

R&D Supporting Sustainable Solutions

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R&D Relevant to Sustainability Outline

- Energy conservation, alternative fuels
- Sustainability through Engineering With Nature
 - Tools: Efficiency, "Footprint"
 - Getting the most from natural processes
 - Getting the most from natural systems
 - EWN Action Projects
- Sustainability opportunities





Evaluation of the Viability of Using Alternative Fuels in USACE Floating Plant





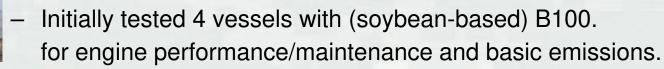




Process

 Preparatory Steps: Educate crew, conduct pretrial engine assessments, and develop vessel-specific action plans.







 Based on successful results, expanded biodiesel testing (ranging from B5 to B100 and included a 2nd generation algae-based biodiesel provided by Navy on 10 additional floating plant and did detailed emissions testing on two of these).



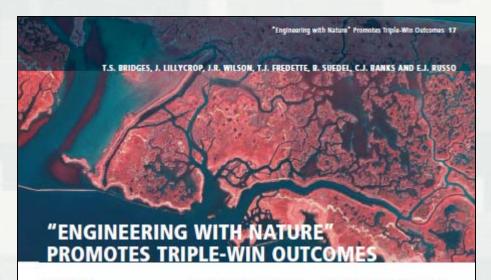








vative solutions for a safer, better world



ABSTRACT

The US Army Corps of Engineers' "Engineering With Narum" (EWN) Instative supports sustainable development of intrastructure by advancing betwiese and communication practices to order to intentionally align natural and engineering processes to efficiently and sustainably deliker continuncy, environmental, and social benefits through collaborative processes. The tools and projects that have been developed through EWN support planning, engineering, and operational practices that beneficially integrate engineering and natural systems to produce more socially acceptable, economically viable, and environmentally sustainable projects.

The EMN initiative's house on developing practical methods provides an achievable puth toward an ecosystem approach to navigation infrastructure development. By combining wound accence and engineering with advanced communication practices, the EMN initiative is providing a return foundation for collaborative project development. Engineering With Nature is being pursued through innovative research, field demonstrations, communicating excess learned, and active engagement with field practitioners across a wide range of organisations. The objectives of EWN are consistent with those communicated in the

"Working with Nature" philosophy of the World Association for Waterborne Starsport Inhistructure (PANC) and the "Suiding with Nature" initiative of EcoShape Foundation, a public private knowledge institute in the Netherlands.

INTRODUCTION

Pursuing the objective of sustainable development of navigation infrastructure possis both challenges and opportunities for the US Army Corps of Engineers (USACE), Advancing best practices will involve identifying the practical actions that can be taken to better align and integrate engineering and natural systems to produce more socially acceptable, economically viable and environmentally. sustainable protects. Engineering With Nature (EWN) is a USACE initiative that supports more sustainable practices, projects, and outcomes, by working to intentionally align natural and ongineering processes to efficiently and sustainably dollar ocurrents; unatermental and social benefits through collaborative

Above: Artist photo of the welliands at the Misstoppi Stee Gulf Outlet taken in Rosentier 2013 as part of the Banaficial Lies of Desdiged Meterial Monitoring Programme. processes (www engineeringwithnature.org: Figure 1). The EWN initiative's focus on developing practical methods provides an achievable path forward an ecosystem approach to navigation initiativisture development and operations that is applicable across methyle USACE missions and dustriess lines.

Science, engineering and demonstration projects within the EWN initiative Business the use of:

- Tyscience and engineering to produce operational efficiencies supporting stationable delivery of project benefits.
- Instural processes to maximum benefit, thereby roducing demands on limited resources, minimising the environmental tootprint of projects, and enhancing the duality of project benefits;
- 3/approaches that will broaden and extend the base of benefits provided by projects to include substantiated economic, social, and emittormental benefits.
- 4) sidence-based collaborative processes to organise and focus interests, stakeholders, and partners to reduce social friction, resistance, and project delays, while producing more broadly acceptable projects.

The objectives of EWN are consistent with those communicated in the Working with Nature (WwN) philosophy of the World

Triple-Win Solutions: From "s" to "S" Sustainability

- Current focus is on energy conservation
- The concept of <u>Sustainability</u> addresses the full distribution of benefits and costs

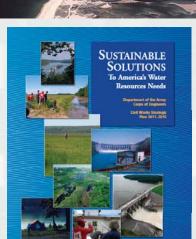




Engineering with Nature for Sustainable, Resilient Systems







Engineering With Nature

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

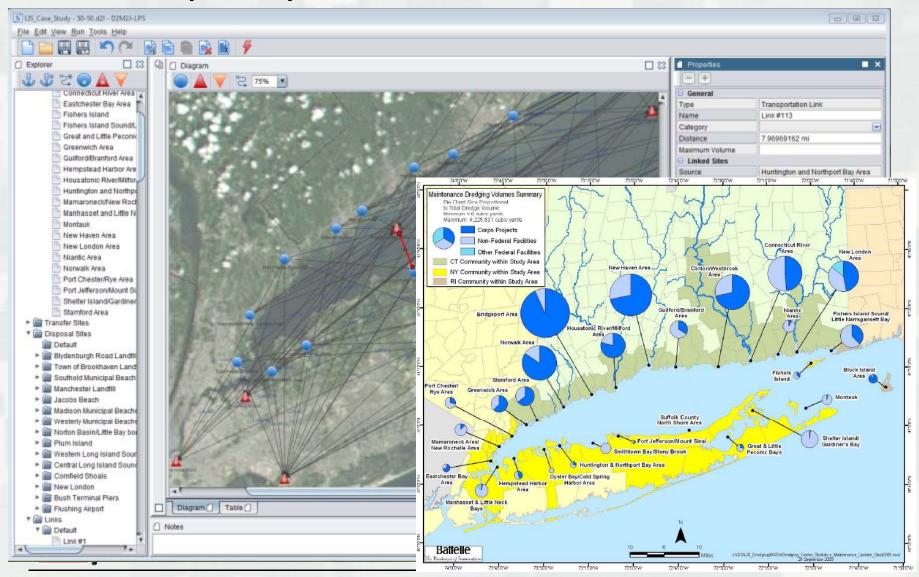
- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Expanding the benefits provided by projects
- Science-based collaboration



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



Optimizing Operations: Dredged Material Management Decisions (D2M2)



Understanding "Footprint": Life Cycle

Assessment

- 1. Goal and Scope Definition
- 2. Inventory Analysis
- 3. Impact Assessment
- 4. Results and Interpretation

Definition

- · Define goal and scope
- · Collect data

Inventory

Results

- Create/import flows
- Process inventory
- Implement characterisation factors
- Choose LCIA method
- Compare alternatives
- Sensitivity analysis

Raw material and energy consumption

Raw Material

Fabrication Steps

Use

End of Life

Emissions to air, water and soils

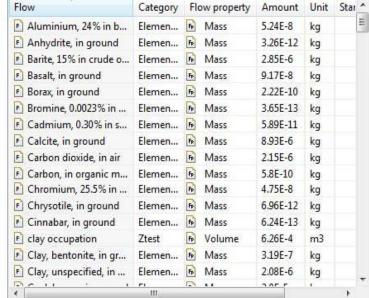


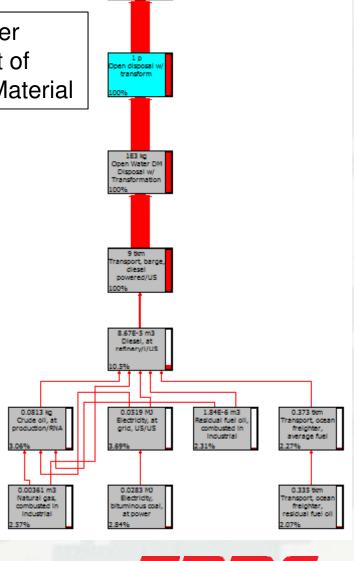


Inputs

Open-Water Placement of **Dredged Material**

Category Flow property F Aluminium, 24% in b... Elemen... Anhydrite, in ground Elemen... 6 F Barite, 15% in crude o... Elemen... F Mass Elemen... 🕞 E Basalt, in ground Borax, in ground Elemen... & Mass F Bromine, 0.0023% in ... Elemen... 6 Elemen... 🕞 Mass F Cadmium, 0.30% in s...







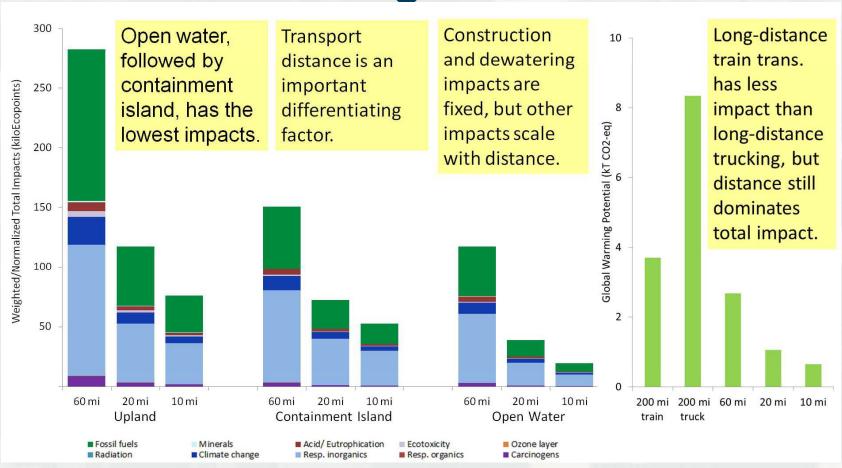


Databases of

Inputs and

Outputs

LCA Results Applied to DM Management

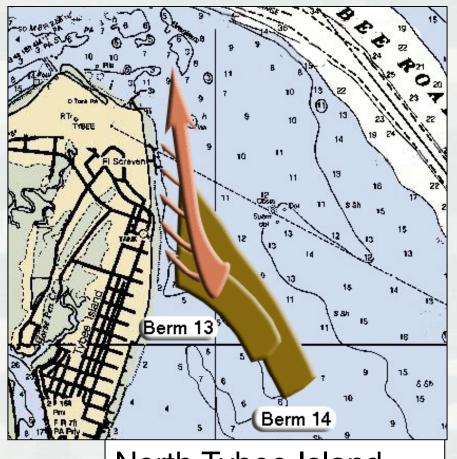




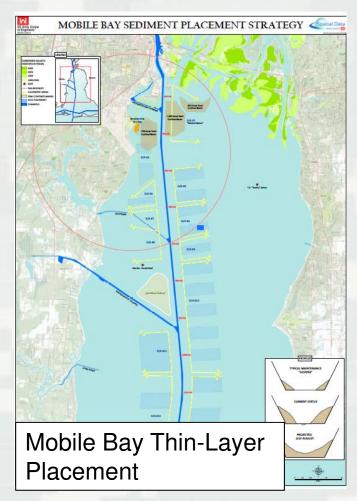


Sustainable Solutions: Strategic

Sediment Placement



North Tybee Island
Savannah, Georgia





Sustainable Solutions: *Using Large-Scale, Natural Forces*

Missouri River:

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

July 2009

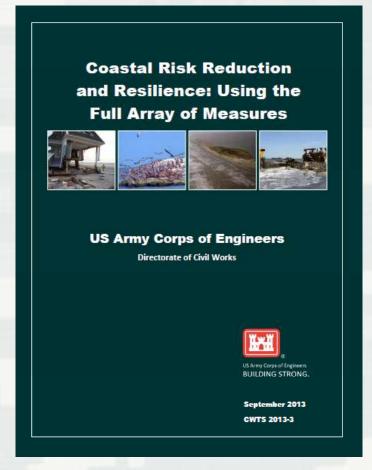
November 2011





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, nonstructural 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."





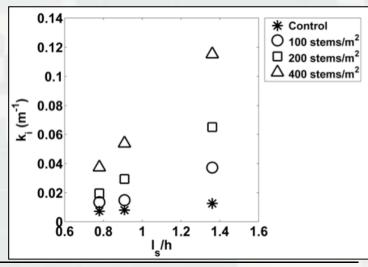


Wave Attenuation by Wetlands

- What are the engineering benefits of wetlands of waves?
- Flume studies being performed in the 10 ft flume
 - Complemented by examination of sediment processes and field studies
- Wave attenuation was found to:
 - increase with stem density
 - increase with submergence ratio
 - slight increase with incident wave height
- Results used to update STWAVE







82nd Annual Conference of Mayors June 20-23, 2014; Dallas, TX Conference Resolution on Natural Infrastructure

BE IT RESOLVED, that The United States Conference of Mayors encourages its members to prioritize natural infrastructure and supports the funding and implementation of natural solutions to protect freshwater supplies, defend the nation's coastlines, maintain a healthy tree and greenspace cover and protect air quality, and create a new generation of environmental leaders, which ensures cities can support a growing population and prepare for the future; and

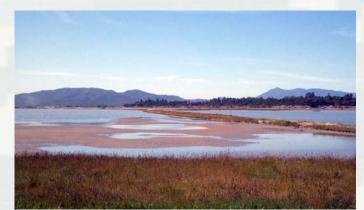
BE IT FURTHER RESOLVED, that The U.S. Conference of Mayors believes partnerships developed between local governments and non-profit organizations are an effective way to identify and implement opportunities for green infrastructure.





EWN Action 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





Sustainability Opportunities

- "Sustainability" provides an opportunity for USACE to remold regulatory paradigms and constraints
 - Balancing consideration of environmental risks with project benefits
- Combining the goals of engineering / operational efficiency with production of broader range of benefits is a stronger argument for infrastructure

