What Should We Do?
Are We Doing It?

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WETLANDS AND WATER RESOURCES

Ecosystem Restoration at the Landscape Scale: The North Delta and Suisun Marsh

CALFED Science Program, November 18-19, 2009
Sacramento, CA

1) We Know Enough to Start

- ✓ Goals and objectives – pretty good
- ✓ Problem understanding – good enough
- ✓ Opportunities and constraints – got it
- ✓ Restoration principles – getting it

2) Policy Frameworks Solidifying

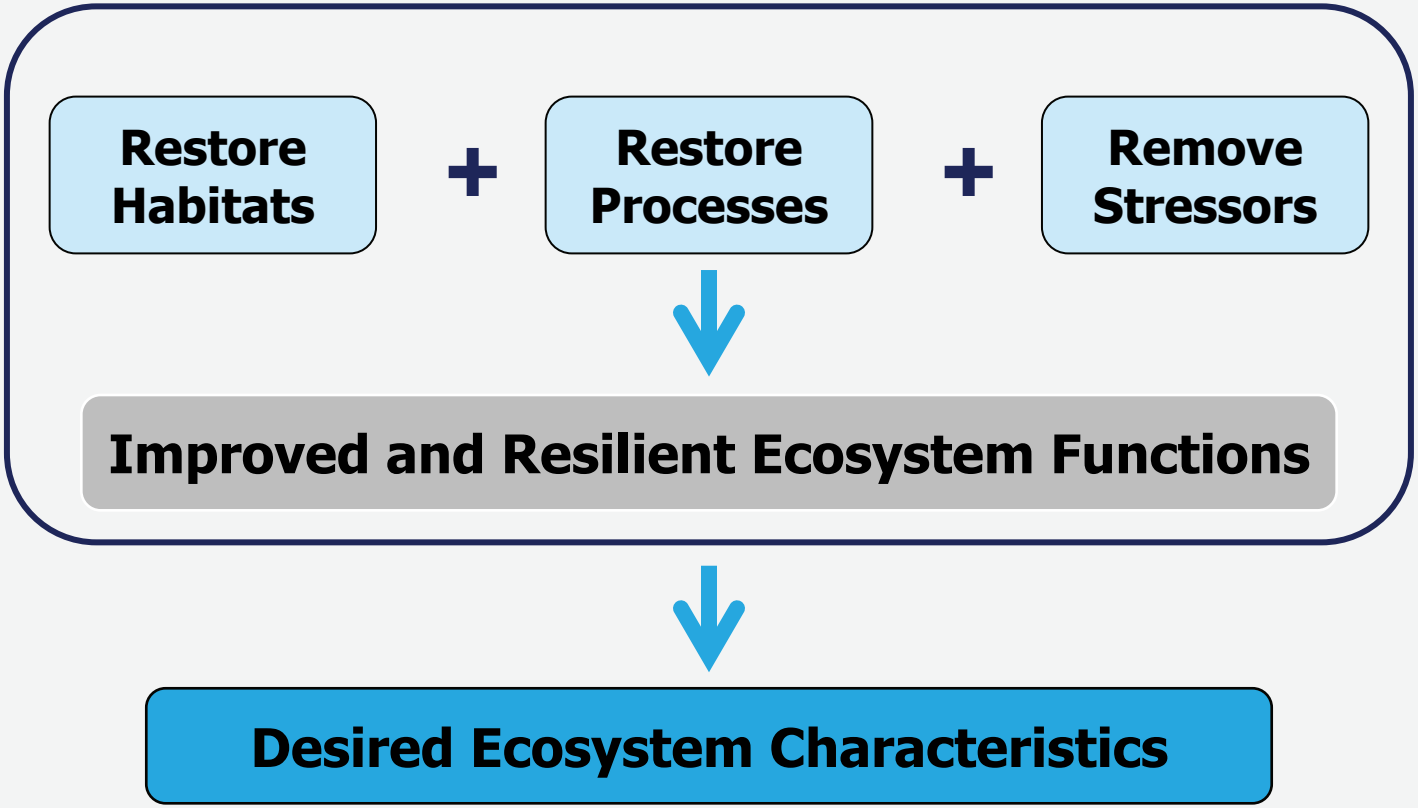
- ✓ Suisun Marsh Plan
- ✓ Bay Delta Conservation Plan
- ✓ ERP Stage 2 Conservation Strategy
- ✓ New Delta Legislation
- ✓ (Courts)

3) Adaptive Management to Guide

- ✓ Goals and objectives
- ✓ Conceptual models – DRERIP, SMP, POD, IRWM, BREACH …
- ✓ Designs can test hypotheses
- ✓ Modeling and monitoring tools
- ✓ Talented scientific community

- ? Commitment and funds

The "Restoration Recipe"



Success depends on implementing adequately funded science-based adaptive management

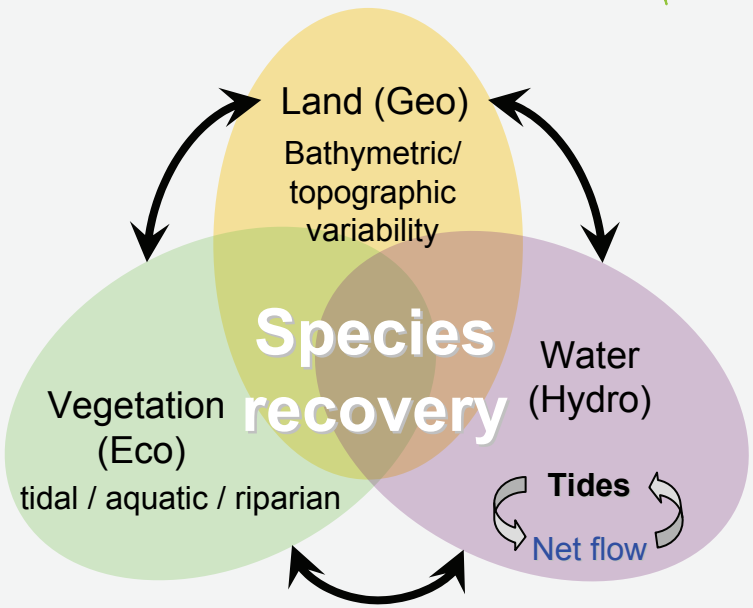
There are no guarantees of success!

Fundamental premise:

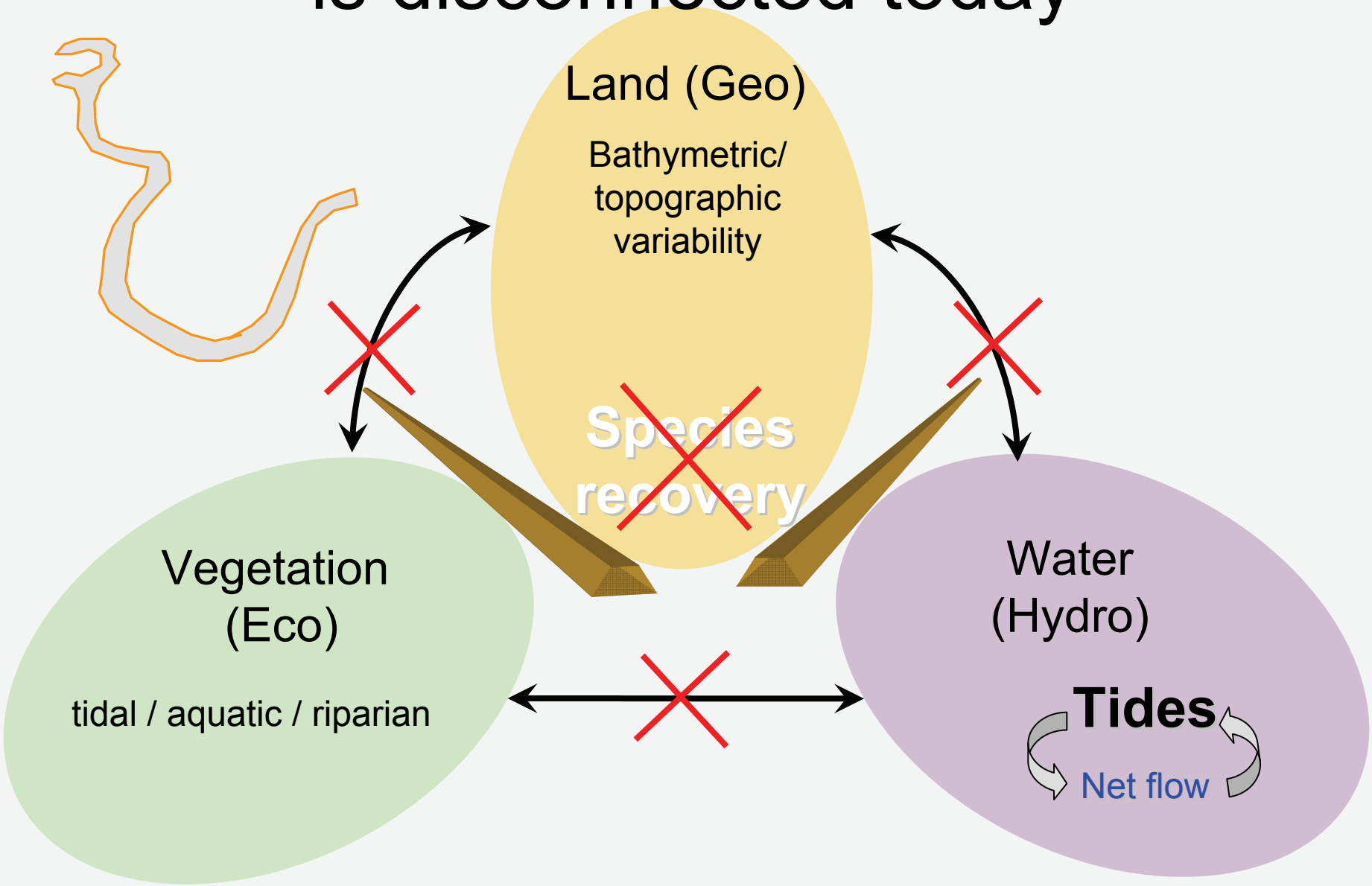
Work with nature, let nature do the work

Reconnect land-water interface:

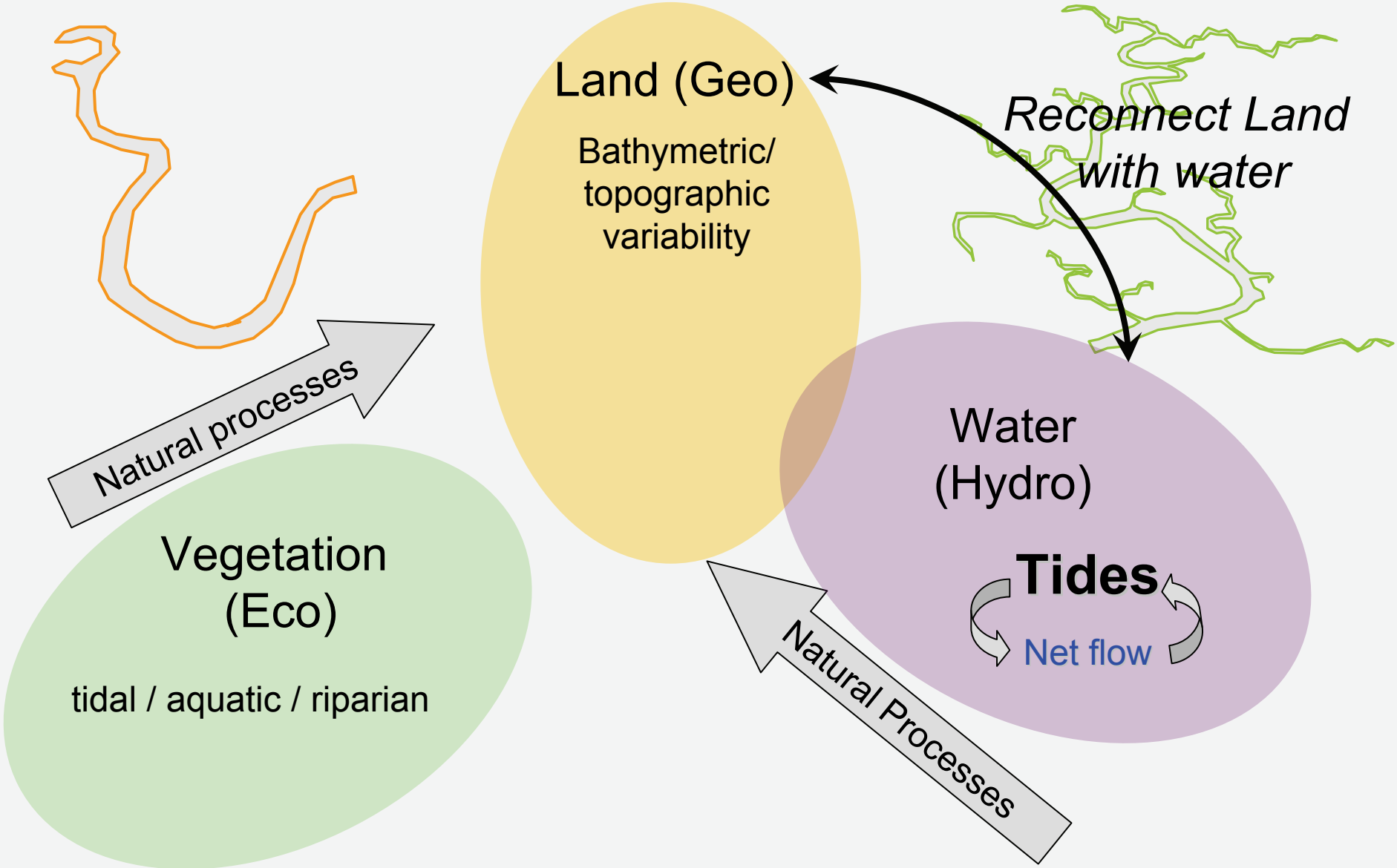
"Hydro-geo-eco-morphology"



Hydro-geo-eco-morphology is disconnected today



Hydro-geo-eco-morphology
“work with nature”



Key Hypotheses and *Restoration Objectives*

1) Aquatic species are food limited

   → *increase the abundance and availability of food*

2) Aquatic, wetland, and terrestrial species are habitat limited

   → *increase amount, geographic distribution, connectivity, and diversity of natural habitats and re-establish their regulating processes*

3) Certain stressors impair ecosystem functions

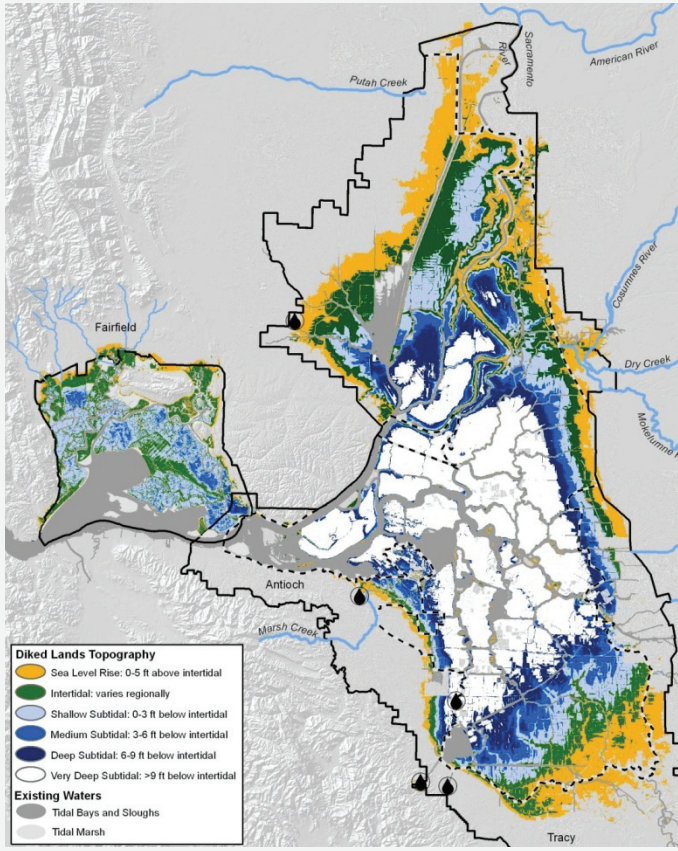
   → *remedy those stressors*

Priorities: “Read” the Landscape

- Topography, hydrology and diverse landscape mosaics
- Align with our understanding of natural processes
- Put restoration where species will benefit
- Face constraints – infrastructure, conveyance, land ownership
- Anticipate sea level rise

Opportunity based on topography *only*

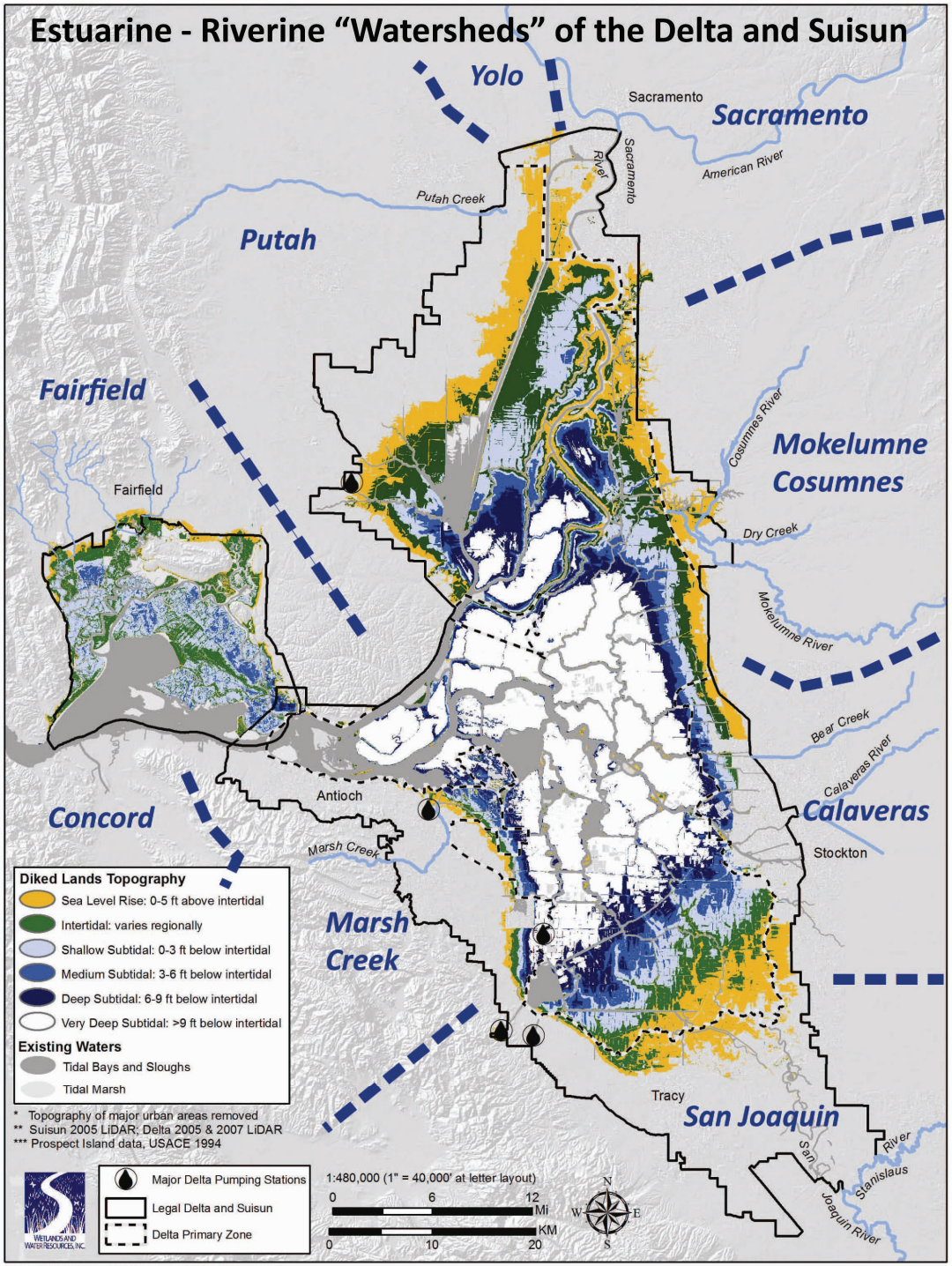
Type	Acres (x1,000)* Delta	Suisun
Excluding "Deep Delta"		
Upland	175	20
Sea level rise accommodation	85	10
Intertidal	70	40
Shallow Subtidal (0 to 2 m)	65	10
Deep Subtidal (2 m or deeper)	15	~0
"Deep Delta"		
Deep Subtidal (2 m or deeper)	~320	



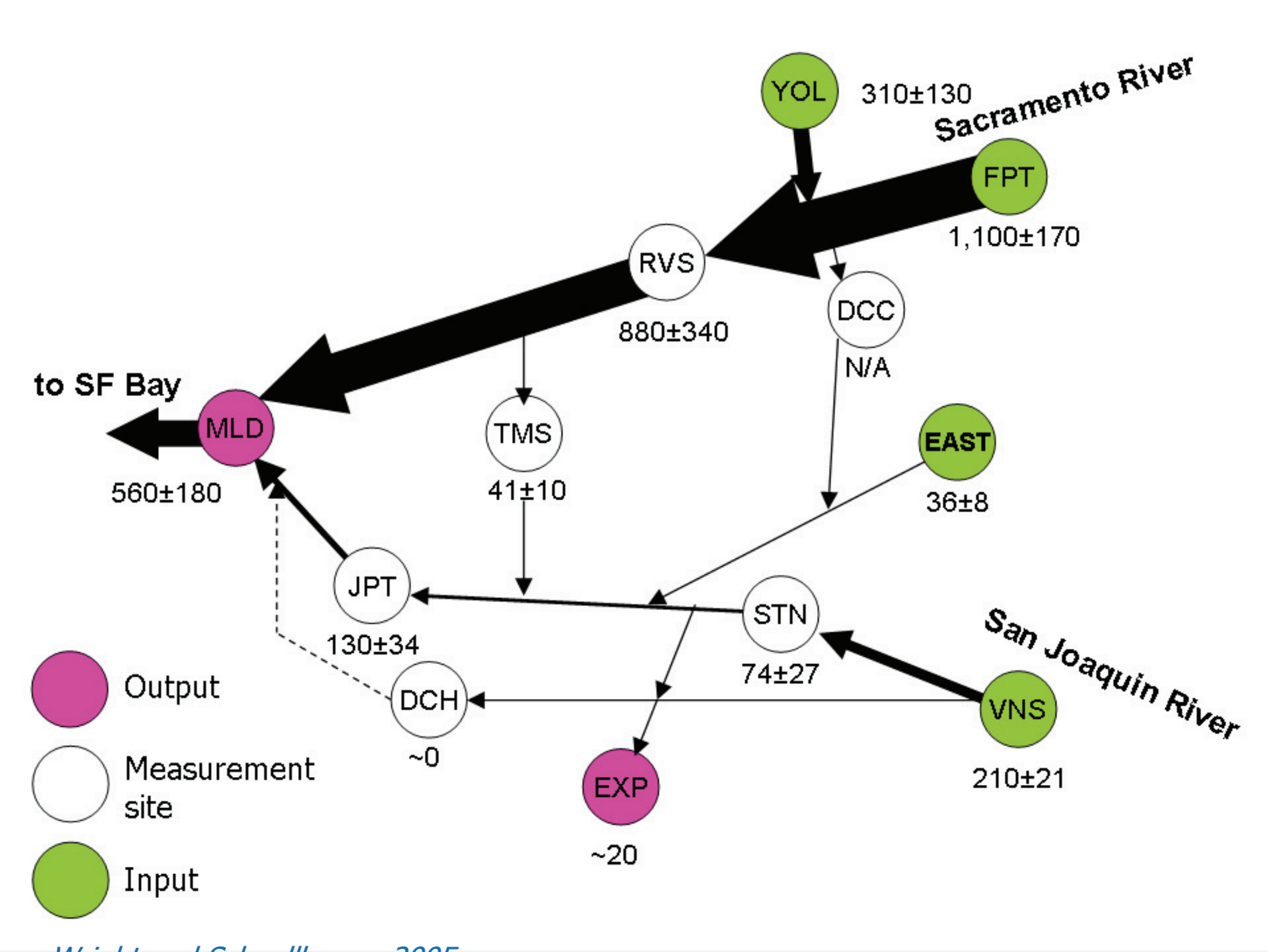
* Restoration potential very approximate to reflect range of potential changes to regional hydrodynamics from restoration and conveyance changes

Estuarine Hydrographic Units

- Fully dissipates hydrodynamic energy
- Links uplands, wetlands, aquatic

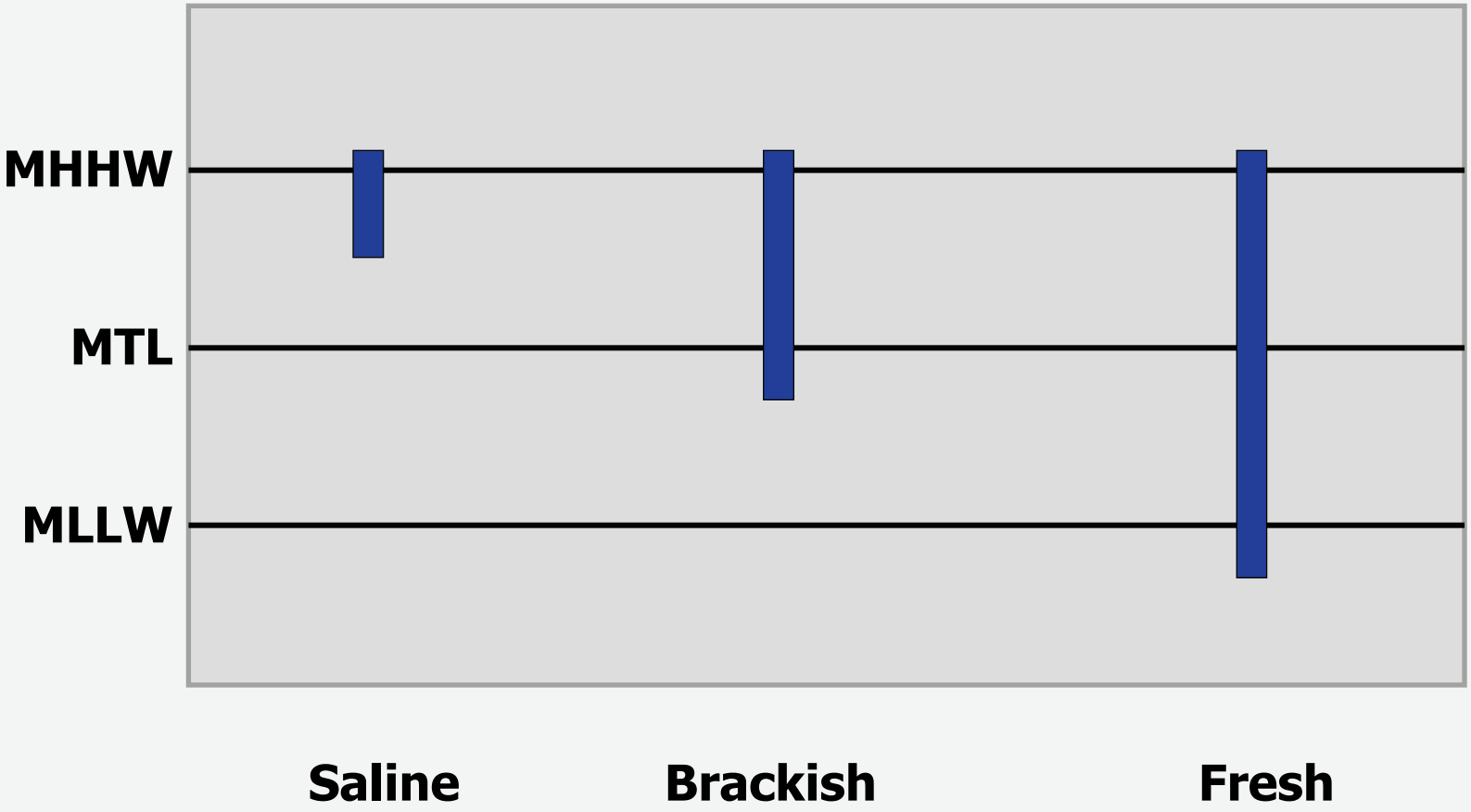


Accretion and Sediment Supply

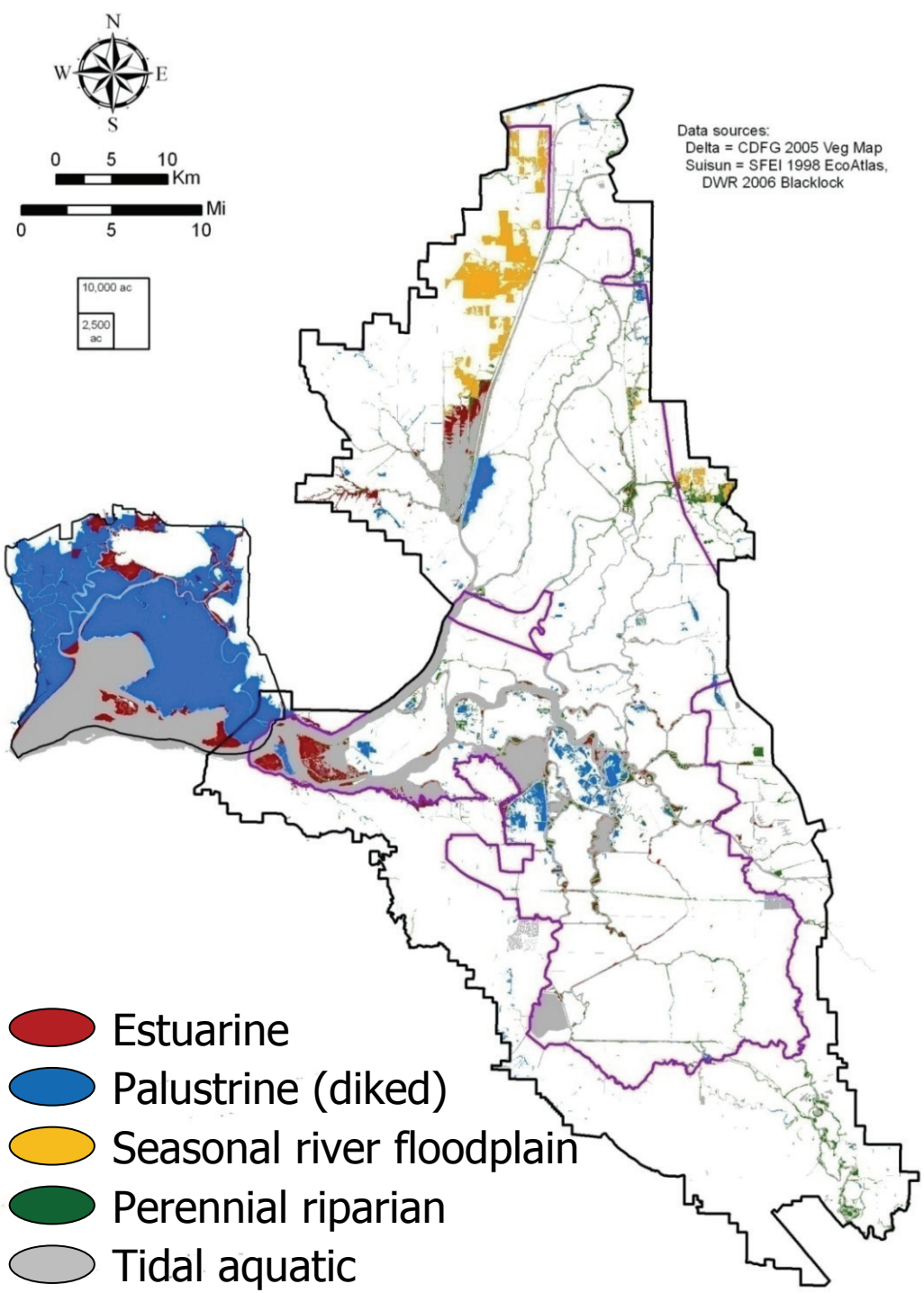


Wright and Schoellhamer 2005

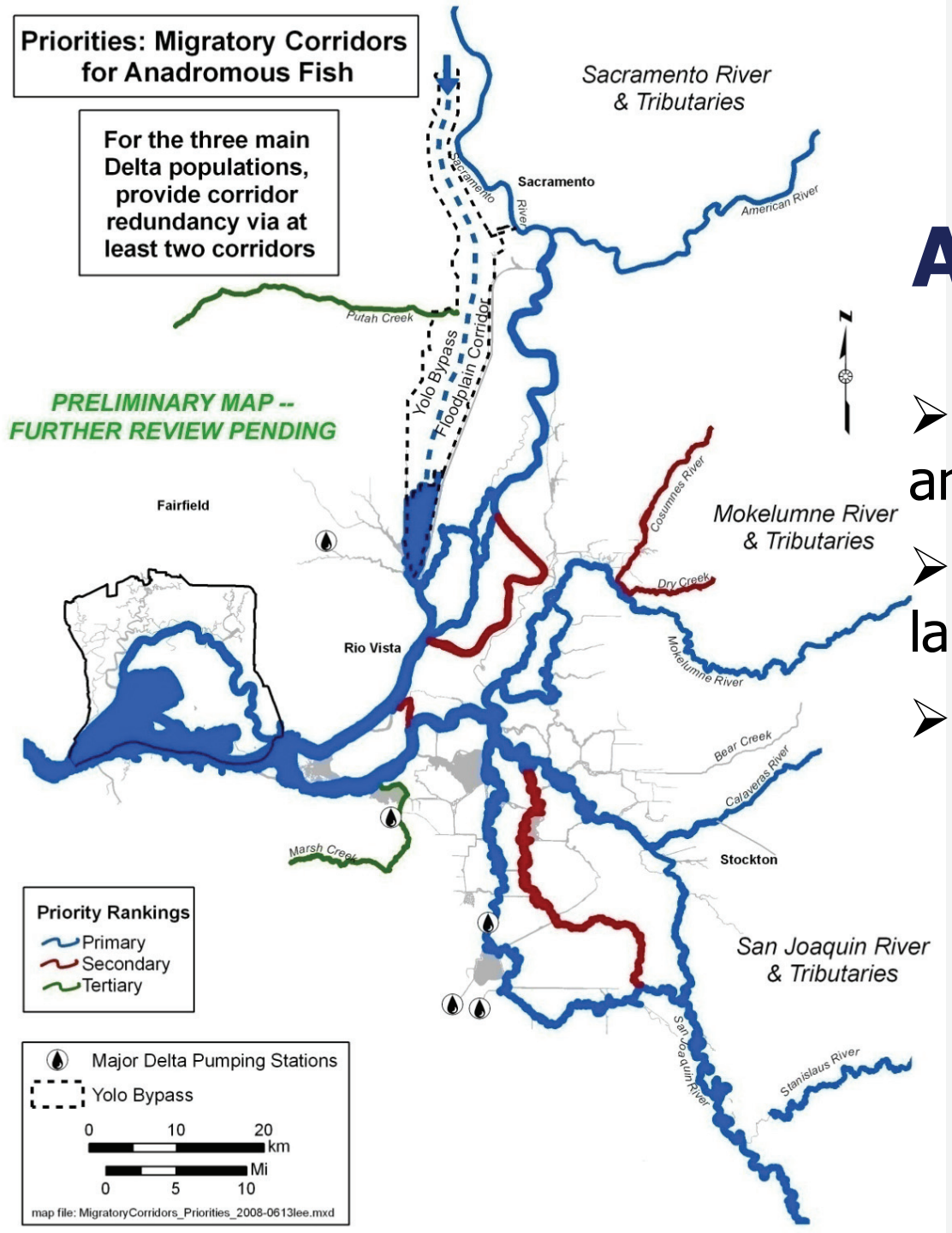
Tidal Emergent Vegetation Elevations and Salinity Regimes



Today's Wetlands in Suisun and Delta



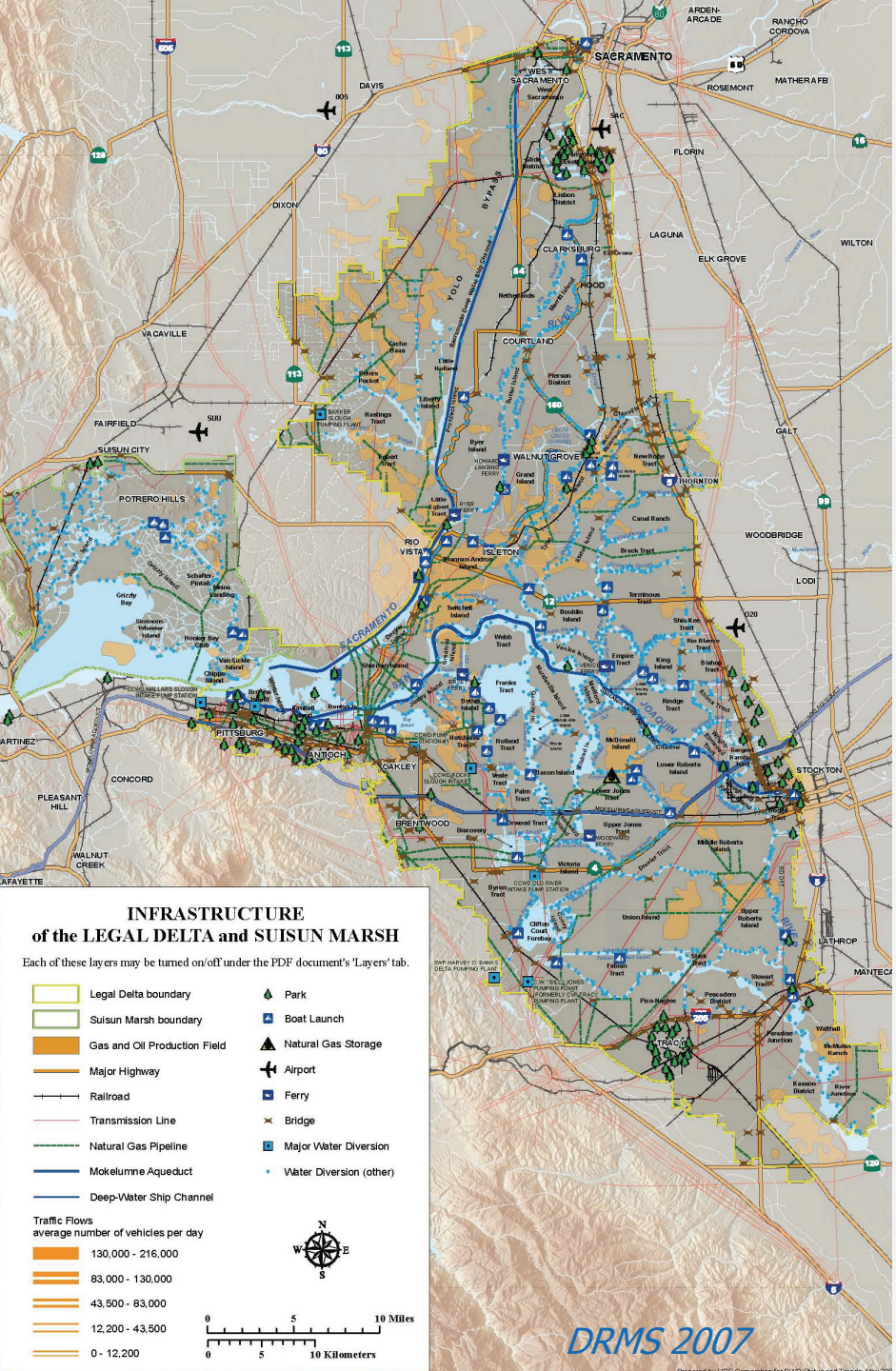
Suisun (ac)	Delta (ac)
7,670	7,900
52,300	10,000
0	11,300
25	14,000
~26,000	~60,000



Location for Anadromous Fish

- Necessary flow quantities and timing
- Functionality of restored lands
- Peter Moyle's talk!

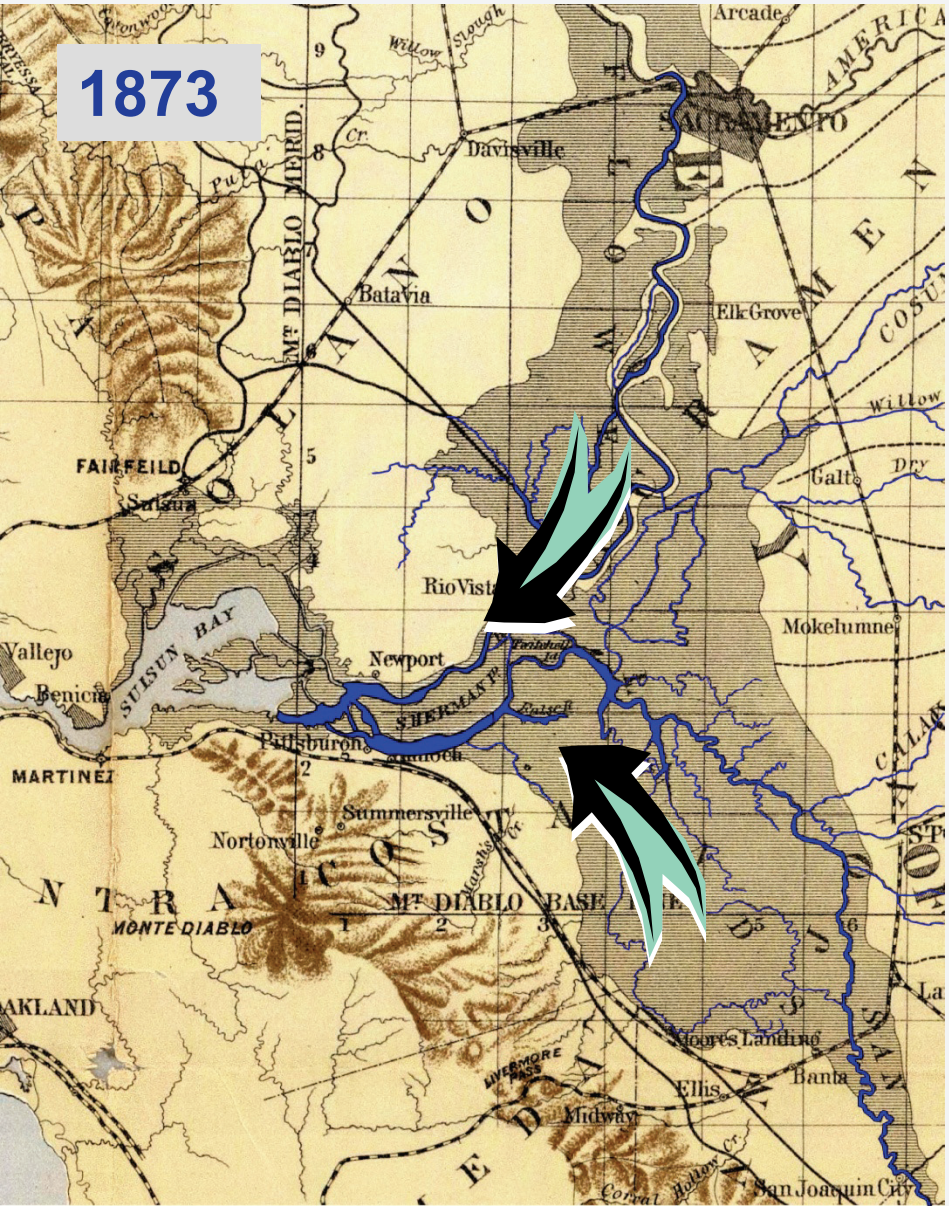
Infrastructure

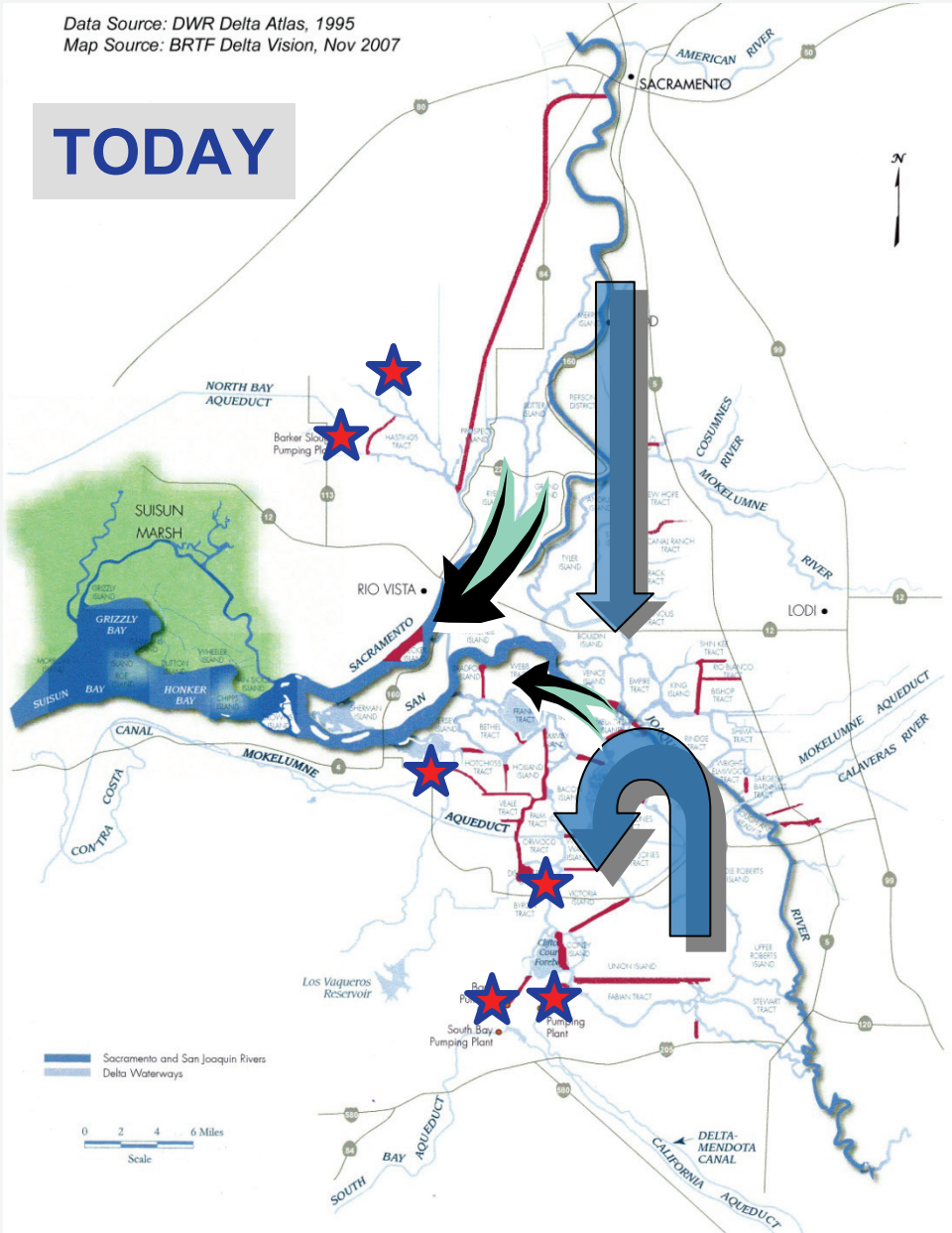


DRMS 2007

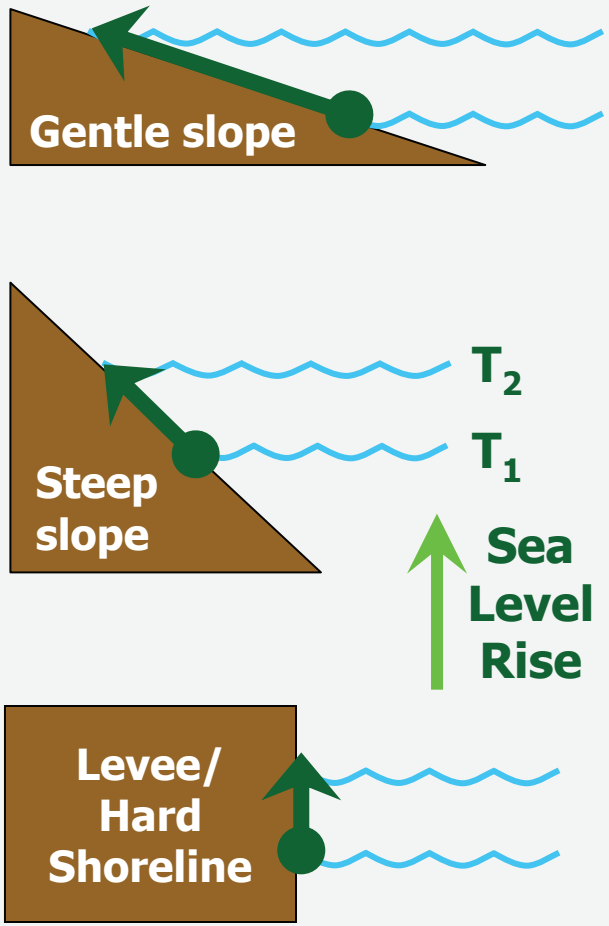
- Roads
- Bridges
- Pipelines
- Transmission lines
- Railroads
- Aqueducts
- Export pumps, siphons
- Gas fields, storage
- Shipping lanes, ports
- Air terminals

Conveyance and Exports





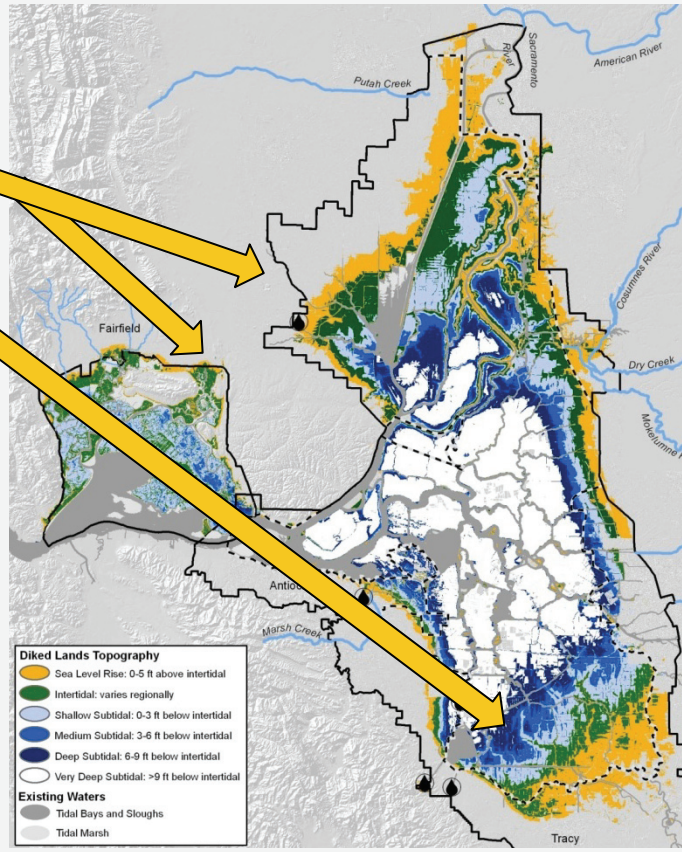
Estuarine Transgression and Sea Level Rise



Ample opportunity

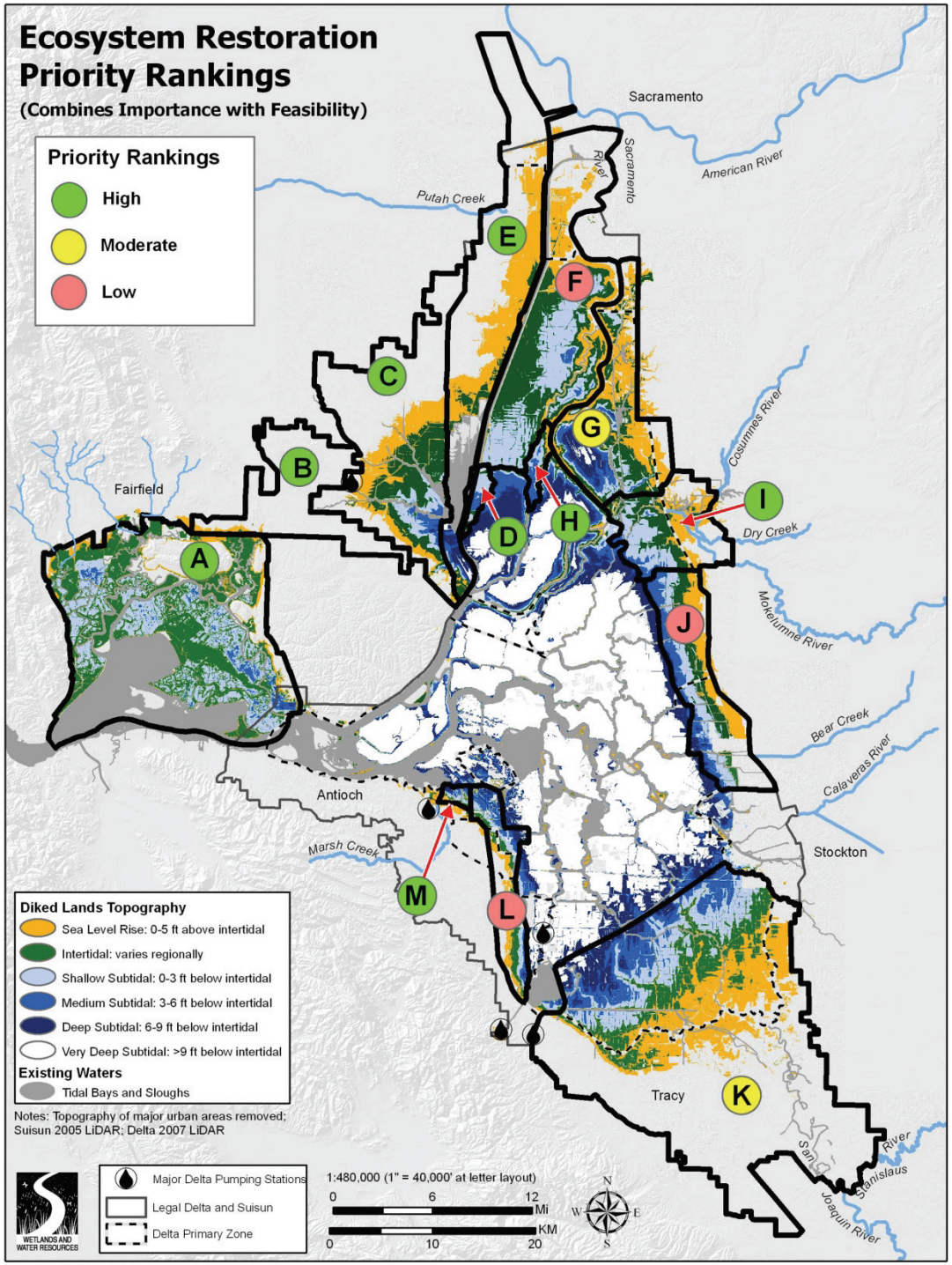
Limited opportunity

No opportunity

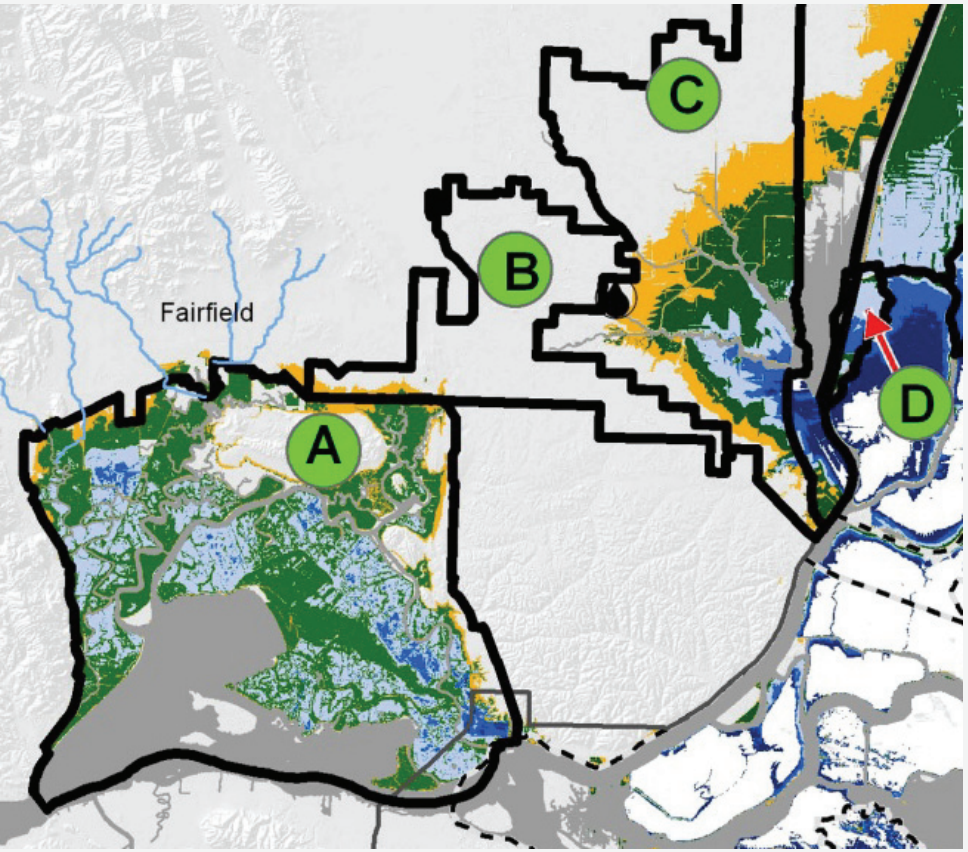


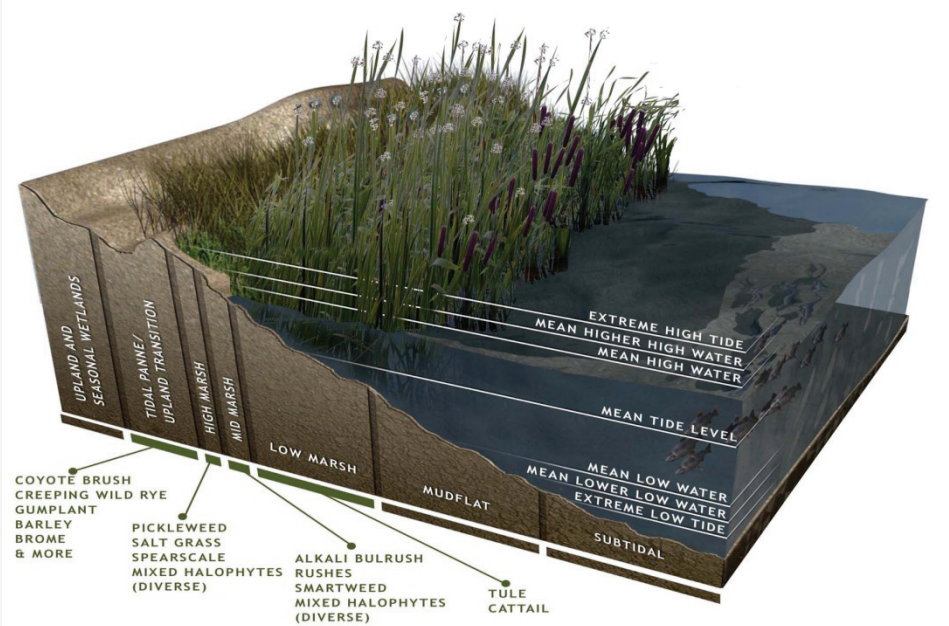
Added all up…

Restoration Priorities

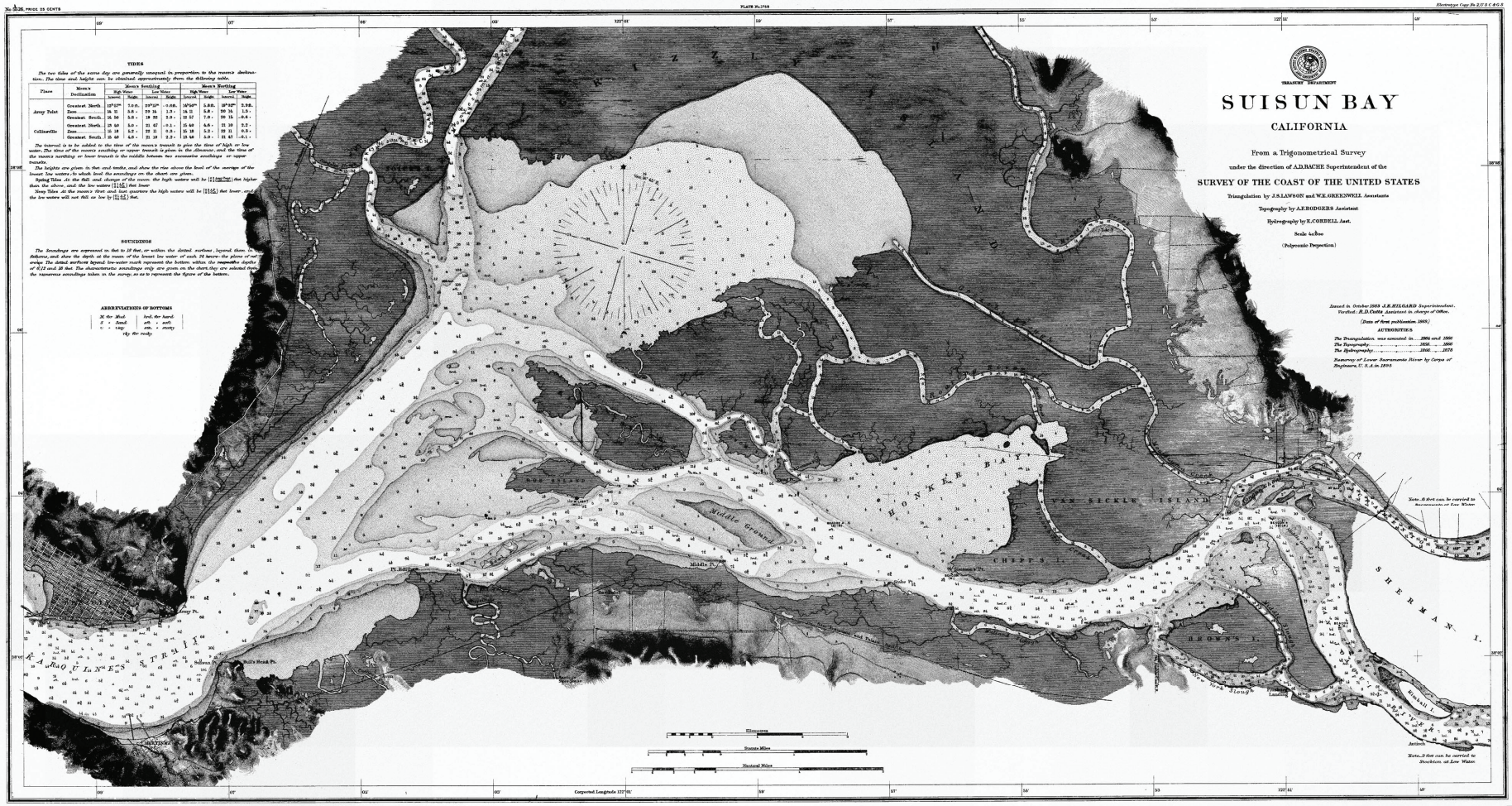


Diverse Mosaics and Scales





Suisun Marsh circa 1860 - 1870



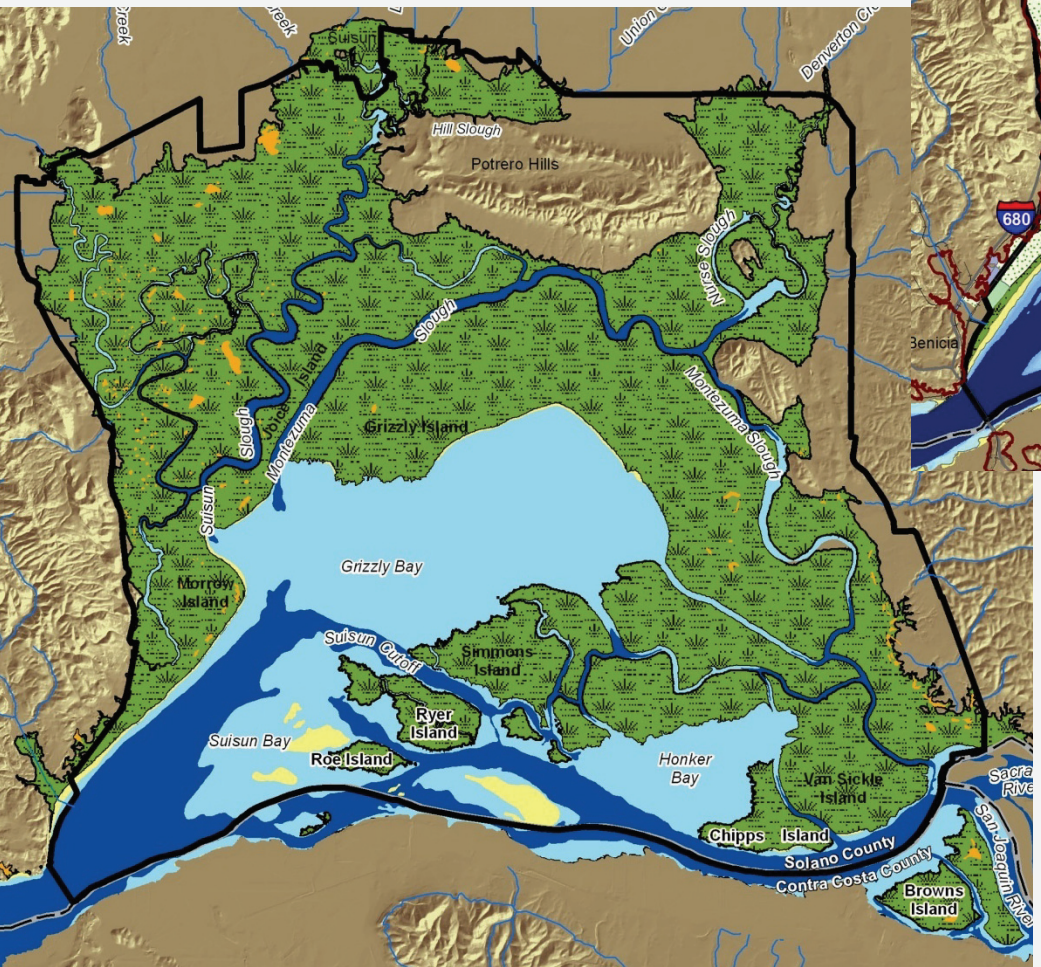
(Suisun Bay) U.S.C.&G.S. 5526

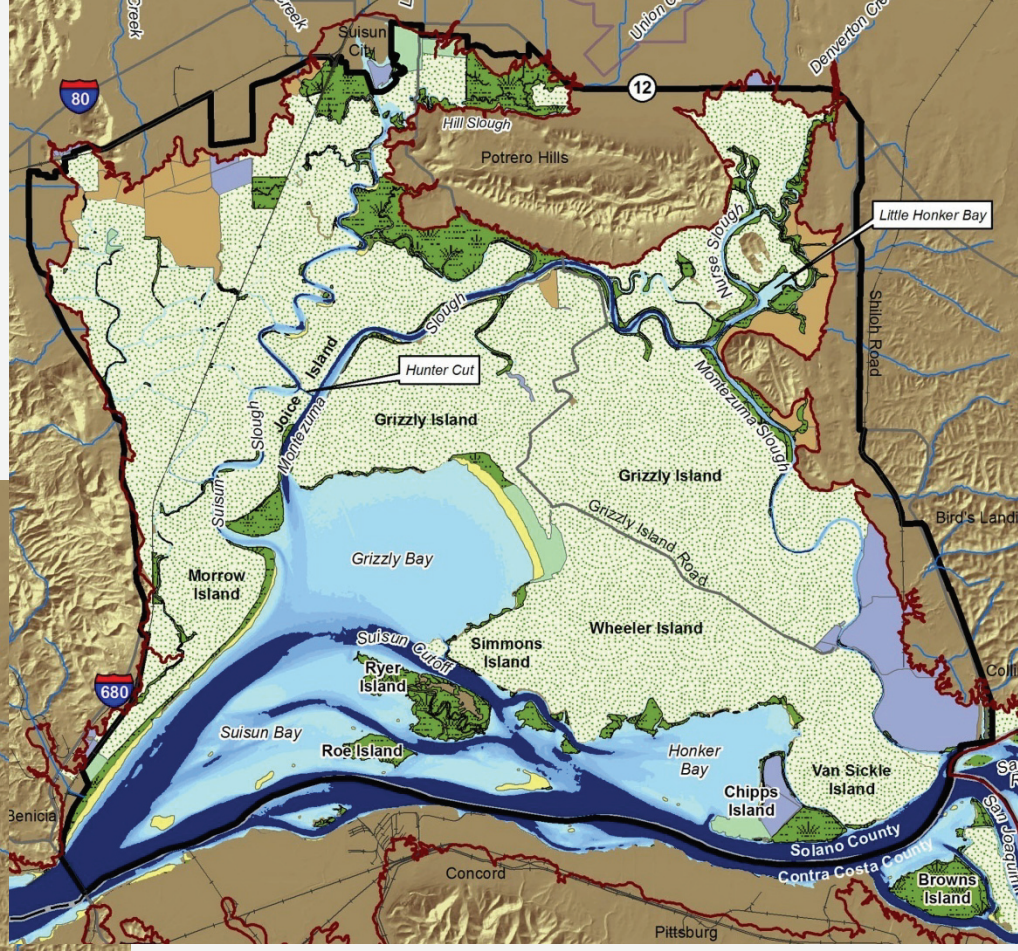
From the Image Archives of the Historical Map & Chart Collection
Office of Coast Survey/National Ocean Service/NOAA

Early in Period of Sierra Nevada Hydraulic Mining (1852-1884) and Its Sediment Loading to the Watershed and Estuary

Then and Now

Suisun

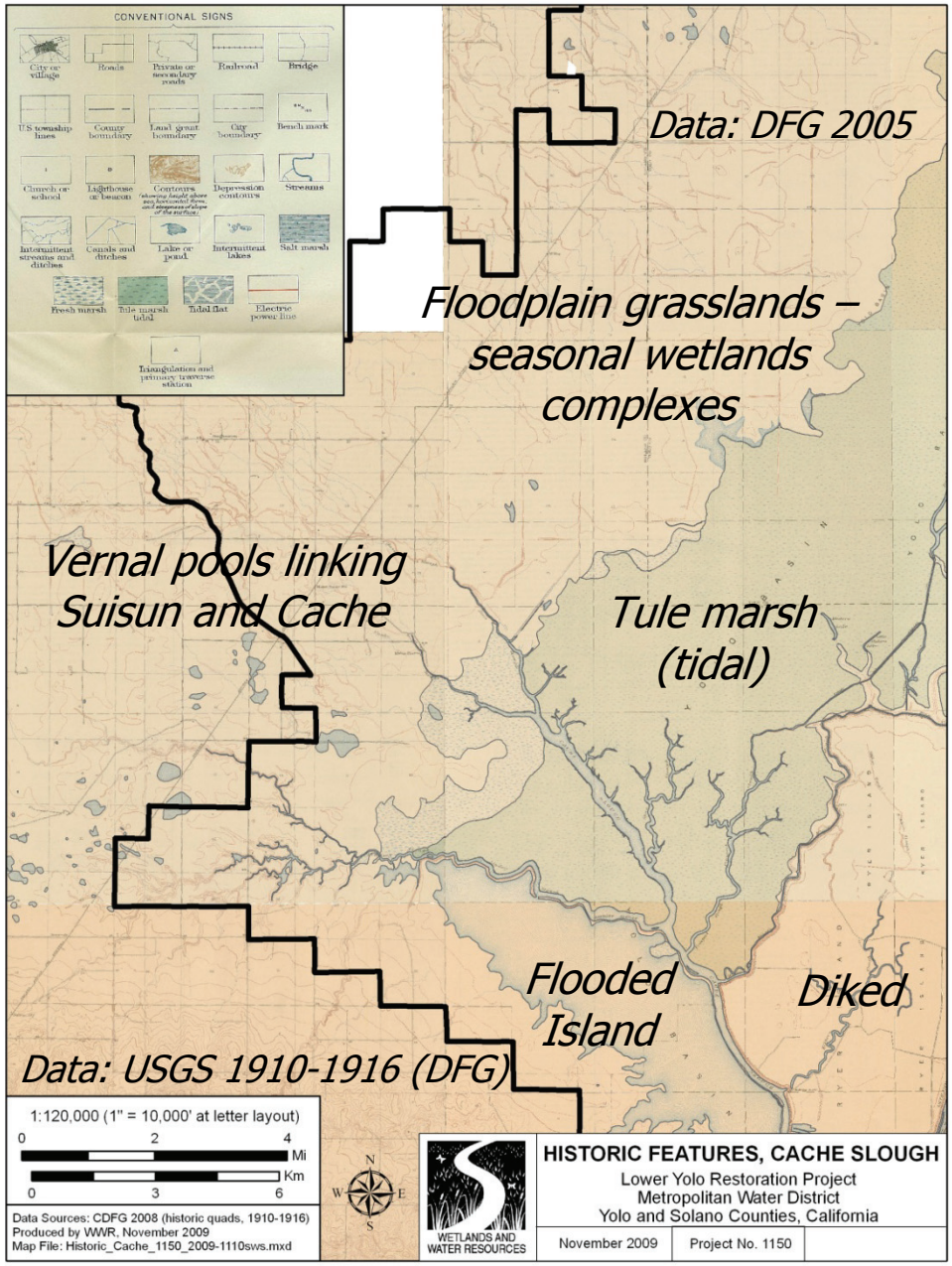


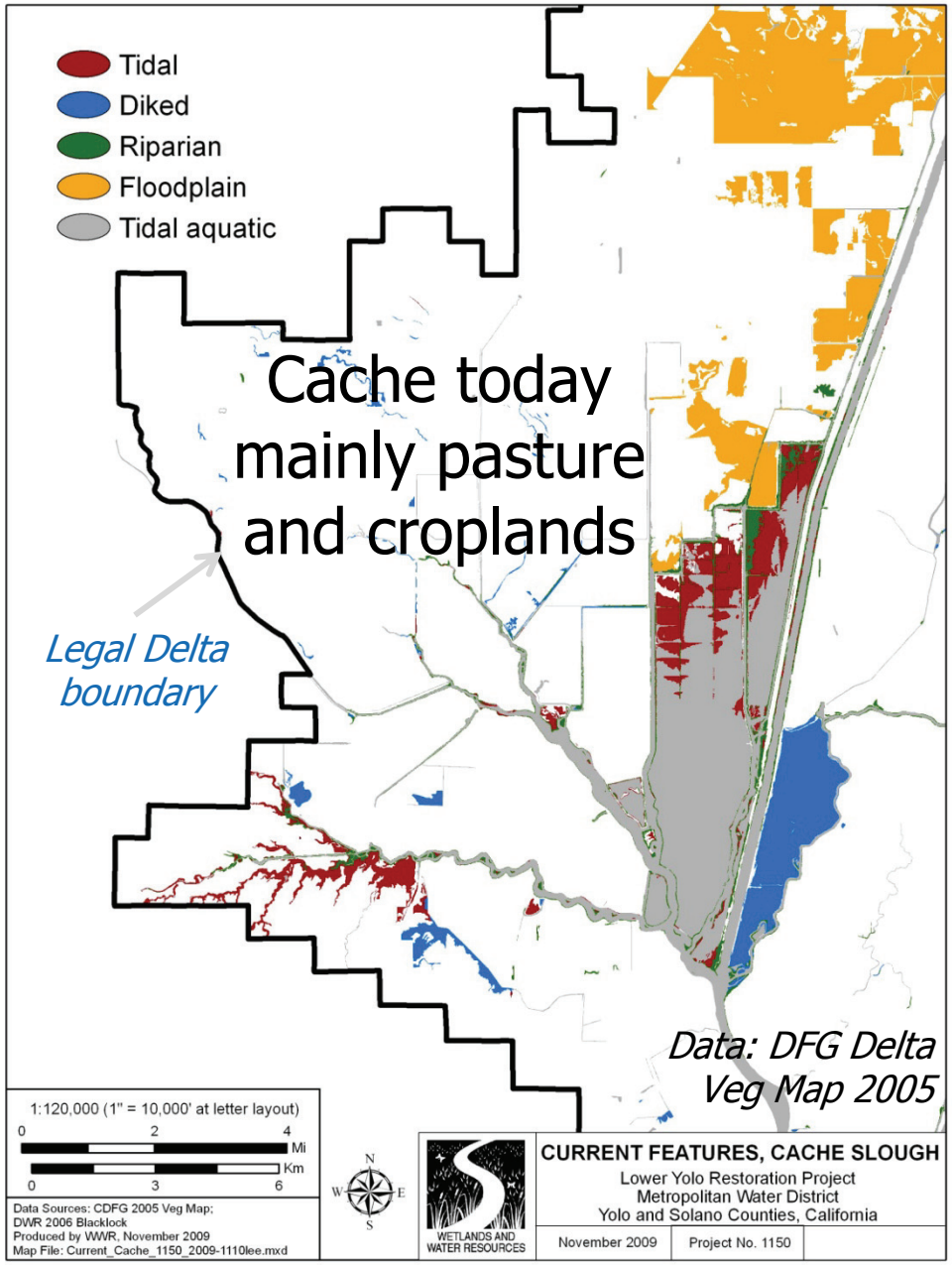


Suisun today mainly diked managed wetlands for waterfowl hunting

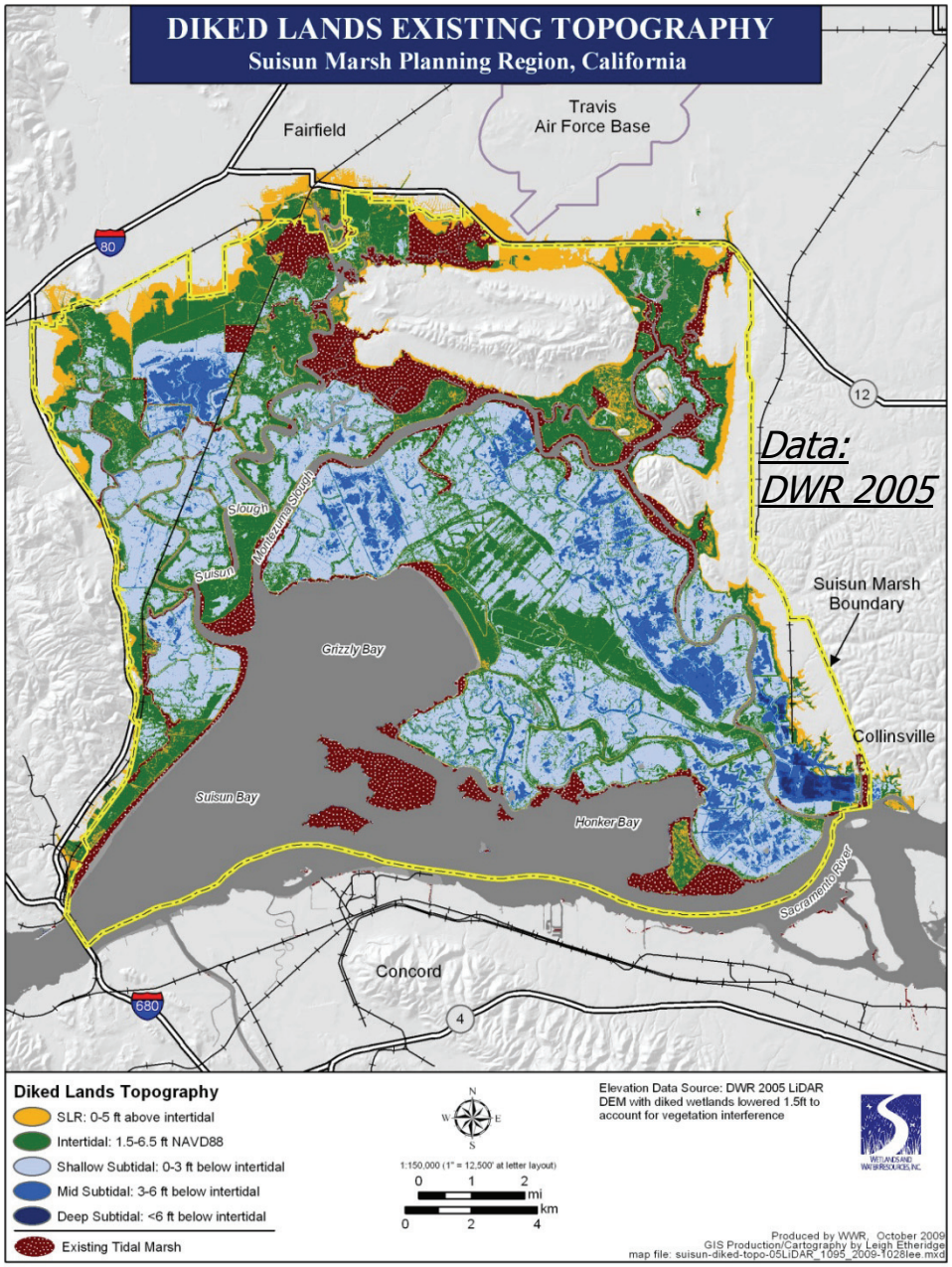
Data: SFEI EcoAtlas, WWR

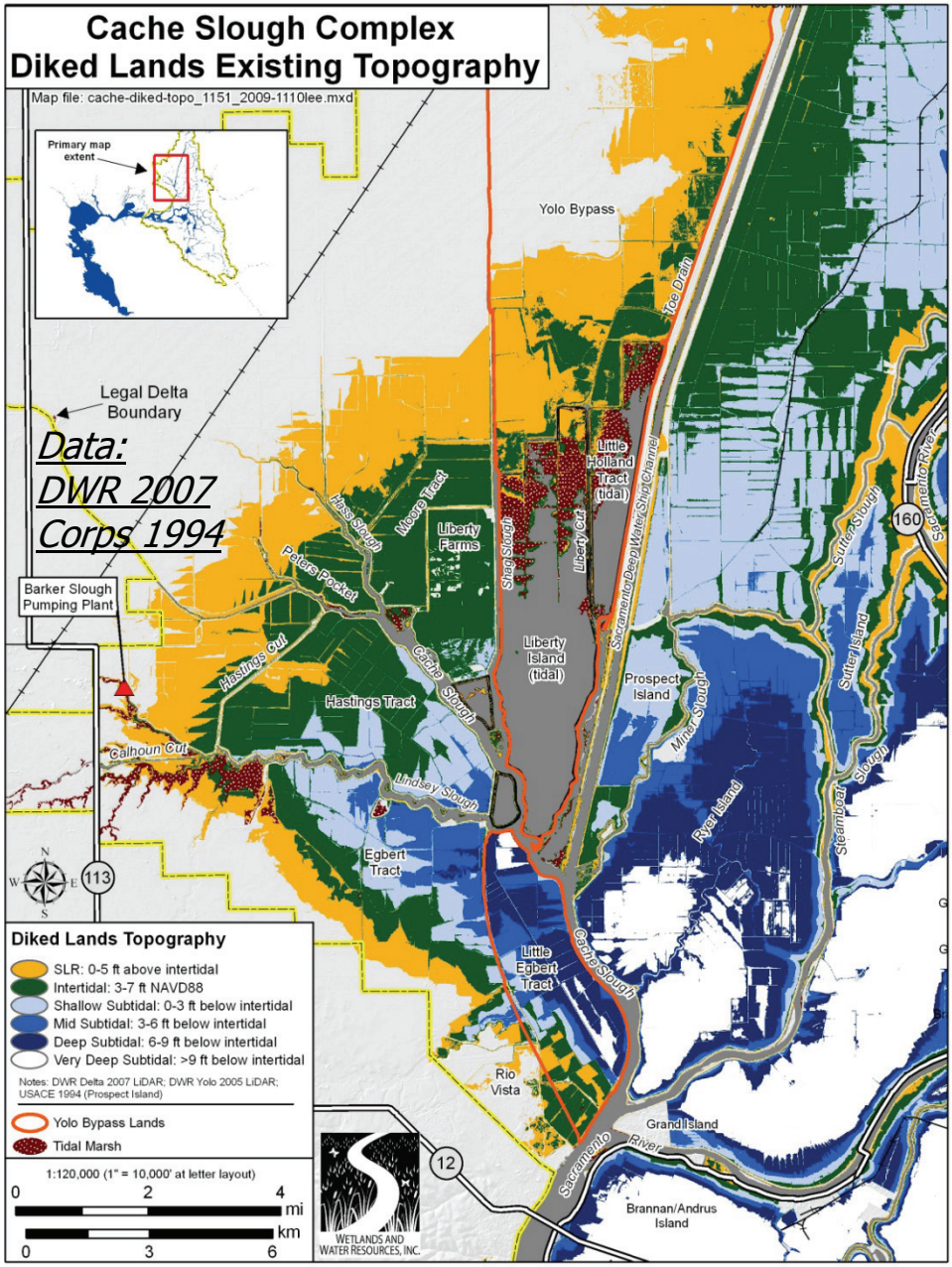
Then and Now
Cache Slough



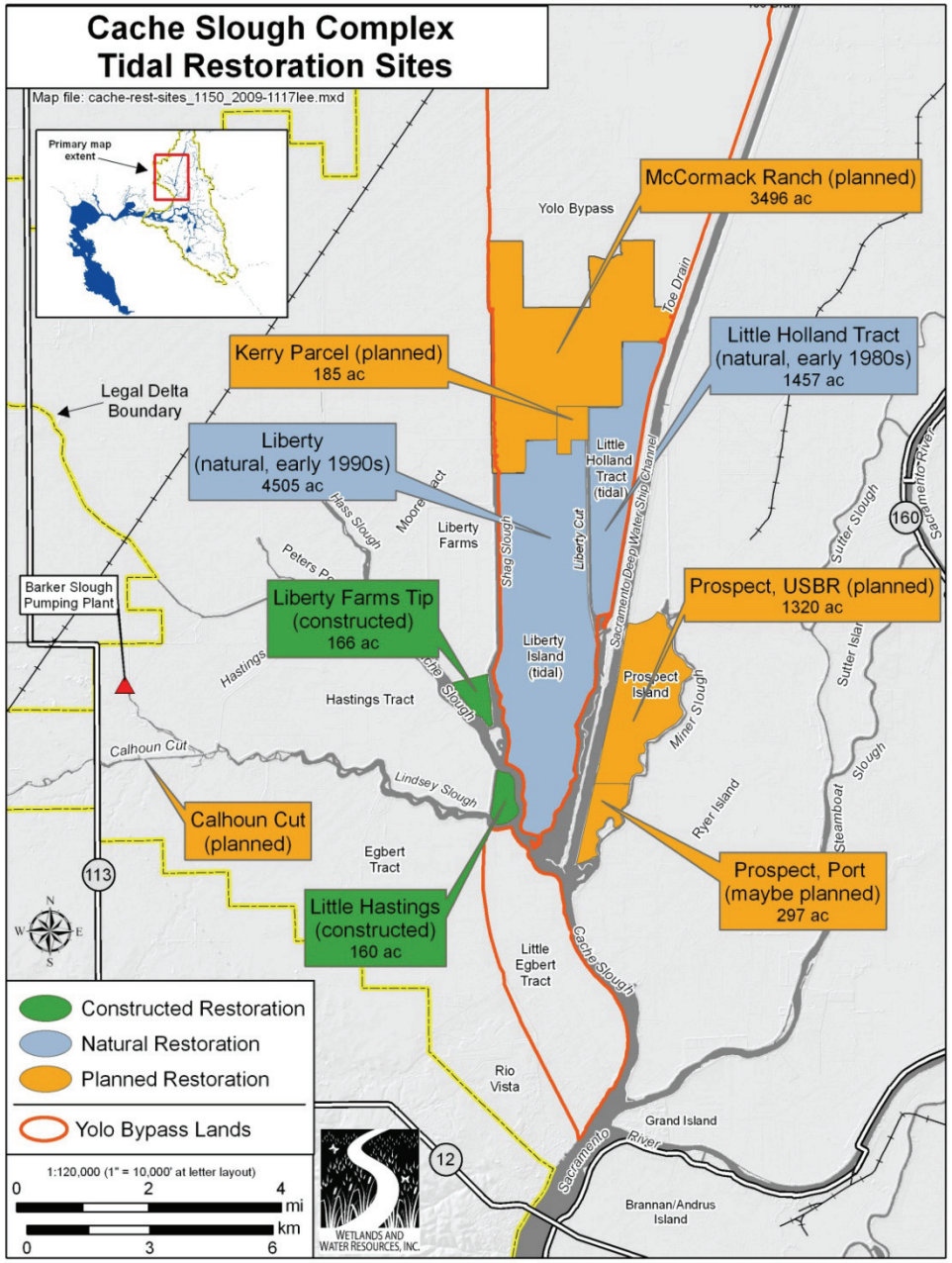


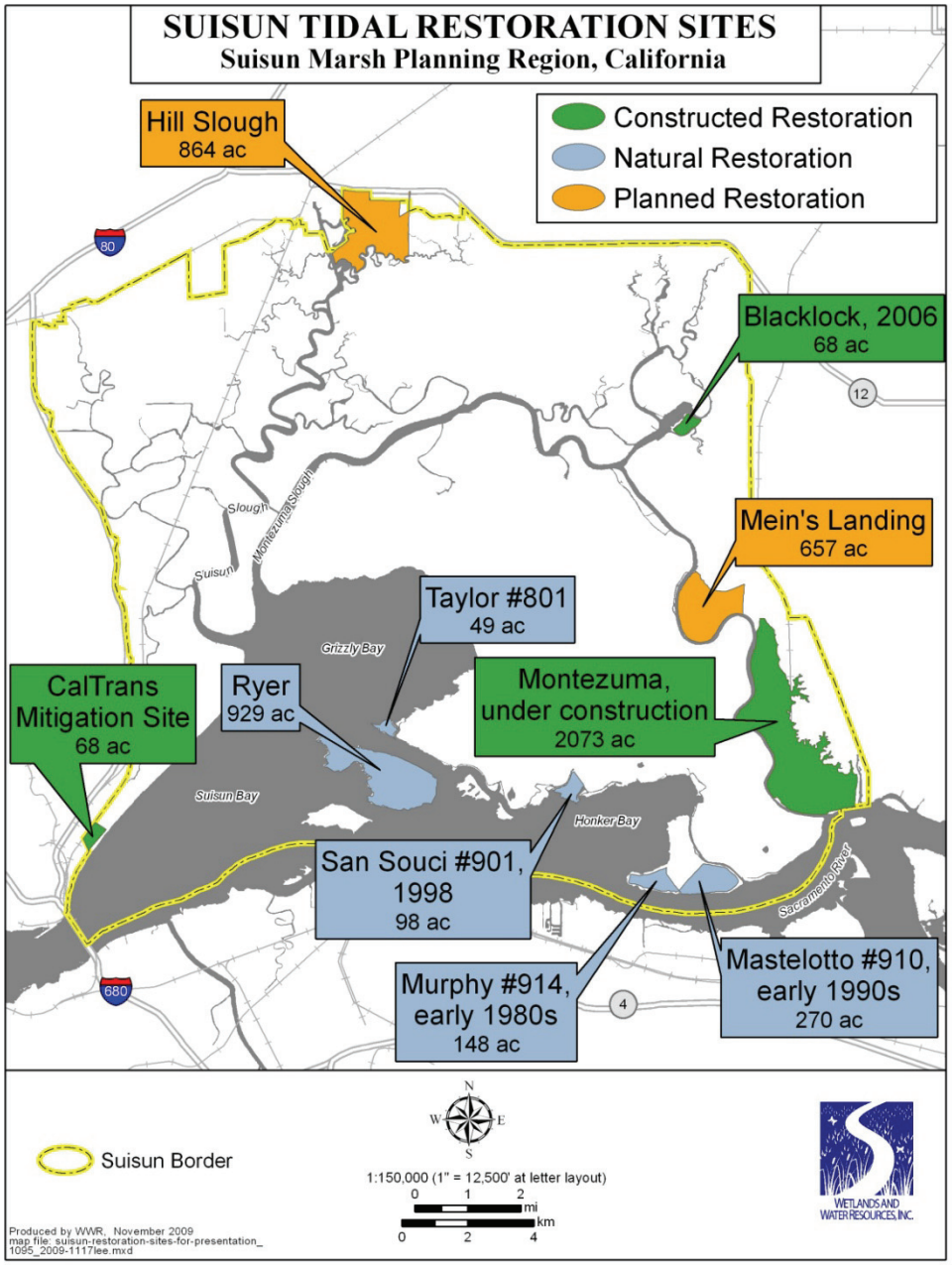
Suisun Marsh and Cache Slough Modern Topography





Current Restoration Sites





- More learning mainly through doing
- Policies aligning for implementation
- Adaptive management must structure learning

THANK YOU !

Browns Island Oct 2003
Photo: S. Siegel

WETLANDS AND WATER RESOURCES

www.swampthing.org

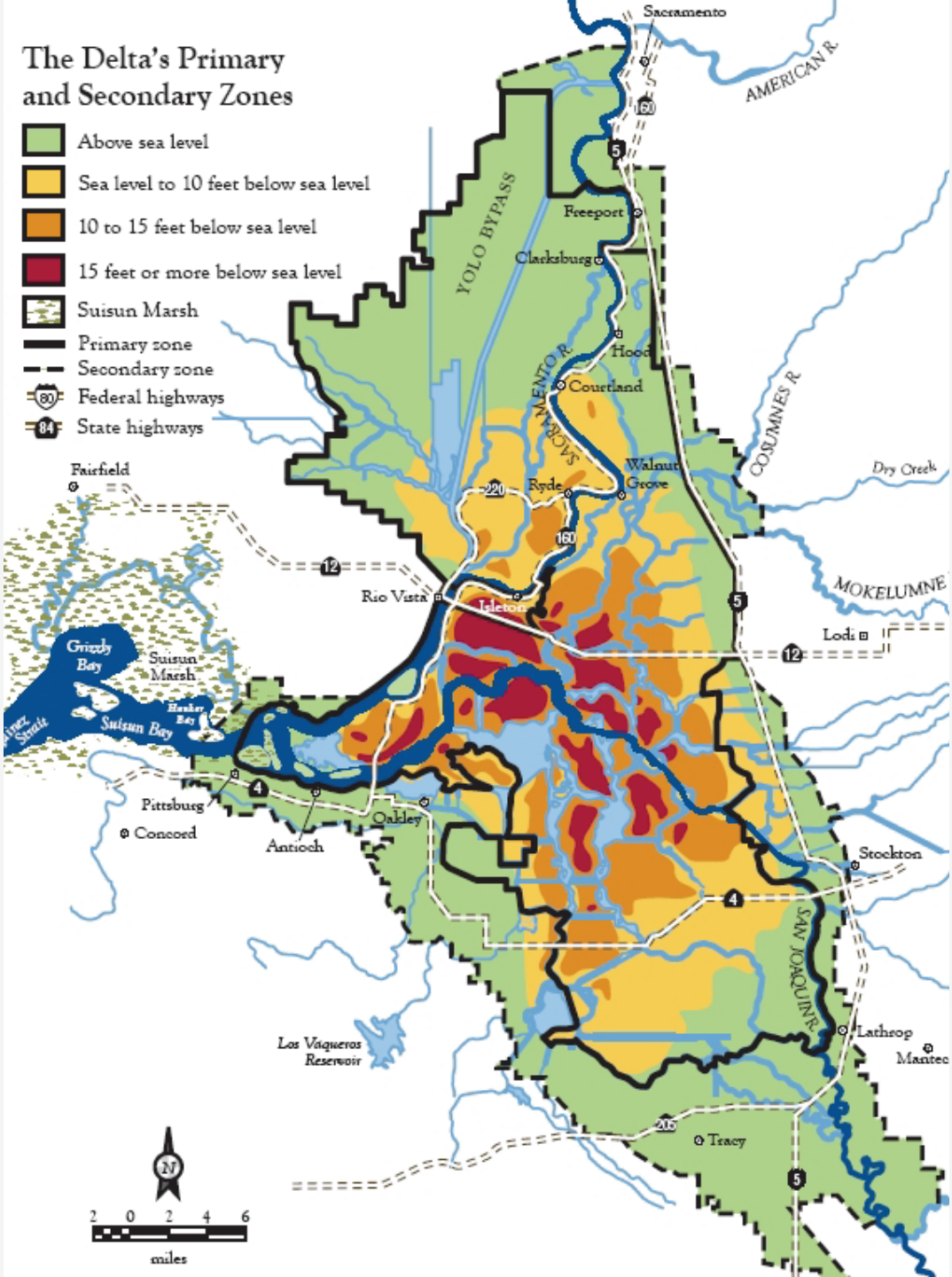
Subsidence: Wetland Carbon Bio-Sequestration

Today's "accommodation space"

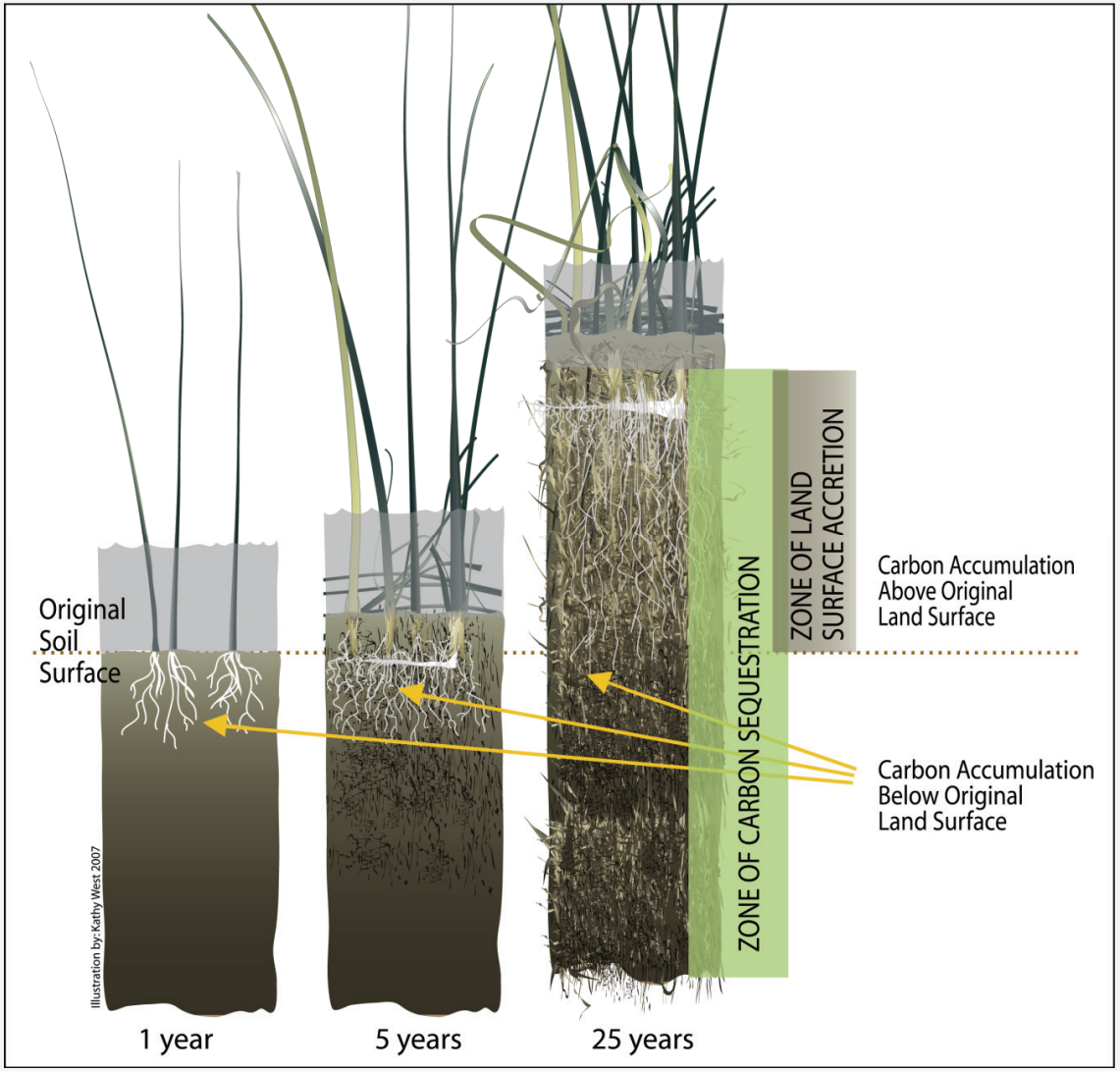
- 2.5 billion m^3
- 300 mile-deep football field

Upper Sea Level Rise Projections for 2100, Add:

- 4.5 billion m^3
- 540 mile-deep football field



How carbon capture farming works

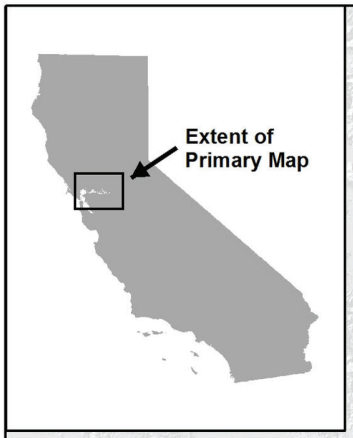


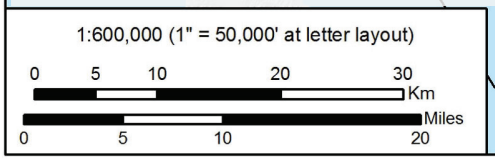
- Submerged about 1 ft
- Low oxygen
- Balance between plant growth and organic matter decomposition

USGS estimated 25 metric tons of CO_2 *per acre* could be removed from the atmosphere and stored in organic matter every year in the Delta

USGS

The Bond-Frozen Twitchell Island Demonstration Project



Benefits

- Virtually eliminates peat soil oxidation, reverses land subsidence
- Reduces levee pressure by raising groundwater and land levels
- Captures and sequesters CO_2 as plant biomass
- Nearly eliminates CO_2 emissions