Publication of Research Article "Wetland Elevation Change Following Beneficial Use of Dredged Material (BUDM) Nourishment"

Impact Statement: The Beneficial Use of Dredged Material (BUDM) is a technique to raise wetland surface elevations, but much remains unknown about the subsequent change in elevation due to consolidation and how quickly the site re-establishes. A manuscript published in Frontiers documents a comprehensive investigation of surface elevation change pre- and post-nourishment, calibrated consolidation models, how quickly the site has re-established, and the increased resiliency.

The article titled "Wetland Elevation Change Following Beneficial Use of Dredged Material Nourishment" was published in *Frontiers* as part of the Special Issue on Coastal Adaptation Through Nature: Natural and Nature-Based (NNBF) Research: https://doi.org/10.3389/fevo.2025.1518759. The effort focused on documenting the surface elevation change of a coastal wetland in southern New Jersey following the Beneficial Use of Dredged Material (BUDM) to better understand the role consolidation plays in wetland geomorphology and vegetation responses. The research was a collaborative effort between ERDC Coastal and Hydraulics Laboratory (CHL), ERDC Environmental Laboratory (EL), The Wetland Institute, USACE Philadelphia District (NAP), University of Pennsylvania, University of Washington, and Louisiana State University, and took place within the Seven Mile Island Innovation Laboratory (SMIIL).

The Beneficial Use of Dredged Material (BUDM) to nourish degrading wetlands is a direct solution to increase surface elevation to help wetlands keep pace with Sea Level Rise (SLR). While there have been numerous demonstrations of BUDM in wetland environments, there is a limited understanding of the resultant spatial and temporal elevation response due to consolidation of the dredged material and underlying wetland foundation soils. To address this, surface elevations were monitored following multiple BUDM nourishments on a back-bay island in New Jersey. Field data were compared to consolidation models to assess the viability of current geotechnical modeling practices. Multispectral surveys were performed to document the revegetation of the nourished island over time. Site geotechnics are shown in Figure 1.

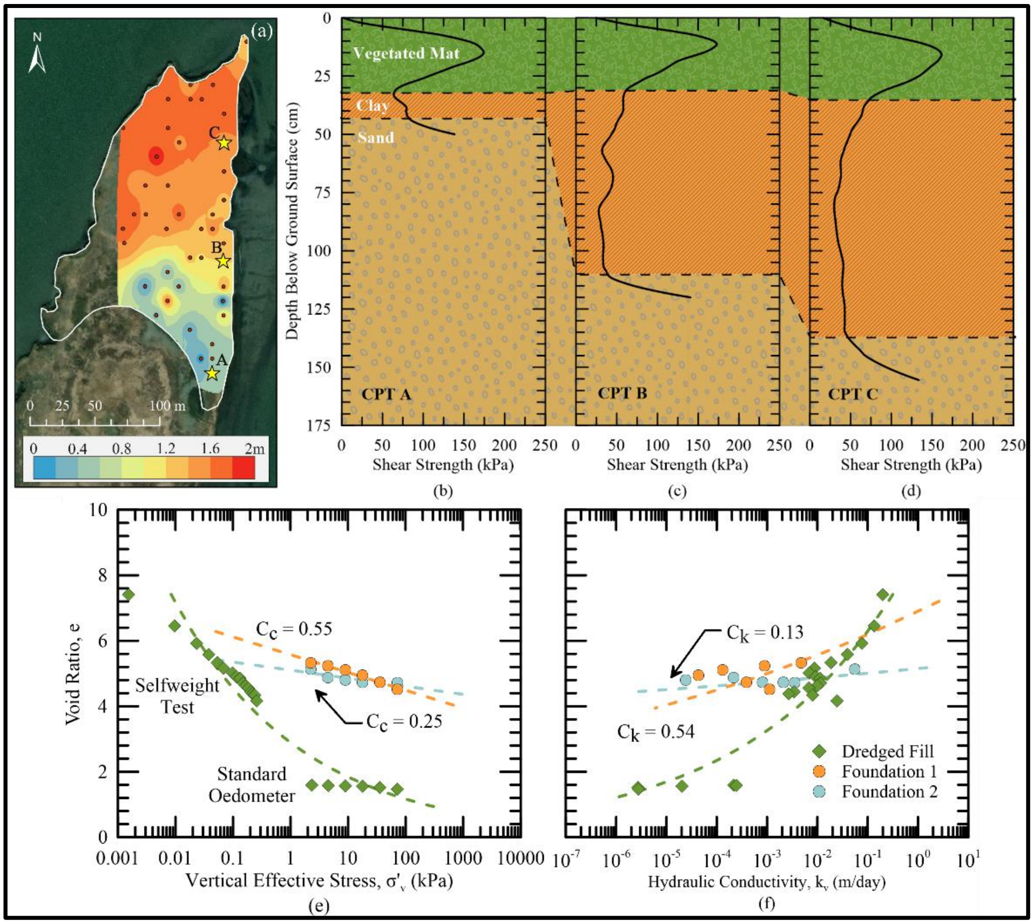

Figure 1. Site geotechnics: (A) Location of Cone Penetrometer Tests (CPTs) (black dots) and interpolated depth to underlying sand foundation across the placement site. (B–D) Example shear strength profiles and interpreted stratigraphy moving northward from the center of the island. (E) Void ratio vs vertical effective stress and (F) void ratio vs hydraulic conductivity relationships for dredged fill and foundation materials.

The placement of dredged material smothered the vegetation, but the site experienced significant revegetation (low of 22% cover in August 2021 to 52% in September 2023) after three full growing cycles. Approximately 2 years post-BUDM, the nourished area experienced a 0.19 ± 0.11-m increase in elevation. The comparison of elevation immediately after nourishment and 2 years post-nourishment found that approximately one-third of elevation loss was the result of consolidation of deposited dredged material and the underlying wetland foundation. It was found that a reliance on solely laboratory data can induce a large degree of uncertainty within projected surface elevations. Thus, the implementation of in-situ geotechnical methods is strongly advised when possible. This investigation allowed for a comprehensive examination of geotechnical modeling methods for planning wetland nourishments, including predicting the ability to keep pace with sea level rise. Ultimately, the two BUDM nourishments offset the effects of SLR by approximately 18-28 years. Orthomosaic surveys and land cover classifications are shown for years 2020, 2021, 2022, and 2023 in Figure 2.

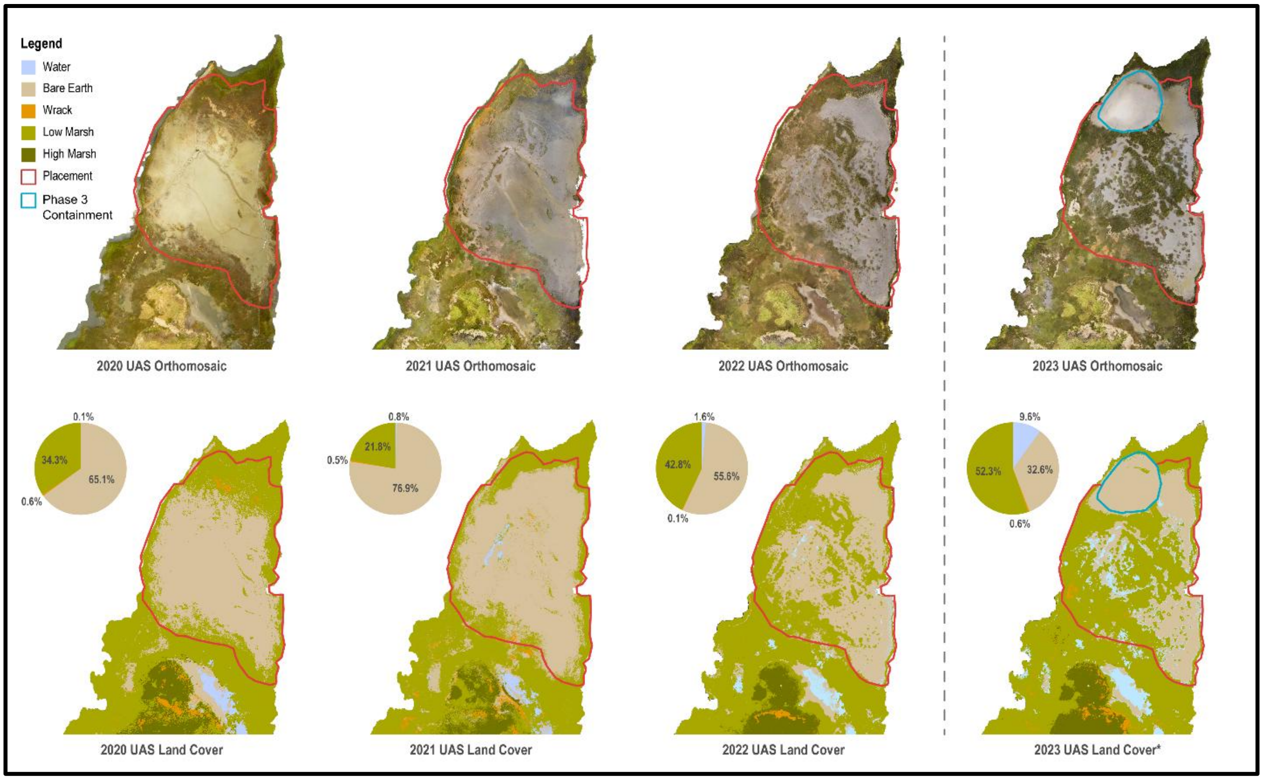

Figure 2. Orthomosaic surveys and land cover classifications from 14 September 2020; 23 August 2021; 26 August 2022; and 9 September 2023. Land cover classifications consisted of water, bare earth, wrack, low marsh, and high marsh with a red boundary line denoting the approximate nourishment area. For 2023 Uncrewed Aircraft System (UAS) Land Cover, the percentages exclude the Phase 3 placement area since additional dredged material was placed here, altering the vegetation cover.

A map of sites used for the consolidation model is shown in Figure 3. Figure 4 shows a comparison of approximate dredged fill thickness to elevation gain from field survey data at 2 years post-nourishment.

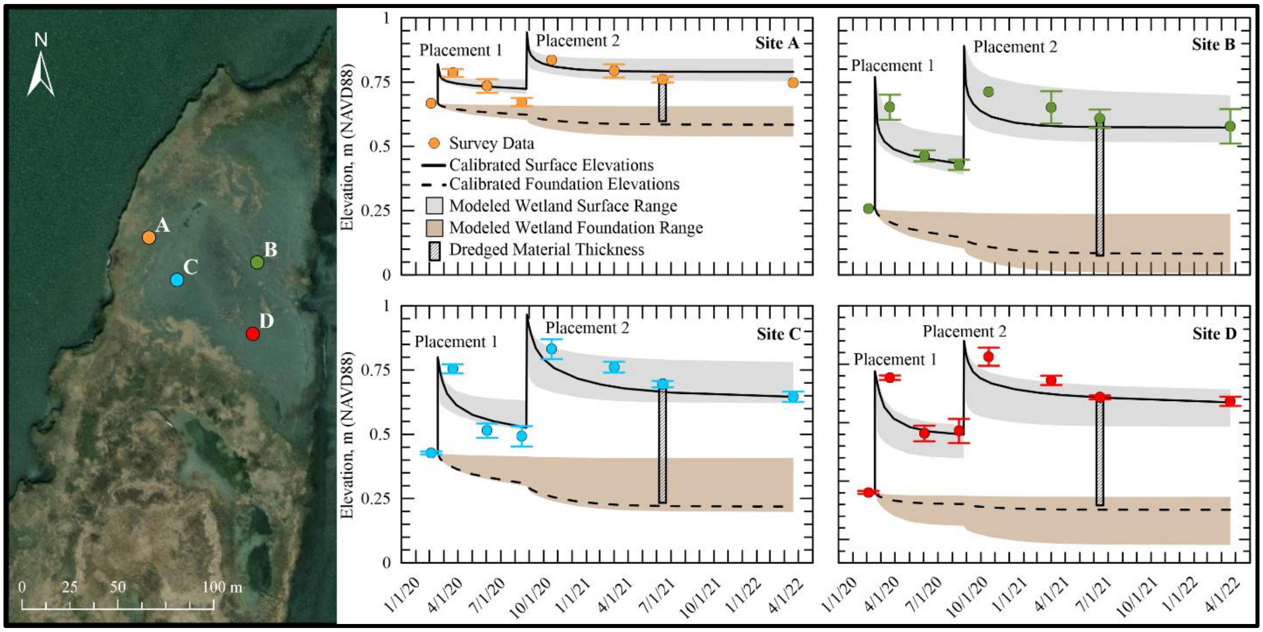

Figure 3. (Left) Map of sites used for consolidation model. (Right) At each site, survey elevation (average values within 2.5-m radius of each point ± 1 standard deviation) overlayed on modeled wetland surface and foundation consolidation ranges and calibrated surface elevations. The thickness of dredged material was determined during the July 2021 field tests.

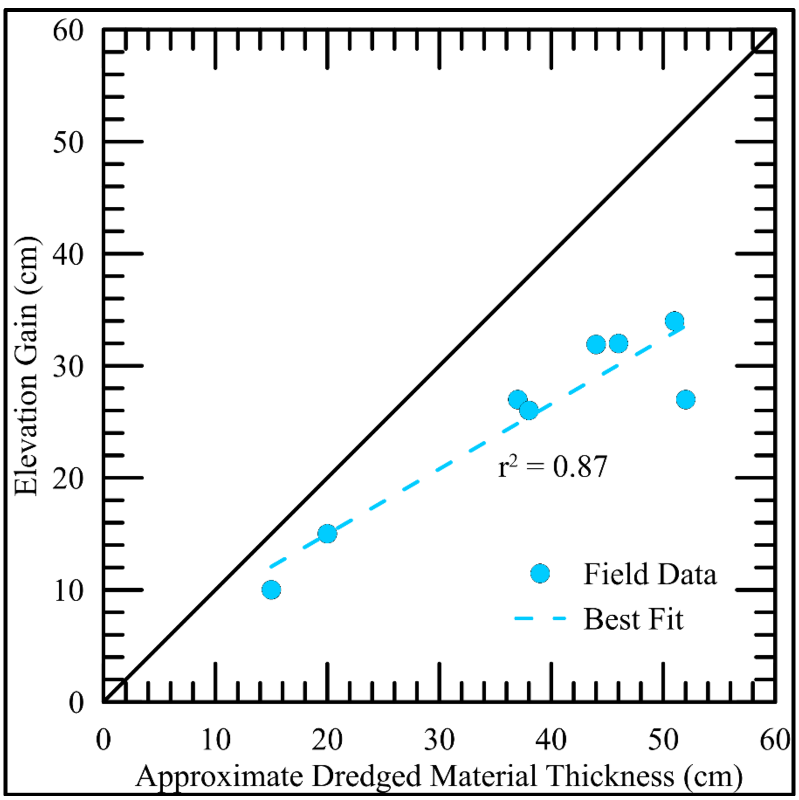

Figure 4. Comparison of approximate dredged fill thickness to elevation gain from field survey data at 2 years post-nourishment.

Funding for this effort was provided by the USACE Dredging Operations and Environmental Research (DOER) Program, and by DoD’s SMART SEED Grant.

PoC: Brian Harris Brian.D.Harris@usace.army.mil