

ADVANCING SEDIMENT SOLUTIONS IN THE SEVEN MILE ISLAND INNOVATION LAB

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BACKGROUND

The United States Army Corps of Engineers (USACE), Philadelphia District has been participating in the national Regional Sediment Management (RSM) and Engineering with Nature (EWN) Programs with considerable lessons learned developed for channel dredging and placement activities in coastal New Jersey (NJ), especially since Superstorm Sandy devastated the region in 2012. Navigation managers from the Philadelphia District continue to partner with USACE's Engineering Research and Development Center (ERDC), the State of NJ's Department of Environmental Protection (NJDEP), various stakeholders such as The Wetlands Institute (TWI), and the dredging industry to utilize EWN and RSM strategies in an innovative regional approach to restore navigation as well as enhance coastal system resilience. Over the last decade, beneficial use placements of dredged material involving shoreline stabilization, natural infrastructure creation and marsh restoration have significantly increased in the region, helping to advance practices and policies that keep dredged material in the natural sediment system versus past disposal methods. In addition to the coastal navigation mission, the Philadelphia District maintains a robust beach nourishment program along the NJ and Delaware coasts and serves as an EWN Proving Ground.

Following Superstorm Sandy, USACE and NJDEP took action to restore navigation and remove channel shoals, but also looked for opportunities to assist with shoreline and ecosystem recovery. Simultaneously, long-term strategies were sought to build a more resilient coastal system using clean dredged sediment of all types. Initial pilot projects were constructed on degraded marsh within NJDEP's Cape May Coastal Wetlands Wildlife Management Area using NJ Intracoastal Waterway (NJIWW) channel sediments, including thin-layer placement with predominantly fine-grained material near Avalon and habitat creation for endangered nesting birds with fine sand on Ring Island (Chasten, et al., 2016).

CREATION OF THE INNOVATION LABORATORY

In 2019, the Philadelphia District partnered with NJDEP, TWI, and ERDC to launch the Seven Mile Island Living Laboratory (Rochette, et al., 2019), a concept adapted from the "Living Lab for Mud" used in the Netherlands (Ecoshape, 2018). The initiative is designed to continue to improve dredging and marsh restoration techniques in coastal NJ through innovative research, collaboration, knowledge sharing and practical application for constructed projects. The name was quickly upgraded to an Innovation Laboratory (SMIIL) to reflect the expanding scale of the program. The location was chosen because: it is a marsh-dominated Atlantic back barrier system in a region rich in historic datasets, builds on ongoing collaboration and research between the Philadelphia

District and ERDC, TWI is centrally located within SMIIL to provide technical expertise, field support and public outreach, federal and state navigation channels have sandy and cohesive sediment as a resource, it contains a number of historic and recent monitored innovative beneficial use projects, and a significant amount of land there is managed by the State of NJ. A SMIIL Working Group creates an opportunity for practitioners and natural resource managers to provide input, learn, and share expertise, manage challenges, and bring science and practice to the SMIIL to better understand the system, tradeoffs and approaches.

BUILDING MOMENTUM IN SMIIL

The SMIIL concept brings technical and social domains together in a collaborative forum that advances science, practice, and innovation for the region. Through key partnerships, monitoring, design, construction and adaptive management, SMIIL efforts evolved to a new level with follow-on projects that used both sand and cohesive channel sediments to build and trial new nature-based solutions including elevated nesting habitat creation and thin layer placement with sandy sediments (Figure 1) and marsh elevation enhancement, marsh edge protection and intertidal shallows creation and enrichment with predominantly cohesive sediments (Figure 2). Innovative techniques such as use of a sediment distribution pipe (U.S. Army Corps of Engineers, 2021) were also trialed while working on building elevation on Sturgeon Island (Figure 3). Tedesco et. al, 2021 provides a summary of the projects including the initial pilots at Avalon and Ring Island and follow-on work at Great Flats, Sturgeon and Gull Islands. Additional dredging and innovative placements are planned for Fall 2022 on and in the vicinity of Sturgeon Island and the southern portion of SMIIL in 2023, via dredging of the NJIWW channel and funded through the Bipartisan Infrastructure Law.



Figure 1 - Sandy elevated nesting habitat at Great Flats during initial construction in 2018 and after adaptive management in 2021 (photos courtesy of Gary Paul).



Figure 2 - Constructed marsh restoration (A), marsh edge protection (B), and intertidal shallows enhancement (C) with fine sand and mud at Gull Island (photo courtesy of Gary Paul, 2020).



Figure 3 - Trialing techniques to build elevation and marsh edge protection with cohesive sediments at Sturgeon Island.

Ongoing monitoring of the projects includes physical and geotechnical studies (elevation evolution, compaction, and dewatering; sediment transport and erosion; wave attenuation and turbidity generation); hydrology and ecological studies (vegetation evolution, benthic community response and focal avian species response). Over 30 researchers from USACE, the State of NJ and various academic institutions are currently working on data collection and analyses for SMILL projects and related practices.

Monitoring and technical advancements continue in SMILL, and a primary success so far has been a paradigm shift leading to momentum for more beneficial use implementation in New Jersey and throughout the region. Challenges are overcome through persistence, proactive leadership, a continual focus on the best available science at both the national and international level, and strong community engagement. All aspects have proved critical to moving forward, especially facing rapidly intensifying climate change impacts in these vulnerable coastal environments.

USACE is a “broker” when it comes to sediment, a much-needed currency in the natural coastal system. SMILL efforts will be presented along with constructed project case studies of mixed sediment types, including performance monitoring. Sharing lessons learned from SMILL continues valuable national and international collaboration on sediments, best sediment management practices and building nature-based solutions.

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