

ADVANCING DREDGING AND INNOVATIVE BENEFICIAL USE PRACTICES FOR MORE RESILIENT SYSTEMS

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Operations Division



US Army Corps
of Engineers®



7 THINGS YOU MAY NOT KNOW...

... About the U.S. Army Corps of Engineers

1. Most of us are civilians
2. Not all of us are engineers
3. We contract for construction
4. We don't work just for the Army
5. Much of our work is about water
6. Our districts are water-based
7. All our work is project-based



THE U.S. ARMY CORPS OF ENGINEERS



Navigation



Flood Risk Management



Coastal Storm Risk Management



Ecosystem Restoration

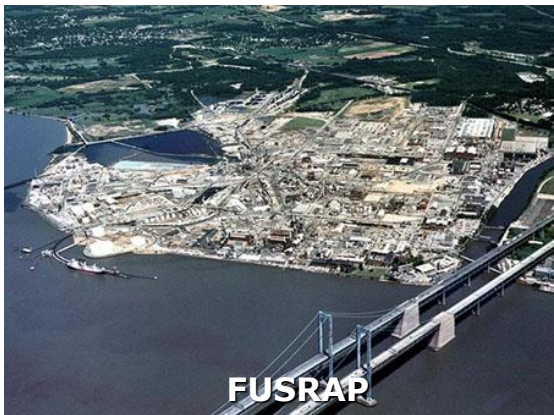


CIVIL WORKS PROGRAM

Watershed Planning



FUSRAP



Emergency Management



Regulatory Program





Organizational Perspective

U.S. Army Corps Of Engineers

Philadelphia District



Navigation Mission

- Operate and Maintain (O&M) district's federal channels including NJIWW and through 4 tidal inlets
- Primarily includes *dredging* and *navigation structures*

Flood/Coastal Storm Risk Management

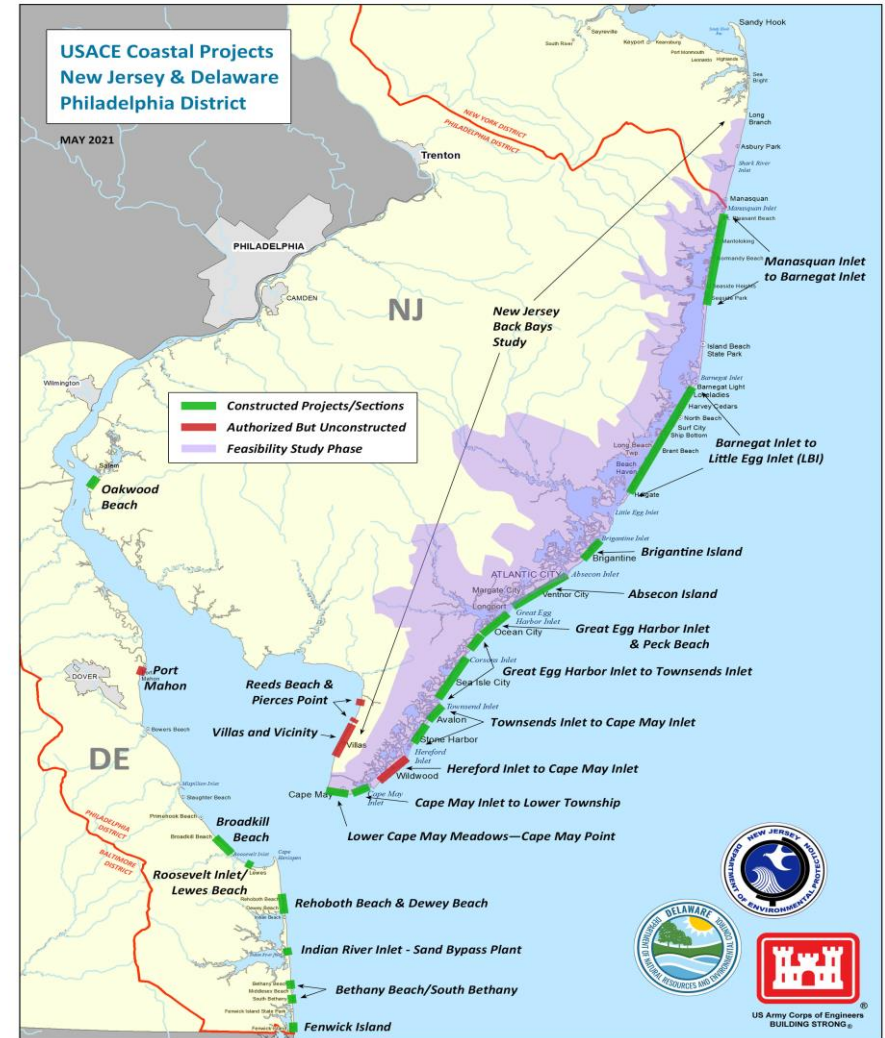
- Robust *beach nourishment* program in NJ & DE carried out under Construction General; borrow areas, tidal inlets
- NJ Back Bays (Planning Study)
- 5 Reservoirs in PA (O&M)

Ecosystem Restoration

- Mordecai Island CAP Study

Regulatory Mission

- Also sits in Operations Division
- We don't permit ourselves but do agency consultations, CZM, WQ



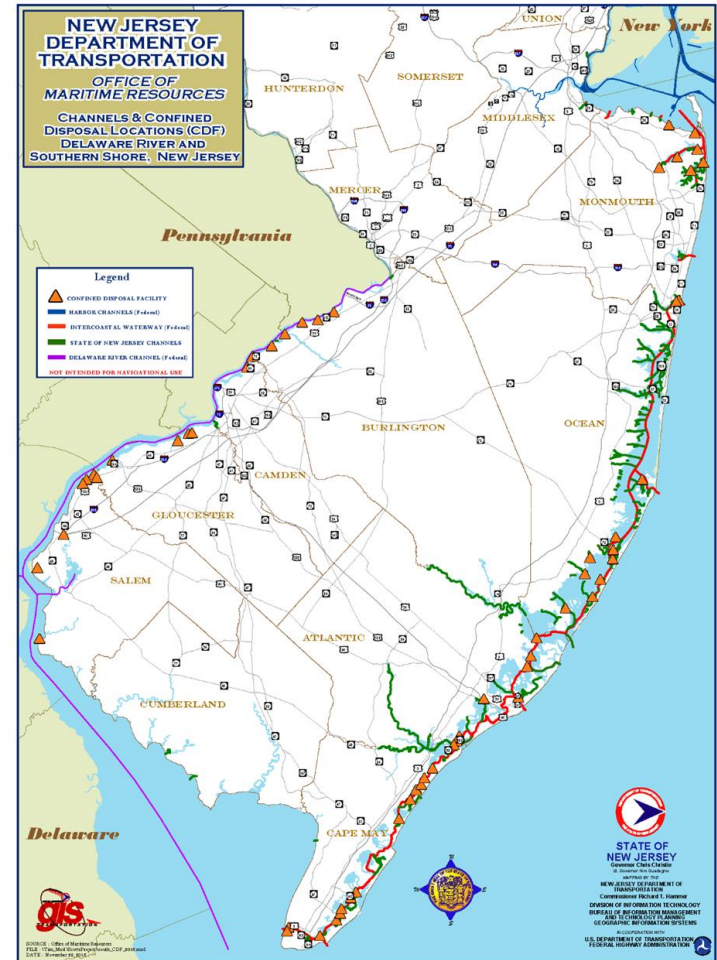
USACE Navigation Mission

- In order to dredge, USACE needs:
 - Authorization (law)
 - Appropriation (\$\$)
 - Placement Area (State of NJ)
- Cost of placement within Federal Standard (or cost-share needed) and need to implement per authorization and appropriation
- New Jersey Marine Transportation System includes Federal, State and Local Channels



New Jersey's Marine Transportation System

- **Federal Channels** in NY/NJ Harbor, Delaware River, and NJ Intracoastal Waterway; over 400 nm of engineered waterways
- **State Channel Network** - 215 Marked and Identified Channels; over 200 nm of engineered waterways
- **Local Channel Network** – Berths, marinas and local access channels; extent and condition is largely unknown
- **Two International Ports** (PONYNJ and South Jersey Port Corporation)
- Internationally recognized tourism destination
- World Class Fishery (most lucrative shellfishery in the U.S.)
- **Worth over \$50 billion annually to the New Jersey economy**





Philosophical Approach



- “Sediment is the currency of marsh ecosystems” ~ Dr. Lenore Tedesco, Exec. Director of The Wetlands Institute
- USACE is perhaps the largest national “sediment broker” due to navigation mission and dredging

Challenge to Change

How can we improve our stewardship of that sediment “currency” and improve system resilience?



When dredged sediment is CLEAN, District strives to find opportunities to use 100% of it beneficially on our marshes & beaches



State endangered Black Skimmer at newly created habitat from dredged sediment, Ring Island, NJ





Regional Sediment Management (RSM)



A systems approach to deliberately manage sediments in a manner that maximizes natural and economic efficiencies to contribute to sustainable, resilient water resource projects, environments, and communities
= *Healthy Systems*

Navigation/ Dredging



Flood Risk Management



Environmental Restoration



RSM Operating Principles

- Recognize sediment as a regional resource; SEDIMENT AS AN ASSET
- Balanced, economically viable, environmentally sustainable solutions
- Improve economic performance by linking multiple projects
- Optimize operational efficiencies & natural exchange of sediments
- Consider local & regional impacts (physical, environmental, social)

Partnership with USACE's Engineering Research and Development Center (ERDC)

Engineering With Nature®

...the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Key Elements:

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



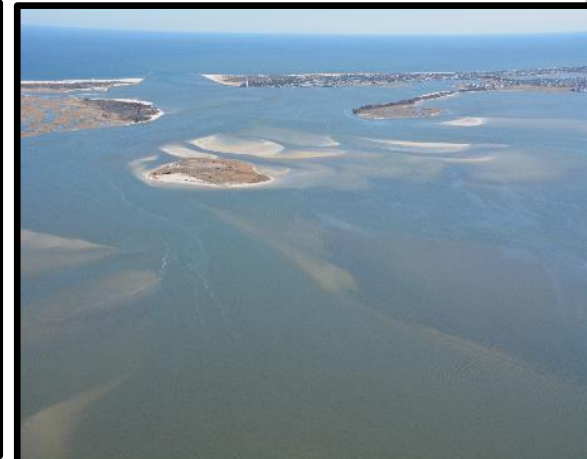
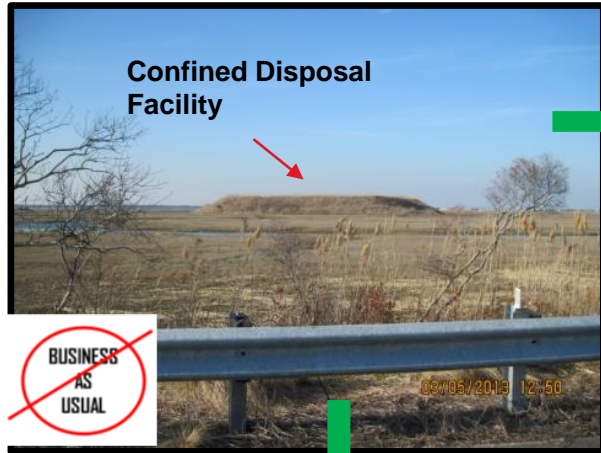
The Nature Conservancy



And Many More!



A Sediment Progression: From Confinement To Natural Infrastructure





Dredging Channels & Waterways



Dredging:

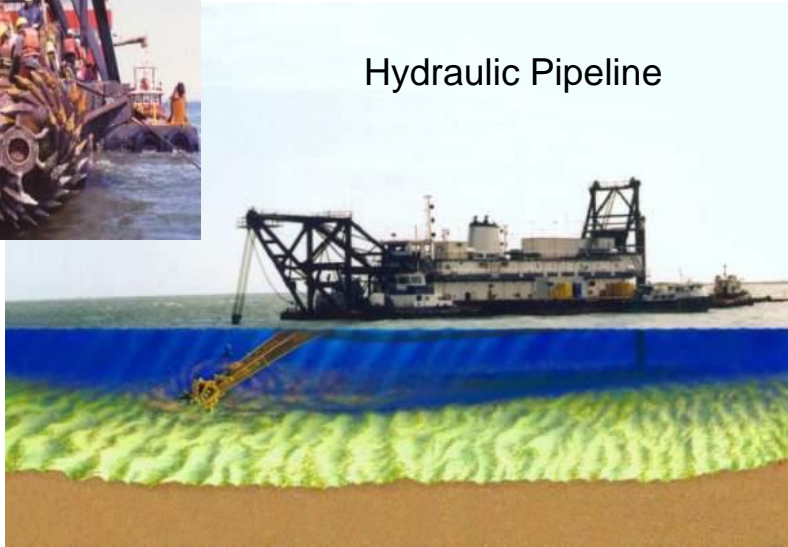
“**excavating sediments** and other materials usually from underwater locations, including the transportation and disposal of the material for purpose of constructing new waterways, **maintaining existing waterway dimensions**, obtaining fill for land reclamation, **beach nourishment**, dike and levee construction, **creating wetlands and marshes**, obtaining materials from borrow areas, or other beneficial uses.”



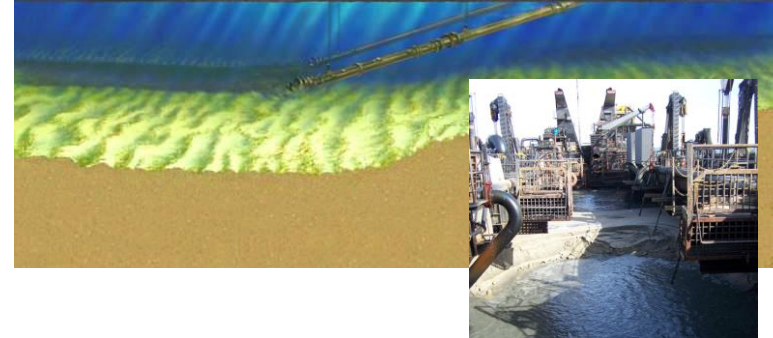
Types of Dredge Equipment



Hydraulic Pipeline



Self-propelled Hopper



Mechanical



Specialty



Sediment Characterization & Constructability Up Front!!



Dredge *TEXAS* working off of Stone Harbor, NJ for beach nourishment



Dredge *Fullerton* working off of Mordecai Island, NJ for navigation and island restoration



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SNELL



CURRITUCK



**WILMINGTON DISTRICT
DREDGE FLEET**

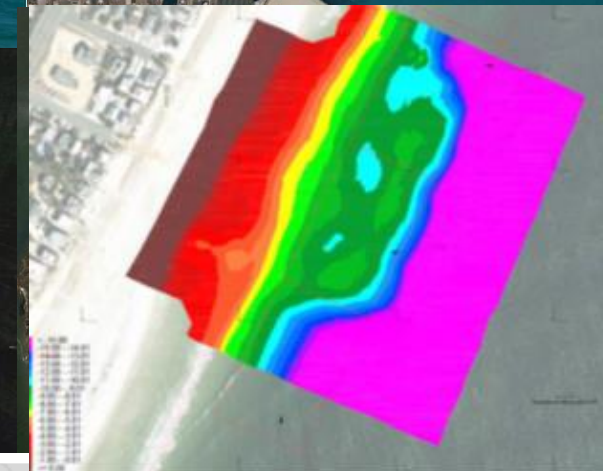
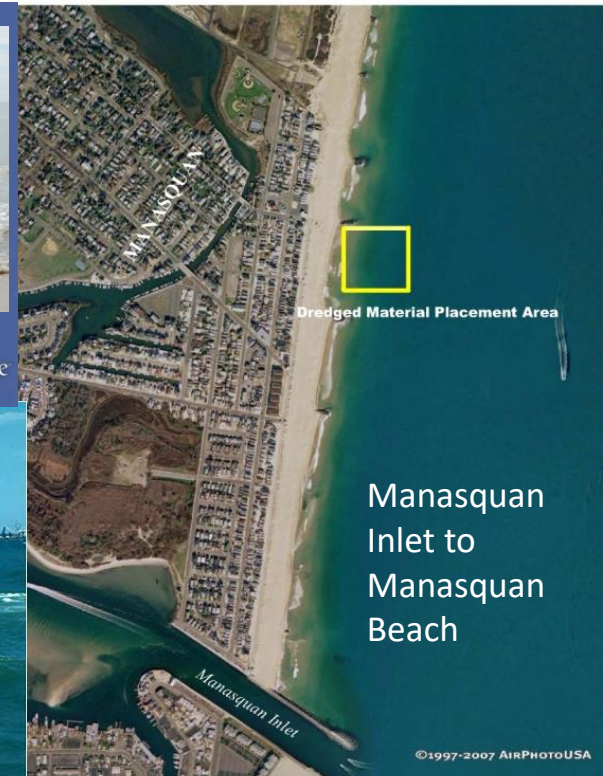
MERRITT



MURDEN



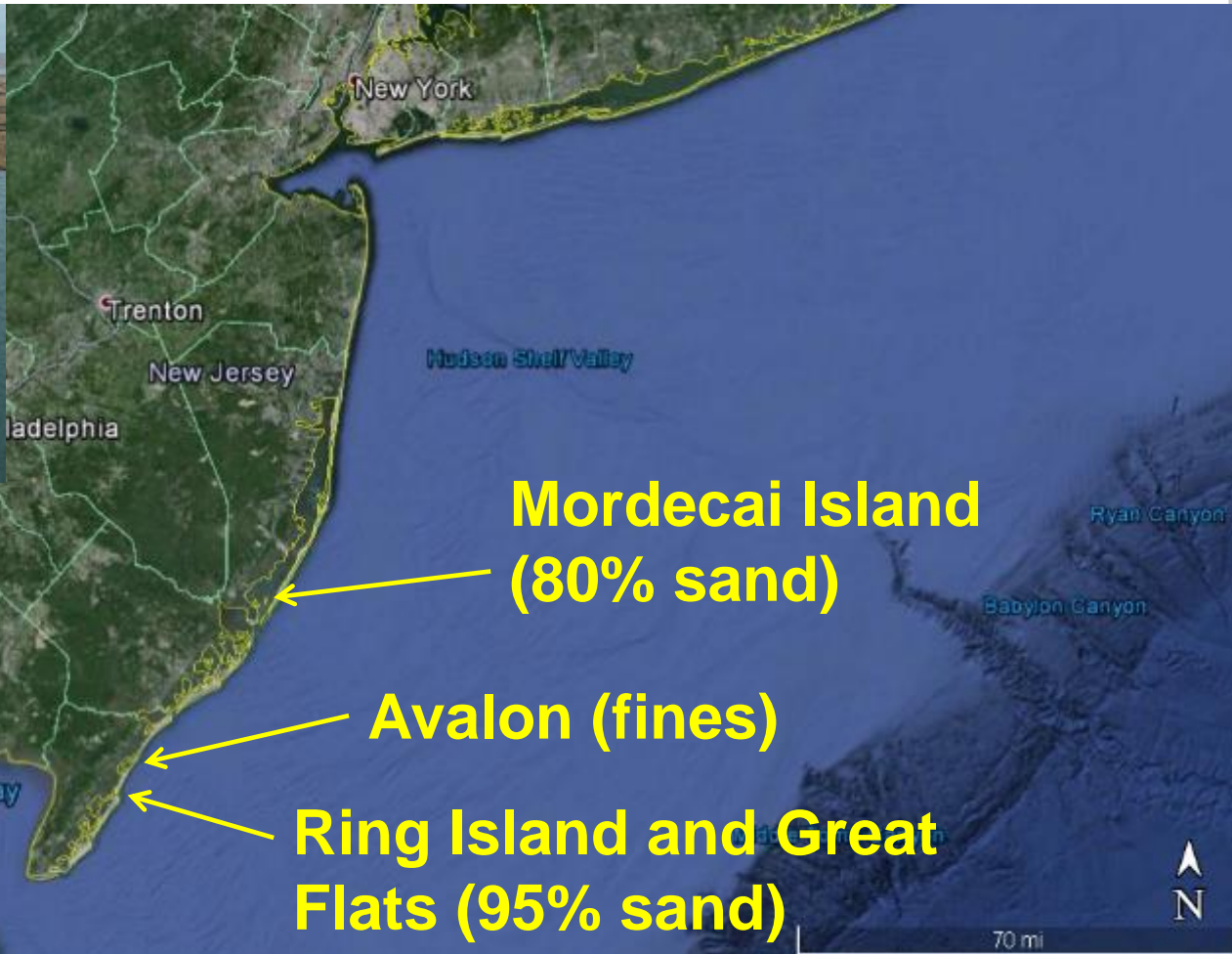
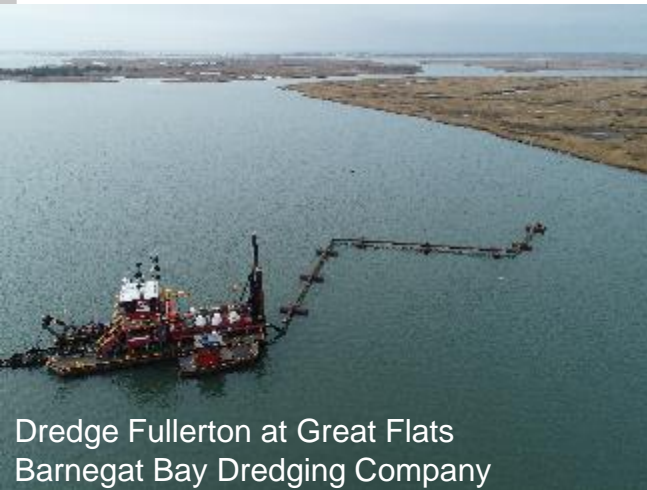
Navigation Channels With Nearshore Nourishment





The Post-Sandy “Pilots”

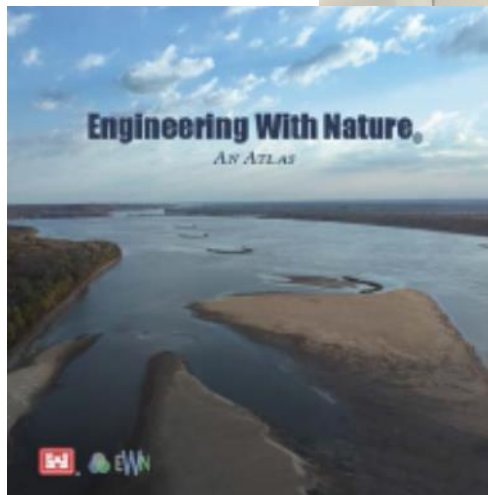
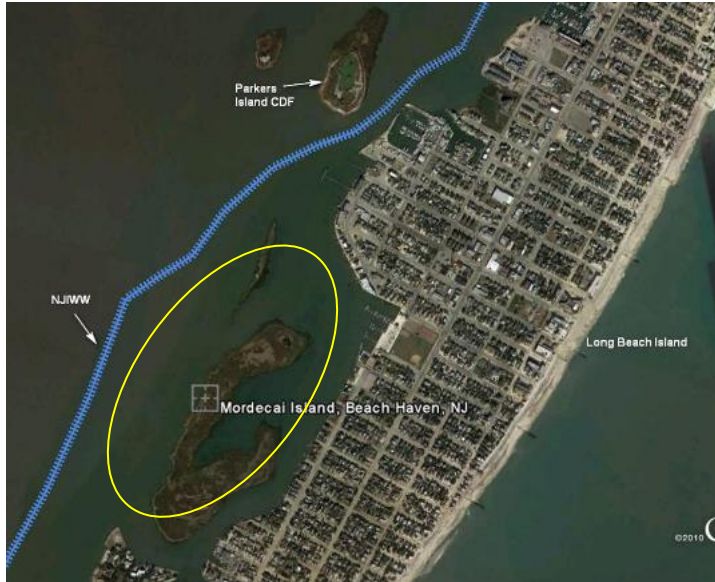
Sediment Testing and Constructability Up Front!



The NJIWW is a 117-mile long federal channel that runs through the NJ Back Bays from Manasquan to Cape May



Mordecai Island Restoration Beach Haven, NJ





NJ Intracoastal Waterway Avalon Pilot Project:

Dredging “The Football Field” and Thin-Layer Placement



- Constructed in two phases: Dec 2014 and Winter 2015/16
- Thin Layer Placement & filling pools
- Fine-grained material 55,000 cy on 50 acres
- Lessons learned document by NFWF Team and Thin Layer Placement Design Guidance by ERDC in preparation
- Multiple ERDC work units support project



Ring Island, NJ: Habitat Creation and Thin-layer Placement



- Initial Placement: Aug 2014
- Placed on degraded land owned by the state instead of Confined Disposal Facility
- Success of habitat creation
 - Shorebird usage
 - Also used by horseshoe crabs & terrapins
- Included small thin layer placement demo with sand
- Adaptively managed habitat elevation in March 2018
- Precedent setting for regional approach with operational efficiencies



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Philadelphia District

ERDC



GreenVest
One Step Ahead.

pH Princeton Hydro

The Nature
Conservancy 
Protecting nature. Preserving life.

Wetlands
INSTITUTE 

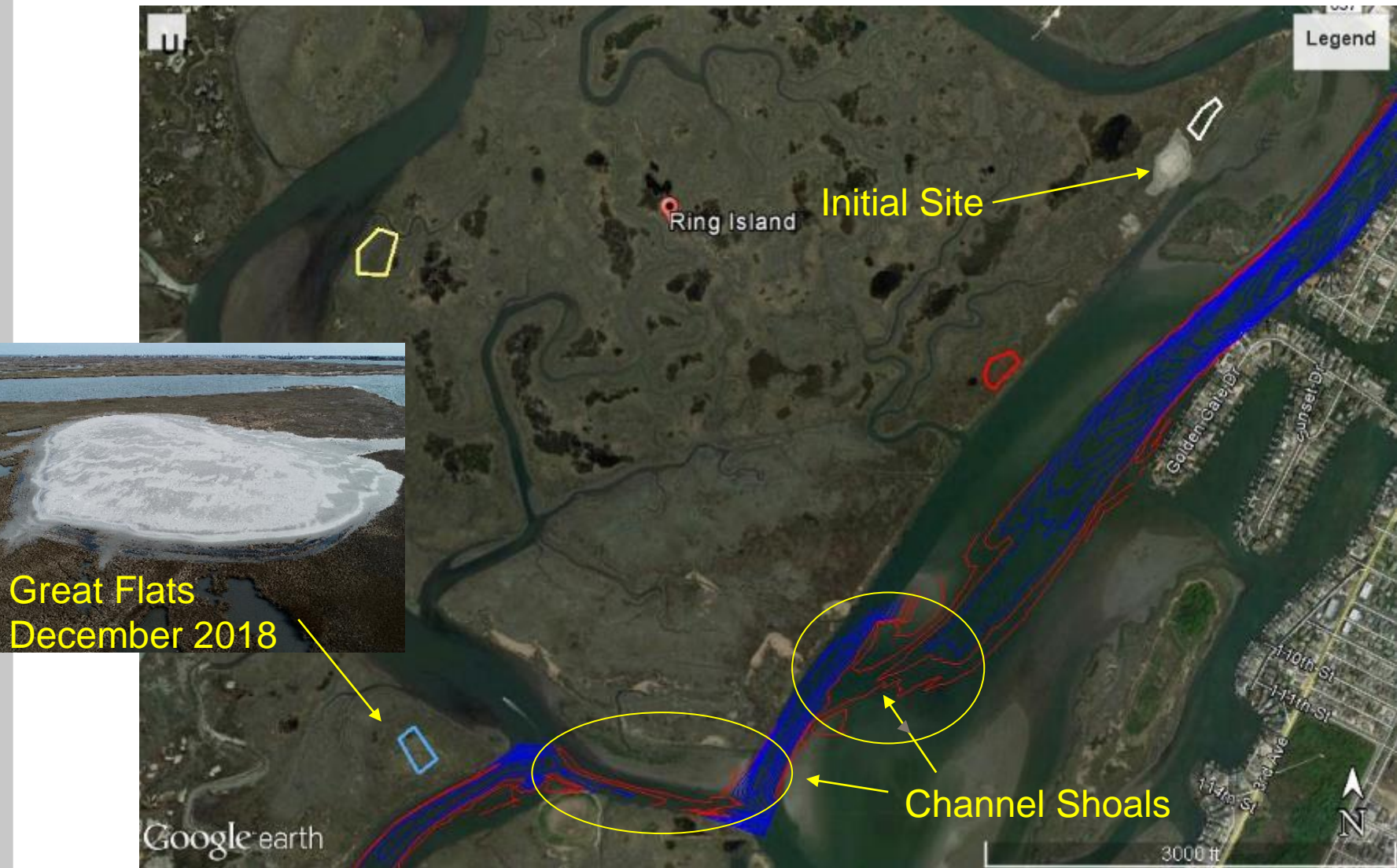


BUILDING MOMENTUM: EVOLVING THE PRACTICE THROUGH SMIL



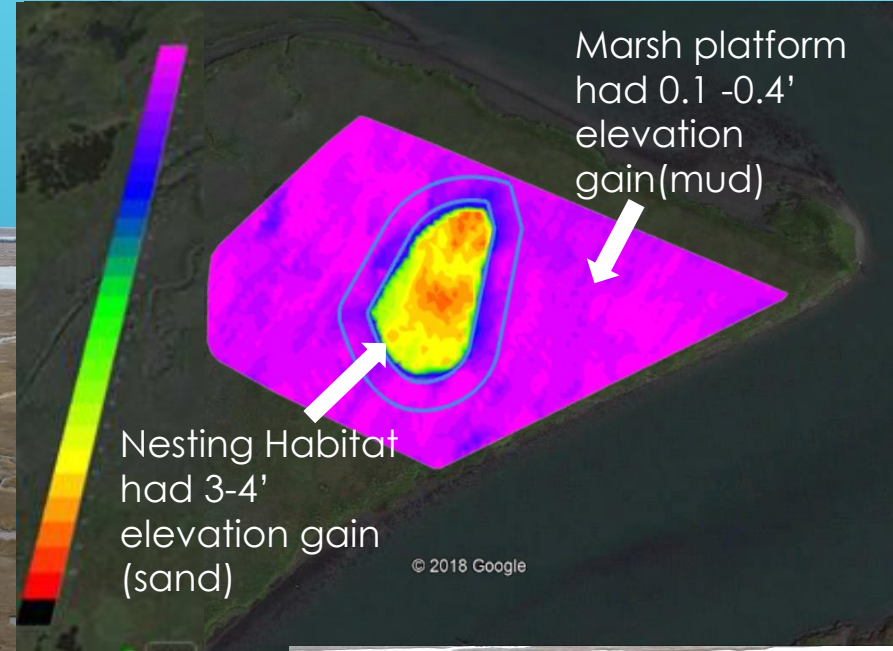


Adaptive Management And Systems Approach *Moving Forward From Pilots To System Solutions*



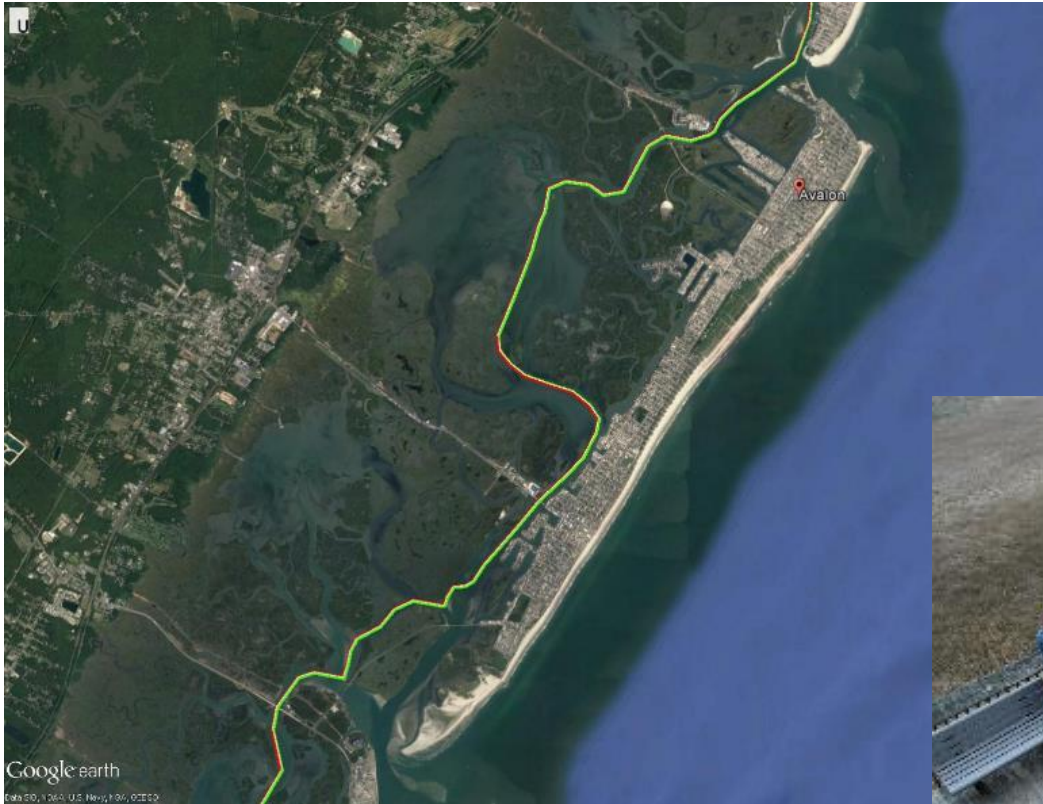
Great Flats Elevated Nesting Habitat

- ▶ Placed 6,000 yd³ on 1 acre habitat
- ▶ Free Pump until Material to Create Containment
- ▶ Target Ecological Elevation 5.5'
 - ▶ Placement to 6.5' for Settling and Anticipated Wind Transport
 - ▶ 95%+ fine sand
- ▶ Had Thin Layer Placement of Mud on Surrounding Marsh Platform





Seven Mile Island Innovation Laboratory



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Inspired by the Dutch



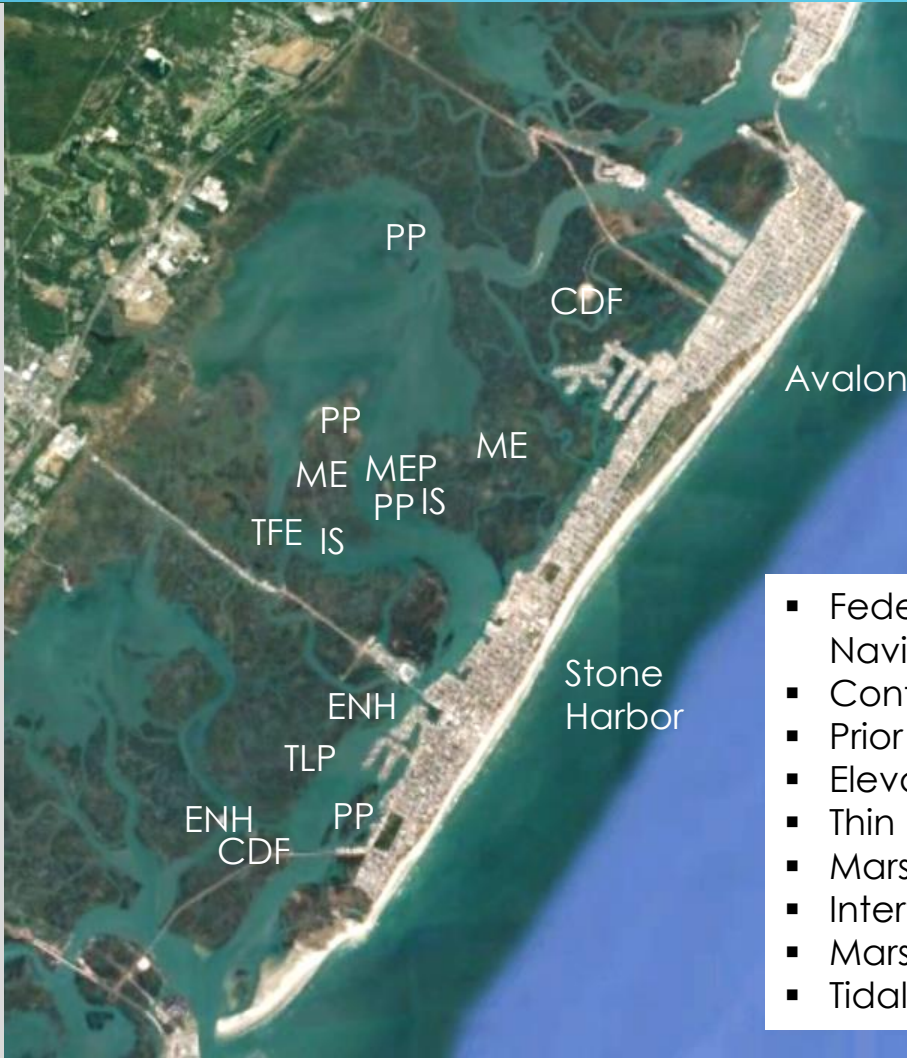
Fine sediment: from waste to resource

Throughout the world, different coasts, shores, lakes and rivers have to deal with excess sediment or sediment shortages. 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 doesn't reach places where it is needed and too much accumulates in other locations. Ecosystems are affected and life 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>

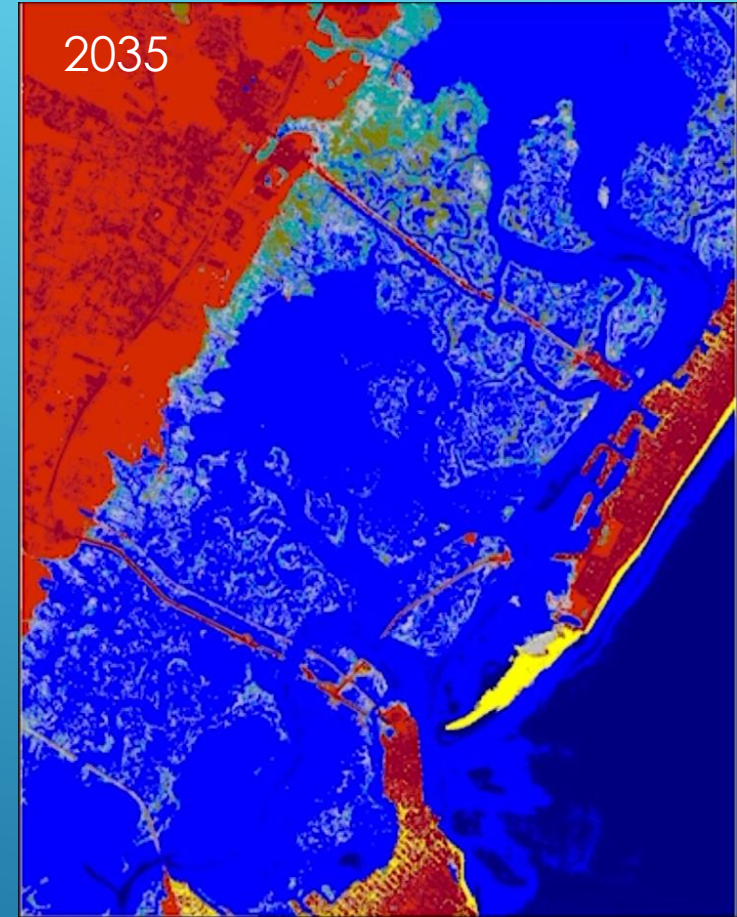
Seven Mile Island Innovation Laboratory Background

SEVEN MILE ISLAND INNOVATION LAB



- ▶ Encompassing 24 mi², and 15,000 acres of Back Bay Tidal Marshes, Shallow Bays, and Inlets
- ▶ Bisected by the NJ Intracoastal Waterway
- ▶ Part of the Cape May Wetlands Wildlife Management Area
- ▶ Home of The Wetlands Institute

- Federal Beach Fill and Navigation Projects
- Confined Disposal Facility (CDF)
- Prior Placement Sites (PP)
- Elevated Nesting Habitat (ENH)
- Thin Layer Placement (TLP)
- Marsh Enhancement (ME)
- Intertidal Shallows (IS)
- Marsh Edge Protection (MEP)
- Tidal Flat Enhancement (TFE)

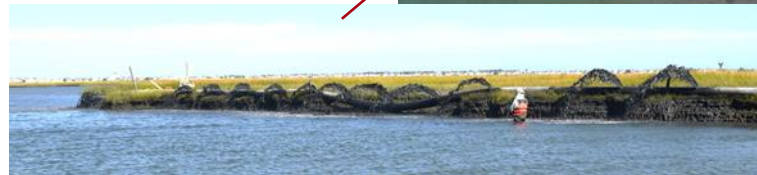
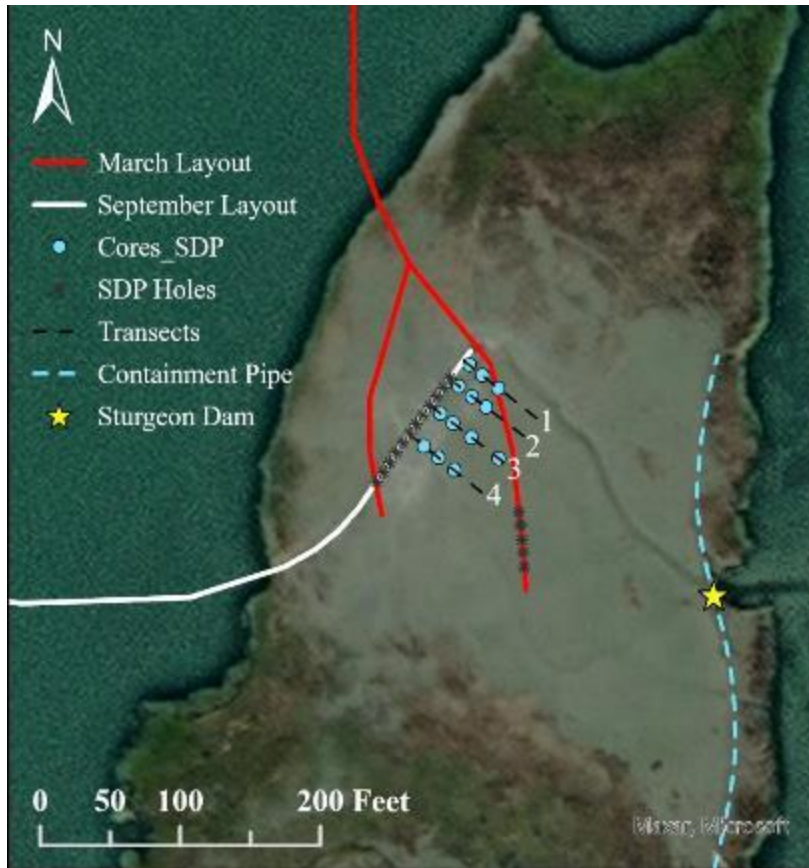


HIGH TIDE FLOODING (MHW SLAMM) AND COASTAL RESILIENCE



Partnering and Advancing Techniques

Sturgeon Island: Island Elevation Enhancement, Marsh Edge Protection, and Intertidal Shallows





STURGEON ISLAND PHASE 3 – FALL 2022



Placed 24,000 cu yd (18,000 cu m) of fine sand to create sandy marsh edge protection features

Used containment to elevate 0.4 acre for elevated bird nesting habitat

- Placed more than 3 ft (1 m) of material
- Built to 4.0 ft NAVD88

Employed Y-valve to switch between containment and subtidal features

- Maintain dredging efficiency
- Allow time for contained area to dewater
- Slow and manage flow volumes and velocities

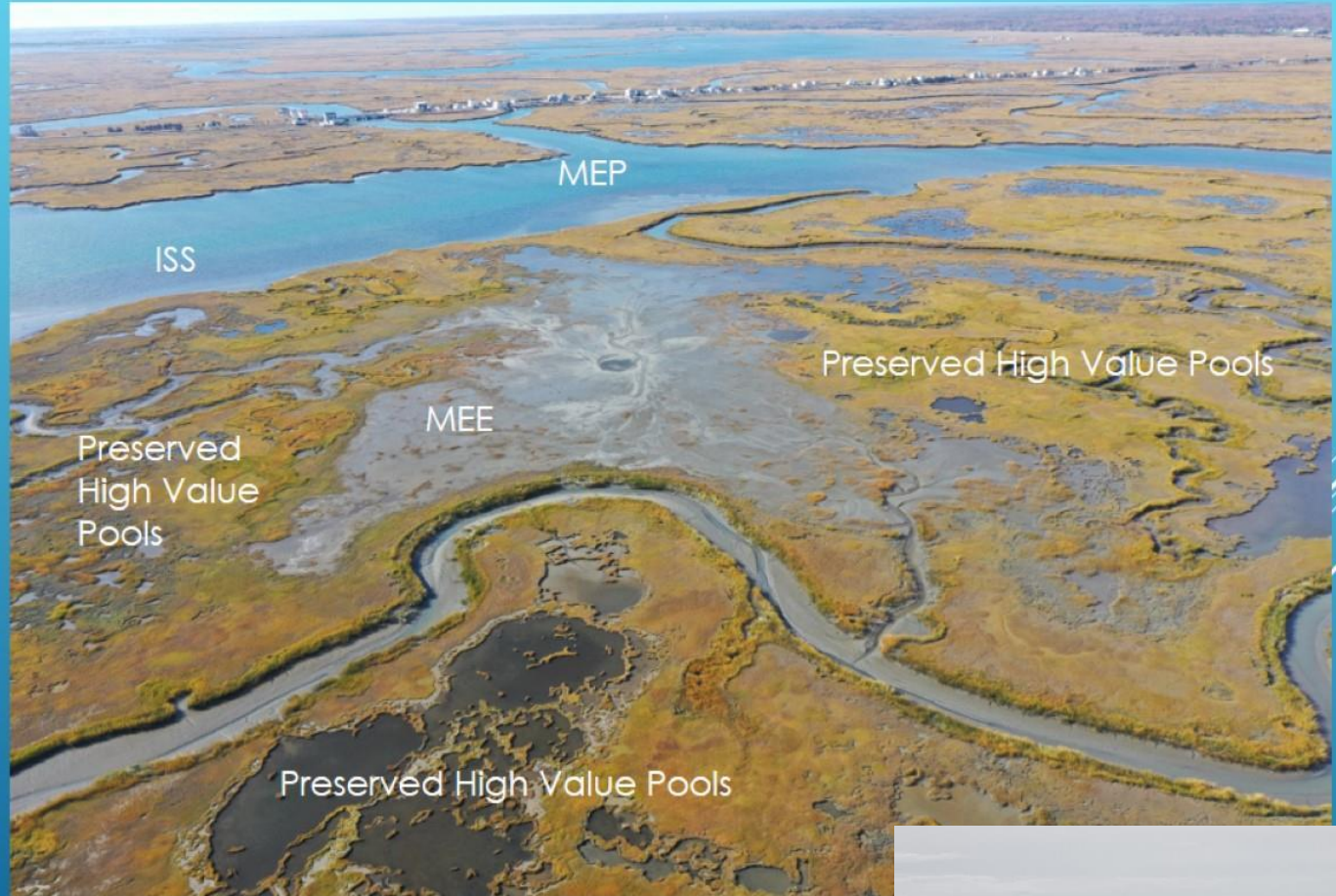




Implementing Projects in the SMIL



- ▶ September 2020
 - ▶ Placed 40,000 cubic yards of mixed fine sand and mud
- ▶ Marsh Elevation 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



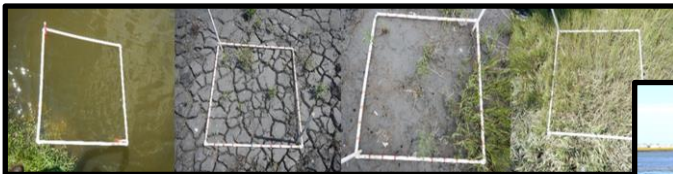
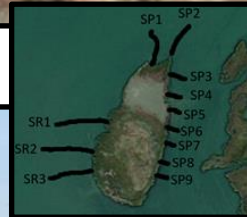
INITIAL ASSESSMENT GULL ISLAND PROJECTS





Importance of Monitoring & Research in SMIL

USACE, State of NJ, TWI, UPENN, BC and Others





Monitoring & Research in the Seven Mile Island Innovation Lab



Marsh Vegetation Surveys	ERDC: Piercy/Russ
Hydrodynamic and Suspended Sediment within the SMILL	ERDC: ERDC/CHL TR-21-9, Fall, Perkey, Tyler and Welp
Gull-Sturgeon Turbidity	ERDC: Fall, et al., 2022, WEDA Journal of Dredging, Volume 20, No. 1
Sediment Distribution Pipe: Sturgeon-Gull	ERDC: Beardsley, et al., WEDA Journal of Dredging, Volume 20, No. 1
Sturgeon/Gull Sediments/Consolidation	ERDC: Tyler/Harris
GCM Observations & Model Development	ERDC: Perkey/Fall
Sediment/Vegetation Interactions	ERDC: J. Smith/Ramirez
Vessel Wake Impacts on Marshes	ERDC: Priestas/Styles/Bain
Macroalgae/Benthic Surveys	ERDC: Altman/Balazik/Reine
Water Quality and Hydrodynamic Modeling	ERDC: Kim/Ding
Remote Sensing & EWN Landscape Architecture Applications	Univ of Pennsylvania: Burkholder & Van Der Sys
Monitoring and Adaptive Management of Elevated Nesting Habitats	The Wetlands Institute, NJ Fish & Wildlife
Monitoring and Adaptive Management of Gull and Sturgeon Islands	The Wetlands Institute, NJ Fish and Wildlife
Community Engagement Using Mental Modeling	ERDC: Thorne, et al., ERDC TR-22-12
Bathy/Topo/Currents/Sediments/Remote Sensing	USACE Philadelphia
Varied University Research	Univ of Penn, Boston College, Texas State, Louisiana State, Stevens, Univ of Washington, Stockton (Work Group)



Upcoming SMIL Presentations & 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, Paper and Presentation, “Advancing Sediment Solutions in the Seven Mile Island Innovation Lab”
- Coastal Sediments 2023, April 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/smil/>



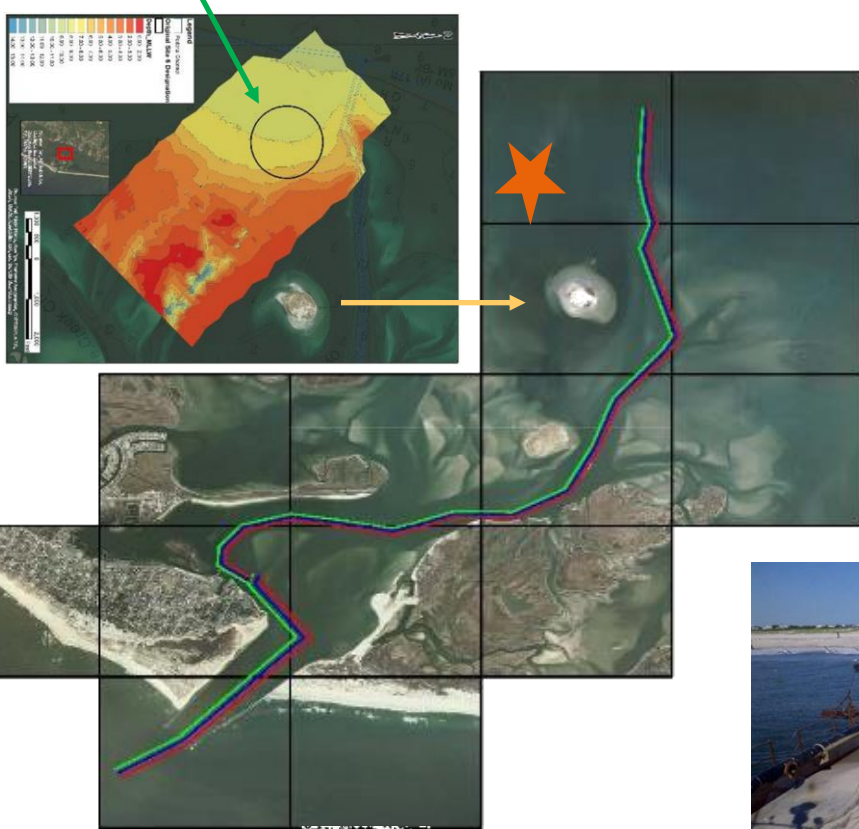
SCALING UP & OVER



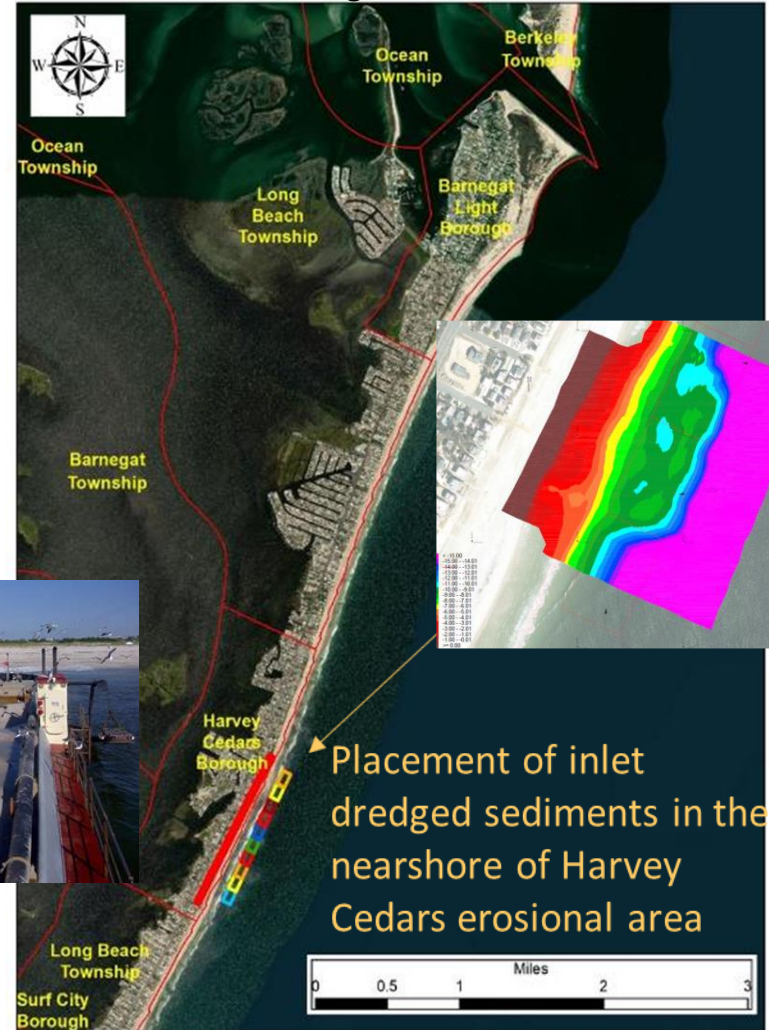
Beneficial Use Placement Opportunities in NJ Using Navigation Channel Sediments: Barnegat Inlet



1122 “Intentional” Island Creation:
Initial Construction Dec 2020



1122 Nearshore Placement:
Constructed Aug 2021

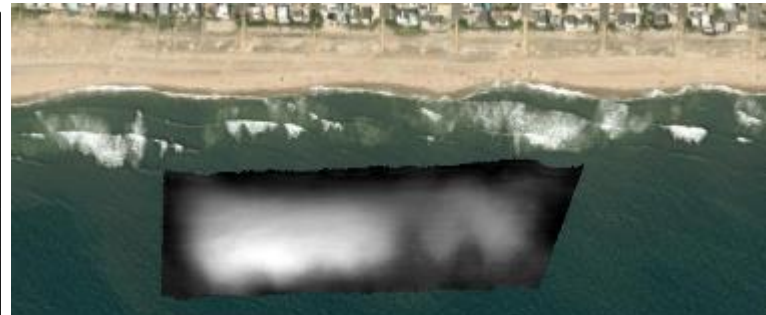
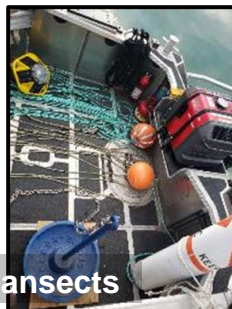
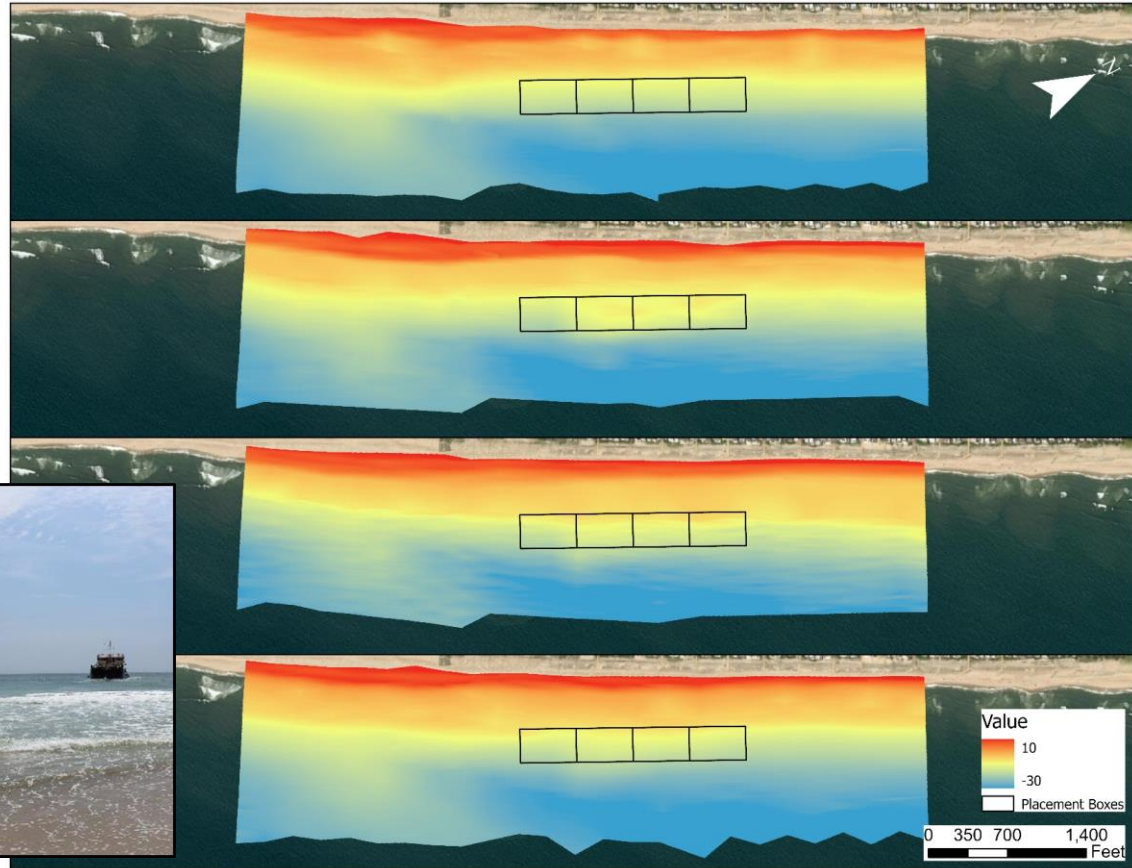
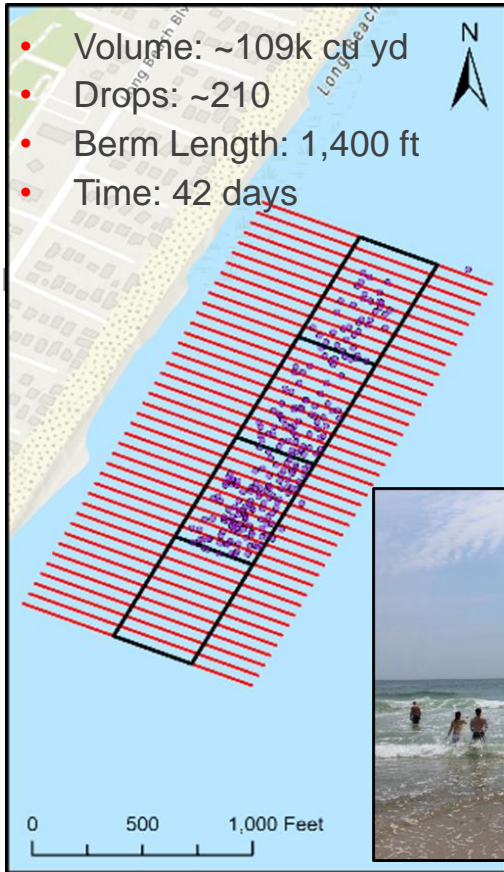


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Regional Sediment Management: Monitoring the Harvey Cedars Placement



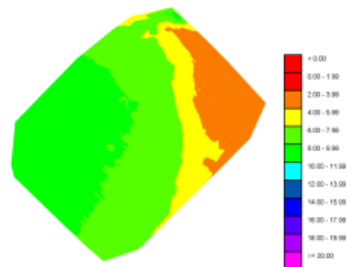


The Importance Of Monitoring & Tracking BU Before It Was BU: The “Bernie Moore” Islands

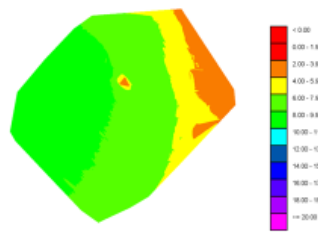




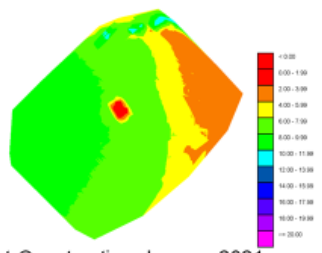
Monitoring the New Island in Barnegat Bay and Developing Lessons Learned



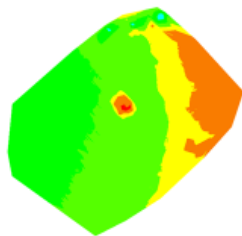
Pre-Construction: October 2020



During Construction: November 2020

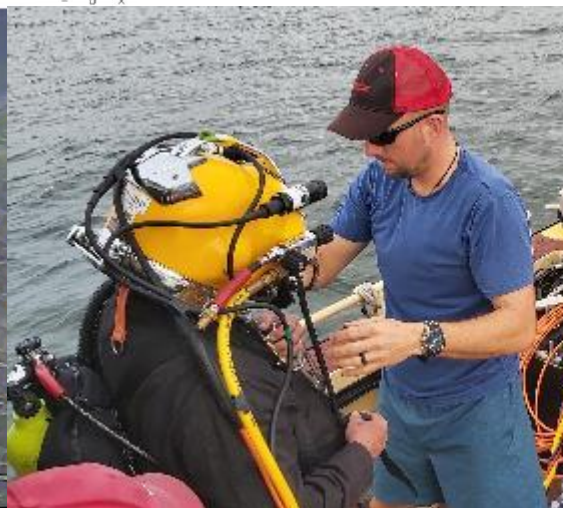
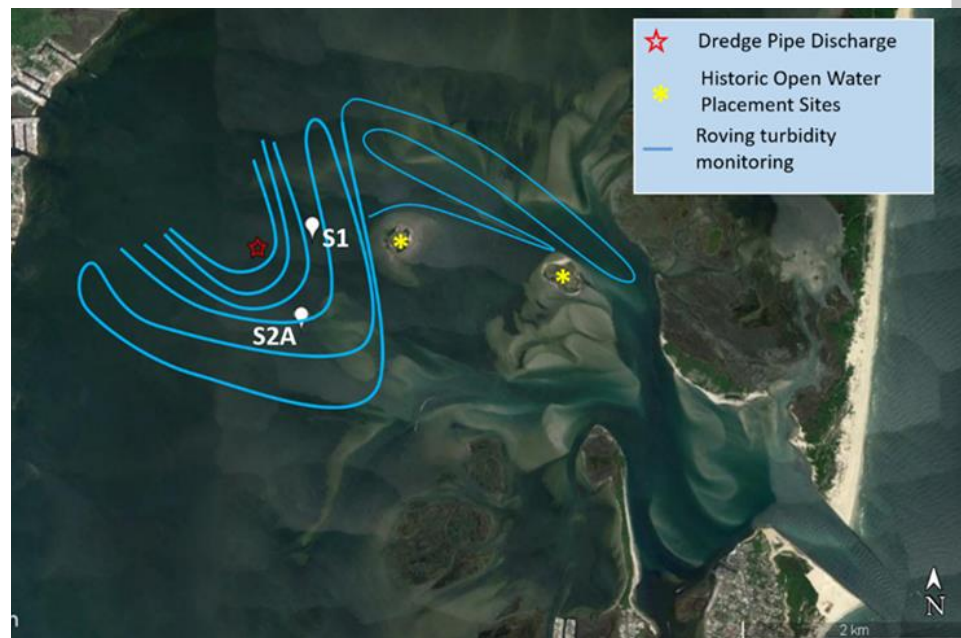


Post-Construction: January 2021



After First Year: December 2021

11

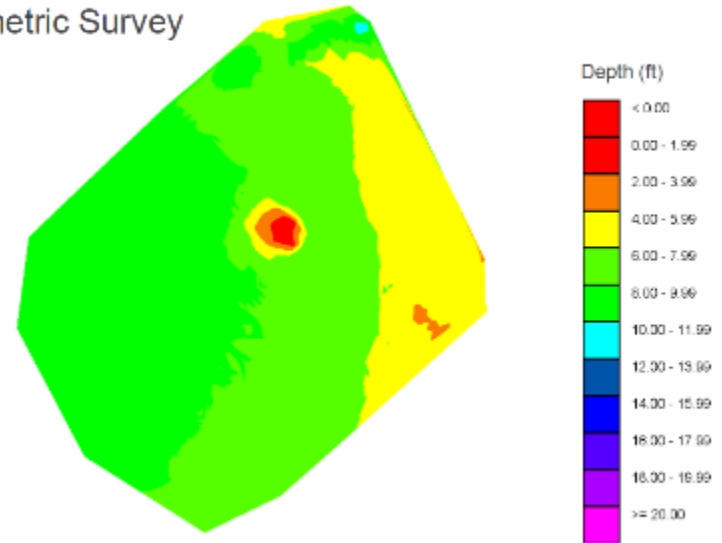




Second Lift of New Island in Barnegat Bay

DECEMBER 2022

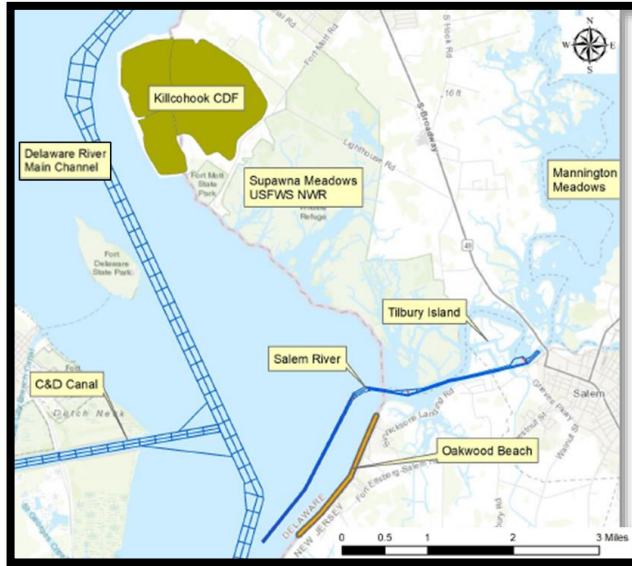
Bathymetric Survey



US Army Corps of Engineers

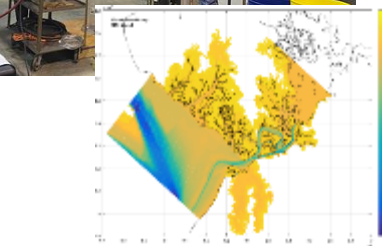
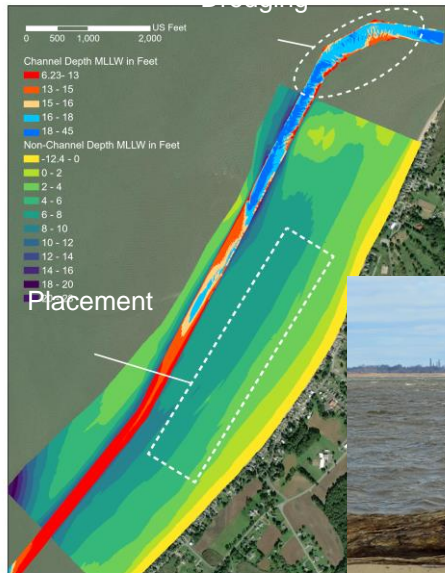


A Systems Approach to Beneficial Use of Fine and Coarse-grained Dredged Material at the Confluence of the Delaware and Salem Rivers



Leveraging/Collaborative Opportunities

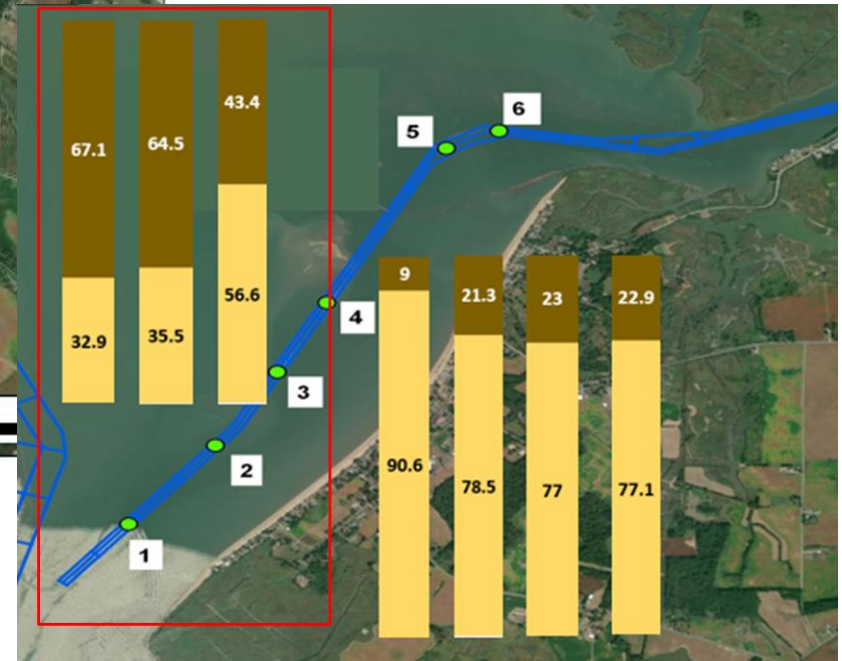
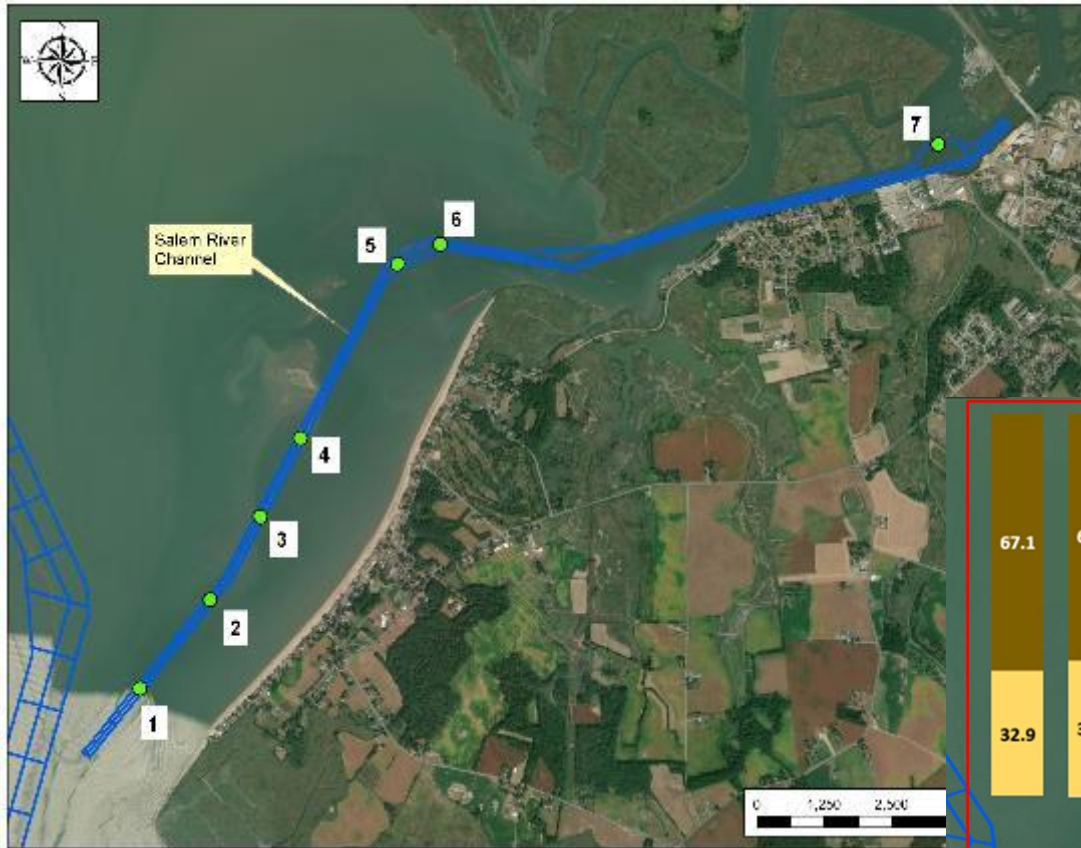
- Leveraged efforts of US Fish & Wildlife Service, Ducks Unlimited and EA Engineering to rehabilitate USFWS Supawna Meadows National Wildlife Refuge
- Nearshore nourishment with Dredge Murden in Feb 2022
- Using Seven Mile Island Innovation Laboratory lessons learned for use of fine-grained dredged material and support an economically challenged community
- Contract award in late July 2023 to dredge 190,000 cy from Salem River channel with BUDM placement in Supawna Meadows Goose Pond area



CMS Modeling



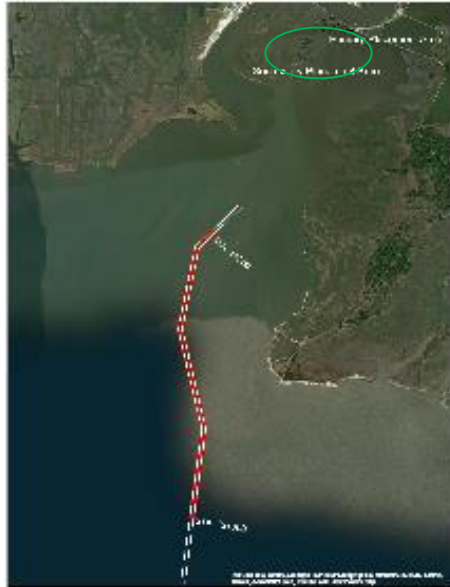
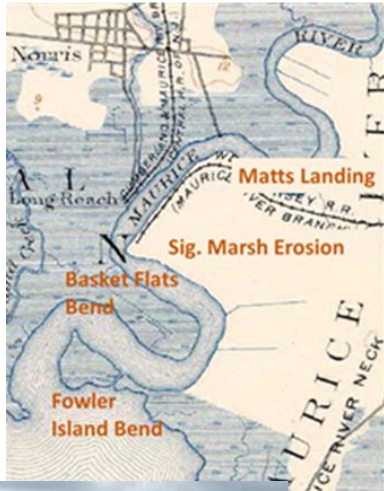
Importance of Sediment Testing and Constructability Up Front





Maurice River NJ

Channel Dredging & Placement



- Previous dredging in 1925 and 1996
- 1996 dredging DISPOSED of material in Cape May CDF while region is experiencing devastating erosion
- Contract to be awarded in July 2023 to dredge channel and beneficially place material in partnership with NJDEP in Heislerville Wildlife Management Area



65,000 cy of fine-grained sediment to be dredged to support a struggling economy

Changing practice with a new twist in this Delaware Bay community: EWN, UPENN Landscape Architects and Lessons Learned from SMIL



Advancing Practice for Coastal Resilience

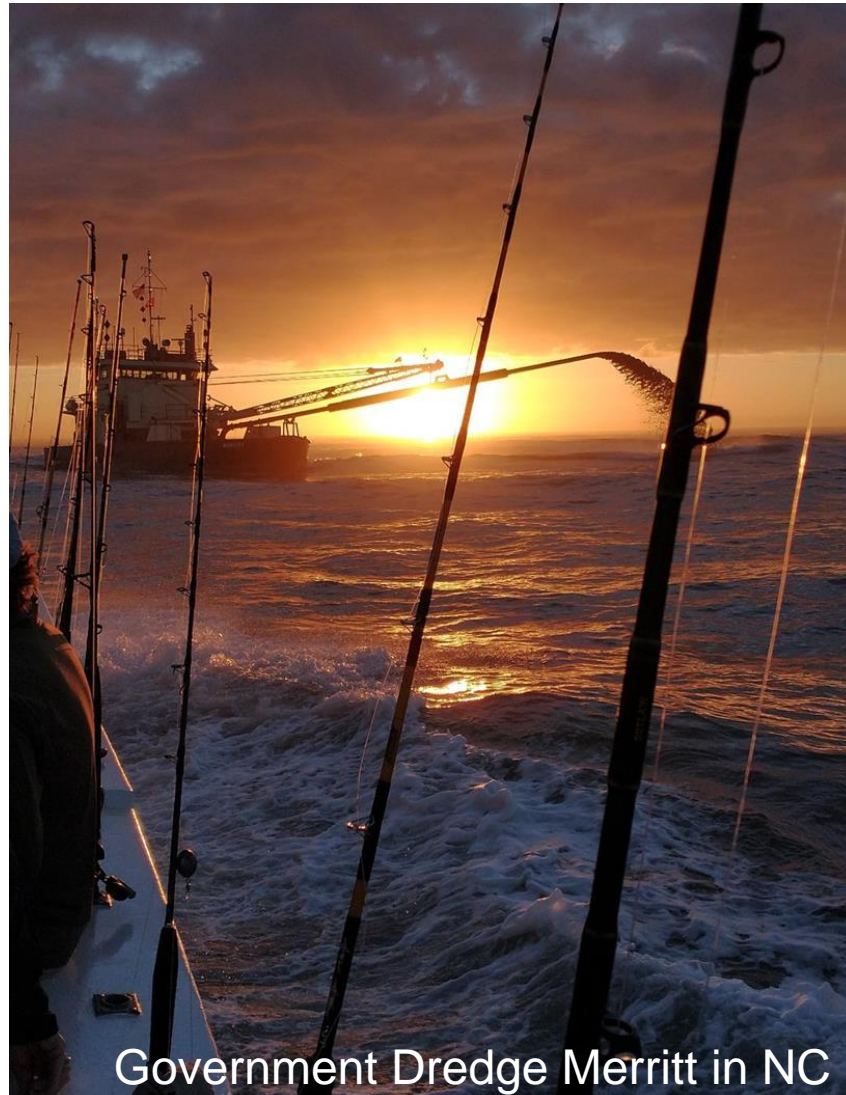
Rapid Progress in 10 Years! But more work to do.....

- **Momentum to embrace change; status quo no longer an option**
- Progression from 25% (pre-Sandy) to 60% (post-Sandy) to goal of 100% **beneficial use of clean channel sediments** in coastal NJ, setting bar high!
- Key **Partnerships** and Long-term Sustainability
- Work with cross-disciplinary teams and industry to **improve designs, constructability and cost efficiency**
- **Importance of monitoring** and leveraging with R&D to develop technologies, guidance, collaboration and knowledge/data management
- **Adaptive management** to manage risk are key in dynamic coastal system
- Projects must be reasonable and scalable; small successes lead to larger actions

<https://www.nap.usace.army.mil/Missions/Civil-Works/Coastal-Dredging-Beneficial-Use/>



QUESTIONS?



Government Dredge Merritt in NC