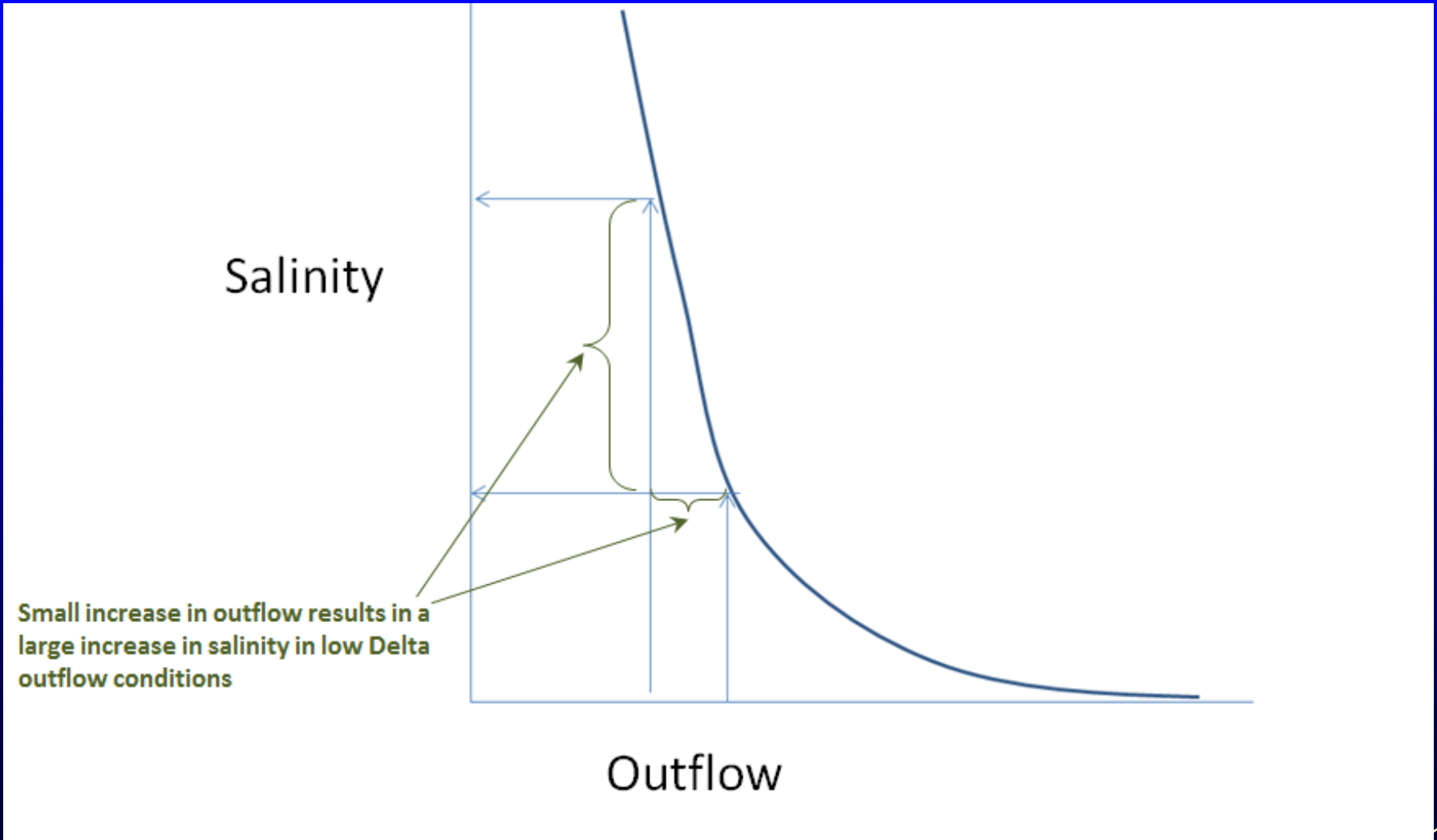
A Difference of 1000 cfs can have a huge impact on salinity intrusion

CU Matters!

Yoga For Delta Models

Models Not Calibrated for Extreme Drought – Outside of Historical Record

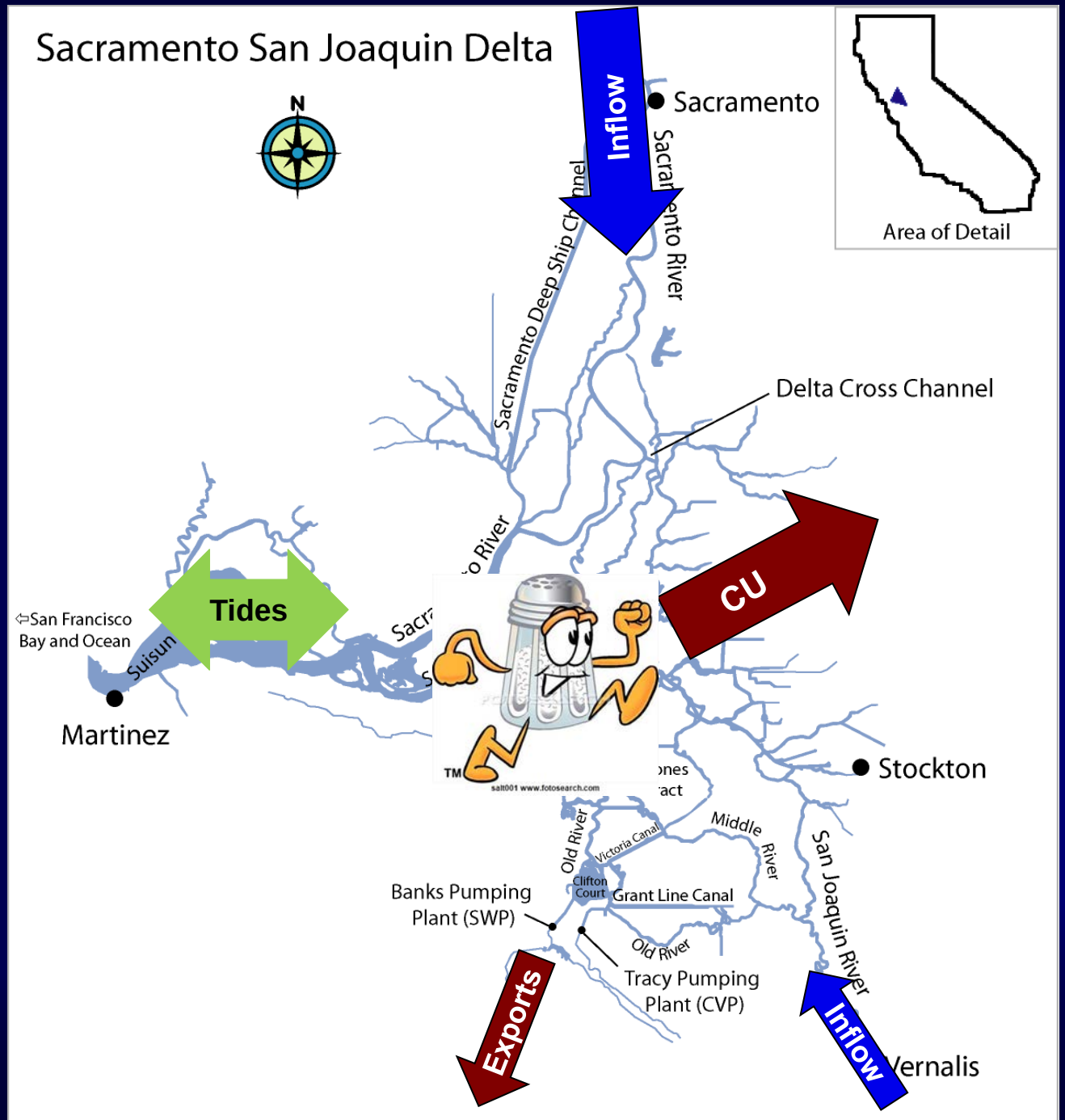
Yoga For Delta Models



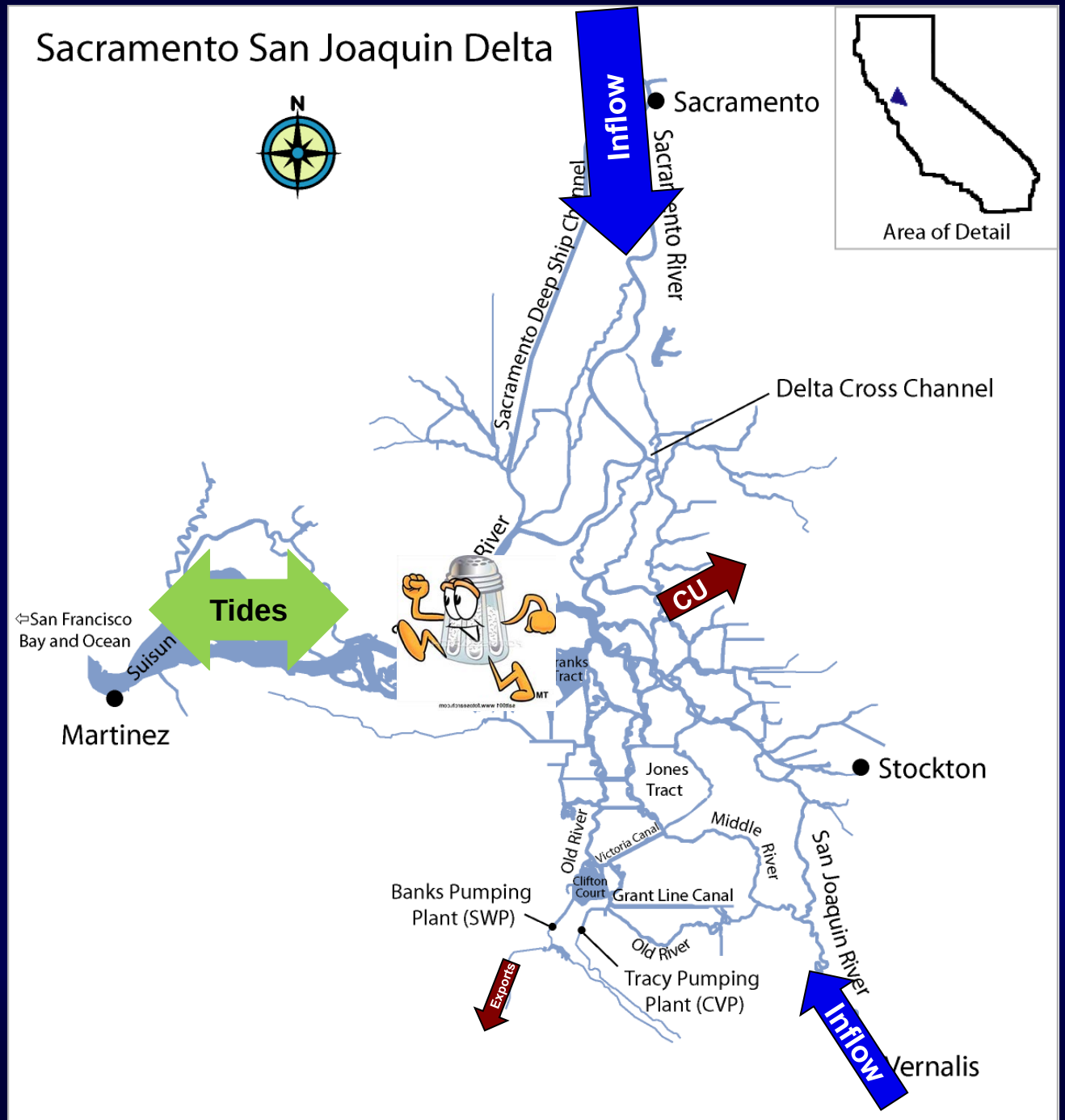
How Bad Can it Be?

Will the Delta Reach Some Equilibrium Salinity?

5


Sacramento San Joaquin Delta
N
Inflow
Sacramento
Area of Detail
Sacramento Deep Ship Channel
Sacramento River
Delta Cross Channel
CU
Tides
⇦San Francisco
Bay and Ocean
Suisun
Martinez
salt001 www.fotosearch.com
Stockton
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

5


Sacramento San Joaquin Delta
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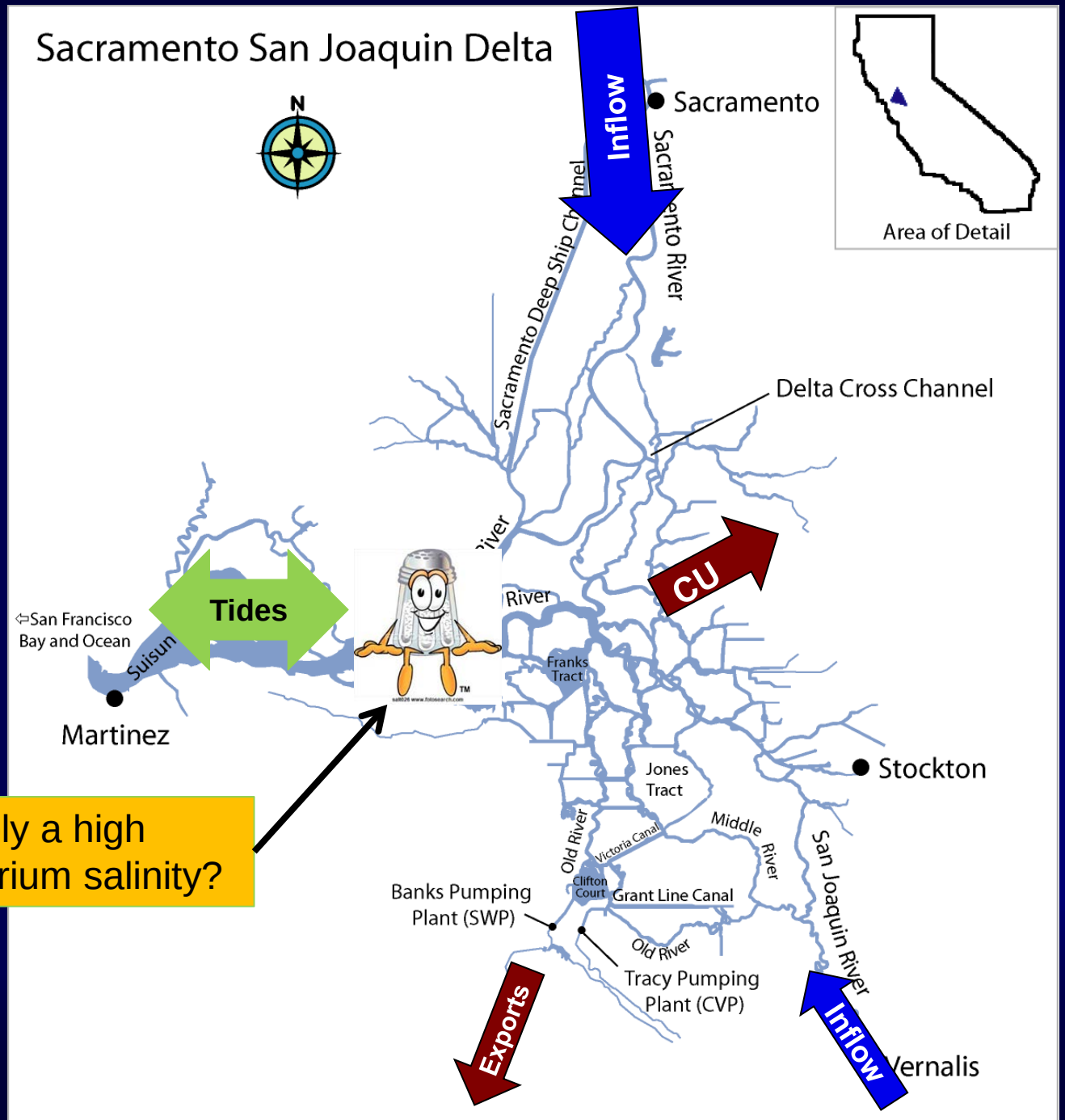
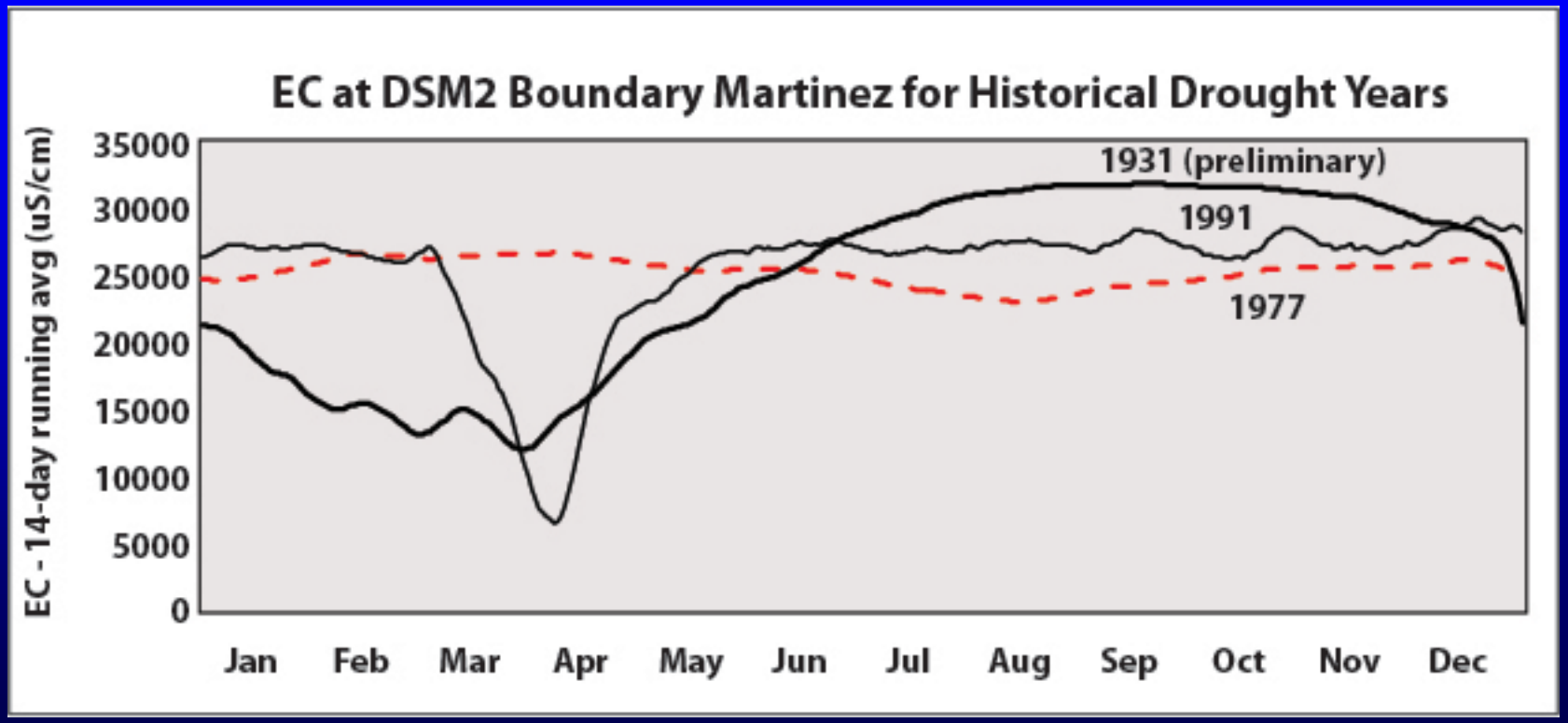
Victoria Canal
Middle
River
San Joaquin River
Clifton
Court
Grant Line Canal
Banks Pumping
Plant (SWP)
Old River
Tracy Pumping
Plant (CVP)
Exports
Inflow
Vernalis

5



Possibly a high equilibrium salinity?

How Bad Can it Be?

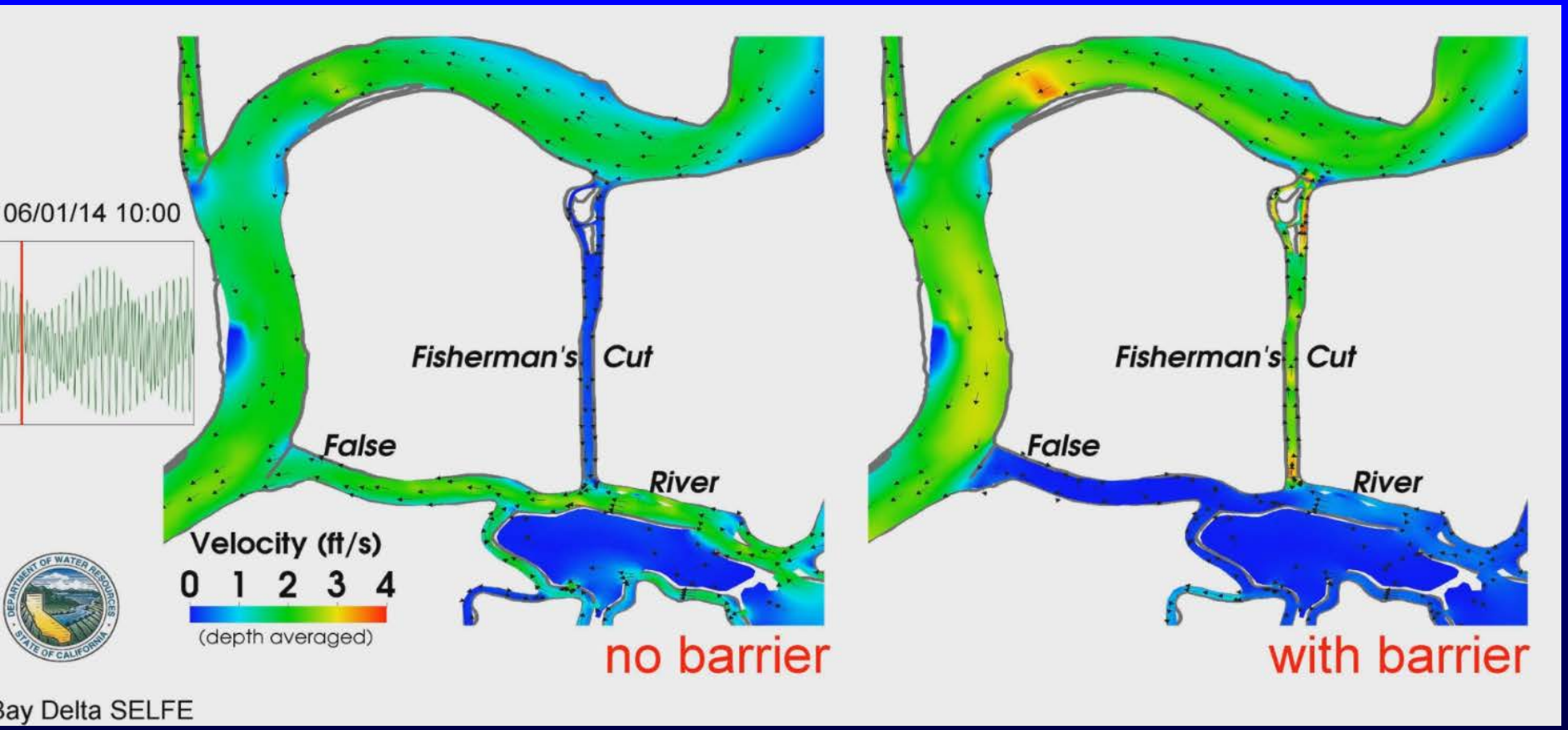


It’s Not Just Salinity

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

Lots of Model Output to Analyze

It's Not Just Salinity



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

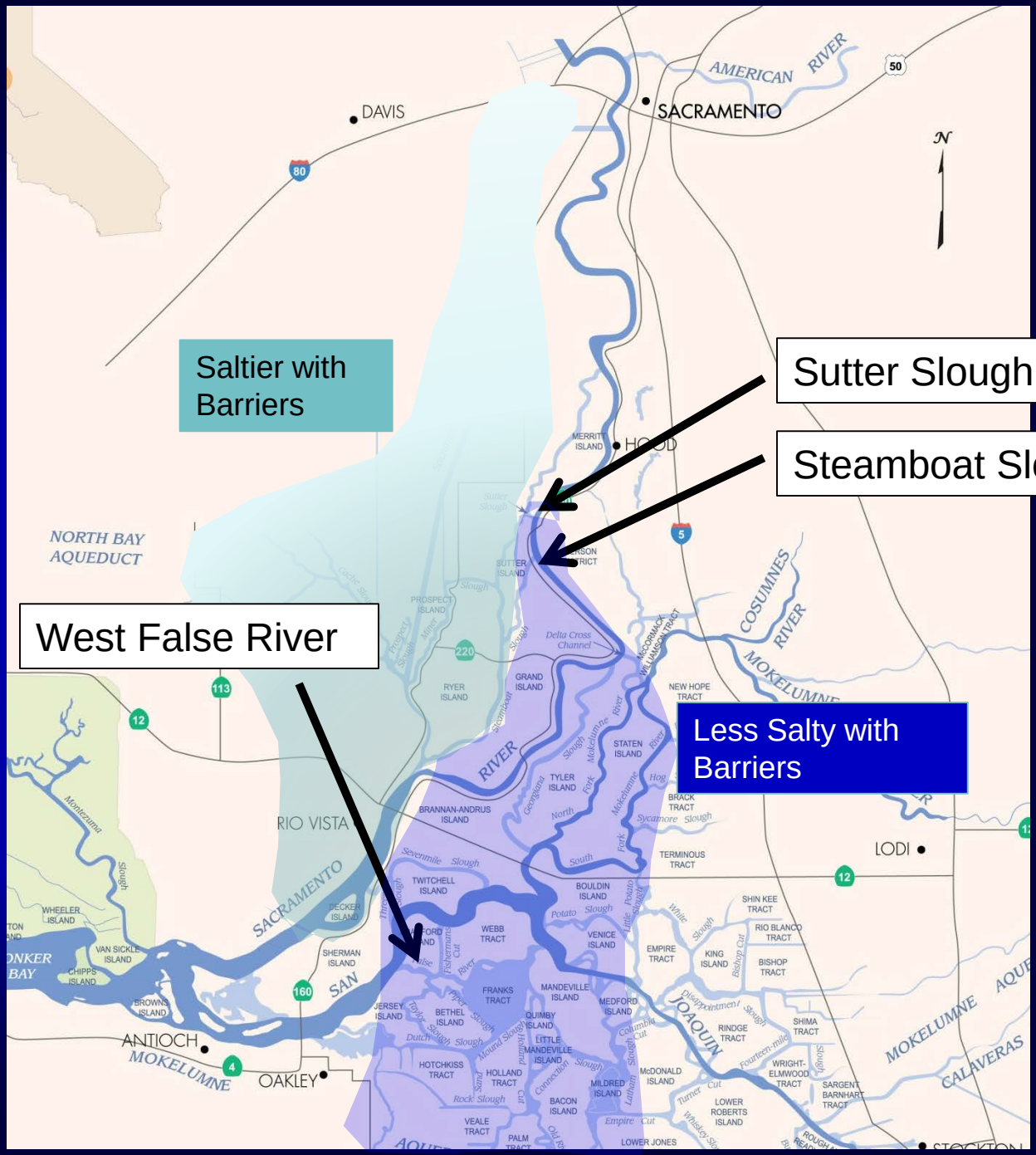
Net Delta Outflow Needed to Meet D-1641 Objectives for Various Alternatives

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

7

General Pattern of Salinity Impacts



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	276 cfs
NDO Difference (positive indicates water savings with relaxed objectives)	612 cfs	1124 cfs	

If you relax the Emmaton objective and keep the barriers, there is a water savings

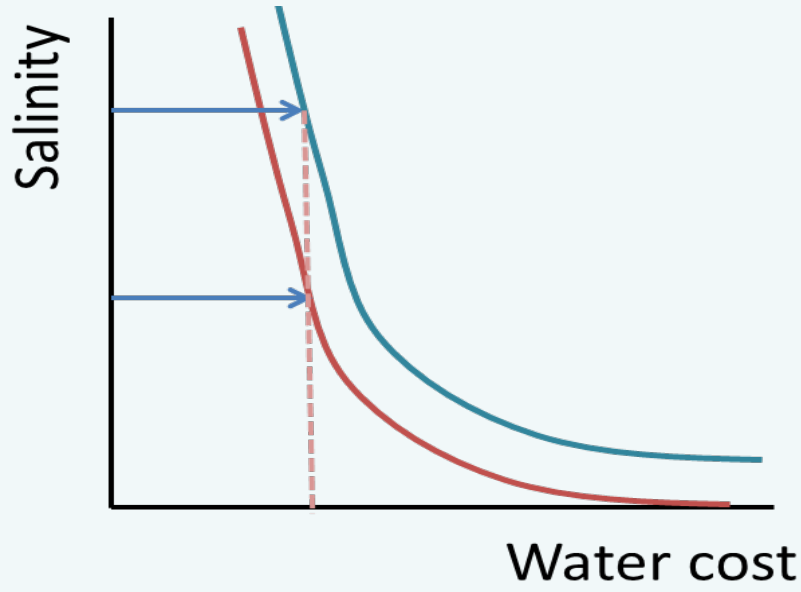
Quality Versus Quantity

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

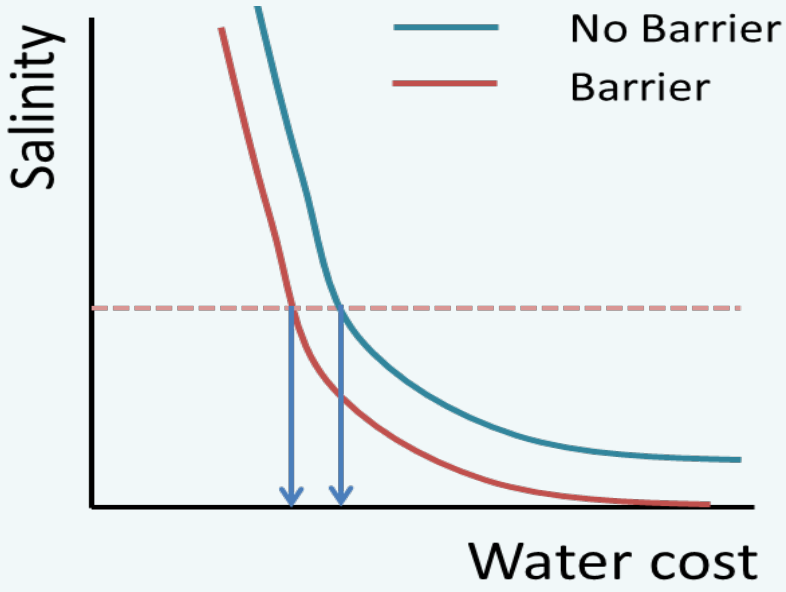
Objective	Without Emergency Barriers	Emergency Barriers	NDO Difference(positive indicates water savings with barriers)
Emmaton	3657 cfs	3893 cfs	-236 cfs
Relaxed	3045 cfs	2769 cfs	276 cfs
NDO Difference (positive indicates water savings with relaxed objectives)	612 cfs		

If you relax the Emmaton objective with no barriers there is a water savings. However, water quality degrades at the export locations

Quality Versus Quantity



Large salinity change for fixed flow pattern



Small water cost savings for fixed salinity constraint

7 Quality Versus Quantity

- Relaxation of, or Movement of Emmaton Objective to Three Mile Slough can Potentially Affect Bromide Levels.
- Those impacts were evaluated.

Current Modeling Related to Drought

- Forecasts
- Modeling for Programmatic EIR
- 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
- Improving DSM2 Model Boundary Extension
- Evaluating Historical Consumptive Use Data including Well Usage
- Reviewing How Well DSM2 Modeled 2014

Thanks!

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

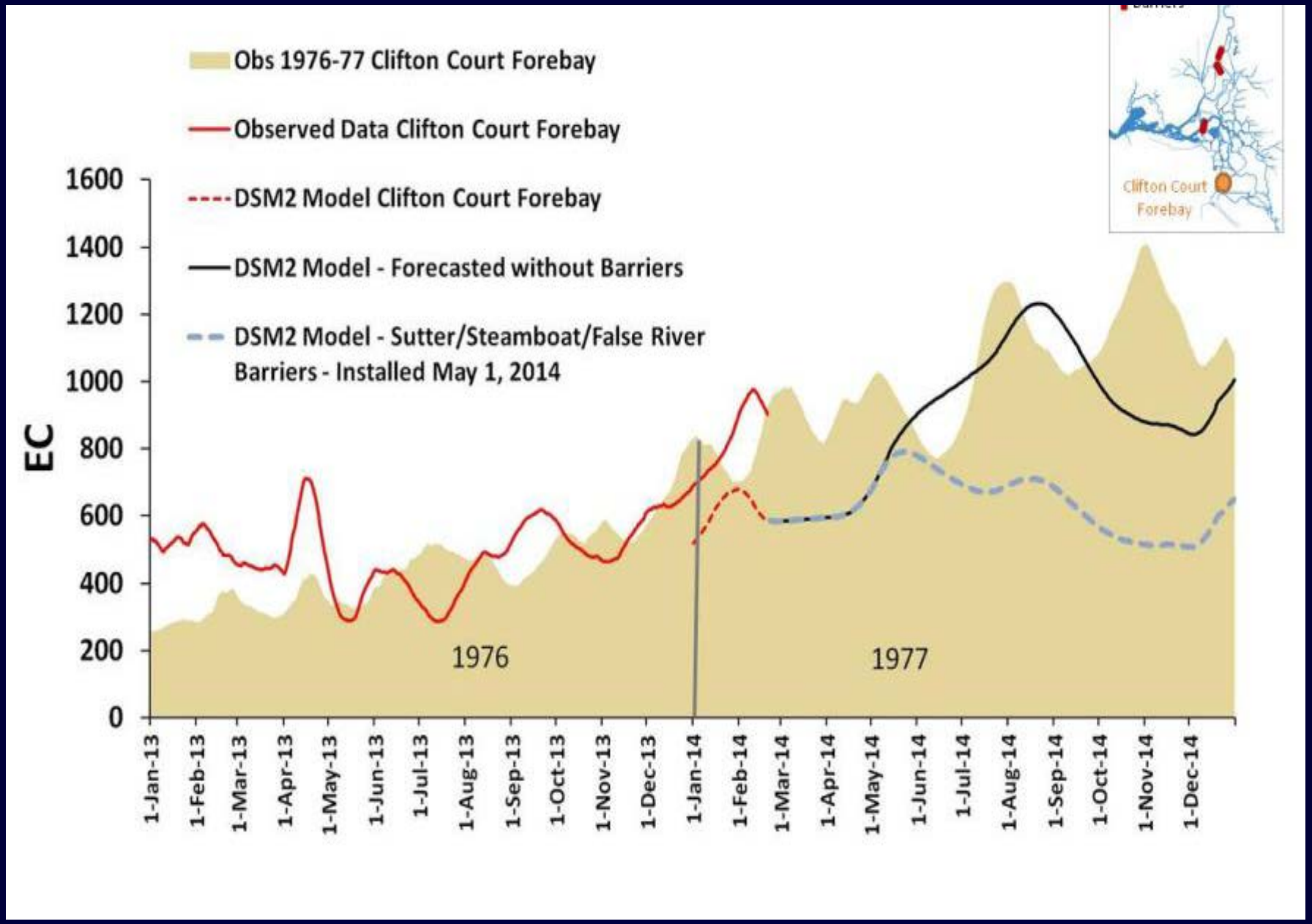
Further Acknowledgements

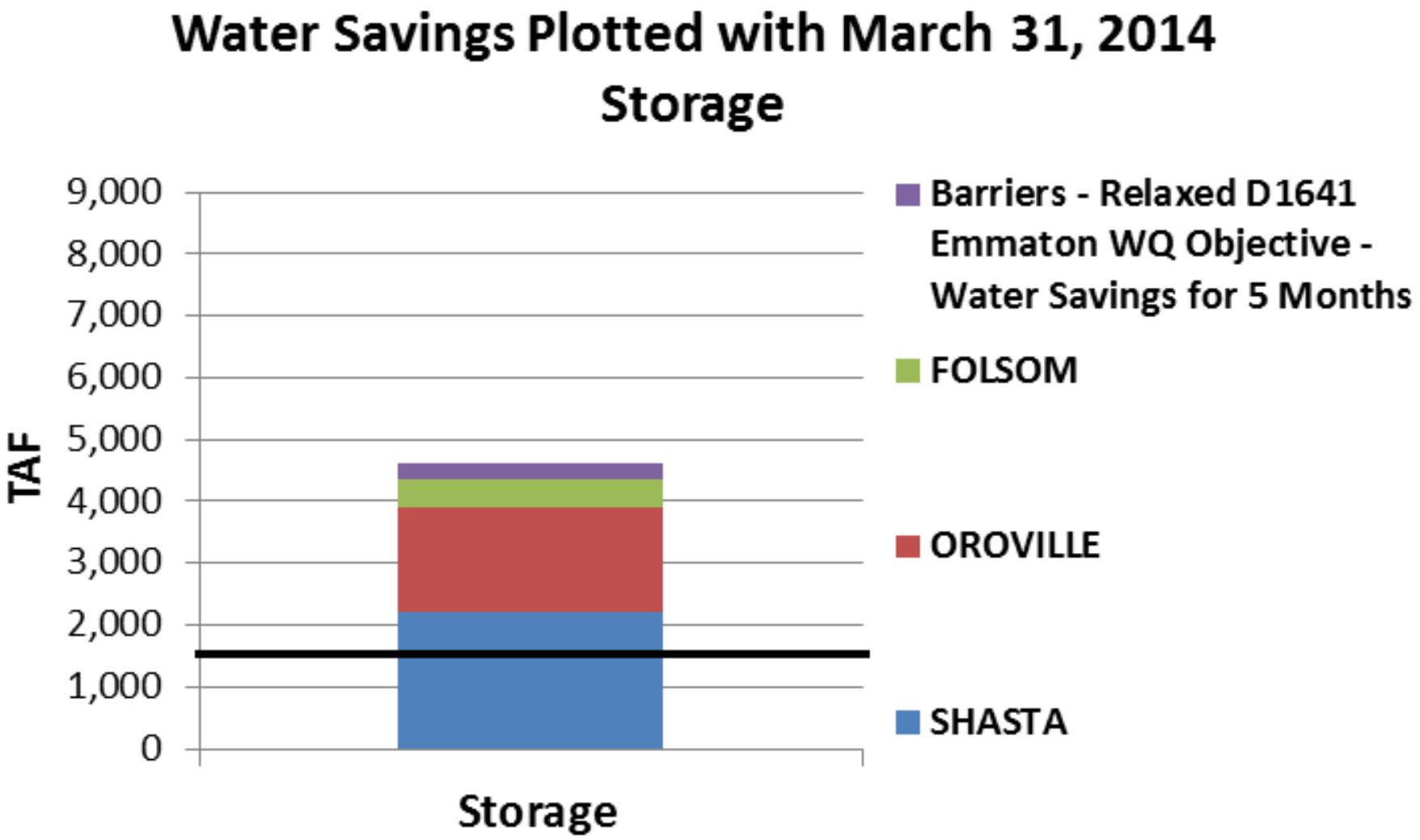
Work/Task	Name(s)	DWR Office/Division
Delta Coordinated Operations (DCO) Modeling	Amritpal Sandhu, Tracy Pettit	Operations and Maintenance
Modeling for 2009 Emergency Barriers Report	Subir Saha	Bay-Delta Office
DSM2 Forecasts – DCO Minimum Releases, Early February Forecast	Bryant Giorgi, James Edwards, 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)

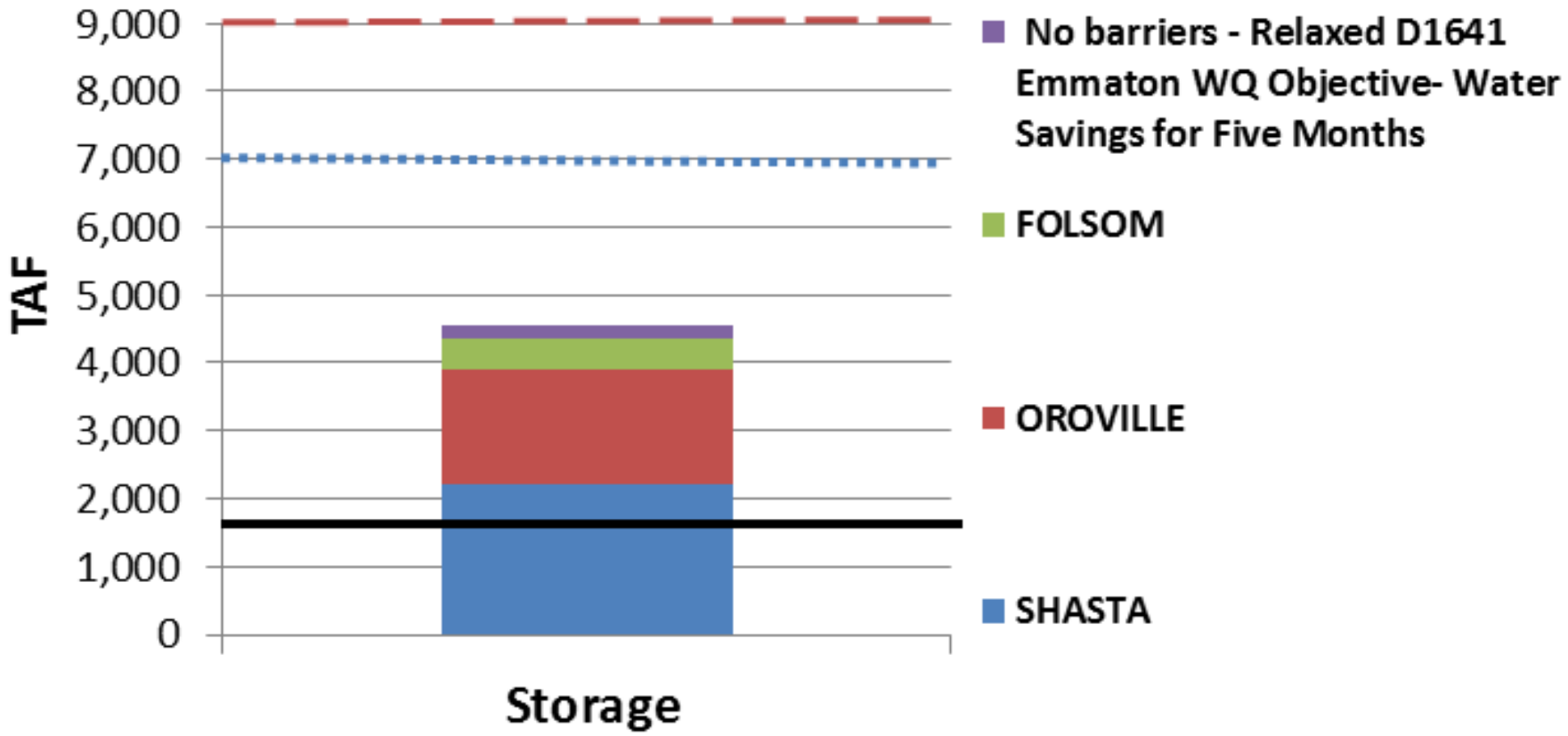
Work/Task	Name(s)	DWR Office/Division
SELFE Simulation using March 21st Forecast	Eli Ateljevich, Kijin Nam, Rueen-Fang Wang, Inez Ferreira, Jon Shu	Bay-Delta Office
SELFE Animations	Jon Shu	Bay-Delta Office
Full Delta Graphics Tool Modification	Subir Saha	Bay-Delta Office
Specific Location Graphics Tools	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


Obs 1976-77 Clifton Court Forebay
Observed Data Clifton Court Forebay
DSM2 Model Clifton Court Forebay
DSM2 Model - Forecasted without Barriers
DSM2 Model - Sutter/Steamboat/False River Barriers - Installed May 1, 2014
EC
1600
1400
1200
1000
800
600
400
200
0
1976
1977
1-Jan-13
1-Feb-13
1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14
1-Mar-14
1-Apr-14
1-May-14
1-Jun-14
1-Jul-14
1-Aug-14
1-Sep-14
1-Oct-14
1-Nov-14
1-Dec-14
Clifton Court Forebay


Water Savings Plotted with March 31, 2014 Storage
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
TAF
Storage
Barriers - Relaxed D1641 Emmaton WQ Objective - Water Savings for 5 Months
FOLSOM
OROVILLE
SHASTA

Water Savings Plotted with March 31, 2014 Storage - No Barriers, Relaxed Emmaton WQ



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1 Don’t Throw Away the Old Studies!

2 Forecasts- Let Me Count the Ways

3 Will the Real Consumptive Use Please Stand Up

4 Yoga for Delta Models

5 How Bad Can it Be?

6 Its Not Just Salinity

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