Climate Monitoring & Assessment and Climate Adaptation – 2021-2022

*[NOTE: make sure to edit **pre**- or **post**- in the text above, to tell the reader whether this logic and action plan is in preparation for your quarterly progress meeting or has been updated based on discussion at the quarterly progress meeting.]*

Long-term Target: (the metric for success of Outcome)
Two-year Target: (increment of metric for success)

Instructions: Before your quarterly progress meeting, provide the status of individual actions in the table below using this color key.
Action has been completed or is moving forward as planned.
Action has encountered minor obstacles.
Action has not been taken or has encountered a serious barrier.

Additional instructions for completing or updating your logic and action plan can be found on ChesapeakeDecisions.

Factor	Current Efforts	Gap	Actions	Metrics	Expected Response and Application	Learn/Adapt
What is impacting our ability to achieve our outcome?	*What current efforts are addressing this factor?*	*What further efforts or information are needed to fully address this factor?*	*What actions are essential (to help fill this gap) to achieve our outcome?*	*What will we measure or observe to determine progress in filling identified gap?*	*How and when do we expect these actions to address the identified gap? How might that affect our work going forward?*	*What did we learn from taking this action? How will this lesson impact our work?*
Outcome: Monitoring & Assessment						
Monitoring & Assessment: Scientific Capabilities. The scientific capabilities to estimate, project, model and monitor	Development of 7 climate change indicators on Chesapeake Progress	Need scientific capability to monitor climate and other stressors simultaneously; need			Development of climate change indicators will depend on the quality of	

Commented [J1]: Merged non-climate related/multiple stressors factor with this factor. CRWG does not have the capacity to address the non-climate factors (other workgroups do). I recommend we collaborate with other workgroups to ensure that information is collected for both climate and non-climate stressors to be able to consider multiple stressors.

ecosystem changes and impacts as a result of climate change are complex ~~just emerging~~ and resource intensive. Additionally, impacts are exacerbated by non-climate stressors (e.g., land-subsidence, land use change, growth and development). Appropriate science and modeling of climate and non-climate related stressors are necessary for Chesapeake Bay Program partners to properly address climate impacts during policy planning and adaptation efforts.	Development of the climate change TMDL model	to ensure that long-term monitoring networks include key parameters to assess climate change impacts and multiple stressors; need to sustain and support long-term monitoring networks (e.g., CBP Monitoring Network, Sediment Elevation Table Marsh Studies); need adequate downscaled climate modeling data and data to develop and test models; need continued efforts to understand thresholds of climate stressors on water quality, fisheries, and habitats, interaction of multiple stressors, and quantification of co-benefits			supporting data, the added value of the indicators for helping to understand and explain management successes, and the priorities and resources of the CBP Partnership. CRWG is planning to develop 1-2 new climate change indicators during 2021-2022.	
Monitoring & Assessment: Geographic Extent/Variability of the Watershed. The impacts of climate change will be varied across the Watershed. It is important to not limit the focus of the management strategy to coastal issues alone but to recognize the wide range of monitoring, assessment and adaptation needs throughout the region. However, the variability of the ecosystem within the Bay proper and the larger	Scientific data collection at DE, MD, VA NERRS sites 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 Healthy Watersheds is incorporating	Need methods aimed to improve data consistency and comparability among regions and sectors			Currently, the CRWG does not have adequate resources to tackle both Bay and watershed climate change assessment needs across workgroups simultaneously	

watershed presents challenges in data consistency and comparability among regions and sectors.	climate metrics and vulnerability into their assessment Development of a Bay-wide climate resilience scorecard for tidal and non-tidal areas.					
Monitoring & Assessment: Complexity of the Monitoring Program. Developing a monitoring program to detect ecosystem change and inform program and project response is a complex undertaking. Developing an acceptable monitoring approach for the watershed will be complex, and there are clear budgetary challenges associated with such long-term monitoring.	Data collected by NOAA Chesapeake Bay Sentinel Site Cooperative (CBSSC), CBP Monitoring Network, and others on key climate change parameters, such as water temperature.	Need institution capacity to develop and perform long-term monitoring to detect ecosystem change, and a steady funding source for such efforts; need to evaluate alternative monitoring strategies, such as use of satellite data			Outside CRWG capacity. Need to identify partners that can support monitoring needs; Monitoring Workgroup is looking into developing a STAC proposal to evaluate new technologies and new partners to enhance monitoring capacity—key climate parameters in connection with climate change indicators should be considered	
~~**Monitoring & Assessment: Non-Climate-Related and Multiple Stressors.** Overall, climate change~~						

~~impacts are particularly difficult to monitor and assess because they can be exacerbated by existing non-climate or human-induced stressors such as regional or localized land subsidence, land use change, growth and development. It is often difficult to differentiate climate impacts from the impacts of other stressors. An increased understanding of these interactions is necessary to successfully assess climate impacts, and the effectiveness of restoration and protection policies, programs and projects.~~						
Outcome: Adaptation						
Outcome Adaptation: Stakeholder Engagement. Although there is acknowledgement that climate change and adaptation need to be addressed, there is a lack of understanding or agreement from stakeholders on what it means to be resilient or what constitutes resiliency, including what kind of actions support an adaptive management approach. Lack of appropriate stakeholder engagement jeopardizes acceptance of choices made about action plans and implementation strategies, introducing additional levels of social discord in an already	Worked with Local Government Advisory Committee on forum that developed recommendations for local governments on what they can do to act more deliberately in addressing flooding issues from changing climate conditions. Collaborating with CBP Local	Need collective agreement; need coordination and collaboration among stakeholders; need willingness to discuss managed retreat as an option; need support in following up on recommendations				Outside current CRWG capacity

complex environmental-economic-social landscape. If social stability is reduced, then policy effectiveness would likely be reduced.	Engagement Team on identifying climate change-related local engagement needs and resources.					
Outcome Adaptation: Capacity. Institutions and the private sector have a general lack of capacity to understand the science and incorporate meaningful change into plans, programs, processes or projects. Although building that capacity is paramount, it can be time consuming and costly, considering the resource constraints faced by governments and organizations and the variability in adaption approaches.		Knowledge of types of technical assistance/expertise needed by jurisdictions (can CRWG member organizations assist?)				
Adaptation: Authority Governments' and institutions' ability to respond to climate change is also limited by legislative, policy, regulatory and other authorities.	Individual jurisdictional incorporation of climate narrative (or voluntary numerical target) into WIPs III. States and communities around the Chesapeake Bay are taking steps to prepare or maintain their climate change adaptation or	Need knowledge of institutional/regulatory barriers; need incorporation of climate change considerations across programs.				Outside current CRWG staff capacity

Commented [J2]: Build into logic item – new workgroup focus – synthesis work to support targeting of adaptation projects, provide technical assistance/expertise to develop

	sustainability plans.					
Adaptation: Guidance. There is currently a lack of clear science (models, tools and metrics) and guidance for the Chesapeake Bay Program, as well as stakeholders, to use to develop plans or to measure efficacy of response. The nature of on-the-ground implementation often requires certainties (e.g., hydrology, water quality, temperature, precipitation, sea level rise, coastal erosion rates) that are not yet available for a changing climate. Additionally, there is variability in institutional responses.	Ongoing research and models, tools and metric development by CBP partners	Need development of clear tools and guidance to develop plans and efficacy of response; lack of extensive information (or information dissemination) on the costs of climate change impacts in specific areas, or the cost savings and ecosystem benefits represented by specific mitigation or adaptation measures.				
Adaptation: Collaboration. The many and diverse stakeholders and organizations that make up the Bay Program are a strength, but it also causes collaboration challenges that must be addressed in order to maximize limited~~leverage~~ resources and provide strategic ~~consistent~~ adaptation approaches across the watershed.	The Climate Resiliency Workgroup meets monthly to discuss a variety of climate topics and provide a forum for information-sharing to encourage collaboration	Need to achieve strategic collaboration that maximizes limited resources; need consensus on strategic adaptation approaches that fit the impact and area of concern ~~consensus and provide consistent approaches.~~				
~~**Outcome Adaptation: Variable adaptation approaches.** There is variability in institutional responses and the capacity to respond.~~						

Commented [J3]: I recommend that we incorporate variability in approaches under this factor.

Commented [J4]: Is "consistent" the right word? Approaches will vary across the watershed? I feel this should focus on best approaches for impacts that need to be addressed for that area.

Key: Rows shaded in blue have been identified as primary actions for the Climate Resiliency Workgroup (CRWG) for the next 2 years. Rows shaded in white are secondary actions capturing climate-related activities across the Chesapeake Bay Program. Support from CRWG for secondary actions will be considered on a case-by-case basis and dependent on the availability of staff and workgroup members. Actions with bolded text indicate activities that the core CRWG members identified that they are most interested in helping with. FTE indicates the estimated full time equivalent needed by workgroup staff (e.g., CRC staffers, coordinator) to support actions within a 2-year timeframe.

Monitoring & Assessment Actions – 2021 - 2022					
Action #	Description	Performance Target(s)	Responsible Party (or Parties)	Geographic Location	Expected Timeline
Management Approach 1: Assess past and future trends of climate change in the Bay and watershed					
1.1 FTE: 0.1	Assess utility of climate change indicators in tracking climate resilience for water quality, living resources, habitats, and public infrastructure and determine strategy for updating prioritized indicators	a. Evaluate the usefulness of existing (on Chesapeake Progress) and proposed climate change indicators with corresponding workgroups, STAR, and the Management Board to prioritize maintenance and development. Archive indicators that are not included in prioritization decisions. b. Develop a climate change indicator framework document that outlines implementation strategies for the prioritized indicators. Identify prospective cross-workgroup pathways connecting physical change (e.g., sea level rise, increased precipitation, warming temperatures) with ecological and community impacts to inform adaptation/resilience strategies related to the Chesapeake Bay Watershed Agreement outcomes. Include considerations for DEIJ application. Determine time periods for updating.	a. Julie Reichert-Nguyen (NCBO/CRWG), Breck Sullivan (CRC/STAR), Kathryn Barnhart (Status and Trends Workgroup), and relevant workgroups b. Climate Change Indicator Framework: Julie Reichert-Nguyen (NCBO/CRWG), Breck Sullivan (CRC/STAR), and summer intern (NCBO)	Bay/ watershed-wide or place-based	CRWG does not have the capacity to maintain all existing and proposed climate change indicators. Maintenance of indicators will rely on the management application and support from other workgroups.
1.2 FTE: 0.4	Coordinate the development of climate change indicators in connection with clear management objectives to inform	a. Coordinate the development of a Bay Water Temperature Change Indicator (previously identified as a cross-workgroup priority) in connection with fisheries management. b. Continue exploring collaboration with USGS to connect their stream temperature compilation	a. Bay Water Temperature Change Indicator: Julie Reichert-Nguyen (NCBO/CRWG) and Bruce Vogt (NCBO/Fisheries GIT)	Bay/ watershed-wide or place-based	CRWG plans to develop 1-2 new indicators (2021-2022). Development of new

	climate resilience activities related to ecological and community impacts	project with updating the stream temperature indicator for use in the Healthy Watersheds Assessment involving brook trout habitat and the identification of potential resilience factors. c. Support the proposed 2021 STAC Workshop, "Rising Watershed and Bay Water Temperatures—Ecological Implications for Ecosystem Processes Influencing Stream, River, and Estuarine Health." Compile water temperature data sources and host cross-workgroup discussion on the utility of water temperature change indicators in connection to fisheries and habitats. d. Explore data needs for developing a wetland loss and/or marsh migration indicator(s) related to sea level rise (see action 1.4).	b. Stream Temperature Change Indicator: Julie Reichert-Nguyen (NCBO/CRWG), Renee Thompson (USGS/Healthy Watersheds) c. Julie Reichert-Nguyen (NCBO/CRWG), Breck Sullivan (CRC/STAR) d. See action 1.4		indicators will depend on the quality of supporting data and the priorities and resources of the CBP Partnership.
1.3 FTE: 0.1	Support application of climate change TMDL projections	a. Review climate model narrative language and provide suggestions on the language for easier interpretation. b. Meet with modeling workgroup to identify where assistance from CRWG will be needed in preparation for applying the climate TMDL model in 2025. c. Assist with relevant activities for application of the climate change TMDL projections to inform adaptation strategies in water quality plans (e.g., Watershed Implementation Plans).	Mark Bennett (USGS/CRWG) Tom Butler (CRC/STAR) Lew Linker (EPA/Modeling Workgroup)	Bay/ watershed-wide	a. Needed before September 2021 b. 2021-2022

Management Approach 2: Work with CBP Goal teams to fill critical data and research gaps and improve understanding of climate change impacts and implications for selected outcomes in the Chesapeake Bay Watershed Agreement					
1.4 **FTE: 0.15**	**Increase capacity to better understand sea level rise impacts to habitats and their ecosystem services**	**a. Partnered on GIT-funding project synthesizing shoreline, sea level rise, and marsh migration data to inform wetland restoration targeting. Explore use of methodology to support development of possible wetland loss/marsh migration indicators related to sea level rise.**	**a. GIT-Funded Technical Lead: Kevin DuBois (Navy/Wetlands/ CRWG)** **Co-lead: Julie Reichert-Nguyen (NOAA/CRWG)**	**Placed-based (target area – Middle Peninsula, VA)**	**2021-2022**
		b. CRWG will identify and invite subject matter experts to present information on sea level rise impacts to habitats and relevant ecosystem services research.	**Steering Committee (CRWG): Breck Sullivan (CRC/STAR), Taryn Sudol (MD Sea Grant), Jackie Specht (TNC), Nicole Carlozo (MDNR), Peter Claggett (USGS, LUWG), Labeeb Ahmed (LUWG)** **Contractor: In process of being selected**		
1.5 FTE: 0.20	Support Water Quality Goal Implementation Team (WQGIT) on BMP climate resilience assessments needed to update Watershed Implementation Plans	a. Coordinate with WQGIT in identifying BMPs where climate change research is most needed b. Review Virginia Tech BMP Climate Resilience Assessment Report (STAC and NOAA-funded) to inform a research agenda. c. Host cross-workgroup meeting to present findings and identify next steps. d. Work with the Management Board to identify alternative options (e.g., jurisdictional help) in supporting a research agenda	Julie Reichert-Nguyen (NOAA/CRWG) Kurt Stephenson (STAC) David Wood (CSN/Urban Stormwater Workgroup) James Martin (VADEQ/WQGIT) Lew Linker (EPA/Modeling Workgroup) Tom Butler (CRC/STAR) Contractor: Zach Easton and Jeremy Hanson (Virginia Tech)	All jurisdictions	2021-2022
1.6 FTE: 0.01	Increase capacity to better understand increased	a. Support climate SAV model synthesis GIT-funding project to better understand climate	Technical Lead: SAV Workgroup Support: CRWG		2021-2022

Commented [J5]: From Nicole Carlozo: Agree that it should be a priority
- Could this be broadened to "impacts to habitats and their ecosystem services"
- Interested in understanding how marsh condition and services (water quality and co benefits) may change as climate change impacts the region
- This type of research could inform large scale restoration prioritization that would be more competitive within federal resilience funding programs (and help us meet our wetland Workgroup goals)
- Academic and research partners? UMCES, CBSSC, SERC

	precipitation and warming temperature on submerged aquatic vegetation (SAV)	change impacts on SAV populations by advising on project when needed	Contractor: In process of being selected		
1.7 FTE: 0.05	Support efforts of STAR to promote use of climate science data and collaborative data partnerships (EnviroAtlas/ Ecosystem Services)	a. Explore collaborative opportunities with existing tools, such as EnviroAtlas and EJ screening, to use data from the Chesapeake Bay Data and Mapping Portal in support of Chesapeake Bay Program needs related to ecosystem services and diversity, equity, inclusion, and justice (DEIJ). Data available at: at https://data-chesbay.opendata.arcgis.com/search?tags=Climate% 20Resiliency	Bill Jenkins and Bo Williams (EPA/Ecosystem Services Team) Bo Williams Tom Butler (CRC/STAR)		Limited CRWG staff resources to support this action in 2-year timeframe

Adaptation Actions – 2021 - 2022					
Action #	Description	Performance Target(s)	Responsible Party (or Parties)	Geographic Location	Expected Timeline
Management Approach 1: Improve knowledge and capacity to implement and track priority adaptation actions					
2.1 **FTE: 0.2**	**Develop a methodology to track climate resilience progress**	**a. Support FY19 GIT-Funded project, "Bay-wide Climate Resilience Scorecard for Watershed Communities." Purpose of project is to identify climate resilience metrics and methodology to track effectiveness of restoration and protection policies, programs, and projects for inland and coastal areas. Include the consideration of social equitable planning.**	**GIT-Funded Technical Lead: Julie Reichert-Nguyen (NOAA/CRWG) Steering Committee (CRWG): Breck Sullivan (CRC/STAR) Elizabeth Andrews (William and Mary), Jim George (MDNR), Melissa Deas (DOEE), Tuana Phillips (DEIJ Workgroup)**		

			Contractor: RAND Corp./MARISA		
2.2 **FTE: 0.1**	**Assist stakeholders with "shovel-ready" design plans for adaptation projects**	**a. Provide advisory support for the Habitat GIT's FY19 GIT-Funded project, "Targeted Local Outreach for Green Infrastructure in Vulnerable Areas."** **b. [Need input from CRWG members]**	**a. GIT-funded Lead (Habitat GIT): Chris Guy (FWS) and Julianna Greenburg** **Steering Committee: Julie Reichert-Nguyen (NOAA/CRWG) and Breck Sullivan (CRC/STAR)**	**a. Cambridge, MD, West Point, VA, and Williamsport, PA**	**a. 2021**
2.3 **FTE: 0.2**	**Assist with capacity-building activities that support the implementation of priority climate adaptation projects**	**a. Identify federal, state and nongovernmental partners who are providing technical and financial assistance for adaptation projects and connect these groups to local governments and communities pursuing climate adaptation planning and implementation.** **b. Identify and convene discussions on priority adaptation outcome actions, obstacles to success, lessons learned, and innovative solutions.** **c. Define goals of potential adaptation workshops/trainings and explore potential funding avenues, partner sponsorship, or leveraging existing regional/local conferences, forums, or workshops.**	**Nicole Carlozo (MDNR) and Jason Dubow (MDP)**	**TBD**	**2021-2022**
2.4 FTE: 0.05	Identify blue carbon science needs to apply existing blue carbon crediting protocols	a. Explore opportunities (e.g., internships, STAC workshop, GIT-funding, etc.) to assess available blue carbon information and identify science gaps in applying existing blue carbon crediting protocols for wetland and SAV restoration projects in Chesapeake Bay.	a. Mentor Molly Mitchell (VIMS/CRWG) Co-Mentor: Julie Reichert-Nguyen (NCBO/CRWG) Support: CRC C-stREAM Summer Intern		2021

Commented [J6]: Pulled from language provided by Nicole and Jason. We need to figure out clear performance targets for this action.

		b. Connect blue carbon science review with groups engaging in implementing finance approaches.	b. Kristin Saunders (Budget and Finance Workgroup)		
Management Approach 2: Undertake public and stakeholder engagement to increase understanding of climate change impacts to inform and support adaptation					
2.5 FTE: 0.1	Provide climate resilience content for educational modules and local government workshops	a. Work with existing Chesapeake Bay educational network to provide data, information, and topical experts in support of targeted engagement related to climate change impacts b. Provide information for the educational modules being developed by the Local Leadership Workgroup c. Provide support to the GIT Funded Project "Planning for Clean Water: Local Government Workshops." Incorporate climate resilience considerations.	Lead: Laura Cattell Noll (Alliance for the Chesapeake Bay/Local Leadership Workgroup) Support: Julie Reichert-Nguyen (NCBO/CRWG), Breck Sullivan (CRC/STAR)		2021-2022
2.6 **FTE: 0.1**	**Coordinate with the CBP Communications and Local Engagement Team to help with the climate resiliency outcome actions related to communications/ outreach and/or local engagement**	**a. Identify CRWG communication and local engagement needs and incorporate them into the Local Engagement Needs and Resources spreadsheet.** **b. The Communications and Local Engagement Team will support the identified actions, particularly in assisting climate resilience actions related to behavior change projects and facilitating communication and outreach.** **[Need input from CRWG members]**	**CBP Communications and Local Engagement Team** **CRWG: ?**		**Limited CRWG staff resources to support local engagement needs**

Commented [J7]: We need to identify performance targets that CRWG members can support.

We still need to run this by the Local Engagement team.

Management Approach 3: Address the institutional capacity of the Chesapeake Bay Program to prepare for and respond to climate change					
2.7 FTE: 0.1	Consult on cross-GIT climate change projects	a. Fish GIT – forage fish indicator related to warming temperatures on abundance b. Social science outcome review (GIT-funded project) c. Provide support to the Urban Stormwater Workgroup where needed from an advisory capacity involving the application of information from the Intensity, Duration, Frequency (IDF) curve GIT-funded project to address climate impacts due to precipitation changes	a. Mandy Bromilow (NOAA/Fisheries GIT) b. Amy Hayden (UMCES) c. Norm Goulet (VA Northern Regional Commission/USWG) Lew Linker (EPA, Modeling Workgroup) a-c. CRWG subject matter experts		Will support on a case-by-case basis when staff resources or CRWG members are available
2.8 FTE 0.25	Utilize the Chesapeake Bay Program's SRS process to conduct a biennial review of the Climate Resiliency Workgroup and assess priorities	a. Develop a workgroup charter that describes workgroup's role, membership contributions, participation benefits, and operating principles – how best the workgroup can support climate resilience outcomes and other workgroup outcomes and within the watershed and member organizations. b. SRS Support – Develop Climate Resiliency Workgroup work plan, logic table and update management strategies to determine the workgroup approach and actions for the next two years c. Prepare document of high priority science needs to disseminate among groups d. Work with the Management Board to identify opportunities with their organizations and other government agencies to support CBP climate-related activities outside the current CRWG capacity.	Julie Reichert-Nguyen (NOAA/CRWG) Mark Bennett (USGS/CRWG) Support: Breck Sullivan and Tom Butler (CRC/STAR)		2021-2022

2.9 FTE: 0.25	CRWG membership and meetings	a. Distribute survey to workgroup members to understand their climate related interests and expertise to identify opportunities and gaps in membership to support Monitoring and Assessment and Adaptation Outcomes and cross-workgroup climate-related projects. b. Seek to expand workgroup membership to include more federal partners where there are likely to be more funding opportunities. c. Organize and facilitate CRWG meetings. Work with members to identify the best structure for meetings to effectively make progress on CRWG actions.	Julie Reichert-Nguyen (NOAA/CRWG) Mark Bennett (USGS/CRWG) Support: Breck Sullivan and Tom Butler (CRC/STAR)		2021
2.10 FTE: 0.15	Prepare for new federal and state climate initiatives and emerging issues related to the Chesapeake Bay climate resilience needs	a. Support PSC Climate Action Team to draft climate activities for EC Directive. b. Federal Office Directors (FOD) communicate with CRWG on new administration climate policy and direction. c. Develop process to document emerging issues provided by workgroup members.	a. Mark Bennett (USGS/CRWG) and subject matter experts b. Lee McDonald and Emily Trentacoste (CBP Office Science Branch), FOD: Scott Phillips (USGS), Sean Corson (NOAA) c. Julie Reichert-Nguyen (NOAA/CRWG), Tom Butler (CRC/STAR)		2021-2022

Commented [J8]: This was recommended during Management Board meeting