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Adaptation Option Template
Resources and Resources-Based Industries
DRAFT

RRI-1 – New Criteria for Identifying Priority Protection Areas

Option Description

Rising sea level will impact coastal ecosystems and natural resource lands. These resources provide important wildlife habitats, have regional significance for migratory birds, protect coastal communities from storm surge and erosion, sequester large amounts of carbon, provide sediment and nutrient water quality benefits, and generate economic benefits through farming, forestry, fishing and passive recreation. As sea level rises, various future conditions are possible. As an example, tidal marshes, beaches and dune habitats have the potential to: 1) migrate landward if there are no barriers to migration, such as roads and buildings, or 2) become eliminated if the opportunity to migrate landward is blocked, or the rate of migration is exceeded by the rate of sea level rise. Identifying where these resources are, how important they are for various ecosystem values and economic services and what the likely impact of sea level rise will be provides the basic information needed to plan for the protection and management of priority coastal natural resources.

This option proposes to develop and test new and existing criteria for identifying ecologically and economically important lands (including important habitats and marsh migration corridors). This would include using existing natural resource assessments such as the Green and Blue Infrastructure and Maryland Strategic Forest Lands Assessment and considering conservation priorities, such as DNR's Priority Conservation Areas and other agency conservation targets. The objective of this option is to identify target areas where strategic actions can be focused to buffer against the impacts of sea level rise and other climate changes.

Strategic actions can include targeted conservation along landward edge of tidal marshes to allow horizontal marsh migration, sand and sediment replenishment to fuel the vertical growth of wetlands, barrier removal, alternative land management practices and others.

Option Design

- **Targets:**
- Identify high ecological and economic priority natural resources
- Identify the degree of risk to natural resources resulting from sea level rise
- Recommend specific management actions appropriate to the value of the resource and the degree of risk

- **Timing:**
- An initial and coarse level assessment of resource vulnerability to sea level rise could be conducted within the first year using results from sea level rise modeling and existing resource assessments.
- Field studies may need to be conducted in order to develop and test specific criteria
- Strategy recommendations will need to be developed based on the results of these assessments and could involve federal, State and local governments, non-profits, natural resource industry sectors and the public.
- A plan for implementing strategies should follow the strategy development, but is not addressed in this option
- **Parties Involved:**
- Resource assessment and threat analysis should be completed by MD DNR, UMD and other technical and scientific organizations
- **Other:** As needed, identify other factors/parties that would need to be engaged for successful implementation of the option in the state.

Implementation Mechanisms

Implementing this recommendation would require the investment of staff and funding to complete the analysis, conduct any specialized studies and to coordinate the development of a suite of strategic actions.

Related Policies/Programs in Place

DNR's existing resource assessments include the following :

- The Green Infrastructure Assessment: identifies an ecological hub and corridor network across the State, prioritizes for ecological value, and is a DNR foundation for focusing conservation and restoration work.
- The Blue Infrastructure Assessment: specifically focuses on aquatic values and the aquatic/terrestrial interface; surveys aquatic, wetland and shoreline natural resources and identifies areas of highest ecological and economic value; currently under development
- Strategic Forest Lands Assessment: specifically focuses on forests; identifies forested areas of highest ecological and economic value
- Shorelines Online: A survey of shoreline condition
- Sea level rise projections

Other studies and programs

- Restoration of Blackwater Wildlife Refuge marshes: ongoing study that is building up degraded marshes by sediment replenishment and marsh grass plantings

RRI-2 – Coastal Hazard Areas Realignment Plans

Option Description

Require local governments to develop Coastal Hazard Areas Realignment Plans, as a component of their comprehensive planning process. This option would direct local governments to consider sea-level rise and storm hazards and the implementation of appropriate adaptation responses in a defined geographic area.

This option would require the addition of a new Coastal Hazard Areas Realignment Plan Element (CHARPE) in future updates of county comprehensive and municipal plans to ensure consistency with key sea level rise adaptation and response recommendations advanced by the Maryland Commission on Climate Change. The new requirement would collectively address multiple planning related issues affecting growth and development and the conservation of existing and future natural resources in areas most likely to be affected by sea level rise and storm hazards over a 20 year plus planning horizon. The CHARPE would identify the physical boundary of the planning area based on state maps, guidelines and local government interpretation of available sea level rise and storm surge hazard scenarios. The purpose of the plan is to identify where gradual realignment of existing structures, population density, land uses and management approaches will be required to protect the long term health, safety and welfare of Maryland residents. At a minimum the CHARPE would address potential threats in affected areas and strategies for a phased implementation response under the following categories:

- land use, zoning and population density and related incentives/disincentives to reduce property damage and threats to human health; and
- the provision of community infrastructure such as roads, schools; public safety and medical facilities; water and wastewater systems; gas, electrical and communications utilities; and
- the maintenance of existing and future natural resource lands and wildlife habitat, and working lands (i.e. agricultural and forest lands); and
- adaptive shoreline erosion control (non-structural and "living shorelines" approaches) and buffer management strategies, including the accommodation of future wetland migration corridors where limited or no development is allowed

Planning guidelines would be developed jointly by the Departments of Planning, Natural Resources and the Environment to ensure consistency and clarity and to facilitate the integration of the new plan element with existing comprehensive planning and zoning requirements. The public must be informed about future impacts and involved with shaping the likely adjustments needed to avoid serious consequences anticipated from future sea level rise and coastal hazards. Of particular importance is the need for a CHARPE to clearly identify, under various scenarios, how the provision of public infrastructure may change, i.e. whether or not local governments plan to fortify and/or rebuild damaged infrastructure; reduce the footprint of vulnerable or damaged infrastructure; or abandon or relocate critical public infrastructure components. Local

governments should also evaluate the estimated costs and benefits of proposed solutions and associated funding mechanisms. These analyses and decisions are of monumental importance to existing and future property owners, insurers, emergency personnel, local, state and federal government agencies, elected officials, the business community and others.

Option Design

Define specific objectives and/or structure to be recommended, and provide a bulleted summary regarding the overall option design modalities, as per the categories listed below.

- **Targets:** 100% of all vulnerable developed and undeveloped coastal areas that could be affected by sea level rise over 20 years and category II or greater hurricanes. Local governments would be granted the flexibility to expand the planning horizon to greater than 20 years or larger hurricane or flood events.
- **Timing:** 2008 prepare proposed administration legislation; 2009 seek passage of legislation; 2010 prepare administrative guidelines, technical assistance materials; 2011 – first year that new local comprehensive plans must incorporate new CHARPE elements.
- **Parties Involved:** Maryland Department of Planning, Department of Natural Resources, and Department of the Environment.
- **Other:** Maryland Association of County Organizations, Maryland Municipal League, affected local governments in Maryland's coastal zone; NOAA, USGS, Corps of Engineers

Implementation Mechanisms

Implementation of these recommendations would include amendments to Annotated Code of Maryland Planning Article 66B to expand sensitive areas, and/or add a section on sea level rise under county comprehensive plans and/or local hazard mitigation plans. Additional modifications to the Chesapeake Bay Critical Area Act (Natural Resources Article, §8-1807) and implementing Criteria (COMAR, Title 27) to enhance sea level rise adaptation and response might be required.

Related Policies/Programs in Place

The Maryland Coastal Program Coastal Communities Initiative provides technical and financial assistance to local governments to promote the incorporation of natural resource and/or coastal management (e.g., coastal hazards, public access, water-use activities) issues into local planning and permitting activities. Additionally, a number of state sponsored activities are currently underway that relate to this option including hazard mitigation planning; incentives and technical assistance for soft shoreline erosion control; sea level rise and storm surge mapping; green and blue infrastructure assessments; and an evaluation of growth management tools in coastal areas. These activities and technical resources will be valuable assets to local governments as they development their CHARPEs.

RRI-3 – Monitoring Programs

Option Description

Adapt Statewide monitoring programs or create new monitoring programs to detect biological, physical and chemical responses to direct and indirect effects of climate change. Systems monitored should include forests, wetlands, streams and other surface water bodies (lakes, rivers, estuaries), ground water, indicator species and other wildlife.

Option Design

- **Targets:**
- Identify "Leading Indicators"
  Convene a panel of experts to determine the appropriate indicators of climate change and appropriate indicators of Maryland's management response or efforts to address (adapt or mitigate) climate change. Indicator groups could include:
    - Biophysical indicators of whether global warming is having an effect
    - Measures of existing vulnerabilities
    - Measures of how much effort (physical and regulatory) is being put into trying to reduce existing vulnerabilities or adapt or respond to those that can't be reduced.
    - Focus on leading indicators of the incentives and constraints that influence adaptive and/or mitigated responses/decisions to climate change which will allow determination of whether unfavorable conditions are likely to get better or worse and how the State could be better able to focus on how much things need to change to improve the situation.
    - Avoid monitoring "after the fact" performance indicators (D- for DO in the Patuxent River) to show how bad our past decisions have been. Develop and monitor leading indicators of future performance (F for enforcement of land use restrictions in the Patuxent River watershed) which measure how current decisions should change.

Define specific objectives and/or structure to be recommended, and provide a bulleted summary regarding the overall option design modalities, as per the categories listed below.

- **Timing:** To be determined.
- **Parties Involved:** To be determined.
- **Other:** As needed, identify other factors/parties that would need to be engaged for successful implementation of the option in the state.

Implementation Mechanisms

For monitoring programs currently in place, sampling strategies and data analysis could be modified to allow assessments of climate change effects. See next section for example.

Related Policies/Programs in Place

MANTA's Maryland Biological Stream Survey

Since 1994, the Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division (MANTA) has sampled and assessed more than 2,000 freshwater, wadeable streams for biological, habitat, and chemical quality through the Maryland Biological Stream Survey (MBSS). Stream quality indicators have been developed for fish, benthic macroinvertebrates, salamanders, and physical habitat. MBSS results have been used in a variety of ways, including 1) watershed characterizations (i.e., targeting areas in need of both restoration and protection) via the Clean Water Action Plan and the resultant Watershed Restoration Action Strategies, 2) listing impaired streams for MDE's 303d list, 3) evaluation of stressors to aquatic fauna, and 4) determining geographic ranges of rare, threatened, or endangered aquatic species.

DNR's MBSS has gained a reputation as one of the best stream monitoring programs in the country. Through an exhaustive QA/QC program, the MBSS has provided high quality, defensible data for use by other state agencies, federal agencies, local governments, consultants, and watershed organizations. Core MBSS staff have about 80 years of collective experience in ecological assessments in Maryland streams and elsewhere. They have authored or co-authored several peer-reviewed papers, award-winning documents, and technical reports. A comprehensive list of MBSS-related publications can be found at http://www.dnr.state.md.us/streams/mbss/mbss_pubs.html .

MANTA's Sentinel Site Network

To track natural variability in stream chemical, physical, and biological conditions, the Maryland Biological Stream Survey (MBSS) established a long-term monitoring component, the Sentinel Site Network, in 2000. The Network consisted of 26 of the highest quality, minimally disturbed streams in Maryland based on physical, chemical, and biological data collected by the MBSS from 1995-1997. These streams represent all geographic regions and stream sizes ranging from 1st through 3rd order. These streams were also located in catchments that would not likely experience increases in anthropogenic disturbances. Since 2000, the MBSS has collected chemical, physical, and biological data at each sentinel site each year. This annual monitoring provides the means to assess natural changes in stream water chemistry, physical habitat quality, and biological communities that occur in minimally-disturbed streams.

In addition to the effects of natural and anthropogenic factors at the local scale, the large-scale threat of global climate change will also have measurable effects on the non-tidal streams of Maryland, including the minimally-disturbed sentinel sites. Long-term monitoring of sentinel sites offers the best hope for detecting the probable effects of global climate change (e.g., temperature increases and flow alterations) on Maryland's non-tidal streams/rivers and will provide important information for the management of stream resources in the face of this threat.

Modifications to MANTA's Sentinel Site Network

To better detect the effects of global climate change on Maryland's non-tidal aquatic ecosystems, MANTA is currently considering short-term and long-term modifications to the Sentinel Site Network. The timeline below illustrates our proposed modifications:

2008-09
Collect ambient air and stream temperature data at the 26 sentinel sites using Hobo ™ temperature loggers throughout the entire year. MANTA is currently collecting stream and air temperature data at these locations during the summer (June through August). Over the next two years, MANTA will evaluate/screen existing ecological data to identify new sentinel sites throughout Maryland to expand the Network to 50 sites. Although an extensive amount of ecological data is currently collected at sentinel sites, MANTA will finalize sampling protocols for the collection of additional physical data at all or a subset of these locations (e.g., continuous stream flow, groundwater temperature, shallow groundwater level, etc.). These modifications will be accomplished within the current MBSS budget.

2010
Initiate a more comprehensive monitoring program (50 sites with additional data collected at all or a subset of sites) that can detect the effects of global climate change on Maryland's freshwater streams and rivers. Additional funds that will be needed to implement these modifications to the existing Sentinel Site Network are estimated to be $150,000 - $160,000.

MANTA's Proposed Monitoring Program for Tidal Freshwater Ecosystems

The MBSS is a comprehensive program that collects biological, chemical, and physical habitat data from ***non-tidal*** streams and rivers in Maryland. However, MANTA realizes that there is a paucity of information available on tidal freshwater streams and rivers in Maryland. Currently, ecological data is not being collected in these unique, transitional habitats and extending the MBSS downstream to include tidal freshwater streams and rivers is beyond the current MBSS budget.

Climate change will significantly impact tidal freshwater ecosystems in Maryland. An extensive literature review illustrated that sea level rise projections in Maryland range from 2 to 4 feet by the end of this century. If these sea level rise projections are accurate, there will be significant changes in the physical, chemical, and biological conditions unique to these aquatic ecosystems. MANTA is currently in the early stages of developing a monitoring program to evaluate the impacts of climate change on these systems. The following outlines MANTA's current thinking.

- Identify 3 long-term monitoring sites in each 6-digit river basin containing tidal freshwater ecosystems (total number of sites = 42)
- Develop/modify sampling protocols for the collection of physical, chemical and biological data in these systems
- Implement the new monitoring program in 2010

New funding that will be required to implement this new monitoring program to assess the effects of climate change on Maryland's tidal freshwater ecosystems is estimated to be $250,000

RRI-4 – Forest and Wetland Protection

Option Description

Use enforcements, financial incentives, and educational outreach to retain and expand forests and wetlands in the Critical Area and other areas subject to storm surge and sea level rise to enhance adaptive response to climate change. The aim of this option is to develop actions that prioritize retention or forest and expansion of forests and wetlands in rural and developed areas that are expected to be impacted. The expected benefits of this option include protection from shoreline erosion, reducing peak runoff during storm events, and avoiding stranded infrastructure.

Critical Areas, buffers, and other future impact areas will be targeted for forest establishment and expansion based on elevation and landscape planning. Future forest and wetlands areas will provide replacement zones for wildlife migration and movement corridors. Research efforts are needed to develop more water and salt tolerant plant species as sea level rise impacts move inland. Forest conservation incentive policies will be increased in targeted areas emphasizing not only preservation and expansion, but forest management issues that optimize forest health.

The climate change benefits are multiple as these forests and wetlands will continue to sequester carbon until called upon to provide a critical storm barrier. Water and air quality, wildlife habitat and multiple other natural resource improvements will be side benefits of implementing this option. Increased forests provide "green" renewable resources for wood products for construction and fuels. Forest industry jobs and related fields help the economy of Maryland.

Option Design

Targets:

1. Undeveloped areas within 1000 ft of mean high tide (current Critical Area definition), floodplain areas in the coastal zone, and areas prone to salt water intrusion are potential areas to target for expansion and protection, preventing further development. Already developed areas will consider all opportunities for tree establishment, raingardens, and other green infrastructure.
2. Future impact areas based on elevation mapping (< 5 ft. in elevation) become priority forest retention and establishment areas. Lower areas are more suitable for salt-tolerant woody species or for wetland establishment, especially where connected to existing wetlands.
3. Realize a goal to have 70% of the riparian area in Maryland forested. Accelerate the timeline to achieve such a goal (i.e., by 2025).
4. Create or augment dedicated sources of local funding, such as through ballot initiatives, for the conservation of forests and support these through state matching grants.

5. Identify and develop programs to enhance and protect wildlife corridors and maintain connectivity of green forest core areas across the landscape.

- ***Timing:*** Program will be implemented in 2009 due to the need to establish forests areas as soon as possible. This will maximize the benefits of growth prior to future needs. An intensive public relations effort will begin prior to full implementation (2008-2009) to the citizens of Maryland, but particularly to the citizens of future impacted areas of the sea level rise issue and the values of promoting and enhancing forest areas. This program should run indefinitely (continuous) and be evaluated every 5 years for effectiveness.

- ***Parties Involved:*** The Maryland Dept of Natural Resources and the Dept. Of Agriculture will be lead agencies involved in the implementation of the program. Infrastructure is already in place through several cooperative programs such as CREP utilizing Soil Conservation Districts as the on-the-ground contact for landowners. DNR and Dept of Ag can provide the promotional staff and resources to identify and target contact areas. Some overlap with existing programs of the federal Natural Resources Conservation Service (NRCS) is noted. Numerous other national, regional, and local private nonprofit organizations also conduct and support land protection (e.g., land trusts) and wildlife enhancement activities (e.g., wildlife and waterfowl habitat restoration groups).

- ***Other:*** County and local governments must become involved in this endeavor both in promotional and implementation efforts including land use planning and zoning efforts.

Implementation Mechanisms

For restoration of riparian forest buffers and wetland restoration, this option can be implemented through existing programs such as CREP and WRP. Other forest restoration incentives are limited and more need to be created. There may be opportunities to use other Farm Bill program and funds to promote forest restoration. Staffing and funding must accompany the program as current on-the-ground and support resources are minimal at this time due to funding cuts and staff reductions.

For conservation, ideally new state legislation that provides matching grants to local government for forest land protection would be invoked. This would accompany local government initiatives, passed by voters, to create dedicated funds to protect these lands and qualify for matching state funds. There may be opportunities to use other Farm Bill program and funds to promote forest protection and management. Staffing and funding must accompany the program as current on-the-ground and support resources for forests are dwarfed by those provided for protection of farm lands.

RRI-5 – Watershed Planning and Management

Option Description

Use a watershed approach, in both urban and rural settings, to locate, plan and design new development and transportation improvement projects. The aim of this measure is to include in the planning process estimations of vulnerability for new or modified infrastructure to sea level rise and storm surge. This process will consider broad floodplain management criteria such that development occurs in areas that best reduce and minimize storm and flood hazards, facilitate natural infiltration, protect/restore riparian buffers, wetlands and forests and allow wetland migration corridors.

Option Design

Targets:

- Identify all public and private land at risk from sea level rise and storm surge. Updated floodplain mapping combined with predictive mapping of storm surge associated with specific weather events should be undertaken by DNR.
- Coastal counties and municipalities will include sea level rise and storm surge vulnerability into comprehensive planning and project-specific planning. To the maximum extent practicable, future development should be located outside of mapped sea level rise and storm surge vulnerable areas.
- State, Federal, and local transportation planners will include sea level rise and storm surge vulnerability into short and long range transportation planning to avoid infrastructure expansion into vulnerable areas. Where existing infrastructure is already vulnerable, options should be evaluated to minimize risks, move infrastructure from vulnerable areas, or otherwise reduce vulnerabilities.
- All new development and transportation projects must include advanced "environmental site design" techniques for stormwater such as infiltration, use of natural features, and bioretention over traditional stormwater management techniques. Stormwater management calculations must also take into account anticipated changes in precipitation associated with climate change in the Mid-Atlantic region and seek to accommodate potentially greater volumes of stormwater within the watershed without creating or exacerbating downstream water quality and habitat problems.
- Provide disincentives for development within high vulnerability areas by ensuring that public funds are not spent on infrastructure that supports new development within vulnerable areas.

- ***Timing:***

- ***Parties Involved:*** DNR,local governments, MDP, MDOT – SHA, USDOT-FHWA, local governments, County and municipality planning departments, MDE, engineering/design consultants, development community
- ***Other:***

Implementation Mechanisms

- Augment mapping updates currently underway at DNR.
- Legislatively required as another comp plan element. Is there a way to connect this to availability of public funds (similar to PFAs?)
- Executive order or legislation? For federal transportation projects perhaps an MOU between the State and Feds?
- In 2007, MD passed a new law requiring ESD of all new development and redevelopment; therefore, this target should be achieved through the development of meaningful regulations reflecting the new requirement, the training of local jurisdictions, and denial or permits/authorizations for development that fails to address the new requirements fully. Additionally, public dollars should be focused on retrofits of inadequate stormwater controls in vulnerable areas with focus on improving watershed-wide sensitive features, such as wetlands, stream channels and floodplains.

Related Policies/Programs in Place

- existing DNT efforts
- HB1141 – water resource element requirement for local comp plans
- Montgomery County road code – I tried to find more information on this, but have been unsuccessful
- Existing SWM law (HB786 – 2007); draft regulations and SW Manual revisions underway at MDE);

RRI-6 – New Guidelines for Local Planning Capacity

Option Description

As part of a comprehensive strategy to reduce Maryland's climate change vulnerability, the state will work with local governments to identify their capacity to plan for and adapt to sea level rise. This recommendation consists of:

- A survey of local governments throughout the state to assess the planning measures already in place for sea level rise, what are some perceived barriers, and how best to share information between state, county and local governments
- A technical review and assessment of planning guidelines used by local communities and municipalities within the coastal zone
- Guidance to assist local governments with identifying specific measures (e.g., local land use regulations and ordinances) to adapt to sea level rise and increasing coastal hazards.

The technical review and assistance in modifying current guidelines should follow a four step sea level rise and coastal hazards planning process: (1) a Vulnerability and Impact Assessment, utilizing mapping and modeling products and technologies for assistance; (2) an assessment of Long-Range and Comprehensive Planning documents to assess whether sea level rise or coastal hazard mitigation has been addressed and recommend provisions guiding future growth and development out of harms way; (3) a review of Code, Regulation and Development Standards for sea level rise and coastal hazard planning applicability and effectiveness; and (4) Public Education and Outreach geared toward the implementation of a peer-to-peer information network for local elected officials. The education and outreach component should also promote policy development and code/ordinance adoption for local governments, and assist homeowners in addressing such issues as land management techniques, shore protection measures, and construction methods.

Option Design

- **Targets:** Conduct survey and technical review of current planning guidelines for 100% of the coastal communities and municipalities, and implementation of peer-to-peer education and outreach network.
- **Timing:** Survey completed by 2009, followed with the development of a peer-to-peer education and outreach network; begin technical review and four phase planning process by 2010.
- **Parties Involved:** Maryland Department of Planning, Department of Environment, and Department of Natural Resources.
- **Other:**

Implementation Mechanisms

Recommendations resulting from the technical review and assessment of current planning guidelines might include amendments to Annotated Code of Maryland Planning Article 66B add a section on sea level rise under county comprehensive plans and/or local hazard mitigation plans.

Related Policies/Programs in Place

The Maryland Coastal Program Coastal Communities Initiative provides technical and financial assistance to local governments to promote the incorporation of natural resource and/or coastal management (e.g., coastal hazards, public access, water-use activities) issues into local planning and permitting activities. Expansion of this program could supply funding for this recommendation. Additionally, the Coastal Program is currently funding and assisting Worcester, Somerset, and Dorchester Counties with the four phase technical review and sea level rise and coastal hazard planning process. The State's 1992 Economic Growth, Resource Protection, and Planning Act articulated the State's Smart Growth policy through seven visions centered around concentrating development in suitable areas, protecting sensitive areas, and establishing funding mechanisms to achieve the visions. Currently, the State has over 80 programs that help to further Smart Growth.

RRI-7 Modify Environmental Protection Regulations

Option Description

Modify the Tidal Wetlands and Critical Areas laws and/or regulations to promote sustainable shoreline and buffer area management practices on public and private lands. These modifications should incorporate the following elements:

- A requirement for state and local governments to cooperatively develop comprehensive shore erosion management plans that determine and specify the type and location of shore protection practices based on their physical and hydrodynamic setting. Additional attention should be given to manage a continuum of habitat and natural resource features that extends from shallow water habitats, beaches and wetlands to upland forested buffers.

- Amend State statutes and regulations to remedy jurisdictional gaps and conflicts between State and local governments within the 100-foot Critical Area buffer.

- A requirement for permit applicants to demonstrate that their preferred erosion control alternative is least disruptive to the shoreline and critical area buffer; and has the least potential to adversely affect natural resources subject to long term erosion. To guide applicants, the State will develop a preferential order of erosion control alternatives and practices, which are presumed to progress from the least to most detrimental effect on natural resources. DNR's Shoreline and Erosion Control Program should be reoriented to promote the installation of innovative shore protection techniques that maximize habitat restoration and enhancement.

- A revision to current tidal wetland regulations enabling private land owners to rebuild storm damaged tidal marshes, including the placement of additional clean sandy fill, plants and temporary biodegradable structures to protect rebuilt areas. Currently, introducing clean sandy fill material requires a state permit, while simple planting of wetland species on existing substrate in the correct hydrologic and salinity regime does not. Repairs would be authorized only if conducted under guidelines issued by the Maryland Department of Environment.

- A requirement directing state agencies to jointly develop and maintain up-to-date guidelines that describe preferred shoreline and buffer management practices that will facilitate climate adaptive strategies for coastal environments subject to sea level rise, erosion and storm hazards.

This option recognizes the need for both planning and permitting level efforts to guide landowner choices in managing shoreline erosion control practices. Designing and

implementing a specific shoreline erosion control practice that achieves a balance between protecting the landowner and minimizing disruption to the coastal environment under state jurisdiction is a complex task. Past efforts to mandate local shoreline erosion control plans, under the Critical Areas law were unsuccessful due to a number of factors. An increased understanding of non-structural and structural erosion control alternatives at the practitioner level; new mapping resources, shoreline inventories and web enabled analytical tools are sufficiently in place to facilitate local comprehensive erosion control management plans. Adopting a collaborative state-local approach to developing such plans will maximize the odds of success.

Option Design

- **Targets:** Implement recommended regulatory and planning requirements for 100% of the area subject to tidal wetlands permitting authority.
- **Timing:** Make required regulatory changes by 2009; promulgate guidance manual by 2010; initiate shoreline management plans by 2011.
- **Parties Involved:** Critical Areas Commission, Maryland Department of Environment, Maryland Department of Natural Resources.
- **Other:** Resource Conservation and Development agencies, local governments in the coastal zone, Board of Public Works, Wetlands Administrator, Army Corps of Engineers other federal resource management agencies.

Implementation Mechanisms

Implementation of this option will include a combination of executive, legislative and programmatic actions. Potential actions will include regulatory amendments to Title 16 of the Environment Article (Wetlands and Riparian Rights Act) to remedy jurisdictional gaps between State and local governments within the 100-foot Critical Area buffer and revise permitting process; modifications to COMAR Title 27 "order of preference" for shoreline protection treatments; and the Annotated Code of Maryland's Natural Resources Article (§8-1001 through 8-1008) to reorient the Shoreline and Erosion Control Program.

Related Policies/Programs in Place

A number of state sponsored activities are currently underway that relate to this option including incentives and technical assistance for soft shoreline erosion control through the Department of Natural Resources Shoreline and Erosion Control Program; sea level rise and storm surge mapping; and green and blue infrastructure assessments. Development of technical assistance tools and products are essential for identifying areas at risk and determining appropriate shore erosion treatment, and currently include: the Erosion Vulnerability Assessment (EVA) and Planning Tool, focusing on defining important infrastructure and environmental risk attributes in the coastal landscape that are vulnerable to shoreline erosion within the next 50 years; and a Living Shorelines Suitability tool being created for Worcester County that identifies areas that are not suitable for living shoreline treatments, those that are suitable and those that may be suitable with design restrictions.

Additional Priority Options to Be Drafted

RRI-8 – Impacts Assessment for Fish Stocks and Habitat

Option Description

Conduct an assessment of the expected impacts of sea level rise on fish habitat and fish stocks. The evaluation will also identify strategies for risk reduction.

RRI-9 – Promote Sustainable Shorelines

Option Description

This option focuses on encouraging the use of living shorelines and providing landowners with technical assistance and subsidies for shoreline stabilization projects. Here we will need to look at current regulatory and non-regulatory programs for vulnerable areas and identifying gaps in Bay-Stat report recommendations. Aspects of this option are covered in RRI-7.