

Marsh Restoration Using Hydrological Techniques in the Maryland Coastal Bays

R4R Webinar 2026



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Content

- Review existing Maryland projects implemented by USFWS
- Discuss overall restoration approach, basis of design, lessons learned through each project
- Current monitoring and ongoing research informing future projects

Who we are...



The USFWS Partners for Fish & Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools and nonprofits interested in improving wildlife habitat on their land.

Projects are voluntary and customized to meet landowners' needs.

Logistics/Practicality

- Landowner Interest
- Parcel Size
- Wildlife Habitat

My Role

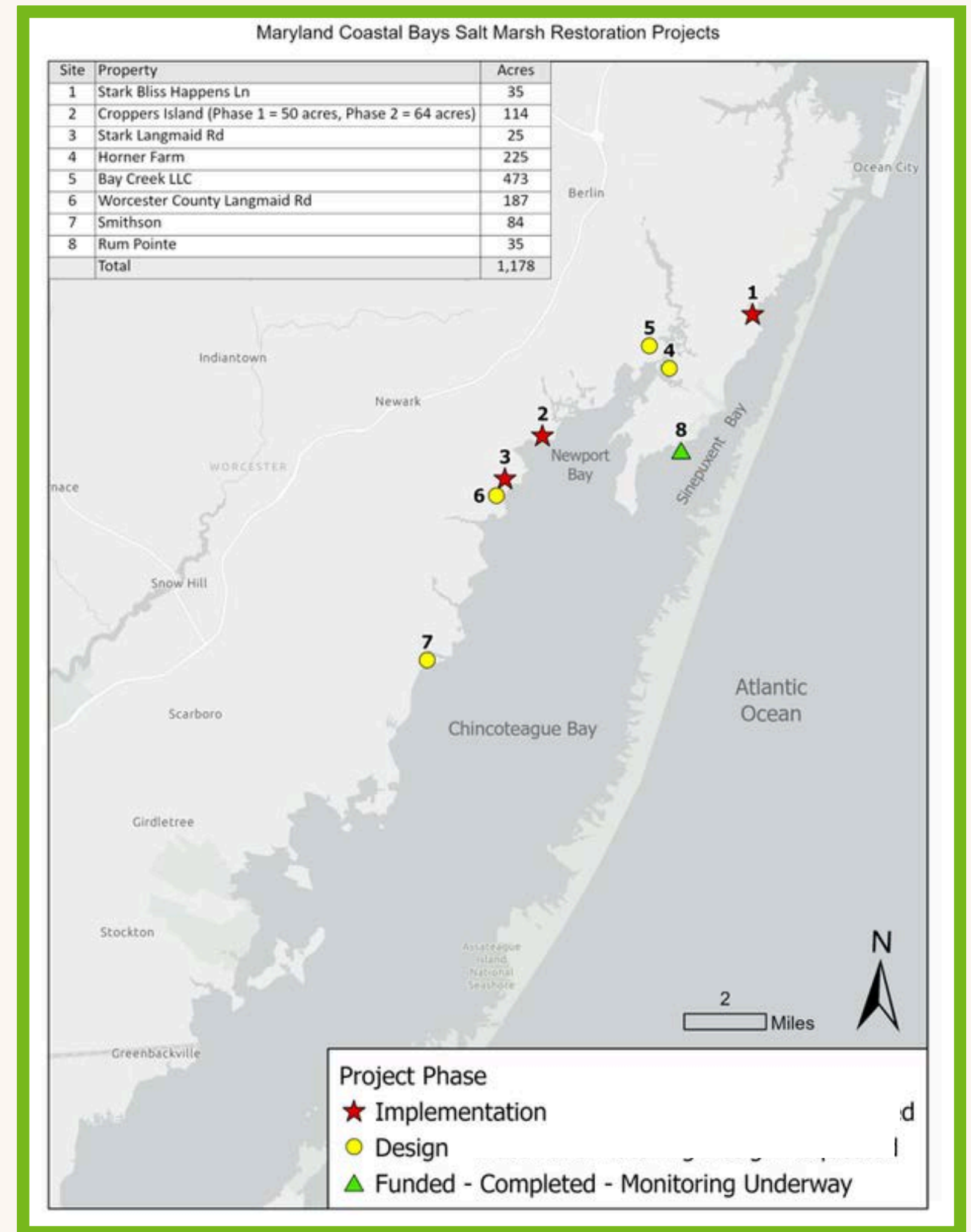
- Background in Ecology, field work
- Habitat/wildlife outcomes
- Landowner relationships
- Project management
- Funding/collaboration



*I am not an engineer or hydrologist
*Took over these projects at the end of 2024

There may be questions I can't answer... I will pass those questions along to the appropriate project partners.

Where we are...



Project Slate



3 salt marsh restoration projects utilizing hydrological improvements through runnels/channels have been implemented to date in Maryland..

1. Rum Point (35 acres) --- constructed in 2023
 2. Bliss Happens Lane (35 acres)
 3. Langmaid Road (25 acres)
- } designed/implemented
in tandem in early 2025

2 additional projects are planned for this fall/winter...

4. Irish Grove Sanctuary --- partnership with Audubon Mid-Atlantic
5. Cropper Island (114 acres)

3 additional projects in the design phase!



Rum Point Marsh Restoration



Overview of Site



photo by: Roman Jesien/Maryland Coastal Bays Program

- 35 acres of salt marsh, Sinnepuxent Bay
- Densely ditched
- many areas of impounded water, widespread vegetation loss
- primarily low-form *S. alterniflora* dominated marsh
- areas of traditional “high marsh” vegetation, along upland/forest transition zone

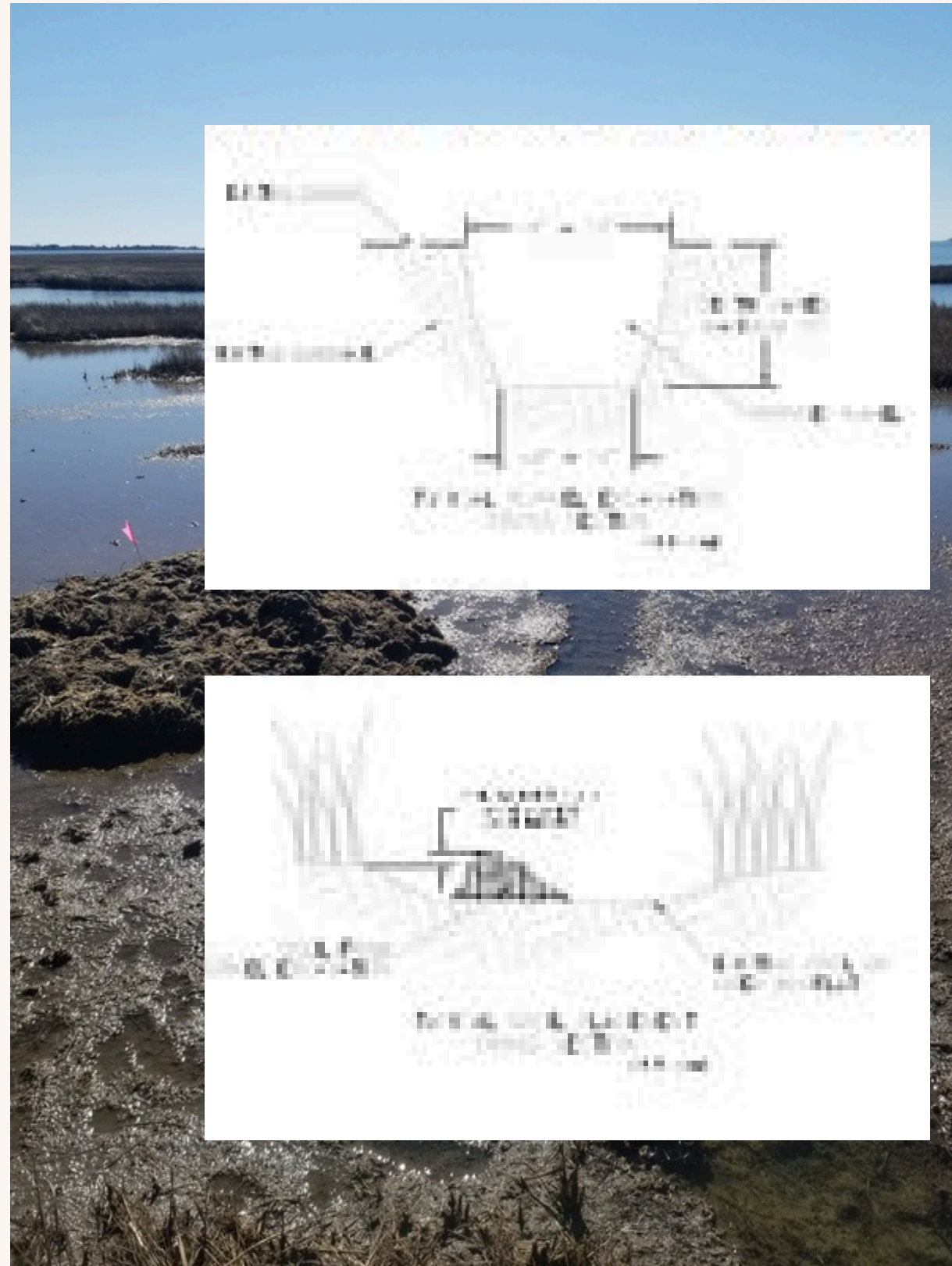
Restoration Techniques and Basis of Design



Runnels

- runnels (8-10") were placed to target pools within the marsh that were causing active vegetation die-back
- locations selected through a combination of desktop analysis, field reconnaissance, and field data (vegetation transects and RTK)

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Hummocks

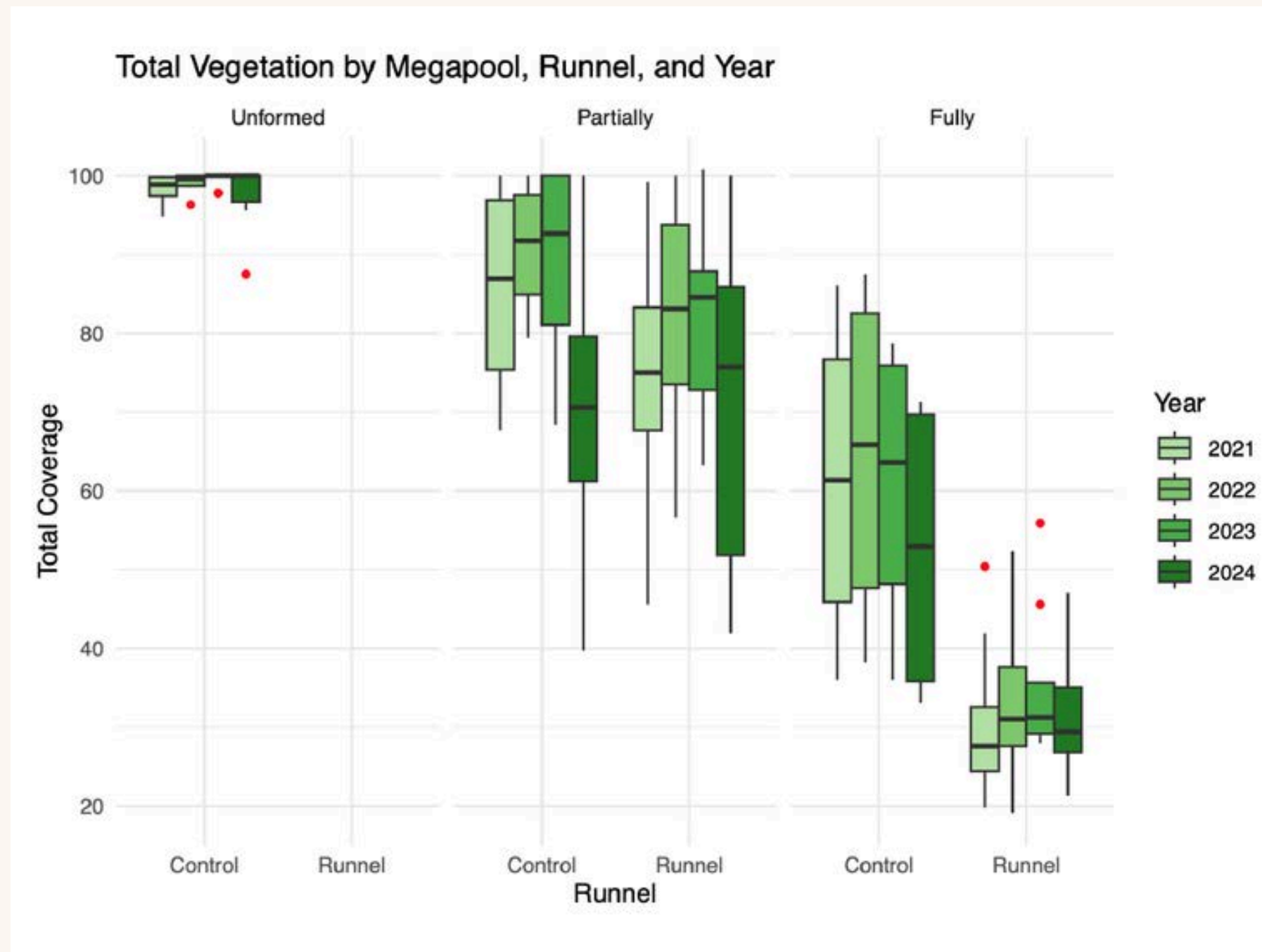
- spoils from the runnels were placed on top of areas of unvegetated marsh in the target pools, spaced out to avoid trapping water
- Hummocks were constructed 8-10" high, lost some elevation capital due to settling/dewatering
- Chunks of vegetation disturbed by digging the runnels were placed on the hummocks as initial plantings.

Initial response



Initial Results

*Vegetation examined as a key indicator of wildlife habitat/breeding and ecosystem function and health



Analysis completed by Katherine Stahl, USFWS

Key Takeaways

Across the site, we are not seeing notable improvements in vegetation for the runneled areas

Lack of clear evidence to suggest that the runnels had an affect

Data suggests external conditions in 2024 may have played a role

Need to know more to figure out what factors may be limiting recovery

It can take time to see results from runnels...

- It has only been 3 growing seasons 2023, 2024, 2025
- Runnel projects typically take 3- 5 growing seasons for improved vegetation coverage (McKown et al., 2023)

Next Steps



01

USFWS has begun analyzing the changes in vegetation using aerial analysis. We are looking at **specific pools** (not in the previous groupings) to see if any individual pools are recovering.

02

Work with academic partners to examine non-hydrological factors (elevation, soil chemistry, crab herbivory, nitrogen stress...) that may be affecting the recovery in specific areas.

03

Modify areas of the project where response is not observed given what we learn about factors allowing or prohibiting vegetation recovery in various areas of the site.

**Bliss Happens Lane
&
Langmaid Road**



Overview of Site Conditions

piloting a new approach to low marsh restoration creating designs using system based tools to design “secondary drainage channels”

- Bliss Happens Lane (35 acres) **designed/implemented**
- Langmaid Road (25 acres) **in tandem in early 2025**

Both sites:

- heavily ditched, mixture of open, partially clogged, and mostly clogged ditches
- impounded water that did not drain at low tide, leading to large areas of vegetation die-off
- More intact marsh platform overall than Rum Point
- primarily low-form *S. alterniflora* dominated marsh
- Some areas of traditional “high marsh” vegetation
- In wetter vegetated areas high-form *S. alterniflora* was dominant, with representations of *Salicornia* sp.



Restoration Techniques Utilized



SOVEREIGN CONSULTING INC.



STRAUGHAN
ENVIRONMENTAL

Excavation of Secondary Platform Channels



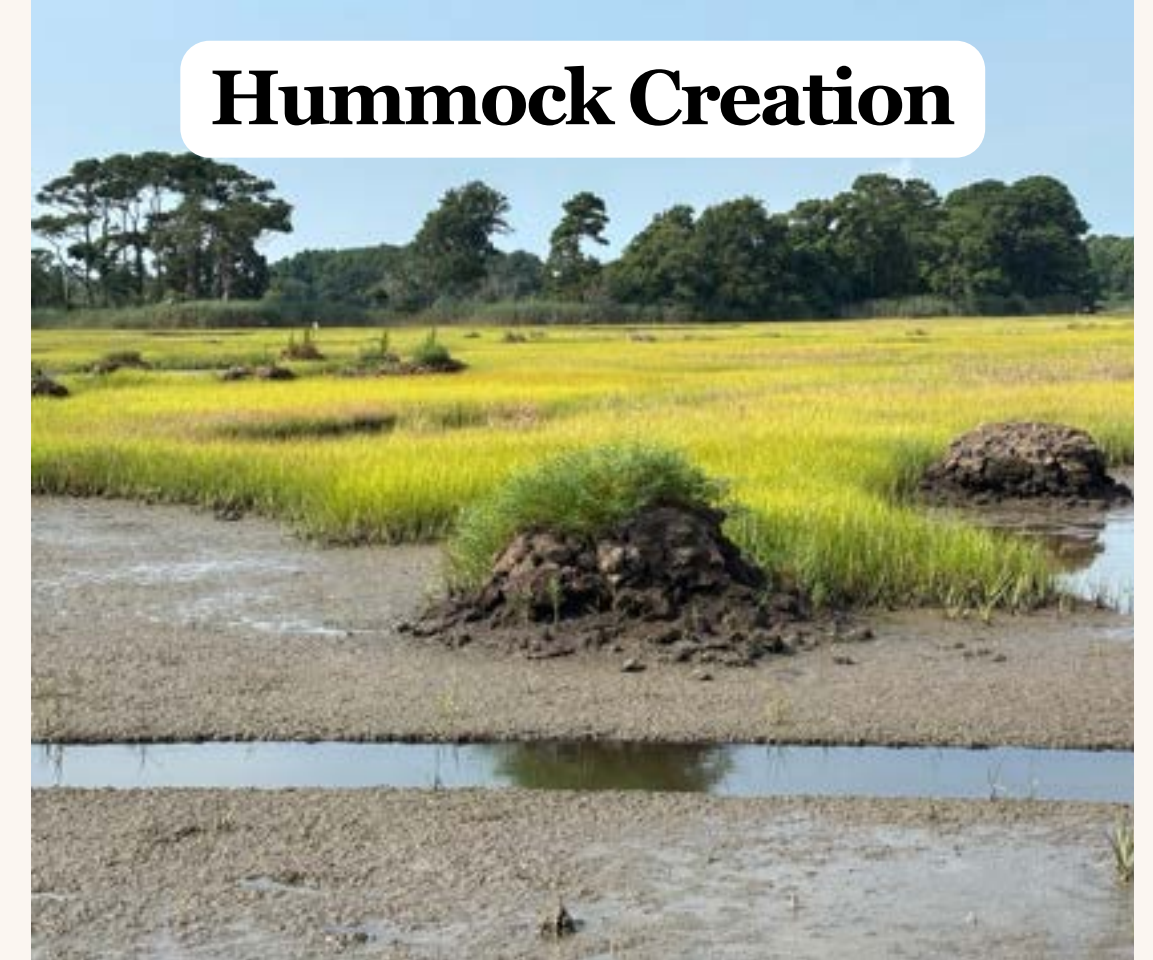
Purpose: release impounded water, reintroduce tidal flow into low marsh areas and lower water table of adjacent marsh marsh

Ditch Cleaning/ Ditch Fill



Purpose: achieve a healthy drainage density and target flow from excavated channels through select ditch cleaning and ditch fill

Hummock Creation



Purpose: utilize excavated material to enhance elevation for high marsh plant and bird species, limit footprint to prevent impoundment

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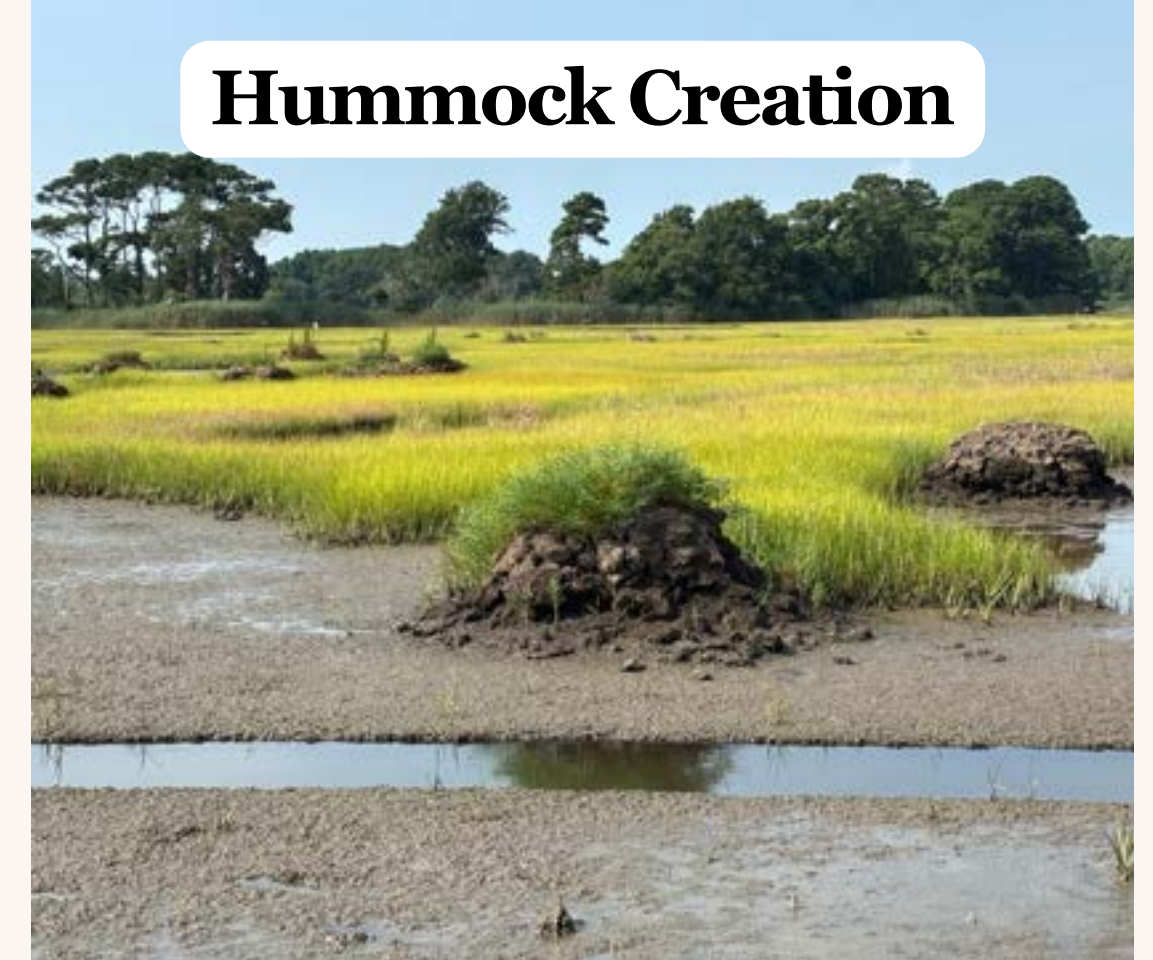
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Goal: 50/50 high marsh/low marsh ratio to provide for nesting habitat while attempting to keep the costs and logisitics feasible.

Design Basis



Excavation of Secondary Platform Channels



1

How did you choose where to put channels?

Developed "Marsh Datums:" Combining tide and vertical datums (elevation) to define optimal low- and high-marsh habitat zones, and the actions needed to achieve them in various areas of the site.

We combined with aerial interpretation of marsh cell waterlogging, average elevation ranges in vegetated areas, and tidal datums to characterize the marsh cells by appropriate restoration prescription.

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Restoration Design Thresholds

- Cells \geq 0.3 ft NAVD88 \rightarrow hydrologic improvements (e.g., runnels/channels).
- Cells $<$ 0.3 ft NAVD88 \rightarrow sediment nourishment to reach optimal elevation.

note: targeting recolonization of low marsh plants in these hydrologically modified areas.

Design Basis



Excavation of Secondary Platform Channels



2

How did you decide what size to make the channels?

- Channel sizing was based on an **equation relating low-marsh area to channel width**
- Completed checks using more traditional open-water drainage calculations
- Channels width options were rounded up to either **3 or 4 ft** to match standard excavator bucket widths
- Pool areas were selected to receive 3 ft or 4 ft wide channels based on cell size and volume

Design Basis



Excavation of Secondary Platform Channels



**These channels are are not technically “runnels” as they are wider (but not deeper) than a traditional runnel.

However, they based off of the same principals, intended to be applied to the more regularly flooded marsh environment of the MD Coastal Bays.

2

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Design Basis



Excavation of Secondary Platform Channels



**Ditch Cleaning/
Ditch Fill**

3

How did you decide where to fill vs. clean ditches?

The design team examined existing ditches and selected them to be **cleaned** if they could serve as an effective outlet for the created channels, and **filled** where not needed as an outlet point

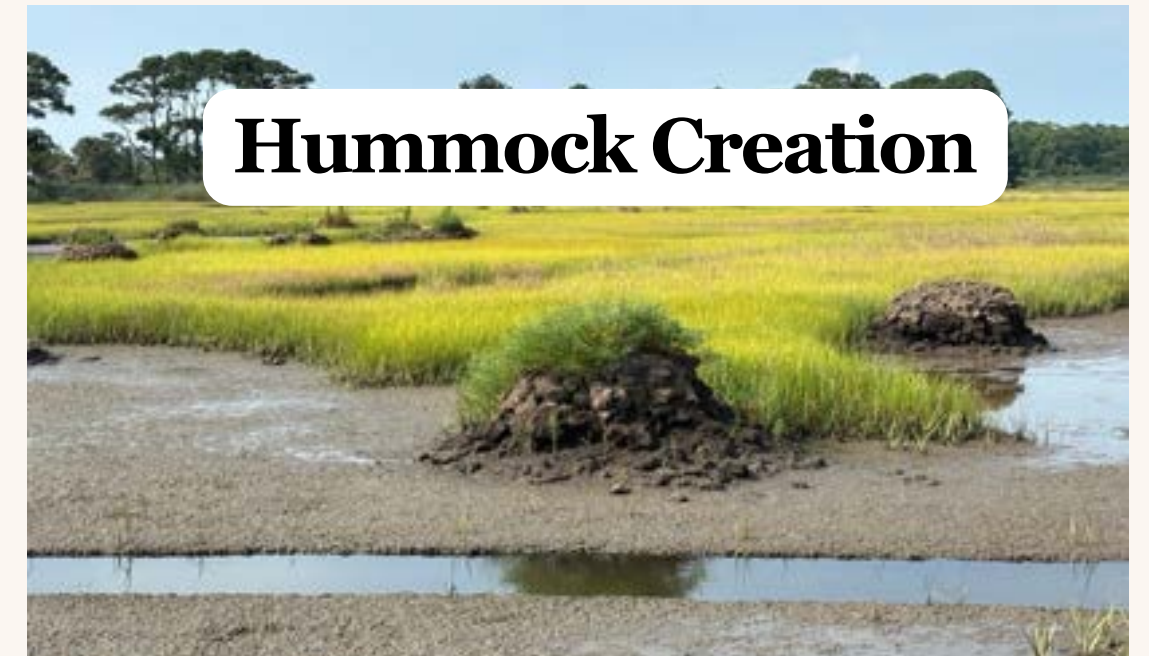
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Excavation of Secondary Platform Channels



**Ditch Cleaning/
Ditch Fill**



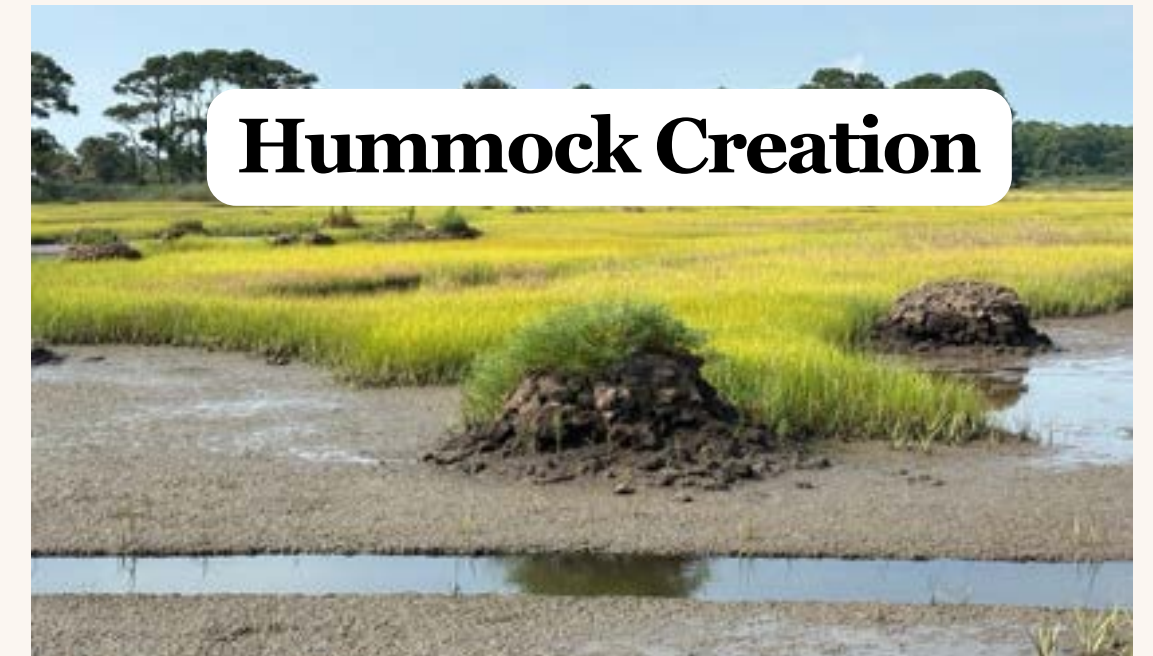
Hummock Creation

4

How was the size of the hummocks determined?

- Capillary action in typical silt soils is estimated at 6–10 in; adding ~6 in for root depth gives a target elevation of 12–16 in above MHW
- With existing marsh substrates averaging 6–8 inches below MHW, the resulting hummock height is about 24 inches to avoid regular flooding
- Final elevations are not exact and will be adaptively managed based on professional judgment and field observations

Design Basis



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GOAL

provide high marsh vegetation habitat for bird species of interest (ex: *Spartina patens*)

Bliss Happens



Langmaid



“System Based Tools”



**Using tidal and vertical datums
to create Marsh Datums**

**Sizing Channels using Drainage
Density Calculations**

**Similar approach to other restoration
projects at Supawna Meadows and
Cape May NWRs**

White paper coming out later this year!

Initial Results - Bliss



Initial Regrowth - Bliss



Initial Results - Langmaid



Initial Regrowth - Langmaid

excited to collect a second year of post-construction monitoring data!



Cropper Island



Overview of Site Conditions

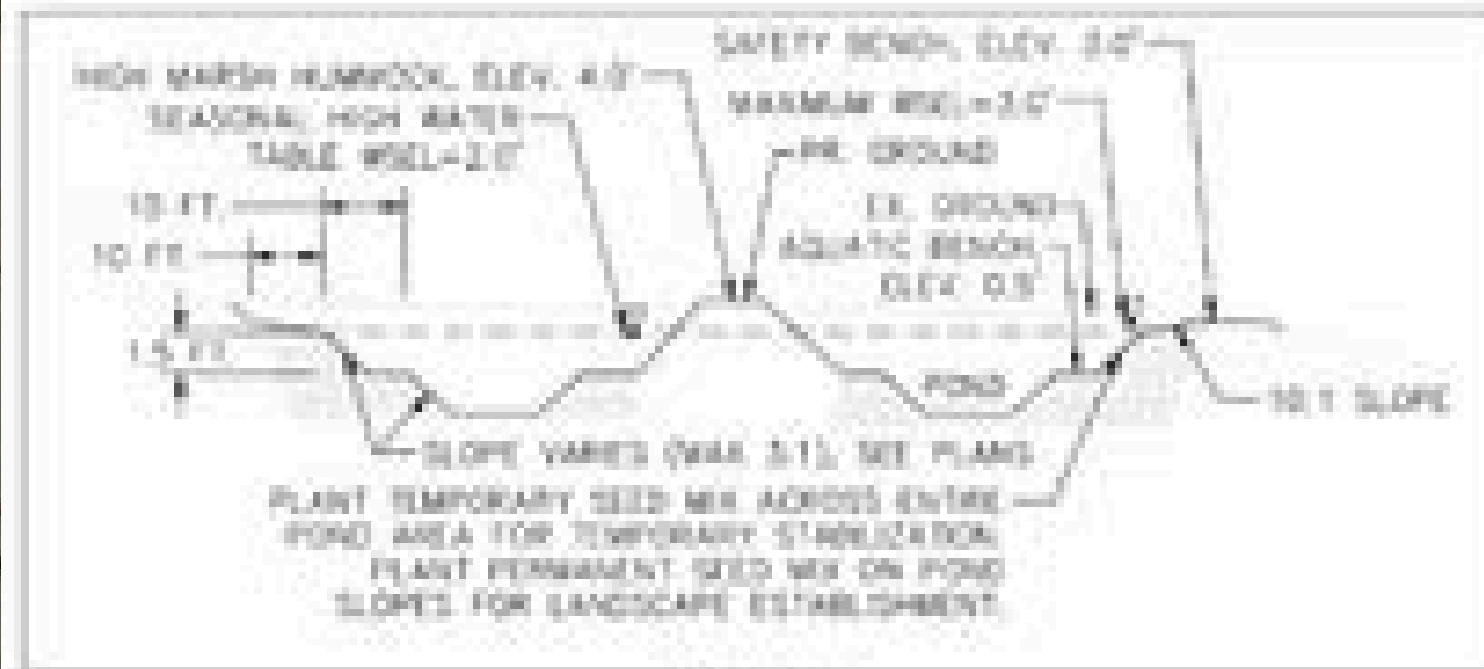
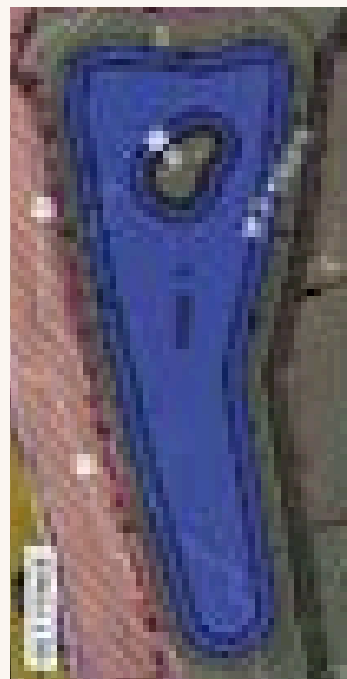
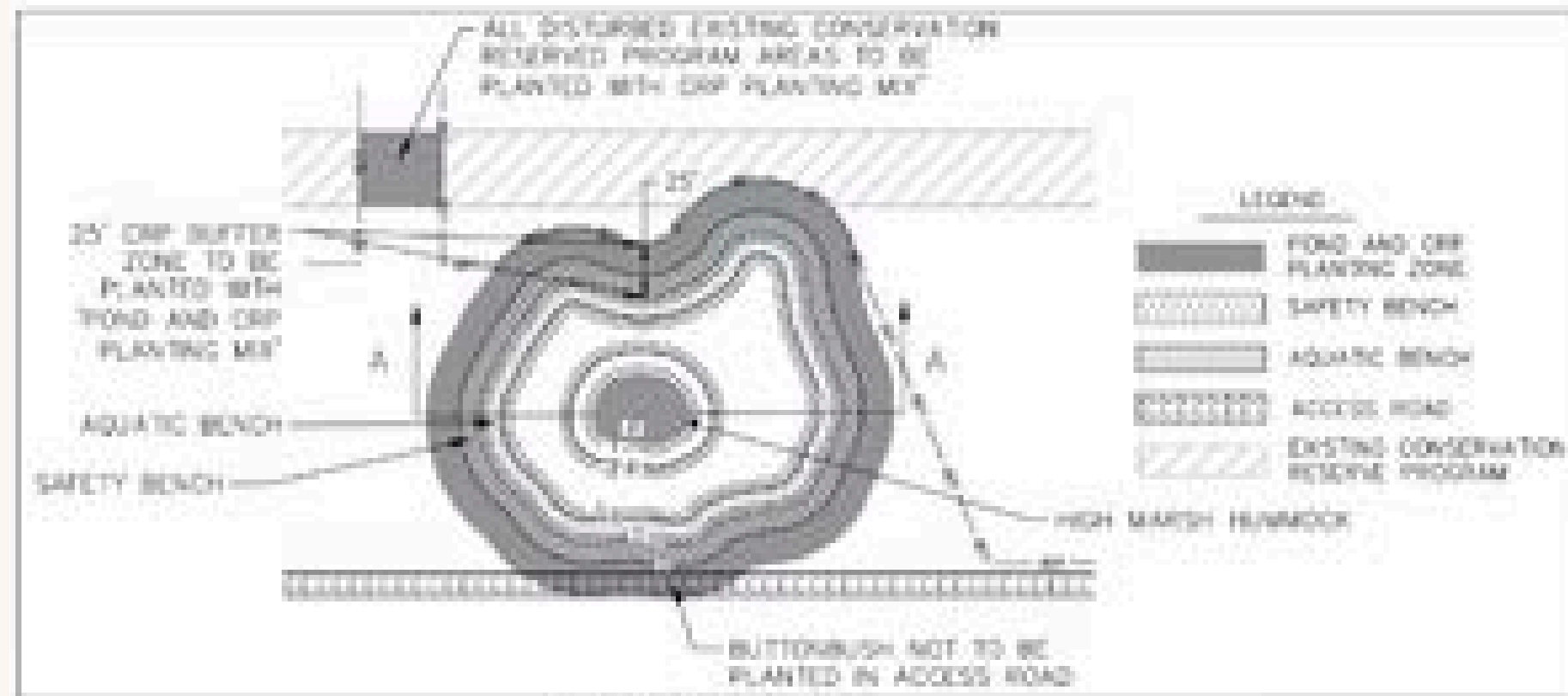
- **Same challenges as the Bliss and Langmaid sites**
- **Similar elevation and tidal range to the Langmaid site**
- **Further degradation/pool expansion**



Addition: Upland Sediment Source!



Pond Specifications



- Shallow ponds 2-3 ft with features to attract water fowl:
 - gradual ledges
 - native waterfowl feed plants
 - ex: button bush, Japanese millet, & cereal rye
 - hummock island for add. habitat
- Pond will be fed by ground water and will fluctuate seasonally depending on precipitation
 - Max in the Spring
 - Lowest in Summer
- Blue shows seasonal high water, upper bench will remain dry

Restoration Techniques



Excavation of Secondary Platform Channels



decreasing channel widths to 2-3 ft based off of efficiencies observed at Bliss and Langmaid

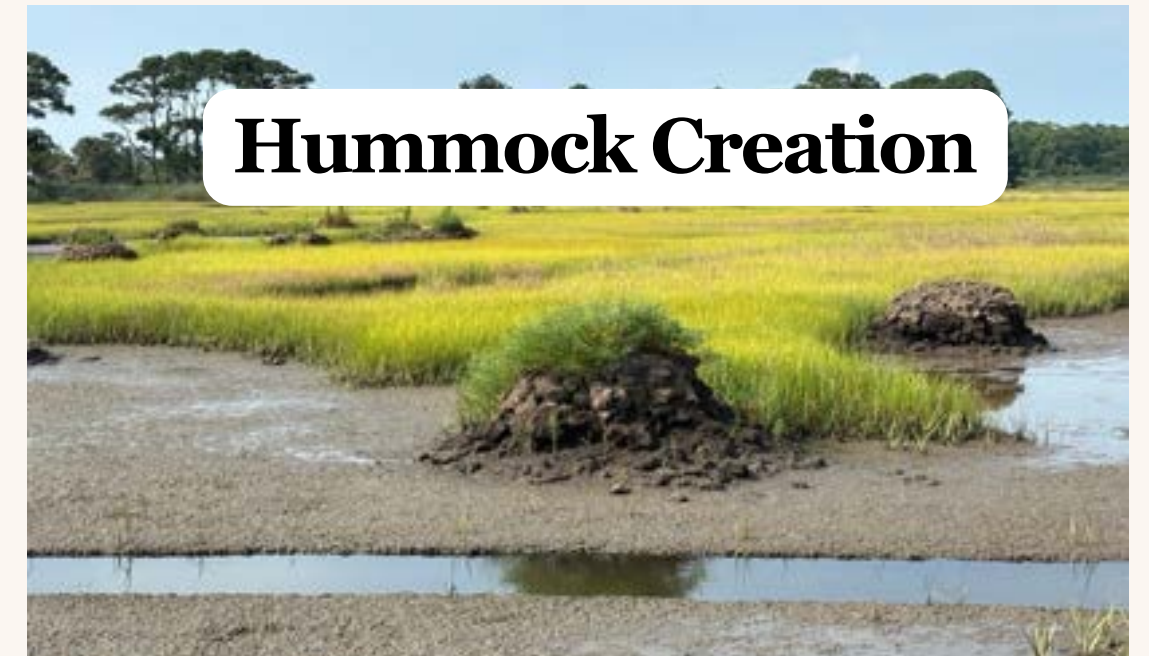


**Ditch Cleaning/
Ditch Fill**

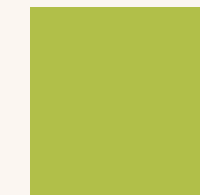


Because of sediment access...

Full-profile ditch fill implemented, with straw bales used strategically for stabilization.



Hummock Creation



Hummocks sized with a variable footprint: generally 5–10 ft wide and 10–15 ft long. Alternating sides of the tidal channel to avoid water flow obstruction and maintain drainage.

Restoration Techniques



elevation enhancement using excavated sediment



Monitoring



Monitoring response through a combination of remote sensing and on the ground data:



- Elevation:
 - LiDAR, supplemented with RTK
- Vegetation:
 - aerial imagery analysis --- broader changes in vegetative communities
 - bearing capacity transects --- pannes vs pools distinction
 - revegetation on created hummocks
 - photo points
- Wildlife:
 - avian and nekton monitoring
- Hydrological Monitoring
 - aerial imagery
 - photo points
 - supplementary water logger/camera traps in areas of delayed response



Bigger Picture



Is this a bandaid solution?

No one “golden solution.”

Runnels/channels are one of the tools available to us and should be used in combination with other tools to help make our marshes healthier.

Healthier marshes have a greater capacity for resilience.



An aerial photograph of a coastal wetland area. In the upper left, a concrete dam or barrier spans across a waterway. To the right of the dam, a network of waterways and marshes is visible, with patches of green vegetation interspersed with blue water. The background shows a dense line of trees and a flat landscape.

Realities of Restoration

A lot of fear around “getting it right” and doing the “ideal project”
But the reality is that there is a cost to not acting.

Practical considerations - sediment sources, cost, landowner willingness.

Realistic expectations for recovery - these systems are under active stress.
Results can take time and sometimes success may not look how we think.

We are learning from these projects.

- Working with academic partners to assess existing restoration projects in the state, site conditions, and variation in technique to understand how these factors relate to site recovery
- This will allow us to produce guidance for future restoration projects
 - **Practitioners Manual for MD Runnel Implementation**
 - Guidance on where/how to do hydrological restoration
 - **Landowner Restoration Toolkit**
 - Overview of tools available to landowners



Thank you!

