BIENNIAL STRATEGY REVIEW SYSTEM
Chesapeake Bay Program

Logic and Action Plan: Post Quarterly Progress Meeting

Water Quality Standards Attainment and Monitoring Outcomes – 2021 - 2022

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?*
Sustaining and enhancing Monitoring in tidal and nontidal waters. Sustaining and enhancing the current **CBP**	-CBP Tidal monitoring network in MD, VA and D.C.. -CBP nontidal network for nutrients and sediment in the watershed.	-Funding not adequate to maintain current tidal and nontidal networks, or to enhance networks to address gaps listed below.	Management Approach 1 contains actions 1.1-1.10 for this factor.			

networks is needed to adequately assess water-quality standards in all tidal segments, and better detect and link watershed changes to management actions.	-Additional monitoring done by local entities, citizens groups, government agencies in selected areas supporting new data streams and interpretation algorithms. - NRCS/EPA/USGS Federal water-quality team developing recommendations for enhanced monitoring in agricultural areas. -Data assurance and management by CBP office QA and data management specialists.	-Inadequate tidal monitoring to assess all attainment in all segments needs to be addressed. -Challenge presented by nontidal monitoring sites being mostly in areas draining over 100 square miles so difficult to assess effects of management actions from other watershed influences needs to be addressed. -Gaps in monitoring and interpretation in below fall line areas to understand loading to tidal segments need to be addressed. -Processes to use additional citizens and local data, remote sensing, coincident software supporting assessment of alternative data streams need to be developed to help				

		assess all applicable criteria or watershed status and changes.				
Improved analysis and reporting of attainment and trends results. Results are needed to assess progress toward attainment of water-quality standards, and changes in watershed loads due to management actions,	Annual analysis and reporting of estimated standards attainment and tidal water quality trends for the entire Bay and tidal waters. Annual analyses and reporting of nutrient loads and trends at River-Input Stations, and 2-year updates of trends for the CBP sites in the watershed.	-More in-depth methods and analysis of tidal data are needed to assess incremental progress towards standards attainment. -More in-depth analysis of nontidal watershed response to nutrient and sediment reduction efforts and targeting of management practices. -improve interactions with WQ GIT and jurisdictions to apply monitoring results to inform decision making	Management Approach 2 contains actions 2.1-2.10 for this factor.			
Improve understanding and communication of the factors affecting the water-quality	Explaining trends in tidal and nontidal waters with and to multiple science partners. Jurisdictional	-More analysis and application using monitoring and modeling tools to better relate tidal and nontidal water-	Management Approach 3 contains actions 3.1-3.25 for this factor.			

and influence of management practices. More in-depth analysis and communication is needed to inform jurisdictional decisions on nutrient and sediment practices for the WIP 2025 outcome.	meetings are being held for technical support.	quality response to nutrient and sediment reduction efforts. -Enhanced communication of the factors affecting trends interactions with jurisdictions on their decisions toward nutrient and sediment practices for the WIP 2025 outcome. -Better aligning and applying of tidal and nontidal monitoring results to inform watershed and estuary modeling efforts.				
Improve understanding of Co Benefits between water-quality practices and other CBP outcomes. Interaction with multiple goals teams needed to improve information on co-benefits between water quality and	Several GIT funded projects (e.g., Toxics in Urban Areas; Tetra-Tech project on BMP relation to other outcomes) provide information on co-benefits. -Previous materials include fact sheets developed on co-benefits for select outcomes and	-Improve the understanding of the relation between nutrient and sediment practices with climate change and selected toxic contaminants. -Increase communication of co-benefits between water quality and selected living resources	Management Approach 4 contains actions 4.1-4.7 for this factor.			

other selected outcomes.	STAC Workshop on co-benefits. -CBP data dashboard contains information for selected outcomes.	outcomes including fish habitat and SAV. -Increase use of ecosystem services to improve understanding of co-benefits.				

ACTIONS – 2021 - 2022					
Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
Management Approach 1: Enhance monitoring for standard attainment and tidal and non-tidal water quality and produce quality data.					
1.1	**Sustain** existing CBP tidal monitoring program as long-standing foundation for data needed to assess Water Quality Standards Indicator, incremental progress indicators (i.e., attainment deficit) and tidal water quality trends	Maintain CBP tidal monitoring program which includes 16 water quality cruises for approximately 160 long-term stations across MD, VA, and D.C..	EPA, State of Virginia, Maryland, Delaware and the District of Columbia, STAC	Tidal waters below the fall line of tributaries and the mainstem Chesapeake Bay	Annually, 2021-22, ongoing
1.2	**Sustain** existing nontidal water quality monitoring program as the long-standing foundation for data needed to assess nutrient and sediment loads and trends in the watershed, and loads delivered to tidal waters.	Maintain the CBP nontidal water quality network, which includes 115 sites, and the associated River-input monitoring of the 9 major rivers entering the Bay.	EPA, USGS, States of PA, MD, WV, VA, DE, and the District of Columbia, SRBC (includes NY), many local partnerships that contribute to	Watershed-wide	Annually, 2021-22, ongoing

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
			network operations*		
1.3	-Develop recommendations to sustain and enhance tidal and nontidal monitoring networks. -Work with programs providing resources to find out if there are viable funding sources alternative to traditional local, state, and federal funding with the aim of sustaining and growing the monitoring network.	-Enhance STAC-STAR-EPA coordination to evaluate options leading to develop technical recommendations on how the existing tidal monitoring programs may adopt updated approaches and interpretations of existing data to inform short-duration DO criteria attainment assessment (e.g., Umbrella Criterion approach); and nontidal monitoring can be improved to address technical gaps -Interaction with potential new funding partners and work with financial professionals to develop funding recommendations.	Budget and Finance WG STAC-STAR	Watershed wide	2020-2021 and moving forward
1.4	**Derive recommendation**s ready for adoption and implementation by CBP partners for 1) addressing short-duration DO criteria gaps in bay assessments and 2) enhancing data collection and assessment through cost effective data collection and analysis	**Initiate a process with STAC and STAR to develop recommendations** to enhance and sustain monitoring capacity using multiple available options (e.g., include new data streams, invest in new technology for data collection, decide on new interpretation tools (e.g., AI/ML), interpolation frameworks and approaches (e.g., new modeling options)).	STAR: Criteria Assessment Protocol WG, Integrated, Monitoring WG, Modeling WG	Tidal Bay + Watershed	2021 – 2022; ongoing

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	approaches and 3) updating interpretation and reporting tools.	Explore ways and what is needed with updates to the water quality attainment assessment computer program to efficiently and effectively accept new data streams. Account for and illustrate the use of Citizen Science based data and nontraditional partner data in the Water quality standards indicator assessment by 2021. Provide support for the reporting of monitoring data (tidal and non-tidal) into the Chesapeake Bay clearinghouse and the WQX from traditional and nontraditional partners.			
1.5	**Partnership commitments expanding the monitoring and assessment of bay conditions** through adopting and incorporating new partners, new technologies, and new assessment protocols that leverage existing programming while	Exercising the 2018 MOU, demonstrating and illustrating the use of Tier 3 Citizen science data from CMC-supported groups in select tidal tributaries for improved water quality standards attainment assessments expanding spatial resolution. Explore Tier 3 citizen science data available for data sets collected at shorter time steps than traditional monitoring cruises at fixed sites in tidal waters of Chesapeake Bay (e.g.,	STAR: Criteria Assessment Protocol WG, Integrated, Monitoring WG, Chesapeake Monitoring Cooperative SAV WG, Fish Habitat Action Team, NOAA	Tidal Bay	2021 – 2022; ongoing

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
	adapting and enhancing approaches that improve information gathering resolution and cost and time efficiency of the processes for gathering, managing, interpreting data and reporting results. Partnership support and use of new and existing data streams such as those being assembled by the Chesapeake Monitoring Cooperative from volunteer networks and data available in the Water Quality Exchange (WQX) (e.g., STORET) and nontraditional partner efforts will expand spatial and temporal resolution of decision-support assessments.	weekly to address short-duration criteria data needs (e.g. 7-day mean)) Assemble dataset from CMC database as appropriate to the needs of contributing to overall Chesapeake Bay water quality standards attainment assessment Report out to CBP community on results of the 2019-2020 GIT-funded hypoxia monitoring pilot project with DO vertical profiling in Chesapeake Bay that could support short duration DO criteria attainment assessments Report out to CBP community on the results of the 2019-2020 STAC-supported workshop "Exploring satellite data integration into the SAV monitoring program". STAR will use information from enhanced analysis to help explain bay condition and water quality trends. Maintain compatibility with TMDL modeling tools	Modeling WG		
1.6	**Expand continuous monitoring in tributaries and the bay** to improve the understanding of direct	Communicate findings to Goal Implementation Teams with a need for improved habitat assessment on pilot vertical profiler hypoxia monitoring project from 2019-2020.	USGS, MD DNR, STAR: Criteria Assessment Protocol WG, Nontidal WG,	Bay profilers, watershed sensor arrays with nutrients, conductivity and	

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
	responses in the bay to watershed inputs	Expansion of continuous sensor use for monitoring in the tributaries, including water temperature assessments targeted at interests in climate change patterns and trends in the watershed, conductivity to track salinization stressor as a factor influencing response and nutrients/sediments of the pollution diet	Integrated, Monitoring WG, Data Integrity WG, NOAA	temperature stressor assessments	
1.7	Ensure quality of field and laboratory data	Pre-COVID estimates were set at five laboratory and field audits per year. The schedule was typically alternated between tidal and nontidal stations every year. In addition, non-traditional groups aiming to collect and submit Tier III data to the Bay program were audited as needed. The post-COVID scenarios are being resolved. The primary focus on data integrity has been to monitor QA sample data more rigorously and develop and use instructional audio/video content as a tool to aid refresher or new recruit training in Bay program sampling methods.	CBP QA coordinator and respective data collection agencies STAR: Data Integrity WG	Watershed-wide	2020-2021 and moving forward
1.8	Manage tidal and nontidal data	Manage traditional partner tidal and nontidal water quality data submittals to our DUET QAQC tool. This data is imported into the CBP CEDR watershed database and	CBP Water Quality data manager, traditional and		2020-2021 and moving forward

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		exported to the WQX for access through the nationwide Water Quality Portal. Work continues with CMC in the attainment of Citizen Science based and nontraditional partner water quality data in an effort to fill monitoring gaps. Manage living resources data submittals including tidal phytoplankton, and tidal and nontidal benthic macroinvertebrate datasets. The living resources data is housed in CEDR with the water quality data. Manage the CBP DataHub that allows for public download of all the above water quality and living resources data holdings.	nontraditional data providers		
1.9	Interact with local governments with the goal of establishing watershed monitoring to assess response to conservation practice implementation.	Have discussions with partners establishing frameworks that will support more local monitoring of nutrients and sediment and to promote data compatibility of the additional monitoring to the NTN.	USGS where they are working with local government cooperative studies. CBP Local Engagement Team		
1.10	Participate in NRCS-EPA-USGS discussions to improve coordination and cooperation for monitoring on effects of conservation practices.	Recommendations will be developed for enhanced communication and cooperation aimed at improving monitoring to observe watershed effects of conservation practices in agricultural areas. Work with EPA,	USGS, CBP Monitoring Coordinator, EPA, NRCS.		

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		NRCS, and USGS on opportunities to implement recommendations			
Management Approach 2: Assess and report changes in attainment of water quality standards, and nontidal and tidal trends.					
2.1	Conduct analysis to update attainment of WQS in the tidal waters	Conduct annual update of standards attainment for the Bay tidal segments.	CBP monitoring team, STAR analyst	Chesapeake Bay Tidal Waters	annually
2.2	Communicate findings on incremental progress in attaining WQS	Provide updates to ChesapeakeProgress.com (and the Bay Barometer) with WQS criteria indicator and loads to the Bay indicator, and communicate to CBP stakeholders	CBP monitoring team, STAR analyst, modeling team, and CBP Communications Office	Tidal Bay + Watershed	annually
2.3	Application of indicators measuring incremental progress towards attaining WQS in the Bay	Expand communication in jurisdictional meetings including measures of incremental progress towards understanding patterns and trends in different parts of the Bay, using results of WQS attainment deficit and attainment buffer	CBP Monitoring Team, STAR analyst, and CBPO GIS team	Chesapeake Bay Tidal Waters	2020-21
2.4	Explore ways to improve the WQS attainment assessment framework	Explore the possibility of automating the WQS assessment procedure in R to achieve reproducible workflow, while also considering incorporating new types of monitoring data and new model advances to assess more WQ criteria.	CBP Monitoring Team, STAR analyst, and CBPO GIS team	Chesapeake Bay Tidal Waters	2020-21
2.5	Conduct and/or process annual analysis of water quality trends at long-	Generate annual update of tidal water quality changes over short- and long-term for all stations and parameters	CBP monitoring team working with MD and VA	Chesapeake Bay Tidal Waters	annually

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
	term monitoring stations throughout the Bay and tidal tributary waters, using the *baytrends* R package. Trends are updated annually for the previous calendar year.	by collaborating with MD and VA on any modifications to methods, processing MD and VA deliverables, QA of results, and combining bay-wide results. Results for all analyzed parameters are posted on the CBP ITAT website. A summary presentation and briefing document will be released annually. Explore computation and incorporation of tidal trends for any additional stations with long enough water quality records, including stations in Washington D.C.			
2.6	Report and communicate findings on tidal trends for management-relevant time frames (annual, summer and spring seasons for chlorophyll *a*, summer and annual for DO, SAV growing season and annual for Secchi depth, annual for N, P, TSS and temperature).	Generate annual updates on ITAT websites to maps and summary presentations, submit annual updates for graphics and trends on Data Dashboard; communicate results in Tributary Reports; explore creating annual summary document of tidal trend results for distribution on a CBP website; and explore other opportunities such as possible collaboration with CBP indicator efforts. Communicate results to CBP stakeholders	CBP Monitoring Team, ITAT, STAR Status & Trends Workgroup, CBP Communication Team	Chesapeake Bay Tidal Waters	annually
2.7	Conduct annual analysis of loads and trends at the River-Input Monitoring	The results for the RIM sites are posted on the USGS Nontidal Monitoring Website. An associated	USGS: VA-WV and MD-DC-DE Water Science Centers	Nine major rivers entering the Bay	Annually

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
	(RIM) stations. Loads and trends of nutrient and sediment at the 9 RIM stations are updated for the previous water year (Oct 1-Sept 30). There will be updates for the WY 2020 and 2021	data release is posted on the USGS ScienceBase.			
2.8	Reporting and communicating RIM loads and trends	A summary of the results is prepared and posted on USGS Nontidal Website. Selected findings are also posted on Chesapeake Progress. Results are communicated by USGS to CBP stakeholders.	USGS: VA-WV and MD-DC-DE Water Science Centers	Nine major rivers entering the Bay	Annually
2.9	Conduct analysis to update loads and trends for the CBP Nontidal Trends Network (NTN) sites. Updates are conducted every two years, with next update for data through WY2020.	The results for the NTN sites are posted on the USGS Nontidal Monitoring Website. An associated data release is posted on the USGS ScienceBase.	USGS: VA-WV; MD-DC-DE; and PA Water Science Centers	Watershed wide	2021
2.10	Reporting and communicating NTN loads and trends through WY2020	A summary of the results is prepared and posted on USGS Nontidal Website. Selected findings are also posted on the CBP data dashboard. Results are communicated by USGS to CBP stakeholders.	USGS: VA-WV; MD-DC-DE; and PA Water Science Centers	Watershed wide	2021
Management Approach 3: Further explain and communicate the factors affecting trends and better understand response to management practices.					
3.1	Increase technical interaction with state	Participate in meetings between EPA, jurisdictional technical staff, and	EPA, USGS, Monitoring team,	Meetings with each jurisdiction.	2021-22

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
	agencies and other stakeholders and citizen groups to identify priority needs to apply monitoring results, and factors affecting change to inform 2-year milestones	USGS to identify high priority needs for 2 – year milestones. Discuss overall findings with the WQ GIT.	ITAT, jurisdictional technical staff		
3.2	Use results of jurisdictional meetings to better summarize existing information and plan new analysis to inform milestones through 2025.	Through jurisdictional technical meetings, have CBP staff and partners (USGS and others) interact with states to apply existing findings to inform 2022-23 milestones (due by end of 2021). Plan and begin to conduct new analysis for 2024-25 milestone (due end of 2023) Provide findings and similar presentations to Water-Quality Goal Team, and associated work groups.	EPA, USGS, STAR interacting with WQ GIT and jurisdictions.	Information for each jurisdiction.	Information for 2022-23 milestones due by end of 2021; Information for 2045-25 milestones due be end of 2023.
3.3	Analyses of nutrient trends in USDA-NRCS showcase watersheds; assessing 10-years of water-quality trends and relation to conservation practices in three NRCS showcase watersheds.	Report of findings to be completed in 2022, with associated communication of results	USGS (VA WSC; Webber lead)		
3.4	Analysis of using finer scale information on BMPs to detect changes;	Report of findings, with associated communication of results	USGS MD WSC (Sekellick lead)		

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	application of SPARROW model				
3.5	Conduct field investigation of factors affecting stream condition	Conduct field work for one selected area 2021, and write-up results in 2022.	USGS (Noe lead)	One ag area to be selected for 2021	
3.6	Enhance analyses of factors affecting trends in major watersheds, with emphasis on response to management efforts. The scope of activities will depend on priority science needs identified in jurisdictional meetings.	Plan to have watershed-based product. Initial efforts focused on Susquehanna Basin; with other places to be identified based on jurisdictional meetings.	USGS, and CBP office Factors team		
3.7	Cover crop analysis - use remote sensing to describe the quality and function of cover crops to support understanding and qualification of cover crop applications and link cover crops use to watershed effects.	This project will establish a wintertime greenness threshold to classify the success of cover crop establishment, create an annual list of fields identified as robust performance vs. poor performance (below wintertime greenness threshold), and estimate crop termination dates.	USGS (Hively lead)		2021 - ongoing
3.8	Management of Annual Data Aggregation organize and execute annual data transfer of 1619 data from USDA, distribute BMP data to USGS PIs and aggregated data to Bay partners.	Deliver aggregated data to Bay partners, provide technical support Bay partners on as needed basis. Deliver data to USGS PIs.	USGS (Nardi lead)		2021

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
3.9	Downscale CAST variables to 1:100K NHD	GIS file of NHD segments with downscaled CAST variables as attributes.	USGS (Nardi lead)	CB Watershed	2021
3.10	Use air photo interpretation techniques to map livestock exclusion fencing (Smith Creek)	GIS file of livestock exclusion fencing in Smith Creek WS.	USGS (Nardi lead)	Smith Creek VA watershed	2021
3.11	Create a preliminary harmonized database that contains combined, but non-duplicated data for the Section 1619 Agreement BMP data and Pennsylvania's Practice Keeper	Database of harmonized PA-DEP and USDA data (these data will be privacy protected and available only to authorized personnel). The project will also generate a report describing methods and results. We expect this report to be available to the public.	USGS (Nardi lead)	Pennsylvania	2021
3.12	Enhanced BMP mapping of living, degraded, hardened shorelines in select areas of the Chesapeake Bay.	GIS file of degraded, hardened shorelines in selected areas.	USGS (Nardi lead)	CB Watershed	2021
3.13	Analyses of interacting endogenous and exogenous factors affecting nutrient and chlorophyll *a* concentrations in tidal waters	Summary report of findings from the Patuxent River test case integrating GAMs, SEMs, and exploratory statistics of water quality and phytoplankton populations. Assess utility of application to the Rappahannock River and Upper Bay, and execute if recommended. Insights will be incorporated into tributary reports as appropriate.	ITAT (Keisman lead)		
3.14	Comparative analysis of changing patterns over time across tidal	Results of cluster analysis comparing water quality changes over time within and across tidal tributaries and the mainstem. Insights will be	ITAT (Keisman lead)		

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	tributaries in N, P, chlorophyll *a*, and DO concentrations	incorporated into presentations to partners and into tributary reports as appropriate.			
3.15	Analysis explaining influence of RIM loads and below-RIM WWTP discharge on estuarine N and P concentration trends and changes in nutrient limitation	Publications including analysis of nutrient load effects on nutrient concentrations in tidal waters; nutrient limitation patterns and changes in the mainstem Bay and major tributaries.	ITAT (Murphy and Zhang leads)		
3.16	Using jurisdictional technical meetings to discuss priorities for watershed-estuary integration topics	Identify potential items for analysis over the next two years.	CBP monitoring team and ITAT		
3.17	Summarize existing information to support technical meetings and inform associated science priorities	Monitoring summaries for respective jurisdictions. USGS-UMCES fact sheet on trends and factors Presentations of recent Factors affecting trends report USGS circular on nitrogen changes, 1950-2050	EPA, USGS USGS USGS (Ator) USGS (Clune)		2020 2020 2020 2021
3.18	Preparation of Tributary Reports	Potomac Tributary report and associated story map will be released. Discuss scope of future tributary reports with stakeholders to balance expedient release of integrated results	CBP monitoring team and USGS		

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		with lagged development of integrated explanations focus mostly current results and less on explanation. Other basins to be discussed based on stakeholder input and CBP capabilities. Candidate reports include Susquehanna/upper Bay; and Rappahannock.			
3.19	Improving understanding and build capacity for analysis and communication of linkage between watershed changes (including BMPs and land change), to loads to tidal waters, and estuary response.	Initial focus on communicating and extending South River analysis to local landscape and potentially comparison with Severn River as well as producing preliminary findings on case study shallow water locations with potential links to local watershed. Continue with Osborn Cove analysis Determine future coastal plain landscape-to- tidal tributary analyses based on jurisdictional input and CBP capacity. Conduct collaborative planning meetings between groups including ITAT, USGS, modeling workgroup to link the watershed and estuary in other places, fisheries habitat team, and SAV workgroup.	STAR ITAT, USGS, UMCES, CBP monitoring and modeling teams, Land Use Workgroup		ongoing

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
3.20	Maintain commitment to enhanced and multidisciplinary synthesis efforts that provide updated information on ecosystem response to management actions to inform decision-making. Next synthesis cycle estimated to be 2025-2026.	Communication of insights from recent syntheses of tidal and nontidal research, including USGS nutrient trends factsheet; ITAT tidal tributary reports; products from STAC gap analysis of TMDL, shallow water synthesis project and other academic efforts (UMCES, VIMS, and others). Preliminary conceptualization of priorities for next cycle of synthesis efforts.	STAR ITAT, USGS, working with WQ source sector WGs, UMCES		ongoing
3.21	Integrate monitoring data and analysis to improve next generation watershed models	Analysis of non-tidal stations flow normalized WRTDS trends, to separate anthropogenic and natural effects Comparison of WRTDS and lagged CAST results (led by Modeling WG)	USGS, STAR monitoring and modeling teams and Modeling Workgroup		
3.22	Integrate monitoring data and analysis to improve the next generation estuarine model and compare monitoring results to estuarine model outputs to identify drivers of inconsistencies and assess the ability to account for these drivers	Presentations to modeling workgroup and WQ GIT on relevant comparisons including temperature, shallow water DO, short-term DO criteria, nutrient limitation, and possibly other factors	USGS, STAR monitoring and modeling teams and Modeling Workgroup	CB watershed	ongoing

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3.23	Plan for communication messages about management practices in place by 2025 but standards are not attained until afterwards	Coordinate with CBP Communication Team to develop a communication strategy on 2025 water quality standards message. The CBP communication strategy may assist state communication teams with their messaging.	STAR, CBP Communication Team		2021 - 2022
3.24	Convene a subset of meetings to share information and updates to improve understanding of progress towards Logic & Action Plan performance targets.	Include Logic & Action Plan discussions and progress updates in STAR meetings. Convene meetings (2 – 4 a year) with WQSAM Outcome leads to have more detailed discussions on action items, performance targets, and expected timelines.	STAR, WQSAM Outcome leads (STAR leadership, CBP Monitoring Coordinator, ITAT leadership, CBPO analysts, Data Manger, CBP QA Coordinator)		2021 - 2022
3.25	The CBP Local Engagement Team will support the WQSAM actions related to communications/outreach and/or engagement	Incorporate WQSAM Logic & Action Plan actions related to communications/outreach and/or engagement with local audiences in the Local Engagement Needs and Resources spreadsheet. The Local Engagement Team will support the actions by assisting in implementation, facilitating communication, and connecting WQSAM leads with groups that want to implement and hear results.	CBP Local Engagement Team		

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Management Approach 4: Contribute to better understanding of co-benefits of water-quality restoration to selected habitats and living resources.					
4.1	Explore topics with subject matter experts to better understand co-benefits of water quality restoration to selected habitats and living resources.	Discussions will be held through STAR on topics identified with the help of the Water Quality GIT.	STAR, WQGIT		2021 - 2022
4.2	Expand existing technical tools and consider development of new tools to provide the information for decision makers to consider practices that provide benefits for multiple outcomes	Contribute to Watershed Data Dashboard to relate water-quality results to other selected outcomes. Topics mentioned by WQ GIT include toxic contaminants, forest buffers, and wetlands.	STAR (GIS Team and CBP monitoring) interacting with WQGIT, EPA, and jurisdictions.		ongoing
4.3	Evaluating the potential future impacts of climate change on water quality in the estuary and watershed.	Work with STAC on Water Temperature workshop; support the CRWG on data needed to assess BMP performance; support model enhancements for shallow water; CAP will discuss climate impacts on water temperature	STAR Climate Resiliency Workgroup, and Modeling WG, CAP		
4.4	Include Tidal Trends data in STAC workshop on Water Temperature	Explore use of Water Temperature Tidal Trends as Bay Wide Temperature Indicator for Climate	CRWG, ITAT, STAC		

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Action #	**Description**	**Performance Target(s)**	**Responsible Party (or Parties)**	**Geographic Location**	**Expected Timeline**
		Resiliency Workgroup physical indicator through the STAC workshop			
4.5	Explore better explaining relation between fish habitat, populations, and water quality.	Convene fish habitat and tidal investigators to plan analyses.	NOAA, CBP Monitoring team support		
4.6	Evaluate the potential impact of climate change on SAV habitat and SAV recovery potential in Chesapeake Bay and its tributaries	Explore the role of climate stressors on SAV. Specifically, model interactions between nutrient loading and emerging climate stressors, including warming temperatures, oxygen depletion, sea-level rise, greater precipitation, and reduced water clarity in determining future SAV abundance and recovery potential, and to determine species and community-level tipping points	SAV WG, CRWG		
4.7	Continue to engage a larger breadth of science providers for meeting CBP science needs.	Launching CBP Science Needs Database; Sharing CBP Science Needs Database with science providers outside of the CBP; Engaging the academic community through STAC meetings; Working with UMCBC and CRC on utilizing science needs list to identify projects for their academic programs.	STAR, CRC		