Understanding and Explaining 30+ Years of Water Clarity Trends in the Bay's Tidal Waters:
A 2016 STAC Workshop Proposal

Submitted by:
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Workshop Steering Committee
Larry Sanford, University of Maryland Center for Environmental Sciences, Co-Chair
Rich Batiuk, U.S. EPA Chesapeake Bay Program Office, Co-Chair
Joel Blomquist, U.S. Geological Survey
Bill Dennison, University of Maryland Center for Environmental Sciences [STAC Rep-Confirmed]
Carl Friedrichs, Virginia Institute of Marine Science [STAC Rep-Confirmed]
Jeni Keisman, U.S. Geological Survey
Ken Moore, Virginia Institute of Marine Science
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Bob Orth, Virginia Institute of Marine Science
Peter Tango, U.S. Geological Survey
Mark Trice, Maryland Department of Natural Resources

Description of the Workshop
Recent observations and analyses have indicated that water clarity has remained low or has continued to decline across much of the Bay's tidal habitats. This resilience of low water clarity, despite stable or declining nutrient and sediment loads from at least some regions of the Bay's watershed, highlights the many complex biological and physical processes that influence water clarity in estuaries. Water clarity is a key management target given the limits it imposes on SAV growth and distribution. In the record of the distribution and abundance of Chesapeake Bay submerged aquatic vegetation, dating back to the 1970s, we have witnessed periodic rises and falls in the acreages of these underwater grasses, but we can only explain some of the reasons behind these trends. An expanded understanding of the controls on water clarity variability will help elucidate these SAV trends, while providing new insights into the interactions between eutrophication, sediment load, and sediment transport. This workshop will bring together the multiple disciplines needed to de-construct what has been happening across the watershed's landscape over the past decades and how those actions and changes have influenced the movement of sediment and suspended materials through the watershed and into the tidal waters. Once within the tidal waters, other disciplines will illustrate the current state of the science regarding influences on the long term patterns of water clarity observed across Chesapeake Bay. Forging those interconnections, based on analyses performed in advance, will be the focus of this workshop.

Justification for the Workshop

The Water Quality Goal Implementation Team, the Scientific, Technical Assessment and Reporting Team, and STAR's Integrated Trends Analysis Team propose a two-day workshop directed towards building scientific consensus on why we have been witnessing no trends or declining trends in water clarify over the past three decades of widespread best management practice implementation on agricultural lands and urban and suburban landscapes. Recommendations are needed on what further statistical analyses and model simulation approaches will flesh out this story. We have a solid grasp on explaining and linking the observed long term trends in nitrogen, phosphorus, and even chlorophyll *a* to actions and changes in the watershed, airshed, shorelines, sources, and other drivers. The scientific and management communities do not have the same level of confidence in explaining trends in water clarity.

Work to Be Accomplished Leading Up to the Workshop

Through coordination by the Partnership's STAR Integrated Trends Analysis Team, work is underway on multiple facets of explaining the water quality trends observed through the 120 station Chesapeake Bay Watershed Monitoring Network and the over 160 stations in the Chesapeake Bay and Tidal Tributaries Monitoring Network. These statistical analysis and model simulation efforts extend from initial identification of water quality trends to explaining these trends via factors such as long-term changes in land cover and land uses, tidal water column process, and climatic forces. Over the coming year, the water clarity-relevant components of these analyses, coupled with planned in-depth trend analyses of the 40+ year record of SAV distribution and abundance survey data, will form the foundation for this proposed workshop.

Questions to be Addressed During the Workshop

- Do we understand enough about sediment delivery processes over land and flood plains, and within stream banks and systems, to tell the upland-to-within-stream loads story over the past three decades for the different basins of the Chesapeake Bay watershed?
- Can we make quantitative connections between observed trends in the loads of suspended sediments from the rivers and adjacent lands and shorelines along the tidal watershed to the long term trends in water clarity in the tidal waters?
- What are the relative influences on observed water clarity from suspended sediment, suspended organic materials, and algal biomass within the water column?
- Have those relative influences changed with any discernable pattern over the past three decades?
- Can we tell a more quantifiable and understandable story about the interactions between eutrophication processes and processes influencing the increased 'suspendibility' of sediment particles within the water column?
- Can we forge strong, quantitative relationships between long term SAV distribution and abundance trends and observed trends in water quality clarity over the past decades at local, regional and/or baywide scales?
- Based on answers to the above questions, what are the prospects for seeing improving trends in water clarity with continued efforts directed towards reducing nutrient and sediment loads from their established sources?

Answers to these questions will be factored into the 2017 Midpoint Assessment and be used directly in modifying expectations for needed nutrient and sediment reductions from what sectors

and which watersheds to achieve the states' Chesapeake Bay water clarity water quality standards. This will an important of part of the larger explaining trends storylines and findings.

Workshop Timing and Urgency
The January/February 2017 proposed timing of the workshop is to provide sufficient time for the explaining trends work focused on the watershed and the tidal Bay waters to progress to a point when the above listed workshop questions have a better chance of being answered by the gathered scientists and managers. Within the Partnership's Chesapeake Bay 2017 Midpoint Assessment schedule, 2016 is the year of review of the myriad of tools and models to be applied. It is also the year of developing a more robust explanation of trends in water clarity and other water quality parameters. In 2017, the Partnership will turn its focus towards applying those tools and models. During this time, clear explanations of decades of watershed and Bay water quality patterns are critical for making needed adjustments in expectations and responsibilities for reducing the remaining nutrient and sediment loads by the agreed to 2025 end date. It is the winter to spring of 2017 when the explaining trends findings will be structured into a series of stories for distribution and widespread presentations and briefings during the rest of 2017 and into 2018.

Targeted Workshop Participants
This workshop will target academic institutional participants from the relevant watershed, floodplain, and stream hydrology and dynamics sciences as well as the estuarine physical, biogeochemical, biological, ecosystem processes, and SAV sciences. The workshop will also target participation of a selected array of agency program managers to ensure the workshop is directed towards ultimately providing answers to be used in management decision making in 2017, 2018 and beyond.

Workshop Logistics, Timing, and Location
The workshop would be scheduled for January/February 2017 so that the outcomes of the workshop can work themselves through the Partnership during the course of 2017. Targeting about 40-45 participants. Would prefer locating the workshop on an academic campus (e.g., UMCES-CBL, UMCES-HPL, SERC, VIMS) if possible, to both save costs and add to the working nature of the workshop.

Estimated Budget
Venue: $1,500 Food: $3,000 Travel for Presenters: $4,000 Total: $8,500

Matching Funds: $2,000 from EPA, supporting the venue costs and part of the travel cost for federal and non-federal participants to offset part of the $8,500 in requested funding.

Past STAC Workshops and Peer Reviews Related to This Proposal
The March 2014 *Enhancing Approaches to Explain Management Effects on Water Quality Trends* STAC workshop laid the foundation for the larger explaining trends work underway across the watershed. This proposed workshop is also direct outcome of that March 2014 STAC workshop.

Attachment: Letter signed by the WGIT chair, STAR co-chairs, and ITAT co-chairs.

Chesapeake Bay Program
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February 16, 2016

Chesapeake Bay Program Scientific and
Technical Advisory Committee c/o
Chesapeake Research Consortium
645 Contees Wharf Road
Edgewater, Maryland 21037

Dear CBP STAC Members:

On behalf of our respective members, we are pleased to submit the attached 2016 STAC workshop proposal entitled *Understanding and Explaining 30+ Years of Water Clarity Trends in the Bay's Tidal Waters*.

Recent observations and analyses have indicated that water clarity has remained low or has continued to decline across much of the Bay's tidal habitats. This resilience of low water clarity, despite stable or declining nutrient and sediment loads from at least some regions of the Bay's watershed, highlights the many complex biological and physical processes that influence water clarity in estuaries. An expanded understanding of the controls on water clarity variability will help elucidate the SAV trends observed over the past four decades, while providing new insights into the interactions between eutrophication, sediment load, and sediment transport.

Decades into the Partnership, we have a solid grasp on explaining and linking the observed long term trends in nitrogen, phosphorus, and even chlorophyll a to actions and changes in the watershed, airshed, shorelines, sources, and other drivers. The scientific and management communities do not have the same level of confidence in explaining trends in water clarity. But heading into the 2017 Midpoint Assessment of the Chesapeake Bay TMDL, we must be positioned to not only explain these past trends, we must understand them well enough to adapt management and prevention programs.

For the first time, we are seeing all the pieces of this puzzle starting to come together. Scientists studying physical processes have teamed up with researchers focused on optical properties and phytoplankton dynamics to put forward new hypotheses that help explain what at first glance does not make sense—declining water clarity in the face of declining nutrient loads. Those deep into simulation of the estuary's complex processes have been increasingly quantifying these interrelationships. The SAV research and management community are looking for patterns, short and long, in their 40 year records of SAV bed distribution and abundance and species diversity. All of this in combination of the work by teams throughout the watershed on explaining watershed and estuarine water quality trends, we are poised to make some major breakthroughs.

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Therefore the timing of this workshop and bringing the best minds from a diverse array of scientific and management disciplines together to tackle this perplexing declines in water clarity is of paramount importance to the Partnership. In the words of one of the proposed Steering Committee members, 'this workshop is long overdue.'

We strongly encourage your consideration of our proposed 2016 STAC workshop. As you can witness by the number of Partnership leadership signatures below and the diversity of partners represented on the recommended Workshop Steering Committee, we believe this topic requires the unique synthetic opportunity provided by STAC workshops.

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