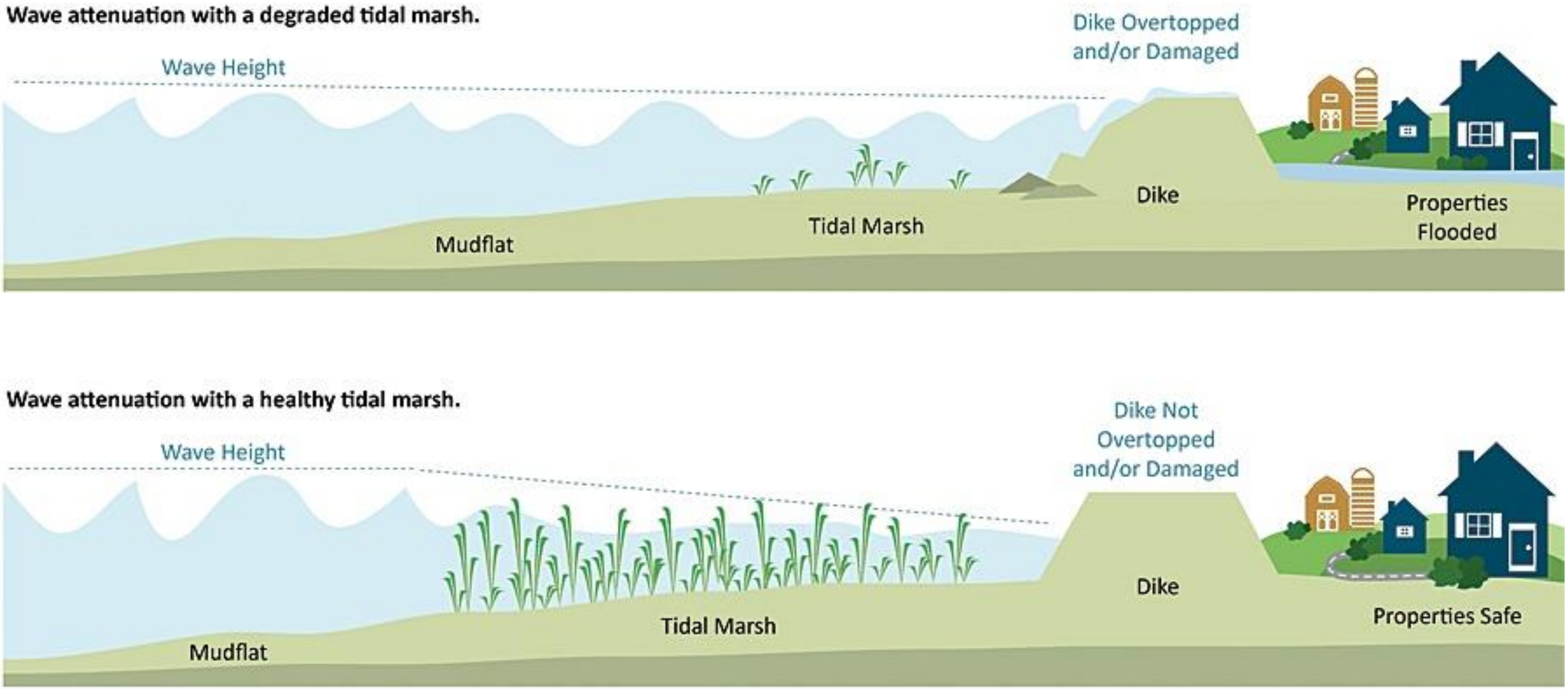
Crisfield Nature-Based Strategies Research

Technical Working Group 3

12/06/2024

How do Nature-Based Strategies work?

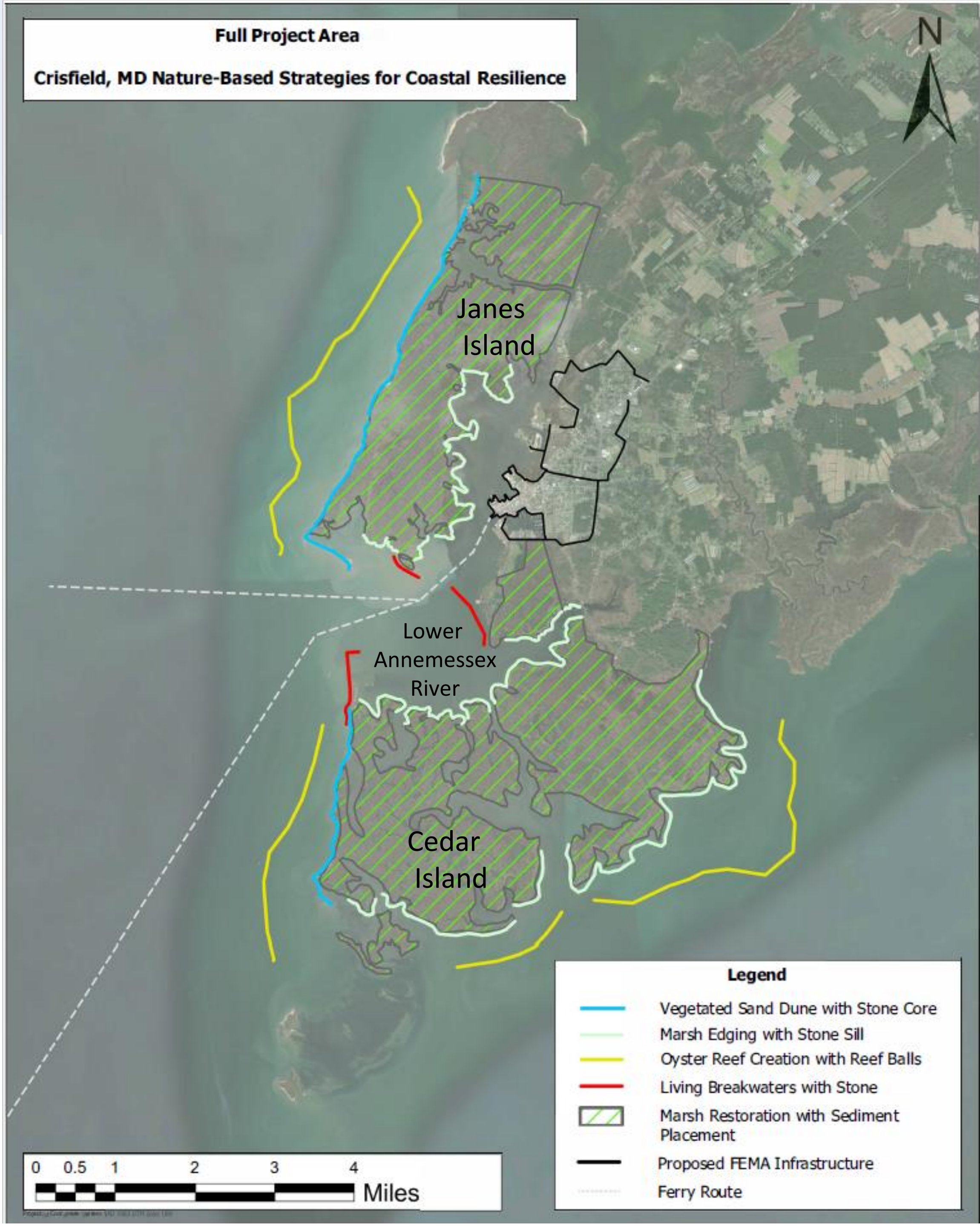
Wave attenuation = Wave energy reduction



https://www.esri.com/about/newsroom/arcnews/gis-helps-integrate-coastal-hazard-risk-and-sea-level-rise/

Crisfield nature-based project options

- Janes Island
  - Marsh restoration
  - Sand dune restoration
  - Artificial oyster reefs
- Lower Annemessex River
  - Living breakwaters
- Cedar Island marsh complexes
  - Marsh restoration
  - Sand dune restoration
  - Artificial oyster reefs

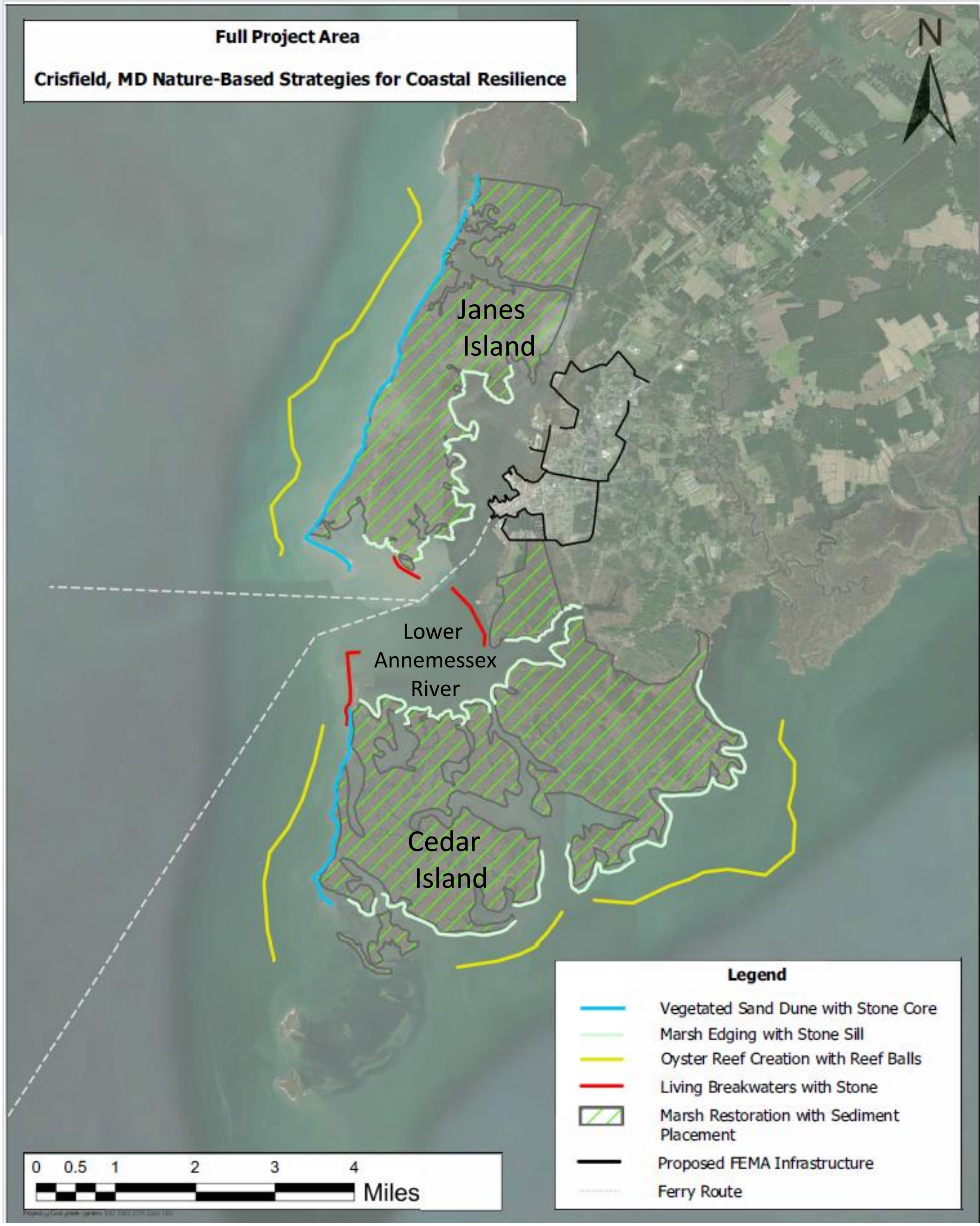


Crisfield NBS Concept Objectives

Location	Solution	Rationale	Concept	Model Representation
Janes and Cedar Island Marsh and Dune Complexes	***Marsh Restoration*** by sediment placement in existing marsh and open water areas; strategic runneling	Existing, degraded marsh system with large open water areas necessitates material placement and runneling for hydrologic connectivity	At minimum, ***maintain current elevations and vegetation density under SLR to 2050 (0.3"/year)*** via sediment placement **Total marsh acreage:** ~2,800 acres, Janes Island; 5,000 acres, Ceder Island Complexes **Yearly elevation gain:** 0.3in	Maintain primary channel (>20m width) representation; estimate finer changes in complexity using variations in roughness based on vegetation characteristics
	Sand Dune Restoration by vegetation planning and stone revetement core	High fetch exposure necessitates dune stabilization; dunes current first line of defense for marsh complex and ultimately Crisfield	***Stabilize dunes and raise elevations based on 50-yr storm*** (MHW + SS = ~5ft NAVD88) + 1ft freeboard **Total linear feet:** ~24,000 lf, Janes Island; 12,000 lf, Ceder Island Complexes **Crest Elevation:** ~+6ft NAVD88	Linear representation with consistent width (20m), height (~+6ft NAVD88), and geometry (trapezoidal); maintaining primary channel connectivity into marsh systems
	Oyster Reef Creation by reef balls or similar	High erosion rate and moderate wind-wave energy; dissipates energy prior to dune/marsh system	Create oyster habitat via ***reef ball placement within the depth of closure*** **Cross shore placement:** ~2-3m contour **Total linear feet:** ~24,000 lf, Janes Island; 46,000 lf, Ceder Island Complexes **Crest elevation:** ~1m above grade, 1-2m subaqueous	Linear representation along 2-3m contour with consistent width (20m), height (1m), and geometry (trapezoidal)
Lower Annemessex	***Living Coastal Breakwaters***	Extreme erosion of sandy cape requires breakwater to protect against longshore drift; primary surge/wave exposure for Crisfield	***Attenuate surge and waves at highest community fetch exposure*** following 2012 USACE feasibility study **Total linear footage:** ~10,000 lf **Crest height:** ~+5ft MLLW	Linear representation with consistent width (20m), height (+5ft MLLW), and geometry (trapezoidal)

Crisfield nature-based project options

- Janes Island
    - Marsh restoration: ~2,800 acres
        - ~7.8 inches sediment placement by 2050
    - Sand dune restoration: ~24,000 feet
        - ~6.5 feet above local mean sea level
    - Artificial oyster reefs: ~28,000 feet
        - ~60 feet width (multiple lines of reef balls)
        - ~3 feet tall in water depths of ~6-9 feet
- Lower Annemessex River
    - Living breakwaters: ~10,000 feet
        - ~4 feet above local mean sea level
- Cedar Island marsh complexes
    - Marsh restoration: ~5,000 acres
        - ~7.8 inches sediment placement by 2050
    - Sand dune restoration: ~12,000 feet
        - ~6.5 feet above local mean sea level
    - Artificial oyster reefs: ~48,000 feet
        - ~60 feet width (multiple lines of reef balls)
        - ~3 feet tall in water depths of ~6-9 feet



Modeling Approach

Goal:

- Evaluate ***NBS effectiveness at attenuating waves and storm surge*** at Crisfield-edge to inform NBS prioritization and future design projects

Approach:

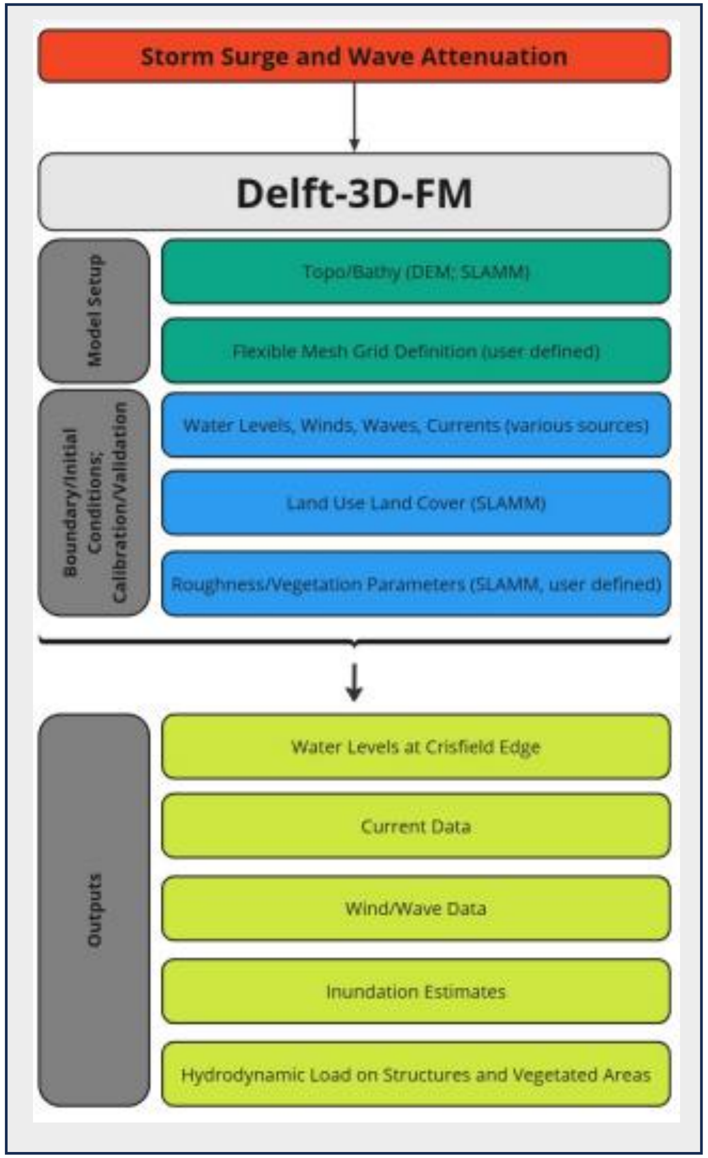
- Implement ***Delft-3D H&H and wave modeling*** under various NBS configurations, storm categories & propagations, climate scenarios (60 total simulations)

Notes:

- Iterative process, ongoing refinement of solutions
- Semi quantitative assessment of erosion potential only
- Coordination with blue carbon, fisheries, and recreation modeling

Assumptions:

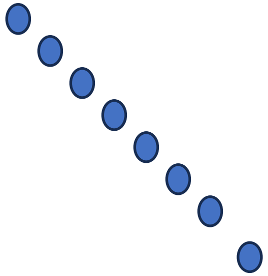
- Finest resolution of 20m in key areas
- Simplified hydrodynamic processes and NBS representation
- Consistent NBS growth/maintenance under SLR

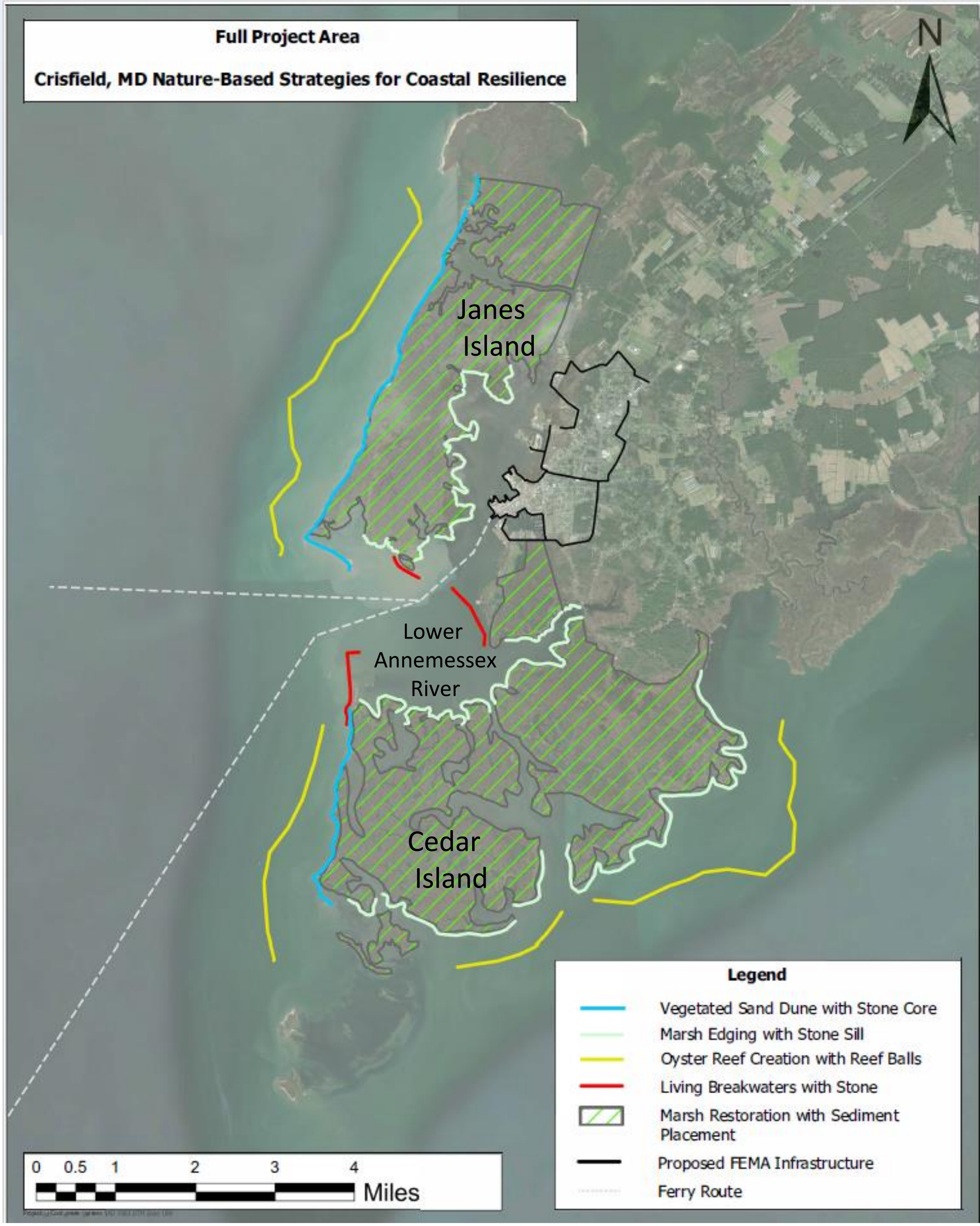


Suggested locations for model output?

- Model output:
  - Total water level:
    - Storm surge +
    - Wave height +
    - Tides +
    - Sea level rise (for 2050 runs)

  - Inundation estimates
  - Water velocity/currents
  - Wind speed and direction





Nature + FEMA project