# Natural and Nature Based Co-Benefits & TMDL Credits

Pamela Mason

Coastal Partners Workshop

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Center for Coastal Resources Management
Virginia Institute of Marine Science

VIMS | Willi & Ma
Virginia Institute of Marine Sci

# Chesapeake Bay Program Approved BMPs

- Shoreline
- Nontidal Wetlands Restoration
- Oysters

# Natural and Nature-based Features Co-Benefits

- Flood mitigation + TMDL/ Stormwater Credits + Community Rating System Credits

# Tidal Shoreline BMPs

| Protocol | Submitted Unit | Total Nitrogen (lbs per unit) | Total Phosphorus (lbs per unit) | Total Suspended Sediment (lbs per unit) |
|---|---|---|---|---|
| **Protocol 1 - Prevented Sediment** | Linear Feet | Project-Specific* | Project-Specific* | Project-Specific |
| **Protocol 2 – Denitrification** | Acres of re-vegetation | 85 | NA | NA |
| **Protocol 3 - Sedimentation** | Acres of re-vegetation | NA | 5.289 | 6,959 |
| **Protocol 4 – Marsh Redfield Ratio** | Acres of re-vegetation | 6.83 | 0.3 | NA |
| **Non-conforming/Existing Practices** * | Linear Feet | MD = 0.04756<br>VA = 0.01218 | MD = 0.03362<br>VA = 0.00861 | MD = 164<br>VA = 42 |

- Basic qualifying conditions for BMPs/sites
- 4 general protocols to define load reductions associated with specific BMPs
- 5-year BMP life, renewable upon field verification

- Protocol 1: Prevented Sediment

Annual mass sediment reduction credit for practices that prevent tidal shoreline erosion. The pollutant loads are reduced for sand content and bank instability (based on the state's assessment).

- Protocol 2: Credit for Denitrification

Annual mass nitrogen reduction credit for vegetative practices (Living shoreline w Marsh).

- Protocol 3: Credit for Sedimentation

Annual mass sediment and phosphorus reduction credit for vegetative practices (Living shoreline w Marsh)

- Protocol 4: Credit for Marsh Redfield Ratio

One time nutrient reduction credit for vegetative practices (Living shoreline w Marsh)

# Shoreline BMP Qualifying Criteria

| Shoreline Management Practice | The Practice Must Meet these Criteria for TMDL Pollutant Load Reduction[1] |
|---|---|
| Living Shoreline –<br>a) nonstructural;<br>b)hybrid system including a sill; and<br>c)hybrid system including a breakwater | 1. The site is currently experiencing shoreline erosion or is replacing existing armor. The site was graded, vegetated, and excess sediment was removed or used.[2]<br>**AND**<br>2. When a marsh fringe habitat (a or b) or beach/dune habitat (c) is created, enhanced, or maintained. |
| Revetment AND/OR Breakwater system without a living shoreline | 1. The site is currently experiencing shoreline erosion,<br>**AND**<br>2. A living shoreline is not technically feasible or practicable as determined by substrate, depth, or other site constraints.<br>**AND**<br>3. When the breakwater footprint would not cover SAV, shellfish beds, and/or wetlands. |
| Bulkhead/Seawalls | 1. The site is currently experiencing shoreline erosion.<br>**AND**<br>2. The site consists of port facilities, marine industrial facilities, or other marine commercial areas where immediate offshore depth (e.g., depths deeper than 10 feet 35 feet from shore) precludes living shoreline stabilization or the use of a breakwater or revetment. |

[1]Projects that impact the Chesapeake Bay Preservation Act protected vegetation without mitigation receive no Chesapeake Bay TMDL pollutant load reduction. Further, WQGIT agreed to allow States to determine, on a case-by-case basis, when the unintended consequences of negative impacts to wetlands and SAVs caused by these shoreline management techniques, outweigh the benefits, in which case the practice will not be reported to the Bay Program for model credit.

# Non-Tidal Wetland Definition Cross-walk

**Approved BMP for this Category. Current Expert Panel working on next categories**

| Proposed BMP Category | Proposed CBP Definition (for Phase 6 CBWM) | CBP will count the BMP acres as | Practice and Project Examples |
|---|---|---|---|
| Restoration | Re-establish<br>The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former wetland. | Acreage gain *(toward Watershed Agreement outcome of 85,000 acre wetland gain and in Phase 6 annual progress runs)* | Restore hydrology to prior-converted agricultural land (cropland or pasture); re-establishing needed vegetation on cropland with wetland hydrology; native wetland meadow planting; elevate subsided marsh and re-vegetate; ditch plugging on cropland; Legacy Sediment Removal<br>NRCS Practice 657 |
| Creation | Establish (or Create)<br>The manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist at a site. | Acreage gain *(toward Watershed Agreement outcome of 85,000 acre wetland gain and in Phase 6 progress runs)* | Modifications to shallow waters or uplands to create new wetlands. Placement of fill material or excavation of upland to establish proper elevations for tidal wetland; Hydrologic measures such as impoundment, water diversion and/or excavation of upland to establish nontidal wetlands<br>NRCS Practice 658 |
| Enhancement | Enhance<br>The manipulation of the physical, chemical, or biological characteristics of a wetland to heighten, intensify, or improve a specific function(s). | Function gain *(toward 150,000 acre outcome and Phase 6 annual progress runs)* | Flood seasonal wetland for waterfowl benefit; regulate flow velocity for increased nutrient uptake;<br>NRCS Practice 659 |
| Rehabilitation | Rehabilitate<br>The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded wetland. | Function gain *(toward 150,000 acre outcome and Phase 6 annual progress runs)* | Restore tidal flow to degraded wetland; ditch plugging in a forested wetland area; moist soil management*; invasive species removal, floodplain reconnection<br>May include some NRCS Code 657 practices .<br>*Moist soil management should only be counted if there are predominantly native wetland plants; and site can sustain itself as wetland without active management, meaning whether water control structure is operated or not. |

# Nontidal Wetland Restoration BMP

| Phase 6 Watershed Model HGMR | Other (Headwater) | Floodplain | Nitrogen efficiency (%) | Phosphorus efficiency (%) | Sediment efficiency (%) |
|---|---|---|---|---|---|
| Appalachian Plateau Siliciclastic | 1 | 2 | 42 | 40 | 31 |
| Ridge and Valley Siliciclastic | 1 | 2 | 42 | 40 | 31 |
| Blue Ridge | 2 | 3 | 42 | 40 | 31 |
| Piedmont Crystalline<br>Mesozoic Lowlands | 2 | 3 | 42 | 40 | 31 |
| Western Shore: Coastal Plain Uplands<br>Coastal Plain Dissected Uplands | 4 | 6 | 42 | 40 | 31 |
| Eastern Shore: Coastal Plain Uplands | 1 | 2 | 42 | 40 | 31 |
| Eastern Shore: Coastal Plain Dissected Uplands | 2 | 3 | 42 | 40 | 31 |
| Coastal Plain Lowlands | 2 | 3 | 42 | 40 | 31 |
| Piedmont Carbonate<br>Valley and Ridge Carbonate<br>Appalachian Plateau Carbonate | 2 | 3 | 42 | 40 | 31 |

# Oyster Aquaculture BMP

| Default Estimates | | | | | | |
|---|---|---|---|---|---|---|
| Oyster Size Class Range (inches) | Size Class Midpoint (inches) | Size Class Midpoint (mm) | Content in Oyster Tissue (g/oyster) | | | |
| | | | Diploid* | | Triploid** | |
| | | | Nitrogen† | Phosphorus‡ | Nitrogen† | Phosphorus‡ |
| 2.0 - 2.49 | 2.25 | 57 | 0.05 | 0.01 | 0.06 | 0.01 |
| 2.5 - 3.49 | 3 | 76 | 0.09 | 0.01 | 0.13 | 0.01 |
| 3.5 - 4.49 | 4 | 102 | 0.15 | 0.02 | 0.26 | 0.03 |
| 4.5 - 5.49 | 5 | 127 | 0.22 | 0.02 | 0.44 | 0.05 |
| ≥ 5.5 | 6 | 152 | 0.31 | 0.03 | 0.67 | 0.07 |

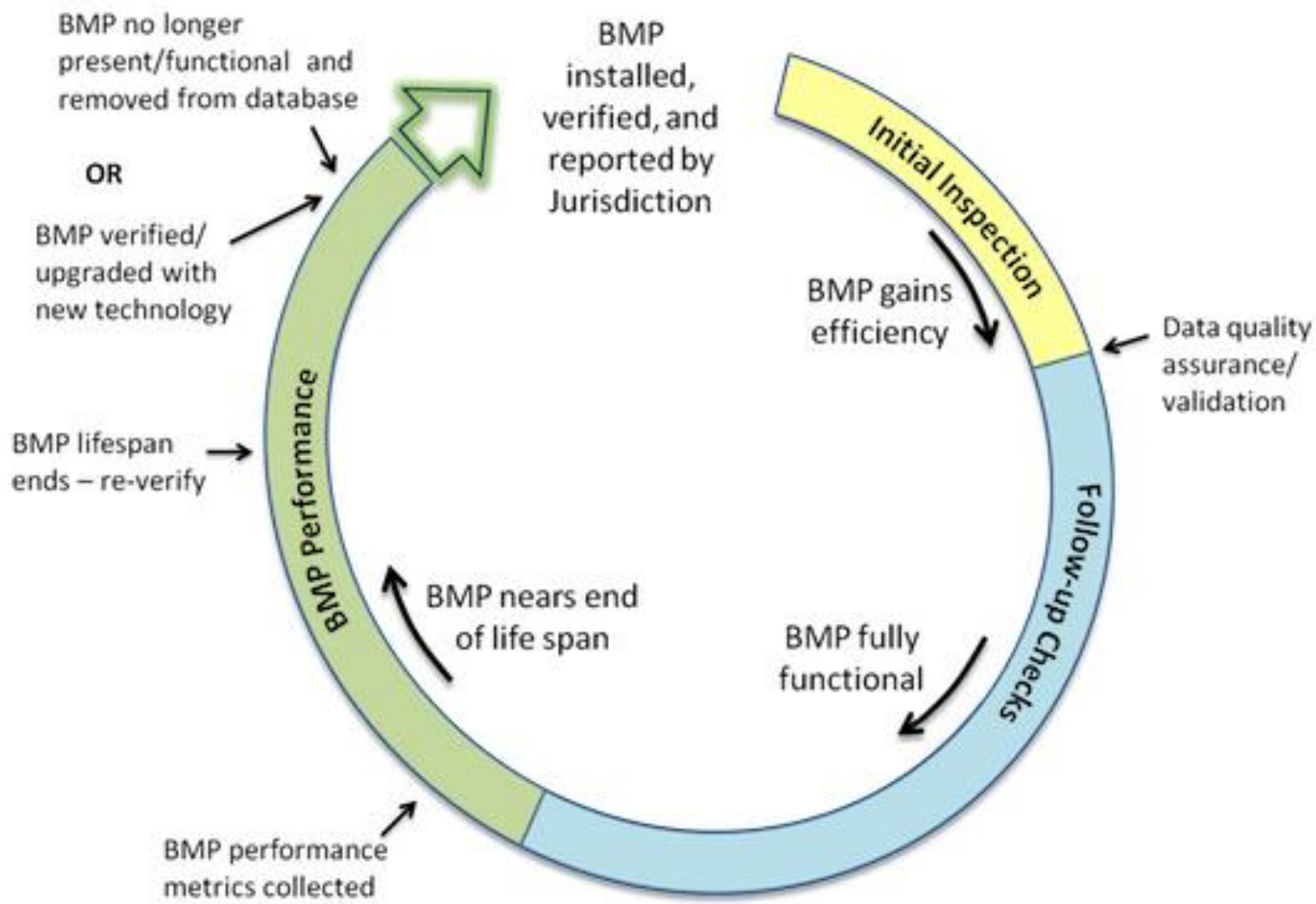
**Qualifying Conditions**

Only includes oysters that are removed moving forward from the time the BMP is approved/ implemented for reduction effectiveness credit in the TMDL. This baseline condition was proposed by the CBP Partnership Management Board and the Panel concurs with their decision.

Oysters had to have be grown from initial sizes < 2.0 inches shell height.

Oysters have to be alive when removed to count toward the reduction effectiveness.

# Verification



# Increasing use of natural and nature-based features to build resilience to storm-driven flooding

**1. NNBF Flooding Mitigation Potential**

**= Capacity * Opportunity**

**2. NNBF Flooding Mitigation Value**

Relative importance of the NNBF based on how many buildings it protects.

**= (NNBF Flooding Mitigation Potential) * (the # of buildings protected)**

**3. Building Flooding Mitigation Metrics**

NNBFs count protecting each building

SUM the NNBF Flooding Mitigation Potential for each NNBF linked to that building

**4. NNBF Co-Benefits**

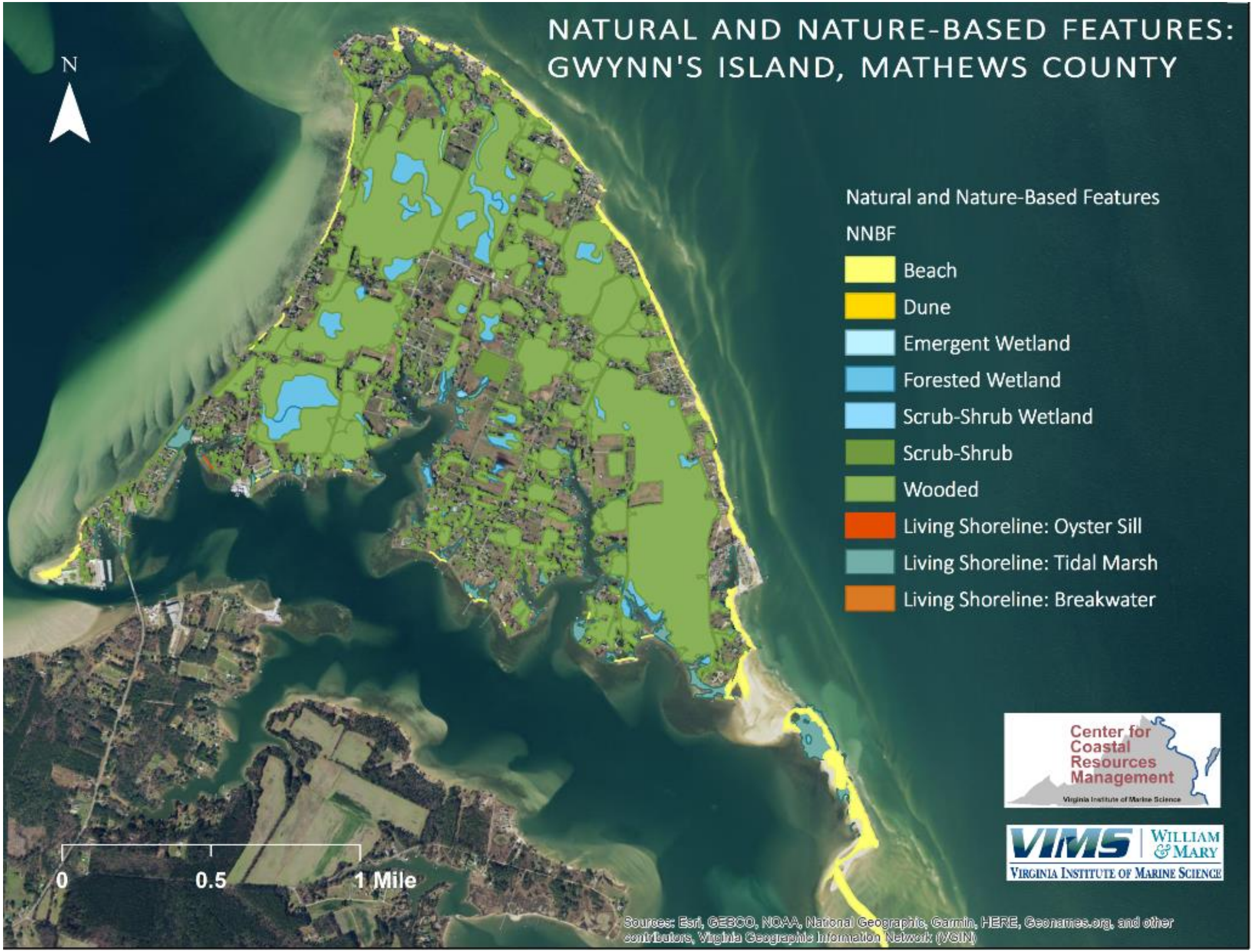
**= (NNBF Mitigation Value) * (Co-Benefit Weighting Factor)**

**Co-Benefits: TMDL credit, Stormwater credit, CRS credit**

*Living shoreline project in Gloucester. Photo: Karen Duhring*

"…Because of their vegetation, the marshes act like shag carpeting, dampening the energy of a wave before it reaches land."

- Lenore Tedesco, PhD, executive director of The Wetlands Institute in Stone Harbor.


NATURAL AND NATURE-BASED FEATURES:
GWYNN'S ISLAND, MATHEWS COUNTY
N
Natural and Nature-Based Features
NNBF
Beach
Dune
Emergent Wetland
Forested Wetland
Scrub-Shrub Wetland
Scrub-Shrub
Wooded
Living Shoreline: Oyster Sill
Living Shoreline: Tidal Marsh
Living Shoreline: Breakwater
0
0.5
1 Mile
Center for Coastal Resources Management
Virginia Institute of Marine Science
VIMS
William & Mary
Virginia Institute of Marine Science
Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors, Virginia Geographic Information Network (VGIN)

# Identify NNBFs Flooding Mitigation Potential

***Capacity:*** how well the NNBF type (e.g., beach, tidal marsh) mitigates coastal flooding.

*Permeability*: potential for floodwaters to soak into the ground

*Surface roughness*: ground surface exerting drag on the movement of water

*Vegetation roughness*: stems will block and slow wave/water movement onto the land

| **Capacity Scoring** | | | | |
|---|---|---|---|---|
| | *1 = low, 2 = medium, 3 = high* | | *2=soft, 3 = woody* | |
| **Feature Type** | **Permeability** | **Surface Roughness** | **Vegetation Roughness** | **Total** |
| Beach | 3 | 1 | 0 | **4** |
| Dune | 3 | 2 | 2 | **7** |
| Wooded | 3 | 2 | 3 | **8** |
| Scrub-Shrub | 3 | 3 | 3 | **9** |
| Non-Tidal Forested Wetlands | 2 | 3 | 3 | **8** |
| Non-Tidal Scrub-Shrub Wetlands | 2 | 3 | 3 | **8** |
| Non-Tidal Emergent Wetlands | 2 | 3 | 2 | **7** |
| Tidal Marsh | 2 | 3 | 2 | **7** |
| Hybrid Living Shoreline: Marsh Sill | 0 | 3 | 0 | **3** |
| Hybrid Living Shoreline: Oyster Sill | 0 | 3 | 0 | **3** |
| Hybrid Living Shoreline: Breakwater | 0 | 3 | 0 | **3** |

***Opportunity:*** how often an individual NNBF is likely to encounter flooding waters. Opportunity is calculated based on 19 years of water level data from a Bay tidal gage.

| Water Elevation | Percentage of flooding events that reach elevation | Opportunity Score |
|---|---|---|
| >5 ft | 0.1% | 0.001 |
| >4 ft | 0.3% | 0.003 |
| >3 ft | 1.0% | 0.01 |
| >2 ft | 10.0% | 0.1 |
| >1 ft | 100.0% | 1 |

# NNBF Flooding Mitigation Potential

**NNBF Flooding Mitigation Potential**

*Green = low score* *Red = high score*

Gwynn's Island, Mathews

Each NNBF is scored based on:

- Capacity: potential to mitigate coastal flooding
- Opportunity: frequency it will be intercept flooding waters based on elevation of the feature

**Tidal Marsh NNBF:**

Capacity for Tidal Marsh = 7

Opportunity: 1

***Flooding Mitigation Potential = 7***

**Wooded NNBF:**

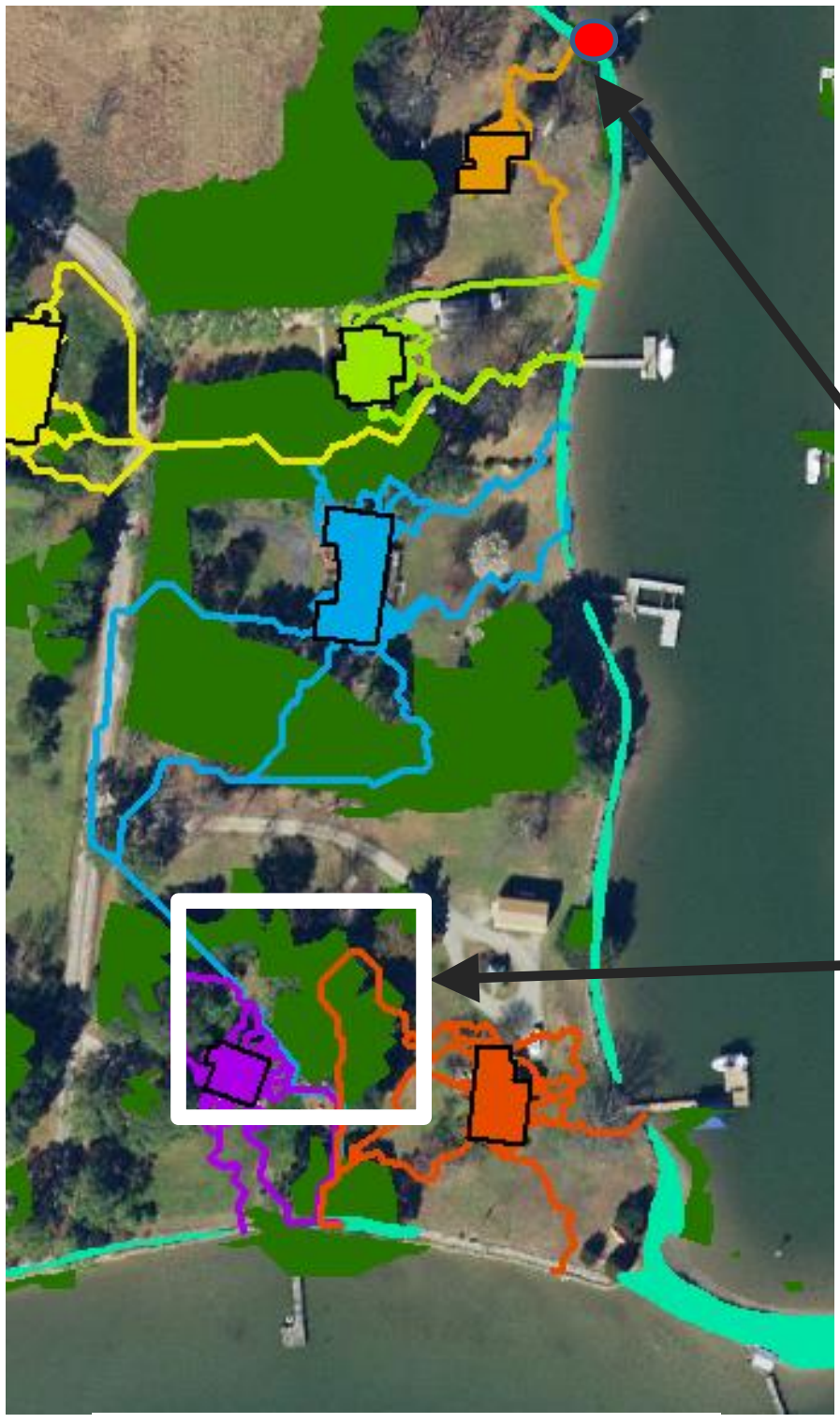
Capacity = 7

Opportunity = 0.001

***Flooding Mitigation Potential = 0.007***

## How to we link NNBFs with the buildings they protect?

# Inundation Pathways (IPs)



Gwynn's Island, Mathews

**Inundation Pathways** represent lowest areas where flooding waters would begin to flood onto the land and approach buildings

- more than 190,000 primary buildings in the coastal area @ less than 10 feet in elevation
- pathways based on land elevation derived from LIDAR data

For each building, we can count the number and types NNBFs that protect it

- *This building is protected by 1 NNBF (a tidal marsh)*

For each NNBF, we can count the number of buildings it protects

- *This wooded area protects 3 buildings*

NNBF Feature Types (in this map):
- Tidal Marsh
- Wooded

# NNBF Co-Benefits in progress

**3 year project with NOAA Coastal Resilience Funding**

**Just started second year**

- **Year 1: NNBFs and Inundation Pathways modeled and in process**
- **Year 2: Focus on development of data and modeling for co-benefits**
- **Year 3: Outreach**

**Partners:**

**VIMS/ CCRM: Project Lead, GIS modeling, Outreach Lead**

**Virginia Coastal Policy Center: Legal issues, Policy Review**

**Wetlands Watch: BMP criteria for model, Policy Review**

**Albermarle Pamlico National Estuary Program: Transferability, Application in Southern Watersheds.**

Pamela Mason
Center for coastal Resources Management
Virginia Institute of Marine Science
804-684-7158
mason@vims.edu