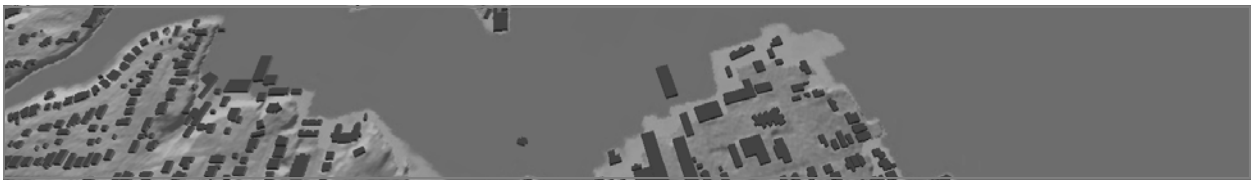
FUTURE COAST

Anne Arundel

What Should Communities Do—or Not Do—about Coastal Flooding and Sea-Level Rise?

Participant Guide



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The Future Coast project is not funded — and has no ties to planning efforts — by Anne Arundel County, the City of Annapolis or the State of Maryland.

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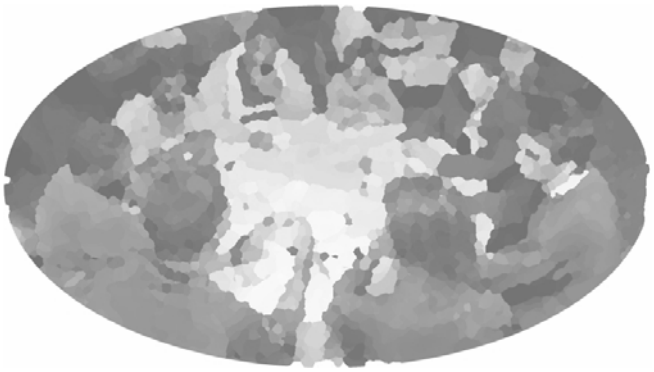
1. INTRODUCTION



This guide was developed as a companion to the Future Coast Issue Book for use in group discussions of the science, impacts and policy of coastal flooding and sea-level rise. It includes key points from the Issue Book as well as provides questions to use as a starting point for discussions.

If you are hosting your own group discussion, we suggest it is important both that everyone feels comfortable during the discussions and that a broad array of options are considered. The following guidelines are recommended by the National Issues Forums (www.nifi.org):

- Everyone is encouraged to participate.
- No one or two individuals dominate the discussion.
- The discussion focuses on the approaches.
- All the major choices or positions on the issue are considered.
- An atmosphere for discussion and analysis of the alternatives is maintained.
- We listen to each other.

Additional information about facilitating group discussions is available in the Facilitator Guide at www.FutureCoast.info under “Reports.” Finally, please let us know what your experiences are in conducting your own discussions on coastal flooding and sea-level rise. You can comment online (see “Host a Discussion”), or email us at coast@gmu.edu.

INTRODUCTION QUESTIONS FOR PARTICIPANTS:

1. Has anyone had a personal experience that illustrates the problems associated with coastal flooding and/or sea-level rise?

2. Within your family, or friends, do you ever discuss this issue?

3. How does this issue affect you?

4. How do you think the issue affects other people in the county?

2. Science and Impacts

Science of Sea-Level Rise, In Brief:

- Over the past 100 years, the waters of the Chesapeake Bay have risen more than a foot compared to the land.
- The change in sea level relative to the land is called **relative sea-level rise.**
- Land that becomes permanently flooded is said to be **inundated.**
- Sinking of the land accounts for approximately half of the rate of change of relative sea level rise that we observe in Chesapeake Bay.
- Today's sea levels have probably not yet reached the same levels of the last glacial retreat 125,000 years ago.
- The most recent United Nations report on climate change predicted that global sea levels will rise between 7 inches to 2 feet by 2100, depending on the amounts of greenhouse gases emitted from sources like cars and power plants.
- The Maryland Commission on Climate Change expects a range of 2.7 to 3.4 feet relative sea-level rise for the state by 2100. They recommended that local planners generally anticipate a 1-foot rise by 2050, and a 2-foot rise by 2100, but for large, long-term investments in property and infrastructure, a 4-foot rise.
- Scientists expect sea-level rise to accelerate, but it can be hard to detect at global and regional scales.
- With higher water levels, hurricane-driven storm surges will reach further inland.

Science Questions:

1. What parts of the science are most relevant to thinking about what communities should — or should not — do about coastal flooding and sea-level rise?
2. When future projections of sea-level rise have some level of uncertainty, how should they be used in community decision-making?
3. Do you have questions about the science?

WHAT IT MEANS LOCALLY, IN BRIEF:

Anne Arundel County

- Most of the communities that may be impacted by a relative rise in sea level are single family residences.
- The Deale/Shady Side and Edgewater/Mayo peninsulas have the most residential buildings that would likely be affected by an increase in sea level of 0- to 2-feet.
- In communities that rely on individual water supply wells and on-site septic systems, these facilities may become damaged.
- The majority of the land at risk of permanent flooding is currently woodlands, open land, and wetlands.

City of Annapolis

- Flooding events are expected to more than double by 2050 due to sea-level rise.
- One of the areas most at risk is the City Dock.
- Annapolis already has built shorelines, so will not be subject to much erosion from sea-level rise.
- The city relies on water from deep wells (300-1,000 feet) which should not be affected by saltwater intrusion.

QUESTIONS ABOUT WHAT IT MEANS LOCALLY:

1. Have you experienced flooding in any areas of the county?
2. Which areas of the county do you think are most at risk from coastal flooding and sea-level rise, if any?
3. How would you describe the risk?
4. Are there impacts to the county that people might not readily associate with coastal flooding and sea-level rise?
5. When should communities begin to make decisions — if any— about what to do?
6. Do you have questions about the local impacts of coastal flooding and sea-level rise?

POLICY STRATEGIES

You just discussed the science and impacts of sea-level rise, so now the question is, what should communities and local governments do about it? How should communities decide what the priorities should be?

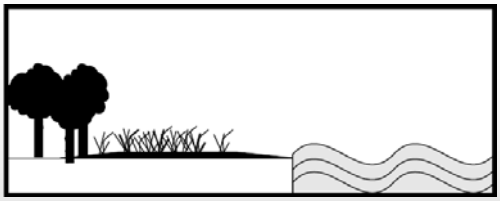
LONG-TERM STRATEGIES FOR PROJECTED COASTAL FLOODING

There are three long-term strategies for responding to projected coastal flooding and sea-level rise:

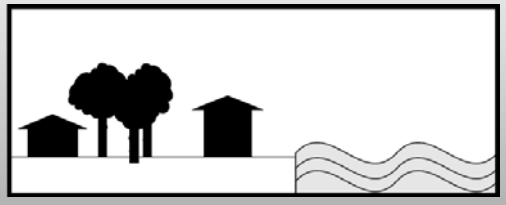
- **move inland over time**;
- **create more resilient communities**;
- **use natural and artificial barriers to protect against rising waters.**

In the following pages, we suggest possible approaches to each of these long-term strategies, and list advantages and disadvantages. We lay out potential strategies for different types of areas within the county, such as a park, residential community, or highly developed commercial and residential area. There is overlap in the types of choices that could be made for each of them, as your preferences may change depending on the context.

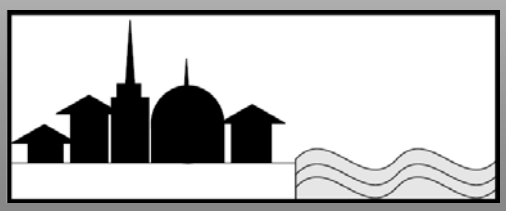
Your role is to think about how these approaches might work or not work. These are complex questions with long-lasting implications.



PUBLICLY OWNED NATURAL AREAS

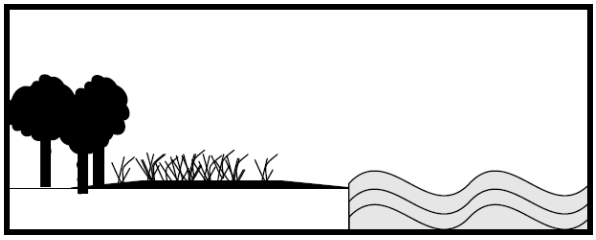


RESIDENTIAL, LOW DENSITY



COMMERCIAL AND RESIDENTIAL, HIGH DENSITY

PUBLICLY OWNED NATURAL AREAS



Strategy #1. Buy adjacent lands to enable natural areas to move inland

How would it work?
Governments, private organizations or non-profits would buy property adjacent to existing public lands to enable habitats to move inland as waters rise. Private organizations or non-profits could donate the lands to the government for public use. The sale would be voluntary for the property owner.

Considerations
Governments and other organizations will need to prioritize which properties to target based on their future value in providing public access, wildlife habitat, and/or buffers to coastal flooding.

Advantages
Lands provide buffers against flooding, preserve wildlife and ecosystems, and ensure continued public access to coastal areas.

Disadvantages
Buying land is expensive. Government or other organizations will need to pay for maintenance, and may need to remove existing structures.

Strategy #2. Maintain beaches and health of wetlands against rising seas

How would it work?
Sand would be replenished in eroded public beach areas. Wetland areas would be restored and potentially elevated with dredged sediment.

Considerations
Depending on the rate of erosion and/or sea-level rise, and the geography, beach and wetland restoration may not be suitable. Dredged sediments may harm the environment.

Advantages

Healthy beaches and wetlands decrease land loss. They provide habitat for wildlife and space for public parks. Wetlands filter pollutants before they reach the Chesapeake Bay. "Living shorelines" are the preferred form of protection in Maryland *(2008 Living Shoreline Protection Act)*.

Disadvantages

Sand replenishment and wetland restoration can be costly and require long-term maintenance. Living shoreline projects may cause changes in local ecosystems, turning shallow-water habitats into marsh habitats.

Strategy #3. Build walls and other structural barriers along the shore to hold back coastal waters

How would it work?

Barriers like rock and sea walls would be placed along shorelines to reduce erosion and flooding. Structures could also be sited offshore to reduce impacts of higher sea levels. For example wetlands could be protected with levee and pump systems, or tidal gates.

Considerations

Structural defenses are not preferred under Maryland law *(2008 Living Shoreline Protection Act)*. Maryland's Department of the Environment controls permitting for hard shoreline defenses.

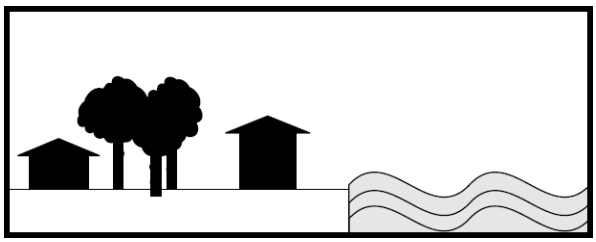
Advantages

Shoreline barriers are familiar forms of erosion- and flood-control, and use well-tested engineering methods.

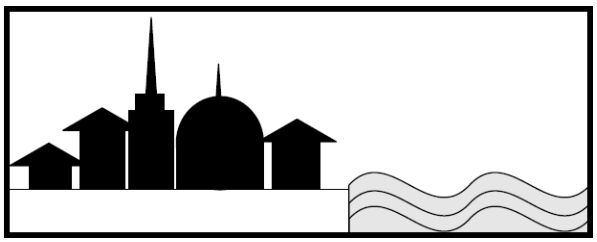
Disadvantages

Barriers and other hard structures are expensive to build, require maintenance, cause erosion of adjacent shorelines, and damage ecosystems. The aesthetics of natural areas may be compromised. Structures may lessen public access to the water.

BUILT COMMUNITIES



RESIDENTIAL
LOW DENSITY



COMMERCIAL AND RESIDENTIAL
HIGH DENSITY

Strategy #1. Retreat — or move — inland over time, restricting new building in areas likely to flood, and moving or abandoning existing structures

How would it work?

Community evacuations from coastal areas sometimes occur as the immediate result of severe storm damage. Optimally moving communities inland take place over long periods of time to minimize social and economic disruptions. This strategy would site new development away from coastal flood hazards, and relocate or abandon structures that become repeatedly or permanently flooded. An array of tools could be used:

- local government planning guidelines;
- changes in local zoning to restrict the development of structures in areas determined to be at risk of flooding;
- additional regulations on structures in floodplains;
- requirements to site buildings inland;
- prohibitions on hard shoreline barriers to maintain the area of public tidal lands as waters move inland;
- and tax benefits, compensation, or credits that homeowners would be able to sell, in return for accepting development restrictions.

Considerations

Planned moves inland require long periods of time to change community expectations and investment strategies regarding land use. Feasibility depends on the density of development, available adjacent land, and the challenges of moving existing structures.

Advantages

Moving inland reduces the exposure of the community to repeated damage from storms and flooding, and losses from permanent flooding (**inundation)**. It allows natural coastal processes to occur, and generally has fewer environmental impacts than shoreline protection.

Disadvantages

Changes in permitted land use will affect property values. Use of these types of tools is relatively new and may be difficult for governments to implement. Contaminated lands may need to be addressed before they are flooded.

Strategy #2. Maintain and restore natural areas such as wetlands as buffers against coastal flooding

How would it work?

The restoration and maintenance of natural shorelines would provide a buffer against flooding and storms. Governments would allocate space for wetlands to move inland by moving barriers. The addition of sand and sediment helps natural areas withstand erosion and flooding. Tools to ensure space for restoration include low density zoning; government land purchases; requiring siting of buildings away from the shoreline; "living shorelines" that provide natural protection from plants and other materials; renourishment of beaches with sand; and buying development interests from owners.

Considerations

Planning for movement of natural areas before adjacent lands are developed is most effective and least costly. The more highly developed the area, the less feasible it will be to provide enough space for the restoration and inland movement of natural areas.

Advantages

Maintaining natural front-line protection provides buffers from flooding and storms, habitat for wildlife, and filtration of run-off water. "Living shorelines" are the preferred form of protection in the State of Maryland *(2008 Living Shoreline Protection Act)*.

Disadvantages

Maintaining natural areas, and purchasing additional lands, can be costly. Federal permits may be needed if fill is required for beaches or wetlands. Living shorelines offer less certain protection against flooding than walls, bulkheads and other forms of structural protection.

Strategy #3. Design and retrofit buildings to be more flood resilient

How would it work?

Sometimes called "floodable development," new buildings and other structures are designed to withstand projected future levels of flooding. This is accomplished primarily through revised building codes and planning of community infrastructure projects. Tax incentives can be provided to retrofit buildings to higher standards. Buildings can be elevated above expected flood levels, tapping designs that reduce the effects of storm surge and placing habitable areas on upper levels. Floating structures are a novel — and extreme — example of this strategy.

Considerations

Local governments requiring new buildings to be more flood-resilient can assist residents in obtaining reduced premiums through FEMA's National Flood Insurance Program. Requiring higher standards for new building design is easier than retrofitting older buildings, particularly ones with historical value. Building public infrastructure to accommodate future sea level rise — such as roads, bridges and coastal drainage systems — is less expensive than later rebuilding.

Advantages

These types of actions are low cost and "low regrets" regardless of eventual sea-level rise impacts, and lessen the risk of flood damage.

Disadvantages

Living in areas of periodic flooding may pose risks. Flood events can be dangerous, and storm waters can carry contaminants that pose public health threats. Elevated buildings can make access more difficult for people with limited mobility. This strategy is more difficult to implement with existing structures.

Strategy #4. Build walls and other structural barriers along the shore to hold back coastal waters

How would it work?

Engineered structures — such as sea walls, bulkheads, and tidal gates — are placed along the shoreline or offshore to stabilize coastal lands, prevent erosion and protect against storm surge. They are used on both private and public property.

Considerations

Hard barriers are not preferred protection solutions under Maryland's Living Shoreline Act. Maryland's Department of the Environment controls their permitting. Protective barriers provide immediate short-term benefits. These may be outweighed by consideration of long-term maintenance costs, value of the structure being protected, and environmental and social costs. Hard defenses may be most suitable in areas with critical infrastructure and highly valuable development that cannot be easily moved or protected using other methods.

Advantages

Hard barriers have traditionally been used to withstand flooding. They can be implemented quickly to provide protection from flooding and erosion. Building protective structures takes less time than building up natural buffers or planned moves inland.

Disadvantages

Structures are designed to certain thresholds that may not withstand stresses under high sea levels and increased storm surges. Barriers prevent public access to the shore. They are expensive to build and require continued maintenance. Environmental impacts of shoreline barriers include erosion to adjacent areas, and loss of shoreline ecosystems. They also prevent wetlands from migrating inland as sea levels rise.

General Questions about Long-Term Flood Protection Strategies for Different Types of Areas:

1. Should certain types of areas be higher priority for public funding and resources to protect them against coastal flooding and sea-level rise impacts?

2. What factors should be taken into consideration in deciding those priorities?

3. Are different strategies of protection more appropriate for certain types of areas within the county?

Questions about Specific Strategies for Each Type of Area:

What Do We Value?

1. What things are important to people who support this strategy?

2. What is appealing about this strategy?

3. What makes this strategy a good idea — or a bad one?

What Would be the Consequences?

1. What would result from adopting this strategy?

2. What might be some of the costs?

3. What might be some benefits?

Where are There Tensions or Sources of Conflict?

1. What do you see as the tension between the strategies, if any?

2. How might there be conflicts that arise from this strategy?

3. What are the “gray areas” that make this issue harder to decide?

WHERE IS THERE COMMON GROUND?

1. Are there trade-offs that county residents would be willing to accept?

2. Are there trade-offs that county residents wouldn't be willing to accept?

3. What do you think your community would be willing to do — if anything — about coastal flooding and sea-level rise?

4. Do you have questions about these potential strategies?

4. CONCLUDING QUESTIONS:

1. How has your thinking changed over the course of these discussions?

2. Has your understanding of other people's views on this issue changed?

3. Are there aspects of this issue that our group wasn't able to address?

4. Are there trade-offs that county residents might be willing to accept?

5. What would be a good consequence of this discussion today?

6. Are there ways we can make that happen?

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