

MARYLAND COMMISSION ON CLIMATE CHANGE ADAPTATION & RESPONSE WORKING GROUP 2016 ACTION PLAN

APRIL 18, 2016

Maryland's Commission on Climate Change is charged with advising the Governor and General Assembly on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change and maintaining and strengthening the State's existing Greenhouse Gas Reduction Plan. The Commission is supported by a Steering Committee and four working groups. The Adaptation and Response Working Group is charged with developing a Comprehensive Strategy for Reducing Maryland's Climate Change vulnerability. The Strategy includes both short-and long-term measures that State and local governments may undertake in planning for and adapting to diverse impacts of climate change.

PURPOSE

Even as the State moves forward with actions that will reduce GHGs and ultimately result in increased energy efficiency, a more sustainable economy, and cleaner air; climate impacts will still be felt into the future. Therefore, adaptation, together with mitigation, is necessary to address climate change. The Maryland Commission on Climate Change (MCCC) has charged the Adaptation and Response Working Group (ARWG) with implementing solutions for reducing Maryland's Climate Change vulnerability.

MEMBERSHIP

Membership of the ARWG is currently comprised of a number of sector leads from seven State agencies, two public sector representatives, two MCCC liaisons, and a number of technical advisors from a variety of state agencies and departments. A priority for the ARWG in 2016 will be to seek opportunities to broadening stakeholder representation to include business and industry representatives, along with local partners with specific expertise in or understanding of the areas of the ARWG' work. A list of working group members may be found: (http://www.mde.state.md.us/programs/Marylander/Pages/MCCC_AR.aspx)

RESPONSIBILITIES

Climate change will affect Maryland in a variety of ways. More obvious impacts could include an increased risk for extreme events such as drought, storms, flooding, and forest fires; more heat-related stress; the spread of existing or new vector-borne disease; and increased erosion, saltwater intrusion and inundation of low-lying areas along the State's shoreline and coast. In many cases, Maryland is experiencing these problems to some degree today. Climate change raises the stakes in managing these problems by changing the frequency, intensity, extent, and magnitude of these problems. ARWG's vision for future preparedness is targeted at overcoming the following four challenges:

1. Reducing impact to existing built environments, as well as to future growth and development;
2. Shifting to sustainable investments and avoiding financial and economic impact;
3. Enhancing preparedness to protect human health, safety, and welfare;
4. Restoring and protecting Maryland's natural resources and resource-based industries.

SOLUTIONS AND TARGETS

In 2008, the ARWG -working collaboratively with more than 80 experts from the governmental, non-profit and private sectors- developed a comprehensive plan to protect Maryland’s people, property, natural resources, and public investments from the impacts of climate change (Comprehensive Strategy for Reducing Maryland’s Vulnerability to Climate Change). Recognizing that climate adaptation is an extremely complex process and there is no single means of response, the Comprehensive Strategy identified a broad spectrum of medium and long term actions that involves active consultation with stakeholders to craft the details surrounding new policies, programs, regulations, and other proposals that may be five to twenty years away. In 2016, the ARWG will develop 2-Year Performance Targets in an effort to improve coordination and emphasize the short-term projects ready for implementation. The performance targets will be based on the actions outlined in the Comprehensive Strategy which is attached. That said, the State is already taking steps for adapting to and becoming more resilient to the possible impacts of climate change. Several of these highlights are provided in the section titled “2016 ACTIONS AND INITIATIVES”.

CHALLENGE: GROWTH AND INFRASTRUCTURE

Reducing impact to existing built environments, as well as to future growth and development.

Solutions

- 1 Take action now to protect human habitat and infrastructure from current and future risks.
- 2 Retain and expand forests, wetlands and beaches for protection against nuisance flooding.
- 3 Provide State and local governments the tools to anticipate and plan for sea level rise, precipitation-related events, weather extremes, and to changing temperatures.
- 4 Ensure long-term safe and adequate water supply for humans and ecosystems.

CHALLENGE: FINANCIAL AND ECONOMIC WELL-BEING

Shifting to sustainable investments and avoiding financial and economic impact.

Solutions

- 5 Develop and implement long-range plans to minimize the economic impacts of climate impacts (e.g. sea level rise, saltwater intrusion) to natural resource based industries.
- 6 Promote market opportunities related to climate change adaptation and response.

CHALLENGE: HUMAN HEALTH

Enhancing preparedness to protect human health, safety, and welfare.

Solutions

- 7 Conduct vulnerability assessments to gain a better understanding of risks and inform preventative responses.
- 8 Integrate impact reduction strategies into State and local planning practices.
- 9 Streamline and revise data collection and information dissemination channels.

CHALLENGE: NATURAL RESOURCES AND RESOURCE BASED INDUSTRIES

Restoring and protecting Maryland's natural resources and resource-based industries.

Solutions

- 10 Increase crop diversity, protect against pests and disease, address saltwater intrusion and other climate risks, and intensify water management.
- 11 Strengthen applied research, risk communication and technical support to improve the relay of climate information and foster stewardship on private lands.
- 12 Enhance existing best management practices, update targeting protocols and revise land protection and conservation targets for agricultural and resource lands.
- 13 Advance management approaches and restore critical bay and aquatic habitats to enhance resilience and protection of at-risk species and habitats.

PROCESS AND ENHANCEMENT OPPORTUNITIES FOR 2016

The ARWG will build from the ongoing work and unique expertise of the ARWG members. The ARWG will also use analyses from outside resources and will invite topic area experts on many issues. For 2016, the ARWG identified four enhancement opportunities to explore during their quarterly forums. The forums are designed to allow the ARWG partners to share capabilities, identify collaboration opportunities around a common purpose and identify gaps that may limit increased adaptation and resilience work. In addition to the quarterly forums, the partners will use virtual collaboration tools and smaller working groups to assist in the development of strong relationships and support partnership activities.

February 4th, 2016 - Forum Focus:

Improve the Delivery of Tools and Assistance for Local Governments:

ARWG members discussed and assessed current efforts and dissemination channels and explored opportunities to improve the delivery of tools and assistance to local governments. The ARWG discussed existing programs and capabilities for assisting coastal governments plan for climate change and opportunities to expand partnership activities to non-coastal areas to address issues such as stormwater, riverine and nuisance flooding. In addition, the Department of Health and Mental Hygiene presented their work on their Climate and Health Profiles, with in-depth dialogue on the anticipated local health impacts of climate change. As a result of the forum the ARWG will:

1. Explore formalizing a *Resiliency Partnership* to leverage funding, personnel, and partnership activities to support efforts that integrate floodplain management, hazard mitigation, and coastal resiliency;
2. Develop an on-line portal to aid in the coordination of the ARWG and in the dissemination/marketing of partnerships resources and information available for local communities;
3. Work the Education, Communication and Outreach Workgroup towards developing common talking points/presentations on ARWG issues and activities so that members can use at future events.

May 2016 - Forum Focus:

Impacts that climate change will have on the State's economy, revenues and investment decisions.

The ARWG will use this forum to explore the impacts climate change could have on the State's economy, revenues, and investment decisions. The ARWG will review the State Highway Administration's vulnerability analysis of transportation infrastructure; Coast Smart siting and design guidelines for State investments and will explore policies and programs from other federal, state and local governments.

August 2016 - Forum Focus:

Challenges facing low income and vulnerable communities.

The ARWG will use this forum to explore the challenge of addressing the disproportionate impact of climate change on vulnerable people and communities. Climate change poses unique and often more devastating impacts to vulnerable and low-income communities. The ARWG will invite officials from the Commission on Environmental Justice and Sustainable Communities, the Education and Outreach Working Group as well as other partners to better understand the specific vulnerabilities and discuss opportunities to address these unique challenges. The ARWG will review the Department of Natural Resources'

Coastal Resiliency Assessment and methodology used to prioritize conservation/restoration priorities in vulnerable communities to enhance resiliency. In addition, the ARWG will review a proposal from the Georgetown Climate Center that explores the intersection between equity and adaptation.

November 2016 - Forum Focus:

Developing broader public/private and federal/state/local partnerships.

In addition to reviewing the 2-Year Performance Targets developed to support the actions outlined in the Comprehensive Strategy and discussing enhancement areas for 2017, the ARWG will use this forum to discuss developing new partnerships. From 2007–2014, the ARWG has primarily been comprised of representatives of the following state agencies: DNR, MDE, MDP, MHT, DHCD, DoIT, MES, MEMA, DBM, DHMH, MDOT, MPA, SHA, MDA, MIA, MEA, DGS. The ARWG members will explore opportunities to broaden stakeholder representation to include business and industry representatives, along with local partners with specific expertise in or understanding of the areas of the ARWG's work.

RESOURCE NEEDS

The ARWG is chaired by the Secretary of DNR and with administrative support provided by DNR. The ARWG is supported with active involvement and leadership from other work group members and agencies. Activities being advanced by ARWG members are already significantly guided by the Scientific and Technical Working Group (STWG). For example, the sea level rise projections that the STWG issues and updates are used in a wide variety of vulnerability assessments and future planning activities. Additional engagement with the MWG would be welcome to better understand possible connections between adaptation/resilience and mitigation efforts. Additional resources may be needed directly or through leveraged means to more completely address some of the draft 2016 priorities.

2016 ACTIONS AND INITIATIVES

In addition to the actions identified in the *Comprehensive Plan* and as 2-Year Performance Targets are developed, there are several key efforts and activities ongoing or planned in 2016 to advance statewide adaptation and resilience goals as described below.

The Maryland Resiliency Partnership: Maryland's Resiliency Partnership is comprised of the Department of Natural Resources, the Department of the Environment, the Maryland Emergency Management Agency, the Maryland Historical Trust, and the Maryland Environmental Service (pictured below). All five agencies are working together to leverage funding, personnel, and projects to support efforts that integrate floodplain management, hazard mitigation, and coastal resiliency. Recently, the Maryland Department of the Environment hosted flood risk outreach workshops in Crisfield and Smith Island. All of the Maryland Resiliency Partnership members were on-hand to provide residents with additional information on grant programs and flood mitigation best practices, like elevating houses above the predicted flood water level. Additional Maryland Resiliency Partnership workshops are being planned for 2016.



Cultural Resources Hazard Mitigation Planning Program: With funding from the National Park Service Hurricane Sandy Disaster Relief Fund, the Maryland Historical Trust has awarded seven grants throughout the state to help protect historic places and archeological sites from future

storms. These grants will be supported by the Trust's Cultural Resources Hazard Mitigation Planning Program, which was created to assist local governments to better plan and prepare for the effects of coastal storms and other hazards that impact historic places and properties. The grant projects – that total nearly \$250,000 – are described below:

- Heart of Chesapeake Country Heritage Area, Hazard Mitigation Planning Project, *Dorchester County*
- Integrating Historic and Cultural Considerations into Baltimore's All Hazards Plan, *City of Baltimore*
- Archeological Society of Maryland, Inc., Sustainable Models for Sites Endangered by Natural Hazards
- Trust for Preservation, Inc., Phase I Hazard Mitigation Planning for Anne Arundel's Cultural Resources, *Anne Arundel County*
- Cultural Resources Inventory and Risk Assessment for Cecil Towns, *Town of Port Deposit*
- Smith Island United, Inc., Cultural Resources Hazard Mitigation Planning Initiative, *Smith Island*
- Documentation and Assessment of Historic Resources in Western Water-Oriented Villages, *Talbot County*

Transportation Vulnerability Assessment: The State Highway Administration has been studying the effects of severe weather on the highway system. SHA with Maryland Transportation Authority (MDTA) developed an adaptation strategy and implementation plan to address severe weather and flooding impacts on the state maintained highway network. SHA conducted a pilot study under a Federal Highway Administration grant to assess vulnerability of the State's bridges and roads. SHA is currently completing detailed vulnerability studies of both State and Local roads for all tidally influenced counties in the State.

Community Resiliency Grants Program: The Maryland Department of Natural Resource's Chesapeake and Coastal Service Unit will be issuing the first awards under the new Coastal Resiliency Grants Program in 2016. This program is supported by funding from the National Oceanic and Atmospheric Administration and the Environmental Protection Agency and was developed to help Maryland communities become more resilient to impacts from the changing climate. Six projects have been selected for funding, four of which help communities respond to coastal hazards and two of which pursue the use of green infrastructure to address stormwater hazards.

Maryland State Hazard Mitigation Plan: Under the planning requirements of the Disaster Mitigation Act of 2000 (44 CFR 201.4), the 2016 Maryland State Hazard Mitigation Plan Update serves as guide to creating resilient communities for the State of Maryland. The plan is supported by a list of specific actions and strategies for Maryland State government, local governments and organizations that will reduce the loss of life and property damages from natural hazards. The plan features a comprehensive natural hazard identification, risk assessment and vulnerability analysis, that ranks hazard risks across Maryland. MEMA will also provide funding and support for hazard mitigation planning for all County governments. As a component of the State's Hazard Mitigation Plan, exposure and risk to coastal flooding and sea level rise was evaluated by intersecting the MDE and DNR coastal layers with the Maryland critical and State-owned facility geospatial database. Risk to State-owned and critical facilities was evaluated for 6 facility categories.

Coastal Resiliency Assessment: In support of MD DNR's 2010 climate change policy and the 2014 Chesapeake Bay Agreement Climate Resiliency Goal (Adaptation Outcome), DNR worked with The Nature Conservancy and other state, federal and non-governmental partners from April 2015–March 2016 to complete a Coastal Resiliency Assessment. The Assessment identified statewide priorities for conservation and restoration where coastal habitats provide high or moderate protective benefits to coastal communities at risk to flooding and other coastal hazard impacts.

DNR is currently working to release final products and integrate the results into existing state programs so that risk-reduction is considered alongside ecological criteria when making decisions about green or blue infrastructure investments.

Resiliency in Working Waterfronts: In February 2016, MD DNR will be working with Talbot County and Rock Hall to support the revitalization of existing and historical working waterfront communities and economies. Funding will support the development of two Talbot County Waterfront Village Master Plans, as well as a Design Master Plan and Working Waterfront Action Plan for Rock Hall Harbor. Work is underway with the selected communities to address potential flooding, storm surge impacts, and MD's Climate Change and Coast Smart Construction Guidelines within the planning process.

Community Resilience in Deal Island: Alongside a network of more than 50 community members and organizations, a team of partners (The University of Maryland, Sea Grant Extension; DNR; resource managers and academia; and the Eastern Shore GIS Cooperative) are conducting an Integrated Community Resilience Assessment of the Deal Island Peninsula using both quantitative and qualitative methods to understand and plan for the impacts of flooding now and into the future. This is a phased approach that starts with a flood vulnerability index model that assesses potential of flooding now through 2050; selection of five focus areas for a more in-depth look at vulnerability to flood events; ground truthing and community discussions about options for flood risk reduction. Ultimately, the community and partners will develop realistic options that can be implemented on both the parcel and community scale and identify ways for implementation.

Human and Animal Health and Safety: To maximize the safety and well-being of Maryland's citizens, the Department of Health and Mental Hygiene will work with the Department's of Agriculture and Natural Resources to strengthen the coordination and management across Agencies responsible for human and animal health and safety.

Community Resilience Grants at MHT: Through federal grant funds, financial and technical assistance is provided to local governments seeking to reduce their vulnerability to the effects of coastal hazards, sea level rise and localized flooding caused by increased precipitation events.

Coastal Erosion Control: In 2016, DNR will continue to work to implement buffer reforestation, wetland restoration, and shoreline practices to enhance ecosystem resilience to sea level rise and coastal erosion impacts. Practices include on-the-ground habitat restoration projects such as stream and shoreline buffer plantings, stream-floodplain reconnection, marsh hydrology restoration, and living shorelines. In conjunction with the on-the-ground restoration, the Department is working with several federal partners to finalize a set of metrics to assess if restoration projects are achieving resiliency goals and the ways to measure success.

Hazard Mitigation Assistance (HMA): The U.S. Department of Homeland Security, FEMA HMA programs present a critical opportunity to reduce the risk to individuals and property from natural hazards while simultaneously reducing reliance on Federal disaster funds. The HMA programs provide funding for eligible activities that are consistent with the Presidential Policy Directive 8: National Preparedness (PPD-8), and the National Mitigation Framework's Long-term Vulnerability Reduction capability. Hazard mitigation projects submitted to MEMA are reviewed for eligibility by the MEMA staff and the Mitigation Advisory Committee to insure that all State applications are consistent with the recommended Coast Smart Siting and Design Guidelines. The HMA program reduces community vulnerability to disasters and their effects, promote individual and community safety and resilience, and promote community vitality.

National Network for Ocean and Climate Change

Interpretation: Strategic Framing, One-day Training Sessions: Staff from the Department of Natural Resources, as trained facilitators of Strategic Framing, have been facilitating one-day workshops in partnership with Maryland Audubon, National Aquarium, and MADECLEAR throughout the region. For the past three years, training has included Maryland State Parks interpretive, and seasonal staff, Salisbury University faculty, and partner organizations (paid and volunteer staff). The one-day workshops help disseminate Strategic Framing methodologies and tools widely. Strategic Framing is a

mode of science communication that is backed by social and cognitive research. The Strategic Framing approach is helping to shift the conversation toward solutions that our communities can implement to reduce the impacts of climate change and build community resilience.

Visualizing Change: Training and Tools to support Informal Educators: Visualizing Change is a 3-year grant funded by NOAA's Office of Education to help build capacity in the informal science education field to more effectively use global data sets to communicate about climate change, its impact on coastal zones and marine life and how people are working to use scientific information to shape our world. Training includes new, tested methodologies to engage audiences with topics of climate and ocean change through using narratives with global data visuals, and by using the best practices based on targeted social and cognitive research. Staff will use these techniques to train both formal and informal educators in using data sets to understand and inform community resilience activities for sea level rise and weather readiness. Sentinel Sites for Climate Change: Recognizing the need for additional on-the-ground data in our coastal areas, the Department of Natural Resources is working with the National Oceanic and Atmospheric Administration to establish Monie Bay in Somerset County as a sentinel site for climate change. This site, along with a sentinel site at Jug Bay on the Patuxent River, and networked with other national sentinel sites provide information to Chesapeake Bay communities and managers who need to address challenges such as storm flooding, long term, local sea level rise, barrier island movement, degraded water quality, and wetland loss. The information will also be useful to federal and state restoration planners and living resources managers who are addressing these challenges.

Climate and Health Profile: DHMH will release a "Climate and Health Profile Report" in 2016. Based on a three-year collaboration between the University of Maryland School of Public Health and DHMH, the CDC-funded report will describe the possible health impacts of climate change in Maryland by region, using detailed health data and climate projections. This report can help to inform the development of local, regional, and State-wide adaptive strategies by identifying likely and less likely health impacts.

A. Prioritizing new and existing climate change adaptation actions and initiatives

SEA LEVEL RISE AND COASTAL STORMS

Priority Recommendations	Action Strategies	Lead Agency	Key Partners	Implementation Priority (L, M, H, TBD)	Implementation Timeframe (C, O, S, M, L, TBD)
<i>REDUCE IMPACT TO EXISTING AND FUTURE GROWTH AND DEVELOPMENT</i>					
Take action now to protect human habitat and infrastructure from future risks	Strongly encourage the integration of coastal erosion, coastal storm, and sea level rise adaptation and response strategies into existing state and local policies and programs.	DNR/MDP	MDE, MDOT, DHCD, local governments	High	Ongoing
	Develop and implement State and local adaptation policies (i.e., protect, retreat, abandon) for vulnerable public and private sector infrastructure.	DNR	MDP, MDE, MDOT, local governments	High	Ongoing
	Strengthen building codes and construction techniques for new infrastructure and buildings in vulnerable coastal areas.	DHCD/DNR	MDP, MDOT, MDE, local governments	High	Ongoing
<i>FINANCIAL AND ECONOMIC WELL-BEING</i>					
Minimize risks and shift to sustainable economies and investments	Develop and implement long-range plans to minimize the economic impacts of sea level rise to natural resource-based industries.	DBED	DNR	Medium	Long
	Establish an independent Blue Ribbon Advisory Committee to advise the State of the risks that climate change poses to the availability and affordability of insurance.	MIA	DNR	High	Complete

	Recruit, foster, and promote market opportunities related to climate change adaptation and response.	DBED	DNR	Low	Long
PROTECTION OF HUMAN HEALTH, SAFETY AND WELFARE					
Maximize the safety and well-being of Maryland's citizens in times of foreseen and unforeseen risk	Strengthen coordination and management across Agencies responsible for human health and safety.	DHMH	MDA/DNR	High	Ongoing
	Conduct Health Impact Assessments to evaluate the public health consequences of climate change and sea level rise-related projects and/or policies.	DHMH	MDA/ MDE/ DNR/MDP	High	Medium
	Develop a coordinated plan to assure adequacy of Vector-borne Surveillance and Control Programs.	DHMH/MDA	DNR/MDE	High	Medium
NATURAL RESOURCE PROTECTION					
Retain and expand forests, wetlands and beaches for protection against coastal flooding	Identify high priority protection areas and strategically and cost-effectively direct protection and restoration actions.	DNR	MDE	High	Ongoing
	Develop and implement a package of appropriate regulations, financial incentives, educational, outreach, and enforcement approaches to retain and expand forests and wetlands in areas suitable for long-term survival.	DNR	MDE	High	Ongoing
	Promote and support sustainable shoreline and buffer area management practices.	DNR	MDE	High	Ongoing
ADAPTATION AND RESPONSE TOOLBOX					
Provide State and local governments the tools to anticipate and plan for sea level	Strengthen federal, state, local, and regional observation systems to improve the detection of biological, physical, and chemical responses to climate change and sea level rise.	DNR/UMD	NOAA/ EPA	High	Ongoing

rise and climate change	Update and maintain state-wide sea level rise mapping, modeling, and monitoring products.	DNR	NOAA	High	Ongoing
	Utilize new and existing educational, outreach, training and capacity building programs to disseminate information and resources related to climate change and sea level rise.	DNR/UMD	MDE/MDP	High	Ongoing
<i>FUTURE STEPS AND DIRECTIONS</i>					
State and local governments' commitment of resources and time to assure progress	Develop state-wide sea level rise planning guidance to advise adaptation and response planning at the local level.	DNR	MDP, local governments	High	Ongoing
	Develop and implement a system of performance measures to track Maryland's success at reducing its vulnerability to climate change and sea level rise.	DNR	Other State agencies	Medium	Ongoing
	Pursue the development of adaptation strategies to reduce climate change vulnerability among affected sectors, including agriculture, forestry, water resources, aquatic and terrestrial ecosystems, and human health.	DNR/UMD	Other State agencies	High	Ongoing

MARYLAND COMMISSION ON CLIMATE CHANGE
PHASE II: Building Societal, Economic and Ecological Resilience
Implementation Guidance Table

Table Key:

Implementation Priority: L (Low); M (Medium); H (High – Needs Immediate Action); TBD (To Be Determined)

Implementation Timeframe: Ongoing (a component of an existing program); Short (1 -3 years); Medium (3 – 5 years); Long-Term (5 + years); TBD (To Be Determined)

Implementation Cost: Low (\$0 - \$100,000); Medium (\$100,000 - \$200,000); High (\$200,000 +); TBD (To Be Determined)

Priority Recommendations	Action Strategies	Lead Agency	Key Partners	Implementation Priority (L, M, H, TBD)	Implementation Timeframe (O, S, M, L, TBD)	Potential Implementation Cost (L, M, H, TBD)
HUMAN HEALTH						
Conduct vulnerability assessments to gain a better understanding of risk and inform preventative measures.	Assess potential health threats and the sufficiency of Maryland’s response capacity.	DHMH	MEMA	TBD	TBD	
	Evaluate impacts to food safety and availability.	DHMH	MDA	Medium	Medium-Term	TBD
	Assess the vulnerability of Maryland’s populations and communities to changing health threats.	DHMH	MDP, MDE	Medium	Long-Term	TBD
	Identify potential barriers to effective emergency response.	DHMH	MEMA	High	Medium-Term	TBD
Integrate impact reduction strategies into	Improve response capacity through the development of new or expanded programs.	DHMH	MEMA	Medium	Long-Term	High

State and local planning practices.	Address climate-related health risks in hazard mitigation and emergency response plans.	DHMH	MEMA	Medium	TBD	TBD
	Support community engagement in planning and emergency response decisions.	DHMH	MEMA	Medium	Long-Term	TBD
	Pursue opportunities to enhance protection of Maryland's "green infrastructure."	DNR	DHMH, MDP	TBD	TBD	TBD
Streamline and revise data collection and information dissemination channels.	Improve the resolution and availability of health and population data.	DHMH	UMD, MDP, CDC, EPA	High	Ongoing	High
	Analyze health and population data along with other spatially explicit information (e.g., land use, air quality, water quality).	DHMH	DNR, MDP, MDE, EPA, CDC	High	Ongoing	High
AGRICULTURE						
Increase crop diversity, protect against pests and disease, and intensify water management.	Promote diversification of crop species and varieties.	MDA	UMD-Extension (UME), Local Agricultural Producers	Low	Ongoing	TBD
	Intensify water management and conservation through research, funding and incentives.	MDA	UME, MDE, DNR, USDA, EPA, Bay Trust	High	Ongoing	High
	Protect against incoming pests, weeds and disease.	MDA	UME	Low	Ongoing	TBD

	Support innovative solutions that foster adaptation and also reduce energy costs and carbon footprints.	MDA	UME, MEA	Medium	Ongoing	TBD
Strengthen applied research, risk communication and technical support.	Enhance dissemination channels to improve the relay of climate information.	MDA	UME, SCDs, NRCS, NGOs, commodity orgs.	Low	Ongoing	TBD
	Identify opportunities to support the transition of farm and agricultural practices.	MDA	UME, NRCS, Farm Credit, Insurance Industry	Low	Long-Term	TBD
	Enhance emergency response and risk management.	MDA	UME, Farm Credit, Insurance Industry	Low	Ongoing	TBD
Enhance existing Best Management Practices and land conservation targets.	Evaluate the effectiveness of BMPs under future climate change scenarios	MDA	UMD, DNR, MDE	Low	Ongoing	TBD
	Assess and revise targets for agricultural land preservation.	MDA	Local and Regional Land Trusts	Low	Ongoing	TBD
FORESTS & TERRESTRIAL ECOSYSTEMS						
Expand land protection and restoration and revise targeting priorities.	Integrate climate data and models into existing resource assessments and spatial planning frameworks.	DNR	EPA, CBP, USDOl, USFWS, NGOs, NASA, NOAA	High	Medium-Term	Medium

	Incorporate climate change adaptation strategies into state resource management plans.	DNR	MDP, EPA, CBP, USDO, USFWS, NOAA USFS NGOs	High	Medium-Term	Low
	Collaborate with federal partners to support regional and national adaptation planning.	DNR	EPA, CBP, USDO, USFWS, NOAA USFS NGOs	Medium	Medium-Term	Low
	Update existing land protection targeting programs and project evaluation protocols.	DNR	EPA, CBP, USDO, USFWS, NOAA USFS NGOs	High	Ongoing	Low
	Develop climate change adaptation guidance and technical tools suitable for local government planning.	DNR	MDP, UMD Cooperative Extension	High	Ongoing	Medium
Adjust management practices and reduce existing stressors.	Strengthen State and local programs to slow the loss and fragmentation of forest and terrestrial ecosystems to new development.	DNR	MDP, MDE MDOT USFWS, USFS, EPA, CBP, NGOs	High	Ongoing	Medium
	Review and revise best forestry management practices.	DNR	UMD-Cooperative Extension	Medium	Medium-Term	Medium

	Continue to support incorporation of the policies and strategies of <i>Maryland's Sustainable Forestry Act of 2009</i> into state and local planning decisions.	DNR	State Forest Conservancy District Boards	High	Ongoing	Low
	Evaluate sustainable forestry certification programs for opportunities to enhance climate resiliency.	DNR	Sustainable Forestry Initiative, Forestry Boards, Forest Stewardship Councils	Medium	Medium-Term	Medium
	Improve capacity to manage and respond to stressors exacerbated by climate change.	DNR	MDA, Maryland Invasive Species Council, Forest Health Emergency Contingency Program	Medium	Short-Term	High
Foster stewardship on private lands.	Develop new tools to guide adaptation stewardship activities on private lands.	DNR	Forest Stewardship Councils, UMD-Cooperative Extension	High	Short-Term	Medium
	Integrate adaptation strategies into existing programs.	DNR	USFS, Forest	High	Short-Term	Medium

			Stewardship Councils, UMD-Cooperative Extension			
	Develop new conservation easement mechanisms to promote adaptation stewardship activities on private lands.	DNR	USFS, Forest Stewardship Councils, UMD-Cooperative Extension MDA	High	Short-Term	Medium
BAY AND AQUATIC ECOSYSTEMS						
Advance protection of at-risk species and habitats.	Revise state-level protection targeting programs to reflect climate change adaptation priorities.	DNR	UMD, USACE, USGS, USFWS, NOAA, NGO's	High	Ongoing	Low
	Develop new protection and conservation mechanisms to promote adaptation stewardship activities on private lands.	DNR	UMD, USACE, USGS, USDO, USFWS, NOAA, NGOs	Medium	Medium-Term	Medium
	Amend legal mechanisms to designate and protect temperature-sensitive streams.	DNR	MDE, EPA	High	Ongoing	Medium
	Implement an adaptive management approach.	DNR	MDE, MDOT,	High	Medium-Term	Low

			MDA, MDP, Federal Partners, NGOs			
Restore critical bay & aquatic habitats to enhance resilience.	Proactively pursue, design and construct habitat restoration projects to enhance the resilience of bay, aquatic and terrestrial ecosystems.	DNR	USACE, USGS, USFWS, NOAA, EPA, CBP, NGOs	High	Long-Term	High
	Conduct an audit of state-owned lands to identify habitat restoration potential for enhancing ecosystem resilience and increasing on-site carbon sequestration.	DNR		Medium	Short-Term	Low
	Increase on-the-ground implementation of existing stream restoration practices.	DNR	USGS, EPA, CBP, USFWS	High	Short-Term	High
Reduce existing stressors.	Remove barriers to habitat connectivity.	DNR	MDE, USFWS, NOAA	High	Ongoing	High
	Reduce impervious surface cover.	DNR, MDE	MDP	High	Ongoing	High
	Prepare for new or expanding ranges of invasive species.	DNR	MDA, Maryland Invasive Species Council, USFWS	High	Ongoing	Medium
Foster a collective response to	Adjust bay and watershed restoration priorities in light of a	DNR	MDE, UMD, NOAA,	Medium	Ongoing in Coastal Plain	Medium

climate change.	changing climate.		USGS, EPA, Penn State, USFWS			
	Integrate both adaptation and mitigation reduction strategies into natural resource management plans and programs.	DNR	USFWS, NOAA, NGOs	High	Short-Term	Low
	Revise fishery and wildlife management to build climate resilient safeguards.	DNR	USFWS, NOAA, NGOs	High	Long-Term	Medium
	Increase collaboration between federal, state, local and regional climate change adaptation partners.	DNR	UMD, NOAA, USGS, EPA, NGOs	High	Short-Term	Low
WATER RESOURCES						
Ensure long-term safe and adequate water supply for humans and ecosystems.	Adopt and fund the recommendations of the 2008 “Wolman Committee” report.	MDE	DNR, MDP, local govts., federal partners	High	Ongoing	High
	Manage water through the lens of future climate and population.	MDE	MDP, DNR, local govts.	High	Ongoing	TBD
	Enhance planning and coordination within the water resource community.	MDE	MDP, local govts.	High	Long-Term	TBD
	Encourage water suppliers to evaluate and improve their resilience.	MDE	Water utilities, Local govts., MEMA, EPA	High	Long-Term	TBD
	Promote demand management and water conservation	MDE	Local govts., MDA,	Medium	Ongoing	TBD

	practices.		Business community			
	Assess, target and protect high-quality water recharge areas.	MDE	DNR, MDP	Medium	Long-Term	TBD
Reduce the impacts of flooding and stormwater.	Encourage the removal of vulnerable or high-hazard water supply and treatment infrastructure.	MDE	Water utilities, local govts.	Low	Long-Term	TBD
	Prevent inundation and overflow of on-site disposal systems.	MDE	Local govts.	Medium	Long-Term	TBD
	Revise Clean Water Revolving Fund criteria.	MDE		Low	Short-Term	Low
	Invest in an improved understanding and communication of flood probabilities and hazards.	MDE	DNR	Medium	Long-Term	TBD
POPULATION GROWTH & INFRASTRUCTURE						
Ensure safety, clean water, clean air and sufficient infrastructure.	Address funding and revenue constraints to ensure adequate support for current and future infrastructure needs.	MDOT, MDE	MEMA, DGS, Utilities, Local govts.	Medium	Ongoing	TBD
	Conduct a comprehensive analysis of the vulnerability of Maryland's infrastructure.	MDOT, MDE	MEMA, DGS, Utilities, Local govts.	Medium	Ongoing	High
	Develop a "lead by example" investment policy to guide state investments.	DNR	All State Agencies	High	Short-Term	Low
	Reduce regional air quality impacts in Maryland.	MDE	MDOT, EPA, MPOs, Other states	High	Medium-Term	High

Plan for precipitation-related weather extremes and increase resilience to rising temperatures.	Assess the economic costs resulting from severe weather events.	MDOT	MEMA, Utility Providers, Local Govts.	Low	TBD	TBD
	Identify state investment needs to prepare for future weather emergencies.	MDOT, MEMA	Utility Providers, Local Govts.	Low	TBD	TBD
	Accelerate use of improved stormwater management strategies and environmental site design (ESD).	MDE	DGS, DNR, MDOT, UMD, Local Govts.	High	Ongoing	High
	Enhance the preparedness of transportation system and utility providers.	MDOT, MEMA	PSC, MEA, Utility Providers, MPOs,	Low	TBD	TBD
	Develop operation contingency plans for critical infrastructure.	MDOT, MEMA	Utility Providers	Medium	Ongoing	TBD
	Increase urban tree canopy.	DNR	Local Govts.	High	Ongoing	High
	Strengthen building and infrastructure design standards.	DHCD	Local Govts., MDOT, MEA, MDE, MEMA	High	Ongoing	TBD
Institutionalize consideration of climate change.	Promote integration of climate change adaptation strategies into state and local policies and programs.	MDP	DNR, MEMA	High	Long-term	Medium
	Integrate climate vulnerability data into state and local spatial planning frameworks.	MDP	DNR	High	Long-term	Medium
	Consider climate change issues in combination with	MDP	Sustainable Growth	High	Short-term	Low

	ongoing growth and development planning efforts.		Commission, Local Govts.			
	Explore incentives to promote sound planning practices	MDP	MEA, UMD	High	Medium-term	TBD
	Investigate the impacts of climate change on future energy needs.	DNR	MDE, MEA, MDA, DBED, MDP, MDOT	High	Ongoing	Medium
	Create a framework and standards for the placement and use of alternative energy.	DNR, MEA	MDE, MDA, DBED, MDP, MDOT, Critical Area Commission, UMD	High	Ongoing	Medium