Large-Scale Marsh Persistence and Restoration in the Chesapeake Bay

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Front cover image credit: Scott Lerberg, Chesapeake Bay National Estuarine Research Reserve –Virginia/ Virginia Institute of Marine Science & Southwings

Maryland Sea Grant College
University System of Maryland
5825 University Research Court, Suite 1350
College Park, Maryland 20740
T 301.405.7500 / F 301.314.5780
www.mdsg.umd.edu

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Workshop Background and Purpose

Workshop background

In the last two decades, climate change and other effects from landscape-level changes (e.g., pollution, fragmentation of habitat, invasive species) on key ecosystem processes in the Chesapeake Bay have elevated concern among scientists, resource managers, and others, to more aggressively develop adaptive management strategies to respond to newly accelerating rates of environmental change (Chesapeake Watershed Agreement, 2020, MCCC Annual Report, 2021). In response to these increasing threats and recent funding opportunities through both the Bipartisan Infrastructure Law and the Inflation Reduction Act, the Chesapeake Bay Sentinel Site Cooperative (CBSSC), coordinated by Maryland Sea Grant (MDSG), met in early 2022 to discuss urgent coastal resilience needs and whether a CBSSC/MDSG science-practitioner dialogue[1] might help move the climate change adaptation needle more rapidly towards solutions. The CBSSC network identified marshes' persistence and restoration in the Chesapeake Bay as critical to protecting coastal communities and that further research and adaptative management is necessary for marshes to adapt to climate change.

Marshes are under threat from a changing climate hastening the rate of relative sea level rise. Rising seas are accelerating incidences of surface flooding and saltwater intrusion (Rezaie et al., 2021). Within the Chesapeake Bay relative sea level rise rates exceed global average rates (Mitchell et al., 2017). The effects of human development (e.g., transgression barriers, fragmentation, pollution) further limit marsh extent and quality (Kennish et al., 2001). Overall, the Chesapeake Bay's tidal wetlands declined by 1,566 acres between 1992–2010 and the Chesapeake Bay Program's wetland goal for 2025 will not be met (Wetlands, 2022). Changing inundation regimes can cause changes to marshes (e.g., low to high marsh transitions or conversion to mudflats) or to optimum conditions for marsh migration (Kirwan et al., 2016). Surrounding communities and private property owners with land at the marsh-upland interface are grappling with adapting to marsh migration and other sea level rise-induced changes to the landscape (Van Dolah et al., 2020). Importantly, some communities and landowners are bearing a disproportionate load of climate vulnerabilities from others (Justice40, 2022).

Workshop purpose

The purpose of this workshop is to increase human resilience and adaptation to climate change through improved marsh management. Big and strategic thinking is required to overcome threats and capitalize on emerging opportunities. In order to think "bigger," we ask the Bay's science and management community to consider:

- **Ecology**–What marshes should be protected and maintained or restored and managed to ensure long-term sustainability?
- **Society**–How can marsh conservation actions benefit the surrounding community and incentivize participation from private land owners?
- **Funding**–How do we work among different funding sources, regional and local priorities, and scientific expertise to implement marsh projects with the greatest impact?

[1] The CBSSC has organized and hosted the 2019 Marsh Resilience Summit, 2020 Vertical Land Motion in the Chesapeake Bay Workshop, and 2020-2021 Coastal Farming Challenges Workshops.

We hope this workshop will lead to a strategic, collaborative approach across institutions and geographies, culminating in regional rather than site-specific benefits.

The goal of this workshop is to advance planning and ability to implement large-scale marsh conservation in the Chesapeake and coastal bays.

Workshop objectives include:

- Use an ecosystem services approach to determine marsh projects that yield multiple benefits. This includes benefits to the surrounding community and incentives to private landowners.
- Evaluate management regimes and specific strategies between 2022–2050 to inform long-term project sustainability.
- Consider a project's benefits, feasibility, and sustainability. Identify characteristics for "large-scale" projects with regional impact and ways to fund these projects.
- Lay the foundation for creating and developing potential large-scale, multi-partner projects that consider both social justice and outreach strategies for involving communities and private landowners in management decisions.

Workshop outcomes include:

- Understand common objectives and recommended actions for a Bay-wide tidal marsh conservation/restoration strategy.
- Identify the site characteristics (e.g. parcel size, geomorphology, quality, ownership, adjacent community priorities) that meet our large-scale concept and the location in the Chesapeake Bay of these significant areas or network of sites.
- Detail constraints on site characterization, project design, and other implementation barriers. Use these knowledge and resource gaps to inform funding opportunities, research proposals, and/or pilot projects.
- Identify key sociologic and economic factors critical to advancing tidal marsh persistence and expansion.

During this workshop, we provide opportunity to collaborate and network on specific ideas and actions. We hope that providing this space helps seed resilience and restoration projects that develop into rigorous research and on-the-ground implementation. Following this workshop, we will synthesize the feedback and ideas generated from our discussion groups to share with the larger community. We will also connect participants on specific ideas generated at the workshop, and work with partners to provide input and guidance as needed on proposal development and funding opportunities. We hope this will inform other marsh planning efforts in the Chesapeake Bay and beyond.

Agenda

9:00 a.m.	Registration opens University of Maryland Golf Course Clubhouse 3800 Golf Course Road, College Park, MD 20742 *Light refreshments served.*
9:30 a.m.	**Welcome** Fredrika Moser, *Director, Maryland Sea Grant*
9:35 a.m.	**Plenary presentations** State of tidal wetlands in the Chesapeake Bay: Grand challenges and big aspirations Pamela Mason, *Senior Research Scientist, Center for Coastal Resource Management, Virginia Institute of Marine Science* Large-scale marsh restoration programs—In progress? Kyle Graham, *Senior Program Manager, Ecosystem Investment Partners*
10:15 a.m.	**Breakout session I: Maximizing ecosystem services** *We discuss ecosystem services marshes provide and how to promote individual services across a range of marsh geomorphologies.*
11:00 a.m.	Break
11:10 a.m.	**Breakout session II: Designing optimal strategies for project longevity** *We discuss optimal conservation/restoration strategies across multiple time scales and scenarios based on marsh geomorphology.*
12:00 p.m.	**Background presentations (continued)** Opportunities for landscape-scale conservation impact: Connecting the dots Holly Bamford, *Chief Conservation Officer, National Fish and Wildlife Foundation*
12:20 p.m.	Lunch

1:15 p.m.	**Breakout session III: Brainstorming large-scale marsh project ideas** *We review our ecosystem services objectives and restoration strategies to generate ideas on specific large-scale projects. One idea per group will be presented.*
2:45 p.m.	Break
3:00 p.m.	**Breakout session IV: Developing a large-scale marsh project** *We further develop an idea generated from the previous session in small groups.*
3:45 p.m.	**Closing remarks** Fredrika Moser, *Director, Maryland Sea Grant*
4:00 p.m.	Workshop concludes

Workshop Overview

Plenary talks

We will begin with three presentations covering:

a. ecologic and socio-economic threats to marsh persistence, and opportunities for innovation and collaboration to meet marsh expansion goals in the Chesapeake Bay;

b. building "large-scale" marsh projects from planning to implementation;

c. funding opportunities to support project frameworks developed through the workshop brainstorming activities.

Breakout sessions

Your nametag has a series of icons to designate your breakout groups with the leftmost icon being your first breakout group. Your designation is based on your responses to registration questions. Breakout sessions 1 and 2 are formed based on similar interest (i.e., ecosystem service or geomorphology). Breakout sessions 3 and 4 should represent diverse interests. In this way, discussions can either focus on common objectives or allow for a balance of different perspectives.

Breakout session I: Maximizing ecosystem services

In our first breakout session, we discuss ecosystem services marshes may provide and how individual services differ across a range of marsh geomorphologies (See Appendices A and B for definitions of ecosystem services and marsh geomorphologies, respectively). Attendees will be divided by specific ecosystem services and discuss which marsh features may best support this service, relevance of marsh scale to the service, as well as the unknowns, barriers, and opportunities to obtaining ecosystem services from marsh conservation and expansion.

Activity: Complete your assigned row of the Ecosystem service-Marsh geomorphology matrix (Appendix C).

Please evaluate the marsh geomorphologies in terms of your ecosystem service.

1. Assign a priority level.
    - Would conserving/restoring this marsh geomorphology type be a high (green), medium (yellow), or low (orange) priority for this ecosystem service?
    - Use quick group consensus to designate the appropriate priority level/corresponding color.
2. Add notes for your priority level choice.
    - What features of this geomorphology help to enhance the ecosystem service?
    - What concerns (e.g., costs, barriers), research questions, or uncertainties do you have about maximizing this ecosystem service for this geomorphology?

If time allows, please examine the row overall and take a general look at the ecosystem service. Discuss among your group how your opinions may differ and where there seems to be consensus.

- What are outreach or engagement strategies for the surrounding community/private lands on the value of this ecosystem service? How can we include local community input and address local community needs?

- In general, do you need certain size thresholds? Can you aggregate small, high quality sites?

For further clarity, Appendix C contains an example using diamondback terrapin habitat as the 'ecosystem service' examined across the different marsh geomorphologies.

Breakout session II: Designing optimal strategies for project longevity

In the second breakout session, we will break out by marsh geomorphologies (See Appendix B for marsh geomorphology descriptions) to determine optimal conservation/restoration strategies across multiple time scales and sea level rise scenarios. From our previous session, we will see what ecosystem services are sought and achievable for the type of marsh. With those services in mind, what management strategies are best suited to sustain the marsh type/marsh goals? We will then consider future sea level rise scenarios (2030 and 2050). Consider if changing environmental conditions cause a shift in management. Note any thresholds or other determining factors when a shift in management is necessary (Appendix D lists some common restoration strategies)? Consider how the surrounding community be engaged and in what ways can private lands participate in this approach.

The information from the previous session will be displayed as a summary on the venue's screens and the full notes will be displayed on the wall. Please review if your geomorphology is a low, medium, or high priority for each service and see related comments on barriers, opportunities, and unknowns.

Activity: Complete three time period summary cells for Ecosystem service-Marsh geomorphology matrix for your assigned marsh geomorphology.

Each group has been provided an example of their marsh geomorphology in the Chesapeake Bay. These maps show current distribution/extent of the marsh and the projected sea level rise impacts in 2030 and 2050. Use these visualizations as an example only.

Please answer the following questions for each of the different time periods based on your assigned marsh geomorphology.

- What conservation/restoration techniques would be most appropriate to benefit the prevailing ecosystem services?
- What are vulnerabilities (e.g., sea level rise, erosion, invasive plants) to this marsh geomorphology?
- Which management options address these vulnerabilities?
- What are costs/barriers/opportunities/unknowns?

Breakout session III: Brainstorming large-scale marsh project ideas

Following our first two breakout sessions, we will be able to look at ways in which a marsh project design can foster multiple ecosystem services in order to yield various benefits. We will divide into new groups to review a matrix formed from our efforts to evaluate ecosystem service by marsh geomorphology. We will look for synergies, acknowledge tradeoffs, identify target areas, and consider funding possibilities for implementation. During this review, we ask participants to share any ideas for specific "large-scale projects", for example addressing research gaps, implementing a restoration project, or coordinated planning efforts to best prepare regional strategies. It is important to include local stakeholder input into the planning process and through to implementation. When targeting different geographies we should consider how a project may benefit underserved communities. Each group will nominate one idea to be shared.

Activity: Generate large-scale marsh project ideas. Choose one idea to present with a one sentence summary and 3-minute presentation.

In the previous sessions, we created a matrix of ecosystem services and geomorphologies with additional notes about restoration strategies over time. Take a moment to look at this matrix in its entirety and reflect on the previous two sessions.

Please complete the following based on the information presented by workshop speakers and aggregated from the previous breakout sessions.

1. Generate potential ideas of large-scale projects for the Chesapeake Bay. These projects should do one or more of the following:
    - Conserve/restore multiple ecosystem services
    - Involve local community input and address local community priorities. Address how private landowners, and incorporated and unincorporated jurisdictions in critical marsh migration corridors will be included in land use decisions.
    - Address one or several of the unknowns or an outreach effort to help overcome a common or specific barrier
    - Determine the project's spatial extent and regional impact (i.e., what makes the project seem "large-scale"?)
2. In the final fifteen minutes, prioritize one of your shared ideas (all ideas will be captured and shared post-workshop) and craft a one-sentence summary on your provided sheet. The facilitator (or another nominated speaker) from each group will have approximately three minutes to share their group's idea.

Breakout session IV: Developing a large-scale marsh project

In our final breakout session, each idea will be explored considering what research components, partner collaborations, or funding resources are required to advance the project. Following this workshop, we hope these projects and any additional ideas will continue to evolve and mature. To the best of our ability, we will connect interested parties to further pursue those ideas.

Activity: Further develop assigned project idea.

In this final session, we would like your group to further develop one of the previously shared ideas. While you may be interested in one or more of the ideas being discussed in other groups, we ask you to focus on the idea assigned to the table and consider the steps necessary to enact this project.

- Are there specific hypotheses to test?
- What partners need to come together for this project? What role does the community play? How is social justice integrated into this project?
- How can you ensure that all partners are included?
- What are resource needs? How are the needs of the community included?
- What sort of timeline does this project require? What are some immediate steps and steps over the next five years?
- How might personnel costs and resource needs be funded (See Appendix D for table of available funding)?

Next steps

At the end of the workshop we will administer a post-survey to help connect workshop participants to the shared project ideas they are interested in continuing to develop and implement. We will connect all interested participants via email.

Post-workshop efforts will include:

- Reporting progress on our workshop objectives and outcomes
- Sharing project ideas with other partners to further their development and yield input on future funding opportunities
- Synthesizing traits and target areas for large-scale marsh projects, which will be shared/presented to funding organizations and those seeking funding

Acknowledgements

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Workshop Guidelines

Maryland Sea Grant (MDSG) is committed to providing safe and welcoming environments for all who participate in MDSG events. MDSG prohibits and will not tolerate any form of harassment, bullying, or discrimination. Together, through the following guidelines, we can ensure that this workshop supports free expression and exchange of ideas in environments that are positive and productive for all.

Face masks are not required for this event, but we ask participants to be considerate to those who are taking extra precautions.

Treat all participants with respect, dignity, and consideration, in the spirit of valuing a diversity of views and opinions. We value all perspectives and encourage everyone to share. We are here to listen and understand. If you prefer not to answer you can say pass or pass for now.

Discuss differences and constructive criticism in a non-confrontational manner with due regard for the viewpoints of others. Please note that disagreement is welcome for the purpose of understanding, but not for convincing. Critique ideas, not individuals. Please actively listen to everyone. We ask that you avoid interrupting others when they are speaking. Please try to minimize distractions when possible.

Be considerate, respectful, and collaborative in your communication and actions. During this workshop we will be developing a shared language. It is always okay to ask what a word or phrase means or to ask for further clarification as we will be doing the same of you! If you know that you need to leave the meeting early, please let the project team, facilitator, or notetaker know ahead of time so that we can allot your time first when doing our breakout sessions.

Demeaning, discriminatory, or harassing behavior and speech will not be tolerated. If you believe you are being subjected to inappropriate conduct, believe someone else is being subjected to inappropriate conduct, or have any other concerns, please do not hesitate to contact MDSG event staff who can work with MDSG leadership to resolve the situation. If the project team determines that any behavior is inappropriate or violates the above guidelines, participants will be reminded of these ethics and/or asked to leave the meeting.

Speaker Biographies

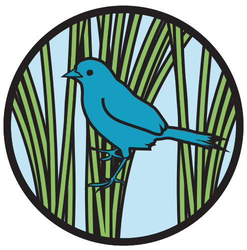
Ms. Pamela Mason is a Senior Research Scientist at the Center for Coastal Resource Management at the Virginia Institute of Marine Science, William & Mary. Ms. Mason has a BA in Biology from the University of Delaware and an MS in Marine Science from William & Mary, Virginia Institute of Marine Science. Ms. Mason has been working on coastal resource issues for several decades with a focus on integrated management of shorelines, wetlands and coastal community resilience. Ms. Mason's current research interest is multiple benefits of natural and nature-based features including living shorelines, tidal and non-tidal wetlands, environmental policy and coastal management. Ms. Mason currently serves as co-Chair of the Chesapeake Bay Program Wetlands Workgroup and is on the Virginia Coastal Policy Team.

Mr. Kyle Graham is Senior Program Manager at Ecosystem Investment Partners (EIP), where he focuses on establishing Pay for Performance contracts to efficiently and effectively implement large scale ecological restoration. Prior to joining the EIP team in January 2020, Mr. Graham was the Executive Director of Louisiana's Coastal Protection and Restoration Authority and served as Louisiana's Trustee for the Deepwater Horizon oil spill. Mr. Graham has a BS in Biology from the University of North Carolina and an MS in Biology from Appalachian State University. Mr. Graham resides in the front range of Colorado where he enjoys all the great outdoors has to offer.

Dr. Holly Bamford is a leader in fish, wildlife, and marine conservation. Currently, Dr. Bamford is the Chief Conservation Officer for the National Fish and Wildlife Foundation (NFWF), the nation's largest private conservation grant-maker, awarding over $400 million on-the-ground conservation investments annually across the country. Dr. Bamford is responsible for advancing the Foundation's outcome-based approaches to conservation investments that cover many ecosystems, including oceans, coasts, forests, grasslands and freshwater environments. The results of these investments help address significant conservation challenges such as climate, habitat loss and increase resiliency for species and habitats. Prior to joining NFWF, Dr. Bamford was the acting Assistant Secretary for Conservation and Management at the National Oceanic and Atmospheric Administration (NOAA) supporting ocean and coastal policy and implementation for the Nation. Dr. Bamford was also the Assistant Administrator for NOAA's National Ocean Service (NOS), where she was the head of over $500 million in ocean and coastal observations, research, mapping, coastal management and marine sanctuaries in support of healthy ecosystems and the economies that depend on them. Dr. Bamford received her PhD in organic environmental chemistry from the University of Maryland, College Park, and her work has been published in over 30 publications widely referenced in the field of environmental chemistry, natural resources, and water quality.

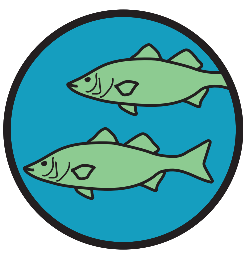
Appendix A
Ecosystem Services

Our planning team has chosen to highlight the following ecosystem services in our breakout groups. In our registration form, we used definitions provided in Barbier et al. 2011; here we expand the definitions to include Chesapeake Bay issues. The information below does not encompass all possible benefits and services a marsh ecosystem may provide and serves merely as a common starting point and space to stimulate discussion.



Bird habitat conservation

Marshes provide suitable reproductive habitat and nesting grounds and sheltered living space for several salt marsh-dependent bird species. In fact, the nation's coastal marshes provide resting, feeding, and breeding habitat for 75 percent of waterfowl and other migratory birds (Lellis-Dibble et al., 2008). Birding and waterfowl hunting are significant sources of recreation revenue. For instance, birding/wildlife viewing in the Maryland Coastal Bays watershed is estimated at $18 million per year and hunting at $10 million per year (Martin et al., 2018). In the Mid-Atlantic region, many salt marsh dependent bird species are in steep decline from habitat loss and degradation due to historic and current human impacts and sea-level rise (Salt Marsh Bird Conservation Plan for the Atlantic Coast, 2019). Low marsh species (Clapper Rail, Seaside Sparrow, American Black Duck) may see an increase in low marsh habitat due to marsh migration (Salt Marsh Bird Conservation Plan for the Atlantic Coast, 2019). However, high marsh-dependent species (Black Rail, Saltmarsh Sparrow, Coastal Plain Swamp Sparrow) are predicted to decrease due to the threats to their habitats including increased flooding and development (Salt Marsh Bird Conservation Plan for the Atlantic Coast, 2019).



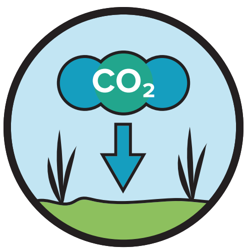
Maintenance of fisheries

Marshes are an essential fish habitat for various recreationally and commercially important species as they provide nursery habitats, refuge from predation, and abundant primary and secondary productivity (Banikas and Thompson, 2012; Essential Fish Habitat, 2022; Minello et al., 2003; Quan et al., 2007; Sheaves, 2009). More than half of the fish caught for sport or sale in the United States depend on estuaries and their coastal marshes at some point in their life cycles (Lellis-Dibble et al., 2008). Evidence indicates that salt marshes support higher population densities, increased growth, and improved survivability of nekton (i.e., swimming aquatic organisms) compared to open water habitat (Minello et al., 2003). The Chesapeake Bay is home to many ecologically and economically important species such as striped bass and summer flounder. Research indicates that these species capitalize on the marshes' abundant productivity for food, as nekton found within the marshes comprise a large portion of their diets (Baker et al., 2016; Rountree & Able, 1992). Marsh loss directly impacts fish populations in the Chesapeake Bay, through both a loss in potential nursery habitats, as well as a reduction in prey availability (Guthrie et al., 2022; Meynecke & Duke, 2008). There is a persisting need for more in-depth research into how marshes support fisheries and fish populations, specifically in the Chesapeake Bay (NOAA Office of Habitat Conservation, 2022).

Coastal protection

Marshes attenuate and/or dissipate wave energy (i.e. velocity, height, and duration) by stabilizing sediment, increasing the intertidal height, and providing friction via vertical structures (vegetation) (Morgan et al., 2009, Gedan et al., 2011). This reduces flood risk from high tide events and storm surge, especially compared to unvegetated mudflats which do not provide the same water uptake and holding capacity. Marshes therefore reduce wave energy that may be directly damaging to infrastructure as well as reduces flooding further inland (Barbier et al., 2011). Marsh storm protection can be considerably valuable. Narayan et al. (2017) estimates wetlands avoided $625 million in direct flood damages from Hurricane Sandy. At a watershed level, Li et al. (2020) modeled that by having low-lying marshes on the Eastern Shore that hold flood waters, water levels were reduced farther north in the watershed during storm surge (e.g., Baltimore, Annapolis, and Washington, DC). Alternatively, if those same shorelines were hardened those cities would experience greater storm surge. Factors that influence how a particular marsh helps to mitigate wave energy include meteorological conditions, local bathymetry, wave height, wave strength/fetch, wind, vegetation density/surface roughness, marsh width, and marsh geomorphology (Resio and Westerlink, 2008).

Carbon sequestration



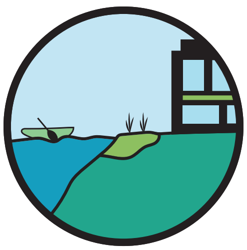
Marshes provide long-term storage of carbon dioxide (sometimes referred to as 'blue carbon') in below ground biomass through photosynthesis and sediment deposition (Holmquist et al., 2018). Blue carbon crediting in salt marshes provides opportunity to make progress towards climate change mitigation targets and can serve as additional financial justification to protect important marsh habitat (Holloway, 2021). In recent years, corporate interest in blue carbon credits has increased (Wetlands Economic Benefits to Landowners, n.d.) and legislation in Maryland (Maryland Conservation Finance Act of 2022) is now supporting blue carbon crediting. There are challenges in achieving accreditation for blue carbon stocks at scale. For example, scientific gaps on the leakage of carbon from degraded seagrasses and the difference in the carbon sink capacity among different seagrass species can lead to difficulties in developing accurate accounts of blue carbon stocks (Holmquist et al., 2018). Another threat is coastal marshes that are currently characterized as carbon sinks are at risk of becoming net carbon emitters if they are unable to migrate and keep up with rising seas (Sanzone, 2022).

Water purification

Marshes perform an important role in improving water quality through trapping and filtering excess nutrients, sediment, and chemical contaminants from polluted stormwater runoff. The restoration and conservation of marshes is critical in achieving the water quality goals to restore the Chesapeake Bay, which has a total maximum daily load (TMDL) in place as a requirement through the Clean Water Act for not meeting dissolved oxygen, aquatic life resources (e.g., submerged aquatic vegetation), and water quality standards (Chesapeake Bay TMDL, 2022). Marshes are considered a Chesapeake Bay Program (CBP)-approved best management practice (BMP) under the shoreline management expert panel report for use by state jurisdictions to meet their nitrogen, phosphorus, and sediment reduction goals. However, research and data were limited for specific shoreline management types and associated denitrification and erosion rates leading to the acknowledgement that improvements to the overall understanding of various marsh types and water quality benefits are needed to update the BMP (Forand et al, 2015). Additionally, the protocols for the shoreline management BMPs did not consider climate change impacts, such as sea level rise, storm surge, and increased precipitation, on the nutrient and sediment reduction effectiveness of various marsh types. A recent literature review by Virginia Tech (2022) on climate change effects on BMP performance found that the majority of the available tidal marsh studies focused on sediment dynamics and processes and less on nutrient and carbon processes (Hanson et al, 2022).

Erosion control & surface accretion

Marshes provide sediment stabilization and soil retention via its vegetation. Aboveground, marsh vegetation decreases erosive wave energy through friction and as a result causes sedimentation in the intertidal zones sometimes building up natural levees (Carter, 1996). Belowground, marsh vegetation's roots and rhizomes promote sediment structural integrity (Carter, 1996). If sea level rise and/or local subsidence increases the inundation of the marsh, then this can cause the vegetation to collapse and the marsh to convert to unvegetated mudflats. Marshes can persist despite rising sea levels if a higher elevation relative to sea level is maintained with the necessary sediment availability (Kirwan et al., 2016). When marshes are unable to keep up with sea level rise, and vegetation is degraded due to an elevation deficit, uplands will likely experience more wave action and erosive forces during storm events. For marshes to provide the maximum shoreline protection, they and the surrounding environment must maintain dense vegetation and keep up with sea level rise (Raposa et al., 2017).



Benefits to the surrounding communities (e.g. tourism, recreation, education, and research)

Marshes provide unique aesthetic landscapes which may yield multiple economic (e.g. tourism, recreation, disaster mitigation) or cultural (e.g. sense of place, health) assets to the surrounding community (Barbier et al., 2011, Sutton-Grier and Sandifer, 2019). We consider the surrounding community to mean community members, community groups, businesses, and/or government agencies near to the marsh complex who have an interest in or are affected by the management of the marsh system or proposed project. Communication channels must be established between these local stakeholders and project managers (Clifford et al., 2022). This will rely on trusted messengers or outreach strategies that best accommodate community members schedules and accessibility issues. Understanding and incorporating the community's priorities will provide insight and guidance on what marsh assets to maintain or how changes in marsh extent may conflict with current or preferred alternative land uses.

Benefits to private agriculture and residential lands (e.g. tourism, recreation, education, and research)

Marshes provide unique aesthetic landscapes which may yield multiple economic (e.g., conservation easements, tourism, recreation, water purification) or cultural (e.g., sense of place, health) assets to landowners if those marshes are located on their property (Barbier et al., 2011, Sutton-Grier and Sandifer, 2019). For this breakout group, we refer to properties with marshlands or properties likely to be directly impacted by marsh migration (in the previous section we make the distinction that there are community stakeholders who care about nearby marshes but do not own properties with marshlands). This primarily means privately-held agricultural and residential lands (a faith-based organization or business with properties that include marshes or are in marsh migration corridors could also be considered). A significant amount (~85%) of tidal marshes exist on private lands that, with protection and restoration, would contribute to marsh goals (Tidal Sediment Task Force, 2005). In the Chesapeake Bay Program's Wetlands goal, they specify that 83,000 acres of the 85,000 acre-goal should occur in agricultural landscapes (Wetlands, 2022). In order to protect marsh migration corridors, private lands will have to be engaged in marsh conversion (i.e., from degraded forest or marginal agricultural lands). Engaging private landowners in marsh restoration can face a number of known obstacles and require further social science research.

Appendix B
Marsh Geomorphologies

For the purposes of our workshop, the planning team organized various Chesapeake and coastal bays marsh geomorphologies into the following seven types. Other marsh geomorphological classification schemes exist, and more specific classification types could be included in the types defined below. Our descriptions of each geomorphologic type as well as prominent defining characteristics (e.g., sediment supply, salinity, stressors) are provided to support your discussions.

Marsh characteristics definitions

Sediment supply

- **Estuarine**: Sand, silts, clay, gravel, and particulate organic matter transported to the marsh from the estuary, from the marsh to the estuary or via overland flow via the tides or storm surge.
- **Riverine**: Sand, silts, clay, gravel, and particulate organic matter deposited to the marsh from a mainland river or tributary, from the marsh to the river or tributary via flooding, tides, or storm surge or via overland flow.

Salinity

- **Freshwater**: Less than 0.5 parts per thousand (ppt) salinity.
- **Oligohaline**: Between 0.5 to <5 ppt salinity.
- **Mesohaline**: Between 5 to <18 ppt salinity.
- **Polyhaline**: Between 18 to <30 ppt salinity.

Typically, in the Chesapeake Bay the salinity is highest in the lower portion of the Bay and lowest in the upper Bay; salinity is also typically reduced the further inland from the shore.

Stressors

- **Anthropogenic nutrients:** Excess nitrogen and phosphorus impairs water quality, and influences vegetation growth and rates of soil organic matter decay.
- **Erosion**: Removes sediment from the marsh surface and/or along marsh-tidal water interface.
- **Increasing temperature**: Higher temperatures may decrease or increase vegetation growth rates, alter plant species composition, and decrease organic matter accumulation due to enhanced rates of litter decomposition.
- **Invasive species**: Exotic, dominant flora/fauna species that may decrease habitat value, alter hydrologic regimes, and change sediment erosion/deposition.
- **Relative sea level rise**: Changes in inundation regimes (e.g., land surface flooding drowns marsh vegetation), salinity, and rising groundwater tables.
- **Sediment supply**: Sediment helps maintain marsh elevation but sources are sometimes restricted and therefore limit marsh accretion.

- **Shoreline hardening**: Man-made structures (e.g., dikes, levees, bulkheads, riprap, sea walls) at the inland or seaward edge of the marsh that prevent marsh expansion inland or enhance erosion/deposition along the seaward marsh edge, and result in decreased marsh extent.
- **Storms:** Cause a temporary increase in erosive forces, flooding (duration, depth, and/or spatial extent), and salinity. More frequent or stronger storms may cause greater adverse impact.

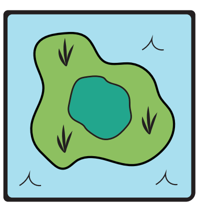
Ability to migrate

- **Topographic barriers:** Natural features such as steep slopes or berms that inhibit migration.
- **Man-made barriers:** Hard shoreline structures (e.g., sea walls, berms, rip rap) or other infrastructure (e.g., roads, buildings) that prevent marsh migration and increase sediment erosion.

Typical vegetation

- **High marsh:** Dominated by plants that are intolerant of intermittent complete submergence by tides (in salt marshes: *Spartina patens, Distichlis spicata, Juncus romerianus, Iva frutescens,* etc.). In the Chesapeake Bay region, this generally includes the portion of marsh that is flooded by mean high tides to highest spring tide extent. They are typically inundated by tides less than once daily.
- **Low marsh:** Dominated by plants tolerant of complete submergence (in salt marshes: *Spartina alterniflora*). In Chesapeake Bay region, this generally includes the portion of marsh that is inundated twice daily by tidal action.

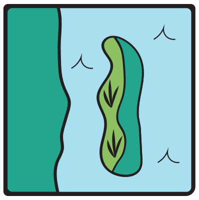
Marsh geomorphologies



Island Marsh

A marsh or marsh upland complex surrounded by water on all sides. An interior portion of the marsh may have higher elevation with shrubs and trees.

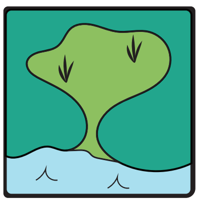
Sediment supply	Amount of sediment available in flood water and ambient tidal waters. Sediment can include mineral and organic particles suspended in tidal water. Available sediment related to shoreline hardening.
Salinity	Ranges from polyhaline to oligohaline.
Stressors	Possible: Relative sea level rise, erosion, storms, invasive species, anthropogenic nutrients, increasing temperature. High Concern: Relative sea level rise.
Ability to migrate	Minimal/none, except migration into interior upland hummocks.
Vegetation	Low and potentially high and upland vegetation types. Potentially invasive species.



Back Barrier Marsh

A fringe salt marsh located on the landward side of a barrier island.

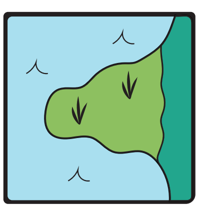
Sediment supply	Sediment (primarily sand) deposited during over-wash events.
Salinity	Typically polyhaline.
Stressors	Possible: Relative sea level rise, erosion, storms, invasive species, stormwater runoff/sewage/nutrient loads on populated barrier islands.
Ability to migrate	Island complex migration. Marsh extent varies as the island migrates. Marsh may also migrate on the leeward edge into forest (if present). Little to no migration to island upland.
Vegetation	High and low marsh species. Potentially invasive species.



Embayed/ Pocket Marsh

A marsh that forms along the shoreline of an semi-enclosed body of water with a narrow inlet to the estuary. Typically contained within a small, essentially semi-circular area on a shoreline.

Sediment supply	Sediment deposition from riverine sources and estuarine sources. Overland flow likely.
Salinity	Ranges from polyhaline to oligohaline.
Stressors	Possible: Relative sea level rise, erosion, storms, sediment supply, invasive species, anthropogenic nutrients, shoreline hardening, increasing temperature. High concern: Relative sea level rise, nutrients, invasive species
Ability to migrate	Yes, if no topographic or man-made barriers.
Vegetation	High and low marsh species. Potentially invasive species.



Headland/Point Marsh

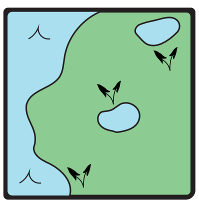
A marsh that projects from the upland into the estuary and surrounded by water on three sides. Its development is usually influenced by tidal currents that form a sand berm behind which the marsh forms.

Sediment supply	Sediment deposition from estuarine sources. Possible overland flow.
Salinity	Ranges from polyhaline to oligohaline.
Stressors	Possible: Relative sea level rise, erosion, storms, sediment supply, invasive species, anthropogenic nutrients, shoreline hardening, increasing temperature. Bifurcation from upland. High concern: Relative sea level rise, increased storm intensity causing high exposure to erosion and flood events.
Ability to migrate	Yes, if no topographic or man-made barriers.
Vegetation	High and low marsh species. Potentially invasives.

Mainland Fringe Marsh

A fringe marsh is adjacent to the mainland. Land use/landcover includes agriculture, non-tidal wetlands, coastal/upland forest, urban and suburban development. Width of the fringe varies.

Sediment supply	Sediment deposition from estuarine and riverine sources.
Salinity	Ranges from polyhaline to oligohaline.
Stressors	Possible: Relative sea level rise, sediment supply, erosion, excess nutrients.
Ability to migrate	Yes, if no topographic or man-made barriers.
Vegetation	High and low marsh species. Potentially invasive species.



Tidal Fresh Marsh

A marsh that experiences regular lunar tides with oligohaline to fully fresh water.

Sediment supply	Sediment deposition from riverine and estuarine sources.
Salinity	Ranges from fresh to low oligohaline.
Stressors	Possible: Relative sea level rise, erosion, storms, sediment supply, invasive species, anthropogenic nutrients, increasing temperature. High concern: Changing salinity, high groundwater.
Ability to migrate	Yes, if no topographic or man-made barriers.
Vegetation	High diversity of emergent vegetation that is intolerant of saltwater. Generally, less vegetation zonation with mixed communities dominated by broad-leaved perennial herbaceous species (*Peltandra spp., Pontedaria spp., Scirpus spp., Cyperus spp.*) May include woody vegetation, trees, and shrubs, especially close to the upland. May be tolerant of temporary exposure to saline water. Potentially invasive species.

Urban Cluster Marshes

A group of marshes that exist in an urban setting within a tidal creek, often small and fragmented due to surrounding development.

Sediment supply	Sediment deposition from riverine, estuarine, overland flow, and stormwater sources.
Salinity	Ranges from polyhaline to oligohaline.
Stressors	Possible: Relative sea level rise, erosion, sediment supply. High concern: Anthropogenic nutrients from stormwater runoff/nutrient loads/sewage and septic systems. High potential for invasive plant and animal establishment, anthropogenic impacts like shoreline hardening, mowing, and debris disposal.
Ability to migrate	Limited due to man-made barriers in the surrounding development.
Vegetation	High and low marsh species. Potentially invasive species.

Appendix C
Restoration Strategies

Below are some restoration techniques our planning team feel are commonly used in the Chesapeake Bay region for marsh enhancement projects. We provide a brief definition, the technique's intended purpose, as well as a few "points of consideration" to help inform if this technique is appropriate for the context of the marsh restoration project you are discussing. This is not an all-encompassing list and we welcome other innovative restoration techniques. We encourage you to discuss other advantages/disadvantages to each of the techniques.

Marsh migration

The process in which low-lying uplands experience enough tidal flooding, storm surge events, or saltwater intrusion that the present vegetation cannot survive and instead conditions become favorable for flood- and salt-tolerant wetland plants (Fagherazzi, 2019). Current land use and slope influence the ability and rate of migration (Salt Marsh Bird Conservation Plan for the Atlantic Coast, 2019). This process of natural succession or active transition to marsh will depend on the existing land use it is replacing, ownership of the land, and community sentiment towards this change.

Points of consideration include:

- **Economics:** Land ownership and available incentives, current land use and associated costs for conversion/remediation.
- **Site selection:** Predicted longevity under sea level rise scenarios, extensive contiguous area, habitat quality, surrounding land use.
- **Design:** Removing topographic barriers, managing invasive species, extending tidal creeks for drainage.
- **Outreach and stakeholder engagement:** Marketing for financial, water quality, or wildlife habitat benefits possibly on private agricultural or residential lands.

Thin-layer placement

Applying a thin layer of sediment—spraying a slurry of water and sediment from dredge sites—to the marsh surface can increase or maintain the elevation of the marsh platform, which may be particularly useful in areas where accretion is not keeping pace with relative sea level rise (Myszewski & Alber, 2017). The addition of thin-layered sediment can increase plant growth by adding minerals and nutrients, increasing oxygen levels through soil aeration, and reducing the frequency and duration of flooding via elevation increase (Parson and Swafford, 2012; La Peyre et al., 2000). Beneficial uses of dredged material for various projects have included raising marsh elevation to create high marsh areas for salt marsh sparrow and wading birds, restoration of unvegetated interior mud flats, enhancing tidal flats for submerged aquatic vegetation and fish habitat and reducing marsh edge erosion (USACE, 2021).

Points of consideration include:

- **Economic:** High project costs, long project timelines, multiple partner coordination.
- **Site selection:** Site sediment needs paired with nearby available dredge material.
- **Design:** Depth of added sediment, evenness of dredge application to the marsh surface, containment of the site's dredge materials, effect of marsh surface compaction, effect on pools and tidal creeks within the marsh, effect on benthic population, and post-construction planting plans, if necessary.
- **Outreach and stakeholder engagement:** Share project timeline and predicted impacts, help calibrate expectations on site aesthetics over time (i.e., period it takes for vegetation to recover).

Hydro-manipulation

Hydro-manipulation involves landscape alterations that encourage tidal flow or improved drainage. In some cases, restrictions to tidal flow (e.g., berms, roadways, other fragmentation) have disrupted flood regimes and sediment supply (U.S. Environmental Protection Agency, 2020). Techniques such as ditch remediation, replacing culverts with box culverts, or tide gate installation have been utilized to restore tidal flow (Salt Marsh Bird Conservation Plan for the Atlantic Coast, 2019). In other cases, improved drainage may help maintain salt marsh integrity if the site is waterlogged or experiences interior ponding (pooling water on the marsh which drowns the plants and converts them from interior marsh platform into open water, which can expand outward rapidly) (Perry et al., 2022). Techniques to improve drainage include runnels and extending tidal creeks (Besterman et al., 2022).

Points of consideration include:

- **Economics:** Future maintenance costs, funding opportunities via federal agencies.
- **Site selection:** Effects on vegetation composition (distribution of high or low marsh, invasive *Phragmites australis* (Phragmites) salinity preferences), sediment supply, and accretion potential.
- **Design:** Address regulatory processes, width/depth of drainage technique, machinery disturbances (e.g., soil compact, vegetation destruction), plantings or plant recolonization rates.
- **Outreach and stakeholder engagement:** Share project timeline and predicted impacts, help calibrate expectations on site aesthetics over time (i.e., period it takes for vegetation to recover), inclusion of transportation departments in planning processes.

Edge Erosion Control

Erosion from waves or currents can diminish a marsh's size and longevity. Marsh systems are typically most vulnerable to erosion if there is longer fetch, weak soil strength, steep shoreline slope, narrow intertidal zones, and/or high boat traffic (Broome et al., 1992). If there is a gentle slope and wide intertidal zone, there is greater ability to establish plantings to withstand erosion. Breakwaters (e.g., living shorelines, oyster reefs, and rock sills) are another erosion reduction technique as they absorb wave energy before those waves reach the marsh edge (Broom et al., 1992). Balancing the desire for shoreline erosion control and infrastructure protection with the need for adequate sediment supply for marsh sustainability is essential in a large-scale (regional) approach to marsh restoration.

Points of consideration include:

- **Economics:** Cost effectiveness for projects with long shorelines.
- **Site selection:** Fetch, amount of foot or boat traffic, marsh width, tidal zones, sediment supply.
- **Design:** Plant selection/availability, shoreline grading, sediment supply, installation of breakwaters, role of Phragmites in erosion control.
- **Outreach and stakeholder engagement:** Education on boat wakes, role of breakwaters and/or benefits of marsh fringe, share project timeline and predicted impacts, help calibrate expectations on site aesthetics over time (i.e., period it takes for vegetation to recover), share regulatory processes and funding opportunities for private lands.

Invasive control

A non-native plant or animal that overpopulates and causes habitat degradation, displacement of native plants and animals and disruption of ecological processes (Invasive and Exotic Species in Maryland, 2022). In Chesapeake Bay marshes, the most prevalent invasive plant species include Phragmites (*Phragmites australis*), non-native cattails (*Typha spp.*), and loosestrife (*Lythrum salicaria*) (Invasive Species, 2022). Control techniques include herbicide and prescribed fire. The most prevalent invasive animal species include nutria (*Myocastor coypus*), Canada geese (*Branta canadensis*), and Mute swans (*Cygnus olor*) (Maryland Invasive Species Council, 2022). Control methods include trapping, hunting, exclusion, visual scaring devices, and reproductive control (nest and egg destruction) (Marks, 2015).

Points of consideration include:

- **Economics:** Cost-benefit of removing invasive species (Does the species provide its own ecosystem services (e.g., carbon sequestration, erosion control) versus harm to ecosystem services provided by other vegetation compositions (e.g., habitat value)? What is the risk of recolonization? What is the frequency of treatment?).
- **Site Selection:** Prevalence of invasive species and its impact to site goals, risk of recolonization.
- **Design:** Timing of control application (e.g., effectiveness in re-growth, risk to nesting birds).
- **Outreach and stakeholder engagement:** Education on why control may be necessary, consideration of public image of invasive species, community science campaigns to report sightings.

Plantings

Re-establishing the vegetative community or installing a new plant composition may be a component of restoration design. Environmental conditions determine the plant community composition and should guide management decisions. Elevation, which is correlated with inundation regimes and salinity exposure, structures plant communities into characteristic zones. High-marsh plants are planted between mean high water and spring high water; species include salt meadow cordgrass (*Spartina patens*), black needlerush (*Juncus roemerianus*), salt grass (*Distichlis spicata*), and marsh elder (*Iva frutescens*). Low-marsh plants are planted between mean tide level and mean high water; the dominate species is smooth cord grass (*Spartina alterniflora*) (Perry et al., 2001). Tidal freshwater marshes are noted for high plant-species diversity, which generally include arrow-arum (*Peltandra virginica*), dotted smartweed (*Persicaria punctata*), wild rice (*Zizania aquatica var. aquatica*), pickerelweed (*Pontederia cordata var. cordata*), rice cutgrass (*Leersia oryzoides*), tearthumbs (*Persicaria arifolia* and *Persicaria sagittata*), and beggar-ticks (especially *Bidens laevis* and *Bidens trichosperma*) (The Natural Communities of Virginia Classification of Ecological Groups and Community Types: Third Approximation, 2021).

Points of consideration include:

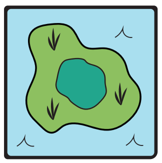
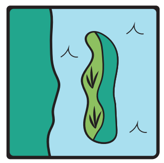
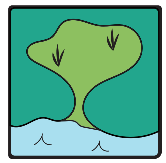
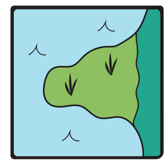
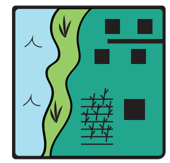
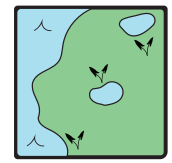
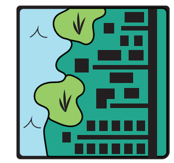
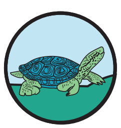
- **Economics:** Costs for plants and labor.
- **Site Selection:** Sediment type (avoid clay), adequate tidal exchange and drainage with minimal standing water, limited to no shade, and protection from excessive wave activity.
- **Design:** Seasonal windows for plant establishment, planting density, availability of plant stock, the need for fertilizer, protection from foot or boat traffic, protection from grazers (e.g., muskrat, nutria, geese), risk of invasion of non-desirable plant species, plant genetic diversity typical of reference marshes within the region (i.e., source plants locally when possible).
- **Outreach and stakeholder engagement:** Time for establishment, aesthetics, volunteer investment.

Finally, **evaluation and monitoring** of any marsh conservation or restoration project is necessary to determine project success or the need for changes in management approach. Monitoring should occur prior to a restoration effort to establish baselines for performance measures and data collected should follow a consistent monitoring protocol. Post-project monitoring may include: (1) determine whether the specific marsh enhancement project's quantitative and qualitative goals and objectives have been met, (2) evaluate whether the project was built as designed, (3) evaluate the effects of the project on populations of interest (*Spartina spp.*, birds, crabs, etc.) and (4) inform potential adaptive management (TNC and NJDEP, 2016). Often, the project's marsh performance is best compared to a reference marsh, though this may be difficult due to different geomorphology or environmental conditions (e.g., nearby land use characteristics, similar-sized watersheds, similar soils, etc.). The CBSSC sentinel sites may serve as an ongoing reference because they provide long-term monitoring for several marsh geomorphologies in the Chesapeake Bay. Data sharing on marsh performance will benefit the greater conservation/restoration community.

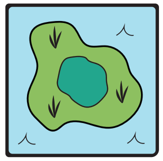
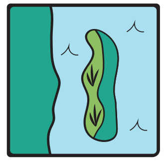
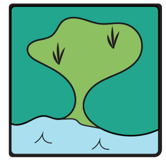
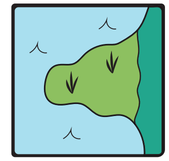
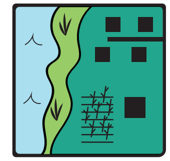
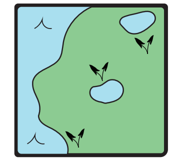
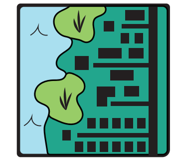
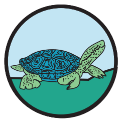
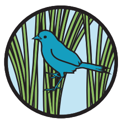
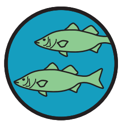
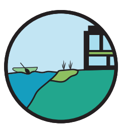
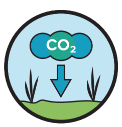
Appendix D
Matrix Examples

Below is an example of the activity for our first breakout session using diamondback terrapin habitat as the 'ecosystem service' examined across the different marsh geomorphologies. The next page gives a preview of the full Ecosystem service–Marsh geomorphology matrix.

Ecosystem service–Marsh geomorphology matrix

Marsh geomorphology / Ecosystem service	 Island	 Back Barrier	 Embayed/Pocket	 Headland/Point	 Mainland Fringe	 Tidal Fresh	 Urban Cluster
 Diamondback terrapin habitat (Example)	• Predator isolation. (asset) • Inability to migrate; may be too small in size; possibly isolated from other nesting habitats. (weakness)	• "Classic habitat." Typically big with good nesting habitat—sandy areas maintained and juvenile habitat nearby (i.e., low marsh). (asset) • Possibly accessible to predators. (weakness)	• See utilization of this habitat in the CB. See high densities in mainland channels. (asset) • May have limited nesting habitat (open sand), may need to travel to nest. (weakness)	• Similar to mainland.	• If wide enough with migration, provides good habitat (high/ low marsh with ability to migrate inland). (asset) • Likely predator access. Terrapins won't use phragmites-dominated landscapes. (weakness)	• Need brackish water. Rarely utilize these habitats. (weakness)	• Possibly good for public education. If a living shoreline, terrapins may utilize. (asset) • Predators likely. Likely limited upland nesting access, fragmentation creating accessibility barriers; also inaccessible if shorelines are stabilized. (weakness)

Ecosystem service–Marsh geomorphology matrix

Ecosystem service \ Marsh geomorphology	 Island	 Back Barrier	 Embayed/Pocket	 Headland/Point	 Mainland Fringe	 Tidal Fresh	 Urban Cluster
 Diamondback terrapin habitat (Example)							
 Bird habitat conservation							
 Maintenance of fisheries							
 Benefits to private agriculture and residential lands							
 Benefits to the surrounding communities							
 Carbon sequestration							
 Coastal protection							
 Coastal erosion							

Appendix E
Funding Opportunities

In August 2022, the Chesapeake Bay Program Wetlands Workgroup led a "Wetlands Attainability" workshop (https://www.chesapeakebay.net/what/event/wetland-outcome-attainability-workshop), which featured presentations on several funding opportunities for resilience and restoration projects. With the workshop organizers permission, we have reproduced their compilation of funding opportunities here with the modification of only including Maryland and Virginia-applicable opportunities. This is a collection of funding opportunities presented at the workshop and a non-inclusive list of the funding opportunities available throughout the region.

Habitat Restoration and Resilience Funding - Transformational Habitat Restoration and Coastal Resilience Grants

Focus Area Description: Restore habitat for fisheries and protected resources while also strenthening the resilience of coastal communities and ecosystems.
Funding Agency/Opportunity Number: NOAA, NOAA-NMFS-HCPO-2022-2007195
Application Deadline: Sept. 6, 2022
Level of Funding: Federal
Total Funding Available: $85 million
Award Range: $1 million - $15 million
Website/Contact: https://www.fisheries.noaa.gov/grant/transformational-habitat-restoration-and-coastal-resilience-grants

Habitat Restoration - Coastal Zone Management Program

Focus Area Description: Coastal habitat restoration; coastal habitat restoration planning, engineering, and design; and land conservation projects that support the goals and intent of the Coastal Zone Management Act (CZMA), the Coastal and Estuarine Land Conservation Program (CELCP), and the Infrastructure Investment and Jobs Act, Public Law 117-58.
Funding Agency/Opportunity Number: NOAA, NOAA-NOS-OCM-2022-2007458
Application Deadline: Oct. 14, 2022
Level of Funding: Federal
Total Funding Available: $35 million
Award Range: $200k - $6 million
Match Requirements: None
Website/Contact: https://coast.noaa.gov/czm/

Environmental Quality Incentives (EQIP) Program

Focus Area Description: Provides financial assistance for conservation practices.
Funding Agency/Opportunity Number: NRCS
Application Deadline: Annually in January
Level of Funding: Federal
Website/Contact: https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/newsroom/features/?cid=stelprdb1193811
Other Notes: Farmers, ranchers, and forest landowners who own or lease agricultural land may be eligible.

USACE General Investigations

Focus Area Description: General construction and large projects, address flood risk management, navigation, water supply, recreation, and other needs and opportunities.
Funding Agency/Opportunity Number: USACE
Level of Funding: Federal
Award Range: >$10M
Match Requirements: Feasibility: 50/50; D&I 65/35
Website/Contact: https://www.swf.usace.army.mil/Portals/47/docs/ContinuingAuthoritiesProgram/Programs%20other%20than%20CAP/General%20Investigations%20Factsheet.pdf
Other Notes: Example: Lynnhaven River Basin Ecosystem Restoration

Wetland Reserve Enhancement Partnership

Focus Area Description: The Wetland Reserve Enhancement Partnership (WREP) is a voluntary program through which NRCS enters into agreements with eligible partners to leverage resources to carry out high priority wetland protection, restoration, and enhancement and to improve wildlife habitat. It is part of the Wetland Reserve Easement (WRE) component of the Agricultural Conservation Easement Program (ACEP), a Farm Bill conservation program.
Funding Agency/Opportunity Number: NRCS
Application Deadline: Sept. 23, 2022
Level of Funding: Federal
Total Funding Available: FY2023 $20 million
Award Range: No more than $5 million
Match Requirements: Match is required (at least 10% cash or in kind to match for easement due diligence cost or restoration costs) and this is only available for governments and NGOs.
Website/Contact: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/easements/acep/?cid=nrcseprd1459249
Other Notes: Individuals may not apply for partnership agreement. Once this is awarded NRCS will work with partners to identify individual landowners.

Planning Assistance to States (PAS)

Focus Area Description: Technical Asisstance (ex. hiring the Corps)
Funding Agency/Opportunity Number: USACE
Level of Funding: Federal
Award Range: ~$25K-$100K
Match Requirements: 50/50 cost share
Website/Contact: https://www.nae.usace.army.mil/missions/public-services/planning-assistance-to-states/
Other Notes: Example: Shoreline and Oyster Reef Restoration, Menchville Marina, Deep Creek, Newport News (Complete)

Continuing Authority Program (CAP), Section 204

Focus Area Description: Beneficial use of dredged material, small projects
Funding Agency/Opportunity Number: USACE
Level of Funding: Federal
Award Range: <$10M
Match Requirements: Feasibility: 100%; D&I 65/35
Website/Contact: https://www.nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program/Section-204/
Other Notes: Example: Hampton Roads Beneficial Use of Dredged Material (Feasibility), Poplar Island

Clean Water Financing & Assistance Program—Virginia Clean Water Revolving Loan Fund (VCWRLF aka CWSRF)

Focus Area Description: Wastewater treatment, stormwater and agriculture BMPs, brownfields remediation, land conservation, and living shorelines. Opportunites for wetlands restoration and enhancements.
Funding Agency/Opportunity Number: VA DEQ
Application Deadline: Annual solicitation June-July
Level of Funding: State (VA)
Total Funding Available: ~$500 million
Match Requirements: Pairing with Stormwater Local Assistance Fund (50/50 matching grant program) may provide additional grant funding
Website/Contact: https://www.deq.virginia.gov/water/clean-water-financing#:~:text=The%20VCWRLF%20is%20a%20self,wastewater%20collection%20and%20treatment%20facilities
Other Notes: Projects can be standalone (funded independently). Low, subsidized interest rates.
May qualify for Green Project Reserve—which has opportunities for reduced or zero interest rates. There is also potential for grant money.

Clean Water Financing & Assitance Program—Stormwater Local Assistance Fund (SLAF)

Focus Area Description: Non-Point Source Nutrient Credit purchases and stormwater projects including: i) new stormwater best management practices; ii) stormwater best management practice retrofits, iii) stream restoration; iv) low impact development projects, v) buffer restorations, vi) pond retrofits, and vii) wetlands restoration.
Funding Agency/Opportunity Number: VA DEQ
Application Deadline: Oct. 3, 2022
Level of Funding: State (VA)
Total Funding Available: $72 million
Award Range: $50,000-$5 million
Match Requirements: 50/50 matching grant program (Pairing with VCWRLF may provide additional grant funding)
Website/Contact: https://www.deq.virginia.gov/water/clean-water-financing/stormwater-local-assistance-fund-slaf
Other Notes: Eligible recipients are local governments, meaning any county, city, town, municipal corporation, authority, district, commission, or political subdivision created by the General Assembly or pursuant to the Constitution or laws of the Commonwealth.

Watershed Assistance Grant Program

Focus Area Description: Provides funding for design and watershed assessment
Funding Agency/Opportunity Number: MDNR and Chesapeake Bay Trust (CBT)
Level of Funding: State (MD)
Total Funding Available: $1.4 million
Award Range: Generally, up to $100,000 for design of stormwater best management practices; generally, up to $150,000 for design of stream restoration practices; Generally, up to $75,000 for watershed planning and programmatic development
Match Requirements: None
Website/Contact: https://cbtrust.org/grants/watershed-assistance/
Other Notes: Allows CBT Fund to target construction ready projects

Small Watershed Grants

Focus Area Description: Focus on tidal and nontidal wetlands
Funding Agency/Opportunity Number: U.S. EPA, NFWF
Level of Funding: Non-Federal
Total Funding Available: $15 to $25 million
Award Range: $75K-$500K
Match Requirements: None, but strongly encouraged
Website/Contact: https://www.nfwf.org/programs/chesapeake-bay-stewardship-fund/small-watershed-grants-2022-request-proposals
Other Notes: Smaller program than Innovative NFWF (see below), but has more available funding currently

Innovative Nutrient and Sediment Reduction (INSR) Grants 2023 Request for Proposals

Focus Area Description: Accelerate the rate and scale of water quality improvements through the implementation of best management practices that cost-effectively reduce nutrient and sediment pollution to local rivers and streams and the Chesapeake Bay
Funding Agency/Opportunity Number: NFWF, EPA, CBP
Application Deadline: Nov. 17, 2022
Total Funding Available: $30 million: $10 million for INSR Partnership Grants and up to $20 million for INSR Infrastructure Grants
Award Range: $500,000 to $1 million each, for an estimated 20-40 individual grant awards
Match Requirements: INSR Partnership Grants require non-federal matching contributions equal to the grant request. Non-federal match is encouraged but not required for INSR Infrastructure Grants.
Website/Contact: https://www.nfwf.org/programs/chesapeake-bay-stewardship-fund/innovative-nutrient-and-sediment-reduction-grants-2023-request-proposals

Appendix F
Workshop Participants

This is a hybrid workshop. Online participants are indicated with a * symbol. Please note participants listed are ones that gave permission to share their information; not all participants are listed.

Mike Allen
Associate Director for Research & Administration
Maryland Sea Grant

Sabine Bailey
NOAA Digital Coast Fellow
The Nature Conservancy/ Maryland Department of Natural Resources

Donna Marie Bilkovic*
Professor, Assistant Director-Center for Coastal Resources Management
Virginia Institute of Marine Science

Sophia Blanco Seufert
Biologist
U.S. Fish and Wildlife Service

Linda Blum
Professor - Retired
University of Virginia

Kristen Saacke Blunk
Field Liaison
Headwaters LLC

Bianca Boggs*
Associate
Skeo Solutions

Libby Brieri*
River Steward
Friends of Rappahannock

Eric Buehl
Regional Watershed Restoration Specialist
University of Maryland Sea Grant Extension

Kevin Bruce
IT Coordinator
Maryland Sea Grant

Elliott Campbell
Acting Director, Office of Science and Stewardship
Maryland Department of Natural Resources

Maggie Cavey
Natural Resource Planner for Beneficial Use
Maryland Department of Natural Resources

Ellie Chetelat
Designer
Underwood & Associates

Jenna Clark
Research Programs Manager
Maryland Sea Grant

Gabe Cohee
Director, Office of Restoration and Resilience
Maryland Department of Natural Resources

Christine Conn
Acting Director, Chesapeake and Coastal Service
Maryland Department of Natural Resources

Nicole Cook*
Environmental and Agricultural Faculty Legal Specialist
University of Maryland Eastern Shore

Hannah Cooper
Science Management and Policy Intern
Maryland Sea Grant

Jeffrey Cornwell
Research Professor
University of Maryland Center for Environmental Science, Horn Point Laboratory

Sean Corson
Director, NOAA Chesapeake Bay Office
NOAA

Carolyn Currin*
Senior Scientist
EA EST

David Curson
Director of Bird Conservation (Maryland)
Audobon Mid-Atlantic

Stephanie P. Dalke
Program Manager, Water Resources and Climate Adaptation
UMD Environmental Finance Center

Kyle Derby
Research Coordinator
Chesapeake Bay NERR-MD, Maryland Department of Natural Resources

Samikshya Dhami*
Climate Policy Intern
Throwe Environmental

Jimmy Dick
Business Development Manager
Environmental Quality Resources, LLC

Emma Dodsworth*
Graduate Student
Virginia Institute of Marine Science

Mike Dryden
Restoration Specialist
The Nature Conservancy

Kevin Du Bois*
DoD Chesapeake Bay Program Coordinator
DoD Chesapeake Bay Program

Brooke Eckert
Grants Coordinator
Underwood & Associates

Lynn Faulkner
Environmental Educator
Harford County ACLEC

Celso Ferreira
Associate Professor
George Mason University

Megan Fitzgerald
Life Scientist
US EPA - Region 3

Woody Francis*
Regulatory Program Manager
Army Corps of Engineers, Baltimore District, Regulatory Branch

Joseph Galarraga*
Resilient Coasts Project Manager
The Nature Conservancy

Neil Ganju
Oceanographer
USGS

Keryn Gedan*
Professor of Biology
George Washington University

Ashley Goetz
Science Writer and Digital Specialist
Maryland Sea Grant

Cirse Gonzalez
Coastal Training Program Coordinator
Chesapeake Bay National Estuarine Research Reserve in Virginia

Whitley Gray*
Landowner Assistance Coordinator
ShoreRivers

Zack Greenberg
Officer, Conserving Marine Life in the U.S.
The Pew Charitable Trusts

Christopher Guy*
HGIT coordinator
USFWS

Anna T. Hamilton
Senior Scientist, Project Manager
Tetra Tech Inc., Center for Ecological Sciences

Lora Harris
Professor
University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory

Sarah Hilderbrand
Restoration Specialist
Maryland Department of Natural Resources

Emily Hinson*
Lower James Regional Outreach Senior Manager
James River Association

Robert Isdell
Associate Research Scientist
Center for Coastal Resources Management, Virginia Institute of Marine Science

Will Isenberg*
Coastal Planner
Virginia Coastal Zone Management Program

Stephanie Jacobs*
Physical Scientist
US EPA

Bill Jenkins
Senior Advisor; and Co-Chair, CBP Habitat Goal Team
US EPA, Mid-Atlantic Regional Office

Madeleine Jepsen*
Science Writer and Digital Specialist
Maryland Sea Grant

Brent Jett
Coastal Resiliency Group Leader
GMB

Shelby Johnson*
Faculty Research Assistant
University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory

Roxolana Kashuba*
Physical Scientist
EPA

Katie Kavanagh*
Seasonal Environmental Scientist
Maryland Coastal Bays Program

Amanda Knobloch*
Education Coordinator
Morgan State University PEARL

Scott Knoche
Director
Morgan State University PEARL

Sarah T. Koser
Restoration Program Manager
Chesapeake Bay Trust

Andy Lacatell*
Virginia Chesapeake Bay Director
The Nature Conservancy

Rachel Lamb
Natural Carbon Sequestration Administrator
Maryland Department of the Environment

Jim LaChance*
Aquaculture Projects Coordinator
Maryland Sea Grant

Scott Lerberg*
Assistant Research Scientist
CBNERR-VA/Virginia Institute of Marine Science

Breese Mark Dickinson
Owner
Trappe Landing Farm

Pamela Mason
Senior Research Scientist
Virginia Institute of Marine Science

Erin McNally
Project Development Coordinator
Ecotone LLC

Aliya Mejias
Graduate Assistant
Maryland Sea Grant

Molly Mitchell*
Research Assistant Professor
Virginia Institute of Marine Science

Fredrika Moser
Director
Maryland Sea Grant

Doug Myers
Maryland Senior Scientist
Chesapeake Bay Foundation

William Nardin
Faculty
University of Maryland Center for Environmental Science, Horn Point Laboratory

Karinna Nunez*
Associate Research Scientist / Geospatial Modeling Manager
Virginia Institute of Marine Science

David O'Brien*
Fisheries Biologist
NOAA Fisheries Service

Joanna Ogburn*
Principal and Founder
JBO Conservation, LLC

Liam O'Meara*
President
EQR

Cindy Palinkas
Associate Professor
University of Maryland Center for Environmental Science, Horn Point Laboratory

Larisa Prezioso
Conservation Specialist
Eastern Shore Land Conservancy

Julie Reichert-Nguyen*
Natural Resources Specialist
NOAA

Ben Sagara
Wetland Biologist
Virginia Department of Wildlife Resources

David Satterfield
Director of Land Conservation
Eastern Shore Land Conservancy

Beth Sheppard*
Agriculture Outreah Specialist
Lower Shore Land Trust

Taylor Sloey*
Assistant Professor
Old Dominion University

Kevin M. Smith
Exec. Director
Maryland Coastal Bays Program

Chris Snow
Stewardship Coordinator
Maryland Department of Natural Resources, Chesapeake Bay National Estuarine Research Reserve

Jamileh Soueidan*
Environmental Management Staffer
Chesapeake Research Consortium

Jackie Specht
Resilient Coasts Program Director
The Nature Conservancy

Lorie Staver
Assistant Research Professor
University of Maryland Center for Environmental Science, Horn Point Laboratory

Jessica Steelman*
Coastal Planner
Accomack-Northampton PDC

Taryn Sudol
Coastal Resilience Coordinator
Maryland Sea Grant

Danielle Szimanski
Ecologist/Project Manager
US Army Corps of Engineers–
Baltimore District

Dylan Taillie
Coastal Analyst
Maryland Department of
Natural Resources

Lauren Taneyhill*
Strategic Partnerships Specialist
NOAA Chesapeake Bay Office

Joanne Throwe*
President
Throwe Environmental

Leon Tillman
Chesapeake Bay Coordinator
USDA-NRCS

Joe Toolan*
Manager, Chesapeake Bay Programs
National Fish and
Wildlife Foundation

Carly Toulan*
Environmental Scientist
Maryland Coastal Bays Program

Bruce Vogt*
Ecosystem Science Manager
NOAA Chesapeake Bay Office

Jonathan Watson
Marine Habitat Resource Specialist
NMFS-HESD

Ross Weaver*
Program Assistant Director
Wetlands Watch

Sara Weglein
Restoration Specialist
Maryland Department of
Natural Resources

Aaron Wendt*
Shoreline Erosion Advisory Service
Virginia Departmet of Conservation
and Recreation

Matt Whitbeck
Wildlife Biologist
Blackwater NWR

Nikki Wildart*
Scientist
EA Engineering

Erik Yando*
Assistant Professor
Biological Sciences, Old
Dominion University

Appendix G
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