



U.S. ARMY

Consolidation of Dredged Material Placed on Marshes at SMIL

- Susan Bailey
 - ERDC-EL, Environmental Engineering Branch
- Seven Mile Island Innovation Lab – Work Group Meeting
- 16 March 2021

Approved for public release.

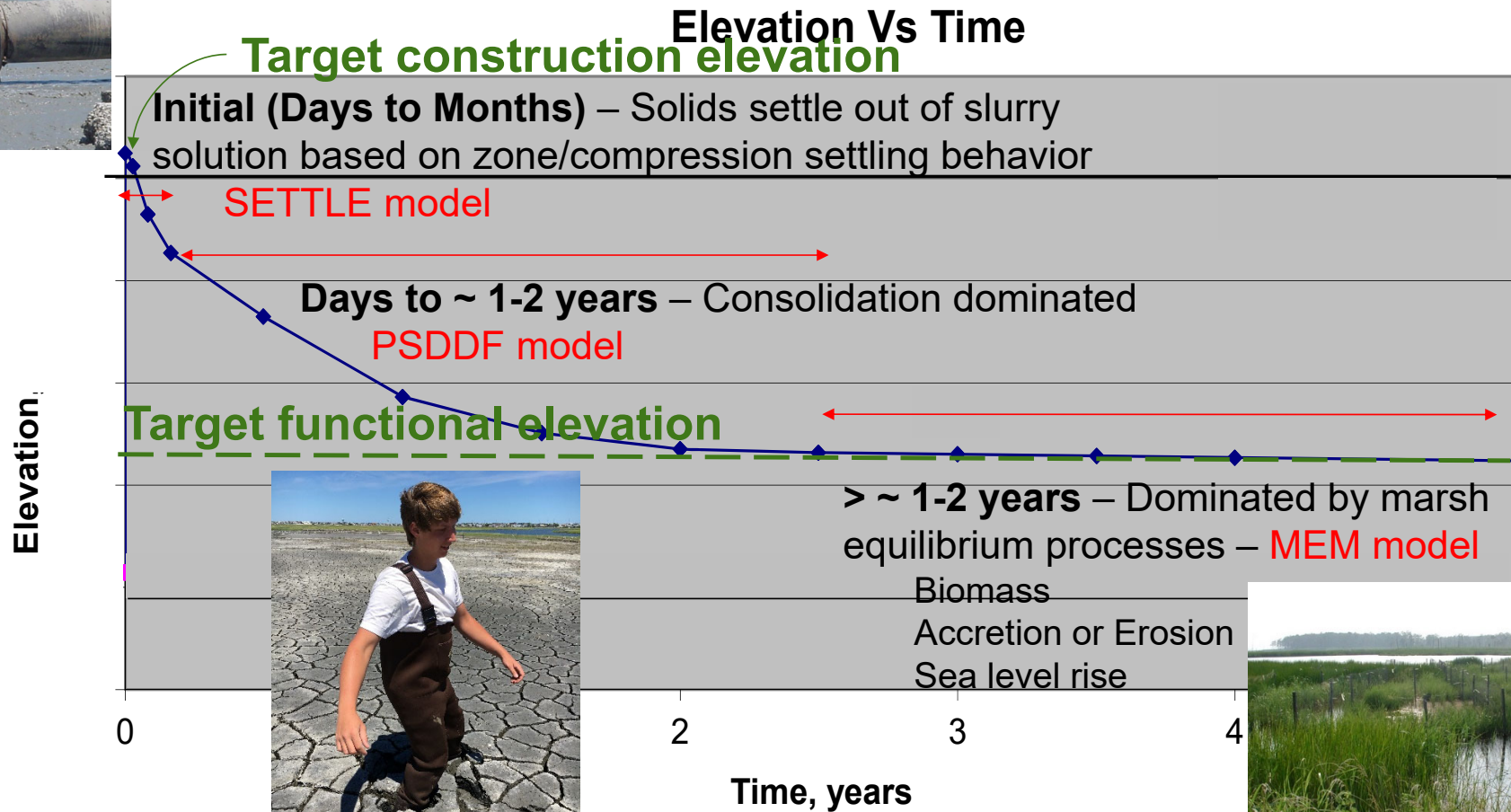


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DISCOVER | DEVELOP | DELIVER

Dominant Processes that Control Marsh Elevation over Time



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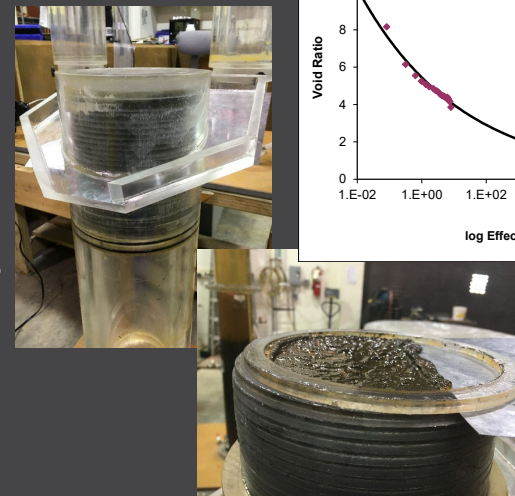
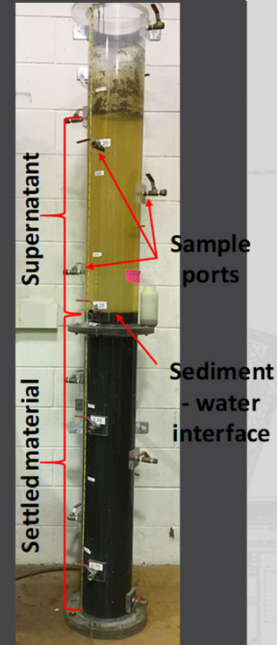
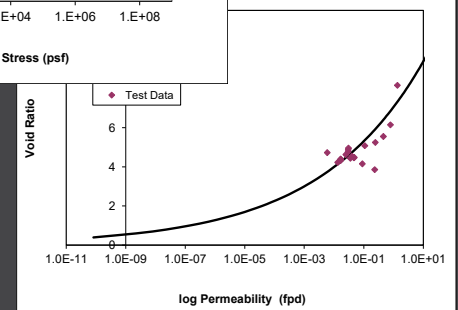
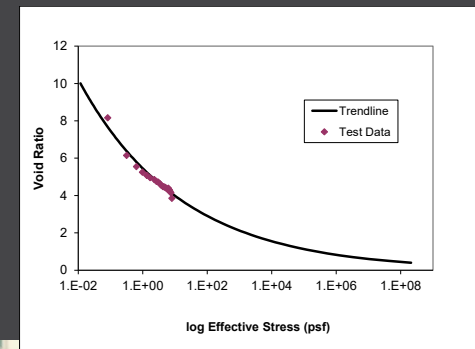
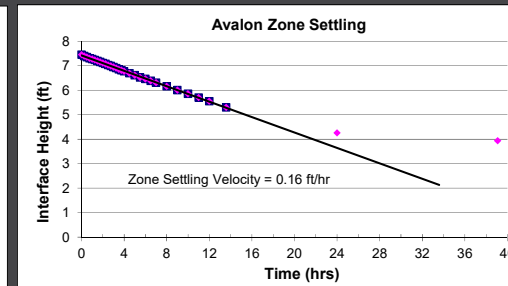
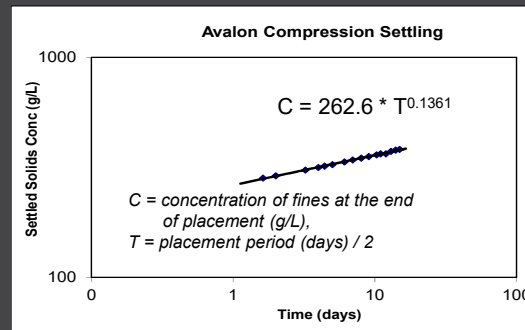
Avalon – Laboratory Analysis & Modeling

■ SETTLE model

- Uses data from laboratory column settling test
- Predict bulking ($V_{\text{final}} / V_{\text{in situ}}$)
- End of placement condition
- Void ratio
- Thickness

■ PSDDF model

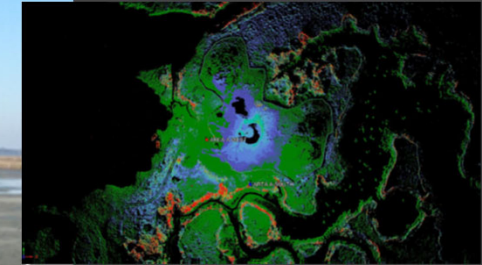
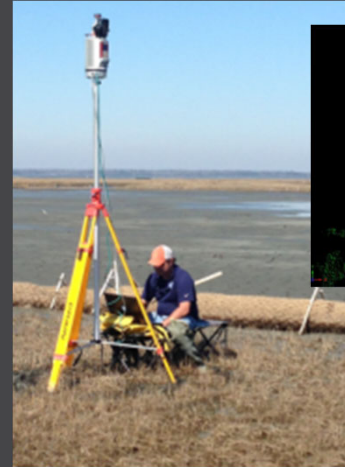
- **P** primary consolidation, **S** secondary compression and **D** desiccation of **D**redged **F**ill
- Models longer term consolidation
- Uses data from laboratory consolidation tests
 - ▶ Self weight (DM only)
 - ▶ Standard oedometer (DM & Foundation)



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Avalon – Field Evaluation

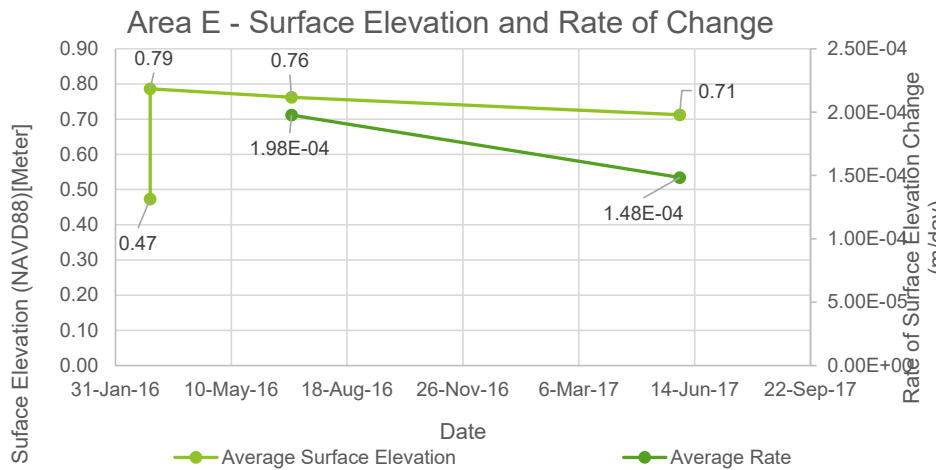
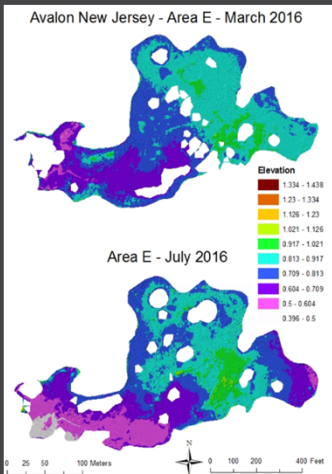
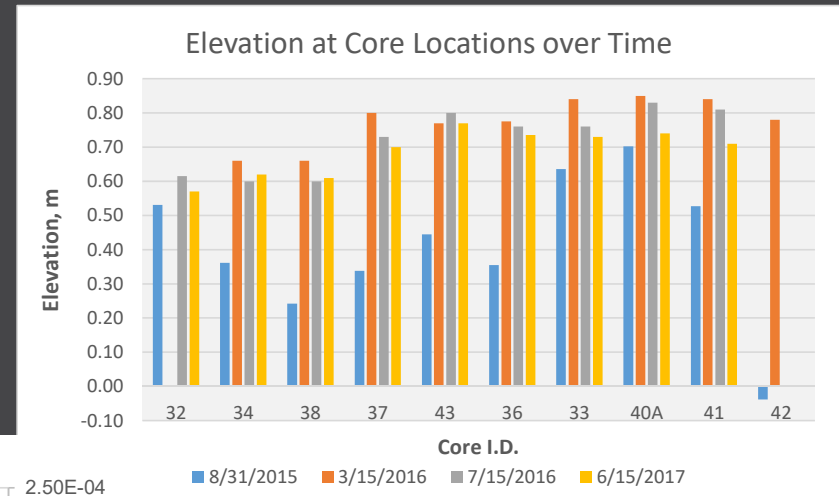
- Surveys
 - March 2016; June 2016; June 2017
- Piezometers – 4 sets in Area E
 - Data loggers deployed Jun - Sep 2016 & 2017
- Core samples : Jun 2016, Jun 2017
 - DM thickness
 - DM composition (grain size, organic content)
 - Void ratio vs. depth
- CPT
 - Aug 2019



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Avalon – Preliminary consolidation results

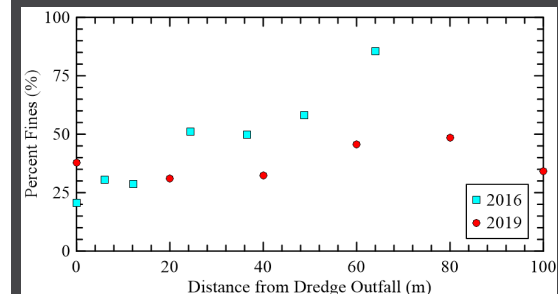
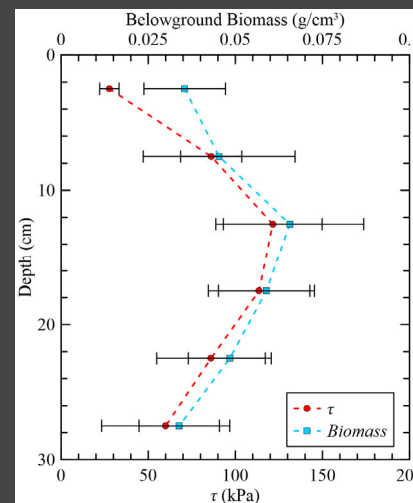
- Compiling extensive data collection
- Would like another round of elevation data for comparison
- Need to adjust model runs and document results



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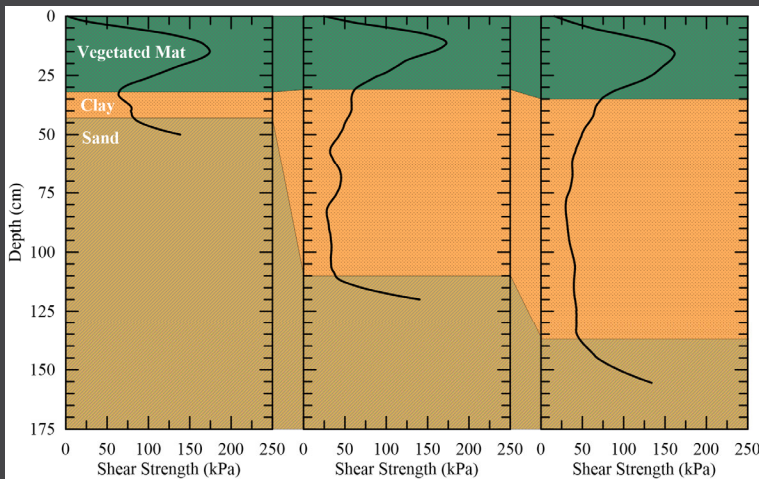
Cone Penetrometer Testing

- CPT characterizes stratigraphy w/ depth
 - Tip resistance, sleeve friction, pore water pressure, soil moisture, resistivity, temperature
 - Correlation with biomass
- CPT conducted at Avalon – Area E, Aug 2019
- PLOS ONE article
 - <https://doi.org/10.1371/journal.pone.0251420>
- CPT provided rapid, continuous strength profiles that correlate well with belowground biomass
- Nourished site weaker than reference site, but vegetation establishing
- Grain size analysis showed redistribution of grain size gradients

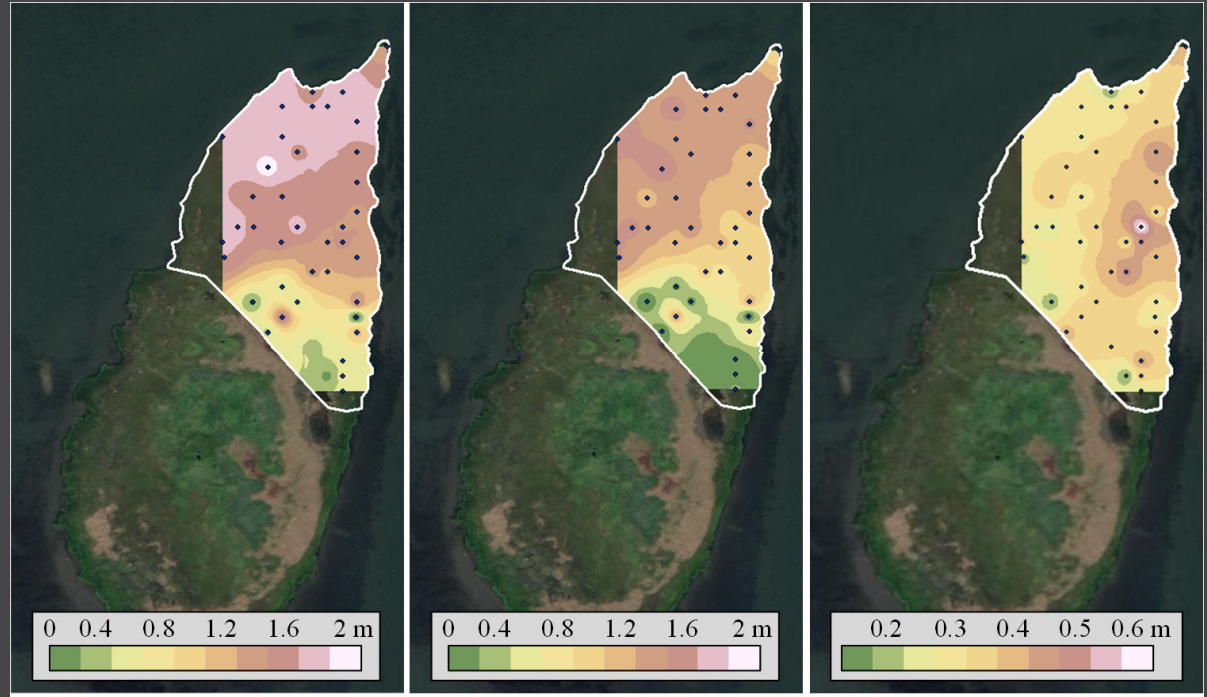


Cone Penetrometer Testing

• CPT at Sturgeon Island – Mar 2020



Example of strength profiles moving 100-m north if the island center with interpolated layers



Depth to sand layer.
-incompressible, freely
draining boundary layer

Thickness of
compressible clay
layer

Thickness of
vegetated mat
layer

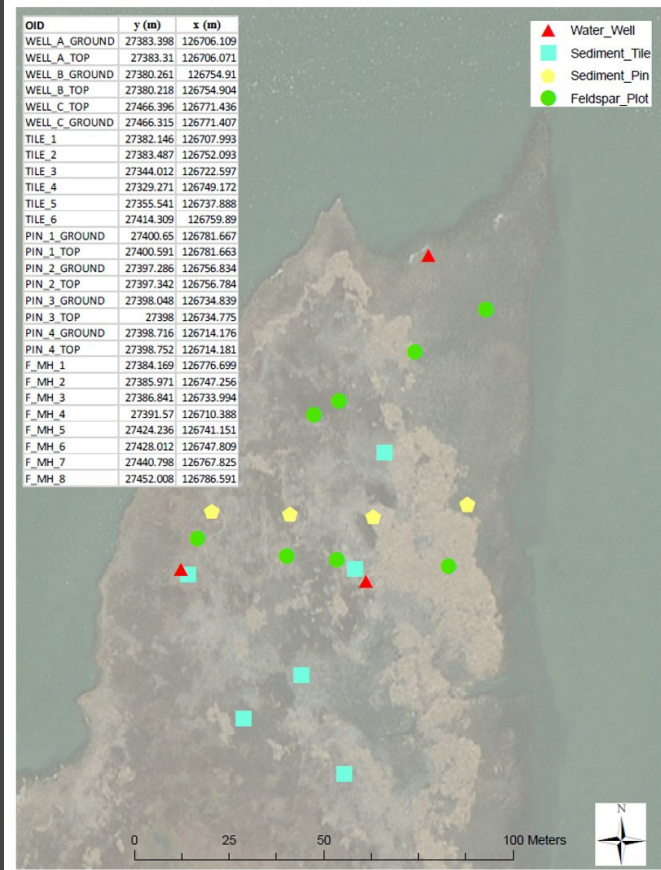
Sturgeon Island – Data Collection and Laboratory Analysis of Consolidation

- Pre-construction field data collection
- Analysis of field data sets

Field	Analysis
Core Samples – Channel	Self-weight consolidation, density , grain size, TOC, Atterberg limits
Core Samples – Placement Site	Standard oedometer , density , grain size , TOC, Atterberg limits
CPT	Tip resistance, sleeve friction, pore pressure, shear strength, moisture content, specific gravity
VRS-RTK Survey	Preconstruction elevation
Vegetation/Features (VRS-RTK)	Map surface features
Sediment Pins, Etc.	Elevation, sediment thickness
Wells	Water level



Sturgeon Island ERDC Deployed Instruments



- Geospatial database
- Documentation

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