Implications of restoration on hydrodynamic and transport processes in the delta

A Valentine’s Day Hangover

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Flow Station Network (circa Nov 2011)

Base-line pre-project data
A restoration/conveyance masterplan is needed supported by a significant modeling capability (Hydro model + operations model).

Conclusion
Today’s Plan

Discuss REGIONAL SCALE implications of two restoration efforts:
(1) Prospect Island
(2) “Sutter/Miner Bypass”
(Levee setback figment of my imagination)
Prospect Island

~1,300 acres
Prospect Island

Design Features

- Breaches
- Overflow weir
- Primary channels
- Secondary branch channels
- Connecting channels depending on selected breaches
- DWR and Port properties
- Adjacent property access
Effect on Salmon outmigration?
Increased population level survival without a single smolt entering Prospect Island?

Any tidal marsh restoration in this region will have this effect.

More tidal energy

Sutter+ Steamboat
Become less bi-directional
Greater entrainment
Higher survival?

Lower Entrainment
In central delta
Higher survival
Greater water deliveries using Proposed Isolated Facility?

Flow becomes bi-directional
At Sac. R. flows of ~10k cfs NOW

Tidal marsh restoration will allow withdrawals into IF at lower Sac river flows – good for drought Operations?

Bi-directional flow Creates converging flows at Intakes! Not good!

More tidal energy
Effect on regional scale water quality? Which in turn could reduce water supply

- More tidal energy
- Greater net flow
- Less tidal energy
- Decrease in delta transfer flow
- Increase in EC @ Emmaton
- Increase in EC @ Jersey Pt.
- Decrease exports
- Increase Reservoir releases
Effect on local turbidity field?

- Suspended Sediment Sink?
- Wind-wave resuspension zone

Liberty Island
Effectiveness of restoration as donor habitat will be influenced by regional scale hydrodynamics.

- Export of Biomass
  - Sac River water? (Fremont weir Knights Landing Ridge cut)
- Ag withdrawals
- North Bay Aqueduct
- Net Flow negative at CCH gage
Finite Tidal Energy – take 1
Restoration Project Interaction

1. Bunch of Tidal marsh Restoration
   Stranded?

2. Bunch of new marsh restoration

3. Salinity Intrusion?

4. Water Cost?

Carquinez St.
Hydraulic control?
Finite Tidal Energy – take 2
Levee Failure – Island Flooding

Bunch of tidal marsh Restoration
Stranded?

Bunch of marsh restoration
Not-Stranded?

Lots of levees Fail – flooding of Several islands

Tidal Energy
Crazy Idea…. Miner Bypass

Summer - low flow

Real Geomorphology!

Prospect I

Gates (Partially Open)

Gates (Partially Open)
Crazy Idea…. Miner Bypass

Winter - Flooded

Prospect I

Gates (open)

Gates Open)
Whoa?! – Prospect Island is in the way!

There are opportunity costs associated with everything we do!

We have limited tidal energy, money and a host of landscape constraints

How does Prospect fit in our longer term plans?
Increase water supply during droughts

Simply Close Gates

(1) Increase Delta Transfer Flow

(2) Reduce upstream tidal influence – increase IF withdrawals
Increase water supply during droughts

Tidal influence will decrease – increase if withdrawals while minimizing environmental impacts

Increase delta transfer flow

Summer - low flow

Real Geomorphology!

Prospect I

Gates (Partially Open)

Gates (Partially Open)
Balance Salinity between Sac and SJ – increase water supply

DWR Project
3mi Slough

Throttle gates

EC standard @ Emmaton

EC standard @ Jersey Pt.

DWR Project
3mi Slough
Rapidly restore exports after large number of levee failures

“Straw”

Close Gates

Create Pool of Fresh water

~30 miles of levee
Increase salmon survival

Open gates wide (winter operation)

(1) Create bypass with actual habitat (cover, forage)

(2) Massively reduce delta transfer flow and entrainment of juvenile salmon into central delta
Good for salmon!

Bypass habitat!

Winter - Flooded

Prospect I

Gates (open)

Gates Open)

Reduction in delta Transfer flow and Entrainment of juvenile salmon

North delta salmon survival ~ 20-25% (100km)
Massive Reduction of Suspended Solids flux into central delta

Attract delta smelt into north delta? Keep delta smelt out of central and south delta?
Conclusions

At the restoration scale proposed:

(1) There will be REGIONAL SCALE implications to proposed restoration efforts

(2) There will be interactions among restoration efforts
Final Conclusion

A restoration/conveyance masterplan is needed supported by a significant modeling capability (Hydro model + operations model).