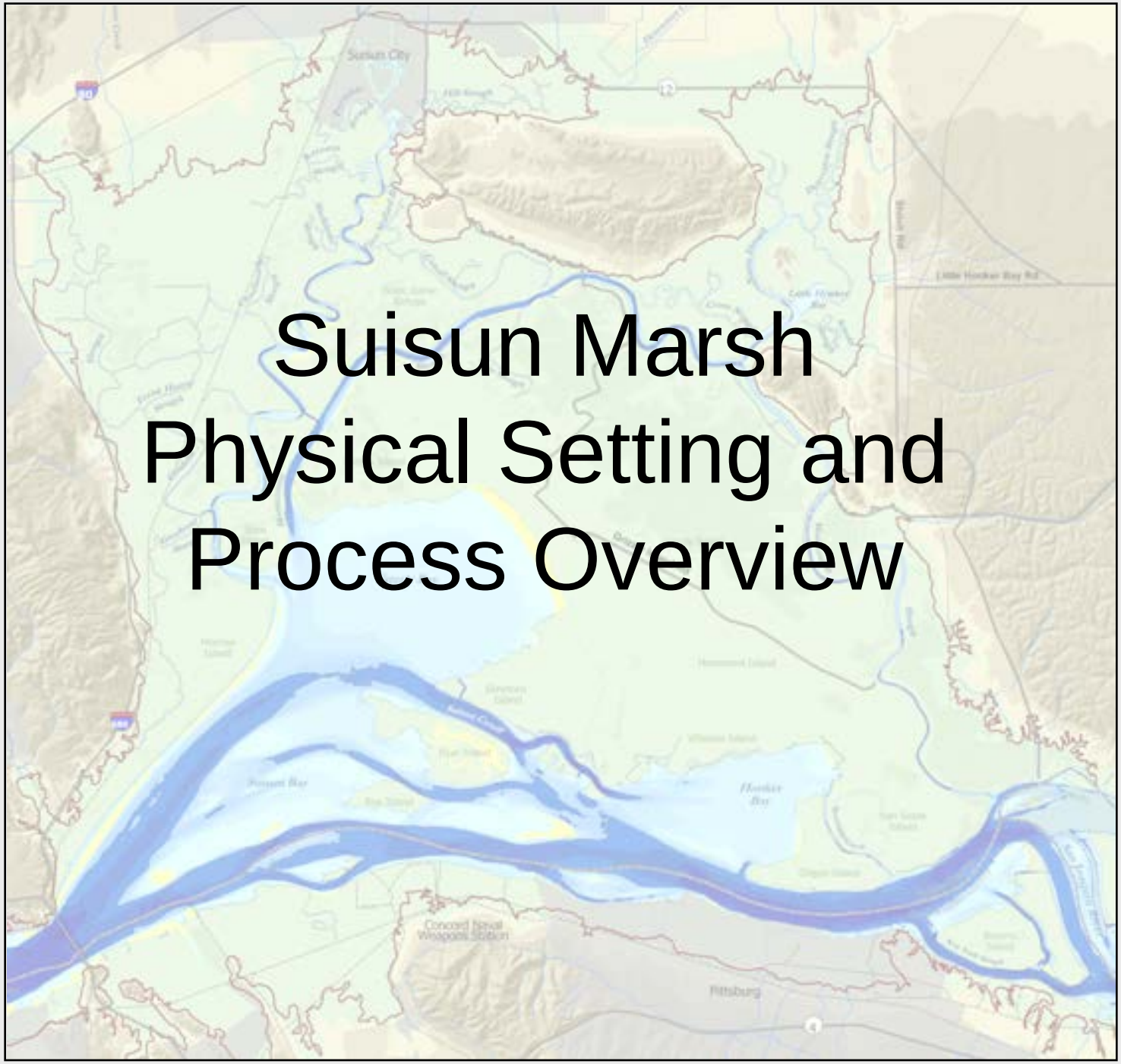
Suisun Marsh Physical Setting and Process Overview

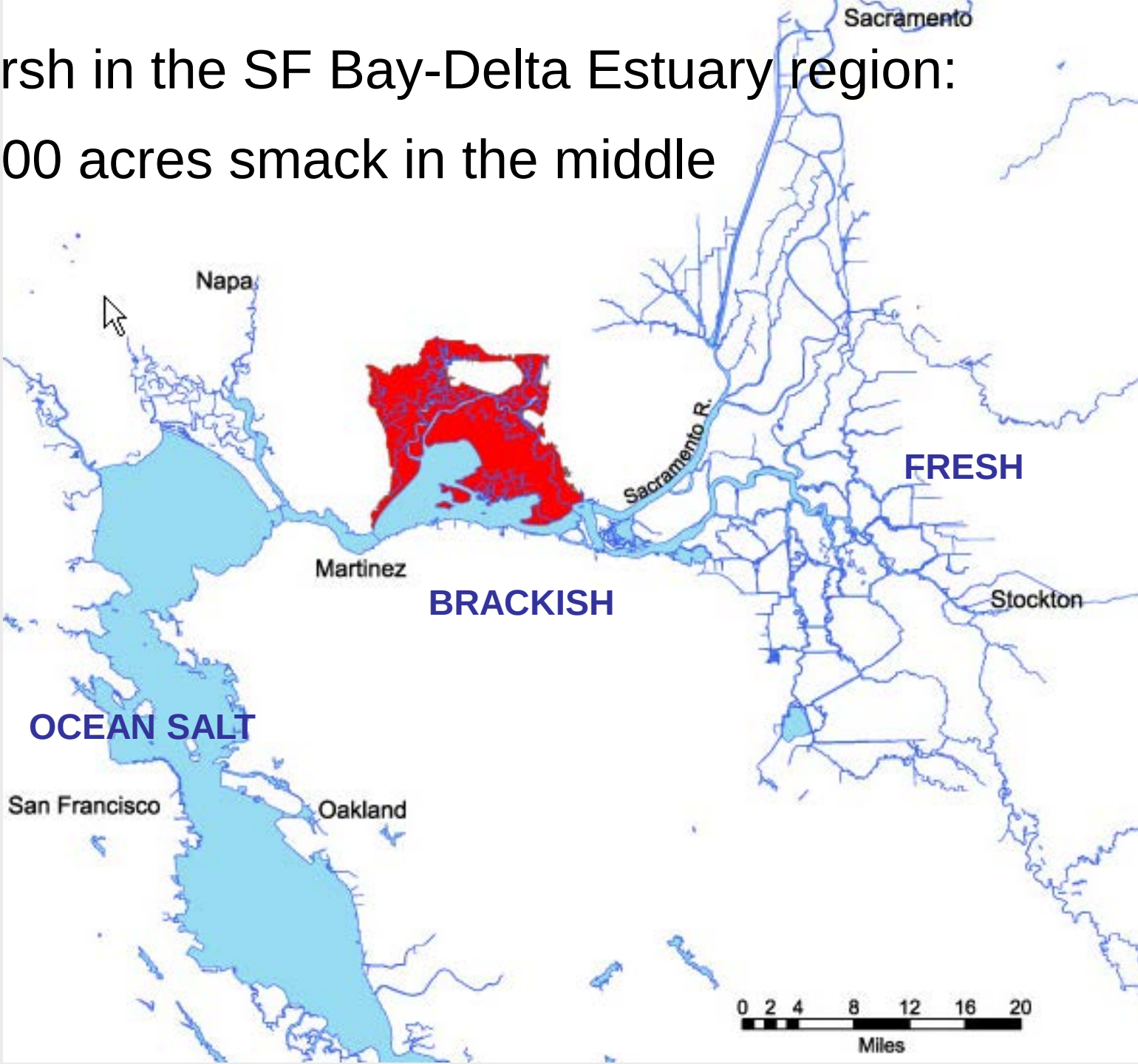


Topics

- Suisun in regional estuary context
- What’s on the land?
- Why are water projects here?
- Connectivity: volume exchange and flows

Suisun Marsh in the SF Bay-Delta Estuary region:

~ 120,000 acres smack in the middle



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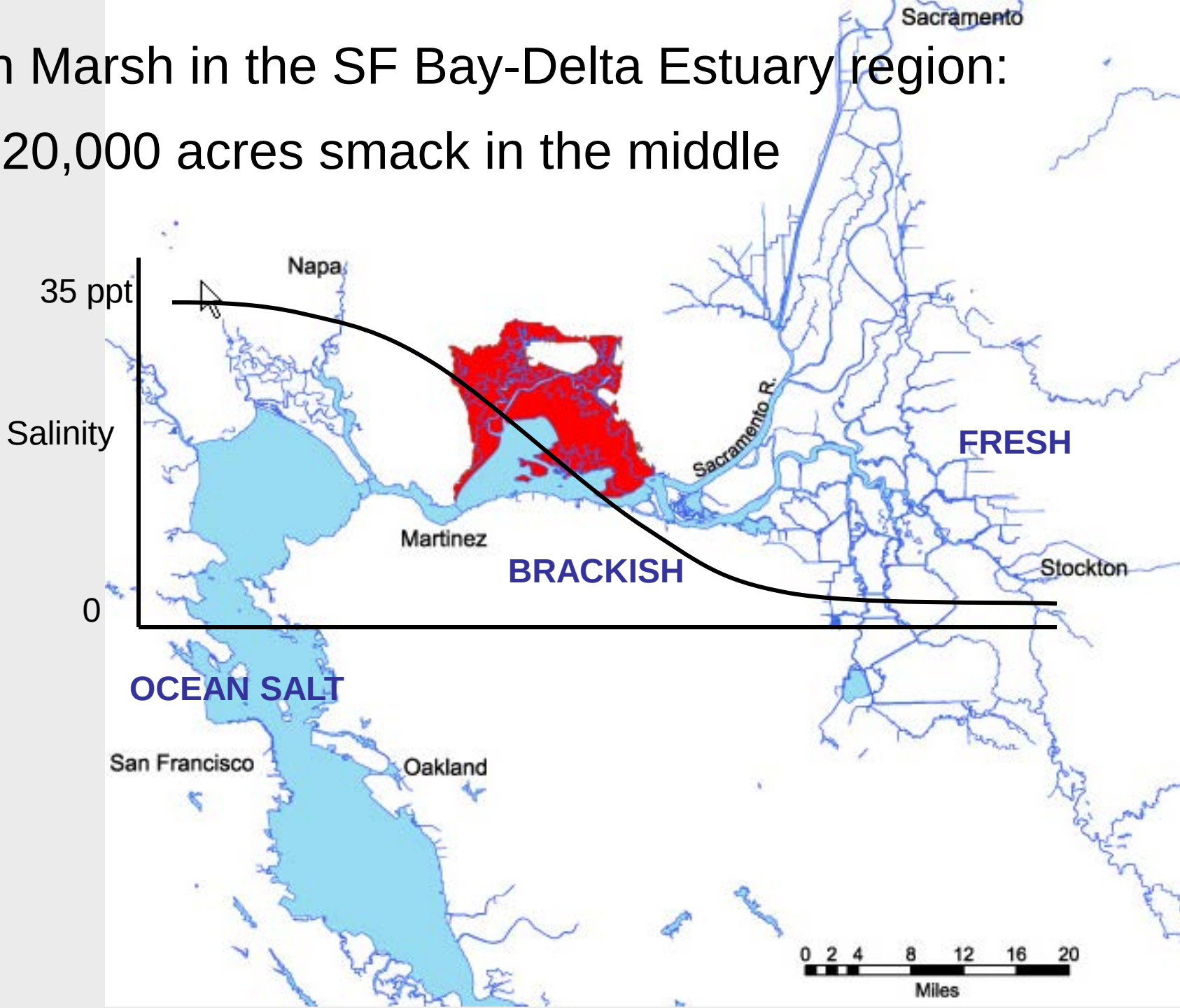

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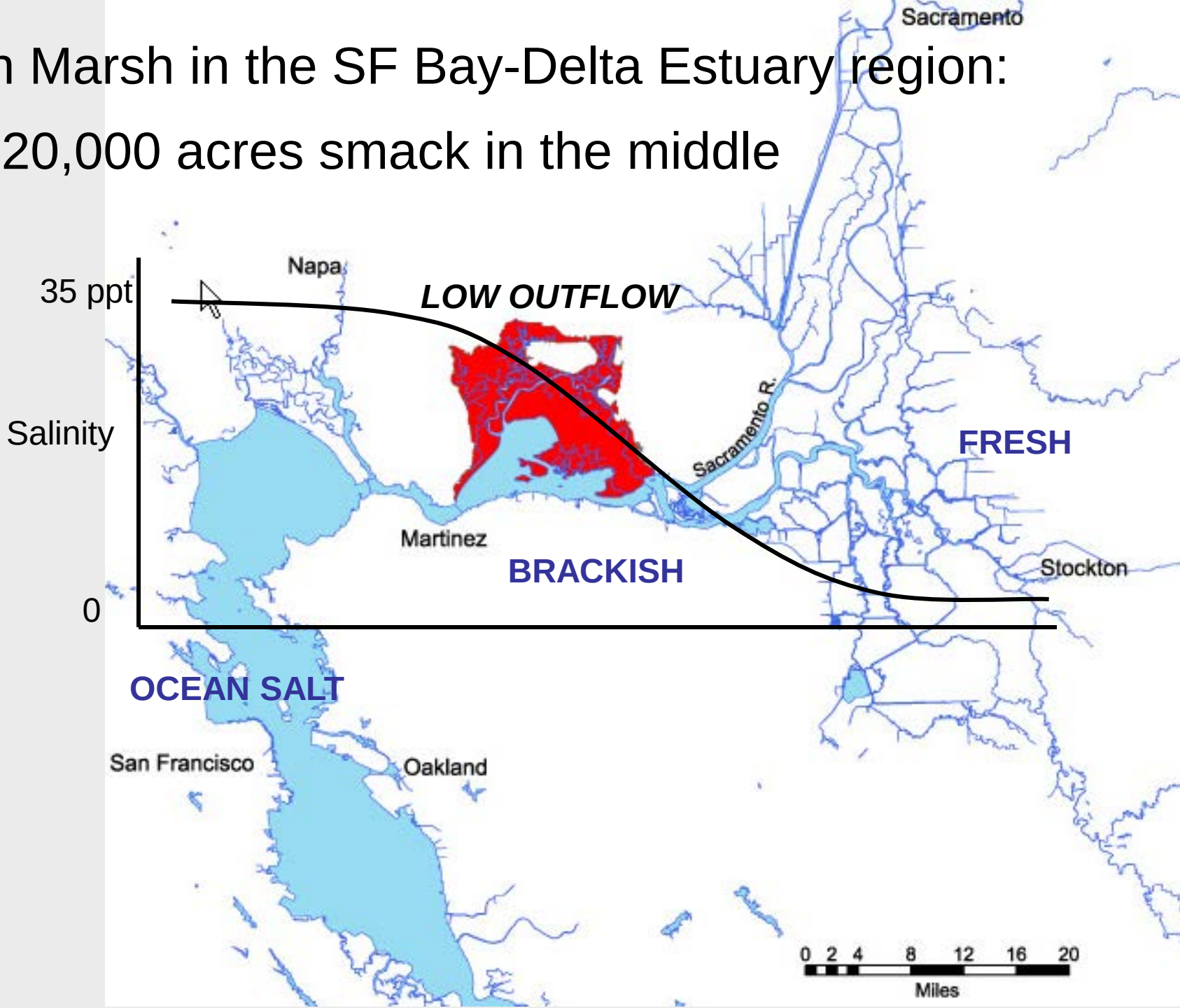

Suisun Marsh in the SF Bay-Delta Estuary region:

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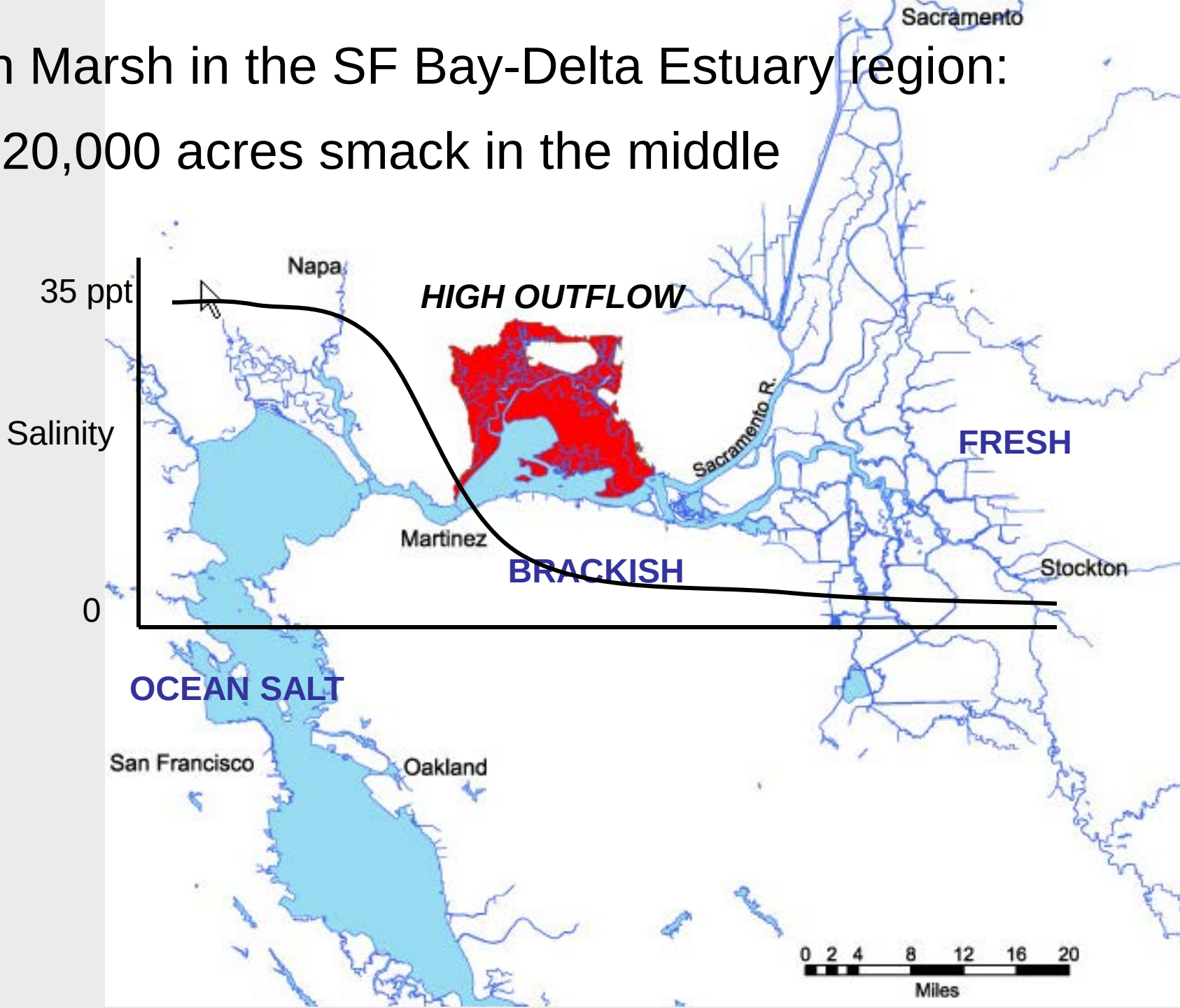
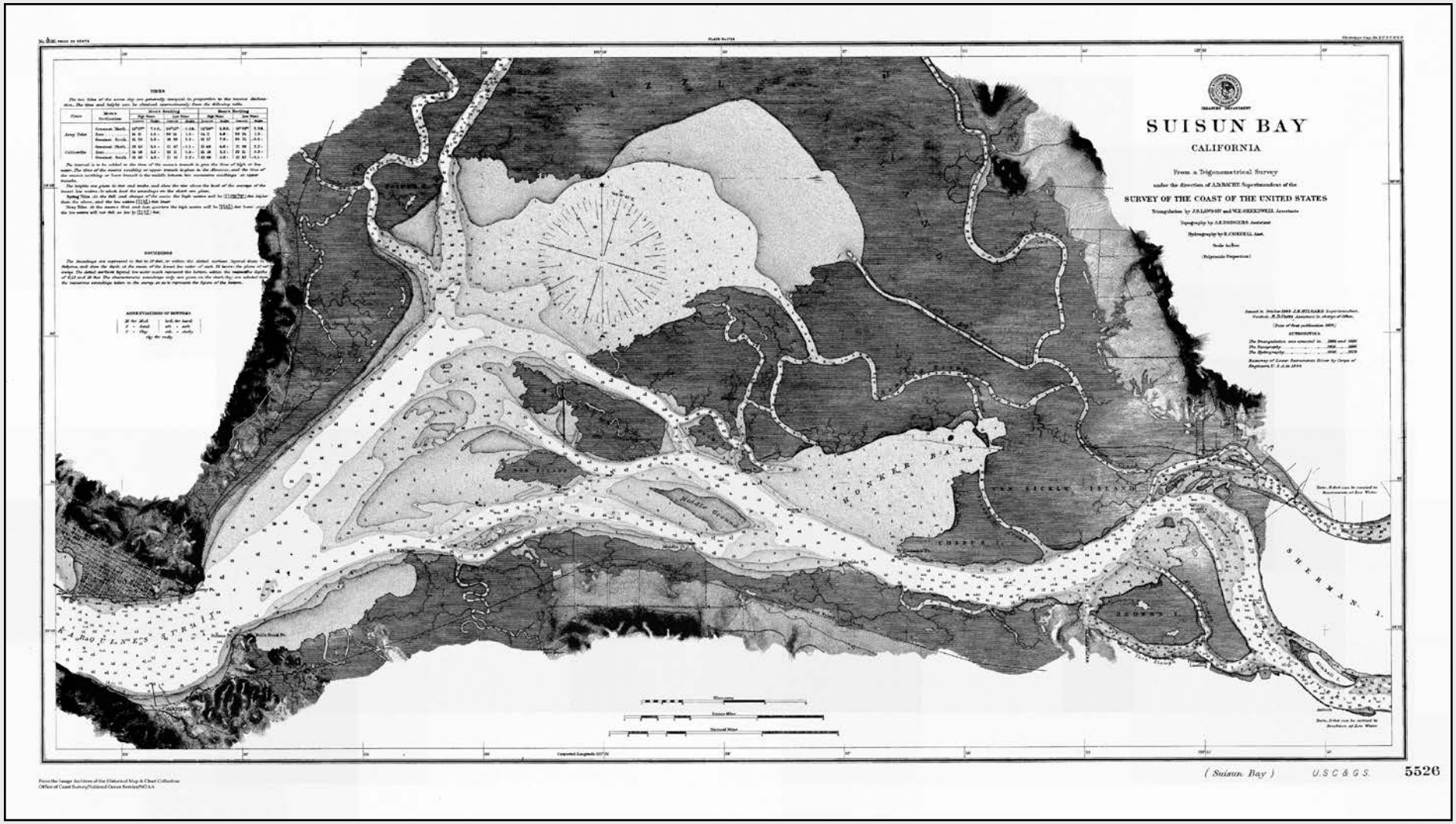


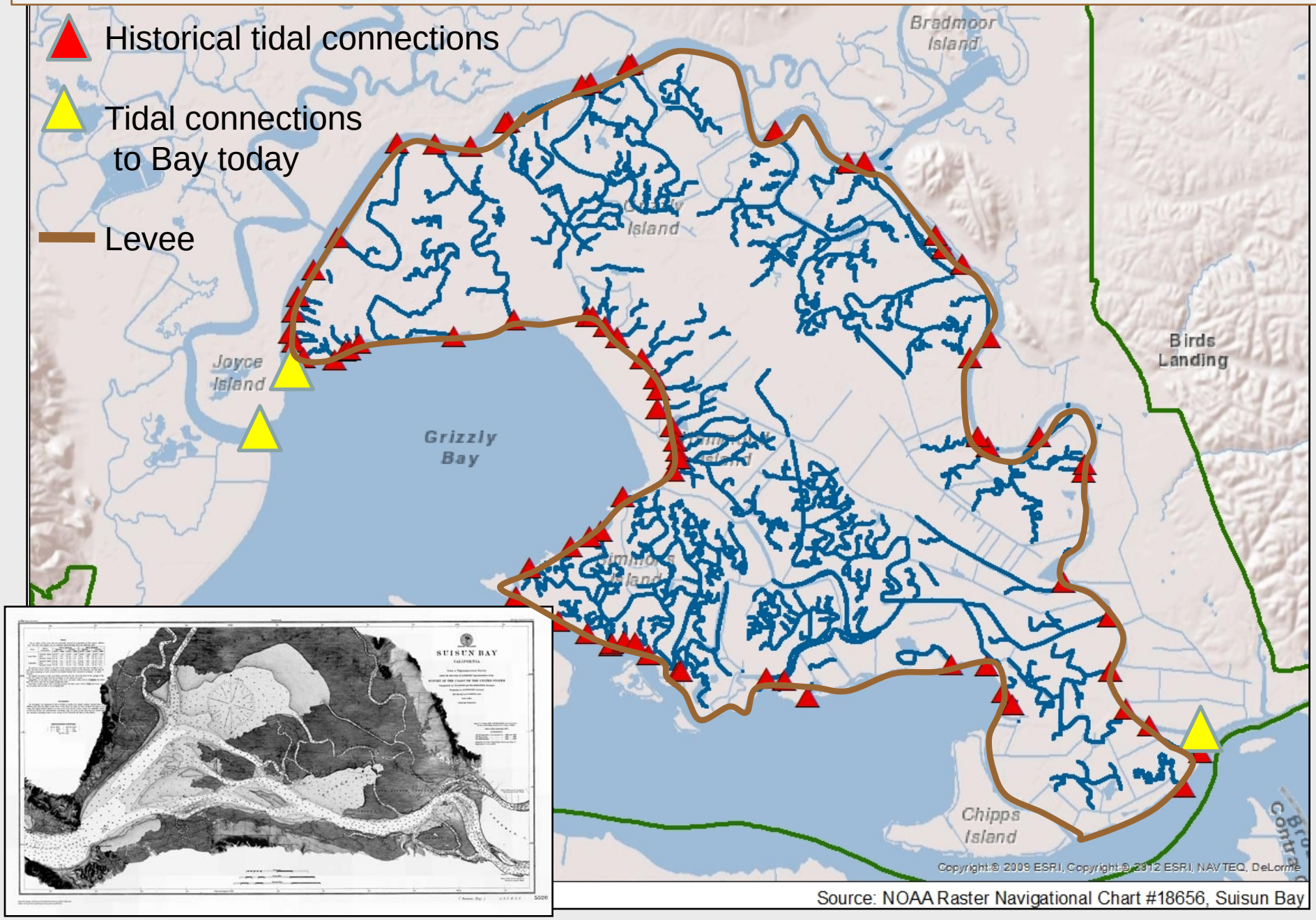
What’s on the land, then and now?

Suisun Marsh 1870's



8/06 2/04

Historical and Contemporary tidal connectivity

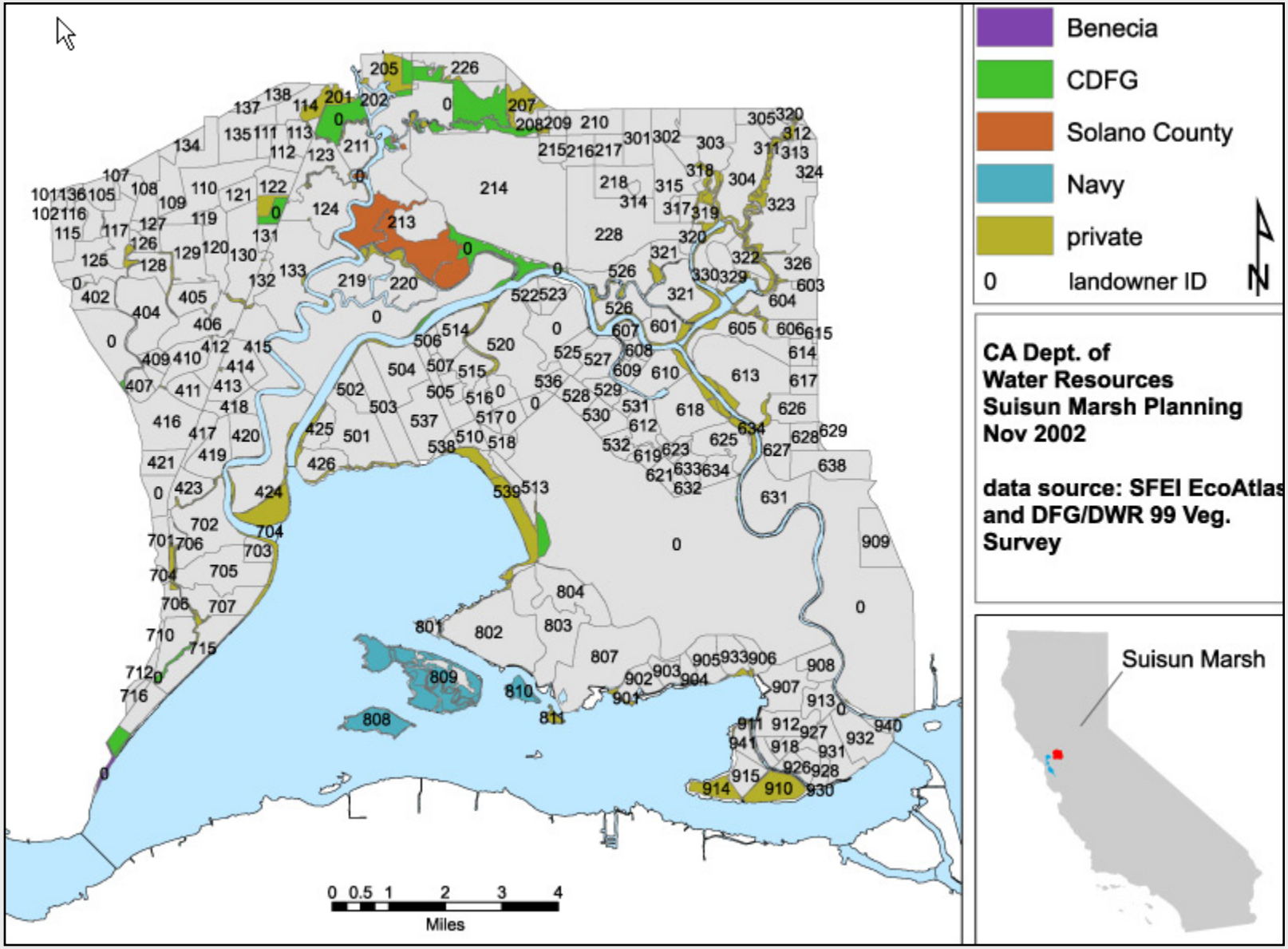


Source: NOAA Raster Navigational Chart #18656, Suisun Bay

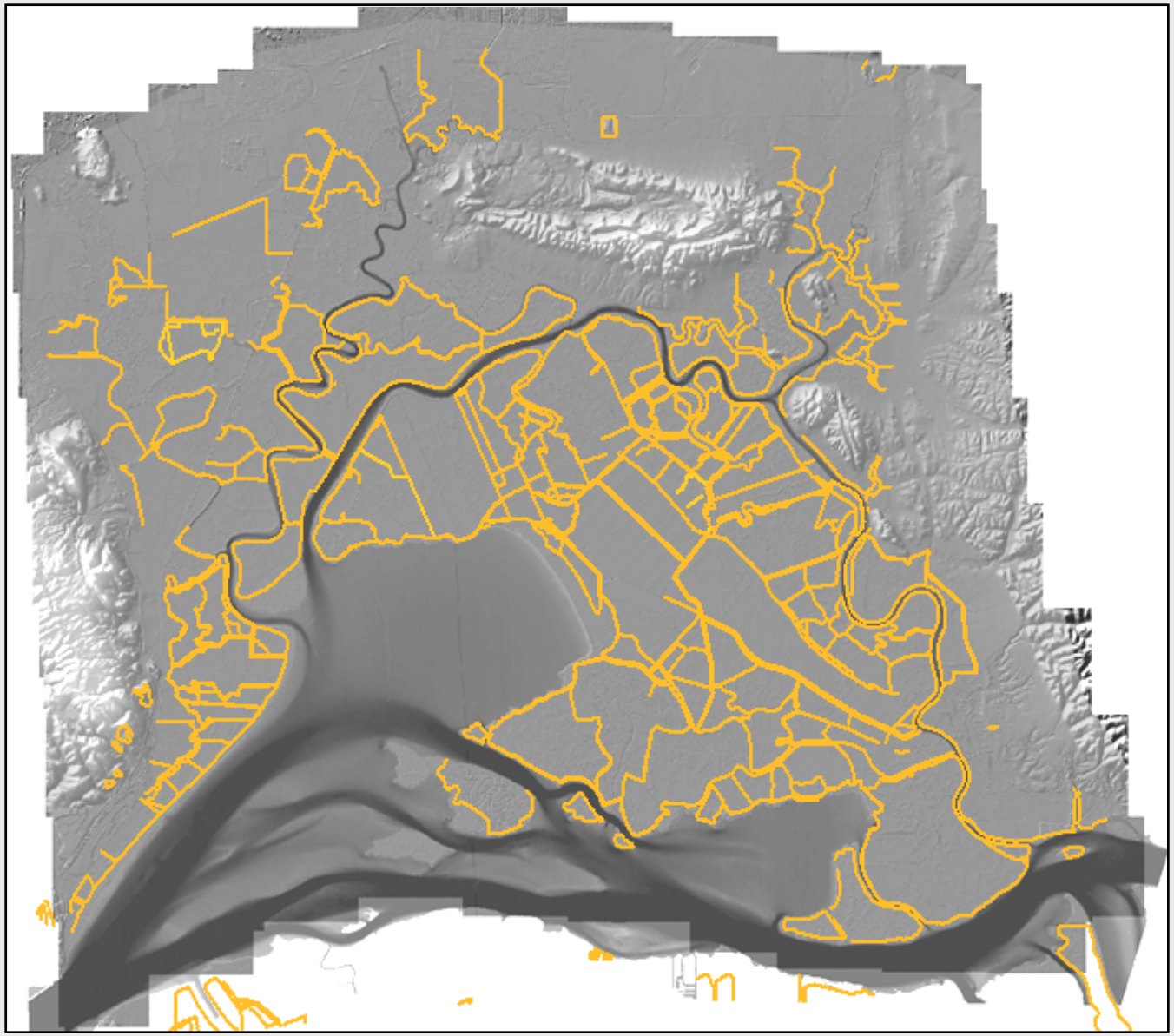
Contemporary land use

- 52,000 acres managed (non-tidal) wetlands
- 30,000 ac bays, channels, sloughs
- 27,000 ac upland grassland
- 6,300 ac tidal wetlands

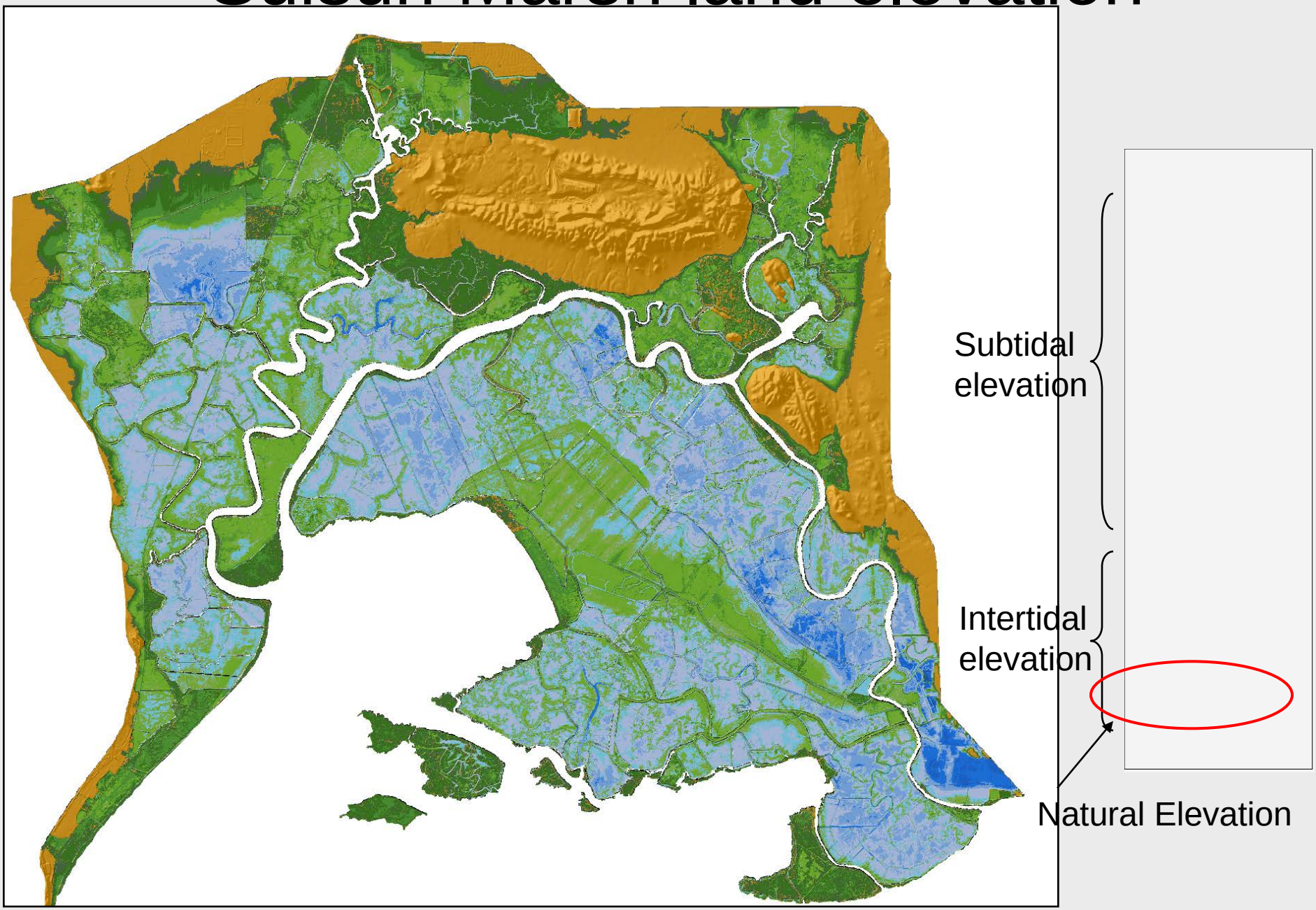
Land ownership



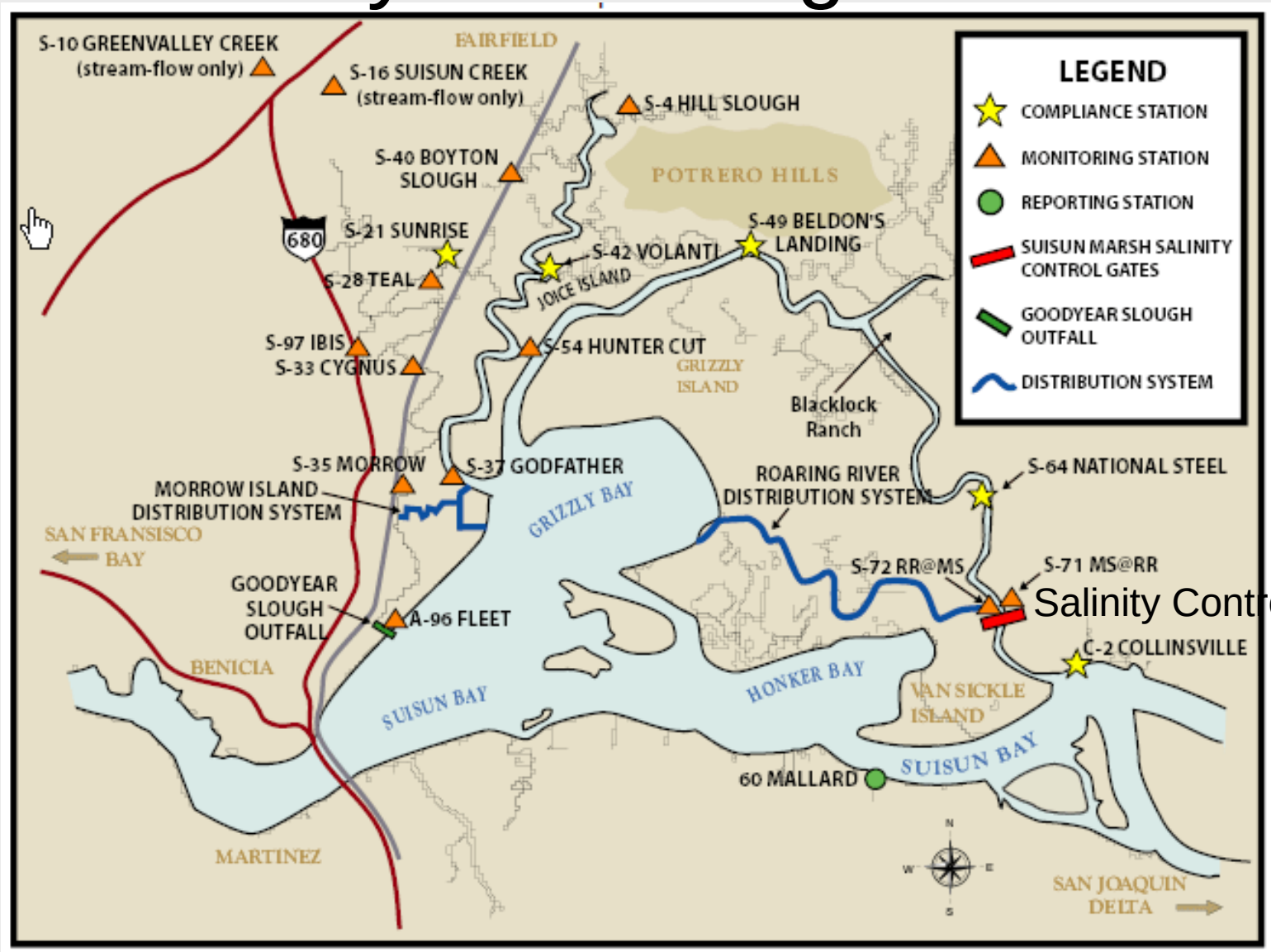
Internal levees between properties



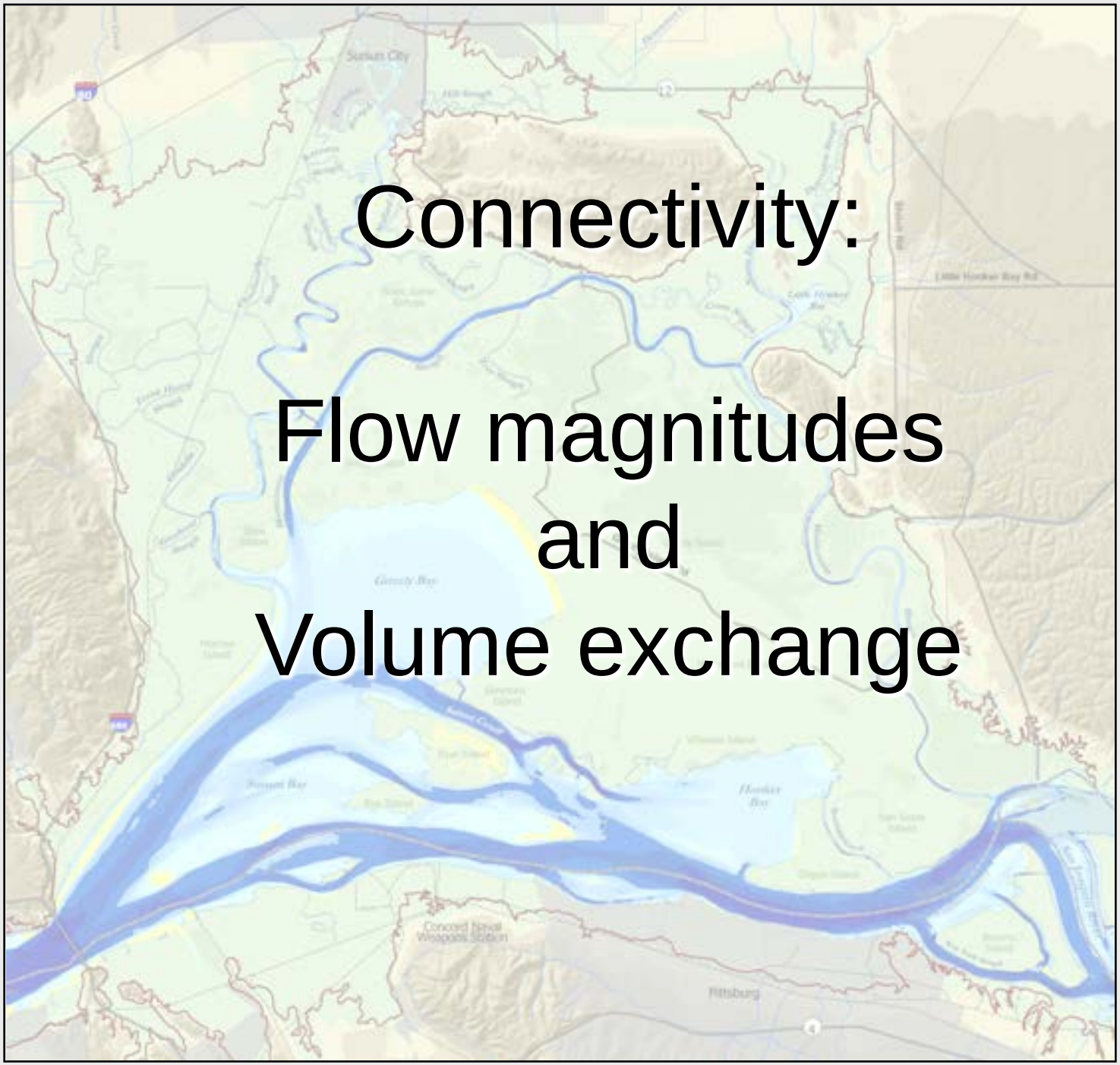
Suisun Marsh land elevation



Salinity Control Facilities and Salinity Monitoring Stations



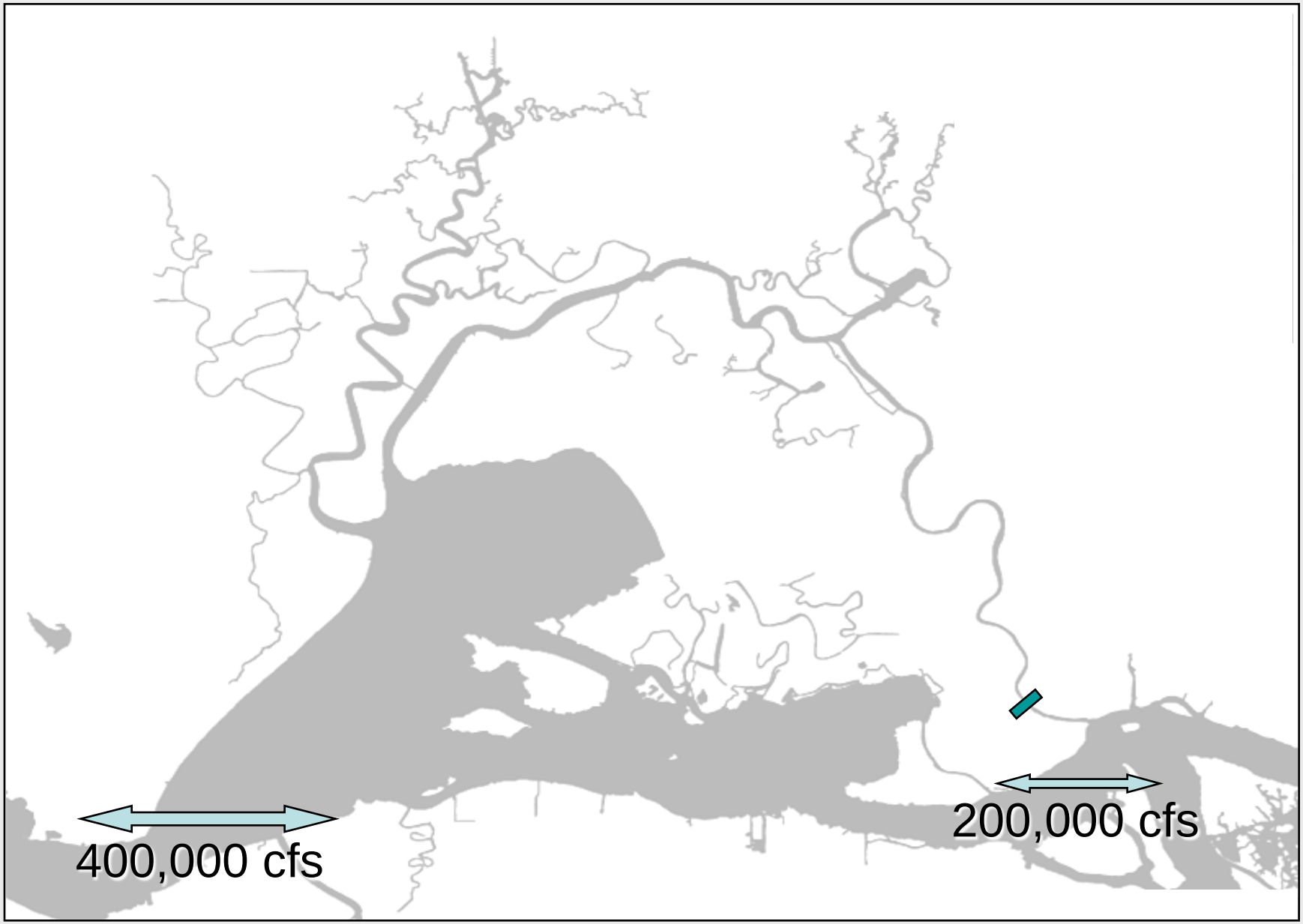
Salinity Control Gate



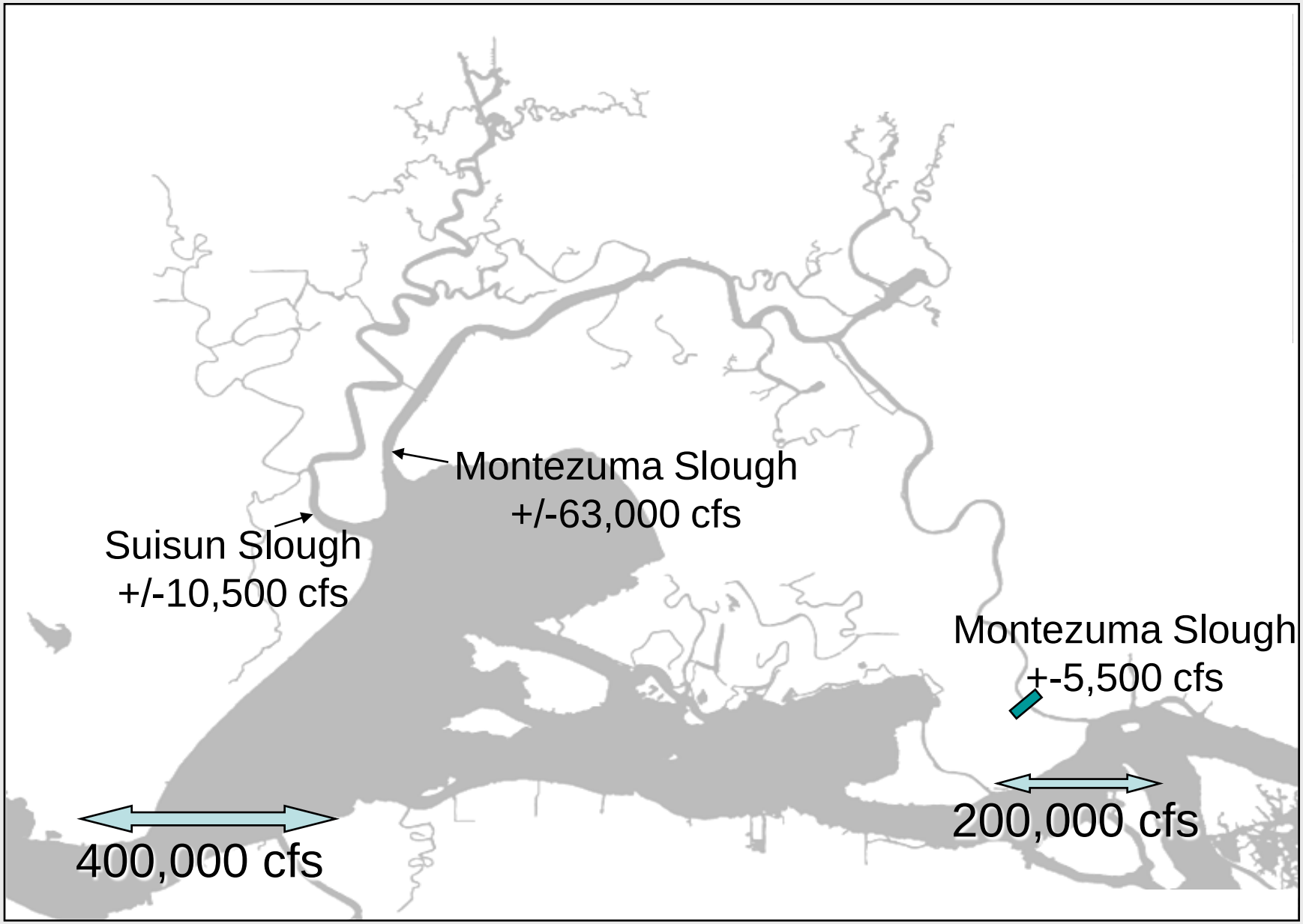
Connectivity:

Flow magnitudes and Volume exchange

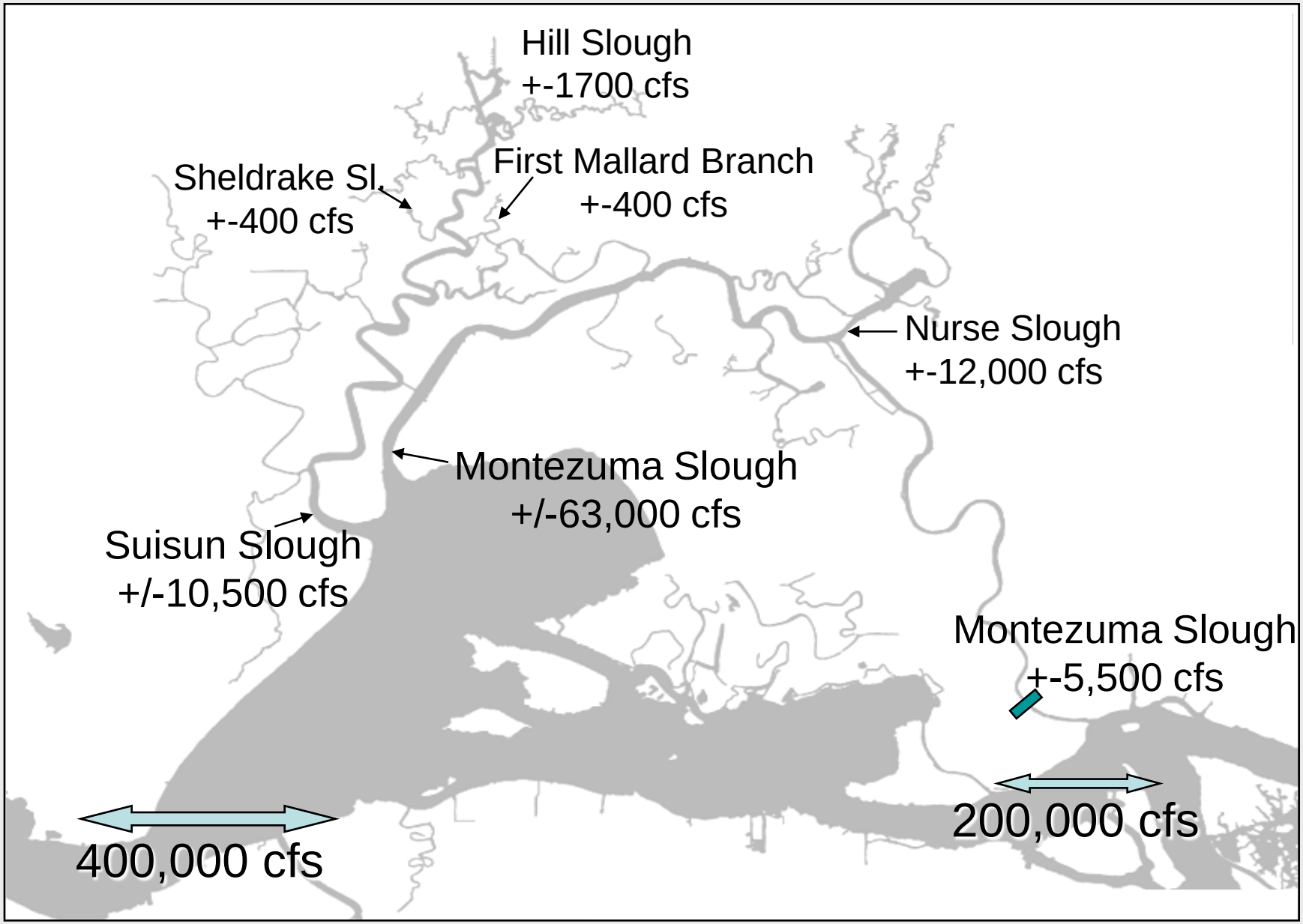
Tidal Time Scale Flows



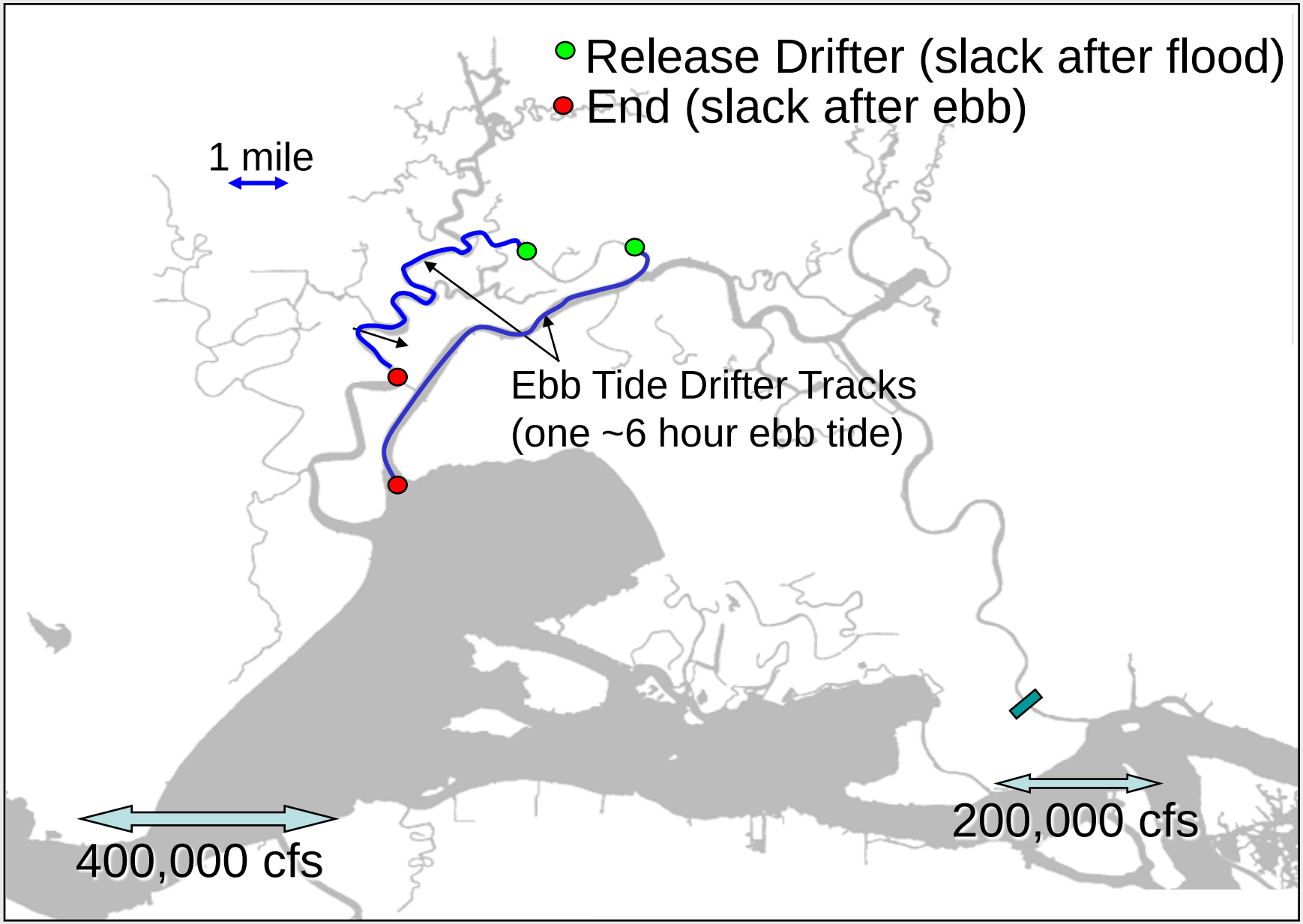
Tidal Time Scale Flows



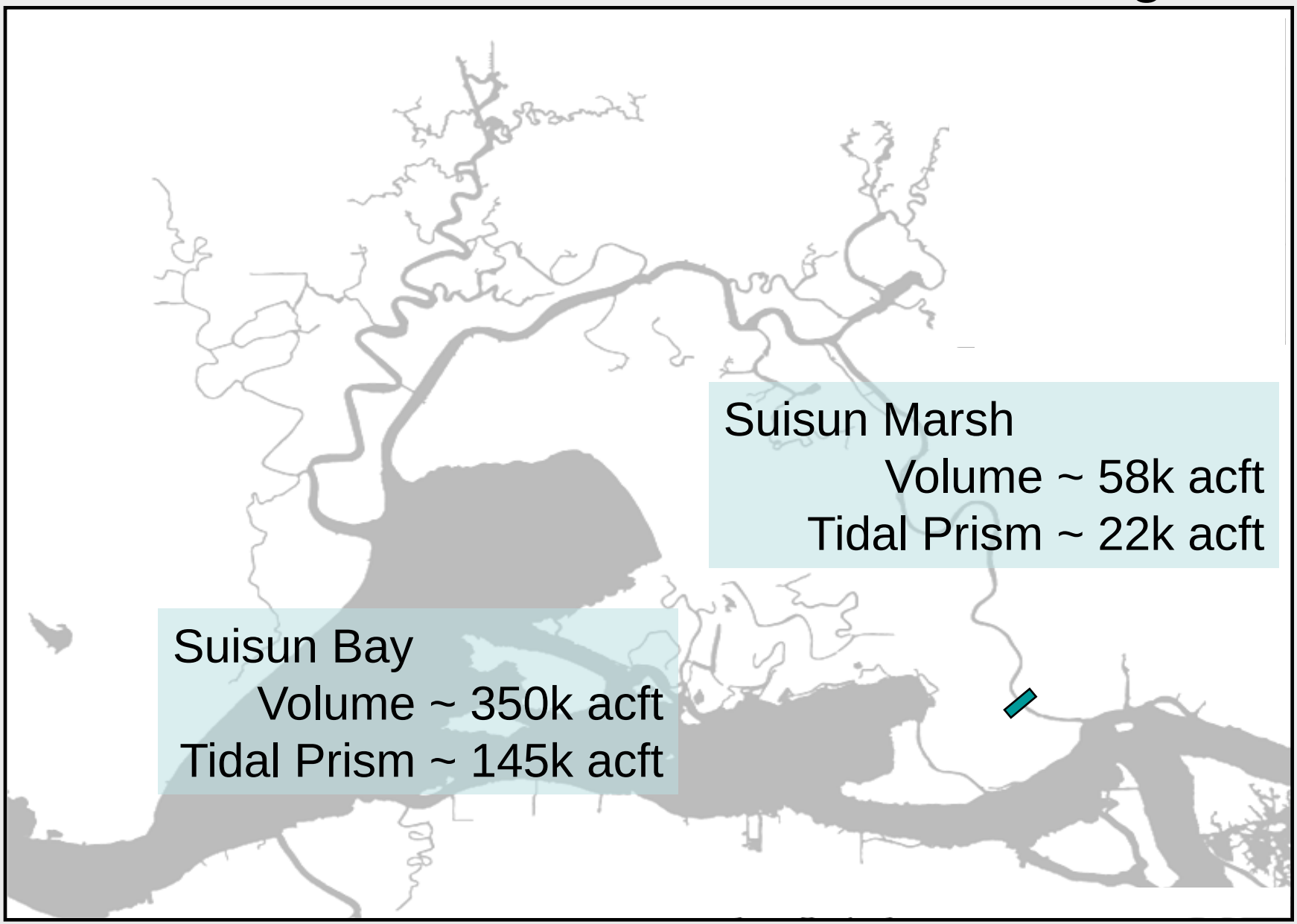
Tidal Time Scale Flows



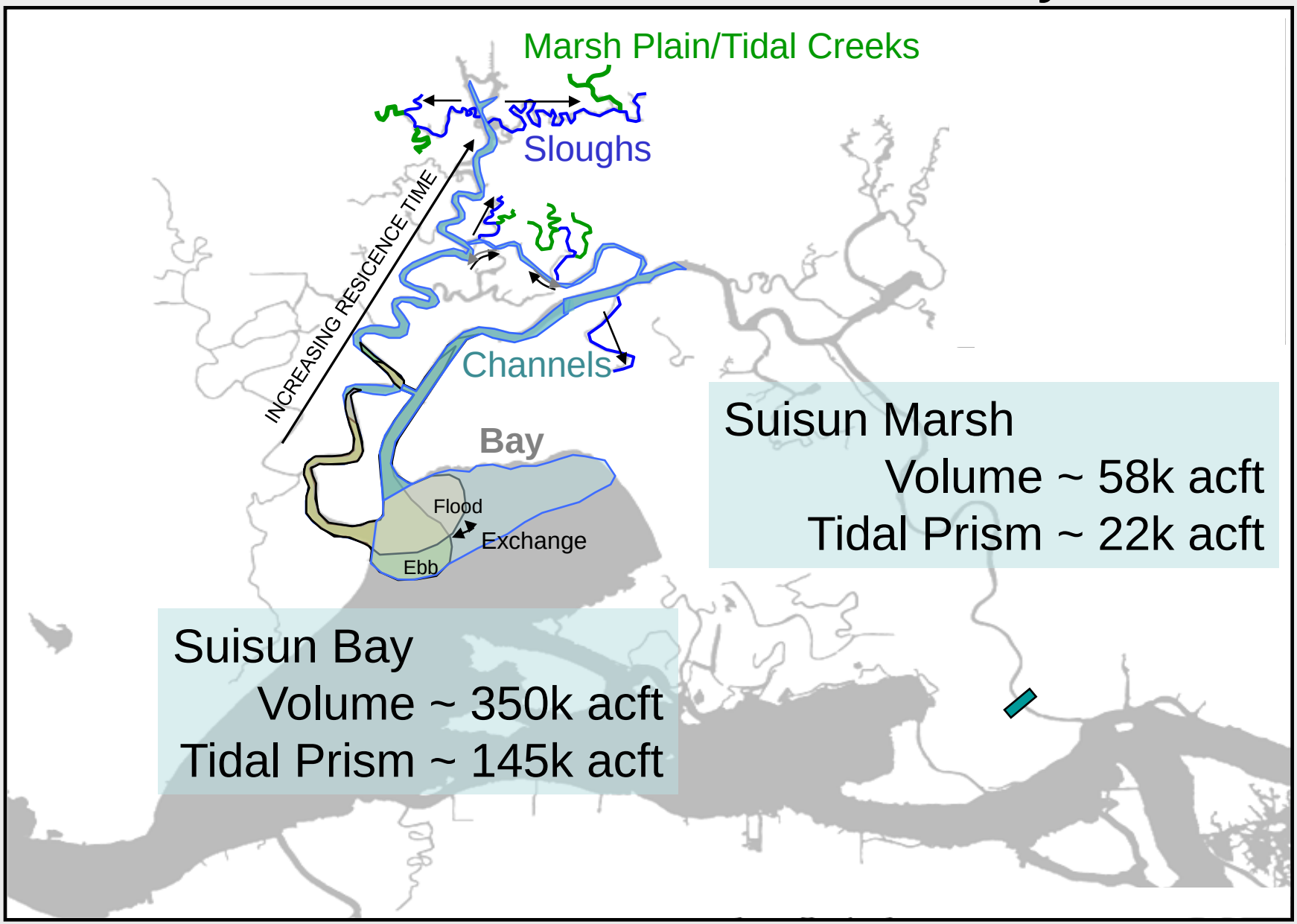
Tidal Time Scale Excursion



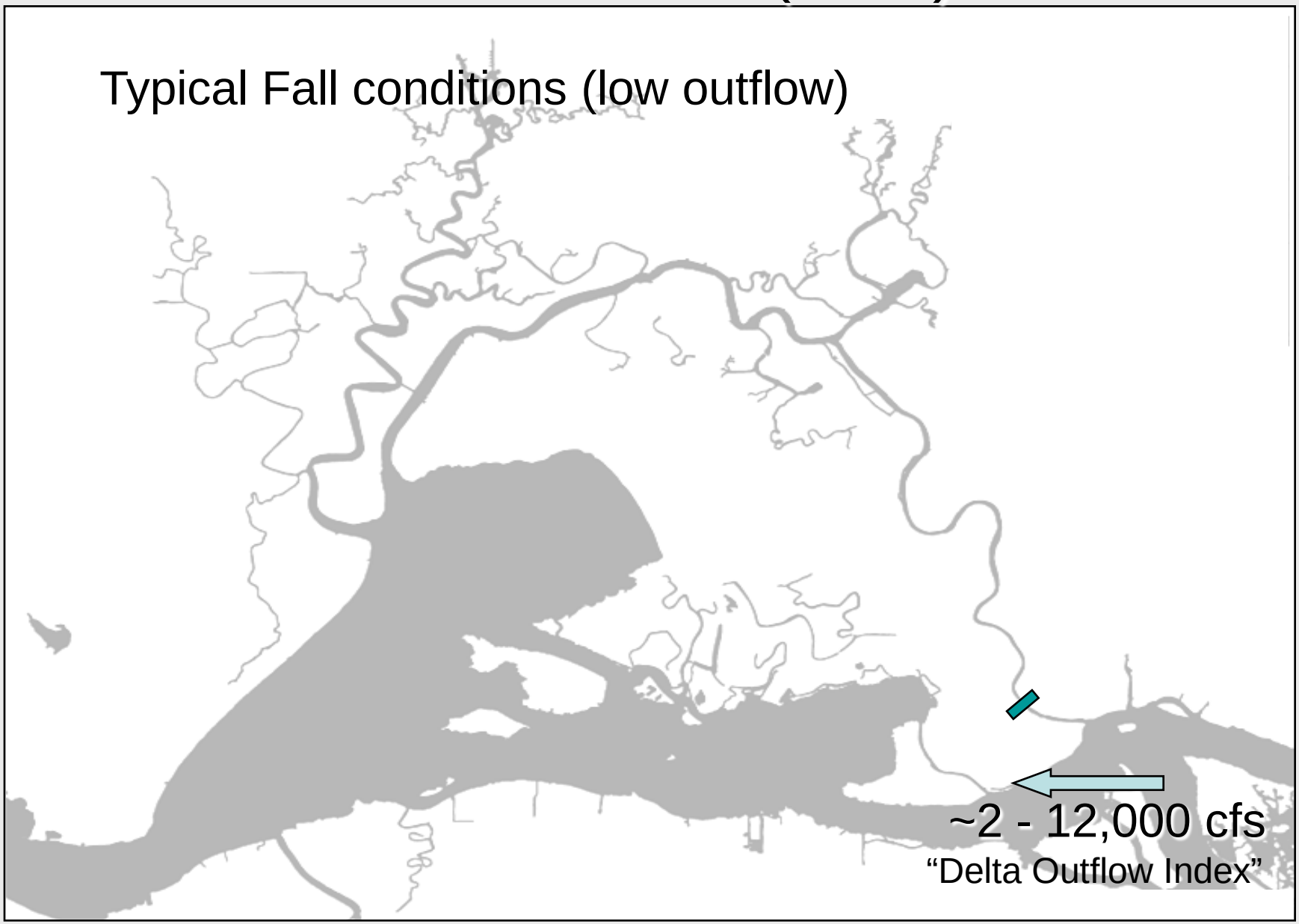
Tidal Time Scale “Volume Exchange”



Tidal Time Scale Connectivity



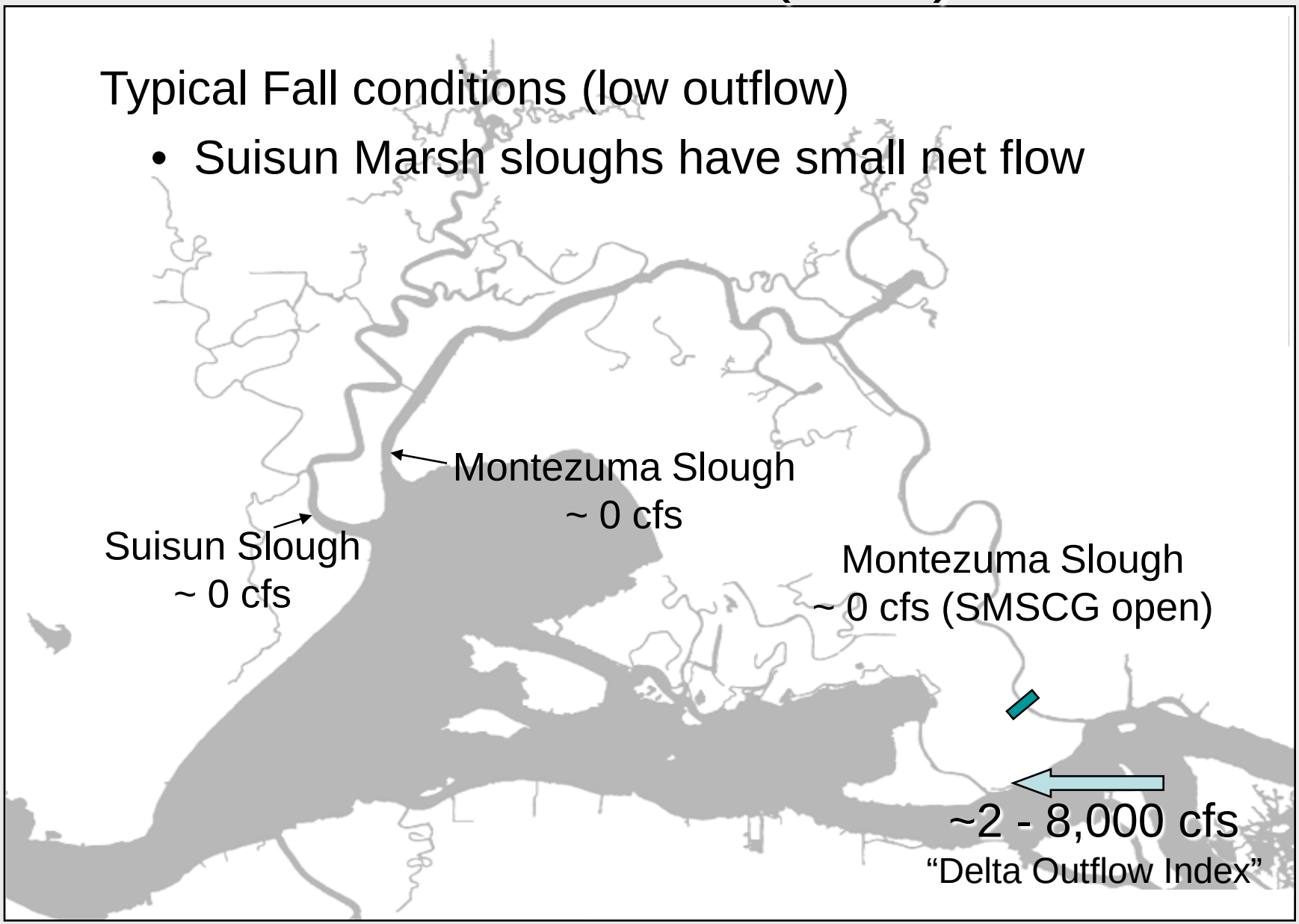
Sub-tidal Time Scale (“Net”) Flows



Sub-tidal Time Scale (“Net”) Flows

Typical Fall conditions (low outflow)

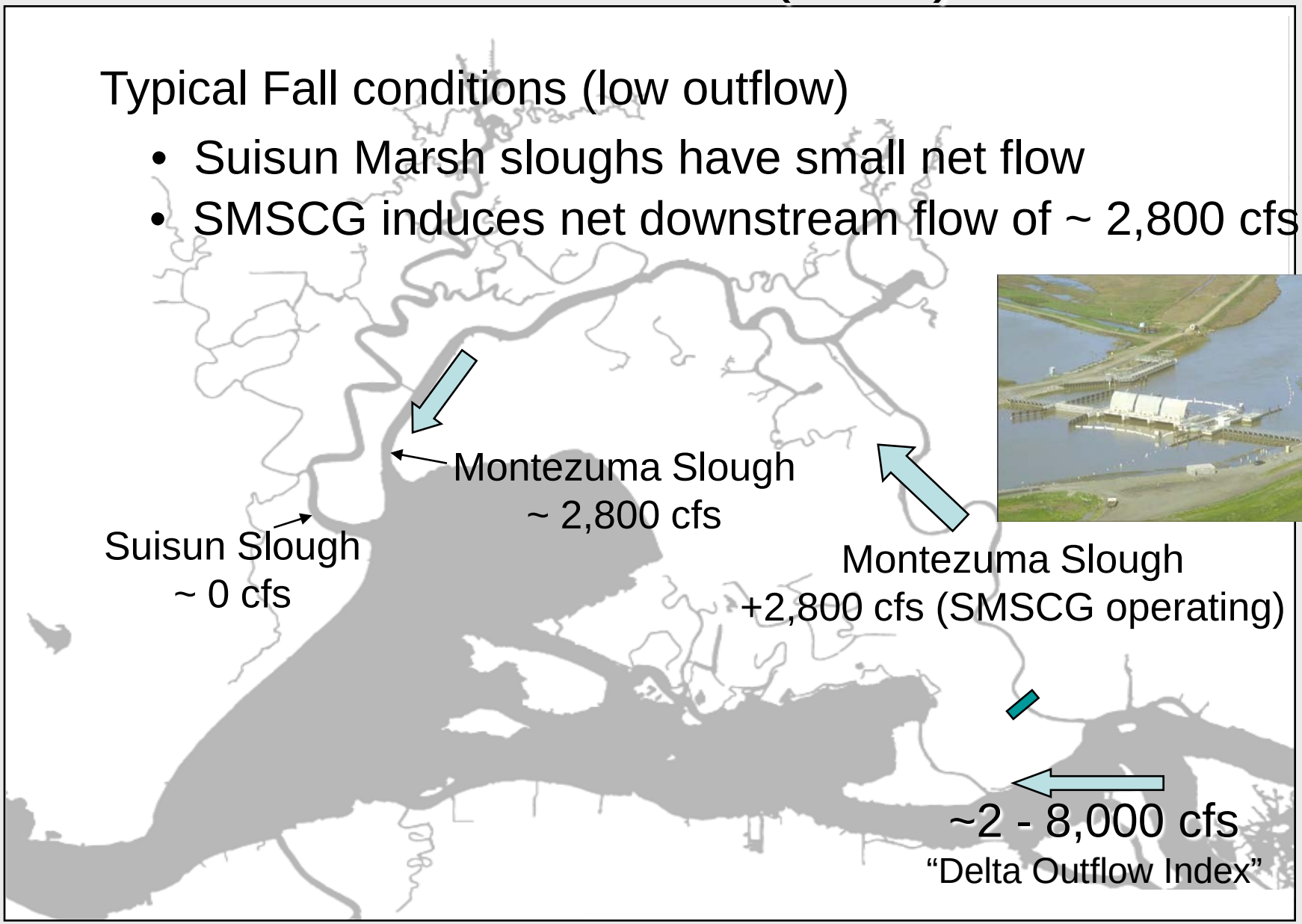
- Suisun Marsh sloughs have small net flow



Sub-tidal Time Scale ("Net") Flows

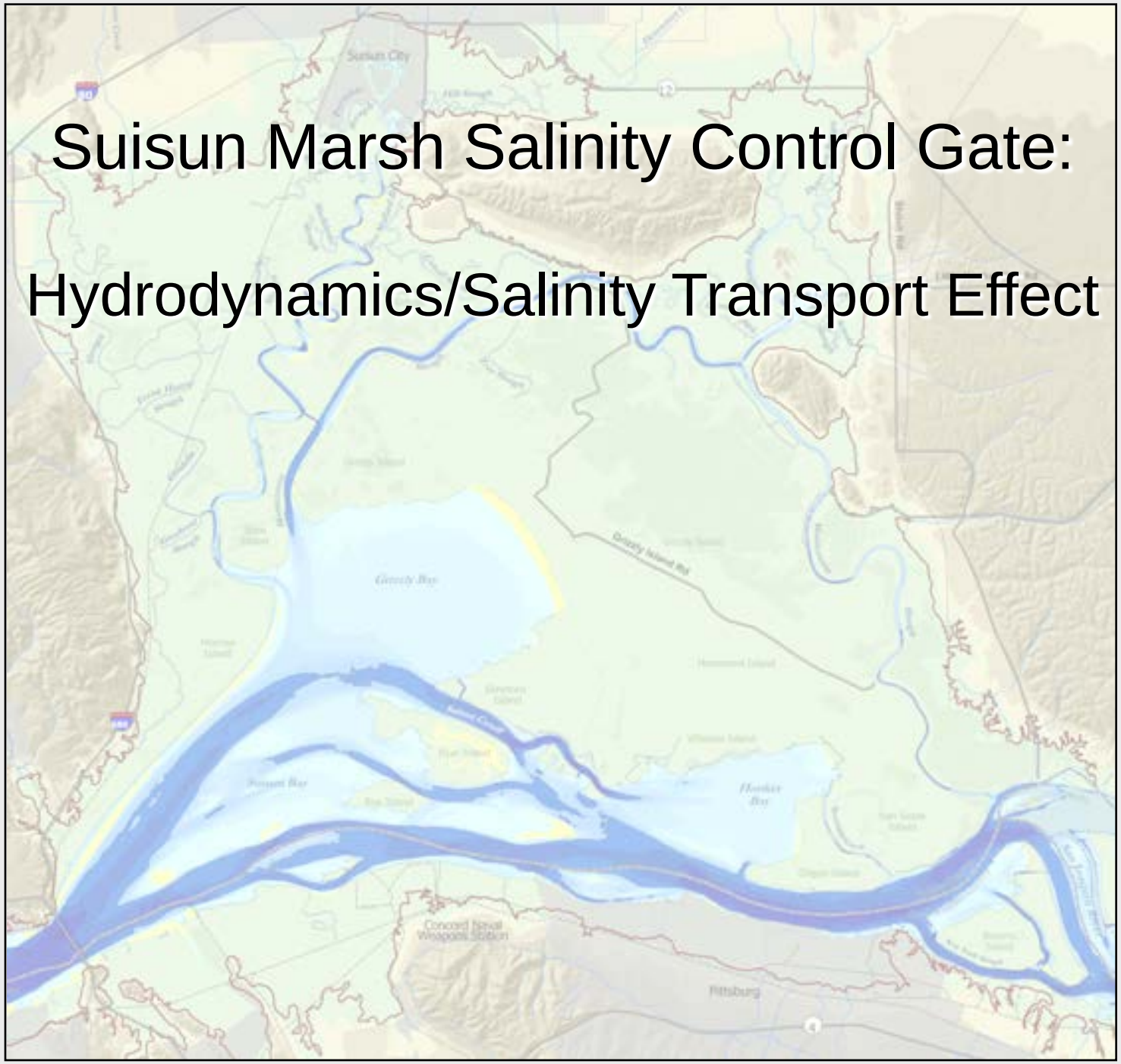
Typical Fall conditions (low outflow)

- Suisun Marsh sloughs have small net flow
- SMSCG induces net downstream flow of ~ 2,800 cfs

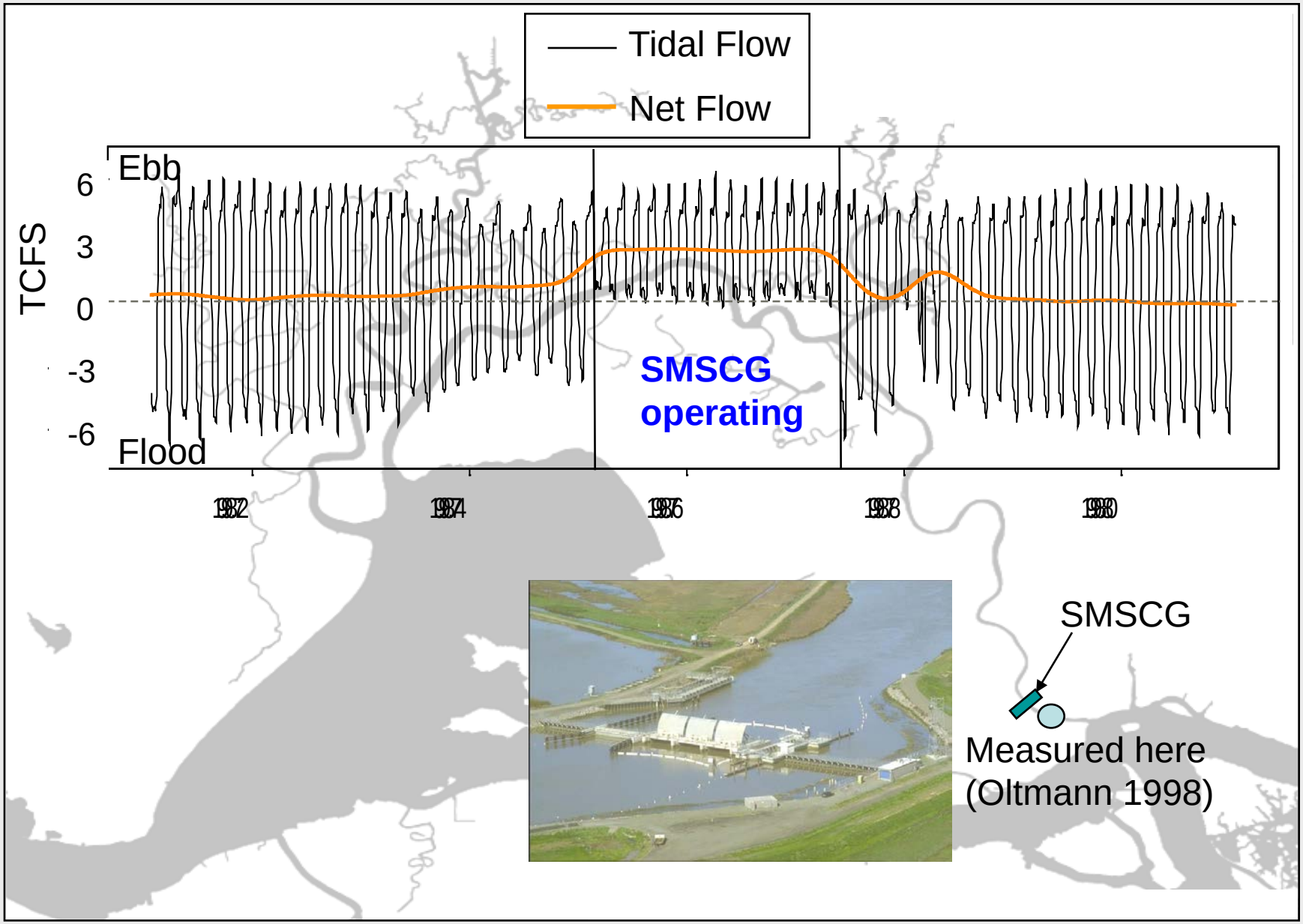


Suisun Marsh Salinity Control Gate:

Hydrodynamics/Salinity Transport Effect



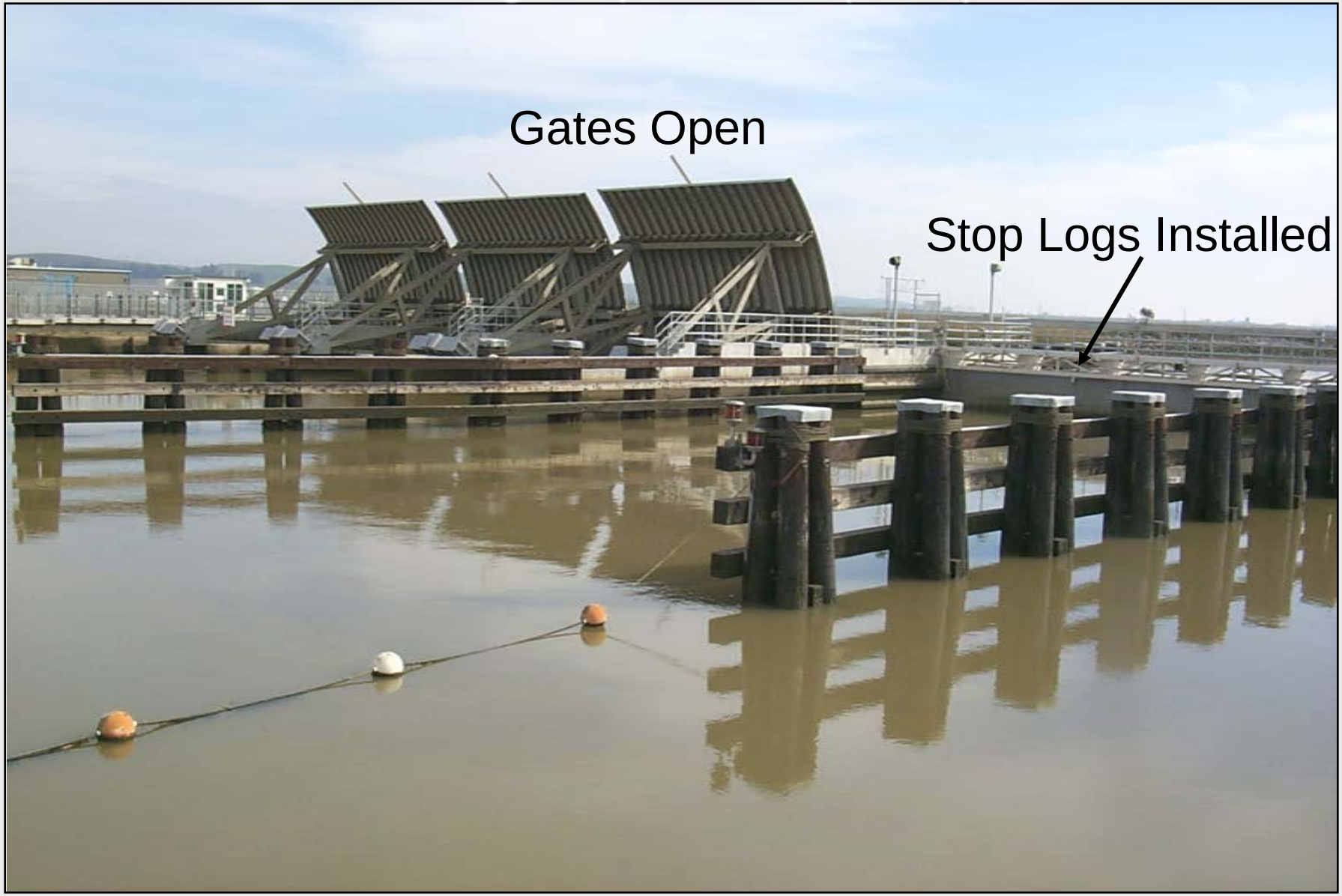
Tidal Time Scale Flows



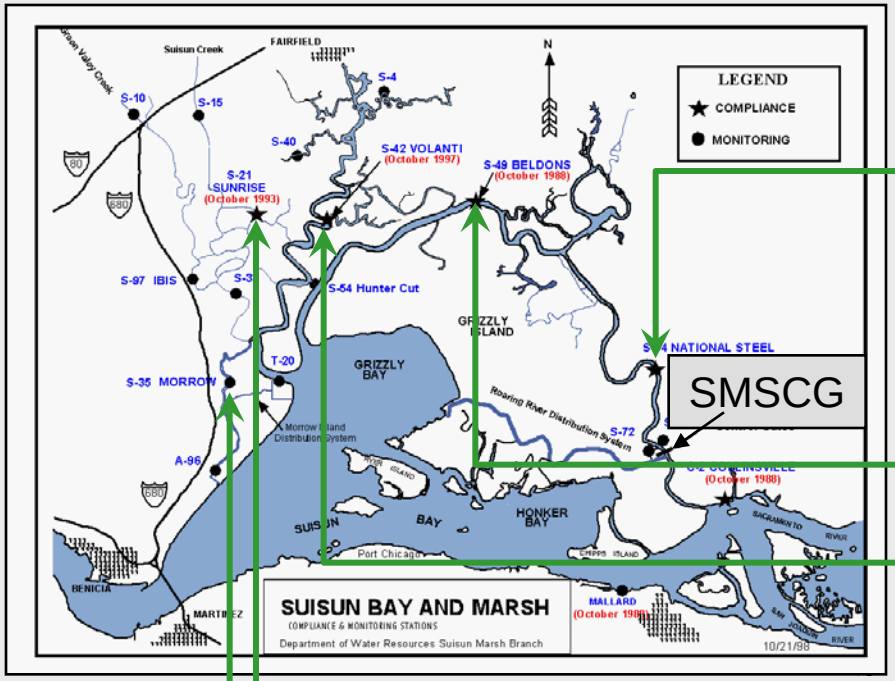
SMSCG Components

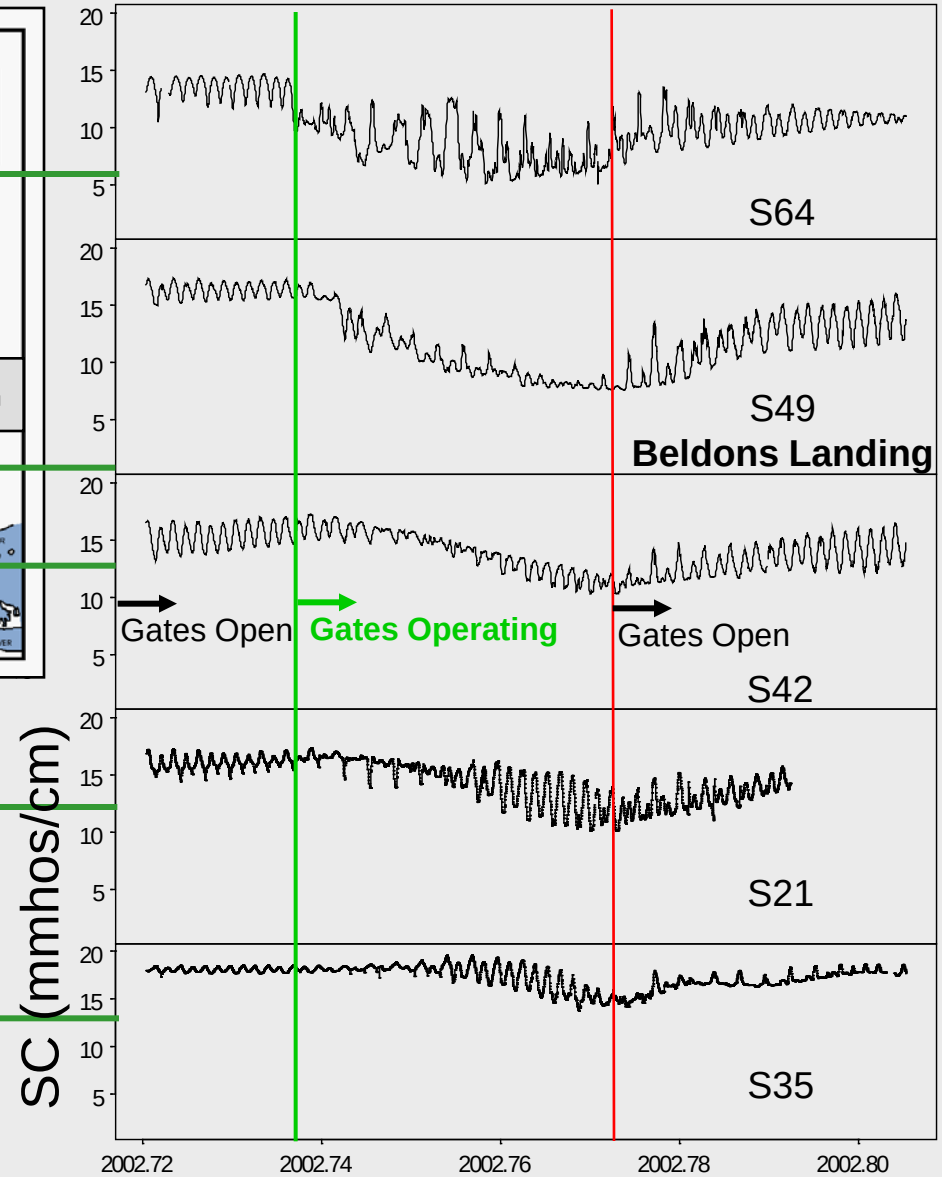
Looking Upstream (southeast)

Looking ~Upstream (east)

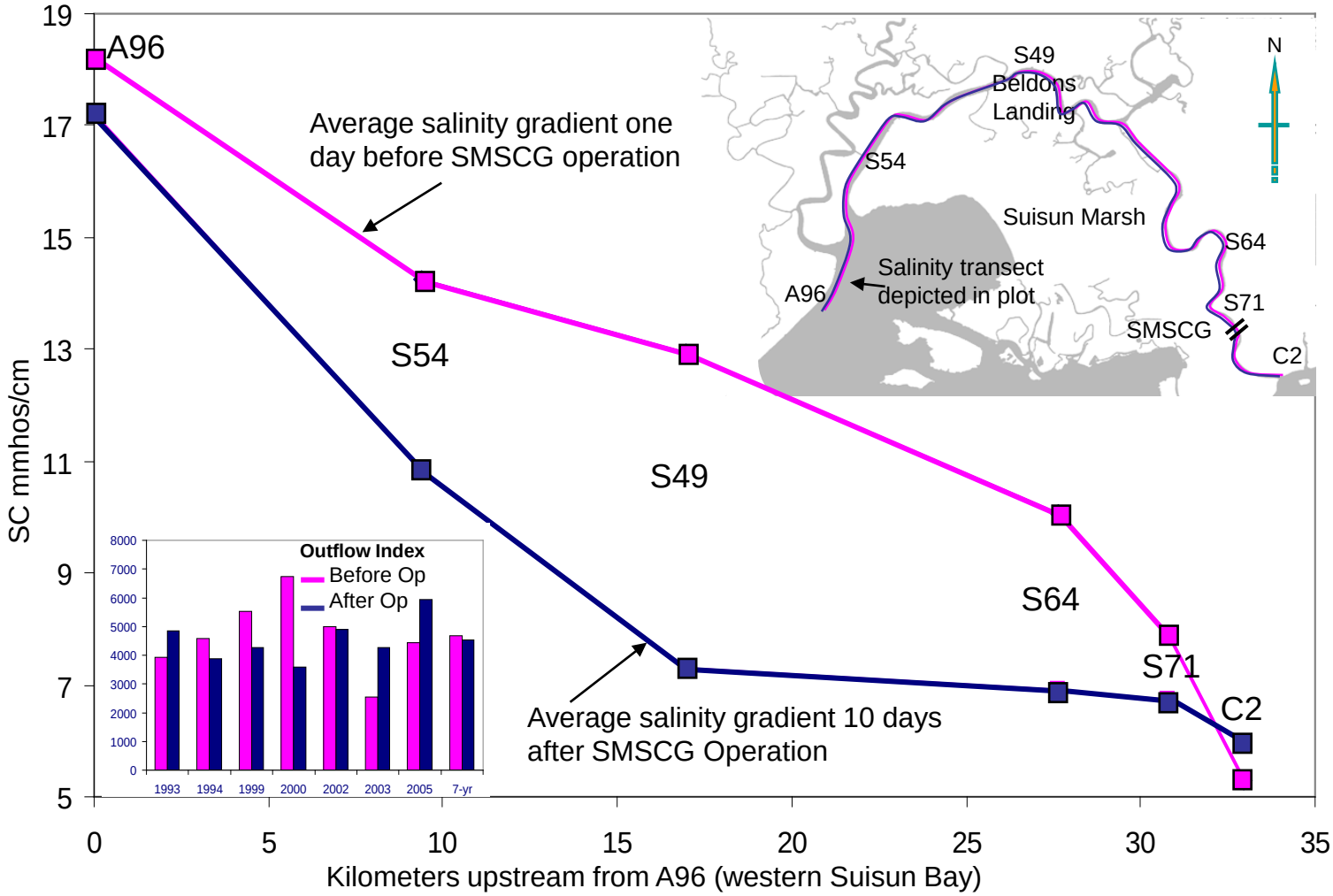


Salinity Response to SMSCG Operation

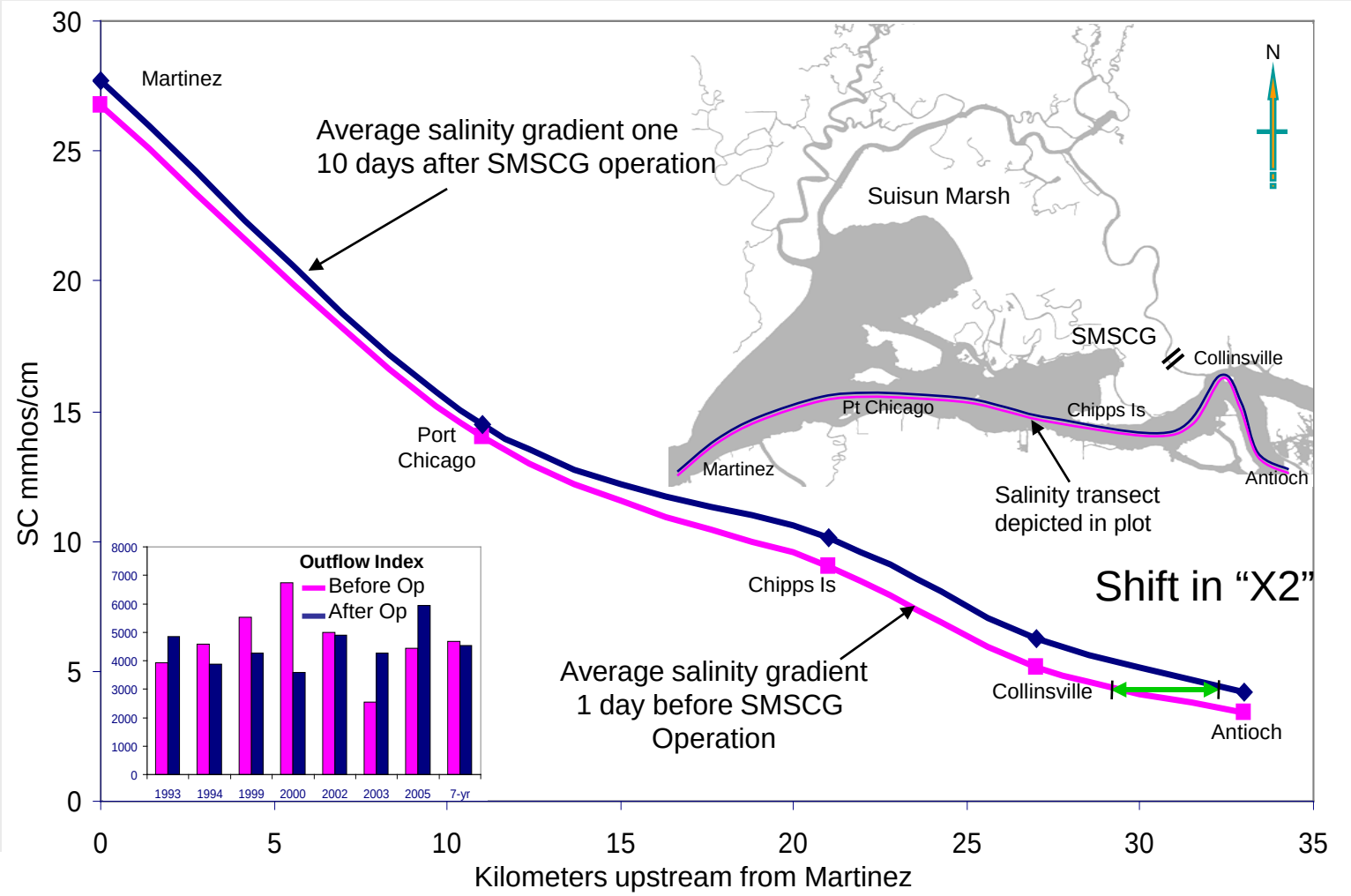


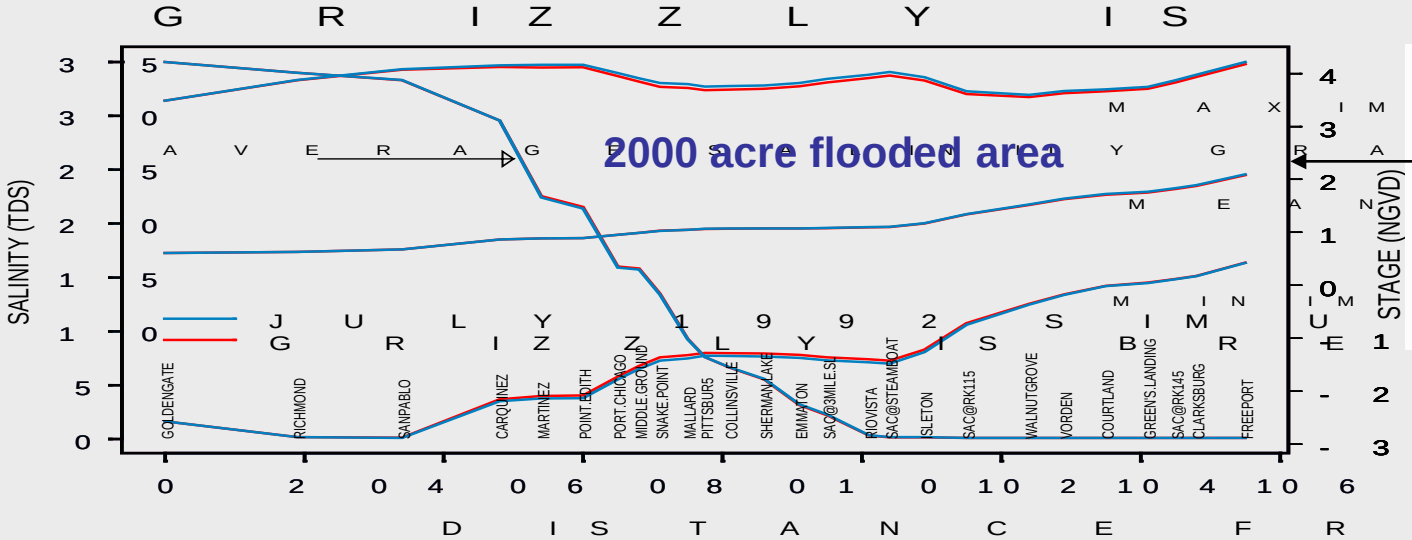


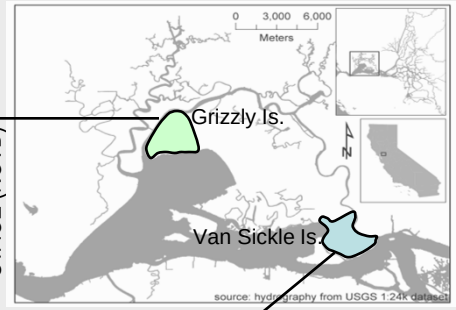
SMSCG effect on Montezuma Slough

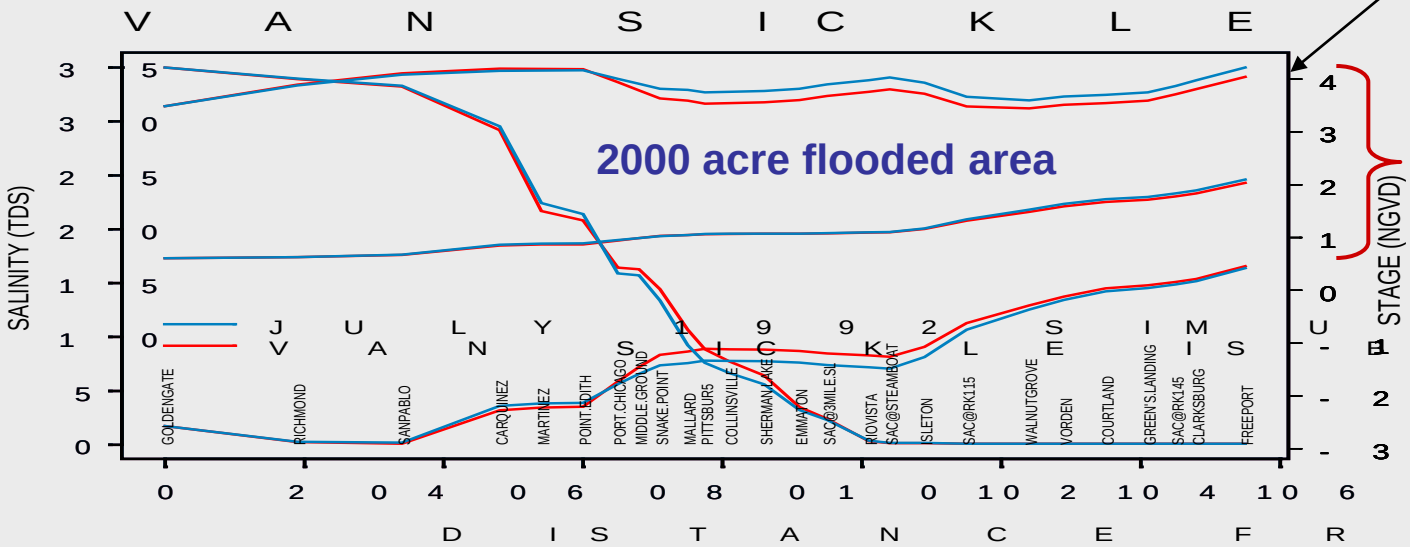


SMSCG effect on Suisun Bay









Tidal range decreases as flooded area increases

Conceptual model of hydrodynamics and transport *within* and *between* physical habitats by spatial scale in Suisun Marsh

1. Marsh plain and tidal creeks

- Marsh plain and tidal creeks are directly connected to the terrestrial environment. In a natural marsh, tidal creek and marsh plain exchange processes are dominated by short-lived pulses (hours) of water from the creeks. These exchanges recharge the marsh plain with surface water, pond storage and pore water. Return to the channels from these marsh-plain overtopping events varies depending on the fine-scale geomorphology. These exchanges are strongly mediated by fortnightly variations in tides (e.g. spring/neap cycle) and seasonal changes in atmospheric pressure and hydrology (high water due to inland flooding).

2. Sloughs

- Sloughs provide conveyance of water and constituents between the tidal creek/marsh plain environments and the channels. Residence time in the sloughs varies from the tidal time scale near the slough mouths to fortnightly and longer timescales near the inflowing creeks. Lower sloughs mix efficiently with distributary channels through tidal trapping. Material fluxes through slough mouths integrate creek runoff, land use, and slough connectivity.

3. Channels

- Channels are characterized by larger cross sections, greater mass fluxes and aren't typically connected to the terrestrial environment. Channel/slough exchange depends upon channel connectivity. Closed channel loops (e.g., Montezuma, Suisun, Cutoff Sloughs) exhibit convergence zones where tidal waves merge from two directions. These zones can accumulate sediment, biota, and contaminants.

4. Bay

- The bay is characterized by open shallow water with partially standing wave hydrodynamics, and tidal trapping gyres. The water column is fully mixed by boundary layer shear flow and wind stress. Ebb-flood tidal flow asymmetry controls exchange with Suisun sloughs.

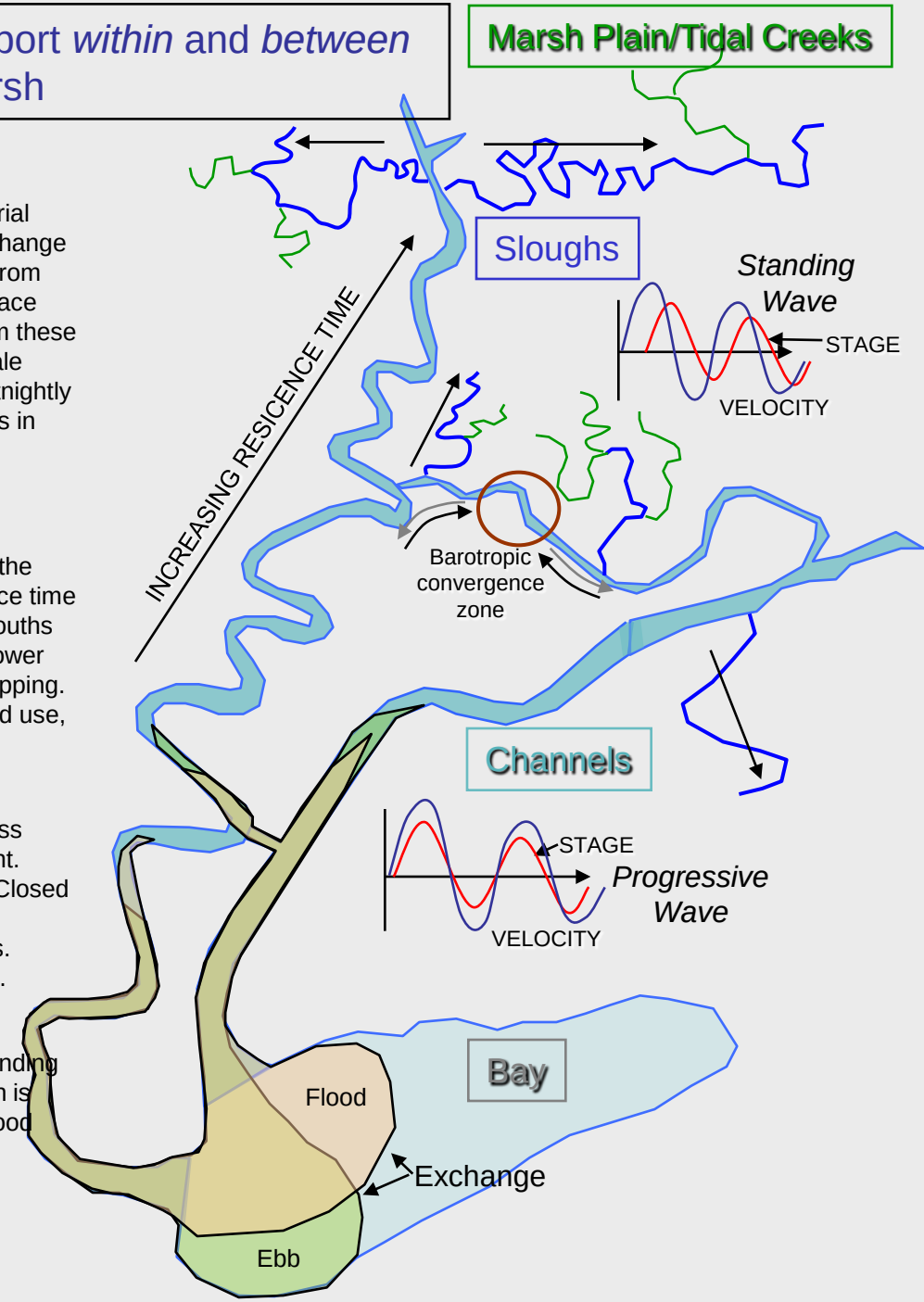
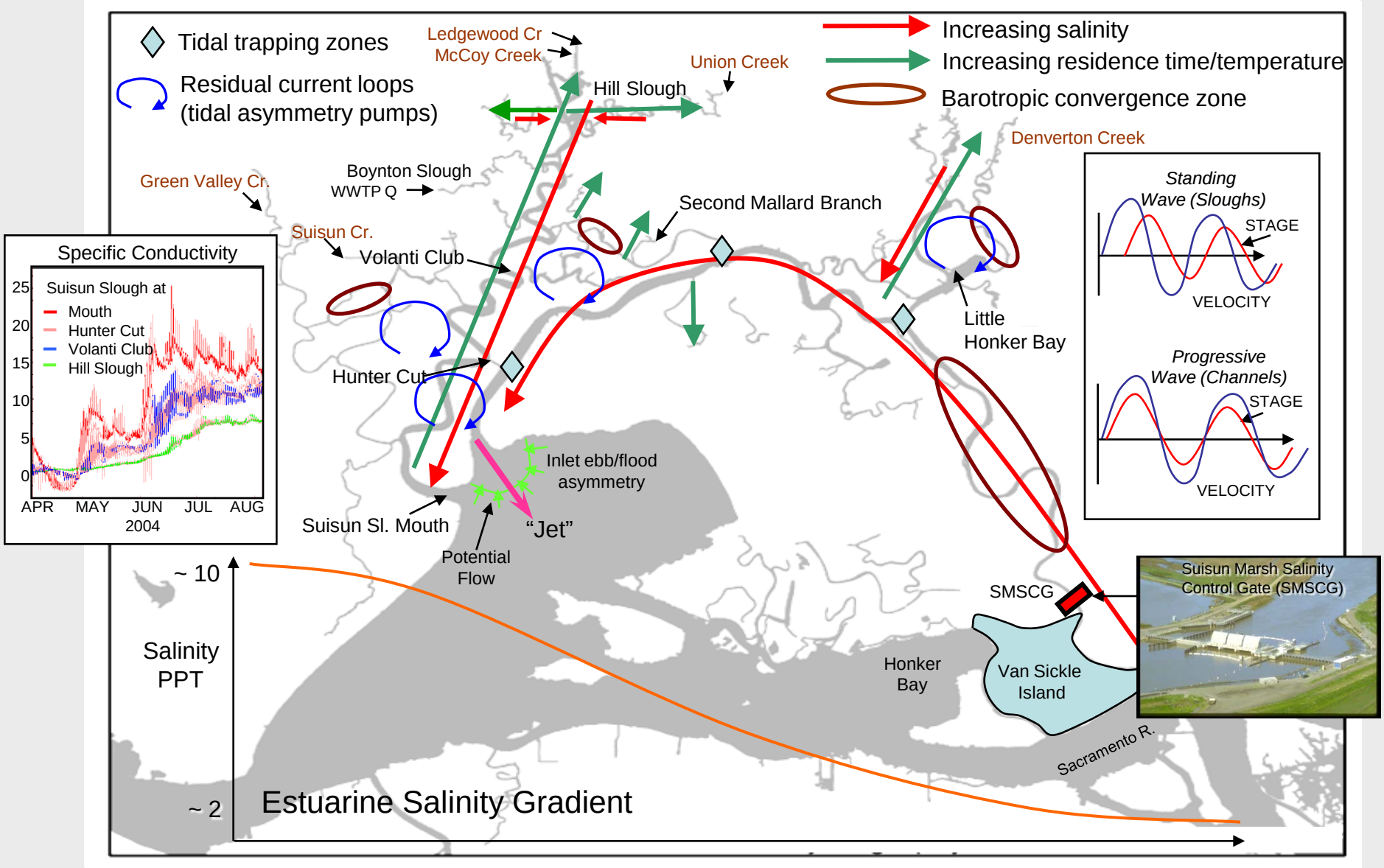
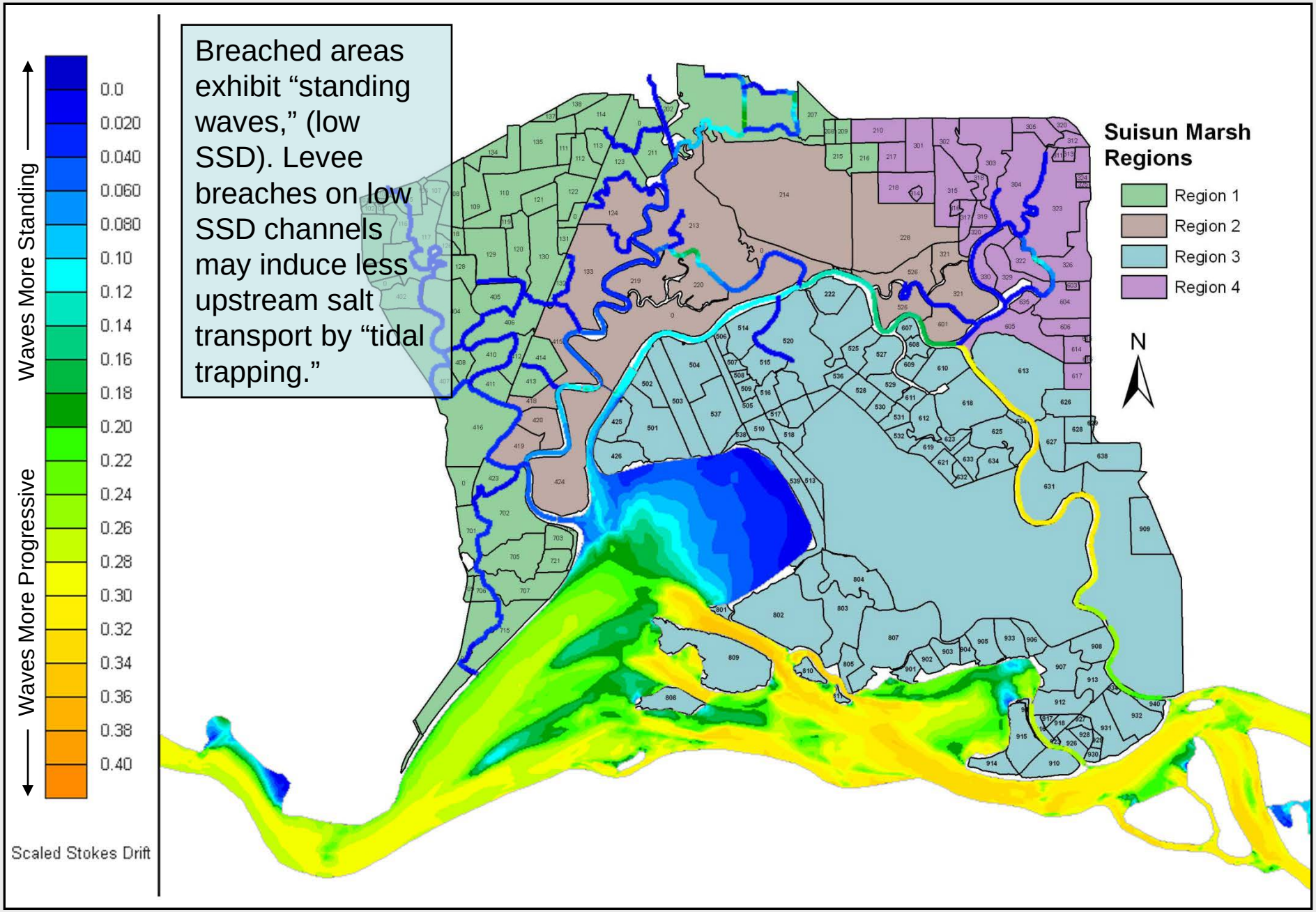


Figure L3.1. Conceptual model showing the complexity of hydrodynamics as related to connectivity among various parts of Suisun Marsh. The model indicates the spatial variability of salinity, residence time, and the locations of barotropic convergence zones, residual current loops, and tidal trapping zones. Also shown are the locations of inflowing creeks, and the ebb/flood asymmetry of flow at the western end of Montezuma Slough. SMSCG is the salinity control gate.



Scaled Stokes Drift (SSD) as and Index of Stage-Current Symmetry in Suisun Marsh