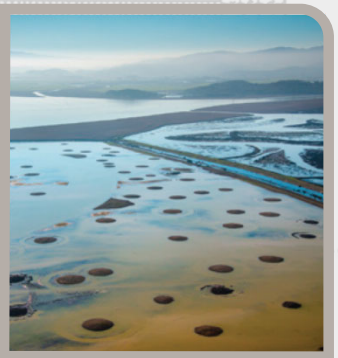
ENGINEERING WITH NATURE

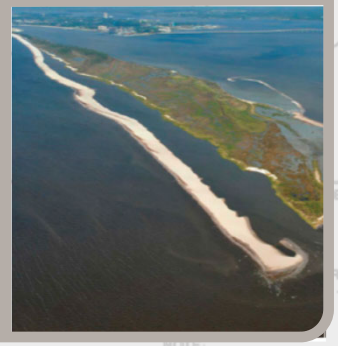


Todd S. Bridges, Ph.D.
Senior Research Scientist (ST), Environmental Science
National Lead, USACE EWN Initiative

U.S. Army Corps of Engineers
U.S. Army Engineer Research and Development Center

OU Visit to ERDC

15 April 2019



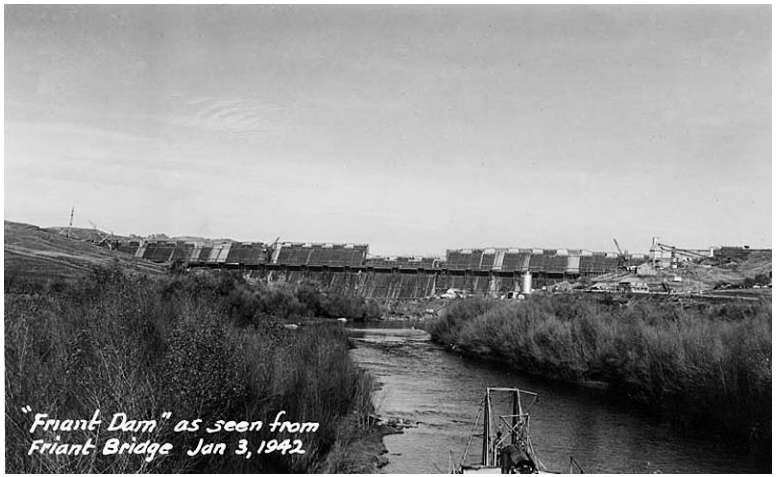
US Army Corps of Engineers.

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

1900-2000: THE CENTURY OF INFRASTRUCTURE (US)

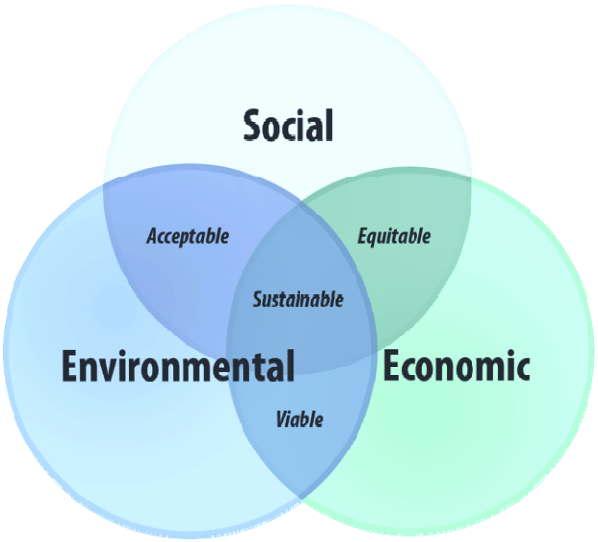
- 4,071,000 miles of roadway
  - 47,182 miles in the Interstate system
- 149,136 miles of mainline rail
- 640,000 miles of high-voltage transmission lines
- 614,387 bridges
- 90,580 dams
- 155,000 public drinking water systems
- 4,500 military installations
- 926 ports

FRIANT DAM ON THE SAN JOAQUIN RIVER, CA



SUSTAINABILITY

Sustainability is achieved by efficiently investing resources to create present and future value



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 Elements:

- 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

And Many More!

www.engineeringwithnature.org

EWN® OVERVIEW

Engineering With Nature® began in 2010

- Engaging across USACE, other agencies, NGOs, academia, private sector, international collaborators
- Guided by a strategic plan
- Established through Proving Grounds
  - Galveston, Buffalo, Philadelphia
- Informed by focused R&D
- Demonstrated with field projects
- Advanced through partnering
- Shared by strategic communications
- Marking progress
  - 2013 Chief of Engineers Environmental Award in Natural Resources Conservation
  - 2014 USACE National Award-Green Innovation
  - 2015, 2017 WEDA Awards; 2017 DPC Award

www.engineeringwithnature.org

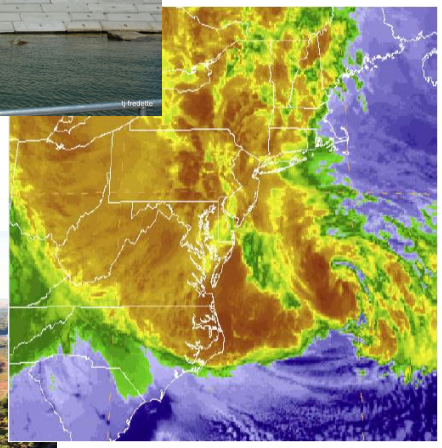
EWN® ACROSS USACE MISSION SPACE

Navigation
- Strategic placement of dredged material supporting habitat development
- Habitat integrated into structures
- Enhanced Natural Recovery

Flood Risk Management
- Natural and Nature-Based Features to support FRM
- Levee setbacks

Ecosystem Restoration
- Ecosystem services supporting engineering function
- “Natural” development of designed features

Water Operations
- Shoreline stabilization using native plants
- Environmental flows and connectivity



EWN® STRATEGY

Wave I: Broaden and Deepen Partnerships

- Build the organization and internal capacity to support, grow, and sustain EWN
- Expand by engaging districts and early adopters throughout USACE
- Expand by engaging agency partners and key external stakeholders
- Establish/expand collaboration through agreements with key international partners
- Advance EWN through effective governance

Wave II: Expand Capabilities

- Continue to develop science and technical alliances
- Leverage social science to better engage agency partners and stakeholders, and build capacity
- Expand and focus the EWN research agenda to strengthen capabilities

Wave III: Expand Applications and Communication

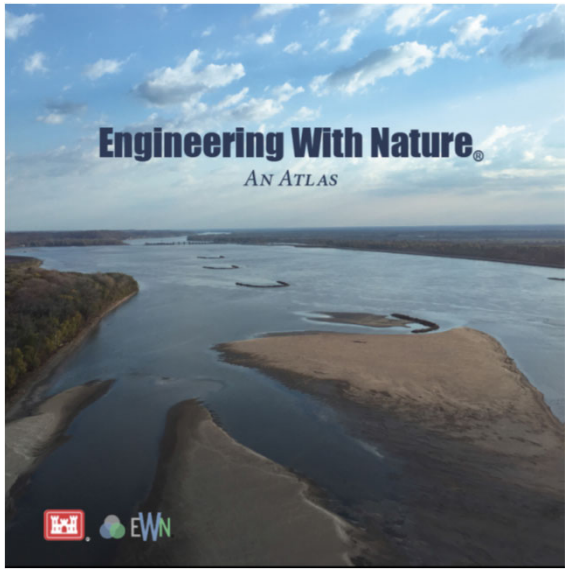
- Support and document multi-scale demonstrations of EWN practices
- Support and reinforce EWN progress through ongoing engagement and communication
- Enable EWN application through development of policies and guidance

EWN PROVING GROUNDS

- Galveston District (2014)
- Buffalo District (2014)
- Philadelphia District (2016)

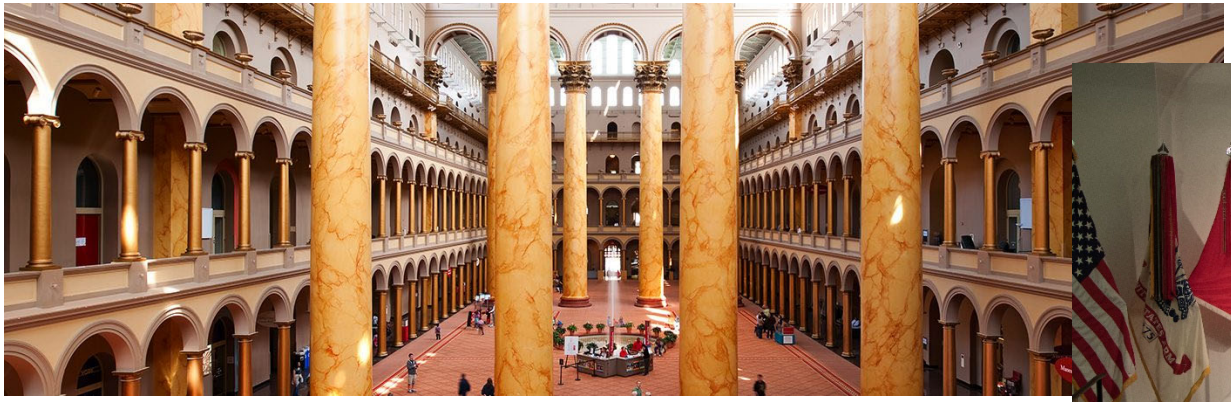
- Method
  - Identify opportunities to implement EWN across current and future programs and projects
  - Pursue opportunities through solution co-development

EWN ATLAS LAUNCH EVENT



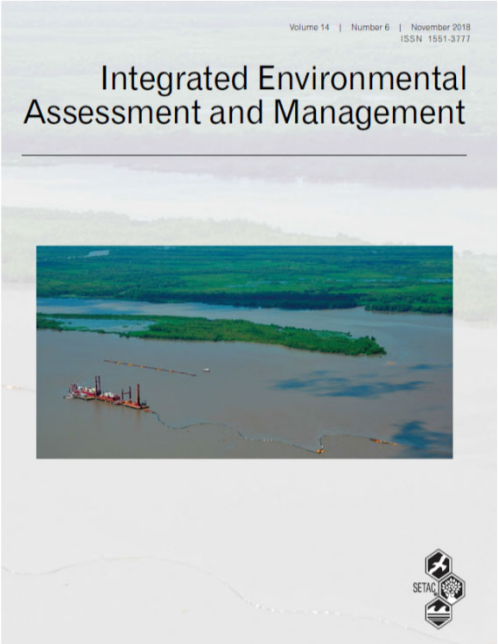
10:30-12:00
January 16, 2019
National Building Museum
Washington, D.C.

"Engineering With Nature is an important initiative for the U.S. Army Corps of Engineers." James Dalton, USACE Director Civil Works



www.engineeringwithnature.org

HORSESHOE BEND ISLAND, ATCHAFALAYA RIVER



Quantifying Wildlife and Navigation Benefits of a Dredging Beneficial-Use Project in the Lower Atchafalaya River: A Demonstration of Engineering with Nature®

Christy M Foran,† Kelly A Burks-Copes,‡ Jacob Berkowitz,‡ Jeffrey Corbino,§ and Burton C Suedel‡*

Project Awards:

- 2015 WEDA Award for Environmental Excellence
- 2017 WEDA Award for CC Adaption
- 2017 DPC Award for Working, Building, and Engineering with Nature

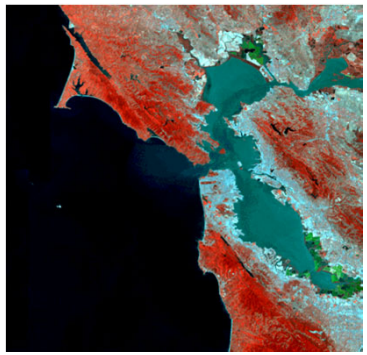
USACE PHILADELPHIA DISTRICT: EWN IN BACK BAY NEW JERSEY

Mordecai Island

Stone Harbor

Avalon

HAMILTON AND SEARS POINT WETLANDS SAN PABLO BAY, CA

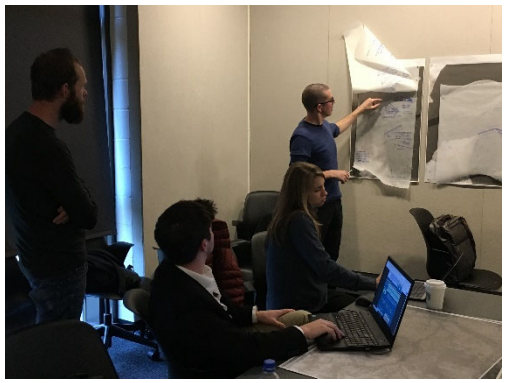


HUMBER ESTUARY; ALKBOROUGH, UK (INCREASED FLOOD STORAGE CAPACITY)

KRUIBEKE, SCHELDT RIVER BELGIUM

INCORPORATING EWN INTO INFRASTRUCTURE THROUGH LANDSCAPE ARCHITECTURE

- Team of EWN and academic and private LAs
- USACE Projects include:
  - Moses Lake Tide Gate Area (SWG);
  - Comite Canal Project (MVN);
  - Franklin Lock/Dam Recreation Area (SAJ);
  - Morehaven West Campground Site (SAJ);
  - Back Creek and Fishing Creek Jetties (NAB);
  - Proctor Creek (SAM); and
  - Sabine to Galveston (S2G) Project (SWG)
- Team has visited project sites and collected data
- Continue working with respective District POCs
- EWN/LA Team met JAN 19 at Auburn to work on initial renderings
- Meetings w/ USACE Districts to discuss rendering will begin in MAR 19
- Final report/renderings delivered to Districts JUL 19



EWN: SCIENCE, ENGINEERING, TECHNOLOGY TARGETS

Fundamental processes
- Sediment transport through and around NNBF
- Long-term engineering and environmental performance of features
- Benefits / Ecosystem Services provided by engineered features and structures
- Processes contributing to system-scale resilience

Modeling systems that support broad-scale application
- Planners, stakeholders and decision-makers
- Engineering design
- Operations and maintenance

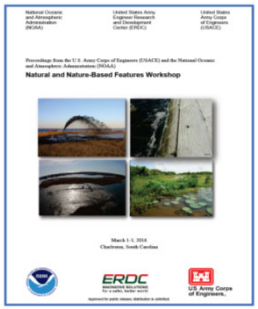
Reliable, cost-efficient monitoring technologies
- Measuring system evolution
- Infrastructure/feature performance

Guidance development and tools
- For planning, design, construction, O&M

Demonstration/pilot projects to innovate and learn
- Facilitate necessary collaboration
- Evolve organizational culture and practice
- Produce credible evidence of success at field scale
- Fuel the “power of the story”

COLLABORATION ACROSS GOVERNMENT

USACE/NOAA Collaboration Workshop: Natural and Nature-based Features, Charleston, SC; 1-3 March 2016



USACE/NOAA-NMFS Collaboration Workshop Engineering With Nature, Gloucester, MA; October 5-6, 2016

www.engineeringwithnature.org (NNBF)

COLLABORATION WITH THE PRIVATE SECTOR

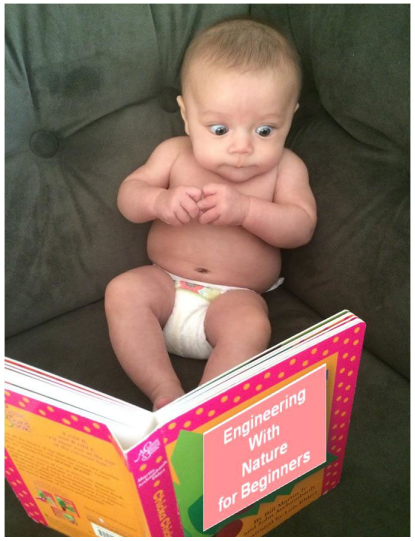
- Caterpillar Inc.
  - Restoring Natural Infrastructure Summit; November 4th, 2015; New York City
  - Natural Infrastructure Initiative – USACE Collaboration Work Streams
    1. NI Opportunity Evaluation Tool. Capitalizing on enterprise-level capability: CE Dredge DST
    2. Evaluation and Decision Making
    3. Field Application and Demonstration
- Western Dredging Association (WEDA)
  - Collaborative technical workshop on "Construction Methods Supporting Engineering With Nature"

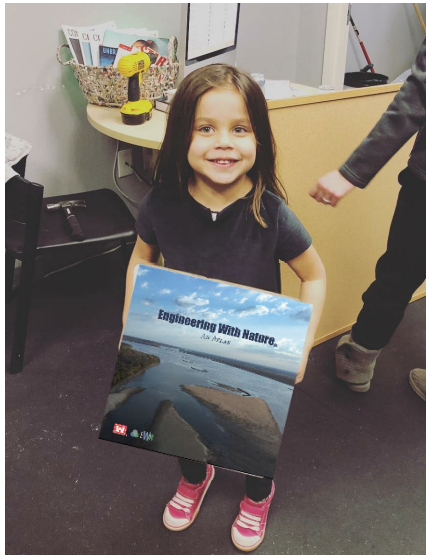
http://www.caterpillar.com/en/company/sustainability/natural-infrastructure.html

COLLABORATION WITH ACADEMIA

- Texas A&M University
  - Partnering through the Coastal Science and Engineering Collaborative (CSEC)
  - Joint research on NNBF
  - EWN Seminar spring 2018
  - Developing graduate curriculum to support EWN
- University of Georgia
  - Institute for Resilient Infrastructure Systems (IRIS
  - Multiple levels of collaboration on EWN and NNBF
  - EWN curriculum development
- University of Oklahoma
  - Water Security
  - Focus on mid-western and western landscapes and water resources
  - Streams, rivers, reservoirs and related infrastructure and purposes

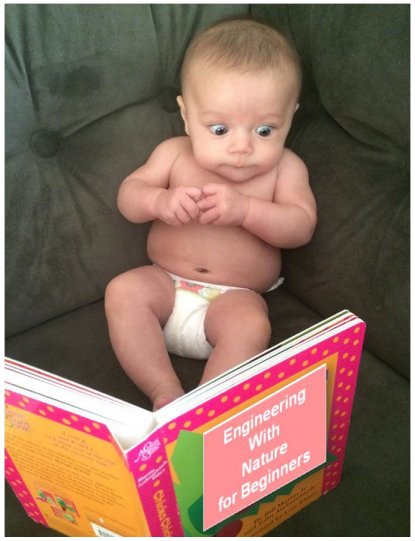
COMMUNICATION ACROSS ALL LEVELS

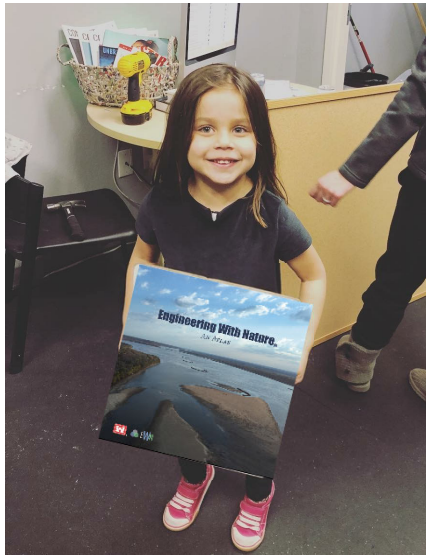




Engineering With Nature

COMMUNICATION ACROSS ALL LEVELS





Engineering With Nature

Urban River Parkways

An Essential Tool for Public Health

Richard J. Jackson, MD, MPH - UCLA Fielding School of Public Health
Tyler D. Watson, MPH - UCLA Fielding School of Public Health
Andrew Tsiu, MPH - UCLA Fielding School of Public Health
Bianca Shulaker, MURP - USC Department of Urban Planning
Stephanie Hopp, MPH - Johns Hopkins School of Public Health
Mladen Popovic - UC Santa Barbara

July 2014

Center for Occupational & Enviromental Health UCLA

Every $1 spent on rec trails results in $3 to >$10 of direct medical benefit