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# DRAFT

## Catalog of State Adaptation Actions

### *Existing Built Environment & Infrastructure*

A catalog of state-level, vulnerability-reducing adaptation actions and policy options.

#### Key to Future Rankings of Options in the Tables that Follow:

Potential Adaptive Capacity Increase <u>1/</u>	Potential Cost or Cost Savings <u>1/</u>
<b>High (H):</b> Able to reduce significantly climate risks associated with the highest impact magnitudes	<b>High (H):</b> Cost-benefit ratio in excess of 1.5
<b>Medium (M):</b> Able to significantly reduce climate risks associated with the medium impact magnitudes	<b>Medium (M):</b> Cost-benefit ratio between 1.0 and 1.5
<b>Low (L):</b> Able to significantly reduce climate risks associated with the lowest impact magnitudes	<b>Low (L):</b> Cost-benefit ratio less than 1.0
<b>Uncertain (U):</b> Not able to estimate at this time	<b>Uncertain (U):</b> Not able to estimate at this time
<u>1/</u> Several measures may overlap in terms of vulnerability reduction and/or cost impacts. Estimates assume measures would be implemented independently from other measures.	

#### Definition of “Priorities for Analysis”:

- **High:** High priority options will be analyzed first.
- **Medium:** Medium priority options will be analyzed next, time and resources permitting.
- **Low:** Low priority options will be analyzed last, time and resources permitting.

#### Notation of Options:

- **Options marked in bold an asterisk (\*)** indicate some of the related state actions that are approved or underway, as described further in the companion options description document. TWG members are encouraged to provide information on other relevant actions.

**Notes:**□ ***Types of vulnerable infrastructure:***

Public built environment & infrastructure	Private built environment & infrastructure
<ul style="list-style-type: none"> <li>▪ Roads</li> <li>▪ Bridges</li> <li>▪ Tunnels</li> <li>▪ Water treatment</li> <li>▪ Wastewater treatment</li> <li>▪ Military installations</li> <li>▪ Public transportation facilities</li> <li>▪ Port Authority Assets</li> <li>▪ Wharfs and boat ramps</li> <li>▪ Boating facilities</li> <li>▪ Parks and beaches</li> <li>▪ Navigation channels</li> <li>▪ Navigation aids</li> <li>▪ Landfills</li> <li>▪ Administrative and institutional buildings</li> <li>▪ Cultural assets (e.g., statues, memorials)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Marinas,</li> <li>▪ yacht clubs,</li> <li>▪ boat yards</li> <li>▪ Retail buildings</li> <li>▪ Commercial buildings</li> <li>▪ Power plants / Industrial facilities</li> <li>▪ Residential homes</li> <li>▪ Farms</li> </ul>

□ ***Fundamental and preliminary action underlying consideration of all adaptation options***

1. *Sea level rise framework:* It is recommended that a comprehensive assessment be undertaken and periodically updated that examines near- and long-term projections for sea level rise along the entire Maryland coastline including the Chesapeake Bay and its tributaries.
2. *Strategic action framework:* It is recommended that a review be undertaken of the advantages and disadvantages of the higher-order strategic choices confronting Maryland regarding adaptation to climate, namely whether to protect, retreat, or accommodate.

□ ***Types of adaptation options:***

1. *Operation Activities:* Includes options that aim to current operations with risk-reducing measures for residential, commercial, and industrial facilities, as well as public works infrastructure.

2. *Maintenance Activities*: Includes options that aim to systematize maintenance protocols for the protection of existing infrastructure through regulations, codes, planning approaches, and specific maintenance protocols.
3. *Replacement Activities*: Includes options that aim to replace or relocate existing vulnerable infrastructure.

## Existing Built Environment & Infrastructure Adaptation Options

### *TWG Recommendations for Early Action Adaptation Options*

Option No.	Adaptation Policy Option	Flexibility	Capital intensity	Adaptive capacity	Level of consensus	Notes
2.1	Evaluate existing shoreline protection structures to determine their effectiveness under varying sea level rise and the need for modification/replacement/abandonment					Should include a review of available Federal, state, and local shoreline protection programs; provide recommendations on how each could be modified to address future changes in sea level rise with respect to infrastructure and other land assets
2.4	Strengthen existing building codes for new infrastructure and incorporate an increase in building inspection effectiveness as part of the strengthened codes					Incorporating projected sea level rise in the design storm event, as the design criteria applicable to vulnerable infrastructure
2.7	Evaluate infrastructure design standards/codes associated with retrofitting activities for existing infrastructure to address lower probability events					e.g. some cities are protecting to the 500 year event rather than the 100 year event because of the increased vulnerability. Instead of using these storm events as the design benchmark, incorporate projected sea level rise in the design storm event
2.11	Develop an early warning system (i.e., enhance hazard preparedness) through incorporation of sea level rise in hurricane and storm-surge evacuation planning.					
2.14	Develop an inventory of potentially impacted infrastructure and maintain this database relative to emerging projected sea level rise findings					This is an essential first step in scoping relevance/viability of potential adaptation options
2.17	Evaluation of vulnerability of existing and future unprotected reaches of shoreline with respect to existing infrastructure.					Determine need for and type of shoreline protection appropriate to these reaches.

## Existing Built Environment & Infrastructure Adaptation Options

### *Full Adaptation Option Catalog*

Option No.	Adaptation Policy Option	Flexibility	Capital intensity	Adaptive capacity	Level of consensus	Notes
<b>1</b>	<b>Operation activities</b>					
1.1	Develop operational protocols that specify disclosure requirements for coastal hazards					does not include underwater structures that may pose a risk to navigation, among other risks
1.2	Improve hazard preparedness of residential homes and commercial entities by providing operational assistance or incentives					
1.3	Assess sea level rise hazard insurance for businesses as part of standard operations					
1.4	Assess sea level rise hazard insurance for home owners in inundation hazard zones					
1.5	Implement standardized community education materials on hazards that addresses the relationship between climate variability and climate change					Noted here separately but could also be folded into Option 3.6
1.6	Evaluate shoreline erosion buffers for zones subject to flooding in which significant infrastructure is located					
1.7	Develop and implement a tree planting program along vulnerable coastal areas as a flooding control strategy					Noted here separately but could also be folded into Option 2.9 as part of a broader initiative
1.8	Add additional planning scrutiny to further development in sensitive areas subject to sea level rise hazards	<i>Noted here but recommend to move to future built environment &amp; infrastructure adaptation option catalog</i>				
1.9	Add additional planning scrutiny to prevent new development from infringing upon sensitive shoreline areas subject to sea level rise hazards	<i>Noted here but recommend to move to future built environment &amp; infrastructure adaptation option catalog</i>				
1.10	Minimize the installation of paved	<i>Noted here but recommend to move to future built environment &amp; infrastructure adaptation option catalog</i>				

Option No.	Adaptation Policy Option	Flexibility	Capital intensity	Adaptive capacity	Level of consensus	Notes
	surfaces as a strategy for flood runoff control					
<b>2</b>	<b>Maintenance</b>					
2.1	Evaluate existing shoreline protection structures to determine their effectiveness under varying sea level rise and the need for modification/replacement/abandonment					Should include a review of available Federal, state, and local shoreline protection programs; provide recommendations on how each could be modified to address future changes in seas level rise with respect to infrastructure and other land assets
2.2	Conduct a comprehensive vulnerability assessment for all public and private properties					This would include critical facilities such as power stations, hospitals, etc, as well as cultural resources such as museums
2.3	Add additional planning scrutiny to future infrastructure investments in undeveloped hazard-affected coastal areas	<i>Noted here but recommend to move to future built environment &amp; infrastructure adaptation option catalog</i>				
2.4	Strengthen existing building codes for new infrastructure and incorporate an increase in building inspection effectiveness as part of the strengthened codes					Using projected sea level rise in the design storm event, as apposed to the standard 100-yr storm event
2.5	Increase construction protocols/conventions for piers and wharves for wave strength					This could be folded into 2.4 and explicitly referenced
2.6	Increase erosion and hazard planning focused on all coastlines, especially sheltered coastlines					This could readily apply to all shorelines and could be an output of the evaluation of existing shoreline protection structures as identified in option 2.1
2.7	Evaluate infrastructure design standards/codes associated with retrofitting activities for existing infrastructure to recognize sea level rise and potential increased severity of storms and storm surges.					e.g. some cities are protecting to the 500 year event rather than the 100 year event because of the increased vulnerability. Use the 100 yr storm, incorporating projected se level rise, as the design criteria
2.8	Design new building codes, design standards including setback zones and phased-out or no development in areas vulnerable to sea level rise					This would include an evaluation of riparian rights/property rights regarding flooding resulting from sea level rise, including the possibility of new building code regulations for consequences to adjacent properties caused by elevating property. Could be collapsed into option 2.7
2.9	Evaluate structural and non-					

Option No.	Adaptation Policy Option	Flexibility	Capital intensity	Adaptive capacity	Level of consensus	Notes
	structural options for beach protection (flood walls, dune restoration and creation, and periodic beach nourishment)					
2.10	Develop and/or strengthen a system for the comprehensive surveillance, monitoring, documentation, and dissemination of rates and locations of sea-level rise in Maryland.					
2.11	Develop an early warning system (i.e., enhance hazard preparedness) through incorporation of sea level rise in hurricane and storm-surge evacuation planning.					Or updates to existing systems if they exist
2.12	Implement strict maintenance regulations for existing infrastructure in acute sea level rise hazard zones					This would involve ensuring that future funding is available for beach replenishment and dune maintenance (see notes for 2.9)
2.13	Develop a system for the regular updating of flood inundation mapping from changes due to sea level rise					
2.14	Develop an inventory of potentially impacted infrastructure and maintain this database relative to emerging projected sea level rise findings					This is an essential first step in scoping relevance/viability of potential adaptation options
2.15	Evaluate the need for redeveloped structures to raise first floor elevations some distance above base flood elevation					Such action would need to be based on compliance with climate change-proofed comprehensive standards/codes; base flood elevation refers to the 100-yr flood incorporating sea level rise considerations
2.16	Evaluate the riparian rights/property rights in the context of sea level rise					Current riparian rights are based on the paradigm that sea level is constant. Could include recommendations for resolving issues resulting from consequences of protective measures.
2.17	Evaluation of vulnerability of existing and future unprotected reaches of shoreline with respect					Determine need for and type of shoreline protection appropriate to these reaches.

Option No.	Adaptation Policy Option	Flexibility	Capital intensity	Adaptive capacity	Level of consensus	Notes
	to existing infrastructure.					
<b>3</b>	<b>Replacement Activities</b>					
3.1	Enhance existing storm water infrastructure capacity in zones subject to increasing high intensity rainfall events					
3.2	Identify public and private systems and facilities at serious risk from sea level rise and initiate a system for siting such facilities away from vulnerable areas					
3.3	Evaluate presence and significance of threatened historical structures and develop plans for their relocation and/or protection					
3.4	Initiate a study that examines the replacement of soft protection options with hard structural options such as dikes, levees, floodwalls, saltwater intrusion barriers (this presupposes a solution)					As a first step, this option calls for a pre-feasibility study to evaluate the pros and cons and potential applications of hard, structural options to large estuaries like the Chesapeake Bay.
3.5	Develop and evaluate a public repurchase program for vulnerable lands and public/private infrastructure					This option would also seek to assess relevance to private sector infrastructure
3.6	Enhance public education programs aimed at informing the public about sea level rise and coastal hazards					
3.7	Develop a mechanism that requires utility companies to relocate existing overhead utility wires underground and require new wires to be placed underground.					This option needs to be reviewed by a utility company representative as it may be risky from a reliability and serviceability perspective (i.e. submerged networks).