



# Nature-Based Solutions to Improve Coastal Resilience of Ports - Lessons Learned from the Department of Defense

*Prepared for:*



The Association of Pacific Ports

*Prepared by:*



EA Engineering, Science,  
and Technology, Inc., PBC

Sam Whitin, CERP  
Vice President, Coastal Resilience Director

25 January 2025

# Introduction: Engineering, Science, and Technology



- § **5** decades in business
- § **625+** staff in 27 nationwide offices
- § **100%** employee-owned Public Benefit Corporation
- § **80%** of business is from repeat clients
- § **\$255M** annual revenue
- § **~1,700** projects for over 575+ clients executed annually



Engineering



Environmental Health and Safety



Site Characterization and Remediation



Natural Resources Management



Data Management and Technology



Laboratory Studies

## EA'S PBC FRAMEWORK AND CSR PROGRAM



PROFESSIONAL DEVELOPMENT



COMMUNITY SUPPORT



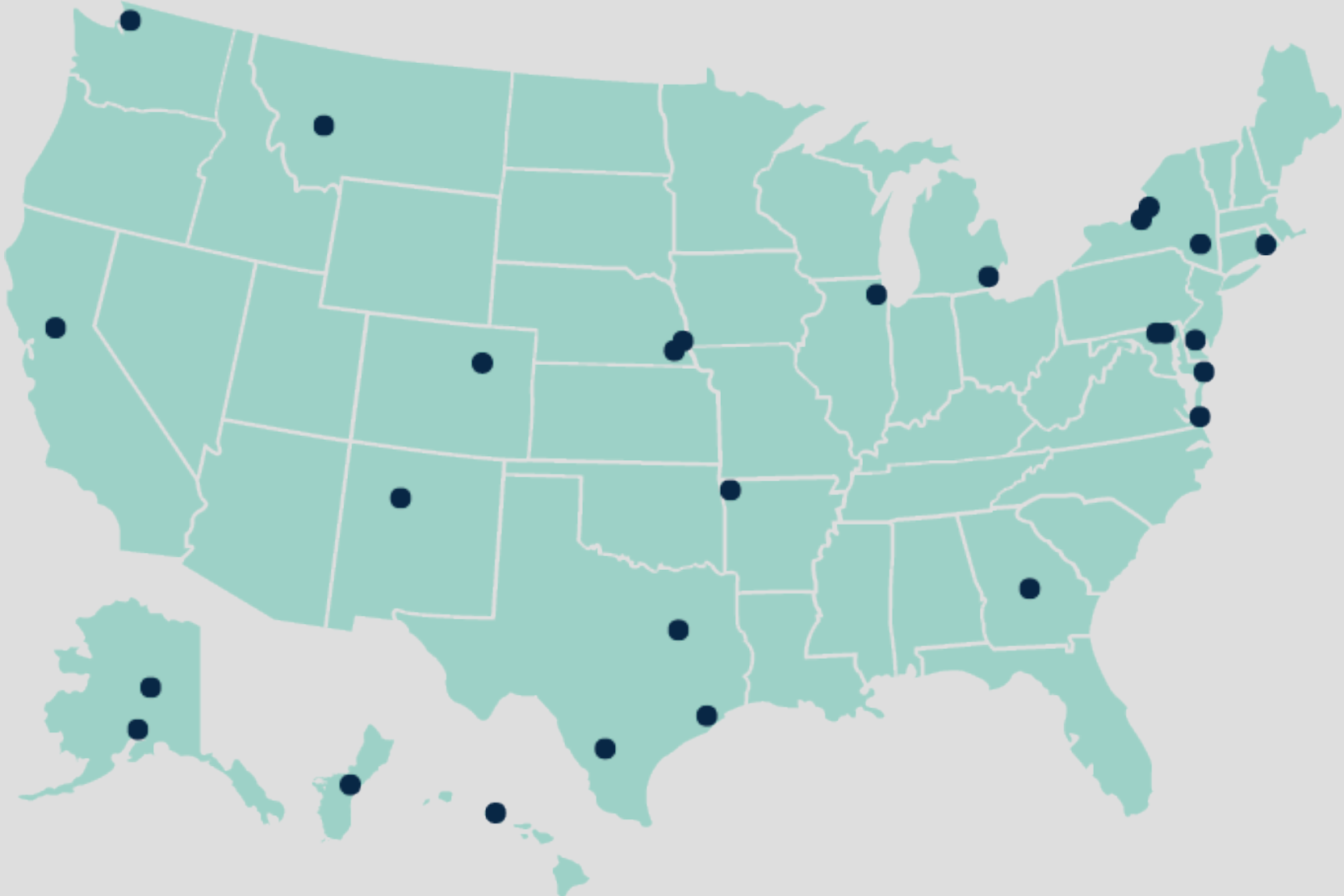
CHARITABLE GIVING



EA'S SUSTAINABILITY PROGRAM



# Geographic Footprint



# Bottom Line Up Front

§ The incorporation of nature-based solutions (NbS) into projects which help protect port infrastructure from coastal risk have had an uptick in interest. Specifically, the use of NbS has specific benefits to Ports in the following areas

- ® Access to additional funding streams and leveraging
- ® Makes permit process easier
- ® Good will to neighbors and improved relationships with all

§ The Department of Defense has been funding and researching how NbS can help them be more resilient to natural disasters and meet mission needs. This presentation will explore NbS and look at DoD and other project examples of processes that can benefit Ports.



## Department of the Navy Hosts Meeting on Climate Resilience in Hawaii

Wednesday October 12, 2022





26-29 September 2022. The Department of the Navy (DON) hosted a discussion on nature-based climate resilience. This meeting is part of a collaboration with the Army Corps of Engineer's Engineering With Nature® program. Stakeholder participants shared ongoing initiatives and opportunities to collaborate on implementing nature-based solutions to enhance resilience for DON installations, as well as [...]



# Defining Nature-based Solutions

§ Actions that are designed to protect, sustainably manage, and conserve natural or modified ecosystems, while also providing benefits to people.

§ Not just “living shorelines”, but a wider array of system level approaches to increase resilience to natural disasters and sea level rise.

NATURAL AND NATURE-BASED FEATURES AT A GLANCE				
				
<b>Dunes and Beaches</b>	<b>Vegetated Features (e.g., Marshes)</b>	<b>Oyster and Coral Reefs</b>	<b>Barrier Islands</b>	<b>Maritime Forests/Shrub Communities</b>
<b>Benefits/Processes</b> Breaking of offshore waves Attenuation of wave energy Slow inland water transfer	<b>Benefits/Processes</b> Breaking of offshore waves Attenuation of wave energy Slow inland water transfer Increased infiltration	<b>Benefits/Processes</b> Breaking of offshore waves Attenuation of wave energy Slow inland water transfer	<b>Benefits/Processes</b> Wave attenuation and/or dissipation Sediment stabilization	<b>Benefits/Processes</b> Wave attenuation and/or dissipation Shoreline erosion stabilization Soil retention
<b>Performance Factors</b> Berm height and width Beach slope Sediment grain size and supply Dune height, crest, and width Presence of vegetation	<b>Performance Factors</b> Marsh, wetland, or SAV elevation and continuity Vegetation type and density Spatial extent	<b>Performance Factors</b> Reef width, elevation, and roughness	<b>Performance Factors</b> Island elevation, length, and width Land cover Breach susceptibility Proximity to mainland shore	<b>Performance Factors</b> Vegetation height and density Forest dimension Sediment composition Platform elevation
<b>General coastal risk reduction performance factors include:</b> Storm surge and wave height/period, and water levels				

# Defining Nature-based Solutions



- ü Certain products which are designed to be more environmentally friendly, can achieve risk reduction goals and provide an easier path for funding, community acceptance, and permitting.
- ü Certain products are not allowed in places like Hawai'i, but that is showing signs of change



 **ECONCRETE**  
**Port of San Diego Coastal Protection**

# Defining Nature-based Solutions

## Using SEDIMENT as a nature-based solution

U.S. Army Corps of Engineers

### Beneficial Use of Dredged Material Program Vision



#### Dredge Material is a valuable resource

- Increased dredging investments create beneficial use of dredge material management opportunities
- Benefits the ecosystem, economy, and can effectively and efficiently deliver the USACE mission.



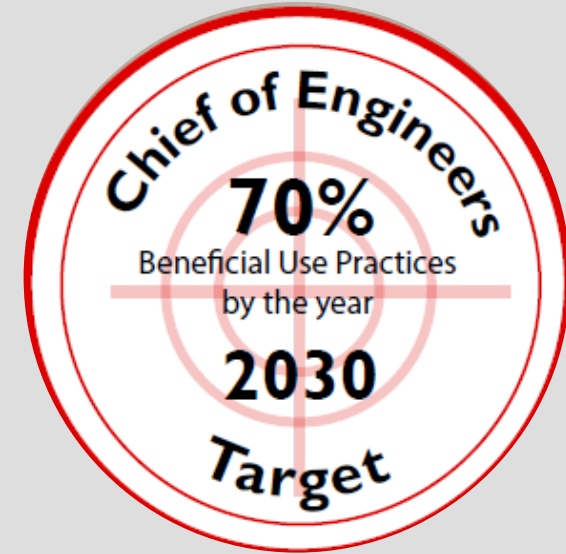
#### There are opportunities to expand beneficial use within the Federal Standard

- Operational strategy should inherently include beneficial use placement options.
- If material is needed to implement a project, beneficial use from dredging operations should be considered as an option in the planning and execution strategy.



#### Partner collaboration is key to our success

- Innovative pursuit, both internally and externally, with partners and stakeholders will:
  - Maximize available solutions, strategies, and tools
  - Develop and apply new approaches and technologies



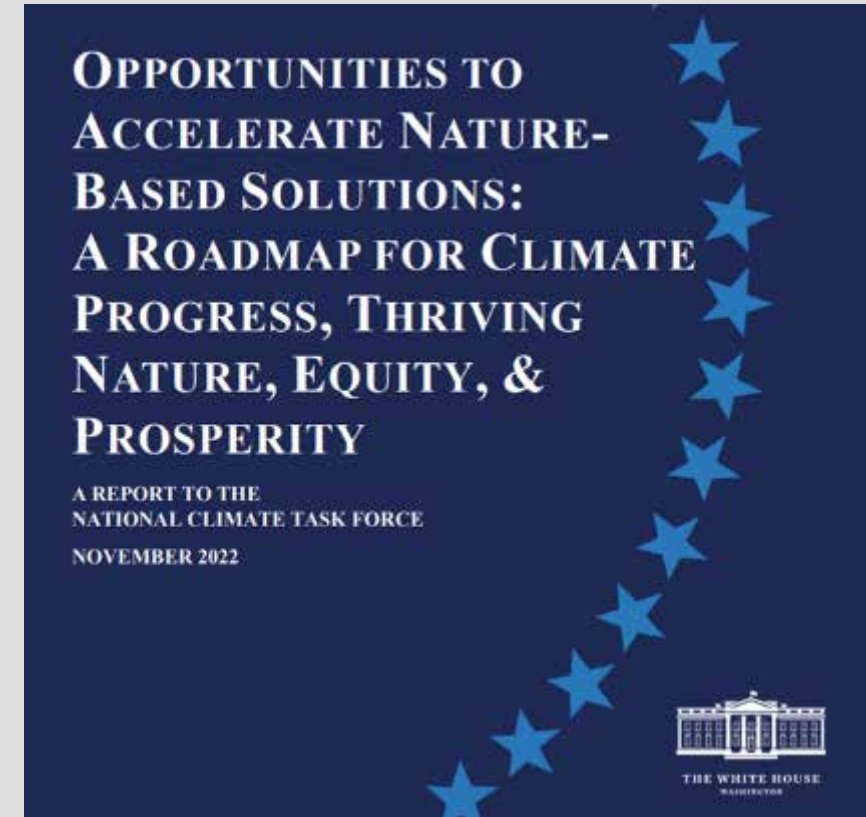
**USACE historically uses 30-40% of the sediments derived from the Navigation mission for beneficial purposes. I have established a goal for USACE to advance the practice of BUDM to 70% by the year 2030 (“70/30 Goal”).**

SCOTT A. SPELLMON  
Lieutenant General, US Army  
Commanding

# Defining Nature-based Solutions

## WHITE HOUSE NATURE-BASED SOLUTION INITIATIVE

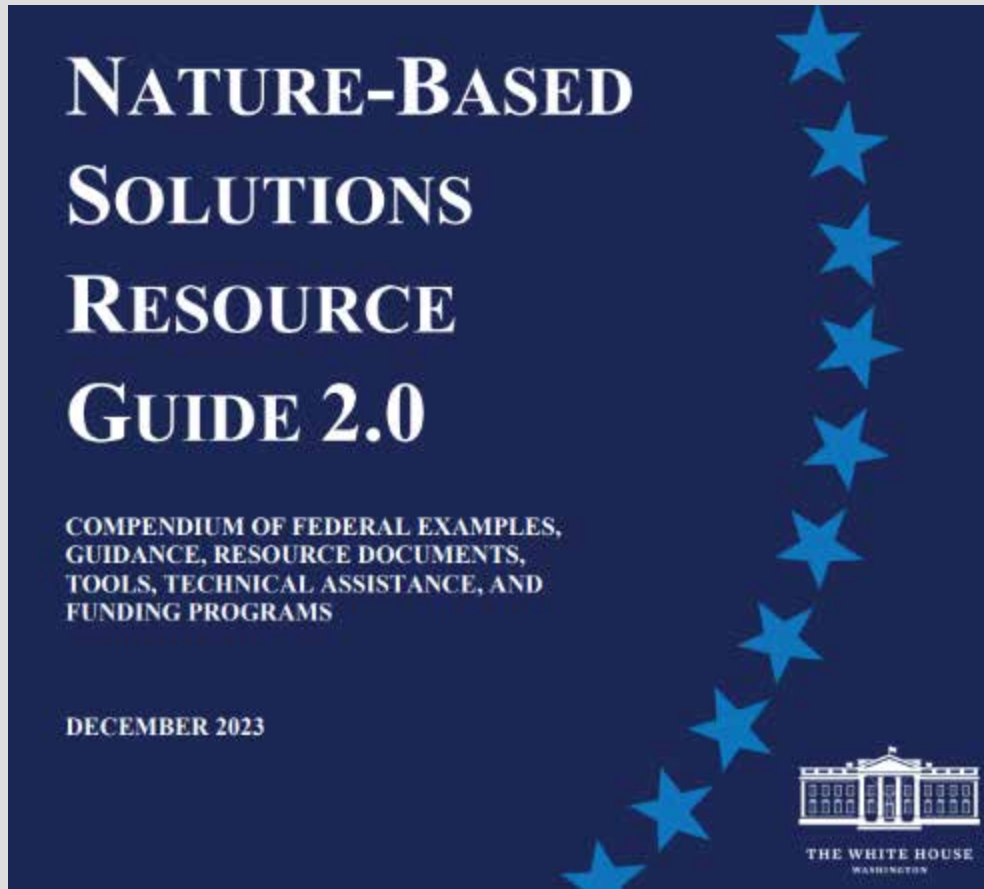
- § The Roadmap calls on agencies with large land holdings to include nature-based solutions in their planning and management, and where appropriate, engage in co-stewardship and co-management with Tribal Nations to build resilience.
- § Federal agency actions to ensure over \$25 billion in infrastructure and climate funding can support nature-based solutions....this funding largely originates from IJA and IRA.



<https://www.whitehouse.gov/wp-content/uploads/2022/11/Nature-Based-Solutions-Roadmap.pdf>



# Defining Nature-based Solutions



<https://www.whitehouse.gov/wp-content/uploads/2023/12/Nature-Based-Solutions-Resource-Guide-2.0-FINAL.pdf>

## Green Infrastructure Federal Collaborative

In May of 2021, EPA re-launched the Green Infrastructure Federal Collaborative.

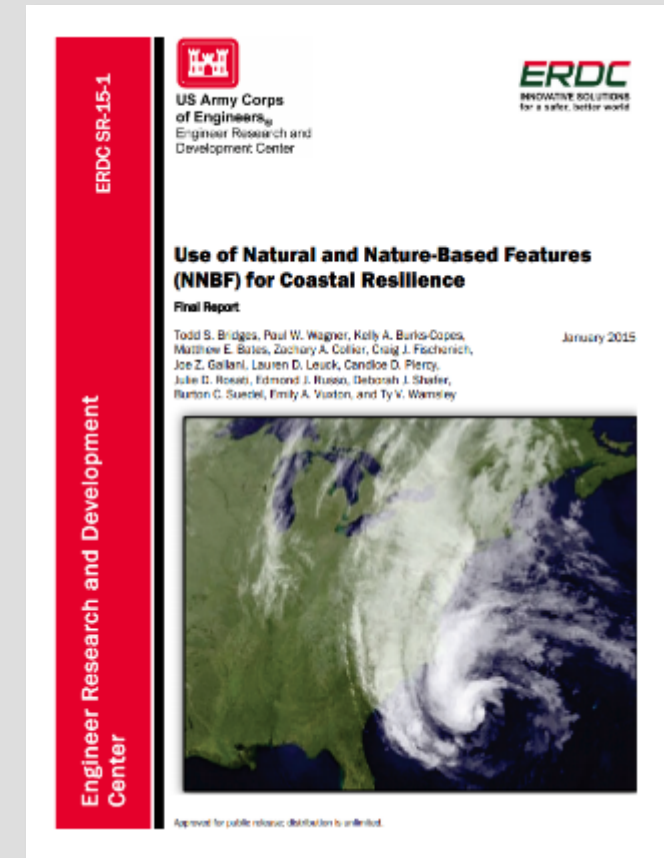
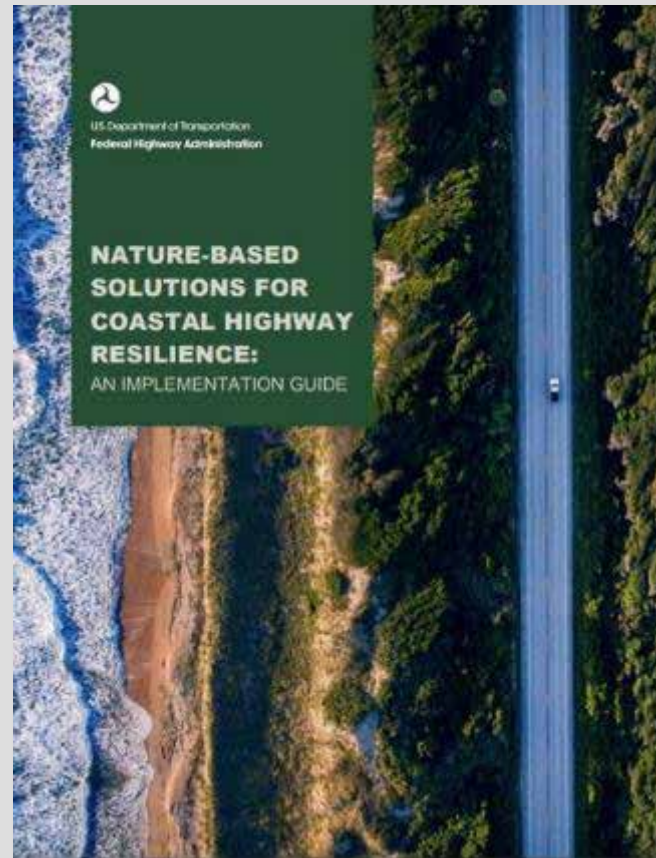
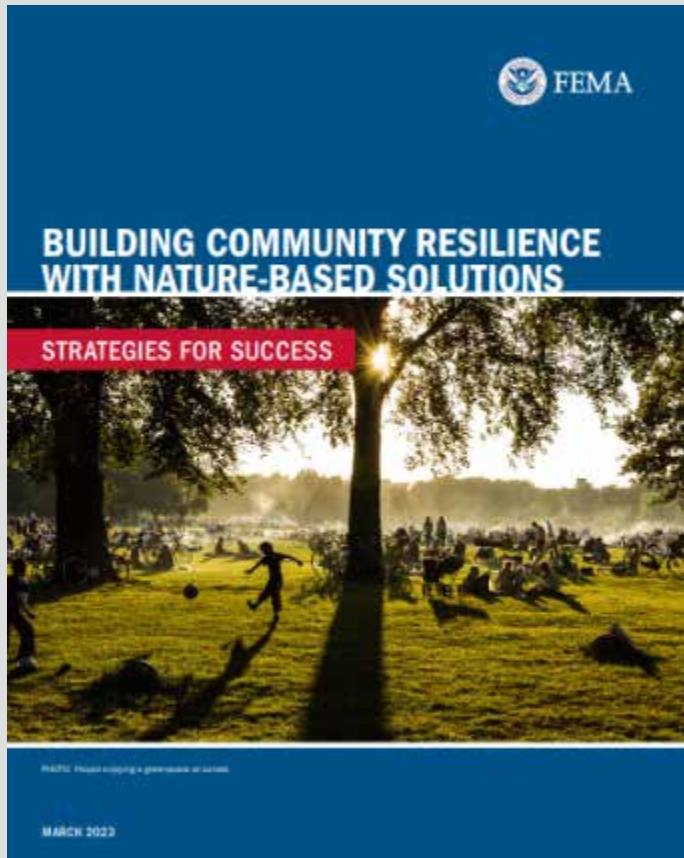
This cooperative effort fosters engagement and cooperation between agencies that actively work to promote the implementation of green infrastructure.

Collaborative members work closely to align knowledge and resources to build capacity for green infrastructure implementation. These coordinated efforts provide a platform to publicize the multiple environmental, economic, and social benefits of green infrastructure. In addition, the collaborative seeks to facilitate strategies that foster climate resilience and encourage the equitable implementation of green infrastructure in all communities.



# Defining Nature-based Solutions

## Examples specific agency guidance



[https://www.fema.gov/sites/default/files/documents/fema\\_nature-based-solutions-guide-2-strategies-success\\_2023.pdf](https://www.fema.gov/sites/default/files/documents/fema_nature-based-solutions-guide-2-strategies-success_2023.pdf)

[https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing\\_and\\_current\\_research/green\\_infrastructure/implementation\\_guide/fhwahep19042.pdf](https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/implementation_guide/fhwahep19042.pdf)

[https://ewn.el.ercd.dren.mil/pub/Pub\\_4\\_NNBF\\_Final\\_Report\\_v2.pdf](https://ewn.el.ercd.dren.mil/pub/Pub_4_NNBF_Final_Report_v2.pdf)

# Defining Nature-based Solutions



## Technical Criterion 3: Incorporation of Nature-Based Solutions (10 points)

To receive the point allotment for this criterion, the subapplication must indicate and describe how the project incorporates one or more nature-based solutions, which are sustainable environmental management practices that restore, mimic, and/or enhance nature and natural systems or processes and support natural hazard risk mitigation as well as economic, environmental, and social resilience efforts. Nature-based solutions use approaches that include, but are not limited to, restoration of grasslands, rivers, floodplains, wetlands, dunes, and reefs; living shorelines; soil stabilization; aquifer storage and recovery; and bioretention systems.

Applicants/subapplicants should include this information in the Scope of Work Section and Cost Effectiveness Section of FEMA GO.



**Building Resilient Infrastructure  
and Communities (BRIC) grant program**

# Defining Nature-based Solutions

## GENERAL EXPLANATION OF NBS

§ Others agency guidance/funding

§ Private sector and insurance

### Successful insurance models for replication – Case study 1

- In 2017, Swiss Re launched the world's first nature-based insurance solution to protect Mexico's **Quintana Roo coral reef**
- Collaboration with The Nature Conservancy (TNC), Mexican regional governments, local universities, property owners, and Swiss Re
- **Parametric insurance** cover based on wind-speed index
- Creation of the Coastal Zone Management to administer the solution

#### Coral Reef Hurricane Cover Mexico

*Innovative insurance solution to facilitate fast recovery and restoration activity*



[https://reefresilience.org/wp-content/uploads/Insurance-to-protect-natural-assets-and-enable-nature-based-solutions\\_Brahin\\_2022.01.11.pdf](https://reefresilience.org/wp-content/uploads/Insurance-to-protect-natural-assets-and-enable-nature-based-solutions_Brahin_2022.01.11.pdf)



### FINANCING NATURAL INFRASTRUCTURE FOR COASTAL FLOOD DAMAGE REDUCTION

JUNE 2017



LLOYDS  
TERCENTENARY  
RESEARCH  
FOUNDATION

[https://www.middlebury.edu/institute/sites/www.middlebury.edu.institute/files/2018-07/6.13.17.LLOYDS.Financing%20Natural%20Infrastructure%201.JUN\\_.2017\\_Lo%20Res.pdf](https://www.middlebury.edu/institute/sites/www.middlebury.edu.institute/files/2018-07/6.13.17.LLOYDS.Financing%20Natural%20Infrastructure%201.JUN_.2017_Lo%20Res.pdf)

# DoD Approach to Using NbS in Built Environment

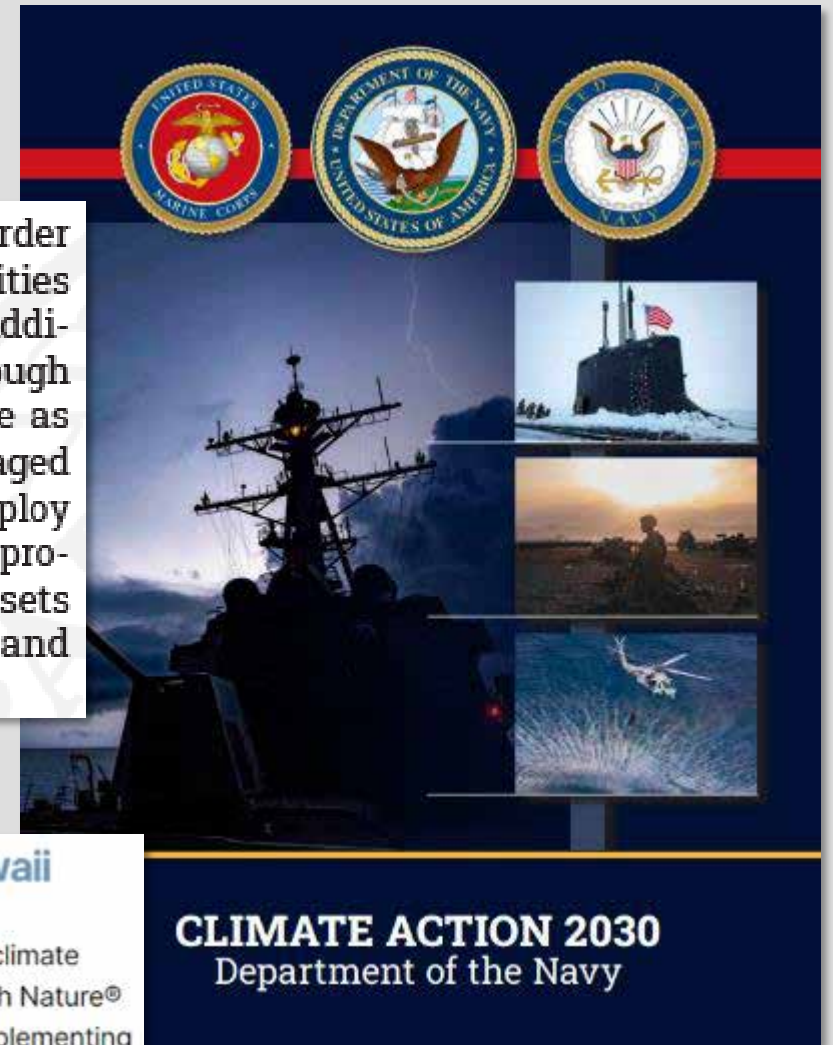
## ARMY CLIMATE STRATEGY

### Implementation Plan



Fiscal Years 2023-2027

**Nature-Based Resilience.** Building on Executive Order 14072, Strengthening the Nation's Forests, Communities and Local Economies, the DON will draw down an additional five million metric tons of CO<sub>2</sub>e per year through nature-based solutions by 2027, roughly the same as removing one million cars off the road, on DON-managed lands or working with partners. The DON will also deploy nature-based solutions to mitigate shoreline erosion, protect mission-critical assets, and improve natural assets that are key to achieving resilient infrastructure and operations.



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**CLIMATE ACTION 2030**  
Department of the Navy

# DoD Approach to Using NbS in Built Environment

Just like data/resources available to Ports, DoD isn't starting from scratch

**CLIMATE ACTION 2030**  
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Global and Regional Sea Level Rise Scenarios for the United States

Regionalized Sea Level Change & Extreme Water Level Scenarios

SERDP ESTCP

Climate Adaptation For DoD Natural Resource Managers

*A Guide to Incorporating Climate Considerations into Integrated Natural Resource Management Plans*

ARMY CLIMATE STRATEGY

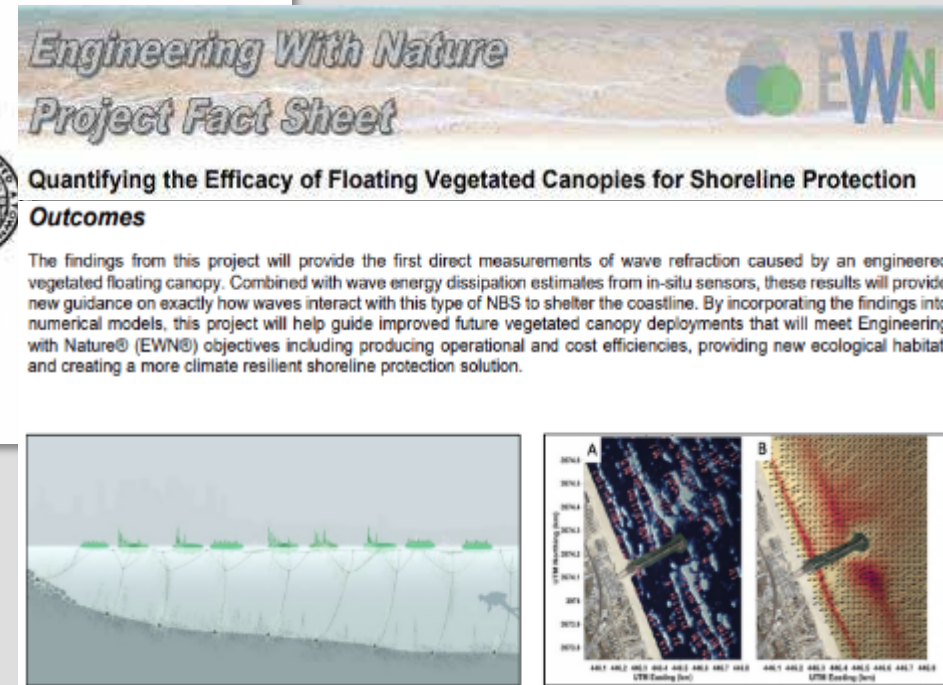
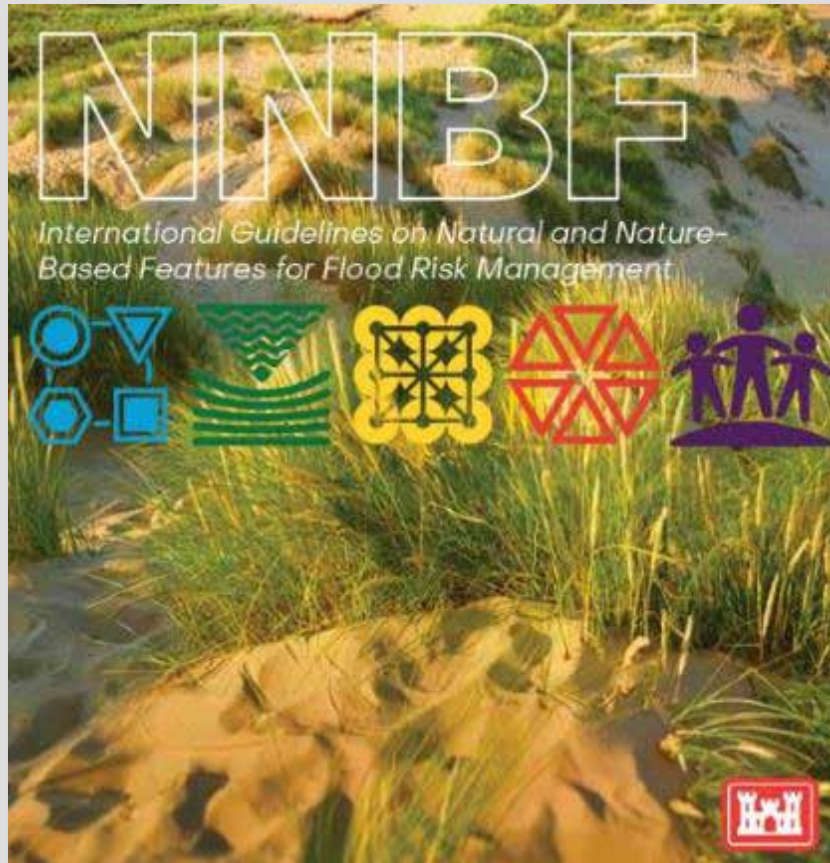
Implementation Plan

U.S. ARMY

Fiscal Years 2023-2027

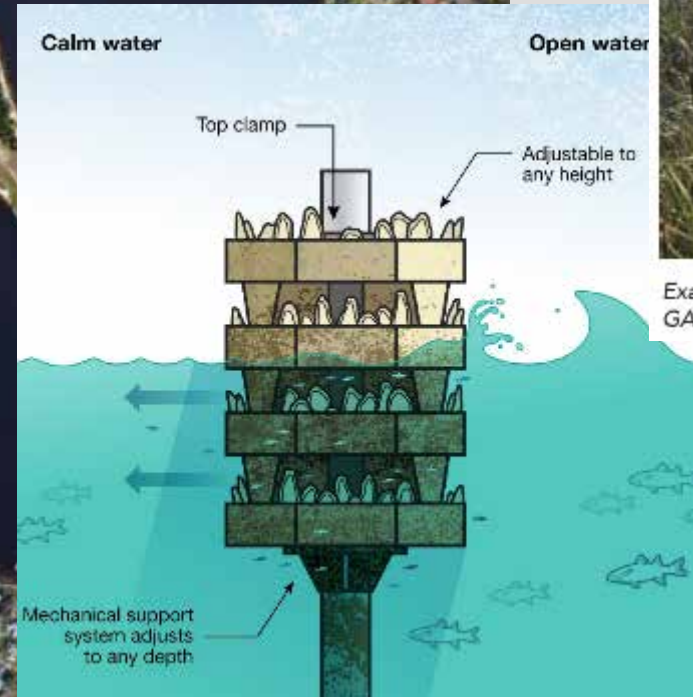
# DoD Approach to Using NbS in Built Environment

Engineering With Nature® (EWN) is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaboration.



<https://ewn.erd.c.dren.mil/>

# DoD Approach to Using NbS in Built Environment



Example: Thin-layer placement project at Jekyll Island, GA (Clay McCoy, USACE Jacksonville)

- ü Reduce wave energy impacting built infrastructure; and
- ü Reduce impacts to neighbors



# DoD Approach to Using NbS in Built Environment

- ü Naval Base Ventura County (NBVC) Point Mugu in California, a premier testing and training facility for the DoD.
- ü Port Hueneme neighbor
- ü Shared hazard threat from sea level rise
- ü Natural resource protection of shared resources benefits both entities (stable Ormond beach system)



**Restoring coastal wetlands for climate resilience**  
A case study at Naval Base Ventura County Point Mugu  
© 2021 The Nature Conservancy

A map of the coastal region of California, highlighting the locations of Port Hueneme, Point Mugu, and San Nicolas Island. The map shows the coastline from Santa Barbara in the north to Long Beach in the south. Key locations marked include Santa Barbara, Port Hueneme, Oxnard, Thousand Oaks, Point Mugu, San Nicolas Island, Channel Islands National Park, Santa Monica, Los Angeles, and Long Beach. The map is overlaid with a grid and various colored regions, likely representing different land use or restoration zones.

The Nature Conservancy

ESA

The logos for The Nature Conservancy, ESA, and the U.S. Navy are displayed in the bottom right corner of the slide. The Nature Conservancy logo is a green globe with a leaf. The ESA logo is the letters 'ESA' in orange. The U.S. Navy logo is a yellow triangle with a blue and white design inside.

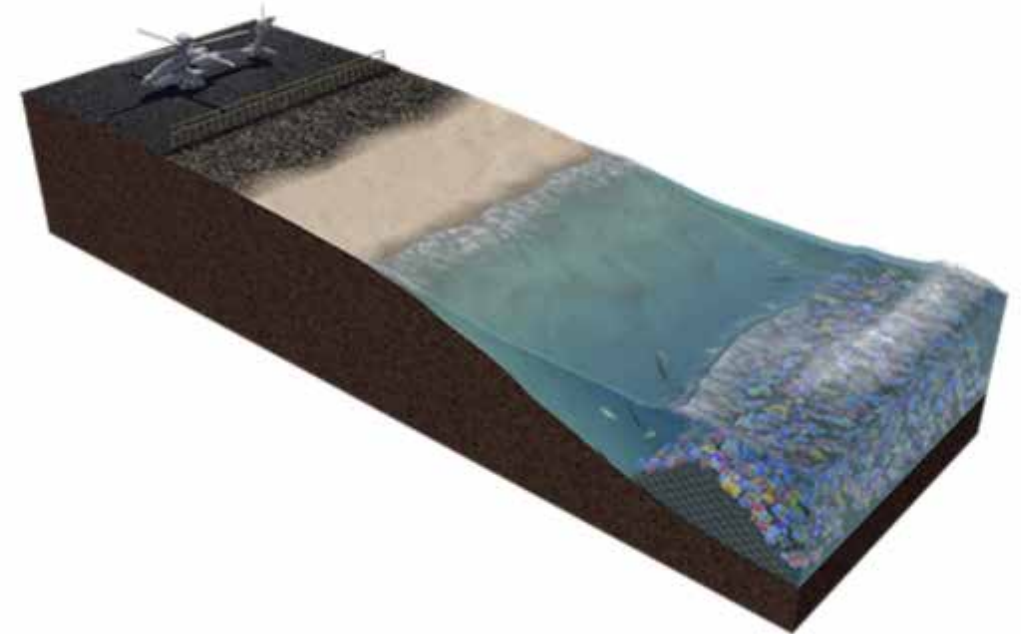
# DoD Approach to Using NbS in Built Environment

- ü Research funding is being applied to fix actual issues
- ü **University of Hawai'i was awarded up to \$25 million by the Defense Advanced Research Projects Agency (DARPA) to develop an engineered coral reef ecosystem to help protect coastlines from flooding, erosion and storm damage.**
- ü The goal of the five-year project, inspired by natural reefs, is to create an engineered structure that dissipates wave energy while providing habitat for corals and other reef life.

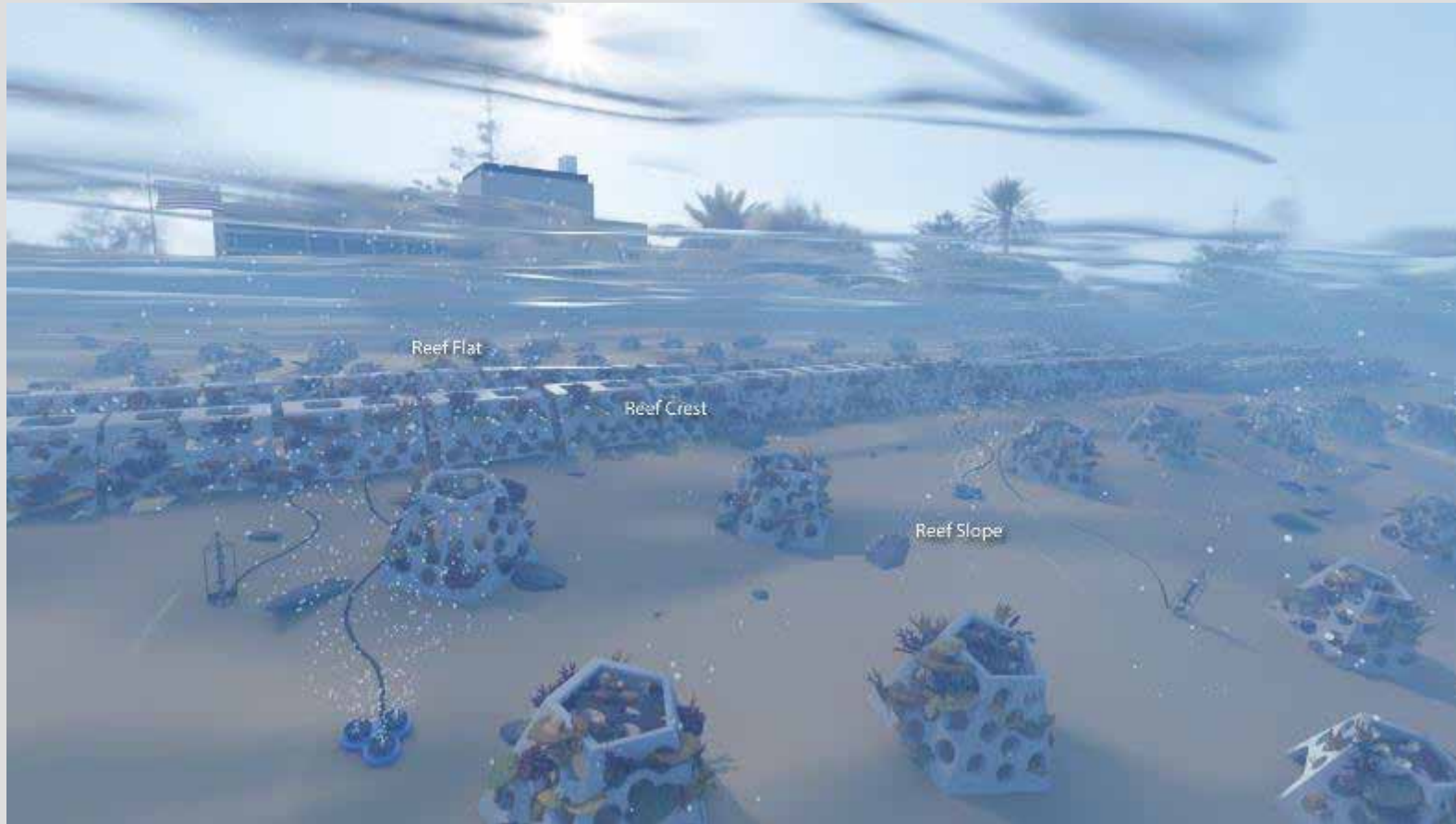
## DARPA Selects Teams to Develop Novel Hybrid Reef-Mimicking Structures

*Reefense aims to protect civilian and DoD infrastructure, personnel by mitigating damage related to coastal flooding, erosion and storm surge*

OUTREACH@DARPA.MIL  
6/15/2022



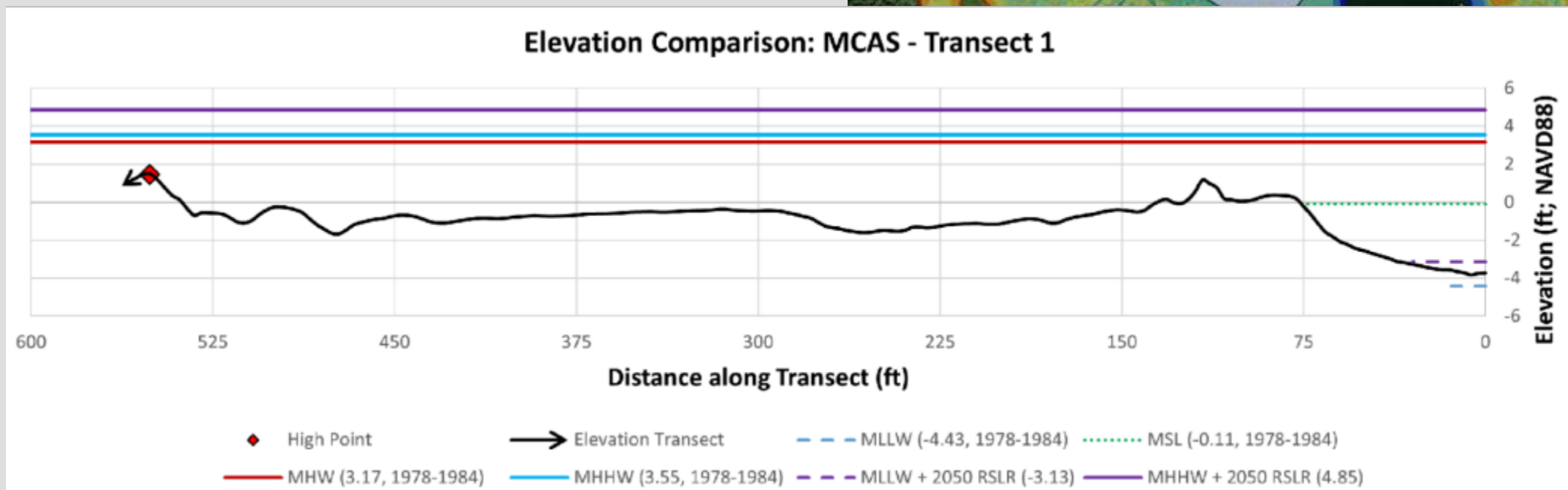
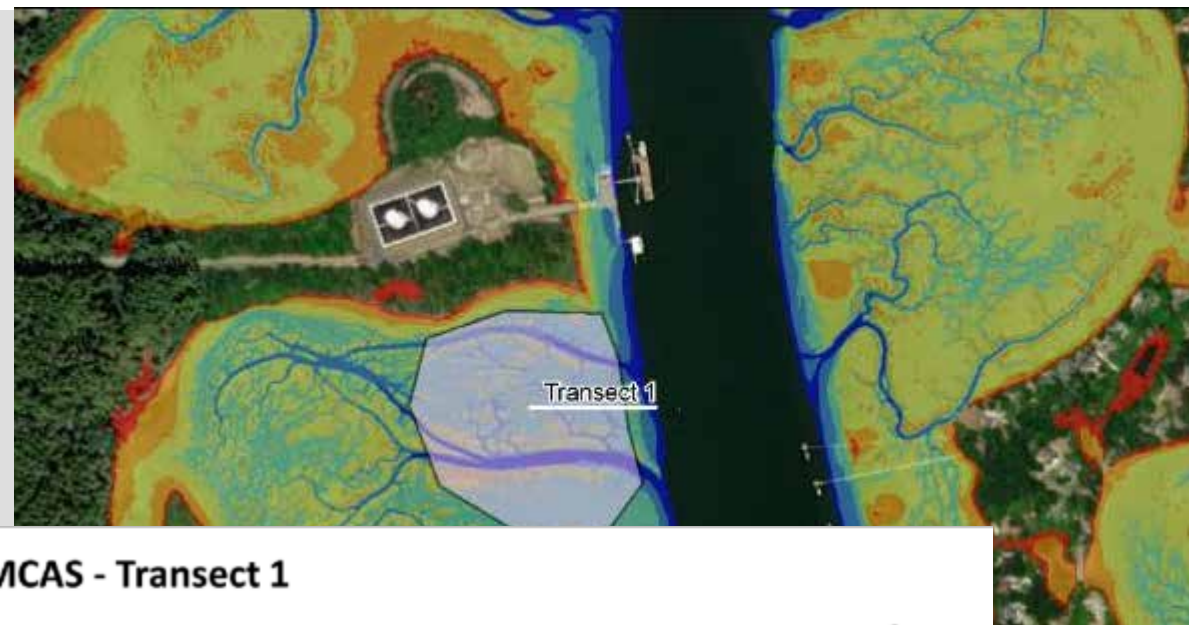
# DoD Approach to Using NbS in Built Environment



- ü Projects need to take climate change into account
- ü These are examples of actual projects to be implemented, not just research efforts for the sake of research
- ü Nature-based solutions don't fit neatly into traditional engineering guidance (i.e. American Society of Civil Engineers/COPRI)

# DoD Approach to Using NbS in Built Environment

Approximate 7.5 ft tide range  
Existing MLLW and MHHW shown in blue  
Projected conditions with +1.3 RSLR by 2050,  
shown in purple



MHW = mean high water | MHHW = mean higher high water | MSL = mean sea level | MLLW = mean lower low water



# DoD Approach to Using NbS in Built Environment

## BLUE CARBON – COASTAL MARSH CARBON SEQUESTRATION POTENTIAL

- § Creation of new intertidal wetland features
- § Submerged aquatic vegetation restoration/creation
- § Need to keep up with rapidly changing policy and science

### Blue carbon will be the next frontier of carbon crediting

The ocean and surrounding coastlands is a vast carbon sink that has yet to be fully tapped while offsetters and companies are chomping at the bit.

By [Jesse Klein](#)

Source: GreenBiz.com

November 9, 2022

#### Coastal wetlands...

Bury carbon in the ground at rates

**10x GREATER**  
than forests

Source: Restore America's Estuaries

Capture carbon at rates

**2-4x GREATER**  
than forests on a per area basis

In addition to sequestering carbon, algae, seagrasses, mangroves, and salt marshes provide critical resilience for shoreline environments. Consistent with Executive Order 14072, Strengthening the Nation's Forests, Communities and Local Economies, the DON will expand its efforts to protect and restore **blue carbon** ecosystems on installations and in neighboring defense communities.

# DoD and Partner Funding

<https://fundingnaturebasedsolutions.nwf.org/>

**Nature-based Solutions Funding Database**

National Wildlife Federation's interactive database for communities interested in pursuing federal funding and/or technical assistance for nature-based solutions. Use the filters below to search for nature-based solutions funding and technical assistance resources that fit your needs. For additional information on search filters, see our Glossary page.

## [NEW] PROTECT Grants (discretionary)

Purpose	Planning, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure
Funding	\$1.4 B (FY 22-26) in Contract Authority from the HTF
Eligible entities	<ul style="list-style-type: none"> <li>• State (or political subdivision of a State)</li> <li>• MPO</li> <li>• Local government</li> <li>• Special purpose district or public authority with a transportation function</li> <li>• Indian Tribe</li> <li>• Federal land management agency (applying jointly with State(s))</li> <li>• <i>Different eligibilities apply for at-risk coastal infrastructure grants</i></li> </ul>
Eligible projects	<ul style="list-style-type: none"> <li>• Highway, transit, intercity passenger rail, and port facilities</li> <li>• Resilience planning activities, including resilience improvement plans, evacuation planning and preparation, and capacity-building</li> <li>• Construction activities (oriented toward resilience)</li> <li>• Construction of (or improvement to) evacuation routes</li> </ul>
Other key	• Higher Federal share if the eligible entity develops a resilience



## READINESS AND ENVIRONMENTAL PROTECTION INTEGRATION



**Biden-Harris Administration recommends \$562 million investment to make communities resilient to climate impacts as part of Investing in America agenda**

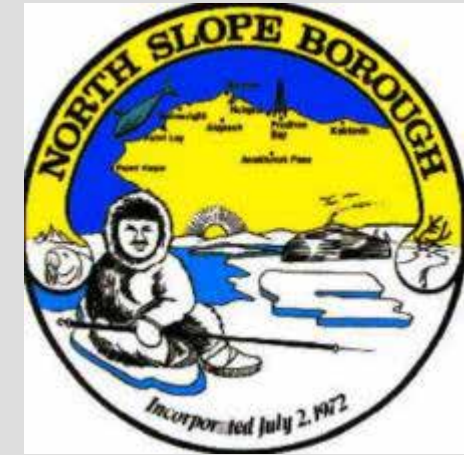
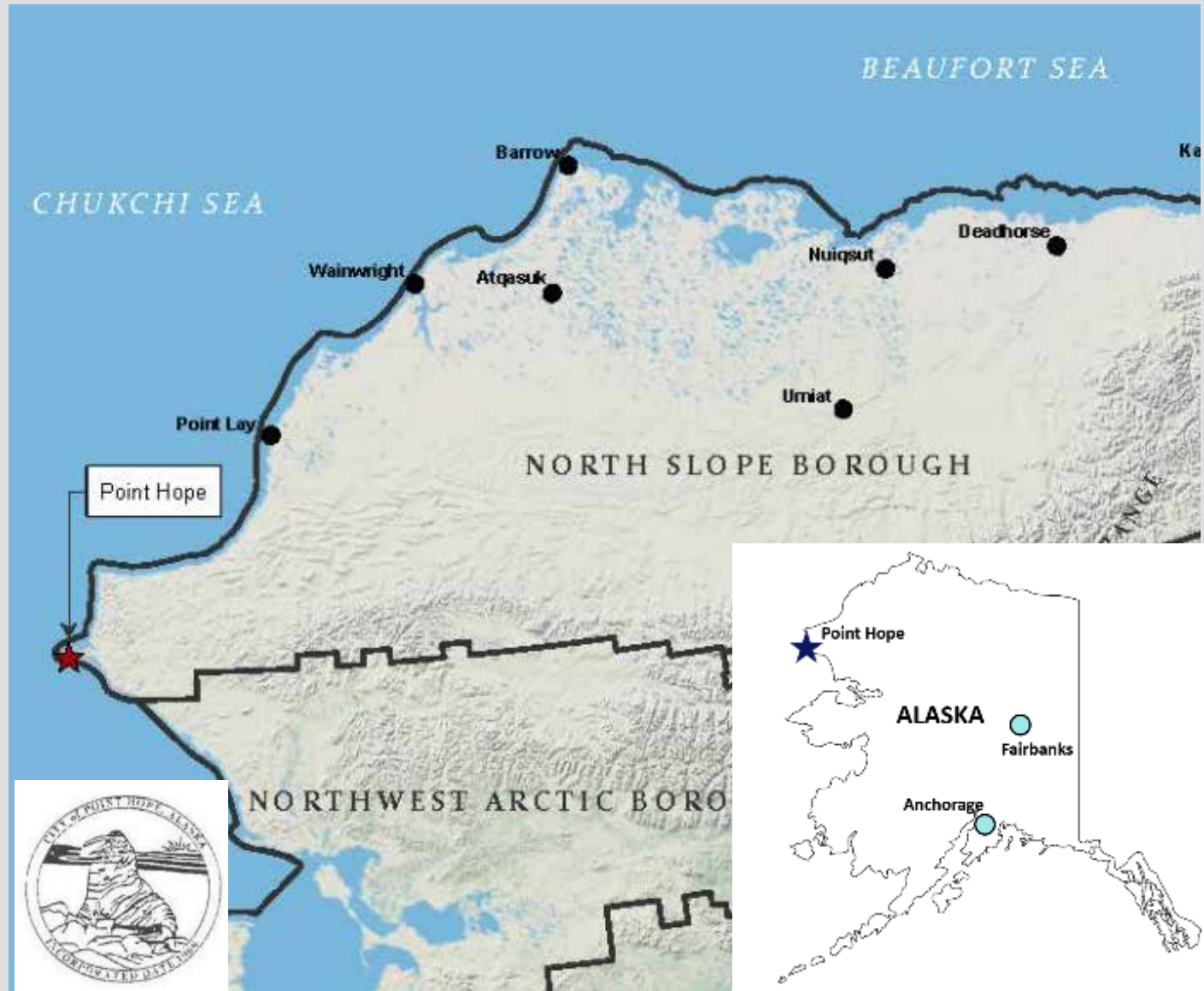
Funding for 149 projects to reach 30 states and territories under NOAA's Climate-Ready Coasts initiative



**NFWF and NOAA Announce \$39.5 Million in Conservation Grants to Fund Coastal Resilience Projects Across the Nation**

Photo credit: NOAA and NFWF. Photo courtesy of NOAA and NFWF.

# Improving Coastal Resilience - Point Hope, Alaska

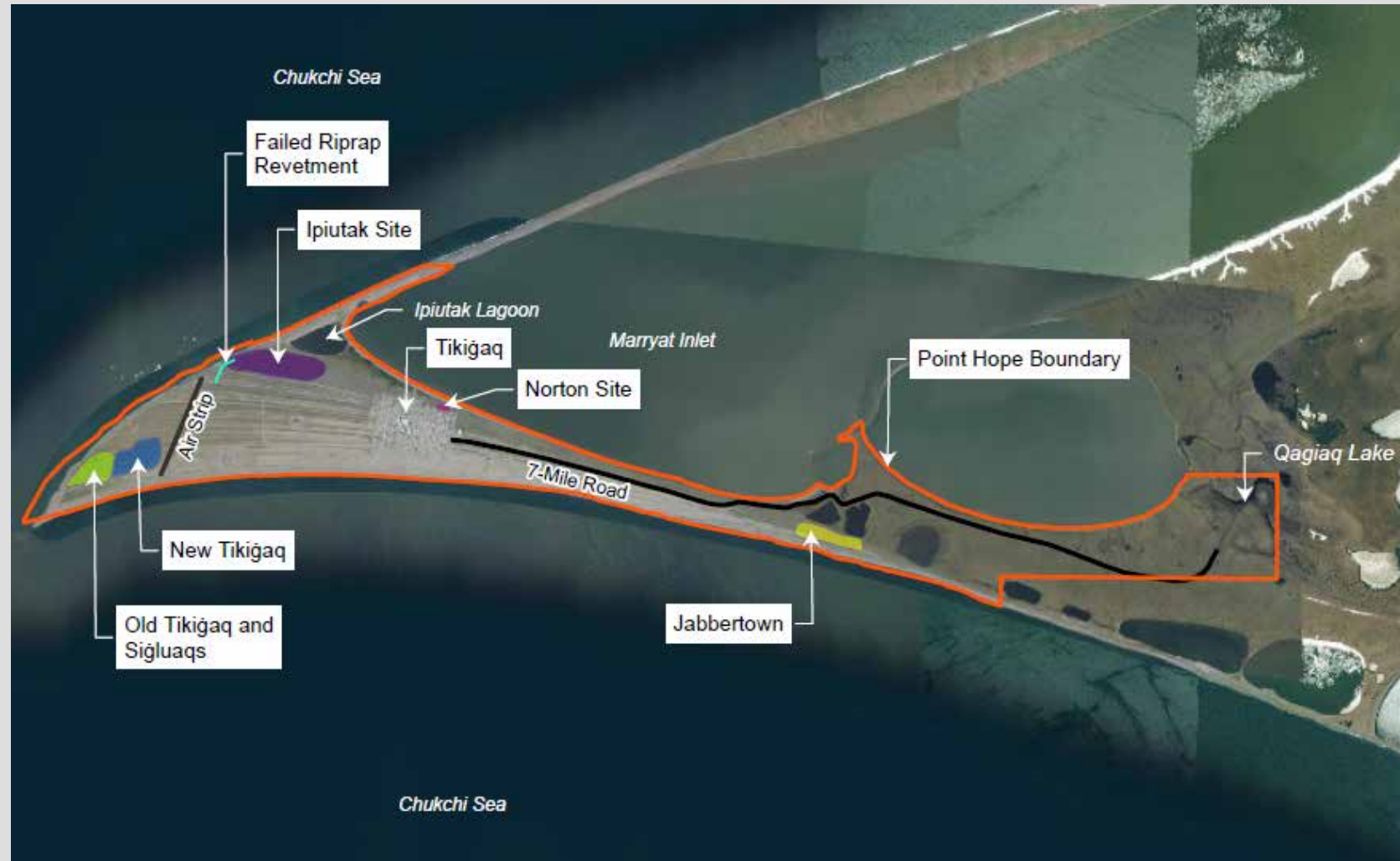


# Project Setting and Context

## AT RISK

- Numerous historically and culturally important sites
  - *Increasing risk to coastal storms due to climate change*
- Key infrastructure
  - *Airport and 7-Mile Road (only overland evacuation route)*

The entire community was moved in 1976 due to flooding and erosion concerns



Overview of key locations



# Introduction – Community Overview



# Implementing Nature-based Solutions



# Location, Culture, and Community

## Whaling in Point Hope

The Iñupiat people of Tikigaq (The Iñupiaq name for Point Hope) have been communal hunters of the bowhead whale for nearly 1,000 years. With the advent of commercial whaling in the mid-19<sup>th</sup> century, the traditional lifeway was profoundly disrupted by depletion of the animal population on which the people were dependent. Famine soon followed...

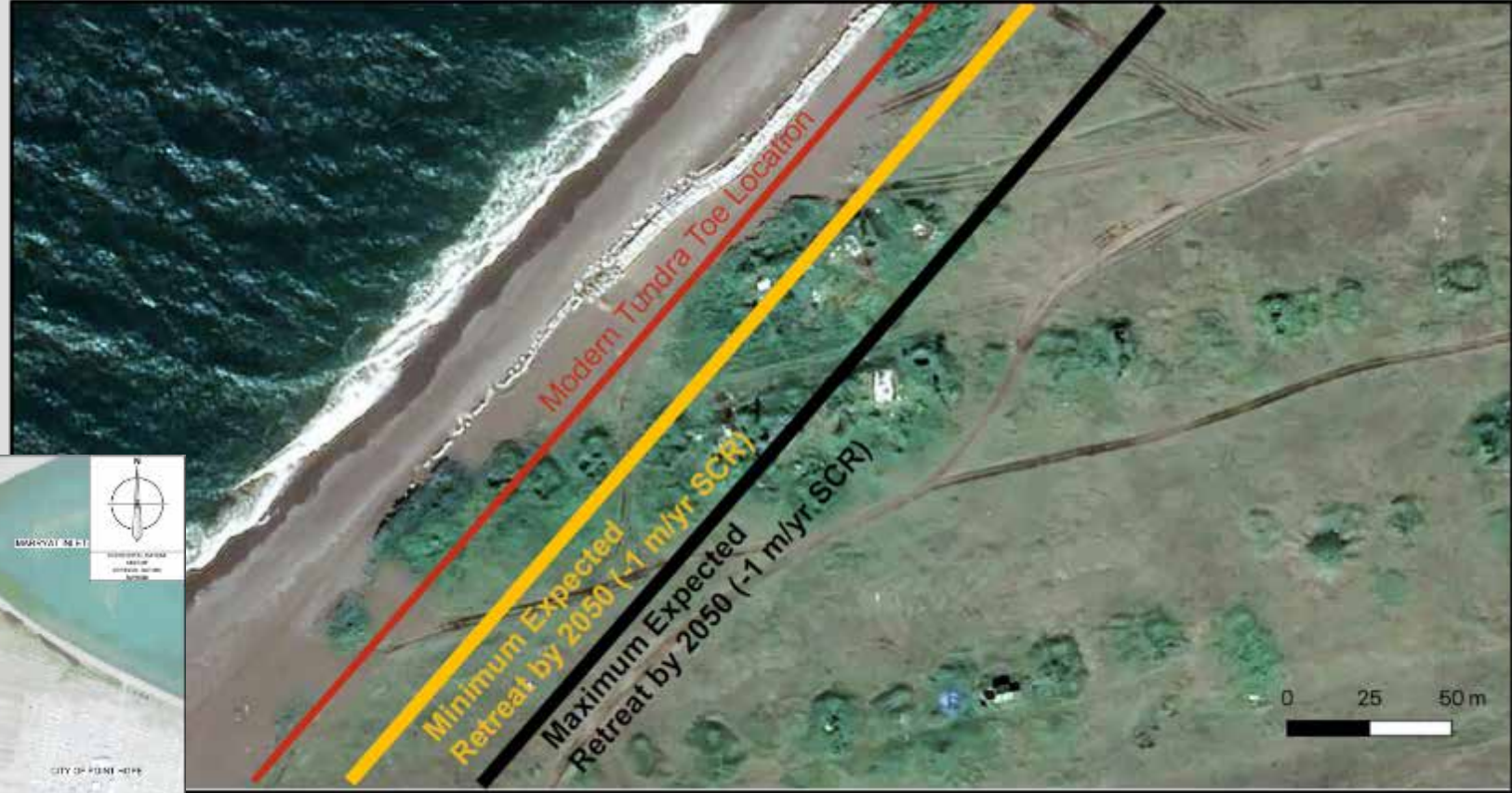
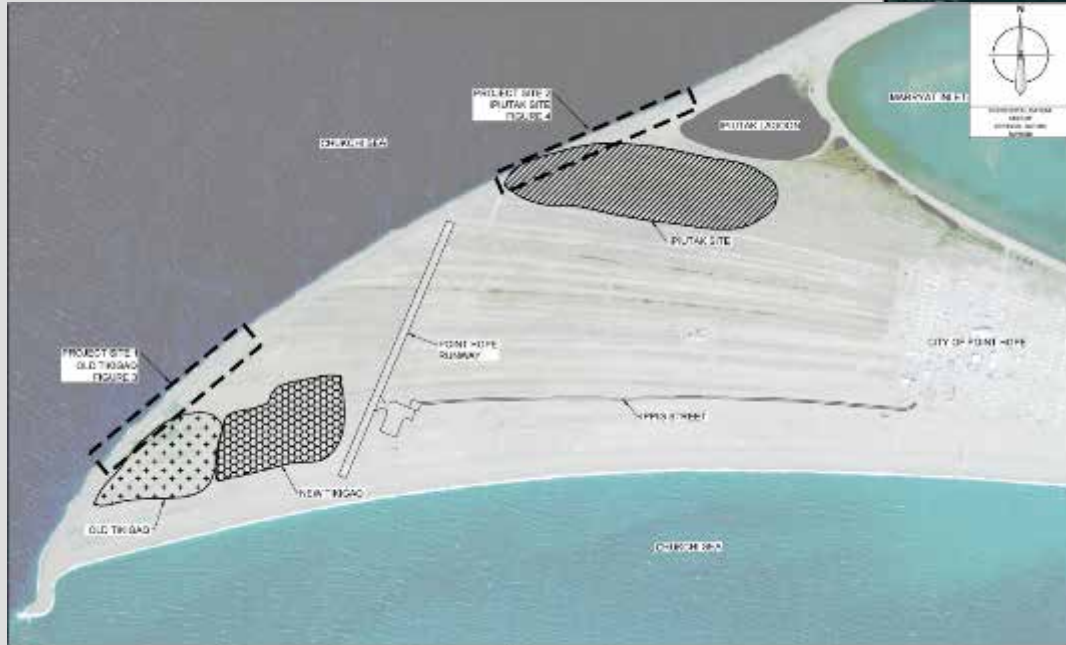
*"The whale is the center of everything to the people, the center of our lives. They are our feast grounds, our graveyards, our houses." -former Mayor, Steve Oomituk*



# Location, Culture, and Community



# Implementing Nature-based Solutions



Projected tundra retreat by 2050

# Coastal Risk – North Shore Erosion



Super sack protection looking southwest

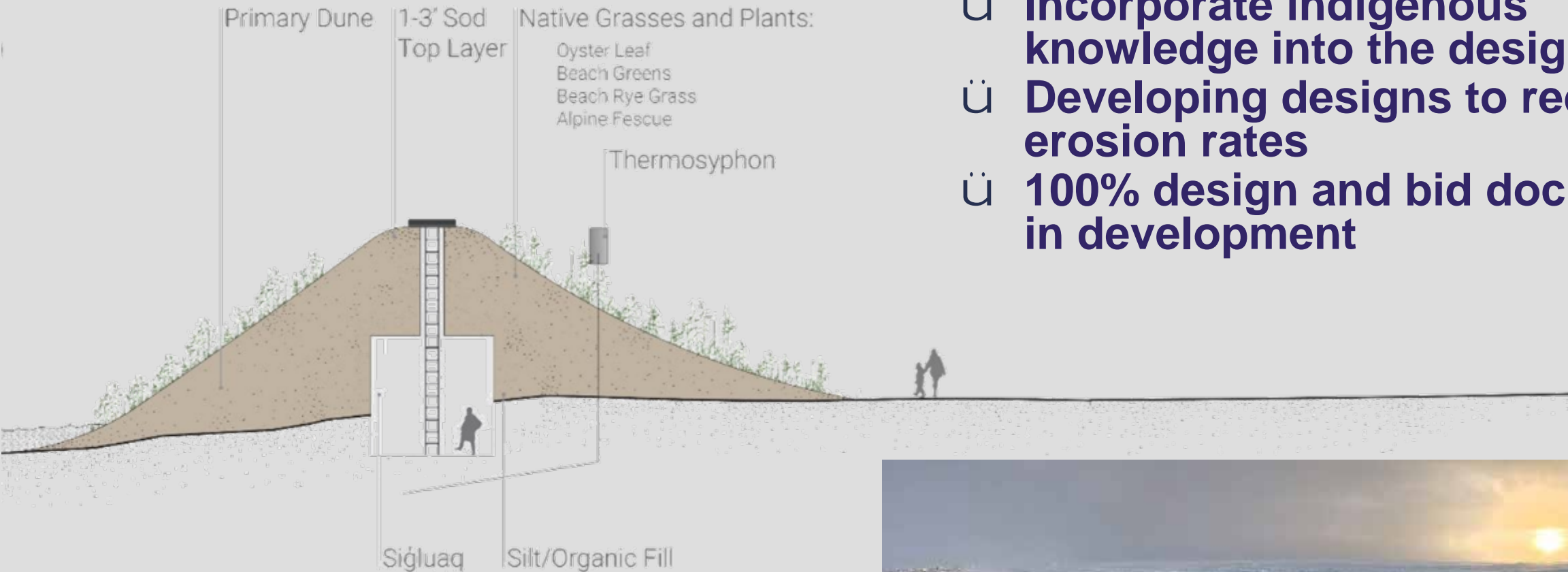


Source: Ford et al., 2020.



Super sack protection looking northwest

# Implementing Nature-based Solutions



- ü Incorporate indigenous knowledge into the design
- ü Developing designs to reduce erosion rates
- ü 100% design and bid documents in development



# Conclusion and Recommendations

- § Nature-based solutions can be an effective tool for additional funding support and to help with community relations as well as permitting.
- § Partner with your neighbors (i.e. DoD) and NGOs
- § Revisit old ideas where you previously hit roadblocks
- § Make sure your planners/engineers are talking to your permitting/natural resource team!





# Questions?



**Sam Whitin, CERP – VP, Director of Coastal Resilience**  
**[swhitin@eaest.com](mailto:swhitin@eaest.com)**