

TOOLS AND TECHNOLOGIES FOR REGIONAL SEDIMENT MANAGEMENT

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US Army Corps
of Engineers®

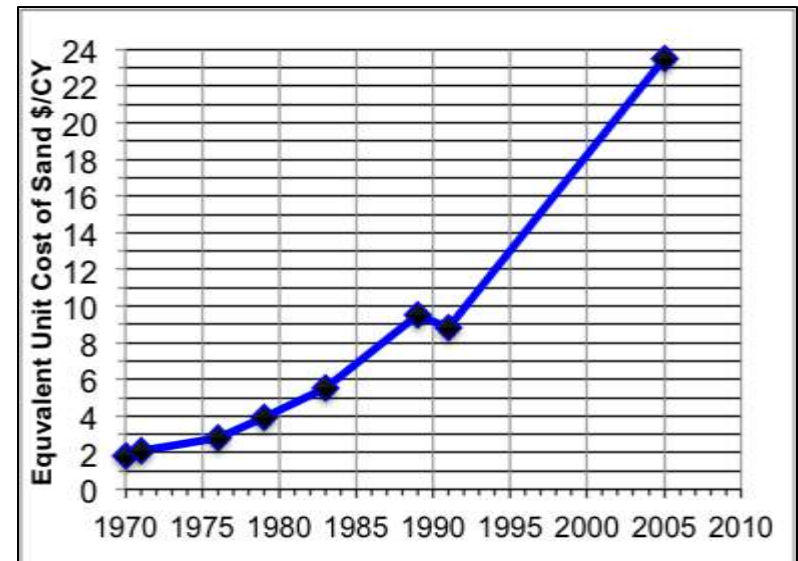
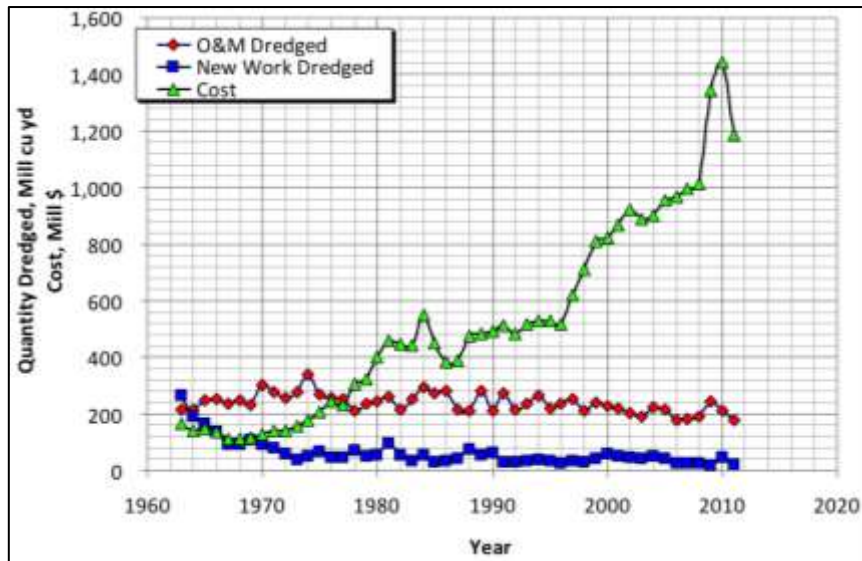


Innovative solutions for a safer, better world

.....The Corps moves
200 Million cu yds of sediment annually



...At a cost of more than
\$1 Billion per year



US Navigation Channels
O&M & New Work Volumes and Cost

Broward Co Shore Protection Project
Cost of Sand

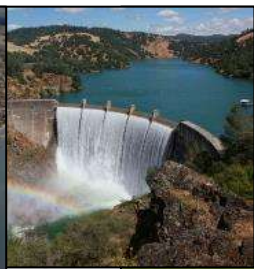
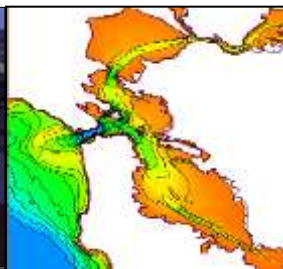
Regional Sediment Management

Established 1999, CERB Charge



“A systems approach using best management practices for more efficient and effective use of sediments in coastal, estuarine, and inland environments for healthier and more resilient systems.”

- Recognizes sediment as a valuable resource
- Work across business lines, projects, and authorities to create short and long-term economically viable and environmentally sustainable solutions
- Improve operational efficiencies and natural exchange of sediments
- Consider regional implications of project scale actions and benefits
- Apply/Enhance tools and technologies for regional approaches
- Share lessons learned, information, data, tools, and technologies
- Communicate and collaborate





RSM Goals and Strategies



Reduce Upland/CDF Disposal



Save Capacity



Reduce Channel Shoaling



Reduce Runoff



Bypass Backpass Sediments



Reduce Erosion



Stabilize Structures



- **Keep sediments in the system**
- **Mimic natural sediment processes**
- **Reduce unwanted sedimentation**
- **Environmental enhancement**
- **Maintain & protect infrastructure**



Ecosystem Habitat Restoration



RSM Network of Experts

National RSM Program Participation (2000-2018)

>200 Projects

Collaboration



29 Districts
 20 Coastal
 9 Inland
 6 Coastal/Inland
 ERDC, IWR, HEC



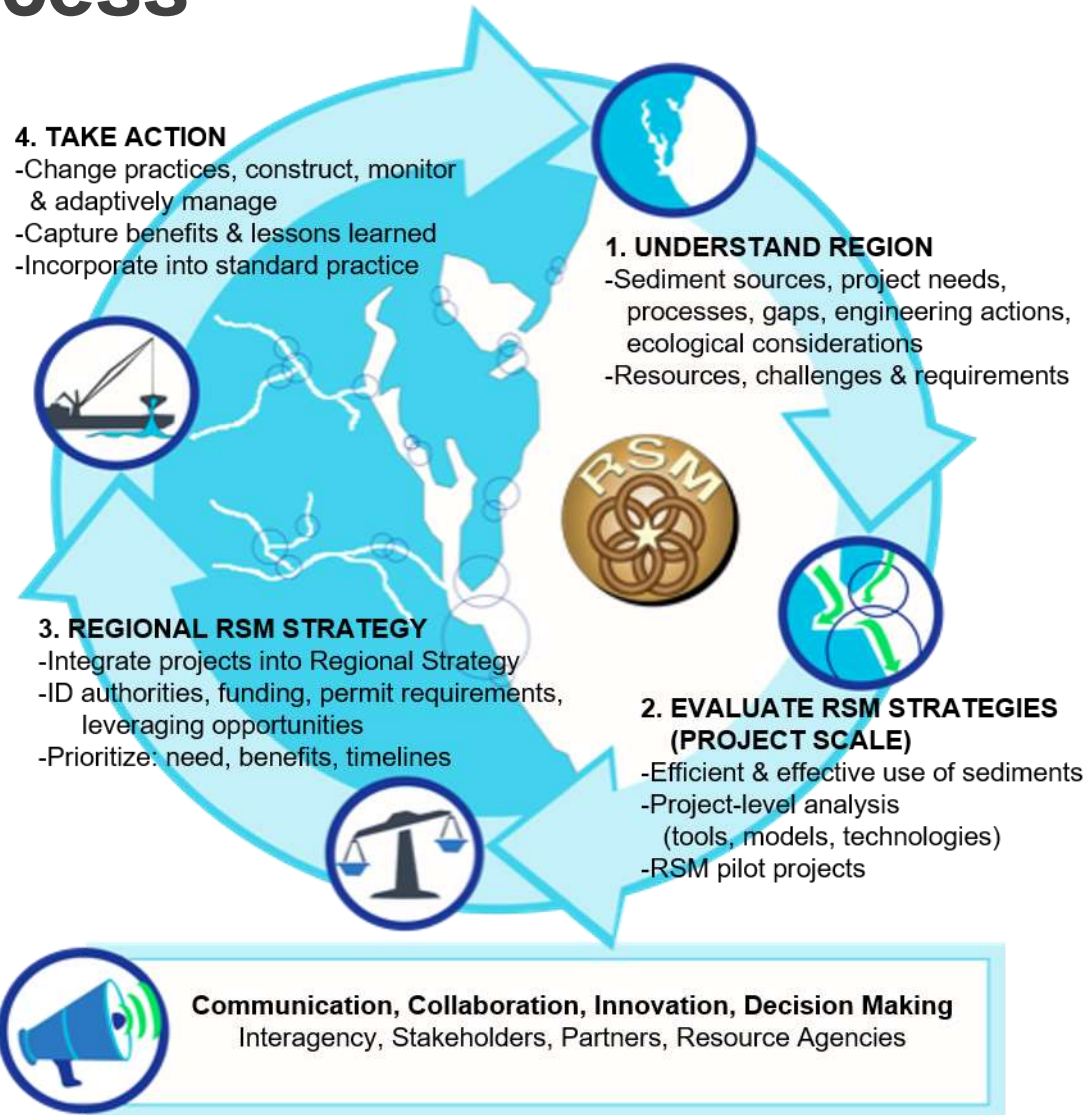
Tools & Technologies

RSM Collaboration: National and Regional Teams





RSM Process



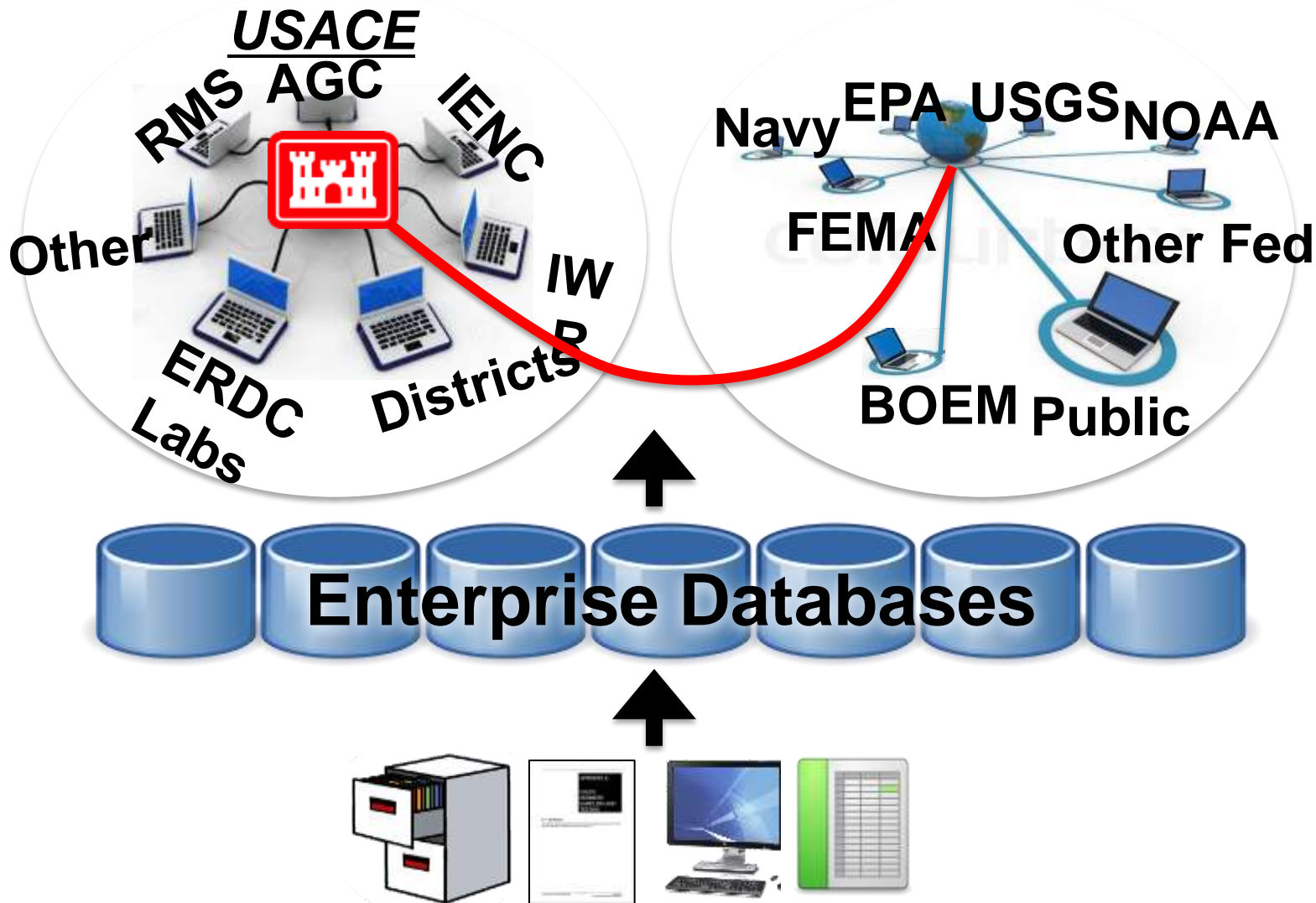
**Where is the data? What format? When collected?
How do I get it?**





Navigation Data Integration Framework (NDIF)

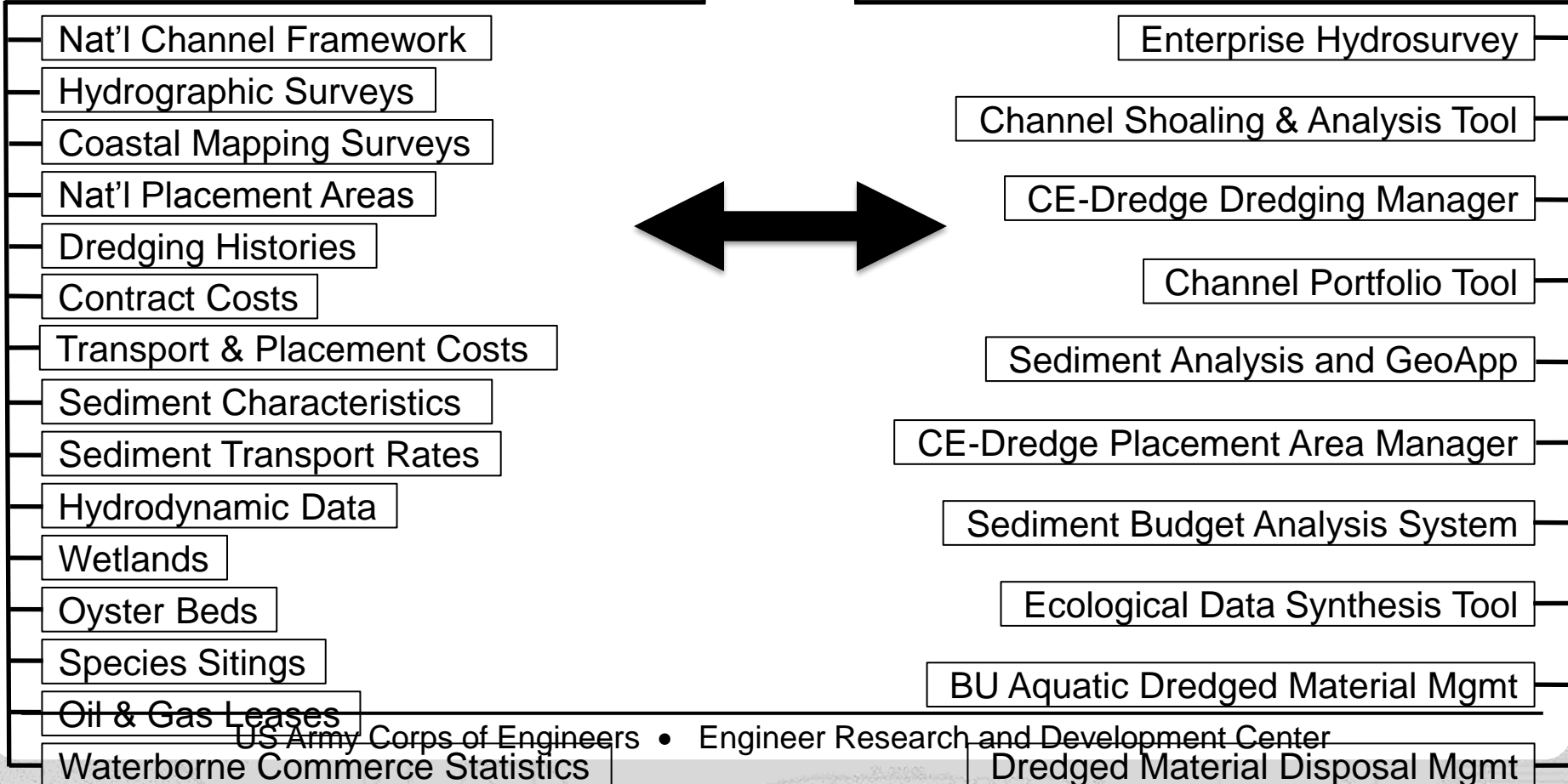
Data Management, Access, Integrated Tools





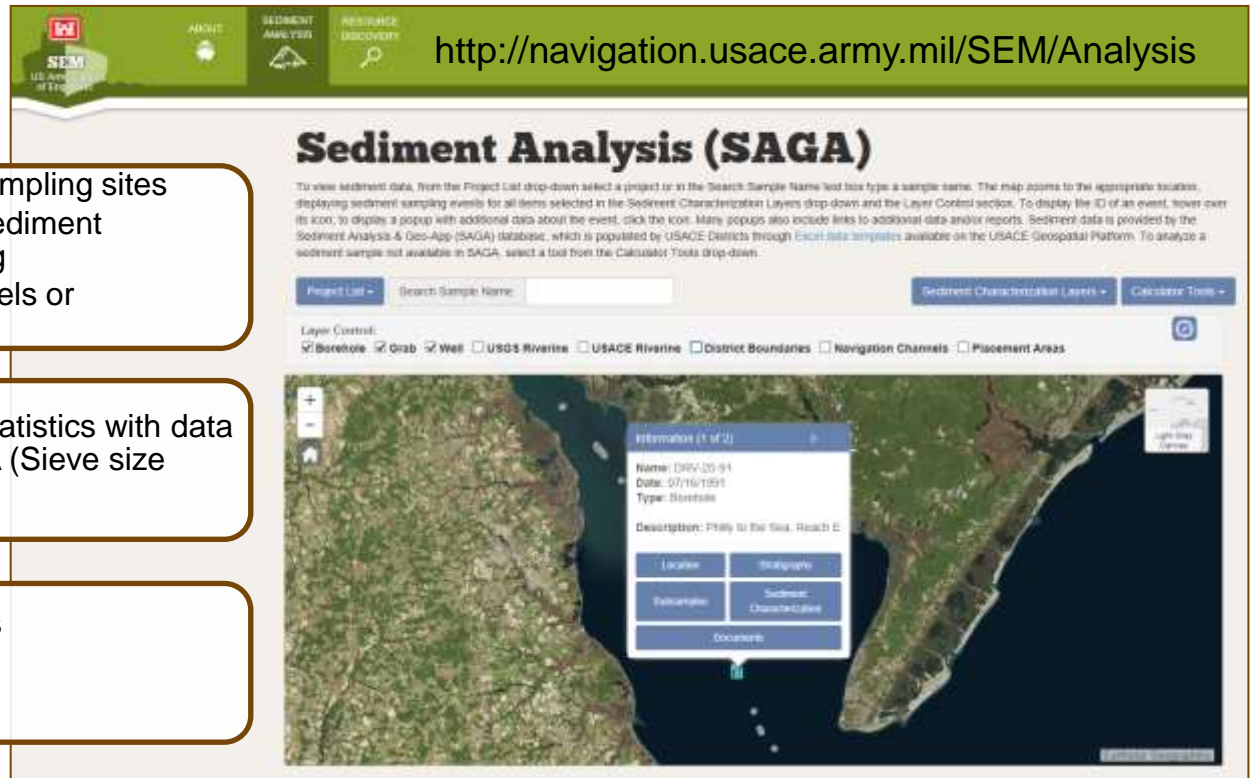
Data

Tools



Sediment Analysis and GeoApp (SAGA)

<http://navigation.usace.army.mil/SEM/Analysis>



Mapped Sites

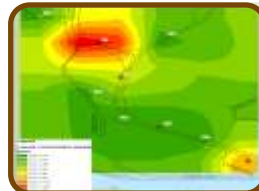
- Show distribution of sampling sites
- Filter sites based on sediment characterization testing
- View navigation channels or placements areas

Tools

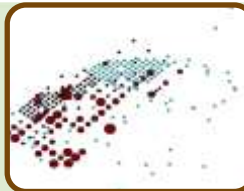
- Compute Grain Size statistics with data not yet stored in SAGA (Sieve size distribution testing)

Site Details

- Retrieve testing results
- View documents
- Access stratigraphy



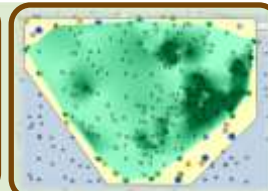
Visualize distribution of detected chemicals



Symbolize sites based on average grain size



Isolate sites based on attributes



Determine volume of material at specified depths

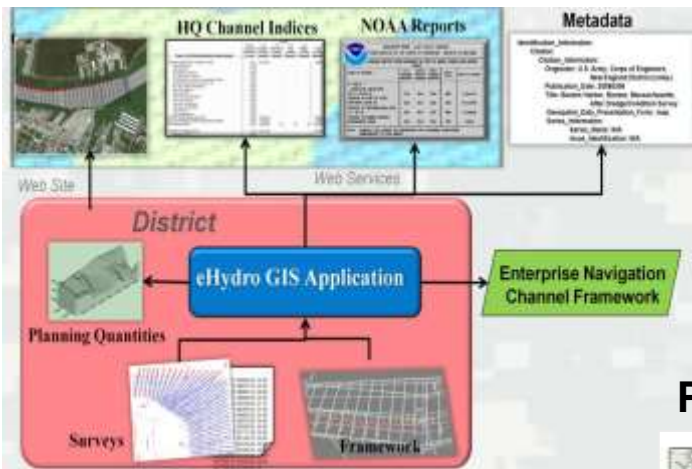


FRF



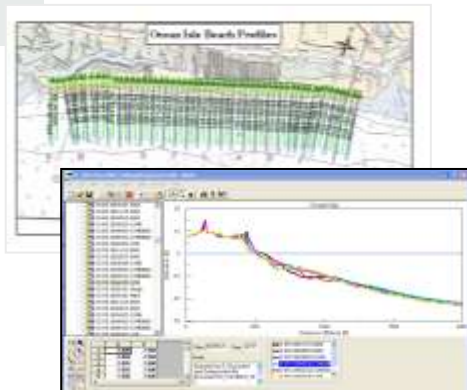
SAC, SPN
MVD

Surveys & Analysis Tools

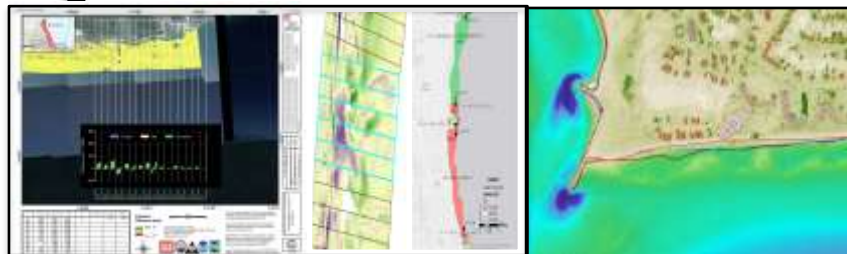


eHydro

Integrate Beach Profiles, Data & Tools



Corps Shoaling & Analysis Tool (CSAT)



JALBTCX ArcGIS Toolbox

elevations, volumes, shorelines, feature detection

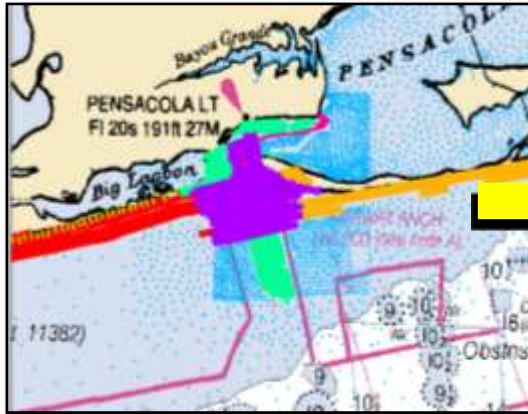
Development Center



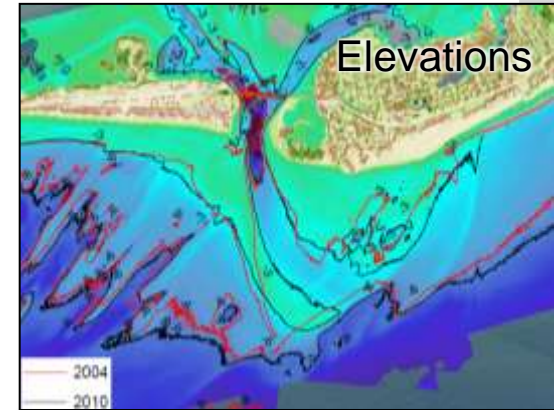
Nat'l Coastal Mapping Program



Piecemeal Surveys



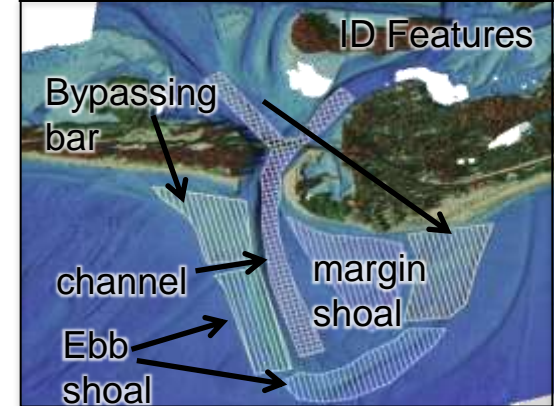
Comprehensive Surveys



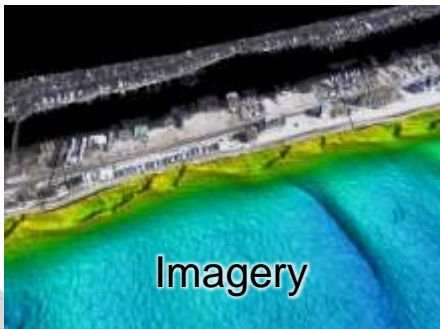
Elevations



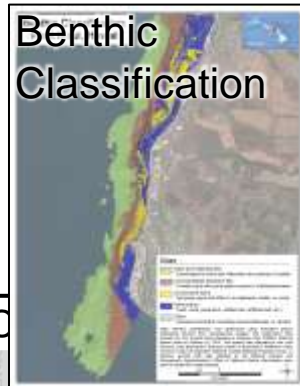
Landscape



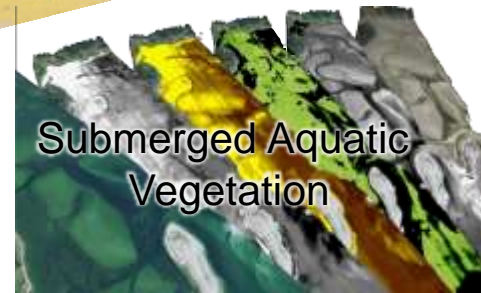
ID Features



Imagery



Benthic Classification



Submerged Aquatic Vegetation



Morphology Change

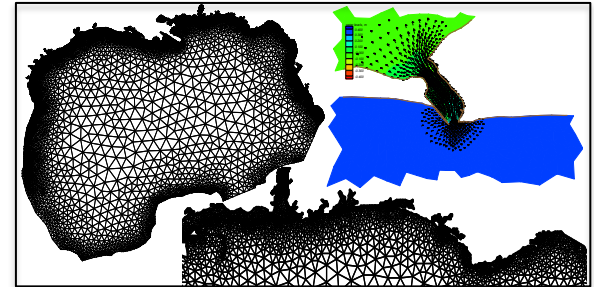
- Engineer Research and Development

Models for RSM

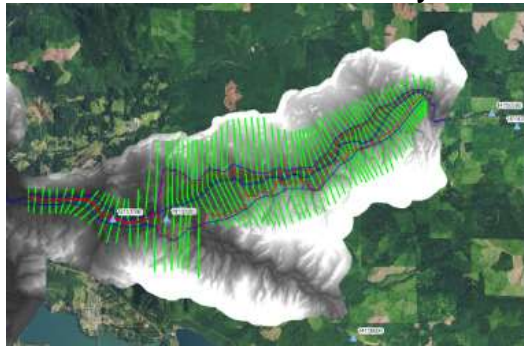


- Sediment sources and sinks
- Regional processes and trends
- Multiple interacting projects
- Connect beaches & inlets
- Connect rivers & reservoirs
- Navigation channel maintenance
- Evaluate local/regional RSM strategies

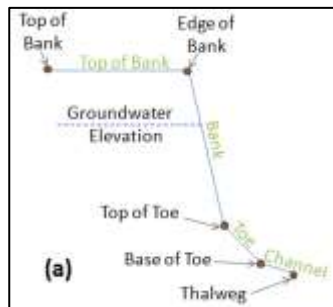
ADCIRC: Storm Surge & Circulation



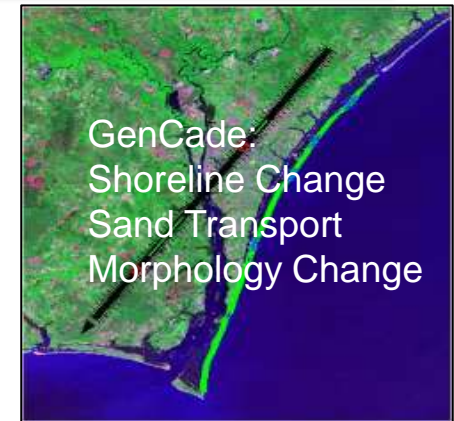
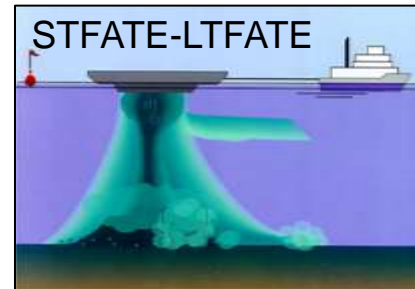
HEC-RAS: River Analysis



Bank Stabilization

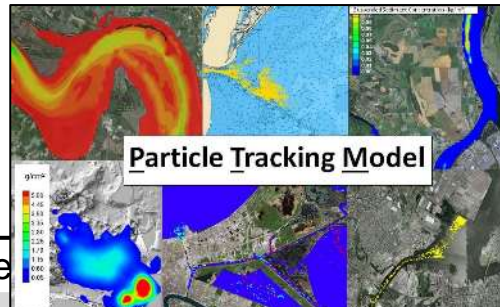
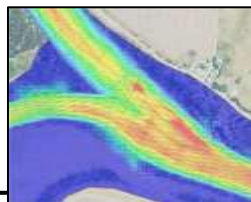
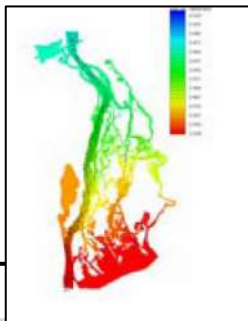


Dredge Material Placement



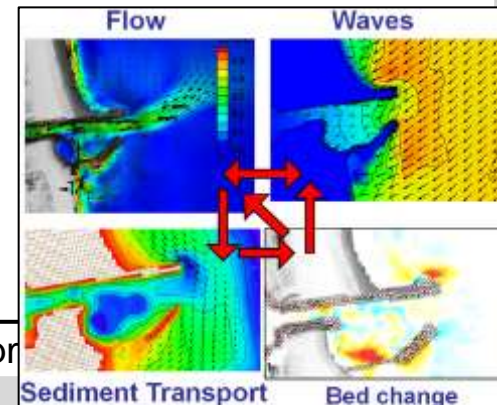
CMS

ADH: Watershed Analysis



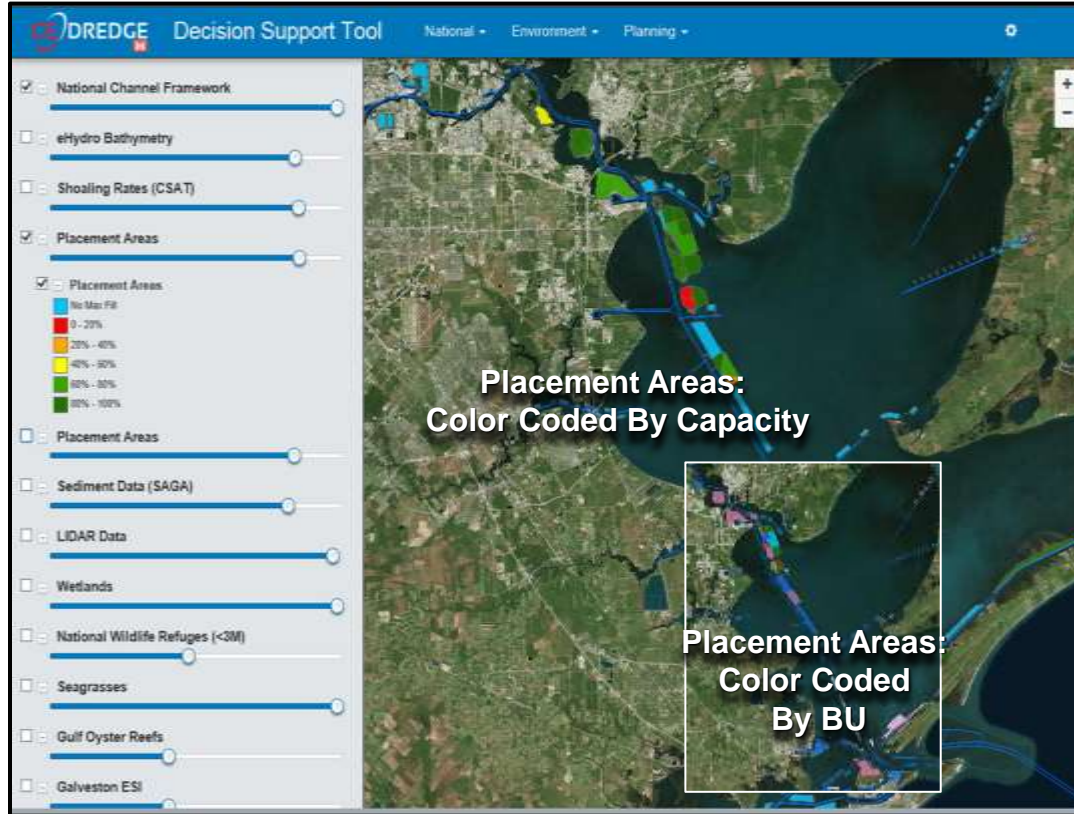
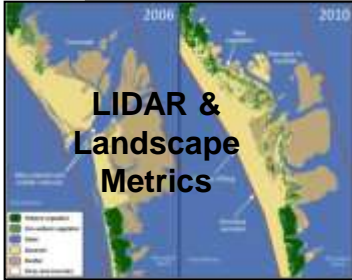
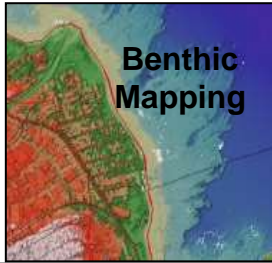
US Army Corps of Engine

d Developr

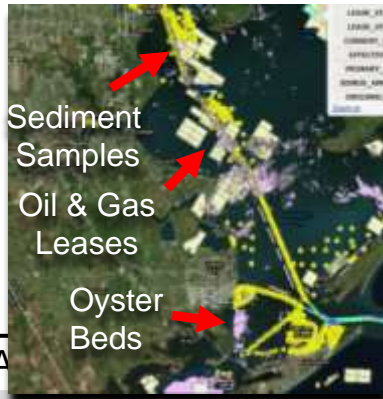
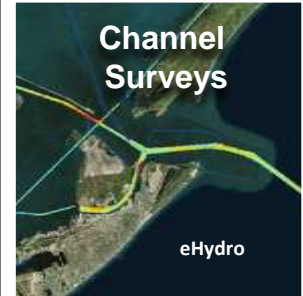
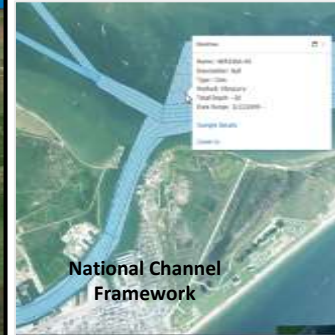


CE-Dredge Decision Support Tool

Integrated, Comprehensive Approach for Strategic Dredged Mat'l Mgmt



Navigation Channels



*Dredging Technologies Web Interface

Selection Criteria, Model Requirements, Available Data, Guidance, Case Studies

Dredging Technologies

A tool to identify appropriate models based on selected criteria

5

Problem Criteria

1

Dredge Type

- Hydraulic
 - Auger
 - Cutterhead
 - Hopper
- + Mechanical

Location

- Dredging Location
 - Entrance Channel
 - Estuary
 - Harbor
 - Inlet
 - River
- Placement Location/Type
 - Beach Nourishment
 - + Beneficial Use
 - Capping
 - Confined Aquatic Disposal
 - Confined Disposal Facility
 - Open Water

Problem Type

- Confined Disposal Facility Design
- Containment Transport
- Sediment Transport

Models

2

Sediment Transport

- LTFATE
- STFATE
- PTM >

Hydrodynamic

Confined Disposal Facility

Contaminant Transport

Health Risk Assessment

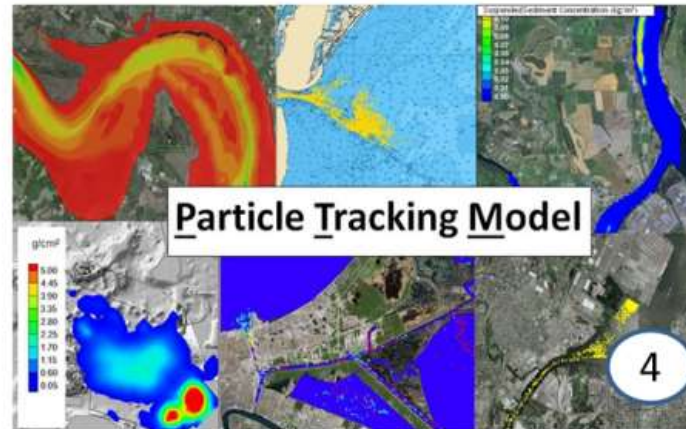
Sediment Assessment and Management

Water Quality

PTM Sediment Transport

3

Particle Tracking Model, a Lagrangian particle tracker numerical model to simulate particle transport processes.



Documentation and Downloads Data Sources Contact

Input Parameters

- + Computational Parameters
- + Simulation Temporal Details
- + Hydrodynamics
- + Native/Bed Sediment Characterization
 - Grid (Bathymetry)
 - Bed Porosity
 - Temperature
 - Salinity

6

Output Parameters

- + Mesh Data Output File (_mesh.h5)
- + Particle Output File (_particle.h5)

7

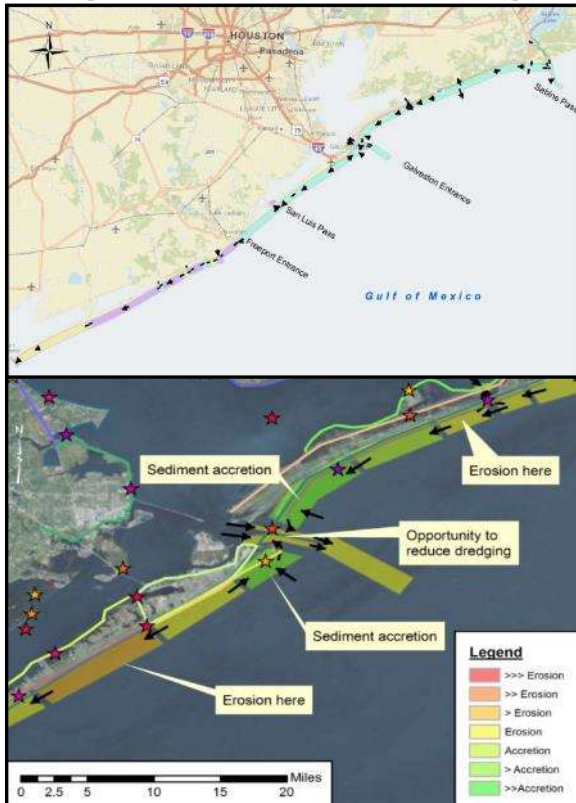
Data changes (including image) based on selected model

Sediment Budgets

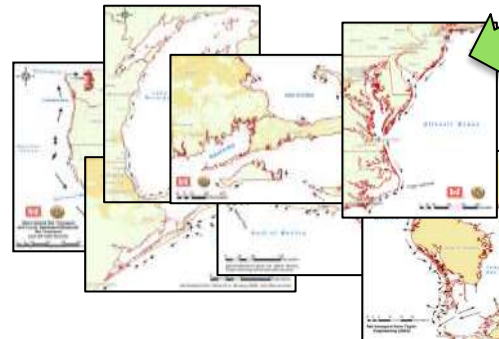
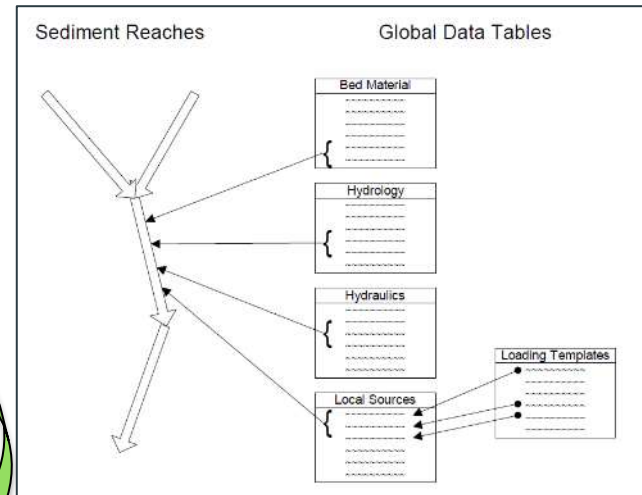
- Sediment Budget Analysis System (SBAS)
- Sediment Impact Analysis Methods (SIAM)



Regional Sediment Budget



Sediment Budget Portal



Sediment Budget Database



Anna Jalowska, UNC-CH



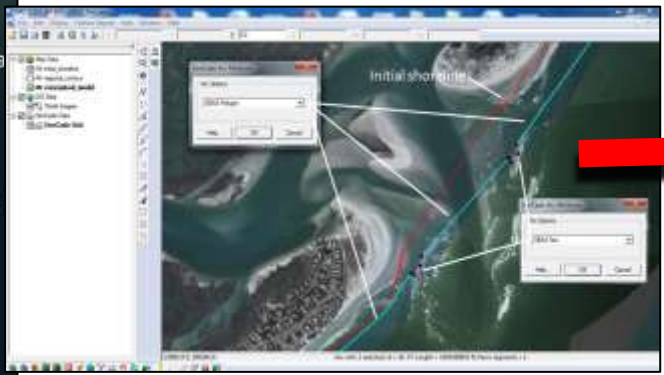
GenCade & SBAS Integration

GenCade

- Regional shoreline change, sand transport, inlet-sand sharing model
- Connects multiple beaches & inlets
- Multiple sources & sinks
- Regional trends
- Evaluate regional strategies

GenCade

SBAS



- Automate Output to SBAS
- Volume change
 - Transport rates
 - Dredging and beach fill volumes
 - Cells and fluxes

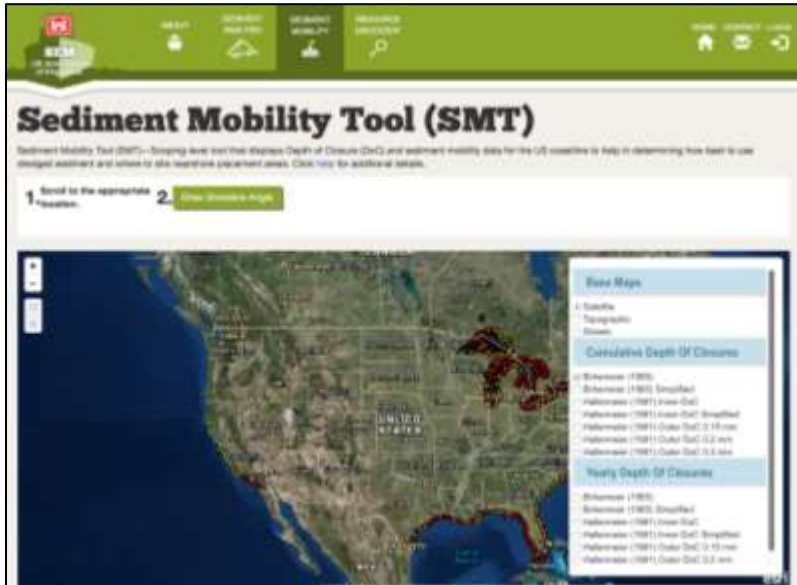
Nearshore Berm Research, Guidance, and Tools

<http://navigation.usace.army.mil/SEM/SedimentMobility>

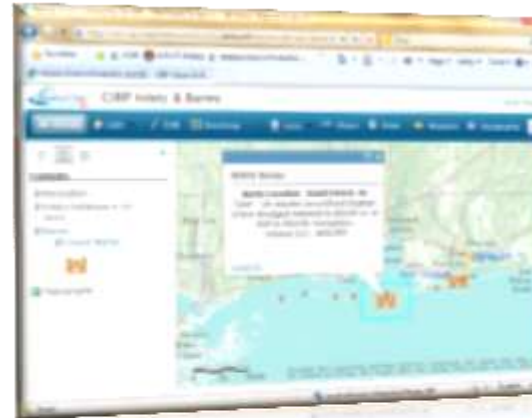
SMT

Preliminary tool: educated decisions w/limited data
Estimates

- Frequency of sediment mobilization
- On/Offshore migration direction
- Dominant axis of wave direction to estimate alongshore migration



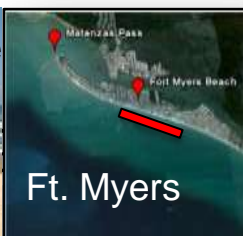
d_{50} (mm)	Frequency of Mobilization	Predicted Sediment Migration
0.1	16 – 38%	83% Offshore
0.2	14 – 30%	60% Onshore
0.3	12 – 26%	84% Onshore



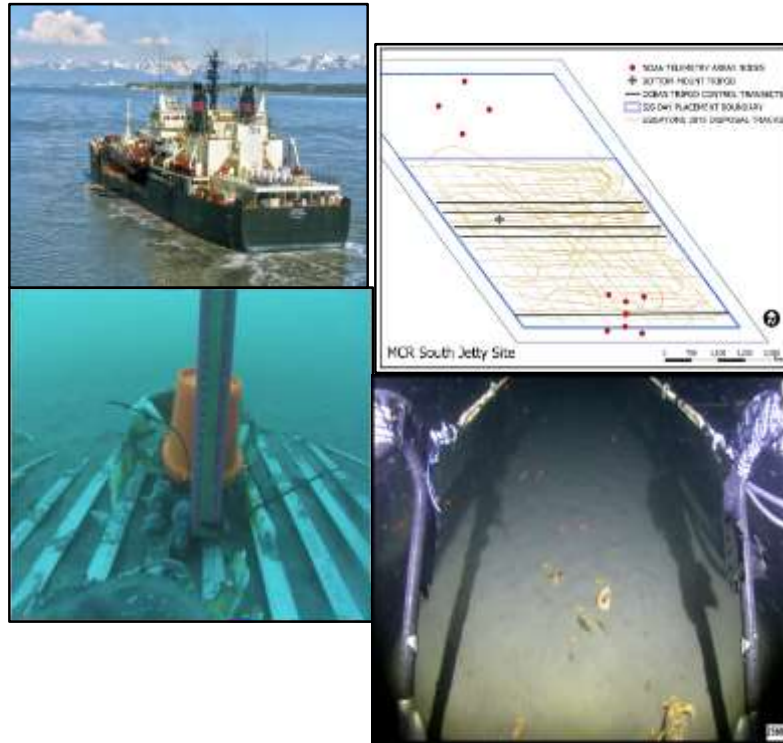
Berm Database



Assateague Island, MD



Thin Layer Placement of Dredged Sediments Open Water Placement



Mouth of the Columbia River
(Lower Columbia River Solutions Group)



Mobile Bay
(Interagency Working Group)

- Understand Behavior - Mobilization, Transport, Consolidation
- Benthic Habitat - Reduce Impacts & Enhance
- Shallow Emergent Tidal Marsh Habitat
- Dredge Hole filling - Recover Hypoxic & Anoxic Zones

Thin Layer Placement of Dredged Sediments - Wetlands



Predict response of coastal wetlands to dredged sediment placement

- consolidation
- settlement
- biomass
- sediment organic content
- carbon sequestration

Better design TLP projects

- achieve design marsh elevations

Advance state of practice

- reducing costs
- maximizing benefits

Provide Guidance

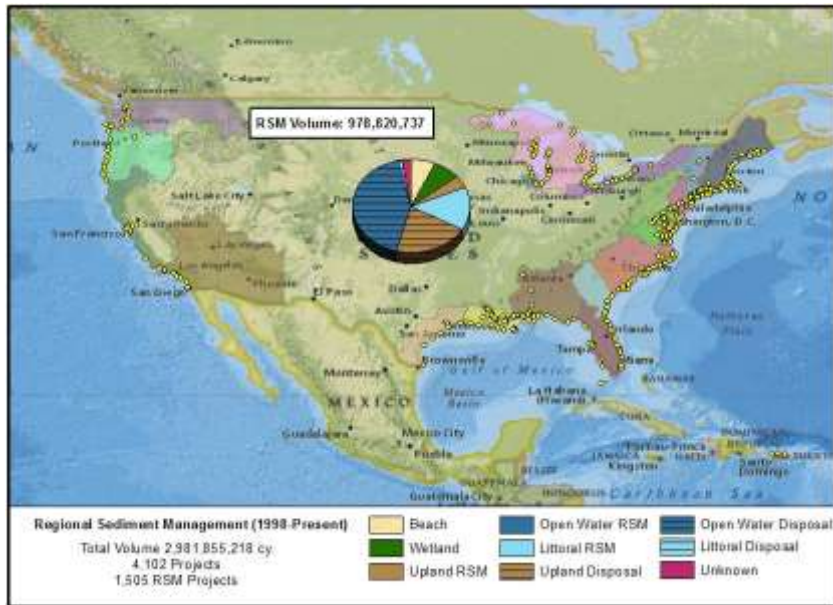


<https://tlp.el.erdc.dren.mil>



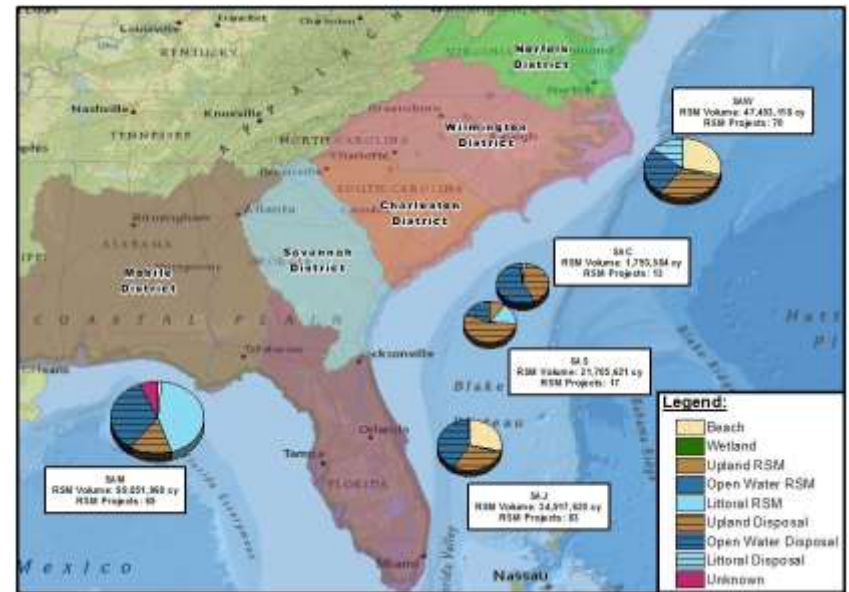
Historical Navigation Sediment Utilization: *Inland FY18

Where, when, volume of sediments placed beneficially? Where can we improve?

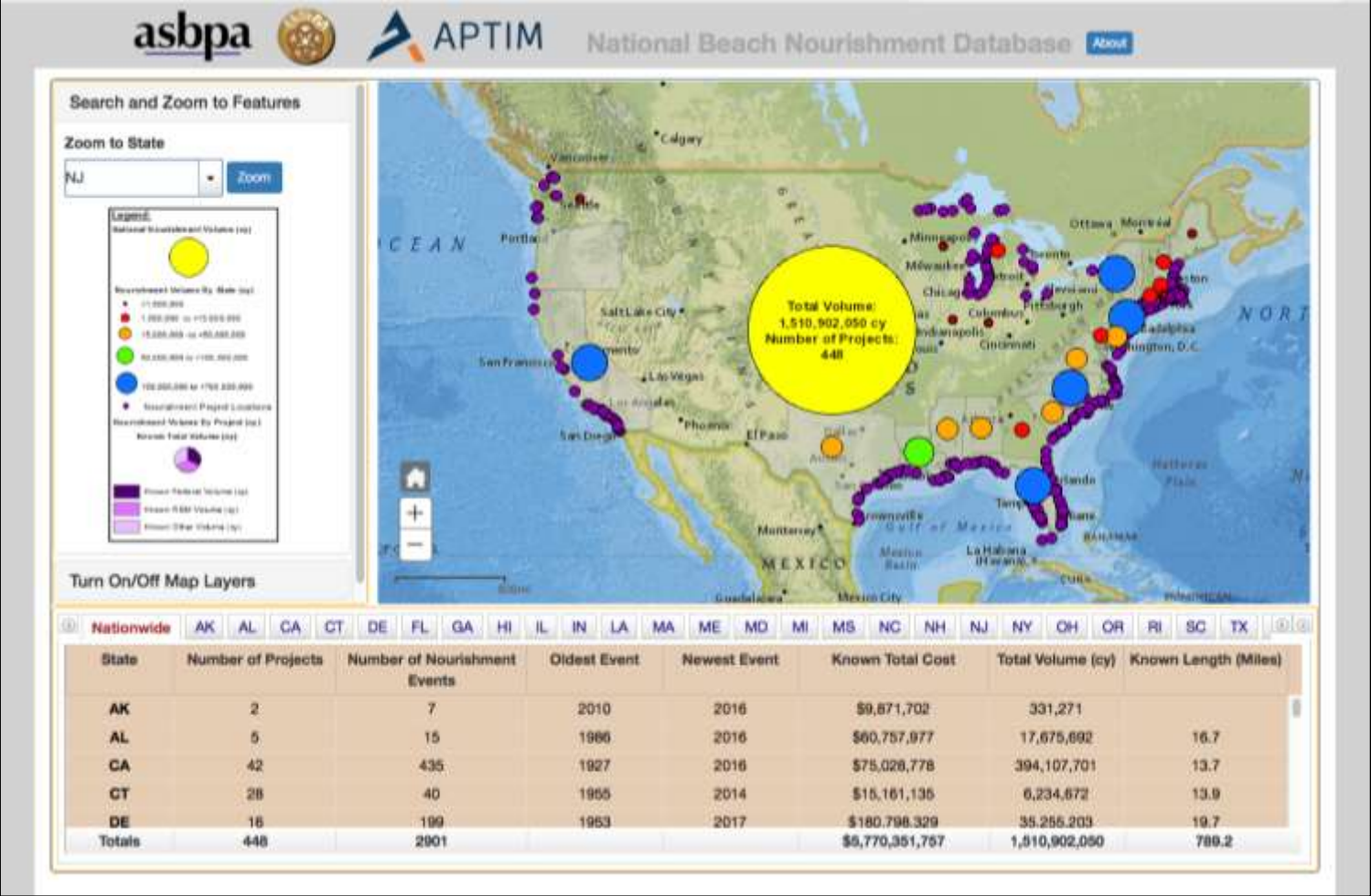


District Data 1998-2014 Coastal Navigation Projects

- 3 Bcy
- 36% placed beneficially
- 9 Mcy/yr placed on beaches
- 5 Mcy/yr Unknown



National Beach Nourishment Database

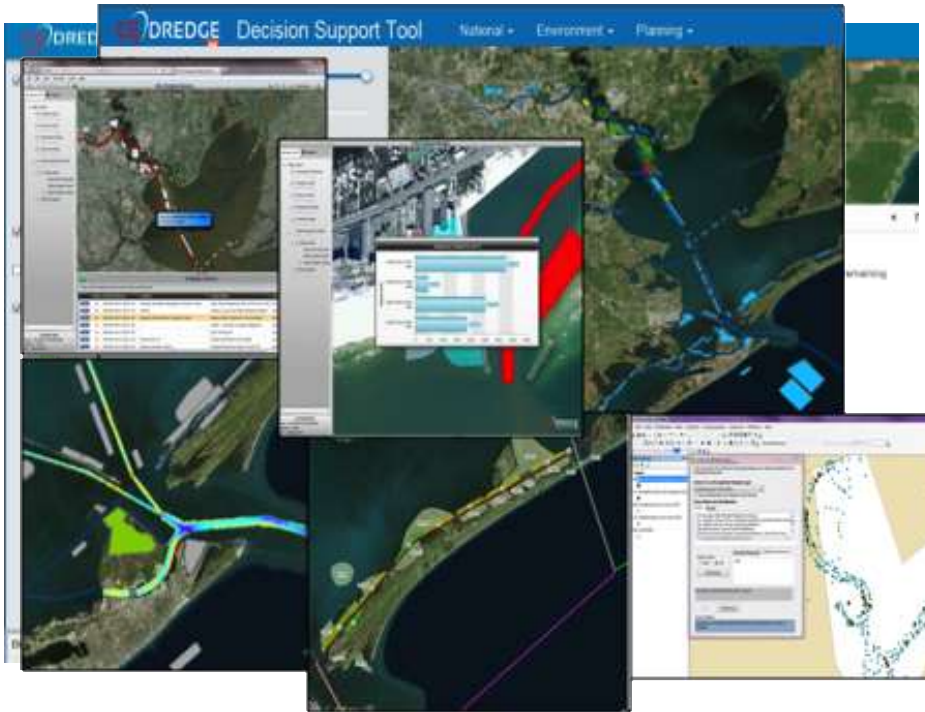


- 449 projects placed >1.5 Bcy sand US beaches since 1920's
- Federal coastal storm damage reduction projects
- Beneficial placement of navigation sediment on beaches
- State/Local/Private beach nourishment projects

Communication, Collaboration, Decision Making



Web-Based Decision Support Tools



RSM-University

Workshops & Training

- Thin-Layer Placement 2017
- Reservoir Sediment Mgmt 2017/18
- Sediment Budgets 2018
- Sediment Tracers 2018
- Interagency Meetings

Lessoned Learned





Regional Sediment Management = Resilient Healthy Systems

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Katherine.E.Brutsche@usace.army.mil



Regional Sediment Budgets
Local Actions=Regional Benefits



ODMDS
Regional Strategies



Riverine & Reservoir Mgmt



Data Management and Access



Improved Relationships
Outreach & Training



Ecosystem/Aquatic
Habitat