<u>Wednesday, December 18 Minutes</u>

Attendance (W: Webinar):

Members: Brian Benham, Craig Beyrouty , Lee Blaney, JK Bohlke, Kathy Boomer, Chris Brosch, Anthony Buda, Amy Collick, Alix Fink, Zach Easton, Lara Fowler, Deidre Gibson, Ellen Gilinsky, Kirk Havens, Jason Hubbart, Tom Ihde, Thomas Johnson, Hamid Karimi, Martin Lowenfish, Chancee Lundy, Andy Miller, Mark Monaco, Greg Noe, Leah Palm-Forster, Kenny Rose, Michael Runge, Larry Sanford, Leonard Shabman, Adel Shirmohammadi, Eric Smith, Jay Stauffer Kurt Stephenson, Jeremy Testa, Tess Thompson, Denice Wardrop, Weixing Zhu

Guests: Steven Darcey (Prince George's Soil Conservation District), Becky Golden (MD DNR), Bob Hirsch (USGS), Caitlyn Johnstone (CBP), Brooke Landry (MD DNR), Gary Shenk (USGS), Scott Philips (USGS)

Administration: Bill Ball, Meg Cole, Melissa Fagan, Annabelle Harvey

Call to Order, Announcements—*Andy Miller (STAC Chair – UMBC)*
Andy Miller (UMBC) called the meeting to order at 9:30 am. Miller requested a motion to approve the September 2019 STAC Quarterly Meeting Minutes and the October 2019 Executive Board Meeting minutes; both were approved. Once started, Kathy Boomer (FFAR) provided a 5-minute report-out on the completed report from the May 2018 STAC workshop on triblets, *Revisiting Coastal Land-Water Interactions: The Triblet Connection*. Following a short recap of the report, Annabelle Harvey (CRC) discussed STAC's Workshop Request for Proposals (RFP) for FY2020 and the process to do so. Harvey then presented the following previously approved 2020 quarterly meeting dates: March 10-11, June 11, September 15-16, and December 18-19. Harvey also requests all STAC members update their biographies on the new STAC website once log-in information is circulated to the group. Finally, member announcements were made, starting with a reminder by Boomer about the upcoming Soil Health and Watershed Workshop on January 23rd and 24th at West Virginia University (WVU) in Morgantown, WV, followed by a recap of the November 22nd Maryland Interagency Watershed Symposium by Adel Shirmohammadi (UMD).

DECISION: Miller requested a motion to approve the July 2019 EB meeting minutes and the June 2019 Quarterly Meeting Minutes. Result: Motion carried.

ACTION: All, in order to log-in to the new STAC website, please open chesapeake.org/stac/ and click on the MySTAC tab. Login using your email and the

password "STACmember2020". Then you can update your bio and contact information. Please also change your password to something secure.

Recap of STAC September 2019 Quarterly Meeting—*Andy Miller (UMBC)*
Miller recapped important takeaways from the September quarterly meeting. At the meeting, Brian Benham (VT) five new at-large members were introduced, Jay Stauffer (Penn States), Leah Palm-Forster (UDEL), Leonard Shabman (Resource for the Future), Jeremy Testa (UMCES-CBL), and Deidre Gibson (Hampton University). Benham had also announced Boomer as STAC Vice Chair. Additionally, there was some discussion into how STAC can better communicate long-term science needs to the CBP resulting from workshop reports and committee activities. Emily Trentacoste (EPA) was invited to speak with members about the needs of the Watersheds cohort (Brook Trout, Fish passage, Protected lands, Fish habitat, Healthy watersheds, and Stream health). Presentations were given on the Microplastics and Triblets workshops.

The bulk of the two-day meeting was devoted to the "Science Gap Analysis" (SGA) with Miller quoting a presentation from Don Boesch (UMD) regarding the SGA project as "necessary, messy, and doable". The SGA activity was discussed generally first as a group, and then in more detail within predetermined workgroups: watershed, living resources, and estuarine workgroups.

Recap of Management Board Discussion on Irrigation BMP Expert Panel—*Andy Miller (UMBC)*
Miller discussed important takeaway from the previous Management Board (MB) meeting, specifically pertaining to the agenda item approval of the cropland irrigation expert panel report. The following three recommendations were made by the expert panel: there is not sufficient science research available to show nitrogen reductions by corn so a N deficiency value cannot be assigned; if more scientific research were to emerge, BMP credits for cropland irrigation could be revisited by another panel; further research is needed on cropland nutrient loss. The report was brought to MB in May but did not reach consensus and was then brought to the Water Quality Goal Implementation Team (WQGIT) in June and also did not reach consensus. MB may refer this matter to STAR, which would result in the matter becoming a research priority for STAC. Boomer (FFAR) and Adel Shirmohammadi (UMD) commented on the importance of understanding soil hydrology and irrigation, with Shirmohammadi expressing interest in future research due to his relevant expertise and a 122% increase in irrigation systems regionally. Chris Brosch (Delaware Dept of Agriculture) agreed on the importance of irrigation studies, especially as they pertain to Delaware, a heavily irrigated state, which was largely left out of the original report.

STAC Workshop Report-Out— *Zach Easton and Kurt Stephenson (VT)*
Zach Easton (VT) and Kurt Stephenson (VT), both Steering Committee (SC) members on the "Increasing Effectiveness and Reducing the Cost of Non-Point Source Best Management Practice (BMP) Implementation: Is Targeting the Answer?" workshop, updated STAC membership on outcomes and recommendations from the November 2019 workshop in Fairfax, Virginia. Workshop objectives included reviewing the effectiveness of existing BMP implementation strategies and on targeting to improve water quality outcomes at lower cost,

identifying approaches to targeting including incentives and barriers, and identifying near and long-term recommendations for the CBP and beyond. Presentations illustrating various case studies and approaches were given by Jonathan Winsten (Winrock Programs), Joe Sweeny (PA Legacy Sediment), and Alan Collins (WV Group Payments). A panel discussion of lessons learned was led by Mark Ribaudo (ERS), Leonard Shabman (RFF), and Winsten. Outcomes included a broad consensus on the desire to increase the amount of nonpoint source (NPS) reductions, the need to recognize some areas produce disproportionate NPS loads and therefore BMP effectiveness varies across the landscape, the need to identify spatial variation in pollutant source areas, and the need to increase flexibility in how we incentive land managers. At the close of the workshop, recommendations for the CBP were as follows: improve spatial prediction capability of CBP TMDL accounting system by developing finer scale modeling, continuing to improve spatial resolution of datasets, and allowing for differential crediting of BMPs; and developing and testing alternative incentive systems for targeting programs through supporting pilot incentives and nonfinancial approaches to encourage participation.

Lara Fowler (Penn) referenced targeting analysis work being done by The Nature Conservancy (TNC) on target field sites has shown there is power in technical information to convince farmers of adopting BMPs. Boomer highlighted the importance of linking social and behavioral science as well. Ellen Gilinsky (Ellen Gilinsky, LLC) cited her research on the Mississippi River, suggested aligning the project across watersheds; Shirmohammadi seconded her suggestion. To this point, Larry Sanford (UMD) recommended reaching out to Tom Fisher (UMCES) who is publishing a study on the integration of farmers in BMPs and water quality on the Choptank River in the Eastern Shore.

Recent analysis of Susquehanna observations—*Bob Hirsch (USGS)*
Bob Hirsch discussed recent increases in the dissolved form of phosphorus at Conowingo. USGS trend analyses shows a large percentage increase of orthophosphorus coming from the Susquehanna that is not explained in any way by the dynamic equilibrium hypothesis at Conowingo. Hirsch reported on a data set of 925 samples of orthophosphorus concentrations, collected by the USGS between October 1985 and September 2018. Excessively wet years (2011, 2018) and dry years (2012-2017) were removed using flow normalization via Weighted Regressions on Time, Discharge, and Season (WRTDS - USGS). According to this data, there was a 33% increase in orthophosphorus from 2006-2017. When looking at change in yields per month, there is nearly no change between May and August, though substantial change is focused between September and December. When isolating the change in the September – December part of the year: the change from 2006 to 2017 is a 54% increase. This change is focused in the months of September through December and is more pronounced at higher flows (but is true across the whole range of flows). Hirsch believes there may be evidence of increased exchange between the bed and water column, related to possible changes in conditions near the bed (temperature, DO, pH, carbon, biological activity, velocity.) Observed increases in aquatic vegetation have been noted.

Hirsch recommends these findings be considered in CBP models but the current scientific understanding to do so is lacking. Much research is being conducted on the landscape, river systems, and the Bay itself, but no long-term ongoing studies are being conducted on the reservoirs at the mouth of the Susquehanna. This is important for implications for any engineered actions related to Conowingo sediments (e.g. dredging). Hirsch suggests the following as possible avenues of future research for STAC:

- identify this as an issue of concern for the Bay, along with other observed trends in PO4 (most trends are trending upwards, especially in agricultural areas (see Fanelli et al. 2019; Kleinman et al., 2019), some dramatic decreases in areas with wastewater treatment programs)
- start thinking about what kind of science is needed (Data collection, data analysis, discovery older data on reservoir conditions (reconstruct the history via photographs, accounts, power company's observations, experimentation.,..)
- promote research and discussion within the MDE x Exelon agreement

Boomer presented a few slides after Hirsch and stated little to no research is being done on low flow conditions or at critical peak flow times. A consensus of STAC members decided more research is needed to monitor the orthophosphate situation at the Conowingo Dam before the MDE agreement with Exelon is outright approved. In addition to funding for research, variables that are potentially influential to biogeochemical change and monitored very easily (oxygen, temperature profiles) are critical.

> **ACTION: The EB and interested STAC members** will draft a letter for the October 29th settlement agreement between MDE and Exelon (document accessed by pdf here) by the public comment period deadline on January 17th.

STAC Scientific Gap Analysis (SGA): Workgroup Introduction—*SGA Steering Committee*
Between the September and December quarterly meetings, the SGA Steering Committee has met to discuss concerns on the direction of the effort. The Steering Committee (SC) wants to ensure everyone is committed to the effort and understands the intended outcome. The EB also met in October to revise the introduction document and further define the scope. The introduction includes an outline for the report, organized by workgroup and ending with synthesis. Kurt Stephenson (VT) started by addressing any concerns about the direction of this effort so that everyone is on the same page.

Regarding the living resources workgroup, Stephenson stated all water quality goals are derived from living resources based on designated uses, but there are still a number of stressors not addressed by the TMDL. Boomer asked whether there is a process for creating a meaningful list of priorities for the living resources group, Rose stated there wasn't but stressors could be categorized by first order estimations. Uncertainty is irreducible and so the goal is to provide the most useful response to the CBP to understand these issues while striving for 2025 targets.

STAC SGA: Watershed Workgroup—*Zach Easton (VT) and Gary Shenk (USGS)*

To discuss issues identified by the watershed group, Gary Shenk (USGS) reviewed the CBP Watershed Model process and results as a conceptual model for the SGA effort. Shenk detailed the Time-Averaged Model, which encapsulates the Chesapeake Assessment Scenario Tool (CAST), Scenario Builder, and Chesapeake Bay Watershed Model (CBWM) into one tool. This model provides a time averaged scenario output, estimates long-term average loads given a set of anthropogenic inputs, and calibrates to estimate for sensitivities. Within the system processes affecting the Bay, this model can project the following: land use and pollutant loads through multiple stochastic iterations, industrial point sources into 2055 and sewer/septic point source growth into 2025, atmospheric deposition using two models (regression model and the CMAQ National-Scale EPA model for historical wet deposition), fine scale spatial analysis using K factor and connectivity index, input sources such as feed, fertilizer, and manure in conjunction with the WQGIT workgroups, soil and phosphorus concentrations over a 25-yr term, nitrogen in groundwater using two MODFLOW models, and finally, sediment flowpath lags. Additionally, the model can allocate for 189 best management practices of which 104 cover crops. BMP expert panels decide the effectiveness of the practices with detail including crop type, location, and planning.

Areas needing further investigation within the larger conceptual model include atmospheric deposition, lag time effect, and uncertainty of the Chesapeake Assessment Scenario Tool (CAST) and Weighted Regressions on Time, Discharge and Season (WRTDS) models. Shenk stated a research need STAC could look into is an isolation of factors to better understand where the model is not accurately modeling observed data.

Following Shenk, Easton reported out on the SGA watershed workgroup's progress so far. Fundamental science questions for the Watershed Model identified by the watershed group were effectiveness of non-point source (NPS) management efforts, climate change, behavioral responses to existing policies, timing/delivery/speciation, and targets other than total nitrogen (TN) and total phosphorus (TP). Easton focused the conversation on NPS management efforts due to 75-80% of the remaining reductions needed deriving from unregulated agricultural sources. A previous STAC report found there has been little change in NPS reductions from 1992-2002. Regarding legacy nutrients, Amy Collick (UMCES) commented on recent P drawdown studies that show a 20% drop in P over ten years, though some fields show little to no reduction at all. Additionally, much of stored P may not be directly available for uptake due to speciation, saturation, iron bonding sites, and local issues. Easton commented on the difficulty in studying legacy nutrients as they may mask the effectiveness of NPS management due to large stores of N and P in soils and groundwater across the watershed. Shenk responded that although it may take time to understand, STAC can begin to focus on scaling down to increase efficiency. Considering mitigation strategies, Miller asked if uptake is the preferred method or if transporting the nutrients out of the watershed is better; Shenk responded that the current dynamic model cannot isolate this on a fine scale. Process questions needing further study such as model uncertainty, bias, accurate modeling data, and estuary lag time were discussed. Issues with nutrient mass balance were also highlighted by the watershed group. CBP maps operate on a broad scale and are unable to isolate by field, leaving huge

variabilities in data. Though this problem is known, the CBP model is unable to identify the cause of hotspots on the landscape at this time.

With these uncertainties, BMP effectiveness is not able to be properly mapped. An assumption of constant effectiveness over a BMP's lifetime, storm events, and lag times all impact BMP efficiency. Though, Bohlke and Leah Palm-Forster (UDEL) suggested if STAC could identify areas with high impact and existing research, BMP effectiveness might be better understood. For example, immediately testing baseflow and/or splitting the watershed into regions or land uses could result in a percent reduction.

Furthermore, the watershed group identified issues that need to be studied in relation to BMP effectiveness but have not yet been unpacked are climate change and land/use population dynamics, timing/delivery/speciation, and behavioral responses. Leonard Shabman reminded the group to not discount other uncertainties such as changes in transportation and Chancee Lundy (Nspiregreen, LLC) asked if there was a standard of research for BMP effectiveness in an urban environment. Past STAC workshops that may speak to these issues are the AEIOU report, the Multifunctional Riparian Buffers report, and the forthcoming Targeting BMPs report.

Finally, the watershed group presented a matrix on the effectiveness of NPS management efforts prioritizing issues based on four criteria: level of impact, level of understanding, level of control, and ease of implementation.

Thursday, December 19 Minutes

Attendance (W: Webinar):

Members: Brian Benham, Craig Beyrouty , Lee Blaney, JK Bohlke, Kathy Boomer, Chris Brosch, Anthony Buda, Amy Collick, Alix Fink, Zach Easton, Lara Fowler, Deidre Gibson, Ellen Gilinsky, Kirk Havens, Jason Hubbart, Tom Ihde, Thomas Johnson, Hamid Karimi, Martin Lowenfish, Chancee Lundy, Andy Miller, Mark Monaco, Greg Noe, Leah Palm-Forster, Kenny Rose, Michael Runge, Larry Sanford, Leonard Shabman, Adel Shirmohammadi, Eric Smith, Jay Stauffer Kurt Stephenson, Jeremy Testa, Tess Thompson, Denice Wardrop, Weixing Zhu

Guests: Steven Darcey (Prince George's Soil Conservation District), Becky Golden (MD DNR), Bob Hirsch (USGS), Caitlyn Johnstone (CBP), Brooke Landry (MD DNR), Gary Shenk (USGS), Renee Thompson (USGS), Emily Trentacoste (EPA), Scott Philips (USGS)

Administration: Bill Ball, Annabelle Harvey, Meg Cole

Science Needs of the CBP –
Emily Trentacoste (EPA), Gina Hunt (DNR), and Renee Thompson (USGS)
Working with the Bay Program, an interactive and filterable Masterlist spreadsheet is being developed to publically share the on-going resource assessment process. Science needs identified by Chesapeake Bay Program (CBP) goal teams and the Strategy Review System (SRS)

process, as well as overlapping STAC recommendations will be publically available on the database for review in the coming months.

The Healthy Watersheds Cohort had their Management Board Review in August 2019 and the Aquatic Life Cohort in November 2019. Emily Trentacoste (EPA) discussed Healthy Watershed (HW) science needs at the previous STAC quarterly meeting in September 2019 and the HW Cohort then had their final materials due in November 2019 for public comment. Trentacoste presented the science needs within the four outcome groups of the Aquatic Life Cohort. The four outcomes for this cohort are the following: blue crab abundance (maintain a healthy population and refine targets over time), forage fish (improve the understanding of the role of forage fish in the ecosystem and establish a strategy for evaluating forage fish in the bay), oysters (restore native habitat and populations), and submerged aquatic vegetation (SAV) (185,000 acres bay-wide). Trentacoste requested STAC members consider whether the presented needs are appropriate, if there is anything missing, if members are interested in utilizing their expertise to address these needs, if there is more information required, and finally, if there are additional recommendations.

There are a number of high-priority science needs for blue crab abundance -- evaluate stock assessment models for fit, examine the difference in catchability between Maryland and Virginia, and standardize models for fishery independence indices. Regarding model accuracy, Denice Wardrop (CRC) commented the underlying assumption that there is a stable population of blue crabs is untrue and Kirk Havens (VIMS) stated climate change may change the results of a winter drudge survey. Seconding this, Rose stated he was interested in working with the Climate Resiliency group for indicators and Mark agreed there is a need to define indicators for the defined outcomes. The most high-priority science need for Forage Fish is to establish an indicator. Greater questions raised for STAC members are how is data collected and stored for key species and further, where might these data repositories be? Program goals for oysters are to expand into the Middle Peninsula and elsewhere in the bay. A "tech memo" is currently being conducted by NOAA and will require site-specific estimations to receive credits. Greg Noe (USGS) asked if there is any meaningful certainty to restore oysters, though it is not a need identified by the CBP. Lastly, Trentacoste presented on cross-outcome science needs of the CBP. Jeremy Testa (UMCES) commented on the lack of benthic invertebrates included in the framework, and their importance in connected water quality to fish populations. To better adaptively manage, Havens suggested STAC members read through the work plan and management strategies to find overlap in expertise as STAC has the ability to provide a "more global view". In an effort to mechanize STAC input in needs without a specific workgroup, Andy Miller (UMBC) suggested a "round-up" of CBP updates at the beginning of STAC quarterly meetings.

Following Trentacoste, Gina Hunt (DNR), Fish Habitat coordinator, presented on the Fish Habitat GIT. The Fish Habitat outcome seeks to "continually improve the effectiveness of fish habitat conservation and restoration efforts by identifying and characterizing critical spawning, nursey and forage areas within the Bay for important fish and shellfish, and use existing and new tools to integrate information and conduct assessments to inform restoration and

conservation efforts". A conceptual model of the process and decision points for regional fish habitat assessment was discussed, with Phase 1 nearly completed. Phase 1 consists of assessing stakeholder needs (due March 2020), executing a GIT funded project via TetraTech, and gathering, organizing, and assessing biological environmental data (due October 2020). Phase 2 consists of communicating with stakeholder, developing and testing analytical methods for geographical area, testing of nontidal fish-habitat methods at different scales, and nontidal watershed assessment at 1:100K. A timeline for a summary of stressor/predictor data and fish occupancy maps in nontidal waters is October 2020. A summary of a regional and national assessment at a finer scale is slated for October 2021. Eric Smith (VT) suggested performing a probability map of currents to guide decision making when developing occupancy models. Tom Ihde (Morgan State) cautioned being careful with mapping as all life stages are not often surveyed (depending on the species). Overall, Mark Monaco (NOAA) applauded the effort for prioritizing and moving forward in phases in order to maximize assessment.

Finally, Renee Thompson (USGS) presented a poster entitled, Chesapeake Healthy Watersheds Assessment: An investigation of health and vulnerability of state-identified healthy watersheds. The project objective is to employ the EPA Preliminary Healthy Watersheds (PHWA) framework for the Chesapeake Bay watershed. Customizing the PHWA vulnerability index for the Bay may provide better scientific and technical understanding of how to fill gaps related to existing threats. Both vulnerability and health indicators are considered. Further explanation on "vulnerability" may be necessary as STAC members were questioning "vulnerability to what?" Additionally, member suggested a more comprehensive discussion on diagnostic indicators versus conditional diagnostics. Boomer suggested looking at conservation as a management strategy, a point seconded by Scott Philips (USGS) and described as a "whole land conservation outcome".

> **ACTION: All,** provide recommendations to STAC Staff in which STAC may better connect with STAR and CBP workgroups to provide input on science needs during the SRS process. **STAC Staff** will continue to work with STAR to facilitate input from STAC.

STAC SGA Workgroup Discussion
With the remainder of the afternoon, the three SGA groups met individually to assess system response, discuss section formatting, and begin brainstorming their sections.

> **ACTION: All,** SGA groups will continue working together between quarterly meetings to make progress on their workgroup document.

Wrap Up
STAC thanks Bill Ball (CRC) for leading the Chesapeake Research Consortium (CRC) as Executive Director. Miller welcomed Denice Wardrop as the next CRC Director. The March quarterly

meeting will take place on March 11th and 12th at the Chesapeake Bay Foundation in Annapolis, Maryland.