

Engineering With Nature

Project Fact Sheet



Innovative Sediment Distribution Pipe For Targeted Placement

Background

All Natural or Nature-Based Feature (NNBF) projects along the coastline involve the construction of features that require, or would benefit from, targeted placement of sediment with specific gradation characteristics. These projects include marsh restoration projects where coarse-grained sediment (sand) is desired for building levees to improve containment of fine-grained sediment (silts and clay) material for maximum time of deposition on a marsh. Beach nourishment projects also have a maximum fine-grained content allowed to be placed on the beach.



Sediment Distribution Pipe demo on Sturgeon Island March 2020

An in-line separation methodology was used in the past to build levees by separating sand from fine-grained material by hydraulic sorting through holes in the bottom of an elevated pipeline. As the dredge pumped the partially stratified mixed sediment slurry in the discharge pipeline to the elevated section, the heavier sand dropped out through the bottom holes by force of gravity while the lighter silts and clays remained in suspension and were transported over the holes and out the end of pipe. Unfortunately, this technique has been poorly documented, and no performance metrics or design guidance exists for its implementation. There is great urgency in the field for construction technologies that are both cost-effective and acceptable to resource agencies.

Objectives

This simple placement method from the past is being evaluated to establish not only separation performance metrics, but is also being further developed to enhance sediment distribution capabilities to optimize targeted placement while dredging, as opposed to rehandling the sediment at a later time and incurring additional (oft times exorbitant) costs. These improvements will be based on the two key EWN elements of using of science and engineering to produce operational efficiencies while using natural process to achieve maximum benefit. The objective of these first two projects is to conduct proof of concept pilots of the sediment distribution pipe to demonstrate functionality, and begin quantification of its sand separation and sediment distribution performance metrics. The project's long-term goal is to provide a robust targeted-placement methodology that both: 1) separates sand from mud and, 2) distributes sediment more efficiently while dredging. Guidance on the use of a sediment distribution pipe and an engineering tool for predicting select hydraulic characteristics of a slurry distribution system that would allow an engineer to customize its design (and optimize subsequent operations) to achieve project objectives under site specific conditions will be produced to further facilitate increased adoption of this technology.

Approach

The first phase of this project will be conducted on the Sturgeon and Gull Island beneficial reuse of dredged material project, which are part of the Philadelphia District's (NAP) Seven Mile Island Innovation Lab (SMIIL), located in Great Sound, west of Avalon, New Jersey. Samples from two different sized discharge holes and the end of pipe will be collected in conjunction with slurry flow velocity measurements at two different flow velocities per hole size.

Outcomes

Two proof of concept demonstration videos will be produced and effectiveness of the sediment distribution pipe documented in a technical report. Upon successful demonstration of the technology at the Sturgeon Island and Gull Island projects, the range of parameters tested can be expanded in out years in other projects and an engineering performance prediction tool produced. Additional tests can be done with physical model testing or CFD numerical modeling testing in out years as well.

Points of Contact: Tim Welp and Brian McFall

Timothy.L.Welp@usace.army.mil, Brian.C.McFall@usace.army.mil

601-634-2083, 601-634-6015