MARYLAND CLIMATE ADAPTATION AND RESILIENCE DRAFT FRAMEWORK

2021-2030

ACKNOWLEDGMENTS

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Cover photos from left: Maryland Department of Transportation, 2019; Maryland Department of Agriculture, 2016; Andrew Rimel, 2016.

LAND ACKNOWLEDGMENT

The geography now known as Maryland is the ancestral land of many indigenous peoples, including the Accohannock, Assateague, Lenape, Nanticoke, Nause-Waiwash, Piscataway, Pocomoke, Shawnee, and Susquehannock tribes and nations. We honor them, and their presence on and relationship with this land, both past and present. We recognize that our current political boundaries did not exist prior to colonization, and that other indigenous peoples also moved through these lands and the Chesapeake Bay watershed. Today, many indigenous people whose ancestral lands are outside of Maryland reside here, and we honor the culture and heritage they bring to our communities.

We acknowledge and honor the people who were brought to Maryland against their will and forced into enslaved labor. We recognize that these people built our communities, but were not considered to be part of them. The devastating legacy of this history continues to cause harm today.

The indigenous and enslaved peoples of Maryland have shown generations of resilience against the processes of genocide and cultural erasure that started with European colonization. As we work toward a climate-adapted future, we must simultaneously pursue actions to repair these injustices in pursuit of equity. We honor the legacy of these peoples and recognize that we have much to learn about their cultural traditions of connection with, and utmost respect for, the earth as we work towards achieving a more climate-resilient Maryland through equitable and inclusive action.

GREETING OF THE GEESE, 2019

STEPHEN BADGER, 2019

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ACRONYMS

STATE AGENCIES, BODIES, AND POLICIES

ARWG	Maryland Commission on Climate Change Adaptation and Resiliency Working Group
CEJSC	Commission on Environmental Justice and Sustainable Communities
ECO	Maryland Commission on Climate Change Education, Communication and Outreach Workgroup
GGRA	Greenhouse Gas Emissions Reduction Act
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDH	Maryland Department of Health
MDHCD	Maryland Department of Housing and Community Development
MDNR	Maryland Department of Natural Resources
MDOT	Maryland Department of Transportation
MDP	Maryland Department of Planning
MEA	Maryland Energy Administration
MEMA	Maryland Emergency Management Agency
MES	Maryland Environmental Service
MET	Maryland Environmental Trust
STWG	Maryland Commission on Climate Change Scientific and Technical Working Group

TERMINOLOGY

BIPOC	Black, Indigenous, or Person of Color
BMP	Best Management Practice
JEDI	Justice, Equity, Diversity and Inclusion
SLR	Sea level rise
WIP	Watershed Implementation Plan

REGIONAL AND STATE NETWORKS

CCAN	Chesapeake Climate Action Network
CSN	Chesapeake Stormwater Network
ESCAP	Eastern Shore Climate Adaptation Partnership
LESCAN	Lower Eastern Shore Climate Adaptation Network
MACO	Maryland Association of Counties
MASFM	Maryland Association of Flood Managers
MEHN	Maryland Environmental Health Network
MML	Maryland Municipal League
WAC	Watershed Assistance Collaborative

TECHNICAL SERVICE PROVIDERS

CBT	Chesapeake Bay Trust
CLA	Climate Leadership Academy
EFC	Environmental Finance Center
ESLC	Eastern Shore Land Conservancy
IEN	Institute for Engagement & Negotiation at the University of Virginia
MARBIDCO	Maryland Agricultural and Resource-Based Industry Development Corporation
MSGE	Maryland Sea Grant Extension
TNC	The Nature Conservancy
WAC	Watershed Assistance Collaborative
UMCES	University of Maryland Center for Environmental Sciences

DIANE CRAWFORD, 2020

DEFINITIONS

ENVIRONMENTAL CHANGE AND RESPONSE

▶ **ADAPTATION**
Action to prepare for and adjust to new conditions, thereby reducing harm or taking advantage of new opportunities.[1] Climate adaptation refers to those actions taken to reduce vulnerability to the impacts of climate change, aimed to enhance the resilience of natural and human-based systems.[2]

▶ **ADAPTIVE CAPACITY**
The extent to which systems, institutions, humans, and the natural environment are able to adapt to the presence of stressors, exploit opportunities when they are presented, or respond to the aftermath of disasters or hazards, climate or non-climate related.[3]

▶ **ADAPTIVE MANAGEMENT**
A systems approach that prioritizes action, even in the face of uncertainty, while including feedback loops and assessments along the system to inform management decisions and improve outcomes.[4]

▶ **CLIMATE CHANGE**
Changes in long-term average weather patterns on a global, continental, regional, or local scale occurring as a result of greenhouse gas emissions. Heightened levels of emissions are being generated by human activities, including burning and producing fossil fuels, agricultural practices, and deforestation. As a result, heat is trapped in the Earth's atmosphere at increased levels, causing global temperatures to rise. As temperatures rise, additional environmental changes, or climate impacts, occur.

▶ **CLIMATE STRESSORS**
A condition, event, or trend related to climate variability and change that can exacerbate hazards, such as sea level rise.[5] In the context of climate adaptation, non-climate stressors refer to those current or future social, environmental, and economic pressures threatening humans and natural systems that do not stem from climate change, such as access to healthcare and housing, socioeconomic status, habitat fragmentation, invasive species, pollution, disease, and over-exploitation. Many existing non-climate stressors will likely be exacerbated by climate stressors, referred to as co-stressors.[6]

▶ **CO-BENEFITS**
Benefits that arise out of climate adaptation strategies by mitigating the effects of climate change on humans and the environment, while also addressing other preexisting, non-climate related problems.[7]

▶ **EXPOSURE**
People, species and ecosystems, environmental services and resources, infrastructure, or other economic, social, and cultural assets are exposed to climate impacts when they are physically located in an area that could be negatively affected by a climate hazard.[8]

A NOTE ON TERMINOLOGY

The multi-disciplinary approach used to develop this Draft Framework presented a challenge for establishing single, universally-held definitions. Sector and focus area group participants coming from different disciplines attach different nuances to specific terms, causing them to use the terms in different ways. By including this brief list of definitions, we hope to clarify our intended meaning for each of these terms when used in this Draft Framework. Care was taken in selecting and defining terms -- particularly those related to justice, equity, diversity and inclusion -- to acknowledge and respect that language is ever-evolving, and can be conflicting and controversial. The authors of this Draft Framework recognize that the terms used will not be preferred by all readers, and that the meanings attached to these are likely to continue to evolve and change over time.

▶ **GRAY INFRASTRUCTURE**
A feature of the urban built environment that collects and conveys excess stormwater through curbs, gutters, drains, piping, and collections systems.[9]

▶ **GREEN INFRASTRUCTURE**
Using natural processes to improve water quality and manage the volume of stormwater runoff at its source through interventions such as rain gardens, bio-retention street planters, and curb cuts to control the flow and direction of water. Green infrastructure can reduce the need for constructing additional gray stormwater infrastructure in many instances by reducing the burden on existing excess water runoff systems.[10]

▶ **GREENHOUSE GAS MITIGATION**
Addressing the root causes of climate change by stabilizing greenhouse gas emissions globally through actions that may include reducing fossil fuel use, and enhancing the Earth's ability to accumulate and store greenhouses in natural sinks like oceans, forests, and soils.[11]

▶ **HAZARD MITIGATION**
In a planning context, any sustainable action to reduce or eliminate long-term risk to people and property from future disasters through actions to break the cycle of disaster damage, reconstruction and repeated damage.[12]

▶ **RESILIENCE**
The ability of a system to recover from a disturbance, adapting a complex network of interactions to maintain productivity and fundamental identity.[13]

▶ **SENSITIVITY**
The extent to which a system, asset, or the natural environment may be negatively affected or benefitted by the effects of climate change.[14]

▶ **VULNERABILITY**
The characteristics of exposure, sensitivity and adaptive capacity that make a system, asset or the natural environment more or less susceptible to harm or change.[15]

DEFINITIONS

JUSTICE, EQUITY, DIVERSITY AND INCLUSION

▶ **EQUITY**
Achieving justice, impartiality and fairness within the procedures, processes, and distribution of resources and rewards by institutions or systems. This requires an understanding of the underlying or root causes of disparities within our society. Equity can be further broken down into categories:[16]

- **Procedural Equity:** inclusive, accessible, authentic engagement and representation in decision-making processes regarding programs and policies.

- **Distributional Equity:** programs and policies result in fair distributions of benefits and burdens across all segments of a community, prioritizing those with the highest need.

- **Structural Equity:** decisions are made with a recognition of historical, cultural, and institutional dynamics and structures that have routinely advantaged privileged groups in society.

- **Trans-generational Equity:** decisions consider generational impacts and do not result in unfair burdens on future generations.

▶ **DIVERSITY**
The demographic mix of a specific collection of people, taking into account elements of human difference. Such differences include but are not limited to: age, racial and ethnic identity, faith-based and religious identity, LGBTQ+ populations, gender identity, conditions of disability, relationship to the natural environment, and rural versus urban development conditions.[17]

▶ **INCLUSION**
The degree to which individuals from diverse backgrounds are able to participate fully in the decision-making processes within an organization or group. While a truly "inclusive" group is necessarily diverse, a "diverse" group may or may not be "inclusive."[18]

▶ **INSTITUTIONAL RACISM**
Features of the social, economic, and political systems in which we all operate that perpetuate racial group inequity, intentionally or not. This includes the public policies, institutional practices, cultural representations, and other norms that work in various, and often reinforcing ways to perpetuate privileges associated with "whiteness" and disadvantages associated with "color." Institutional racism is also known as structural racism or systemic racism.[19]

▶ **JUSTICE**
The realized ability of all individuals to live a full and dignified life. Achieving justice requires directly dismantling barriers to resources and opportunities in society.[20] **Environmental justice** is the equal protection from environmental and public health hazards for all people regardless of race, income, culture, and social status.[21] Similarly, **climate justice** is the pursuit of eliminating inequitable and disproportionate climate impacts on certain communities, including as a result of existing inequitable social conditions exacerbated by climate change.[22]

STEPHEN BADGER, 2019

▶ **UNDERSERVED AND OVERBURDENED COMMUNITIES**
Populations which, as a result of historic and current systemic inequities caused by racism, classism, xenophobia, and other prejudices, (1) receive inadequate or inequitable investment and services; (2) are excluded from decision-making, and as a result may have little influence over outside decisions that impact their daily quality-of-life; and consequently (3) experience environmental or quality-of-life disparities when compared to surrounding populations.[23] These communities routinely experience the cumulative and compounding impacts of industry, environmental hazards, and displacement, among other burdens, and have little to no recourse to address harms. Populations who have been marginalized include Black people, Indigenous people, persons of color, immigrant communities, the elderly, and disabled individuals.

▶ **WHOLE-OF-GOVERNMENT**
A collaborative and interdisciplinary approach under which government programs work in alignment through formal and informal networks. This approach recognizes the need for collaborative responses to the public's needs to improve public service. This is also called "whole government."

EXECUTIVE SUMMARY

Adaptation, as defined in the Third National Climate Assessment, is action taken to prepare for and adjust to new conditions, thereby reducing harm or taking advantage of new opportunities. Climate change is a challenge that needs to be addressed through significant and sustained adaptation efforts. At the state level, the Maryland Commission on Climate Change (the Commission) is charged to advise the Governor and General Assembly "on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change." In 2020, the Commission's Adaptation and Resiliency Working Group (ARWG) was tasked with furthering this work by updating the state's current "Adaptation Plan" and developing a framework for guiding and prioritizing action over the next 10 years, specifically in vulnerable and under-served communities.

This Maryland Climate Adaptation and Resilience Draft Framework: 2021-2030 (Framework) was created to establish the vision, goals, strategies, and activities that will guide the next decade of adaptation implementation across the state.

2030 VISION FOR MARYLAND

In the next 10 years, Maryland will build its adaptive capacity and resilience to climate change impacts. The process of adapting will prioritize restorative justice in order to address historical inequities that have created disparate climate impacts, balancing the needs of the state's natural, human, social and economic systems. Maryland will implement the strategies and activities described within this Framework through collective action with partners at the state, local, and community level. All work will be conducted with a focus on equity and commitment to transparency and accountability.

The Framework development process was designed and facilitated by the University of Virginia Institute for Engagement & Negotiation (IEN). The process was organized into 5 sector groups and 3 focus areas that cross-cut all adaptation work. A working group was created for each sector and focus area to include representatives from state agencies, local government, non-profit organizations, and academia. The working groups met routinely over the course of a year to identify key issues that would need to be tackled in the coming decade, review previous adaptation progress and goals, and develop a set of consensus recommendations for priority goals and specific strategies to achieve a more resilient Maryland by 2030.

This document shares the results of these groups' work. Each sector and focus group has a chapter with its 2030 vision and priority goals as well as identified strategies and activities needed to achieve them. A set of principles was developed by each focus area to provide guidance on how to develop climate work that is equitable and inclusive, creates job and training opportunities, and successfully empowers climate action at the local government level. Although the development process was organized into separate groups to facilitate discussion, many connections and points of overlap were established. These ideas were captured in a separate set of cross-framework priorities with recommended actions that are not specific to a particular sector but important recommendations for state adaptation as a whole.

SECTORS AND GOALS

Water Resources

Address changing water quality impacts in the face of climate change; Ensure equitable access to safe, plentiful water statewide; Increase the resilience of Marylanders to water-driven climate hazards; Align and coordinate water-related adaptation work; Secure resources to support water resilience needs.

Working Lands & Natural Resources-Based Economies

Preserve and restore working lands and waters while ensuring land uses support other statewide resiliency goals; Support the economic development and sustainability of agriculture, forestry, and working waters; Adopt climate resilient practices across the sector; Create food security in the face of climate change; Expand education and outreach to support the sector to achieve adaptation goals.

Protecting Critical Infrastructure

Create an inventory of all critical infrastructure in Maryland; Integrate an Asset Management Adaptation Plan framework into critical infrastructure decision-making; Create a decision support toolbox to inform critical infrastructure planning and operations; Update plans to reflect top infrastructure resilience priorities; Implement priority critical infrastructure projects.

Human Health

Protect from direct and indirect climate impacts by understanding climate impacts on health and reducing morbidity and mortality; Establish a statewide climate and health partnership network to create a climate and health surveillance program; Integrate a Health Impact Assessment framework for health equity into all climate adaptation decisions statewide; Expand climate and health communication and education efforts to increase awareness and understanding of individual risk.

Natural Resources & Ecosystems

Manage lands and waters to protect, conserve, connect and restore natural resources; Create regulatory and policy cooperation for climate adaptation; Empower and engage communities to support natural resources' adaptation; Practice adaptive management to incorporate flexibility into natural resource management; Establish funding opportunities to advance adaptation goals and preserve resources.

FOCUS AREAS AND GOALS

Justice, Equity, Diversity & Inclusion

Invest in adaptation projects and programs that address historic and current inequities and equitably involve underserved and overburdened communities; Coordinate and collaborate on aligned adaptation actions that avoid unintended consequences and achieve equitable outcomes; Co-create adaptation solutions with communities and local and state government.

Local Government Action & State Service Delivery

Build local government capacity to adapt to climate change; Collaborate between state and local governments to understand climate impacts and implement adaptation solutions; Co-create local adaptation solutions through supporting and engaging in regional partnerships; Conduct public educational outreach; Provide sufficient funding, tied to adaptation goals, to support local governments.

Climate Jobs & Training

Ensure no net job loss as a result of changing climate conditions; Increase opportunities for climate change training for early career professionals; Provide re-training to support employees during climate-driven industry changes; Invest in new and emerging technology and restoration efforts; Enhance industry and worker safety in the face of climate impacts.

FRAMEWORK IMPLEMENTATION

Now that the Framework has been developed, it is vital for the ARWG to provide leadership in implementation. This work must be carried out transparently with a system of accountability and routine progress assessment. The cross-framework priorities will serve to guide next steps for implementing this Framework, initiating the decade's work with shared actions across sectors. In the conclusion of this document, you will find a list of best practices that if followed, will help ensure success across the entire Framework. As transparent and accountable action is vital to the success, this Framework also provides a starting point for tracking the progress both through an implementation and tracking table provided in Appendix B and with the alignment to the Maryland Coastal Adaptation Report Card.
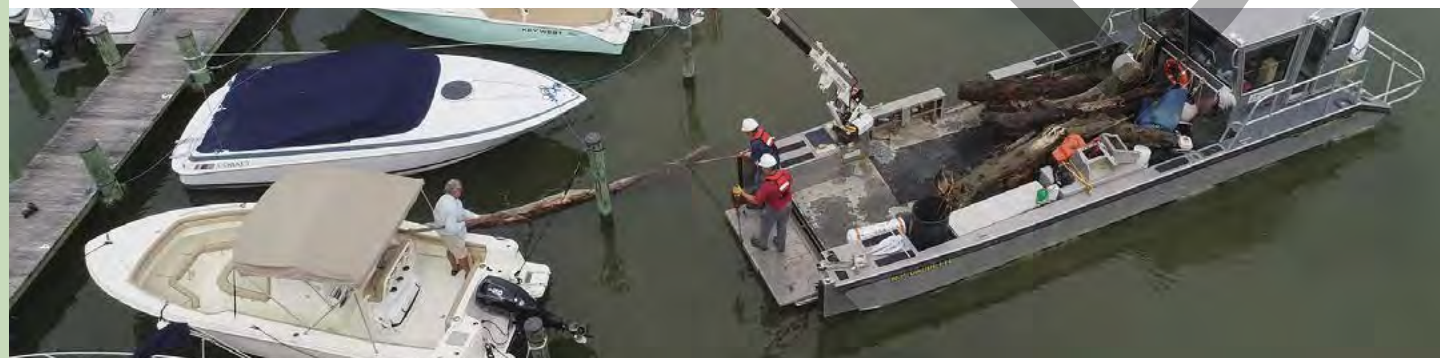
STEPHEN BADGER, 2018

CROSS-FRAMEWORK PRIORITIES

1. **Online Adaptation Hub:** Establish an online adaptation hub to serve as a one stop shop for all adaptation related efforts of the state, including the Framework. The hub should provide curated tools and resources, such as a GIS platform for visualizing climate-related risks, that support action and decision-making decisions. Progress tracking for the Framework should be hosted on the hub to ensure transparency and accountability in Framework strategies and activities.

2. **Reporting on Progress:** Utilize existing climate change reporting requirements, like those in Environment Article §2-1305 of the Maryland Code to streamline communicating on the progress of goals, strategies, and activities as well as any recommendations or identified needs for successful implementation on climate change related efforts. Work with the ARWG members from these agencies to include Framework progress and all progress and identified needs or recommendations into the annual reports.

3. **State Agency Resource Allocation:** Assess and ensure adequate staffing and resource allocation for implementation at all agencies. Identifying and accessing the technical and financial resources needed to support their efforts is essential to effective implementation. Robust interagency communication will be integral to the success of these efforts.

4. **Local-Level Capacity Building:** Provide robust capacity assistance services to small local governments and community-based organizations. This could be pursued through the expansion of existing service providers, creation of a new program and/or alignment with federal initiatives that may be enacted (Civilian Climate Corps). Examples of the types of assistance to be provided include developing conceptual plans for resilience projects, developing grant proposals, and assisting with grants management.

5. **Evaluating the Economic Impacts of Climate Change:** Coordinate across sectors, agencies, organizations and the State Treasurer's Office to evaluate the impact of climate change on the state's economy (including the cost of inaction) and evaluate existing funding programs, identifying gaps in available programs to cover adaptation needs. As part of the evaluation, determine the sources of match available to fill federal program requirements and ensure that they are adequate. Institute coordination between funding programs to ensure they are leveraged to the greatest extent, the funds are unified in their approach of considering vulnerable communities and anticipated climate impacts in proposal evaluation.

The complex challenges presented by climate change can seem insurmountable. However, the State of Maryland has the capacity and commitment to bring its talent and resources together to successfully address these challenges. Development of this Framework was only possible through the contribution of time, energy and resources by dozens of stakeholders. This same spirit of collaboration will help fuel its implementation and achieve the vision of a stronger, more resilient and adapted Maryland in 2030.

INTRODUCTION
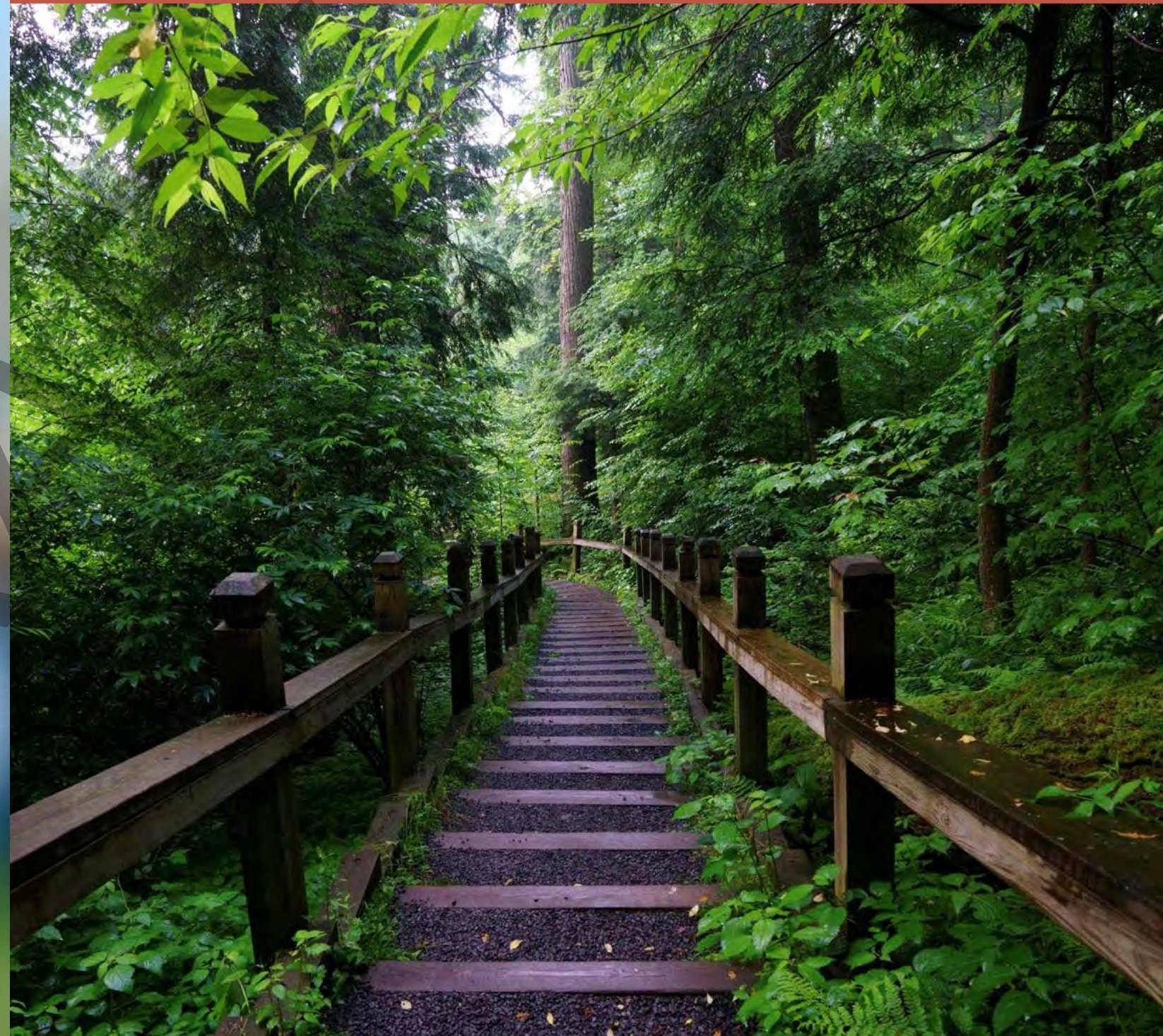
WHAT IS THIS FRAMEWORK AND WHY IS IT NEEDED?

Climate change is occurring globally as human activities, primarily greenhouse gas emissions caused by burning fossil fuels, result in heightened levels of heat trapped in Earth's atmosphere. Between 1901 and 2016, the global average temperature rose by approximately 1.8°F. Scientists predict that warming will continue in coming decades, even if drastic efforts to cut greenhouse gas emissions and mitigate climate change are pursued.[24] The effects of climate change in Maryland are already apparent and are anticipated to worsen in coming decades. Sea levels are rising, summers are becoming hotter, winters are warming, and violent thunderstorms are becoming more frequent. Communities across the state are regularly affected by nuisance flooding, extreme heat, heavy precipitation events, and saltwater intrusion. Climate impacts transform the natural environment, compromise human health, disrupt working lands, impair built infrastructure, and damage connections between communities. All of these changes affect Maryland's residents, their livelihoods, our natural resources, and the state's economy.

To respond to the immense challenges posed by climate change, the State of Maryland is acting to mitigate its worst impacts and to adapt to those that cannot be prevented. Adaptation is action taken to prepare for and adjust to new conditions, thereby reducing harm or taking advantage of new opportunities. Climate change is a challenge that needs to be addressed through significant and sustained adaptation efforts. By adapting, Maryland will build its resilience to climate impacts, maintaining the state's productivity and identity in the face of disturbances climate change creates.

AMY MCGOVERN, 2012

A "one size fits all" approach is not effective when planning for a more resilient Maryland, as climate change impacts are not experienced uniformly across the state. Maryland's geography is varied, ranging from the beaches of Assateague Island to the mountains of Garrett County. Although some climate trends are uniform across our state and region - such as increasing summer temperatures - others, like sea level rise, erosion, and urban heat island effect, among others, are location-specific. Localized approaches, including adaptation efforts undertaken by local governments, will be crucial to successful adaptation. The extent of climate impacts is also highly dependent on the environmental, social, and economic systems in each community. Not all communities have the same resources available to effectively respond and adapt to climate impacts. Recognizing and addressing disparities between communities requires an equitable approach to the entire adaptation process, from planning through implementation and evaluation, to ensure all Marylanders are protected in the face of climate impacts.

Time is of the essence, and the next 10 years will be crucial for climate adaptation work. Recognizing this urgency, the Maryland Commission on Climate Change (the Commission) charged its Adaptation and Resiliency Working Group (ARWG) to develop this Maryland Climate Adaptation and Resilience Framework: 2021-2030 (Framework). The purpose of the Framework is to guide the next decade of statewide climate adaptation action, including establishing structures for adaptation that will continue, adapting to changing needs, well past 2030. It presents goals, strategies and activities to shape adaptation and resilience actions across Maryland; provides recommendations for local government adaptation approaches; and serves as a road map through which existing and new programs, policies, regulations and networks can help realize a climate-adapted future.

MDOT, 2019

HOW WAS THE 2020-2030 DRAFT FRAMEWORK DEVELOPED?

The Framework was developed using a highly collaborative, multidisciplinary and multi-stakeholder approach, bringing together representatives from across Maryland. The Framework development process kicked off in June 2020, three months after the COVID-19 pandemic public health emergency transformed the way that government and organizations do business. As a result, project partners, participants, and stakeholders contributed to the Framework through an entirely remote and virtual process led by the University of Virginia Institute for Engagement & Negotiation (IEN). A nationally recognized leader in fostering collaborative change, IEN's team of facilitators and mediators supports organizations, agencies, industries, and communities in making bold, sustainable, and equitable decisions across a broad range of environmental, social, and economic issues. IEN worked closely with the MDNR to design and facilitate the process. Throughout the process a project team of representatives from state government, and the nonprofit community provided high-level guidance to steer the effort.

SECTOR GROUPS

The Framework is organized using a sector-based approach. Each sector had a multidisciplinary working group that reviewed, updated, developed, and prioritized the sector's vision, goals, strategies and activities.

▶ **Water Resources:** Addressing the risks of coastal, riverine, and stormwater-based flooding and sea level rise and their impacts on water supply and water quality, including salinization; integrating climate considerations into water-resources related plans; and addressing coordination and funding approaches to support adaptation action.

▶ **Human Health:** Addressing impacts to human health resulting from exposure to climate impacts, including respiratory, cardiovascular, and mental health diseases. Ensures availability and accessibility of necessary data and information to support decision making to increase individual and population level resiliency.

▶ **Working Lands & Natural Resources-Based Economies:** Achieving climate-resilient agricultural, agroforestry, fishing, and aquaculture practices, including by addressing climate impacts on animal and plant health. Ensure healthy soils, stores of blue carbon and good water quality into the future.

▶ **Natural Resources & Ecosystems:** Planning for and addressing terrestrial and aquatic habitat migration, changing conditions, and species shifts; engaging communities in the natural resource adaptation process; and creating an effective and cooperative environment for adaptive management.

▶ **Protecting Critical Infrastructure:** Adapting transportation networks, water provision systems, stormwater and wastewater systems, utility infrastructure, and critical facilities for climate resilience. Ensure affordability, accessibility, and access to federal funding.

ELENA GILROY, 2014

FOCUS AREA GROUPS

In addition, three focus areas cross-cut each sector group. These focus areas represent key values and considerations that are integrated throughout this Framework, in addition to establishing unique recommended goals, strategies and activities. The focus areas serve to holistically incorporate key values that underpin how Maryland will achieve a resilient future. Each focus area also had a multidisciplinary working group that developed the recommendations included in this Framework.

▶ **Justice, Equity, Diversity & Inclusion:** Ensuring that climate adaptation work acknowledges and addresses historic and current inequities; equitably involving underserved and overburdened communities in developing and implementing resiliency efforts across all sectors; and allocating equitable investments and resources through decision-making processes.

▶ **Local Government & State Service Delivery:** Incorporating considerations for local government action, including planning and project implementation, educational outreach, and funding needs. Structuring state service delivery to meet local needs and support local action.

▶ **Climate Jobs & Training:** Integrating climate-smart principles and practices into commerce, and funding decisions through improved climate training, investment in climate-related or climate-enhanced jobs, and connections with higher-education networks.

Throughout this Framework document, icons are used to represent each of the focus areas. These icons are used to emphasize the goals, strategies, and activities related to each focus area, and to highlight the ways in which those elements are integrated throughout the Framework's sector groups. Recognizing these interconnections in the Framework will facilitate cohesive implementation by emphasizing the need for collaboration with multidisciplinary teams of stakeholders.

JUSTICE, EQUITY, DIVERSITY & INCLUSION	LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY	CLIMATE JOBS & TRAINING

The sector and focus group membership included representatives from multiple state agencies, local government, academia, and nonprofits. Before the Framework was launched, outreach was performed to recruit members outside of the ARWG membership. All of the working groups solicited input from other stakeholders who were not participating in the project to gain insights from a larger and more diverse group of subject matter experts.

WHO IS THE FRAMEWORK'S AUDIENCE?

The Framework provides recommendations that also apply to, and will require the engagement of, a wide range of audiences in Maryland, including state and local government, nonprofits, academia, businesses and the public. The principles include best practices that apply broadly to adaptation work and could be transferred to a range of adaptation programs and projects. The strategies and actions recommended for each sector are presented at three levels: state government, local government, and non-governmental stakeholders, including academia, the private sector, nonprofits, and the public. Many of the strategies and actions presented in this document are ambitious and will rely on an integrated approach across partners and sectors. The Framework provides inspiration and a starting point for new efforts as well as the means to reinvigorate existing programs that may need to be updated, revised or expanded.

MARYLAND COMMISSION ON CLIMATE CHANGE

The Commission was initially established by executive order in 2007 and was charged with developing an action plan and firm timetable for the mitigation of, and adaptation to, the likely consequences and impacts of climate change in Maryland. Another executive order in 2014 and subsequent legislation in 2015 strengthened and then codified the Commission into law. When codified, the Commission maintained many of the tasks and responsibilities that had been assigned under the executive orders, and was officially 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."[25] The Commission is chaired by the Maryland Department of Environment (MDE) Secretary and consists of members representing state agencies and the legislature, local government, business, environmental nonprofit and philanthropic organizations, organized labor, and the University System of Maryland.

The Commission is supported by four working groups whose members are appointed by the Commission Chair. The Adaptation & Resiliency Working Group (ARWG) supports the charge of the Commission by developing a comprehensive strategy for reducing the state's climate change vulnerability and providing state and local governments with tools to plan for, and adapt to, the more extreme weather and rise in sea levels anticipated as a consequence of climate change.[2] The ARWG works closely with the Commission's Scientific and Technical Working Group (STWG) to incorporate the latest climate guidance, research, and science into its priorities and work.

STEPHEN BADGER, 2020

STEPHEN BADGER, 2019

PHASE I AND II DOCUMENTS FOR CLIMATE ADAPTATION

Maryland's first statewide adaptation efforts were documented in two phases of the *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change* in 2008 and 2011. These reports, published by the ARWG, assessed anticipated impacts of climate change in Maryland and set a vision and plan for directing adaptation actions into the future.

Phase I: Sea Level Rise & Coastal Storms, August 2008

The Phase I Strategy focused on Maryland's vulnerability to sea level rise and coastal storms. Its vision was to protect Maryland's future economic well-being, environmental heritage, and public safety through recommendations to guide government-led coastal adaptation activities over a five-year period. The strategy focused on addressing coastal climate threats' impacts on human habitat and infrastructure; sustainable economies and investments; human health, safety, and welfare; and natural resource protection. It provided multiple recommended policy changes and short-term implementation strategies for accomplishing them.

STEPHEN BADGER, 2019

Phase II: Building societal, economic, and ecological resilience, January 2011

The adaptation strategies and recommendations contained within the Phase II Strategy expanded upon the recommendations set forth in Phase I, as well as *Global Warming in the Free State,* a 2008 report by the Scientific and Technical Working Group that outlined the threats posed by climate change to various sectors across Maryland. The Phase II Strategy outlined general adaptation strategies and action items for the state government to reduce the effects of climate change in sectors including human health, agriculture, forest and terrestrial ecosystems, bay and aquatic environments, water resources, and population growth and infrastructure. The report also includes a chart detailing the necessary steps for each sector's recommendations to be implemented with an emphasis on actors and time frames.

PROGRESS SINCE PHASE I & II REPORTS

In the years since the Phase I and Phase II reports were published, numerous policy initiatives, programs, and legislative actions at the state and local levels were enacted to adapt to or mitigate the effects of climate change. However, a 2018 assessment identified that progress toward some previously established adaptation goals had lost momentum. The Phase I and Phase II strategies had accomplished mixed results, with many key actors and programs no longer aligned with or aware of the original climate adaptation strategies presented in each report. In addition, the state's adaptation goals did not explicitly address or adequately consider justice, equity, diversity, and inclusion (JEDI), which need to be integrated into all aspects of adaptation work if we are to help all Maryland communities build a climate-resilient future. In an effort to reinvigorate the state's climate adaptation strategy, the Commission's 2019 Annual Report directed the ARWG to begin developing a climate adaptation framework "for guiding and prioritizing action over the next 10 years, specifically in vulnerable and under-served communities." The result of that effort is the culmination of this document, the Maryland Climate Adaptation and Resilience Framework: 2021-2030. A list of the current climate-related policies that show the current legislatively mandated climate efforts across state can be found in the Framework's appendices (see Appendix C: State Policies for Climate Adaptation).

CROSS-FRAMEWORK VISION, PRINCIPLES & PRIORITIES

MDNR CHESAPEAKE AND COASTAL SERVICE, 2019

JULIE BORTZ, 2020

2030 VISION FOR MARYLAND

In the next 10 years, Maryland will build its adaptive capacity and resilience to climate change impacts. The process of adapting will prioritize restorative justice in order to address historical inequities that have created disparate climate impacts, balancing the needs of the state's natural, human, social and economic systems. Maryland will implement the strategies and activities described within this Framework through collective action with partners at the state, local, and community level. All work will be conducted with a focus on equity and commitment to transparency and accountability.
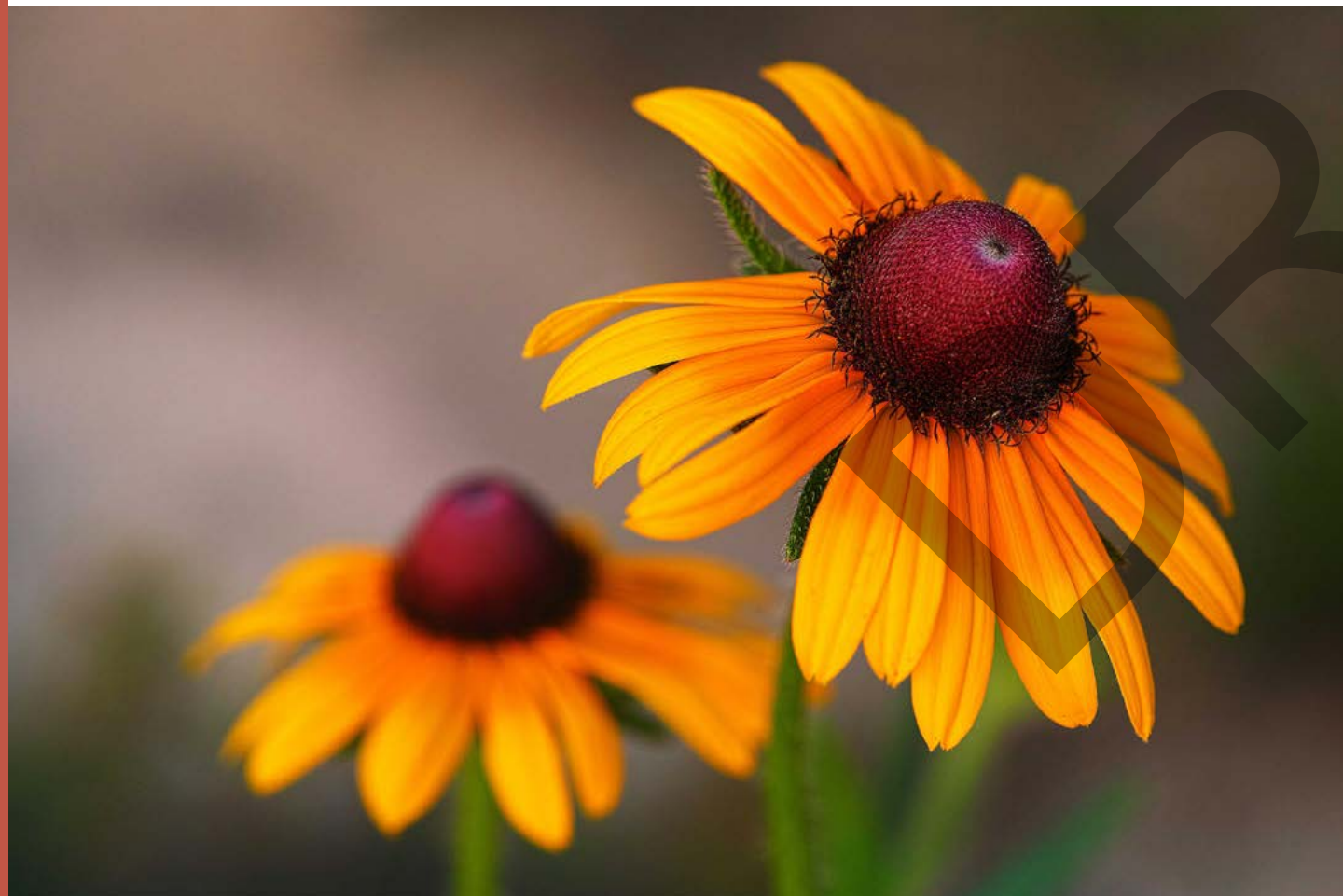
MIKE CABLE, 2015

CROSS-FRAMEWORK PRINCIPLES

The goals, strategies, and activities included in this Framework are predicated on, and will be informed by, the following principles that embody best practices in climate adaptation and resilience planning and that ensure Maryland's resilience is achieved in accordance with the values we embrace.[26]

JUSTICE, EQUITY, DIVERSITY & INCLUSION

Achieving equitable adaptation and resilience will require careful design and execution of policies and programs to improve outcomes for underserved and overburdened communities, as well as substantial investment and commitment to building local capacity and fostering long-term relationships. To ensure equity in outcomes, state agencies and local governments must:

1. Acknowledge that underserved and overburdened communities have experienced generations of systemic disinvestment due to racism and other forms of marginalization, creating social, health, environmental, and economic inequities that will be further exacerbated by the impacts of climate change.

2. Recognize that each community has its own history, character, culture, assets, priorities, and concerns, and that a "one-size-fits-all" approach will not be effective and may, in some cases, exacerbate inequities.

3. Adopt transparent and inclusive processes that enable underserved and overburdened communities to directly shape the design and implementation of climate adaptation solutions.

4. Provide open and ongoing culturally competent communication about climate change, planning processes and implementation strategies in clear and accessible ways.

5. Explicitly identify and consider the assets and needs of, and specific climate impacts on, underserved and overburdened communities in adaptation analysis, assessment, planning, and implementation.

6. Promote initiatives that build the capacity of the most underserved and overburdened communities with an eye toward local resilience, self-governance, and self-reliance.

7. Prioritize investment in Maryland's most underserved and overburdened communities to expand equitable access to services, resources, and economic opportunities.

8. Support and coordinate adaptation efforts using a "whole government" or "whole of government approach" that spans across agencies, jurisdictions, and policy areas to maximize community resilience and minimize cumulative burdens.

9. Implement climate adaptation solutions that address the community as a whole by meeting the community's expressed needs, reducing cumulative impacts, and producing multiple benefits such as, environmental sustainability, ecological diversity, economic development and human health and well-being.

10. Measure, track, and assess progress for all initiatives and make this data readily and equitably accessible.

LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY

Climate change is a global problem whose impacts will be felt most intensely at the county, municipality, neighborhood and community level. The state's successful response to climate threats will depend on its ability to cohesively mobilize support and resources fairly and equitably around concrete local adaptation actions. An effective response to addressing climate impacts will require careful design informed by climate projections and current science (acknowledging the uncertainty that exists) as well as community knowledge and input. It will also require substantial investment and shared commitments to building the capacity of local governments to take action. To ensure local governments are empowered to take action, state agencies must:

1. Conscientiously engage and consider the needs of local governments in adaptation analysis, assessment, planning, implementation, and decision support.

2. Support and coordinate adaptation efforts within and across jurisdictions using a "whole-of-government" approach to minimize the burden on local governments due to outreach redundancies (i.e. track grant programs across departments, work collectively to identify a single-point of contact for all resilience efforts).

3. Emphasize synchronization between state and local planning efforts to ensure local climate adaptation and resilience needs can be met (i.e. enabling better hazard mitigation planning or management of nuisance flooding, providing resources for local projects, or enhancing local spending authorities).
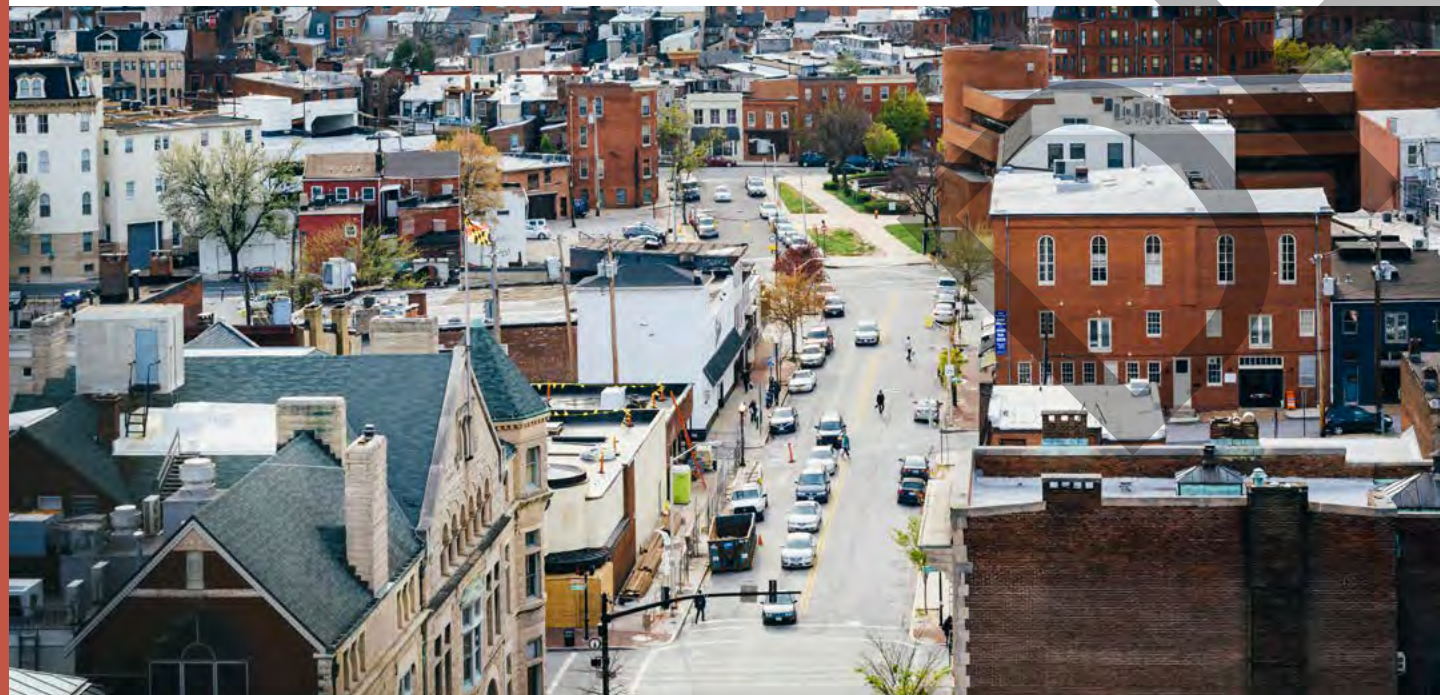
CLIMATE JOBS & TRAINING

The impacts of climate change have the potential to transform our economies and workforce. Achieving adaptation outcomes will require that we include foundational climate change principles in our educational systems; provide training and retraining opportunities to support skill development and work adjustments; anticipate and support industry transformation and growth; and ensure the safety of our workers in potentially more hazardous heat and flooding environments. To meet these challenges, state agencies, and local governments should:

1. Build climate awareness and long-term resilience in existing and future workforce and economy by incorporating climate change in Pre-K, K-12, trade school, and higher education programs and curricula.

2. Support skilled-worker retention for climate-impacted and transitioning industries by offering on-the-job training and retraining opportunities to ensure that sectors requiring adaptation have a sufficient workforce.

3. Build resilient economies and support industry transformations by (1) understanding and planning for future training, industry, and occupational needs; (2) aiding workforce recruitment efforts; (3) supporting evolving community employment, job markets, and economic development strategies; and (4) supporting new markets and technological advancements through research and development.

4. Protect Maryland workers from on-the-job climate-related hazards such as increased temperatures and flooding.

MDOT, 2019

STEPHEN BADGER, 2019

CROSS-FRAMEWORK PRIORITIES

Although presented separately, the focus areas and sector groups share common priorities for climate adaptation action that underpin this Framework's successful implementation over the next decade. The priorities below identify areas that will require sustained leadership by the ARWG to ensure successful group collaboration, which will help to maximize efficiency and accelerate progress.

1. **Online Adaptation Hub:** Establish an Online adaptation hub to serve as a one stop shop for all adaptation related efforts of the state, including the Framework. The hub should provide curated tools and resources, such as a GIS platform for visualizing climate-related risks, that support action and decision-making decisions. Progress tracking for the Framework should be hosted on the hub to ensure transparency and accountability in Framework strategies and activities.

2. **Reporting on Progress:** Utilize existing climate change reporting requirements, like those in Environment Article §2-1305 of the Maryland Code to streamline communicating on the progress of goals, strategies, and activities as well as any recommendations or identified needs for successful implementation on climate change related efforts. Work with the ARWG members from these agencies to include Framework progress and all progress and identified needs or recommendations into the annual reports.

3. **State Agency Resource Allocation:** Assess and ensure adequate staffing and resource allocation for implementation at all agencies. Identifying and accessing the technical and financial resources needed to support their efforts is essential to effective implementation. Robust inter-agency communication will be integral to the success of these efforts.

4. **Local-Level Capacity Building:** Provide robust capacity assistance services to small local governments and community-based organizations. This could be pursued through the expansion of existing service providers, creation of a new program and/or alignment with federal initiatives that may be enacted (Civilian Climate Corps). Examples of the types of assistance to be provided include developing conceptual plans for resilience projects, developing grant proposals, and assisting with grants management.

5. **Evaluating the Economic Impacts of Climate Change:** Coordinate across sectors, agencies, organizations and the State Treasurer's Office to evaluate the impact of climate change on the state's economy (including the cost of inaction) and evaluate existing funding programs, identifying gaps in available programs to cover adaptation needs. As part of the evaluation, determine the sources of match available to fill federal program requirements and ensure that they are adequate. Institute coordination between funding programs to ensure they are leveraged to the greatest extent, the funds are unified in their approach of considering vulnerable communities and anticipated climate impacts in proposal evaluation.

FOCUS AREA FRAMEWORKS

STEPHEN BADGER, 2018

JUSTICE, EQUITY, DIVERSITY & INCLUSION

2030 VISION

Underserved and overburdened communities experiencing historic and current systemic inequities receive support for climate adaptation that ensures new or ongoing access to health, safety, job opportunities, natural and cultural resources, and improved quality of life.

GREG SHIELD, 2018

While all Marylanders will be impacted by climate change, those who have historically had more resources will be in a better position to respond, recover, and adjust as climatic changes occur, while others will be disproportionately affected. In many cases, the communities most vulnerable to climate impacts are underserved and overburdened as a result of generations of disinvestment due to racism and other forms of marginalization, creating social, health, environmental, and economic inequities. One example of this reality is the pattern of urban heat in Baltimore City. Researchers have found that the hottest areas of Baltimore are also the least wealthy, and Baltimore's hottest neighborhoods today align with those areas that were "redlined" by the Home Owners Loan Corporation in the 1930s. Redlining is a process that was used to identify certain areas as high-risk for mortgage lenders, which would not issue loans for housing in "hazardous" areas. Two of the factors used to label an area as high-risk were the racial identity and socioeconomic status of its residents.[27] By removing the possibility of homeownership from certain members of society, redlining entrenched racial segregation and disinvestment. Today, redlined areas in Baltimore tend to have more pavement and less green space than other areas, causing residents of these neighborhoods to experience temperatures up to ten degrees hotter than other parts of Baltimore.[28] Climate change will continue to exacerbate this disparity as temperatures keep rising.

In many cases, the communities most vulnerable to climate impacts are underserved and overburdened as a result of generations of disinvestment due to racism and other forms of marginalization, creating social, health, environmental, and economic inequities.

All adaptation work must engage a diversity of stakeholders in order to develop and implement approaches that appropriately reflect many voices and opinions. It is also integral that community-scale work is led or co-led by community members and honors community wishes and experiences. Government agencies need to understand institutional racism and structural systems that create and perpetuate social inequities and in turn develop cross-sector or cross-government collaborations to address the root causes of disproportionate social and environmental impacts. This "inside" government approach should parallel the "outside" government strategy of equitable partnership with community members most impacted by climate risks. The Justice, Equity, Diversity and Inclusion (JEDI) principles (page 29) and Guiding Questions (page 37) help demonstrate the types of approaches and considerations that need to be integrated into climate adaptation work for it to be equitable and inclusive, and can serve as resources for state agencies' and local governments' planning processes.

Addressing the root causes of social inequities that disproportionately impact certain communities presents both a challenge and an opportunity to improve government processes. Complex issues, such as increased social vulnerabilities to climate hazards, rarely have a singular solution that can be implemented by one sector or government agency alone. The collaborative and interdisciplinary approach (often called a "whole government" or "whole-of-government" approach) promoted by the Framework principles will help government programs work in alignment, not in tension, toward equitable adaptation solutions. Efforts to address equity in climate adaptation can build upon work that has begun at the state and local level in Maryland. Case studies illustrating equitable adaptation are showcased below.

LEGISLATIVE ACTION IN RESPONSE TO PERSISTENT INEQUITIES

The Tree Solutions Now Act of 2021 (House Bill 991) was passed in the 2021 state legislative session. The bill calls for the planting of five million new trees across the state, at least 10 percent of which will be placed in underserved communities, and also provides funding for the trees to be maintained. The planting of trees in underserved communities will help reduce air pollution and mitigate the effects of "urban heat islands" which disportionately affect low-income and Black communities and persons of color.

REDEFINING EXISTING RESOURCES TO PRIORITIZE EQUITY & DIVERSITY

Legislation was passed in 2021 that expanded the membership and scope of the Commission on Environmental Justice and Sustainable Communities (CEJSC). Senate Bill 674 tasks CEJSC with examining and engaging with underserved communities across the state, determining how much state funding each would require to meet greenhouse gas emissions reductions goals during the next 25 years, ensure accessibility of CEJSC activities, and increasing coordination with the Office of Minority Health and Health Disparities and the Commission. Increasing accessibility of, engagement with, and coordination across commissions set the foundation for a more equitable implementation of climate adaptation strategies, ensuring protection for all Marylanders regardless of historic or current inequities.

EQUITABLE CLIMATE CHANGE PLANNING AT THE LOCAL LEVEL

Montgomery County has recently updated their leading planning policy document — "Thrive 2050" – that jointly-addresses racial equity, public health, and climate change within the locality by dictating how much of the County's growth and development will unfold during the next 30 years. More specifically, Thrive 2050 sets out to establish "Complete Communities'' in which their inhabitants are within 15-minute walking, biking, or driving distance to grocery stores, retail centers, places of employment, public transit, parks, and other amenities in the community. The reduced commute times and increased residential density will ideally mitigate transit-induced environmental pollution and provide more housing options to underserved communities in neighborhoods that have been historically white and wealthy.

GUIDING QUESTIONS
FOR EVALUATING EQUITY CONCERNS AND IMPACTS IN DECISION-MAKING

The following questions provide a structure to help evaluate equity concerns and impacts in decision-making processes. They are designed to help state agencies and local governments better integrate equity into policies, programs, and initiatives by reinforcing equity as a priority throughout the planning and development process. Decision-makers may need to add internal expertise in JEDI issues to confidently consider these questions and apply the responses.

The questions are intended to be thought-provoking, and do not represent an exhaustive list of questions to consider. Depending on the project and context, users may choose to add questions.

- What is your proposal for climate adaptation? What are the desired results and outcomes?
- Who are the most underserved and overburdened communities that will be affected by this climate adaptation proposal?
  - How are you defining underserved and overburdened, and what methods and criteria are you using to identify these communities?
  - Who are the existing community leaders and organizations currently working on these issues?
- How have or will these underserved and overburdened communities be engaged in the planning and implementation of the climate adaptation proposal?
  - What is the best way to inform, outreach, engage, partner and learn from community members most impacted?
  - How will underserved and overburdened communities be engaged to help anticipate and avoid unintended harm by the climate adaptation proposal?
- What are the potential impacts of this adaptation proposal on underserved and overburdened communities?
  - To whom and where are the benefits of this strategy likely to occur?
  - Are anticipated benefits small or large, short-term or long-lasting?
  - Does this strategy exacerbate barriers or burdens to underserved and overburdened communities?
  - How will implementation of this strategy affect key determinants of physical, social, and economic well-being for underserved and overburdened communities?
  - How does this strategy or goal improve current and future conditions for, and address the needs of, the most impacted individuals?
- What are your strategies for advancing equity with the adaptation proposal?
  - How can the benefits be made more equitable, and/or centered on underserved and overburdened communities?
  - Can the strategy be changed to reduce current or anticipated barriers or burdens?
  - How will harm to underserved and overburdened communities be reduced? Will compensation for past harms be provided?
- How will you ensure accountability, communicate, and evaluate results?
  - How will success in equity be measured?
  - Who will be better off and how will we know?
  - How will you detect and address unanticipated harms?
  - How will you continue to partner and deepen relationships with underserved and overburdened communities?

JUSTICE, EQUITY, DIVERSITY & INCLUSION GOAL 1:
INVESTMENT

STEPHEN BADGER, 2018

Prioritize state investment and support local government investment in projects and programs that (1) explicitly address climate change impacts and (2) support new or ongoing access to health, safety, job opportunities, natural and cultural resources, and a better quality of life in underserved and overburdened communities.

STRATEGY 1.1 | STATE

Identify underserved and overburdened communities threatened by climate change.

Activity 1.1.1. Evaluate all applicable factors that contribute to a community's burdens, including geography, public health disparities, lack of access to safe and affordable housing, environmental hazards, legacies of racism and other inequities, and socio-economic conditions.

Activity 1.1.2. Identify co-stressors, including exposure to climate impacts, that reduce community resilience.

Activity 1.1.3. Integrate the results of activities 1.1.1 and 1.1.2 to identify communities that will be adversely impacted by climate change and develop publicly available maps that show the results of these assessments, demographic data, and climate change impacts.

Activity 1.1.4. Establish statewide guidance for identifying communities that are underserved, overburdened, and climate vulnerable to align existing state agency and local jurisdiction efforts.

MDOT, 2019

STRATEGY 1.2 | STATE & LOCAL

STRATEGY 1.3 | STATE

Improve decision-making processes for funding programs to prioritize investment in underserved and overburdened communities.

Provide resources to local governments to help them enact inclusive and equitable environmental initiatives.

Activity 1.2.1. Define an equitable investment framework, including criteria for project inclusion, scoring or evaluation criteria, and processes for prioritizing expenditures.

Activity 1.2.2. Develop an investment strategy and evaluation scorecard through extensive public input, in order to ensure a prioritization process that is fair, transparent, and based on shared community goals.

Activity 1.2.3. Require vulnerability assessments, including a review of potential cumulative impacts on residents, for all proposed projects over an explicit threshold (dollar or percent) established by the agency or jurisdiction.

Activity 1.2.4. Emphasize adaptation and equity in scoring criteria.

Activity 1.3.1. Conduct a survey or focus group of local governments to identify their needs.

Activity 1.3.2. Identify opportunities that address historic inequities and co-stressors while meaningfully adapting to climate change, thereby helping communities become more resilient and secure for the future. This approach should be used to find opportunities to address the vulnerabilities identified in Activity 1.2.3.

Activity 1.3.3. Develop templates, case studies, model ordinances, and learning opportunities to build local government capacity.

Activity 1.3.4. Pass enabling legislation as needed to support the ability of local governments to create and implement initiatives.

Activity 1.3.5. Identify opportunities for increased funding and staff to help local governments implement initiatives.

STEPHEN BADGER, 2018

TENANTS TO GUIDE EQUITABLE INVESTMENT

- *Community-informed design:* Funding should be responsive to community needs and support community assets (as identified by the community)

- *Serve multiple needs:* Funding should address community priorities and support projects that include enhancements to community opportunities, including access to economic opportunities, healthy environment, secure food sources, cultural and natural resources, and recreational opportunities

- *Center on BIPOC:* Funding should invest in Black communities, Indigenous communities, and persons of color that have suffered historic disinvestment and blight

- *Promote infill development*: Funding should prioritize redevelopment in existing underserved communities over new development and include strategies to proactively avoid displacement

- *Consider environmental and climate impacts:* Funding should invest in infrastructure that is designed to mend divides, not exacerbate them. It should prioritize remediating brownfields, relocating out of floodplains, and increasing access to clean air and water.

JUSTICE, EQUITY, DIVERSITY & INCLUSION
GOAL 2:
COORDINATION & COLLABORATION

STEPHEN BADGER, 2018

State and local governments will coordinate and collaborate across agencies, departments, and programs to ensure that climate adaptation efforts are aligned, avoid unintended consequences, and achieve equitable outcomes for underserved and overburdened communities.

STRATEGY 2.1 | STATE & LOCAL

Identify patterns and legacies of structural disinvestment and obstacles to access for underserved and overburdened communities.

Activity 2.1.1. Identify the government programs related to climate adaptation across sectors. Within each, identify potential burdens, lack of alignment, and potential for cumulative impacts.

Activity 2.1.2. In consultation with affected communities, evaluate burdens and cumulative impacts (and identify potential solutions - see Goal 3).

Activity 2.1.3. Produce guidance and technical assistance for state agencies and local governments undertaking this work.

STRATEGY 2.2 | STATE

Ensure that state agencies are aligned in centering the environment and climate impacts on underserved communities.

Activity 2.2.1. Create interdisciplinary task forces and working groups with community representation to assist coordination across levels of government and political boundaries.

Activity 2.2.2. Develop training for state agency leaders and staff to improve core competencies around the intersection of climate change and JEDI. Create a shared culture and responsibility for centering underserved communities in adaptation and resilience initiatives.

Activity 2.2.3. Create a shared understanding and process for what it means to implement policies and programs that are transparent, measurable, enforceable and realistic to accomplish.

STRATEGY 2.3 | STATE & LOCAL

Create systems of accountability to ensure that outcomes are aligned and equitable.

Activity 2.3.1. **(State)** Develop a suite of community well-being indicators that can be easily adopted by agencies and local governments to track and monitor program and policy outcomes (e.g., health, employment, access to food, access to housing, access to green space).

Activity 2.3.2. **(State)** Develop metrics for evaluating equity including strategies for assessing cumulative impacts.

Activity 2.3.3. Regularly assess programs, strategies, and policies to understand who is benefiting from them.

Activity 2.3.4. Make evaluation data publicly available through an Online dashboard or other easy-to-use process to share climate equity data, outcomes, and specific initiative successes and challenges.

Activity 2.3.5. Create avenues and mechanisms for receiving community input and responding to feedback.

Activity 2.3.6. Establish adaptive management processes for addressing inequitable outcomes.

JUSTICE, EQUITY, DIVERSITY & INCLUSION GOAL 3:
CO-CREATION

MDNR, 2018

Communities share in decision-making to co-create adaptation solutions with state and local governments.

STRATEGY 3.1 | STATE & LOCAL

Commit resources to develop working relationships, information exchange, and trust between agencies and underserved and overburdened communities affected by climate adaptation planning and implementation processes.

Activity 3.1.1. Collaborate with the CEJSC and the Governor's Office of Community Initiatives on outreach planning and implementation.

Activity 3.1.2. Contract with organizations led by and serving BIPOC, community-based organizations, and organizations that prioritize JEDI to conduct outreach and engagement efforts.

Activity 3.1.3. Provide paid positions to community members to serve as local liaisons.

Activity 3.1.4. Consider other ways to increase the capacity for involvement by overburdened communities/community members.

Activity 3.1.5. Dedicate staff to serve as liaisons between agencies and communities.

DONNA SEYMOUR, 2019

STRATEGY 3.2 | STATE & LOCAL

Develop and implement a comprehensive communications and engagement strategy that resonates with residents and aligns with community needs.

Activity 3.2.1. Establish an equitable engagement task force to develop a comprehensive communications plan. The task force should be made up of organizations led by and serving POC, community-based organizations, and organizations that prioritize JEDI.

Activity 3.2.2. Consider how to best engage underserved and overburdened communities in the climate adaptation planning and implementation processes (i.e., evaluate timing availability, content and language needs, and technology access).

Activity 3.2.3. Develop an on-going engagement program to "meet people where they are," such as utilizing a variety of tools and providing multiple opportunities and formats to engage.

Activity 3.2.4. Frame outreach around community interests and priorities. Use arts, music, cultural heritage, and storytelling to engage people in conversations about climate risk and resilience and build social cohesion.

Activity 3.2.5. Establish outreach goals, evaluate outreach efforts, and revise strategies as needed utilizing community focus groups, surveys, and interviews as a way to assess outreach efforts and ensure adaptation actions are aligned with community priorities.

STRATEGY 3.3 | STATE & LOCAL

Build equitable representation into governance.

Activity 3.3.1. Improve hiring processes to attain a more diverse workforce, including targeted advertising of job announcements, reevaluating job requirements, and establishing a pipeline program for actively engaging more BIPOC.

Activity 3.3.2. Modify civil service laws and job descriptions and/or establish alternative career pathways within agencies such as enhanced interdisciplinary qualifications, honoring climate certificate programs as credentials, and embedding climate into in another field (e.g. finance, accounting, or wastewater specialist receives on the job or certificate training on climate).

Activity 3.3.3. Actively invest in career development opportunities such as youth outreach on climate adaptation career opportunities, training pipelines, and instituting an apprenticeship program that does not require higher education degrees for entry-level positions.

Activity 3.3.4. Regularly assess and publish findings of diversity and inclusion at all levels of state agencies, boards, and commissions, and actively seek to increase representation from underserved communities.

Activity 3.3.5. Administer an anonymous survey to regularly assess the culture of state agencies to ensure the work environment is culturally competent and supportive of BIPOC staff. This will help with retention of diverse staff.

CARLOS BAUTISTA, 2018
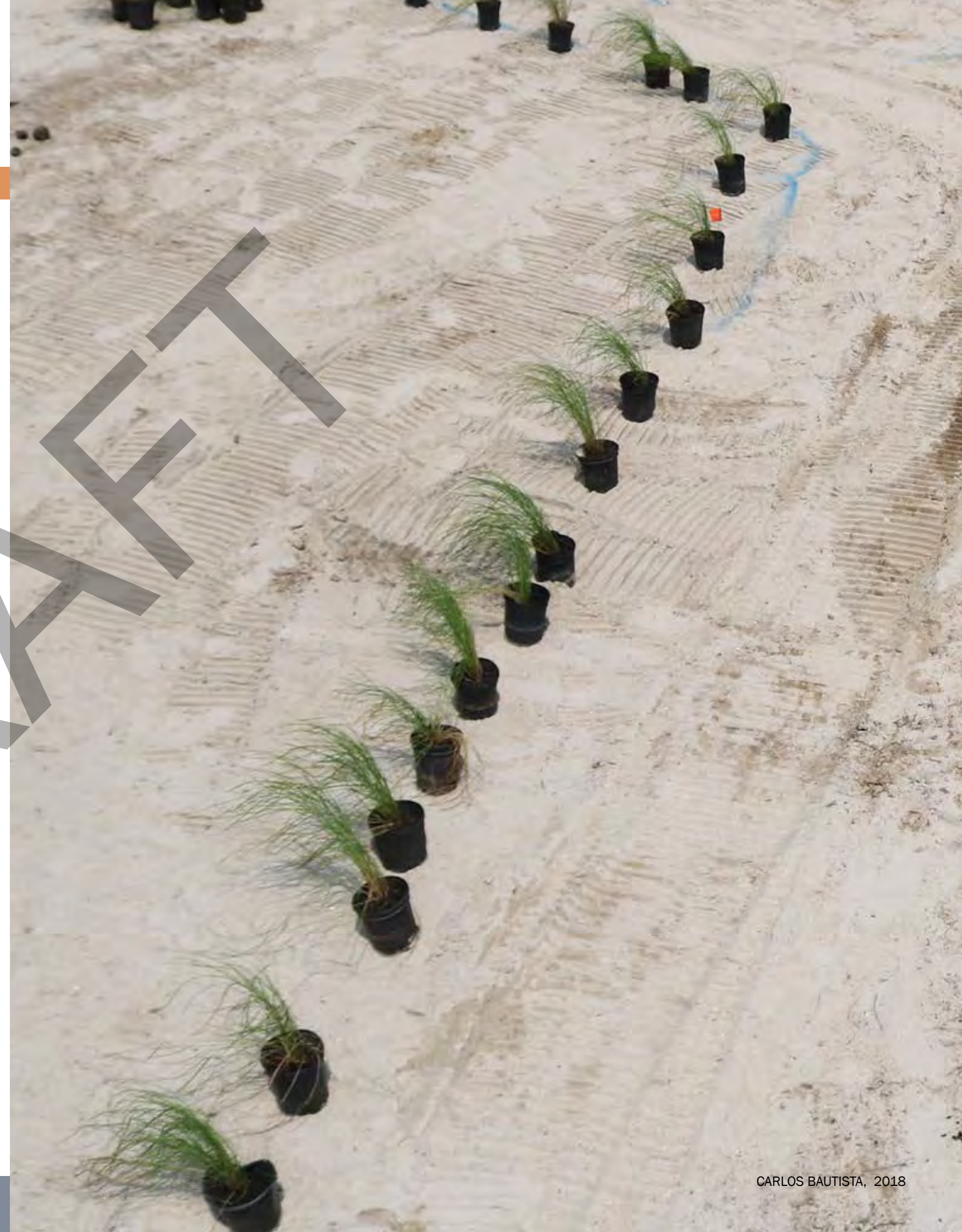
LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY

2030 VISION

All local governments and state agencies voluntarily integrate climate change considerations into plans, procedures, policies and decision-making of all types. State legislation, policies, plans and funding support robust local climate resilience work. An integrated network of assistance service providers (federal, state, regional and NGOs) enable, empower, and support local action.

TIM MOSSHOLDER, 2021

Local governments will shoulder much of the burden in planning for and adapting to the impacts of climate change in the coming decade. As the severity of climate impacts increases, local governments will need to adjust their operations and seek innovative solutions to new problems. Sea level rise may drive land use change, creating ripple effects across planning and zoning, infrastructure needs, and tax bases. Changing precipitation patterns may require new approaches to stormwater system maintenance programs and revisions to floodplain ordinances. Emergency services will need to grapple with extreme heat events and potential impacts to accessibility caused by storm-induced flooding as well as chronic nuisance flooding caused by sea level rise. An effective response to addressing these and other climate impacts at the local level will require careful planning informed by risk assessments, as well as substantial investment and shared commitments to building the capacity to take action. This investment will require participation by federal, state, regional, and non-governmental stakeholders to enable and empower local governments to achieve climate change adaptation goals and milestones.

An effective response to addressing climate impacts will require careful planning informed by risk assessments as well as substantial investment and shared commitments to building the capacity to take action.

This Framework recognizes the important role that local governments will play in climate change adaptation by emphasizing the need to support them through capacity building and collaboration. A "one size fits all" approach will not be sufficient; just as Maryland's geography varies widely across the state, all of our local governments operate differently and have distinct challenges. At the state level, it will be imperative to learn from local governments about the tools they will need to plan and implement their adaptation work, and use the results of those conversations to develop a robust toolkit to support local climate adaptation work. Sustained efforts to conduct educational outreach and secure funding resources to support resilience-building projects will also be critical for long-term success.

Climate impacts are already being felt in many communities and local governments are already taking action, creating a strong baseline of local adaptation action to be expanded upon. The following case studies illustrate this ongoing work.

PURSUING LEGAL REMEDIES FOR NUISANCE FLOODING

Annapolis has experienced a 925 percent increase in nuisance flooding days over the past 50 years and in February 2021 filed a lawsuit against more than a dozen fossil fuel companies to hold them accountable for contributing to climate change in the city. Annapolis seeks to obtain a monetary settlement as a means of funding its climate change adaptation initiatives.[29] The City of Baltimore filed a similar lawsuit in 2018, jurisdictional arguments for which were recently heard before the Supreme Court. However, in May 2021, the Supreme Court ruled 7-1 that the request of the involved fossil fuels companies for the suit to be heard in federal court must be reconsidered by the 4th Circuit Court of Appeals.[30]

CLIMATE-ADAPTED INFRASTRUCTURE FINANCING AND CONSTRUCTION

Annapolis is also undertaking a number of hard infrastructure climate change adaptation projects throughout the city, such as constructing four miles of flood walls to mitigate inundation from the Chesapeake Bay and raising the city's historic dock by nine feet in order to prolong its existence. To raise the City Dock and implement other climate change adaptation initiatives, a one percent hotel tax increase has been proposed to help fund the work in addition to federal and state emergency money, grants, and private funding.[31]

RESILIENCE AUTHORITIES

State legislation passed in 2020 authorized local Maryland governments to create resilience authorities to help accelerate the financing and implementation of resilience infrastructure projects. Charles County was the first local government in the state to do so, creating the Resilience Authority of Charles County in December 2020 as a nonprofit organization. The purpose of this organization is to "undertake and support resilience infrastructure projects that mitigate and adapt to the effects of climate change by offering a range of financing structures, forms, and techniques that levage public and private investment."[32]

LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY GOAL 1:
CAPACITY BUILDING

STEPHEN BADGER, 2021

The state actively engages in adaptation resilience capacity building for local governments by providing key tools and resources.

STRATEGY 1.1 | STATE

STRATEGY 1.2 | LOCAL

The ARWG provides a web-based toolkit of capacity-building tools, resources, grant opportunities, training, etc. to assist local partners.

Include resources from state and federal governments as well as from NGOs and private grant making organizations. Address all climate change impacts, including sea level rise, coastal storms, salinization, increasing temperatures, and changing precipitation patterns. Provide the toolkit as part of the Online adaptation hub to be developed through cross-framework priority #1.

Activity 1.1.1. In the first year, perform a review of existing tools and resources and a gap analysis to identify resource needs.

Activity 1.1.2. By the end of year 2, develop and launch a toolkit with resources to fill the gaps identified in Activity 1.1.1.

Activity 1.1.3. Starting in year 3 of implementation review the toolkit annually and determine necessary adjustments to keep it current (i.e. add new resources, delete dated resources).

Activity 1.1.4. State agencies and environmental or land trust NGOs coordinate to convene small group discussions among and within local governments, including elected officials and staff, to assist in the use of the toolkit and identify improvements . Provide opportunities for local governments to network with experts for peer-learning among local governments both within and outside of Maryland.

Activity 1.1.5. Continue to support the Maryland Climate Leadership Academy training, the Maryland CRS User's Group, Sustainable Maryland, and other agency training efforts for local staff and officials in order to increase local climate change adaptation capacity and competencies.

Help to improve the toolkit of state-provided tools and resources.

Activity 1.2.1. Participate in the small group discussions introduced in Activity 1.1.4 to provide feedback and help improve the toolkit.

Activity 1.2.2. Apply the toolkit resources to local projects.

Activity 1.2.3. Provide feedback on lessons learned during Activity 1.2.2 to share success stories, identify gaps, explain suggested improvements, etc.

STEPHEN BADGER, 2018

LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY GOAL 2:
COLLABORATIVE ASSESSMENT, PLANNING AND ACTION

STEPHEN BADGER, 2017

State and local government staff work together to understand climate vulnerabilities and develop resilience and adaptation solutions. By 2030, all county governments and larger municipal governments have voluntarily integrated adaptation approaches into applicable local plans, procedures and policies.

Work with local governments to identify and develop a greater understanding of climate impacts, and then respond to those impacts, prioritizing local governments with capacity needs.

Activity 2.1.1. Provide technical assistance and resources to help develop new or update existing local assessments, plans and policy language to understand and respond to climate hazards. Provide direct assistance through state-level agency staff, through other assistance providers (e.g., Watershed Assistance Collaborative), or by helping localities acquire funding for contractors. Provide sufficient opportunities for community and stakeholder involvement in the plan or policy development process.

JOHN BILDAHL, 2016

STRATEGY 2.2 | LOCAL

Develop, implement, and integrate approaches to climate change impacts into all applicable plans, procedures and policies that enable adaptation at the local level.

Activity 2.2.1. Voluntarily expand use of existing tools and criteria (ex. Watershed Resources Registry, MD EJScreen, CS-CRAB, and Coast Smart criteria) when implementing all siting and design projects.

Activity 2.2.2. Voluntarily adopt higher regulatory standards to go beyond minimum NFIP requirements to ensure protection against worsening flooding forecasted due to climate change and that reflect the state of climate science. This applies to jurisdictions in both tidal and non tidal areas.

Activity 2.2.3. Assign oversight of climate adaptation plan and strategy alignment and implementation as a permanent responsibility to a high-level managerial staff position. Where possible, establish a Sustainability Manager or Chief Resilience Officer position to carry out this work.

MDOT, 2019

LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY GOAL 3
CO-CREATING LOCAL ADAPTATION SOLUTIONS

JENN RAULIN, 2016

Empower local governments to co-create local adaptation solutions by encouraging and coordinating regional partnerships, including non-governmental stakeholders and other entities within Maryland's existing networks of sustainability efforts.

STRATEGY 3.1 | STATE

Employ multiple means of increasing technical support to local governments, including regional partnerships and a local resilience capacity assistance service.

Activity 3.1.1. Establish a resilience capacity assistance service through a circuit rider, Maryland Cooperative Extension, or other delivery approach to connect local governments to existing service providers at NGOs and federal and state agencies.

Activity 3.1.2. Collaborate with local governments to create and maintain a coordinated portfolio of local shovel-worthy (both most valuable and ready to go) and shovel-ready resilience-building project proposals to compete for a variety of federal annual grant funding opportunities.

Activity 3.1.3. Identify jurisdictions where capacity is a limiting factor and provide consistent state-level staff assistance and/or provide coordination with regional and local NGOs.

MDNR, 2013

LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY GOAL 4:
EDUCATIONAL OUTREACH

STEPHEN BADGER, 2019

Support the success of local adaptation efforts by incorporating educational outreach to the public.

Initiate a strong educational outreach campaign to build local support for bold, sustained, equitable climate adaptation action.

Consider focusing messages on the cost of inaction in terms of health, fiscal impacts, and local economy and jobs using local examples, visualization and trusted messengers.

Activity 4.1.1. Develop communication resources and decision-making tools such as training materials and workshops to help decision makers and communities to understand and use climate projections to inform policy change at the local level. Ensure overburdened and underserved communities are reached and engaged.

Activity 4.1.2. Making use of existing networks where available, assist with small group meeting facilitation and workshops and help to build community awareness and support. Provide guidance for residents on obtaining approvals for adaptation projects. Potential partners to lead small group discussions include Eastern Shore Climate Adaptation Partnership (ESCAP), Lower Eastern Shore Climate Action Network (LESCAN) and Sustainable Maryland.

Initiate a robust campaign to listen to community resilience needs, provide climate change education, promote steps individuals can take to build their own resilience beyond government action, and build local support for climate adaptation action.

Activity 4.2.1. Engage communities through listening sessions to learn about local climate impacts and resilience needs. This will help to honor community voices and experience and provide direction for the development of the outreach approach.

Activity 4.2.2. Maximize opportunities for parallel and complementary education efforts among regional groups, local governments, NGOs and state agencies (e.g., Maryland Flood Awareness Month).

Activity 4.2.3. Integrate public outreach campaigns with existing public engagement processes developed by local jurisdictions for climate change adaptation.

JOE EVANS, 2016

LOCAL GOVERNMENT ACTION & STATE SERVICE DELIVERY GOAL 5:
FUNDING

MDNR, 2019

Tie state funding to adaptation and resilience goals, and provide sufficient funding to support local government adaptation goals.

Tie state funding and programs to climate adaptation efforts that also enhance environmental sustainability, water resource restoration, ecological diversity, economic development and inclusion of underserved and overburdened communities at the local level.

Activity 5.1.1. Streamline grant application processes and procedures.

Activity 5.1.2. Provide dedicated state-level staff support to develop local grant applications for state, non-governmental stakeholders and federal opportunities, including strategizing on how these different programs can be leveraged.

Activity 5.1.3. Connect local governments to interns and graduate students at universities and community colleges who can assist with research, analysis and writing to support the pursuit of funding opportunities.

Activity 5.1.4. Consider developing a state greenbank to fund local government adaptation projects.

Activity 5.1.5. Integrate resilience criteria into state contracts, which local governments can model for local contracts.

STRATEGY 5.2 | LOCAL

Evaluate funding sources and financing approaches that can support adaptation action.

Activity 5.2.1. Evaluate existing sources of funding that can support adaptation activities, including state and federal grant programs.

Activity 5.2.2. Identify projects that satisfy multiple programs' needs and leverage funds across those programs to implement them.

Activity 5.2.3. Consider pursuing innovative financing approaches, such as green banks, public-private partnerships, and resilience authorities, to support adaptation action.

STEPHEN BADGER, 2021

MDOT, 2019

CLIMATE JOBS & TRAINING

2030 VISION

Targeted training and retraining programs, policies and practices to maintain worker safety, and investment in emerging technologies helps position companies, industries, and workers to thrive under future climate scenarios and meet adaptation needs in all regions of the state. Maryland's economic sectors will have planned for climate change's impacts on (1) areas of job loss, (2) areas of job growth, and (3) emerging training needs.

JEREMY ZERO, 2021

Maryland's economy is diverse, with job sectors ranging aerospace and defense, agriculture and commercial fishing, biotechnology, finance and insurance, manufacturing, telecommunications, and transportation and trade that lead the state's economic growth. In 2019, 18.1 percent of the state's workforce was employed in the public sector and 81.9 percent in the private sector.[33]

Climate change will alter, create, and impact job opportunities across Maryland. Existing industries may transform to meet climate goals, requiring their workforces to transfer existing or acquire new skills to adjust to new job requirements. New job sectors may emerge to deploy climate-smart technologies or implement projects that build resilience in our natural and built environments. Innovative climate change mitigation and adaptation technologies will lead to new job growth opportunities as these technologies often require hardware and software manufacturing, deployment, and maintenance. Education, training, and re-training can build climate awareness across all job sectors and help to position the state's workforce and economies to meet future adaptation challenges. Climate change presents an opportunity for the state to re imagine its existing and future economies and their associated distribution and supply chains. The state can act now to ensure that vital industries such as agriculture for food production, energy production and distribution, and habitat restoration can not only adapt to a changing climate, but create new economic opportunities and foster sustainable local and regional economies.

Innovative climate change mitigation and adaptation technologies will lead to new job growth opportunities as these technologies often require hardware and software manufacturing, deployment, and maintenance.

This Framework approaches jobs and training through the lens of understanding how implemented climate adaptation activities across sector groups may demand unique knowledge, skills, and market strategies. The Climate Jobs & Training goals outline the types of approaches and considerations that could be integrated into short- and long-term economic development plans, industry adjustment approaches, and workforce education, training, and retraining opportunities in response to climate adaptation activities.

Many existing local, regional and state initiatives and programs are positioned to directly or indirectly create new jobs that address the growing effects of climate change, or that can aid existing job sectors in adapting to changing environmental conditions. For example, a number of educational and outreach programs are already underway addressing industry job adjustments, providing grant and loan programs promoting job security, or promoting worker safety.

SUPPORT FOR CLIMATE-SMART PRACTICES

MDA's Low Interest Loans for Agricultural Conservation program (LILAC) incentivizes farmers to implement best practice measures and install equipment that conserves water and protects overall water quality.

EMERGING TECHNOLOGIES

The Innovative Technology Fund provides funding for technologies that hold promising benefits for Maryland's economy, improving water quality, and bolstering Maryland's resilience to climate change.

NEW WORKER SAFETY STANDARDS

The Maryland Department of Labor is developing and will adopt new regulations that address occupational exposure to excessive heat that will require certain employers to develop, implement and maintain an excessive heat-related illness prevention plan for employees. This will aid in preventing worker heat stress as temperatures continue to change into the future.

USING SURVEYS TO INFORM THE FRAMEWORK

The consideration of unique job and training needs that may be required to implement sector group activities used in this Framework is a new facet of Maryland's state adaptation strategies. To help scope and develop this section, a brief survey was distributed to subject matter experts with expertise in the five goals presented: no net job loss, training, retraining, new industry development, and industry safety. Representatives from higher education, state government, and business development organizations provided feedback on the goals and corresponding strategies. Survey responses received were used to help inform the development of the jobs and training focus area. Additional, targeted engagement and outreach should be conducted with underserved and overburdened communities in order to effectively direct activity implementation and to ensure the benefits of these jobs and training efforts are broadly realized in all communities.

CLIMATE JOBS & TRAINING GOAL 1:
'NO NET LOSS' OF JOBS

TRYSTAN SILL, 2019

Ensure that Maryland continues to see job growth and prosperity under changing climate conditions.

Success in implementing this goal will be measured by:

1. *Average positive job growth through 2030;*
2. *Positive cumulative median income growth through 2030 with a three percent or other discount rate;*
3. *Positive cumulative gross state product (GSP) growth through 2030 with a three percent or other discount rate;*
4. *Equitable distribution of job growth and income increases throughout the state's regions, across all education levels, and including underserved populations.[35]*

Conduct a state-level strategic economic analysis of the potential for job losses resulting from direct climate impacts in Maryland and identify corresponding jobs and training needs.

Activity 1.1.1. Put out a request for proposals, develop a contract with a consultant, and complete the analysis.

The analysis should: (1) Identify demographic groups, regions, and economic sectors (e.g. manufacturing, food service, agriculture, fisheries, energy production, etc.) that may present more opportunity or need more government support for adaptation; (2) Assess potential opportunities to bolster local, regional, and sustainable economies and consider equity for underserved and overburdened communities; (3) Frame results to convey the importance of climate adaptation adjustments for future economic growth and competitiveness; (4) Consider building upon the modeling analysis by Hsiang et al. with a Maryland specific focus and expanded consideration of demographics and additional economic sectors and expanded consideration of demographics and additional economic sectors.

Activity 1.1.2. Conduct outreach by hosting targeted webinars and meetings to communicate analysis results to localities and businesses. Outreach will help localities and businesses prioritize their efforts to mitigate potential jobs losses due to climate change.

Once analysis is completed, community organizations and businesses participate in outreach highlighting state-level strategy economic analysis results.

Activity 1.2.1. Participate in webinars and meetings highlighting state-level strategy analysis results once study is completed.

STEPHEN BADGER, 2018

CLIMATE JOBS & TRAINING GOAL 2:
TRAINING

MDA, 2019

Increase opportunities for early career climate change training by connecting local employment needs with climate related job needs.

Success in implementing this goal will be measured by increased state and local financial investment in early career training programs, revised curricula, and increased worker participation in these training programs over time.

Continue investing in early career training programs and incorporate climate into K-12, higher educational, and professional curriculum requirements.

Activity 2.1.1. Initiate outreach to localities, community organizations, and businesses to connect them with training resources and programs, including ones such as the Chesapeake Conservation Corps and the EARN grant.

Activity 2.1.2. Continue investing in the incorporation of climate content in K-12 and higher education curricula through efforts such as Project Green Classrooms, and include a focus on issues of environmental justice and geographically-specific job needs.

Activity 2.1.3. Incorporate materials on existing job opportunities in the restoration economy and climate change sectors into K-12, higher educational, and professional curriculum.

Activity 2.1.4. Provide guidance to local governments on how to integrate climate related job needs within regional CEDS and ways to advance climate-related job needs through grant and technical support programs.

Strategy success will be measured by (1) an increased number of participants in existing training programs for early career professionals, and (2) initiated coordination with the university system of Maryland system to update curriculum with enhanced material on climate change and climate change career/restoration career opportunities.

STRATEGY 2.2 | LOCAL

Conduct outreach for entry level and other job seekers to connect them with state-level resources, grants, and training opportunities.

Activity 2.2.1. Initiate outreach by partnering with Chambers of Commerce, community organizations, and major employers to connect job seekers to training resources, and identify employers who will hire these job seekers upon training completion.

Activity 2.2.2. Hire specialists in climate change adaptation and encourage training for local government staff in these areas (e.g. through the Association of Climate Change Officers).

Activity 2.2.3. Update the regional CEDS to incorporate climate-related job needs.

Strategy success will be measured by an increased number of participants in early career training programs.

STRATEGY 2.3 | NON-GOVERNMENTAL STAKEHOLDERS

Facilitate training and encourage education in climate adaptation for employees at all levels.

Activity 2.3.1. Develop or facilitate climate adaptation career training and educational opportunities for all employees staff.

Activity 2.3.2. Hire specialists in climate change adaptation.

Strategy success will be measured by an increased number of participants in early career training programs.

CLIMATE JOBS & TRAINING GOAL 3:
RETRAINING

MDNR, 2018

Provide opportunities for employees and companies to access retraining that helps them understand and respond to industry changes and secure living-wage jobs with fair benefits and advancement opportunities. Retain Maryland workers in "like" industries.

Success in implementing this goal will be measured by increased state and local financial investment in middle career training programs and increased worker participation in these training programs over time (e.g. Commercial Driver's License operators shift from coal-fired power plants to that need elsewhere, or helping those employees transition to a different job type with different skill sets).

STRATEGY 3.1 | STATE

Agencies managing specific grant and technical support programs engage with trade associations, local economic development departments, community groups, higher education, and companies to support a bottom-up connection between jobseekers and companies with state grants and training resources (e.g. EARN grant, Partnership for Workforce Quality, etc).

Activity 3.1.1. Initiate outreach to localities and businesses to connect them with retraining programs directed toward skill sets required for existing jobs in green technologies and restoration fields (for example, the new wind turbine manufacturing at the former Sparrows Point Steel Mill at Tradepoint Atlantic).

Activity 3.1.2. Target engagement to economically disadvantaged areas of the state and aim to reach underserved and overburdened communities. Consider geographically-specific needs and diversity of participants during outreach efforts.

Strategy success will be measured by an increased number of participants in state and local retraining grant programs. External guidance will be obtained to determine a metric that demonstrates sufficient progress.

MARYLAND GOMA, 2015

STRATEGY 3.2 | LOCAL

Conduct outreach for mid-career job seekers to connect them with state resources, grants, and retraining opportunities.

Activity 3.2.1. Initiate outreach by partnering with Chambers of Commerce, community organizations, and major employers to connect mid-career job seekers to retraining resources, and identify employers who will hire these job seekers upon retraining completion.

Strategy success will be measured by an increased number of participants in mid-career retraining programs.

STRATEGY 3.3 | NON-GOVERNMENTAL STAKEHOLDERS

Facilitate for employees or participate in retraining and educational opportunities.

Activity 3.3.1. Facilitate for employees or participate in career re-training and educational opportunities.

Strategy success will be measured by an increased number of participants in mid-career retraining programs.

CLIMATE JOBS & TRAINING GOAL 4:
NEW INDUSTRY DEVELOPMENT

STEPHEN BADGER, 2018

Continue to fund and refine existing grant programs and expand or establish contract and business accelerator opportunities to invest in new and emerging technologies and restoration efforts (e.g. NPS pollution grants).

Continue, refine, and expand grant programs and accelerator opportunities to support technologies to reduce Maryland's reliance on fossil fuels, create jobs, increase resilience to the effects of climate change, and support underserved business owners (e.g. for each activity include Minority-Owned Business Enterprises and Women-Owned Business Enterprises, and state MBE/WBE goals).

Activity 4.1.1. Refine investments in research and development through continued identification and support of new industries. Focus on industries with the potential to create many jobs and to use state incentives and regulations to help secure and expand those jobs.

Activity 4.1.2. Revisit and refine grant RFPs with a goal of increasing the number of applications for technologies that will build resilience to climate change:
- Coordinate with local governments, industry and accelerator programs to ensure that RFP language reflects key potential technology needs most beneficial to improving resilience and increasing employment opportunities.
- Structure grant programs to leverage or build upon existing federal research initiatives, other climate change-oriented research and development activities, and restoration funding that contributes to job creation (such as the Advanced Research Projects Agency-Energy and Chesapeake and Atlantic Coastal Bays Trust Fund).

Activity 4.1.3. Continue broad investment in restoration grant initiatives such as the Chesapeake and Atlantic Coastal Bays Trust Fund, which contribute to job creation in addition to increasing resilience to climate change.

Activity 4.1.4. Design grants and low-interest or no-interest loans for businesses that have developed technologies and are ready to demonstrate or pilot them. MARBIDCO's loans and grants to new farmers and existing farm businesses looking to expand their production may serve as a model for this program.

STRATEGY 4.2 | LOCAL

County-level economic development commissions inform state grant giving and contract making organizations of large technical gaps that could benefit from various new technologies.

Activity 4.2.1. Initiate coordination between localities and state grant giving and contract making organizations to communicate technology and local industry development needs, and increase funding for climate change oriented R&D.

Activity 4.2.2.
Develop a revised or new grant program, modeled off the RISE program in Virginia, to identify local resiliency challenges and solicit solutions from local businesses and groups.

STRATEGY 4.3 | NON-GOVERNMENTAL STAKEHOLDERS

Industry associations (e.g. Regional Manufacturing Institute of Maryland) communicate key technology and industry development gaps to grant giving and contract making agencies to inform RFPs.

Activity 4.3.1. Apply for and utilize funding for climate change- oriented R&D.

Activity 4.3.2. Industry associations solicit feedback from organizational memberships about barriers to or gaps in key technology and industry development and provide input to funding and regulatory partners.

CLIMATE JOBS & TRAINING GOAL 5:
INDUSTRY SAFETY

STEPHEN BADGER, 2018

Improve understanding of how worsening climate impacts affect workers and update appropriate worker safety management and regulations.

Conduct research on climate-specific industry safety and health.

Activity 5.1.1. Coordinate with the Maryland Department of Health (MDH) to incorporate climate-specific worker health and safety into future Environmental Public Health Tracking (EPHT) Program sampling efforts.

Activity 5.1.2. Coordinate with MDH to incorporate climate-specific industry safety and health findings into the upcoming 2025 update to the Maryland Climate and Health Profile Report, including the development of recommendations for protecting worker health and safety in specific industries as extreme heat and other climate change impacts worsen.

STRATEGY 5.2 | LOCAL

Coordinate with MDH to conduct and support state-level research and outreach on worker health and safety.

Activity 5.2.1. Initiate coordination between localities and MDH to conduct research.

Coordinate with MDH to conduct and support state-level strategy research and outreach on worker health and safety.

Activity 5.3.1. Adopt worker-safety policies that account for heat, air quality, or flooding conditions that may be present on job sites.

MDA, 2018

STEVE SMITH, 2016

SECTOR FRAMEWORKS

STEPHEN BADGER, 2019

WATER RESOURCES

2030 VISION

Maryland's water resources are healthy, resilient and sustainable into the future, and Maryland's residents and communities are safe from climate-driven water hazards.

All Marylanders rely on clean, healthy water resources for our freshwater supply, industry, recreation, and culture. In total, Maryland has more than 3,100 miles of shoreline.[36] The Chesapeake Bay, one of the state's greatest treasures, has a watershed that spans the vast majority of the state and portions of surrounding states as well. Dammed rivers create lakes and reservoirs that supply our energy and fresh drinking water and provide flood control and recreation. Both humans and the natural environment depend on these waters to survive and thrive.

Predicted changes in sea level, precipitation patterns, and drought due to climate change threaten to disrupt our relationship with water and will require us to change the ways in which we manage it as both a resource and a hazard. Drought, sea level rise and saltwater intrusion may diminish sources of fresh, potable water. The increase in large, flashy precipitation events that we are experiencing creates more stormwater runoff from impervious surfaces, which carries toxins and pollutants into our waterways and degrades water quality. Storm events can cause flooding, as periods of heavy precipitation overwhelm systems that were not designed with sufficient capacity to manage them, and sea level rise-induced nuisance flooding can be chronically present regardless of storm events. Changes to our shoreline as a result of sea level rise may impact the ways we access and interact with the water for recreation, which may be further exacerbated by degraded water quality and its impact on the ecosystems our water resources support.

Water resources is a complex sector, elements of which are woven throughout many aspects of climate adaptation planning. The Water Resources sector group used these three main topics to organize its work:

- *Water quality:* the physical, chemical and biological qualities of Maryland's waters and their impacts on ecosystem health
- *Water supply:* the use of water resources to support human life
- *Water hazards:* the incidence of flooding, sea level rise, storm surge, drought, and other hazards.

Informed adaptation plans will require robust research and monitoring to understand climate impacts to all aspects of water resources across the state. Findings from this research must then be incorporated into policy and programmatic updates. In order to be successful, this work will require robust communication and collaboration by many stakeholders, including through partnerships made across each of the other sectors included in this Framework.

A significant amount of work has been performed by state and local partners on this topic to date. However, there is still much work to be done to ensure that Maryland's communities adapt to the impacts of climate change on water resources. The following case studies illustrate the strategies that partners have undertaken to understand and make progress on water resource adaptation.

PRESERVING FRESHWATER AND COUNTERING THE EFFECTS OF SALTWATER INTRUSION

In 2019, the Maryland Department of Planning released a comprehensive Plan to Adapt to Saltwater Intrusion and Salinization. This plan examines the current and future effects of saltwater intrusion into freshwater sources and includes recommendations for how to best adapt to the increasing salinity of water resources in coastal areas. Among the recommendations for immediate action were to develop a statewide wetland adaptation plan, establish transitional land use designations for inundated crop and forest land, and conduct educational outreach to affected landowners and farmers.

RESOURCES FOR LOCAL COASTAL ADAPTATION PLANNING

In 2019 and 2020, the Eastern Shore Land Conservancy released two reports outlining adaptation strategies for local governments along the Eastern Shore: Mainstreaming Sea Level Rise Preparedness and Preparing for Increases in Extreme Precipitation Events. Strategies proposed included using hybrid "green-gray" infrastructure, integrating resilience into capital improvement planning, and upgrading existing infrastructure relative to future precipitation estimates.

PARTICIPATORY FLOOD DATA COLLECTION

In 2019, the Department of Natural Resources introduced the MyCoast app to enable any resident with a smartphone to self-report instances of flooding caused by precipitation and coastal events. This data can help communities and floodplain managers quickly visualize where the effects of such events are most frequent and severe, while also educating the public on the risks of flooding incidents.

WATER RESOURCES GOAL 1:
WATER QUALITY

MDE, 2016

Ensure Maryland's waters and the communities they support are resilient by: (1) conducting robust research and monitoring efforts to better understand the physical, chemical and biological qualities of Maryland's waters and how climate change is impacting them; and (2) routinely reviewing and strengthening policies, programs and regulations by integrating research and monitoring results.

Improve policies, programs, and regulations to incorporate the best available science on the impacts of climate change on water resource quality.

Activity 1.1.1. Routinely evaluate how research and monitoring results can inform updates to policies, programs and regulations. Examples include updating best management practice (BMP) implementation in watershed implementation plan (WIP) milestones to account for increased loads and BMP performance losses from climate change; adjusting land use management practices to account for saltwater intrusion; revising erosion and sediment control and stormwater BMP design standards and specifications; and updating water quality standards and permits to incorporate climate change and resiliency.

Activity 1.1.2. Evaluate subject matter connections between the best available water resource science and policies, programs and regulations. Identify gaps to inform research and monitoring needs.

Activity 1.1.3. Work with water resources researchers, subject matter experts and state agency leadership on a topic by topic basis to integrate research and monitoring results into draft updates of specific policies, programs and regulations.

Activity 1.1.4. Conduct an equity analysis for each candidate update to existing policies, programs, and regulations. Improve proposed updates by considering the cumulative impacts faced by underserved and overburdened communities, and developing approaches to lessen those impacts. Do not pursue changes that would negatively impact underserved and overburdened communities.

Activity 1.1.5. Implement the updates that have positive equity analysis results.

Research climate impacts on water quality and apply the results.

Activity 1.2.1. Starting with the results of Activity 1.1.2, conduct a gap analysis of research needs to inform policy, programmatic, and regulatory updates. Examples of research needs include: updating intensity, duration and frequency (IDF) statistics on a regular interval; determining impacts of climate change on BMP efficacy and physical integrity; investigating impacts of saltwater intrusion on soil composition and the potential for nutrient leaching; evaluating potential actions to protect the most climate sensitive watersheds; investigating the impacts of sustained drought on water quality and ecosystems; and studying the thermal tolerances of native aquatic species.

Activity 1.2.2. Partner with the Commission's STWG to create a research repository to inform policy and program changes. Evaluate the repository on an annual basis, identifying gaps to determine new priority research needs to inform effective policy, regulatory, and programmatic change.

Activity 1.2.3. Actively track research that is already in progress and communicate with researchers to learn about their work and its implications.

Activity 1.2.4. Coordinate with institutes of higher education to pursue research needs. Seek new partnerships with HBCUs to implement research projects.

Activity 1.2.5. Identify research funding support, such as the Chesapeake Bay Trust Restoration Research Grant Program and the Goal Implementation Team funding available through the Chesapeake Bay Program.

Activity 1.2.6. Disseminate research deliverables and results to a broad audience. Use a variety of means to share information, including through climate research forums. Communicate research findings with state agency staff and leadership on a topic by topic basis to help integrate research results into programs, regulations and policies.

STRATEGY 1.3 | STATE

STRATEGY 1.4 | LOCAL

Monitor climate impacts on water quality and apply the results.

Activity 1.3.1. Work with water resource monitoring experts, including the Maryland Water Monitoring Council, to determine the ideal suite of climate variables to be measured in Maryland associated with climate adaptation for water resources.

Activity 1.3.2. Develop and employ analytical approaches for using monitoring data to evaluate climate impacts.

Activity 1.3.3. Adjust existing water quality monitoring programs as needed to implement the analytical approaches and reflect in updates to Maryland's 2009 Water Monitoring Strategy. Assess the location of water quality efforts to ensure they are equitably distributed. Consider the role of various partners, including citizen scientists, in collecting data.

Activity 1.3.4. Identify and pursue funding available for monitoring and analytical support.

Activity 1.3.5. Implement the monitoring and use the results to inform University of Maryland Center for Environmental Sciences (UMCES) Coastal Adaptation Report Card updates as well as to update regulations, policies and programs.

Identify and adopt or develop enhanced water quality management practices and programs that align with state research efforts, restore and protect water quality by prioritizing nature-based approaches, and yield climate resilience co-benefits particularly in underserved and overburdened communities.

Activity 1.4.1. Review climate-related state ordinances and guidelines for water quality as they are updated and ensure they are appropriately incorporated into local ordinances.

Activity 1.4.2. Evaluate all water-quality projects at the concept stage to determine if and how a green infrastructure approach can be used, and how climate resilience measures can be achieved. Prioritize natural filter green infrastructure projects that will provide the most co-benefits and will benefit underserved and overburdened communities.

Activity 1.4.3. Integrate anticipated water-related climate impacts (such as precipitation changes and SLR projections) into the designs, maintenance plans, and inspection programs for all projects.

Activity 1.4.4. Participate in the climate research forums detailed in Activity 1.2.6 to communicate with researchers about the type of water resource information needed at the local level to enact change.

STEPHEN BADGER, 2019

CARLOS BAUTISTA, 2018

STRATEGY 1.5 | NON-GOVERNMENTAL STAKEHOLDERS

Engage community stakeholders in local water quality by participating in water monitoring, clean up, and stormwater programs and practices.

Activity 1.5.1. Implement residential and community-scale practices to clean local waters, including structural approaches (rainwater harvesting, rain gardens, etc.) and actions (trash cleanup, avoiding single-use plastics, etc.).

Activity 1.5.2. Leverage grant opportunities to support small-scale community water quality projects.

Activity 1.5.3. Join and support local watershed organizations and support volunteer monitoring programs.

ANTHONY BURROWS, 2021

WATER RESOURCES GOAL 2:
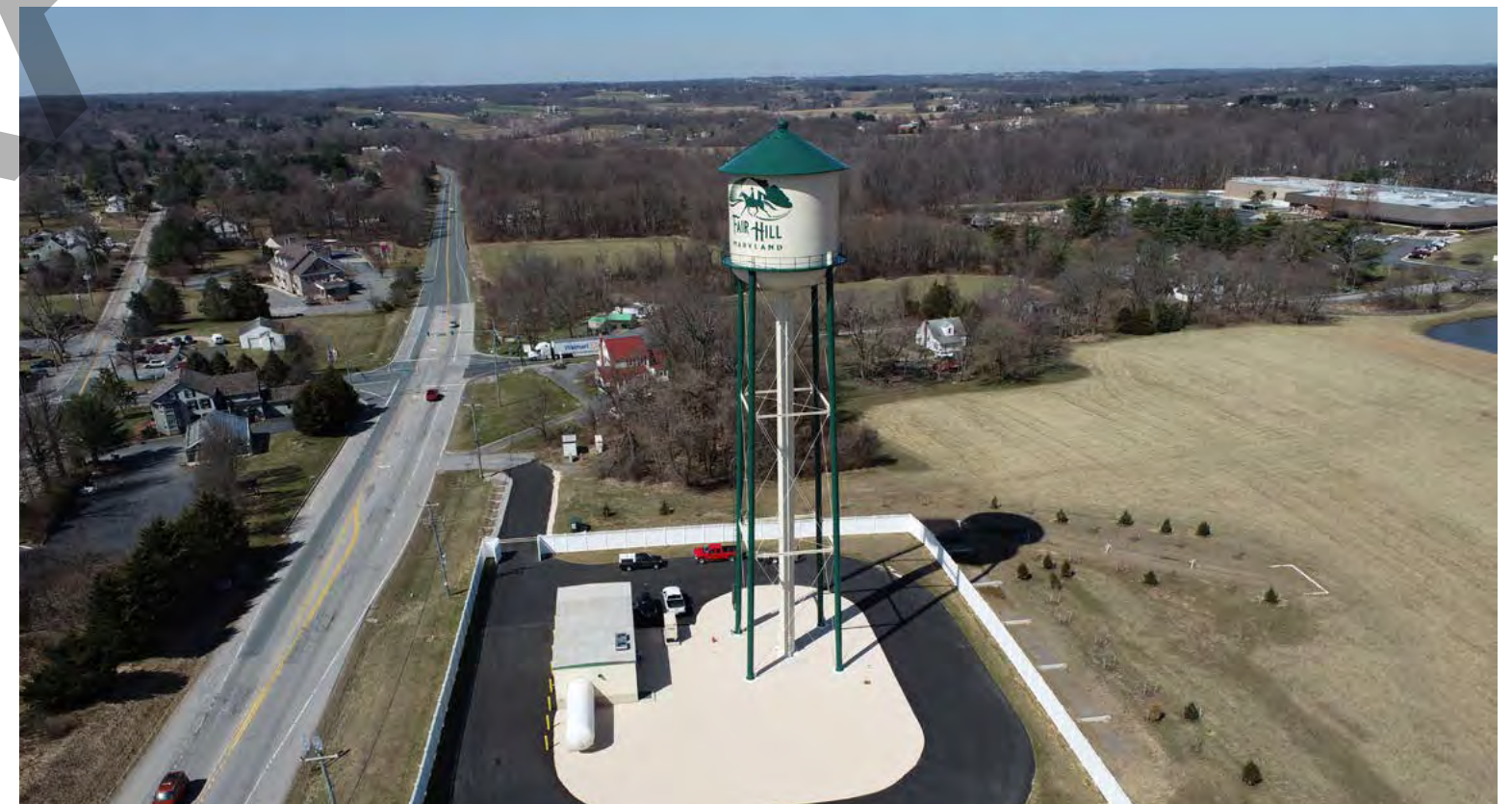
WATER SUPPLY

JOS SPEETJENS, 2021

Ensure equitable access to plentiful, safe water across Maryland by accounting for the projected impacts of climate change and ensuring source waters are protected, drinking water is safe, and population centers have reliable and sustainable water supplies.

Proactively adjust water supply management practices and programs to account for climate change impacts to both water supply availability and source water quality. Address risks due to drought, heat-induced increases in water demand, sea level rise, storm surges, and flooding as well as severe weather. Ensure adequate state staffing levels to proactively manage these risks.

Activity 2.1.1. Maryland's Source Water Protection Program should update source water assessment plans and interconnect and create regional water systems or otherwise build redundant sources of supply in anticipation of emergency situations developing (e.g. drought or contamination). Groundwater management strategy areas should be utilized and updated as part of this process. The sustainability of key coastal water sources to account for sea level rise and saltwater intrusion impacts should be evaluated and mitigation actions implemented. Potential climate threats to community surface water supply source quality that might warrant avoidance measures or enhanced water treatment processes should be evaluated, as should drought-vulnerable community supply systems so that corrective action plans can be developed. State legislation and revised regulations should require local jurisdictions to assess and protect source waters and financial and technical assistance should be provided to help them do so.

Activity 2.1.2. In collaboration with MEA, MDE should help local water supplies evaluate water demand increases associated with energy generation and cooling tower demand.

Activity 2.1.3. Continue research initiated in past investigations that identified areas with large concentrations of individual wells under the influence of surface water, which are at risk of contamination. Initiate actions for cases that can be remedied by the creation of public supply systems, including grouping smaller systems.

Activity 2.1.4. Enhance current algal bloom monitoring operations and evaluate water system adaptation capacities, such as the potential for water intake relocation, incorporation of additional treatment for algal bloom toxins, and expanded storage capacity.

Activity 2.1.5. Evaluate the socio-economic aspects of water supply management including identifying local water access problems and the intersection with equity and environmental justice issues. If and where safe and reliable drinking water is inaccessible to residents, develop and employ interventions, including State administrative penalty and enforcement authority.

Activity 2.1.6. Establish policies and procedures for permitting potable reuse for community water supply systems.

Activity 2.1.7. Expand state staffing levels to achieve this strategy. Secure the funds needed by the state water supply program to implement measures identified by the Wolman Commission for preventing any future water supply problems and establishing a sound science-based understanding of the state's water resources, like the coastal plain aquifer system.

MDNR, 2021

Local water supply system managers participate in local hazard management planning processes; local leaders participate in developing projects to compete for federal hazard mitigation funding and state technical assistance services for disadvantaged communities; and localities strengthen partnerships with county health departments and local databases.

Activity 2.2.1. Community drinking water systems serving more than 3,300 people should use the EPA's Vulnerability Self-Assessment Tool (VSAT) and Climate Resilience Evaluation Awareness Tool (CREAT) to assess the risk and resilience to natural disasters in compliance with America's Water Infrastructure Act (AWIA) of 2018.

Activity 2.2.2. Avoid and minimize water supply risks exacerbated by climate change by investing more in conservation and leak detection and remediation programs. Use existing processes, like updating water resource elements of local comprehensive plans and land development project reviews to embed water supply protection activities.

Activity 2.2.3. Ensure operating wells are capped to prevent contamination from inundation and identify abandoned wells for capping. If groundwater recharge patterns change, evaluate how exposure to naturally occurring contaminants may also change. Through land use planning and implementation, water and sewer planning, and other means, discourage the use of individual wells in areas at risk for well contamination and strive to use public water supply systems instead.

Activity 2.2.4. With state technical assistance provided as needed, adjust public drinking water system rate structures to cover the costs of operation and maintenance, projected infrastructure needs, long-term planning, and the identification and development of new water sources for the future. Adopt rate systems, assistance programs and water shut-off ordinance changes that account for socio-economic disparities to ensure that rate changes ameliorate, and do not exacerbate, existing inequities to clean water access.

Activity 2.2.5. Leverage and support the capacity of NGOs, community and faith organizations to communicate key water messages and serve as trusted partners, e.g., gaining access to identify and fix leaks.

Promote responsible water use management among residents.

Activity 2.3.1. Broaden understanding of where water comes from and how it gets from source to sink.

Activity 2.3.2. Encourage residents' evaluation of their own water use and adoption of habit changes to reduce and reuse water whenever possible, including selection of water conserving appliances for new purchases and replacing lawns with native vegetation.

Activity 2.3.3. Encourage people on private wells to periodically have their water quality tested.

Activity 2.3.4. Work with local governments as community liaisons and trusted messengers for key water information as described in Activity 2.2.6.

JOHN BUCHANAN, 2018

WATER RESOURCES GOAL 3:
WATER HAZARDS

STEPHEN BADGER, 2018

Increase the resilience of Maryland's residents and infrastructure to water-related climate hazards by equitably implementing state and local climate vulnerability analyses and action plans to help communities identify, understand, and address water-related climate hazards. Routinely update land use practices, ordinances, building codes, and design specifications to incorporate the most recent climate science.

Conduct statewide climate vulnerability assessments, starting with the most underserved and overburdened communities, that incorporate future climate change scenarios into state and local mitigation and action plans. Assessments should consider water-related hazards as well as drought, and make connections to non-water-related stressors.

Activity 3.1.1. Inventory existing climate vulnerability assessments and develop a triage approach for developing new assessments, directing resources at plans that will focus on the most underserved and overburdened populations first.

Activity 3.1.2. Develop the tools, datasets, and visualizations needed to evaluate vulnerability to water hazards, including visualizations for the 2018 SLR projections and the Coast Smart Council Climate Ready Action Boundary. Consider how these resources may not adequately represent underserved communities and develop strategies to overcome these gaps.

Activity 3.1.3. Review existing local plans that address water and hazard management, such as hazard mitigation plans, watershed implementation plans, comprehensive plans, water and sewer planning, floodplain management, and zoning planning and decision processes. Identify common strategies across planning efforts that indicate local priorities. Evaluate whether technical and funding support are available to make progress toward those priorities. Initiate a pilot study to develop efficient watershed flood analyses and mitigation plan methodologies.

Activity 3.1.4. Develop strategies to implement priorities through community engagement. Provide opportunities for community members to share their experience and vision for their communities and co-create the strategies to be pursued.

Activity 3.1.5. Create a coordinated engineering initiative to develop technical guidance and standards for public works programs. The initiative will provide methods for evaluating vulnerability and standards of practice to improve resilience of water management infrastructure including bridges and culverts, stormwater systems, wastewater collection and treatment works, and drinking water treatment and distribution systems. Methods will include optimal use of green infrastructure

and nature based solutions as a complement to gray infrastructure.

Activity 3.1.6. Work with MEMA to develop tools and training to assist local governments in integrating climate resilience considerations into local hazard mitigation plans, which should consider and identify water quality and other co-benefits in addition to flood mitigation, including the use of non-gray options and conservation easements in hazard mitigation strategies.

Activity 3.1.7. Provide dam safety programs the staff capacity to ensure all dams are inventoried and routinely assessed. Perform research to inform dam design and management protocols. Dam safety practices should include: develop and run emergency event training scenarios, make maps of flood inundation areas readily available to emergency responders and the public, enforce timely updates of dam emergency action plans, and urge local land use plans to deter development in inundation areas.

Activity 3.1.8. Ensure updated quantitative standards are incorporated into permits and regulatory documents to fully account for climate change and ensure critical water related and water dependent infrastructure (dams, wastewater treatment plants, water treatment plants, etc.) are resilient to high intensity storms and other projections under climate change.

Activity 3.1.9. Undertake a study of federal, state, and local authorities for managing runoff to prevent or minimize impacts of higher intensity rain events. Develop and implement regulatory processes to manage water quality, mitigate local flooding (particularly avoiding the flooding of neighboring properties by new or expanded development), and ensure stormwater and drainage systems are resilient to high intensity rain events.

Conduct local climate vulnerability assessments and create and implement action plans that prioritize resilience-building actions to mitigate water-based hazards while integrating multiple goals.

Activity 3.2.1. Utilize state resources to achieve a comprehensive understanding of local water hazard vulnerabilities and implement actions to address them.

Activity 3.2.2. Integrate climate change considerations into all applicable planning processes (such as hazard mitigation, floodplain management, stormwater, sewer, and comprehensive plans) to minimize the impacts of climate change associated water hazard risks. Use the resources described in Activity 3.1.2 to support this work.

Activity 3.2.3. Collaborate with other local governments to share resources and approaches and to partner to develop proposals to acquire funding.

Activity 3.2.4. Increase staff capacity to ensure locally-owned dams meet all inspection and maintenance requirements and have robust emergency action plans. Identify funding that can be used to correct any maintenance needs identified as well as dam removals or replacements.

Activity 3.2.5. Use buy-outs and other financial incentives to remove infrastructure from floodplains and restore vegetated buffers. Consider changes to regulations and ordinances to minimize new development in floodplains and other vulnerable areas located outside the regulated floodplain.

Activity 3.2.6. Conduct public education campaigns to expand awareness of risks (such as flooding outside of designated floodplains), mitigation actions, and opportunities for grants and assistance to help build resilience.

STRATEGY 3.3 | NON-GOVERNMENTAL STAKEHOLDERS

Leverage Online tools and resources to promote residents' awareness of risk and mitigation action for water-based hazards. Encourage local governments to participate in the National Flood Insurance Program's (NFIP) Community Rating System (CRS) to reduce flood damage and help lower flood insurance rates.

Activity 3.3.1. Use Online tools to learn if homes and workplaces are located in flood zones and identify emergency evacuation route locations. Review nuisance flooding and sea level rise visualizations to learn about current and projected impacts.

Activity 3.3.2. Implement residential and community-scale activities to prevent localized flooding, e.g., storm drain inlet cleaning.

Activity 3.3.3. Encourage local governments to enroll in FEMA's Community Rating System or maintain enrollment if it is already participating.

Activity 3.3.4. Consider implementing efforts to protect homes from floods and to buy flood insurance even if not in the Special Flood Hazard Area or regulated floodplain. If already insured, review policies to understand coverage and ensure compliance.

Activity 3.3.5. Report water-based hazards such as nuisance and storm-based flooding to the MyCoast app.

Activity 3.3.6. Take advantage of grants, technical assistance, and cost offset opportunities to improve home, business, and personal resilience.

WATER RESOURCES GOAL 4:
COORDINATION

TOM NAPPI, 2016

Effectively implement the water resources strategies and actions identified in this Framework by using aligned and coordinated approaches to collaborate and leverage resources to mainstream climate resilience.

STRATEGY 4.1 | STATE

STRATEGY 4.2 | LOCAL

Charge a multi-agency group with integrating work on water resources issues associated with climate change across state programs and projects.

Activity 4.1.1. Create a multi-agency state working group to focus on water resource strategy implementation that includes, at a minimum, MDA, MDE, MDNR (including Critical Area Commission and Maryland Geological Survey), MDP, MEMA and MDOT.

Activity 4.1.2. Develop the working group's charge, solicit or assign members, and launch the group. Determine how to track and communicate progress.

The multi-agency state working group for water resources should:

Activity 4.1.3. Identify other partners that work on water resource climate adaptation issues, determine how efforts can be integrated, and offer opportunities for local governments to be part of the state's coordination strategy. Reach out to a wide range of potential partners to ensure that connections made are inclusive.

Activity 4.1.4. Use pilot studies, as needed, to confirm the applicability of proposed activities and to increase the chances for their support by leadership.

Activity 4.1.5. Prioritize the water resources goals, strategies, and activities presented in this Framework and work to implement them. Coordinate on developing proposals to state and federal funding programs.

Activity 4.1.6. Operationalize Maryland's equity goals by prioritizing actions that will provide the greatest benefit to underserved and overburdened communities. Establish equity procedures and target outcomes for each activity.

Activity 4.1.7. Develop a "Climate Ready Water Resources Project Portfolio" that identifies key state and local projects to increase resilience. The portfolio will help state agencies take advantage of funding opportunities as they arise by having a list of projects in-hand when developing proposals.

Invest in deliberate coordination on climate adaptation among local government agencies and utilities responsible for water resources management and other functions that impact water resources. Use this enhanced internal coordination framework to better collaborate with external partners and stakeholders on more rapid and effective advancement of mutual goals.

While these activities are more applicable to larger local governments, smaller local governments can adopt appropriately-scaled versions of the same concepts.

Activity 4.2.1. Adopt the "dig once" philosophy in infrastructure projects, through advanced coordination and enhanced operating procedures, to open up opportunities for incorporating climate adaptation features into traditional infrastructure projects. This same coordination concept is used to align broadband installation opportunities with local government infrastructure projects.

Activity 4.2.2. Establish points of contact for partnering with state climate adaptation coordination bodies in the water sector. For example, consider a chief climate officer position or department leads on climate adaptation.

Activity 4.2.3. Develop written policies or strategies for the water sector that provide a common touchstone to promote both internal and external coordination on climate adaptation goals and priority actions.

Activity 4.2.4. Invite state agency partners to contribute to local strategy processes and projects.

STRATEGY 4.3 | NON-GOVERNMENTAL STAKEHOLDERS

Contribute community member voices and knowledge to state and local conversations and coordination efforts on water resources and climate change.

Activity 4.3.1. Learn how state and local governments are working on climate change and offer active support or serve as an advocate for action.

Activity 4.3.2. Participate in open meetings in which water resources and climate topics are discussed.

Activity 4.3.3. Volunteer with groups that match your interests (e.g. Watershed Stewards Academies, local waterkeepers, conservation groups).

Activity 4.3.4. Help other groups you belong to consider the importance of healthy water resources and the potential impacts of climate change.

MARYLAND DEPARTMENT OF HUMAN SERVICES, 2019

WATER RESOURCES GOAL 5:
FUNDING
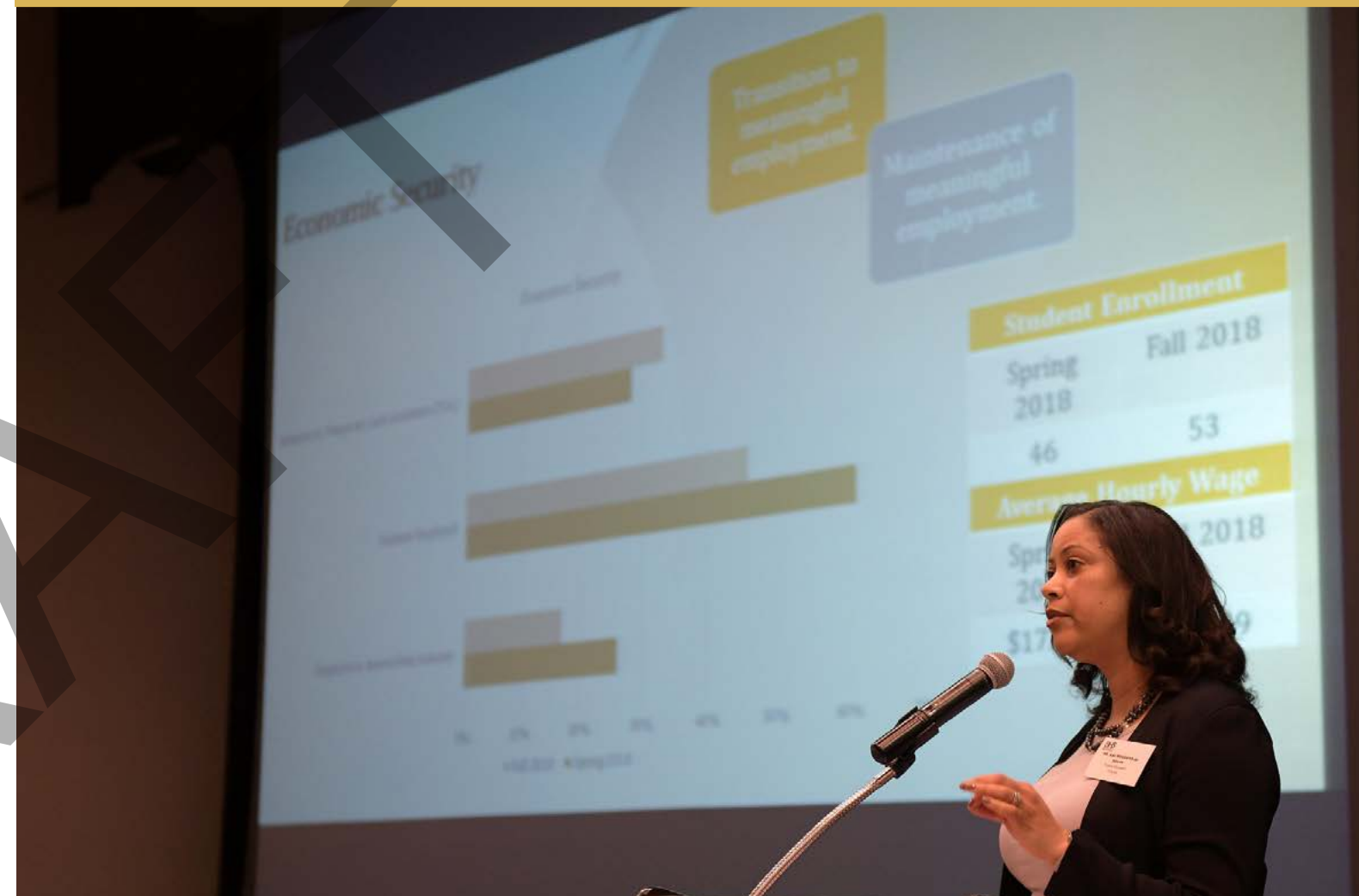
MARYLAND DEPARTMENT OF HUMAN SERVICES, 2019

Secure significant financial and staffing resources through a diversified set of funding strategies developed to meet the anticipated state and local water resources resilience needs.

Establish a Resilience Fund to coordinate funding resources to support the water sector's goals, working in collaboration with other sectors to expedite the process and identify mutual opportunities. Invest the necessary funds to create a robust project portfolio, recognizing a three-to-one return on investment when securing federal planning and capital funds. Prioritize projects in underserved and overburdened communities first, with preference for grants, as opposed to loans, and support for funds administration and project management.

Activity 5.1.1. Evaluate the anticipated cost to achieve state and local resilience goals and needs related to water resources.

Activity 5.1.2. Identify existing funding sources that can support the water sector's goals. Coordinate the management of these resources as a "Resilience Fund." The intent of the Resilience Fund is not to change the state agencies administering each funding source, but to better leverage and communicate related funding programs to maximize their impact.

Activity 5.1.3. Identify new revenue sources, or revenue enhancements, to provide additional dedicated and sustained funding and staff for agencies and other entities responsible for this work.

Activity 5.1.4. Develop a framework for how administration of the Resilience Fund will meet the water sector's goals. This includes: (1) determine how lines of communication between managers of existing funds will be enhanced; (2) identify the types of projects the fund can support, funding arrangements, eligibility criteria, and accountability oversight; (3) determine how underserved communities will be prioritized and supported; and (4) appoint a diverse advisory board to provide high-level guidance to the Fund.

Activity 5.1.5. Evaluate the Resilience Fund to determine whether the state resources it includes are adequate to fulfill federal grant match requirements and ensure Maryland is positioned to maximize its receipt of federal funds.

Activity 5.1.6. Generate materials on the purpose, scope, and requirements of the Fund to educate potential applicants, interested citizens, and community leaders.

Activity 5.1.7. Develop or adjust project selection criteria as possible operating within the requirements of each funding source. Criteria should: (1) prioritize projects that benefit underserved and overburdened communities; (2) align with state and local climate vulnerability analyses and state and local hazard management plans; (3) integrate multiple co-benefits; and (4) make progress toward sustainability goals. Include clear policies and procedures to evaluate proposals in terms of mitigating anticipated climate impacts.

Activity 5.1.8. Work with local governments and other funding recipients to gain insights on implementation hurdles that cut across programs and funding sources. Make program adjustments, as possible, to remove the hurdles.

Activity 5.1.9. Establish funds and staffing to provide local technical assistance toward scoping and developing projects for federal capital grant funds. Explore the use of technical assistance circuit riders, ombudsman, design and engineering staff, etc., to meet this need. This effort will be prioritized for underserved and overburdened communities.

STEPHEN BADGER, 2019

Evaluate the potential impact of water resource-related climate hazards on local government budgets and pursue means of addressing financial needs.

Activity 5.2.1. Include water hazard mitigation projects in the local hazard management plans to ensure they are eligible for federal funding.

Activity 5.2.2. Identify matching funds needed to invest in federally-funded capital projects, which can generate as much as a six-to-one return on investment.

Activity 5.2.3. Evaluate multiple funding mechanisms to support resilience projects, such as: changes to capital improvement programs, creating or joining a resilience authority, and proposing projects that will achieve multiple co-benefits (such as water quality and quantity management) to state, federal and private funding solicitations, including the Resilience Fund detailed in Strategy 5.1.

Activity 5.2.4. Use a climate change checklist for all capital and operations projects during budget and procurement cycles.

Activity 5.2.5. Coordinate with the state to seek technical assistance in scoping and developing projects for federal capital grant funding.

TIM HAMILTON, 2018

Through educational outreach and partnership building, help individual stakeholders gain a greater understanding of the need to enhance the resilience of water resource systems and improve protections from water hazards.

Activity 5.3.1. Participate in developing and implementing educational outreach campaigns designed to build support for Maryland's Climate Adaptation Framework.

Activity 5.3.2. Create outreach materials that underscore climate adaptation needs, climate action benefits and the value of making the financial investments to realize the benefits.

Activity 5.3.3. Investigate developing micro-grants, and other modest funding mechanisms in collaboration with local governments, that can provide incentives for individual resilience-building actions.

STEPHEN BADGER, 2019

HUMAN HEALTH

2030 VISION

All Marylanders are able to thrive physically, mentally, and socially under changing climate conditions, regardless of demographics, regional or socio-economic factors.

The physical environment, including the air we breathe, water we consume, and weather we experience, plays an important role in influencing population and individual health outcomes. Some environmental consequences of climate change have direct impacts on health that are readily apparent. For example, flooding from an extreme precipitation event can cause drowning events which are typically immediate and visible. However, other environmental consequences of climate change also create indirect impacts on health that may be profound, while less immediate and visible. For example, increased precipitation might set off a chain of events in which more homes are flooded, leading to greater quantities of mold developing in homes and businesses, in turn contributing to higher incidences of asthma in the community. Changes in extreme temperatures may affect crop yields and food supply and pose a risk to cardiovascular and respiratory health.

Natural resources, green infrastructure, resilience planning for the built environment and other resources provide important opportunities to abate some of the worst climate impacts and protect human health. For example, trees in urban environments help to cool their surroundings, absorb stormwater, and improve air quality. By increasing the quantity and accessibility of natural resources, communities can directly act to address public health risks posed by climate change, while ensuring equitable access to green spaces.

Equity is a key focus of Maryland's health sector climate change adaptation framework to ensure environmental and climate justice for all residents.

These initiatives require the continued development of epidemiological data analysis tools, technical project support, and education and outreach strategies. To reduce the public's burden of disease from climate impacts, partners at the state, local, and regional level must work collaboratively to monitor climate-related health outcomes and develop effective adaptive interventions. While working to reduce the burden of these health outcomes, it is also necessary to focus on promoting health equity for all Marylanders. Underserved and overburdened communities experience a greater burden of health impacts, due to both greater environmental exposures and lower access to resources resulting from the legacies of institutional racism and marginalization (for example, care providers, green space, transportation, healthy foods, economic security, and adaptation tools and resources). This lower access will be exacerbated with the emergence of climate change as a threat multiplier. To address these disparities, equity is a key focus of Maryland's health sector climate change adaptation framework to ensure environmental and climate justice for all residents.

Efforts are underway throughout the state to understand the relationship between climate change and health, develop and employ strategies, and educate individuals to reduce their risk. Examples of strategies that address climate impacts to health include:

The following case studies illustrate the strategies that address climate impacts to health.

CLIMATE CHANGE RESPONSE AND PUBLIC HEALTH

The Maryland Climate Change Health Adaptation Program was established in 2012 with funds from the Centers for Disease and Control and Prevention (CDC). The program, housed in the Maryland Department of Health (MDH), was created to address the human health impacts of climate change and develop adaptive resiliency in the state. Through the program, MDH has worked closely with the University of Maryland to characterize the health impacts of climate change on Marylanders, educate communities on their risk, and identify and fund climate adaptation response initiatives to reduce health burdens.

HEAT HAZARDS IN LOCAL PLANNING

A 2017 review by the Maryland Department of Planning (MDP) identified Montgomery, St. Mary's, and Talbot Counties, as well as Baltimore City, as having included heat hazards in their comprehensive plans. Under the City of Baltimore's Code Red Program, a strategy outlined in their comprehensive plan, the Health Commissioner can declare a "Code Red Extreme Heat Alert" to mobilize cooling centers across the city to protect public health. Extreme summer heat events have been on the rise in Maryland since the 1980s, with the frequency of summertime heat events doubling between 1980 and 2010 compared to the average during the 1960s and 1970s.[37] As a result, these cooling centers are likely to be more frequently employed.

PROMOTING PUBLIC HEALTH THROUGH PRESERVATION OF EQUITABLE GREEN SPACE

The Greater Baltimore Wilderness Coalition (GBWC) consists of nonprofit institutions, non-governmental organizations, and public agencies. It works to preserve green spaces in the Greater Baltimore area in order to connect community members with natural areas, and enable the community to reap the many health benefits natural areas provide. One tool used by GBWC and other organizations is the Maryland Park Equity Mapper. The mapper is a tool that analyzes presence of and access to park space across the state. The data helps to inform decision-making on where resources are needed to improve and preserve green spaces.

HUMAN HEALTH GOAL 1:
PROTECTION FROM DIRECT AND INDIRECT CLIMATE IMPACTS

STEPHEN BADGER, 2019

Achieve a sustained reduction in forecasted morbidity and mortality by using insights from the Maryland Climate and Health Profile Report (CHPR). Regularly update the CHPR using the best available science and most recent health data to accurately characterize the impact of climate change on health, identifying emerging risks and establishing a baseline.

STRATEGY 1.1 | STATE

STRATEGY 1.2 | STATE & LOCAL

MDH works with a university partner to update the [Maryland Climate and Health Profile Report](#) (CHPR) every five years to identify and analyze climate impacts on health, including forecasting anticipated disease burden using updated climate change projections.

Activity 1.1.1. Secure sufficient funding to fully support the Climate and Health Adaptation Program. Sufficient funding would support the analysis and publication of the Climate and Health Profile Report every 5 years, climate and health adaptation implementation and evaluation, technical assistance and capacity support and sufficient staff resources for the efforts.

Activity 1.1.2. Establish a cross-sector steering committee and research team to support every update to the Climate and Health Profile Report. Expertise should include collection and evaluation of state- and county-level health outcome data, local weather data, and climate models.

Activity 1.1.3. Include epidemiological, climate change, and health outcome projections analysis in the Climate and Health Profile Report update(s), using a seasonal to sub-seasonal (S2S) prediction model on a regional scale for climate impact analysis.

Activity 1.1.4. Publish and disseminate the Maryland CHPR through identified networks using outreach, webinars, training, and technical assistance to ensure data and findings are utilized effectively.

Improve the availability, quality, and access to green spaces in at least three communities, utilizing available health data and expertise at the state and local level to support green space programming.

Activity 1.2.1. **(State & Local)** Work with green space practitioners in Maryland to ensure all efforts are captured in the MDH's Environmental Public Health Climate Adaptation Tracker (EPHCAT) [portal](#).

Activity 1.2.2. **(Local)** Expand local jurisdiction engagement with Project Green Classrooms to support efforts at the state and local level, improve coordination and increase capacity.

Activity 1.2.3. **(State)** Analyze green space programming efforts, identify tools for evaluating health benefits and provide technical assistance to encourage adoption of evaluation processes for programming.

Activity 1.2.4. **(State)** Using the Maryland Park Equity Analysis, Project Green Classrooms, and other partners or organizations as necessary, develop a prioritization for green space programming expansion opportunities based on co-benefits to health outcomes of the population. Prioritization should take into account equity considerations like historical planning practices that have led to a concentration of negative health outcomes (for example heat stress or negative mental health impacts) in areas with low green space.

Activity 1.2.5. **(State)** Ensure funding, data, tools, and technical assistance is available at the state, local and non-governmental stakeholder level to support projects in high priority areas (as identified by Activity 1.2.4). Continue to work collectively to support the implementation and maintenance of green space programming. Develop and implement an evaluation process for programming to track improvements to health outcomes in the communities.

MDH partners with local health departments to introduce a pilot program in five communities aimed at reducing morbidity and mortality of heat-related disease.

Activity 1.3.1. **(State)** Understand the current rate and distribution of heat-related diseases in Maryland. Evaluate heat-related disease burden in all communities, with particular attention on communities who have been historically underserved and overburdened by heat-related disease risk factors (urban areas, occupational groups, low tree cover spaces, etc.).

Activity 1.3.2. **(State)** Prioritize area impacted based on heat-related disease distribution. Identify what technical, financial, and other resources required to address heat-related diseases in the prioritized areas. Work alongside local health departments or other partners as identified to develop interventions to reduce the burden.

Activity 1.3.3. **(Local)** Pilot participants use technical support, financial support, data, capacity support, etc. to develop adaptation programs, working with the MDH to implement, maintain and evaluate programs.

Activity 1.3.4. **(State)** MDH works to ensure inclusion of all heat-related disease interventions are captured in the EPHCAT database. Outreach and training on the EPHCAT database occurs to ensure peer learning and reduced redundancies.

Develop a Maryland specific Health Impact Assessment (HIA) process that expands from the standard HIA process to be inclusive of climate and equity considerations.

Activity 1.4.1. In consultation with the Health in All Policies Council, establish a Maryland Health Impact Assessment Climate Working Group (MHIAC) to spearhead the development of an expanded HIA process that includes climate considerations and centers equity. The MHIAC works to identify metrics for climate and health adaptation program evaluation, with particular focus in measuring program success in underserved or overburdened communities.

Activity 1.4.2. The MHIAC expands the HIA process to be inclusive of climate and equity considerations.

MDA, 2021

HUMAN HEALTH GOAL 2:
CLIMATE & HEALTH PARTNERSHIP NETWORK

JENNA LINHART, 2017

Maryland state leadership establishes a partnership network of state and local governments, health provider organizations, educators, employers and others through existing and new workgroups to develop a database, tools and technical assistance for climate and health adaptation efforts, establish metrics for evaluation, and create a public health surveillance program for climate change and health.

STRATEGY 2.1 | STATE

Establish the Maryland Department of Health as a full member of the Maryland Commission on Climate Change.

Activity 2.1.1. Pass legislation that expands membership of the Commission to include the Maryland Department of Health. Secretary of MDH begins serving on the Commission.

STRATEGY 2.2 | STATE, LOCAL & NON-GOVERNMENTAL STAKEHOLDERS

Working together, ARWG and ECO establish best practices for community engagement to inform the updated Health Impact Assessment (HIA) framework in partnership with local governments and non-government stakeholder groups. These best practices should integrate climate and health programming and evaluation with a focus on health equity.

Activity 2.2.1. Establish a Stakeholder Engagement subgroup of the Maryland Health Impact Assessment Climate Working Group (MHIAC) to inform the development of a Health Impact Assessment Framework that includes climate and equity considerations.

Activity 2.2.2. Stakeholder Engagement subgroup works with ARWG, ECO, CEJSC and CEPHAC to develop best practices for outreach, communication and community engagement specific to the use of the updated Health Impact Assessment Framework.

STRATEGY 2.3 | STATE

The MDH Climate and Health Program updates, publicizes and maintains information on all climate and health related programming, data, and mapping efforts in the state Environmental Public Health Climate Adaptation Tracker (EPHCAT).

Activity 2.3.1. Update the EPHCAT database. Expand information available to include program, evaluation and climate information, as well as point of contact.

Activity 2.3.2. Design and deploy an outreach plan for the EPHCAT to encourage utilization and submission by stakeholders throughout the state.

Activity 2.3.3. Work to integrate EPHCAT into the Environmental Public Health Tracker (EPHT) to move the state toward integration of all climate and health related efforts. Provide and annually update a complete inventory of climate and health adaptation actions taking place across the state that are receiving funding and programmatic support.

STRATEGY 2.4 | STATE

MDH creates an expanded surveillance program through the State's Environmental Public Health Tracking (EPHT) Program to display data on direct and indirect health impacts attributable to climate change.

Activity 2.4.1. Secure funding to expand the EPHT Program.

Activity 2.4.2. Expand health outcome surveillance at the state and county levels. Partner with the Department of Labor to concurrently collect or analyze data related to climate impacts on occupational health.

HUMAN HEALTH GOAL 3:
HEALTH EQUITY IN ACCESS & OUTCOMES

STEPHEN SCHATZ, 2018

Use an expanded Health Impact Assessment framework that considers climate and health equity to implement all climate change adaptation policy, planning and programming decisions throughout Maryland.

STRATEGY 3.1 | STATE, LOCAL & NON-GOVERNMENTAL STAKEHOLDERS

STRATEGY 3.2 | STATE

Local governments and non-governmental stakeholders successfully integrate updated Health Impact Assessment considerations into their decision-making processes.

Integrate updated Health Impact Assessment considerations into decision-making and programming in state agencies throughout Maryland.

Activity 3.1.1. **(State)** Introduce the best practices for community engagement and evaluation of health equity in Maryland established under activity 2.2.4 to the Health Impact Assessment workgroup. Integrated the best practices into the updated Health Impact Assessment framework.

Activity 3.1.2. **(Local & Non-Governmental Stakeholders)** Government agencies and individual stakeholder groups participating in the Health Impact Assessment Workgroup pilot the updated Health Impact Assessment framework by applying it to local level decisions.

Activity 3.1.3. **(Local & Non-Governmental Stakeholders)** Lead the implementation of pilot projects. Pilot participants produce reports on local implementation of the updated Health Impact Assessment framework for statewide distribution.

Activity 3.2.1. Update the HIA process to include climate and equity considerations using the health data, health adaptation examples, best practices for community engagement, and intervention and equity assessment metrics.

Activity 3.2.2. Disseminate the updated HIA framework to all state agencies. MDH conducts training on the implementation of the updated HIA process and considerations.

Activity 3.2.3. Integrate climate and equity HIAs into three state agency's decision-making. These state agencies produce reports on implementing HIA considerations and health equity evaluations.

Activity 3.2.4. MDH engages in a broad communication campaign to disseminate the updated HIA framework, provide training and capacity assistance to stakeholders to support the integration and utilization of the updated HIA.

MARYLAND DEPARTMENT OF AGRICULTURE, 2017

ANNE GILBERT, 2017

HUMAN HEALTH GOAL 4:
CLIMATE & HEALTH EDUCATION & COMMUNICATION

STEPHEN BADGER, 2020

Increase the awareness and understanding of climate and health risks and adaptation opportunities throughout the state to improve individual and population health outcomes, address inequities and increase overall resilience.

STRATEGY 4.1 | STATE, LOCAL & NON-GOVERNMENTAL STAKEHOLDERS

Convene an expert workgroup to assess existing climate and health education and communication capacity in the state. Then establish a communication protocol that includes best practices for communicating climate and health risk, vulnerabilities, and adaptation opportunities, with attention paid to impacts on underserved or overburdened communities.

Activity 4.1.1. Identify and solicit representatives from state and local governments and non-governmental stakeholders, academia, and practitioners to come together and form a Climate and Health Communication Workgroup. Assess existing capacity for climate and health education and communication. Publish a report summarizing the findings.

Activity 4.1.2. Develop a communication protocol that includes best practices for communicating on climate and health and allows for versatility in use depending on selected health outcome. For example: In conjunction with the 2025 update to the CHPR, implement the communication strategy based on findings of the updated historical epidemiological analysis relating asthma to extreme heat and precipitation events. Couple this with analysis on the association between spring onset asthma timing and respiratory disease exacerbation to inform respiratory disease communication efforts. Inform the public of risks and actionable strategies to reduce their risk.

Activity 4.1.3. MCCHAP, in partnership with others, creates materials that communicate the risks of climate change for human health, how to assess vulnerability, and what actions to take to reduce risk.

STRATEGY 4.2 | STATE, LOCAL & NON-GOVERNMENTAL STAKEHOLDERS

Implement the communication protocol for climate and health outcomes to increase awareness and understanding of climate and health risks to the population.

Activity 4.2.1. The Stakeholder Engagement subgroup advises on how best to disseminate updated information, tools, and training to all stakeholders in Maryland to improve awareness of and preparedness for negative health outcomes impacted by climate change. Subgroup provides input to the development of the communication protocol.

Activity 4.2.2. The MCCHAP works with ECO and the ARWG to convene meetings with the Children's Environmental Public Health Action Network (CEPHAC), the Commission on Environmental Justice and Sustainable Communities (CEJSC), and other groups or experts identified begin implementing the communication protocol for one health outcome and expand education and communication about climate and health.

Activity 4.2.3. Continue deploying the communication protocol across the state, for all health outcomes based on updated data findings of the CHPR and efforts by partners to address health concerns. Ensure all Maryland stakeholders receive the necessary education, training, and outreach to understand and utilize the suite of tools and resources developed for climate and health. It is recommended that the protocol established is for respiratory disease burden.

Activity 4.2.4. Community-based groups (religious, church, neighborhood, advocacy) expand their focus on and inclusion of climate and health considerations in meetings and town halls. Share lessons learned with the communication workgroup to inform and improve future iterations of the best practices.

Activity 4.2.5. Industry and business leaders expand their considerations to include climate risks and adaptation opportunities to increase the resiliency of population health. Industry focuses on those with climate-vulnerable occupational exposures, to ensure workplaces, processes and procedures reflect the best available science to protect worker health and safety.

MDNR, 2020

WORKING LANDS & NATURAL RESOURCES-BASED ECONOMIES

2030 VISION

By 2030, those engaged in Maryland's working land, working water, and natural resources-based economies will enjoy greater prosperity and an enhanced quality of life through adopting practices, programs, and policies that foster a resilient, sustainable, and diverse ecosystem while meeting development, and infrastructure needs.

RAHUL GADAI, 2018

The lands and waters across Maryland support a wide variety of working uses and natural resources-based economies. From farming to fishing to timbering, Maryland workers build their livelihoods on the abundance and health of natural resources and working lands, fueling industries for residents and visitors alike to enjoy. Maryland has more than 12,400 farms statewide, which cover more than 1.9 million acres of cropland, pastureland, and woodlands.[38] These farms serve as an important source of livelihood for Maryland residents, while providing a food supply for our state and the region. Each year, watermen harvest approximately 500 million pounds of seafood from the Chesapeake Bay, providing beloved and iconic blue crabs, oysters, and striped bass.[39] Forestry is the fifth largest industry in the state, employing an estimated 18,000 Marylanders and supplying wood for homes, furniture and paper products.[40]

Climate change will alter the way that these lands and resources are managed, used, and sustained. Changes in seasonality may influence the growing and food production season, in turn impacting food accessibility and affordability. Successful expansion of forestry-based economies may be hindered by heat stress and longer droughts, increased pests or disease due to increased temperatures and saltwater intrusion impacting coastal forests viability. Changes in water temperatures and salinity may alter fish and other aquatic species habitat ranges, disrupting fishery management and seafood supply.

From farming to fishing to timbering, Maryland workers build their livelihoods on the abundance and health of natural resources and working lands, fueling industries for residents and visitors alike to enjoy.

Sustaining working lands and natural resources-based economies into the future will require land and resource managers to address the complex inter-relationships between resource use and the natural environment, protect water supply and quality, and embrace opportunities to sequester carbon. Applied research and innovative technologies will help this sector increase its resilience to climate impacts and capitalize on changing market conditions.

Programs and resources exist at the local, state, regional, and federal levels that can be employed or expanded to ensure that natural resources-based economies continue thriving in a sustainable manner.

HEALTHY SOILS

Legislation passed in 2017 established the Maryland Department of Agriculture (MDA) as the state lead in developing the Maryland Healthy Soils Program. This program promotes practices and technologies that improve the health, productivity, and profitability of agricultural soils by increasing soil organic matter and enhancing their capacity to hold nutrients, retain water and store carbon. MDA convened a Soil Health Advisory Committee in 2019 to provide guidance and support in the design and implementation of the program. That same year, it received a $1 million grant through the Chesapeake Bay Stewardship Fund to encourage the adoption of further soil health and climate friendly practices.

PROTECTING VULNERABLE COASTLINES

Climate change and opportunities to facilitate gradual landscape change are considered during the evaluation of Coastal Resilience Easements purchased by the Department of Natural Resources. Easement provisions, such as development setbacks in areas at risk of sea level rise, riparian buffers that support wetland adaptation, and impervious surface limits that reduce stormwater runoff and pollution, can all help to further positive natural and working land outcomes.

MARYLAND SEAFOOD COOPERATIVE

A cooperative of watermen who have begun to sell pollution reduction credits generated to local counties to assist in their water quality goals. In the spring of 2020, MD Seafood Cooperative brokered a deal with Anne Arundel County that pays $4,950 for 107 pounds of nitrogen and 12 pounds of phosphorus to be removed from rivers in the county by oysters cultivated there.

WORKING LANDS & NATURAL RESOURCES-BASED ECONOMIES GOAL 1:
LAND USE

BRITTANY HAAS, 2018

Preserve and restore the working lands sector while meeting the state's 40 percent forest cover statute requirement, achieving the Greenhouse Gas Emissions Reduction Act's goals, and implementing other state-level resiliency recommendations.

STRATEGY 1.1 | STATE

Within three years, form a plan for addressing land retention and aquatic habitat changes that is equitable, inclusive of interests and addresses issues of all affected farmers, foresters, landowners, and watermen in the state.

Activity 1.1.1. Develop new markets and revenue streams for farmers, foresters, and watermen who implement practices that mitigate or aid in adaptation to climate change. For example, support forest or agricultural management practices that sequester carbon; compensate landowners for wetland conversion on lands impacted by saltwater intrusion.

Activity 1.1.2. Promote widespread adoption of land preservation and adaptation measures to ensure protection of lands necessary to achieve state and local goals.

STRATEGY 1.2 | LOCAL

Counties voluntarily adopt ordinances that encourage and enable climate resiliency actions.

Activity 1.2.1. Voluntarily update zoning ordinances to consider risks associated with climate change and facilitate climate adaptation, including for wildlife habitat corridors and wetland and forest migration spaces. Ordinances will consider expanded allowable land and water uses such as agrotourism or aquaculture, and the application of new and innovative technologies.

Activity 1.2.2. Voluntarily remove regulations that make participating in the natural resources-based economy more difficult.

Activity 1.2.3. Voluntarily adopt Forest Conservation Act or Critical Area Forest Protection Requirements, as well as forest management regulations that result in no-net loss of forest.

STRATEGY 1.3 | NON-GOVERNMENTAL STAKEHOLDERS

Farmers across the state increase their adoption of soil health and conservation practices beyond cover cropping and conservation tillage to improve soil health, sequester carbon, and help meet goals outlined in the Greenhouse Gas Reduction Act.

Activity 1.3.1. Farmers and landowners increase their participation in the The Healthy Soils Program to increase their implementation of soil health and conservation practices on lands.

Activity 1.3.2. Non-governmental stakeholders continue to assist in recruiting and organizing farmers in their communities to increase awareness of soil health issues and existing programs at the federal, state, and local levels.

LISA BROADWATER, 2012

WORKING LANDS & NATURAL RESOURCES-BASED ECONOMIES GOAL 2:
ECONOMIC DEVELOPMENT

STEPHEN BADGER, 2018

Establish programs and resources to increase the economic viability, sustainability, and profitability of agriculture, forestry and working waters for all types of producers and landowners.

STRATEGY 2.1 | STATE

Within five years, establish a comprehensive ecosystem marketplace that provides additional financial, ecological, and technical resources for working lands and waters.

Activity 2.1.1. Add carbon to the Maryland Nutrient Trading Tool used to calculate nutrient and sediment credit generation capacity, and expand participation in a comprehensive ecosystem marketplace.

STRATEGY 2.2 | LOCAL

Strengthen the urban-rural food system interface to improve access to and affordability of food while supporting increased profitability for all types of producers and operations.

Activity 2.2.1. Voluntarily update zoning ordinances to not only consider risks associated with climate change, but also facilitate climate adaptation, including in wildlife habitat corridors, wetland and forest migration spaces. Consider expanding in ordinances allowable land and water uses, such as for agrotourism or aquaculture, and encouraging the use of new innovative technologies. Remove county-level regulations that deter participation in natural resources-based economies.

Activity 2.2.2. Implement pilot projects to improve access to and affordability of food while increasing profitability for all types of resources-based producers and operations.

Strategy success will be measured by at least three pilot projects implemented statewide by the end of year four.

Growth in forest landowners with forest management plans, participating in carbon markets, and practicing climate smart forest management. Incentives will need to be increased and market participation will have to be eased for this to happen.

Activity 2.3.1. **(State)** Expand a variety of incentive payments, expand educational opportunities, continue research, and enhance technical services.

Activity 2.3.2. **(Non-governmental stakeholders)** Forest landowners adopt a forest management plan and generate economic returns through periodic forest product sales or participation in an ecosystem credit market.

Activity 2.3.3. **(Non-governmental stakeholders)** Landowners, foresters, and watermen participate in carbon markets and nutrient trading.

Strategy success will be measured by attainment of more than 50 percent of forest landowners implementing a forest management plan and generating an economic return; and a measured annual increase in participation in carbon markets and nutrient trading.

Explore opportunities to develop new markets emerging for agriculture, forestry, and fisheries as a result of climate impacts.

Activity 2.4.1. Academic institutions complete three studies (agriculture, forestry and fisheries) that identify market opportunities that may emerge from climate change.

Activity 2.4.2. Increase (or implement new) monitoring practices by academic institutions to understand how fisheries are changing including the range expansion of warm-water species, and aquaculture.

CANDY THOMSON, 2018

STEPHEN BADGER, 2017

WORKING LANDS & NATURAL RESOURCES-BASED ECONOMIES GOAL 3:
CLIMATE RESILIENT PRACTICES

MARYLAND ENVIRONMENTAL SERVICES, 2015

Develop, incentivize, and adopt advanced land, water, and natural resources-based economy practices and programs that increase resilience to climate impacts and enhance sustainability.

Adopt Climate Smart agriculture and forestry statewide.

Activity 3.1.1. MDA develops a Healthy Soils Program that promotes climate smart practices and provides funding and other support to farmers and landowners.

Activity 3.1.2. The Healthy Soils Advisory Committee assists MDA in identifying and implementing appropriate soil health practices, as well as procuring permanent funding sources for incentive and cost-share payments.

Activity 3.1.3. Within four years, incorporate climate smart forestry practices into all forest management plans, and climate smart agricultural practices into all soil and water conservation plans.

Activity 3.1.4. Regularly convene a comprehensive group of partners from federal, state, local, non-governmental and individual stakeholders to inform and provide recommendations to resource-related state agencies for programs, funding, research, policy, and implementation activities related to climate adaptation on working lands and in natural resources-based economies

MELISSA NASH, 2019

STRATEGY 3.2 | LOCAL & NON-GOVERNMENTAL STRATEGY 3.4 | STATE
STAKEHOLDERS

STRATEGY 3.4 | STATE

Integrate key recommendations related to working lands and natural resources-based economies from Maryland's Plan to Adapt to Saltwater Intrusion & Salinization into public and private decision-making processes.

Assess, understand and plan for climate change impacts on outdoor recreation facilities and uses throughout the state.

Activity 3.2.1. Implement climate resiliency and adaptation measures related to working lands based on recommendations in applicable county-level planning documents. Examples include adaptive retreat or land acquisition.

Activity 3.4.1. Use the Maryland Department of Transportation's State Highway Administration Climate Change Vulnerability Viewer to identify potential risks to outdoor recreation facilities and inform planning efforts.

Activity 3.4.2. Use the Maryland Park Equity Mapper to assess access to green space and include environmental justice principles in planning efforts for state recreation facilities.

STRATEGY 3.3 | NON-GOVERNMENTAL STAKEHOLDERS

Activity 3.4.3. Draft a resilience and climate preparedness plan for all state recreation facilities, informed by the analysis and assessment under activities 3.4.1 and 3.4.2.

NGOs, universities and corporations in Maryland use carbon credits or offsets to support Maryland's working lands, including for recreational purposes.

Activity 3.3.1. Purchase carbon credits or offsets generated in Maryland to support working lands and recreation-based industries.

Strategy success will be measured by ten or more Maryland-based non-governmental stakeholders purchasing Maryland-generated carbon credits or offsets by 2030.

CANDY THOMSON, 2018

WORKING LANDS & NATURAL RESOURCES-BASED ECONOMIES GOAL 4:

FOOD SECURITY

ED LISKE, 2013

Address food and fiber insecurity concerns exacerbated by climate change through implementing climate smart practices for agricultural and forest lands and working waters, reducing inequity in food supply and distribution chains, and expanding technical assistance and support to farmers, foresters, and watermen.

STRATEGY 4.1 | STATE

Ensure Maryland's local food production and distribution is resilient to climate impacts on working lands' and waters' operations and service delivery needs.

Activity 4.1.1. Develop a working group to assess transportation infrastructure and distribution network vulnerability. Solicit or assign members, and launch the group. Evaluate and produce a report with findings and identified priority actions to take. Implement projects annually. Determine how to track and communicate progress. Ensure evaluation as the program is implemented.

STRATEGY 4.2 | STATE, LOCAL & NON-GOVERNMENTAL STAKEHOLDERS

Encourage innovation and adoption of new technologies to enable farmers, foresters, landowners, and watermen to increase sustainability and resiliency of operations.

Activity 4.2.1. Implement electric vehicle-based, increasing fuel and engine efficiency, and other efficiency improvements in food distribution and farming equipment whenever technologically feasible. State and local funding and resources programs support expansion of electrification of farming equipment.

Activity 4.2.2. Develop public-private partnerships among state agencies, food suppliers and farmers, processors, and distributors to ensure business continuity for food supply during emergencies and crises, and to provide food where most needed, especially underserved areas.

Activity 4.2.3. **(Local)** Local governments lead implementation of at least three pilot projects to improve access to and affordability of food while increasing profitability for all types of resources-based producers and operations.

Evaluate the food system network to identify inequities and vulnerabilities in supply or distribution chain, and production or producer limitations.

Activity 4.3.1. Identify an existing working group or develop a new working group to evaluate the food system network for inequities and vulnerabilities. Solicit or assign members from all stakeholder groups (state, local, non-governmental, farmers, foresters and fishermen). Plan scope of analysis and any communication approaches.

Activity 4.3.2. Complete the evaluation with particular attention to underserved or overburdened communities and minority producers. Evaluation should include a prioritization of actions to take to address the vulnerabilities.

Activity 4.3.3. Disseminate the findings of the evaluation and use in programmatic, funding, and technical support decisions to address inequities and vulnerabilities in the system to address food security.

STACY SCHAEFER, 2018

WORKING LANDS & NATURAL RESOURCES-BASED ECONOMIES GOAL 5:
EDUCATION & OUTREACH

STEPHEN BADGER, 2019

Expand educational, communication, outreach, and technical assistance offerings to better support farmers, foresters, watermen, and other related stakeholders in the management, harvest, or use of land and water resources. Emphasize best practices that ensure the equitable and environmentally-sound management of resources while strengthening climate resilience.

State agencies and Soil Conservation Districts expand partnerships and research, and explore and implement ways to make farming, forestry and fishing more attractive to youth and others and eliminate structural barriers to increase the diversity of resources-based industries in Maryland.

Activity 5.1.1. Support urban farming, including by providing opportunities for urban communities -- and particularly youth -- to experience rural working lands and waters in operation.

Activity 5.1.2. Adapt requirements and incentives for existing and future programs to enable participation by small-scale producers and operators. For example: cover crop program awards seed rather than payments per acre; land preservation programs allow contiguous properties to be combined to meet minimum acreage requirements.

Activity 5.1.3. Conduct outreach in partnership with existing outreach efforts for working lands and waters, including: UMD Agricultural Extension New Farmers, Beginning Farmers Success and Citizen Training programs; MARBIDCO; or Maryland Sea Grant Watermen Resources and Graduate Fellowships.

Activity 5.1.4. Expand opportunities and training for individuals to experience working land and water activities in order to explore their career potential. Provide financial, mentorship, or capacity support to individuals interested in entering the working water or working lands career field.

Strategy success will be measured by: Growth in the percentage of minority populations participating in natural resource economies in Maryland; Growth in the percentage of farmers that are below the age of 40, women, and minority-identifying; Increased participation in programs including MARBIDCO's young farmer loans, Future Harvest's beginning farmer training, and USDA loans for minority farmers and ranchers.

Research, technical assistance, and educational organizations or nonprofits perform research and education on working lands and natural resources-based economies, including transportation dimensions.

Activity 5.2.1. Produce research reports on topics including food supply chain resilience and continuity, and food supply distribution as critical infrastructure during disasters, among others.

Activity 5.2.2. Establish curricula related to Climate Smart agriculture and soil health at high schools, community colleges, universities, and via extension services. Prioritize establishing curricula at Minority Serving Institutions and Historically Black Colleges and Universities (MSIs/HBCUs).

STEPHEN BADGER, 2018

NATURAL RESOURCES & ECOSYSTEMS

2030 VISION

In 2030, the natural resources and ecosystems sector's decision makers, including resource managers, communities, and individuals, consider the impact of increasing disturbance events (e.g. forest fire, fungal disease, storm events), long-term environmental changes, and the ability of resources to adjust. To do this, we will have built a management and regulatory environment that allows for and encourages adaptation and supports resource and system-wide adjustments as impacts from climate change develop. We will have fostered a better approach for understanding and managing change at all levels and in all communities. When decisions are made and projects are planned and implemented, funding programs will be flexible, resourced and accessible enough to advance or phase in goals over time.

ANDY CASTILLE, 2020

Maryland is rich in wildlife and natural diversity, spanning ecosystems and habitats from the Appalachian plateau to the low-lying coastal plain, and the many aquatic environments in between. These varied ecosystems are critical to the vitality of the state's wildlife and other biodiversity that make up our natural resources and benefit Marylanders in many ways. Natural resources and ecosystems provide recreational opportunities and sustenance, clean our air and water, serve spiritual and cultural needs, benefit our quality of life, and tie together community heritage.

These same resources buffer us from natural hazards and climate impacts, for example, marshes help to absorb wave impact, reducing storm surge and mitigating flood damages. Yet these protective services and benefits may themselves be diminished by climate change over the next decade and beyond. Rising sea levels threaten to submerge the state's vast marshes that filter water and provide fish spawning and nursery habitat. Changing precipitation patterns may result in more wildfires. Warmer temperatures may create or exacerbate non-native and invasive species management challenges, warm coldwater streams, and increase ocean acidification.

Natural resource and ecosystem adaptation offers a profound opportunity to enhance wildlife habitat while also building resilient communities and conserving and restoring ecosystems for long-term environmental benefit.

Employing programs and adaptation strategies that protect natural resources, foster ecosystem resilience, and create opportunities for habitat and species movement will help the state to build a better approach for understanding and managing change at all levels and in all communities. In turn, natural resource and ecosystem adaptation offers a profound opportunity to enhance wildlife habitat while also building resilient communities and conserving and restoring ecosystems for long-term environmental benefit.

Continued support and alignment of efforts underway at the state, local, and regional levels can protect natural resources and ecosystems while ensuring that damage caused by development and climate hazards are mitigated. Examples of existing programs include:

INCORPORATING NATURE-BASED DESIGN

Increasingly, communities are working with nature to build resilience through restoration by implementing nature-based projects. This approach is now explicitly implemented in the context of climate change adaptation through a state initiative entitled "Resiliency through Restoration." One example within the Deal Island Peninsula engaged members of the local community to assess flood risk and dune erosion. An assessment was used to identify solutions to improve the natural environment while benefiting the community and sustaining a seafood harvesting economy.

IDENTIFYING AREAS FOR CONSERVATION

MDNR retrofitted the State's Green Print tool, which identifies Targeted Ecological Areas (TEAs) of significance across the state, to include climate adaptation and habitat migration considerations. For example, areas that are likely to be inundated by sea level rise by 2050 have been removed from the TEAs.

COASTAL DEVELOPMENT AND LAND USE

Through Maryland's Critical Area Program state agencies and private property owners are required to meet numerous standards when developing or redeveloping coastal properties. The program's goal is to conserve the natural environment and maintain ecosystem services. For example, local Critical Area Programs, implemented through zoning and subdivision ordinances, have limits on impervious surfaces, requirements to establish, maintain, and replace forests, and limit development within riparian buffers.

NATURAL RESOURCES & ECOSYSTEMS GOAL 1:
LAND & WATER MANAGEMENT

STEPHEN BADGER, 2018

Protect, conserve, connect and restore terrestrial and aquatic habitats and manage species to support biodiversity, ecosystem services, and outdoor recreation during climatic changes.

STRATEGY 1.1 | STATE

Update and prioritize conservation and restoration targets (e.g. TEAs, oyster reefs, endangered and listed species). Set numeric goals to address significant vulnerabilities or changes and facilitate climate migration by utilizing the latest information and climate science about habitat vulnerability and migration, and species shifts.

Activity 1.1.1. Implement an increasing number of preservation and restoration actions that specifically advance and address natural resource and ecosystem climate adaptation. For example, conserve TEAs in perpetual resilience easements, construct oyster reefs, and create or protect wetland migration corridors.

Activity 1.1.2. Develop or update conservation, management, and restoration plans and projects that reflect anticipated future conditions and include climate adaptation measures.

STRATEGY 1.2 | LOCAL

Identify and incorporate new natural resource and ecosystem focus areas into comprehensive, hazard mitigation, nuisance flood, and other local planning documents to afford more protection.

Activity 1.2.1. Incorporate natural resource and ecosystem adaptation priorities across local planning documents, including in comprehensive plan sensitive areas elements.

Activity 1.2.2. Support transition of repetitive loss properties to community open space where they could facilitate habitat migration.

STRATEGY 1.3 | NON-GOVERNMENTAL STAKEHOLDERS

Offer assistance and a toolkit for landowners to easily understand natural resource changes occurring and BMPs to implement on their properties.

Activity 1.3.1. Conduct outreach and behavior interventions to encourage participation in existing stewardship programs (e.g. homeowner oyster gardening, Bay Ambassador Program).

Activity 1.3.2. Practice forest stewardship and adopt BMPs that allow natural systems to adapt and migrate over time.

Strategy success will be measured by an increasing rate of participation in existing stewardship programs.

MARYLAND ENVIRONMENTAL SERVICES, 2015

NATURAL RESOURCES & ECOSYSTEMS GOAL 2:
REGULATORY & POLICY COOPERATION

STEPHEN BADGER, 2019

All parties and partners involved in implementing adaptation-focused natural resource and ecosystem management goals on land or in water have a clear understanding of priorities, responsibilities and roles and seek to eliminate barriers and obstacles.

STRATEGY 2.1 | STATE

Develop adaptation implementation plans and policies for resource management issues that would benefit from inter-agency coordination to accelerate adaptation (e.g. wetland migration, dredged material management, upland wildlife habitat management).

Activity 2.1.1. Identify and select three key adaptation priorities that require close coordination and develop collaboration. Develop plans and policies for each priority that clearly identify: (1) key funding, planning, policy and regulatory actions; (2) the partners responsible for particular actions or elements; and (3) how to conduct work collectively across a network to implement actions and maintain accountability on progress. Implement established plans and policies.

STRATEGY 2.2 | LOCAL

Apply "Coast Smart" practices or "Climate Smart" considerations to a broader set of local project development, review, and approval processes.

Activity 2.2.1. Incorporate adaptation-specific natural resource and ecosystem adaptation priorities into local projects.

Activity 2.2.2. Identify, maintain, and protect natural and nature-based features that support ecosystem and habitat resilience when siting local projects.

Activity 2.2.3. Consider opportunities to establish habitat connectivity on and around local project sites when creating, enhancing, or restoring natural and nature-based features during mitigation.

STRATEGY 2.3 | NON-GOVERNMENTAL STAKEHOLDERS

Work with local stakeholders to identify natural resource climate-risks and opportunities in your community.

Activity 2.3.1. Develop and compile information from new or existing outreach programs that highlight community science and user-generated reporting tools (e.g. MyCoast, insight, i-Tree apps or 311 Baltimore reporting tools) to collect and record climate impacts and adaptation opportunities.

STEPHEN BADGER, 2017

NATURAL RESOURCES & ECOSYSTEMS GOAL 3:
ENGAGED COMMUNITIES

MDE, 2015

Empower all communities to aid in the adaptation of our natural resources by connecting them to places in ways that are accessible to and equitable for all people and by including them in the protection and conservation process so that they have a vested interest in safeguarding natural resources in a changing climate.

STRATEGY 3.1 | STATE

Connect people to climate impacts and adaptation options through public lands and recreation, and engage them in the process of defining future solutions.

Activity 3.1.1. Identify an initial three public land sites that will experience climate impacts and engage recreational users in defining and implementing solutions. Ensure that underserved communities can access and participate in the process and that investments in implementation are inclusive and equitable.

Activity 3.1.2. Deliver activities and programs that connect recreational users with information about the ways climate impacts could change their future use and enjoyment of public lands and waters. Engage them in the process of identifying new trails or recreational uses in areas that may be impacted.

Activity 3.1.3. Build an engaged and diverse recreational community by incorporating equity into open space, water access, and recreational infrastructure projects (e.g. boat ramps, land acquisition, ball fields).

STRATEGY 3.2 | LOCAL

Assess and support capacity building needs for community-based organizations and work with them to emphasize the benefits of natural spaces to communities (less stress, recreational, cleaner air, etc.).

Activity 3.2.1. Create easily-accessible resources for community-based organizations to connect with funding, training, and coordination opportunities that support their priorities for natural resource and ecosystem project implementation. Use existing models and partnership programs, such as watershed stewards and urban forestry programs, to accelerate connections.

STRATEGY 3.3 | NON-GOVERNMENTAL STAKEHOLDERS

Work with community partners, family and student groups, and neighborhood associations to conserve and restore natural resources and ecosystems and reduce climate risks.

Activity 3.3.1. Conduct outreach to increase awareness and understanding of where natural resources or habitats in your community are in need of adaptation support. Use tools like the MyCoast app to record flooding impacts and identify conservation and restoration opportunities.

STEPHEN BADGER, 2018

NATURAL RESOURCES & ECOSYSTEMS GOAL 4:
ADAPTIVE MANAGEMENT

STEPHEN BADGER, 2019

Incorporate flexibility into the processes and regulations governing natural resource management to allow for adaptation to occur in response to climate-induced ecosystem and habitat shifts.

STRATEGY 4.1 | STATE

Develop data, tools and protocols that allow resource managers across the state to more cohesively understand, plan for and respond to changing conditions and impacts, including more quickly addressing invasive species concerns.

Activity 4.1.1. Compile or develop relevant resources such as mapping tools, monitoring protocols, and conservation guidance for resource managers. Provide applied management support to address adaptation actions for both species and landscapes.

Activity 4.1.2. Develop and adopt rapid response protocols to address newly introduced and aggressive invasive species.

Activity 4.1.3. Build periodic reviews into long term permits, plans and project approvals to respond to changing conditions.

STRATEGY 4.2 | LOCAL

Consider approaches that "roll" over time or "phased" actions in planning or permitting, such as rolling easements.

Activity 4.2.1. Phase resource management approaches that support gradual change over time.

STRATEGY 4.3 | NON-GOVERNMENTAL STAKEHOLDERS

Understand changing growing zones and invasive species that may be moving into the area.

Activity 4.3.1. Establish partnerships with or provide training to professional organizations for nurseries, master gardeners, fisheries organizations, or app users (e.g. iNaturalist) that support natural resource adaptation outcomes and convey consistent best practices or monitoring needs. Develop partnerships in and equitably deliver training for diverse communities.

STEPHEN BADGER, 2019

NATURAL RESOURCES & ECOSYSTEMS GOAL 5:
FUNDING

CARLOS BAUTISTA, 2018

Establish funding opportunities to advance land and resource conservation goals and preserve resources under future climatic conditions.

STRATEGY 5.1 | STATE

Complete a funding audit to identify (1) funding solutions to fill gaps, (2) opportunities for funding realignment, (3) opportunities to fund climate co-benefits, and (4) funding that incentivizes adaptation action.

Activity 5.1.1. Conduct a comprehensive audit of funding programs that exist to support and incentivize natural resource and ecosystem adaptation goals.

Activity 5.1.2. Identify funding gaps and suggest funding opportunities to address needs.

STRATEGY 5.2 | STATE & LOCAL

Support and utilize capacity building or circuit-riders for small communities that don't have staff to apply for grants or manage projects.

Activity 5.2.1. Support and utilize grant writers, technical service providers, and project managers for under-capacity local areas.

STRATEGY 5.3 | NON-GOVERNMENTAL STAKEHOLDERS

Explore financial benefits of climate or habitat easements/programs and ecosystem markets.

Activity 5.3.1. When considering a resilience easement explore and implement resilience components and land management practices that allow for and support habitat change over time.

STEPHEN BADGER, 2018

PROTECTING CRITICAL INFRASTRUCTURE

2030 VISION

Maryland has developed an inventory of its critical infrastructure and a Statewide Implementation Plan to provide for that infrastructure's continued protection. Priority is given to resiliency measures constructed in the most underserved and overburdened communities.

MDOT, 2019

Critical infrastructure provides services that act as a backbone for the health, safety and continued operation of the state. Maryland residents and workers rely on safe and functional transportation networks, healthcare infrastructure, utility infrastructure, and critical facilities in their everyday lives. This includes the communications and cyber security systems that support these systems and services.

These facilities, like other assets in the state, are at risk from climate impacts that threaten to disrupt the systems that power Maryland's day-to-day operations. For example, nuisance flooding is impacting roads and the services reliant on them, sea-level rise is necessitating relocation of emergency services facilities, and changing precipitation patterns are increasing demand on stormwater infrastructure. There are a wide variety of existing programs and resources at the local, regional, and state levels that could be employed or expanded to protect and improve critical infrastructure across the state in the face of climate impacts. The following case studies illustrate existing strategies to adapt critical infrastructure to climate impacts.

HAZARD MITIGATION INFRASTRUCTURE IMPROVEMENTS

The Federal Emergency Management Administration partners with states to distribute multiple sources of grant funding for hazard mitigation assistance and infrastructure improvements. Maryland's State Hazard Mitigation Plan identifies various hazards posed to critical and state-owned facilities across Maryland, and the 2021 draft document is under development. As extreme weather events related to climate change increase in frequency, these resources will need to be updated and expanded to meet demand.

COASTAL INFRASTRUCTURE ADAPTATION

Maryland's Coast Smart Construction Program facilitates infrastructure adaptation to sea level rise and coastal impacts through its guidelines and directives. The program establishes siting and design criteria applicable to state and local construction or reconstruction of structures and construction of highway facilities waterward of the Coast Smart - Climate Ready Action Boundary that cost at least $500,000 and receive at least 50 percent state funding.
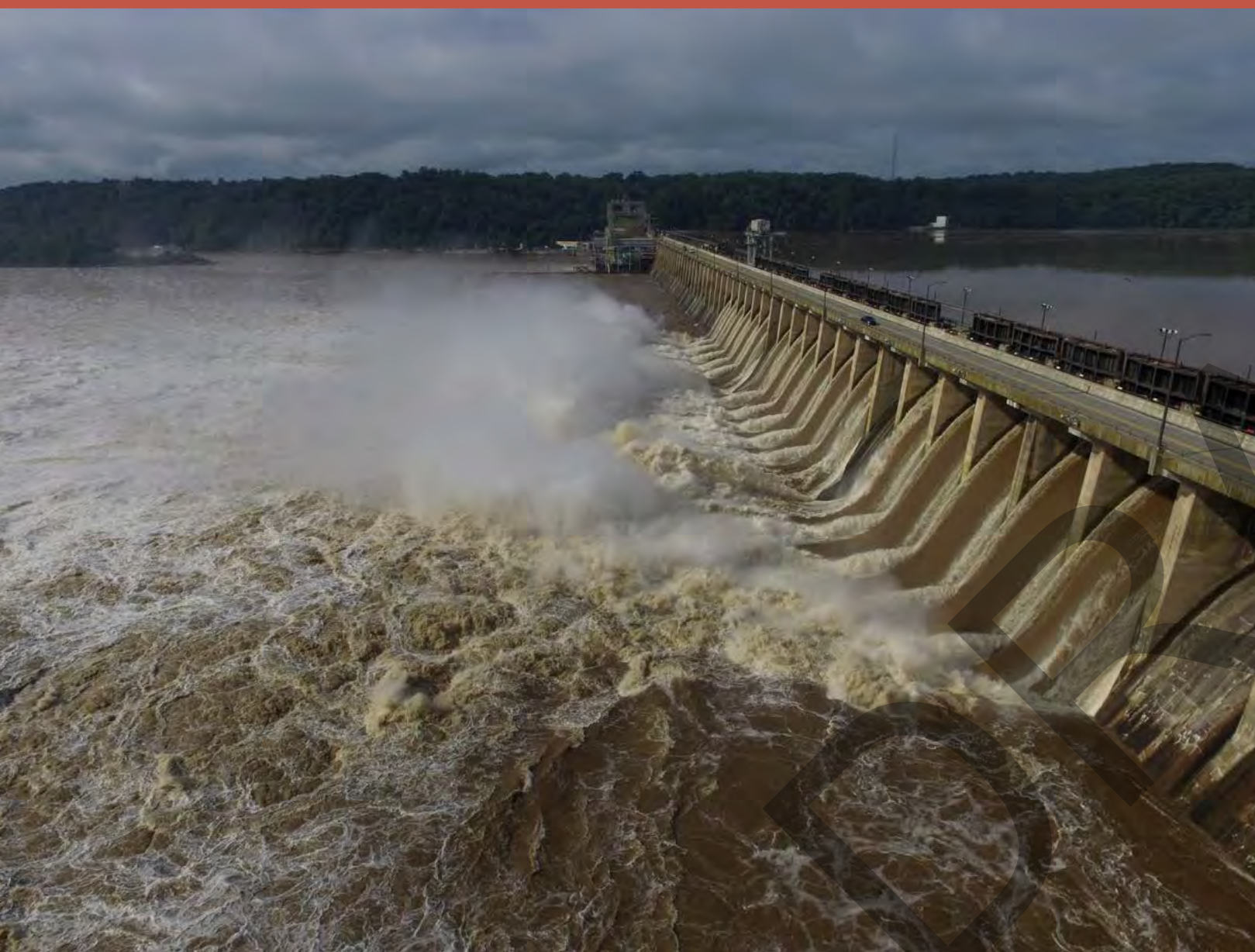
LOCAL INFRASTRUCTURE PLANNING

MDNR and MDP hold joint training sessions to assist localities in developing their own nuisance flood plans, as required by state law. For example, the Town of Ocean City published its Nuisance Flood Plan in September 2020 and includes an inventory of nuisance flood areas, thresholds for warnings and response, and documentation of flooding events and response activity. Among the mitigation strategies outlined in the plan are both green infrastructure (rain gardens, rain barrels, bioswales, infiltration basins, pervious paving, buffers, tree canopy) and gray infrastructure (backflow preventers, replace and up size degraded pipes, reconstruct streets for drainage flow) approaches. These strategies are a direct response to flooding already being caused by climate change.

PROTECTING CRITICAL INFRASTRUCTURE GOAL 1:
COMPREHENSIVE INVENTORY

DAVID TURNBULL, 2018

Within 4 years, complete a comprehensive inventory of all critical infrastructure in Maryland, identifying whether it is state, local, or privately owned.

Within two years, establish a definition for critical infrastructure.

Activity 1.1.1. Within the first year, establish an expert panel on critical infrastructure, develop the expert panel's charge, solicit representatives from state and local governments and the private sector and initiate the panel. Determine how to track and communicate progress.

Activity 1.1.2. The panel consults specialists on JEDI within six months of first meeting and develops criteria for defining critical infrastructure with an additional focus on equity.

Activity 1.1.3. The panel convenes and reviews existing lists used by MEMA, Maryland Coordination and Analysis Center, Cybersecurity and Infrastructure Security Agency of the Department of Homeland Security, and others.

Activity 1.1.4. Within two years from inception, the expert panel submits the definition and findings to the ARWG for approval.

MDOT, 2019

STRATEGY 1.2 | STATE

Within four years, compile and publish a comprehensive critical infrastructure inventory with ownership identified.

Activity 1.2.1. Establish guidance and criteria to use in determining the vulnerability of identified critical infrastructure, with an emphasis on structures experiencing repeat damages or that are vulnerable to climate change.

Activity 1.2.2. Identify or expand an existing data management plan to receive inventory data and ensure sensitive information is handled in a secure and consistent manner.

Activity 1.2.3. Identify and implement an engagement strategy to reach key stakeholders who will submit data on critical infrastructure to include in the comprehensive inventory. Stakeholders will include local governments and non-government entities such as Chambers of Commerce, energy providers, and boards of engineers and planners.

STRATEGY 1.3 | LOCAL

Within four years, submit a county-level inventory of critical infrastructure to the state based on the state's adopted definition of critical infrastructure.

Activity 1.3.1. Identify local critical infrastructure or review and update existing inventories based on the state's adopted definition of critical infrastructure.

Activity 1.3.2. Submit an inventory of critical infrastructure to the state's comprehensive inventory following guidelines provided by the state government.

STRATEGY 1.4 | NON-GOVERNMENTAL STAKEHOLDERS

Within four years, private stakeholders identified by the state to contribute to the comprehensive inventory have submitted an inventory to the state, based on the state's adopted definition of critical infrastructure. Stakeholders will include chambers of commerce, energy providers, and boards of engineers and planners, among others.

Activity 1.4.1. Identify managed critical infrastructure or review and update existing inventories based on the state's adopted definition of critical infrastructure.

Activity 1.4.2. Submit an inventory of critical infrastructure to the state's comprehensive inventory following guidelines provided by the state government.

MDOT, 2019

PROTECTING CRITICAL INFRASTRUCTURE GOAL 2:
ASSESSMENT MANAGEMENT ADAPTATION PLAN

MDOT, 2009

Select, test, and apply an AMAP Framework to be used statewide to inform planning studies, capital improvement programs, systems risk assessment and management, and flexibility to maximize infrastructure life cycles.

STRATEGY 2.1 | STATE

Select, test, and apply an AMAP Framework to be used statewide to inform planning studies, capital improvement programs, systems risk assessment and management, and flexibility to maximize infrastructure life cycles.

Activity 2.1.1. Select an AMAP framework within three years.

Activity 2.1.2. Design and implement a pilot study to test the AMAP framework.

Activity 2.1.3. Recommend the approval of the selected and tested AMAP framework for statewide use within five years.

Activity 2.1.4. Implement the AMAP framework for the remaining critical infrastructure.

Activity 2.1.5. Provide guidance documents and technical support to local and non-governmental jurisdictions for their application of the AMAP framework and any assessments that need to occur.

STRATEGY 2.2 | LOCAL

Within seven years, outline a plan for integrating the AMAP framework into their capital improvement planning and resiliency-based programs.

Activity 2.2.1. Review existing capital plans and local hazard mitigation plans to identify potential gaps that may exist to align with the selected AMAP framework.

STRATEGY 2.3 | NON-GOVERNMENTAL STAKEHOLDERS

Within seven years, regulated entities outline a plan for integrating the AMAP framework into their capital improvement planning and resiliency-based programs.

Activity 2.3.1. Review existing plans to identify potential gaps that may exist to align with the selected AMAP framework.

MARYLAND ENVIRONMENTAL SERVICE, 2013

PROTECTING CRITICAL INFRASTRUCTURE GOAL 3:
DECISION SUPPORT

MDNR, 2018

Within three years, create a decision support toolbox (DST) that includes existing and new data, analyses, and resources like MDOT's decision tree for resilience to inform the selected AMAP framework implementation for each type of critical infrastructure in Maryland.

STRATEGY 3.1 | STATE

Determine necessary elements to incorporate in the DST, including equity analysis, risk identification and tolerance, and costs to minimize risk and resiliency measures. Develop guidance for use of the DST for end users within two years.

Activity 3.1.1. Compile existing decision support tools and complete a gap analysis to identify needs for additional decision support tools.

Activity 3.1.2. Conduct at least three outreach seminars with local, state and non-governmental stakeholders to inform the development of the DST.

Activity 3.1.3. Develop the DST, guidance document and provide access to training and technical support on the DST to all stakeholders.

STRATEGY 3.2 | STATE & LOCAL

Within three years participate in ARWG-led outreach seminars with stakeholders to inform the creation of the DST and associated AMAP framework.

Activity 3.2.1. Identify communities and stakeholders necessary to contribute to the DST and AMAP framework discussion and development.

Activity 3.2.2. Local governments actively engage in the development process for the AMAP framework and DST.

STRATEGY 3.3 | NON-GOVERNMENTAL STAKEHOLDERS

Within three years, stakeholders identified by local governments participate in ARWG-led outreach seminars to inform the creation of the DST and associated AMAP framework.

Activity 3.3.1. Robust, active participation in stakeholder seminars to inform the creation of the DST and associated AMAP framework.

MDOT, 2018

PROTECTING CRITICAL INFRASTRUCTURE GOAL 4:
PLANNING FOR RESILIENCE

STEPHEN BADGER, 2018

Within five years, update develop capital improvement plans and operating and maintenance (O&M) strategies that include critical infrastructure assets prioritized using the AMAP.
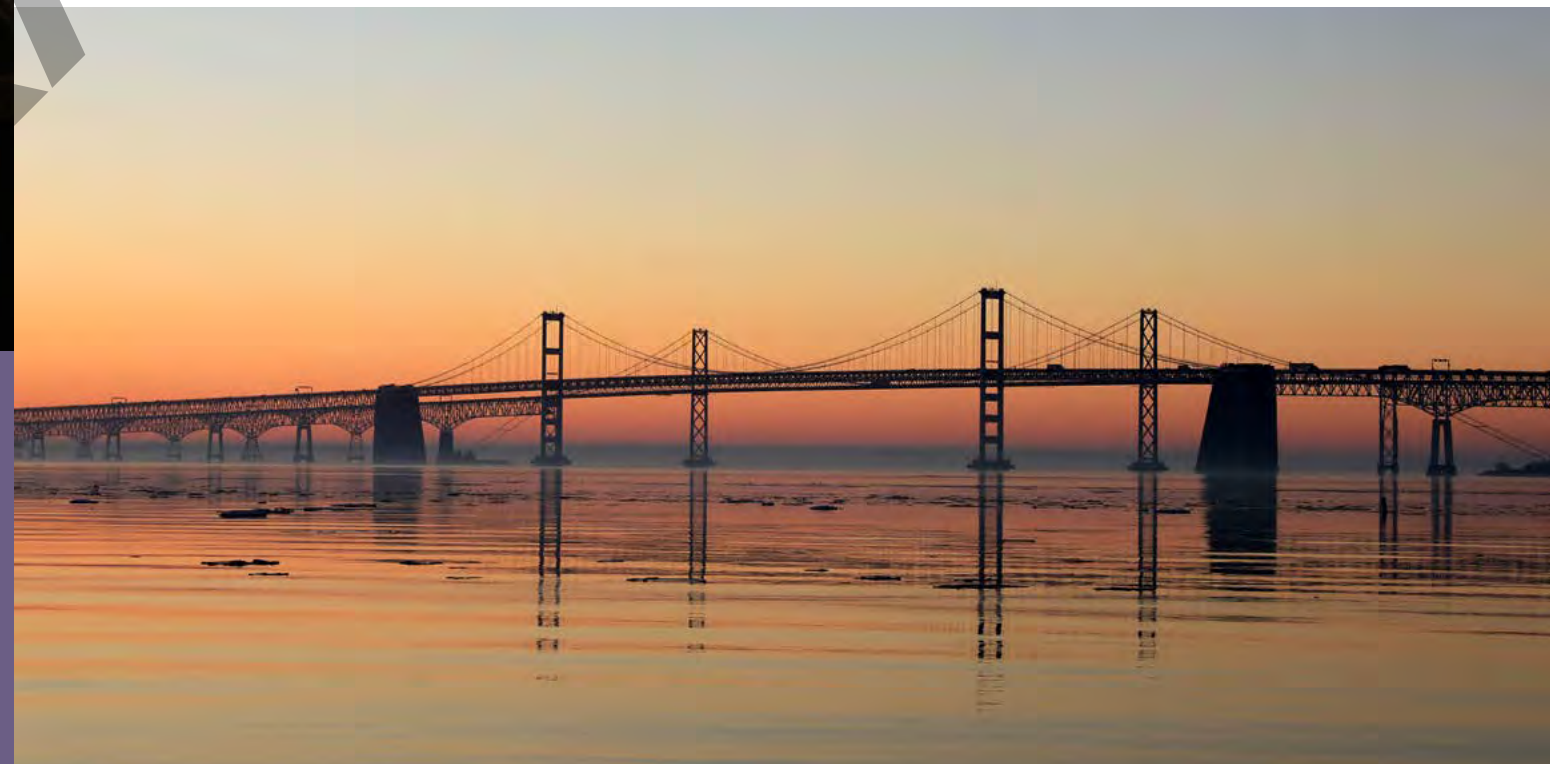
STRATEGY 4.1 | STATE

Establish plans, strategies, and processes that facilitate funding allocation to high-priority critical infrastructure projects, with an emphasis on underserved communities.

Activity 4.1.1. Leverage the DST and stakeholder perspectives from development to prioritize state-funded critical infrastructure projects and establish key performance indicators for tracking future progress.

Activity 4.1.2. Update capital improvement plans and O&M strategies with a project pipeline for prioritized critical infrastructure projects. Prioritize projects that will be ready to implement when funding becomes available, including federal or other outside funding made available in post-disaster circumstances.

Activity 4.1.3. Develop and annually update a "Red Book" of funding opportunities for critical infrastructure planning and project implementation. Integrate considerations for circuit riders to support funding allocation to underserved communities.


IGOR BRAVEMORE, 2018

STRATEGY 4.2 | LOCAL & NON-GOVERNMENTAL STACKEHOLDERS

Prioritize critical infrastructure projects and integrate them into planning and project implementation.

Activity 4.2.1. Leverage the DST and stakeholder perspectives from development to prioritize critical infrastructure projects and establish key performance indicators for tracking future progress.

Activity 4.2.2. Update capital improvement plans and O&M strategies with a project pipeline for prioritized critical infrastructure projects. Prioritize projects that will be ready to implement when funding becomes available.

Activity 4.2.3. Beginning in year four, use the state-created "Red Book" of funding opportunities for critical infrastructure to inform planning and project implementation.
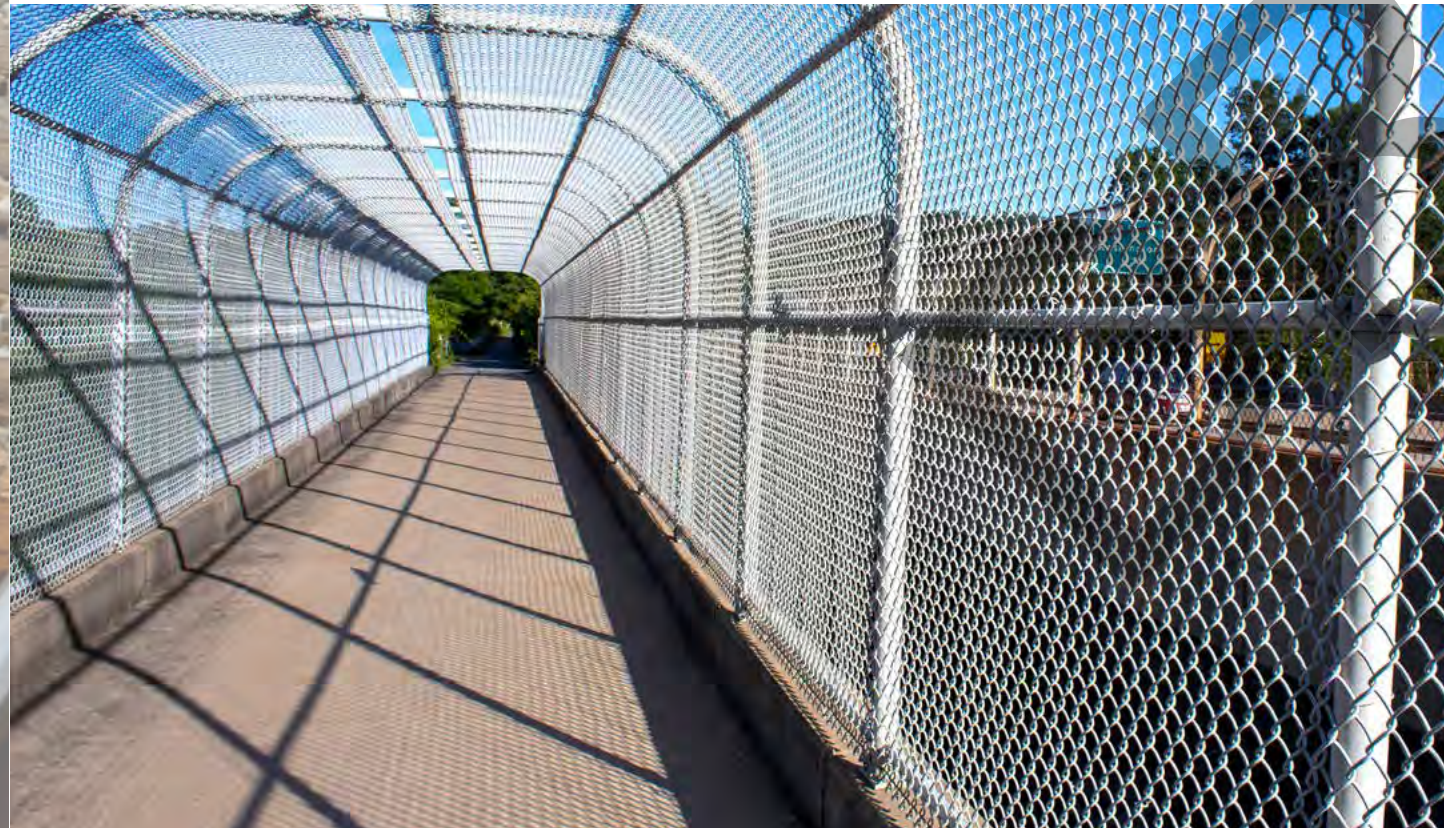
MDOT, 2019

PROTECTING CRITICAL INFRASTRUCTURE GOAL 5:
PROJECT IMPLEMENTATION

MDOT, 2011

Implement priority critical infrastructure resiliency projects.

STRATEGY 5.1 | STATE

Develop a CIP and O&M strategies investment program.

Activity 5.1.1. Develop a business plan to integrate CIP and O&M funding strategies into the AMAP.

Activity 5.1.2. Implement projects.

Activity 5.1.3. Track and report on annual resiliency expenditures to inform future benefit/ cost analysis and resource needs.

STRATEGY 5.2 | LOCAL

Develop a CIP and O&M strategies investment program.

Activity 5.2.1. Develop a strategic business plan to integrate CIP and O&M funding strategies into the AMAP.

Activity 5.2.2. Track and report on annual resiliency expenditures to inform future benefit/ cost analysis.

STRATEGY 5.3 | NON-GOVERNMENTAL STAKEHOLDERS

Review business plan to ensure alignment with State and local priorities.

Activity 5.3.1. Beginning in 2023, and annually thereafter, update the AMAP inventory for critical infrastructure held by non-governmental stakeholders.

Activity 5.3.2. Track and report on annual resiliency expenditures to inform future benefit/ cost analysis.
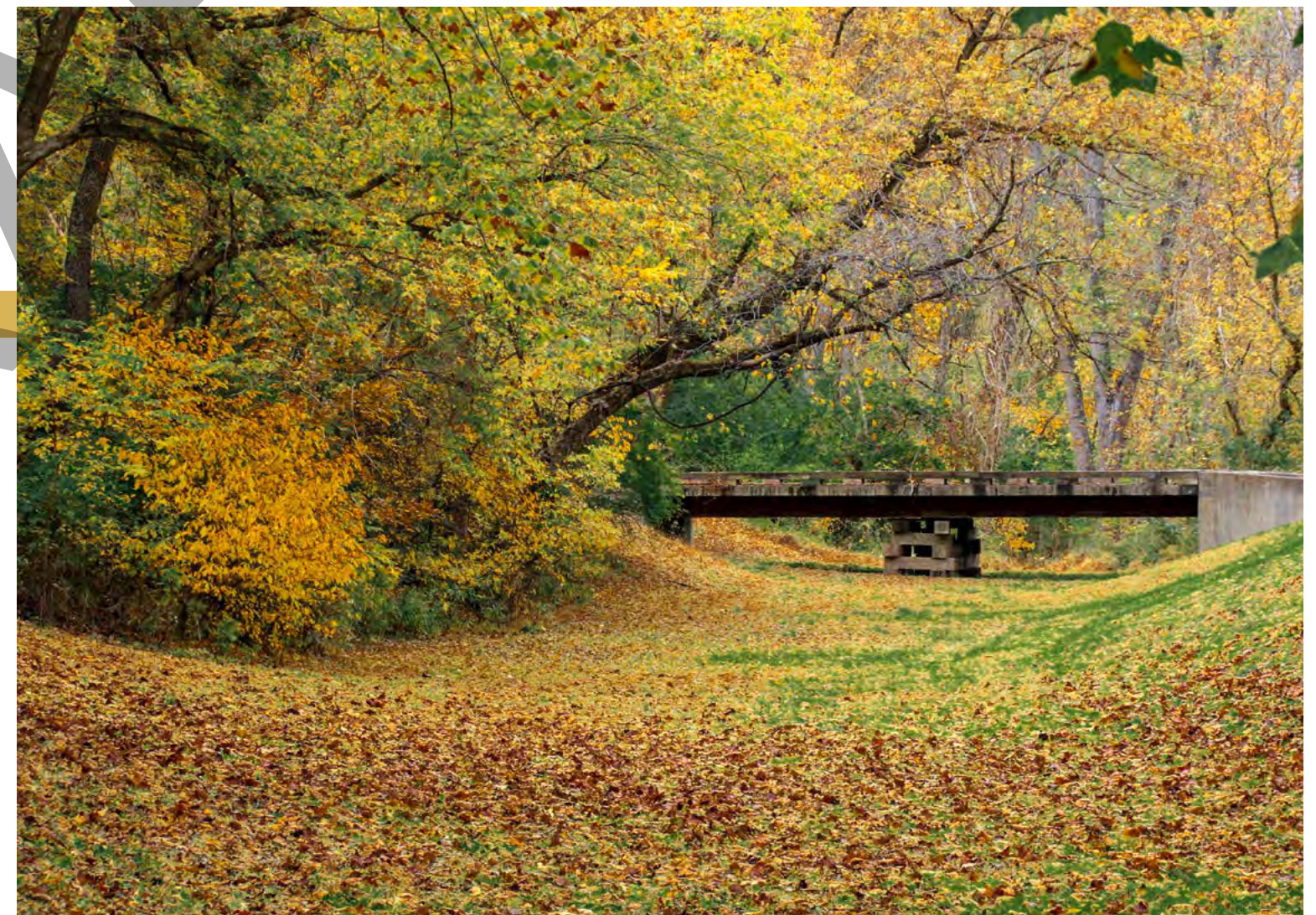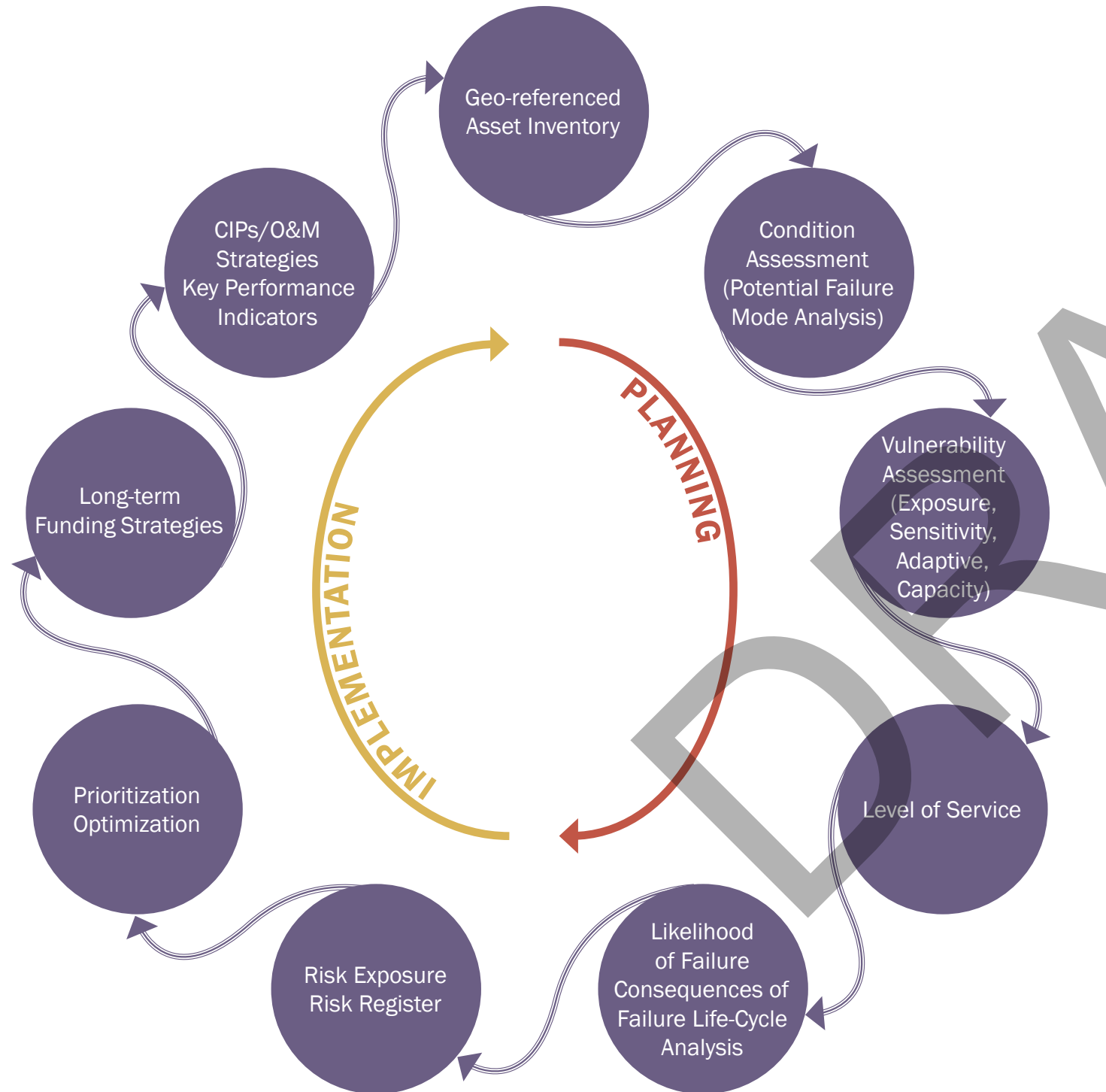

KAREN LOWRY, 2015

ASSET MANAGEMENT & ADAPTATION PLAN (AMAP)

The Asset Management & Adaptation Plan (AMAP) is a proposed initiative that will establish a comprehensive inventory of Maryland's critical infrastructure, assess the vulnerabilities of identified infrastructure, and include a decision support toolbox to inform the process each critical infrastructure owner may follow for resiliency and adaptation implementation. AMAP implementation will follow the process illustrated below.

Geo-referenced Asset Inventory

CIPs/O&M Strategies Key Performance Indicators

Condition Assessment (Potential Failure Mode Analysis)

PLANNING

IMPLEMENTATION

Long-term Funding Strategies

Vulnerability Assessment (Exposure, Sensitivity, Adaptive, Capacity)

Prioritization Optimization

Level of Service

Risk Exposure Risk Register

Likelihood of Failure Consequences of Failure Life-Cycle Analysis

CONCLUSIONS

STEPHEN BADGER, 2019

ACHIEVING A CLIMATE-RESILIENT FUTURE IN MARYLAND

The vision for a more resilient Maryland captured in this Framework can only be achieved through the steadfast implementation of the Framework's strategies and activities. This effort will require the commitment of state leadership, engaged collaboration by many partners, and significant financial resources. All stakeholders are encouraged and challenged to identify how their decisions and programs can help contribute to furthering Maryland's adaptation progress. Some of the suggested strategies and activities in this Framework will require deviation from traditional approaches. Others will require existing programs and policies to be reviewed and revised. Climate change is already causing serious repercussions for our communities, resources, and economies. Now is the time for bold and inspired action.

Developing the Framework virtually as a result of the 2020-2021 COVID-19 pandemic presented many obstacles. However, it also provided an opportunity to think through climate adaptation at a time of disruption and change. The pandemic allowed Framework contributors to challenge long-held "business as usual" approaches and created space to identify innovative solutions. It also served to demonstrate that not all collaborative work requires commute miles and associated emissions. Climate change is already testing our ability to live in a rapidly changing world, and it will continue to do so. The virtual processes used to develop the Framework can serve as a climate-smart model for the future. Further, the resilience Marylanders showed in adapting to a vastly different way of life during the pandemic can provide inspiration for the adaptation required to respond to climate change.

MDOT, 2019

NEXT STEPS FOR IMPLEMENTATION AND TRACKING PROGRESS

Implementation of the Framework will be led by the ARWG, with oversight from the Commission. As its first step in implementing the Framework, the ARWG should review its membership and seek to expand participation where necessary. A diverse membership is crucial to ensure that work appropriately represents the many stakeholders called upon in the Framework. It is also imperative that membership and Framework implementation include not only experts in the areas of climate adaptation, resiliency, and the various sectors identified in this Framework, but also those with expertise in equity, climate justice, jobs and training, and education. Other innovative and non-traditional partners and voices will bring perspectives that can help to accelerate progress.

Expanding and diversifying partnerships and the ARWG membership to include new non-governmental stakeholders - or representatives from state agencies that have previously not been engaged - will ensure that the range of expertise required to successfully implement this Framework are effectively tasked. Tribal representation on ARWG has been lacking in the past, but moving forward it is essential to include tribal and indigenous engagement and expertise as part of all state climate adaptation efforts. Tribal representation is not the only area of increased diversity needed, and ARWG will need to be purposeful about assessing the membership and work alongside the Commission and its Climate Justice group to ensure appropriate representation.

> *Some of the suggested strategies and activities in this Framework will require deviation from traditional approaches. Others will require existing programs and policies to be reviewed and revised. Climate change is already causing serious repercussions for our communities, resources, and economies. Now is the time for bold and inspired action.*

An approach for ensuring accountability, transparency, and coordination will benefit Framework implementation. Success metrics, routine monitoring, and progress assessments that are widely and honestly shared would contribute clarity to where additional work is needed. Tracking success is not only about deciding what to measure, but also developing a methodology for how to measure. Understanding what data is available and how often they should be used for assessment will support effective evaluation. Whenever possible, implementation reporting should align with existing reporting requirements, processes, and partnerships. The ARWG

will coordinate with the Commission's Climate Justice Group and other equity experts to determine how to structure accountability measures that specifically focus on the equitable implementation of the Framework's strategies. Implementing cross-framework priority #1 to create an Online adaptation hub for Maryland could provide a first step towards sharing progress and results in an open, and accessible way. The ARWG should employ multiple communications strategies to share the results of progress assessments and annually report progress to the Commission, potentially highlighting work in a Framework-specific section of the annual Commission report.

The Maryland Coastal Adaptation Report Card is one tool that the ARWG can use to report progress. The Report card uses a suite of indicators to establish a baseline score and methodology for measuring adaptation progress, and several indicators can directly inform Framework tracking and reporting. The Report Card currently only measures progress in the coastal zone, but its development methodology allows for applications across the state.

Successful implementation of the Framework and achieving a climate-adapted future will require significant financial resources. Opportunities already exist to integrate resilience criteria into existing funding and progress in this area can be expanded. Many state and local governments, as well as non-governmental stakeholders, already incorporate resilience into funding while concurrently meeting their agency or organization's needs. Framework implementation will need to bring together multiple conversations to reduce funding redundancies, increase investment efficiency, and advance progress securing the funding and staff resources necessary for successful implementation.

The ARWG will need to determine how to share the responsibility of achieving progress, such as by developing steering committees or subgroups to lead specific strategies and set milestones. In addition, a Climate Resilience Cabinet that is convened by the MDNR Secretary (ARWG Chair) at least twice per year could provide high-level guidance for Framework implementation. Moving forward, the ARWG will structure its meeting agendas around Framework priorities, implementation and progress toward its goals. The ARWG will also dedicate two working sessions per year to reviewing the Framework, selecting priorities, and planning implementation. The "Implementation Table" provided in Appendix B will be used to support these efforts.

BEST PRACTICES FOR IMPLEMENTATION

A number of best practices for implementation were developed by the sector groups as they drafted their goals, strategies and activities. These best practices apply across disciplines and will be used by the ARWG to inform Framework implementation.

▶ **Principles and Equity Evaluations**
Integrate the Framework principles and the questions presented in the "Evaluating Equity Concerns and Impacts in Decision-Making" section when planning and implementing all strategies and activities.

▶ **Goals and Performance Evaluation**
Set clear goals against which to assess performance and refine program planning, policy design, and implementation. Include numeric targets where appropriate. Measure, track and assess progress for all initiatives and make this data transparent and equitably available.

▶ **Behavior Change Interventions**
Develop education and outreach campaigns to help Marylanders understand the Framework initiatives being pursued. Start these campaigns early during the planning process and incorporate feedback into the project to increase buy-in. These campaigns will be crucial to build the public support needed for successful project implementation.

▶ **Adaptive Management and Systems Approaches**
Use tactics to reduce the risk of operating under uncertainty. Build adaptive management into project timelines to allow new knowledge, and changing conditions, to be incorporated over time. Consider the cost of inaction compared to the cost of proactively adapting to projected climate impacts. Consider pilot programs, portfolio approaches, multi-objective trade-offs and other innovative techniques to operationalize increasingly complex decision-making situations.

▶ **Partnerships, Capacity Development and Coordination**
Strive for collaboration among all levels of government, business and non-commercial sectors to manage adaptation needs. Collaborate with others on the research, planning and actions needed to adapt to climate change impacts. Strive to use existing governance systems and coordinating bodies rather than creating new ones.

▶ **Interdisciplinary Integration**
Design integrated and resilient solutions that address the inter-relationships among environmental, public health, social, and economic aspects of climate change impacts. Seek to integrate the management of air, water, land, from an energy-water-food nexus perspective, which can generate more effective and efficient results.

▶ **Prioritization of Natural Approaches**
Nature-based solutions (i.e. "green infrastructure") can provide a wide range of co-benefits compared to standard, or "gray" approaches. Where possible, emphasize the use of nature-based solutions as well as green and gray hybrid approaches in planning, design, engineering and financing policy.

This Framework provides a comprehensive road map for Maryland to strengthen its adaptation efforts during the next ten years and beyond, while addressing the historical inequities that have resulted in disproportionate burdens for certain communities.

However, a road map is only a guide, and this Framework alone will not make Maryland more resilient by 2030. The adaptation and resilience vision and goals described can only be achieved through commitment by all partners to sustained, collaborative, and equity-focused action. By diligently implementing the Framework's strategies and activities, Maryland can ensure that its residents, ecosystems, resources, and economy are protected from and more resilient to the increasingly frequent and severe impacts of climate change.
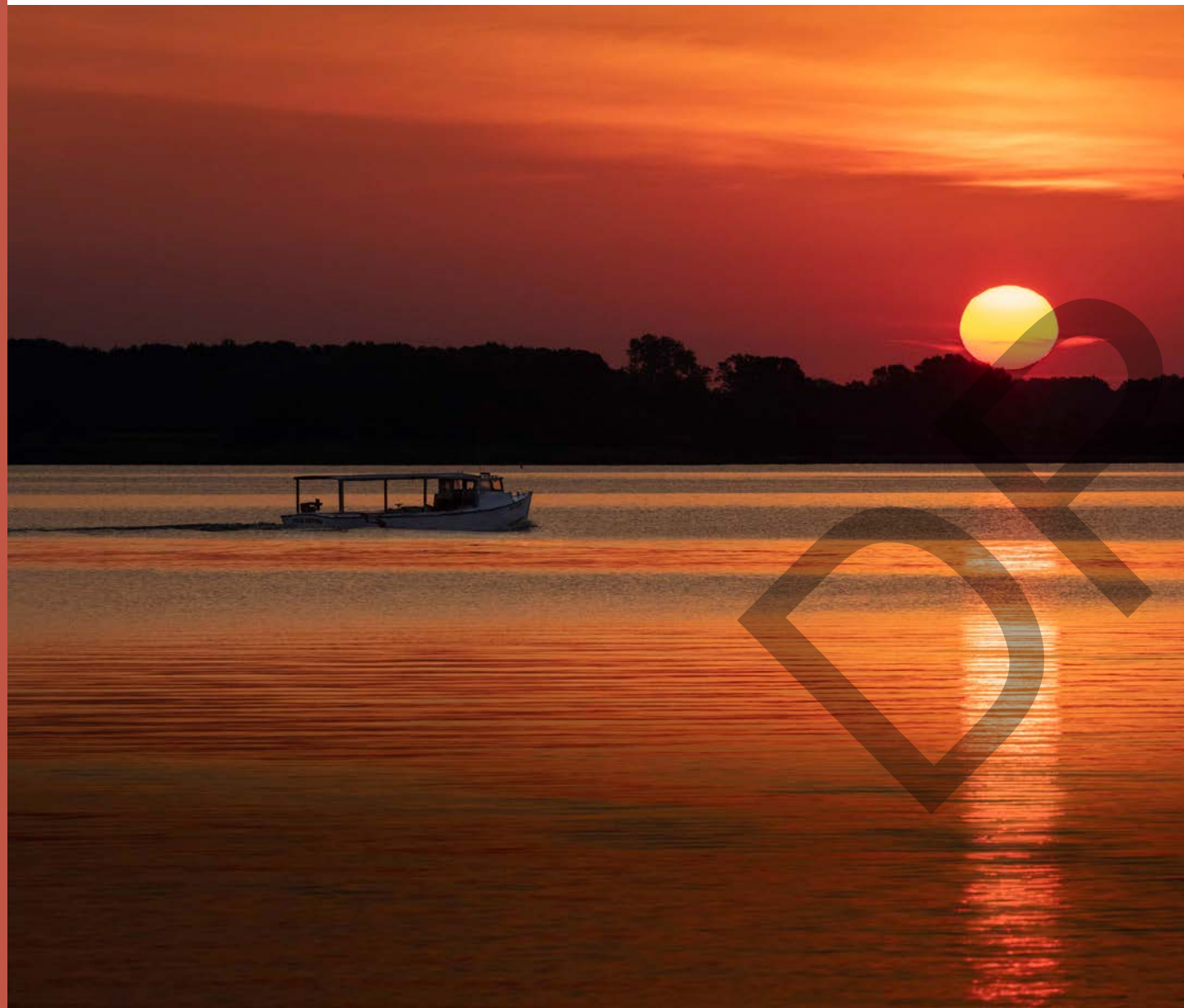
SCOTT BRUCE, 2019

APPENDICES

MICHAEL MONTILLO, 2016

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APPENDIX B: IMPLEMENTATION TABLE

The goals, strategies, and activities for each focus area and sector group are presented in full in a separate PDF reference document.

APPENDIX C: STATE POLICIES FOR CLIMATE ADAPTATION

Policy requirements established in Maryland, either by executive order or legislation, shape and support climate change adaptation for all sectors. Some policies establish structures to support the advancement of climate change efforts, while others outline requirements for planning to address a climate change impact. Understanding the requirements established in state climate policies allows successful development and implementation of climate adaptation strategies, ensuring Maryland successfully protects its communities, resources, and economy in the face of changing climate.

HOUSE BILL 514 / SENATE BILL 258 "MARYLAND COMMISSION ON CLIMATE CHANGE" (2015)

THE COMMISSION

First established in 2007 by Executive order (01.01.2007.07) to advise the Governor on climate change topics and develop a climate plan for the state. The Commission was reauthorized in 2014 by Executive Order (01.01.2014.14) which expanded the scope, responsibilities and membership. In 2015, the Commission was codified into law (Senate Bill 258). The Commission continues to lead the charge in addressing climate change in the state and is chaired by the Secretary of the Environment.

SEA LEVEL RISE

Per House Bill 514, the University of Maryland Center for Environmental Science is required to publish sea level rise projections for Maryland's coastal areas every 5 years. The most recent projections were published in 2018.

REPORTIING

Per House Bill 514, identified state agencies are required to annually report on programs that support the Greenhouse Gas Reduction Act Plan and aim to address climate change impacts (§ 2-1246 of the State Government Article).

HOUSE BILL 610 "GREENHOUSE GAS EMISSIONS REDUCTION ACT - REAUTHORIZATION" (2016)

The development of the state's climate plan in response to the 2014 Executive Order for the Commission, was a catalyst for the passing of the Greenhouse Gas Emissions Reduction Act of 2009. The GGRA of 2009 required the development of a Plan to establish steps to achieve a 25 percent reduction in GHG's from a 2006 baseline by 2020. A reauthorization of that Act in 2016, reaffirmed the goals of the Act, required an updated plan, incorporated protections for jobs and the economy and added additional emissions reduction targets of a 40 percent reduction by 2030 from 2006 baseline. The Greenhouse Gas Emissions Reduction Plan includes a chapter on adaptation.

HOUSE BILL 1350 "SEA LEVEL RISE INUNDATION AND COASTAL FLOODING - CONSTRUCTION, ADAPTATION, AND MITIGATION" (2018)

This legislation, originally passed in 2014 was expanded in 2018 and includes requirements relevant to climate adaptation efforts. The first, a requirement for MDP to establish a plan to adapt to saltwater intrusion. The second, requires local jurisdictions to develop a plan to address nuisance flooding and submit those plans to MDP. This legislation also includes the Coast Smart Council, and the requirement to update the Coast Smart Construction Program Siting and Design Guidelines in accordance with the expanded scope that now applies to state and local capital projects funded with at least 50 percent state funds.

SENATE BILL 674 "COMMISSION ON ENVIRONMENTAL JUSTICE AND SUSTAINABLE COMMUNITIES" (2021)

The Commission on Environmental Justice and Sustainable Communities, as established in § 1-701 of the Environment Article of the Md. Ann. Code "Commission" (2001) saw its membership and charge expanded with the passing of Senate Bill 674 in 2021. The legislation expanded the membership of the CEJSC, charged the CEJSC to reflect the diversity of the state, meet regularly (6 times a year), host listening sessions (at least 4 annually), and host meetings throughout the state, in an accessible manner to ensure participation by all communities is viable.

SENATE BILL 434 "LABOR AND EMPLOYMENT - OCCUPATIONAL SAFETY AND HEALTH - HEAT STRESS STANDARDS" (2020)

This legislation establishes a requirement of the Commissioner of Labor and Industry to adopt regulations establishing a standard for occupational heat stress, ensure employers comply with occupational exposure standards for heat, and develop a prevention plan to reduce excessive heat-related illness, on or before October 1, 2022.

SENATE BILL 227 "WATER POLLUTION - STORMWATER MANAGEMENT REGULATIONS AND WATERSHED IMPLEMENTATION PLANS - REVIEW AND UPDATE" (2021)

Legislation that requires the Department of the Environment to update stormwater management regulations incorporating updated precipitation data at least every 5 years, revise water quality and quantity control standards (when necessary) based on updated data, and report annually to the General Assembly on the analysis and regulation update plan.