

## Biennial Strategy Review System: Climate Resiliency Monitoring and Assessment Logic Table

Factor	Current Efforts	Gap	Actions (critical in bold)	Metrics	Expected Response and Application	Learn/Adapt
<i>What is impacting our ability to achieve our outcome?</i>	<i>What current efforts are addressing this factor?</i>	<i>What further efforts or information are needed to fully address this factor?</i>	<i>What actions are essential to achieve our outcome?</i>	<i>Optional: Do we have a measure of progress? How do we know if we have achieved the intended result?</i>	<i>Optional: What effects do we expect to see as a result of this action, when, and what is the anticipated application of these changes?</i>	<i>Optional: What did we learn from taking this action? How will this impact our work?</i>
Scientific/technical capabilities.	<p>Establish guidance of the application of climate change scenarios, projections and <small>realizations</small> for Chesapeake Bay Program assessments.</p> <p>Report on PA Climate Impacts and Assessment, a report that is required to be updated every 3 year.</p> <p>Synthesize latest scientific research on sea level and water level trends; precipitation and evapotranspiration; and temperature change in both air and water</p> <p>Review USACE regional literature synthesis for the mid-Atlantic region</p> <p>Report on PA Climate Impacts and Assessment</p> <p>Use a combination of field, experimental and biogeochemical</p>	Continued efforts needed; Lack of scientific capabilities to monitor; Lack of adequacy of downscaled climate data	1.1, 2.1, 2.2., 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3			

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	<p>modeling to delineate contributions of atmospheric and eutrophication drivers to Chesapeake Bay acidification.</p> <p>Simulate the effects of the projected changes on the living resources of the Bay system through application of an integrative ecosystem modeling approach (es) (e.g., CAM).</p> <p>Assess effects of climate change on flow, temperature, and water quality in streams of the Bay watershed.</p> <p>Investigate the risk of flooding and salt water intrusion to state wildlife impoundments and ponds and consider how to support important wetland communities and related species.</p> <p>Conduct research on the mechanisms and potential migration path</p>					

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	<p>of wetlands and habitat conversion as water levels rise and salt tolerance lines move.</p> <p>Compile and synthesize existing Gulf and Atlantic Coast vulnerability/resilience information on ~30 priority coastal species and models that quantitatively link SLR and increased storm severity and frequency with system response, impacts to habitats and species, and restoration and management alternatives.</p> <p>Provide science on wetlands prioritization</p> <p>Develop a vulnerability assessment guidance document for NER parks based on lessons learned from completed and ongoing NER</p> <p>Undertake a follow up vulnerability assessment building on that</p>					

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	<p>guidance for Colonial National Historical Park beginning in 2016.</p> <p>Undertake a follow up vulnerability assessment building on that guidance for Colonial National Historical Park beginning in 2016.</p>					
Geographic extent/variability of watershed.	<p>Review USACE regional literature synthesis for the mid-Atlantic region</p> <p>Conduct shipboard and autonomous sampling to study the diurnal, seasonal, and interannual variability of the CO2 system in the Chesapeake Bay.</p> <p>Analyze latest scientific data collected at MD CBNERRS sites (i.e., SETs, water quality, vegetation data) to gain a better understanding of what is happening at the reserve level and how that can be applied to the Bay as a whole.</p>	Cross-cutting programmatic gaps	1.1, 2.1, 2.2, 2.3, 2.4, 3.1, 4.1, 6.1			

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	Share USACE Climate Preparedness and Resilience Community of Practice sea level calculator and watershed-level climate vulnerability assessment, as well as a non-stationarity detection tool currently in development					
Range of climate trends and impacts across watershed.	Analyze available climate monitoring and climate sensitive data on extreme events to document past trends and impacts. Analyze climate model projections similarly to predict future. Use CB NERRS data in conjunction with other available data to tell specific stories about climate impacts on NERRS. Develop climate change chapter for Chesapeake Bay Ecosystem Atlas for use in formal and informal education.	Lack of coordination  Partner Coordination: Shared understanding of climate trends and impacts across the watershed	<b>2.1, 3.2, 4.1, 4.2, 4.3</b>	Establishment of Indicators		

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	Analyze available climate monitoring and climate sensitive data on extreme events to document past trends and impacts Synthesize latest scientific research on sea level and water level trends; precipitation and evapotranspiration; and temperature change in both air and water					
Complexity of the monitoring program, including numerous partners and institutions engaged in collection effort.	Evaluate the capacity of CBIBS to contribute to climate science and the CBIB's Data Enterprise to determine applicability for template for CBP climate data portal. Work with 4-select Workgroups to determine current and future monitoring needs by geography, habitat type, and BMP and outline gaps at Workgroup or GIT level. Outline gaps for watershed scale	Coordination of modeling; Institutional capacity	2.1, 2.2, 2.3, 2.4, 5.1			

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	<p>monitoring effort, including gaps related to monitoring of non-climate stressors that could exacerbate climate impacts to Chesapeake Bay habitat or BMPs.</p> <p>Identify opportunities to better integrate data collected by the NOAA Chesapeake Bay Sentinel Site Cooperative (CBSSC) with CBP monitoring efforts.</p> <p>Explore need for consistent bay-wide wetland monitoring in brackish and freshwater tidal and non-tidal wetlands.</p> <p>Identify agencies/organizations through which commitments could be sought to fund or participate in filling monitoring gaps.</p> <p>Identify geographical overlap in monitoring and modeling efforts to</p>					

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	explore opportunities for cost saving efficiencies and integration of priorities to include climate factors. Explore the use of citizen-based monitoring networks.					
Scientific and Technical Understanding: Availability of climate indicators	Conduct an evaluation of existing data sets, long-term trends, projects and research studies at each Sentinel Site in the Chesapeake Bay Sentinel Site Cooperative (CBSSC)	Lack of indicators	3.2	Establishment of climate trends and impacts indicators	How to differentiate between climate and non-climate related or multiple stressors.	
Funding and financial resources	Identify costs associated with closing monitoring gaps.	monitoring gaps	2.4			
Continuity of data collection programs	Undertake the NSF Coastal SEES Project: Chesapeake Bay Sustainability: Implications of Changing Climate and Shifting Management Objectives Work with its regional offices, states, tribes, river basin commissions and other entities to establish Regional Monitoring Networks (RMNs)	Institution capacity; Coordination with Modeling	2.1, 2.2, 2.3, 4.2, 4.3			



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	for freshwater wadeable streams. Monitor a number of sites in the Susquehanna River watershed for thermal changes.					
Guidance (e.g., defined data collection parameters to monitor impacts on BMP performance)	Incorporate RMN sites into the existing Water Quality Network (WQN). The WQN is a long-term monitoring program with approximately eleven long term continuous monitoring sites operated by USGS on large river systems. Share and disseminate set of projections in temperature and precipitation for the DC metro area Launch climate data portal to provide access to climate projections data (temperature and precipitation) based on downscaling analysis conducted in 2013. Develop the Virginia Coastal Adaptation Data Portal	Institution capacity Partner coordination	4.1, 4.2	Publication of indicator implementation plans		

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	<p>Disseminate information on CBP's climate change activities to MWCOG region local governments and water utility staff and stakeholders through existing committees (e.g., LGAC) and websites, and share lessons learned with other metro regions.</p> <p>PA DEP has created a "Climate Change" button on the Department's webpage for the purpose of posting climate related data and links. Information pertaining to the Climate Change Advisory Committee, including the Climate Impacts and Assessment Report and the Climate Change Action Plan, will be published on this site.</p>					

## MONITORING & ASSESSMENT WORK PLAN ACTIONS

**Green** - action has been completed or is moving forward as planned    **Yellow** - action has encountered minor obstacles

**Red** - action has not been taken or has encountered a serious barrier

Action #	Description	Performance Target(s)	Responsible Party (or Parties)	Geographic Location	Expected Timeline
<b>Management Approach 1: Define Goals and Establish Baselines; Develop Conceptual Monitoring, Modeling and Assessment Model; and Prioritize Climate Impacts</b>					
<b>1.1</b>	Develop and implement a methodology to establish climate related goals and baselines for individual Chesapeake Bay Agreement Management Strategies.	Complete a Literature Review of existing ecosystem-based climate resiliency approaches, aids (e.g., tables, matrices) and processes or decision making products.	CRWG	Watershed	Complete.
		Compile existing climate change vulnerability research and data, including available assessment products and tools, specific to SAV and tidal wetlands/Black Duck, within the Chesapeake Bay region.	CRWG	Watershed	Complete.
		Create a Climate Resiliency Analysis and Decision Making Matrix to enable the assessment of climate impacts on existing management goals and outcomes and the effect of climate change on the performance of specific management practices (BMPs).	CRWG	Watershed	Complete.
		Conduct a review of approach to factor climate change considerations into the 2017 Chesapeake Bay TMDL Midpoint Assessment	CRWG, STAC, WQGIT, Modeling WG	Watershed	Complete.

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<b>Management Approach 2: Design Monitoring and Modeling Plan</b>					
2.1	Identify and evaluate the continuity of existing monitoring data and models within federal agencies, state partners, and academic partners, to explain climate factors of interest to the Bay Program Partnership (i.e., sea level rise, precipitation, temp) at the watershed scale.	Conduct STAC Workshops on: 1) Climate Forecasts and Projections for CB Assessments; and 2) Aligning Chesapeake Bay Program Monitoring Efforts to Support Climate Change Impact and Trend Analyses and Adaptive Management.	CRWG, STAC	Watershed	Complete.
2.2	Catalogue monitoring and modeling gaps for 4 select Chesapeake Bay Agreement Management Strategies	Work with 4-select Workgroups to determine current and future monitoring needs by geography, habitat type, and BMP and outline gaps at Workgroup or GIT level.	CRWG, STAR, CBP Workgroups	Watershed	Complete.
		Outline gaps for watershed scale monitoring effort, including gaps related to monitoring of non-climate stressors that could	CRWG, STAR	Watershed	Complete.

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		exacerbate climate impacts to Chesapeake Bay habitat or BMPs.			
2.3	Identify gap-filling solutions by expanding the Partnership to include identified ongoing or planned monitoring efforts of climate factors.	Identify opportunities to better integrate data collected by the NOAA Chesapeake Bay Sentinel Site Cooperative (CBSSC) with CBP monitoring efforts.	CRWG, NCBO, CBSSC	Watershed	Ongoing
		Explore the use of citizen-based monitoring networks.	CRWG, STAR	Watershed	
2.4	Develop a plan to fill identified gaps.	Identify costs associated with closing monitoring gaps.	CRWG, STAR	Watershed	
		Identify agencies/organizations through which commitments could be sought to fund or participate in filling monitoring gaps.	CRWG, STAR	Watershed	
		Identify geographical overlap in monitoring and modeling efforts to explore opportunities for cost saving efficiencies and integration of priorities to include climate factors.	CRWG, STAR	Watershed	
<b>Management Approach 3: Assess past and future trends in sea level, precipitation patterns, temperature and ecosystem response</b>					
3.1	Establish guidance of the application of climate change scenarios,	Facilitate a workshop to evaluate applicability of international, national, regional and state climate scenarios, projections,	CRWG, STAC	Watershed	Complete.

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	projections and realizations for Chesapeake Bay Program assessments.	forecasts and assessments and to develop process for establishing a recommended set of climate projections for use in Chesapeake Bay Program assessments.			
		Convene a group of sea level rise researchers and resource experts to reach agreement on sea level rise estimates to apply to MPA modeling efforts; how to best approach simulating effects of sea level rise on living resources and wetlands; and the range of sea level rise scenarios to run.	CRWG, CBSSC	Watershed	Complete.
3.2	Conduct a literature review and synthesis of latest scientific research on past and future climate change impacts on the Chesapeake Bay, as was done in the 2008 Scientific and Technical Advisory Committee report.	Assess international, national, regional and state-level (DE, MD, PA, WV, VA, NY, DC) climate change assessments.	CRWG, STAC	Watershed	Complete with exception of state-level assessments.
		Synthesize latest scientific research on sea level and water level trends; precipitation and evapotranspiration; and temperature change in both air and water	CRWG, STAC	Watershed	Complete.

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3.3	Gain a better understanding of past and future impact of ocean acidification on Chesapeake Bay waters.	Convene federal, state and regional experts along with academic partners to assess current knowledge surrounding ocean acidification trends within the Chesapeake Bay.	CRWG, MACAN, NCBO	Watershed	Ongoing
<b>Management Approach 4: Develop a research agenda to improve understanding of climate impacts or fill critical data or research gaps</b>					
4.1	Compile a research agenda to improve understanding of climate impacts or fill critical data or research gaps.	Conduct a cursory review and analysis of 29 individual management strategies to initial climate-related research needs.	CRWG, CBP Workgroups	Watershed	Complete.
		Conduct an assessment of research needs to support future policy dialog related to the integration of climate change considerations into the Water Quality Management Strategy.	CRWG, WQGIT	Watershed	Complete.
		Work with regional partners (e.g., LCC, Climate Hubs and Climate Science Centers), academic institutions and other stakeholders to collaboratively define climate related science and research needs at the broader watershed-scale or within a defined geographic area.	CRWG, LCC, Climate Hubs and Climate Science Centers	Watershed	Ongoing

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4.2	Undertake targeted research to improve understanding of climate impacts or fill critical data or research gaps.	No collective action identified.	CRWG	Watershed	
4.3	Compile available data, tools and resources that can be used to support Chesapeake Bay watershed vulnerability assessments.	No collective action identified.	CRWG	Watershed	
<b>Management Approach 5: Undertake public, stakeholder and local engagement</b>					
5.1	Increase availability and access to monitoring and assessment data.	Develop a Chesapeake Bay Watershed Climate Data and Mapping Repository	CRWG	Watershed	November, 2018
<b>Management Approach 6: Review progress and reassess implementation priorities</b>					
6.1	Review progress on a biennial basis.	Evaluate progress toward the closing of gaps in baseline monitoring and gaps in assessment tools and scientific research.	CRWG	Watershed	