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Brief Description of Proposed Priority Options
Resources and Resources-Based Industries Technical Working Group
DRAFT

RRI-1. New Criteria for Identifying Natural Resources Priority Protection Areas

Option Description

This option provides the technical and scientific foundation for developing and testing new and existing criteria for identifying priority protection areas. The assessment will focus on identifying undeveloped lands and ecologically and economically important land and aquatic areas (including important habitats and marsh migration corridors) that will be critical for targeted conservation and coordinated restoration in response to sea-level rise and its associated effects. The assessment will also address the future distribution and condition of underwater habitats and resources such as Submerged Aquatic Vegetation (SAV) and oyster beds. This information will be fed into other policy options to strategically and cost-effectively direct and implement specific conservation, restoration and growth management actions.

Rising sea level will impact coastal ecosystems and natural resource lands. These resources provide important ecosystem services and benefits. Coastal resources support wildlife habitats, have regional significance for migratory birds, sequester large amounts of carbon, provide sediment and nutrient water quality and flood control benefits, and generate economic benefits through farming, forestry, fishing and passive recreation. Preserving undeveloped, vulnerable lands also offers a significant opportunity to avoid placing people and property at risk to sea level rise and associated hazards including storm surge, coastal flooding, and erosion.

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 other unsuitable physical factors 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. Existing assessments should be used to develop GIS-based and modeled criteria. These criteria should be ground-truthed and enhanced by additional field-based criteria.

The objective of this option is to identify target areas where strategic management actions, identified in other policy options, can be focused to buffer against the impacts of sea level rise and other climate changes. These actions can include expanding the priorities for existing land conservation to promote horizontal marsh migration, risk reduction and other land use goals. Other actions may focus on appropriate areas for restoration or rehabilitation projects, such as sand and sediment replenishment to fuel the vertical growth of wetlands, barrier removal or other

coastal ecosystem and land management practices.

Option Design

Targets:

- Identify high priority ecological and economic natural resource lands and aquatic habitats in the coastal zone (a condition assessment).
- Identify coastal land areas that will be important for wetland migration corridors, for maintaining ecosystem integrity and connectivity, to support farming, forestry and fisheries industries and to confer risk reduction to coastal communities in response to projected sea level rise inundation and coastal flooding scenarios (a functional assessment).
- Determine through conserved lands and protective zoning overlays where high priority coastal lands are currently protected and where strategic conservation and forest and wetland restoration targets should be identified.
- Develop a peer-reviewed method for modeling wetland migration resulting from sea-level rise.
- Develop a set of field-based criteria to further identify the suitability of lands for protection and/or restoration in order to ensure eligibility for implementation programs.

Timing:

- Within the first year, develop a scoping plan for conducting the study which includes identifying existing data and models, determining what additional data, models and criteria are needed, developing a timeline to include initial assessment using best available information and additional assessments as new data, models and criteria are developed, and determine the level of staffing and funding resources needed to complete each phase of assessment.
- Implement the assessment plan over the following 2 years provided technical resources can be secured. Phase I implementation can include an initial and coarse level assessment of resource priorities, current level of protection and resource vulnerability to sea level rise using results existing resource assessments and sea-level rise projections.
- Field studies may need to be conducted in order to develop and test specific criteria. For examples, indicators may need to be developed that would allow formerly upland agricultural lands that are transitioning into wetlands to be eligible for wetland restoration funds or wetland regulatory protection. The timing of this would be dependent on the programs being concerned for adaptation responses as detailed in other policy options.

Parties Involved:

- Resource assessment, threat analysis and model development should be completed by MD DNR, UMD and other technical and scientific organizations.

- The MDP should evaluate the degree of current protection of vulnerable lands targeted as conservation and restoration priorities through local and State growth management controls MDE to evaluate degree of protection through regulatory mechanisms

Implementation Mechanisms

Implementing this recommendation would require the investment of staff and funding to complete the analysis, conduct any needed specialized studies and document and publish the results. Potential funding mechanisms that could be explored include Section 309 (Coastal Zone Management Act) Coastal Enhancement Strategies dealing with coastal hazards. A National Oceanic and Atmospheric Administration (NOAA) Coastal Zone Management fellowship could also be pursued to recruit the staffing expertise needed for developing the first year plan and focusing on Phase I implementation.

Related Policies/Programs in Place

Existing natural resource assessments can be used, in concert with other modeling and mapping efforts. In addition, existing conservation priorities, such as DNR's Priority Conservation Areas, those identified in Maryland's Coastal and Estuarine Land Conservation Plan and other agency conservation targets.

Existing resource assessments and conservation priorities include the following:

- The Green Infrastructure Assessment (DNR): 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 (DNR): 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 (DNR): specifically focuses on forests; identifies forested areas of highest ecological and economic value
- Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland (MDE): Uses GIS to map and and rank opportunities for wetland restoration, mitigation and preservation.
- Shorelines Online (DNR): A website that provides a digital GIS survey of shoreline condition (built, soft/hard stabilization, naturalized), erosion rates and habitat benefits. GIS-based sea level rise inundation areas are also available on the site.
- Sea level rise projections, elevation assessments and inundation maps (DNR)
- DNR Priority Conservation Areas: DNR's Program Open Space has identified landscapes with high ecological value (based on Green Infrastructure and other resource assessments) and designated these areas as Priority Conservation Areas. POS then focuses in on a subset of these areas to target its ecologically based land conservation objectives.

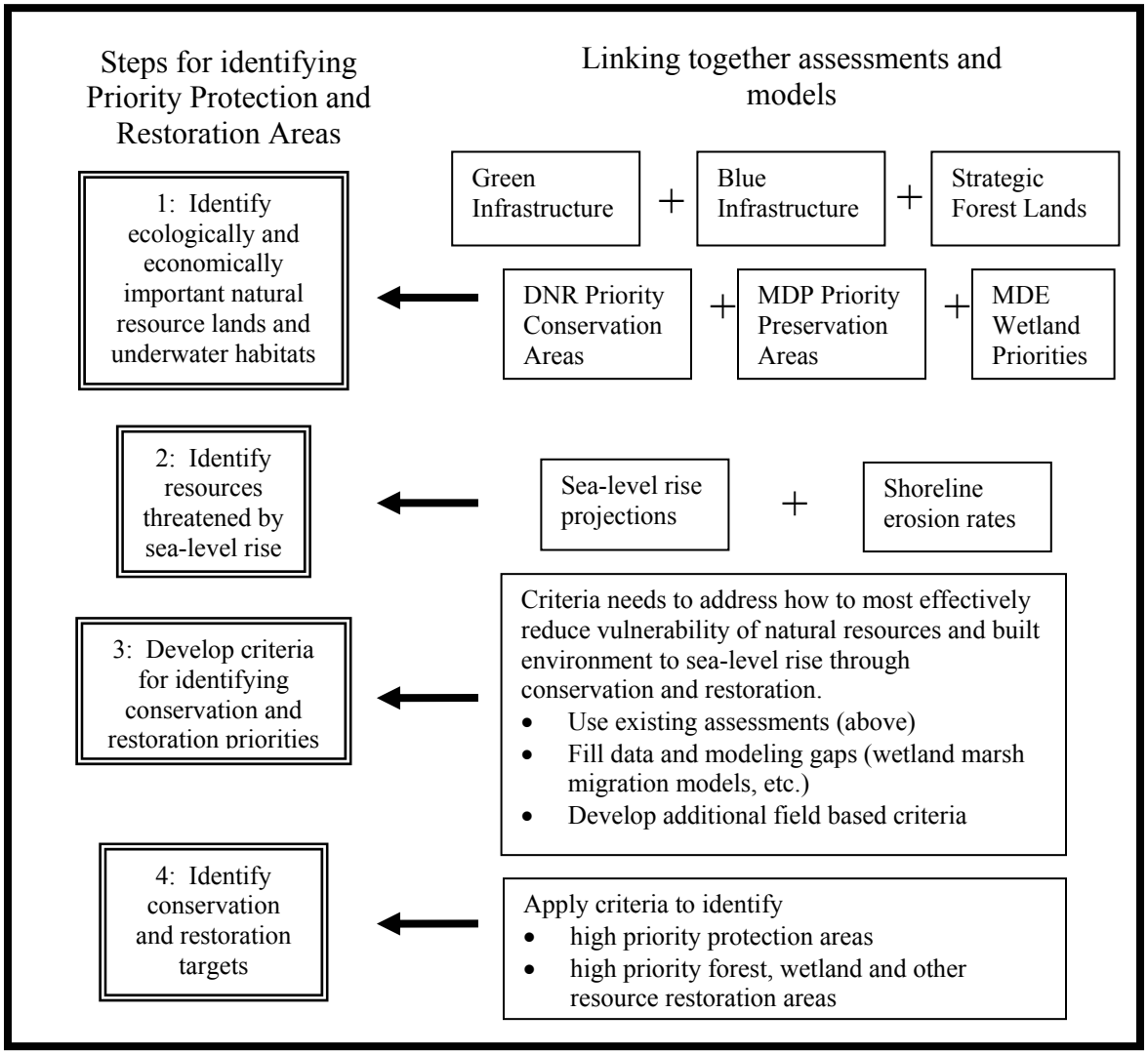
- MDP Priority Preservation Areas: These areas have been identified, as required through the 2006 Agricultural Stewardship Act (House Bill 2; 2006), as high priority agricultural resource lands and will be the targets for agricultural land preservation programs.

Other studies and programs

- Restoration of Blackwater Wildlife Refuge marshes: This is an ongoing study that is building up degraded marshes through sediment replenishment and marsh grass plantings. Marsh accretion and carbon sequestration is being intensely monitored at this site and will provide the basis for field and modeled criteria and factors for determining suitable marsh migration corridors and restoration sites (University of Maryland, US FWS, MD DNR, Constellation Energy).
- Sea Level Affecting Marshes Model (SLAMM): This is an EPA funded modeling effort first developed in the mid-1980s and currently being refined as version 5. Results for the Chesapeake Bay will be available by mid-2008 and were funded by The National Wildlife Federation.

Integration Strategy

A framework diagram will illustrate how these various assessment and models could be linked together to determine the location of high priority natural resource conservation and restoration areas.



Estimation of Adaptation Benefits and Costs

The costs associated with implementing a program of identifying priority areas for strategic management actions will be incremental to those already incurred to develop and maintain existing natural resources assessments. These incremental costs fall into four major categories: staffing, assessment, equipment, and maintenance. The primary cost associated with this option involves recruiting dedicated staff to develop the scoping plan and conduct the resources assessment. Assessment costs involve the costs associated with developing and testing new methodologies and criteria for prioritizing protection areas. Equipment costs involve the costs associated with any new equipment (e.g., gauges) and/or software (e.g., database management)

that are required to complete field studies. Finally, there will likely be a set of annual costs associated with the maintenance of physical equipment and database systems.

The benefits associated with identifying priority protection areas center on the flexibility that this information offers to other programs that seek to implement strategic actions to protect against the anticipated impacts from sea-level rise.

Feasibility Issues

Implementation feasibility is largely hindered by inadequate staffing and funding resources. For the first year, one full-time staff member at DNR would need to be dedicated to the development of the resource assessment plan, to coordinate the necessary peer review required to approve and move forward with the plan and to direct early action analysis. The analytical steps outlined in the flow diagram could be separated into two work phases.

Early action phase: The technical assessments needed to complete Steps 1 and 2, are complete, except for the Blue Infrastructure Assessment (completion date targeted for December 2008). Preliminary analyses to coarsely identify resources at risk could begin immediately if dedicated staff time and expertise could be identified for both technical analysis and technical direction.

Project coordination and final product phase: Significant review and coordination with relevant scientific and technical expertise needs to be initiated within the next year to begin the development of criteria and the identification of model and data gaps (Step 3). Technical direction and documentation of the final product listed as Step 4 is also needed. This will require the funding and dedication of one full-time staff person, in addition to other staffing and resource investments needed to complete the comprehensive identification of high priority protection and restoration areas.

Status of Group Approval

Barriers to Consensus

RRI-4 & RRI-11. 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 expansion and retention of working forests and wetlands in areas suitable for long-term survival and ambient land-use 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. The forest and wetland protection option for adaptation and response builds upon the Mitigation proposal and analysis done by the Agriculture, Forestry, and Waste (AFW) Management Technical Work Group, especially AFW-3 and AFW-4.

Critical Areas, buffers, and other non-urban, 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 immeasurable side benefits of implementing this option. Increased forests will provide local needs for renewable resources such as wood products for construction, pulp, and fuels, the demand for which will increase.

Option Design

Targets:

1. Use the product from RRI-1, the new criteria for identifying priority protection areas, to identify priority forest and wetlands for protection, such as 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 appropriate opportunities for setting and realizing tree canopy goals, establishing raingardens, and promoting other means of green infrastructure to simulate the benefits of intact forest and wetlands.
2. Develop, package, and market new and existing incentive programs to landowners for ease of targeting protection and restoration.
3. Future impact areas, based on elevation mapping, 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.

4. Create and augment dedicated sources of local funding, such as through ballot initiatives, for the conservation of forests and support these through state matching grants (New Jersey model, see below).
5. Identify and develop programs to enhance and protect migration corridors from shorelines to inland habitats and maintain connectivity of forest core areas across the landscape.
6. Provide officials and staff to better enforce existing laws such as Critical Areas.

Timing: Program will be implemented in 2009 due to the need to establish and conserve forested areas as soon as possible. This will maximize the benefits of the new forest or wetland prior to their need as replacement habitat. 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 regularly for effectiveness and when new information becomes available.

Parties Involved: The Maryland Dept of Natural Resources and the Maryland Dept of Agriculture will be lead agencies involved in the implementation of most aspects of this Option. Technical assistance infrastructure is already in place, especially for restoration, through cooperative programs such as the Maryland Forest Service, Soil Conservation Districts, and Agriculture and Forestry Extension Agents as the on-the-ground contact for landowners. DNR and MDA can provide some 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 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). Maryland legislature would have to approve new incentives for land protection.

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

Identification of priority working forests and wetlands to protect will be implemented as identified in the mapping and analysis exercise described in RRI-1. In order to protect these priority lands, it is expected that Maryland will use a mix of increased tax benefits, easements from willing landowners, creative local financing and acquisition, and other incentive programs. The reason to invest in these lands is to avoid the costs of inundation in the built environment, and to avoid the economic and environmental costs incurred by losing these resource lands.

For restoration of riparian forest buffers and wetland restoration, this option can be implemented through existing and ramped-up Farm Bill programs such as the Conservation Reserve Enhancement Program (CREP) and the Wetlands Restoration Program (WRP). There may be untapped opportunities to use Farm Bill programs and funds to promote forest restoration. But forest conservation and restoration incentives are currently limited and are dwarfed by those provided for protection of farmlands. Additional staffing and funding will be needed as current on-the-ground and support resources for forests and wetlands are minimal at this time compared

to the past (reductions in funding and staff) and compared to what would be needed to fully implement this Option.

One researched mechanism to greatly increase available funds for land conservation without additional expenditures by state government is known as the New Jersey Model. In this Model, local governments in Maryland are enabled to post ballot initiatives to create a dedicated source of funds to protect forests and wetlands. Recent polling shows that a wide majority of Maryland voters would support such an initiative. Concurrently, state legislation would be passed to provide matching funds to those funds raised by local governments. This mechanism would conservatively generate 4x current available funding for land conservation without spending additional state funds.

Related Policies/Programs in Place

1. Maryland's Forest Conservation Act
2. Critical Areas Law
3. Maryland's Program Open Space including Rural Legacy, uses funds garnered through realty transaction taxes to acquire priority land. Land has not been prioritized according to sea-level rise, but includes other criteria such as scenic value and lands beneficial to water quality.
4. National-level policies such as the Coastal and Estuarine Land Protection Act and Forest Legacy, and conservation acquisition programs supported by The Nature Conservancy, The Conservation Fund, and other non-governmental environmental groups
5. State-level programs such as Chesapeake Bay Trust and Maryland Environmental Trust, and programs supported by organizations like the Chesapeake Bay Foundation, 1000 Friends of Maryland.
6. Various programs supported by local and regional land trusts, watershed organizations (planning, networking, and education function), and other non-governmental groups
7. Chesapeake Bay Program (CBP) water quality cap maintenance goals--- Under the Sound Land Use goal area of *Chesapeake 2000* are goals for identifying and protecting valuable resource lands. Since 2000, these goals have been better defined and geographically targeted (e.g., 2007 Forest Conservation Directive (conserve forests for water quality and riparian forests, expand use of tree canopy goals) and the Chesapeake Action Plan (due out in 2008)). There currently is no CBP goal for wetland protection.
8. Farm Bill Programs offer conservation practices such as riparian and shoreline afforestation (CREP) and wetland enhancement (WRP) that provides short-term easements of 10-30 years and permanent easements in the case of the Farm and Ranchlands Protection Act. At this point, the latter program excludes forestlands and wetlands except where they are incidental to farms.

Estimation of Adaptation Benefits and Costs

The costs of conserving and/or restoring forests and wetlands are associated primarily with capital costs of acquiring easements on the land identified as critical to buffering against the impacts of sea-level rise. These costs vary according to the implementation mechanism, or range of mechanisms used. As noted above, some federal funding, and local funding, may be able to

assist the state in this regard. In addition to acquiring easements, there are incremental costs associated with dedicating agency staff to managing conservation and restoration programs.

Maintaining healthy coastal forests and wetlands provides many important ecosystem services to the state, including protection from shoreline erosion, reduction of peak runoff during storm events, protection of water quality, and carbon sequestration. These functions of forests and wetlands directly benefit aquatic and terrestrial ecosystems by preserving habitat for native and migratory species, which in turn support the resources that sustain recreational and commercial endeavors.

Feasibility Issues

1. Proposed changes to the Critical Areas definition, which increases the initial band width on which one can not develop from 100 ft to 300 ft; this may cause confusion and a rush-to-develop in the short-term, but in the long-term will be helpful for adapting to climate change).
2. Legislative issues: identify and maximize targeted landowner incentives, and get them approved; pass enabling legislation that allows for local ballot measures to create dedicated funding for local land protection.
3. The mapping product from RRI-1 may not be available for timely use in implementing RRI-4.
4. Economic feasibility issues such as protecting expensive waterfront properties.
5. Technical feasibility issues such as developing, packaging, marketing, and processing landowner programs and incentives on a large scale.
6. Social feasibility issue of populations who insist on living and developing areas within identified sea-level rise.

Status of Group Approval

Barriers to Consensus

RRI-7 & RRI-9/EBEI-6 Sustainable Shorelines and Buffer Area Management Practices

Option Description

Shoreline erosion is a significant issue facing Maryland's diverse coastal environment. Approximately 70% of Maryland's 7,700-mile shoreline is experiencing some degree of erosion, which will worsen as a result of increased rates of sea level rise, and increased frequency and/or intensity of coastal storms from climate change. Comprehensive shoreline management must be an integral part of any future erosion control planning effort, and should aim at striking a balance between protection against erosion and preserving natural shoreline processes and habitats. Natural shorelines are essential for maintaining and promoting important aquatic and terrestrial habitats, trapping sediment, and filtering pollution. 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 now sufficiently in place to facilitate such plans. Adopting a collaborative state-local approach to developing such plans will maximize the odds of success in designing and implementing a specific shoreline erosion control practice that achieves a balance between protecting land and minimizing disruption to the coastal environment.

The recommendation for a unified approach to shoreline management was presented in the Interim Report to the Governor and the Maryland General Assembly: Climate Action Plan. As a direct result, two bills were introduced and passed in the 2008 Maryland General Assembly. The first, The Living Shorelines Protection Act of 2008 (HB 973), directs erosion control projects to consist of nonstructural shoreline stabilization measures that preserve the natural environment, such as marsh creation, except in areas mapped by the state (MDE and DNR) as being appropriate for structural stabilization measures. There is also a provision that responsibility for demonstrating that such nonstructural measures are not feasible to the Maryland Department of the Environment's satisfaction lies with the property owner. The second strengthens the Chesapeake and Atlantic Coastal Bays Critical Area Protection Program (HB1253/SB844). In general, the changes provide greater authority to the Critical Area Commission; update the basic components of the program, including the Critical Area boundary; enhance buffer and water quality protection; coordinate new development more closely with Smart Growth principles and other environmental protection/planning processes; and strengthen enforcement and variance provisions. Implementation of these legislative actions will require coordination across multiple levels of government (state, local/county, municipality), recognizing that each level of government will need to address these from different aspects.

In addition to moving the new legislation forward, this recommendation focuses efforts on filling in any gaps that remain and should incorporate the following elements:

- A reorientation of DNR's Shoreline Conservation and Management Program (formerly the Shore Erosion Control Program) to promote the installation of innovative shore protection

techniques that maximize habitat restoration and enhancement, and accommodate for projected SLR.

- Develop a general permit that streamlines the rebuilding process of 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 under guidelines issued by the Maryland Department of Environment.

- A requirement directing a joint effort of state agencies to standardize design and construction methods and protocols employed for shore erosion control structures – both new and retrofit – that will facilitate climate adaptive strategies for coastal environments subject to sea level rise, erosion and storm hazards. Guidelines should be developed and tailored for specific target audiences, including marine contracting professionals, government officials, and public citizens.

- Expand current outreach and education programs directed at the public and marine contracting professionals to help ensure a smoother transition toward broader implementation of nonstructural and hybrid techniques. Using up-to-date protocols mentioned previously, contractors can receive training about the design and installation of proven control practices that may also maintain or enhance coastal processes and habitats. Contractor training will increase the likelihood of successful installations and boost property owner confidence in the benefits of increased state oversight. A certification program should be considered as part of the implementation of this element.

- Integration of mapping and modeling products into state and local planning and implementation efforts. This should include a mechanism to update the Maryland Comprehensive Shoreline Inventory (CSI) to include type and quantity, location, and conditions of shore erosion control structures, on the order of every 5 to 10 years. This could be linked to the permitting process, to create a system for automatic entry and updates to the database for projects being proposed and implemented.

Option Design

- **Targets:**

There are 4 key targets associated with this option, as outlined below:

- Implement recommended regulatory requirements for 100% of the area subject to tidal wetlands permitting authority.
- Work with an interdisciplinary team with expertise in wetlands, coastal processes, biology, restoration, and coastal erosion control design and engineering to standardize design and construction protocols for erosion control structures and tidal shoreline habitat enhancement projects.

- Distribute modified/new design and construction standards to engineering, contractor, local governments, NGO's and property owner communities. Appropriate training will be developed for engineering and contracting outfits in order to transfer critical information about the design and installation of these innovative techniques.
- Development of a strategy for updating the Maryland Comprehensive Shoreline Inventory every 5 or 10 years.

- **Timing:** Adopt required regulatory changes in October 2008; promulgate guidance manuals and attendant training programs by 2009; have a strategy for updating CSI in place, with the first subsequent update by 2010; following CSI update, initiate shoreline management plans in 2011 with target completion date for plans by 2013.
- **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; engineering, contracting, and property owner communities; Army Corps of Engineers and other federal resource management agencies; the Center for Coastal Resources Management (VIMS); and others.

Implementation Mechanisms

Implementation of this option will include a combination of executive, legislative and programmatic actions. The first step is the adoption of regulatory amendments passed during the 2008 Maryland General Assembly. Second, updated design and construction standards and protocols for SEC structures – both new and retrofit, should be developed to include climate adaptive strategies for coastal environments subject to sea level rise, erosion and storm hazards. These guidelines should be distributed to the engineering, construction, and property owner communities via state agencies, county planning offices, and Resource Conservation and Development agencies.

Additional programs that would support the implementation of this option could include professional development programs for contractors and permit reviewers to establish a quality control mechanism, revitalizing and expanding the financial assistance program through DNR's Shoreline Conservation and Management Program, and expanding outreach and education programs for local governments and waterfront landowners.

Related Policies/Programs in Place

A number of state and federal sponsored activities and programs are currently underway that relate to this option, including:

1. The *Shoreline Conservation and Management Program* (formerly the *Shore Erosion Control (SEC) Program)*, Department of Natural Resources, provides subsidies and technical assistance for non-structural projects to Maryland property owners in resolving shoreline erosion problems along the Chesapeake Bay and its tributaries.

2. The *Comprehensive Coastal Inventory (CCI) Program* through the Center for Coastal Resources Management at the Virginia Institute of Marine Science. This program has developed shoreline situation reports for the Maryland *Comprehensive Shoreline Inventory (CSI),* which include land use, bank conditions, and shoreline features (including erosion control structures). The inventory captures baseline shoreline conditions throughout the tidal portions of Maryland's coastal counties. The CSI can be used as a state and local planning tool to inventory and assess coastal infrastructure vulnerable to sea level rise inundation or coastal flooding.
3. The Department of Natural Resources, various programs are conducting sea level rise and storm surge mapping.
4. The Department of Natural Resources Green and Blue Infrastructure Assessments (Blue Infrastructure is still under development).
5. Strategic Shore Erosion Assessment (SSEA). From 2000 – 2002, a NOAA Coastal Services Center Coastal Management Fellow worked with the Maryland Coastal Program to initiate the development of a comprehensive approach to shore erosion planning for Maryland. The Fellow was tasked with developing a protocol to create regional strategies to deal with shoreline erosion issues. The Fellow worked closely with two counties, Dorchester and St. Mary's, to identify an approach to balance the need to address risk from erosion, while also maintaining natural shoreline habitat.
6. *Erosion Vulnerability Assessment (EVA).* The Maryland Coastal Program in conjunction with VIMS, the Corps of Engineers and MDE, is participating in the development of *EVA* as a component to the Chesapeake Bay Shore Erosion Control Feasibility Study and Master Plan. This assessment is designed to evaluate stretches of shoreline and prioritize these areas for erosion control activities. The outcomes of the project will include outreach material for marine contractors and homeowners, and a guide for potential shore erosion management activities for various government agencies.
7. *Living Shorelines Suitability Tool*. The Maryland Coastal Program and VIMS are creating a tool 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. This tool is slated for completion in September 2008.
8. The *Living Shorelines Stewardship Initiative (LSSI)* is a collaborative effort by various public and private entities to promote the use of "living shorelines" (i.e. vegetated buffers) to waterfront property owners.
9. The Maryland Coastal Program (DNR) has collaborated with MDE and contractors that currently install "living shorelines" to offer outreach and education workshops for marine contractors and homeowners. Among other aspects, these courses focus on the designs, installations, permitting, and benefits of "living shorelines".
10. *Shore Erosion Control Guidelines: Marsh Creation and Sample Drawings*. MDE prepared guidance and sample drawings for marsh creation as shore erosion control practice and habitat benefit. These guidelines were developed based on completion of an MDE-funded study to the University of Maryland. Fact sheets are also available on contractor selection, practice selection, maintenance, and marsh creation.
11. *Shore Erosion Control Guidelines for Waterfront Property Owners 2nd edition*. MDE's update of its 1992 publication addresses structural and nonstructural practices. Expected to be completed in 2008.

Estimation of Adaptation Benefits and Costs

While mandating the use of nonstructural shoreline construction techniques will not have a fiscal impact on MDE's regulatory program or an adverse economic impact on marine contractors, the requirement may have other associated costs. Depending on the contractor hired to perform the work, the cost individual homeowners pay to protect their property could increase. To illustrate this point, MDE solicited prices from several marine contractors and DNR. The following table compares average construction costs for a shore erosion control project located in an area that experiences moderate wave energy. It is important to note that construction costs will generally be less in low energy areas and more in high-energy areas.

COST OF SHORE EROSION CONTROL PROJECTS		
	Revetment Dollars/Linear Foot	Marsh Dollars/Linear Foot
Department of Natural Resources	300	188
Eastern Shore Contractor #1	80	163
Eastern Shore Contractor #2	230	203
Southern Maryland Contractor	230	158
AVERAGE PROJECT COST	210	178

Additionally, Ecosystem Restoration Services and the Maryland Coastal Program of the Department of Natural Resources will likely be impacted by this recommendation. The Ecosystem Restoration Service may see an increase in shoreline property owner requests for technical and financial assistance for implementation of nonstructural shore protection practices and the Coastal Program will undoubtedly experience increased demand for their ongoing "Living Shoreline" Contractor's Training and Homeowner Education Programs. There will also be incremental costs associated with managing a program to update the Maryland Comprehensive Shoreline Inventory.

Developing clear guidelines for the design and implementation of shoreline erosion control practices has distinct benefits. As noted above, implementing this option increases the odds of success in achieving a balance between protecting land and minimizing disruption to the coastal environment. Thus, the benefits can generally be viewed as the avoided costs of property damage from storm events and the maintenance of ecosystem services provided by natural shorelines, which include sediment trapping and pollution filtering.

Feasibility Issues

The need to address professional development opportunities for the marine contracting industry is a key issue of the feasibility of this recommendation. At present, there are limited marine contracting companies that are capable of designing and installing these innovative and nonstructural approaches to shoreline erosion control. Many companies have focused on

structural erosion control techniques, such as rip-rap and bulkheads. To help ensure a smoother transition toward broader implementation of nonstructural and hybrid techniques, additional offerings of contractor training are a logical approach. The Maryland Coastal Program (DNR) has collaborated with MDE and contractors that currently install "living shorelines" to conduct a limited number of training sessions to address this emerging need. However, more training is needed to transfer critical information about the design and installation of proven control practices that may also maintain or enhance coastal processes and habitats. Additional training will increase the likelihood of successful installations and boost property owner confidence in the benefits of increased state oversight.

Status of Group Approval

Barriers to Consensus

RRI-8 Resource-Based Industry - Economic Initiative

Option Description

Resource-based industries such as forestry, agriculture, commercial and recreational fishing, and sportsmen's activities represent the economic backbone of rural Maryland. These industries are heavily dependent on the health and vitality of the Chesapeake Bay and its tributary ecosystems. While potential climate change impacts to these industries are widespread (changes in salinity, temperature, rainfall, disease, invasive species, etc.), sea level rise (SLR) and associated hazards such as storm surge, coastal flooding and erosion threaten areas where the current primary land use supports these industries. Comprehensive adaptation response strategies that investigate all possible impacts should be addressed, recognizing that many will fall outside the focus of this phase of adaptation planning.

Baseline information regarding the impacts of climate change, including SLR and associated coastal hazards, on the economics of varying sectors of resource-based trades and industries is lacking. Research within each respective field should aim to identify these potential impacts, and lead to developing an appropriate strategy to buffer such effects as well as identifying potential opportunities for expansion and development. State agencies, in cooperation with the private sector, should focus efforts on the development of long-range plans (i.e. fishery management plans, forestry management plans, marine sensitive areas initiatives, and agriculture land use plans) that are flexible enough to adjust to ongoing and future change. Such plans should be developed in ways consistent with local land use master plans, and foster small local mills and farms. This option addresses protection mechanisms to minimize the economic impacts of climate change on natural resource industries, or adaptation by the use of new non-conventional methods.

- *Fisheries-based industries*
  The total estimated value of the Maryland seafood industry is $700 million. There are 73 processing plants employing 1,360 people and over 6,000 watermen who work the Chesapeake Bay. Impacts to this industry due to climate change are largely unknown, mainly due to the uncertainty attendant to climate change effects on aquatic habitats and populations. Resource populations (i.e., crabs, oysters and finfish) and the industries associated with them are already under stress due to present land use practices, overfishing, degradation and loss of nursery habitat, and extensive inshore and coastal pollution. Conserving habitat and diversity is a present challenge, and sea level rise may further aggravate habitat fragmentation. Additionally, not knowing what population and species changes will follow makes it difficult to predict what could replace the current economic engine for which Maryland is famous. Concern over species and habitat shifts is real and likely not amenable to mitigation through traditional planning. Long-range plans for these resources will have to be innovative, and should consider all aspects of the seafood industry. This includes, but is not limited to, areas such as: the methods in which the resource populations and associated habitats are managed; processing, packaging and distribution practices; aquaculture practices; etc. in order to streamline costs and maximize

profits while ensuring sustainability.

Management efforts should focus on conserving a diversity of habitats to maintain functionality and persistence of populations so they can be resilient during times of stochastic climate conditions and associated coastal hazards. Significant opportunities for industry development might exist within the aquaculture field. Maryland currently produces a wide variety of aquatic fish, shellfish and plants, the value of which was nearly $3.4 million in 2003. Research is needed to determine whether there are additional populations that could be supplemented, restored in the wild, or generated simply for supply.

- *Forestry-based industries*

Maryland's forest products industry is a $2.2 billion industry, considered to be the largest in Western Maryland and the second largest on the Eastern Shore. The long-term profitability of the forest products industry is directly linked to a sustainable forest resource base and stewardship of forests and forest lands in a way that maintains their potential to fulfill relevant ecological, economic, and social functions to ensure the future health and usefulness of the forest. Forests, like other open space areas, are under intense development-related pressures for residential, commercial, and industrial conversion attendant to the demands of a growing population. Identifying areas where the forest products industry is likely to be viable in the long-term provides focus for effective management activities, but should also be adaptive so that if future conditions change and the forest shows signs of stress or decline, silvicultural management techniques can be adjusted. Programs and policies should be developed – through financial incentives and cost share programs – that encourage private forest and waterfront/riparian landowners to favor the retention of forests and other native habitats over development and conversion. Additional attention should address streamlining and modernizing the processing, manufacturing, reduction and/or beneficial use of waste and by-products (to create heat and/or power), and distribution aspects of this important resource-based industry.

The intent of potential industry directives should be to enhance a broad-based understanding of the measurable environmental and economic benefits attendant to a healthy forest system and the stewardship practices of private landowner and industry alike, which would serve to help Maryland meet its commitment under the Chesapeake 2000 Agreement and the 2007 Forest Conservation Initiative. Any initiatives should take into account impacts from climate change, and may include: integration and streamlining of land conservation (acquisition and easement) programs within DNR and across State agencies and local governments to better prioritize the conservation and restoration of forest and stream/coastal buffer habitats and meet the goals established by the Maryland Wildlife Diversity Conservation Plan; adopting management plans that incorporate supplemental planting on poorly stocked lands, age extension of managed stands, thinning and density management, fertilization and wood waste recycling, expanded use of short-rotation woody crops for fiber and energy, with expansion in accompanying industries (e.g. Fuels for Schools program), expanded use of genetically preferred species, and salt tolerant species within projected SLR impacted areas, modified biomass removal practices; an initiative that directs the use of local wood for construction, furniture or other value-added

wood products to enhance local economies while reducing carbon emissions by lowering transportation distances and sequestering carbon in those products; and forest stewardship plans – on both public and private forest lands – that, among other things, foster forest landowners better manage their land for wildlife habitat enhancement, sustainable timber production, and the protection of soil and water quality, wetlands and streams by re-developing forested riparian buffers with salt tolerant species.

- *Agricultural industries*

The total market value of agricultural products produced in Maryland was estimated at $1.3 billion in 2006. Within the state there are approximately 12,000 farms, totaling over 2 million acres of farm land. A number of these operations, both agriculture and livestock combined, lie in low elevation areas and are subject to flooding and inundation as a result of SLR. Long-range management plans should discourage further establishment of operations within these areas, and where feasible relocated or protected to minimize impacts. Additional considerations should be made to protect or move ground water wells and waste storage structures associated with existing operations in vulnerable areas.

Potential industry directives could include: identifying and utilizing new non-conventional agriculture crops which are salt tolerant; expansion of nurseries specializing in native wetland plants for use in nonstructural erosion control projects, or "living shorelines"; processing the by-products of farm practices (chicken litter, methane, slash, switchgrass, cornstalks, and other agricultural by-products and feedstocks) for renewable energy and transportation fuels; state and local level programs that promote the sustainable production and consumption of locally produced agricultural goods, or so-called "Buy-Local" initiatives.

- *Tourism industry*

More than 28 million people visited (traveled >50 miles) Maryland in 2006 and generated more than $11.6 billion in spending, according to the Maryland Tourism Development Board. Of those visitors, 7% visited state beaches and waterfront destinations. Of particular interest, resource-based recreational activities contribute significantly to Maryland's economy. Recreational fishing generated nearly $600 million and wildlife watching activities generated over $600 million in expenditures that same year (including food and lodging, transportation, equipment, and other items), according to the US Department of Interior publication, "2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation". One of Maryland's (and Virginia's) most popular national parks, Assateague Island National Seashore, attracted 1.9 million visitors in 2006, which spent nearly $140 million and supported over 2,600 jobs (in both Maryland and Virginia). This island is particularly vulnerable to SLR, as it is a long, narrow, low barrier island. This economic base is contingent on the continued availability and accessibility to the natural resources that define Maryland and the Chesapeake Bay region.

- *Marine trade and port activities*

The recreational marine trades industry in Maryland contributes $2.3 billion per year to the economy, employs more than 28,000, and serves some 220,000 boats registered in

Maryland plus boats visiting from other states. This industry is comprised of boatyards, marinas, and commercial marine service facilities, including docking, service, and market facilities for the catch. Many of the recreational and commercial facilities are located on the waterfront within a few feet of the current sea level. These water dependent businesses are especially vulnerable to the impact of sea level rise (SLR). Depending on the elevation of adjacent upland land, some will ultimately need to relocate; others will be able to defend against SLR by raising the elevation of their properties.

Port activities account for a significant portion of Maryland's economy and employment, with a combined 128,000 jobs linked to the Port of Baltimore alone. According to the report "*Economic Impacts Generated by the Port of Baltimore in 2005* (August 22, 2006)", the Port of Baltimore was responsible for $2.4 billion in personal wage and salary income in 2005; generated $1.9 billion in business revenues in 2005; local purchases by businesses directly dependent on port activity amounted to $1.1 billion; activities of the Port generated state, county and municipal taxes of $278 million; and the U.S. Customs Service collected $507 million in 2005. These facilities are also vulnerable to the impact of SLR and will need to be addressed through strategic planning efforts.

- *Coastal management and restoration industries*
  Managing shoreline erosion, either through living shorelines, or other stabilization methods, will continue to grow as an emerging industry in Maryland's coastal counties. In addition, other industries related to coastal ecosystem and infrastructure management, whether it be wetland or forest restoration, retrofitting of coastal infrastructure or water management, will continue to grow and prosper. Many new economic opportunities will develop. Efforts should be focused to support these emerging industries and developing guidance on standardized practices and fostering innovations represents opportunities in restoration and coastal management economies that should be harnessed. (Cross-cutting with Sustainable Shorelines and Buffer Area Management Practices, Economic Development Initiative)

Option Design

Targets:

The resource-based industries discussed above are vulnerable to a broad spectrum of climate change impacts beyond SLR and coastal hazards. Due to limitations of state staffing and financial resources, a concurrent evaluation of all resource based industries does not appear to be feasible. The Adaptation and Response Workgroup staff will consult with the Scientific and Technical Working Group of the MCCC to determine a protocol and priorities for evaluating specific resource-based industries and their relationship to sea level rise.

Phase 1: Research and Data Collection
Teams with expertise within the resource-based industry should convene to evaluate key vulnerabilities and potential economic impacts from climate change. The team will conduct an assessment intended to provide guidance to decision and/or policy makers.

Research should address, but not be limited to, these key areas:

- Identification of geographic areas vulnerable to SLR and coastal hazards that currently support resource industries
- Assessing the importance of the system(s) at risk, in terms of ecosystem goods and services, and the direct economic impacts on the state as a result of no action (e.g., loss of jobs, loss of revenue from both residents and visitors of the state, loss of ecosystem services, etc.). This evaluation should consider the magnitude, timing, persistence, and likelihood of potential economic impacts
- Identification of prospective adaptation mechanisms with associated cost/benefit analyses

Phase 2: Systematic and Strategic Planning

Subsequent to the economic studies, overarching management and planning guides for the industry should be developed using a cross-cutting, systematic and strategic approach.

Areas of consideration include:

- Developing a framework for making abandon/modify/move/protect decisions to address long-term strategic planning and potential solutions for at risk facilities and operations.
- Identifying potential areas for streamlining costs via processing and manufacturing, transportation and distribution, and waste reduction and utilization
- Identifying potential supplement or replacement industries, to promote alternative businesses or practices which can supplement and/or replace traditional means
- Inclusion of a mechanism to monitor or track leading economic indicators of change within each sector (i.e. geographic ranges, migratory patterns, disease outbreaks, invasive species, etc.) of certain species (e.g., plants, birds, mammals, insects) that are known to be hypersensitive to early climate change impacts and that have significance to the economics of a particular industry
- Identifying specific targets and timelines for each sector or industry.

Phase 3: Implementation

The implementation of the management and planning programs could occur via programmatic modifications, executive order, and/or legislative action.

Strategies could include:

- Mitigation of regulatory and programmatic burdens to facilitate sustainable management of natural resources in the face of climate change
- Development of guidance and training programs for professional and public development
- Identification of opportunities within existing programs, or development of new financial assistance programs, that focus on proactive or prevention management rather than reactive treatment (e.g. non-conventional crop use and tree species, protection of ground water wells and waste storage structures of poultry and livestock operations)

- **Timing:**

Phase 1 would startup following the release of the final report from the MCCC to the Governor, and no later than 2009. Appropriate and key partners will be identified to participate in the research and assessment team for the established priority industry. Phase 2 would initiate

immediately following the completion of the assessment. Implementing proposed strategies and programs, Phase 3, would occur in different stages. Other industries should comply as seen fit.

An intensive public relations effort should accompany the implementation phase. This should be directed at the citizens of Maryland particularly located in future SLR impacted areas, but span across the various resource-based sectors. This program should run indefinitely (continuous) and be evaluated every 5 years for effectiveness.

- **Parties Involved:**

DNR, MDA, MDE, numerous fisheries, forestry and agricultural organizations and business interests.

- **Other:**

Various levels of local government, Chesapeake Bay Program, NRCS, USFS, the Partnership of Sustainable Forestry, private land owners, public land owners, private sawmills, landscaping industry, nursery industry, MD Cooperative Extension and Master Gardeners. Agricultural and wood product primary producers such as Maryland farmers, lumber mills, farmer's market associations and promoters; value-added producers such as Maryland caterers, producers of packaged food for retail, furniture makers, construction businesses, wholesalers and retailers of construction and do-it-yourself products, architects and designers; applicable trade associations, LEED certification entities, and others.

Implementation Mechanisms

There are many existing programs (agricultural assistance, economic development grants, etc.) and policies in place that will support the implementation of this option. Overall implementation would include such elements as land acquisition, conservation easements, purchase and transfer of development rights, tax credits and structures, and zoning. The toolbox would also include refining land use planning policies and funding programs to allow users of these tools – governments, non-governmental organizations and private citizens. Additional opportunities include the utilization of new Farm Bill program funding to promote alternative crops. State and local regulations may be needed through existing zoning programs to prohibit new poultry and livestock operations in at risk areas. The Md. Dept of the Environment may need to investigate if existing regulations are in effect for the installation of well protection devices to prevent salt water contamination of ground water sources.

Specific incentives include:
• Provide credit through LEED for wood products sustainably grown and harvested locally
• Increase incentives through programs such as Fuels for Schools, tax-forgiveness
• Establish incentives for utilizing renewable heating fuels (such as tax credits similar to those afforded electric producers in the MD Clean Energy Act)
• Support all activities through an extensive outreach and education effort

It should be noted this recommendation has multiple areas of crosscutting implementation mechanisms for a recommendation being proposed by the Future Built Environment and Infrastructure Technical Working Group – "Economic Development Initiative"

Related Policies/Programs in Place

Fisheries Programs

The Task Force on Fisheries Management, created by Chapter 217 of the Acts of 2007, is charged with overseeing a full review of current fishery management processes and developing recommendations for methods to improve, modernize, and streamline fishery management. The Task Force will look in depth at a range of fisheries conservation challenges, management issues, and a variety of science concerns, including stock assessment capabilities and limitations, ecosystem based interactions, and socioeconomic considerations associated with Maryland's fisheries.

Farming and Forestry Assistance Programs

The Maryland Departments of Natural Resources and Agricultural, the U.S. Department of Agriculture, academic resources, such as those available through the University of Maryland system, and local forestry and farming boards offer a wide range of technical, financial and research assistance and training programs to members of the State's rural resource based industries. Adaptation guidance and assistance can be developed and delivered through these existing programs, so long as financial resources are made available to them to effect responsive outreach efforts.

Estimation of Adaptation Benefits and Costs

Implementing Phase 1 of this option will require funding for research and data collection activities that will identify specific risks and propose a range of adaptation strategies. Some of these costs would be covered by implementing other resources assessment (RRI-1) and monitoring (EBEI-2) options also proposed by the ARWG. Phases 2 and 3 of this option involve incremental costs associated with dedicating agency staff to develop strategic action plans and manage new programmatic elements designed to facilitate the sustainable management of natural resources.

The benefits associated with implementing this option focus on the enhanced flexibility of responding to perceived threats of sea-level rise and the avoided costs of inaction. By quantifying the potential risks to natural resources-based industries and articulating a range of responses to those risks, the industries vulnerable to the impacts of sea-level rise can quickly and judiciously employ appropriate strategies. This design also allows for the adoption of strategies that most effectively mitigate the deleterious impacts to the various industries.

Feasibility Issues

Due to limitations of state staffing and financial resources, it does not seem feasible to conduct concurrent evaluations for all resource-based industries. A protocol should be established to prioritize the timing of such evaluations, and be based on MCCC findings and state agency priorities. Implementing any policies, initiatives, or programs that result from said evaluations would require further appropriation of staff and funding.

Status of Group Approval

Barriers to Consensus