



U.S.ARMY

Demonstration of Innovative Placement Techniques in Coastal New Jersey

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WEDA Dredging Summit and Expo

Las Vegas, NV July 18, 2023



**US Army Corps
of Engineers**



US Army Corps of Engineers (USCAE) Sediment Mission Areas

Navigation



Flood Risk Management

Dredging



~150 – 225 M m³/yr
>4B m³ over last 25 yrs



Environmental

Beneficial Use of Dredged Material Program Vision



National Policy for Beneficial Use of Dredged Material

Congressionally established by section 125 of WRDA 2020 in doing so, Congress has underscored the importance of the Beneficial Use of Dredged Material Program

Dredged material is valued as a resource not to be wasted but used for benefits to the ecosystem, economy, and project delivery



Address key obstacles to execution

Identify Key Contributors

Unify Enterprise Purpose

Foster Strong Partnerships

Deliver the Mission

Identify, develop, and share beneficial use practices

Collaborate on innovative financing

Dredge Material is a valuable resource

- Increased dredging investments create beneficial use of dredge material management opportunities
- Benefits the ecosystem, economy, and can effectively and efficiently deliver the USACE mission.

There are opportunities to expand beneficial use within the Federal Standard

- Operational strategy should inherently include beneficial use placement options.
- If material is needed to implement a project, beneficial use from dredging operations should be considered as an option in the planning and execution strategy.

Partner collaboration is key to our success

- Innovative pursuit, both internally and externally, with partners and stakeholders will:
 - Maximize available solutions, strategies, and tools
 - Develop and apply new approaches and technologies

Over the next 3-5 years, the Corps will expand the beneficial use of dredged material program. Achieving this vision will require all of us to be innovative and work alongside our partners, both internally and externally, to ensure we are finding the best use of sediments derived from our Navigation mission.

Philosophical Approach

- **“Sediment is the currency of marsh ecosystems”** ~ Dr. Lenore Tedesco, The Wetlands Institute
- The USACE is perhaps the largest national “sediment broker” due to navigation mission and dredging (we have the currency!)

Challenge to Change

- Improve stewardship of sediment “currency” and optimize system resilience
- Evolve from caution and risk-averse to cost-effective, proactive and innovative methods with measured risk
- Improve Design, Permitting, Construction, Monitoring, Adaptive Management, Predictability(?)



U.S. Army Corps of Engineers Navigation Mission

- Philadelphia District (NAP) maintains federal channels, including the Delaware River & Bay, coastal inlets, and the 188-km long New Jersey Intracoastal Waterway (NJIWW)
- Goal of **100% beneficial use (BU)** of CLEAN channel sediments in coastal NJ, setting the bar high!
- Navigation O&M is fast time scale!



The Post-Superstorm Sandy "Pilots" Sediment Testing and Constructability Up Front!



Dredge Fullerton at Great Flats
Barnegat Bay Dredging Company

Confined Disposal Facility



Mordecai Island (80% sand)

Avalon (fines)

Ring Island and Great Flats (95% sand)

Progression from 25% BUDM (pre-Sandy) to 60% BUDM (post-Sandy)



Apply Regional Sediment Management (RSM) & Engineering With Nature® (EWN) Principles



RSM Operating Principles

- Recognize sediment as a valuable resource
- Improve operational efficiencies & natural exchange of sediments
- Consider local & regional impacts/benefits (physical, environmental, social)
- Work across business lines, projects, authorities

EWN Key Elements

- Using natural process to maximum benefit
- Science & engineering that produces operational efficiencies
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners

Navigation/ Dredging



Flood Risk Management



Environmental Restoration



Seven Mile Island Innovation Laboratory

Established 2019



Inspired by the Dutch



Living Lab for Mud



Fine sediment: from waste to resource

Throughout the world, different coastal, stream, and river users have to deal with excess sediment or sediment overloads. The natural balance between the removal and deposition of sediment is disrupted by human interventions such as dams in a river or ports in an estuary. As a result, sediment does not reach places where it is needed and too much accumulates in other locations. Excess silt is deposited and it becomes difficult for plants and animals. People are also pressured, for example in terms of food supplies, ports and leisure activities.

<https://www.ecoshape.org/en/projects/living-lab-mud>

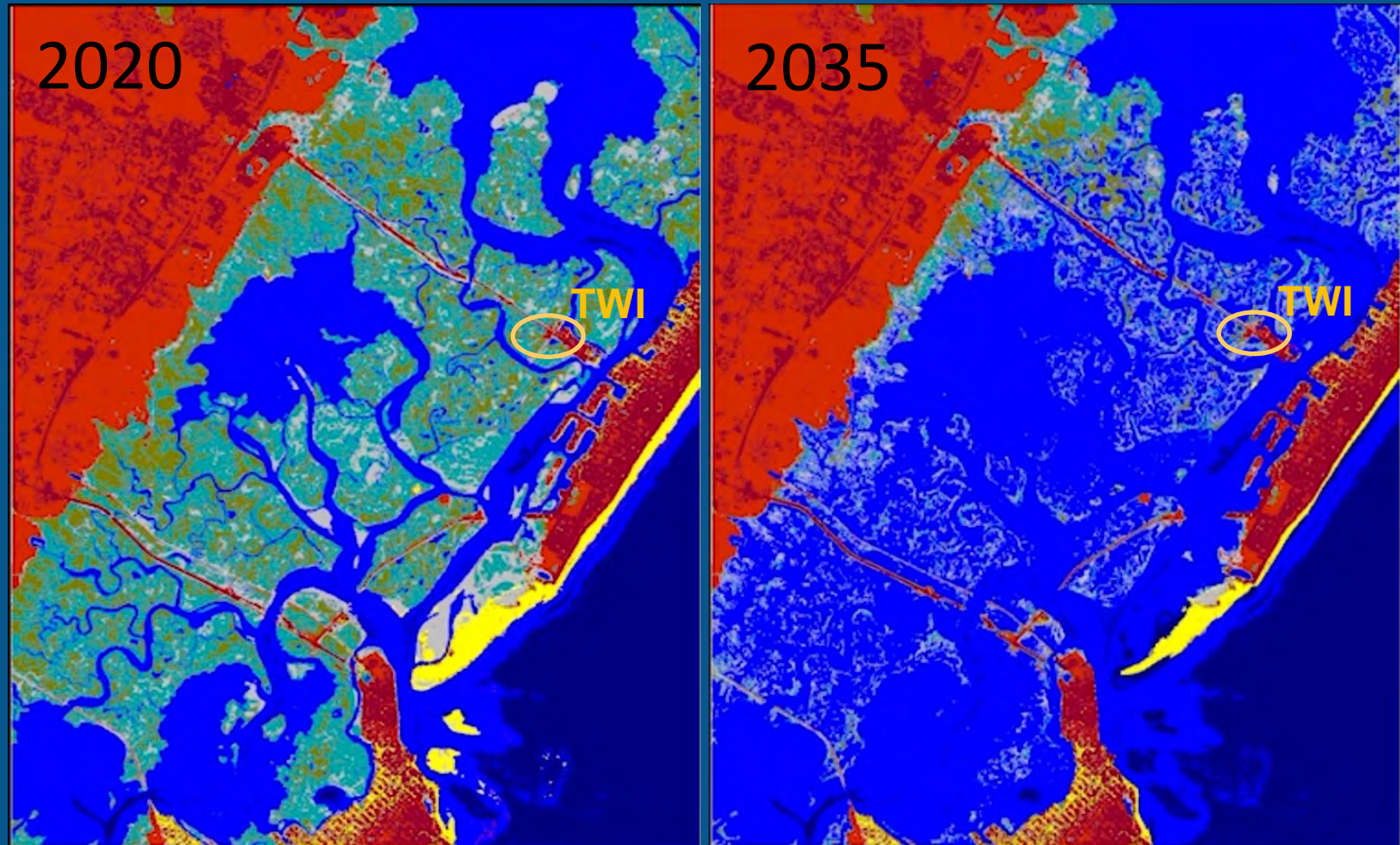
Encompassing 24 mi², and 15,000 acres of Back Bay Tidal Marshes, Shallow Bays, and Inlets.

Goal: To advance and improve dredging, beneficial use, and marsh restoration techniques.



Why Seven Mile Island?

- *Bisected by NJIWW federal channel*
- *Home of The Wetlands Institute (TWI)*
- *Wildlife Management Area*
- *Ongoing & previous projects*
 - Avalon TLP
 - Ring Island
- *Forecasted Sea level Rise heavily impacts the region*



High Tide Flooding (MHW SLAMM) and Coastal Resilience

Advancing Dredging & Placement Techniques in SMILL Learning from the Past, Innovating Now and Evolving to the Future



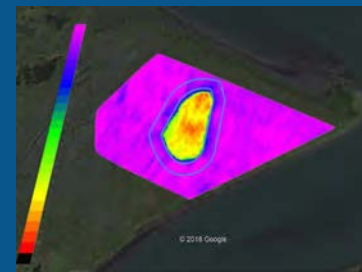
Ring Island



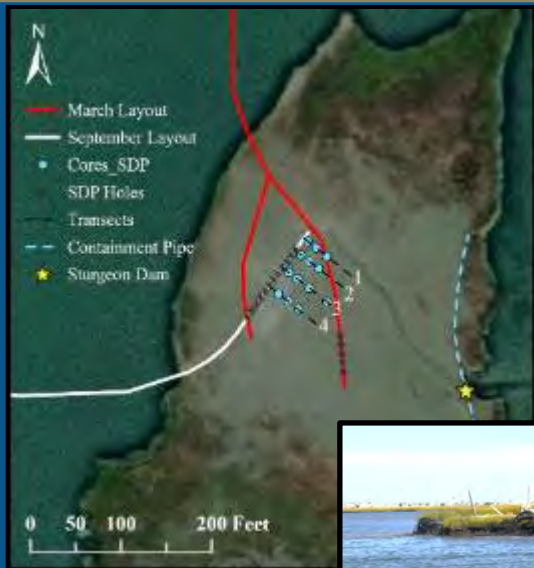
Avalon



The Original Pilots & Beyond



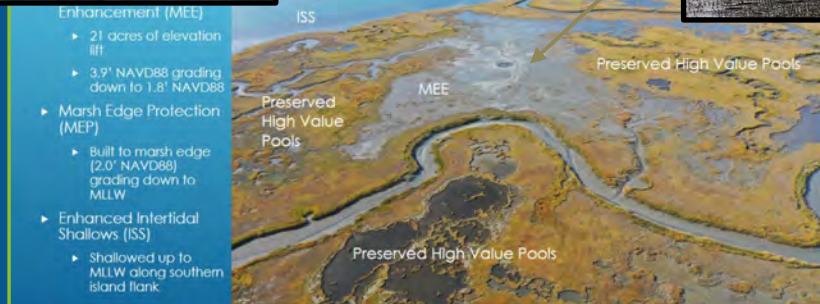
Great Flats and a System of Solutions for the NJIWW



Taking it to the Next Level at Gull and Sturgeon Islands



Landscape Approach at Gull Island, RSM/EWN



- Enhancement (MEE)
 - 21 acres of elevation lift
 - 3.9' NAVD88 grading down to 1.8' NAVD88
- Marsh Edge Protection (MEP)
 - Built to marsh edge (2.0' NAVD88) grading down to MLLW
- Enhanced Intertidal Shallows (ISS)
 - Shallowed up to MLLW along southern island flank

INITIAL ASSESSMENT GULL ISLAND PROJECTS

Sturgeon Island Placements

- Placed in Two Phases in 2020
 - March 2020
 - 4,200 cubic yards
 - September 2020
 - 15,000 cubic yards
 - Sediment Distribution Pipe (SDP) Demonstration
- Marsh Elevation Enhancement
 - 3.5 acres of enhancement
- Marsh Edge Protection
 - Placed small sand ridge along toe of erosional slope
- Enhanced Intertidal Shallows



Sediment Distribution Pipe



Traditional configuration

Video Here

Phase 1:
Elevated

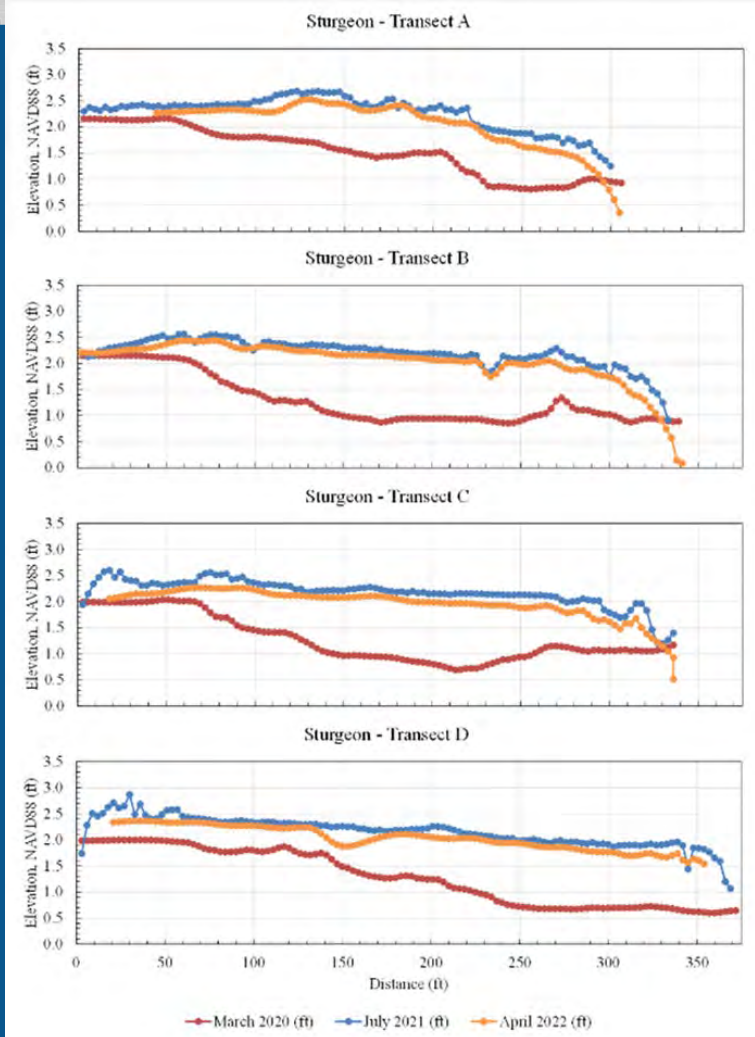
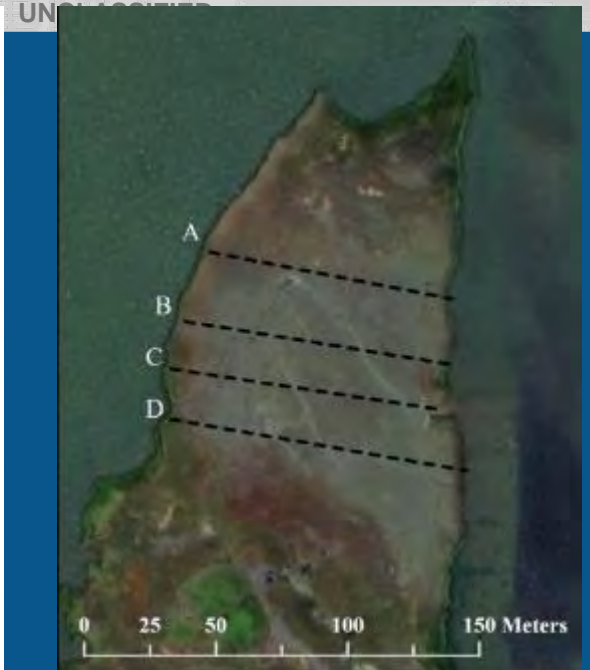


Phase 2:
On Surface



Marsh Edge Nourishment

SDP as containment & measuring throw distance



- 2020 uncontained placement achieved 1.5 – 2.5' of marsh elevation enhancement
- Vegetation recolonization is rapidly occurring naturally via seed bank in year 2



Courtesy of Harris et al.



Bathymetry Southern Gull Island August 2020

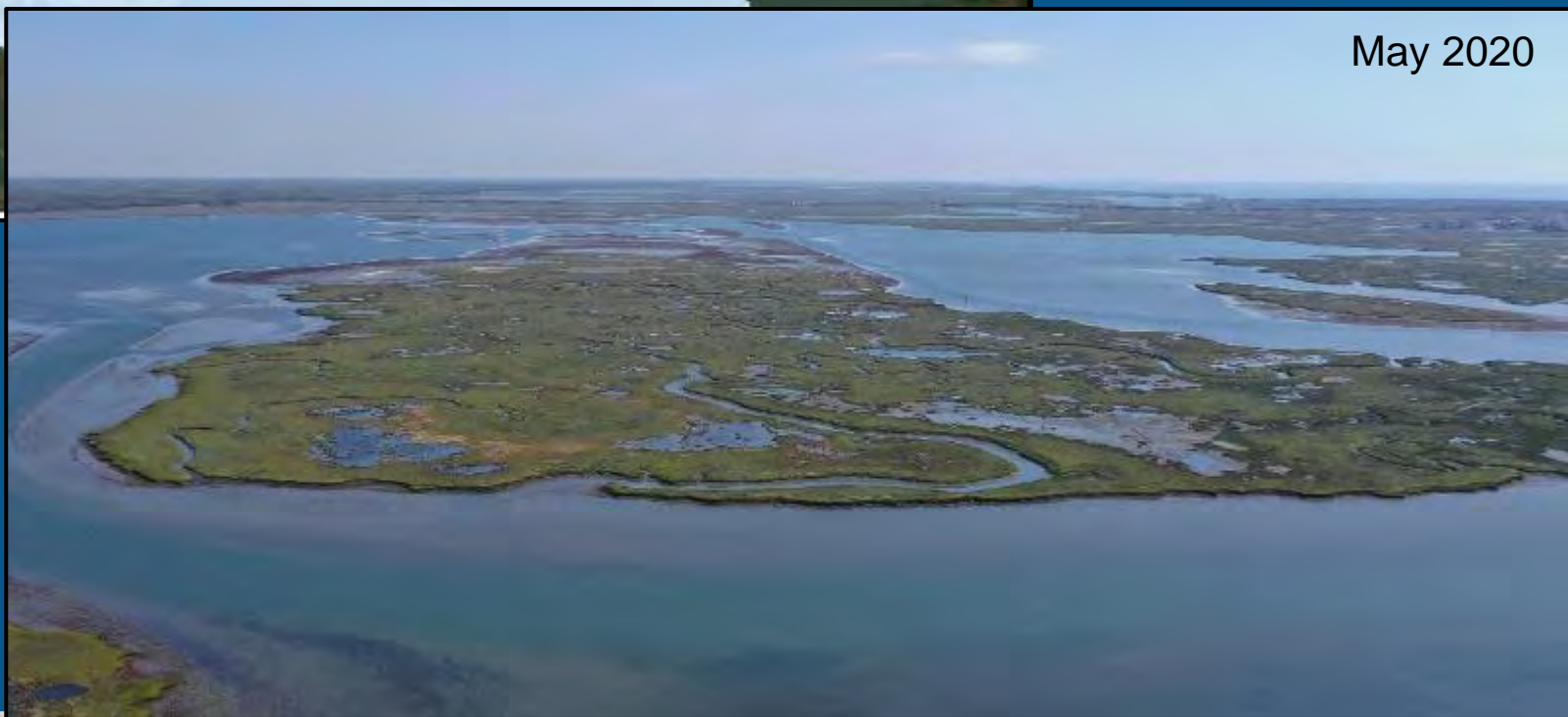
Aug2020_ft
(MLLW)

VALUE

- 2.714 - -1
- 0.999 - 0
- 0.001 - 1
- 1.001 - 2
- 2.001 - 3
- 3.001 - 4
- 4.001 - 5
- 5.001 - 6
- 6.001 - 7
- 7.001 - 8
- 8.001 - 9
- 9.001 - 10
- 10.001 - 11
- 11.001 - 12
- 12.001 - 13



Loss of critical bird habitats in the marshes and tidal flats of Gull Island



Gull Island Projects

- September 2020
- Marsh Elevation Enhancement (MEE)
 - Unconfined placement of 40,000 cy of fine sand & mud
 - ~22 acres of elevation lift
- Marsh Edge Protection
- Placed ~9000 cy
- Enhanced Intertidal Shallows
- Documented very low turbidity during and following placement (Fall et al., 2022)



Video Here



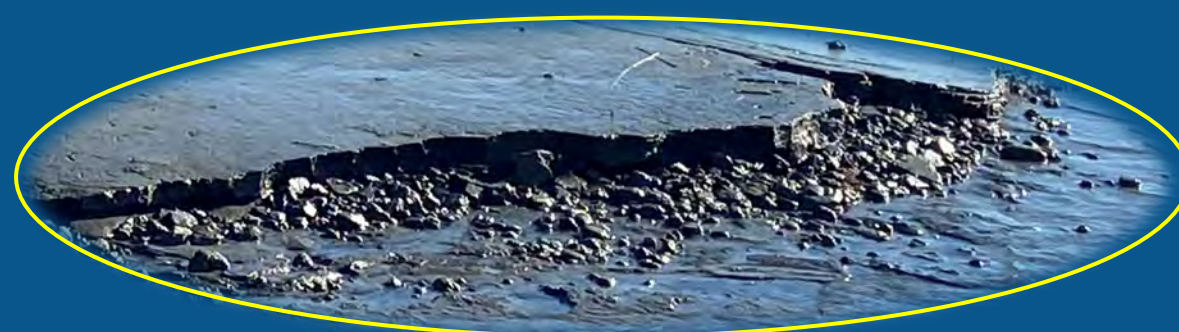
Features Along Southern Edge of Gull Island-1 Month Post-Placement



Direct Placement



Indirect Placement



Bathymetry Change Aug 2020 to Mar 2021

Mar2021 to
Aug2020 Change
(ft)

Value

-2.628 - -2

-1.999 - -1

-0.999 - 0

0.001 - 1


1.001 - 2


2.001 - 3

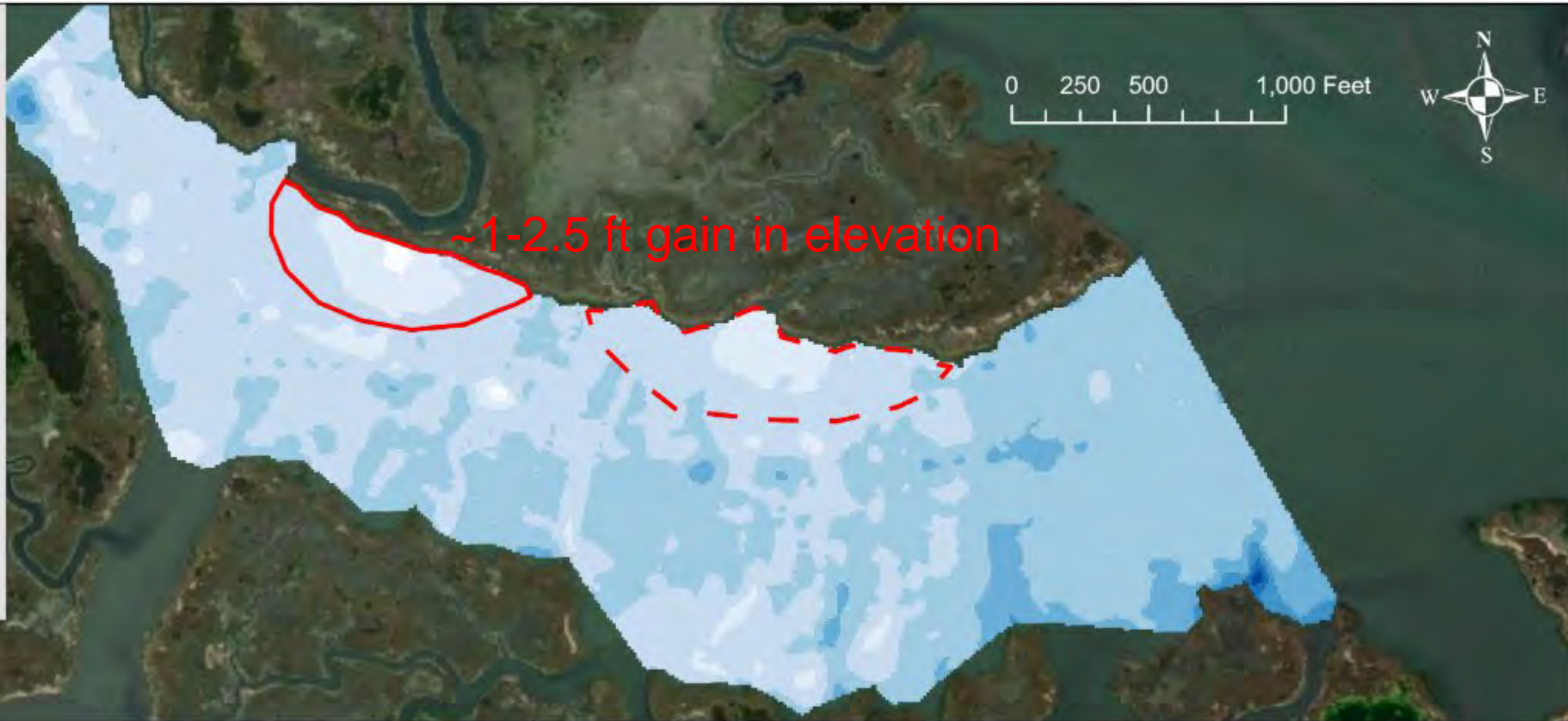
3.001 - 4

4.001 - 5

5.001 - 6

 Direct Placement

 Indirect Placement

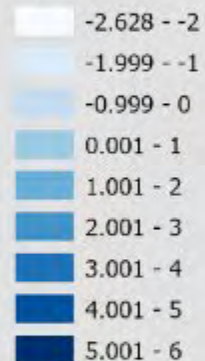




Approximately 6 months after placement

Bathymetry Change Aug 2020 to Mar 2021

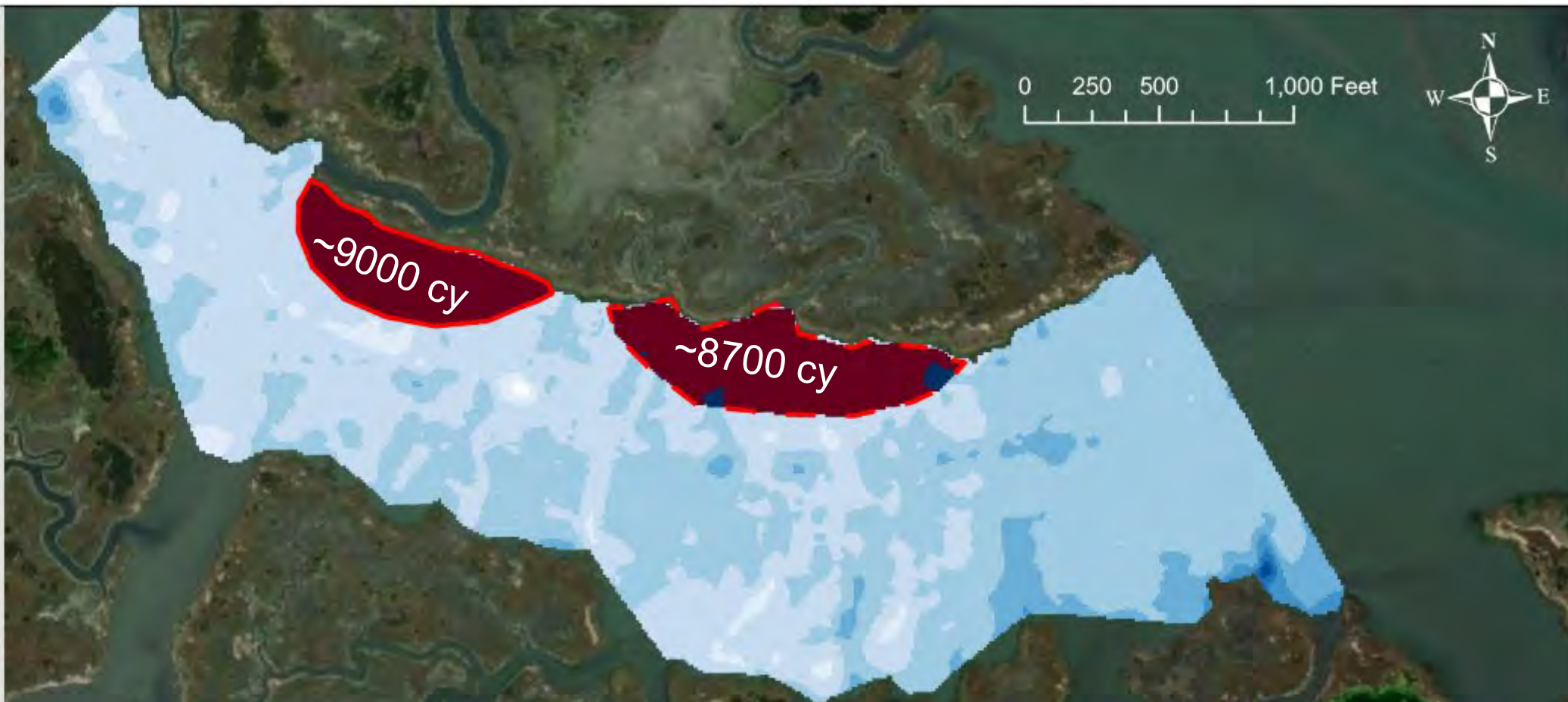
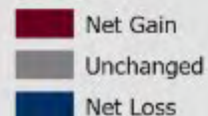
Mar2021 to
Aug2020 Change
(ft)

Value



 Direct Placement
 Indirect Placement

VOLUME



Approximately 6 Months After Placement

Bathymetry Change Aug 2020 to Feb 2022

Feb2022 to
Aug2020 Change
(ft)

Value

-1.744 - -1

-0.999 - 0


0.001 - 1


1.001 - 2

2.001 - 3

3.001 - 4

4.001 - 5

 Direct Placement

 Indirect Placement



Approximately 16 Months After Placement

Bathymetry Change Aug 2020 to Feb 2022

Feb2022 to
Aug2020 Change
(ft)

Value

-1.744 - -1

-0.999 - 0


0.001 - 1


1.001 - 2


2.001 - 3


3.001 - 4


4.001 - 5

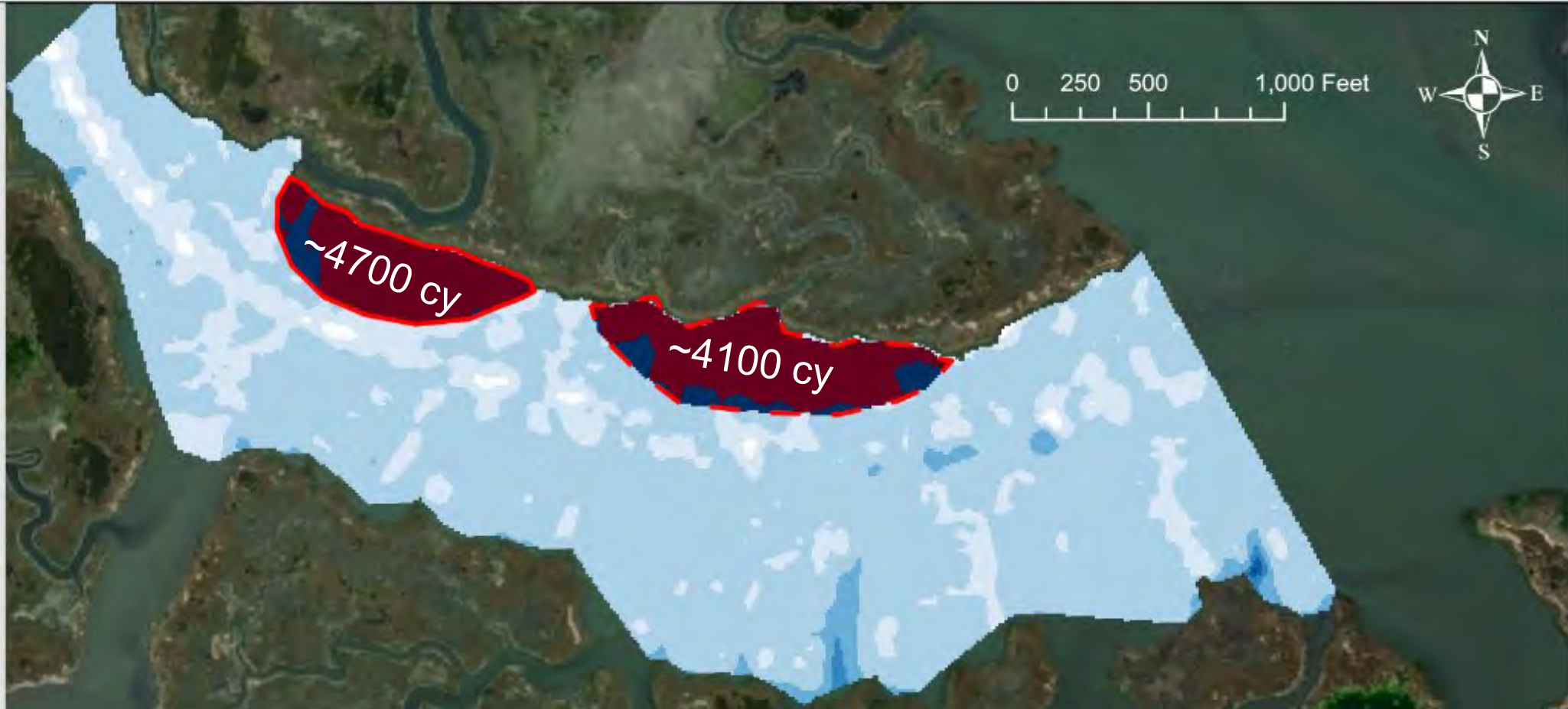
 Direct Placement

 Indirect Placement

 Net Gain

 Unchanged

 Net Loss



**Features still present but show
~50% reduction in volume from March 2021 to Feb 2022**

What's Next in SMIL?

➤ Pilot to clear shoals with sidecast Government Dredge Merritt using “Fertilizing the Garden” approach

➤ Track shoaling rates and patterns for long-term strategies that are nature-based and less “big” construction efforts

➤ Risk acceptance and adaptive management

➤ Agricultural & dredging industry coordination

➤ Leverage SMIL with communities

➤ Utilize techniques in remaining portions of NJIWW

➤ Scale Up and Over (Maurice & Salem Rivers, NJ)



g Lab



Seven Mile Island Innovation Lab

Primary References

- **American Shore and Beach Preservation Association National Conference, Sept 2022, Long Beach, Presentation, “Advancing Navigation Dredging and Innovative Placements to Support Coastal System Resilience in USACE's Philadelphia District”**
- **37th International Conference on Coastal Engineering, December 2022, Sydney, Australia, “Advancing Sediment Solutions in the Seven Mile Island Innovation Lab”**
- **Coastal Sediments 2023, March 2023, New Orleans, Paper and Presentation, “Seven Mile Island Innovation Laboratory: Advancing Beneficial Use Practices to Support Coastal System Resilience”**
- ***Additional Info and Fact Sheets:***
- **<https://www.nap.usace.army.mil/Missions/Civil-Works/Coastal-Dredging-Beneficial-Use/>**
- **<https://wetlandsinstitute.org/smii/>**