Sediment Sorting During Coastal Restoration Projects:
Implications for Resource Management, Environmental Impacts, and Multiple Use Conflicts

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RSM RCX (USACE)

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Jarrell Smith, Anthony Priestas, Katie Brutsche, Duncan Bryant

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*USACE supporting funds provided by SAD/SAJ, RSM Program

The Project

2 Year Study Initiated in October 2017

Objective:

Quantify changes in sediment characteristics (i.e., grain size, sorting) and the degree, timing, and variability of sediment sorting during dredging and placement operations to determine the extent of potential sediment coarsening to better inform sediment compatibility analyses and subsequent management of sediment resources.

Process:

- Literature review, conceptual model
- Proof of concept, develop field sampling plan
- Field sampling
- Laboratory analyses
- Analyze data, write up reports

So What? Who Cares?

THE NEW YORKER

ANNALS OF GEOLOGY MAY 29, 2017 ISSUE

THE WORLD IS RUNNING OUT OF SAND

It's one of our most widely used natural resources, but it's scarcer than you think.

By David Owen

The Economist explains

Why there is a shortage of sand

It may be plentiful, but so is the demand for it

Machine Crushes Beer Bottles Into Sand to Save New Zealand Beaches - Geek.com

Drink beer, save the environment. That's the rallying cry of DB Breweries, a New Zealand-based company helping to combat the global sand shortage. The firm, as...

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South Florida Sand Wars

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The New York Times

Where Sand Is Gold, the Reserves Are Running Dry

Miami Beach has run out of sand. Now what?

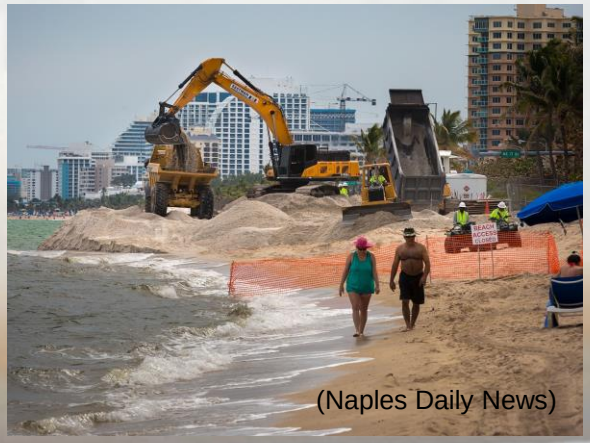
For years the sea has been eating away at the shore, and the city has spent millions of dollars pumping up sand from the seafloor to replace it, only to have it wash away again.

THEVERGE.COM

VeroNews.com

YOUR LOCAL NEWS SOURCE FOR INDIAN RIVER COUNTY

County to Miami-Dade: Keep your hands off our sand



(Naples Daily News)

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As of:
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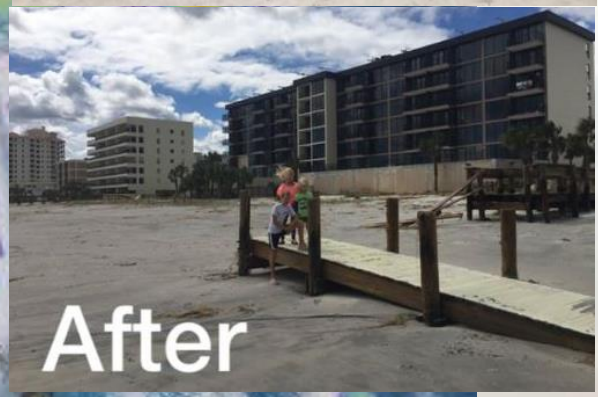
Hurricanes and Coastal Erosion



Hurricane Matthew:

- Overwashed 177 miles of beach dunes in 4 states
- 11% in Florida, 30% in GA, 58% in SC, and 9% in NC (USGS)

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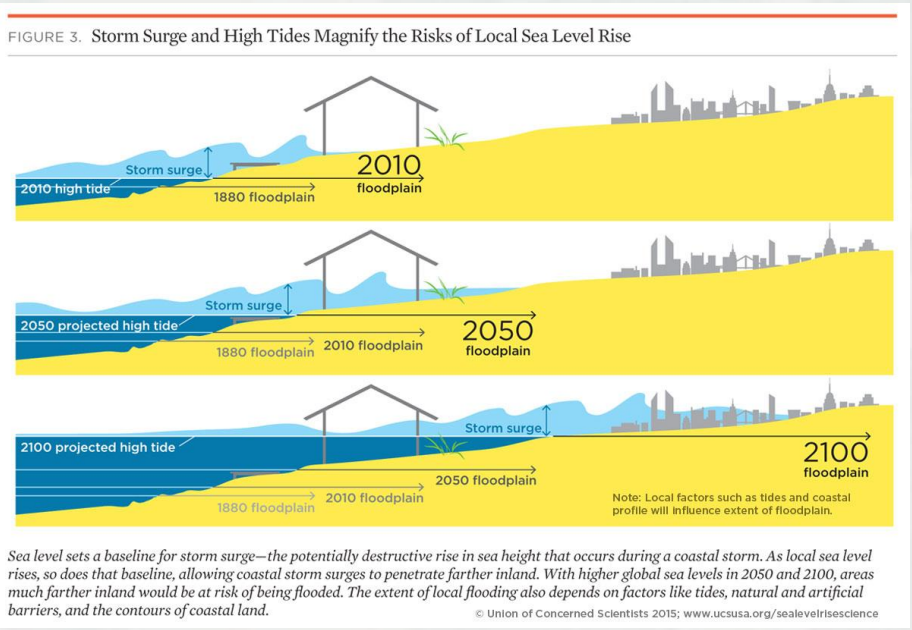
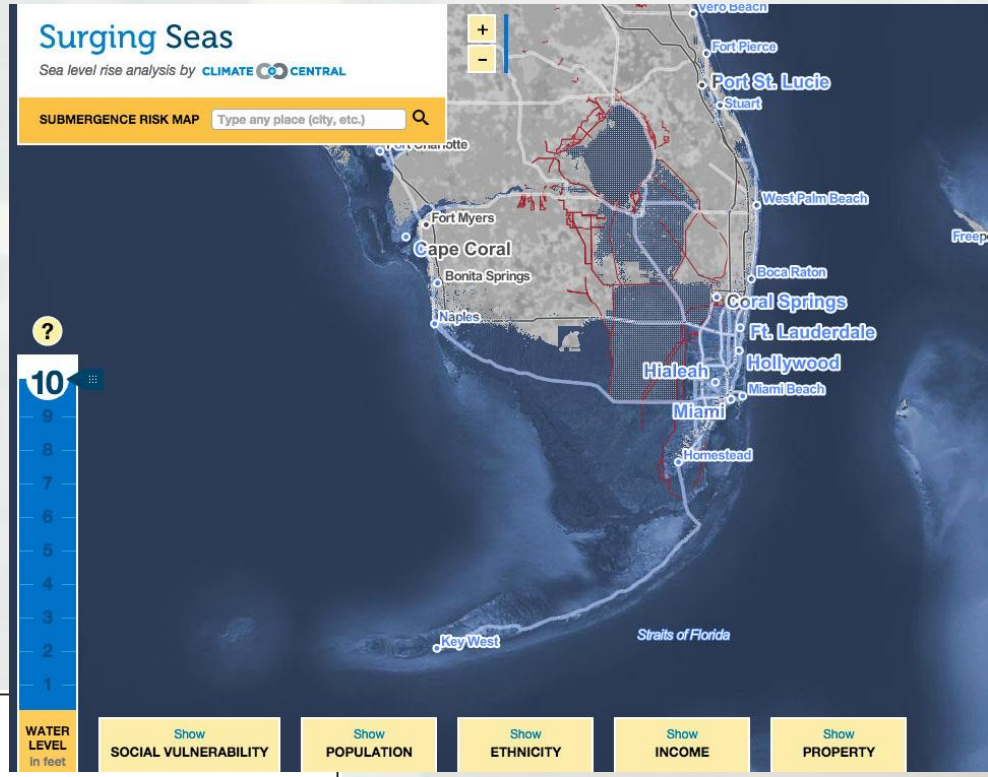
Sea Level Rise





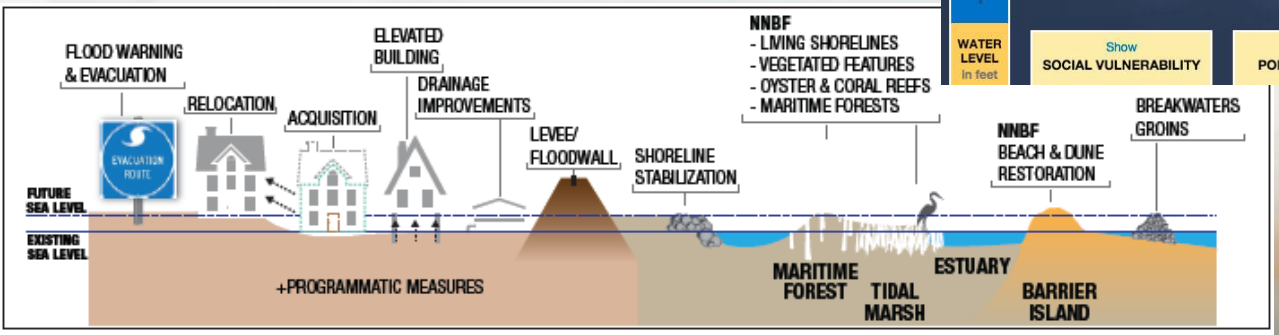


Figure II-1. Combinations of Adaptable Measures That May Be Used to Improve Redundancy, Robustness, and Resilience Associated with Coastal Flood Risk Management (not to scale)

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Florida's "Sand Rule"

FAC 62B-41.007(2)(j)(k)

- Material for beach nourishment similar in grain size distribution to native or existing beach to protect environmental function and general character of the coastal system
- Fine sediment must be <5% (pass through #230 US Standard Sieve)
- Use of navigation channels dredged material (O&M):
  - <10% fines for beach placement
  - <20% fines for nearshore placement

*Rule assumes conservative assumption of 0% fines loss during dredging and placement process.

Other states with comparable regulations: ME, RI, MA, CT, NY, MD, VA, NC, SC.

BOEM Interests

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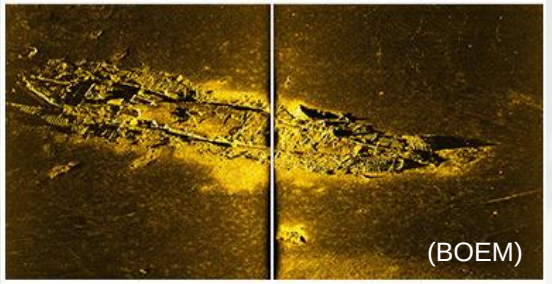
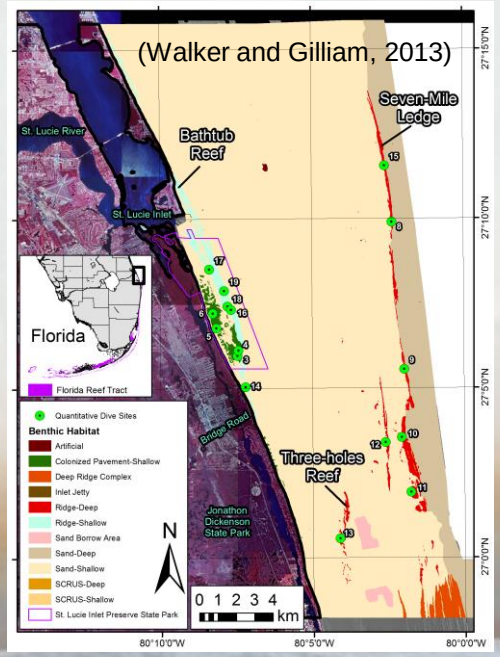
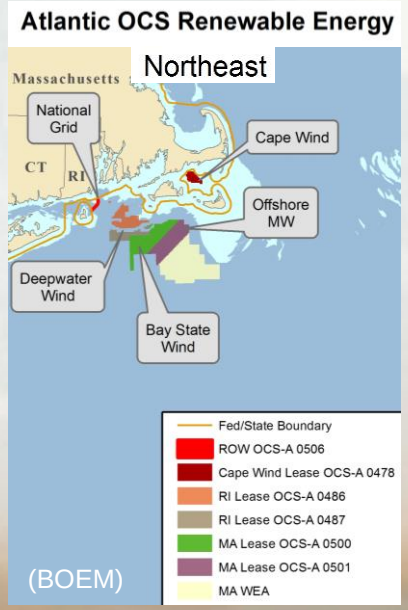
Encourages science-based resource management policies to support resource stewardship responsibilities

Potential increase in borrow area inventory

Potentially reduce environmental impacts and multiple use conflicts







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USACE Interests

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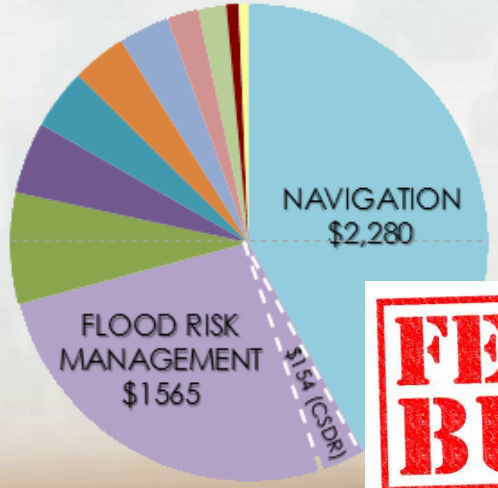
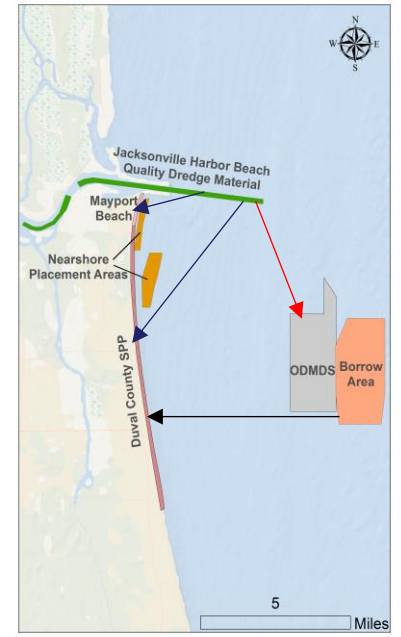
Save taxpayer money by reducing project costs

- Distance from borrow source to project location is huge project cost
- Scarcity : Cost

Reduce potential impacts to offshore and nearshore resources





FEDERAL BUDGET

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RSM Interests

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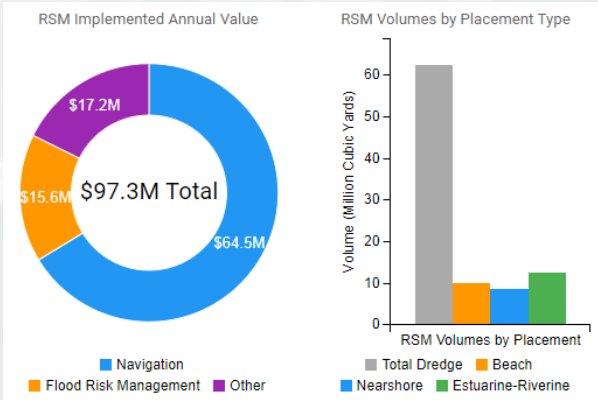
Promotes **R**egional **S**ediment **M**anagement principles

- Supports concept of sediment as a resource and beneficial reuse of sediments
- Support cross-business line approaches to achieve long-term environmental, economic solutions
- Enhances relationships with stakeholders and partners
- Advancing applied science and technology



South Atlantic Division Optimization Pilot

- Identified nearly $100 million in annual value for implemented RSM projects in division

Project Type	Implemented RSM Annual Value	Identified RSM Opportunity Annual Value
Navigation	$64.5 Million	$4.2 Million
Flood Risk Management	$15.6 Million	$5 Million
Other	$17.2 Million	$7.2 Million
Total	$97.3 Million	$16.4 Million

Minor changes to current state regulations could have HUGE implications on available sediment sources and project costs!

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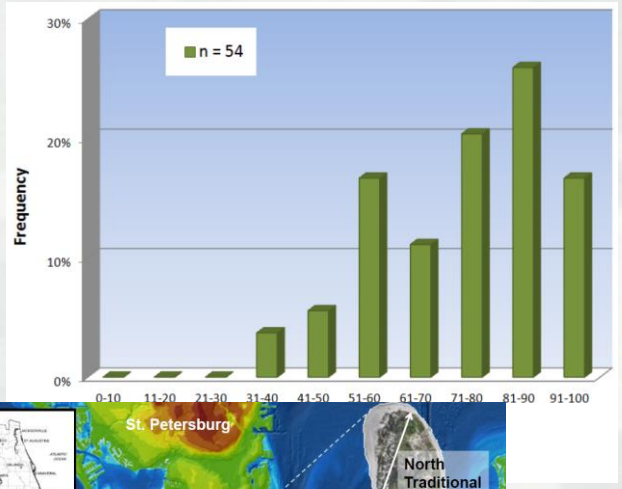
Recent USACE Studies

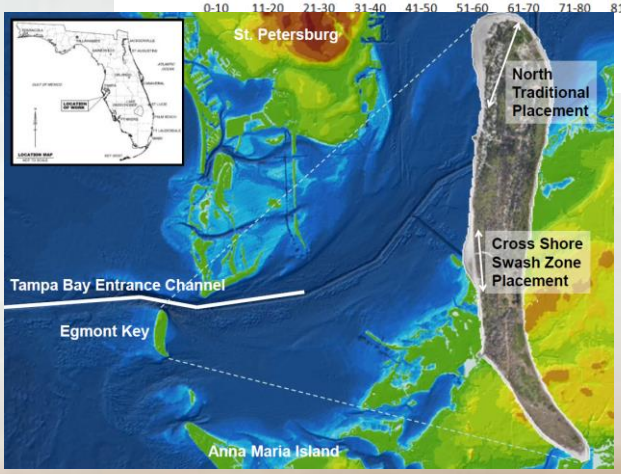
Ousley and Coor (2015)*

- FY14 Hopper and Pipeline beach projects in Jacksonville District (n=54)
- Mean loss: 74%
- Most frequent: 81-90% loss



Coor and Ousley (submitted)*

- Historic projects (1982 – 2014) in Florida (n=72) including FY14 projects
- Mean loss: 76%
- Most frequent: 81-90% loss
- 91% greater than 50% loss



Egmont Key – Maglio et al.

- Placement of high silt (20% fines) from Tampa Harbor

*Analyses based on comparison of in situ borrow area sediment samples and post construction beach sediment samples.

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Sediment Sorting During Coastal Restoration Projects

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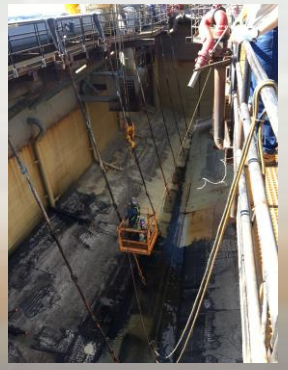
Current study:

- Specific focus on defining changes in sediment characteristics at loss points in process
- Laboratory experiments to develop hopper sampling methodology and define statistically significant sampling requirements
- Coordination with dredging industry
- 2 planned sampling events aboard dredge plants



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Tasks

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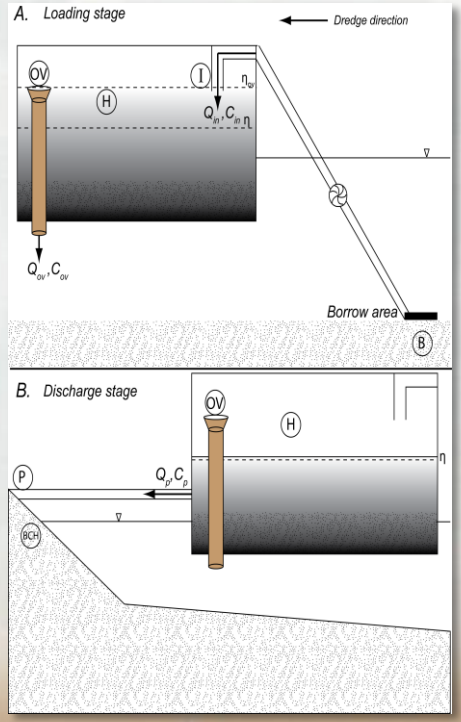
Task 1: Literature Review, Conceptual Model; Completed March 2017

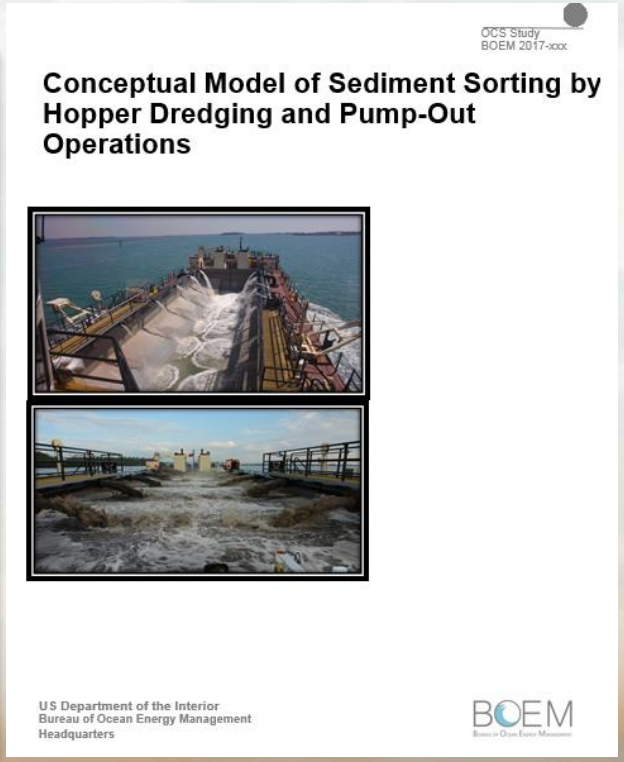
Task 2: Proof of Concept, Develop Field Sampling Plan

Task 3: Field Sampling

Task 4: Laboratory Analyses

Task 5: Draft Report, Final Report





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Loss Points and Sampling Strategy

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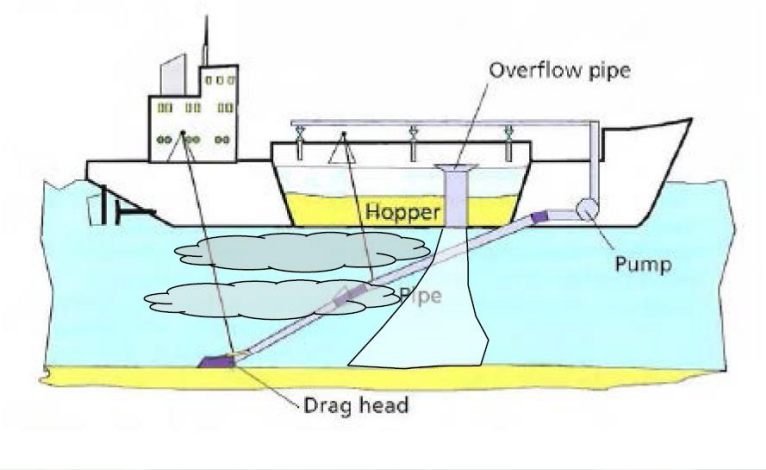
Loss Points:

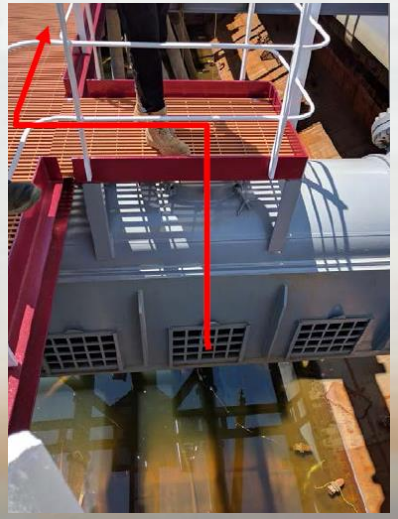
- Drag head
- Overflow
- Pump-Out
- Placement

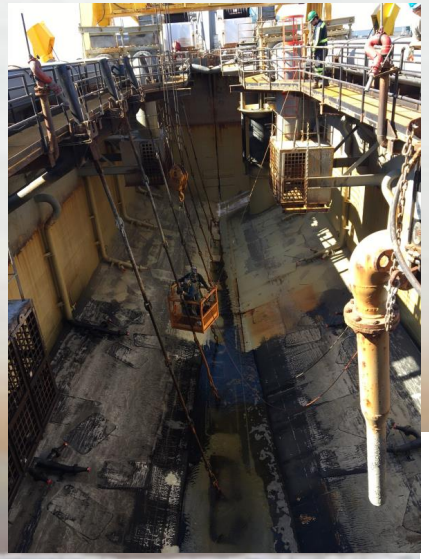


Sampling Locations:

- Borrow Area*
- Inflow
- ~~Weir~~ Hopper
- Beach (coring)

*Geotechnical data for borrow area from USACE Mobile District (MsCIP - Ship Island Restoration)





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Industry Engagement

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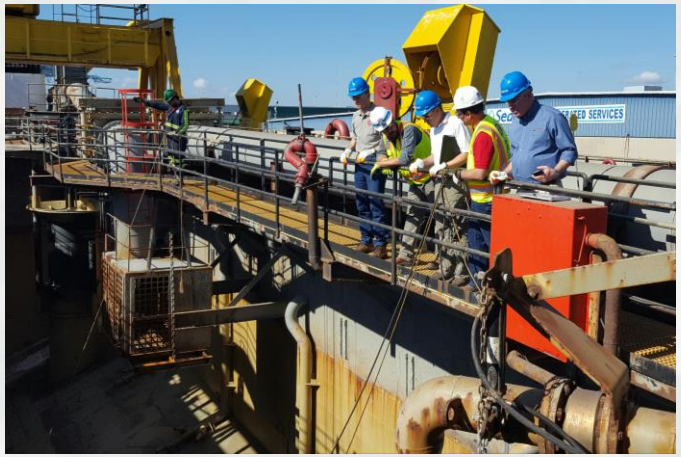
Industry Day: January 2017

- Meeting to solicit industry input to develop safe sampling methods aboard industry dredges
- Industry supported study objectives
- Did not support weir sampling but did support hopper sampling

Industry Partner: Great Lakes Dredge and Dock

- Coordination, dredge plant site visits
- Engineers and safety personnel active in method development
- Sampling aboard GLDD dredge plant at Ship Island Restoration Project



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Proof of Concept

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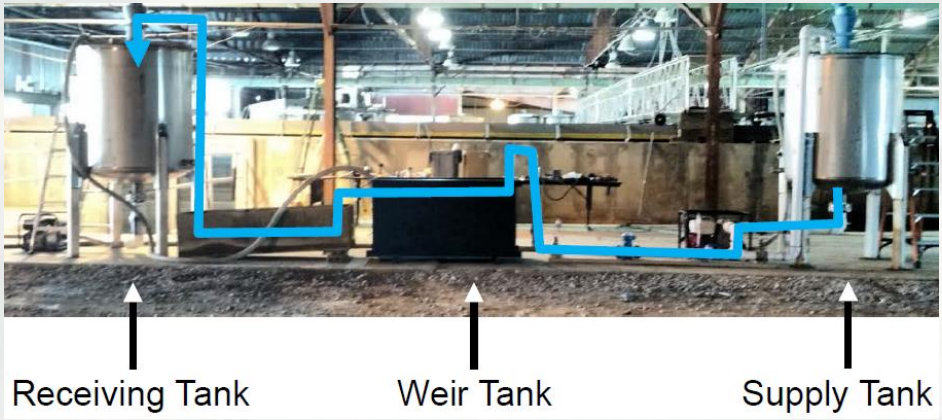
Laboratory tasks to evaluate:

- Weir sampling methods
- Composite sampling to achieve statistical significance, define potential error
- Hopper sampling



Preliminary Implications:

- Composite overflow sampling equal to that measured from receiving tank
- Composite sampling can serve as cost effective method to determine mean sediment concentrations and % fines.




*Test cases completed in July. Details of laboratory tasks to be presented in Oct. 2017 (ASBPA).

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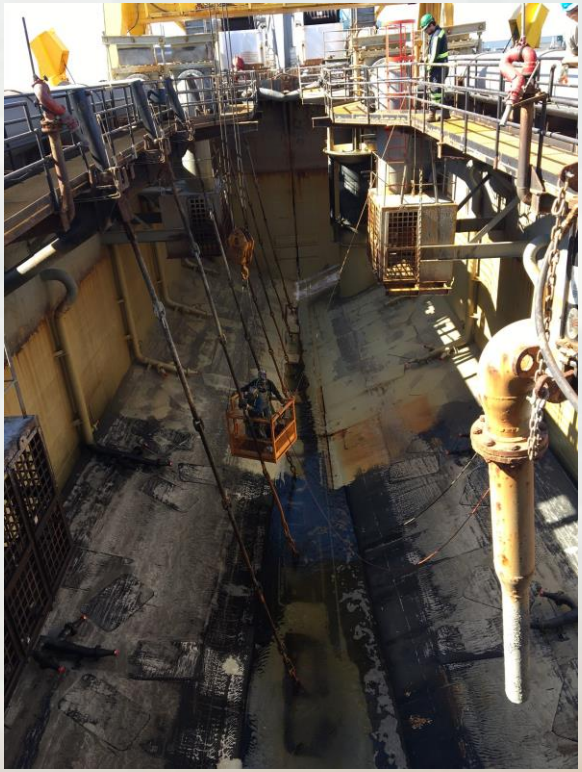
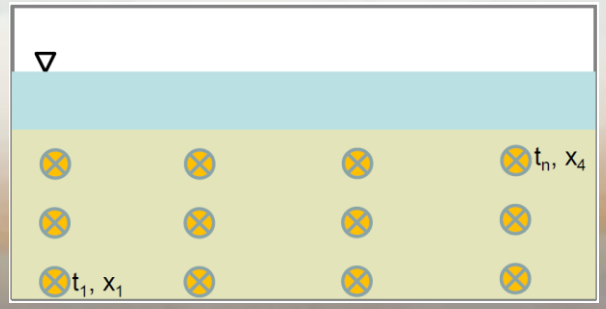
Hopper Sampling

Significant Challenge:

- Industry requirements: no interference with production, methods approved by project manager, project engineers, safety personnel
- Coring: Can't core to 30 ft
- How to collect representative samples without impacting hydrodynamics and biasing sample via sampling methodology?





Upcoming Field Sampling

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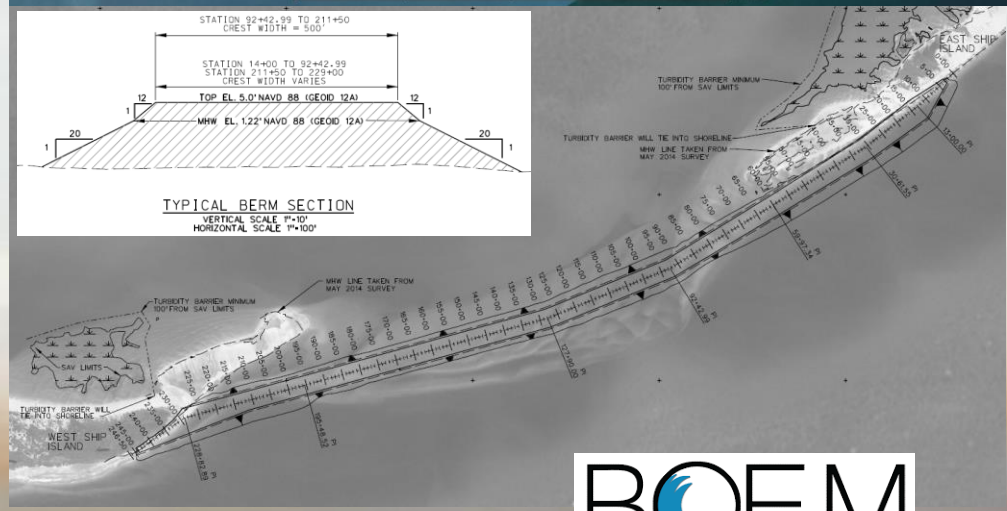
Ship Island Restoration Project:

- Estimated field effort: mid Sept – end Oct
- Inflow, hopper, beach sampling
- 5 – 10 hopper loads
  - 20+ miles from borrow area to pump-out
- Challenge to collect full placement depth at restored beach

Field Effort 2: TBD

- Spring 2018



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