Designing for Climate Resilience in a California Coastal Salt Marsh

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Funders

California Department of Fish and Wildlife
California Ocean Protection Council
California State Coastal Conservancy
California Wildlife Conservation Board
USFW National Coastal Wetlands Conservation
NOAA BIL Habitat Restoration

Salt Marsh Working Group

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Beth Watson, Stony Brook University
Carolyn Geraghty, Morro Bay National Estuary Program
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John Callaway, U. of San Francisco
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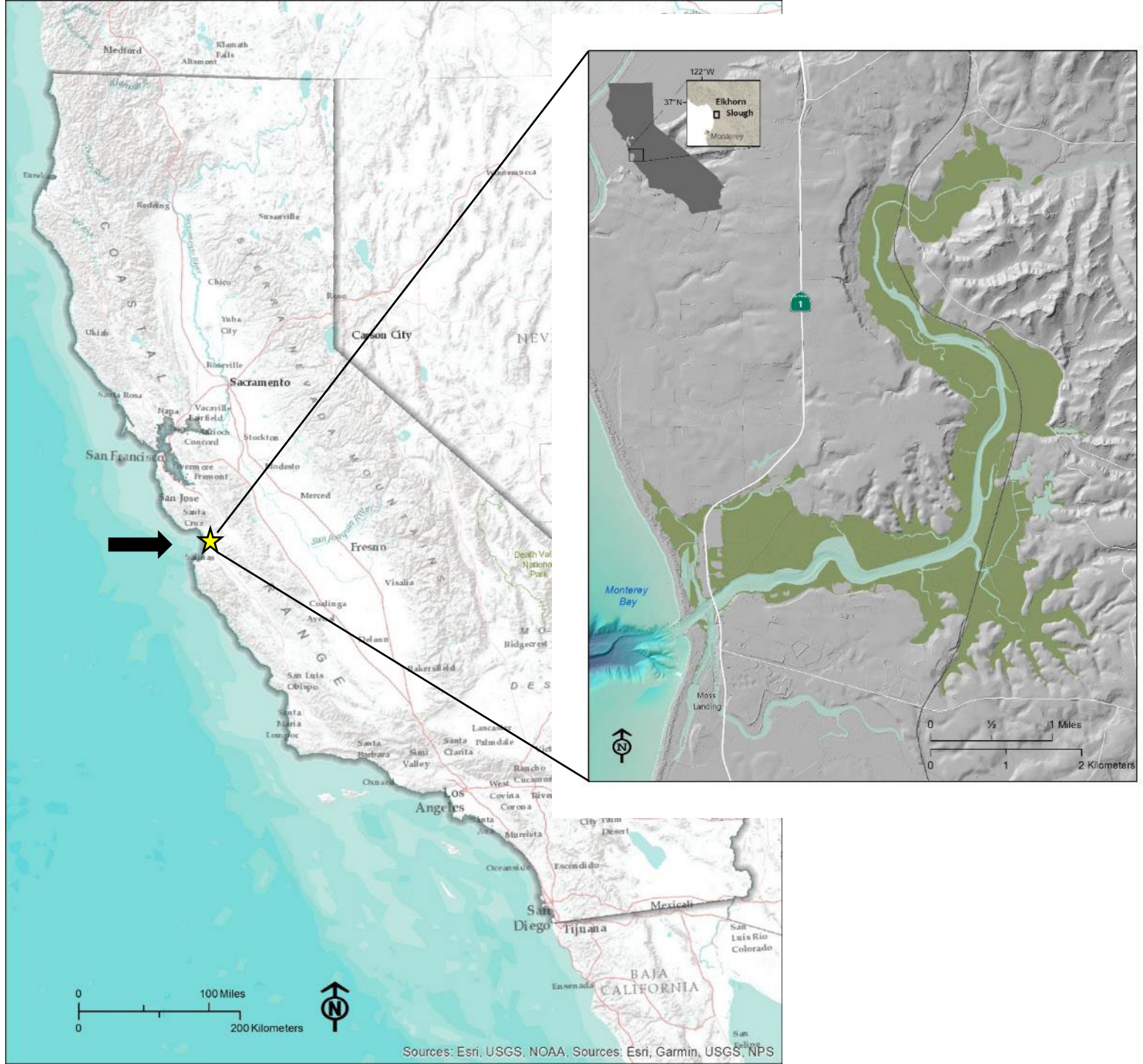
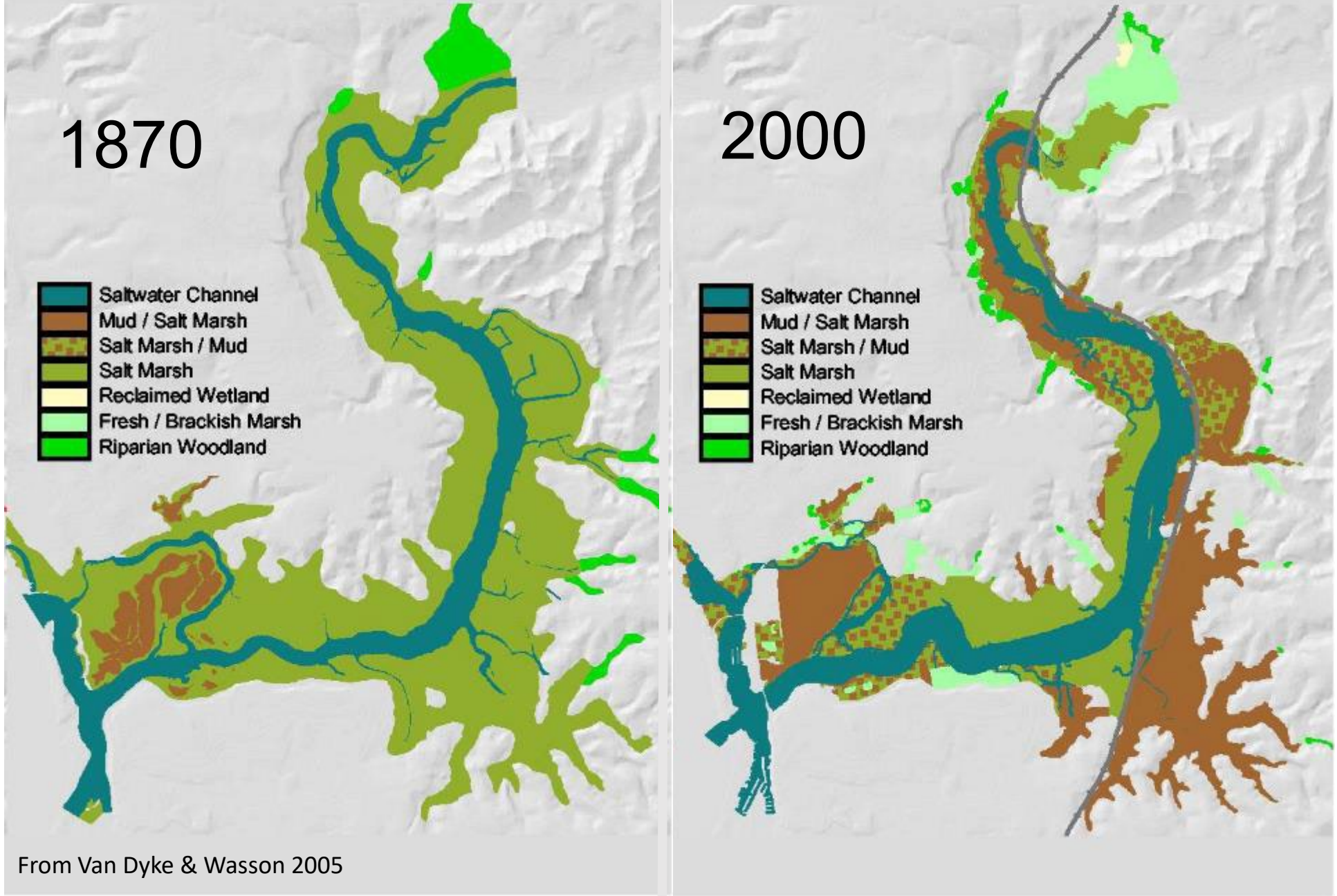
Rich Ambrose, UCLA
Steve Schroeter, U. of California Santa Barbara
Walter Heady, TNC
Wenley Ferguson, Save the Bay


122°W
37°N
Elkhorn Slough
Monterey
Monterey Bay
Moss Landing
0 ½ 1 Miles
0 1 2 Kilometers
Medford
Klamath Falls
Redding
Susanville
Chico
Reno
Yuba City
Ukiah
Carson City
Roseville
Sacramento
Santa Rosa
Napa
Vacaville
Fairfield
Antioch
Concord
Stockton
San Francisco
Livermore
Fremont
Modesto
San Jose
Santa Cruz
Merced
Fresno
Visalia
Coalinga
Delano
Ridgecrest
Bakersfield
San Luis Obispo
Santa Maria
Lompoc
Santa Barbara
Simi Valley
Santa Clarita
Palmdale
Lancaster
Oxnard
Los Angeles
Covina
Corona
Murrieta
Temecula
Oceanside
Escondido
San Diego
Tijuana
Mexicali
San Luis Rio Colorado
Ensenada
BAJA CALIFORNIA
0 100 Miles
0 200 Kilometers
Sources: Esri, USGS, NOAA, Sources: Esri, Garmin, USGS, NPS

What are we restoring?

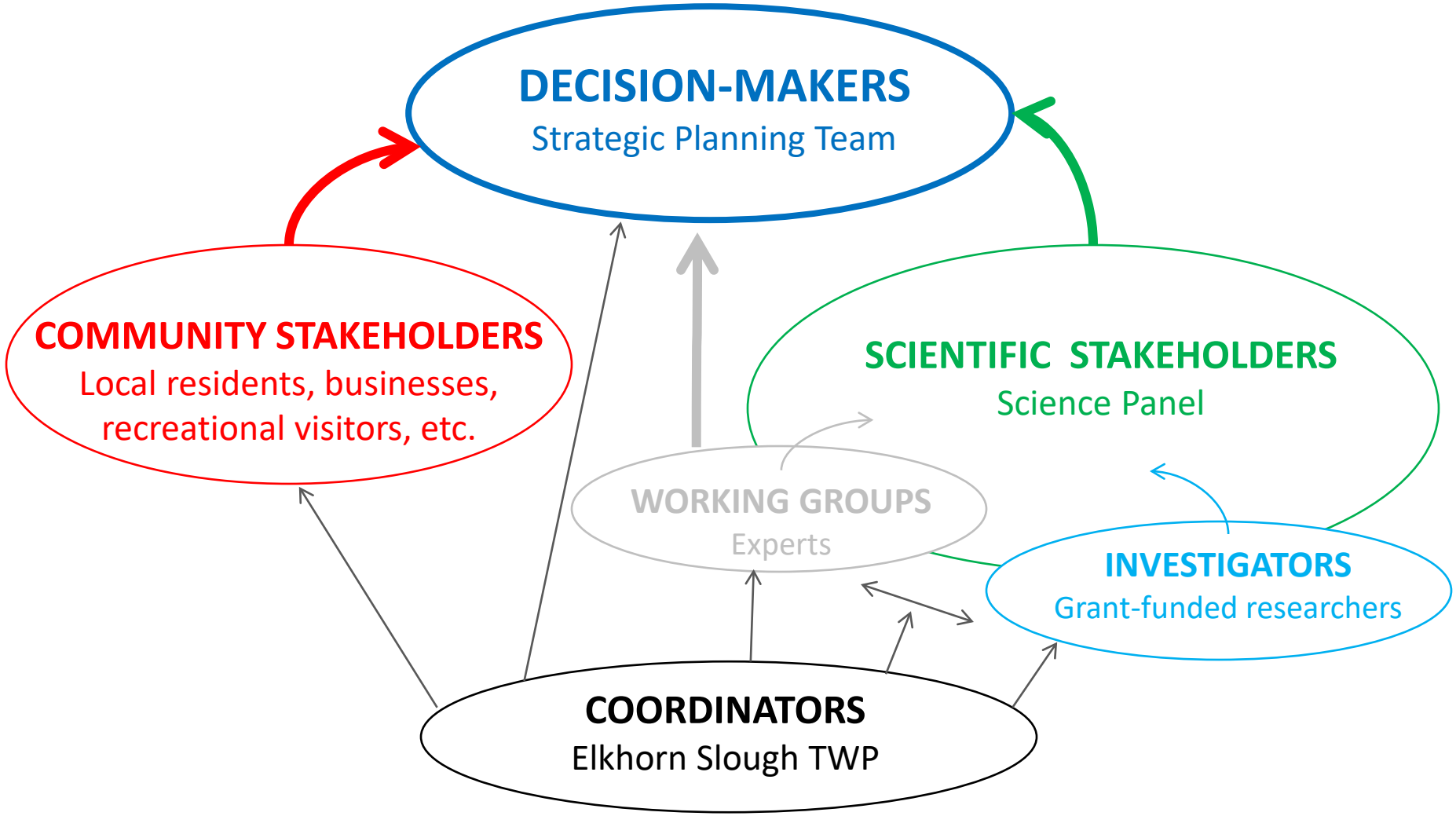


From Van Dyke & Wasson 2005

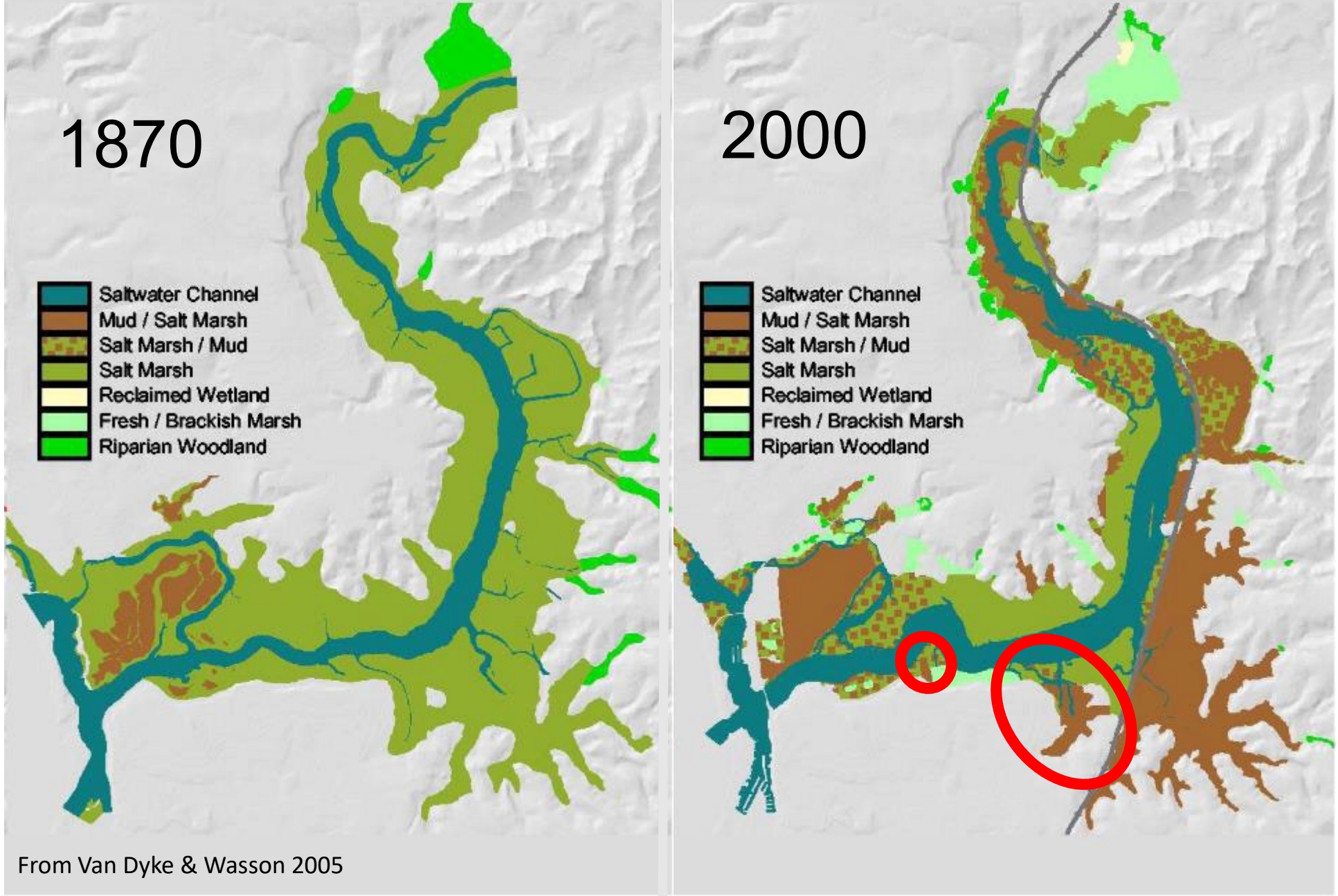
Legacy of diking persists in system with low sediment supply and subsidence

Remaining marshes are drowning already now, and will not survive much sea-level rise

ESNERR TIDAL WETLAND PROGRAM: strategic planning for the estuary



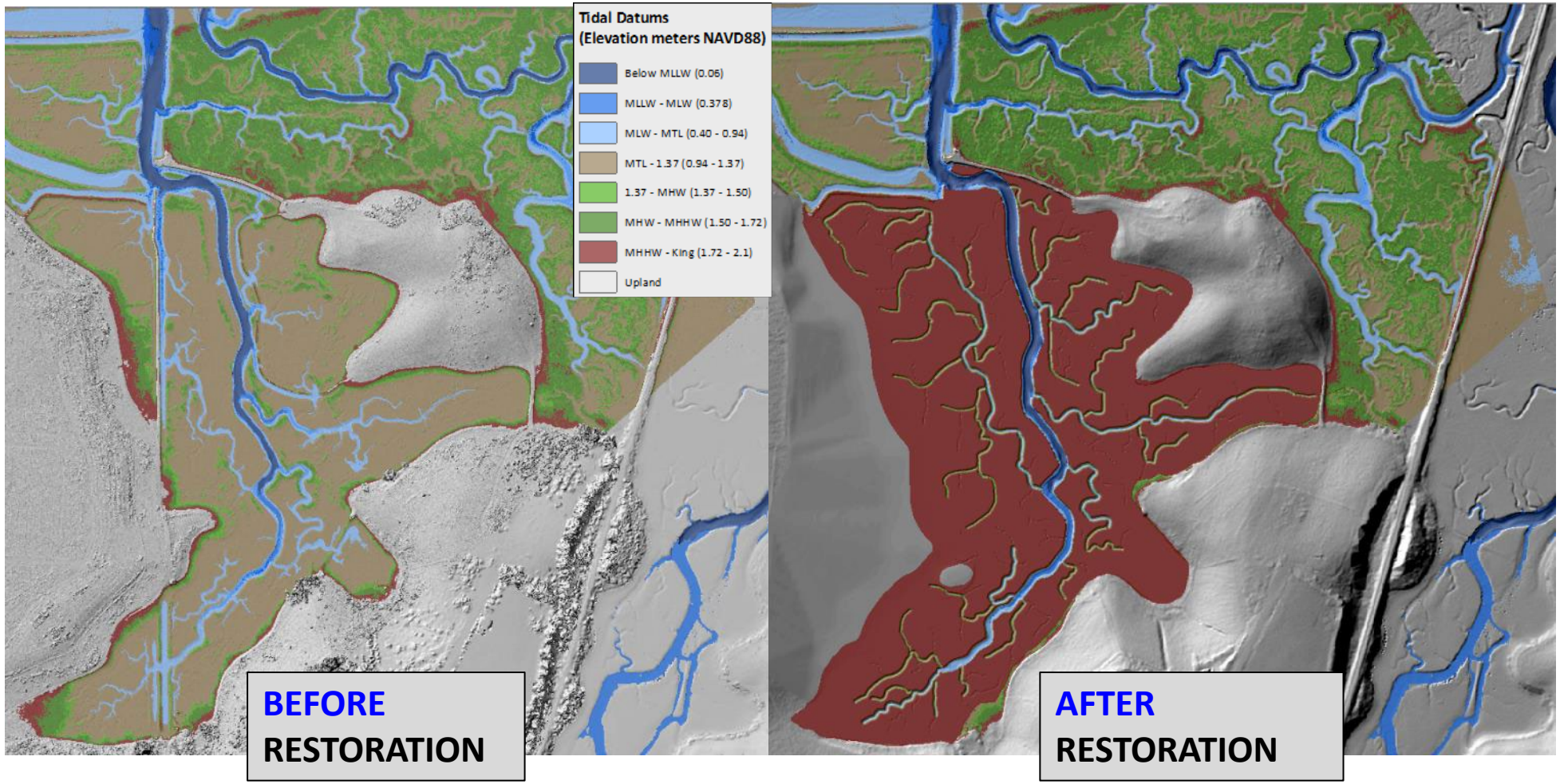
Hester marsh restoration

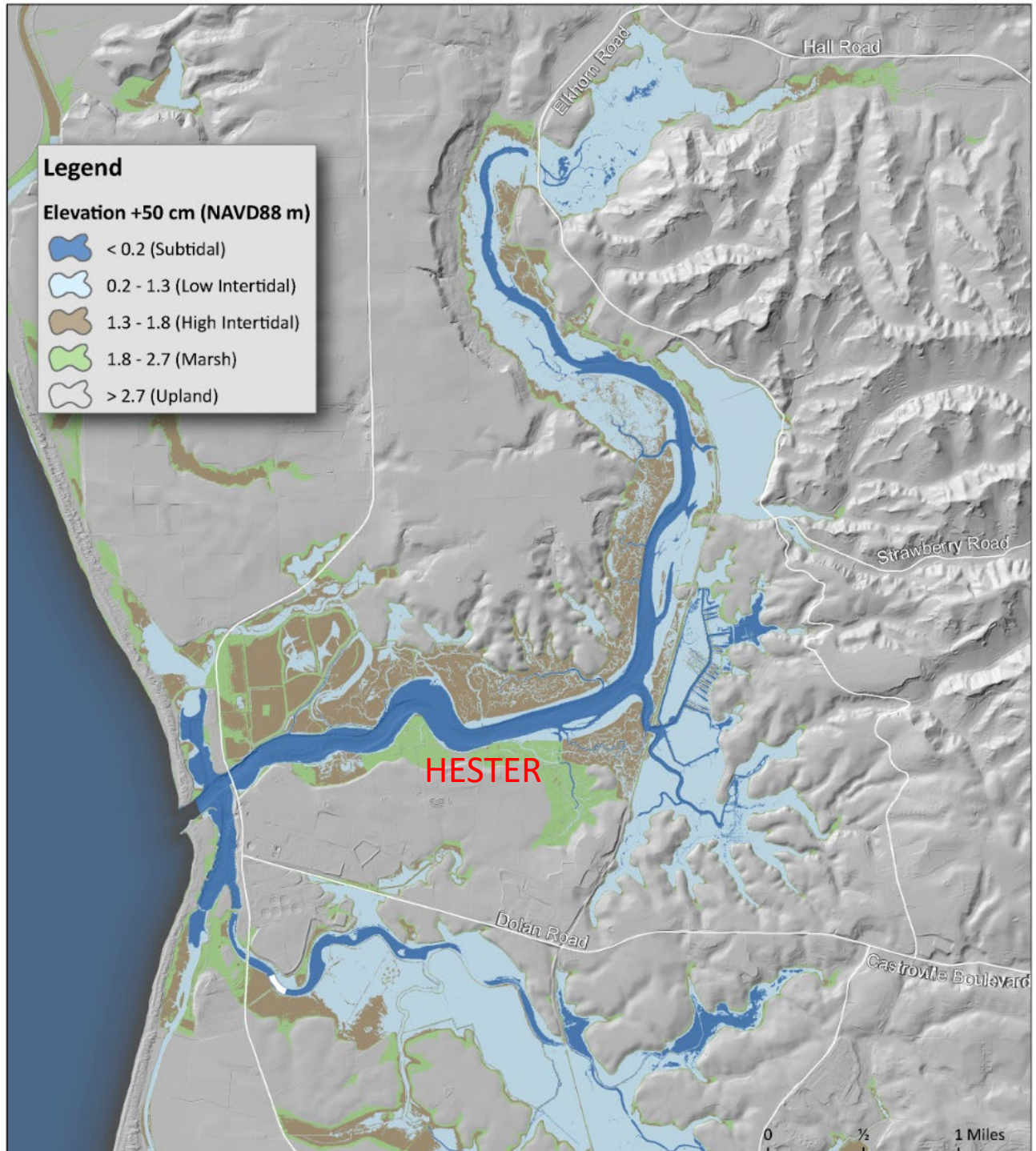


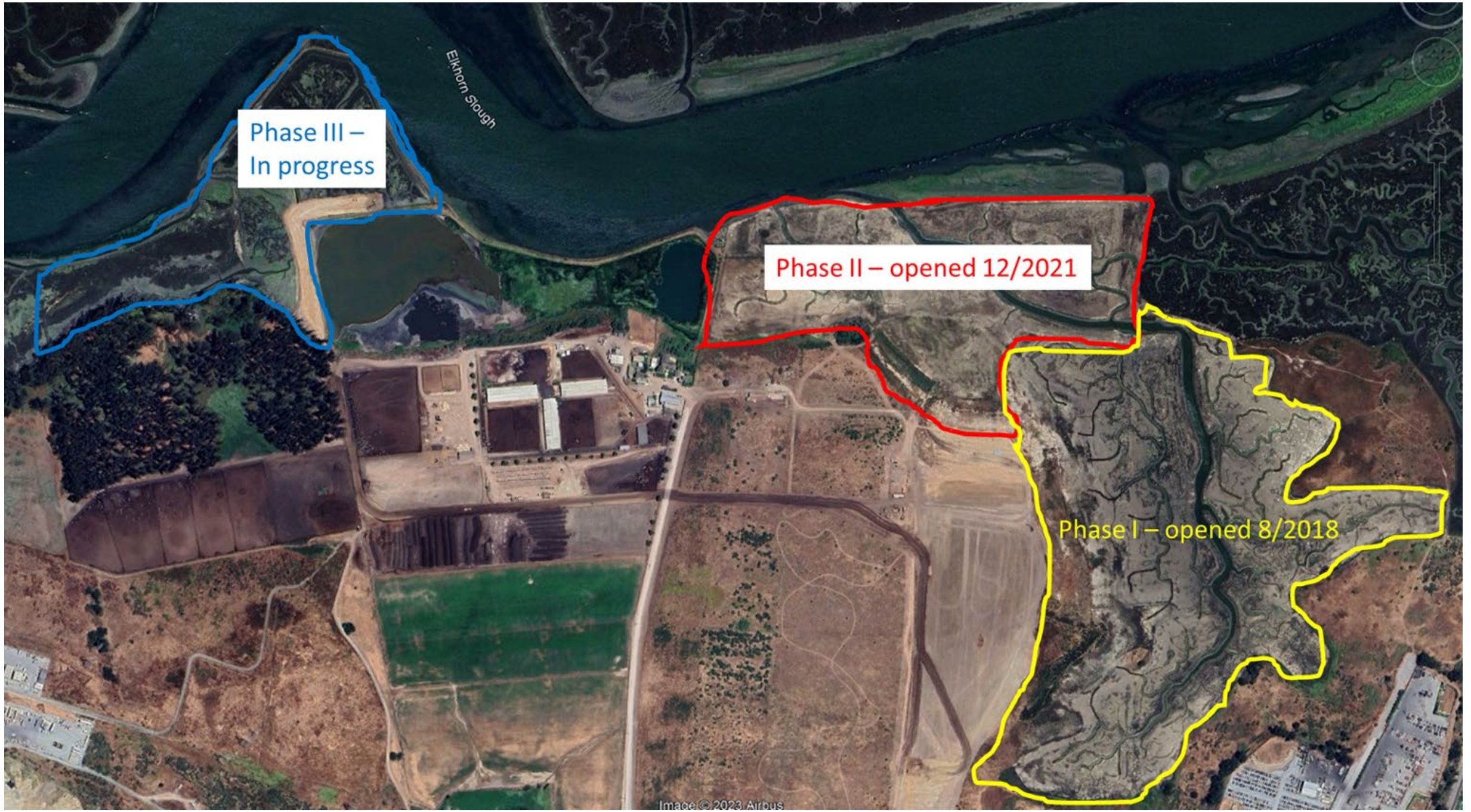
From Van Dyke & Wasson 2005

Restoration site – then and prior to restoration

Transforming a formerly diked, degraded site to a high, climate-ready marsh

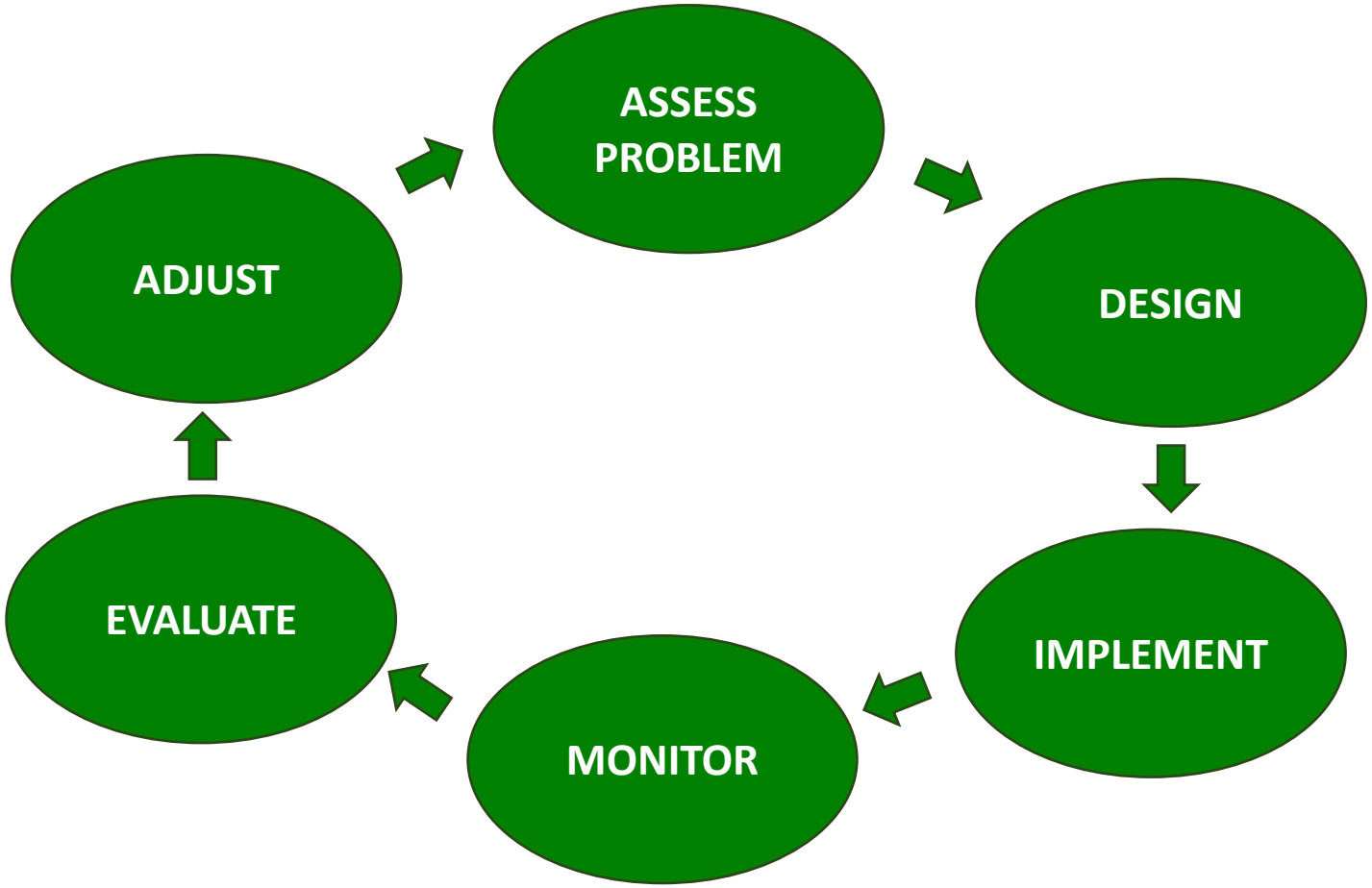



Legend
Elevation +50 cm (NAVD88 m)
< 0.2 (Subtidal)
0.2 - 1.3 (Low Intertidal)
1.3 - 1.8 (High Intertidal)
1.8 - 2.7 (Marsh)
> 2.7 (Upland)
Elkhorn Road
Hall Road
Strawberry Road
HESTER
Dolan Road
Castroville Boulevard
0
½
1 Miles


Elkhorn Slough
Phase III –
In progress
Phase II – opened 12/2021
Phase I – opened 8/2018
Image © 2023 Airbus


What does success look like?

Adaptive Management Framework



Adopted from DOI Technical Guide

Experiments & Monitoring

Lessons Learned

Key Physical Elements

- **Elevation Changes**
- **Firm Channel Edge**

Carbon Sequestration

Plant Communities

- **Marsh Recruitment**

Lessons Learned

Key Physical Elements

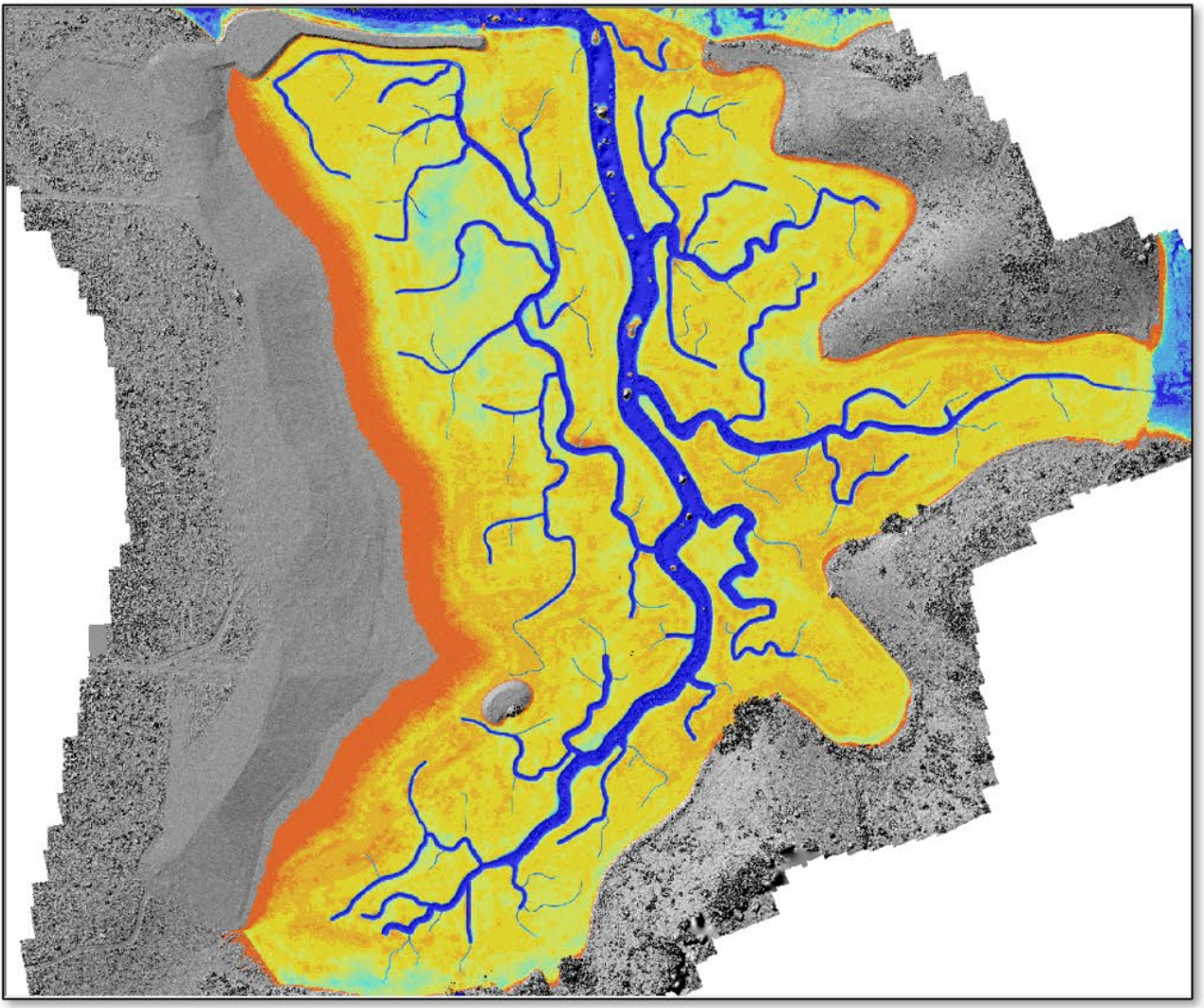
- **Elevation Changes**
- Firm Channel Edge

Carbon Sequestration

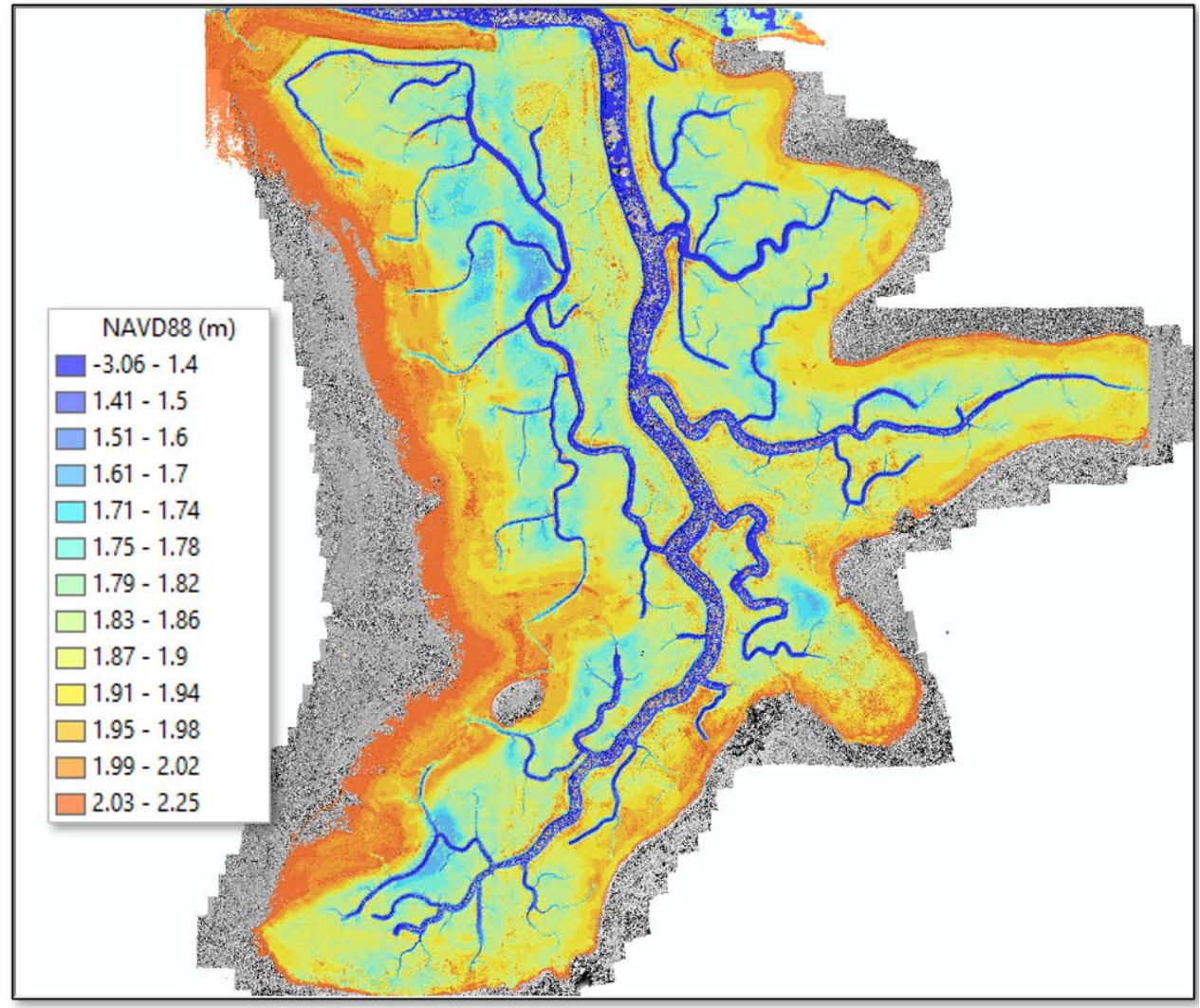
Plant Communities

- Marsh Recruitment

2018

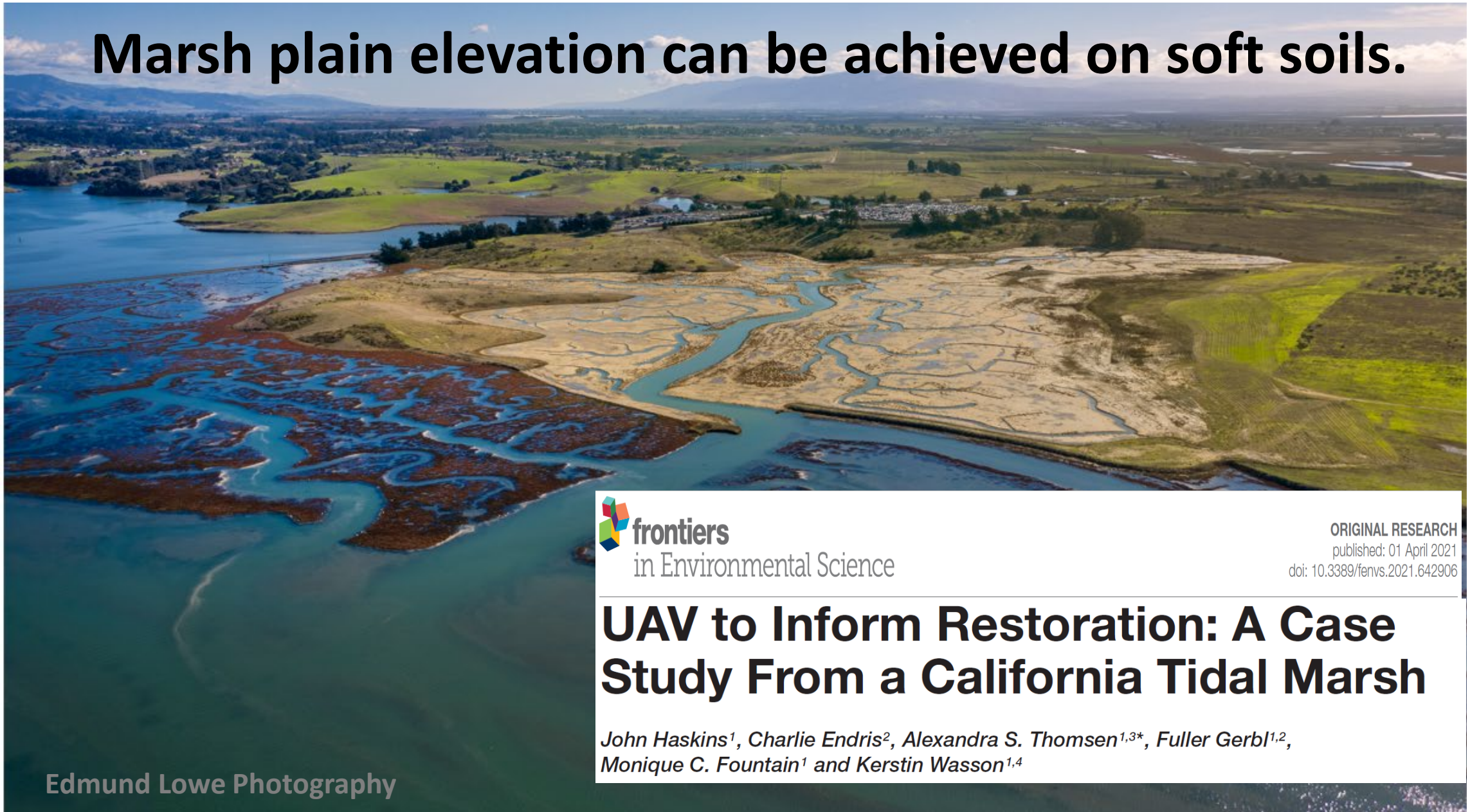


2023


NAVD88 (m)
-3.06 - 1.4
1.41 - 1.5
1.51 - 1.6
1.61 - 1.7
1.71 - 1.74
1.75 - 1.78
1.79 - 1.82
1.83 - 1.86
1.87 - 1.9
1.91 - 1.94
1.95 - 1.98
1.99 - 2.02
2.03 - 2.25

Lesson Learned: Constructability

Marsh plain elevation can be achieved on soft soils.



Edmund Lowe Photography

frontiers in Environmental Science

ORIGINAL RESEARCH
published: 01 April 2021
doi: 10.3389/fenvs.2021.642906

UAV to Inform Restoration: A Case Study From a California Tidal Marsh

John Haskins[1], Charlie Endris[2], Alexandra S. Thomsen[1,3], Fuller Gerbl[1,2], Monique C. Fountain[1] and Kerstin Wasson[1,4]*

Lessons Learned

Key Physical Elements

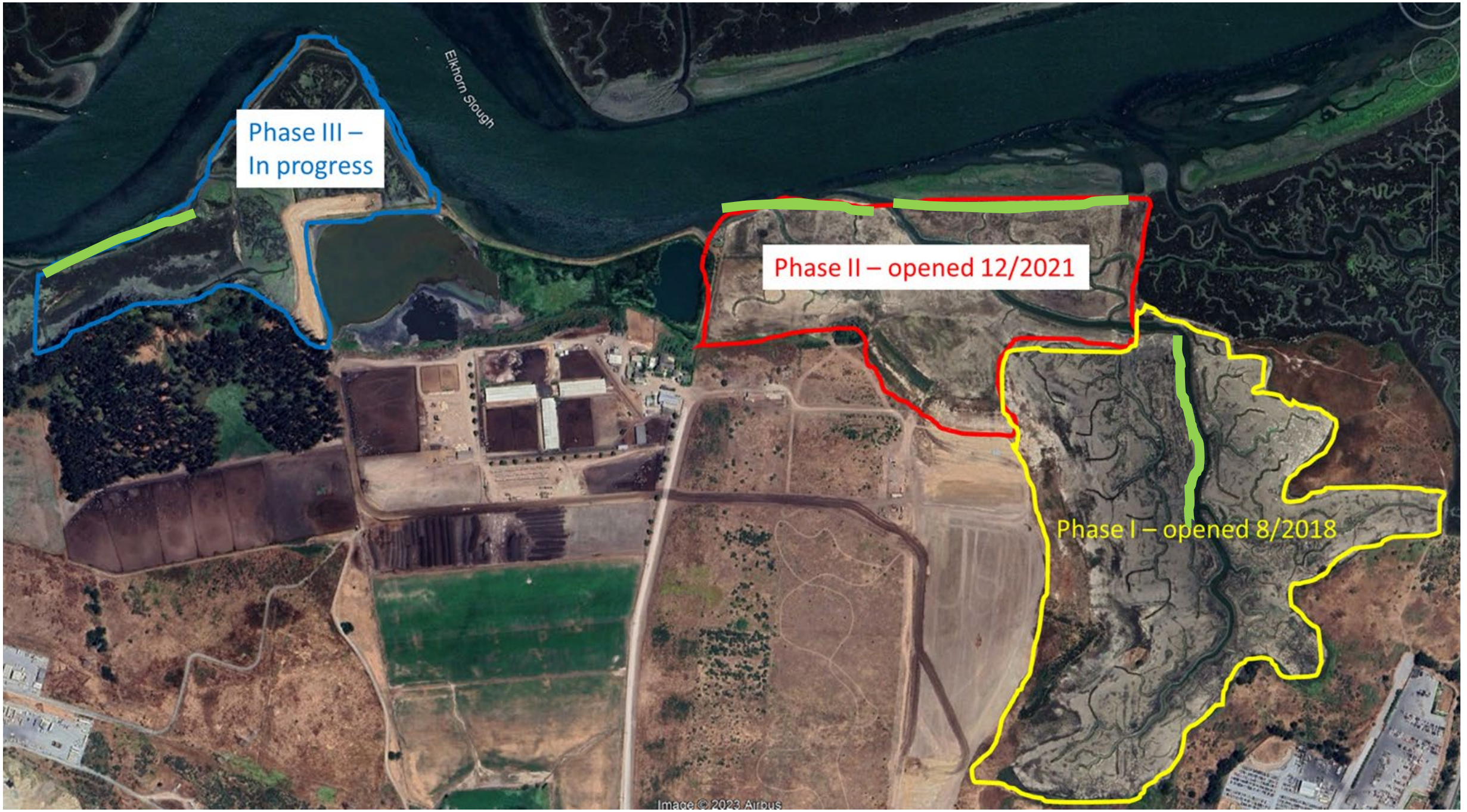
- Elevation Changes
- **Firm Channel Edge**

Carbon Sequestration

Plant Communities

- Marsh Recruitment

Lesson Learned: Constructability


Elkhorn Slough
Phase III –
In progress
Phase II – opened 12/2021
Phase I – opened 8/2018
Image © 2023 Airbus

Lessons Learned

Key Physical Elements

- Elevation Changes
- Firm Channel Edge

Carbon Sequestration

Plant Communities

- Marsh Recruitment

Intensive blue carbon monitoring: multiple metrics

Above-ground C
in plants, sediment

Below-ground
in plants, sediment,
production/decomposition

Gas flux

Lesson Learned: Blue Carbon

Trade-offs between blue carbon function now vs. future climate resilient marsh

Lessons Learned

Key Physical Elements

- Elevation Changes
- Firm Channel Edge

Carbon Sequestration

Plant Communities

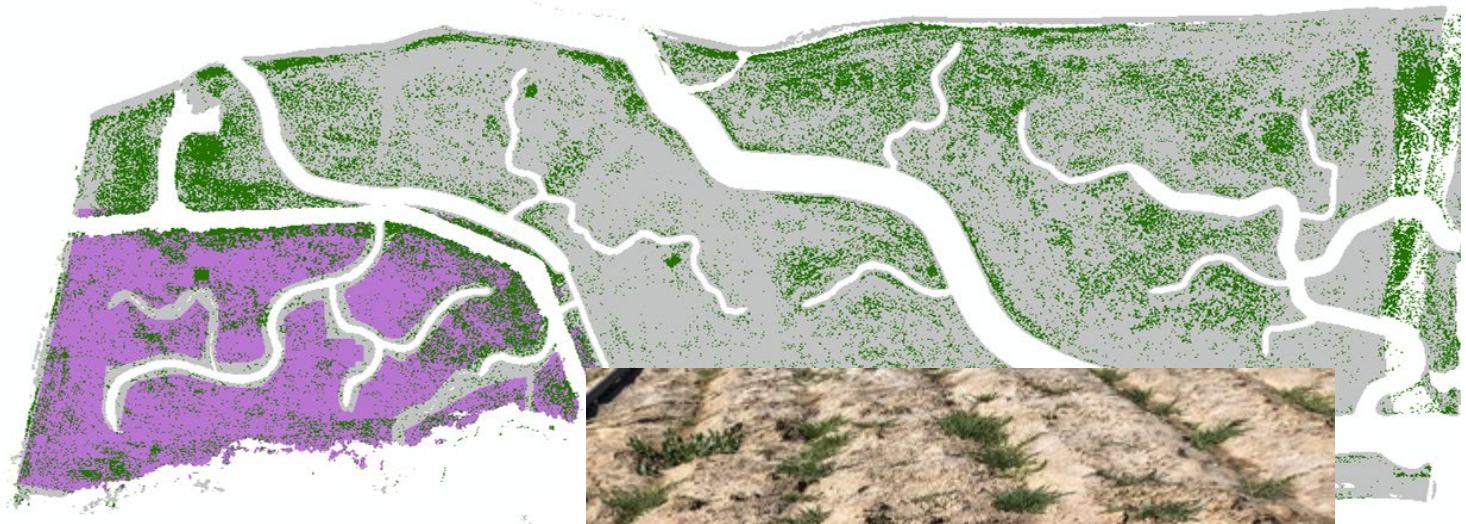
- **Marsh Recruitment**

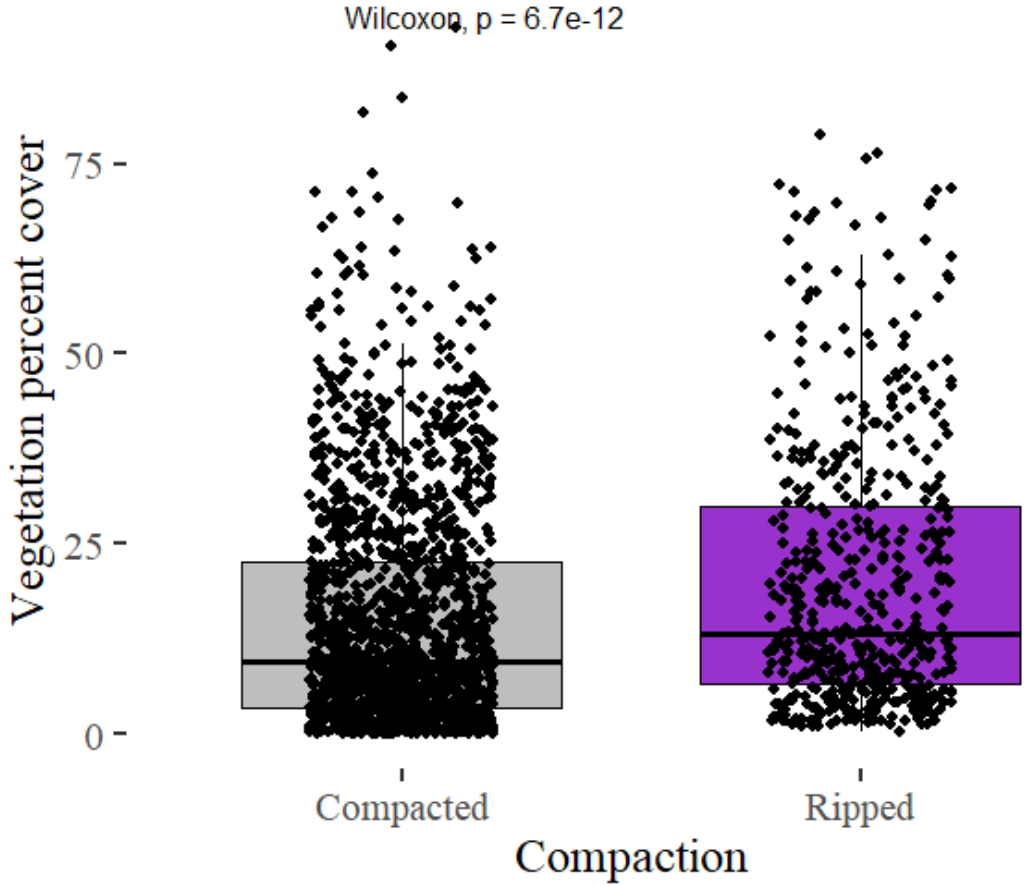
Colonization by vegetation takes time

Interesting patterns of colonization

Ripped vs. Compacted

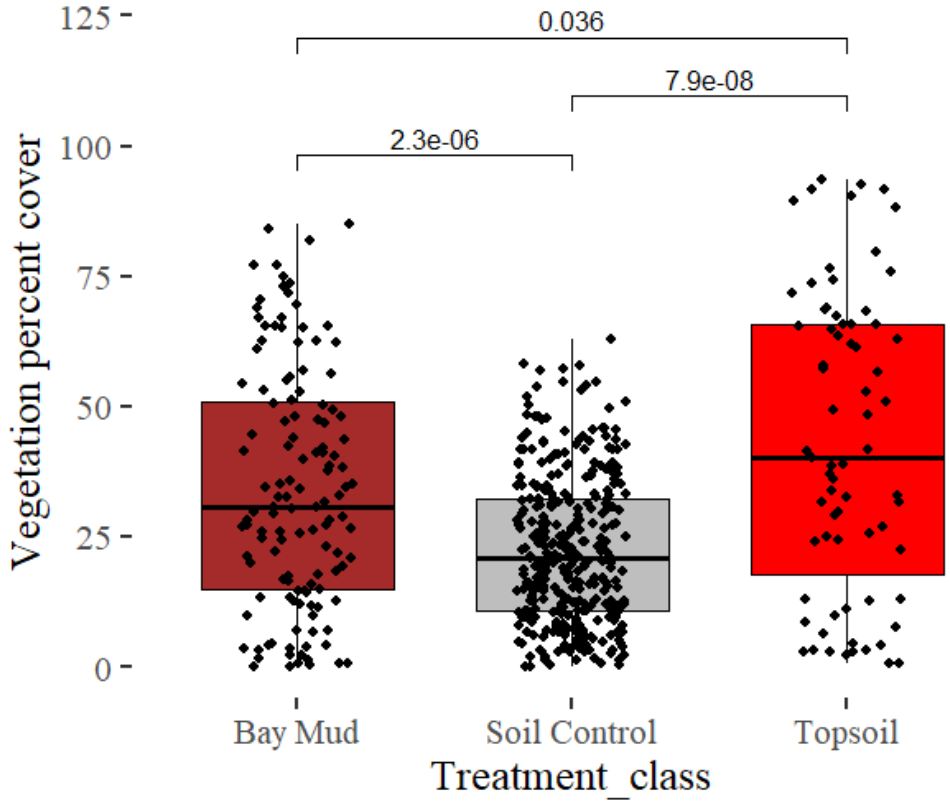
More vegetation in ripped





Organic topping

LOTS more vegetation in mud-topped and top-soil topped areas than adjacent



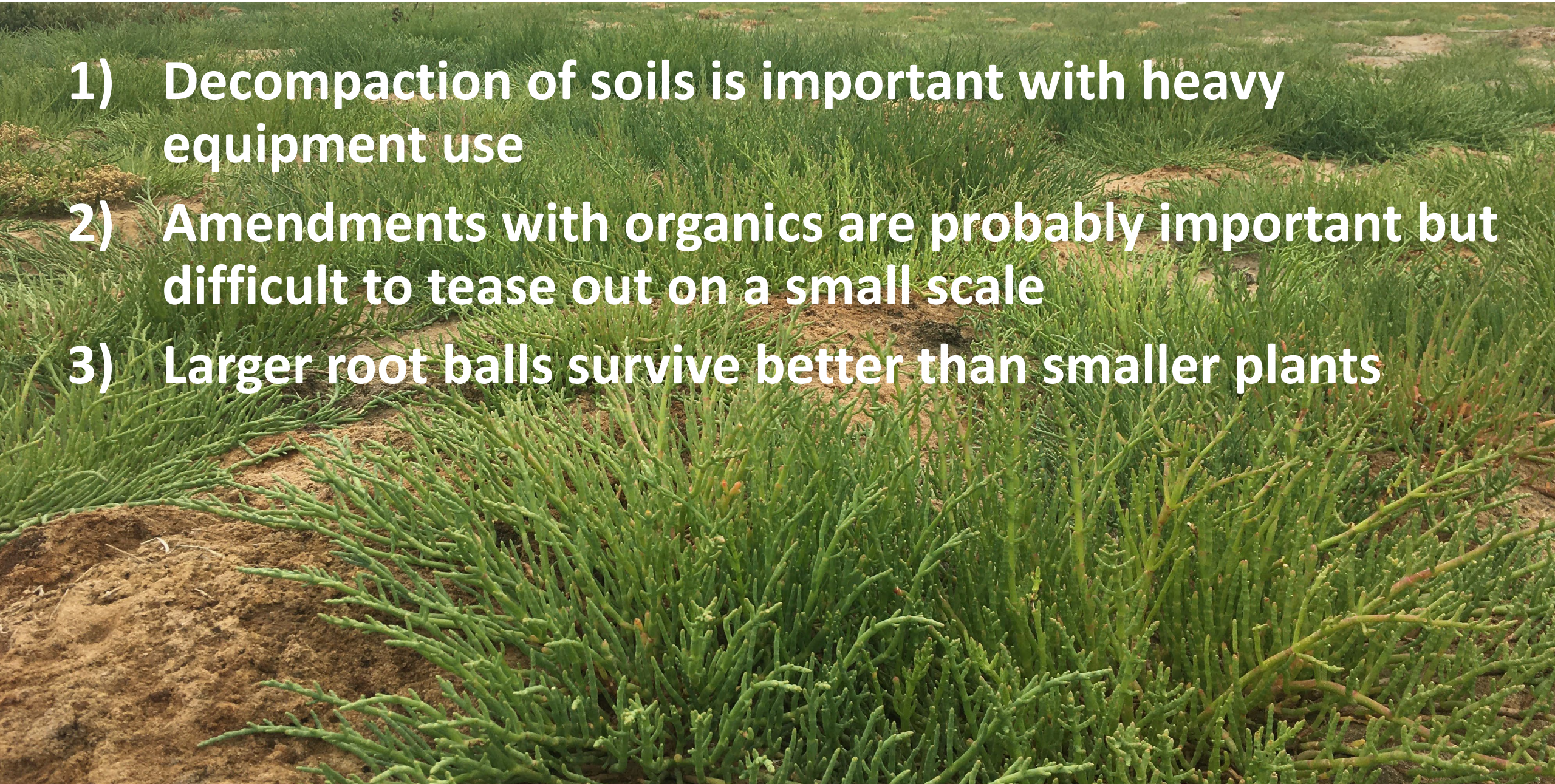
transplant

n cover in these patches

Dec

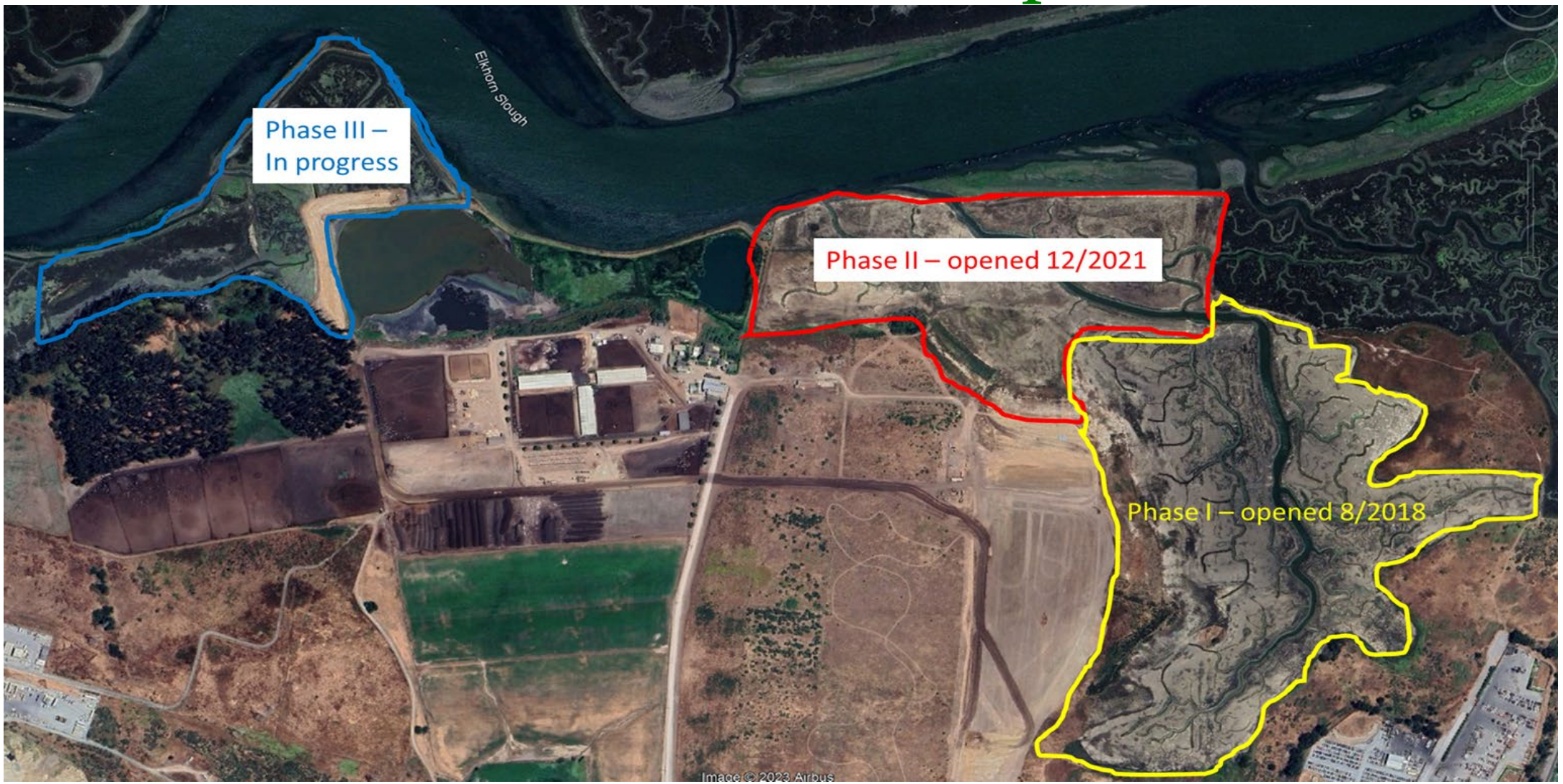
Aug 2023

Lesson Learned: Marsh Recruitment and Survival



1) Decompaction of soils is important with heavy equipment use
2) Amendments with organics are probably important but difficult to tease out on a small scale
3) Larger root balls survive better than smaller plants

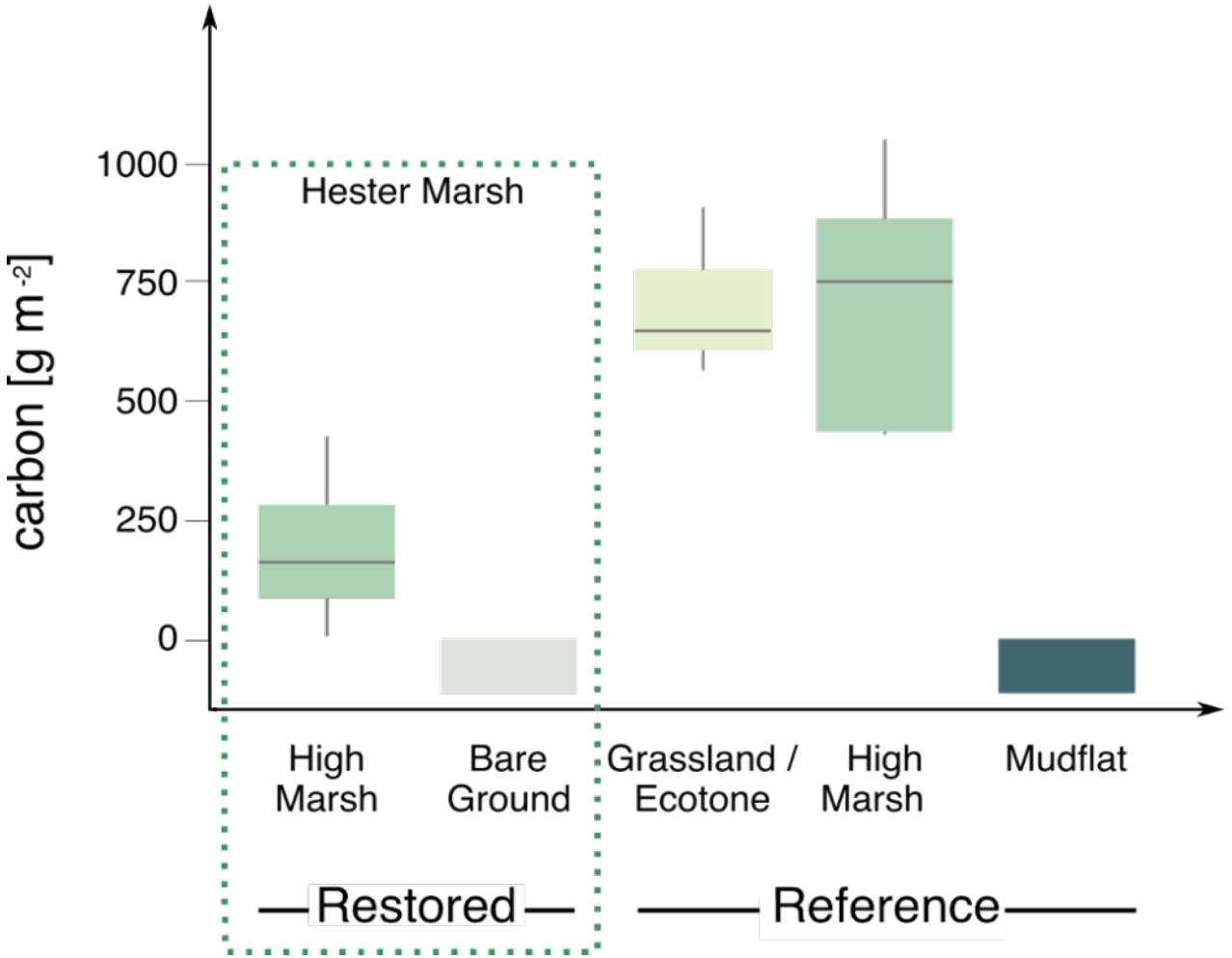
Phased approach allows for adaptive restoration within and between phases

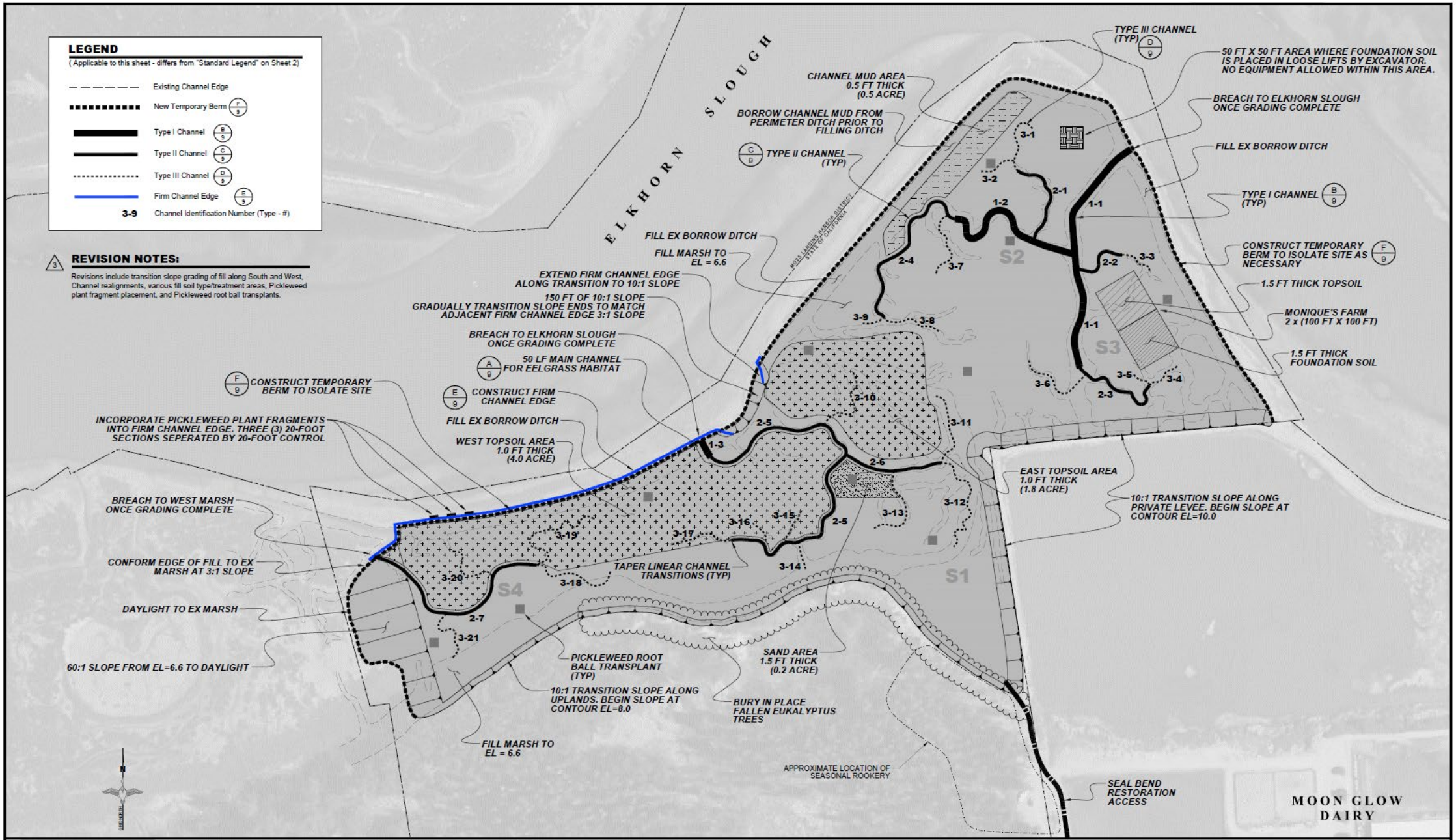


Questions?

Extra slides

Above-ground carbon storage will be lower at restoration site than reference site for a while





Unauthorized Changes & Uses
The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes must be in writing and must be approved by the preparer of these plans.

Indicates calculated property boundary lines per documents of record as noted on Sheet 1.

REVISIONS			
REV. NO.	DESCRIPTION	DATE	APPROVED
5			
4			
3	SEAL BEND FILL & CHANNEL GRADING CHANGES, FILL MATERIAL	9-20-23	
2			
1			

CONSTRUCTION SET

DUCKS UNLIMITED

PROJECT NO. US-CA-485-4 DATE: 10/3/2023
E.S.N.E.R.R.
HESTER II TIDAL MARSH RESTORATION PROJECT
SITE PLAN - SEAL BEND AREA

DESIGNED BY: SC
DRAWN BY: JS
SURVEYED BY: DU
CHECKED BY:
SHEET NO. 6 of 9

Restoration Goals

- Restore 130 ac. of salt marsh ecosystem
- Protect and improve water quality
- Reduce tidal scour in Elkhorn Slough
- Increase understanding of “blue carbon”
- Improve Southern sea otter habitat
- Improve resilience to climate change

Photo courtesy of Keith Ellenbogen