

Seven Mile Island Innovation Laboratory

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Introduction

- U.S. Army Corps of Engineers Philadelphia District, the State of New Jersey, The Wetlands Institute, and the USACE Engineer Research and Development Center (ERDC) launched the Seven Mile Island Innovation Laboratory (SMIIL) in spring, 2019.
- SMIIL focuses on maintaining safe navigational channels while retaining dredged sediment in the system to benefit natural ecosystems and coastal communities.
- Goal is to advance and improve dredging and marsh restoration techniques in coastal New Jersey through innovative research, collaboration, knowledge sharing and practical application.

Problems: Ring Island & Great Flats

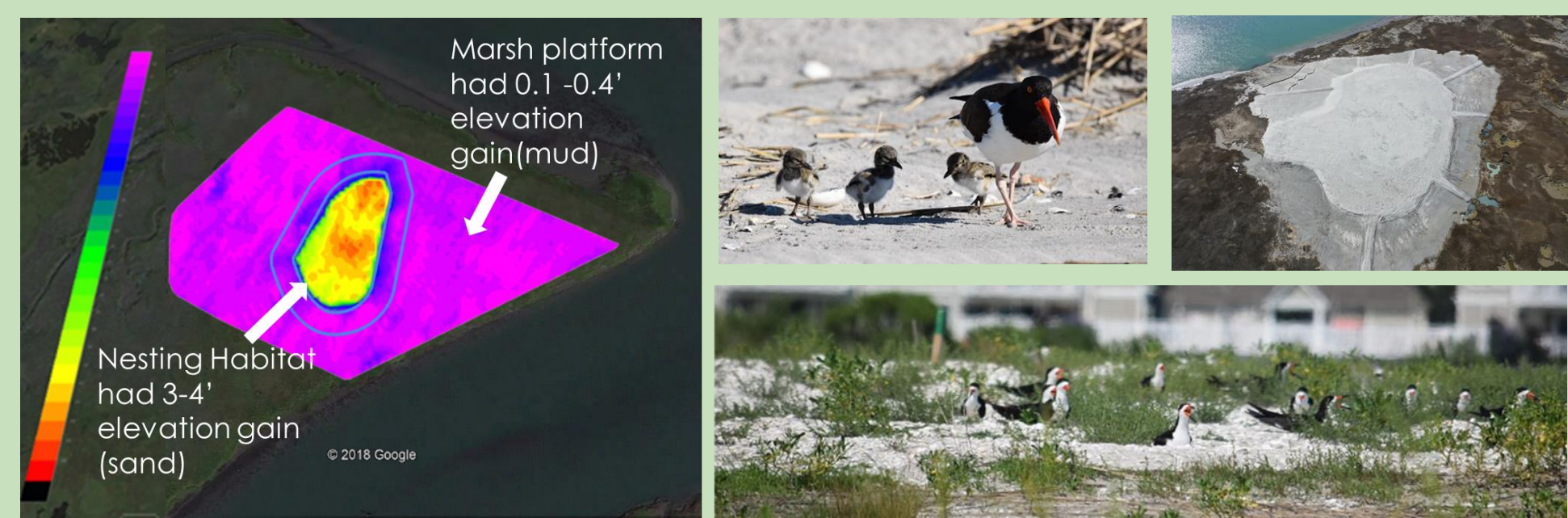
- Beach-nesting colonial birds are declining due to habitat loss, nest loss from sea level rise, and competition for space on recreational beaches.
- Habitat creation requires materials. Maintenance dredging of sandy shoals in the NJ Intracoastal Waterway (NJIWW) repetitively provides clean sand for habitat creation and enhancement matching dredging needs to habitat needs for at-risk species.

Opportunity: Habitat Creation

- Constructed two 1-acre elevated nesting habitats with NJIWW dredged sand.
- Unconfined pumping supplied materials to site.
- Containment berms of dredged materials used to achieve target elevations.

Outcome: Elevated Nesting Habitat

- Elevated Nesting Habitat Creation
 - Target construction elevation 6.5' NAVD88; Target ecological elevation 5.5' NAVD88
 - Ecosystem established 3-4 year adaptive management cycle for replenishment
- Ring Island Habitat Creation
 - Fall 2014
 - 1 acre 6,000 cy
 - March 2018
 - 1,200 cy
 - Cleared 120' of shoaled channel
 - Reestablish berm crest to 5.5' NAVD88 after decrease to 4' NAVD88
 - Disturbed stabilizing vegetation to maintain early successional habitat
- Great Flats Habitat Creation
 - December 2018
 - 1 acre 6,000 cy
 - Had thin layer placement of mud on surrounding marsh platform for elevation capital to marsh
 - January 2021
 - Placed 3,200 cy on habitat to restore berm crest to 5.5' NAVD88 after drop to 4' NAVD88



SMIIL Beneficial Use Projects



Fig. 1. Image of Seven Mile Island Innovation Laboratory showing beneficial use projects constructed to date. The SMIIL encompasses 24 square miles and more than 15,000 acres of tidal marshes, coastal lagoons, tidal channels and bays in Cape May County, NJ and is bisected by the NJ Intracoastal Waterway (dashed line).

Project Name funding source(s) (year(s))	Volume of Sediment (acreage)	Placement Methods	Sediment type	Project Goals and Outcomes
Sturgeon Island Restoration USACE (2020/2022)	20,000 CY/24,000 CY (elevation: 6 acres / edge protection: 3.5 acres)	<ul style="list-style-type: none"> • Split (via y-valve) direct pumping on marsh through distribution pipe and/or spray. Partial then full containment. • Direct placement off marsh edge via distribution pipe and floating discharge pipe with spreader plate. • Indirect tidal channel distribution. 	Mixed, mud & fine sand	<ul style="list-style-type: none"> • Marsh elevation enhancement and uplift for wading bird nesting habitat. • Tidal delta enhancement. • Subtidal placement resulted in berm for marsh edge protection. • Ongoing monitoring of elevation, site usage and vegetation establishment.
Gull Island Restoration USACE (2020)	40,000 CY (elevation: 22 acres, edge protection: 5.5 acres)	<ul style="list-style-type: none"> • Split (via y-valve) direct pumping: <ul style="list-style-type: none"> – On marsh, uncontained, with spray nozzle. – Off marsh edge (intertidal), floating discharge pipe with spreader plate. • Indirect tidal channel distribution. 	Mixed, mud & fine sand	<ul style="list-style-type: none"> • Enhanced marsh elevation for high marsh nesting birds and marsh restoration across range of elevation goals. • Subtidal placement berm for marsh edge protection. • Turbidity impacts were localized, short lived, and on scale with levels during storm events.
Great Flats Nesting Habitat USACE (2018/2021)	6,000 CY/ 3,900 CY (1.2 acres)	<ul style="list-style-type: none"> • Direct pumping on marsh to provide material to create sandy berm. Berm used for containment to build to target elevation. 	95% fine-medium sand	<ul style="list-style-type: none"> • Build transitional early successional upland habitat for colonial beach nesting birds. • Planned adaptive management to reestablish elevation and disturb vegetation on roughly 3-year cycle.
Ring Island Marsh Enhancement and Nesting Habitat USACE/NFWS (2015/2018)	7,000 CY/1,200 CY (2 acres)	<ul style="list-style-type: none"> • Direct, spray from barge at marsh edge without containment. • Direct, spray from barge at marsh edge with containment and grading for nesting habitat. 	95% fine-medium sand	<ul style="list-style-type: none"> • Build transitional early successional upland habitat for colonial beach nesting birds. • Planned adaptive management to reestablish elevation and disturb vegetation on roughly 3-year cycle.
Avalon Marsh Enhancement Project USACE/NFWS (2015-2016)	55,000 CY (45 acres)	<ul style="list-style-type: none"> • Direct pumping on marsh with spreader plate. • Containment with coir logs. 	Mixed, mud & fine sand	<ul style="list-style-type: none"> • Placement over two years into fully contained areas for marsh elevation enhancement and pool infilling.

Acknowledgments: We thank the members of the SMIIL Working Group, comprised of federal and state sister agencies, area universities and resiliency concerned non-profits for their contributions and participation in project identification, knowledge sharing and information dissemination.
<https://www.nap.usace.army.mil/Missions/Civil-Works/Coastal-Dredging-Beneficial-Use/> <https://wetlandsinstitute.org/smiil-2/>

Problems: Gull and Sturgeon Islands

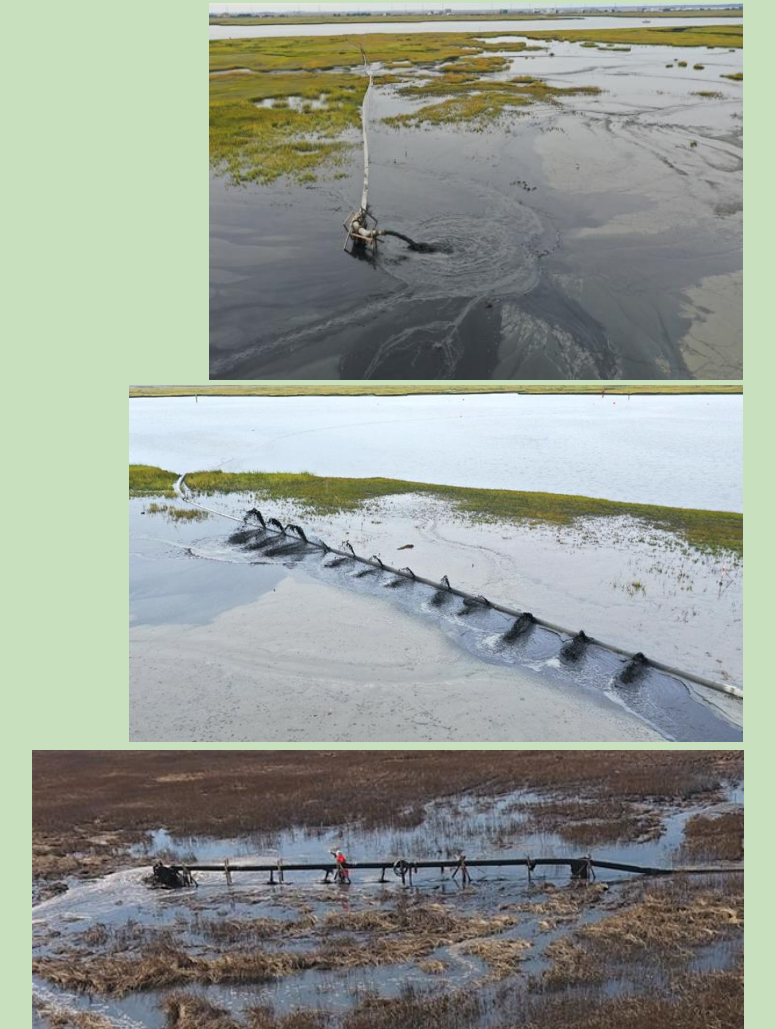
- Sea level rise (SLR) is drowning marsh islands as evidenced by frequent inundation, conversion of marsh to unvegetated flats and open water areas.
- Marsh edge erosion contributes to marsh loss and breaches to interior marsh pools.
- Historic dredged material placement represents the only remaining high marsh in SMIIL. These sites are home to 1/3 of colonial nesting wading birds in the state of NJ.
- Sites are experiencing habitat degradation with elevation loss impacting nesting success.

Opportunity: Marsh Enhancement Opportunities

- Maintenance dredging of NJIWW provides mixed fine sand and mud to enhance marsh resilience while testing new marsh restoration and habitat creation projects.
- Utilized unconfined pumping to a) raise elevation of marsh platforms for several target species and increase marsh resilience; b) create marsh edge protection zones; and c) enhance intertidal and subtidal shallows.
- Developed and tested sediment distribution pipe to separate sand and mud and tested subtidal pumping to build marsh edge protection features.

Outcome: Elevation Enhancement & Edge Protection

- Marsh Island Enhancement Projects (MEE)
 - Raise Elevations of Marsh Platform Across Gradient of Ecological Targets
 - Transitional Upland Elevation for Wading Bird Nesting (>3.5' NAVD88)
 - High Marsh Elevation for Saltmarsh Sparrow (2.8'-3.3' NAVD88)
 - Low Marsh Elevation for Fish Habitat and Shorebird Foraging (2.1'-2.7' NAVD88)
 - Utilize Unconfined Placement Coupled with Tidal Flooding and Tidal Channel Transport to Distribute Materials, Naturalize Channels (NC), and Extend Effective Area of Marsh Elevation Enhancement



- Marsh Edge Protection Zones (MEP)
 - Create More Natural Marsh Edge Slope
 - Create Wave Energy Buffer From Waves and Boat Wakes
 - Subtidal Pumping or Distribution Pipe Discharge Along Marsh Edge from Intertidal to Marsh Edge (2' NAVD88)



- Intertidal and Subtidal Shallows Enhancement (ISS)
 - Utilize Indirect Placement from Unconfined Placement Methods to Shallow Bottom Above MLLW Where Macroalgal Flats Transition from Sparse to Densely Vegetated (-1.0 MLLW – 0' MLLW)

