Site Report: Swan Island, Maryland

Original restoration completed in 2019

The restoration of Swan Island, Maryland was the result of a partnership between the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. This project used ~60,000 cubic yards of sediment dredged from a nearby navigation channel to elevate the island platform and restore its historical footprint.

Where, What, Why

Coastal islands and marshes of the Chesapeake Bay are disappearing along with the critical ecosystem services and shoreline protection benefits they provide. Swan Island, within the Martin National Wildlife Refuge, is an uninhabited island located directly to the northwest of the town of Ewell, MD. Due to its location and orientation with respect to prevailing winds and waves, Swan Island serves as a natural wave break, protecting the shoreline of Ewell from waves generated in Chesapeake Bay (Figure 1). Like other mid-bay islands, high rates of shoreline erosion and subsidence have deteriorated Swan Island's natural habitats and threatened its continued ability to serve as a wave break. To counter such losses, in 2019, the USACE Baltimore District restored Swan Island with sediment dredged from the channel that provides access to the town of Ewell. ***The goals of this project included: increasing the elevation capital of Swan Island to maximize its function as a wave break, enhancing the diversity of habitats on the island, and increasing resilience to future sea level rise***.

Figure 1. Location of Swan Island within the greater Chesapeake Bay (top) and with respect to the developed shoreline of Ewell, MD (bottom).

How

Prior to sediment placement, the project area (which spanned 12 acres) consisted predominantly of highly fragmented, low-elevation marsh vegetated by *Spartina alterniflora*. Sediment was placed via a hydraulic pipeline dredge and then contoured with a low-pressure excavator. The placement design involved grading the placed sediments to produce a smooth transition of elevations to support low marsh, high marsh, and dune vegetation (Figure 2). The design included the use of sandier sediments to build dunes and high marsh, while the finer material was reserved for the low marsh. The target elevations for regions of the island slated to become low marsh, high marsh, and dune were 0.9, 1.9 and > 1.6— 3.6 ft NAVD88, respectively, based on the elevation distribution of these habitats in the local area. The planting design included the use of *Ammophila breviligulata*, *Panicum amarum*, *Panicum virgatum*, *Spartina patens* and *Spartina alterniflora* at appropriate elevations. In April 2019 when the planting began, neither species of *Panicum* was available from local growers, nor was *Ammophila*. As a result, the project area was planted with either *Spartina patens* (all areas above 0.9 ft NAVD88) or *S. alterniflora* (all areas below 0.9 ft). Planting was conducted by hand in a grid design with 1.5 ft (*S. patens*) or 2 ft (*S. alterniflora*) spacing among individual plugs. In total, 200,000 2-inch nursery-grown plugs were planted.

As part of the restoration effort, a shore-parallel sill of stacked 2 ft concrete armoring units (A-Jack ®, Contech; West Chester, OH) was installed along the northeast shoreline (Figure 2). The structure was pyramidal (2 blocks wide on the bottom, one block on top) and designed to extend to 2.0 ft MLLW.

Figure 2. Map of Swan Island indicating relative position of target vegetative communities and Sill. Inset: Sill of stacked A-jacks units.

Site Physical Characteristics

Swan Island is bordered on its southern shoreline by the navigation channel that provides access to the town of Ewell. Aside from the channel, water depths in the area directly surrounding the island are less than 3 feet. While winds in this region most commonly blow from the south, the strongest winds tend to come out of the NW (Figure 3). Swan Island is relatively sheltered from wind waves coming from the east and south however, it is fully exposed to waves coming from the west and northwest (Figure 3). Analysis of time series aerial imagery clearly indicates erosion of the northern shoreline in recent decades. Tidal amplitude in this region of the Bay is ~1.5 feet. The average height of waves impacting the northern shoreline of Swan Island ranges between 15 and 25 cm (6 – 10 inches).

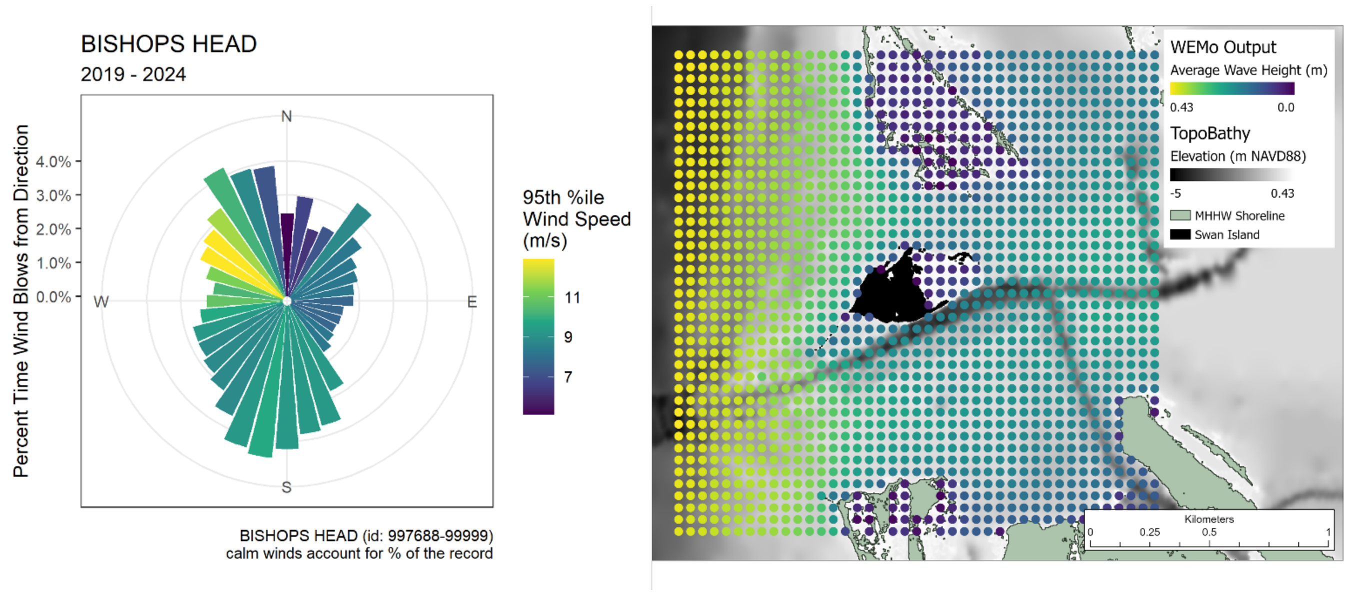

Figure 3. Wind conditions (top 95% of wind events) over the project lifespan (left) were used to model wave energy conditions using the Wave Exposure Model (WEMo, right). Colored points represent modeled average wave heights within a 2 x 2 km grid surrounding Swan Island. Gridded points are spaced 50 m apart.

Performance Over Time

As of the writing of this report, the Swan Island placement project is relatively recent (5 yrs post placement) thus this description should be considered preliminary. Imagery-based evaluation of change in shoreline position over time (Figure 4, Table 1) indicates a significant increase in the extent of Swan Island habitat at intertidal or higher elevations as a result of the placement.

Table 1. Total extent of intertidal or higher island area by year

Year	Extent of intertidal or higher habitat (acres)
2016	20
2019	28
2022	27

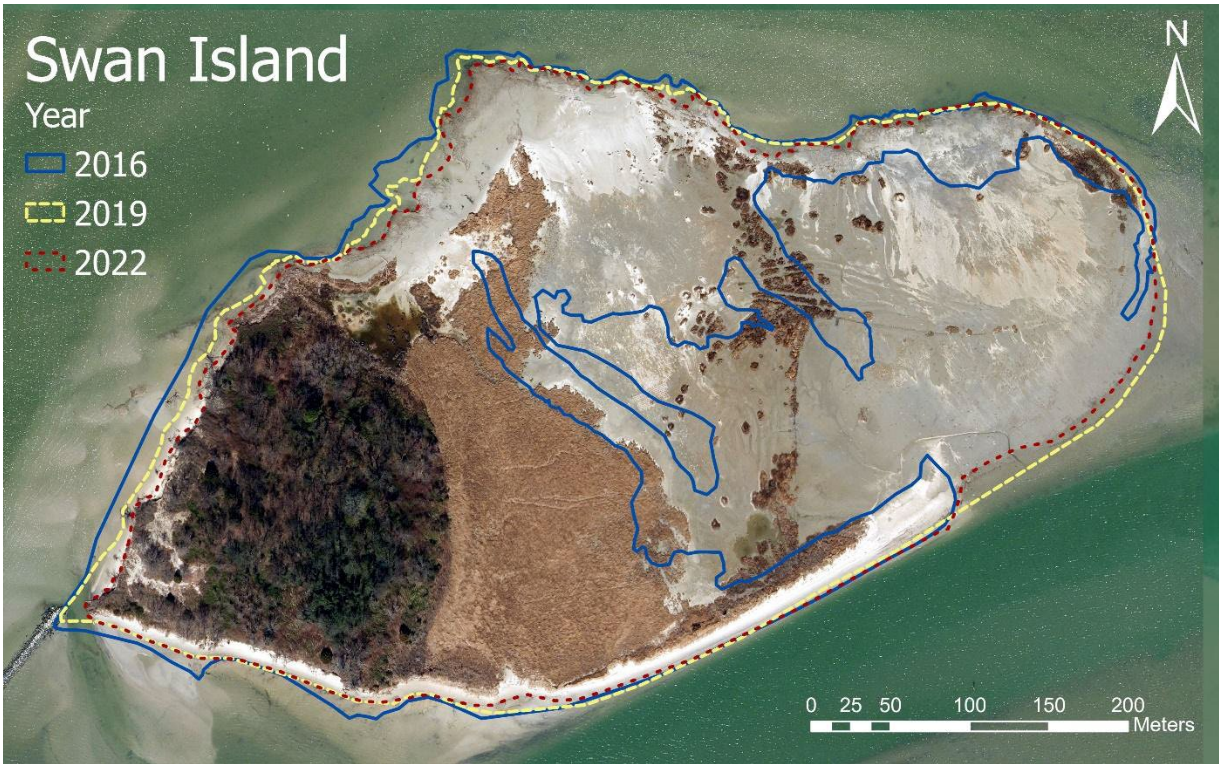

Figure 4. Shoreline position overtime as delineated from aerial imagery. Imagery used to generate these shorelines were 6-inch resolution orthoimages obtained from the MD iMAP system. The background image shown here is from 2022.

Although the target elevations were achieved, the success of vegetative plantings was variable across the spatial scale of the project. The *S. patens* planted in the area designed to be high marsh grew in rapidly, exhibiting dense cover by the end of the second growing season. The western-most created dune was rapidly colonized by lateral spread of existing, naturally occurring dune vegetation and expansion of the planted *S. patens*. The *S. patens* planted on the eastern dune did not survive the first growing season and that dune was rapidly flattened by overwash. The majority of the *S. alterniflora* planted in the large areas of the island intended to be low marsh habitat did not survive the first growing season. A portion (roughly one acre) of the area created to serve as low marsh was replanted in 2021. There wasn't enough funding available to support replanting the entire low marsh, so this effort was limited to the area deemed most susceptible to erosion. This secondary planting was partially successful: in the portion of the planting area that was furthest from the northern shoreline, the plants thrived and reached dense cover within 1 growing season. In portions of the planting area that were closer to the shoreline, there was no sign of the installed plugs after 1 growing season. This more northern portion of the re-planted area experiences greater waves and currents and many of the planted plugs were dislodged presumably, as a result of those forces. As of 2024, the majority of *S. alterniflora* (which still exhibited only patchy cover at that time) appeared to have been the result of lateral spread from native plants that survived the original placement action.

Current Habitat Distribution

As of 2023, the area designed to serve as high marsh habitat was densely vegetated with *S. patens* and some natural vegetation (*Bacharris halimifolia*) was beginning to recruit to the area. In the area designed to serve as low marsh, vegetation, where present, was dense, but large portions of the area remained unvegetated (Figure 5). In several locations within the low marsh, the vegetation had trapped enough sediment to form mounds that were 30-50 cm (1-1.5 ft) above the existing low marsh elevation. The tops of several of the mounds were vegetated with high marsh and/or dune vegetation. Although the majority of the low marsh habitat remained unvegetated, it was still within the appropriate elevation range to support *S. alterniflora*.

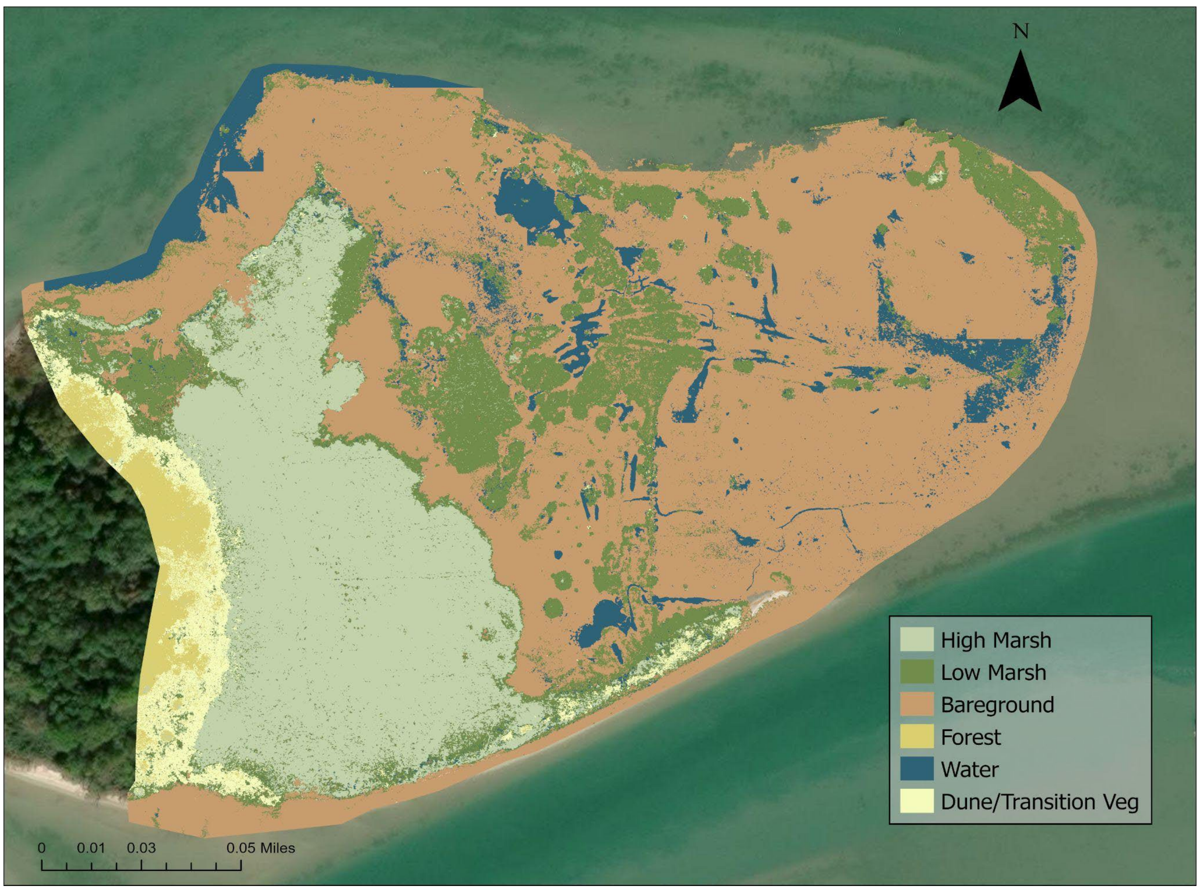

Figure 5. Drone-imagery based habitat classification created using supervised object-based image analysis in QGIS (QGIS Development Team 2025).

As long as the appropriate elevations are maintained it appears likely that lateral expansion of the established vegetation will continue.

Performance Summary

As of 2023, almost 5 years post-construction, the majority of the project footprint still reflected the design conditions. The one exception to this was the low dune on the northeastern shoreline (Figure 6). The sediment that was placed to create the dune was washed southward across the island surface and spread across the low marsh area landward of the dune.

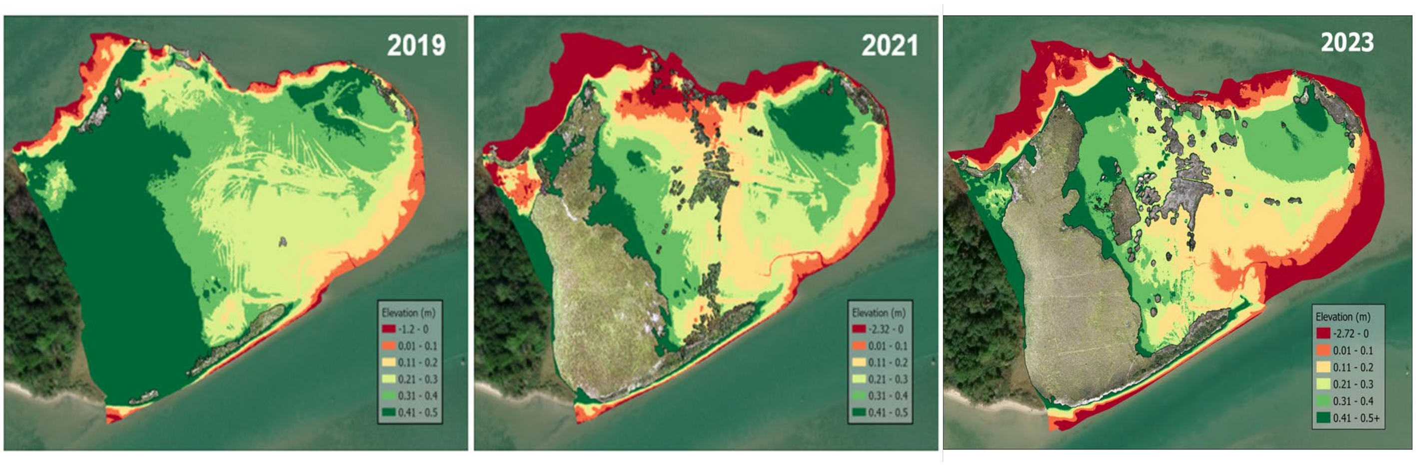

Figure 6. Digital Elevation Models of Swan Island created from high resolution drone imagery. Colors correspond to elevation of the sediment surface where no vegetation is present. Elevation categories are in units of meters NAVD88. Red = < 0m, Yellow = 0.21-0.3 m, dark green = > 0.41 m.

In the zone intended to serve as high marsh, the planted vegetation flourished quickly and has consistently exhibited dense cover. The larger, eastern lobe of the island that was designed to serve as low, regularly flooded marsh habitat remained largely devoid of vegetation five years after project completion. It is likely that this area will eventually become vegetated through lateral spread if it remains at an appropriate elevation to support low marsh vegetation. Additional plantings would still be appropriate for this site as the presence of a vegetative canopy will help to defend against erosion of the placed sediments and ensure long-term project success. To date, the project has met the objectives of resulting in an island surface that is more resilient to future sea level rise and that supports a wider range of habitats.

Report Credit: Davis, J., Walker, Q., and Giannelli, R. LeClaire, A., Bost, M. (2024). Site Report: Swan Island. US DOC NOAA NOS National Centers for Coastal Ocean Science (NCCOS). Islands.