**MIDPOINT ASSESSMENT PRIORITY WORK PLAN:**
**ASSESS AND EXPLAIN WATER-QUALITY CHANGES**
**LEAD: SCIENTIFIC, TECHNICAL ANALYSIS, AND REPORT (STAR) TEAM**
***2014 EXPECTATIONS***

**Full Title of Priority:** Enhanced Analysis and Explanation of Water-Quality Data for the TMDL Mid-Point Assessment

**Short Description of Priority:** The Chesapeake Bay Program (CBP) will enhance the assessment and explanation of monitoring information as part of the Mid-Point Assessment for the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment* (Bay TMDL). The CBP partners have endorsed (PSC, May 2012) an integrated approach that includes three primary pieces of information to assess progress toward water-quality standards:

- Reporting of water-quality management practices.
- Trends of nitrogen, phosphorus and sediment in the watershed.
- Attainment of dissolved oxygen, chlorophyll-a, and water clarity/SAV standards.

The activities described in this work plan will provide an integrated assessment and explanation of changes in watershed and estuary water-quality monitoring information. The five major work elements are:

- Analyze trends of nitrogen, phosphorus and sediment in the watershed.
- Enhance approaches using tidal monitoring data to assess attainment of water-quality standards.
- Explain water-quality trends in Bay and its watershed.
- Use improved understanding of trends to enhance CBP Models.
- Synthesize and communicate results and implications for the TMDL.

The results will be used by CBP WQ GIT and other partners to help prepare Phase III watershed implementation plans for the TMDL Mid-Point Assessment. The findings will contribute to the WQ GIT's goal of carrying out the decision framework that was developed for the TMDL and associated water-quality standards in the Bay.

**Partners:** The effort will be coordinated through STAR with leadership from USGS, CBPO Office (Modeling and Monitoring Teams), and UMCES. Many activities require coordination among the STAR Nontidal Workgroup (NTWG), which includes all Bay States and DC, USGS, SRBC, and ICPRB; STAR Tidal Monitoring and Assessment Workgroup (TMAW), which includes MD DNR, VA DEQ, and academic partners; Water-Quality Goal Implementation Team (WQGIT) Watershed technical WG and BMP verification WG; and the CBP Communications Team. The USGS and the CBPO have also established a shared position to help coordinate and conduct analysis for the effort.

**Study Approach, Necessary Datasets, Analyses, or Decisions:** The integrated approach to assess and explain water-quality trends in the Bay and its watershed relies on monitoring information, enhanced BMP implementation data, and use of several models (CBP WSM and estuary models, USGS SPARROW model, and GW models). The following activities will be coordinated through the CBP STAR team and interaction with the WQGIT:

- Analyze trends of nitrogen, phosphorus and sediment in the watershed.
- Enhance approaches to using tidal monitoring data to assess attainment of water-quality standards.
- Explain water-quality trends in Bay and its watershed.
- Use improved understanding of trends to enhance CBP Models.
- Synthesize and communicate results and implications for the TMDL.

Below is a brief description for each major work element.

*Element 1: Analyze trends of nitrogen, phosphorus and sediment in the watershed*. The USGS will work with the NTWG to provide an annual update of trends in nitrogen, phosphorus and sediment concentrations for two time periods: 1985 to present, and the most recent 10 year period. The USGS will work with the NT WG and CBP Office on approaches to compare and communicate the newly reported trend in flow-normalized loads (from WRTDS) with watershed model results and Bay TMDL allocations/targets loads.

Expectations for 2014: The focus will be on developing an indicator(s) for flow-normalized loads at the nine river-input monitoring (RIM) stations. The USGS and NT WG will interact with TMAW and academic partners to develop an integrated communication product that describes trends in water quality reported for both the watershed and the estuary.

The NT workgroup is considering focusing on the 9 tributaries to Chesapeake Bay for this year, and delaying reporting for the remainder of the nontidal stations until the following year, when the number of stations with 5-year load and ten-year trends begins to increase significantly.

*Element 2: Enhance approaches to use tidal monitoring data to assess attainment of water-quality standards*. The CBPO monitoring team has developed a combined indicator of progress toward attainment of DO, clarity/SAV and chlorophyll-standards in the tidally-influenced segments of the Bay and tributaries. Work is underway to enhance approaches to examine trends over time in tidal waters (GAM approach).

Expectations for 2014: TMAW will interact with NT WG, USGS and academic partners to begin to develop an integrated communication product that describes trends in water quality indicators reported for both the watershed and the estuary. This product will be based on the planned nontidal trend indicator that is shown in Element 1 (above).

*Element 3: Explain water-quality trends in Bay and its watershed.* The STAR team (NT and TMAW workgroups, CBPO modeling and monitoring teams, USGS, and academic partners) will collaborate on an integrated approach to explain water-quality trends in the Bay and its watershed. The effort will include both geographically-specific and watershed-wide approaches to explain trends in the nontidal and estuarine areas. In addition to the watershed-wide analysis, the geographic areas that have tentatively been selected include: (1) Eastern shore, (2) Potomac River, (3) Lower VA rivers (Rappahannock, York, James), and (4) Susquehanna and upper Bay. The team will work to integrate findings to explain the relationship between the watershed and estuarine areas. The team will investigate approaches for explaining trends in relation to both anthropogenic factors (including implementation of water-quality management practices and land-use changes) and natural factors (such as residence times of nutrients and sediment).

The USGS and the CBP modeling teams will collaborate on some specific efforts to explain watershed trends. Trends in nutrients and sediment will be investigated for the major basins listed above and down to the most localized level possible within those basins. The teams will examine water-quality changes at selected CBP monitoring stations (with an emphasis on the River-Input Monitoring (RIM) sites) using the new WRDTS approach. The factors to be examined at each site include: (1) inputs of nutrient (such as fertilizer, manure, air deposition) and sediment sources, (2) land-use change, (3) implementation of practices to reduce nutrients and sediment, and (4) influence of watershed properties. Several models (e.g. the CBP WSM, USGS SPARROW model, and ground-water models) will be used to help examine regional processes affecting trends. Results from small watershed studies being conducted by USGS and academic institutions will also be used to help understand processes affecting water-quality change. The teams will interface with academic partners to focus on different topics.

Results from the watershed efforts described above will be used to help explain estuary trends. The effort will focus on explaining trends in DO, clarity/SAV and chlorophyll in the tidal waters of the Bay in the context of trends occurring in the watershed. The factors to be examined include: (1) inputs of nutrient and sediment loads from the watershed, (2) implementation of practices to reduce nutrients and sediment, and (3) influence of estuarine properties. The effort will include TMAW, the CBP monitoring team and the new USGS-CBP analyst.

> Expectations for 2014: Release Eastern Shore Trends report (USGS) and continue analysis of Potomac Basin and selected basin-scale analyses.

*Element 4: Use improved understanding of trends to enhance CBP Models.* The CBP modeling team will enhance the WSM and estuary models with the new understanding gained through explaining trends in the watershed and tidal waters. The planned enhancements are explained in additional work plans that were prepared for the Mid-point Assessment of the TMDL. The CBPO will use results from the trends study to improve the suite of Chesapeake Bay Program

Partnership modeling tools (e.g., watershed model, Scenario Builder, CAST). The modeling team will also be working with the USGS SPARROW modeling team to test the significance of selected variables to consider for WSM enhancements. The USGS SPARROW team will also be enhancing their models to provide partners with a finer resolution of geographic information that can be used by partners to help focus implementation of practices for the TMDL.

Expectations for 2014:

- CBP modeling team will work with USGS on a product that evaluates modeled expectations of long-term trends in comparison to observed trends in load at key locations across the Chesapeake watershed
- CBP modeling team will continue efforts to identify changes in BMP implementation and expected changes in water quality since 1985.
- CBP modeling team will continue partnership with USGS, and academic partners to explain changes using the watershed modeling tools.
- USGS land use team will provide a description of land use changes in the bay watershed.

*Element 5: Synthesize and Communicate Results and Implications for the TMDL.* Three primary audiences and associated products have been identified that will use the results of the efforts described above:

- Science Audience/WQGIT workgroups: Technical Reports/Journal articles.
- Water-Quality Goal Team, Federal and State managers on Management Board: Science Fact Sheets/tailored PowerPoint presentations/briefings.
- Implementers: local governments/conservation districts/watershed organizations: less complex and more geographically specific explanations and clear statements of implications for ongoing implementation programs and efforts.

The project team will provide key results to these groups using different communication products so they can better apply the CBP adaptive management framework to focus and potentially refine their efforts to achieve the TMDL and associated water-quality standards. Additionally, the information will be available for inclusion into decision-support tools (such as ChesapeakeStat) and other WWW applications. This effort will require interaction between STAR and CBP Communications Office.

Key Collaborating Activities include:

- *Using BMP information being reported for progress toward the Bay TMDL*. The CBP is working to enhanced tracking and verification of BMP implementation, which will increase the accuracy of annual progress reports that are used to track 2-year milestones (lead: Rich Batiuk). The accuracy of the historical BMP information will have to be assessed and improved to be more useful to explain trends.
- *Maintaining monitoring, and enhancing data management, in the watershed*. The EPA has worked with the jurisdictions and USGS (through the STAR NTWG) to add 35 monitoring sites during 2011-2012 in suburban, urban, and agricultural areas. With the

new sites, CBP nontidal water-quality network will have about 120 locations where monitoring data can be used to help assess status and trends of nitrogen, phosphorus and sediment loads and concentrations. This information will be used for enhanced analysis but data management efforts will need to be increased given the number of new stations.

Expectation for 2014: UMCES and CBP STAR team will release a report about case studies in the Bay watershed and other national efforts for a "lessons learned" report about the effect of BMP implementation on water-quality improvements.

**Start Date:** October, 2012, **Completion Date:** October, 2017

**Interim Deliverables, Including Leads and Deadlines.**

Projects released in 2013:

- USGS report on flow-normalized trends in nutrient and sediment loads
- Annual update of water-quality trends in watershed and Bay (Bay Barometer and supporting indicators).

Products expected in 2014:

- Lessons learned on BMPs implementation and water-quality improvements (UMCES, Winter 2014)
- Description of land cover and land-use changes in the Bay watershed (CBPO and USGS) (2014)
- Synthesis of factors affecting nutrient trends in nontidal waters on the Eastern Shore (USGS)
- Combined reporting of trends in the watershed and estuary (TMAW and NT WG)

Longer-term products:

- Synthesis of factors affecting nutrient and sediment trends in nontidal watershed in the Potomac basin (USGS, CBPO modeling team, NTWG, 2016/17)
- Synthesis of factors affecting nutrient and sediment trends in nontidal watershed in VA Rivers (USGS, CBPO modeling team, NTWG, 2016/17)
- Response of tidal waters in selected estuaries (TMAW)
- Summary of factors affecting trends in the Bay and its watershed (2017)
- Other report and products are being planned.

**Level of Effort for Lead and Supporting Partners, Including (as relevant) CBPO Modeling Team:** High level of effort for CBP monitoring team, USGS, NTWG, TMAW, CAP, moderate effort for CBPO modeling team. USGS and the CBPO are pursuing a new shared position to help coordinate and conduct analysis for the effort.

**Potential Conflicts with Other Priorities:** CBP modeling team may not be able to provide effort needed to help explain trends given other commitments.

**Issues Requiring Input from Full WQGIT:** indicator development, verification protocols, review of key findings.

**Issues Requiring Input from Management Board and/or Principals' Staff Committee? A** Approach for assessing progress has already approved by MB and PSC.

**Other Notes:** STAC will have a responsive workshop (spring, 2014) on to discuss research approaches to explain trends in the Bay and watershed.