



Salt Marsh Restoration through Sediment Nourishment in Massachusetts

Prepared for:
Soil Matters 2026

Prepared by:
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EA Engineering,
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Technology, Inc., PBC

Background

- $\pm$ 90,000 acres of salt marsh in New England
- Exist along a narrow elevation and salinity gradient
- Dominated by graminoid halophytes
- May form behind barrier beaches, along tidal rivers, within sheltered embayments, or along the open coast

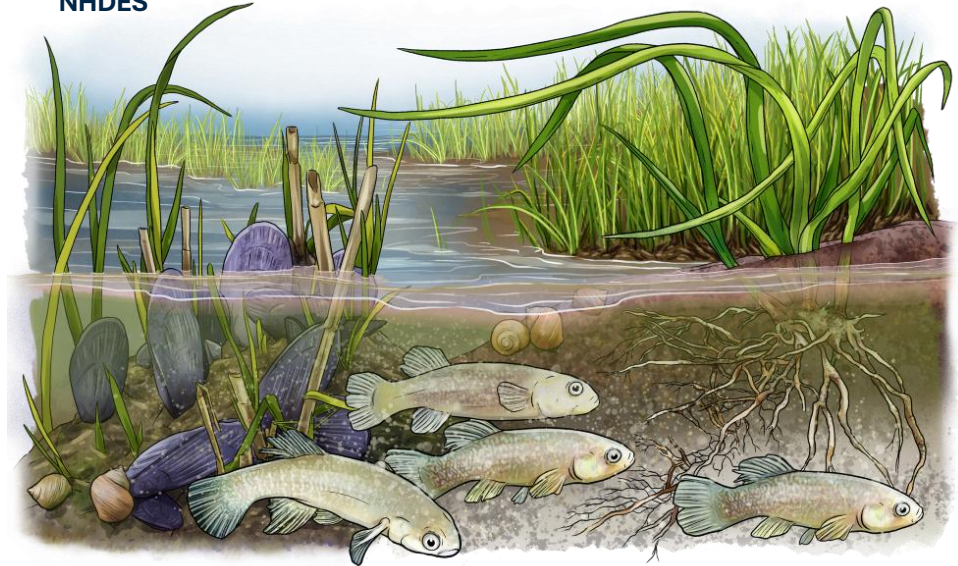


Background

- Healthy salt marshes provide wide range of functions and benefits to communities and the environment:
 - Attenuate floodwaters
 - Reduce coastal erosion
 - Support healthy fish and shellfish populations
 - Filter nutrients and improve water quality
 - Store carbon in plant matter
 - Provide habitat for wildlife
 - Contribute to natural aesthetics and historical community character
 - Support local economies



NHDES

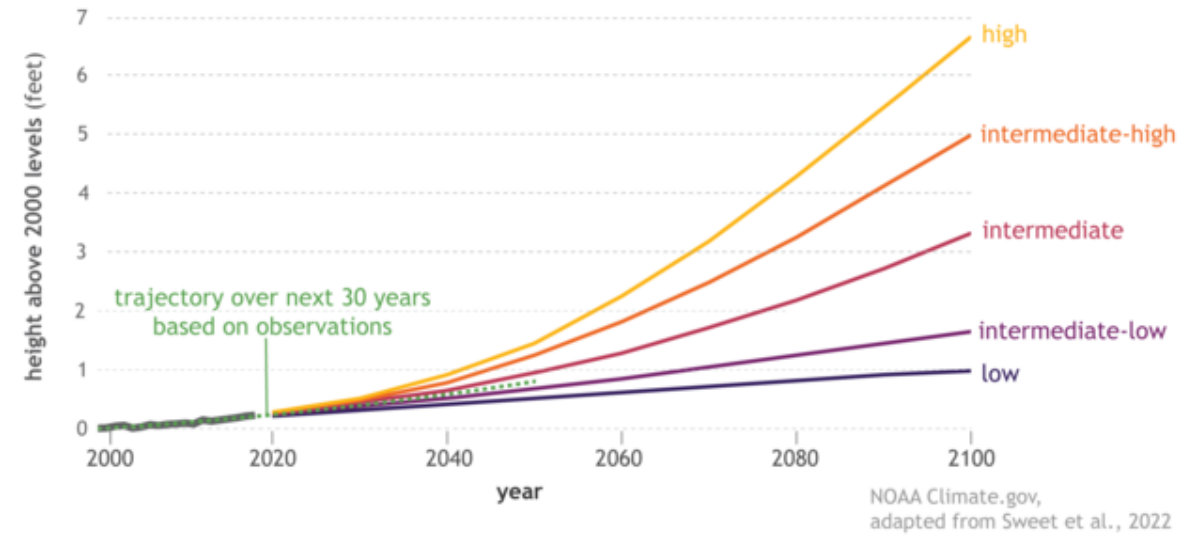


NHDES

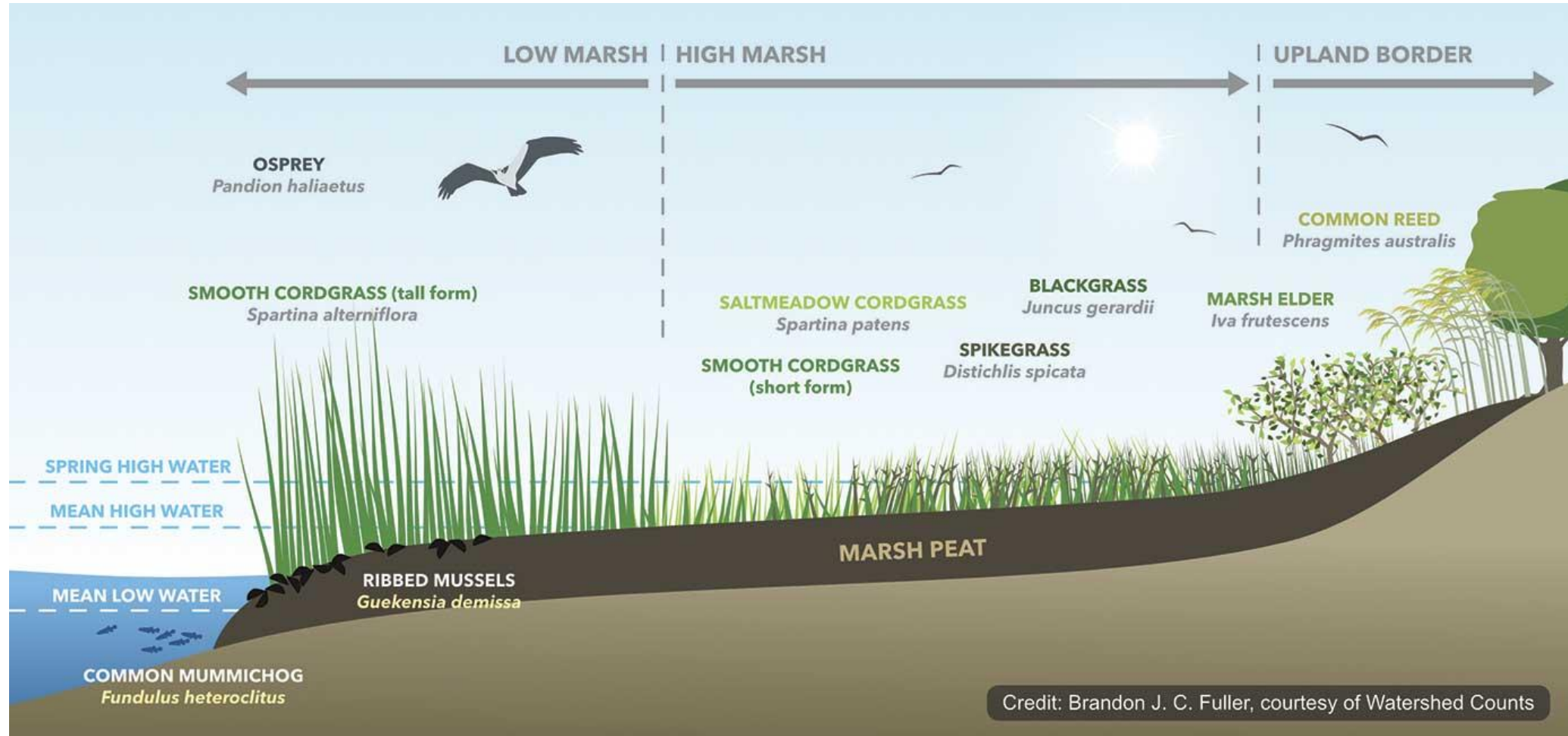
Background

- Salt marshes are threatened by several factors including:
 - Sea level rise
 - Tidal restrictions
 - Historical ditching
 - Invasive *Phragmites*
 - *Sesarma* crab herbivory
 - Eutrophication of coastal waters

Possible pathways for future sea level rise



Background



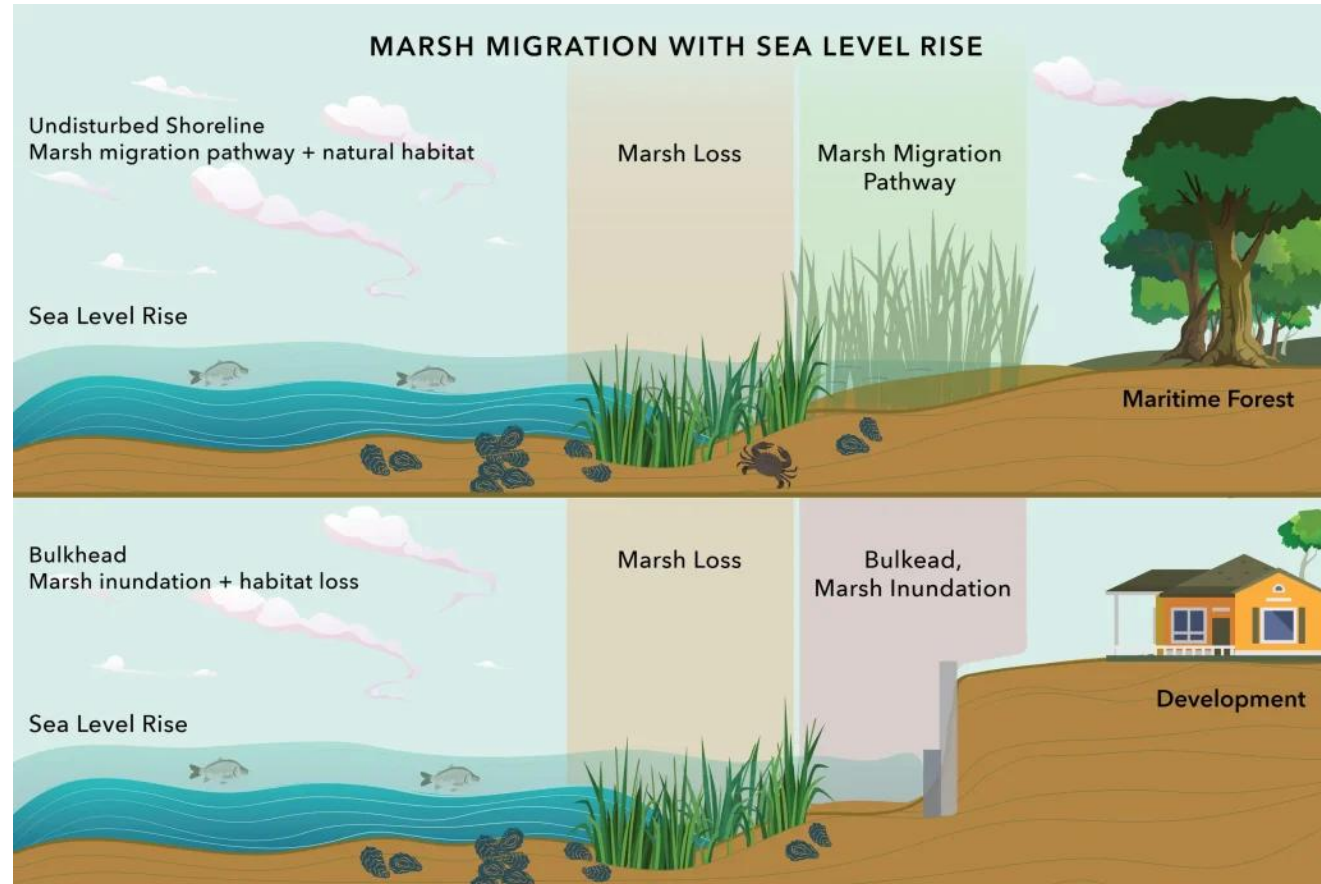
Source: https://www.rimonitoring.org/ws/wp-content/uploads/2018/04/Saltmarsh_Profile_WC.jpg

Background



Background

- Salt marshes can naturally migrate landward in response to sea level rise *if* landward conditions are suitable
- Steep coastal bluffs, human development, invasive species, and other factors limit marsh migration in many areas
- Maintaining salt marsh within its existing footprint is critical



Source: Georgia Conservancy

Background

- Salt marshes have historically kept pace with background rates of sea level rise through biomass accumulation and sediment deposition – collectively referred to as marsh accretion
- For the marsh to persist, these processes must occur at equal or greater rates than sea level rise



Source: UMass

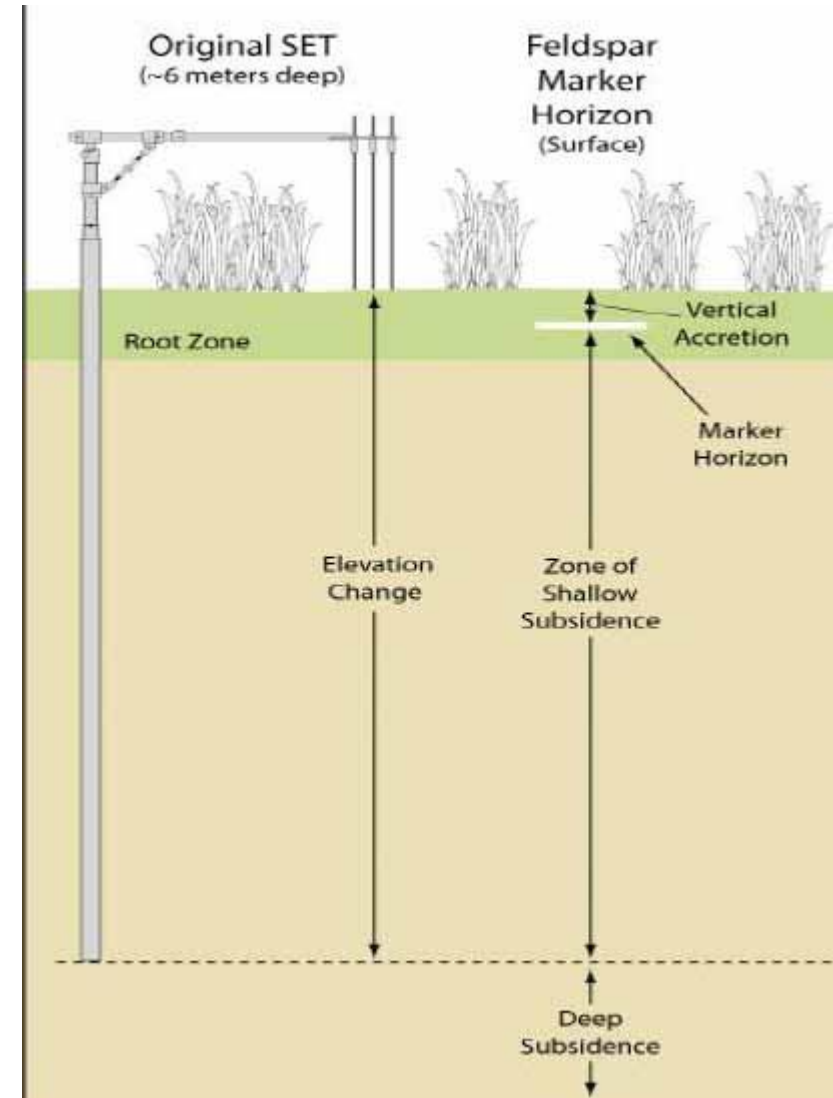
Background

- In northeastern salt marshes, sediment deposition is a smaller (but important) component of overall marsh accretion compared to biomass accumulation
- Narrow coastal plain, less erodible landscape, many dams compared to SE US



Background

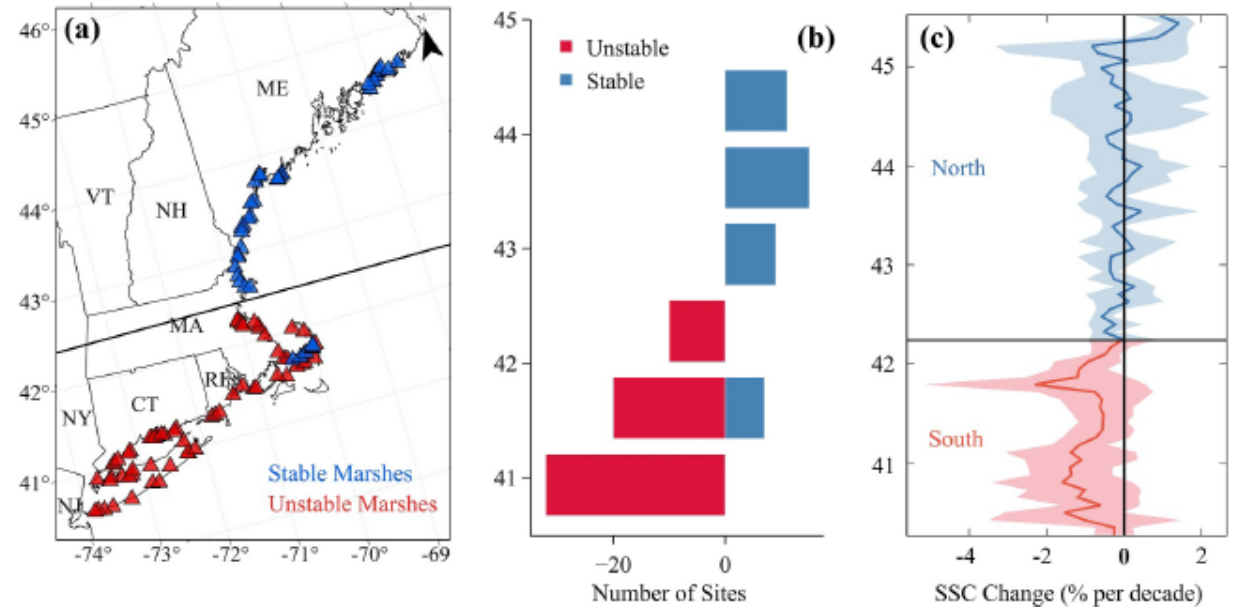
- Marsh accretion is measured on a scale of mm/year
- Requires precise, long-term monitoring to establish trends
- Synthesis of published sources across southern New England indicate a range of accretion rates between 0.54 to 7.5 mm/year, with most values between 1.5 and 3 mm/year



Source: NPS

Background

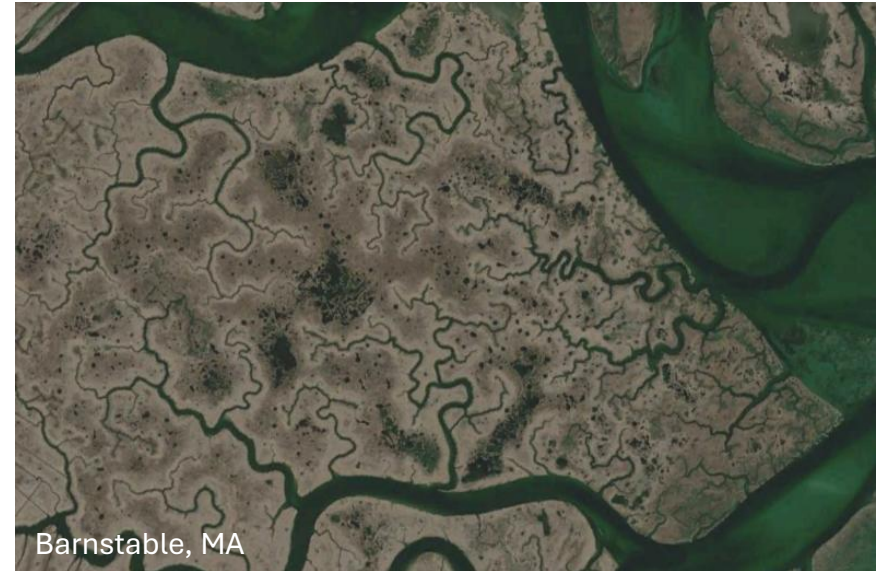
- Suspended sediment concentrations (SSC) of < 20 mg/L combined with RSLR rate of ≥ 5 mm/year have been cited as tipping point beyond which marsh loss is likely (Carey et al 2015)
- Average SSC at Cape Cod National Seashore = 2.9 mg/L (Smith et al. 2017)
- Average SSC at Prudence Island, RI = 9.5 mg/L (Raposa et al. 2016)



Source: Teng et al 2025

Background

- Commonwealth of MA has developed RSLR scenarios
- Optimistic “intermediate” emissions scenario results in 13.5 mm/yr of RSLR (2008-2100)
- “High” emissions scenario results in 25.5 mm/year of RSLR (2008-2100)
- Observed rate from 2008-2026 is approx. 6.6 mm/yr
- Thus, many marshes are unable to keep pace with SLR and are slowly being lost



Looking Ahead

- Salt marsh restoration is a relatively new field
- Several techniques have been developed and continue to be refined
 - Ditch remediation
 - Runneling
 - Marsh habitat mounds
 - **Sediment nourishment**



Wellfleet Bay Wildlife Sanctuary, Wellfleet, MA



Looking Ahead

- Marsh nourishment can take a variety of forms:
 - Sand motor
 - Passive sediment augmentation (PSA)
 - Direct placement
 - Thin-layer placement (TLP)
 - Thicker placement
- Key challenges include cost, logistics, and regulatory hurdles



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**Wetlands Program Guidelines on Massachusetts Wetlands Protection Act and
Water Quality Certification Provisions Regarding
Management and Beneficial Reuse of Dredged and Fill Material for Salt Marsh
Restoration: Thin Layer Placement
December 3, 2024**

Effective Date: December 3, 2024

DWW Guidelines #: 2024-2

Program Applicability: MassDEP Boston and MassDEP Regional Wetlands Program staff, municipal conservation commissions, state and federal resource agencies, project proponents, consultants, and others.

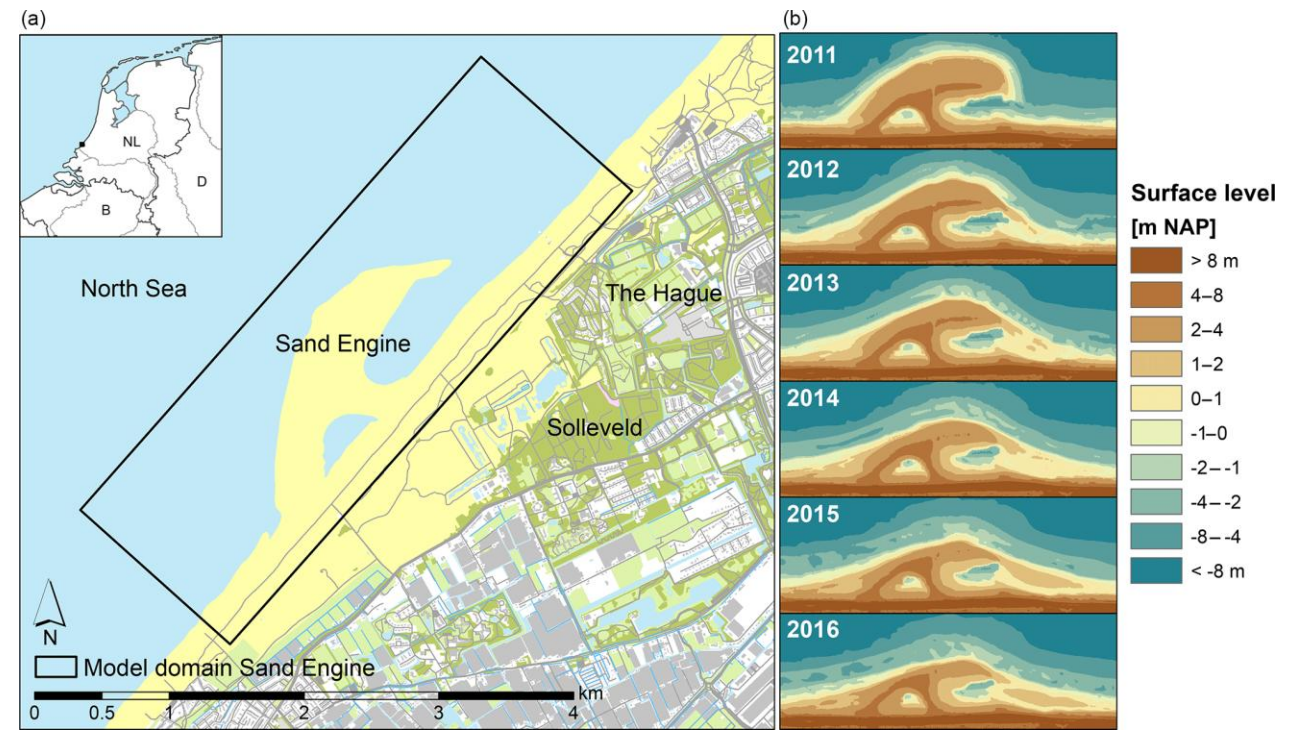
Supersedes Guidance: None

Approved by: Tim Jones, Acting Director, Division of Wetlands and Waterways

Purpose: MassDEP has developed this Guidance to improve the efficiency of permitting and implementation of projects to restore the elevation of degraded or subsided areas of Salt

Sand Motor

- Typically used for beach nourishment, but could be applied to salt marshes
- Typically involves very large volumes of material
- Allows tide to naturally distribute sediment
- Understanding sediment transport dynamics is key to predicting success



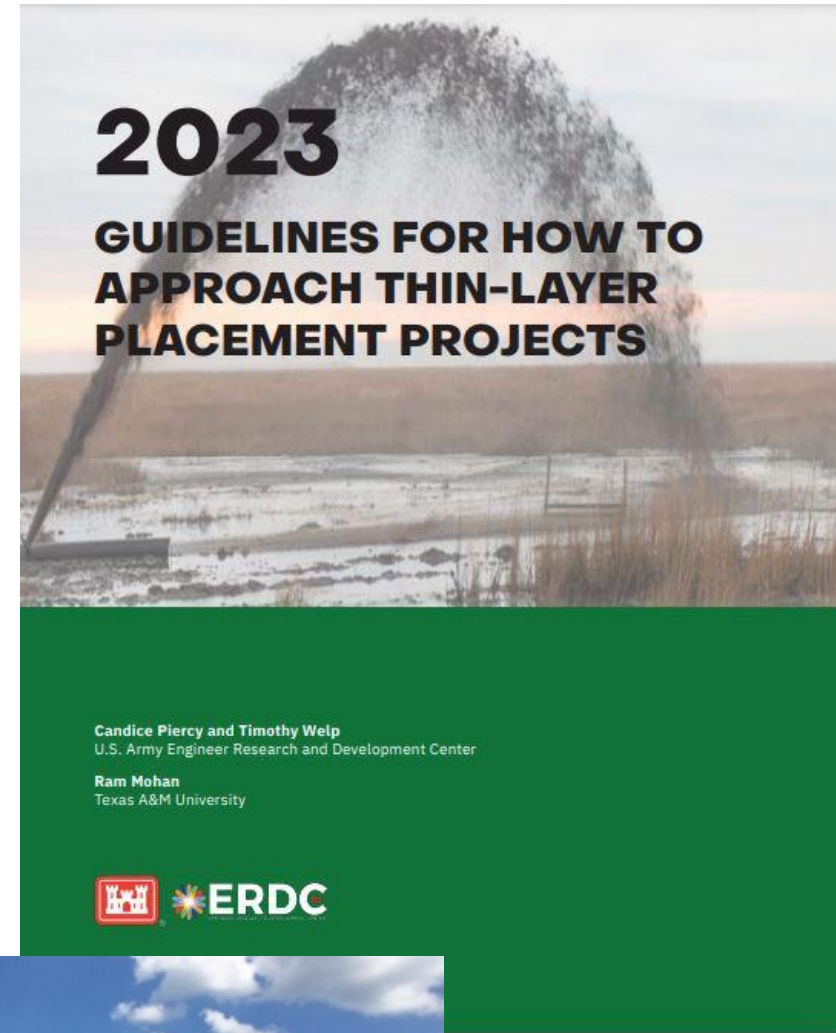
Passive Sediment Augmentation

- Initial feasibility study recently completed by MA CZM
- Only suitable for fine-grained sediments
- Material is released into the water column and distributed by tidal currents
- More study is needed to understand feasibility



Direct Placement

- TLP typically means up to 12” thickness, or less in some contexts
- Material can be applied via aerial spray, pumped in a slurry, or placed mechanically
- Thicker applications provide greater resilience against SLR, but entail increased short-term impacts and may require planting to re-establish vegetative structure



Marsh Sediment Nourishment in Massachusetts

- Past projects completed in multiple states – RI, DE, NC, SC, others
- Regulatory pathway created by MassDEP in December 2024
- Multiple projects current in planning, design, and permitting phase
- Currently envisioned projects range from small pilots to multi-acre placements



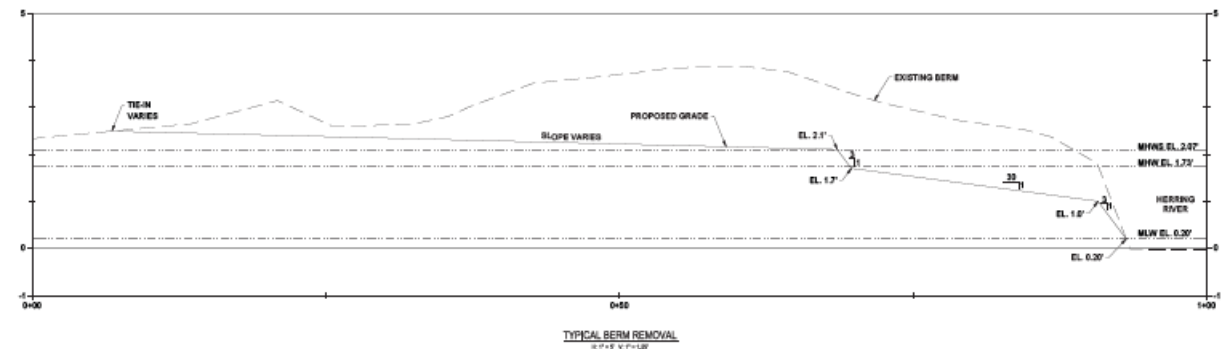
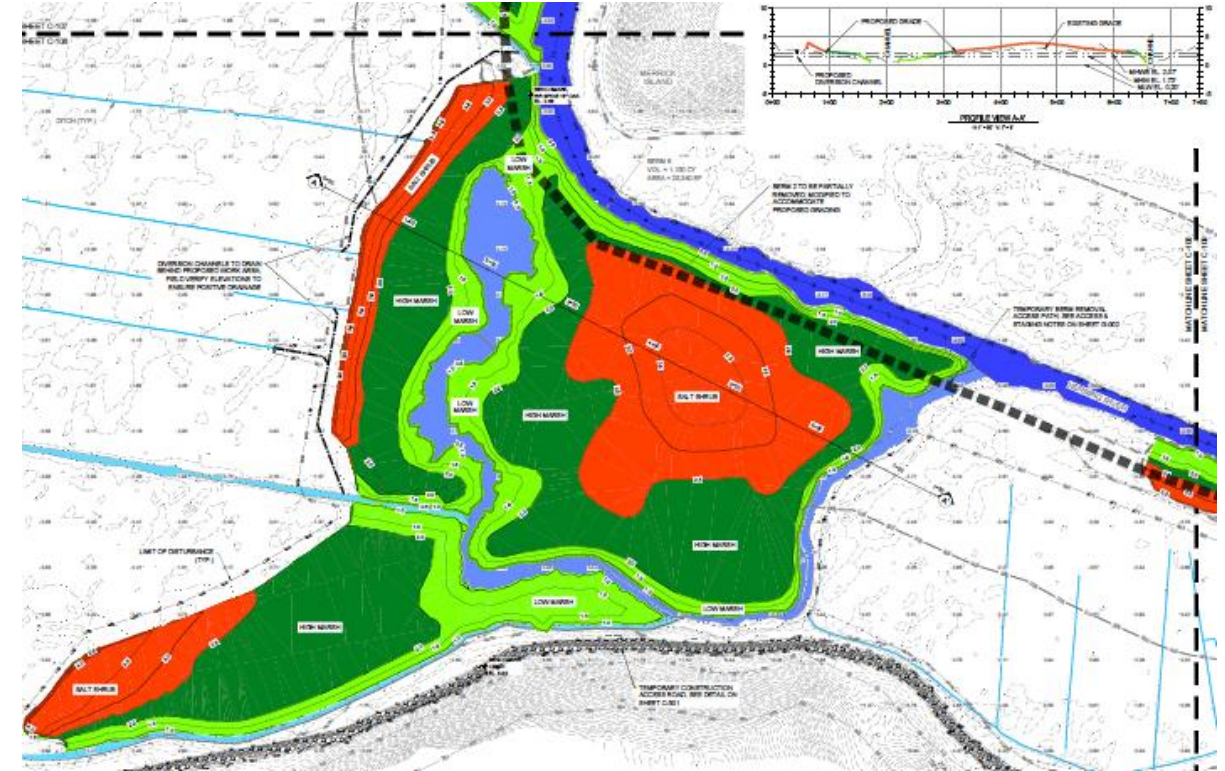
Wellfleet Bay Wildlife Sanctuary

- Mass Audubon, DER, USFWS, EA, and other partners
- Two pilot project areas currently identified, in the process of expanding to larger footprint
- Sediment source identification and characterization is key consideration
- Goal is to re-establish *Spartina patens*-dominated high marsh and set a marsh-building trajectory



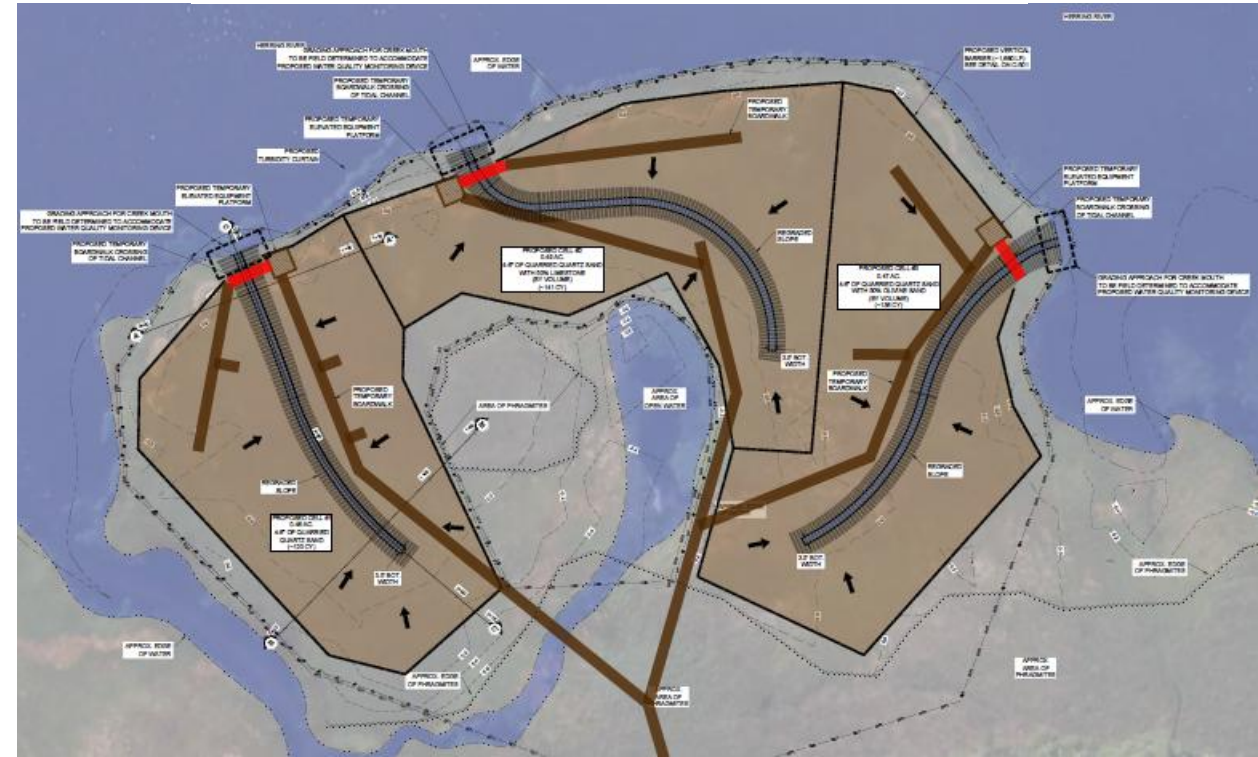
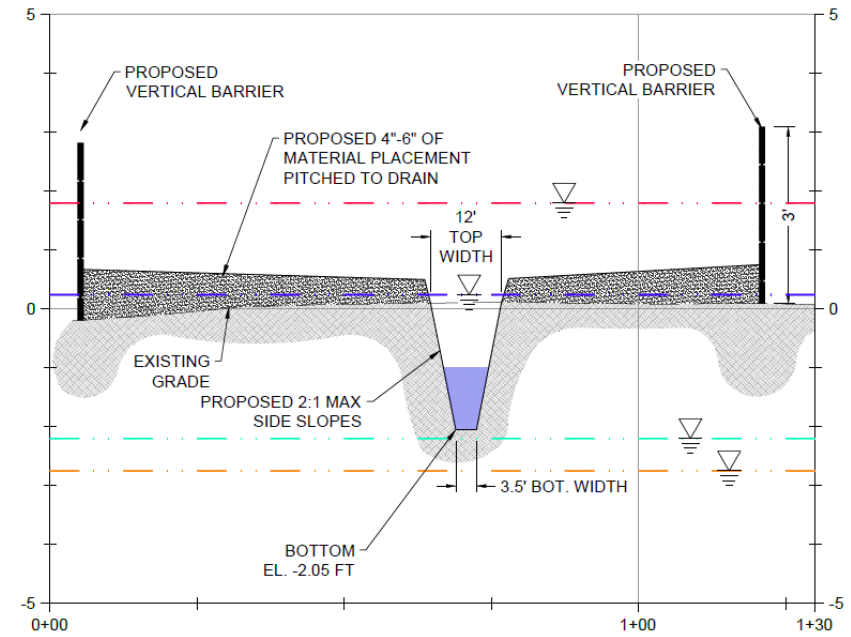
Herring River/Duck Harbor

- NPS, Ducks Unlimited, Friends of Herring River, EA, and other partners
- Goal is to remove berms along portion of channelized river and beneficially re-use sediment to enhance marsh prior to tidal restoration
- Mechanical placement allows for elevation gradients and vegetative communities that will shift over time



Herring River/Mill Creek

- NPS, USGS, Center for Coastal Studies, Friends of Herring River, EA, SumCo, and other partners
- Goal is to study how marsh nourishment using alkaline minerals can support carbon capture
- Study area is very low-lying marsh that is likely to be lost following tidal restoration in the absence of nourishment





Thank you!

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