Use of Dredge Material for Wetland Restoration: 2 Case Studies

CIB STAC
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Delaware Department of Natural Resources and Environmental Control
Wetland Monitoring and Assessment Program

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Background

- Many tidal marshes along the east coast of the U.S. are sinking due to land subsidence and/or have drowned due to rising sea levels
- Mid-Atlantic region of the U.S., including Delaware, is a sea-level rise hotspot
- DNREC regularly dredges Indian River to stay navigable; disposing of materials in upland containment units
- Beneficial use of dredge material is a wetland restoration strategy used to address this issue
- Spread dredged sediments onto a degraded existing salt marsh to raise elevation, or sediments are used to recreate submerged former marsh
Examples

Blackwater National Wildlife Refuge (MD)

Prime Hook National Wildlife Refuge (DE)

Ring Island (NJ)
Two DNREC Case Studies

- Completed: Piney Point (thin layer)
- In Progress: Millsboro (platform recreation)
Project Goals

• 2015 Delaware Wetland Management Plan action item
• DNREC seeking alternate uses of dredge material
• Reduce reliance on disposal areas
• Goal:
  • Build DNREC capacity for beneficial use
  • Test the efficacy of treating tidal wetland with dredge materials
  • Investigate techniques, equipment, logistics, biological results
  • Focus on information transfer
  • Serve as a baseline examples for permit requests
Project 1: Piney Point 2013

Piney Point Tract of Assawoman Wildlife Area, Dagsboro

21 acre wetland

Upland Disposal Unit

Pepper Creek
Site Selection
Site Selection
Project Plan

- Raise elevation to 1.05’ NAVD88
- Stay below Phragmites elevation, plan for SLR
- Supply sediment and boost surface elevation
- Apply up to 10,000yd³ of sediment in thin layer
- Target only silty sediments for application, pass over sand
- Allow sediments to flow and spread out naturally
- Prevent sediment loss and plumes with temporary sills
- Plant as necessary, allow for colonization
Equipment
Monitoring Sediment Depth

Sediment Depth
Spring 2013 to Early Winter 2014
Pre-restoration to First Survey taken Post-restoration

Spring 2013 to Early Winter 2014
Sediment Depth (cm)
-18.21-3.33
3.34-6.25
6.26-8.75
8.76-11.45
11.46-14.34
14.35-17.81
17.82-22.05
22.06-30.91

FTP_Ditches
Wattles_Haybales
Type
Straw Bales
Wattles
Sediment Settling

Pepper Creek Elevation Change
Spring 2013 to Fall 2016
Pre-restoration to Last survey to date
Plantings

- April 2015 planting in demonstration area
- Planted 2,600 *Spartina alterniflora* plugs
Plant Regrowth
Lessons Learned:

- Site specific conditions will vary greatly!
- Vegetation prevents major sediment runoff
- Spray distance is limited by debris and wind
- Difficult to measure precisely how much is being applied
- Limit sediment to 10-12 cm
- Do not apply before heavy freeze
- Limit days of application in one spot (2)
- More feldspar plots
- Monitor mussels
- Quantify sediment volume with pre & post channel surveys
- Pair biomass and feldspar plots
Lessons Learned:

• **Big Picture**
  • Aerially broadcasting material is possible
  • Pre and Post monitoring is crucial
  • Biological need should be carefully considered
  • Responsive dredging and spraying teams
  • Grain size and depth & re-vegetation plan

• **Future Needs**
  • Longer revegetation monitoring
  • Threshold thickness for mussels and oysters
  • Project cost estimates
Project 2: Millsboro Public Works

Restore 15 acres of tidal wetlands on Town of Millsboro property through wetland recreation and invasive Phragmites treatment.
Current Site Conditions

- Extremely shallow water; exposed mudflat at low tide (old marsh platform)
- Many old tree stumps where forest used to be
- Several small drainage areas running through marsh
- Marsh dominated by invasive European reed (*Phragmites australis*)
Shoreline change over decades
Proposed Project Area: 2 Parts
Proposed Project Goals

a) Test efficacy of recreating a former, submerged tidal wetland with the reuse of dredge materials in Delaware
b) Restore Phragmites invaded area to native marsh
c) Investigate techniques, equipment, logistics, and results
d) Share lessons learned with other states and organizations
e) Educate public about project goals and benefits of tidal wetlands
Part 1: Restoring native high marsh

• Treat invasive *Phragmites* (8 acres) to eradicate it and keep it from invading new created marsh platform
  • Aerial spray via helicopter with herbicide for 2-3 years (state contractor); already sprayed once in fall 2019
  • Burning after the 2-3 years of spraying to remove dead material and allow new seeds to sprout (DE Forest Service)
  • Seed with native high marsh species after burning
Part 2: Recreating former low marsh

• Build new marsh platform (7 acres) using dredged sediments from the upper reaches of the Indian River (fall/winter 2020)
  • Pump dredged sediment to site up to target elevation
  • Hold sediment with containment materials (sediment berms, straw waddles)
  • Allow area to slowly drain out water and settle
  • Work with, not against, natural drainage areas
Part 2: Recreating submerged low marsh (continued)

- After several months dewatering and settling, seed area with native plants (spring 2021)
  - Aerial seeding combined with hand seeding
Monitoring Plan

- **Monitor** a set of parameters **for at least 3-5 years** after construction

<table>
<thead>
<tr>
<th>Goal is to create a marsh that...</th>
<th>Metrics</th>
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</thead>
</table>
| Has robust native low marsh vegetation | Vegetation percent cover  
| | Vegetation species composition  
| | Vegetation thickness  
| | Biomass |
| Has proper elevation and stability to sustain native low marsh vegetation | Marsh elevation  
| | Marsh accretion  
| | Bearing capacity |
| Is used by wildlife | Bird surveys |
| Can be adaptively managed in a timely manner and be used as a demonstration site | Photo points |
## Monitoring Plan

<table>
<thead>
<tr>
<th>Metric</th>
<th>Method</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>Vegetation percent cover</td>
<td>1x1m quadrats along transects</td>
<td>Once per year (summer)</td>
</tr>
<tr>
<td>Vegetation species composition</td>
<td>1x1m quadrats along transects</td>
<td>Once per year (summer)</td>
</tr>
<tr>
<td>Vegetation thickness</td>
<td>Horizontal veg obstruction board along transects</td>
<td>Once per year (summer)</td>
</tr>
<tr>
<td>Biomass</td>
<td>Cores at specific points</td>
<td>Once every 2 years (summer)</td>
</tr>
<tr>
<td>Bird surveys</td>
<td>Area search or point count surveys</td>
<td>Once per year (summer)</td>
</tr>
<tr>
<td>Bearing capacity</td>
<td>Slide hammer along transects</td>
<td>Once per year (summer)</td>
</tr>
<tr>
<td>Marsh elevation</td>
<td>RTK along transects</td>
<td>Once per year (summer or winter)</td>
</tr>
<tr>
<td>Marsh accretion</td>
<td>Feldspar marker horizons</td>
<td>Once per year (summer or winter)</td>
</tr>
<tr>
<td>Photo points</td>
<td>Photos from fixed markers</td>
<td>4 times per year</td>
</tr>
</tbody>
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Proposed Timeline 2019-2022

- **Fall 2019**: Spray Phragmites
- **2020**: Baseline Monitoring
- **Fall 2020**: Spray Phragmites, Wetland platform restoration part 1
- **Spring 2021**: Monitor sediment elevations
- **Fall 2021**: Spray Phragmites, Wetland platform restoration part 2
- **Early Spring 2022**: Burn dead Phragmites off, Seed restored high marsh
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