Drafted on February 25, 2021 by CRWG Leadership

**INFORMATION FOR THE CLIMATE CHANGE INDICATOR DISCUSSION DURING MARCH 11, 2021 MANAGEMENT BOARD MEETING**

**Management Board Decision Request**

The Management Board will review the recommended list of climate change indicators in advance and come prepared to decide whether they agree with the selected climate change indicators to focus CBP Partnership efforts to develop and update for Chesapeake Progress at their March 11, 2021 meeting.

**List of Climate Change Indicators and Decisions by the Climate Resiliency Workgroup and STAR**

**Existing Climate Change Indicators on Chesapeake Progress**

**Leave Method As Is/Updates Planned**

- **Avg. Air Temperature Increase**
- **Total Annual Precip Change**

**Possible Refinement of Method to Better Connect with Chesapeake Bay Outcomes**

- **Stream Temperature Change—connect with stream health and brook trout habitat**
- **Relative Sea Level Rise—connect with wetlands and adjacent land use (e.g., forest, ag)**
- **Change in High Temperature Extremes—connect with tree canopy and Environmental Justice**

**Leave Method As Is/No Updates Planned**

- **River Flood Frequency**
- **River Flood Magnitude**

**New (Not Currently on Chesapeake Progress)**

**Method Being Explored in Connection with Chesapeake Bay Outcomes**

- **Tidal Bay Water Temperature Change—connect with water quality thresholds for fish and SAV**

Additional details on these selected climate change indicators can be found in the Appendix.

**Guiding Principles for Selecting Climate Change Indicators**

Given the complexity and time-intensive nature of developing and updating climate change indicators and the workgroup's limited capacity, the Climate Resiliency Workgroup (CRWG) recommends using the following guiding principles when considering which climate change indicators to pursue for Chesapeake Progress:

- They have a clearly defined management purpose to inform adaptation decision-making for the Chesapeake Bay Watershed Agreement outcomes related to water quality, habitats, living resources, and people.
- They have a respective workgroup to lead the coordination in updating the climate change indicators and review the metadata documentation.
- They have an agency/organization committed to being the indicator developer (i.e., pulls data, formats indicator, run stats).

**Appendix: Additional Details on Climate Change Indicators**

**Background**

During the Climate Change and Resiliency Cohort Quarterly Progress Meeting (November 2020), the Climate Monitoring & Assessment and Climate Adaptation outcomes leads asked the Management Board to help identify the utility (i.e., management application) of climate change indicators being selected for development and updating on Chesapeake Progress. The Management Board in return asked the leads, in coordination with STAR, to come back to a future meeting with a list of climate change indicators that have been prioritized based on requests from other GIT workgroups. The Management Board was also interested in the identification of potential responsible parties and timeframes for updating. Since the selected indicators are in different stages of development, timeframes for updating and responsible parties are not known for all the proposed indicators at this time. In these cases, the Climate Resiliency Workgroup (CRWG) provided information on workgroups that are assisting with the development and indicated where timeframes are to be decided "TBD."

**Selection Process**

In selecting climate change indicators, the CRWG assessed and compiled information and feedback from the 2018 Climate Change Indicator Implementation Strategy, cross-workgroup CRWG meeting (January 2020), and STAR meeting (February 2021). The initial 2018 strategy identified over 200 climate change-related topics for potential indicator development and narrowed the options to 21 possible climate change indicators. Of the 21, seven of the climate change indicators were available immediately through a partnership with the U.S. EPA indicator team and posted to Chesapeake Progress. However, these existing indicators were part of a national program and the management applications for the Chesapeake Bay Program were not clearly defined. Moving forward, the CRWG recommends that these existing climate change indicators are reassessed and potentially refined to better connect to the outcomes in the Chesapeake Bay Watershed Agreement related to water quality, habitats, living resources, and people.

An updated climate change indicator framework and implementation strategy will be developed for the selected climate change indicators during the summer of 2021 with support from a NOAA Chesapeake Bay Office (NCBO) intern. This document will incorporate identified management applications for the selected climate change indicators. Feedback from the Management Board on selected indicators will help with the development of this document. Development and updating of these indicators will depend on available data, staff support from identified responsible parties and indicator developers, and acquiring funding through sources like the GIT-funding opportunities from the Chesapeake Bay Trust.

**Recommended Climate Change Indicators, Responsible Parties, and Timeframes for Updating**

The recommended climate change indicators to focus CBP Partnership efforts in the near-term (within 2-4 years) are described below. For the recommended responsible parties, the CRWG will need to reach out to these workgroups to confirm their capacity to take the lead in coordinating updates for their assigned indicators. All the workgroups identified have expressed interest in the listed climate change indicators and some workgroups are already evaluating their use related to their outcomes (see utility and status bullets).

**Currently Exists on Chesapeake Progress (leave methodology as is):**

1. **Average Air Temp Increase**
    a. Utility: Provides general trends for communication purposes (e.g., Bay Barometer). Based on temperature anomalies within defined climate regions to obtain a rate of change per century. Interest was also expressed to scope out management applications at a finer temporal scale.
    b. Recommended updating timeframe: Every 3-5 years
    c. Recommended responsible parties to coordinate updates: Status and Trends
    d. Supporting workgroup(s): Communications Workgroup and CRWG
    e. Indicator developer: U.S. EPA climate change indicator team
    f. Status: Ready for update; send data request to U.S. EPA

2. **Total Annual Precipitation Change**
    a. Utility: Provides general trends for communication purposes (e.g., Bay Barometer). Based on temperature anomalies within defined climate regions to obtain a rate of change per century.
    b. Recommended updating timeframe: Every 3-5 years
    c. Recommended responsible parties to coordinate updates: Status and Trends Workgroup
    d. Supporting workgroup(s): Communications Workgroup and CRWG
    e. Indicator developer: U.S. EPA climate change indicator team and NOAA National Centers for Environmental Information
    f. Status: Ready for update; send data request to U.S. EPA

**Exists on Chesapeake Progress, but possible refinement in the methodology may be needed to connect with the identified management purpose(s):**

3. **Stream Water Temperature Change**
    a. Utility: Connect stream water temperature change with stream health and identifying & protecting resilient brook trout habitat.
    b. Recommended updating timeframe: Coincide with updates to the Healthy Watersheds Assessment
    c. Recommended responsible parties to coordinate updates: Healthy Watersheds GIT
    d. Supporting workgroup(s): Brook Trout, Stream Health, and CRWG
    e. Indicator developer: USGS
    f. Status: Methodology being explored by Healthy Watersheds, CRWG, and USGS to connect trends in stream temperature change with brook trout occupancy projections based on 6 degree Celsius increase. Further evaluation planned as part of the 2021 STAC Workshop proposal, “Rising Watershed and Bay Water Temperatures—Ecological Implications and Management Responses” (~ March 2021 to March 2022).

4. **Relative Sea Level Rise**
    a. Utility: Connect sea level rise trends and projections with tidal marsh extent and migration corridors related to adjacent land use (e.g. forests, ag) to inform targeting of wetland restoration/conservation efforts.
    b. Recommended updating timeframe: TBD (exploring location-based approach since a Bay-wide indicator would be difficult to manage).

c. Recommended responsible parties to coordinate updates: Wetlands Workgroup
d. Supporting workgroup(s): CRWG and GIS Team
e. Indicator developer: TBD (data sources currently being explored)
f. Status: Methodology being explored through FY20 GIT-Funded project, "Synthesis of Shoreline, Sea Level Rise, and Marsh Migration Data for Wetland Restoration Targeting" (~ March 2021 to August 2022).

5. **Change in High temperature Extremes**
    a. Utility: Connect extreme heat with vulnerable underserved areas to inform targeting of tree canopy resilience projects.
    b. Recommended updating timeframe: TBD
    c. Recommended responsible parties to coordinate updates: Forestry Workgroup
    d. Potential supporting workgroup(s): DEIJ and CRWG
    e. Indicator developer: TBD
    f. Status: Discussions underway between CRWG and Forestry Workgroup to identify potential resources to support development.

**New (not currently on Chesapeake Progress; methodology discussions underway):**

6. **Tidal Bay Water Temperature Change**
    a. Utility: Connect tidal water temperature change with water quality thresholds for fish and submerged aquatic vegetation (SAV) habitat to inform adaptive management decisions.
    b. Recommended updating timeframe: TBD once indicator format is decided on
    c. Recommended responsible parties to coordinate updates: TBD
    d. Supporting workgroup(s): STAR, Fisheries GIT, SAV, Modeling Workgroup, Integrated Trend Analysis Team (ITAT), Monitoring Networks Workgroup
    e. Potential indicator developer: NOAA, ITAT, Chesapeake Bay Monitoring Network
    f. Status: Methodology and management needs are being explored as part of the 2021 STAC Workshop, "Rising Watershed and Bay Water Temperatures—Ecological Implications and Management Responses" (~ March 2021 to March 2022).

**Other Proposed Climate Change Indicators**

Additional proposed climate change indicators can be found in the 2018 Climate Change Indicator Implementation Strategy. During the February 25, 2021 STAR meeting, participants expressed interest in continuing to have climate change indicators related to flooding. There are no plans to update the current flood-related indicators on Chesapeake Progress. Before pursuing any future updates for these indicators, the CRWG recommends that the Chesapeake Bay Program Partnership first identify the potential management applications related to the Chesapeake Bay Watershed Agreement, in addition to, potential indicator developers and data sources.