

Sustainable Development of Navigation Infrastructure through Engineering with Nature

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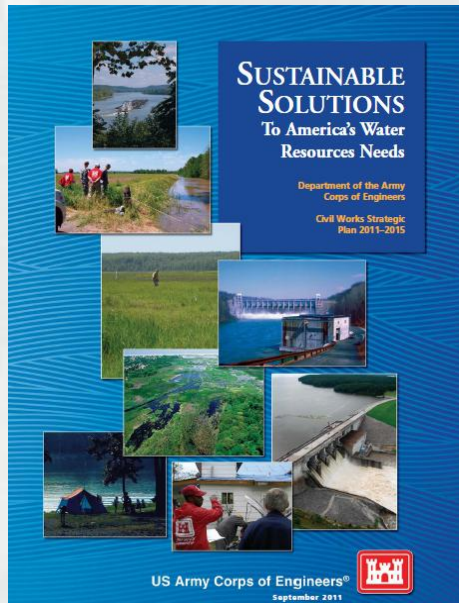


Moving Beyond the *Status Quo*



Needs:

- Efficient, cost effective engineering and operational practices
- More collaboration and cooperation, less unproductive conflict.
 - ▶ Ports, commercial interests, regulators, NGOs, and others
- Sustainable projects. Triple-win outcomes integrating social, environmental and economic objectives.



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

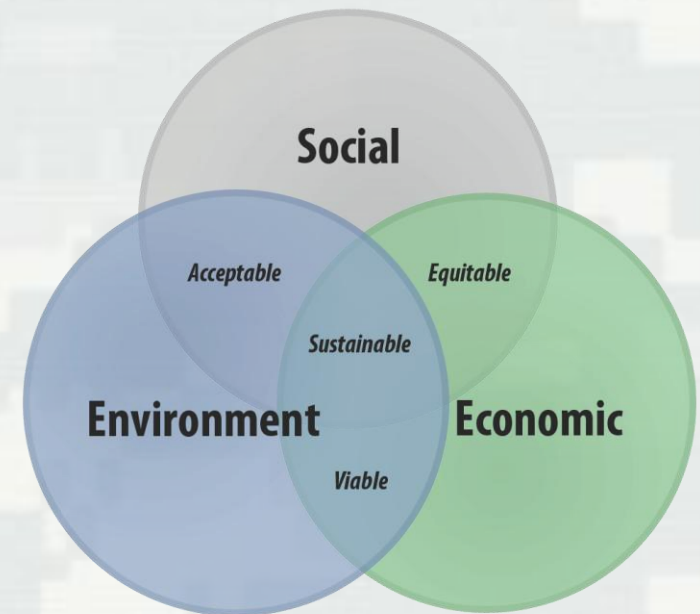


Engineering With Nature...

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

Key Ingredients

- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners





***Working
with Nature***

***Engineering
with Nature***

***Building
with Nature***



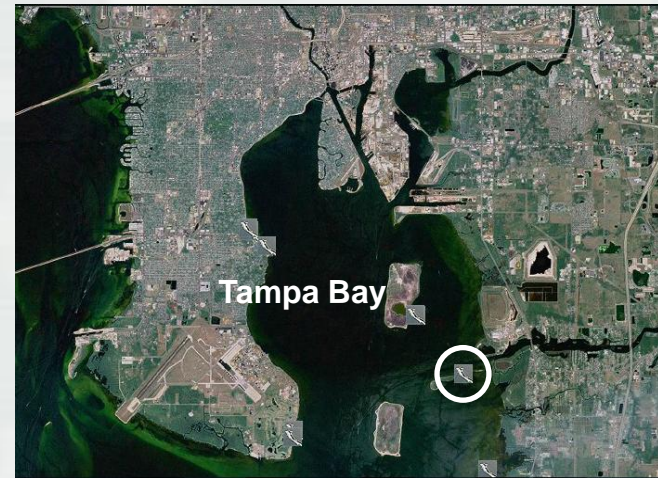
EWN Status

- *Engineering With Nature* initiative was started within the USACE Civil Works program in 2010. Over that period we have:
 - ▶ Engaged > 300 ind. across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
 - Workshops (10), dialogue sessions, project development teams, etc.
 - ▶ Developed a strategic plan
 - ▶ Focused research projects on EWN
 - ▶ Initiated field demonstration projects
 - ▶ Begun implementing our communication plan



Alafia Banks Bird Sanctuary, FL

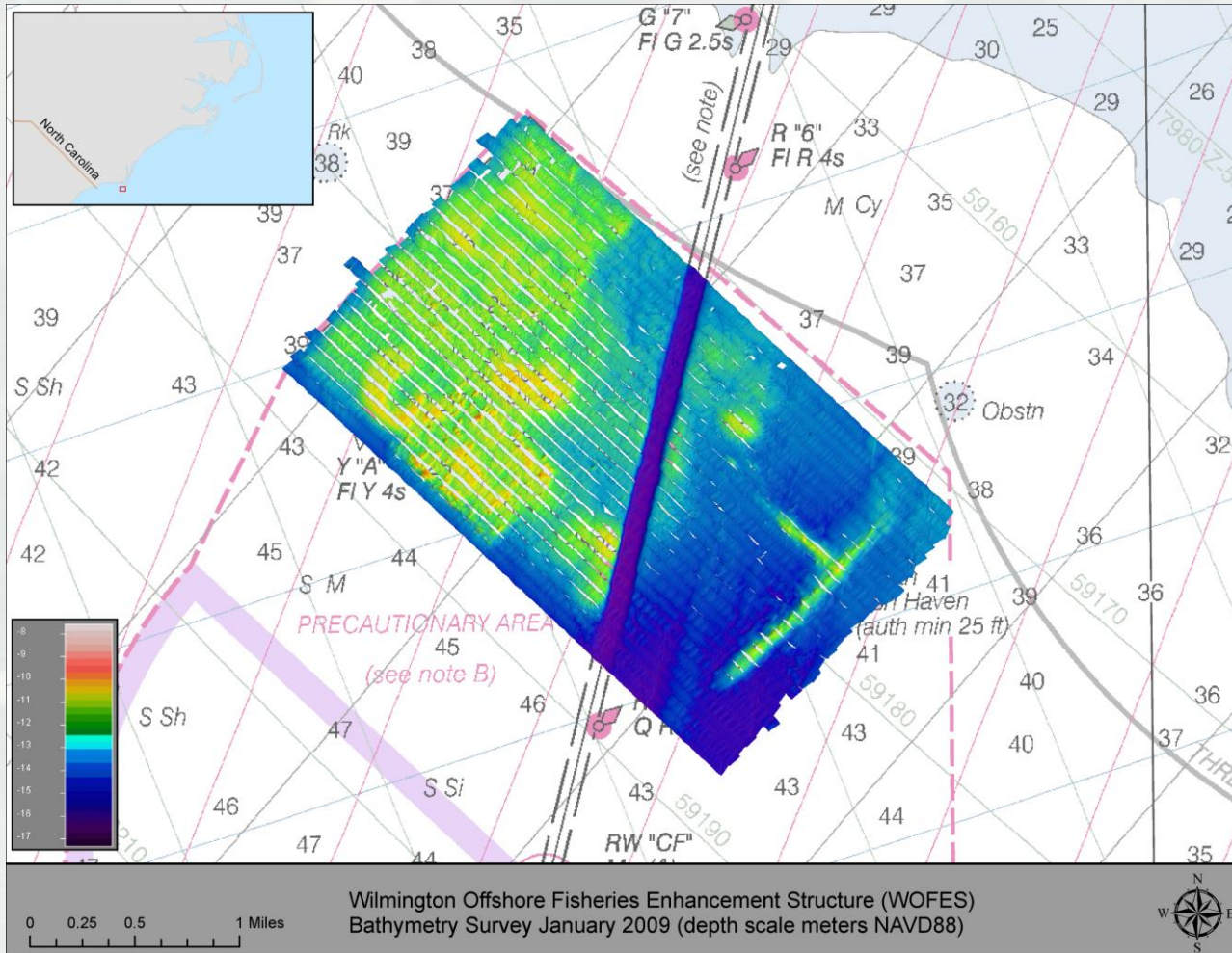
- 8000 lb reef module breakwaters (930 ft)
- Shore protection for Audubon bird sanctuary islands
- Help restore oyster populations
- Provide habitat



Example: www.reefball.org



Example EWN Solutions

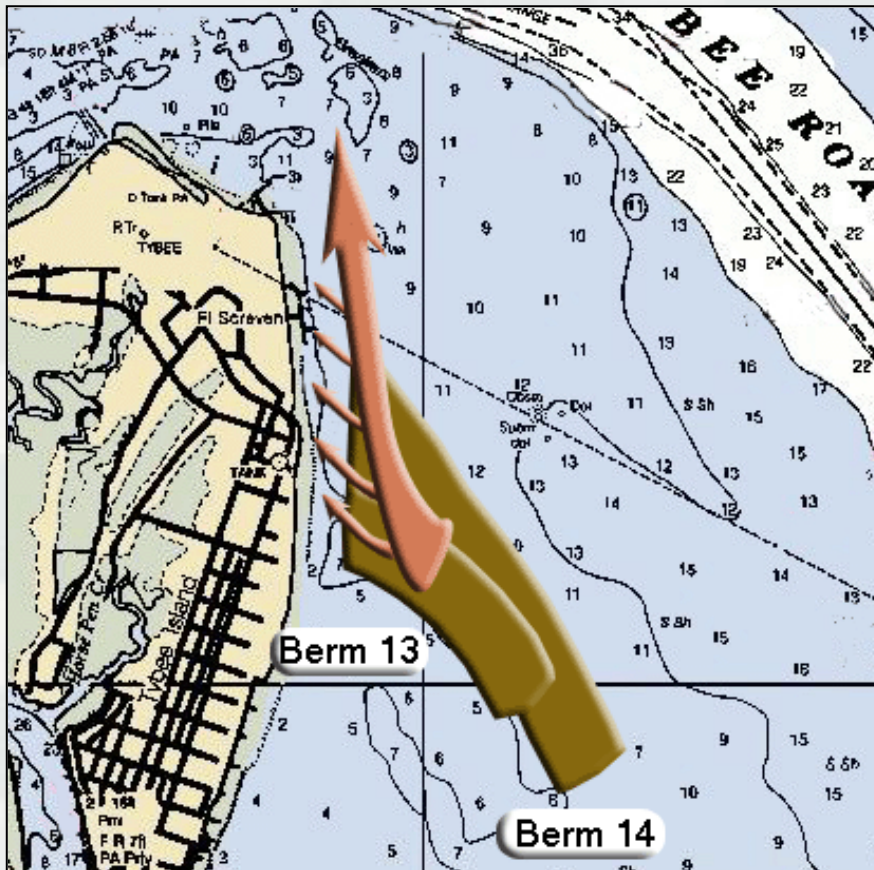


Wilmington Offshore Fisheries Enhancement Structure

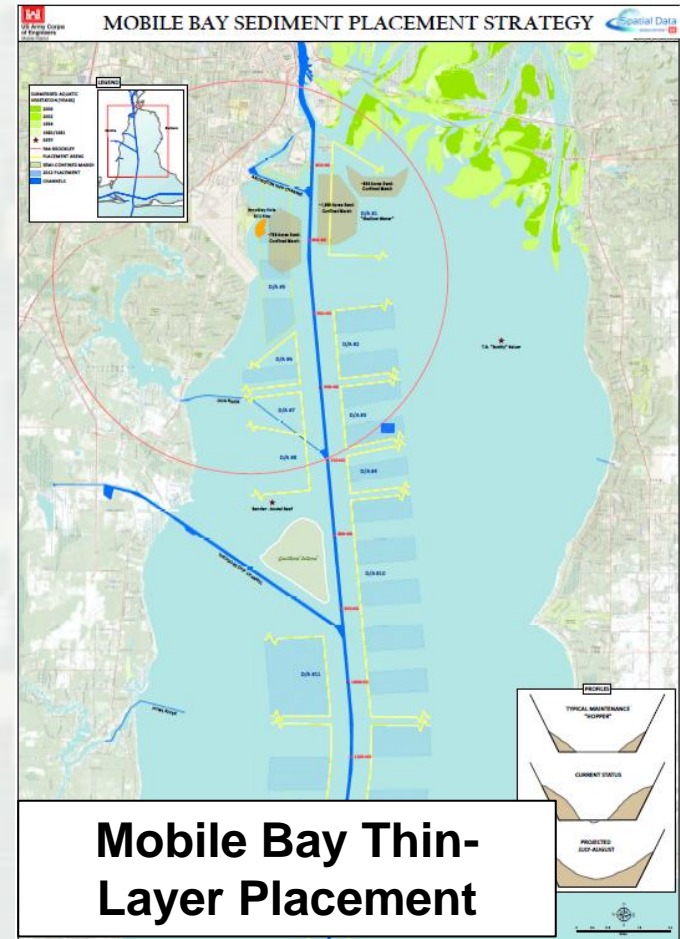


Example EWN Solutions

Strategic Sediment Placement



**North Tybee Island
Savannah, Georgia**



Mobile Bay Thin-Layer Placement

Example EWN Solutions

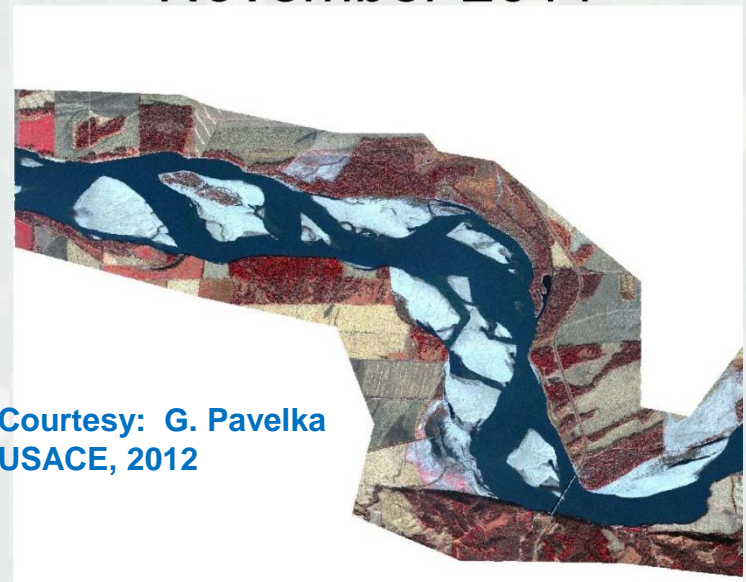
Upper Missouri River Sandbar Habitat

- \$25 Million to construct 650 acres of sandbar
- 16,000 acres created by the flood of 2011

July 2009

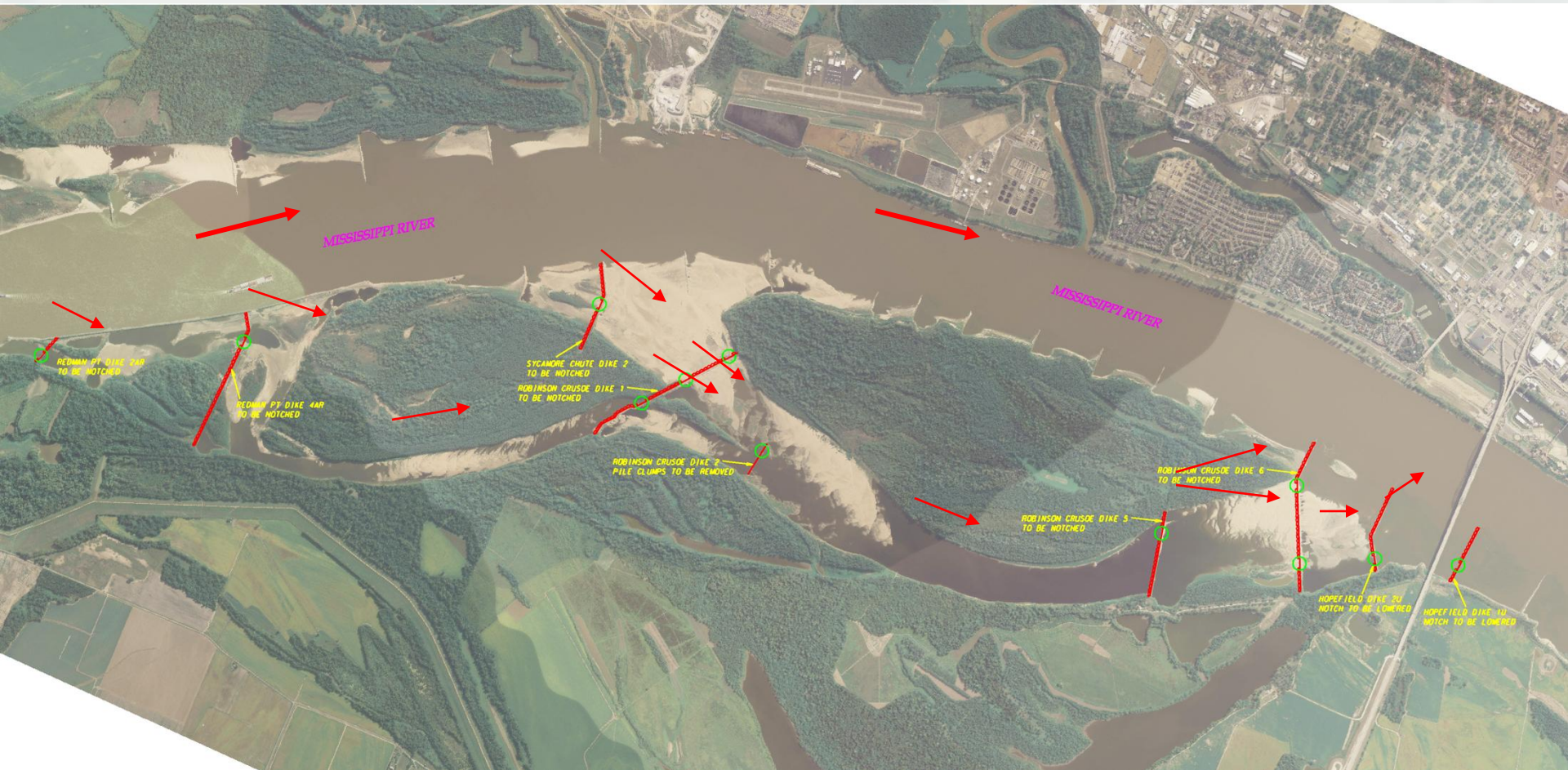


November 2011



Courtesy: G. Pavelka
USACE, 2012

Example EWN Solutions



Loosahatchie Bar
Aquatic Habitat Rehabilitation



EWN Action Demonstration Projects

- Sediment Retention Engineering to Facilitate Wetland Development (San Francisco Bay, CA)
- Realizing a Triple Win in the Desert: Systems-level Engineering With Nature on the Rio Grande (Albuquerque, NM)
- Atchafalaya River Island and Wetlands Creation Through Strategic Sediment Placement (Morgan City, LA)
- Portfolio Framework to Quantify Beneficial Use of Dredged Material (New Orleans and New England)
- Engineering Tern Habitat into the Ashtabula Breakwater (Ashtabula, OH)
- Living Shoreline Creation Through Beneficial Use of Dredged Material (Duluth, MN)
- A Sustainable Design Manual for Engineering With Nature Using Native Plant Communities



Systems: Coastal Risk Reduction and Resilience

“The USACE planning approach supports an **integrated approach** to reducing coastal risks and increasing human and ecosystem community resilience through a combination of **natural, nature-based, non-structural and structural measures**. This approach considers the engineering attributes of the component features and the dependencies and interactions among these features over both the short- and long-term. It also considers the **full range of environmental and social benefits** produced by the component features.”

Coastal Risk Reduction and Resilience: Using the Full Array of Measures



US Army Corps of Engineers
Directorate of Civil Works



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Natural and Nature-Based Infrastructure at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM INTENSITY, TRACK, AND FORWARD SPEED, AND SURROUNDING LOCAL BATHYMETRY AND TOPOGRAPHY



Dunes and Beaches

Benefits/Processes

Break offshore waves
Attenuate wave energy
Slow inland water transfer

Performance Factors

Berm height and width
Beach Slope
Sediment grain size and supply
Dune height, crest, width
Presence of vegetation



Vegetated Features:

Salt Marshes, Wetlands, Submerged Aquatic Vegetation (SAV)

Benefits/Processes

Break offshore waves
Attenuate wave energy
Slow inland water transfer
Increase infiltration

Performance Factors

Marsh, wetland, or SAV elevation and continuity
Vegetation type and density



Oyster and Coral Reefs

Benefits/Processes

Break offshore waves
Attenuate wave energy
Slow inland water transfer

Performance Factors

Reef width, elevation and roughness



Barrier Islands

Benefits/Processes

Wave attenuation and/or dissipation
Sediment stabilization

Performance Factors

Island elevation, length, and width
Land cover
Breach susceptibility
Proximity to mainland shore



Maritime Forests/Shrub Communities

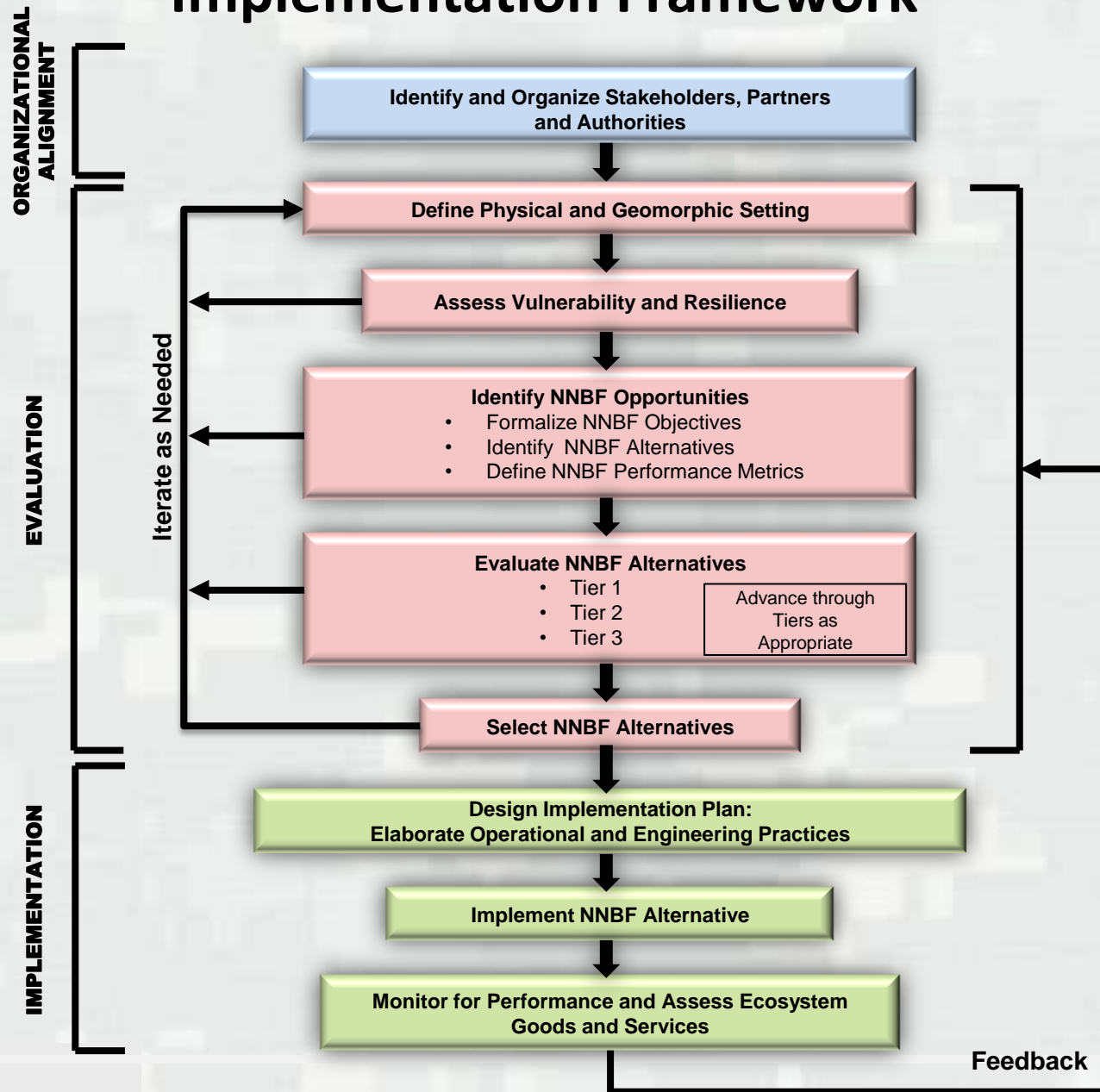
Benefits/Processes

Wave attenuation and/or dissipation
Shoreline erosion stabilization
Soil retention

Performance Factors

Vegetation height and density
Forest dimension
Sediment composition
Platform elevation

Natural and Nature-Based Features Evaluation and Implementation Framework



Process Research: Physical Processes within Wetlands

■ Problem

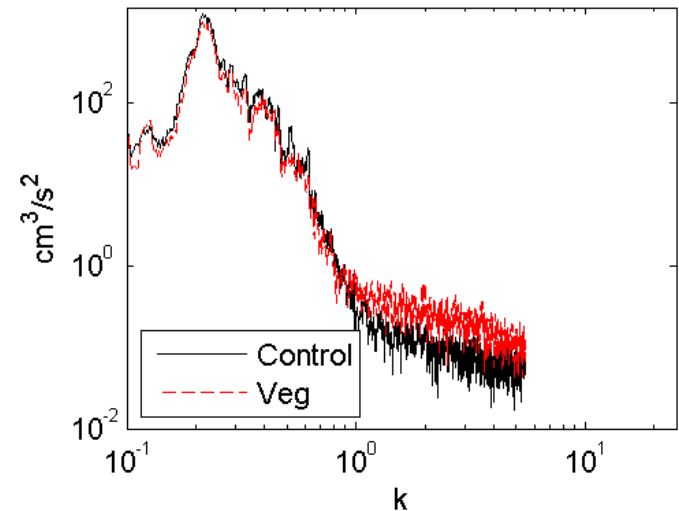
- Poor understanding of mixed sediment transport in vegetated regions with waves and currents
- Unacceptable uncertainty when evaluating nearshore and wetland placement alternatives

■ Approach

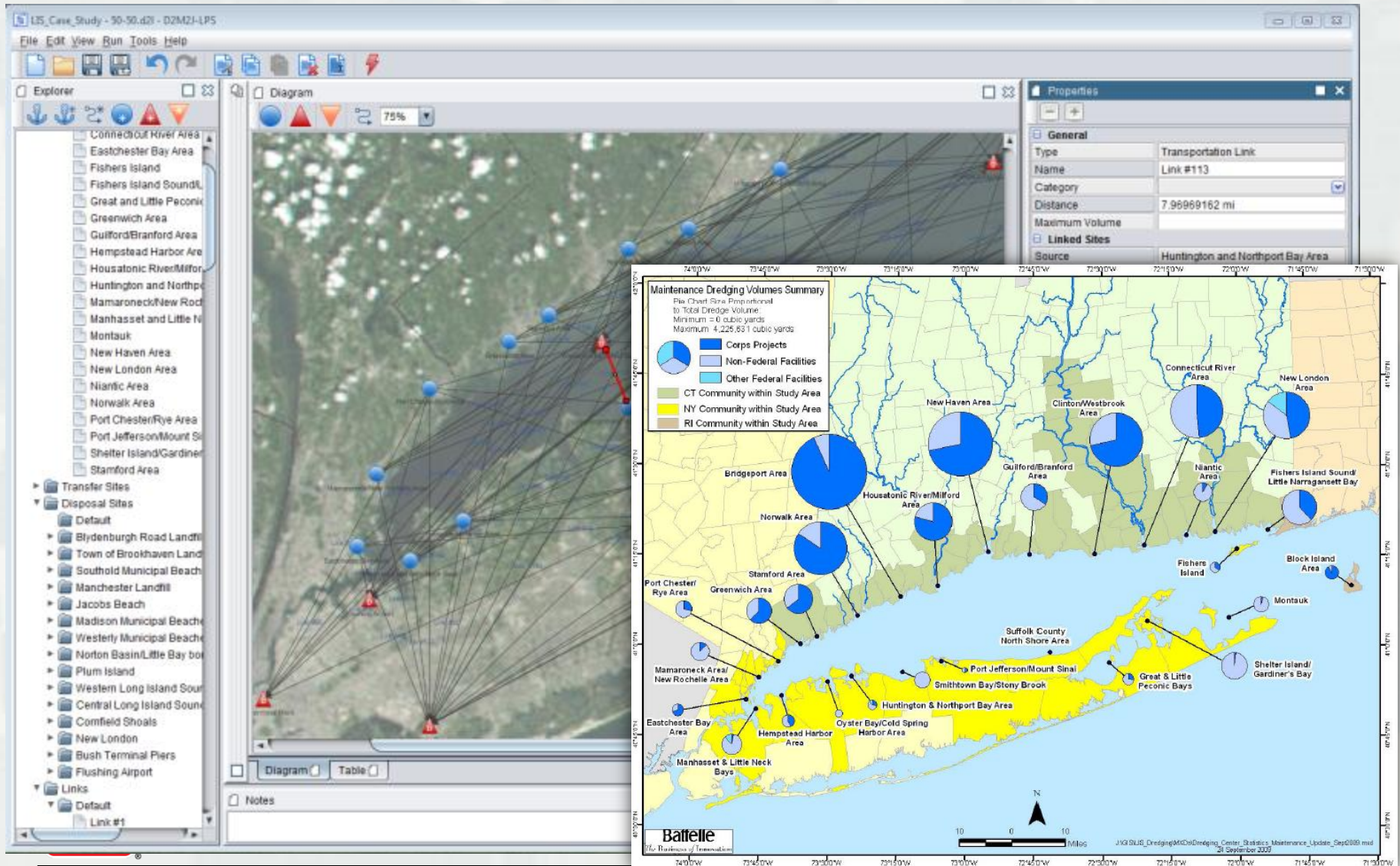
- Laboratory experiments to quantify hydrodynamic and transport processes in vegetation
- Laboratory experiments → 10' flume; Investigated wave energy transformation and limited sediment studies
- Field experiments (planned) → Tampa SAV, Fort Saint Phillip, Currituck Sound



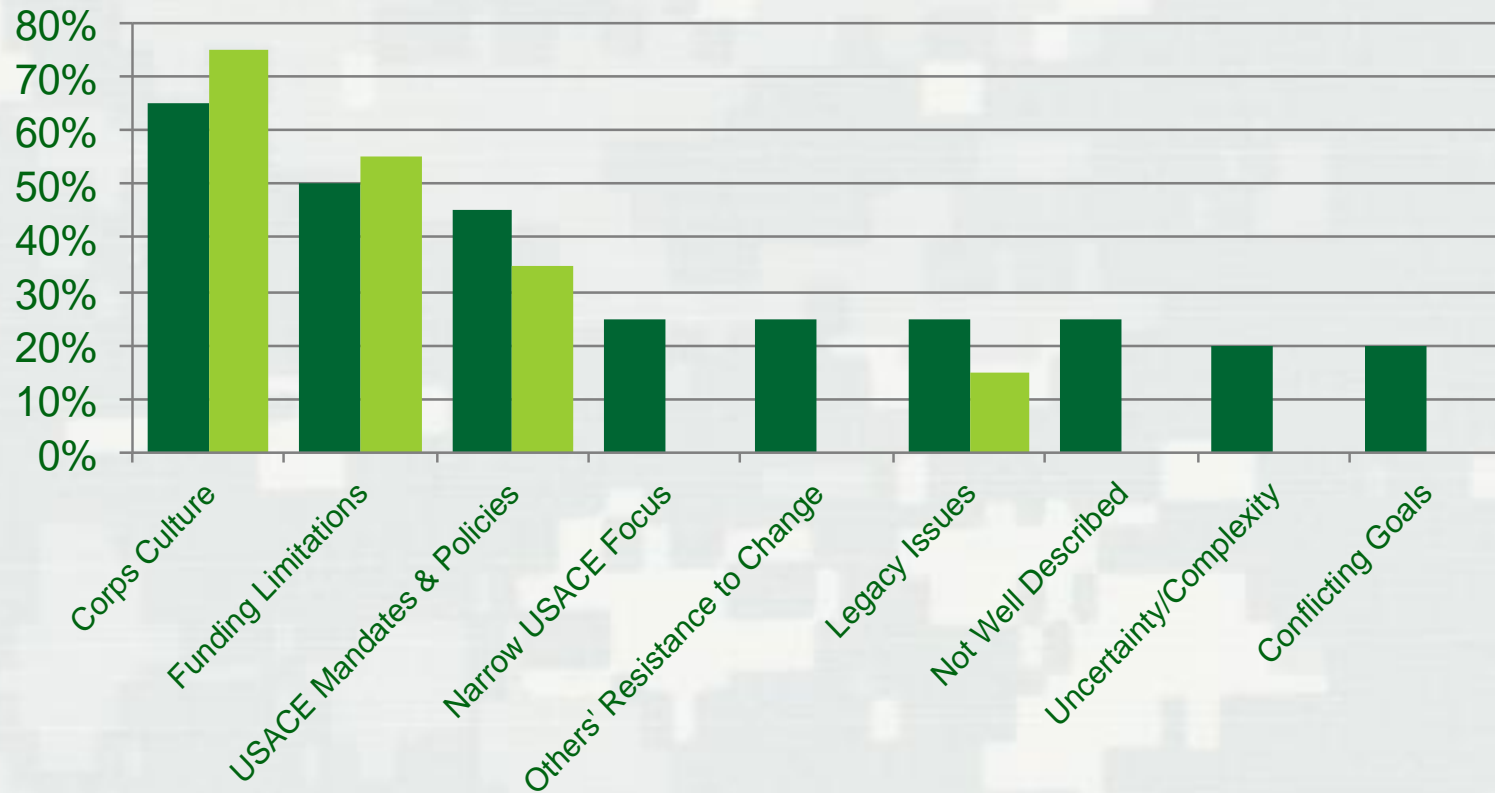
(d)



D2M2: Dredged Material Management Decisions



Barriers to EWN Adoption

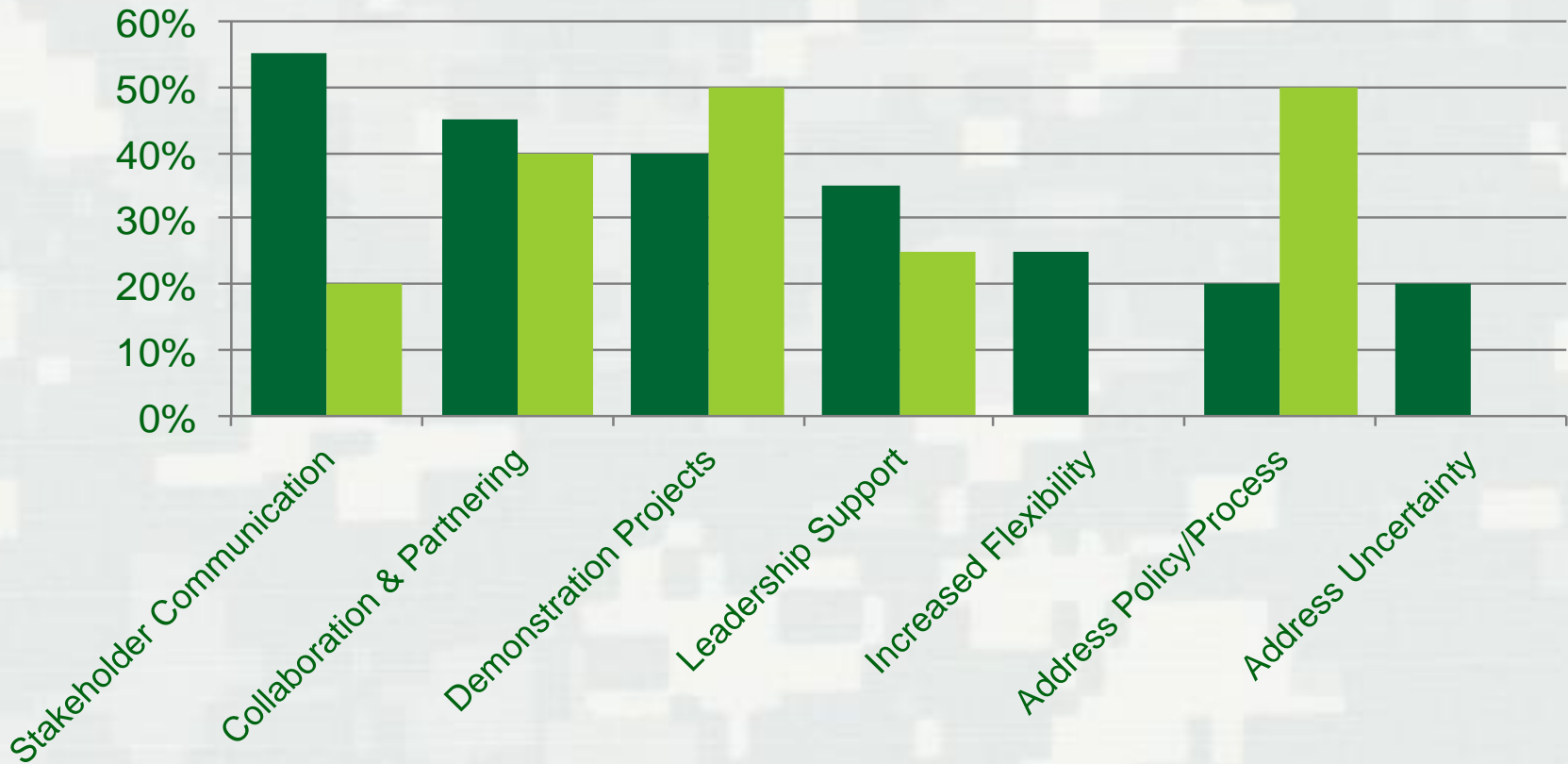


External MM (n=34)

Internal MM (n=22) (Only common factors shown)



Overcoming Barriers to EWN



External MM (n=34)
Internal MM (n=22) (Only common factors shown)



Engineering With Nature

- Expand the range of benefits provided through water-based infrastructure
 - ▶ Create value!
- Balancing consideration of environmental risks with project **benefits**
- A path to more sustainable projects
 - ▶ 2013 Chief of Engineers Environmental Award in Natural Resources Conservation
 - ▶ 2014 USACE Sustainability Award-Green Innovation





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WHAT IS ENGINEERING WITH NATURE?

Engineering With Nature (EWN) is an initiative of the U.S. Army Corps of Engineers (USACE) to enable more sustainable delivery of economic, social, and environmental benefits associated with water resources infrastructure. EWN directly supports USACE's "Sustainable Solutions to America's Water Resources Needs: Civil Works Strategic Plan 2011 - 2015" and contributes to the achievement of its Civil Works Mission and Goals. EWN is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaborative processes.

UPCOMING EVENTS

21-23 MAY USACE Coastal Resilience Conference: New Orleans, LA

1-5 JUNE 33rd PIANC World Congress: San Francisco, CA

15-18 JUNE Western Dredging Assoc. and Texas A&M University Conference: Toronto, Canada

WHAT'S NEW

Dr. Todd Bridges, Senior Research Scientist, describes how Engineering With Nature fits within the USACE Navigation mission.



FEEDBACK FROM OTHERS

"In the old days, the Corps would identify a problem and come up with a solution and approach fish and wildlife and its partners very late in the process after resources had been pretty much committed, especially in the design phase. But because it was so late in the process, there was never any discussion about alternatives and it was pretty much take it or leave it. Engineering With Nature allows us to get involved early and have the dialogue that is needed to try some non-traditional approaches that work." -Partner Agency



Environmental Laboratory | Engineer Research & Development Center

www.EngineeringWithNature.org
<http://el.erd.c.usace.army.mil/ewn>



EWN ProMap

- Online GIS database of projects illustrating EWN principles and practices
 - ▶ Illustrating the key attributes of EWN
- Currently contains >200 projects
 - ▶ Name
 - ▶ Manager/Owner
 - ▶ Description
 - ▶ Infrastructure association e.g., jetty, breakwater, channel
 - ▶ Benefits e.g., fish habitat, bird habitat, recreation
 - ▶ Links, reports, photos
- Designed to facilitate communication about opportunities, lessons learned, and good practices
- Projects examples will be added through a process of self-nomination and independent evaluation

