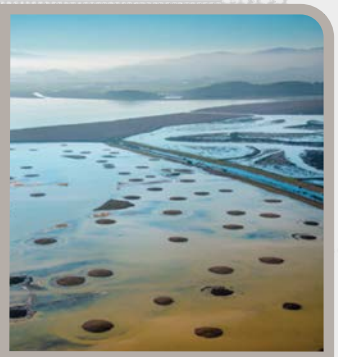
ENGINEERING WITH NATURE: OVERVIEW AND EXAMPLE PROJECTS



Jeffrey K. King, Ph.D., P.E.
Deputy National Lead
USACE EWN Initiative

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

NOAA in the Caribbean (NOAA Carib) Partner Event
Puerto Rico: August 19-20, 2019
St. Croix, Virgin Islands; August 22-23, 2019

US Army Corps of Engineers

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

Engineering With Nature®

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

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

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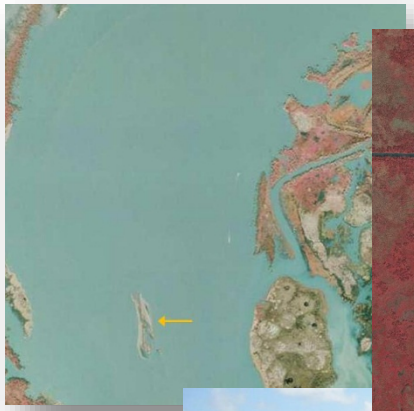
“TRIPLE WIN” OUTCOMES: HORSESHOE BEND ISLAND, ATCHAFALAYA RIVER



- Options for managing DM via shore-based wetland creation were exhausted
- Strategic placement of sediment (0.5-1.8 mcy/1-3 yrs) was used to create a ~70-acre island
- Producing significant environmental and engineering benefits
- Project Awards:
  - 2015 WEDA Award for Environmental Excellence
  - 2017 WEDA Award for CC Adaption
  - 2017 DPC Award for Working, Building, and Engineering with Nature

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 EWN Proving Grounds
  - Galveston, Buffalo, Philadelphia
- Shared by strategic communications and education
- Advanced through partnering/collaboration
- Informed by focused R&D
- Demonstrated with field projects
- 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

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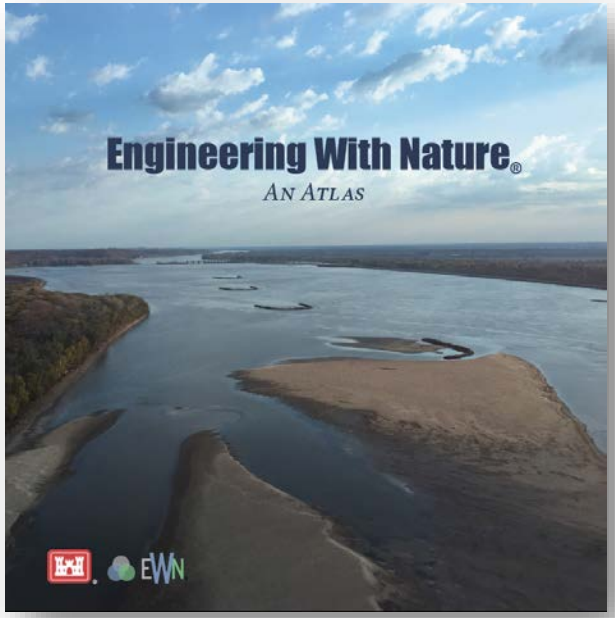
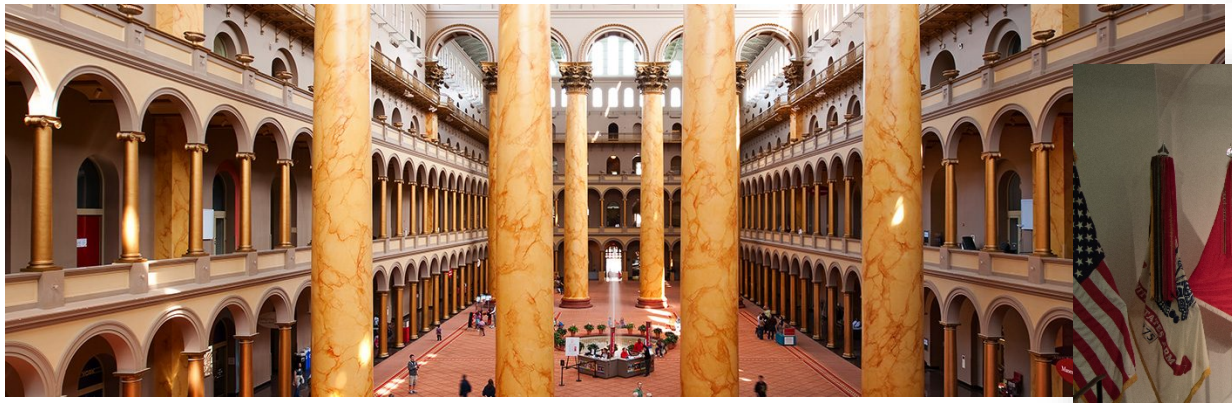
SHARED BY STRATEGIC COMMUNICATIONS AND EDUCATION

EWN ATLAS LAUNCH EVENT

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



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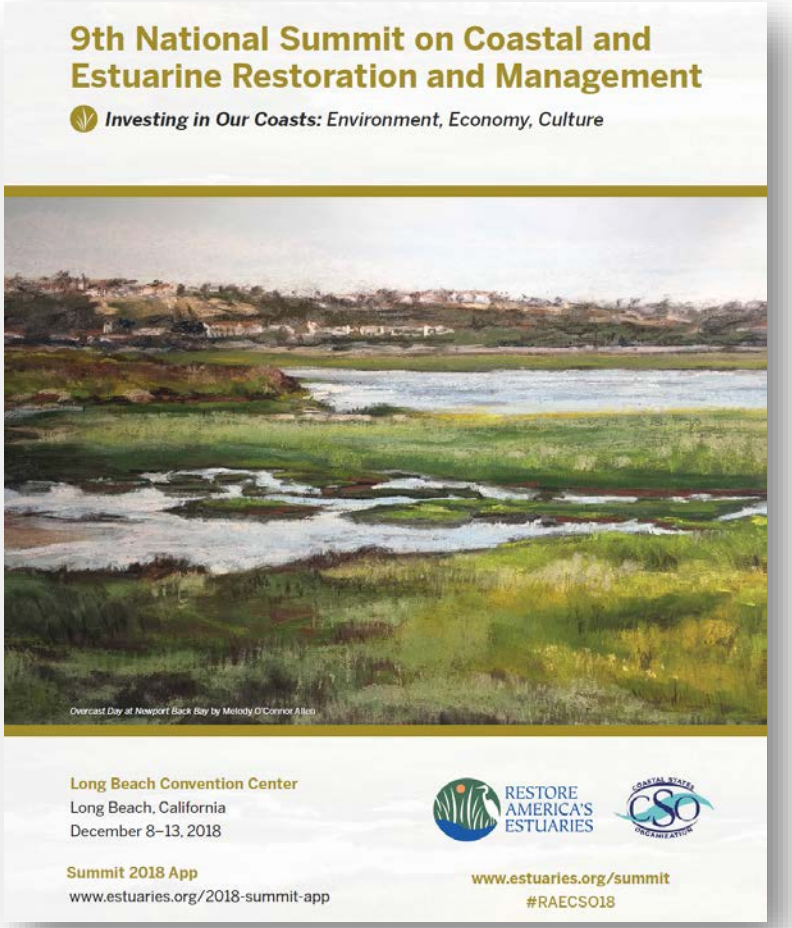
NNBF AND EWN TRAINING

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



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

ADVANCED THROUGH PARTNERSHIP AND COLLABORATION

Collaboration with Federal Agencies

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)

INTERNATIONAL GUIDELINES ON THE USE OF NATURAL AND NATURE-BASED FEATURES FOR SUSTAINABLE COASTAL AND FLUVIAL SYSTEMS

Purpose: Develop guidelines for using NNBF to provide engineering functions relevant to flood risk management while producing additional economic, environmental and social benefits.

Publish NNBF technical guidelines by 2020:

- Multi-author: government, academia, NGOs, engineering firms, construction companies, etc.
- Addressing the full project life cycle
- Guidelines in 4 Parts
  - Overarching
  - Coastal Applications
  - Fluvial Applications
  - Conclusions

INFORMED BY FOCUSED R&D

AND

DEMONSTRATED WITH FIELD PROJECTS

SCIENCE, ENGINEERING, TECHNOLOGY RESEARCH TARGETS

Fundamental processes
- Sediment transport through and around NNBF
- Long-term engineering and environmental performance of features
- Environmental 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

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

Natural Infrastructure Initiative

Natural Infrastructure & Opportunities Tool Development

The public facing *Natural Infrastructure Opportunities* web-viewer, developed in collaboration with the Natural Infrastructure Initiative Group, focuses on identifying beneficial use opportunities. Prototype version of viewer developed to address a number of questions identified by NII group.

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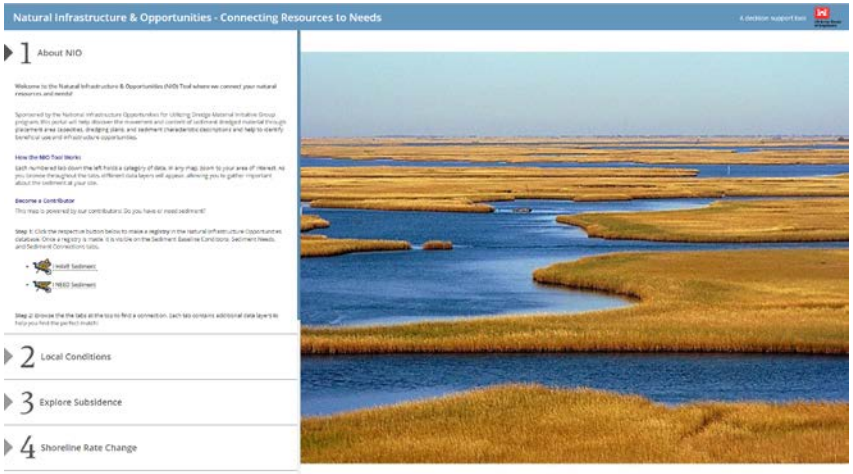
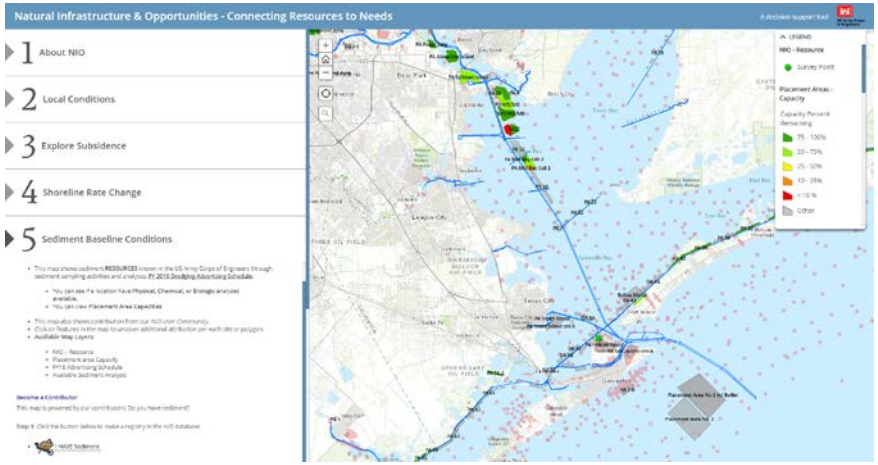
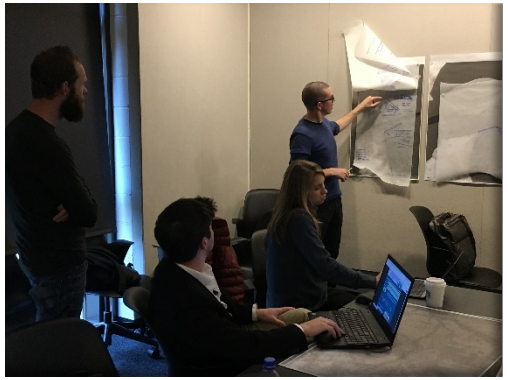




INCORPORATING EWN/LA TECHNIQUES AND PRACTICES INTO USACE INFRASTRUCTURE

Work on USACE infrastructure projects with private/academic LAs

- 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
  - NEW: Sabine to Galveston (S2G) Project (SWG)
  - NEW: NJ Bay Bays Study (NAP)
- Team visits project sites and collects data
- EWN/LA Team met JAN 19 at Auburn to work on initial renderings
- Meetings w/ USACE Districts to discuss rendering beginning MAR 19
- Final report/renderings delivered to Districts JUL 19



APPLYING EWN STRATEGIES AND NNBF TO PROTECT COASTLINES

Understand
The System

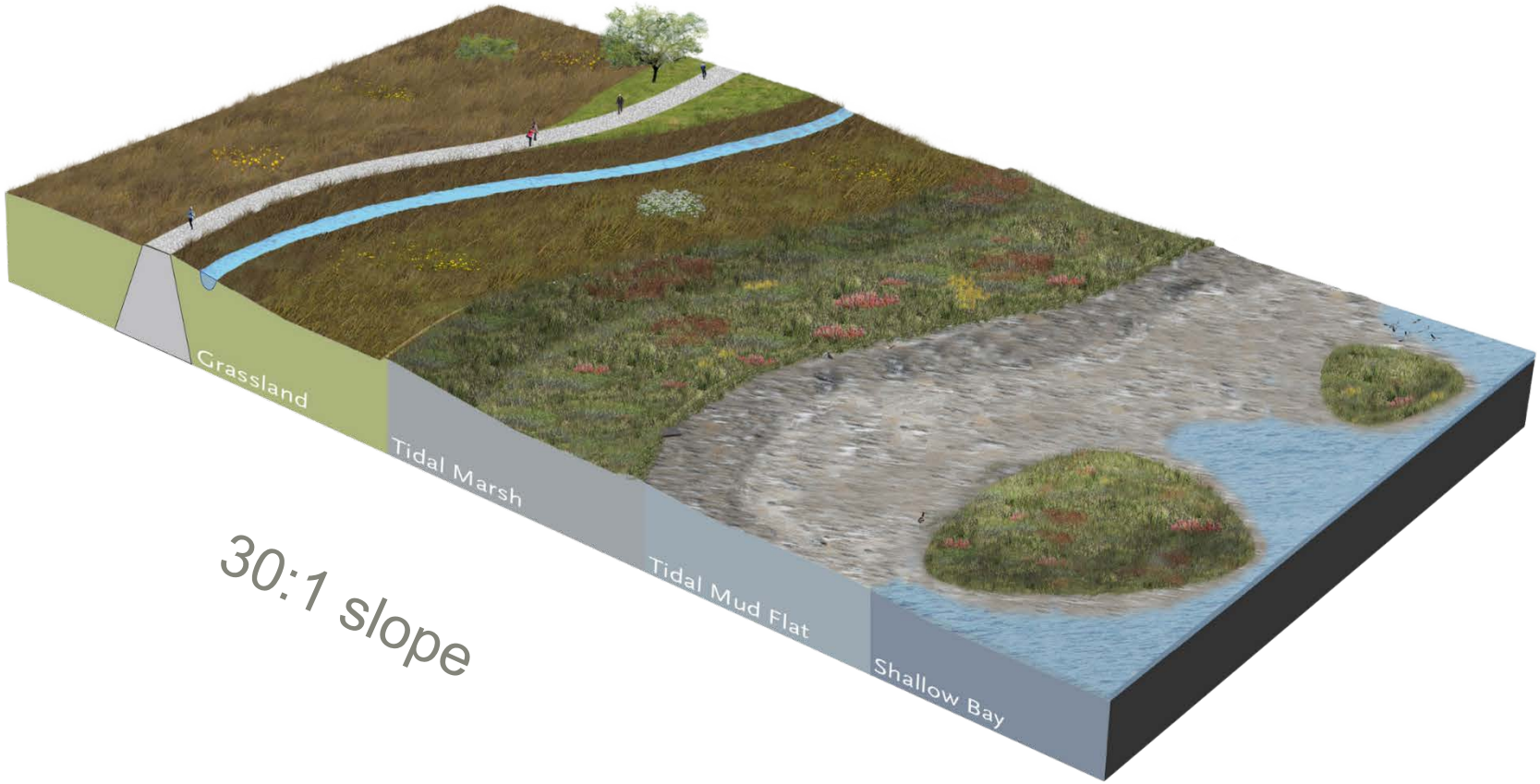
Not “One-Size Fits All”

Multi-Dimensional Approach

Not Achieved by a “Build-One-And-Done Approach”

Communication and Partnering Are Critical

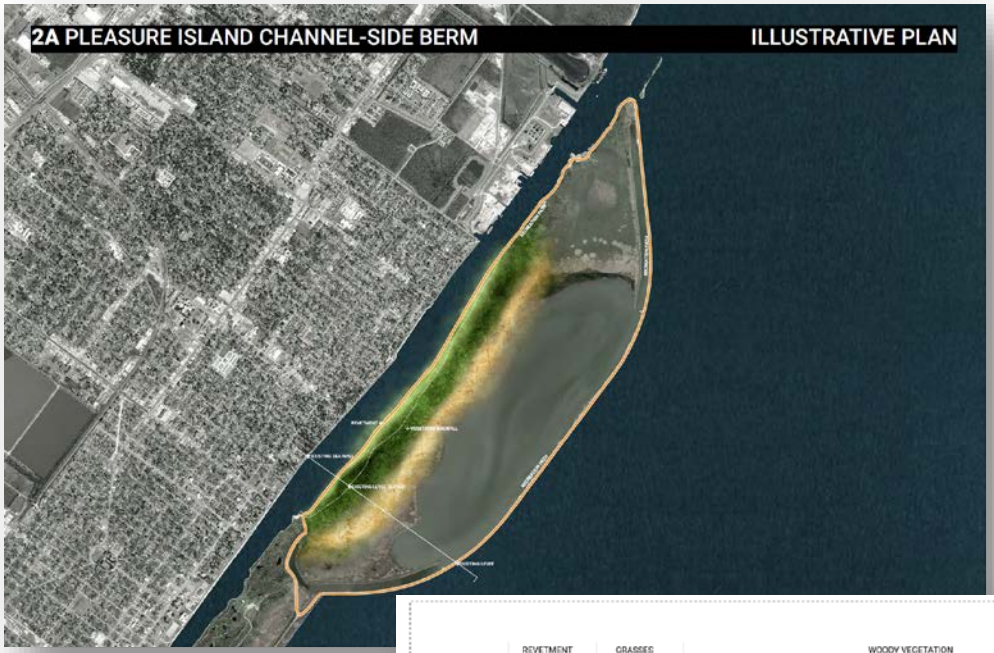
SYSTEMS APPROACH

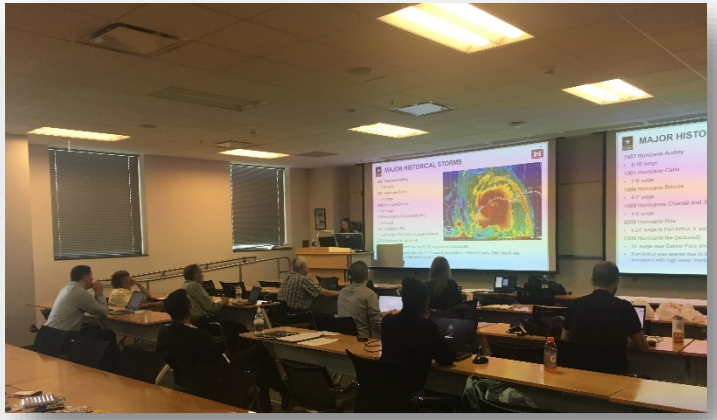


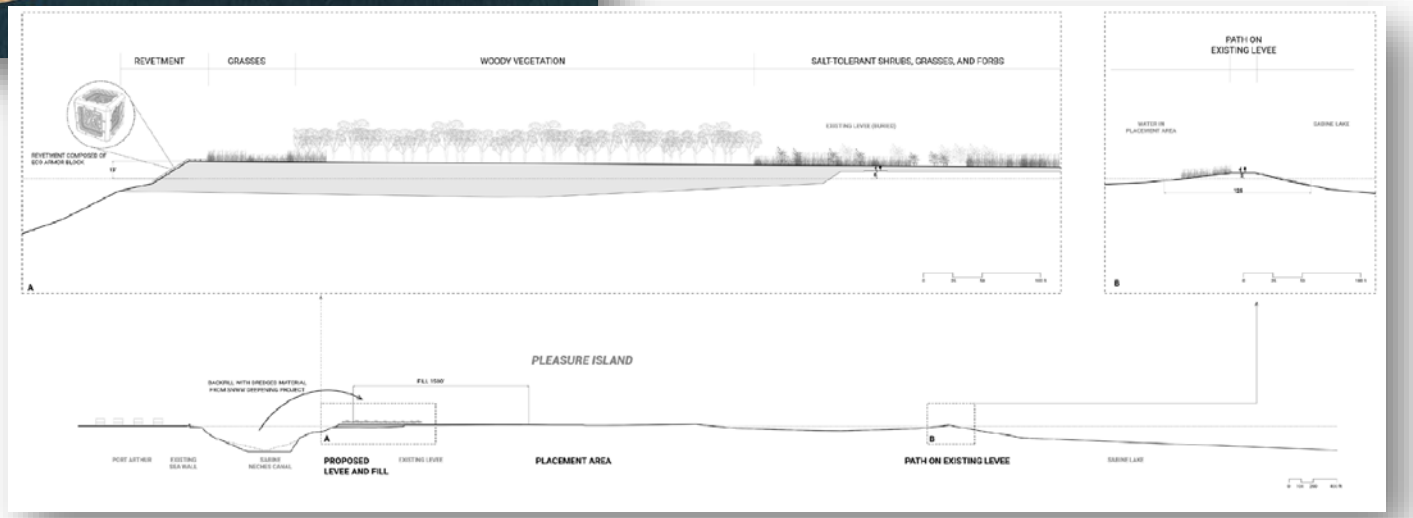
"Horizontal levee" concept

SABINE TO GALVESTON – HORIZONTAL LEVEES

SABINE TO GALVESTON – ISLAND EXPANSION



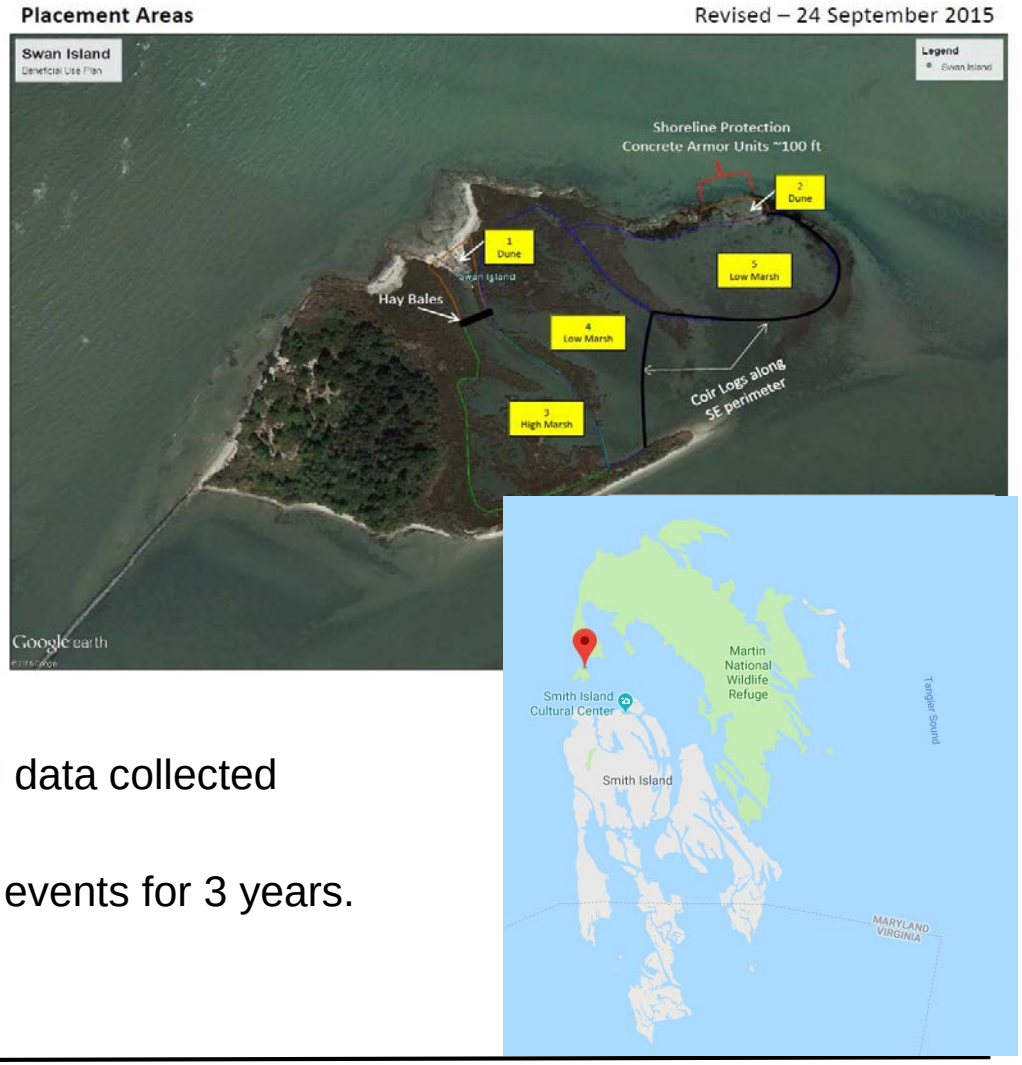




MAXIMIZING THE LONG-TERM FUNCTION OF COASTAL ISLANDS DERIVED FROM EWN EFFORTS (19-15)

Initial YR 1 Effort Focused on Swan Island

- ✓ Platforms Installed SEP 2018 (data collection ongoing)
- ✓ Pre-Construction biological/ecological data collected (AUG/SEP 2018)
- ✓ Swan Island construction Initiated (OCT/NOV 2018)
- ✓ Placement of sediment completed (MAR 2019)
- ✓ Swan Island planting occurs (MAY/JUN 2019)



- ✓ Post-Construction biological/ecological data collected (MAY/JUN 2019)
- ✓ Sampling 2 per yr and pre-/post-storm events for 3 years.

SWAN ISLAND POST-CONSTRUCTION MONITORING

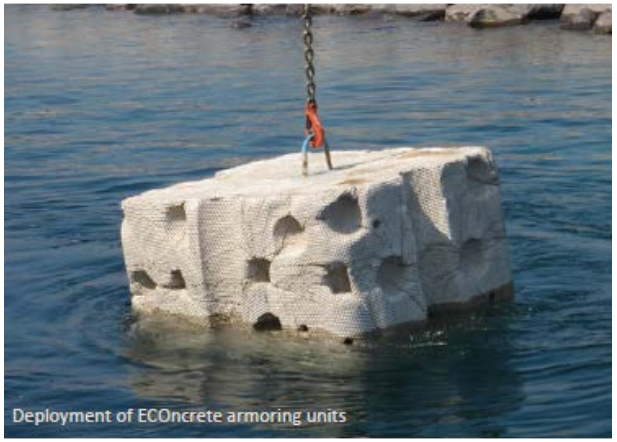
August 2019

SWAN ISLAND COLLABORATION

- ✓ ERDC EL and CHL Researchers
- ✓ NAB Operations Staff
- ✓ NOAA/NCCOS – "Evaluating the Efficacy of Island Restoration and Enhancement for Coastal Protection" - 3 NOAA Labs and NOAA HQ personnel
- ✓ USFWS – Blackwater NWR facilities and personnel
- ✓ MDDNR – Boats, personnel/field sampling
- ✓ Dredging Research Collaborative – Landscape Architects

FORT PIERCE CITY MARINA, FLORIDA

ECOncrete® Armoring Units


Deployment of ECOncrete armoring units

ECOncrete 24 months post deployment

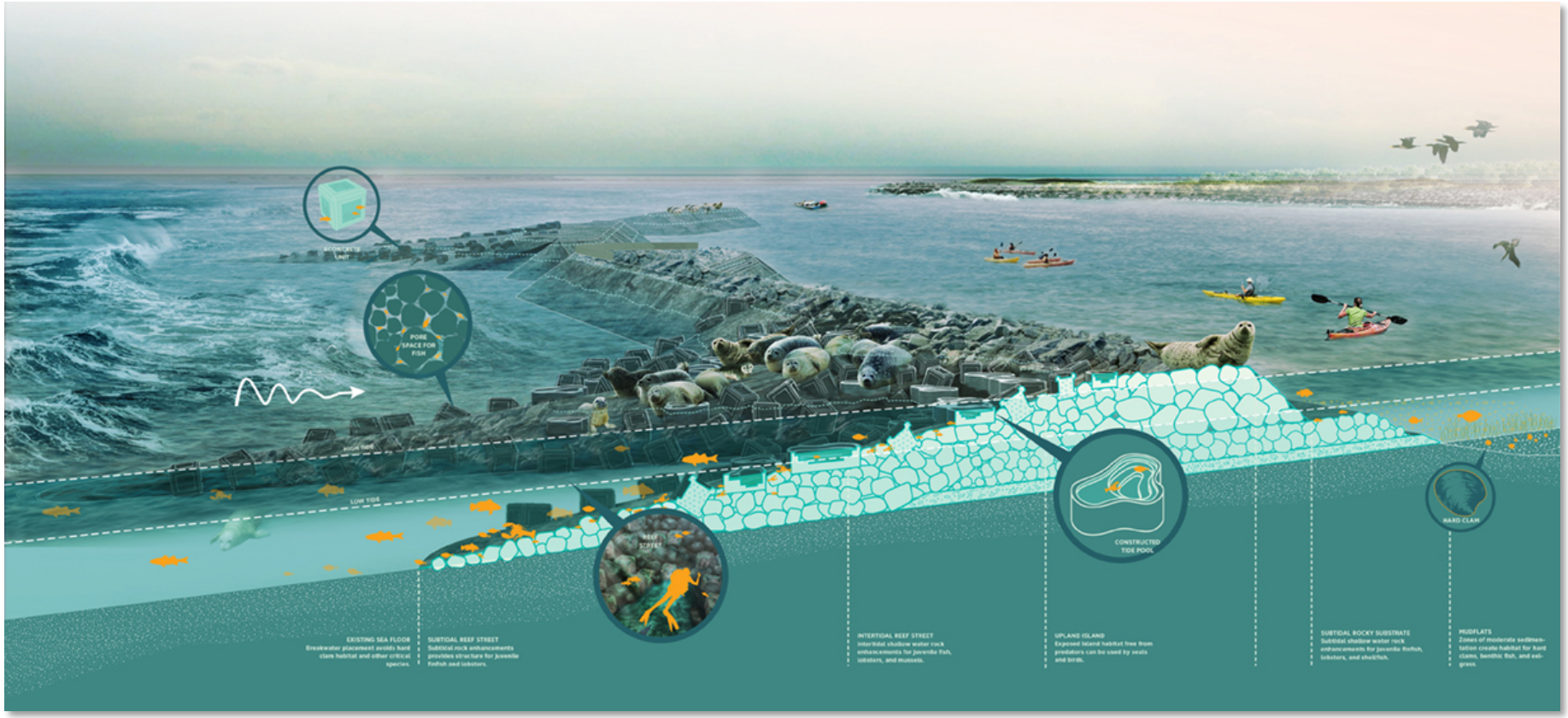
Deployment of ECOncrete armoring units

"Concrete chemistry, surface complexity and macro-design: these three elements combined, mimic natural marine habitats and decrease the negative effect of coastal development"

ECOncrete® Tidal Pools

Tidal Pools Installed at Brooklyn Bridge Park, NY

Rendering of EWN-Enhanced Breakwater



Engineering With Nature®

THANK YOU

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