



Invasive *Spartina* Project at a Turning Point: Eradication on the Horizon, Reconciling Clapper Rail Impacts, and Native Cordgrass Reintroduction

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What is invasive *Spartina*?

Spartina is a cordgrass that grows in salt marshes, mudflats and brackish channels

Four introduced species of *Spartina* in San Francisco Bay



**Hybrid
*Spartina alterniflora***



Spartina densiflora



Spartina anglica



Spartina patens



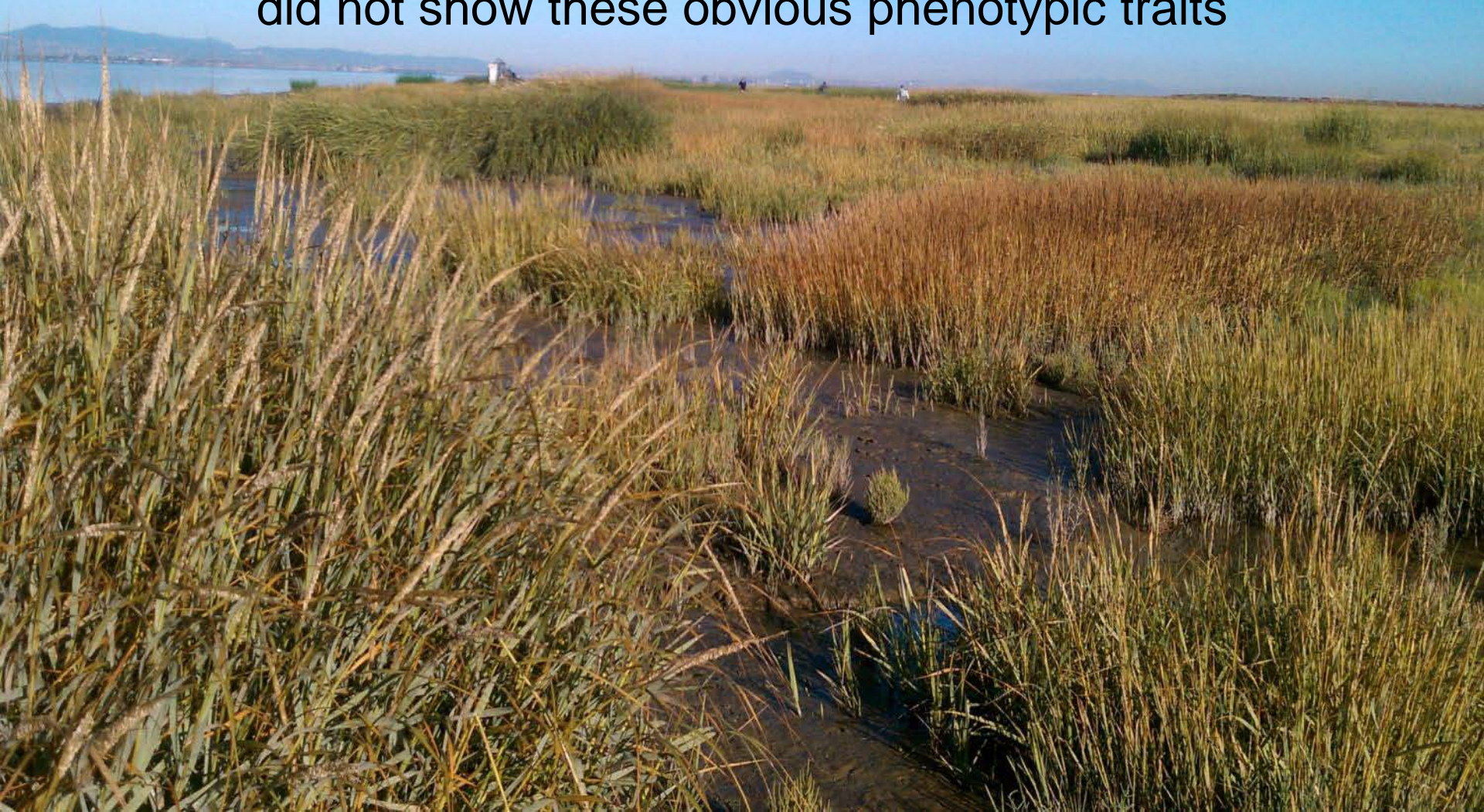
Spartina foliosa – the only native cordgrass species in San Francisco Bay marshes

Hybrid *Spartina*

- *Spartina alterniflora* introduced circa 1976
- Spread slowly for years (seeds, propagules, vegetatively)
- Hybridization w/ native *S. foliosa* discovered mid-90's
- Backcrossing of multiple generations (Introgression of highly fertile hybrid swarm)
- Emergence of novel, ecologically distinctive phenotypes
- Transgressive traits = can exploit all niches

Variety of hybrid forms beginning to dominate the beautiful native *S. foliosa* meadow at Calaveras Marsh (2010)

These invaders were cryptic hybrids just 2 years earlier that did not show these obvious phenotypic traits



San Francisco Estuary Invasive *Spartina* Project

Created in 2000 by the California State Coastal Conservancy and the U.S. Fish and Wildlife Service to coordinate Estuary-wide *Spartina* control efforts

Goal since inception of arresting the spread and eventually eradicating (eliminating) non-native *Spartina* from the San Francisco Estuary.

Funding from the Conservancy is directed to nine grantees positioned around the Estuary

Grantees implement Site-Specific *Spartina* Control Plans produced by the ISP according to programmatic environmental permitting and documentation (PEIR and USFWS BO)

Annual surveys over 35,000 acres inform Control Program

Currently in the 7th season of full-scale implementation of an Estuary-wide *Spartina* control effort

Why is invasive Spartina a Problem?

Degrades endangered species habitat

Hybridizes with native Pacific cordgrass

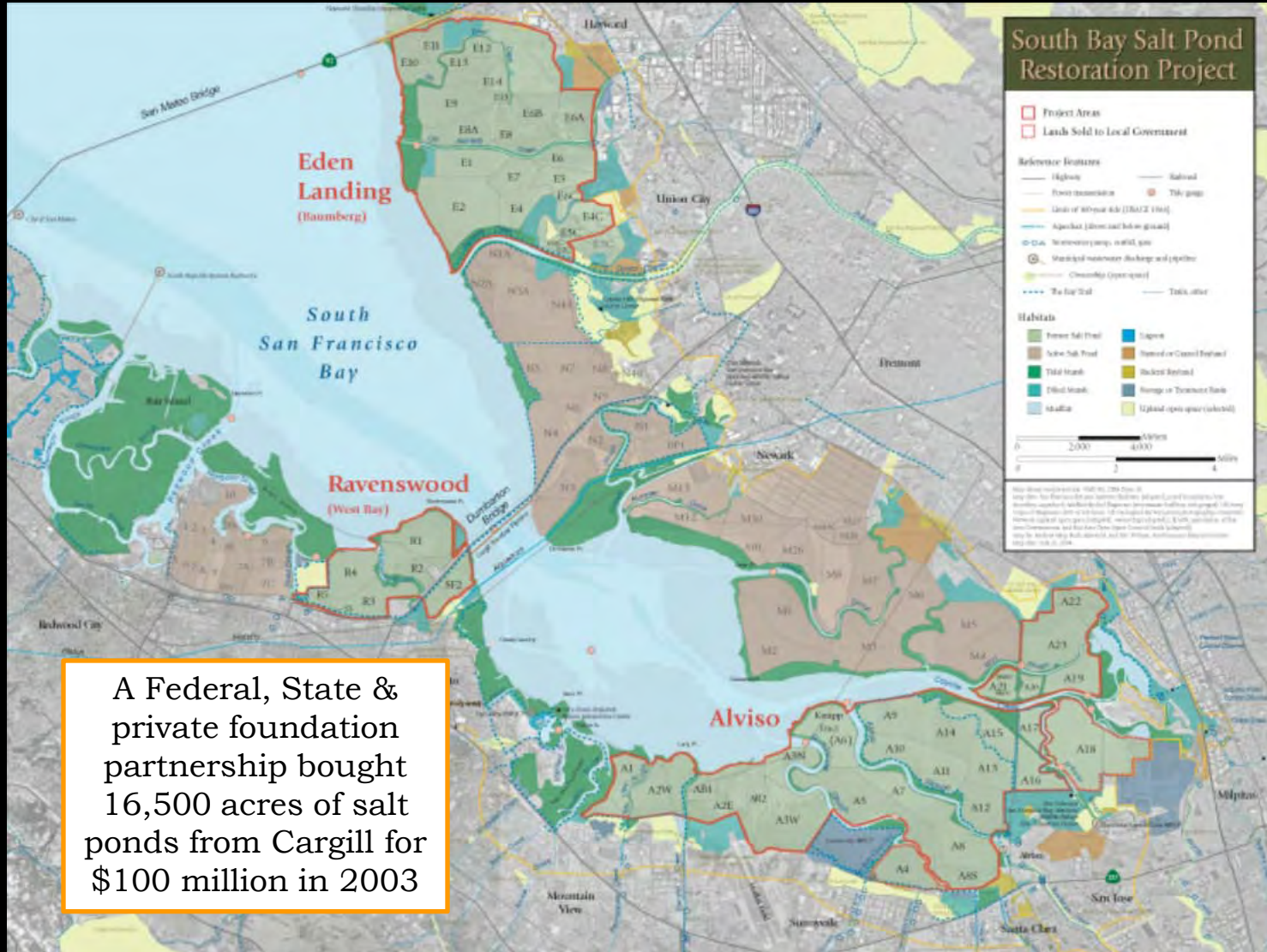
Dominates mudflats and restoration sites

Reduces flood control capacity

Creates mosquito breeding areas

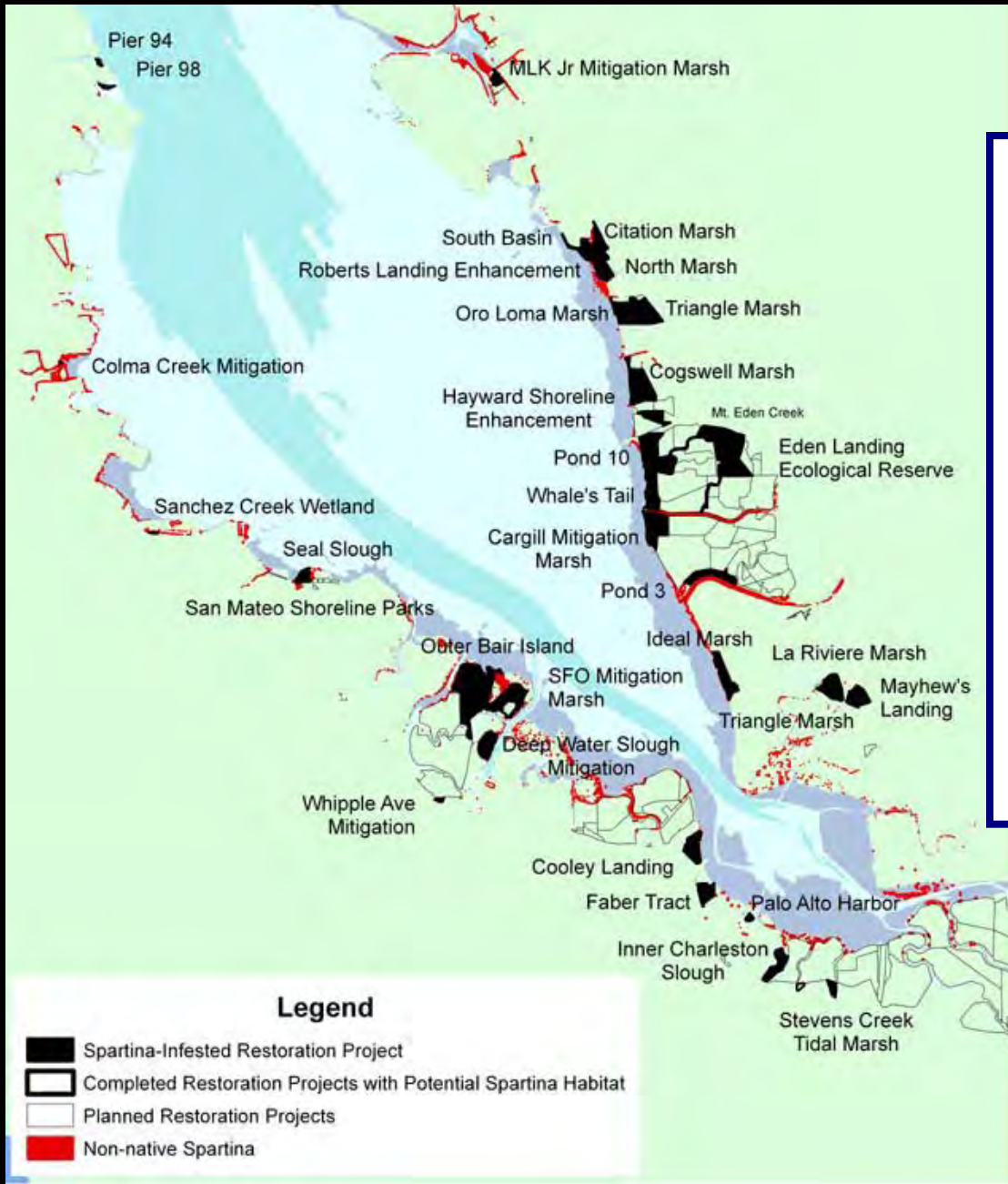


Eradication of invasive *Spartina* is a key first step in the South Bay Salt Pond Restoration Project, the most ambitious wetland restoration on the West Coast



A Federal, State & private foundation partnership bought 16,500 acres of salt ponds from Cargill for \$100 million in 2003

Invaded Restoration Projects circa 2006



Recent Additions:

- 2007 Nordstrom/Shorebird Marsh, Marin
- 2008 Richmond Parkway Marsh, Contra Costa
KGO Towers Marsh, Alameda
Triangle Marsh, Marin
- 2009 Baumberg Marshes, Alameda
Plummer Creek Mitigation Marsh, Alameda
Color Spot Marsh, Contra Costa
Outer Bair Island, San Mateo
- 2011 SF-2

WATCH LIST:

- ISLAND PONDS
- ~~SF-2~~
- KNAPP TRACT

**Ecosystem Engineer: *Spartina* marsh built
in < 20 years by sediment accretion due to
hybrid *Spartina* colonization of mudflats**



Robert's Landing, San Leandro Shoreline



MLK Mitigation Marsh, constructed in 1998 (photo 2005)

**Hybrid *Spartina* invading the open mud of
Middle Bair Island Restoration opened autumn 2008**



Photo taken from airboat
during treatment (Sept. 2010)

REGIONAL CONTROL PROGRAM

170 sites
within 24 complexes

2006 Baywide infestation:
Over 800 net acres
within 24,000 acres of
tidal habitat

2010 Baywide infestation
<100 acres

2011 Baywide infestation
<50 acres

99% of remaining Baywide
infestation is composed of
hybrid *Spartina alterniflora*

2011-2015 ISP Site-Specific *Spartina* Control Plans



Helicopter Boom Applications

89% reduction in the number of acres treated by helicopter in 2010 compared with 2006

ISP partners now able to minimize aerial applications because of the success of treatment

In most cases, ground-based methods are now more appropriate *AND* more effective





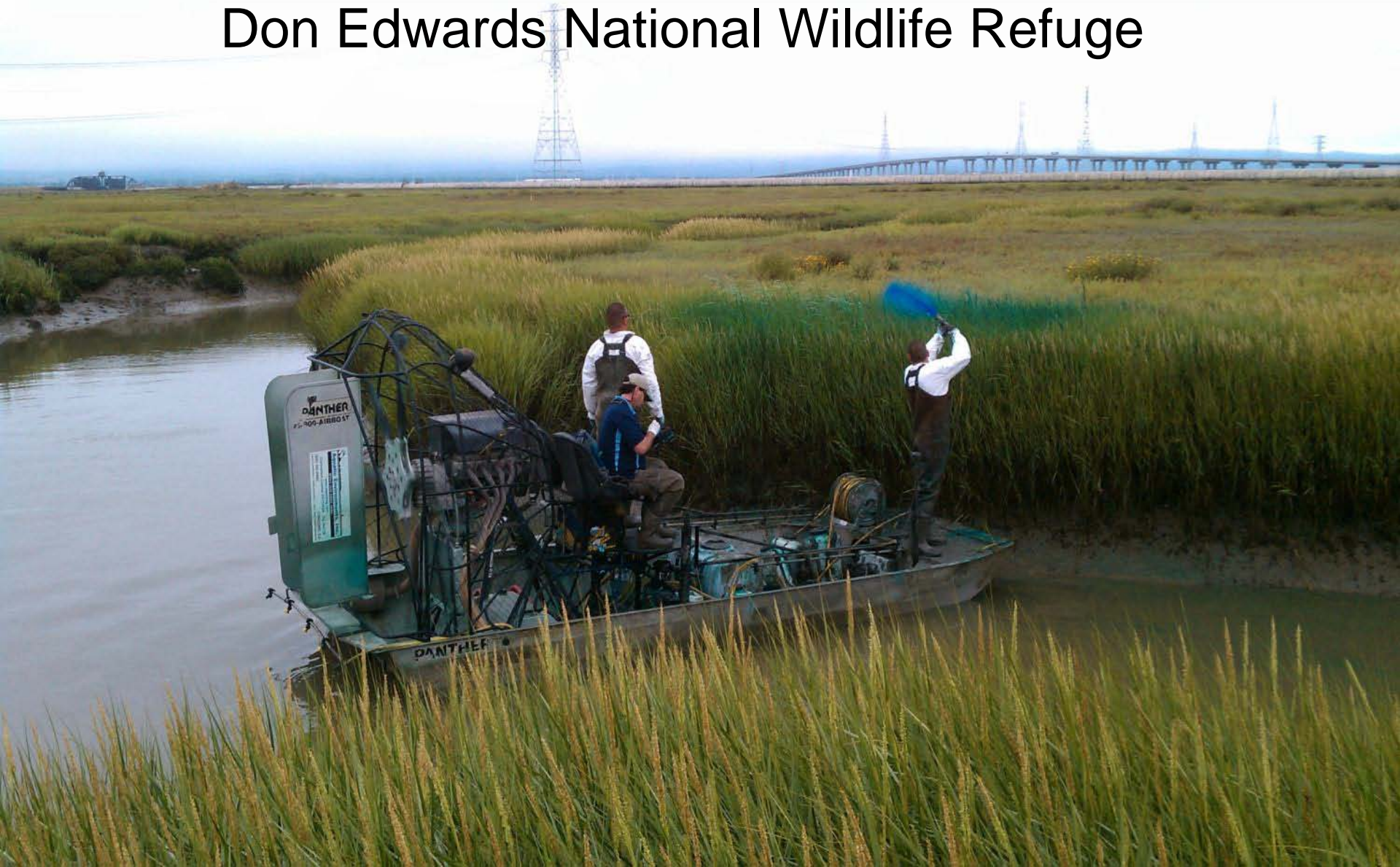
Hose from truck with extra long wand attached for longer reach

Backpack application



Argo amphibious tracked vehicle has very low ground pressure. It can go where you can't even walk

Audubon Marsh Don Edwards National Wildlife Refuge



Airboat has been invaluable for treatment on mudflats and to access sites on the proper tidal regime for successful control by maximizing dry time exposure



Using airboat to refill
backpacks at Cooley Landing
in East Palo Alto



Airboat

Cooley Landing from
helicopter on Day 2 of
treatment

Backpack applications continue to be a big part of the eradication work, especially as infestations dwindle



ISP Monitoring Program staff in Mowry Marsh using helicopter monitoring data collected 2 weeks earlier to guide 3 backpack applicators with GPS to the hybrid *Spartina* needing treatment



The labor and time-intensive work of treating scattered small infestations in these vast marsh and mudflat systems (above new breach of Mt. Eden Creek)



Colma Creek 2006 (after one year of partial treatment)



Colma Creek 2009 (after 3 seasons of full treatment)



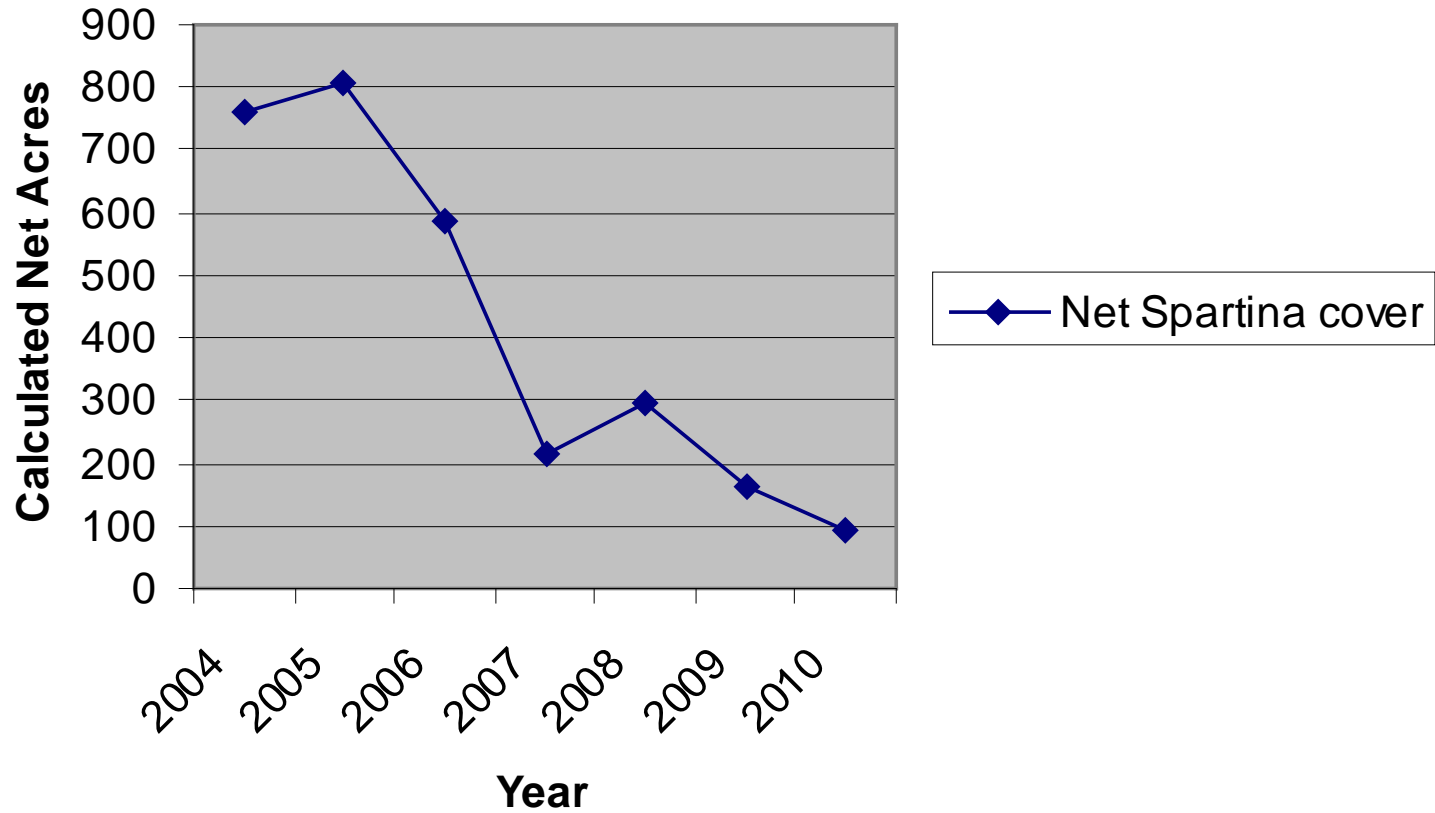
Old Alameda Creek 2006 (untreated)



Old Alameda Creek 2009 (after 3 seasons of full treatment)



Progress Towards Eradication of Invasive Spartina



Progress Towards Eradication

Colma Creek/San Bruno Complex

2006 infestation = 54.4 net acres

2010 infestation = 1.6 net acres

Alameda Flood Control Channel

2004 infestation = 135.3 net acres

2010 infestation = 0.9 net acre

West Bay Complex

2004 infestation = 73.7 net acres

2010 infestation = 4.3 net acres

Eden Landing/Whales Tail Complex

2005 infestation = 80.6 net acres

2010 infestation = 0.7 net acre

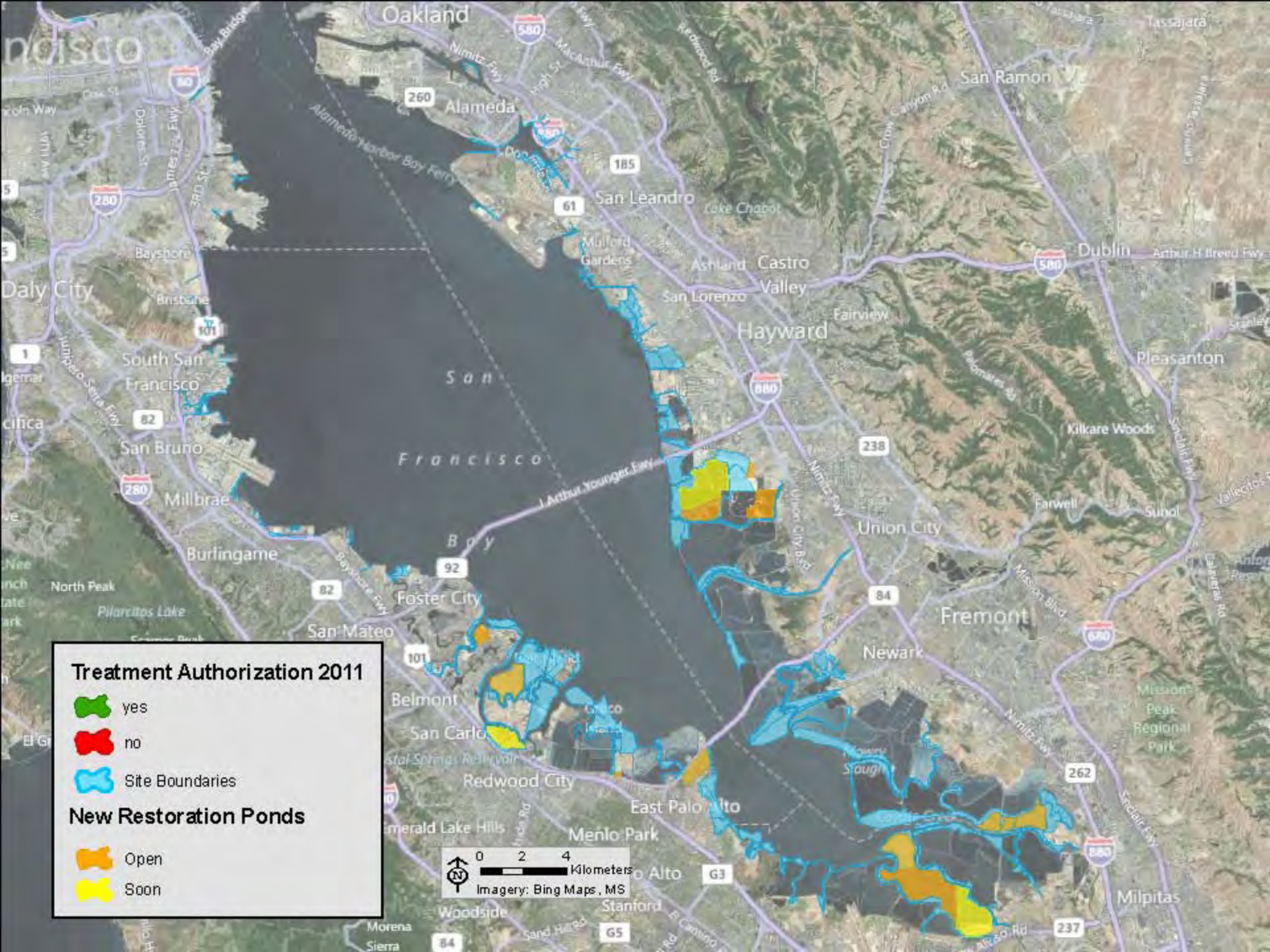


Prospectus for 2013

PRIOR TO DELAYED 2011

BIOLOGICAL OPINION

- ~ 90% (153 of 170) sites @ the first year “zero detection”
 - 3 years of zero detection until that infestation would be considered “eradicated” (possibly 2016 for these 153)
- ~ 10% (17 of 170) sites will require treatment for at least 3 more years
 - Add 3 years of zero detections, and these sites could be at eradication by 2019

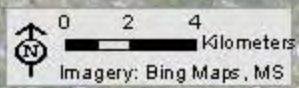


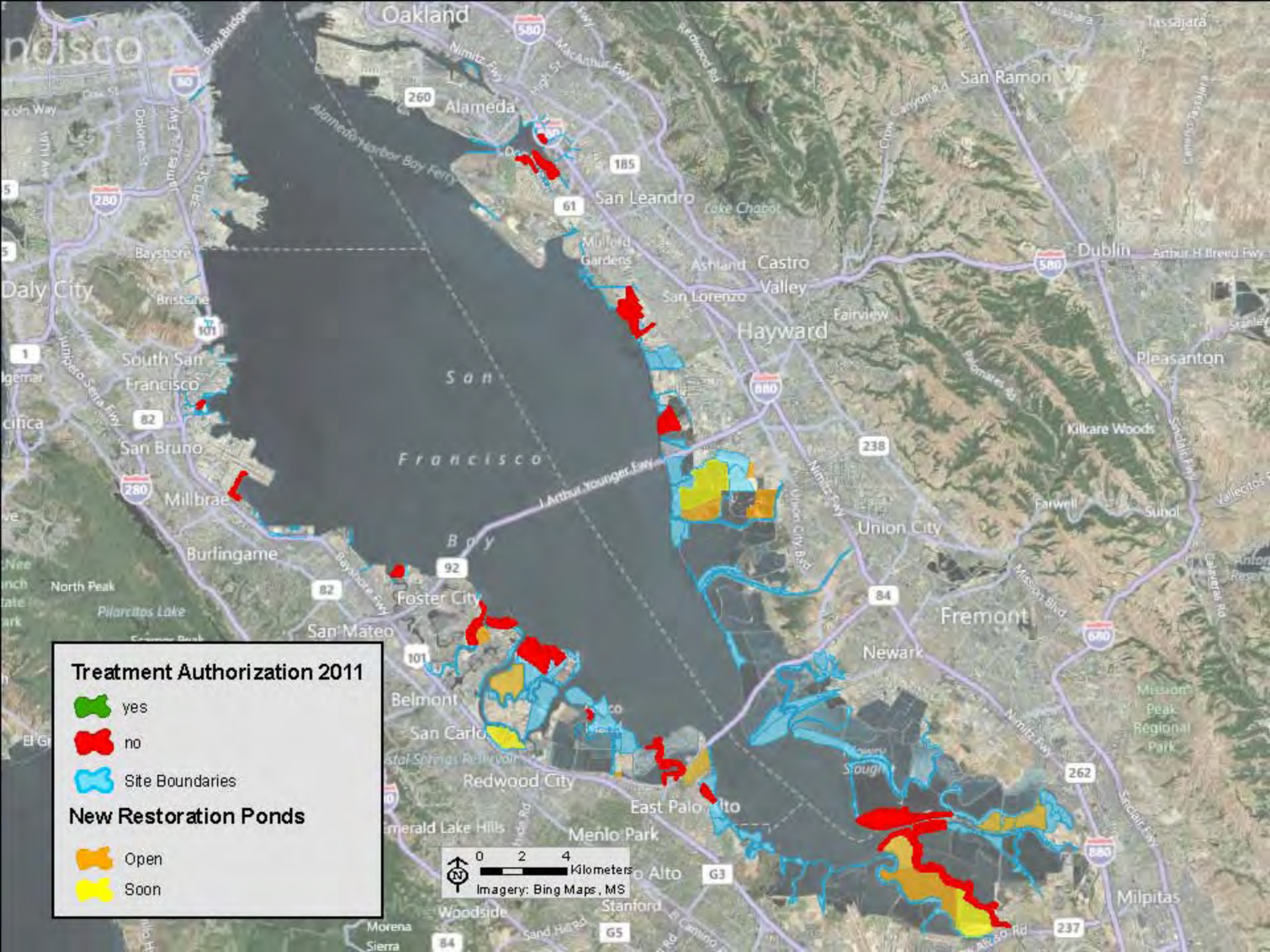
Treatment Authorization 2011

- yes
- no
- Site Boundaries



New Restoration Ponds


- Open
- Soon





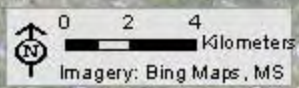
Treatment Authorization 2011

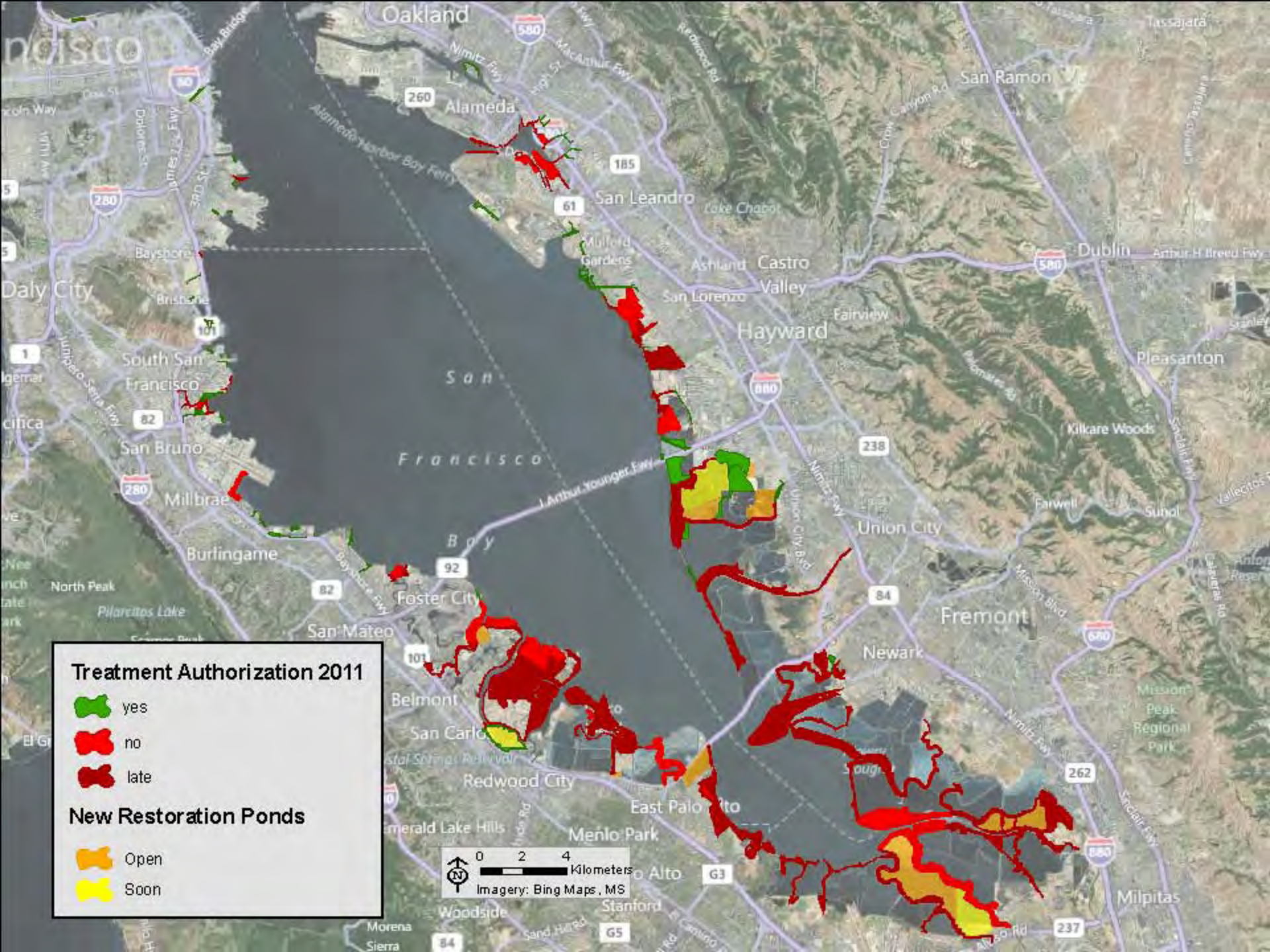
-  yes
-  no

 Site Boundaries

New Restoration Ponds

-  Open
-  Soon





Treatment Authorization 2011

- yes
- no
- late

New Restoration Ponds

- Open
- Soon

0 2 4
 Kilometers
 Imagery: Bing Maps, MS

Clapper Rails and Hybrid *Spartina*

- Reduced macroinvertebrates
- Displaced native *S. foliosa*
- Dominated native marshes
- Filled in channels

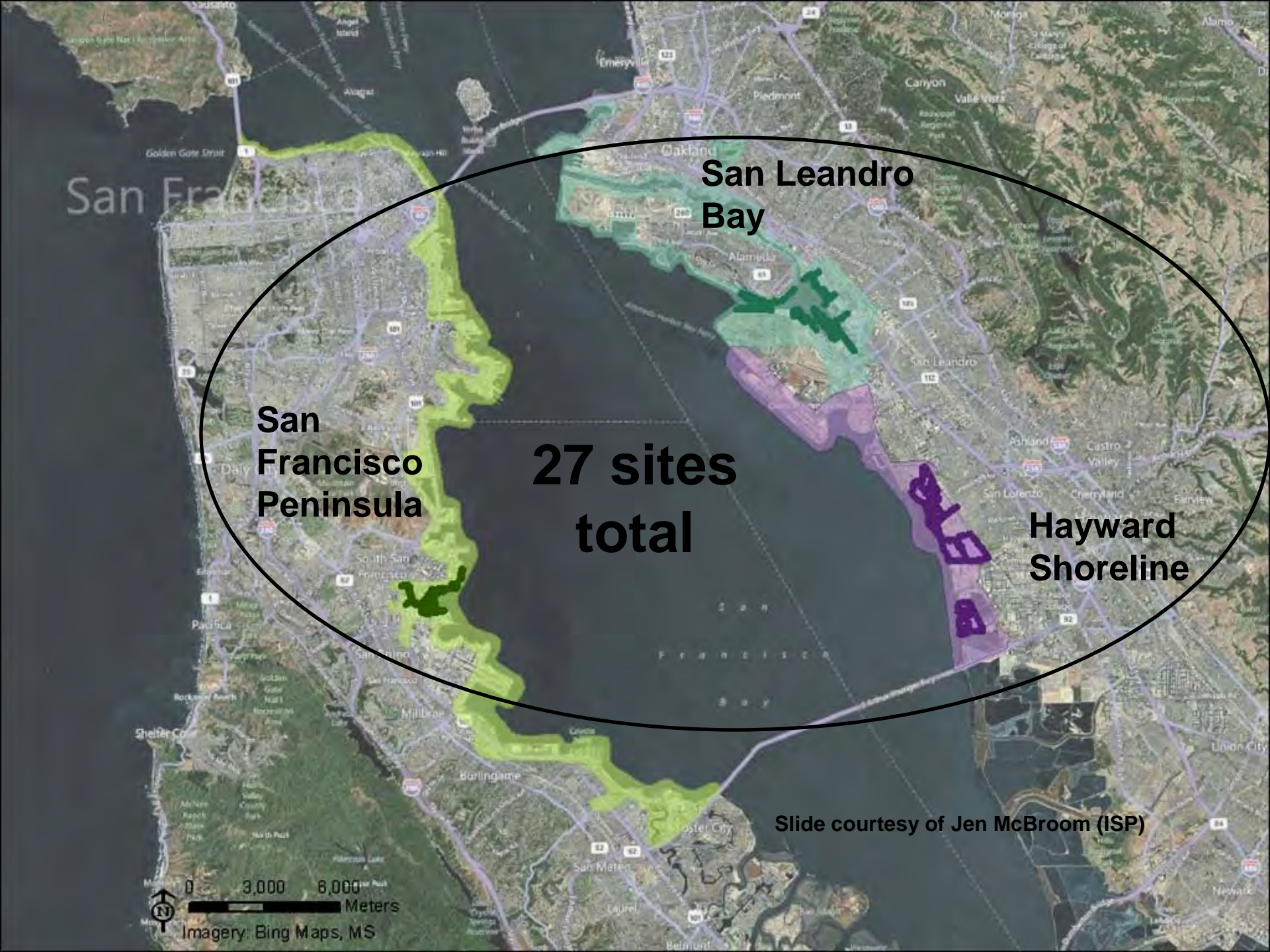
- Created new tidal marsh
 - Provided excellent cover
- Clapper rail populations expanded and grew



Major Obstacle to *Spartina* Control in San Francisco Estuary



- Entry to California clapper rail marshes during breeding season
 - Until 2008, ISP was not permitted entry before Sept 1 (either to inventory sites or to treat them on the ground). Full comprehensive treatment of all *Spartina* sites was AN IMPOSSIBLE TASK for the first 3 years.
 - Hybrid *Spartina alterniflora* flowers by July/August, enabling pollination of neighboring *S. foliosa* and creation of hybrid seed



San Francisco

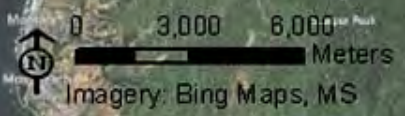
San Leandro Bay

San Francisco Peninsula

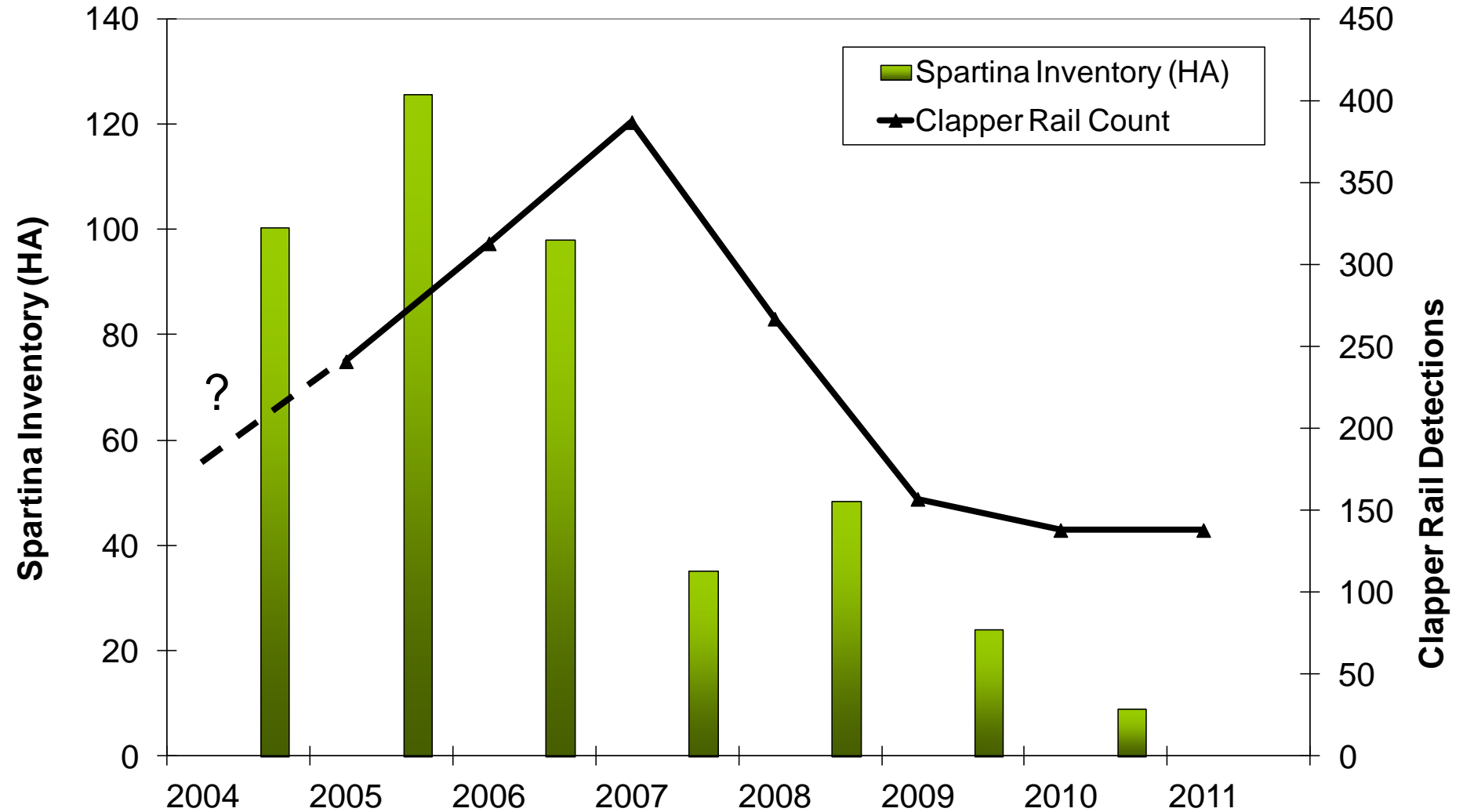
27 sites total

Hayward Shoreline

Slide courtesy of Jen McBroom (ISP)



Three Regions Combined



Slide courtesy of Jen McBroom (ISP)



2006



2008



2010

← Pickleweed

← *Grindelia*

***Sarcocornia pacifica* (pickleweed):**

- Minimal impact from imazapyr
- Benefits from competitive release from hybrid *Spartina*
- Widespread passive revegetation after *Spartina* treatment

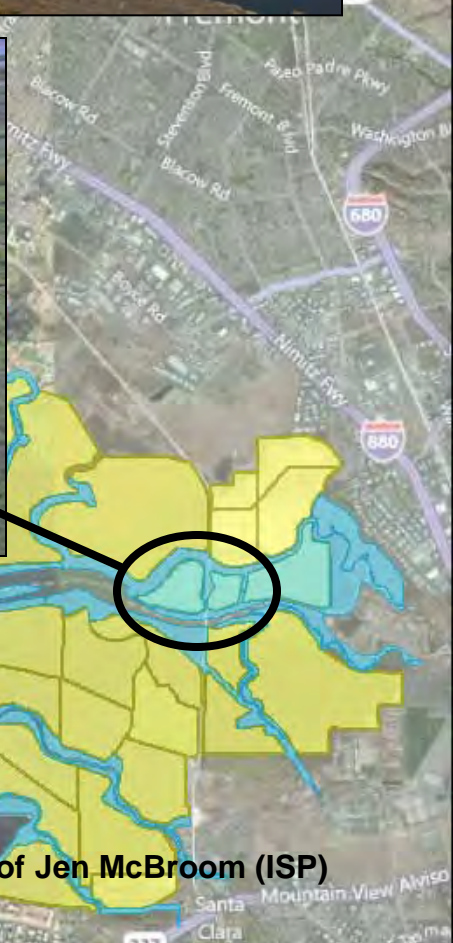
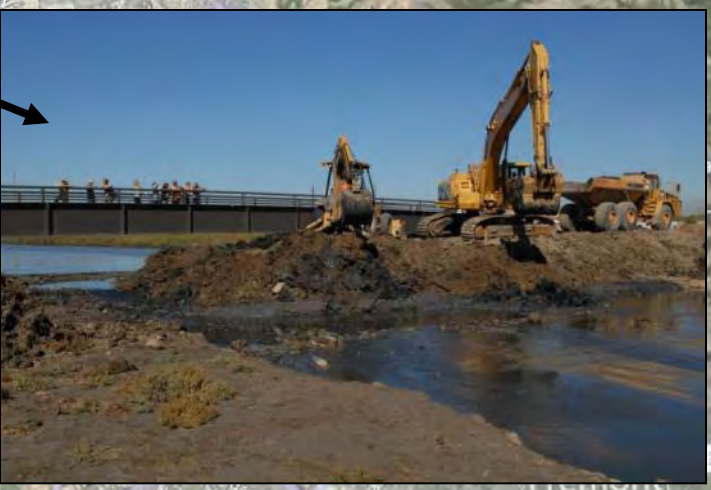


What's Next...?





Detected clapper rail in 2010 & 2011



0 Woods 2e 4 Kilometers
Imagery: Bing Maps, MS

Slide courtesy of Jen McBroom (ISP)

ISP Revegetation Work

- Most of the active revegetation efforts have been on hold until ISP gained sufficient control over the hybrid *Spartina*
 - Planting native *S. foliosa* was not an option (with pollen swamping it would become an agent for hybrid seed)
 - Robust hybrid would engulf neighboring plants
 - Plantings could be destroyed during future treatment
 - State budget crisis and bond-funded work stoppage 2009
- Imazapyr has little effect on pickleweed (*Sarcocornia pacifica*) so many sites have experienced extensive passive revegetation



ISP Revegetation Work

- ISP Draft Revegetation Plan (2011) includes:
 - Site selection criteria & ranking system
 - Plant palette focused on *S. foliosa*, *Grindelia stricta*, and high marsh ecotone
 - Reference sites
 - Ground-truthing digitized planting zones
 - Monitoring plan
 - Success criteria (short, medium & long-term)

- Coastal Conservancy has convened a Technical Advisory Committee (TAC – 1st meeting Oct. 2011) to review and provide expert input to enhance the plan

- Coastal Conservancy approved \$1 million on Sept 22, 2011 for 2011-2013 Baywide Revegetation Plan pilot projects

ISP Revegetation Work

- Winter 2010/2011: ISP began pilot project planting native *Spartina* at two sites [applied research that can inform SBSP]
- Pilot projects 2011-2013 at up to 20 sites
- Reintroduce *S. foliosa* to areas like Eden Landing where:
 - native was assimilated into the hybrid swarm
 - no cordgrass component after successful treatment
- Focus on sites with existing marsh structure as well as freshly opened areas (former salt ponds) within a marsh complex
- Medium-term goal of passive intra-site dispersal
- Also focused on *Grindelia* where under-represented (provides big benefits to clapper rails)
- Partnering with Save the Bay's volunteer-based planting programs in high marsh ecotone



Baywide Restoration Projects

Map produced: 6/20/2011
Imagery: Bing Maps



Monocot propagation beds at The Watershed Nursery



Restoration Mantra: Build it and they will come...



If we can propagate dogs can we also propagate clapper rails?





Alameda Flood Control Channel
Pre-treatment in 2005



Alameda Flood Control Channel
Approaching eradication in 2010

Dense meadow of coalesced clones of hybrid *Spartina* at the mouth of the Alameda Flood Control Channel (2005)



Pond 3 (aka Ecology Marsh): original *S. alterniflora* introduction from the East Coast in 1976

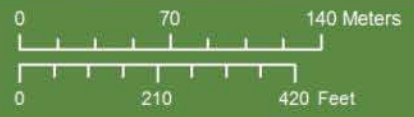


Legend: Revegetation

ISP Proposed

- Channel - *S. foliosa*
- Fringe - *foli*
- Levee - *Grindelia stricta*

San Francisco Estuary Invasive *Spartina* Project
AFCC Mouth



Map produced: 7/27/2011
 Imagery: Bing Maps





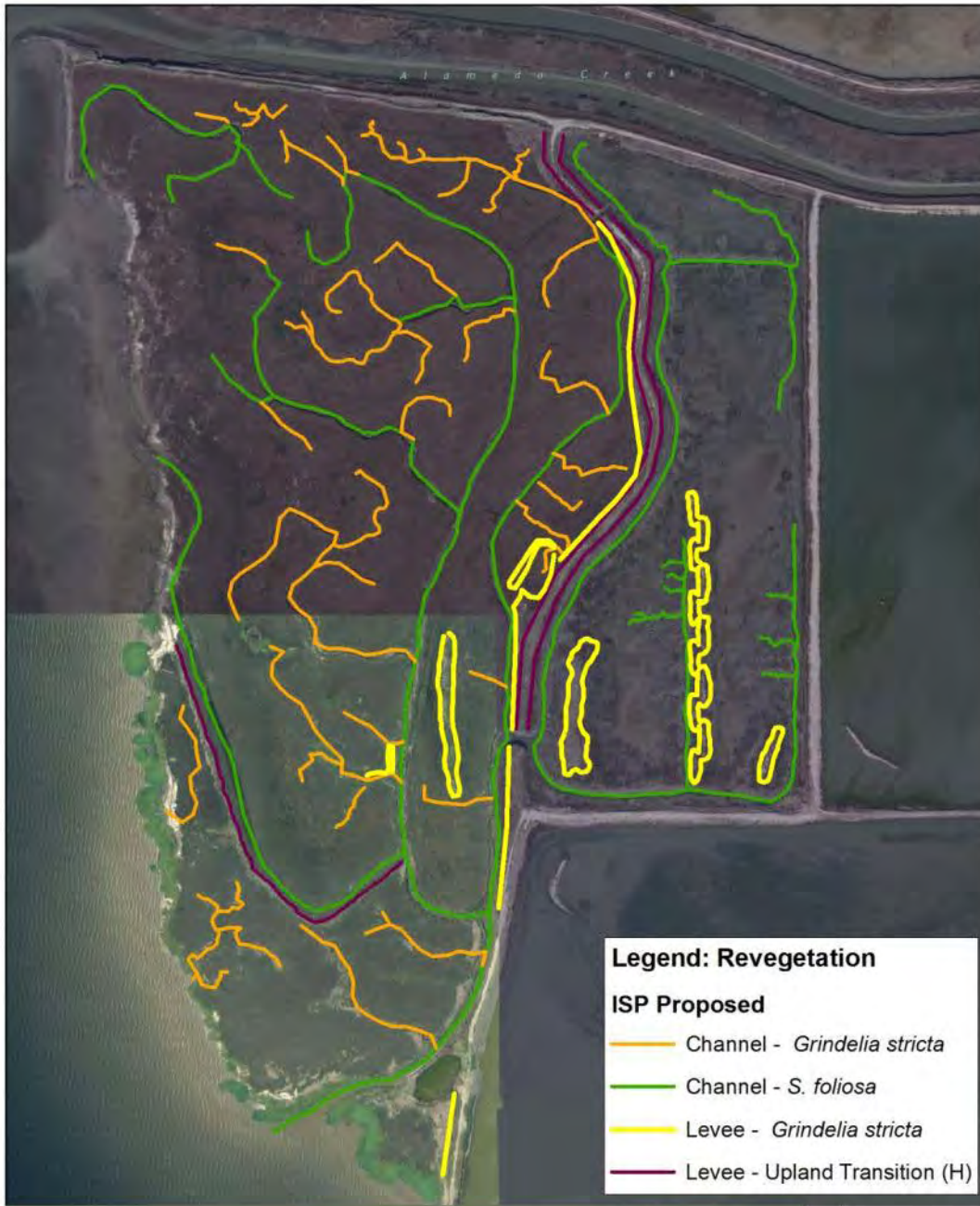
Cargill Mitigation Marsh 2006 (1 year aerial treatment)
The brown *Spartina* was killed or impacted from the first
aerial work in 2005

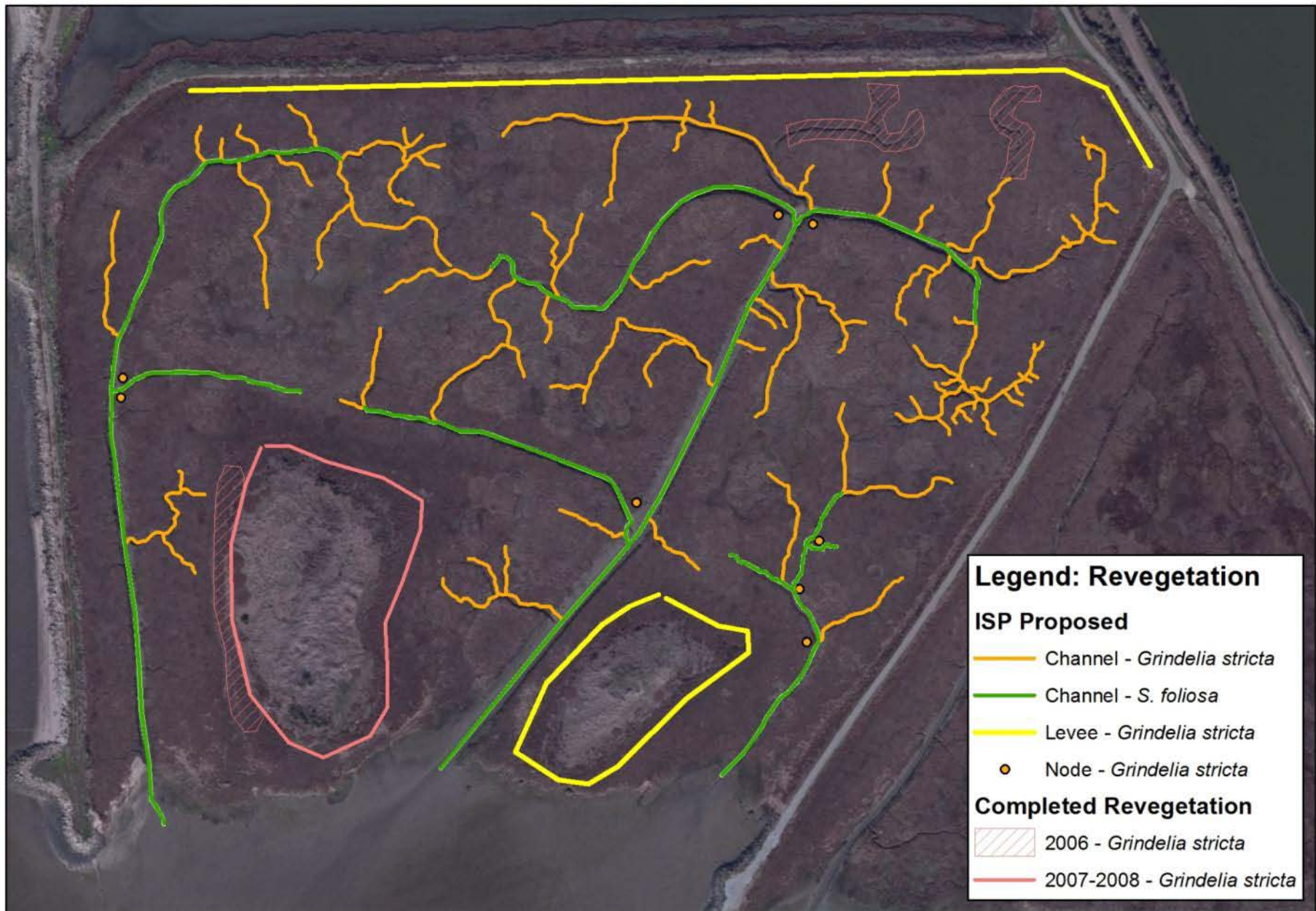


Cargill Mitigation Marsh 2009 (after 4 seasons of aerial treatment)

The green in the marsh is almost exclusively pickleweed

This 50-acre marsh was treated by backpack in just a couple hours in 2010. It was 70% infested in 2005.





Legend: Revegetation

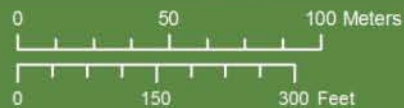
ISP Proposed

- Channel - *Grindelia stricta*
- Channel - *S. foliosa*
- Levee - *Grindelia stricta*
- Node - *Grindelia stricta*

Completed Revegetation

- 2006 - *Grindelia stricta*
- 2007-2008 - *Grindelia stricta*

San Francisco Estuary Invasive *Spartina* Project
 Cogswell A

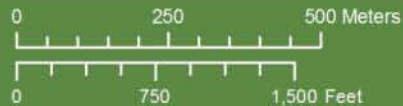


Map produced: 7/22/2011
 Imagery: Bing Maps





San Francisco Estuary Invasive *Spartina* Project
Greco North



Map produced: 7/27/2011
Imagery: Bing Maps



Can I get a hand?

