South Bay Salt Pond Restoration Project

Restoring the Wild Heart of the South Bay

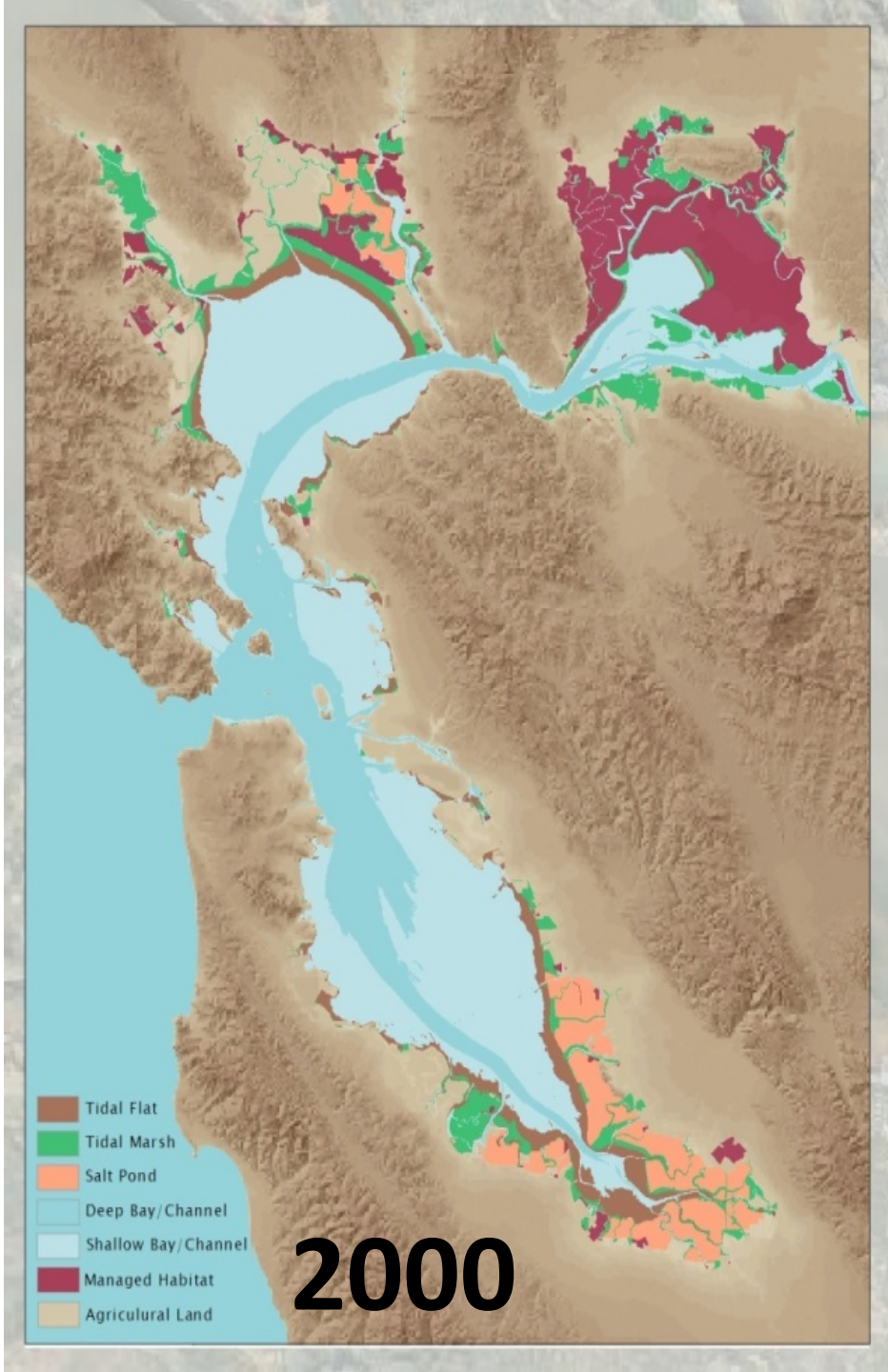
Large Scale and Long Term: The Role of Science and Collaboration in Large Ecosystem Restoration Projects

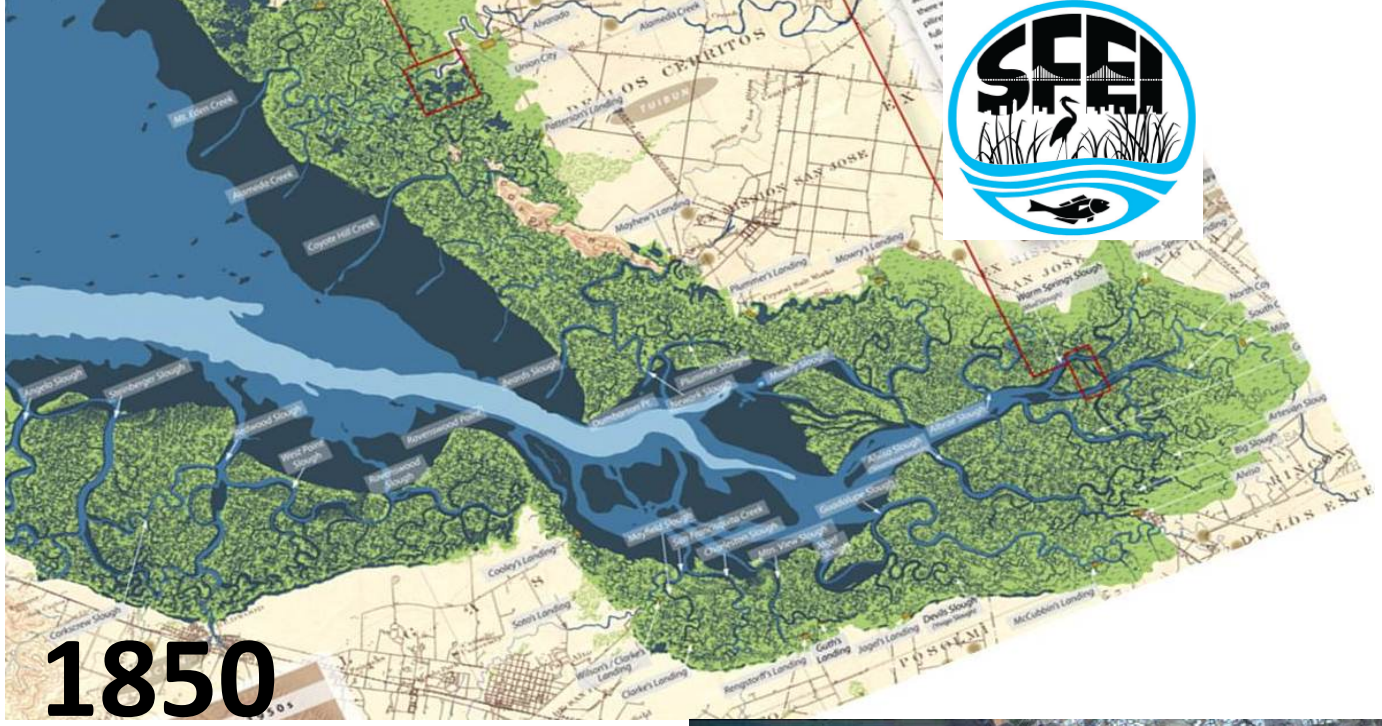
NCER 2016
Coral Springs, FL
April 18-22, 2016

Anne Morkill
U.S. Fish & Wildlife Service
San Francisco Bay National Wildlife Refuge Complex


N
San Pablo Bay NWR
SONOMA
NAPA
SOLANO
Vallejo
MARIN
San Rafael
Concord
Antioch Dunes NWR
Marin Islands NWR
CONTRA COSTA
Oakland
San Francisco
S.F.
Farallon NWR
Don Edwards S
Francisco Bay NW
Francisco
Bay
ALAMEDA
Fremont
Redwood City
SAN
MATEO
San Jose
SANTA CLARA
Pacific
Ocean
SANTA CRUZ
Santa Cruz
Elkhorn Slough NWR
Monterey
Bay
MONTEREY
Salinas
River NWR
Monterey
NEVADA
CALIFORNIA
Enlarged Area
0 5 10 20 km
0 5 10 20 Miles
0 250 Miles


Tidal Flat
Tidal Marsh
Salt Pond
Deep Bay/Channel
Shallow Bay/Channel
1850

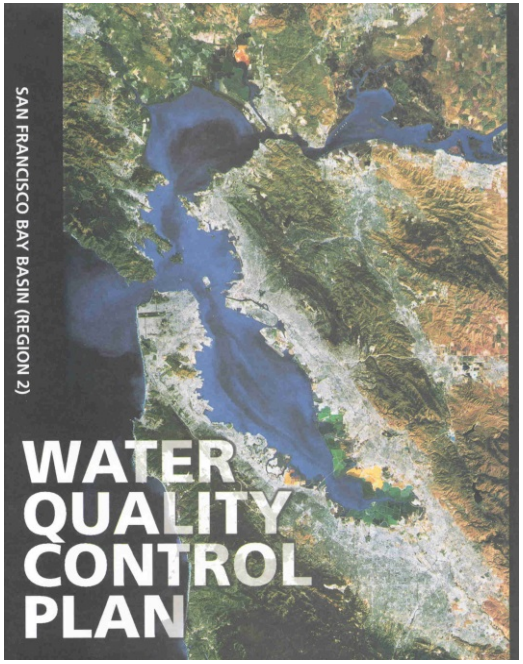

Tidal Flat
Tidal Marsh
Salt Pond
Deep Bay/Channel
Shallow Bay/Channel
Managed Habitat
Agricultural Land
2000


1850


2000


VALLEJO
AREAS PROJECTED TO BE FILLED BY 2020
OAKLAND
SAN FRANCISCO
PACIFIC OCEAN
BAY OR RIVER?
In 1960, city planners wanted to pave most of the bay.
WE STOPPED THEM.
Let's keep fighting for a healthy San Francisco Bay.
SAVE THE BAY
www.saveSFbay.org


San Francisco Bay Plan
San Francisco Bay Conservation and Development Commission


SAN FRANCISCO BAY BASIN (REGION 2)
WATER QUALITY CONTROL PLAN

Don Edwards San Francisco Bay National Wildlife Refuge

Nation's first "urban" refuge; established 1974

- preserve and enhance wildlife habitat
- protect migratory birds and threatened and endangered species
- provide opportunities for wildlife-oriented recreation and nature study for the surrounding communities

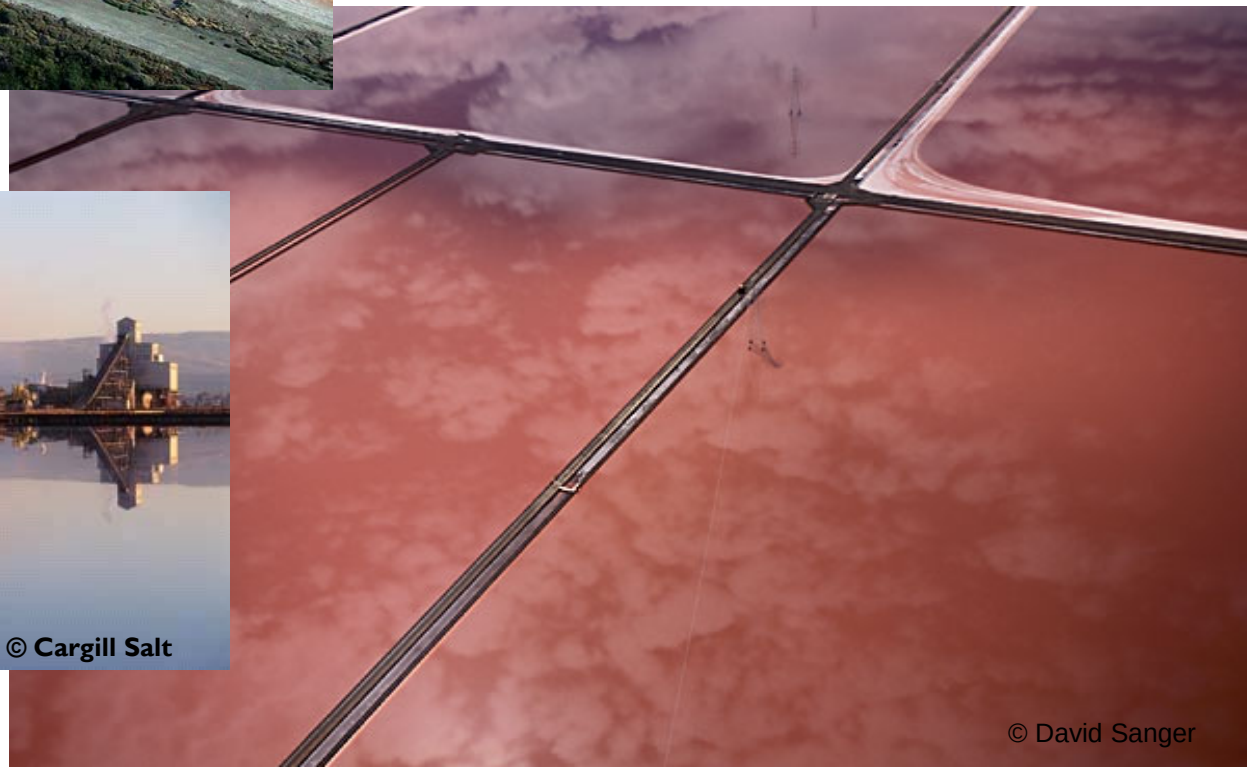
San Francisco Bay today

- Ramsar Treaty Wetland of International Importance
- Western Hemisphere Shorebird Reserve Network

San Francisco Bay today

Source: U.S. Army Corps of Engineers Digital Visual Library

Salt production has left us with a dramatically altered Bay ecosystem.



South Bay Salt Pond Restoration Project

Restoring the Wild Heart of the South Bay

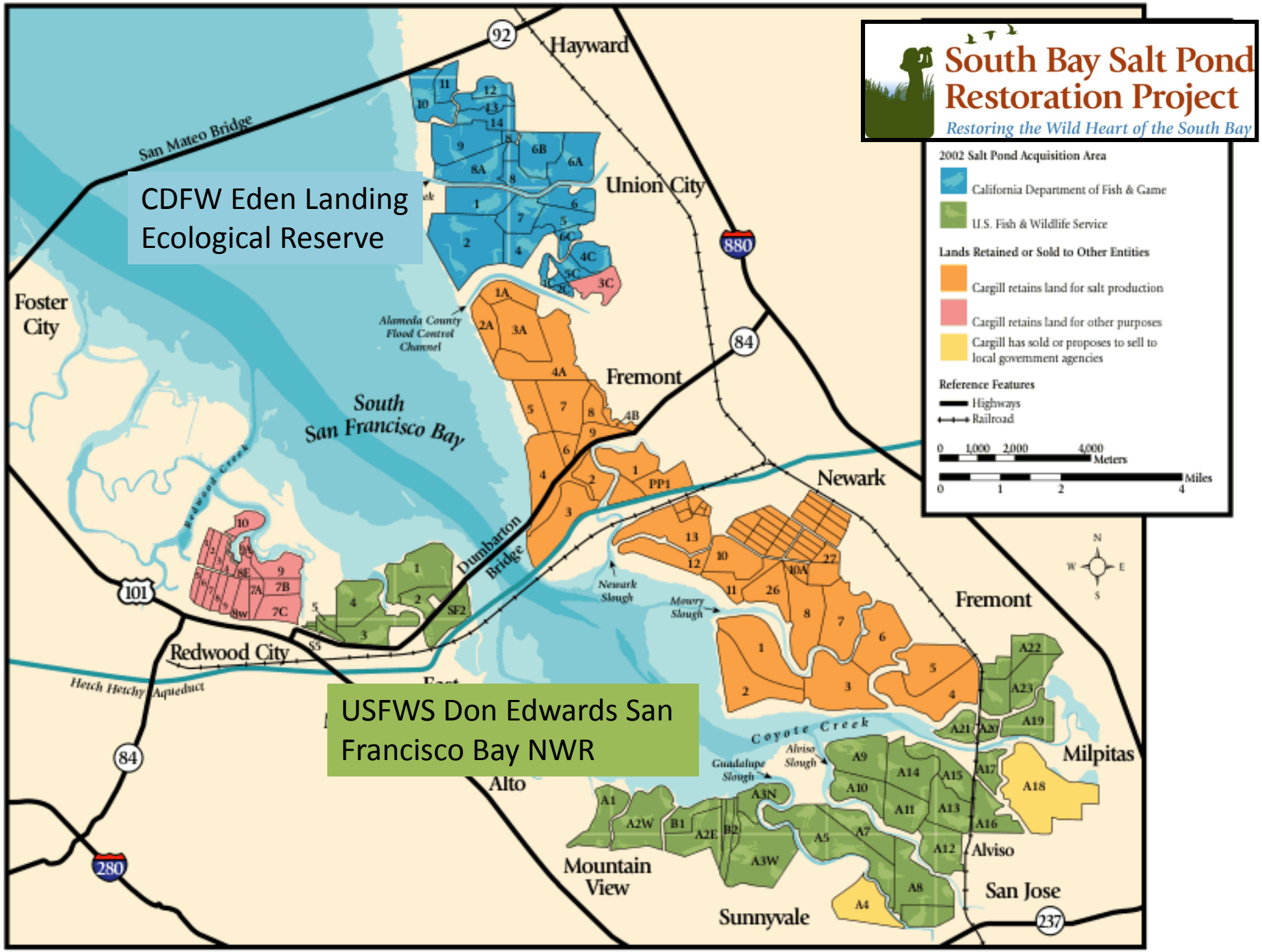
- Salt Pond Acquisition in 2003
- 16,500 acres
  - 15,100 in South Bay
  - 1,400 in North Bay
- Public/Private Partnership
  - $100 million
  - State, Federal and Private dollars

Coastal Conservancy

U.S. Fish & Wildlife Service

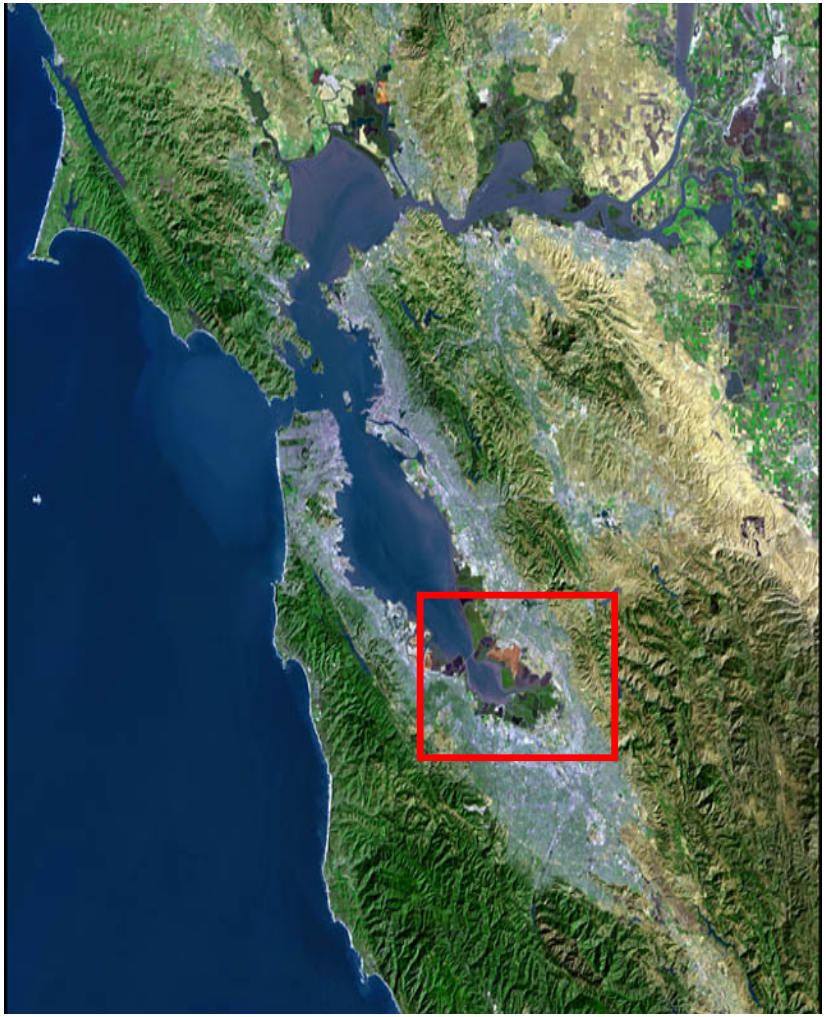
Resources Agency California Department Fish & Game

Cargill


South Bay Salt Pond Restoration Project
Restoring the Wild Heart of the South Bay
CDFW Eden Landing Ecological Reserve
USFWS Don Edwards San Francisco Bay NWR
2002 Salt Pond Acquisition Area
California Department of Fish & Game
U.S. Fish & Wildlife Service
Lands Retained or Sold to Other Entities
Cargill retains land for salt production
Cargill retains land for other purposes
Cargill has sold or proposes to sell to local government agencies
Reference Features
Highways
Railroad
Meters
Miles
Hayward
Union City
Fremont
Newark
Foster City
Redwood City
Alto
Mountain View
Sunnyvale
San Jose
Alviso
Milpitas
San Mateo Bridge
Dumbarton Bridge
Hetch Hetchy Aqueduct
Alameda County Flood Control Channel
South San Francisco Bay
Coyote Creek
Guadalupe Slough
Alviso Slough
Newark Slough
Mowry Slough
Redwood Creek
92
880
84
101
280
237

Balancing Multiple Objectives

- Restoration of fish and wildlife and their habitats
- Recreation access for 4+ million people
- Flood protection for Silicon Valley



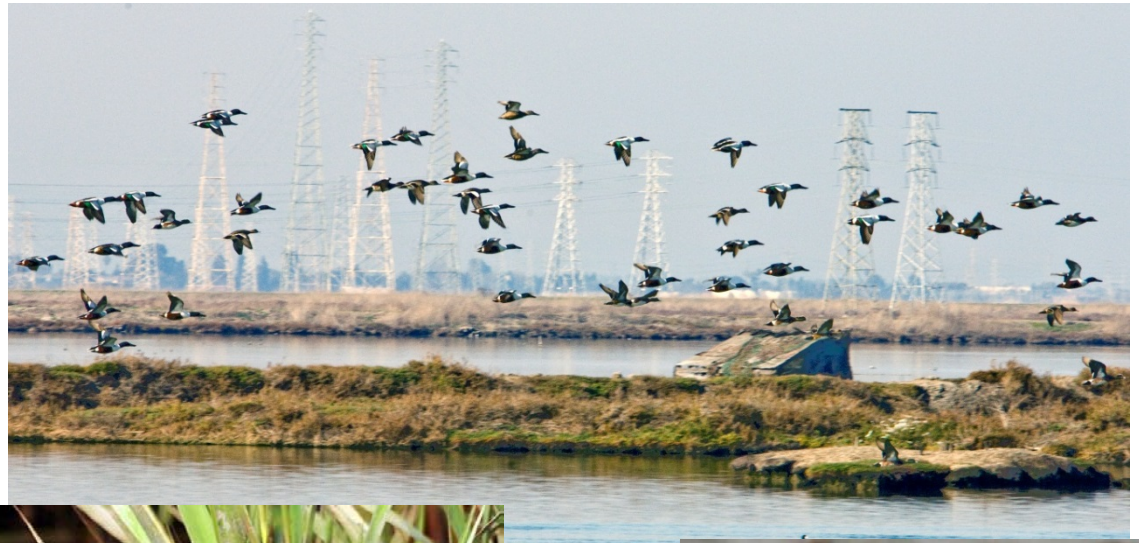
Balancing Multiple Objectives

Key Uncertainties

- Wildlife use of changing habitats
- Habitat evolution and sediment dynamics
- Mercury methylation
- Water quality
- Invasive species
- Public access & wildlife disturbance
- Infrastructure support
- Sea level rise and climate change

Balancing Multiple Objectives

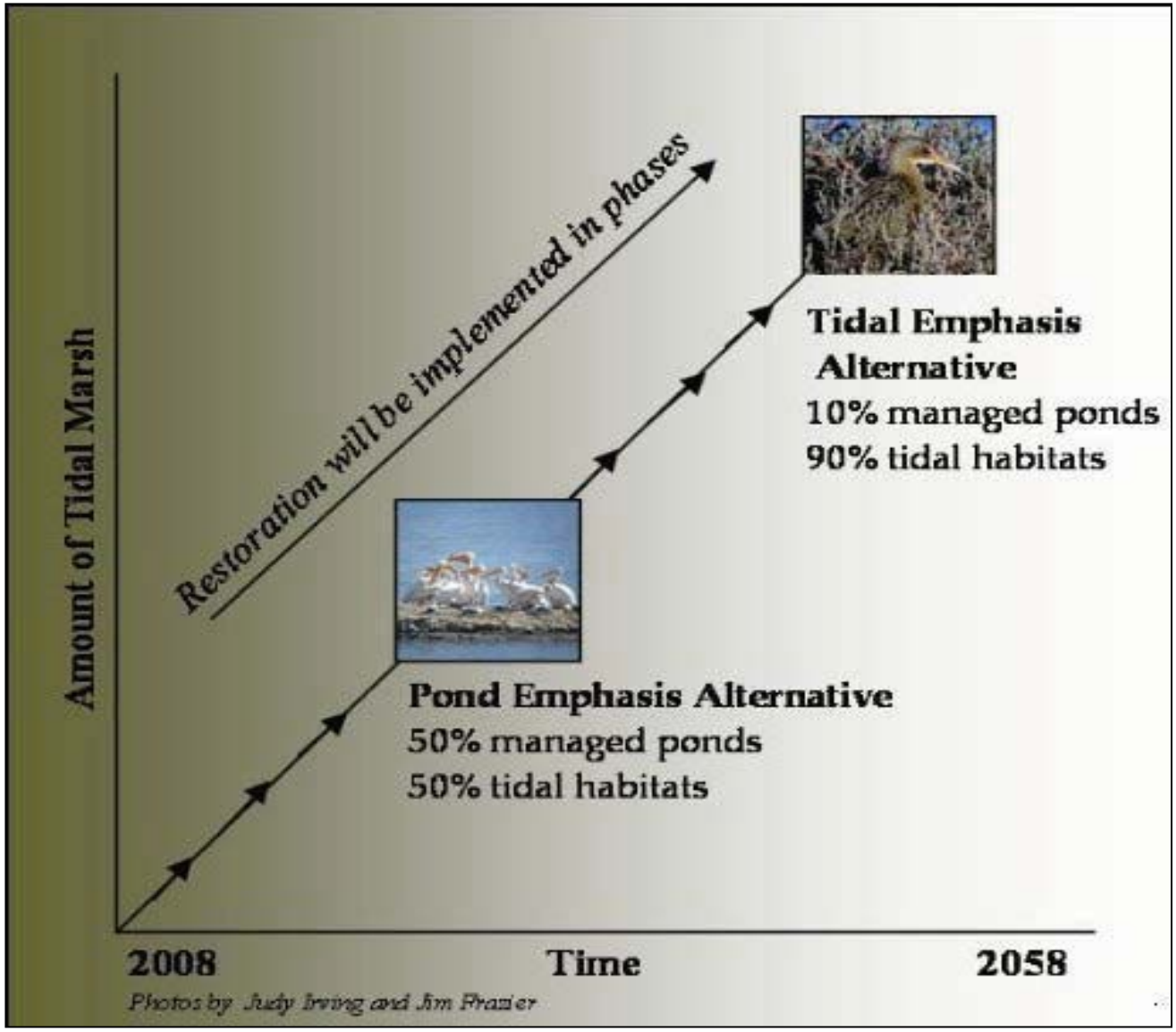
- Tidal Marsh species vs. Salt Pond species

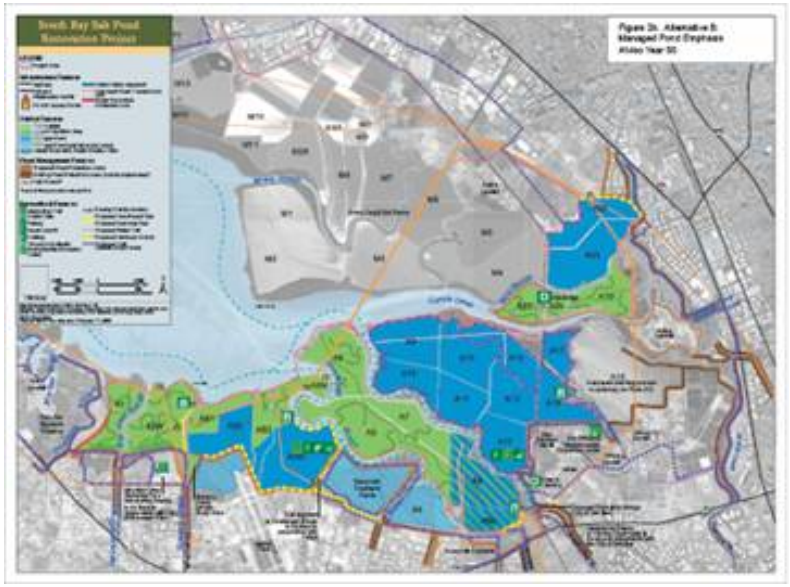


Balancing Multiple Objectives

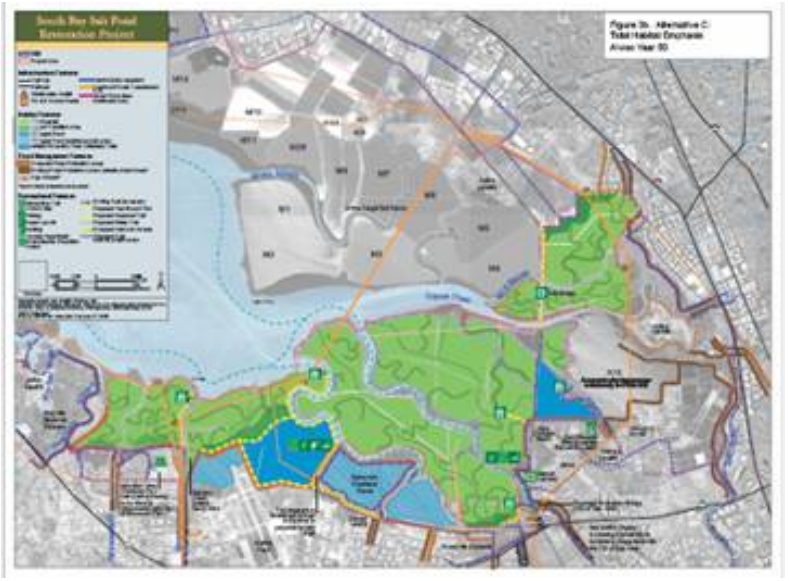
- Public recreation vs. wildlife sanctuary

50-year restoration plan

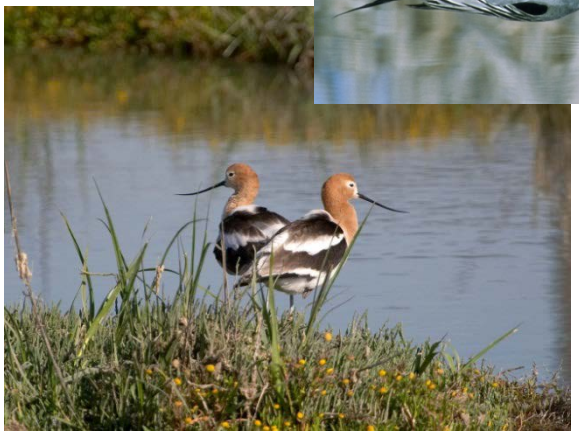




Managed Pond Emphasis



Tidal Marsh Emphasis



Why manage ponds?

- Key habitats for dense migratory bird populations in migration and winter
- Western snowy plover nesting habitat
- Pacific Flyway Migration and Wintering Area for water birds
- Western Hemispheric Shorebird Reserve Network

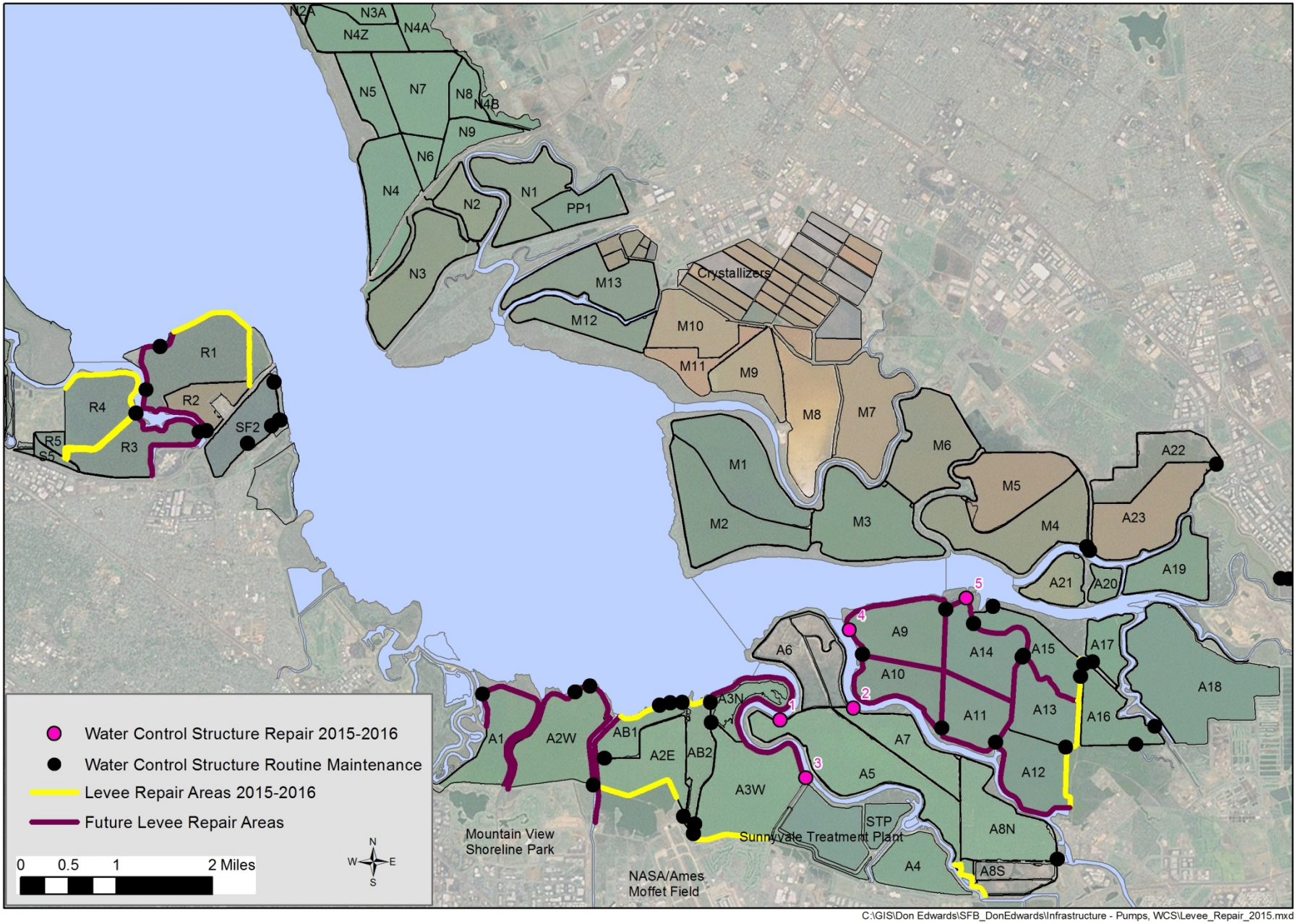
Why restore tidal marsh?

- 90% of historic SFB tidal marshes have been lost to development
- Many tidal marsh species are now threatened or endangered
- Conversion of salt ponds to marsh is critical for the recovery of these species

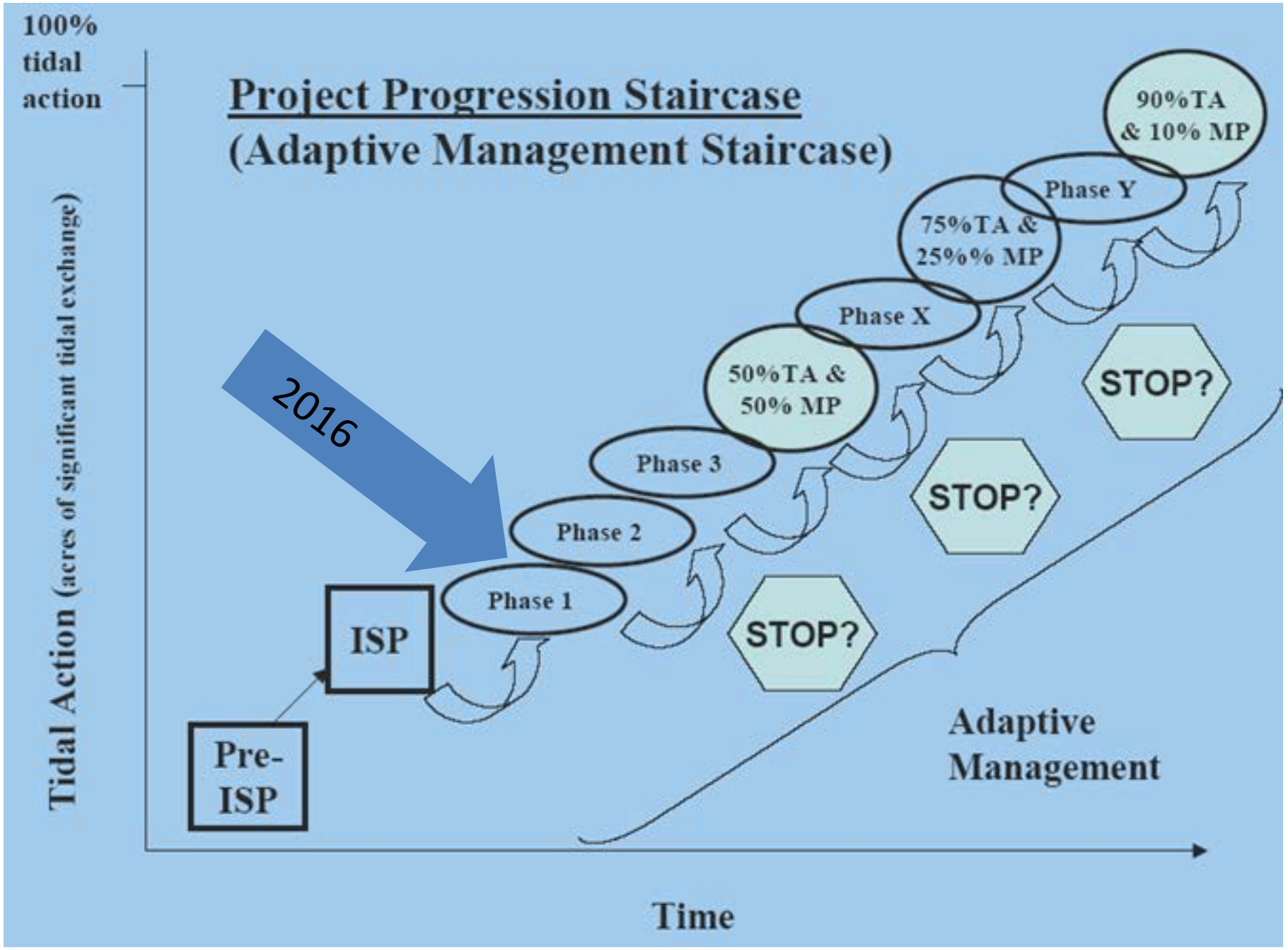
U.S. Fish & Wildlife Service

Don Edwards San Franicisco Bay National Wildlife Refuge

Levee Maintenance June 1, 2015 - May 31, 2016



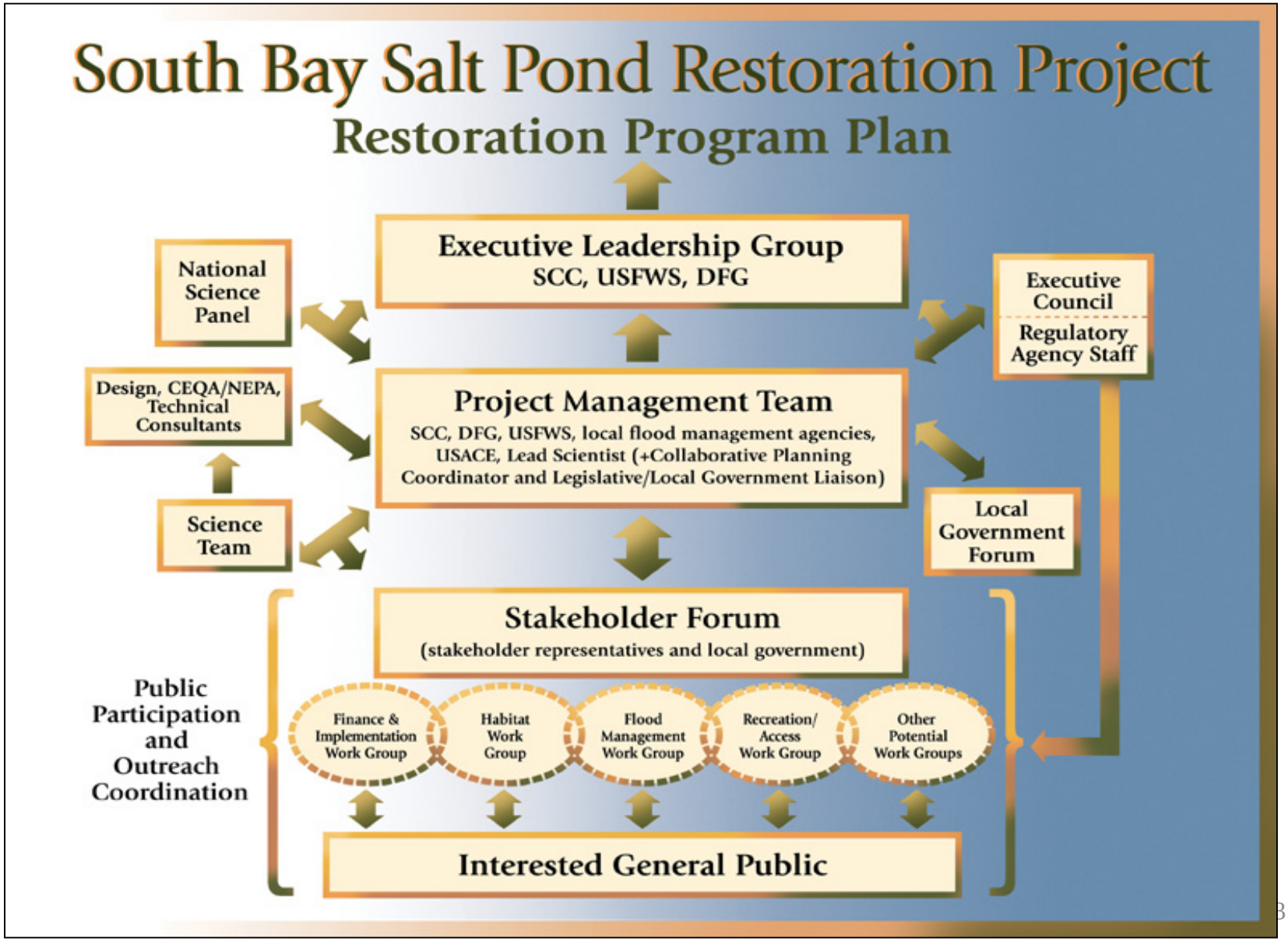
C:\GIS\Don Edwards\SFB_DonEdwards\Infrastructure - Pumps, WCS\Levee_Repair_2015.mxd


100% tidal action
Project Progression Staircase
(Adaptive Management Staircase)
90%TA & 10% MP
Phase Y
75%TA & 25%% MP
Phase X
50%TA & 50% MP
Phase 3
Phase 2
Phase 1
2016
STOP?
STOP?
STOP?
ISP
Pre-ISP
Adaptive Management
Tidal Action (acres of significant tidal exchange)
Time

Excerpt from South Bay Salt Pond Restoration Project Adaptive Management Plan

CATEGORY/	RESTORATION TARGET	MONITORING PARAMETER (METHOD)	SPATIAL SCALE FOR MONITORING RESULTS	EXPECTED TIME FRAME FOR DECISION-MAKING	MANAGEMENT TRIGGER	APPLIED STUDIES	POTENTIAL MANAGEMENT ACTION
Sediment Dynamics Project Objective 1	1. No decrease in mudflat or subtidal channel habitat	1. Area of mudflats	1. Pond Complex level and South Bay	1. 10-20 years for mudflats; 0-5 years for channels	1. Mudflat decreases greater than natural variability	1. Will sediment move from mudflats to restored areas; will this impact biota?	1. Studies; slow restoration; redesign restorations.
	2. Accretion rate of ponds is sufficient to create marsh	2.Sedimentation rate inside breached ponds	2. Pond scale	2. Two to 10 years depending on initial elevation	2. Projected accretion rates	2. Is there enough sediment to create new marsh?	2. Studies; slow restoration; redesign restorations.
	3. No long-term net loss of tidal marsh in S. Bay	3. Total area of marsh in S. Bay	3. Pond Complex level and South Bay	3. 10 to 20 years	3. Observed net loss of marsh greater than natural variability	3. Is there enough sediment to maintain existing marsh and create new?	3. Studies; slow restoration; redesign restorations.

Stakeholder Engagement



Project Management Team

- ✓ Multi-agency
- ✓ Meets monthly
- ✓ Working Groups: Pond management, mercury studies, plant restoration

Stakeholder Group

- ✓ Public & private entities
- ✓ Meets at least annually

Manager-Research Group

- ✓ PMT members & Principle Investigators
- ✓ Meet annually

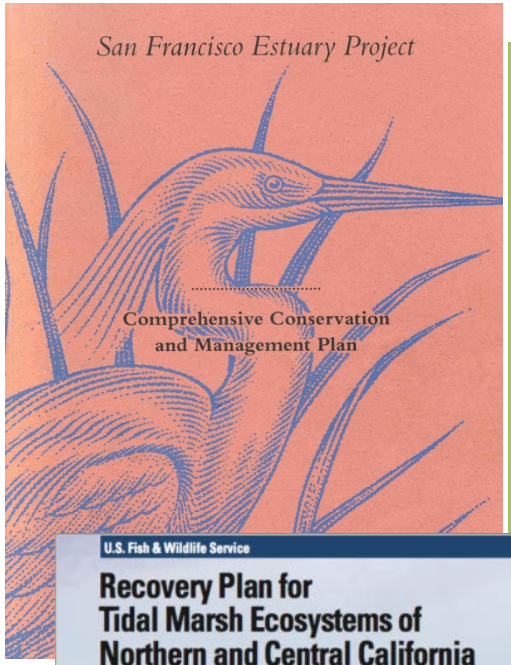
Science Symposium

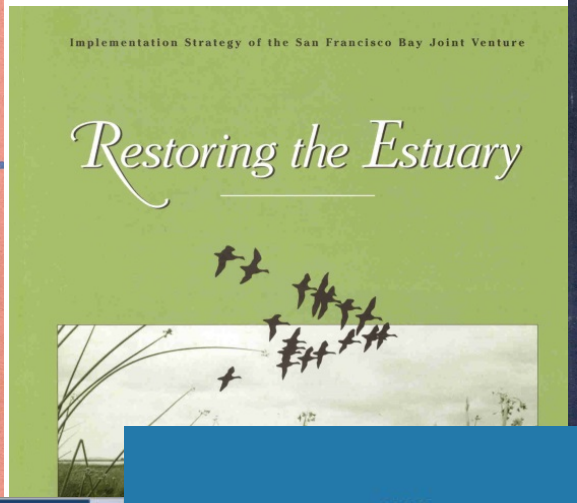
- ✓ Meets biennially

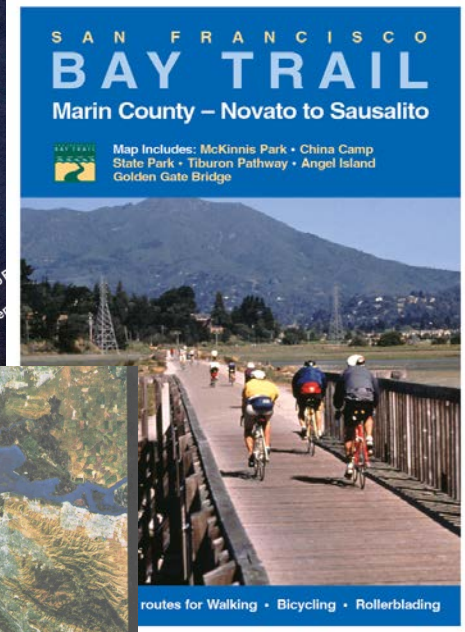
South Bay Salt Pond Restoration Project

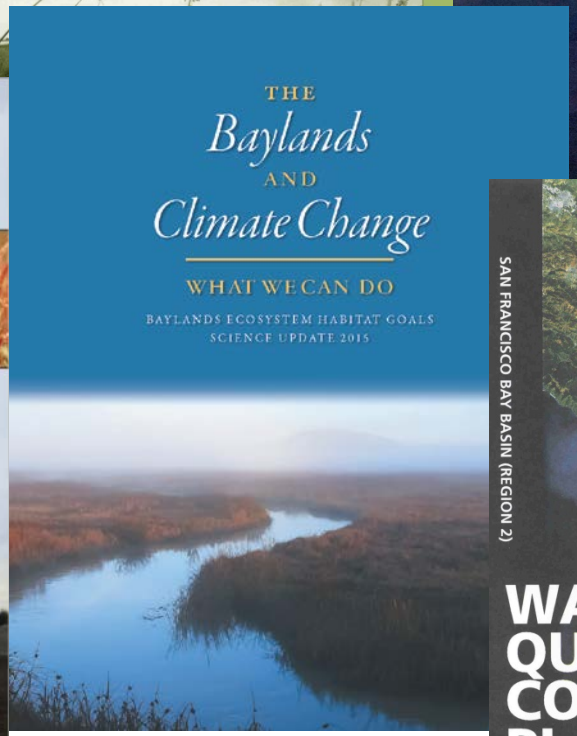
Restoring the Wild Heart of the South Bay

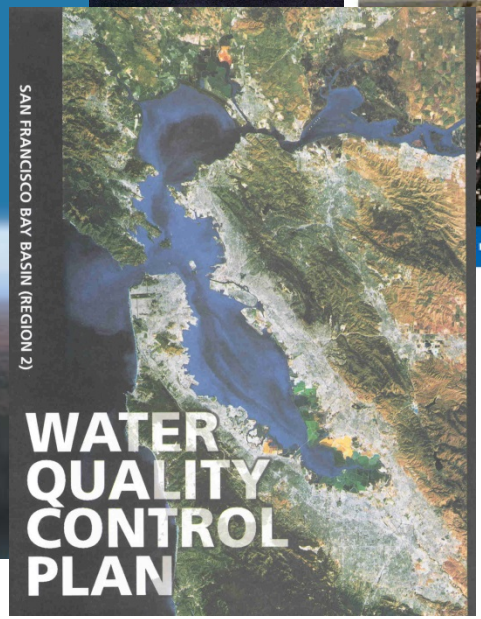
Regional Planning Efforts





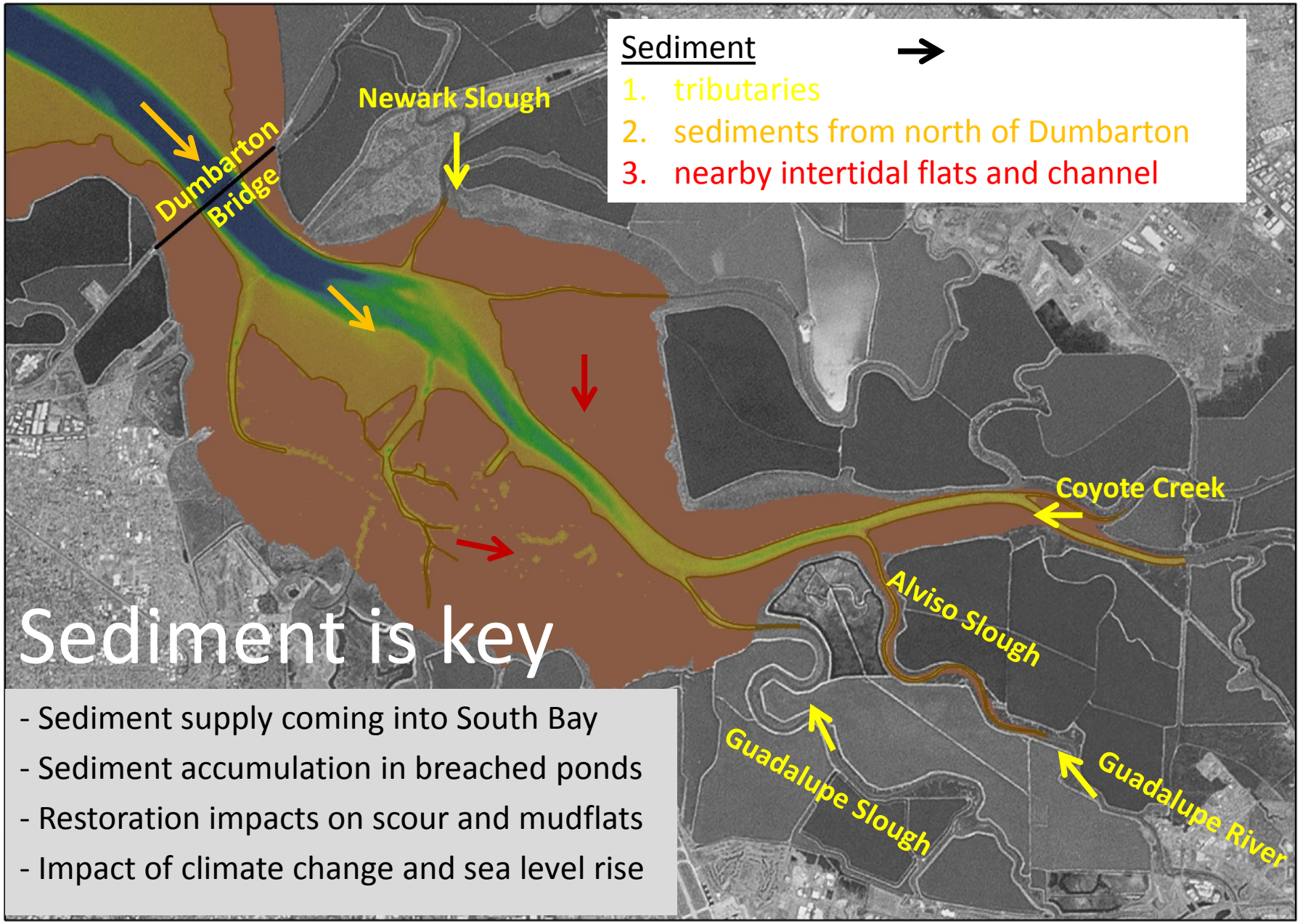






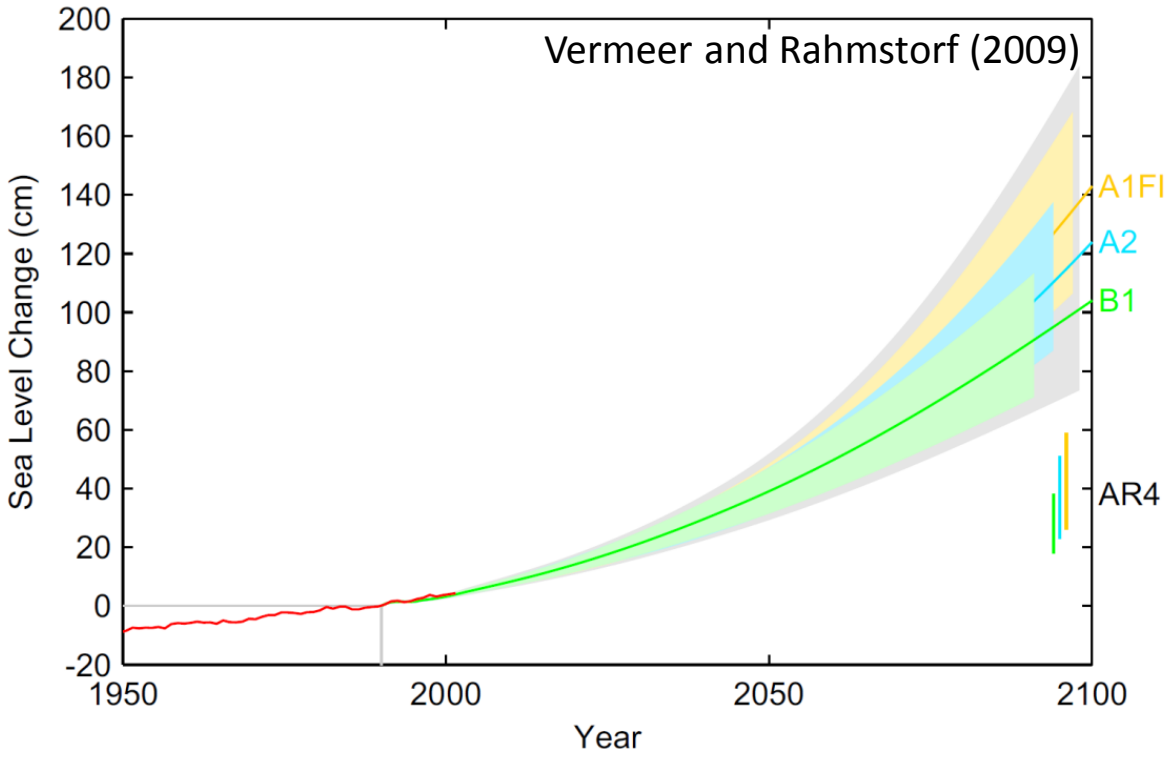
Breaching a levee is the "easy" part…

Sediment is key



see Shellenbarger et al., in press

Sea Level Rise (SLR) Scenarios



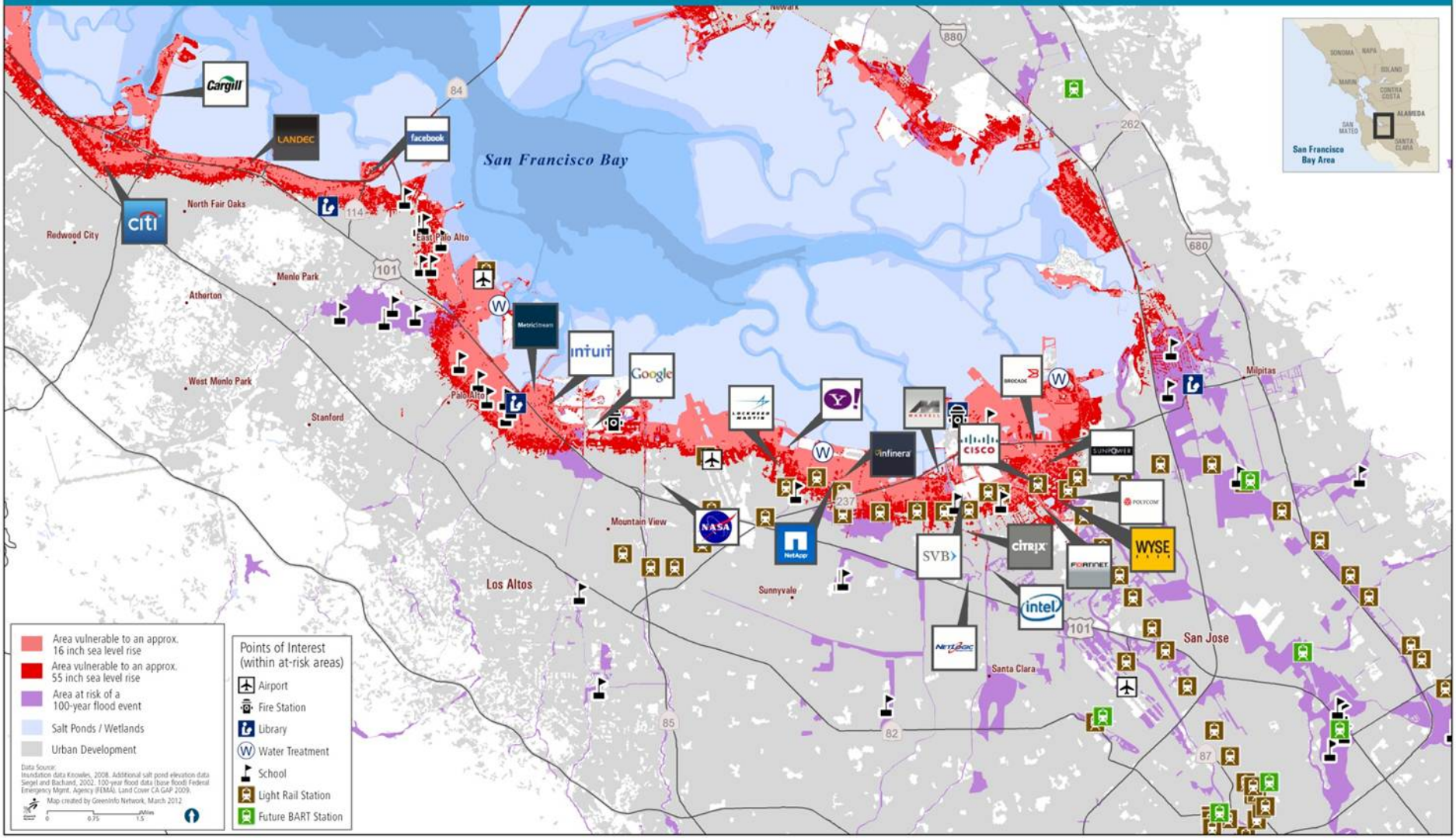
IPCC Emission Scenarios, semiempirical SLR=f(T)

Last IPCC Estimates (2007)

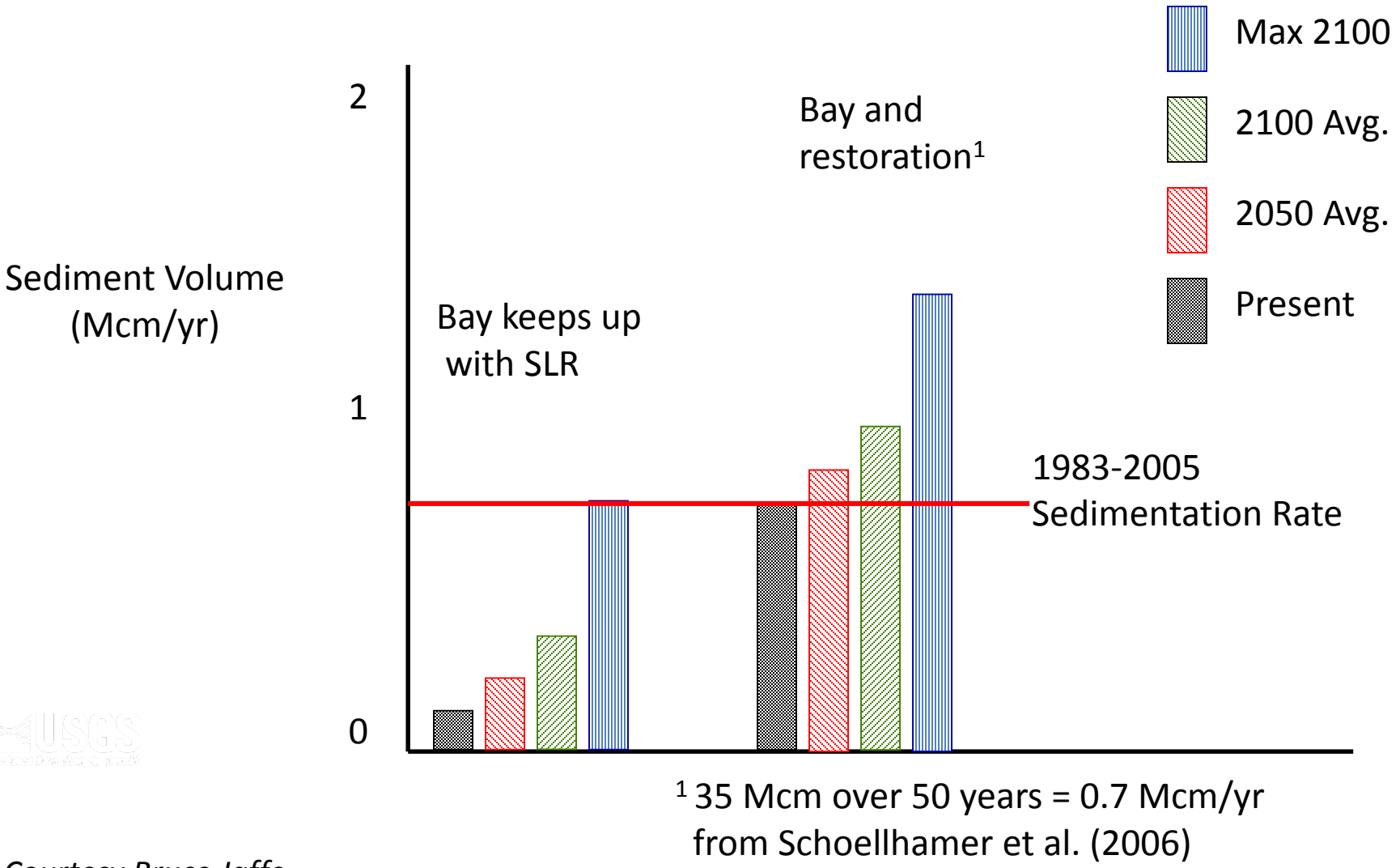
From National Research Council (2012) "*Sea-Level Rise for the Coasts of California, Oregon, and Washington*"

Flood Risk and Sea Level Rise – South Bay

Economic Impact, San Francisco Bay Area

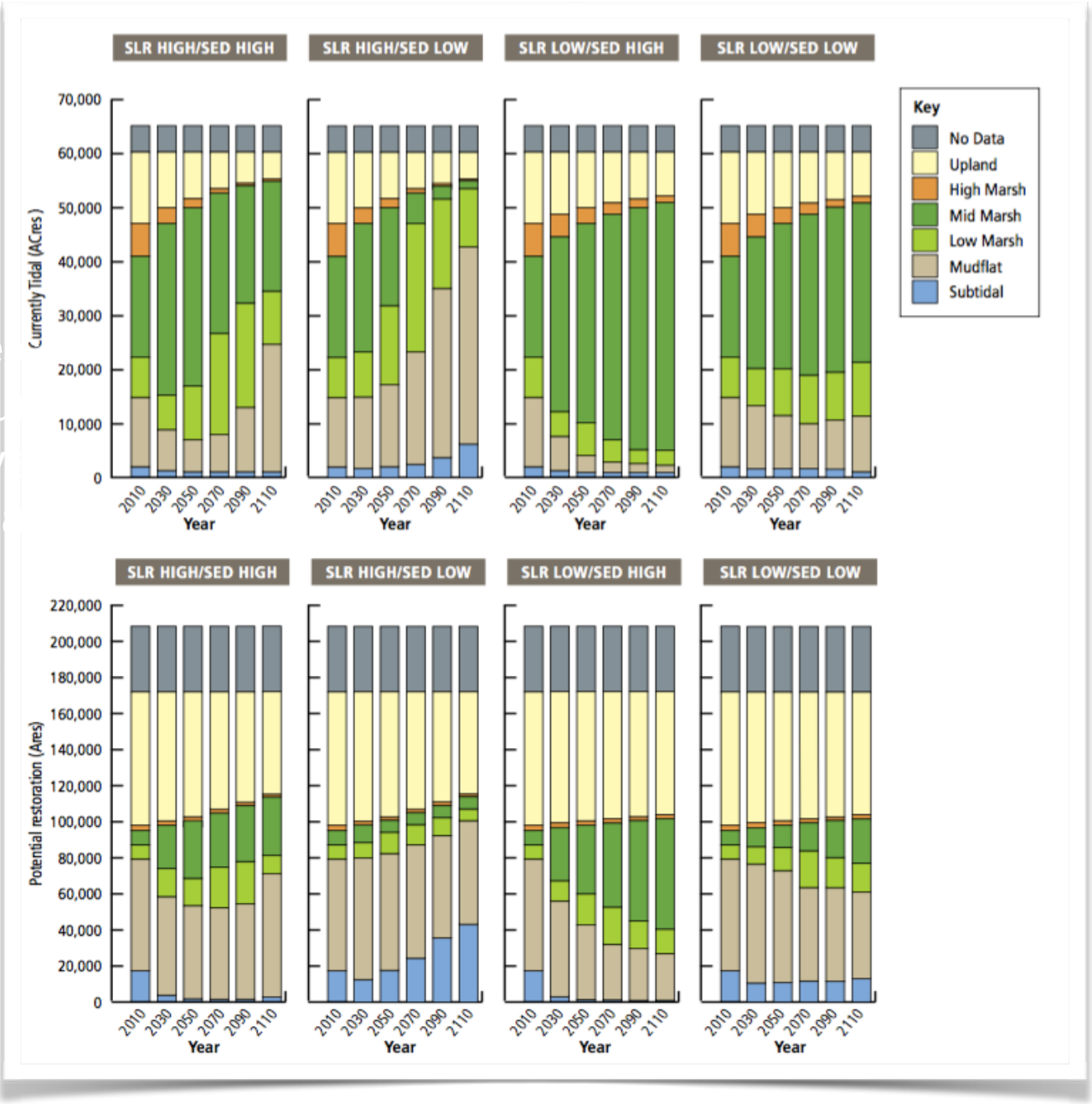


Estimated bay and restoration sediment "demand" from SLR



Courtesy Bruce Jaffe

If we act quickly, we can save over 80% of our existing wetlands over the next hundred years

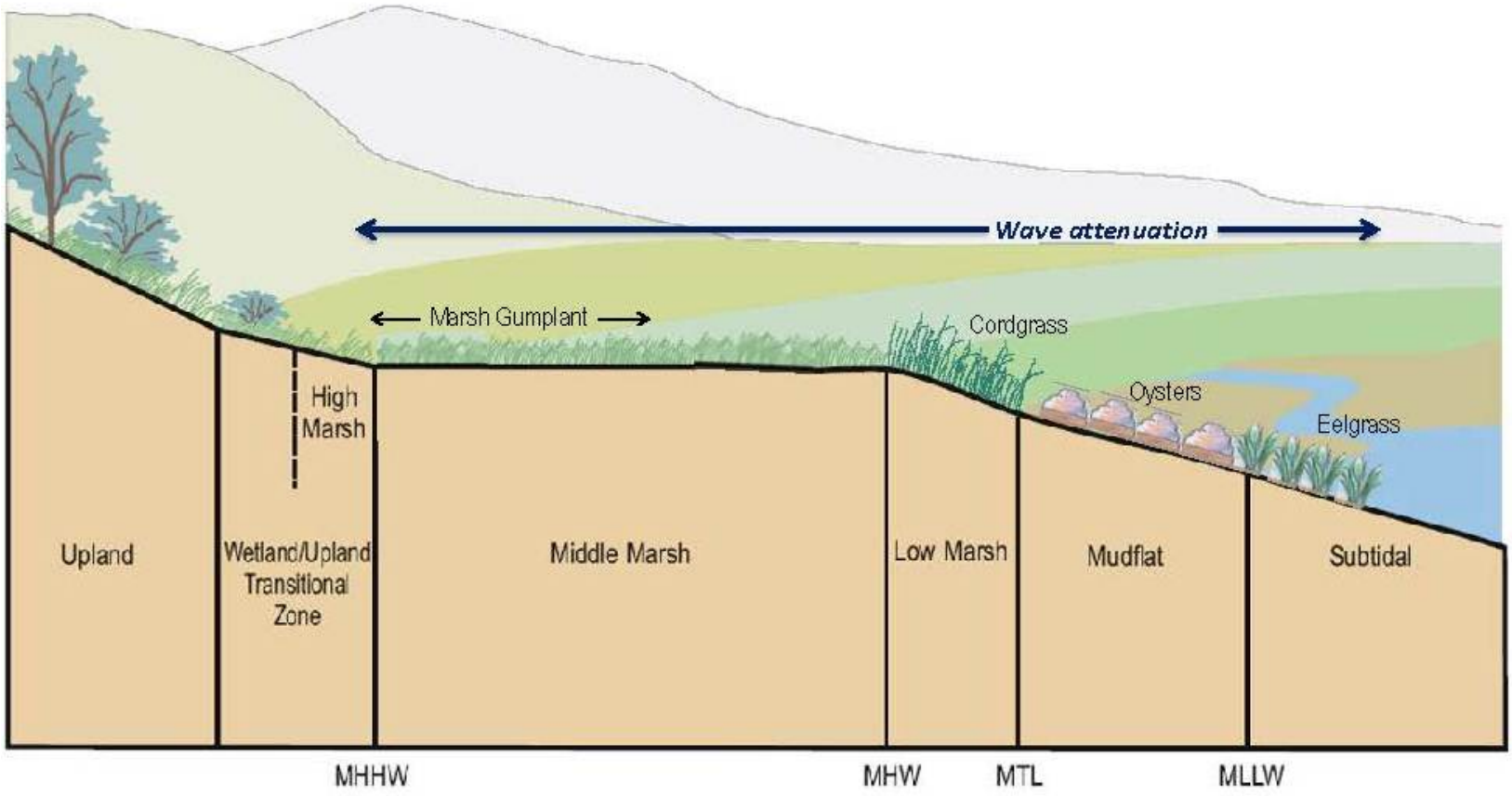


Graphic from *The Baylands and Climate Change: What We Can Do*

Management Response – Adaptation Strategies

- Restore complete tidal wetland system
- Restore wetlands sooner rather than later
- Use of upland fill or beneficial reuse dredge material to increase elevation & accelerate marsh plain development
- Creating high tide refugia – planting upland transition zones and creating marsh islands

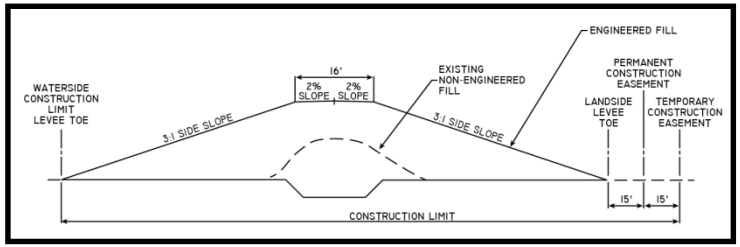
Restoring the complete tidal wetland system



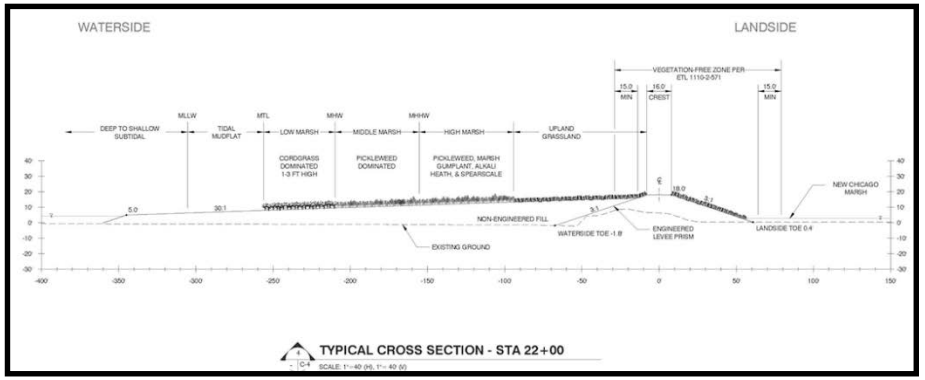
ESA PWA

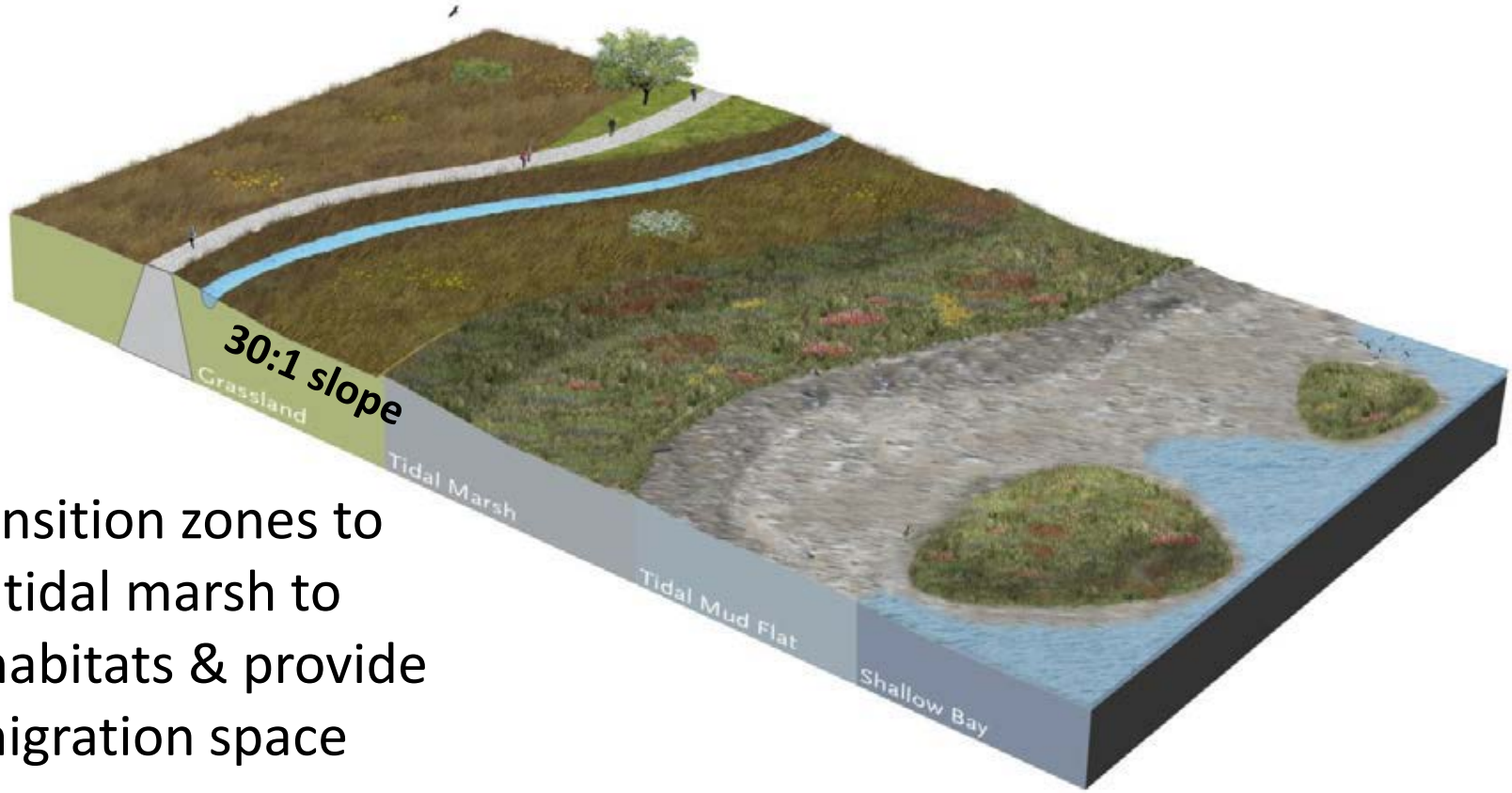
Coastal Conservancy

Traditional 3:1 sloped levee



"Horizontal" 30:1 sloped levee

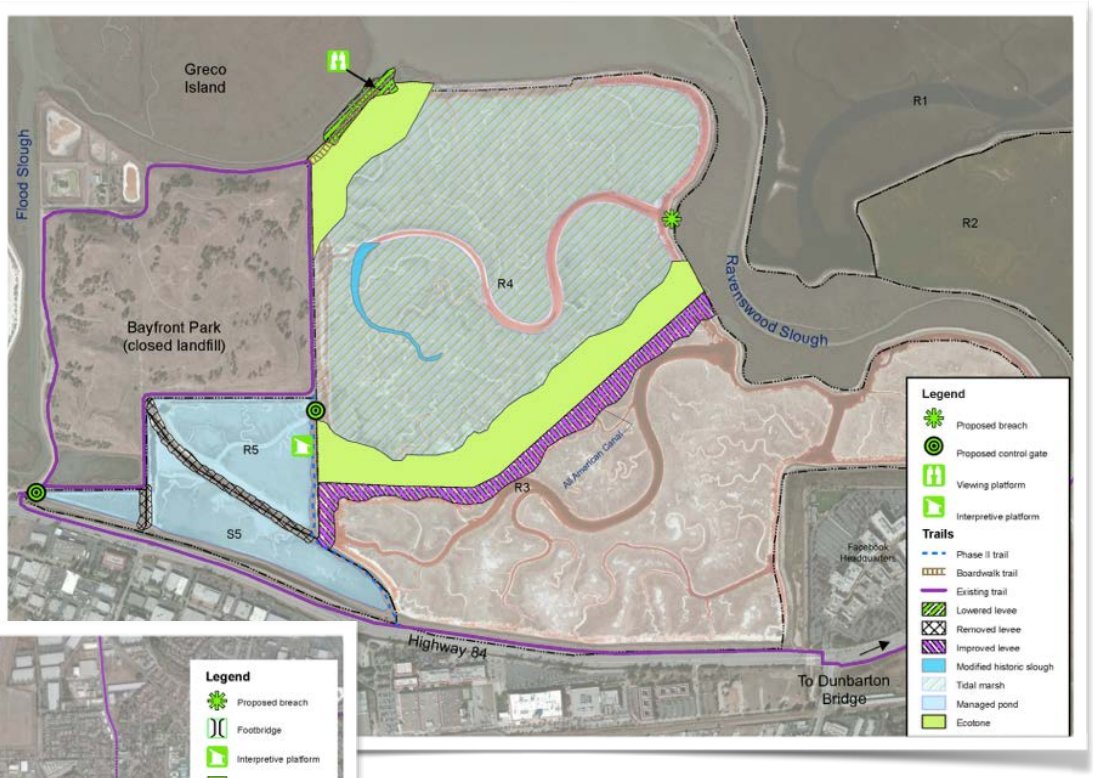




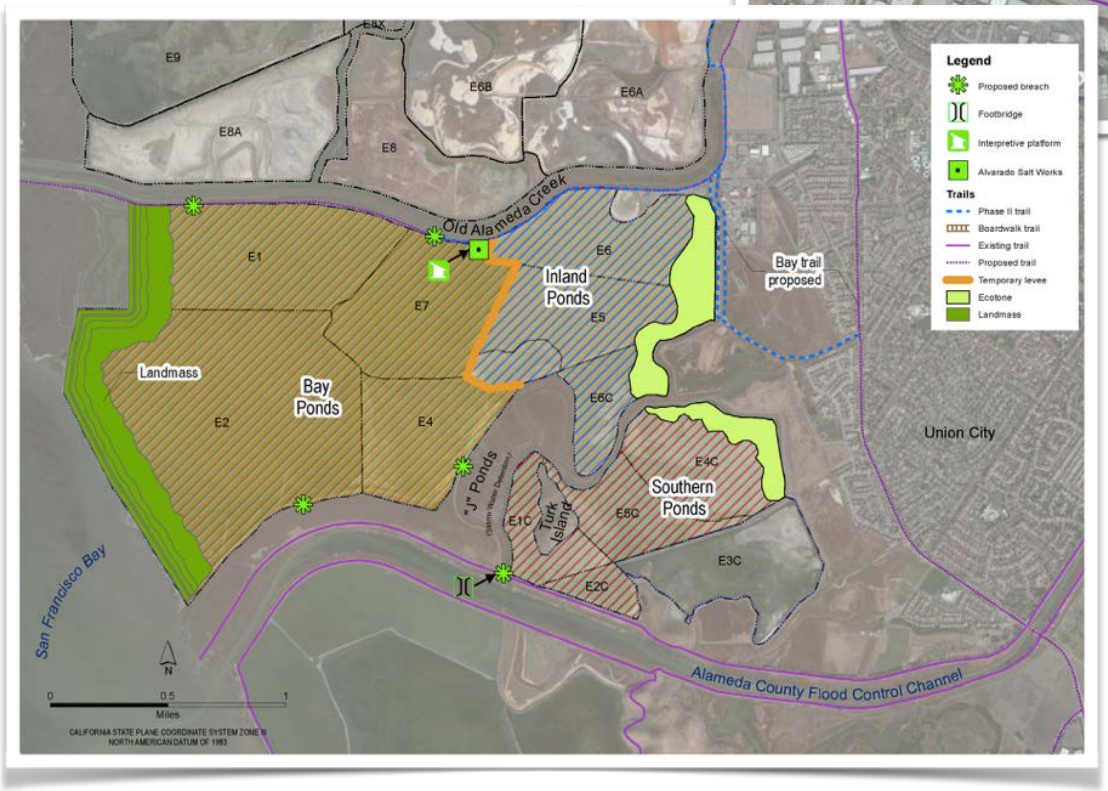
Build transition zones to connect tidal marsh to upland habitats & provide marsh migration space

Horizontal levee graphic courtesy of Bay Institute

Examples: Phase 2 Alternatives



Ravenswood

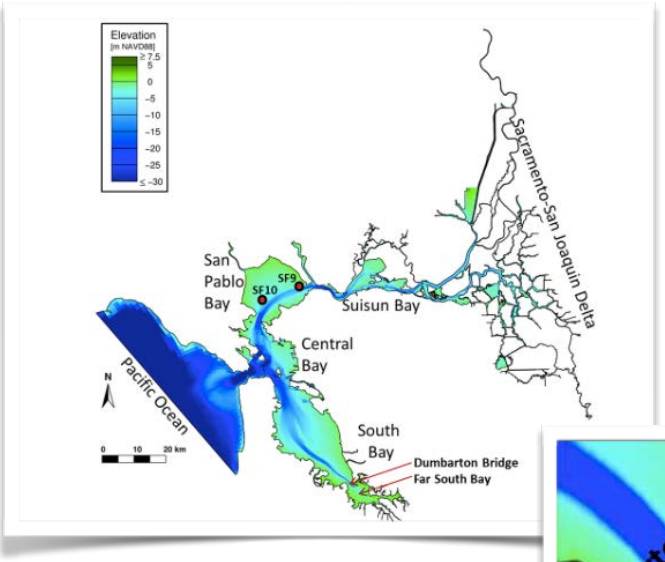


Eden Landing

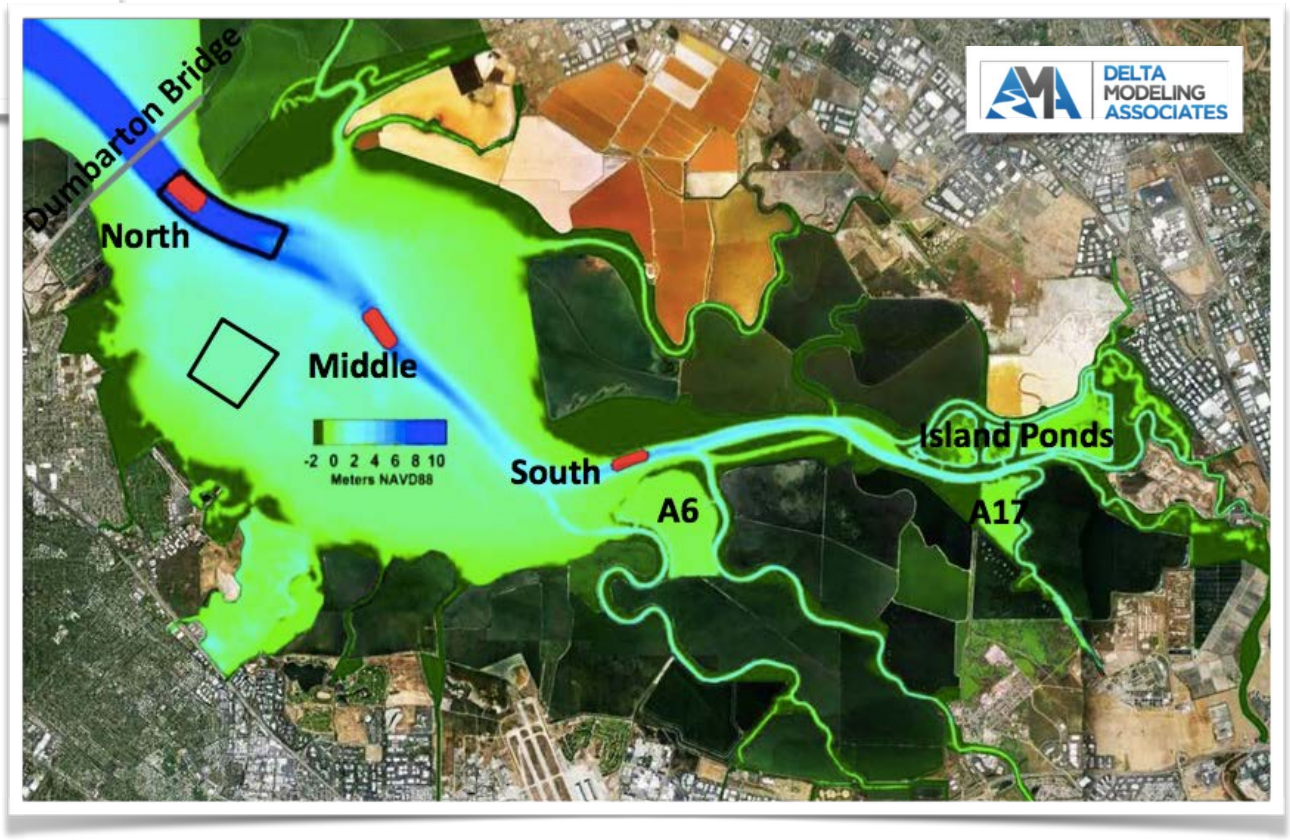
Import clean upland fill material to
build high marsh-upland transition zone

Example: Inner Bair Island Restoration

Raise subsided areas to accelerate marsh development by pumping in dredged sediment



Augment natural sediment supply to mudflats and breached ponds with in-Bay placement of dredged sediment



UnTRIM San Francisco Bay-Delta Hydrodynamic Model graphics from: Bever et al. 2014

Strategic placement of bird nesting islands serve as wave breaks and sediment catchers

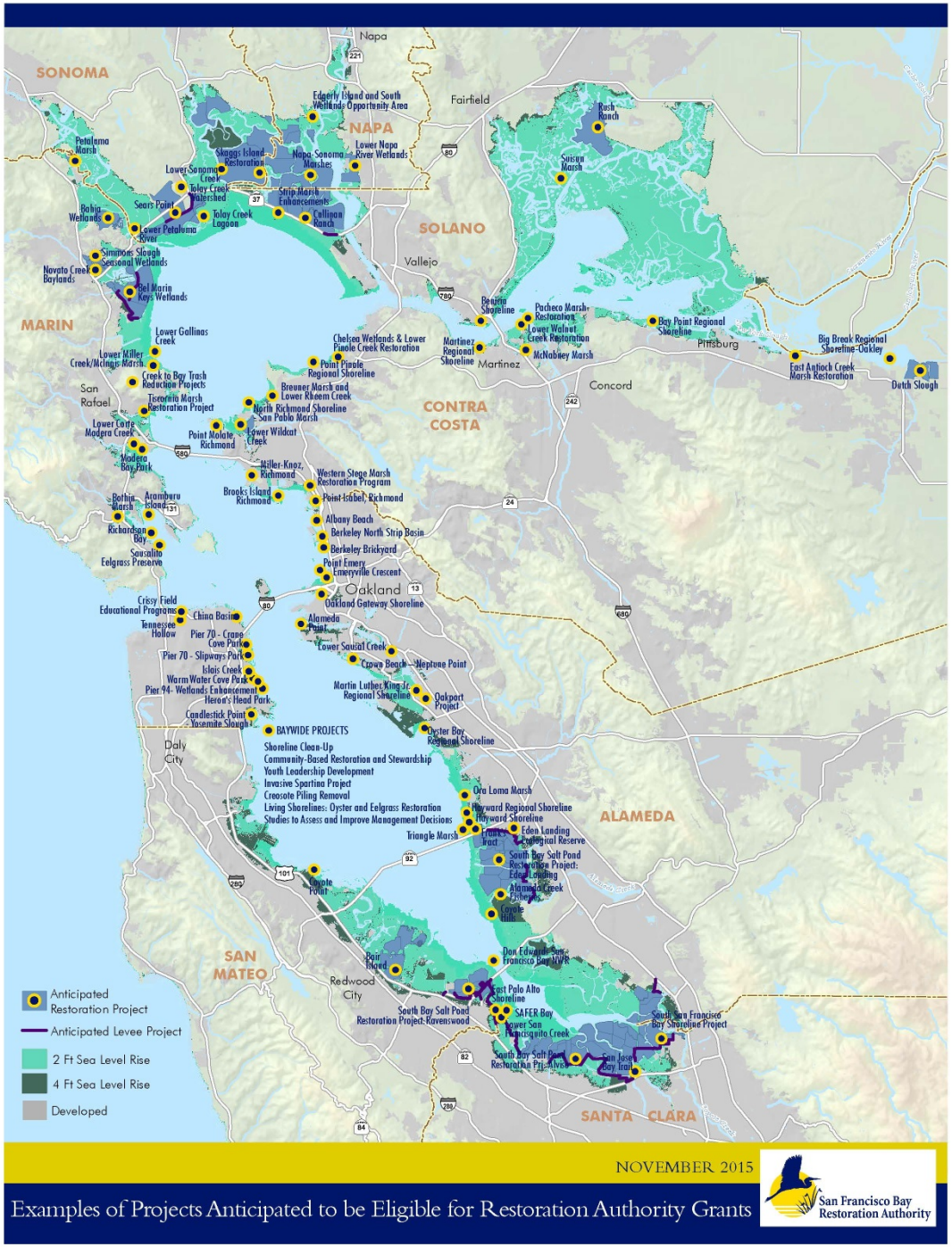
Enhance marsh benefits for wildlife by building high-tide refuge islands and planting native species

Photos courtesy of the Invasive Spartina Project

Invasive *Spartina* eradication

- ✓ 97% reduction since 2005 (805 acres reduced to less than 28 acres today

- ✓ Informing regional restoration actions throughout the San Francisco Bay



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