



NATURAL AND NATURE-BASED FEATURES: THE US CONTEXT

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NNBF Symposium
May 16, 2019



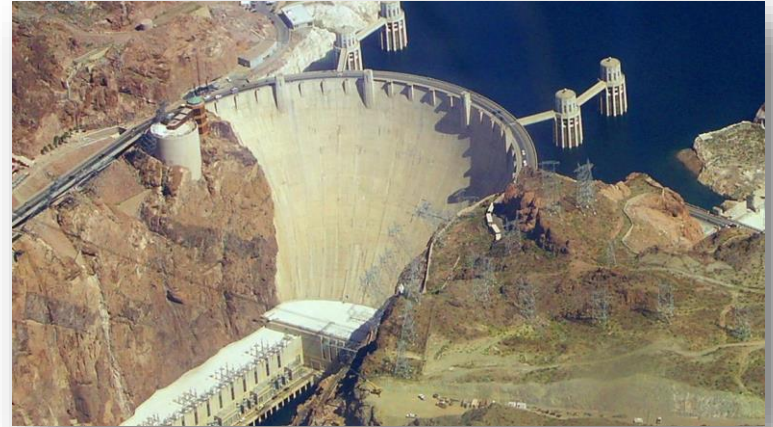
US Army Corps
of Engineers



ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

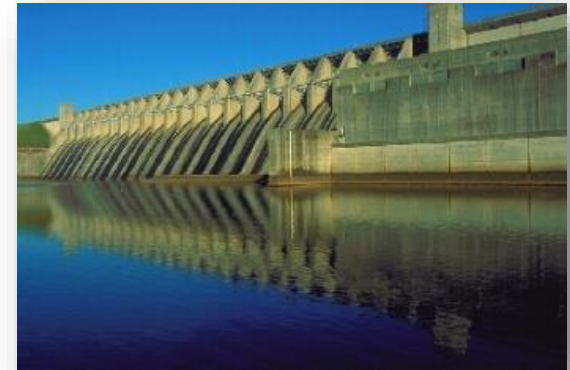
1900-2000: THE CENTURY OF INFRASTRUCTURE (US)

- 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



USACE INFRASTRUCTURE

- 25,000 miles of navigation channel
 - Supporting 926 ports
- 707 dams
 - 75 hydroelectric power facilities
 - 55,390 miles of shoreline
- 14,500 miles of flood levee
- 236 lock chambers at 192 lock sites
- 929 navigation structures
- 844 bridges
- 12 million acres of public land and water



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



The Nature Conservancy

And Many More!



www.engineeringwithnature.org

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EWN[®] ACROSS USACE MISSION SPACE

Navigation

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

Flood Risk Management

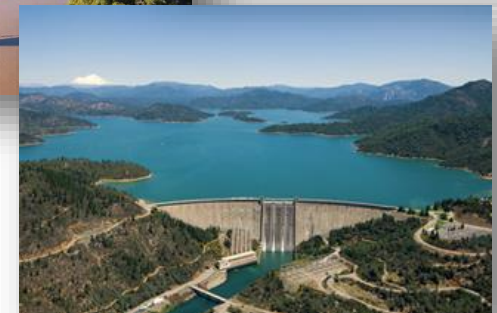
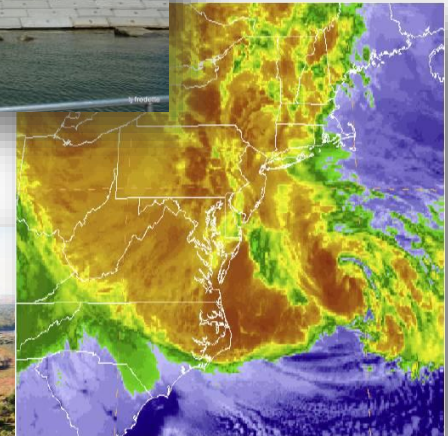
- Natural and Nature-Based Features to support FRM
- Levee setbacks

Ecosystem Restoration

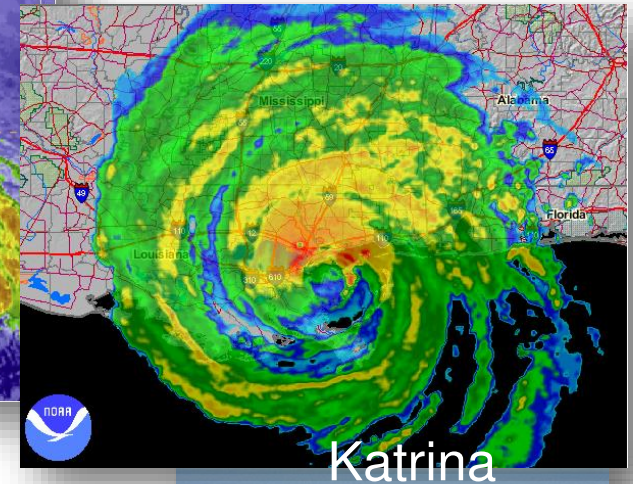
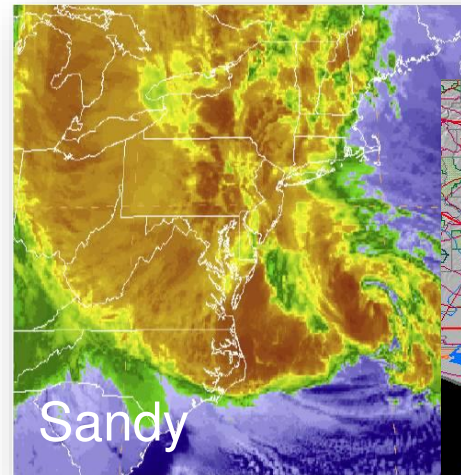
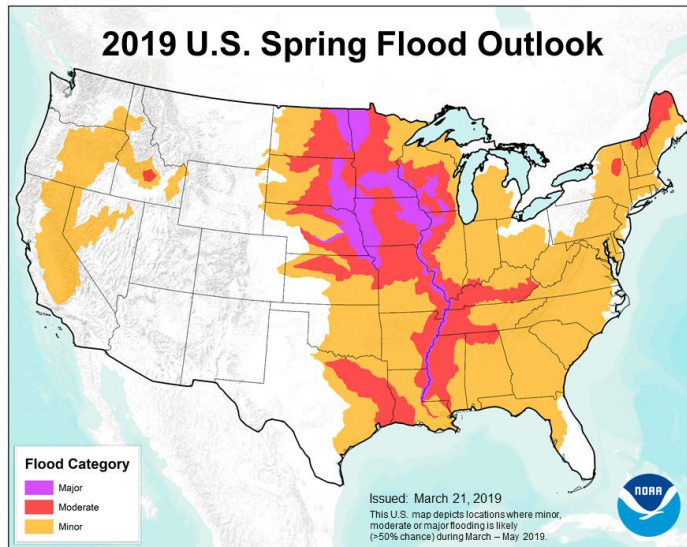
- Ecosystem services supporting engineering function
- “Natural” development of designed features

Water Operations

- Shoreline stabilization using native plants
- Environmental flows and connectivity



EVIDENCE SUPPORTING THE NEED FOR INNOVATION



US Army Corps of Engineers • Engineer Research and Development Center

NATURAL AND NATURE-BASED FEATURES

NNBF are landscape features that are developed to provide engineering functions relevant to flood risk management while producing additional economic, environmental and social benefits.

Natural and Nature-Based Infrastructure at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM INTENSITY, TRACK, AND FORWARD SPEED, AND SURROUNDING LOCAL BATHYMETRY AND TOPOGRAPHY



Dunes and Beaches

Benefits/Processes
Break offshore waves
Attenuate wave energy
Slow inland water transfer

Performance Factors
Berm height and width
Beach Slope
Sediment grain size and supply
Dune height, crest, width
Presence of vegetation



Vegetated Features:

Salt Marshes, Wetlands, Submerged Aquatic Vegetation (SAV)

Benefits/Processes
Break offshore waves

Attenuate wave energy
Slow inland water transfer
Increase infiltration

Performance Factors
Marsh, wetland, or SAV elevation and continuity
Vegetation type and density



Oyster and Coral Reefs

Benefits/Processes
Break offshore waves
Attenuate wave energy
Slow inland water transfer

Performance Factors
Reef width, elevation and roughness



Barrier Islands

Benefits/Processes
Wave attenuation and/or dissipation
Sediment stabilization

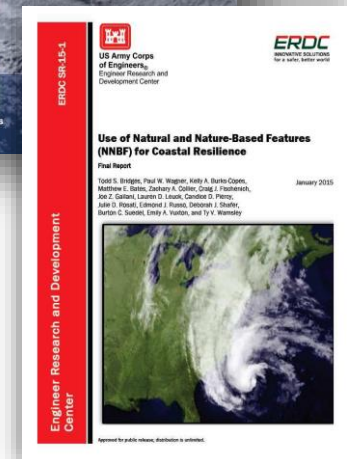
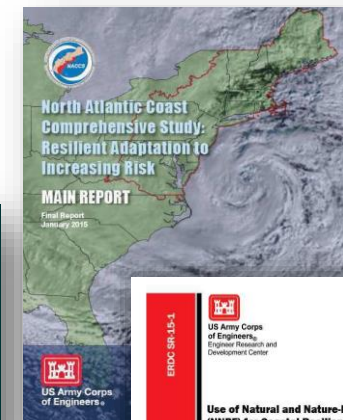
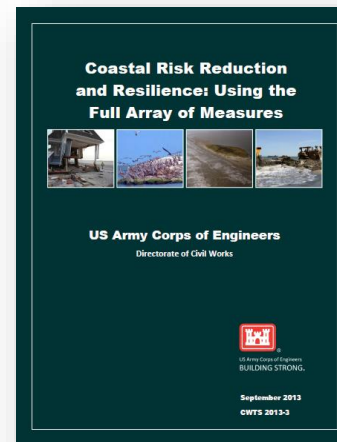
Performance Factors
Island elevation, length, and width
Land cover
Breach susceptibility
Proximity to mainland shore



Maritime Forests/Shrub Communities

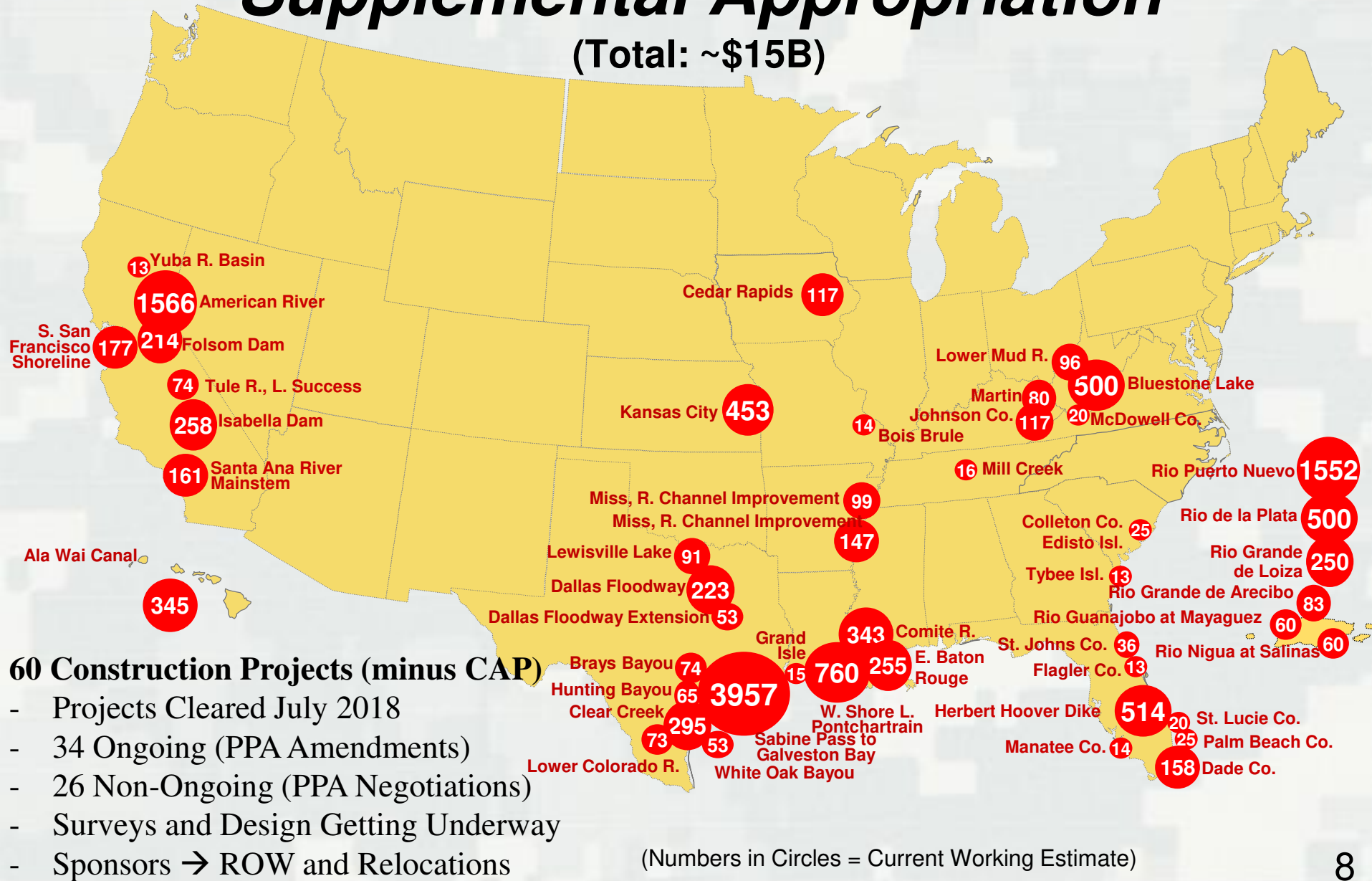
Benefits/Processes
Wave attenuation and/or dissipation
Shoreline erosion stabilization
Soil retention

Performance Factors
Vegetation height and density
Forest dimension
Sediment composition
Platform elevation





(Total: ~\$15B)



WATER INFRASTRUCTURE IMPROVEMENTS FOR THE NATION ACT (WIIN ACT) 2016

SEC. 1184. Consideration of measures.

(a) Definitions.—In this section, the following definitions apply:

(1) NATURAL FEATURE.—The term “natural feature” means a feature that is created through the action of physical, geological, biological, and chemical processes over time.

(2) NATURE-BASED FEATURE.—The term “nature-based feature” means a feature that is created by human design, engineering, and construction to provide risk reduction in coastal areas by acting in concert with natural processes.

(b) Requirement.—In studying the feasibility of projects for flood risk management, hurricane and storm damage reduction, and ecosystem restoration the Secretary shall, with the consent of the non-Federal sponsor of the feasibility study, consider, as appropriate—

- (1) natural features;
- (2) nature-based features;
- (3) nonstructural measures; and
- (4) structural measures.

GAO 2019 Report on Natural Coastal Infrastructure



United States Government Accountability Office
Report to Congressional Requesters

March 2019

ARMY CORPS OF ENGINEERS

Consideration of Project Costs and Benefits in Using Natural Coastal Infrastructure and Associated Challenges

GAO-19-319

“The Corps faces challenges in developing cost and benefit information for some types of natural infrastructure and has initiated steps to address this.”

“In particular, in October 2016, the Engineer Research and Development Center began collaborating with several entities, including other federal agencies, 42 international partners, academic institutions, and nongovernmental organizations, to develop guidelines for using some types of natural infrastructure...”



<https://www.gao.gov/products/GAO-19-319>

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ENGINEERING WITH NATURE ON CAPITOL HILL



NATURAL INFRASTRUCTURE: A SMART INVESTMENT

Come hear representatives from Great Lakes Dredge and Dock, Caterpillar, AECOM, The Army Corps of Engineers and The Nature Conservancy discuss why and how their organizations are making investments in natural infrastructure.

Thursday, March 21, 2019

10:30 am – 11:30 am

2253 Rayburn House Office Building

Featured Speakers

Bill Hanson, Great Lakes Dredge and Dock (moderator)
Vice President, Government Relations

Don M. McNeill, Caterpillar
Strategic Growth Manager
Director, Natural Infrastructure Initiative

Michael J. Donahue, PhD, AECOM
Vice President, Water Resources and Environmental Services and
Director, National Coastal and Ecosystem Restoration Practice

Todd Bridges, PhD, U.S. Army Corps of Engineers
Senior Research Scientist (ST), Environmental Science, U.S. Army Engineer
Research and Development Center

Sarah Murdock, The Nature Conservancy
Director, U.S. Climate Resilience and Water Policy

[Click Here to Register](#)

CATERPILLAR AECOM

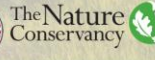


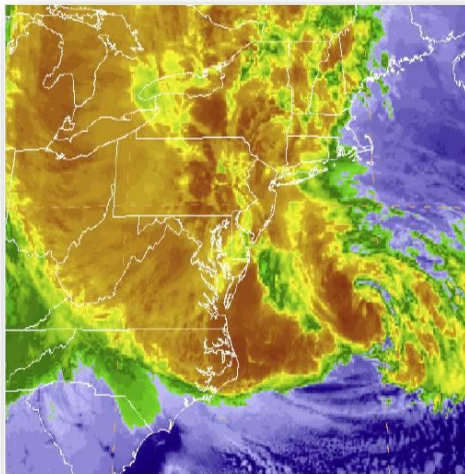
Photo © Jennifer Ewing



LEVERAGING NATURE FOR ENGINEERING VALUE

Following Hurricane Sandy:

- Risk industry-based tools used to quantify the economic benefits of coastal wetlands
 - Temperate coastal wetlands saved more than \$625 million in flood damages.
 - In Ocean County, New Jersey, salt marsh conservation can significantly reduce average annual flood losses by more than 20%.



COASTAL WETLANDS AND FLOOD DAMAGE REDUCTION

Using Risk Industry-based Models
to Assess Natural Defenses in the Northeastern USA

October 2016



The Nature
Conservancy

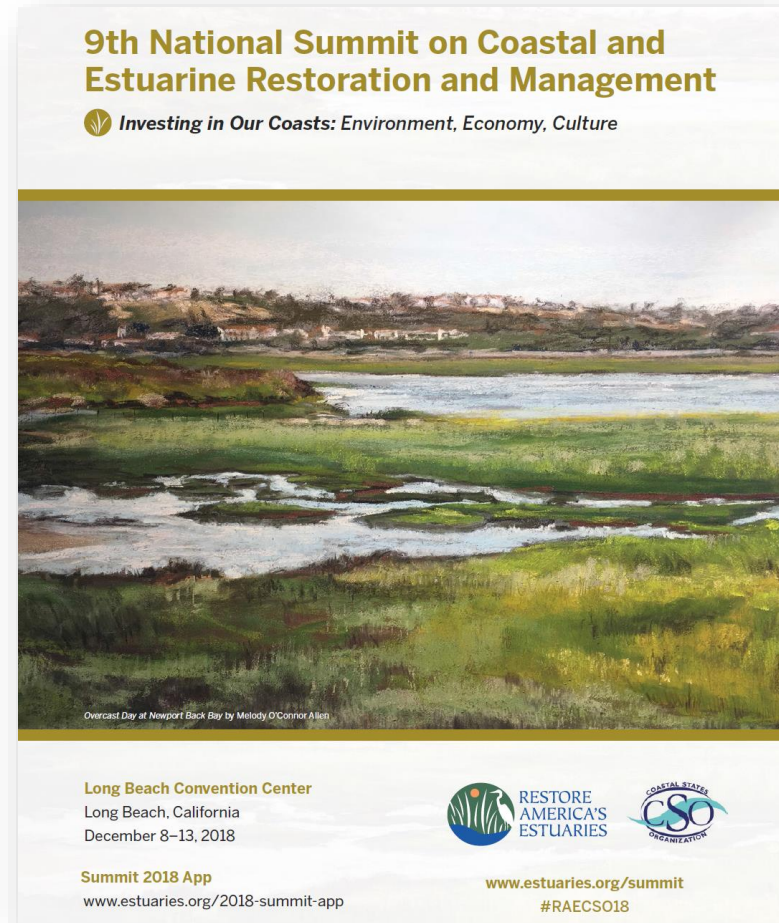


LLOYDS
TERCENTENARY
RESEARCH
FOUNDATION

NNBF AND EWN TRAINING



ICCE, 1-day NNBF training workshop; 29 July, 2018



RAE, 1-day EWN training workshop; 13 Dec, 2018

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*
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



USACE PHILADELPHIA DISTRICT: EWN IN BACK BAY NEW JERSEY



Mordecai Island

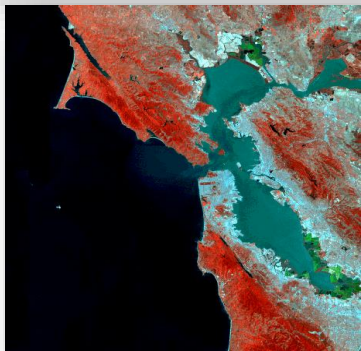


Stone Harbor



Avalon

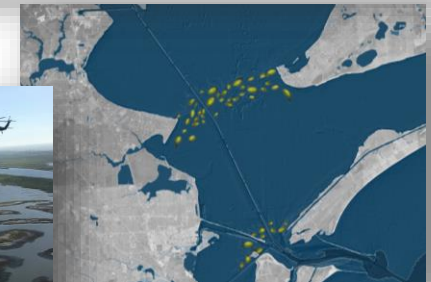
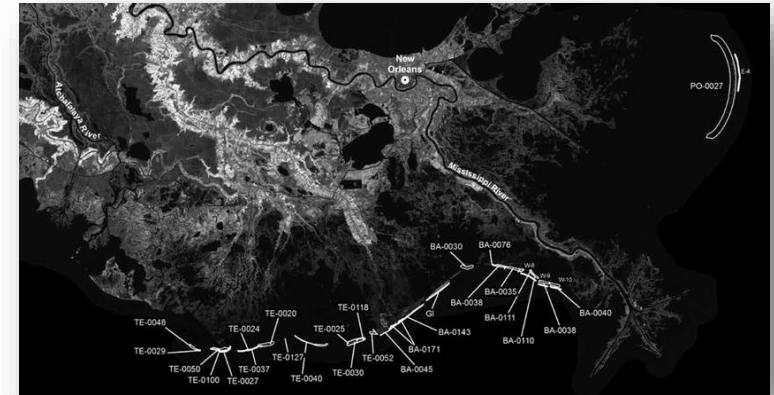
HAMILTON AND SEARS POINT WETLANDS SAN PABLO BAY, CA



PROGRESS TOWARD SUSTAINABILITY



- Look forward, not back
- Expand the “vision” to diversify project benefits
- Increase collaboration and cross-sector partnerships
- Commit to innovation
- Pursue realistic and affordable projects
- Document the value created
- Coordinate communication across partnering organizations for maximum impact





“I wonder how long it will be, before nature and man accept each other again.” Walter Anderson