Designing Navigation and Coastal Infrastructure for Greater Environmental Sustainability: An Overview of Projects

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Environment, Energy
Security and Sustainability
Symposium

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Outline

- USACE Policy
- *Engineering With Nature* (EWN) definition and essential ingredients
- EWN projects
- Path Forward
- Acknowledgments
The USACE Navigation Mission

To provide safe, reliable, efficient, effective and **environmentally sustainable** waterborne transportation systems for movement of commerce, national security needs, and recreation.
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.
The USACE Campaign Plan

Goal 1. Deliver USACE support to combat, stability, and disaster operations through forward deployed and reach back capabilities

Goal 2. Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders

Goal 3. Deliver innovative, resilient, sustainable solutions to the armed forces and the Nation

Goal 4. Build and cultivate a competent, disciplined, and resilient team, equipped to deliver high quality solutions

Goal 2: Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders.

Objective 2a: Deliver integrated, sustainable, water resources solutions.

Objective 2b: Implement collaborative approaches to effectively solve water resource problems.

Objective 2c: Implement Streamlined and Transparent Regulatory Processes to Sustain Aquatic Resources.
Environmental Operating Principles

One Corps Serving The Army and the Nation

Further information is available at: http://www.usace.army.mil

1. Strive to achieve Environmental Sustainability. An environment maintained in a healthy, diverse, and sustainable condition is necessary to support life.

2. Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.

3. Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

4. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.
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.
Working with Nature

Building with Nature

Engineering With Nature
The Essential Ingredients of Engineering With Nature

- Use science and engineering to produce operational efficiencies
  - Contributing to sustainable delivery of project benefits
- Use of natural processes to maximum benefit
  - To reduce demands on limited resources, minimize the environmental footprint of the project, and enhance the quality of benefits produced
- Broaden and extend the base of 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
Engineering With Nature
Project Overview
Environmental Enhancement and Navigation Infrastructure (EENI)

- To increase application of environmental sustainability to the design and maintenance activities associated with navigation infrastructure
  - Webinars
  - On-line Survey
  - Telephone Follow-up
  - Meeting/Conference Presentations
  - Data Summary
  - Report
Engineering With Nature Example

Photograph 2.12. A Series of Chevrons on the Mississippi River

Photograph 2.13. A Series of Chevrons Aligned To Split Flow Between the Main Channel and a Side Channel, While Protecting the Existing Shoreline

Upper Mississippi River Training Structures
(Photos courtesy of USACE Rock Island District)
Environmental Engineering of Navigation Infrastructure: A Survey of Existing Practices, Challenges, and Potential Opportunities

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ABSTRACT

Navigation infrastructures such as channels, jetties, near-tracing structures, and lock and dams are facilities that are primarily comprised of a safe and efficient water transportation system. Planning for such infrastructure has until recently involved efforts to evaluate impacts on the environment through the standardized environmental assessment process. More recently, consistent with environmental sustainability concepts, planners have begun to consider how such projects can also be constructed with environmental enhancements. This study reviewed the existing infrastructure condition within the US Army Corps of Engineers, Vicksburg District. The data collected were compiled into a database that was then used to establish a survey instrument. The survey instrument was distributed to the US Army Corps of Engineers-managed navigation infrastructure projects. The study sought to (1) investigate institutional attitudes toward the environmental enhancement of navigation infrastructure (EENI) concept, (2) identify potential impediments to implementation and solutions to such impediments, (3) identify existing navigation projects designed with the express intent of enhancing environmental benefits in addition to the primary project mission, (4) identify new ideas for incorporating environmental benefits for navigation projects, (5) identify needs for additional technical information or research, and (6) identify legal, regulatory, and policy issues that both support and hinder such design features. The principal investigation took place over a six-month period, with 144 questionnaires. The survey captured a wide range of perspectives on the EENI concept including ideas, concerns, research needs, and relevant laws and policies. Study recommendations included further promotion of the concept of EENI by planners and designers, formation of pilot studies on some of the innovative ideas presented through the survey, and cooperative agreements to facilitate implementation.

Environmental Policy & Regulation

Preliminary

EENI Products
USEPA Great Lakes Restoration Initiative (GLRI) Breakwater Ecosystem Improvement Study

- To evaluate opportunities for enhancing aquatic ecosystem benefits at existing breakwaters and navigation structures
- During routine repairs and maintenance, as part of modifications, or during comprehensive structural repairs and replacements
- Concept extends to shore protection structures, non-USACE structures
GLRI Products
Cleveland Harbor Pilot Project

- Cleveland Harbor East Arrowhead Breakwater was identified as a coastal structure with critical repair needs located in an Area Of Concern (Cuyahoga River)
- The project involves:
  - Providing features that will create habitat opportunities for Great Lakes fish and invertebrates
  - Modifying the design (shape and surface texture) of the standard concrete toe blocks used for breakwater maintenance
    - Dimpled surface texture
    - Horizontal line surface texture
    - Protected indented shelf (horizontal line)
    - No alterations (control)
Modified Breakwater Toe Blocks

The left photo shows a dimpled block surface. The right photo shows a horizontal line block surface. A fish habitat shelf with a horizontal line texture is shown bottom center.
EWN Concept Promotion

- Conferences – 8
- Meetings – 8
- Webinars – 7
- Workshops – 4
- Technical Documents – 3
- Brochures/Magazine Articles – 2

Total = 32
Engineering With Nature
Path Forward

We will implement *Engineering With Nature* through a series of actions:

1. Establish the foundation of EWN using examples of “best-practice” projects from across USACE
2. Develop and execute a “Strategic Plan for EWN” to expand application within USACE and with our external partners and stakeholders
3. Demonstrate the EWN progression in future project case studies, communicating lessons learned and successes broadly
4. Focus R&D investments to expand technical and communication science needed to advance EWN
5. Establish leadership and partnerships on EWN through effective engagement and application
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