Building Coastal Resilience Through Dredge Management

FSBPA February 2024

Napkin Sketch

Building Coastal Resilience

The Coastal Resilience Project is a web-based, decision-support tool that enhances resilience through strategic placement of dredged material.

**APPROACH**

Integrate existing tools:

- NavPortal
- RSM DST – Regional Sediment Management Decision-Support Tool
- CERI – Coastal Engineering Resilience Index
- Dredge Optimization

Address challenges/objectives:

- Tool interoperability
- Data accessibility, security
- Actionable results, metadata

BUILDING COASTAL RESILIENCE

NavPortal   RSM DST   CERI   Dredge Optimization
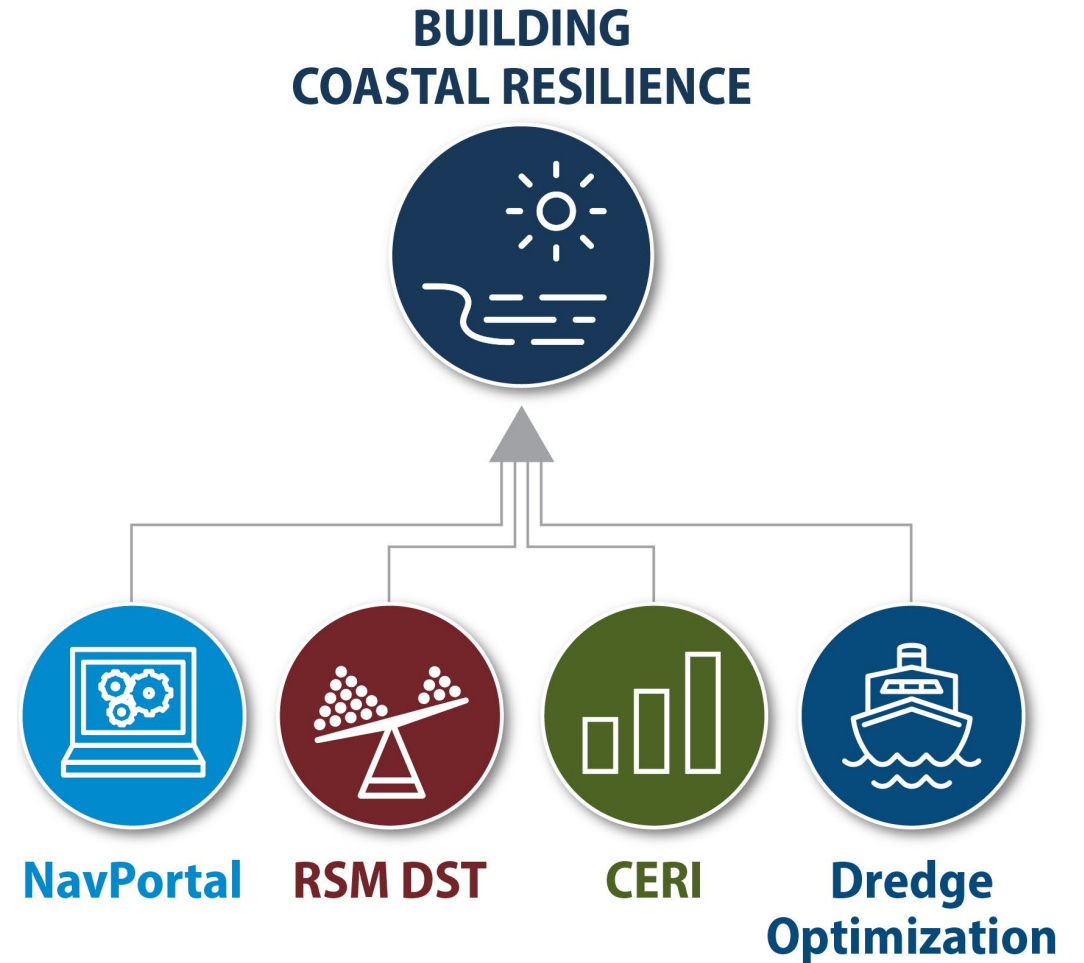
BCR Team
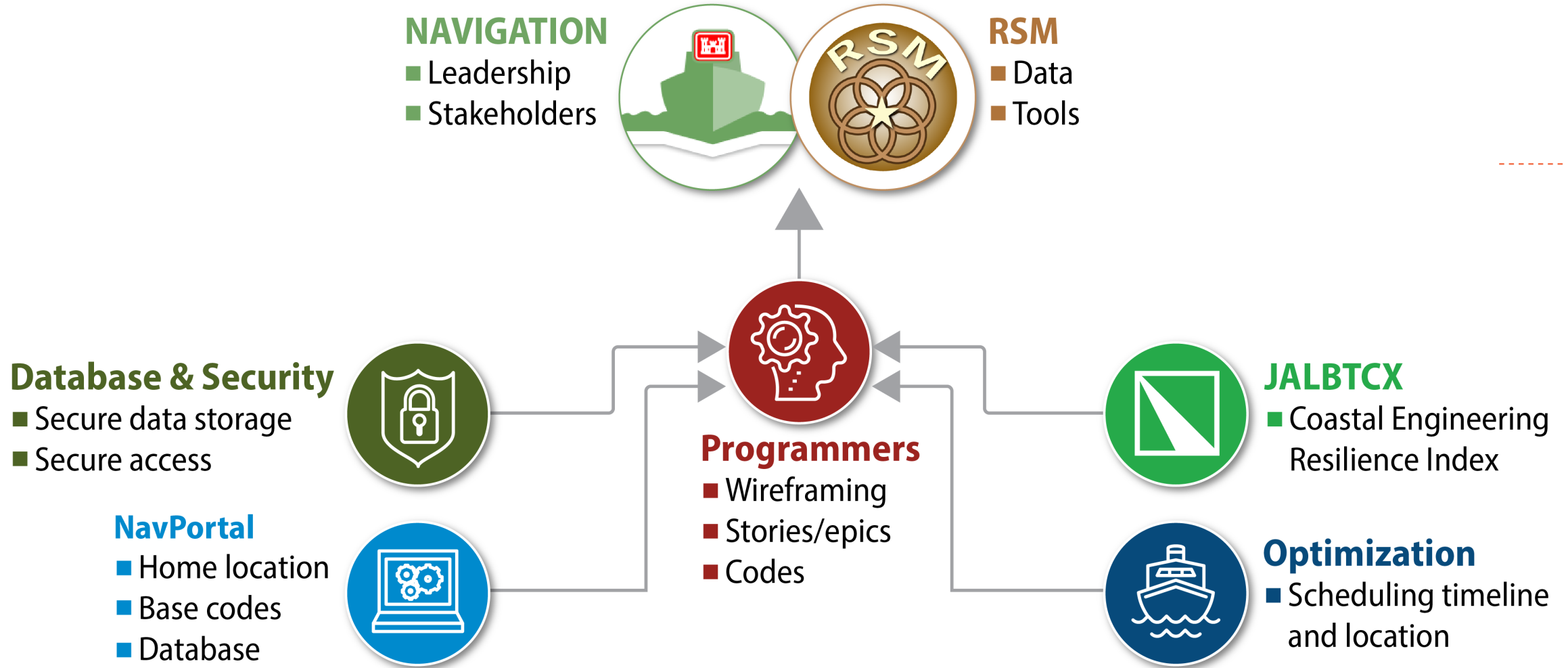
Vocabulary

NavPortal

- **Centralized data science platform**

- **Enterprise datasets**
  - Project and channel boundaries
  - Dredge Reach(es), HexBins
  - Placement locations
  - Shoaling locations and rates

RSM Decision-Support Tool

- HTML user input-based tool

- Assimilate RSM DST into NavPortal

- Expand tool to calculate multiple options, with costs and benefits

- Automate volume calculations via NavPortal HexBins

** required Input
☐ parameter will be obtained from map tool

Dredge Costs

This section includes input parameters the calculator will use to estimate dredge costs for the project. Enter all the required parameters as accurately as possible for the best results. The final results will display below this form with a total cost and costs broken down by category.

General

** Project Name:
Project 1

Project Description/Details:

** USACE Division:
Great Lakes & Ohio River (LRD) ▾

** Project Purpose:
New Work ▾   *Is the proposed project new or is it maintenance work?*

** RSM Placement Type:
Aquatic ▾

RSM placement type based on guidance presented in EM1110-2-5025.
Notably upland uses include agriculture, horticulture, forestry, confined (diked) placement, construction and industrial or commercial uses, multipurpose uses, parks and recreation, or upland habitats.

JALBTCX Toolbox
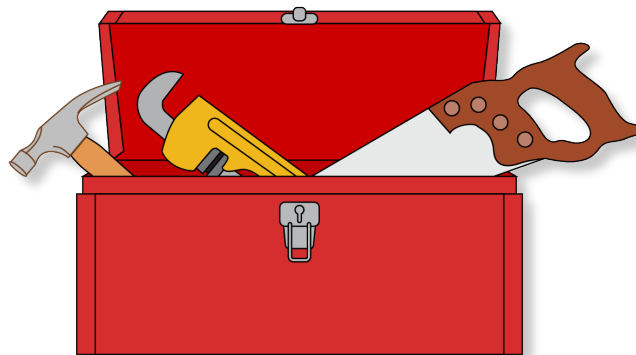
Quick Response

- Generate and edit baseline and transects
- Quantify shoreline and volume change
- Standardized mapping

Profile Feature Extraction

- Profile metrics
- Coastal Engineering Resiliency Index

Multiple Dataset

- Multiple years
- Quantify trends

Coastal Engineering Resilience Index

- Based on feature extraction from lidar data, tools developed for JALBTCX

- Similar to BeachFX, SBEACH, CSHORE

- Leveraging location specific NOAA water level, surge and ERDC WIS data

- Equation currently being refined by comparing results with calibrated CSHORE profiles

- CERI values hosted online using feature servers

- BCR Updates:
  - Construction templates
  - Latest beach profiles (CSV)
  - Non ESRI ArcPy code
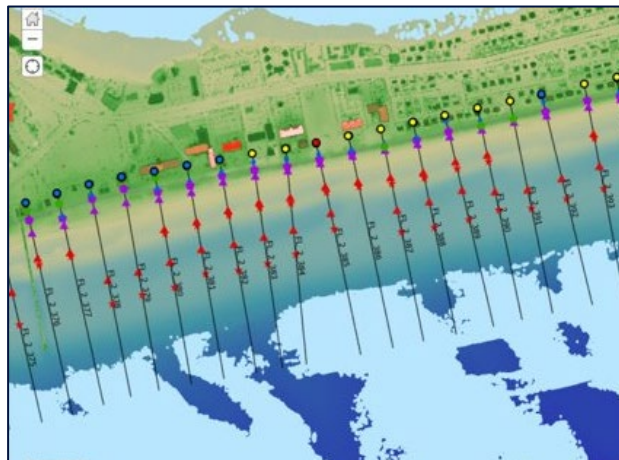
$$a = \frac{PE}{PE_0}$$

Protective Elevation

$$b = \frac{PE * PW * (1 - s)}{PE_0 * PW_0}$$

Volume Density

$$c = \frac{PW - MR}{PW_0}$$

Shoreline Δ

$$d = \frac{DE - (MS + MHW)}{CF_0}$$

Overtopping

$$e = \frac{WR_0}{WR}$$

**Wave Runup**

$$CERI = a + b + c + d + e$$

CERI in Building Coastal Resilience

- Quantify increase in resilience

- Tool to operate outside ArcPy

- Pull existing CERI values for placement areas
  - NCMP CERI Values
  - JALBTCX Feature Services

- Quantify CERI values based on template
  - Locate and format templates from USACE (NavPortal)
  - Use existing profiles for volume calculations (NavPortal)
  - Template – Existing Profile = Volume Available

- Quantify increased CERI based on placement location
  - Entire area - max volume or equal density
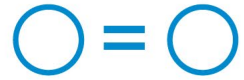 - Hot spot - maximize CERI
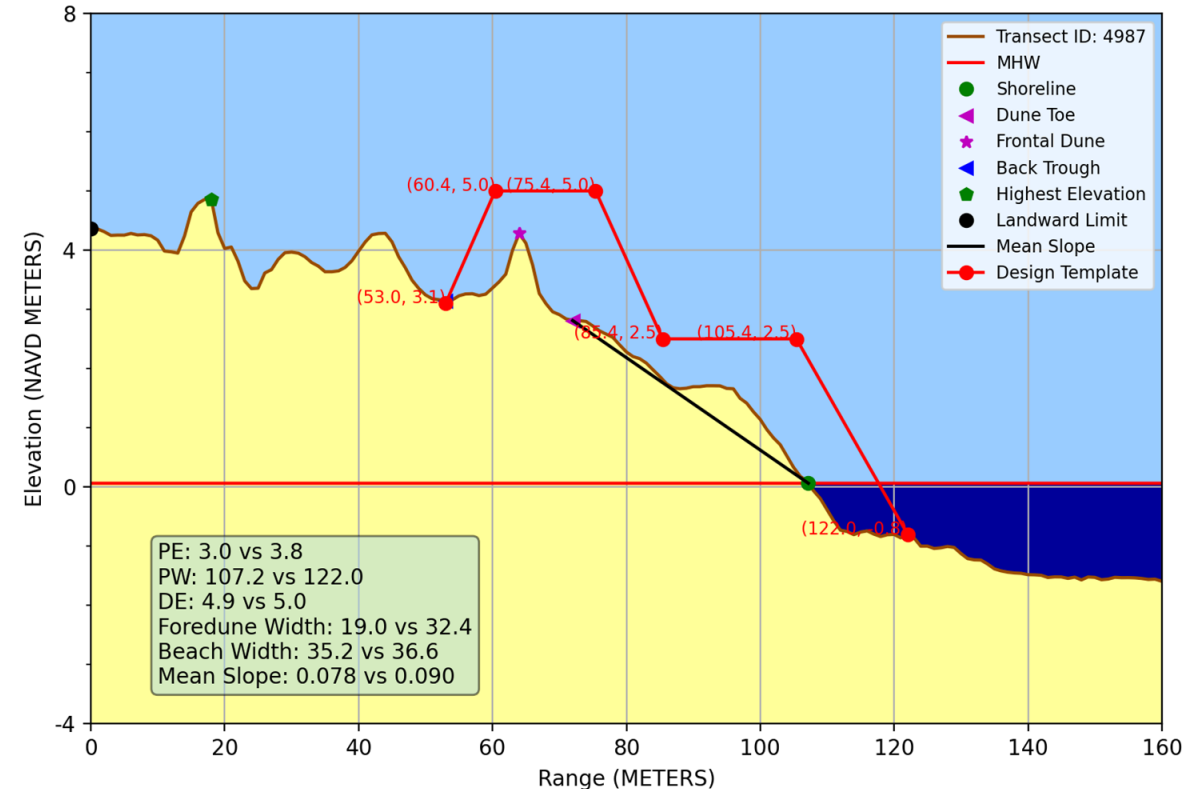
Dredge Optimization

- Use Case 2+
- Regional and nationwide approach
- USACE and commercial dredgers
- Leveraging multiple projects that require the same dredge
- Bidding multiple dredge locations as a single project
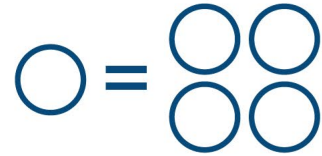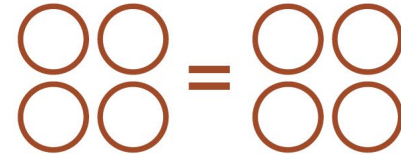- Saves dredging cost by reducing mobilization

Now → Optimized
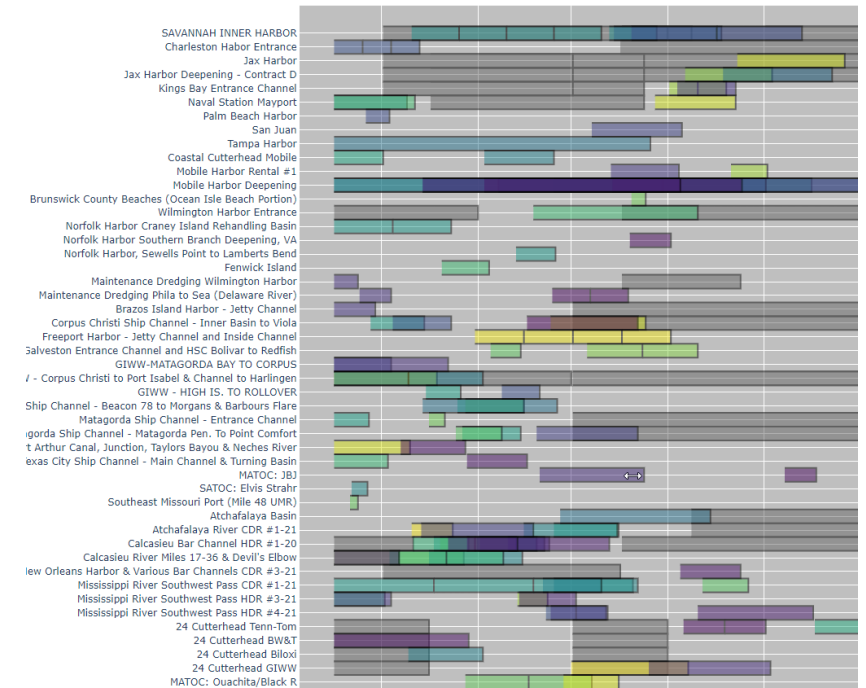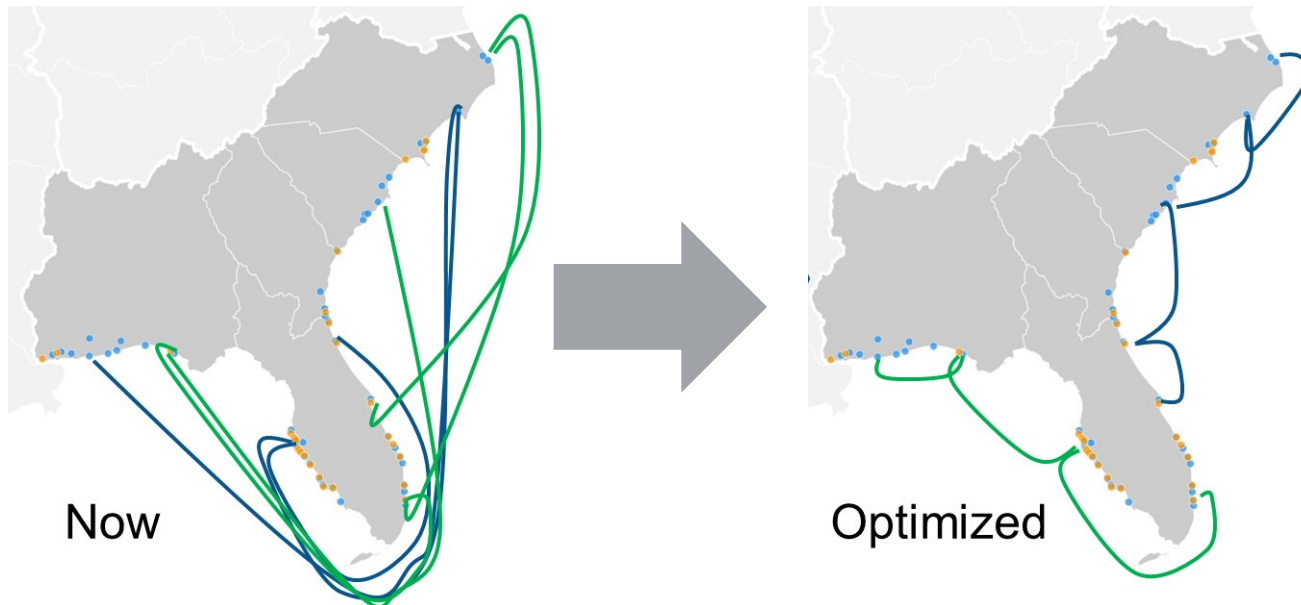
BCR Use Cases
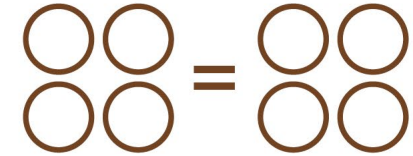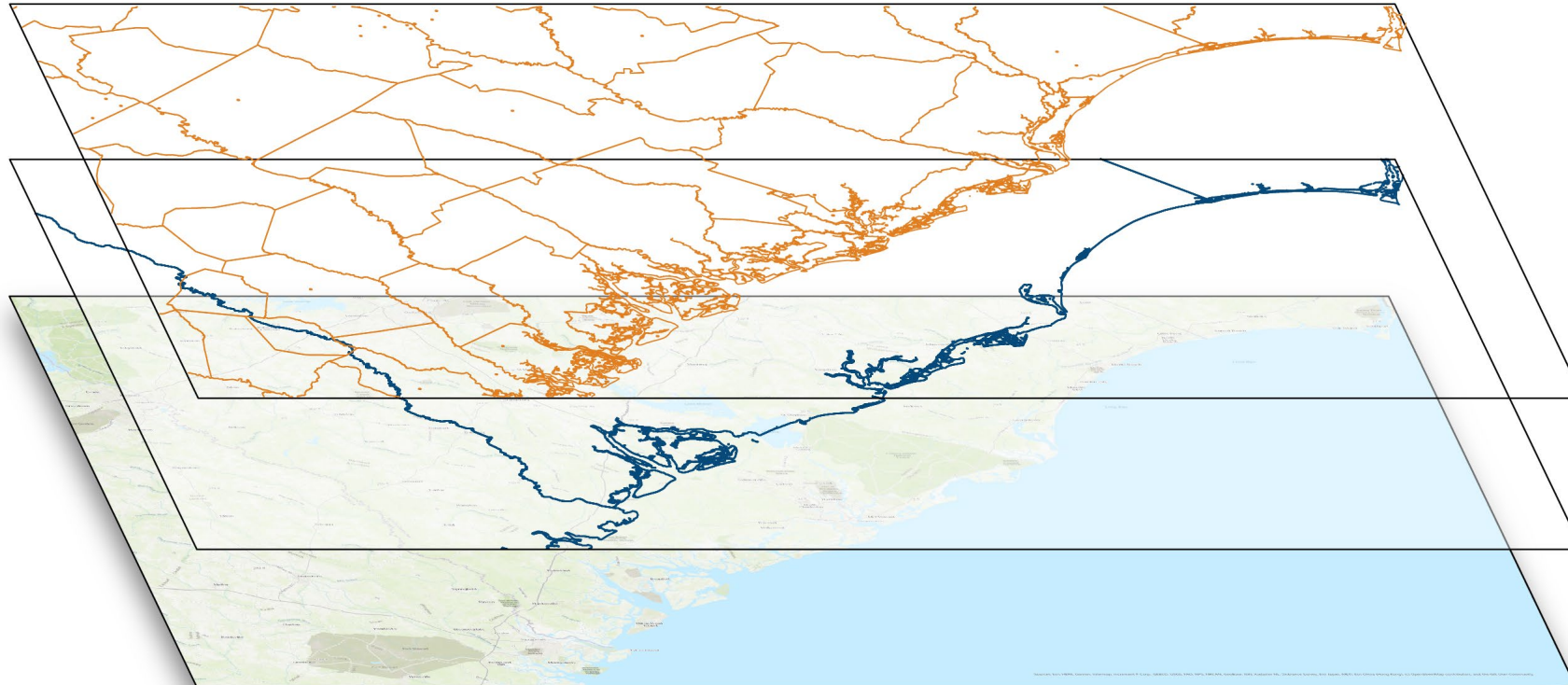
USE CASE 1a/b

USE CASE 2

USE CASE 3

Regional link multiple projects/schedule optimization

USE CASE 4

National link multiple projects/schedule optimization

Workflows

Diagram

Building Coastal Resilience

User 1a: Known Dredge & Placement
User 1b: Suggest Placement
Rev18

Flowchart nodes:

- Open NavPortal
- Select Coastal Resilience Tool
- Load Previous Project or Start New?
- Project Name / Project Purpose / Construction Window
- New Work or Maintenance? Locally Preferred?
- New Dredge Reach(s)?
- Digitize Dredge Reach(s)
- Dredge Reach(s)
- Edit Sub-Reach(s)?
- Edit Reach(s)
- View Shoaling
- View RSM Sediment Placement
- Dredge Type(s)
- Material Type(s)
- No / Yes
- New Placement Location(s)?
- Placement Location(s)
- Digitize Placement Location(s)
- View CERI
- Edit Placement Location(s)?
- Edit Placement Location(s)
- Link Reach(s) with Placement Site(s)
- New Transport Route(s)?
- Transport Route(s)
- Digitize Transport Route(s)
- Transport Method(s)

Note: Defaults, not needed. Multiple possible, scow to truck, scow to pipeline, etc. Linked to subset of transport route, can have multiple. — Scott Robertson

Note: CERI default, maybe pull GLVI layer — Scott Robertson

Note: Import data? Lines, polygons, points. Separate button on right? V2.07 — Scott Robertson

Note: Return intervals. Planning, anticipated values. Forecast CERI value — Scott Robertson

Note: NavPortal? — Scott Robertson

Legend

- Decision (green diamond)
- Process (purple)
- Data Source (yellow cylinder)
- Input (blue parallelogram)
- Data (red)

NavPortal

- eHydro
- RSM Sediment Placement
- National Sediment Management Framework
- CSAT

Data nodes:
- Shoaling Location(s)
- Dredge Reach(s)
- HexBins
- Placement Location(s)
- Shoaling Rate(s)

Input: Dredge Volume
- Total
- Reach(s)
- Placement Site(s)

Process
- RSM DST
- Cost Benefit Calculator

Data list (red box):
- Project Name
- Project Purpose
- Construction Window
- USACE District
- Dredge Reach(s)
- Placement Location(s)
- Transport Route(s)
- Transport Types(s)
- Transport Distance(s)
- Dredge Type(s)
- Material Type(s)
- Dredge Cost(s)
  - Unit Cost ($/CY)
  - Initial Cost
  - New Work Cost Increase
  - Mobilization Cost
  - Material Cost
  - Turbility Cost
  - Endangered Species Cost
  - Screening Cost
  - Tilling Cost
  - Remediation Cost
  - Miscellaneous Cost
  - Transportation Cost

Fill Template?
- Spread
- Max CERI

- Construction Template(s)
- Beach Profiles

Placement data (red box):
- Placemet Volume(s)
- Placement Location(s)
- Construction Window

CERI (purple)

- CERI Values

Placement data (red box):
- Placement Transects
- Placement Volume
- Placement Density
- TO CERI
- T1 CERI
- CERI Benefit

Data Sources (yellow cylinders)
- Resilience Database
- JALBTCX Feature Services
- Volume Change Rate

Summary Output (1a)
- Cost
- Benefit
  - B/C Ratio
  - Resilience

Summary Output (1b)
- Lowest Cost
- Most Benefit
- Highest Volume
- Locally Preferred

Table Output
- Dredge Reach
- Dredge Type
- Construction Window
- Placement Site
- Dredge Volume
- Placement Volume
- Dredge Cost
- Placement Cost
- Total Cost
- Placement Benefit
- CERI Benefit

Metadata
- Tools Used
- Versions
- Assumptions
- Data Sources
- Data Dates

Wireframing

Stories/Epics/Sprints

Gantt Chart

Security & Access

Cloud - Based Tools

Safe Data Storage

Security+

Common Access Card (CAC)

Government Furnished Equipment (GFE)

Timeline

Thank You!

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Woolpert

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WOOLPERT

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