REVIEW OF RECENT EXPERIENCE WITH THIN LAYER PLACEMENT AND FUTURE GUIDANCE


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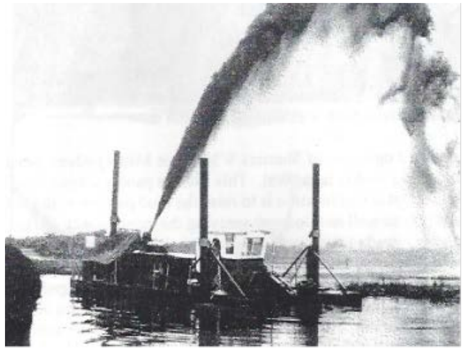
What is “thin layer placement (TLP)?”

Terms associated with TLP within available literature	
Term	Source
Marsh nourishment	LA CPRA, 2018
Artificial sediment enhancement	La Peyre et al., 2009
Thin layer placement	USACE, others
Thin layer deposition	Ford et al., 1999
Sediment subsidy	Mendelssohn and Kuhn, 2003
Sediment slurry application/addition/amendment	Schrift et al., 2008
Sediment enrichment	Slocum et al., 2005
Thin layer sediment renourishment	Croft et al., 2008
Thin layer disposal	USACE, others

(Modified after Berkowitz et. al.)

TLP Documented History



Source: Cahoon and Cowan 1988

- Louisiana oil and gas exploration started dredging access canals for submersible drilling barges in late 1930s with draglines and cutterheads – spoil banks
- Late 1960s early 1970s spoil banks determined enviro-bad
- High pressure spray placement first applied southern Louisiana 1979*

USFWS Blackwater National Wildlife Refuge

- In 2002, a thin layer of fine-grained material was sprayed onto 2.5 acre sites - total project cost: $300,000
- Modified hydroseeding technique attempted by adding seeds to the spray
- Post placement monitoring indicated revegetation occurred immediately within the refuge and outside of the treatment area as well
- Larger follow up project conducted initiated in 2016 with 26,000 yd^3 to restore 40 acres at a total cost of approximately $1.1 M
- Ongoing monitoring, report in preparation

Source: Bob Blama

Source: Dredge America

Pepper Creek (2013) Dagsboro, DE

- Targeted to restore 25 acre area of tidal marsh
- Sediment hydraulically dredged and pumped to a barge for aerial application
- Approximately 35,000 yd^3 of dredged material was sprayed on the marsh
- Lift thicknesses ranging from 1 to 6 inches
- Marsh is showing signs of positive response

Source: Bart Wilson

Prime Hook (2014-2016) Milton, DE

- 8,000 acre degraded tidal marsh and barrier beach located within a formerly impounded wetland system
- The site's salt marsh habitat has been adversely affected by 30 years of impounded freshwater drowning marsh plants
- Project was completed in September 2016 by dredging 21 miles of channels
- Sediments from the channel dredging were applied directly from the dredge into open water areas in thin layers to promote marsh vegetation growth
- *Spartina patens* and *Spartina alterniflora* plugs (in addition to seeding) were planted in exposed mudflats after channel restoration was completed
- Restored mudflats were covered with new vegetation after one growing season in many areas where there was shallow open water prior to restoration

Avalon, NJ (2014-2016)

- Pilot Project constructed Dec 2014 with fine-grained material
- Filled pannes and pools to restore marsh (5,000 yd^3 on 6 acres) with minimal coir log containment
- Documented lessons learned and informed NJ permits for construction of next larger TLP project
- Larger project continued from Nov. 15 2015 to Feb 2016 (45,000 yd^3 on 35 acres)
- Still in long term monitoring, but initial vegetation response is somewhat positive
- Lessons learned with regards to elevation control and more lessons learned regarding containment

Source: Jackie Jahn

John H. Chafee National Wildlife Refuge (2016-2017) Narragansett, RI

- 24,000 yd^3 of reclaimed material on 14 acres with a construction cost of $1.7M
- Placement of 3,000 bags of clam and oyster shells to protect against marsh edge erosion and to hold sediment and water on the marsh platform
- No more than 6 inch placement
- Shallow water levels made dredging and equipment difficult
- Custom made machinery and in-field equipment modifications
- Additional spreading was accomplished via amphibious excavator
- Initial positive vegetation response, monitoring continues

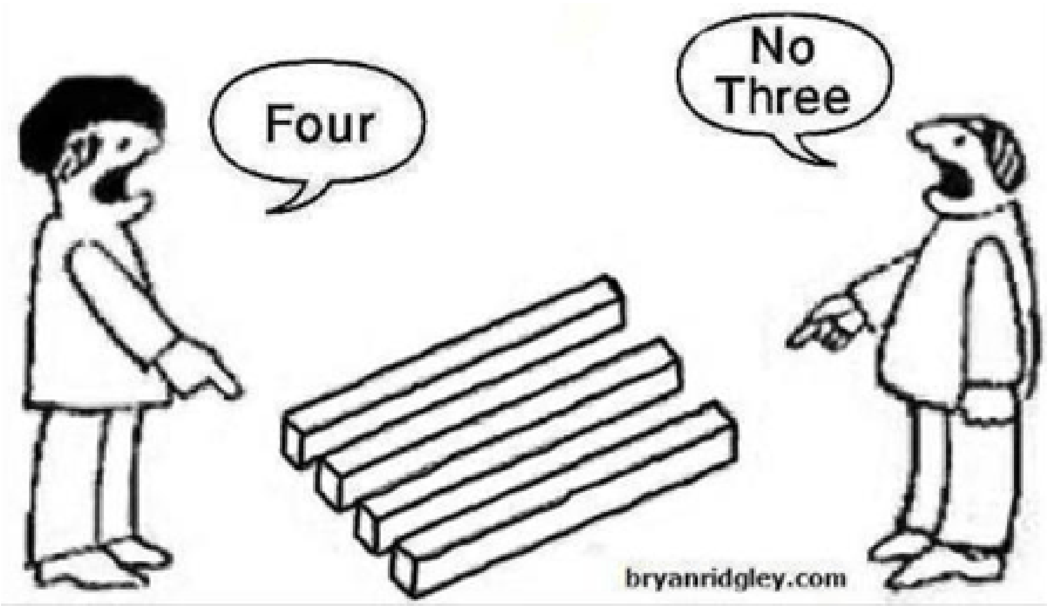
Source: Greg Thompson/USFWS

Source: https://tlp.el.erdc.dren.mil

Source: The Nature Conservancy

General Lessons Learned - Ideal Application

- TLP is best for projects where:
  - Elevation has been lost considerably (from subsidence and/or sea level rise)
  - Natural sediment inputs alone are insufficient to nourish the marsh over time
- TLP should be a “wetland restoration or maintenance” project, and not designed as a dredged material disposal project
- TLP requires the blending of the different perspectives and objectives of wetland owners and dredging contractor.



General Lessons Learned

- Strong partnership between stakeholders
  - Early engagement and "buy in" is critical
- Approach permitting agencies early on
  - Build a true partnership for success
- Include habitat diversity as part of restoration concept
- Incorporate adaptive management from project beginning, during construction, and long term monitoring
- Allow for natural processes to facilitate long term recovery

Avalon NJ

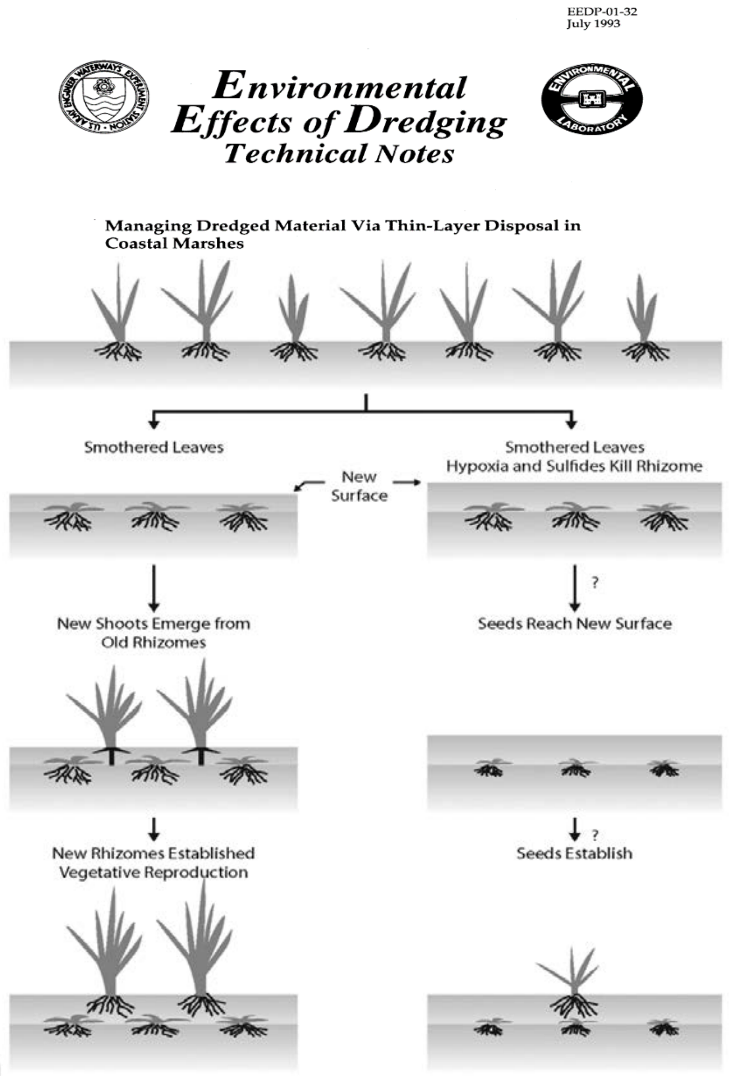
General Lessons Learned - Ideal Application

- TLP in the upper tidal range generally provides the best marsh resilience
  - Should incorporate SLR and consolidation/subsidence
- Adequate characterization of the dredged material and placement site are vital to project success
  - Bathymetry, topography, water levels, tides
  - Atterberg properties, moisture/solids content, grain size, texture, contamination, etc.
  - Use numerical models, verified by real-world data
  - Do not be afraid to revise assumptions
- Direct placement still has some challenges
  - Damage to marsh during construction
  - Material containment questions

Source: Gary Ray 2007

General Lessons Learned - Design

- Protect key features (edges, channels/creeks)
- Material/Elevation Balance:
  - Bulking noted: two to four times in situ
  - Shrinkage: 10% to 40% in first 10-15 days
- Vegetation responds well to TLP generally in the range of 6 to 12 inches
- Recovery times vary, but is generally on the order of 3-5 years
- Natural recovery is possible, particularly for thin (less than 12 inches) placement
  - Natural recolonization is preferred
  - Planting should therefore be a secondary (contingency) criterion



General Lessons Learned - Construction

- Do not overengineer or over-prescribe
- Use experienced engineering and construction teams to avoid costly field changes and/or delays
- Prequalify contractors - evaluate for demonstrated experience on similar projects
- Provide the contractor with the ability to innovate in the field
- Adaptive management can be key to success

Source: NJDOT Fortescue NJ

Source: Jackie Jahn Avalon, NJ

Source: DNREC – Pepper Creek, DE

TLP Use as ONE of the Tools for Coastal Restoration with Dredging

- Been a recent resurgence of TLP projects, but implementers have been hampered by limited guidance "starting from scratch"
- Dredging Operations and Environmental Research (DOER) program currently producing guidance for designing and constructing TLP projects

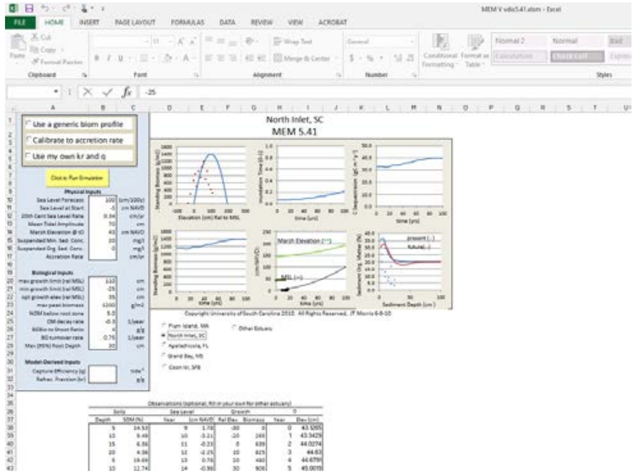
DOER

Source: Mohan et al 2016 – Lessons Learned from Three Decades of Coastal Restoration Projects

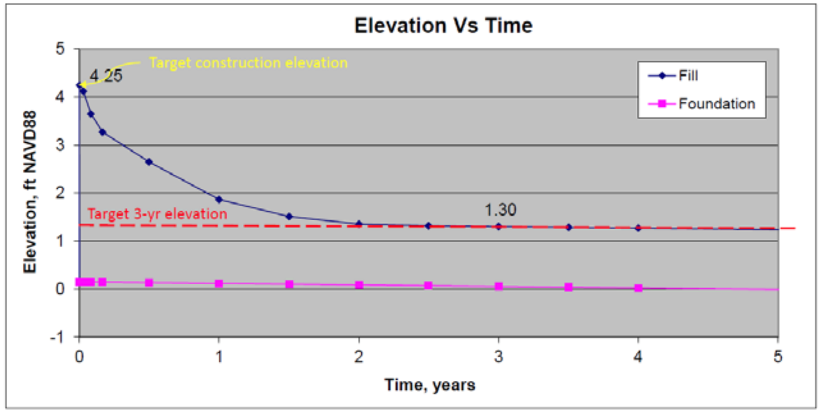
Guidance for Designing and Constructing of TLP Projects

Objectives:

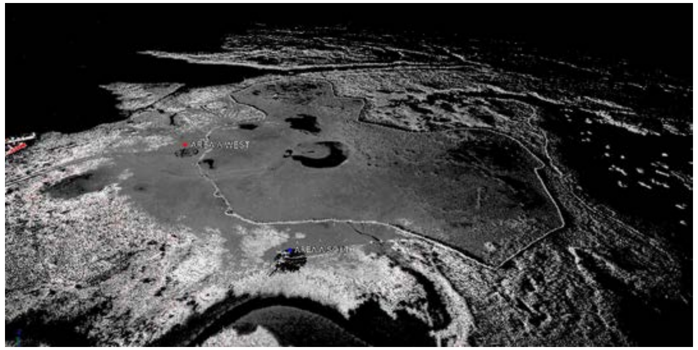
- Distill knowledge & information from past current, and developing TLP projects, and evolving pertinent R&D activities
- Synthesize into guidance document designed for use by both USACE and stakeholders to optimize engineering and construction of TLP projects.



Marsh Equilibrium Model (MEM)



PSDDF - Primary Consolidation, Secondary Compression, And Desiccation Of Dredged Fill



Just Finished a Meeting Last Week:

Goal: To explore the **technical aspects** of thin layer placement (TLP) of sediment for **wetland restoration and coastal resiliency**, specifically related to the **engineering** and **construction factors**.

Source: Bob Blama