

# Engineering With Nature for Sustainable Water Resources Infrastructure

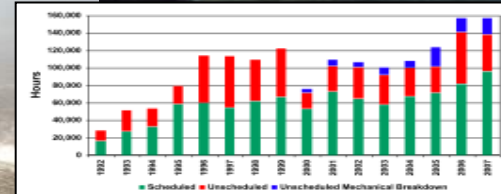


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US Army Corps of Engineers  
**BUILDING STRONG®**

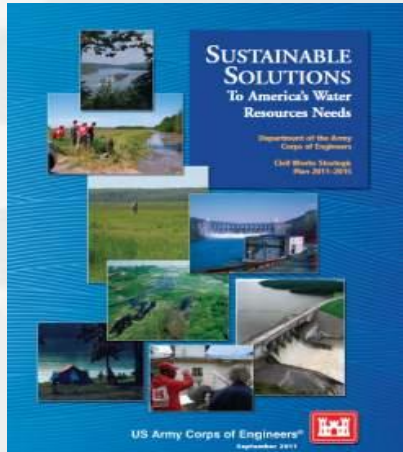


# Status Quo is Not An Option



## 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.”

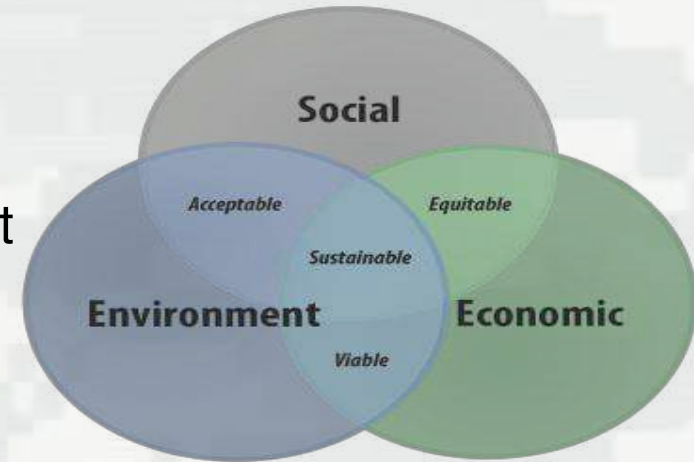


# Engineering With Nature (EWN)...

*...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 processes in a systems context
- Broaden and extend project benefits
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners



# EWN Status

- Began in USACE Civil Works program during 2010
- Engaged > 200 individuals across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
- Used 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





# ***A Sediment Progression: From Confinement to In-Water Creation***

**Craney  
Island, VA**



**Times  
Beach,  
NY**



**Poplar Island, MD**



**Wetland  
creation in LA**

# Example EWN Solutions

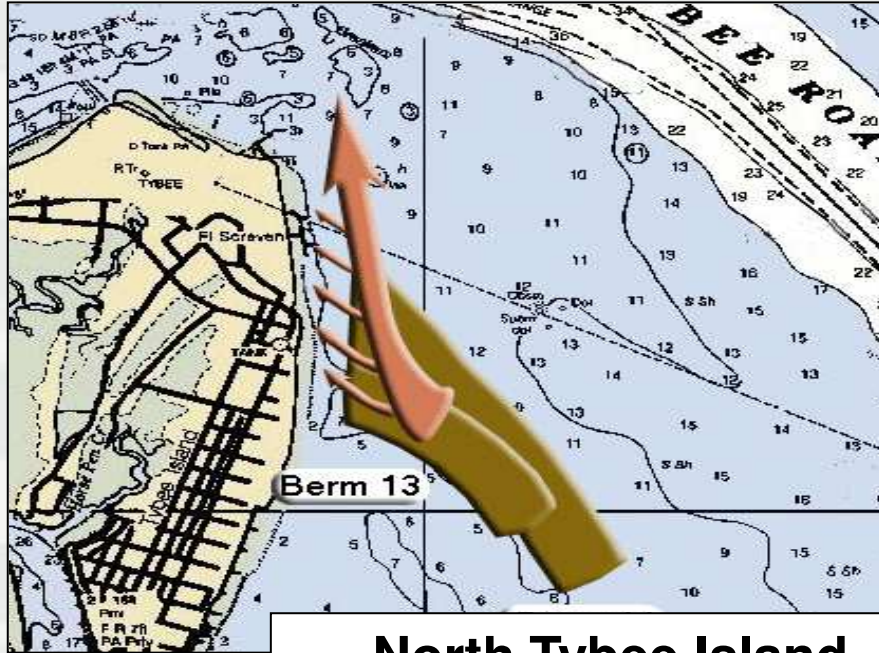


**Long-distance  
pumping of dredged  
material for wetlands  
creation in coastal  
Louisiana, USA**

- *How to exploit  
natural transport  
processes to expand  
opportunities?*

# Example EWN Solutions

## *Strategic Sediment Placement*



**North Tybee Island  
Savannah, Georgia**



**Mobile Bay, AL  
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



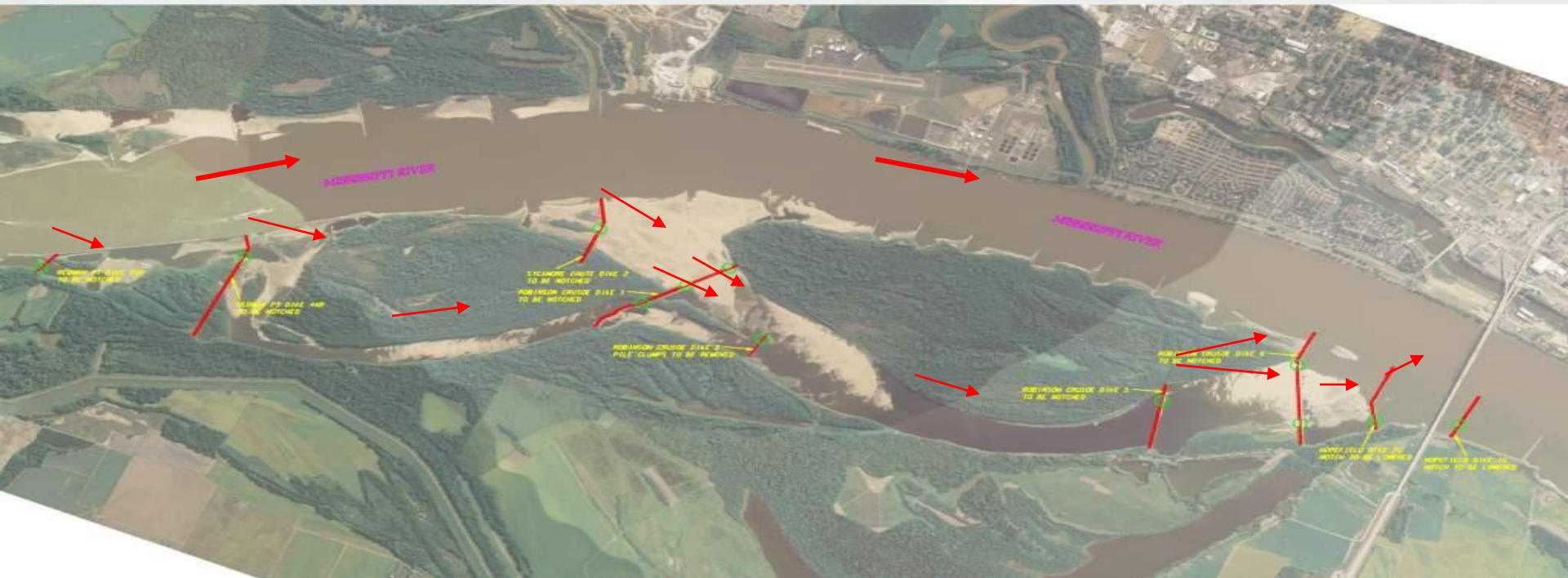
November 2011



Courtesy:  
G. Pavelka  
COE, 2012



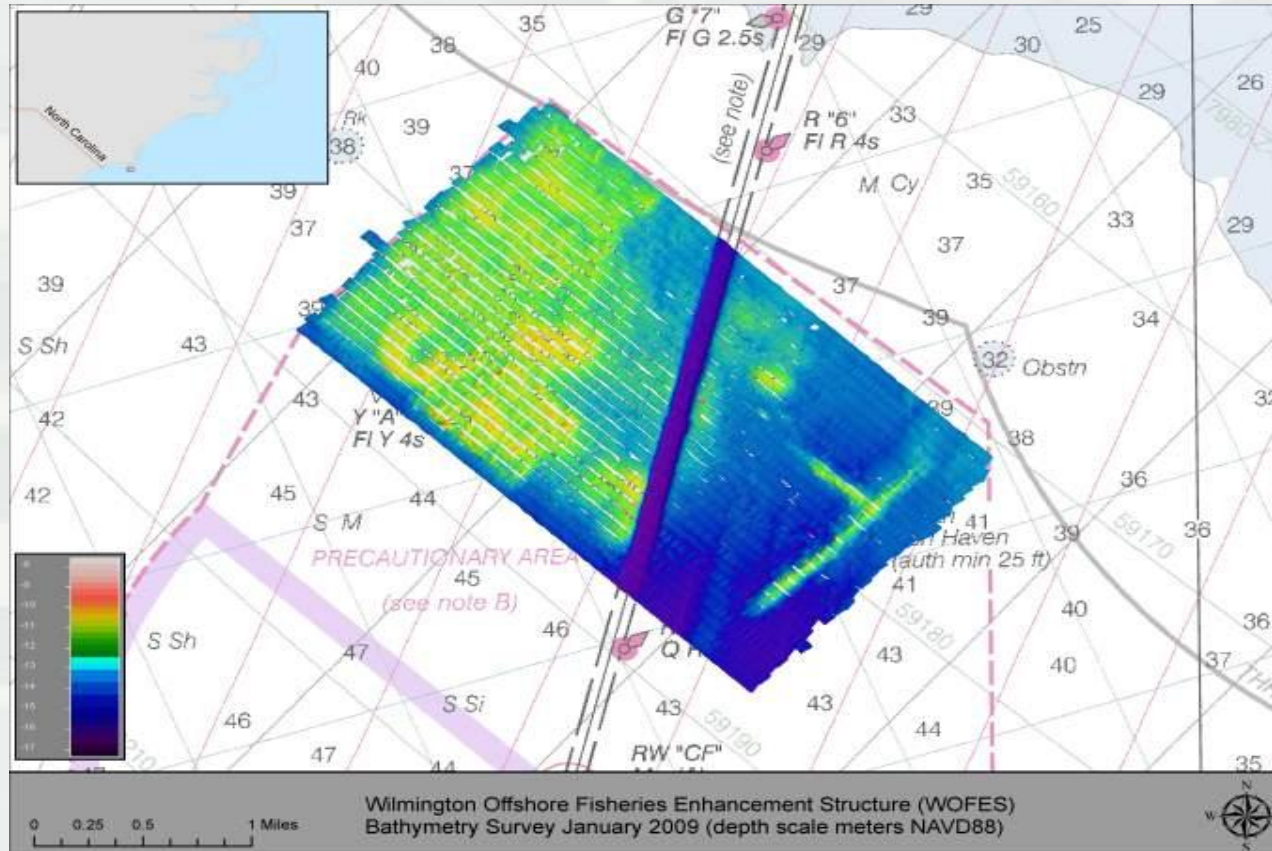
# Example EWN Solutions



## Loosahatchie Bar Aquatic Habitat Rehabilitation

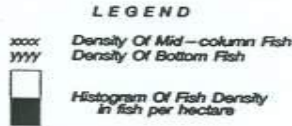
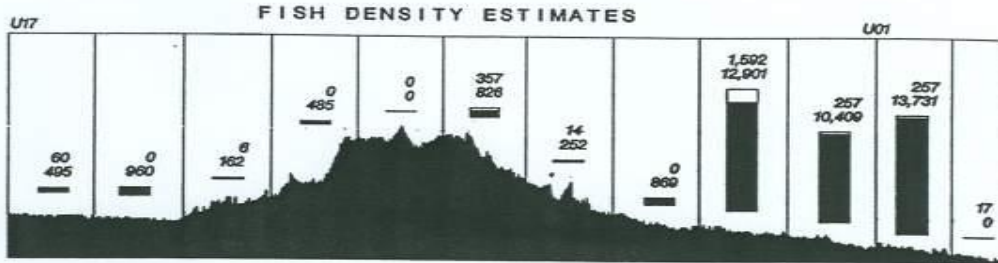


# Example EWN Solutions



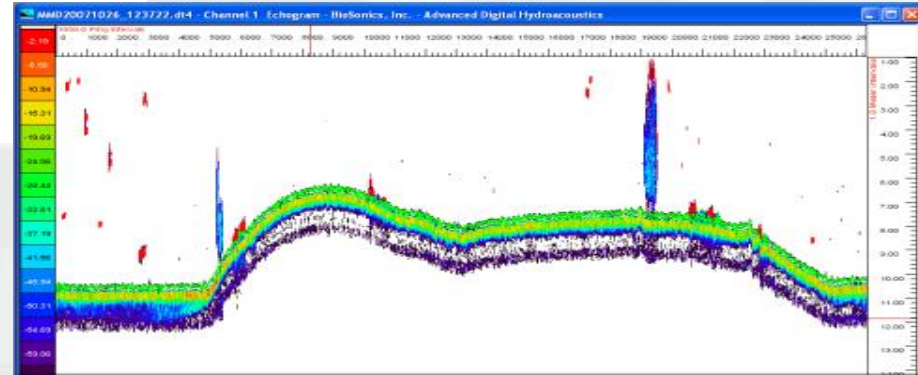
**Wilmington  
Offshore  
Fisheries  
Enhancement  
Structure**

# Example EWN Solutions



Hydroacoustics and trawling data used to document fisheries benefits provided by topographic relief created with dredged material

Mobile Offshore Dredged Material Mound





# Example EWN Solutions



**Upper Mississippi River Training  
Structures: Chevrons**



**River Bendway Weirs**



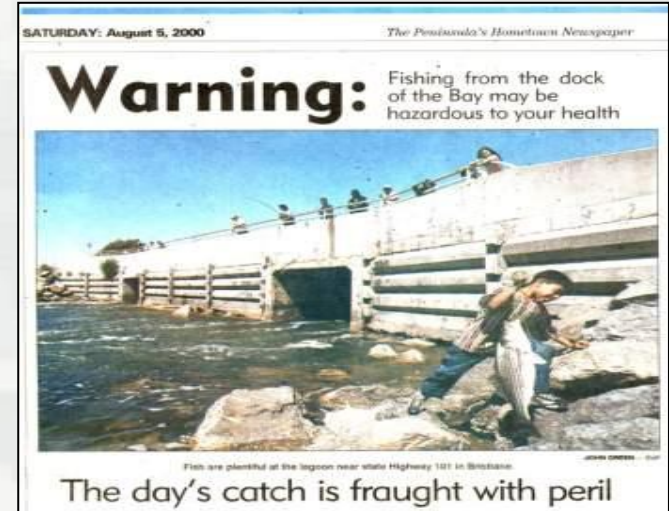
**Environmentally  
Enhanced  
Breakwater  
Toe Blocks**





# Scope of Contaminated Sediment Problem in US

- EPA 1997 sediment survey report concludes 1.2 billion yd<sup>3</sup> surface sediments “pose potential risks”
- Cleanup programs
  - ▶ ~350 sediment sites in Superfund
    - ~ 30 megasites (> \$50M)
- Navigation dredging
  - ▶ 250 M m<sup>3</sup> of sediment dredged annually in the US
  - ▶ Management costs for sediment range over 3 orders of magnitude



# Monitored Natural Recovery (MNR)

- Natural recovery processes will operate at all sites
  - Chemical transformation
  - Reduced contaminant mobility and bioavailability
  - Physical isolation
  - Dispersion
- What additional engineering is needed to bring about acceptable risk reduction?
- How to develop lines-of-evidence to support decisions



DoD 2009 *Technical guide: Monitored natural recovery at contaminated sediment sites.* ESTCP-ER-0622.

<http://www.epa.gov/superfund/health/conmedia/sediment/documents.htm>

# Using Natural Recovery Processes to Facilitate Ben Use at Fifi Island – Bayou Rigaud, LA

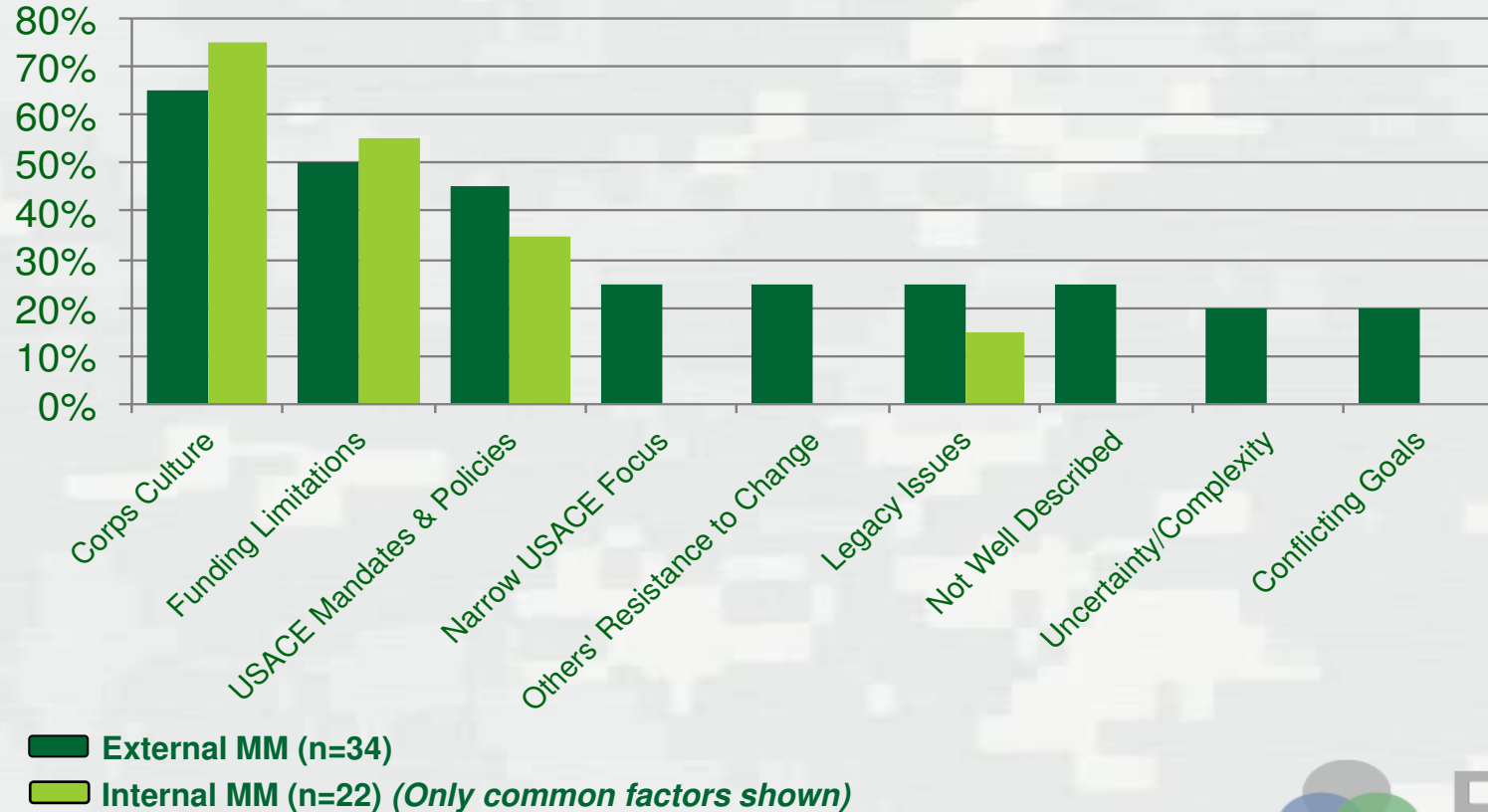


- $\text{NH}_3$  contaminated sediments/effluent
- Eco-hydraulic design
  - ▶ Sediment settling
  - ▶ Wetlands  $\text{NH}_3$  uptake
- 24 Ac mudflats and 7 Ac marsh created



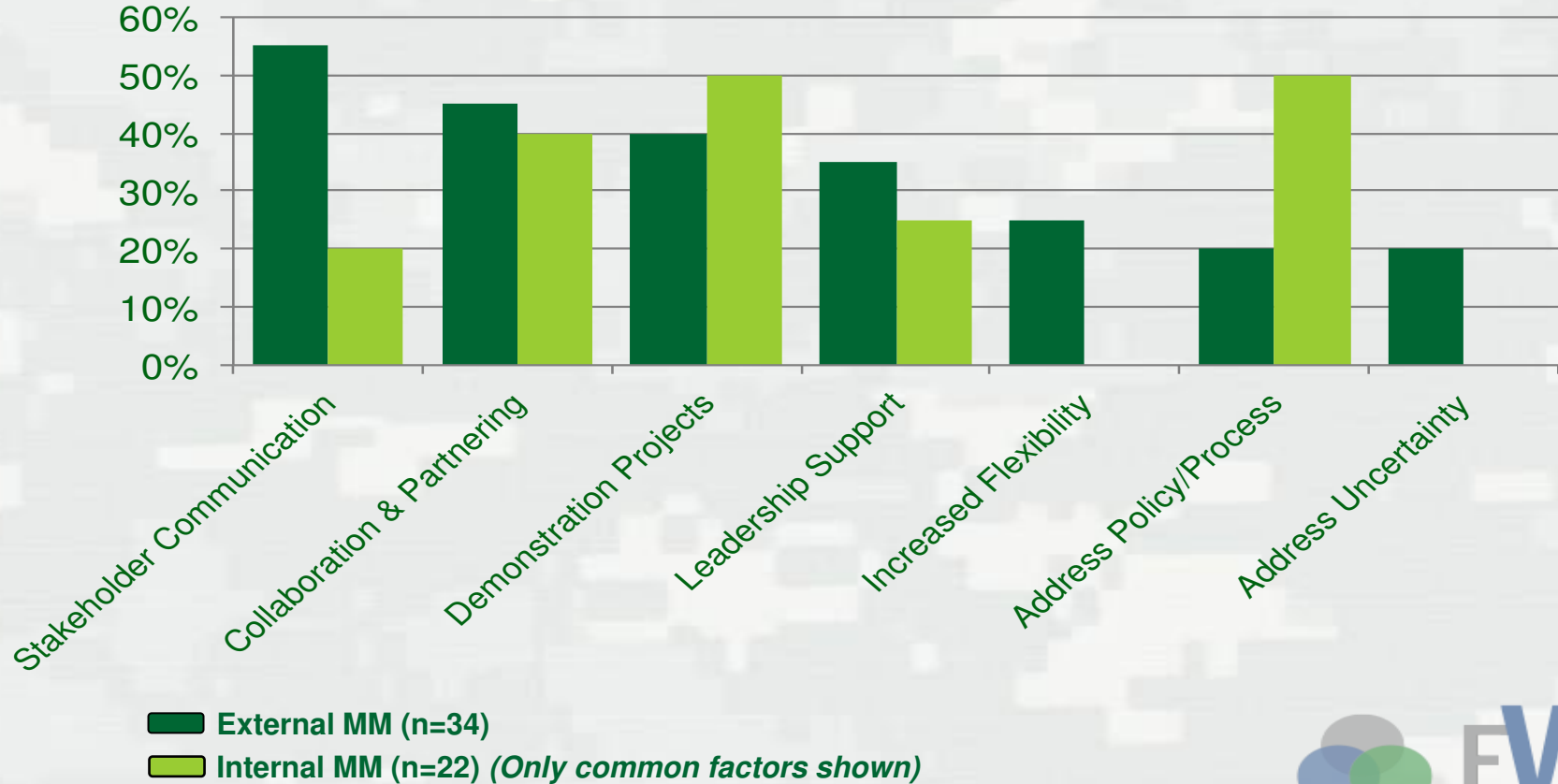
**USACE,  
New Orleans District**

# Stakeholder Dialogue Sessions on EWN: Barriers to EWN Adoption





# Stakeholder Dialogue Sessions on EWN: Overcoming Barriers to EWN



# Research: EWN for Coastal Resilience

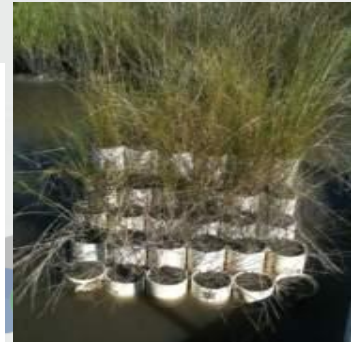
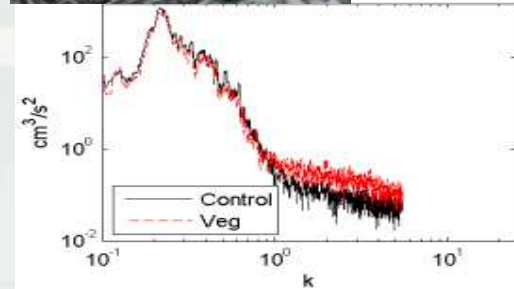
Research collaboration to improve the efficiency of engineering and operational practices, expand and extend project benefits, and improve resilience and sustainability of coastal systems under climate change.

## Field Research Activities:

- Wetland primary productivity
- Sediment processes
  - ▶ Cohesive sediment settling
  - ▶ Sediment resuspension
  - ▶ Marsh platform erosion

## Laboratory Analyses:

- Transport in vegetation
- Wave energy transformation



# EWN Field 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)
- Engineering Tern Habitat into the Ashtabula Breakwater (Ashtabula, OH)
- Living Shoreline Creation Through Beneficial Use of Dredged Material (Duluth, MN)



- Online GIS database of projects illustrating EWN principles and practices
- Currently contains 120 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
- Examples will be added via a self-nomination and independent evaluation process

# EWN ProMap





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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

25-28 AUG

Western Dredging Assoc.  
and Texas A&M University  
(WEDA/TAMU) Conference  
Honolulu, Hawaii

## 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



US Army Corps  
of Engineers

[www.EngineeringWithNature.org](http://www.EngineeringWithNature.org)  
<http://el.erdc.usace.army.mil/ewn>



# Engineering With Nature

- Expand the range of benefits provided through water-based infrastructure
  - ▶ Create value!
- Balancing consideration of environmental risks with project benefits
- Path to more sustainable projects

