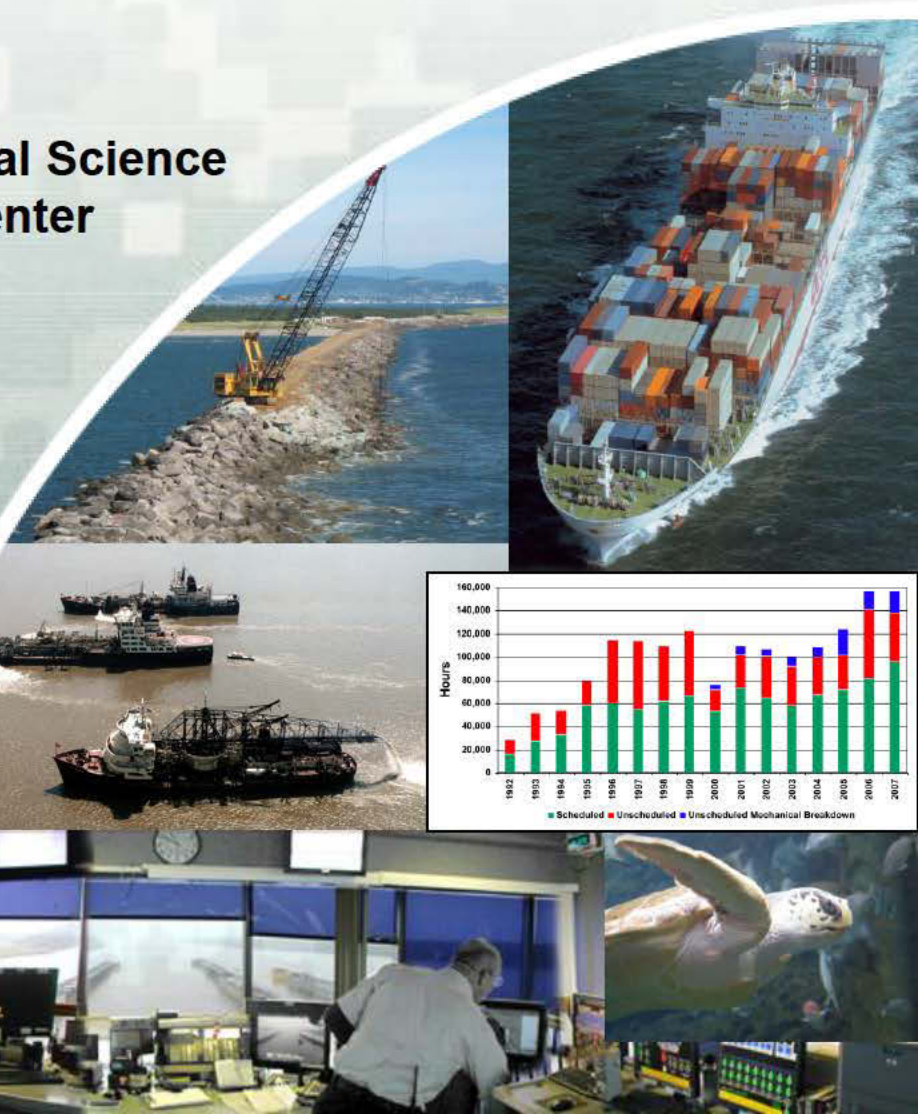
Engineering With Nature

Dr. Todd S. Bridges

Senior Research Scientist, Environmental Science
Engineer Research and Development Center

May 2012

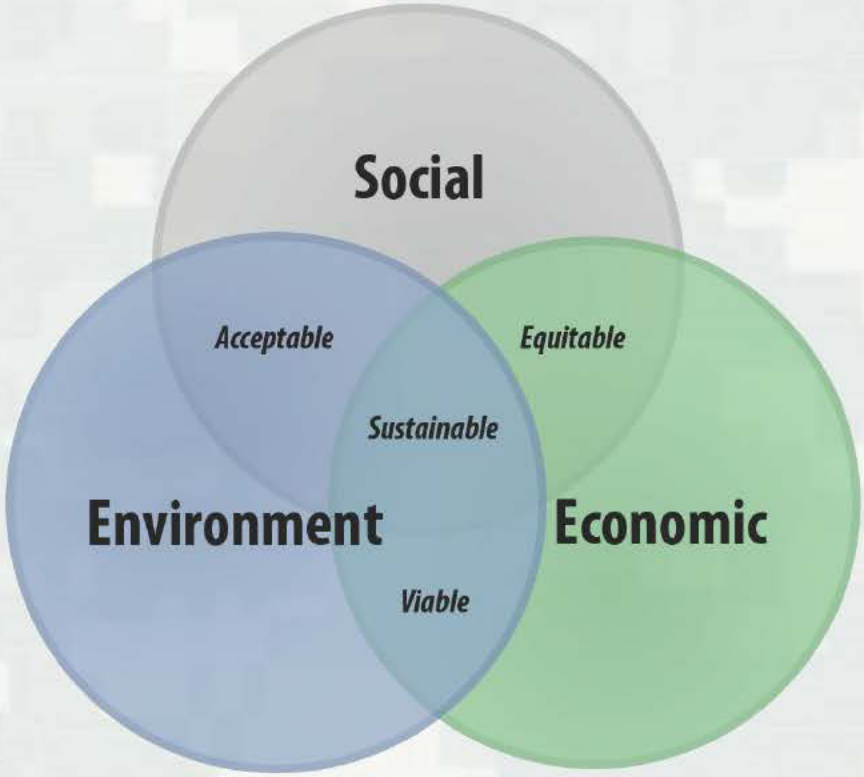


US Army Corps of Engineers
BUILDING STRONG®

The Challenge:
The *Status Quo is Not An Option*

The need:

- Efficient, cost effective engineering and operational practices
- More collaboration and cooperation with our partners and stakeholders.
  - Ports, commercial interests, regulators, NGOs, and others
- Sustainable projects. Triple-win outcomes integrating social, environmental and economic objectives.

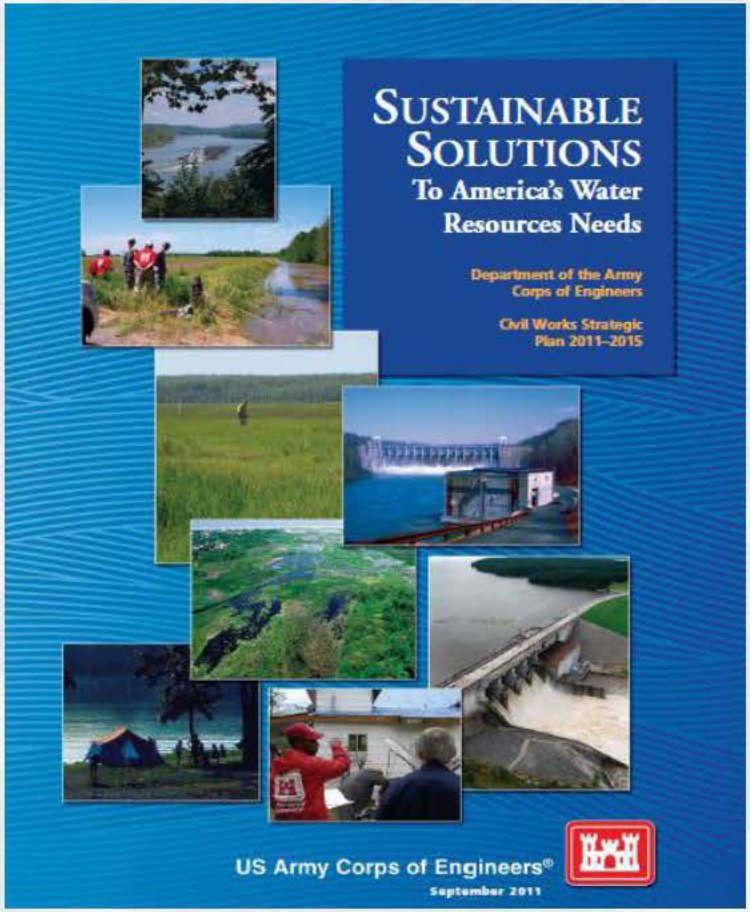


The USACE Civil Works Strategic Plan

Sustainable Solutions to America's Water Resources Needs

- Vision: "Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation's water resources challenges."

- The goals established by this strategy are to:
  - Assist in providing for safe and resilient communities and infrastructure.
  - Help facilitate commercial navigation in an environmentally and economically sustainable fashion.
  - Restore degraded aquatic ecosystems and prevent future environmental losses.
  - Implement effective, reliable, and adaptive life-cycle performance management of infrastructure.
  - Build and sustain a high quality, highly dedicated workforce.

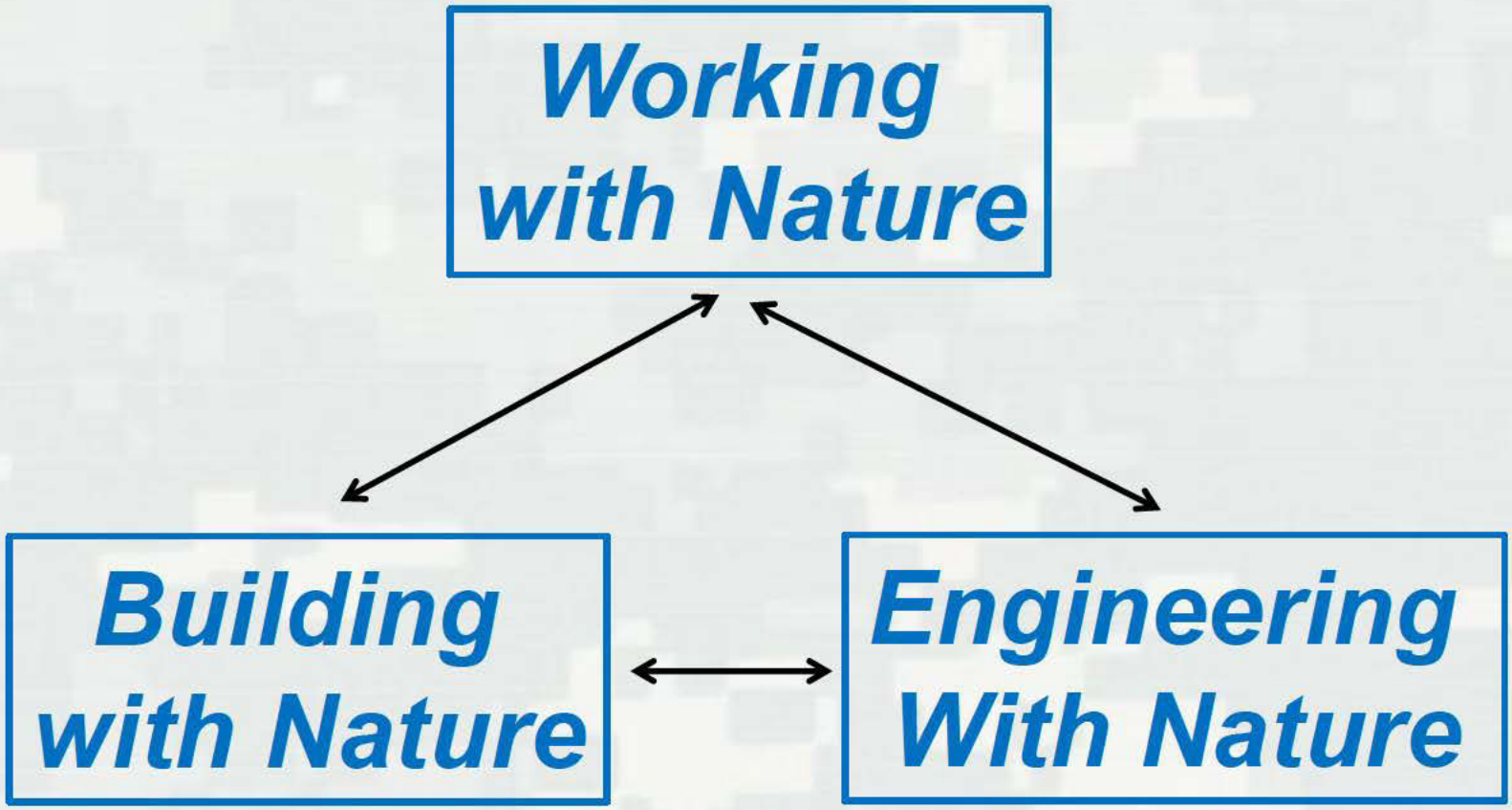


Definition

Engineering With Nature is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Background

- *Engineering With Nature* initiative was established by the USACE Navigation program in 2010. Over that period we have:
  - Conducted 7 workshops that have defined the scope and technical approach
    - Participants have included HQ, Districts, other agencies, NGOs, academics, private sector, international collaborators
  - Developed a strategic plan for the initiative
  - Initiated research to support the intent of EWN
  - Numerous briefings and discussions in a variety of fora


Working with Nature
Building with Nature
Engineering With Nature

EWN, A Natural Extension of RSM

- EWN- An *ecosystem approach* to infrastructure development and operations
  - Applied across missions and business lines
  - Expanding environmental benefits and services provided by infrastructure

The Essential Ingredients of EWN

- Use science and engineering to produce operational efficiencies
  - Support sustainable delivery of project benefits.
- Use natural process to maximum benefit
  - To reduce demands on limited resources, minimize the environmental footprint of the project, and to enhance the quality of benefits produced
- Broaden and extend the benefits provided by projects
  - To include substantiated economic, social, and environmental benefits
- Use science-based collaborative processes to organize and focus interests, stakeholders, and partners
  - To reduce social friction, resistance, and project delays while producing more broadly acceptable projects

Example EWN Opportunities

- Cost-efficient engineering practices
  - E.g., for enhancing the habitat value of infrastructure
- Use engineering to focus natural processes that achieve operational and environmental objectives
  - E.g., to minimize navigation channel infilling and to transport and focus sediments for positive benefits
- Strategic placement of sediments for beneficial use of dredged material
  - E.g., make use of hydrodynamics and natural transport processes to build near-shore habitats
- Optimizing the use of natural systems, such as wetlands and other features
  - E.g., to reduce the effects of storm processes and sea level rise on shorelines and coasts
- Science-based communications processes
  - To significantly improve stakeholder engagement, collaboration and communication

Example EWN Solutions

River Bendway Weirs

Upper Mississippi River Training Structures: Chevrons

Example EWN Solutions

Upper Missouri River Sandbar Habitat

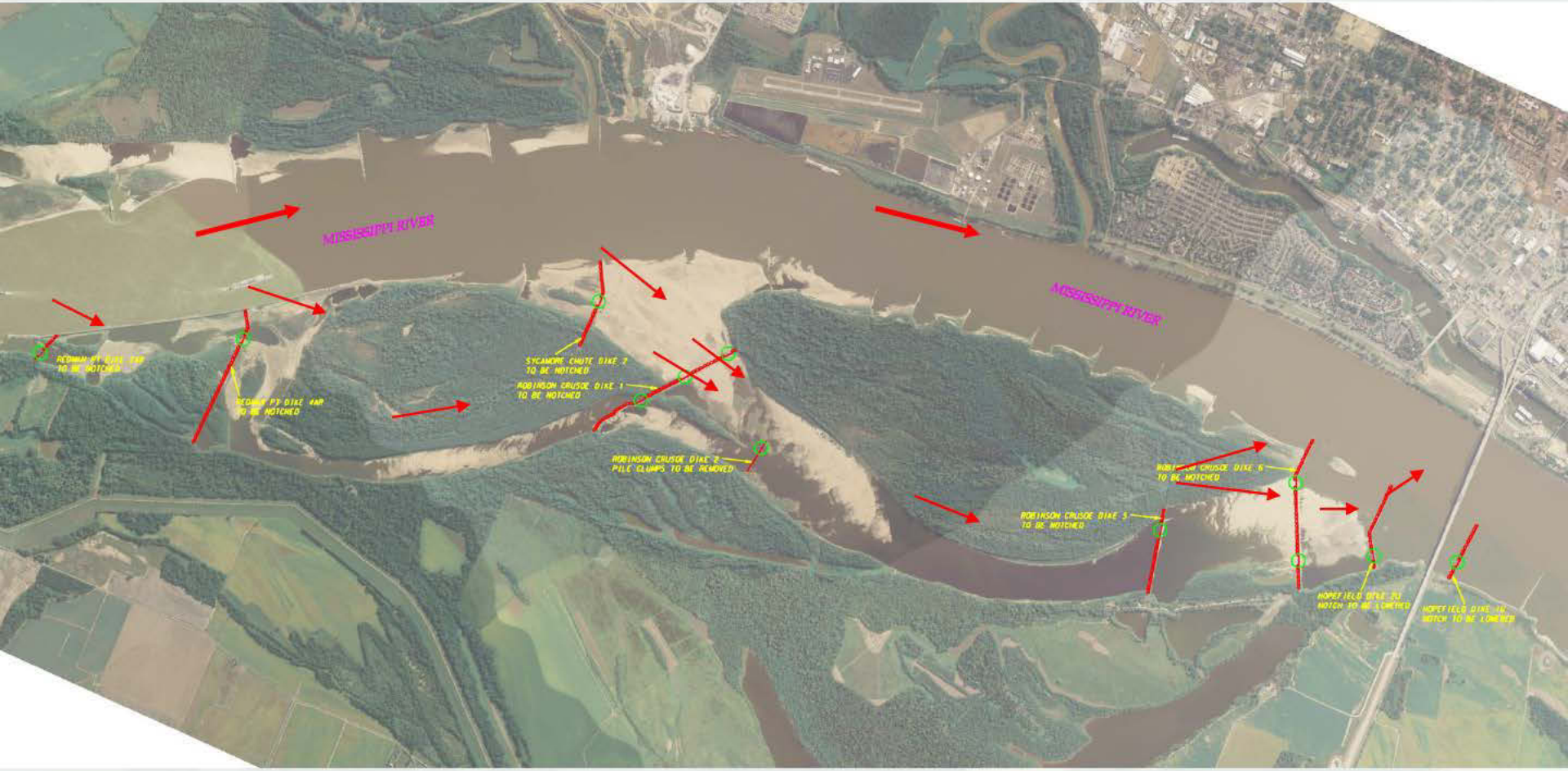
- $25 Million to construct 650 acres of sandbar
- Buried under 16,000 acres, 2011 flood

July 2009

November 2011

Courtesy: G. Pavelka
COE, 2012

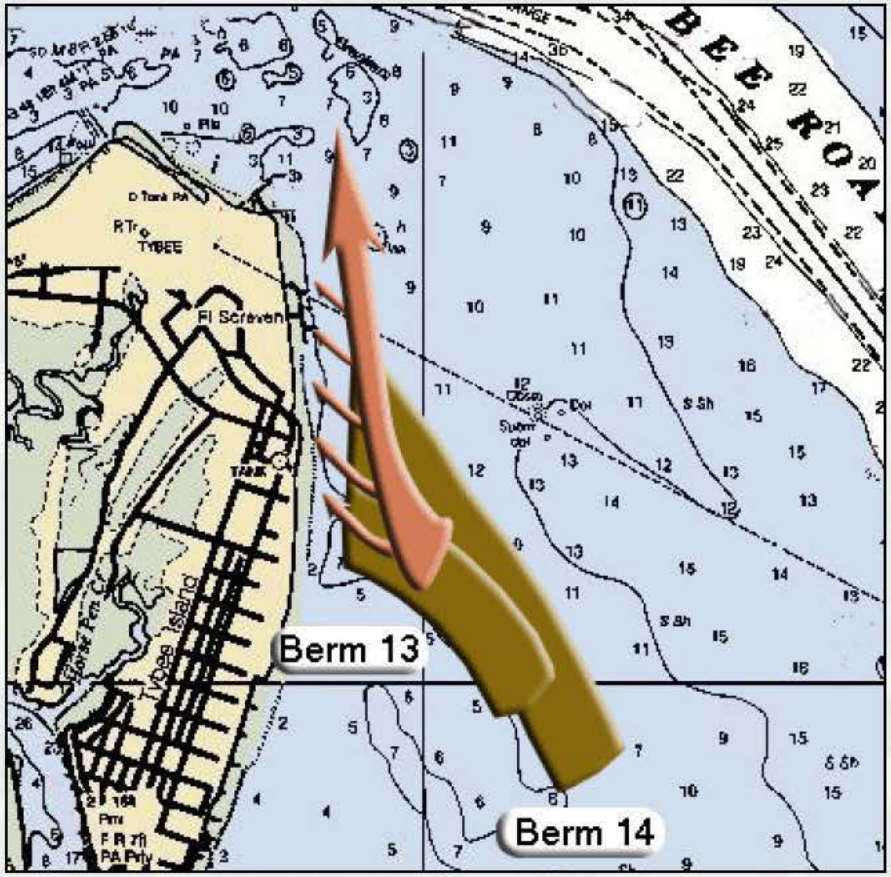
Example EWN Solutions



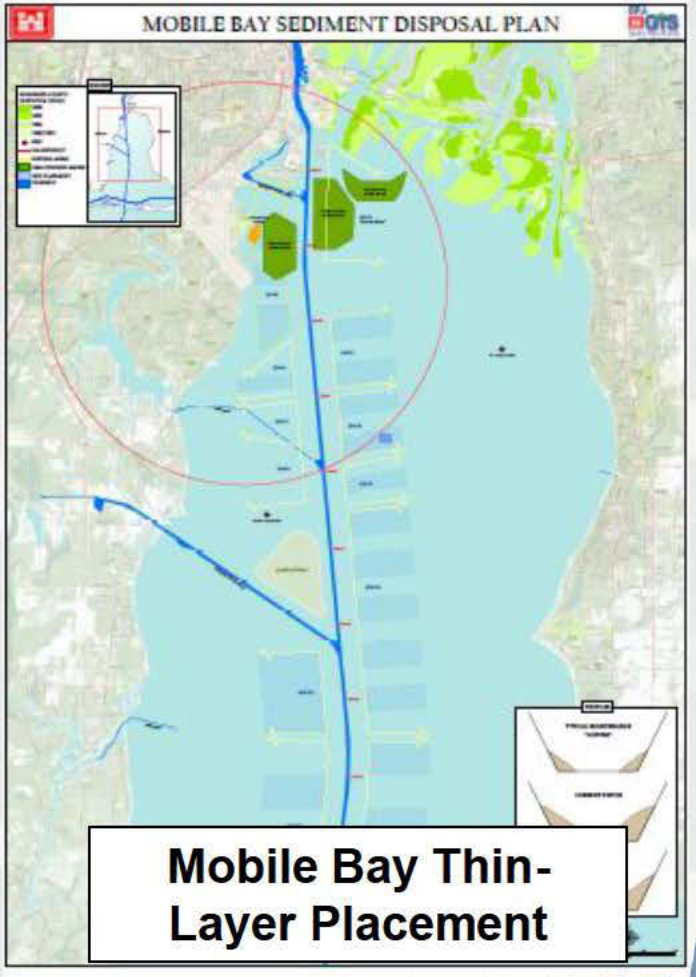
Loosahatchie Bar
Aquatic Habitat Rehabilitation

Example EWN Solutions

Strategic Sediment Placement

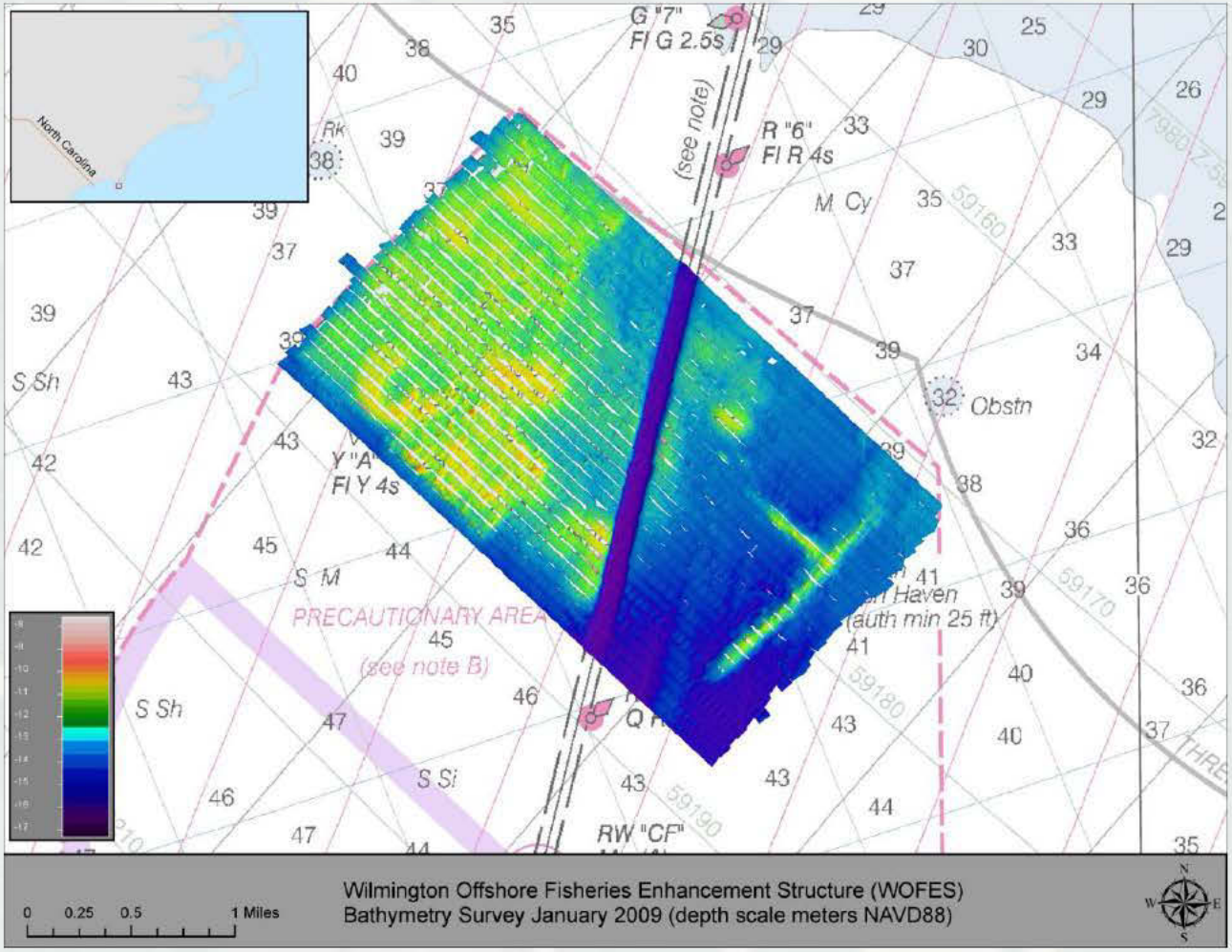


North Tybee Island
Savannah, Georgia



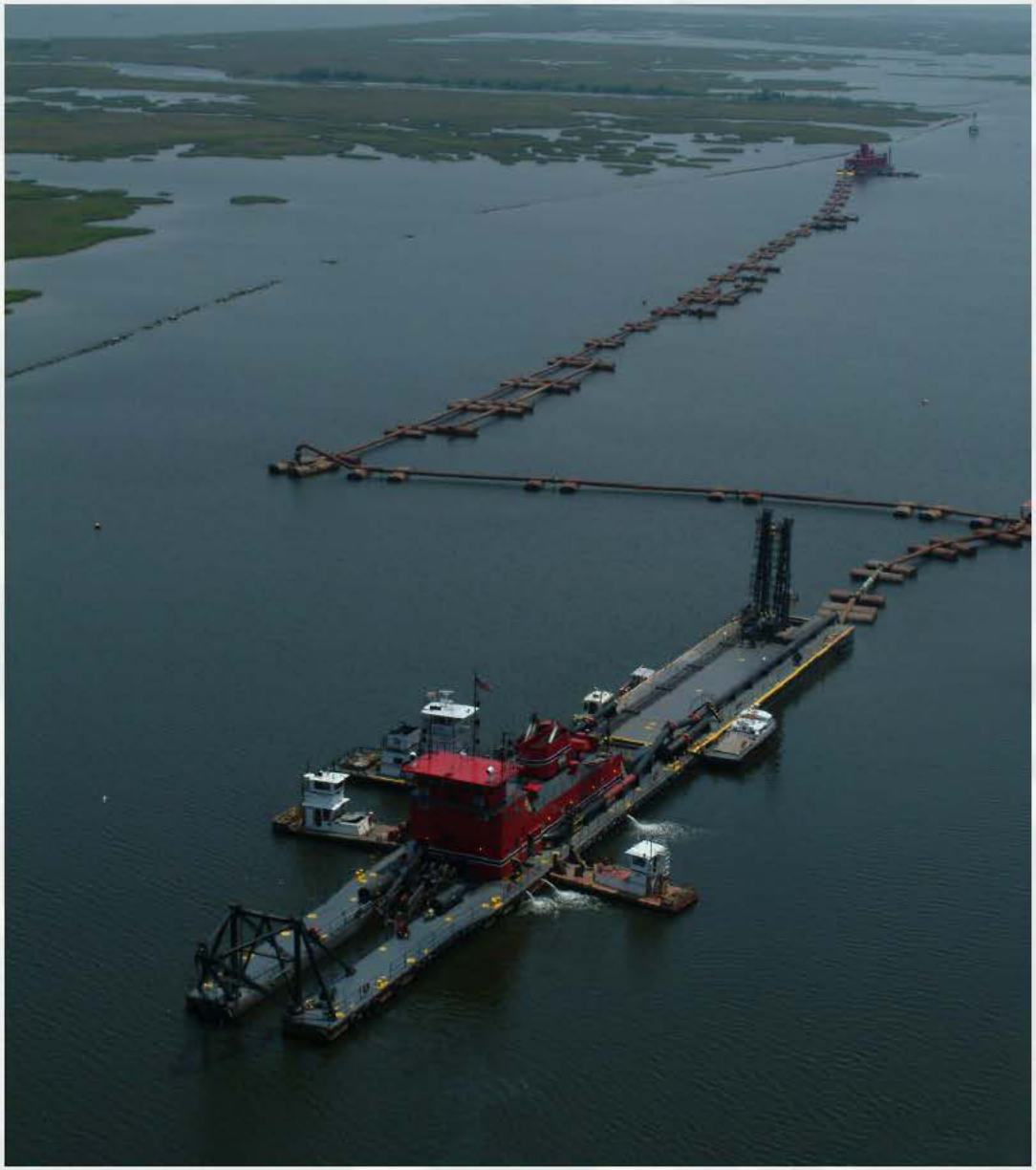
Mobile Bay Thin-Layer Placement

Example EWN Solutions



Wilmington Offshore Fisheries Enhancement Structure

Example EWN Solutions



Long-distance pumping of dredged material for wetlands creation in coastal Louisiana, USA

- ***How to marry LDC with natural transport processes to expand opportunities?***

Engineering With Nature:
The Progression

Inputs and Outputs
'Degree of'

Outcomes

- System Resilience
- Efficiency
- Benefits Related to the Project

Inputs

- Communications and Technology Transfer
- Technical Understanding
- Innovation and Creativity
- Diversity of Skills and Expertise
- Stakeholder Engagement

STAGES

1. Business as Usual
2. Understanding Natural Processes
3. Aligning Processes
4. Expanding Benefits
5. Enabling Self-Sustaining Benefits

EWN

Engineering With Nature

- Smart, efficient engineering practice
- Expand the range of benefits provided through water-based infrastructure
  - Emphasis on environmental outcomes
- Progress achieved through productive, collaborative project dynamics