

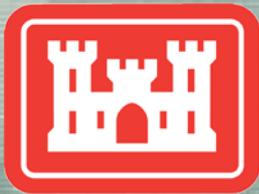
# Engineering With Nature

## Summary of Prior Work & Results

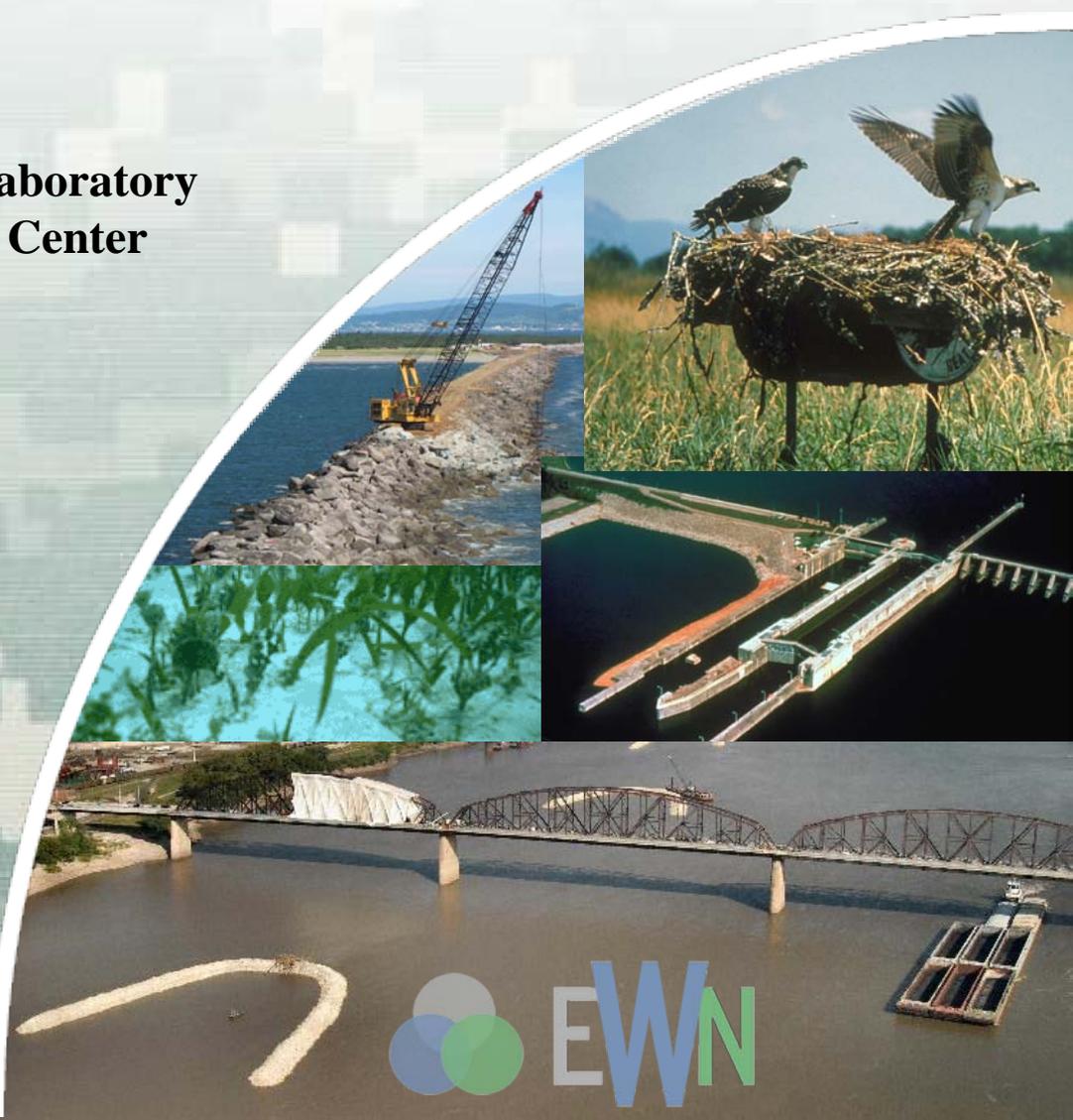
**Dr. Thomas J. Fredette**

**Research Biologist, Environmental Laboratory**

**Engineer Research and Development Center**



US Army Corps of Engineers  
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# Opportunities?





US Army Corps  
of Engineers®  
Engineer Research and  
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# 2010 Study

## **Environmental Enhancements and Navigation Infrastructure: A Study of Existing Practices, Innovative Ideas, Impediments, and Research Needs**

Thomas J. Fredette, Christy M. Foran, Sandra M. Brasfield,  
and Burton C. Suedel

July 2011



# Project Approach

- **Webinars**
- **On-line Survey**
- **Telephone Follow-up**
- **Meeting/Conference Presentations**
- **Data Summary**
- **Report**

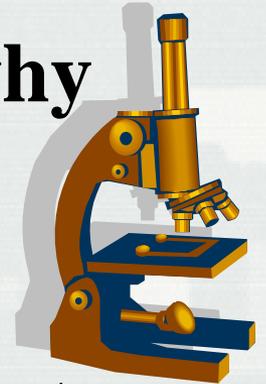


# Survey Sections

- **Environmental Enhancements: Present and Potential (13 Qs)**
- **Laws, Policies, and Regulations (6 Qs)**
- **Impediments to Use (12 Qs)**
- **Research Needs (8 Qs)**
- **Is There Anything We Missed? (3 Qs)**
- **Invite Others (2 Qs)**
- **Information About You (9 Qs)**

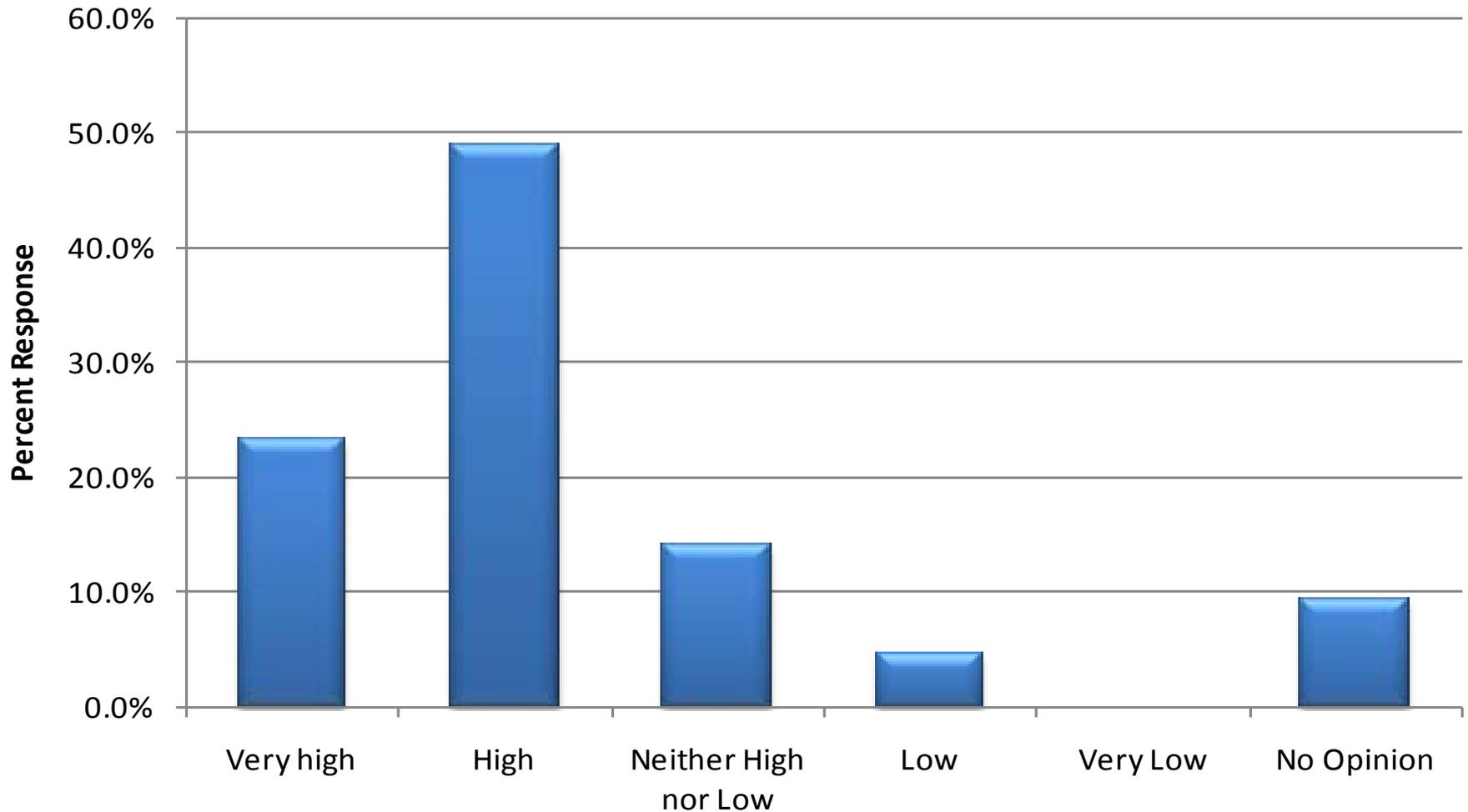
# Information Needs

- **Key policies, regulations, & laws**
- **Things we already do**
- **Ideas for new possibilities**
- **Things tried that haven't worked and why**
- **Impediments to improvement**
- **Potential solutions to impediments**
- **Items needing further *research* to support use**
- **Case studies and relevant reports**



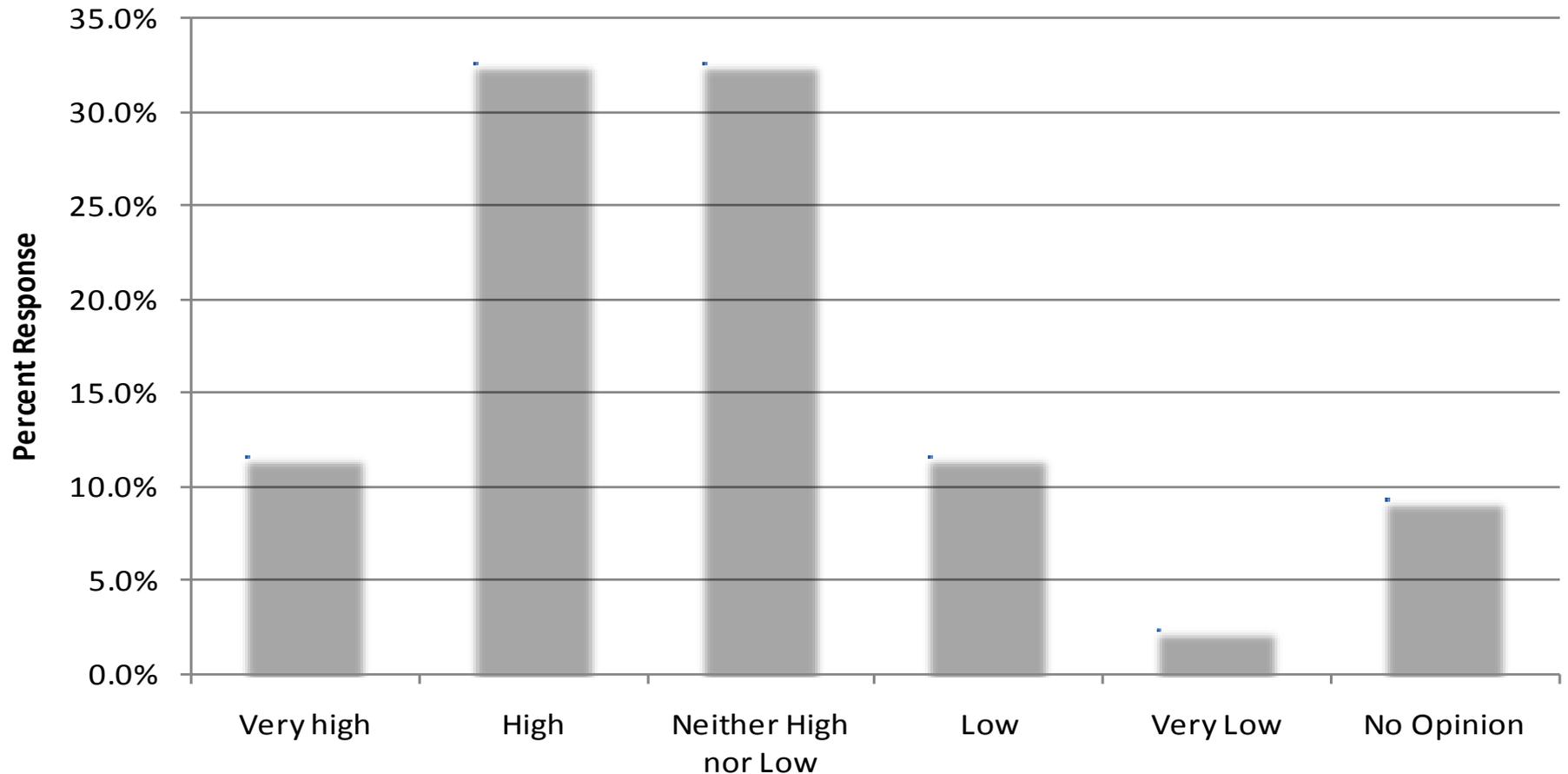
# Views on Impediments

How high of an impediment do you believe cost sharing is to EENI?



# Views on Impediments

**Inclusion of environmental enhancements may be believed to constrain/complicate future maintenance operations of navigational infrastructure. How important of an impediment do you think this belief may be to consideration of EENI?**



# **Suggestions to Reduce Impediments**

- **Greater stakeholder interaction**
- **Interagency agreements**
- **Special program funding**
- **Promote the EENI concept**
- **Document case studies**
- **Develop agency goals/metrics**

# Some Examples



# Tern Nesting Habitat

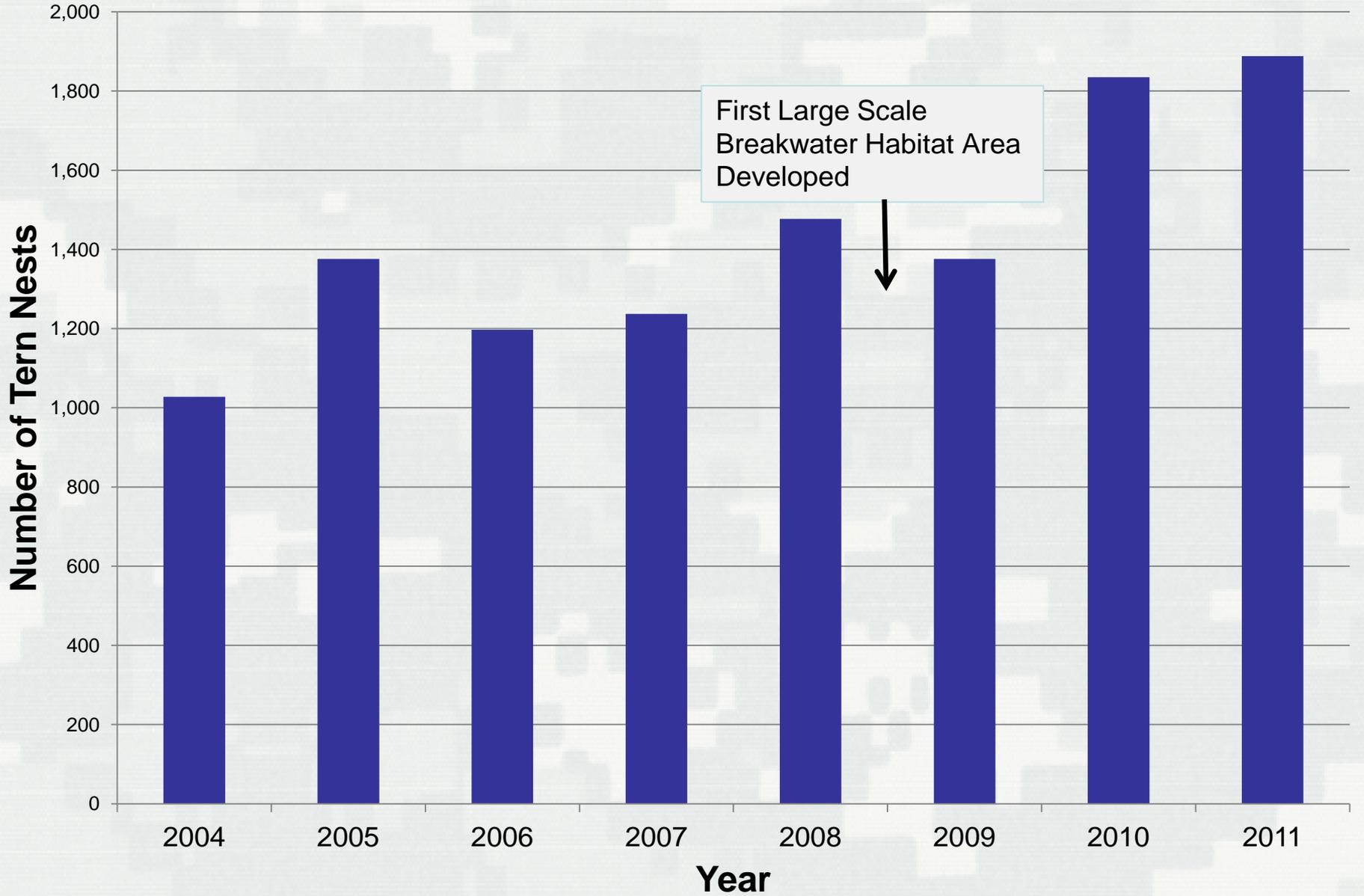
## New York Power Authority – Buffalo, NY



**NYPA  
Tern  
Nesting  
Habitat**

See <http://niagara.nypa.gov/EcologicalStandingCommittee/EcoStanddefault.htm>

# Buffalo Harbor Breakwaters Tern Nests



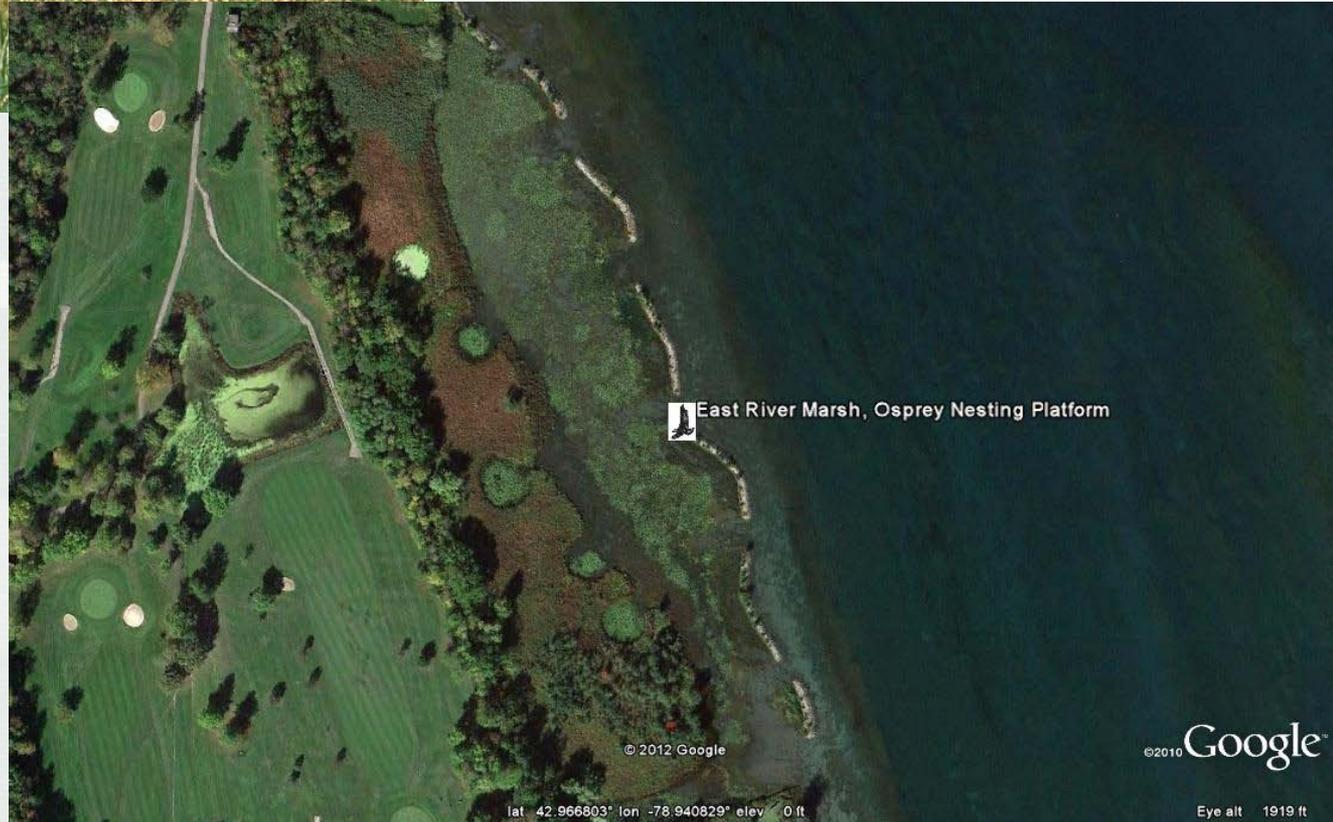
# South Bay Marina

South Bay Marina, Green Bay, MI



- Spur jetties to create marsh and protected shallows.
- Fish spawning stones incorporated into design.

# East River Osprey Nest Platform, Buffalo, NY

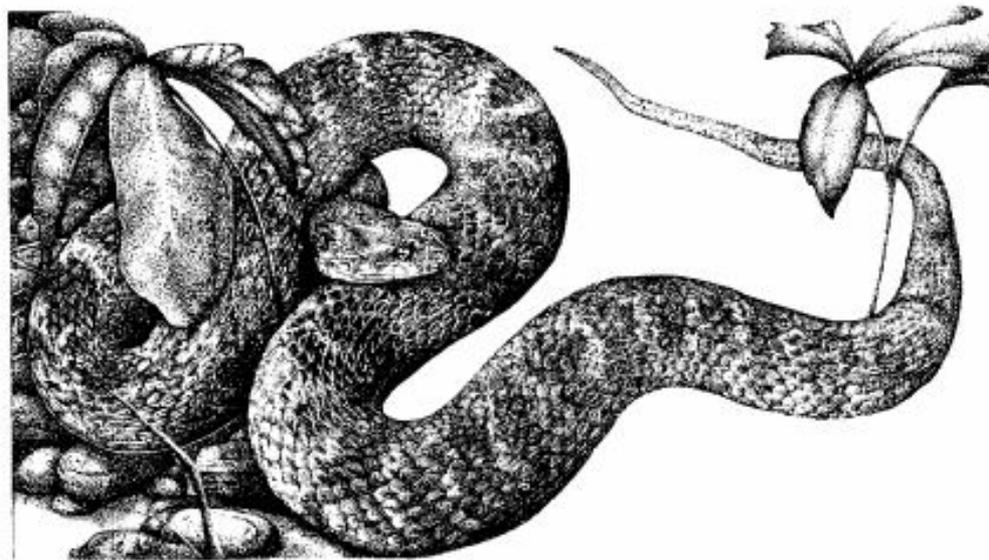


**New York Power  
Authority**

U.S. Fish & Wildlife Service

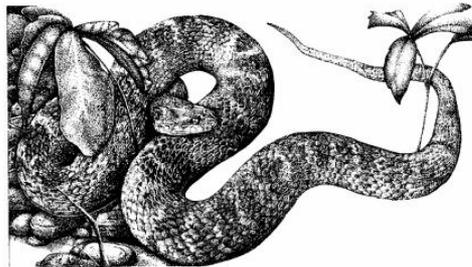
# Lake Erie Watersnake Recovery Plan

*(Nerodia sipedon insularum)*



September 2003

Lake Erie Watersnake  
Recovery Plan  
(*Nerodia sipedon insularum*)



September 2003

The ODNR, in consultation with the Ohio Environmental Protection Agency (OEPA) and USFWS, published Coastal Guidance Sheet No.9, entitled, “Shore Structures and the Lake Erie Watersnake” (Appendix C). This document briefly describes the life history and habitat of the snake, and types of shoreline projects that can be designed to benefit the Lake Erie Watersnake. Since the snake was listed under the ESA, the most common type of projects that the USFWS reviews on the islands are private docks. The conservation of Lake Erie Watersnakes can be aided by incorporating rock-oriented designs into shoreline developments and associated erosion control structures. Research indicates that Lake Erie Watersnakes will use rock-filled timber or steel crib docks for summer basking and resting habitat, while sheet steel docks provide no habitat for the snake. In addition, erosion protection such as riprap provides some summer habitat for the snake, while sheet steel or poured concrete erosion protection does not provide habitat for the snake. The guidance sheet provides recommendations to use “snake-friendly” designs to benefit both the landowner and the snake. Such measures have already been adopted by many construction projects on the U.S. islands. By designing these projects in snake-friendly



# Public Notice

**Applicant:**  
Predevelopment, Ltd.

**Date:**  
Published: December 8, 2005  
Expires: January 6, 2006

**U.S. Army Corps  
of Engineers**

**In Reply Refer To:**

**Buffalo District CELRB-TD-R RE: 2003-01621(1) Section: OH 10 and 404**

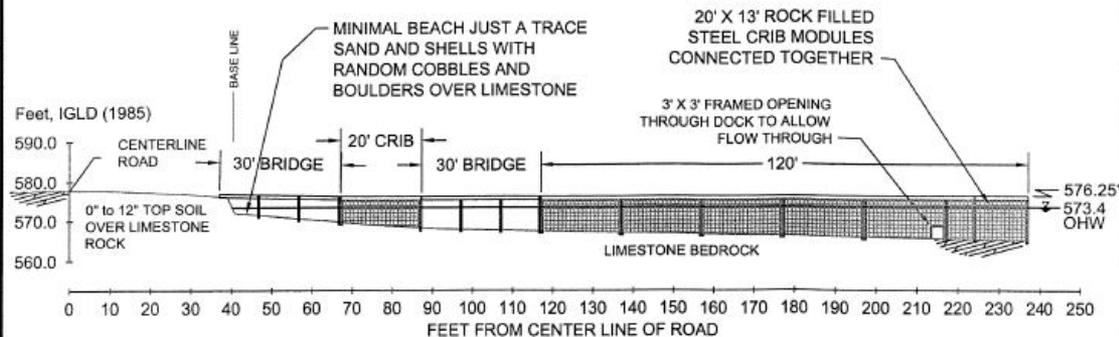
**Application for Permit under Authority of  
Section 10 of the Rivers and Harbors Act of 1899 and  
Section 404 of the Clean Water Act (33 U.S.C. 1344).**

Predevelopment, Ltd., 2235 Second Street, Suite A, Cuyahoga Falls, Ohio, 44221, has requested a Department of the Army permit to construct a private rock-filled steel crib dock/pier and one stone jetty and install three floating docks in Lake Erie, located on the northwest side of Monagan Road, Kelleys Island, Erie County, Ohio.

The project consists of the following:

1. The construction of a "J" shaped rock filled steel crib dock/pier, with a 10-foot wide by 200 foot long leg containing two 30-foot long bridges, one at the shore attachment and one waterward of a 20-foot crib dock/pier section. Perpendicular to and west of the north end of this dock will be a 10-foot wide by 186-foot long steel crib dock/pier section. Perpendicular to the west end of this dock and running south will be a 10-foot wide by 40-foot long steel crib dock/pier section. This project was designed to provide habitat for the Lake Erie watersnake (*Nerodia sipedon insularum*) and to maintain water flow along the shoreline.
2. The installation of three 6-foot wide by 24-foot long floating docks on the south side of the 186-foot long dock/pier.

IGN, INC.	PROFILE A-A APPROX.	APRIL
LANE	PERPENDICULAR TO SHORE	PREP
HISTORY	PROPOSED STEEL CRIB PIER	2335
	IN LAKE ERIE	CUV#
	KELLEYS ISLAND, ERIE COUNTY, OHIO	SHE



**PROFILE A-A**

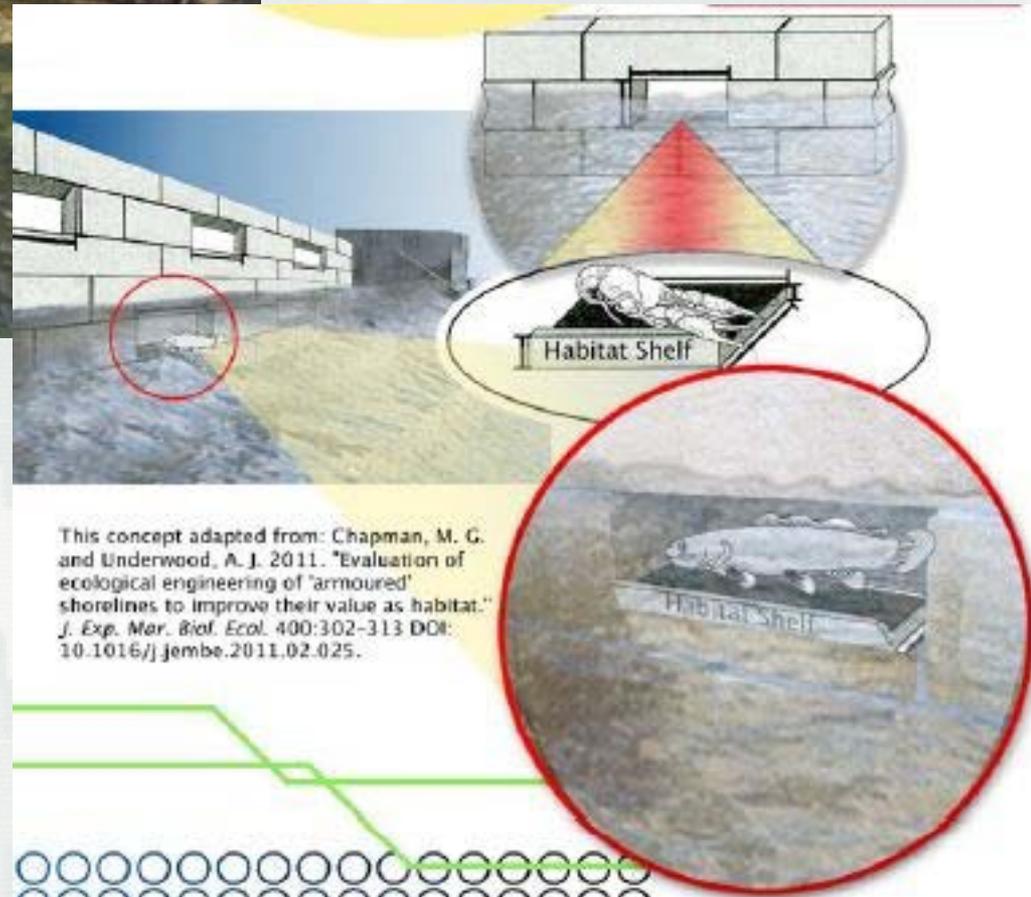


# Seawall $\frac{1}{2}$ Flower Pots

## Seawall Habitat Shelves

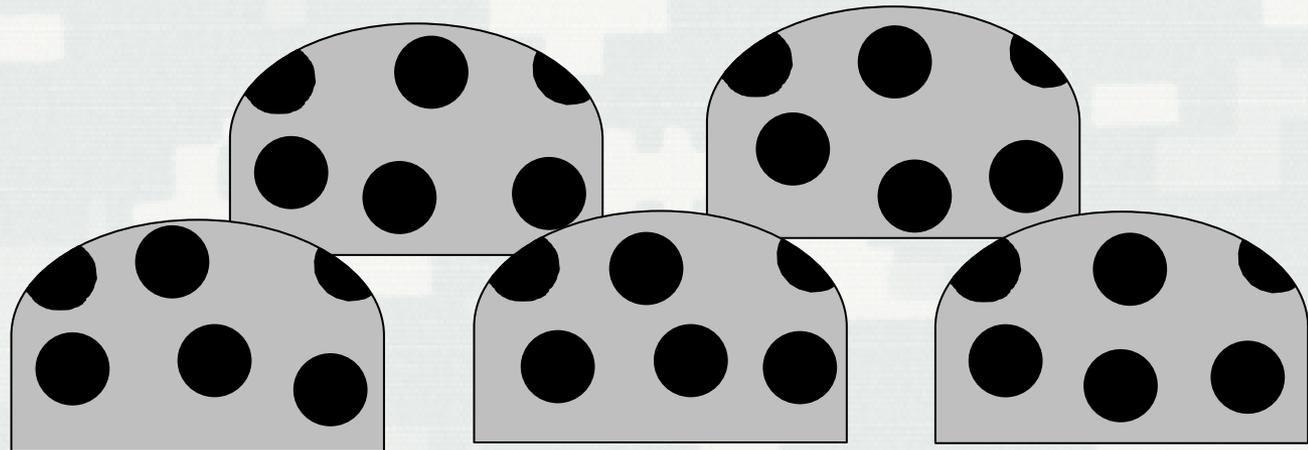
Dr. Mark Browne

<http://youtu.be/iuDmTVHKi40>





# Reef Habitat Breakwaters, Pensacola, FL



# Comparison of Environmental Project Types

Criteria	EWN	Mitigation	Restoration
Extent to which natural processes are used to produce benefits and outcomes	★	★	★
Extent to which the project and its configuration broaden the base of benefits provided (economic, social, and environmental)	★		★
Extent to which the project makes use of collaborative processes to organize and focus interests, stakeholders, and partners	★		★
Extent to which the project produces and makes use of efficiencies to contribute to sustainable delivery of project benefits, including consideration of how the project function is sustainable in the broader systematic context (e.g., regional watershed or sediment systems)	★	★	★
Extent to which the added benefits are incorporated in association with (but not as mitigation for) construction or maintenance of civil works infrastructure	★		

# EWN Products

ERDC/EL TR-11-7

Environmental Laboratory



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July 2011



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ERDC TN-DOER-R16  
June 2011

## Environmental Enhancements and Navigation Infrastructure: Existing Practices, Innovative Ideas, and Research Needs

by Thomas J. Fredette, Christy M. Foran, Sandra M. Brasfield,  
and Burton C. Suedel

**PURPOSE:** The concept that navigation infrastructure can serve as valuable habitat is not novel. However, the concept of designing navigation infrastructure with the specific intent of accomplishing both the engineering goal and specific environmental goals is, in most instances, a new idea for many planners and designers. The inclusion of environmental enhancements in navigation infrastructure represents both opportunities and challenges for project managers. The purpose of this document is to present an overview of the advantages, while addressing some of the implementation challenges, as seen by the current planning and engineering contingents. This study sought to (1) identify existing and potential navigation project features that were designed with the express intent of enhancing environmental benefit, (2) identify laws, regulations, and policies (formulation boundaries) that both support and hinder such design features, (3) identify opportunities for increasing environmental benefits for navigation projects within existing formulation boundaries, (4) propose potential changes to formulation boundaries that would further increase opportunities for environmental benefits, and (5) identify potential areas where research may increase the opportunity to integrate environmental features into future projects.



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Integrated Environmental Assessment and Management — Volume 8, Number 1—pp. 175-182  
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## Environmental Engineering of Navigation Infrastructure: A Survey of Existing Practices, Challenges, and Potential Opportunities

Thomas J. Fredette,<sup>1</sup> Christy M. Foran,<sup>1</sup> Sandra M. Brasfield,<sup>1</sup> and Burton C. Suedel<sup>2</sup>

<sup>1</sup>Environmental Laboratory, US Army Corps of Engineers, Engineer Research and Development Center, 696 Virginia Rd, Concord, Massachusetts 01742, USA  
<sup>2</sup>Environmental Laboratory, US Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, Mississippi, USA

(Submitted 2 March 2011; Returned for Revision 3 May 2011; Accepted 15 July 2011)

### ABSTRACT

Navigation infrastructure such as channels, jetties, river training structures, and lock-and-dam facilities are primary components of a safe and efficient water transportation system. Planning for such infrastructure has until recently involved efforts to minimize impacts on the environment through a 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 examined the existing institutional conditions within the US Army Corps of Engineers and cooperating federal agencies relative to incorporating environmental enhancements into navigation infrastructure projects. The study sought to (1) investigate institutional attitudes towards 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 benefit in addition to the primary project purpose, (4) identify innovative ideas for increasing environmental benefits for navigation projects, (5) identify needs for additional technical information or research, and (6) identify laws, regulations, and policies that both support and hinder such design features. The principal investigation tool was an internet-based survey with 53 questions. The survey captured a wide range of perspectives on the EENI concept including goals, concerns, research needs, and relevant laws and policies. Study recommendations included further promotion of the concept of EENI to planners and designers, initiation of pilot studies on some of the innovative ideas provided through the survey, and interagency agreements to facilitate implementation. Integr Environ Assess Manag

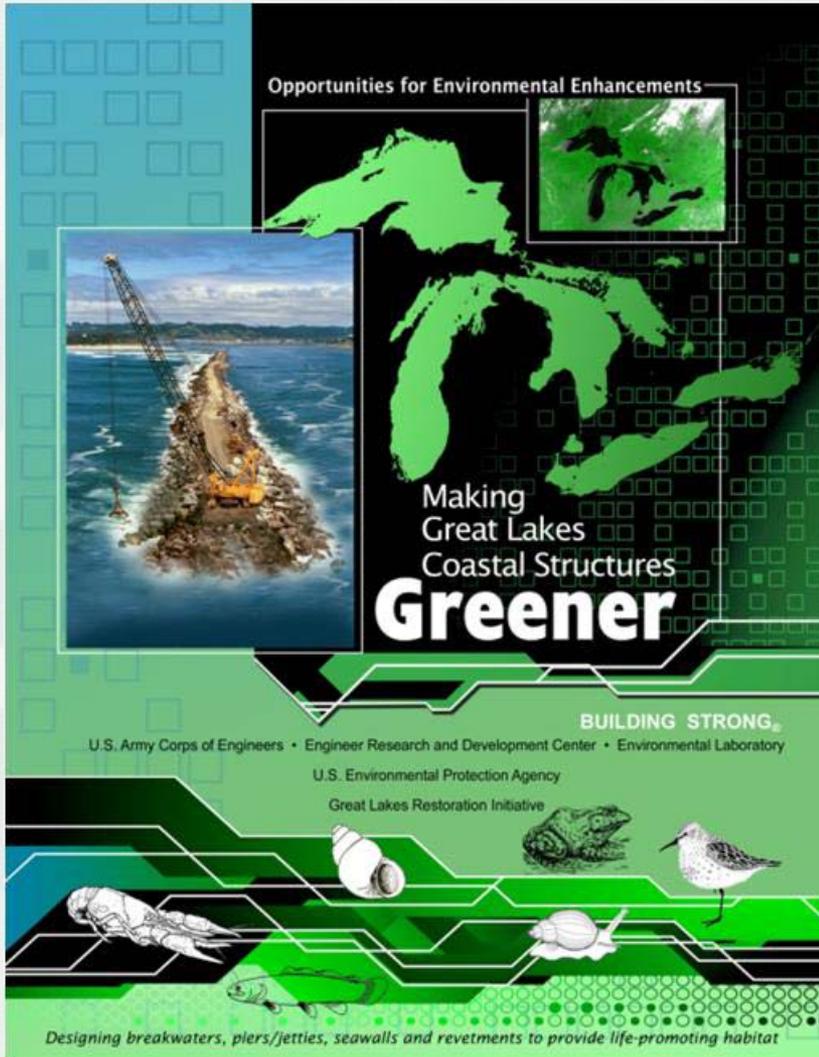
Jetties Breakwaters Sustainability Lock and dam

The US Army Corps of Engineers (USACE) has responsibility for an extensive coastal, intracoastal, and inland navigation system with over 19,000 km of navigation channel, 195 navigation locks, and hundreds of jetties, breakwaters, and anchorages. For example, the New England District alone has over 130 breakwaters and jetties with a total length of 1,600 km, over 60 km, over 800 hectares of anchorage, and over 750 km of channel. In addition to maintenance and replacement of existing structures, the USACE is also tasked with building new infrastructure on an ongoing basis. As a consequence, applying an environmental sustainability paradigm during the planning for new infrastructure or maintenance of existing infrastructure could result in substantial benefits for ecosystem services where the concept is applied. It is also important to recognize, however, that the USACE is a very large organization and that its activities are governed by a complex set of environmental and local laws, regulations, and policies. Paradigm shifts must contend with such realities. Accordingly, this study was designed to examine the existing institutional conditions within the USACE and cooperating federal agencies relative to incorporating environmental enhancements into navigation infrastructure projects. The study sought to (1) investigate institutional attitudes towards 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

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Environmental Policy & Regulation

# EWN-Related GLRI Products



**Opportunities for Environmental Enhancements**

**Making Great Lakes Coastal Structures Greener**

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U.S. Army Corps of Engineers • Engineer Research and Development Center • Environmental Laboratory  
U.S. Environmental Protection Agency  
Great Lakes Restoration Initiative

*Designing breakwaters, piers/jetties, seawalls and revetments to provide life-promoting habitat*

The cover features a central map of the Great Lakes region in green. To the left is a photograph of a large breakwater structure under construction in a body of water. Above the map is a smaller inset photo of a green landscape. The bottom section includes illustrations of various aquatic life forms: a crayfish, a snail, a frog, a seagull, and a fish, all set against a background of green circuit-like patterns.



**Inland Port**  
2011 Issue VI

**USACE Promotes Environmental Sustainability**

**Panama Canal Impact Projections  
Inland Ports Must Promote Trade with Mexico  
PIANC and IRPT Conference Wraps**

The cover features a large photograph of a yellow and black tugboat named 'MCFARLAND' on a body of water. The title 'Inland Port' is written in large, bold, orange letters at the top. Below the title, the text 'USACE Promotes Environmental Sustainability' is written in white, bold letters. At the bottom, three lines of text in white, bold letters list the main topics of the issue: 'Panama Canal Impact Projections', 'Inland Ports Must Promote Trade with Mexico', and 'PIANC and IRPT Conference Wraps'.

# EWN Mapping Project

USACE Engineering With Nature  
A Look At Global Engineering With Nature Sites

ERDC  
U.S. ARMY  
ENGINEERING RESEARCH AND DEVELOPMENT CENTER

EWN  
Map

Map Widget

Search for EWN site name

- Dike
- Breakwater
- PPO Groin
- PPT Beach
- PEG Chevron
- SEG Reef
- TEG Island
- Wetland
- Revetment
- Jetty
- Default
- Pier/Wharf

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# Path Forward

<b>EWN Issues</b>	<b>Potential Solutions</b>
Complication of Future Maintenance	Interagency Agreements
Cost Sharing	Section 1135, 206, 107
Compromising Primary Function	Pilot Studies, Modeling
Agency Priority	Agency Goals & Visible Support from Top
Technical Support Basis	<b><i>Pilot Studies</i></b> <b><i>Success Documentation</i></b>

