Water Cost Analysis of Drought Barriers

DSM2 User Group
May 14, 2014

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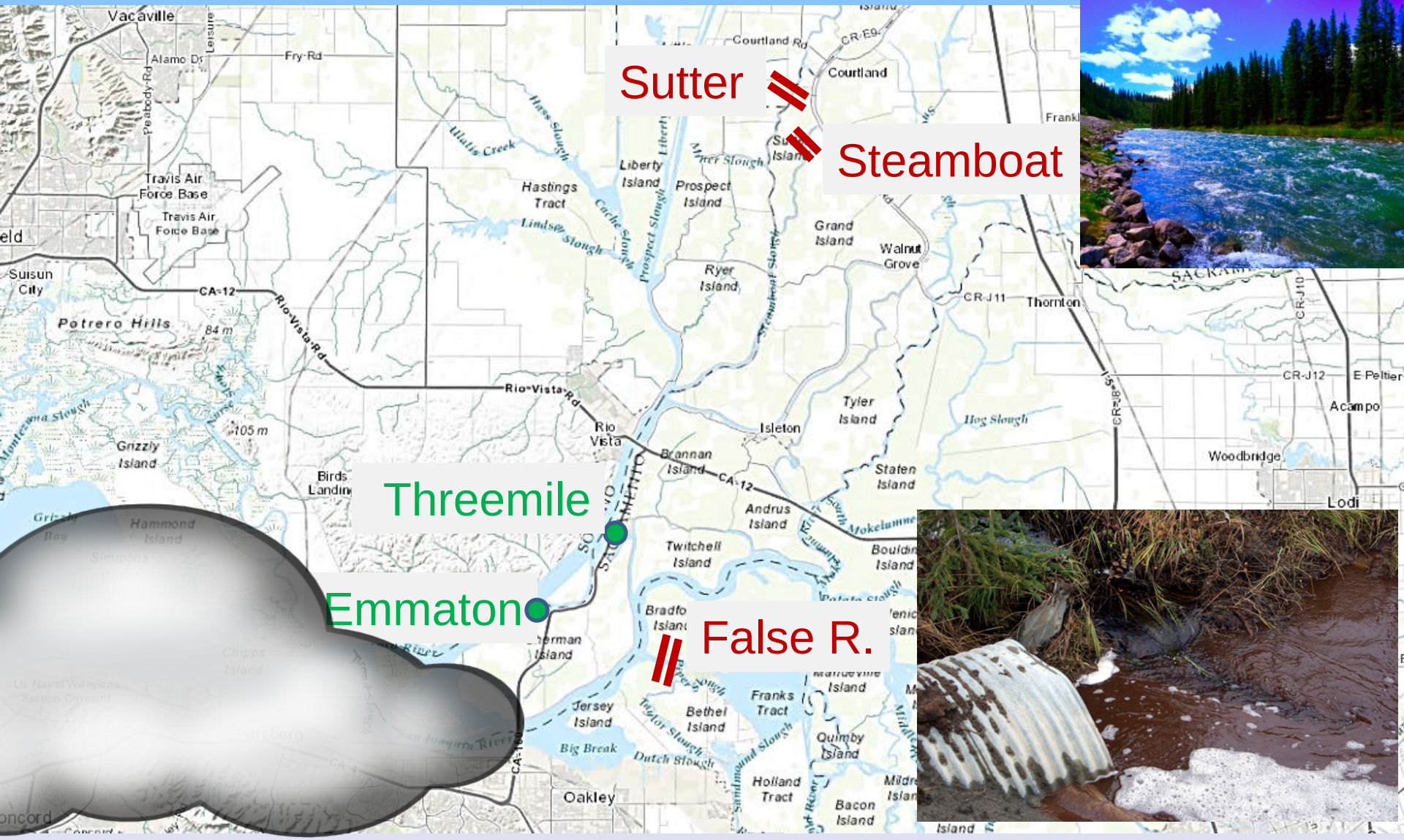
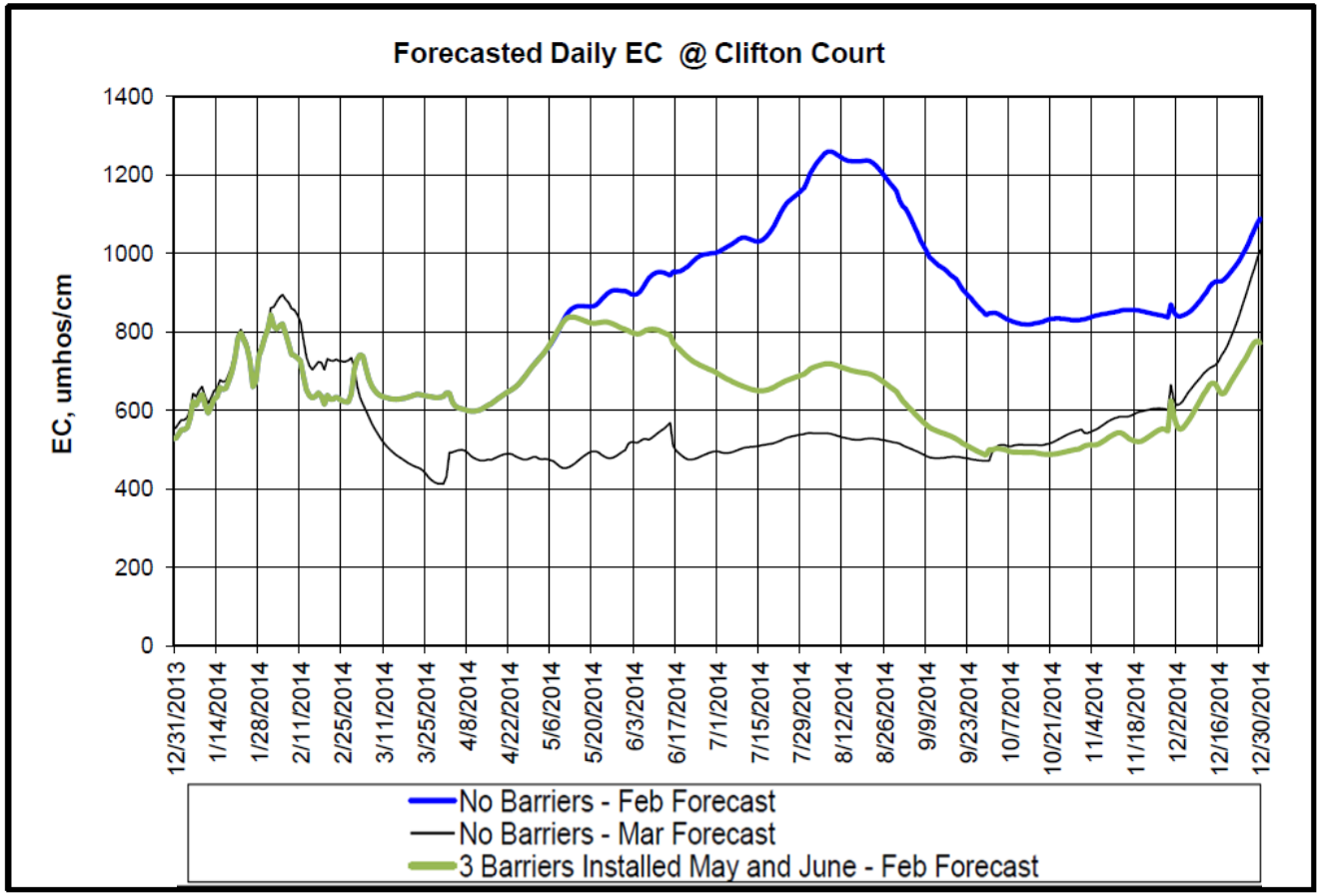
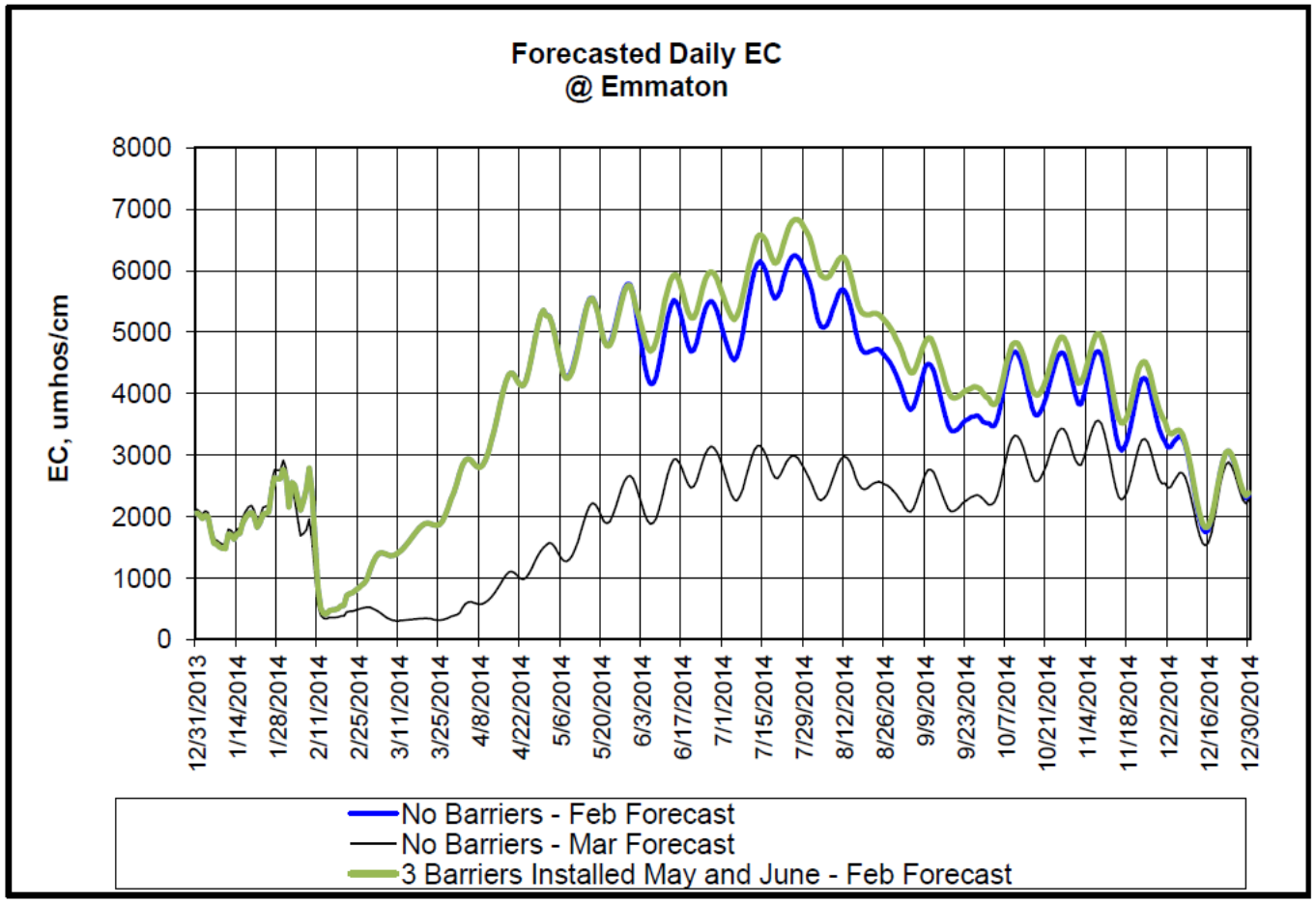
Modeling Support Branch
Bay-Delta Office

Setting the stage … Drought Barriers


Sutter
Steamboat
Threemile
Emmaton
False R.
Vacaville
Travis Air Force Base
Suisun City
Potrero Hills
Rio Vista
Grizzly Island
Hammond Island
Courtland
Walnut Grove
Thornton
Isleton
Tyler Island
Staten Island
Andrus Island
Twitchell Island
Brannan Island
Grand Island
Ryer Island
Liberty Island
Prospect Island
Hastings Tract
Lindsey Slough
Cache Slough
Prospect Slough
Steamboat Slough
Hog Slough
Woodbridge
Lodi
Acampo
E Peltier
Jersey Island
Bethel Island
Franks Tract
Quimby Island
Holland Tract
Bacon Island
Big Break
Dutch Slough
Oakley
Rio Vista Rd
CA-12
CR-J11
CR-J12
CR-J10
I-5
Courtland Rd
Fry Rd
Peabody Rd
Montezuma Slough
Suisun Slough
Mokelumne


Forecasted Daily EC @ Clifton Court
EC, umhos/cm
1400
1200
1000
800
600
400
200
0
12/31/2013
1/14/2014
1/28/2014
2/11/2014
2/25/2014
3/11/2014
3/25/2014
4/8/2014
4/22/2014
5/6/2014
5/20/2014
6/3/2014
6/17/2014
7/1/2014
7/15/2014
7/29/2014
8/12/2014
8/26/2014
9/9/2014
9/23/2014
10/7/2014
10/21/2014
11/4/2014
11/18/2014
12/2/2014
12/16/2014
12/30/2014
No Barriers - Feb Forecast
No Barriers - Mar Forecast
3 Barriers Installed May and June - Feb Forecast


Forecasted Daily EC
@ Emmaton
EC, umhos/cm
8000
7000
6000
5000
4000
3000
2000
1000
0
12/31/2013
1/14/2014
1/28/2014
2/11/2014
2/25/2014
3/11/2014
3/25/2014
4/8/2014
4/22/2014
5/6/2014
5/20/2014
6/3/2014
6/17/2014
7/1/2014
7/15/2014
7/29/2014
8/12/2014
8/26/2014
9/9/2014
9/23/2014
10/7/2014
10/21/2014
11/4/2014
11/18/2014
12/2/2014
12/16/2014
12/30/2014
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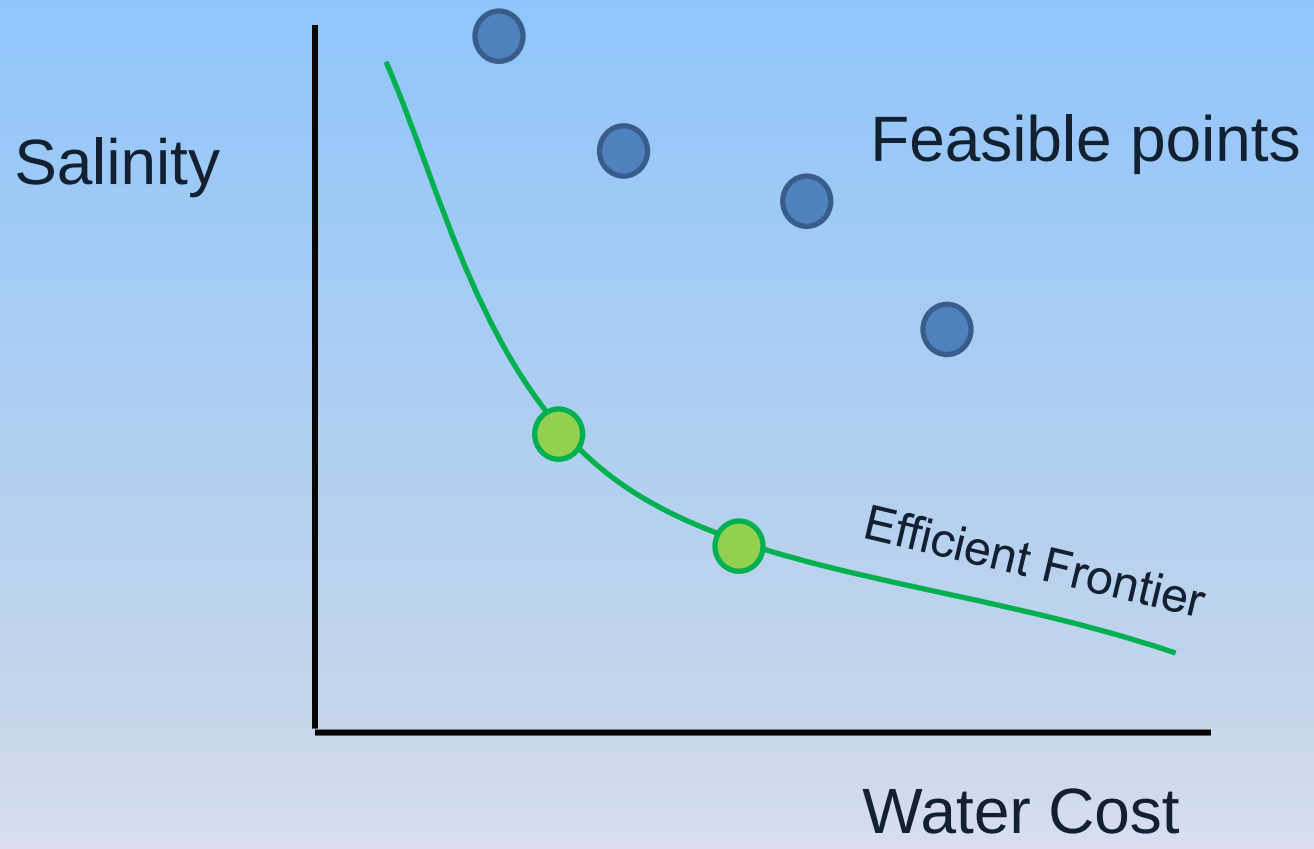
Water Cost Optimization

The Quality-Quantity Frontier

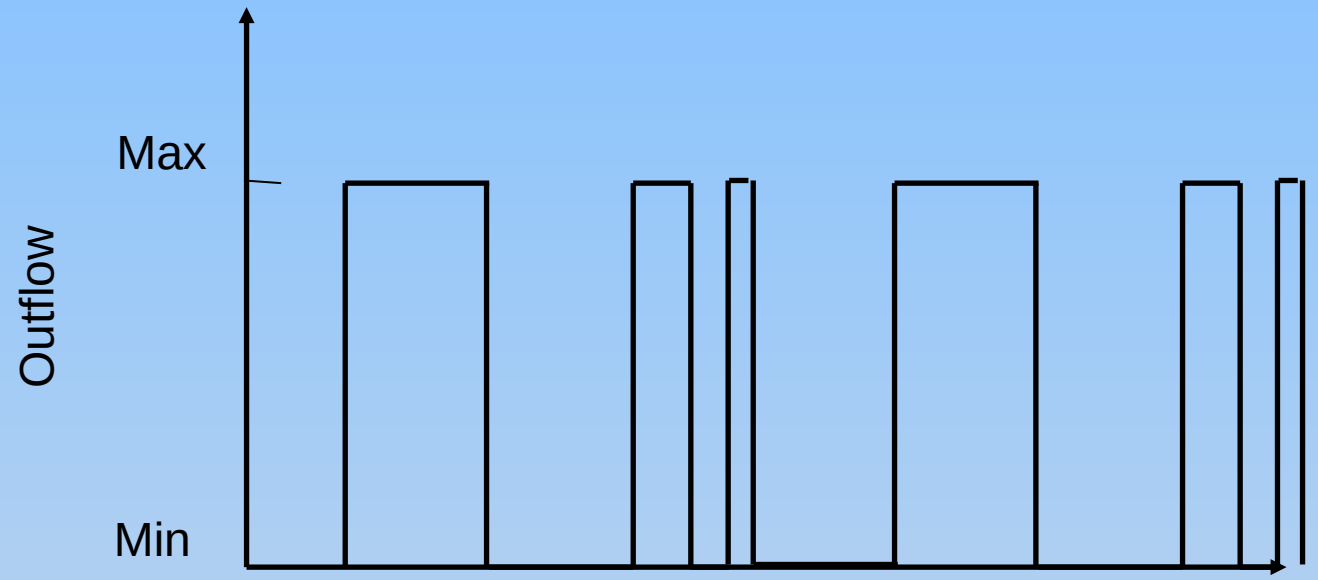


Water Cost Analysis

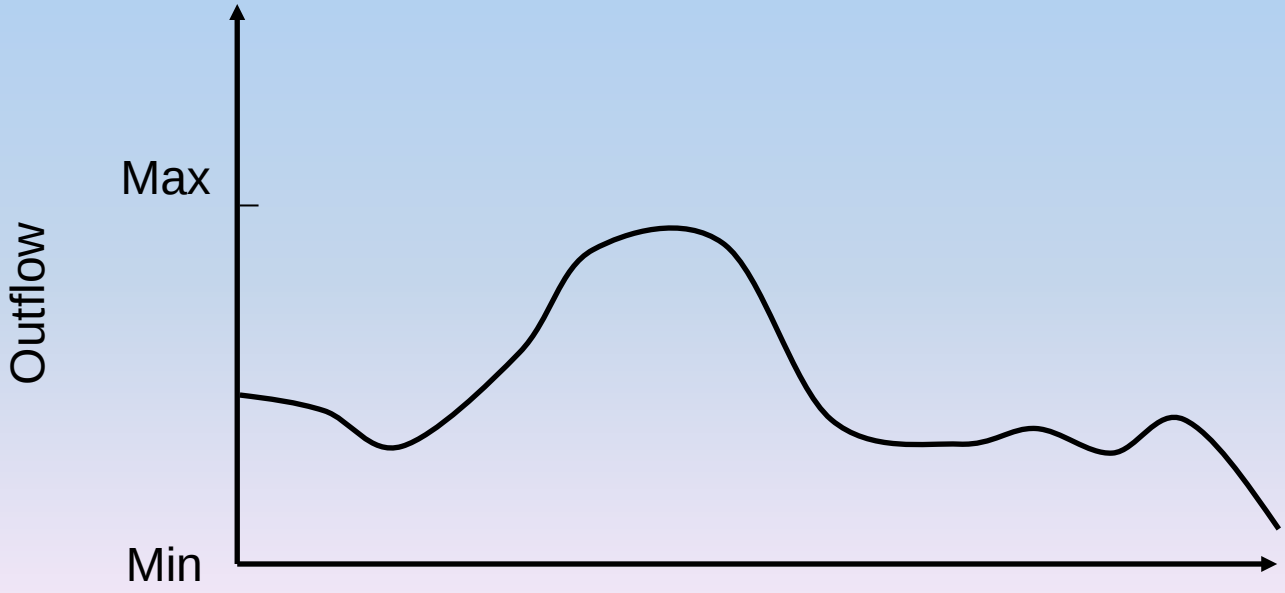
- Minimize sum of outflow that …
- Meets D-1641 EC (or anything you want)
- Constrained Optimization By Linear Approximation (COBYLA)
- Regularization to get rid of whacky results
- (Most) solutions are “in the calibration zone”

What does optimality look like?

First … some rocket science

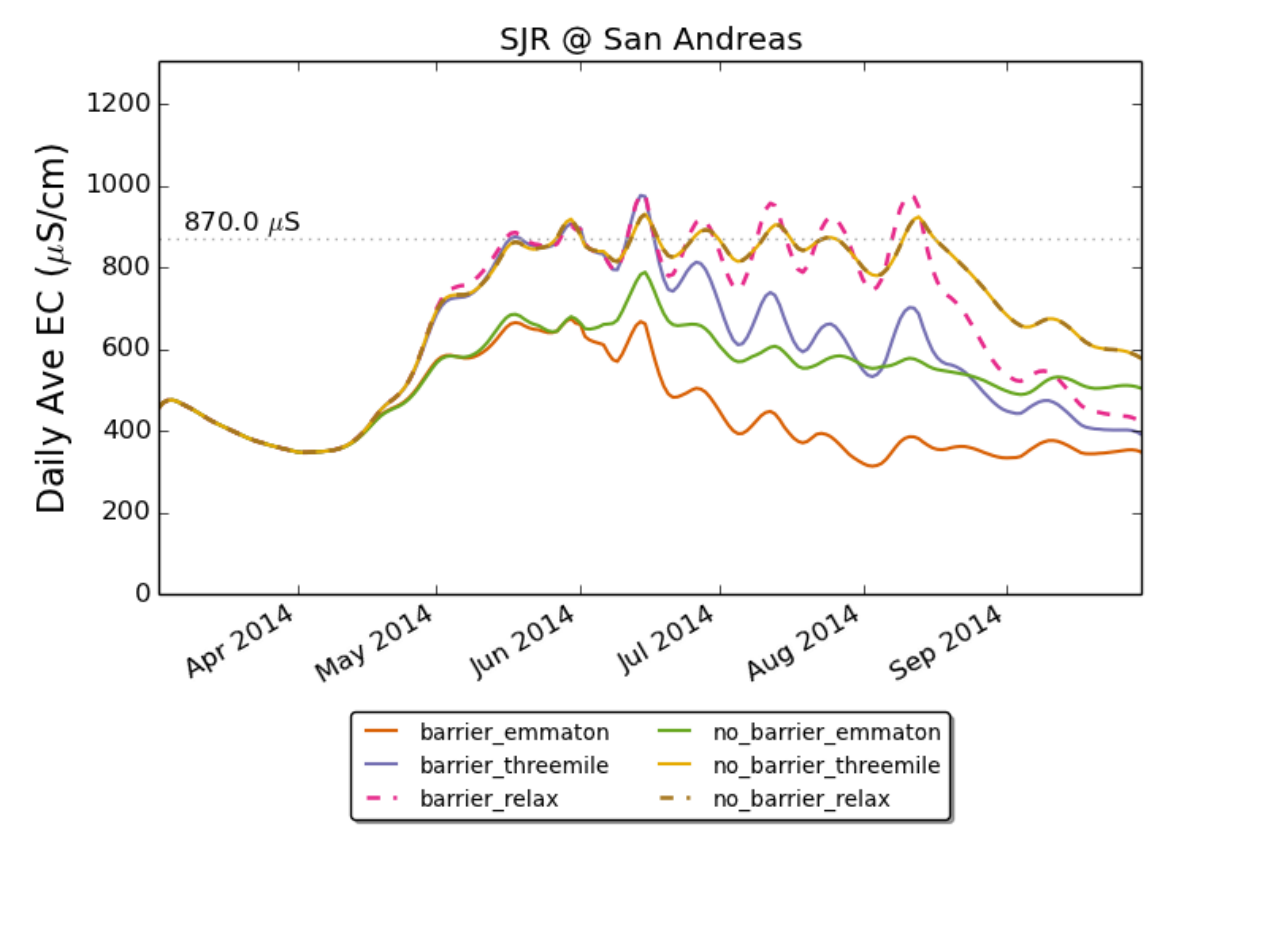


"Bang-bang"



"Regularized"
(worth the extra
couple cfs)

Binding Standards

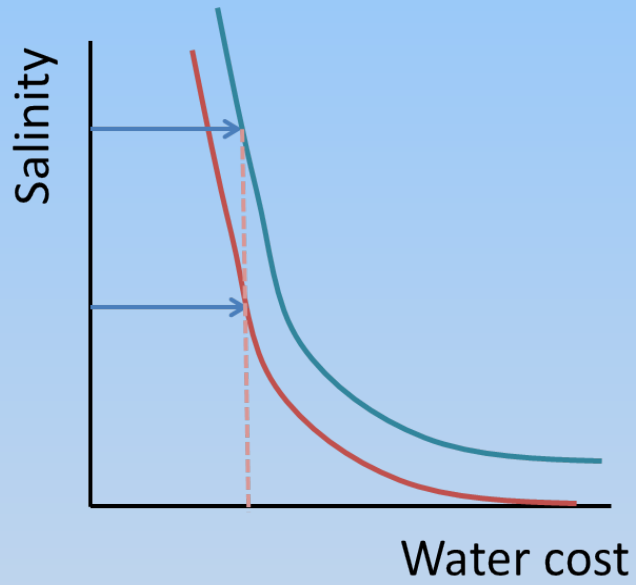


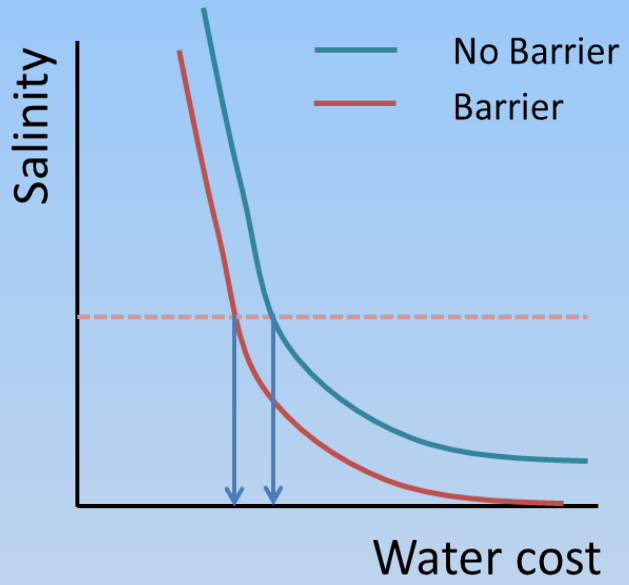
What did we learn?

The Main Result

Objective	Emergency Barriers	Without Barriers
Emmaton	3893 cfs	3657 cfs
Three Mile	3050 cfs	3045 cfs
Relaxed	2769 cfs	3045 cfs

Barriers shift challenges to Sacramento



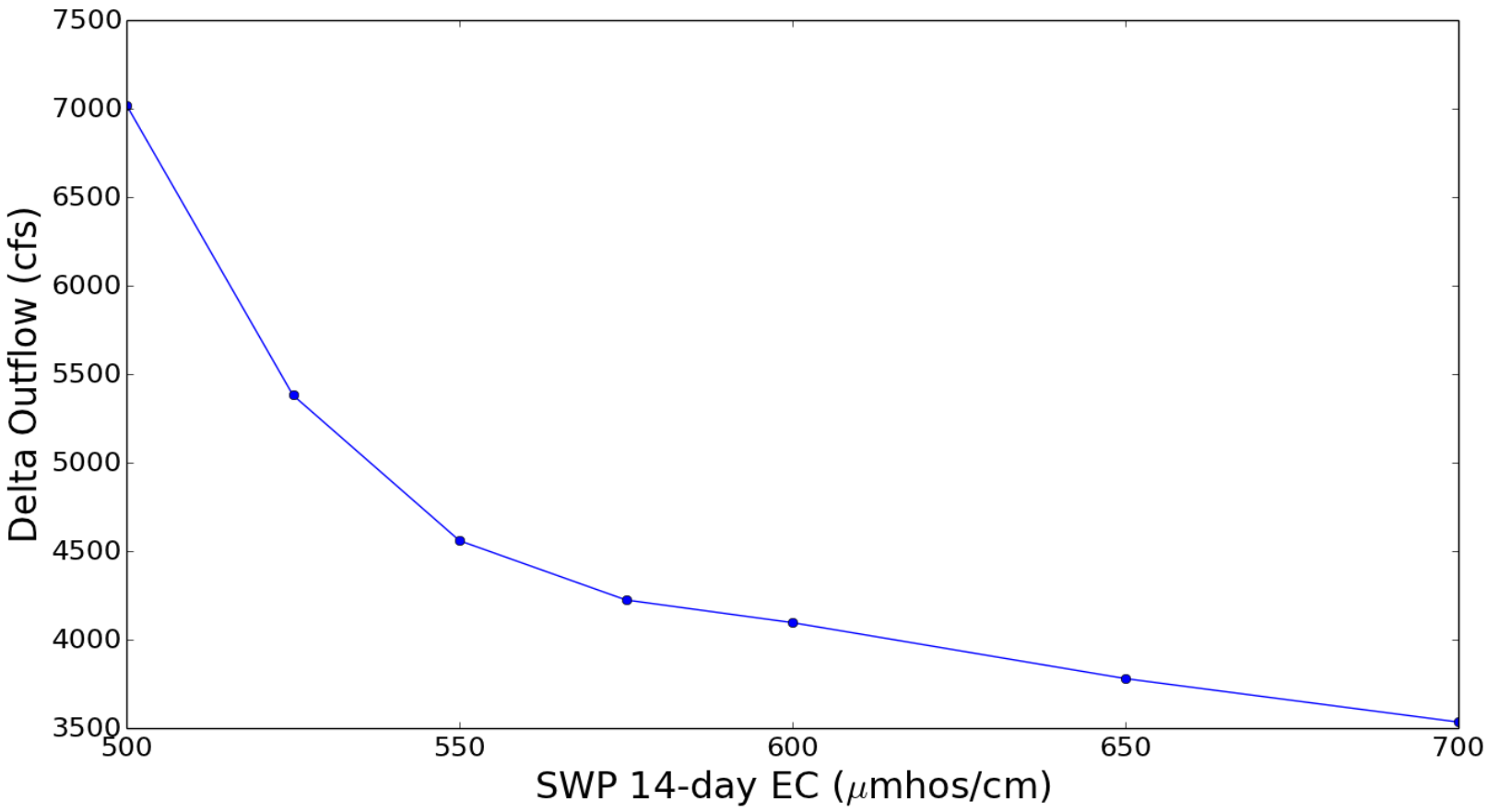


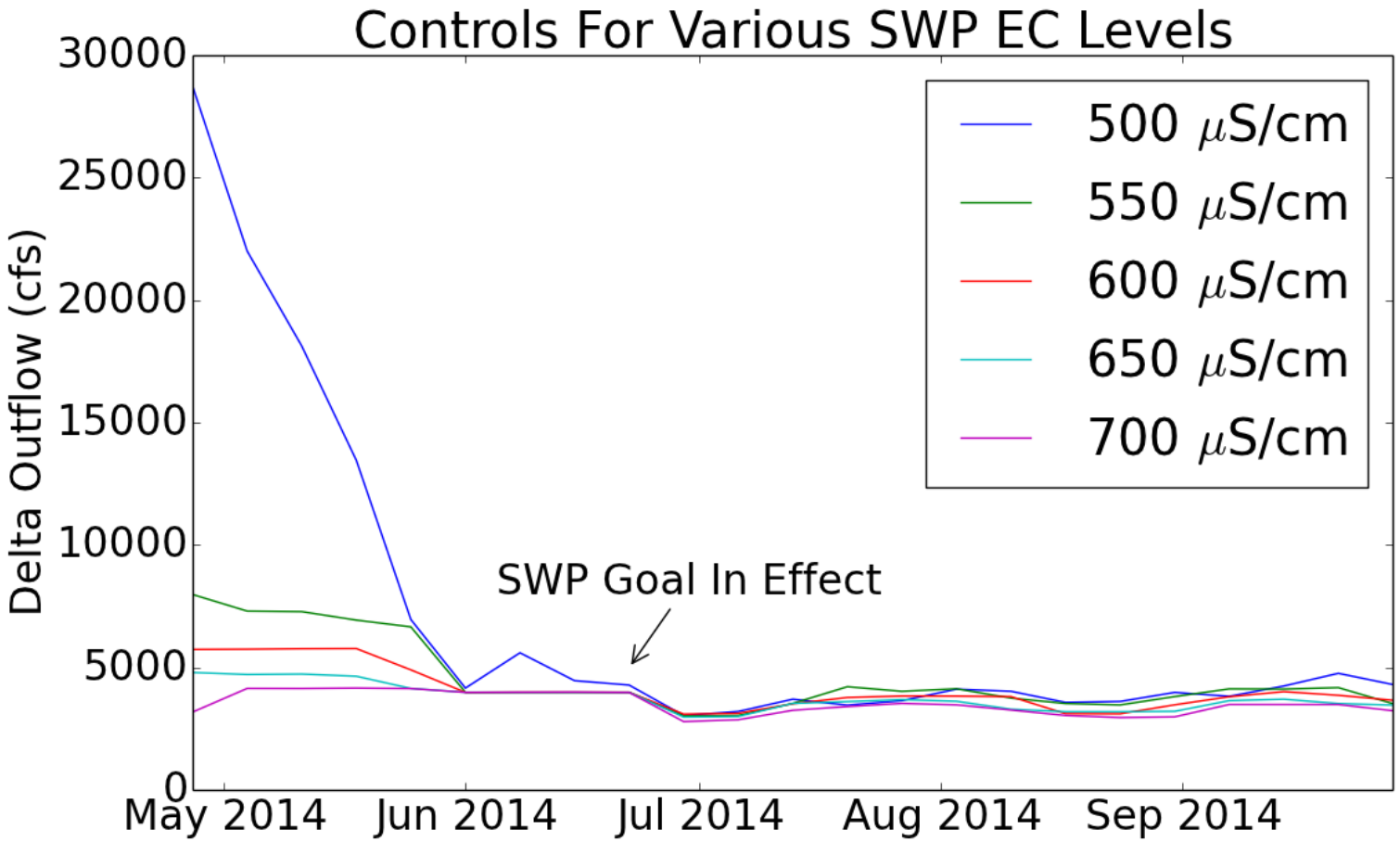
Large salinity change for fixed flow pattern

Small water cost savings for fixed salinity constraint

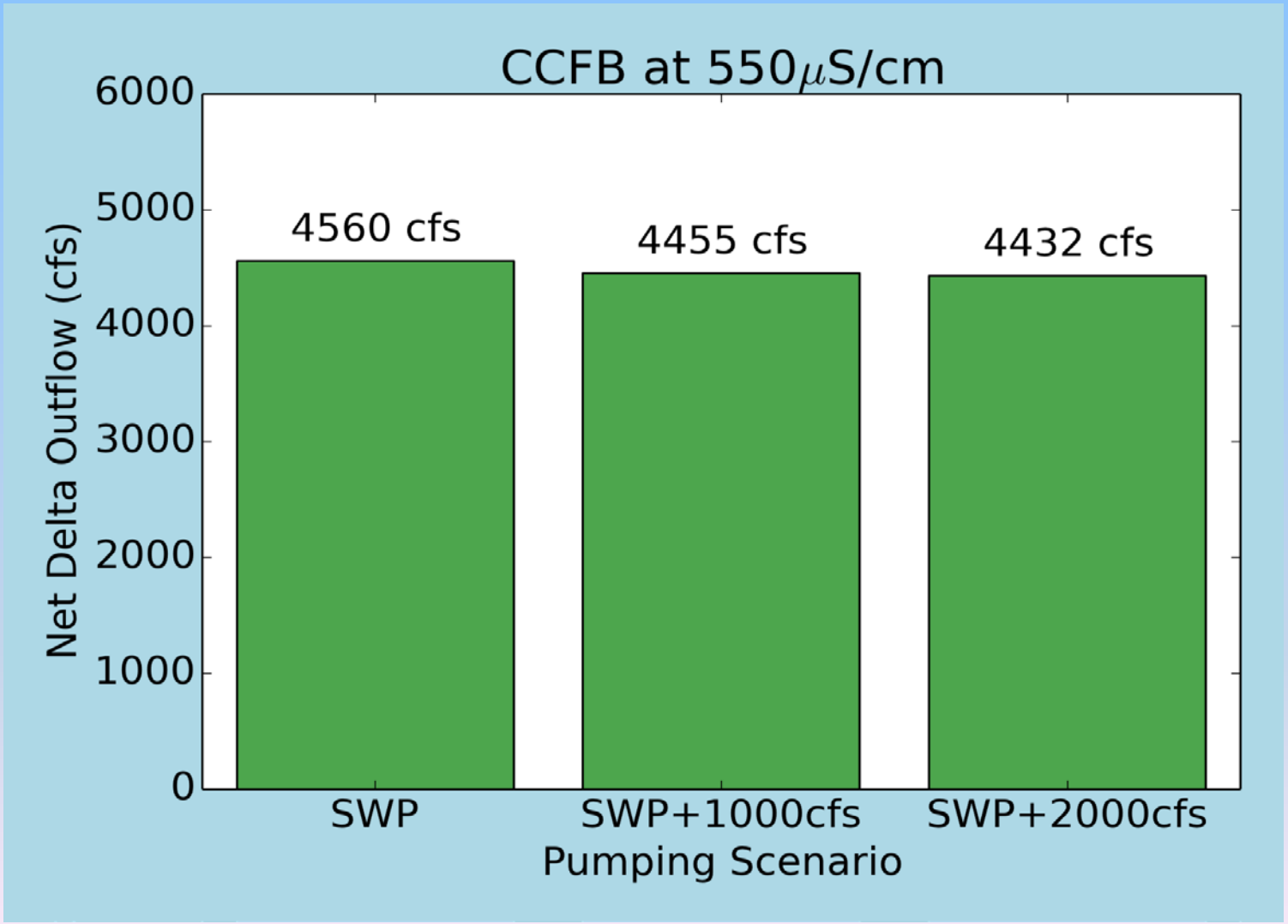
Round 2: SWP and Drinking Water

Clifton Court: Beyond D-1641?




Controls For Various SWP EC Levels
Delta Outflow (cfs)
30000
25000
20000
15000
10000
5000
0
May 2014
Jun 2014
Jul 2014
Aug 2014
Sep 2014
SWP Goal In Effect
500 μS/cm
550 μS/cm
600 μS/cm
650 μS/cm
700 μS/cm

CCFB Cleaner than Ambient? …. Negative Carriage Water



Summary

- Water cost analysis is well-defined
  - Prevents or exaggerates absurd proposals
  - In the “calibration zone”
- Salinity improvement, water cost not similar
- If it looks optimal, its probably close
- Secret is tracking western stations
- Ambient Delta conditions matter for low EC

Questions? eli@water.ca.gov

Thanks to Siqing Liu and folks at O&M who prepared most inputs to these runs