

Responses to STAC modeling related STAC workshops

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Presentation to STAC 3/10/15

Process – review by groups

- Water Quality Goal Implementation Team
- Modeling Workgroup
- STAR
- Communications Workgroup

- Management Board - Pending

Incorporating Lag-Times Into The Chesapeake Bay Program

- ***Increasing the priority given to identifying Best Management Practice (BMP) maturation and effective operational periods in the CBP models.***
- BMP review protocol: Includes
 - Temporal performance of the BMP including lag times between establishment and full functioning
 - Useful life: effectiveness of practice over time
- Verification Framework
 - Develop specific life spans for all CBP BMPs
 - Reduced effectiveness early and late in life cycle

Incorporating Lag-Times Into The Chesapeake Bay Program

- *Revising water quality models to include **BMP efficiencies** as a function of **precipitation** amount and **age** of BMP, while also expanding consideration for different **landscape** types and geographic locations.*
- Ability existed since 2008 review
 - Not much data to drive it
 - Used in EPA/RAND study of the robustness of the Patuxent WIP
 - BMP Panel charge will be updated
- BMP Efficiencies vary based on landscape and physiographic criteria. 2000 cover crop variants.

Incorporating Lag-Times Into The Chesapeake Bay Program

- *Prioritizing the development of a **comprehensive local inventory** of all agricultural and urban BMPs, including performance characteristics and previously unaccounted measures, such as farm and recreational ponds and stream bank restoration.*
- Verification protocols will require evidence of implementation and maintenance
- Historic BMP cleanup
- USGS-USDA providing BMP data formally unavailable
- Urban stream restoration and stormwater control BMP expert panel reports specify reporting with site-specific characteristics.

Incorporating Lag-Times Into The Chesapeake Bay Program

- ***Developing and applying **supplemental models** to inform the Chesapeake Bay Watershed Model (CMWM) on processes not currently simulated, to facilitate insights into lag-time, and to provide site-specific targeting of BMP placement for more effective load reduction. Specific priorities should include models to improve the representation of lags in 1) sediment storage during transit in the basin and 2) nitrogen loading from groundwater in all physiographic provinces of the watershed should be modeled in these complementary efforts, following collection of need data of transport times and flow paths.***
- Partnering with regional researchers
 - JHU Ciaran Harmon – Transit time distributions
 - USGS Ward Sanford and others – data to calibrate TTDs
 - Center for Nutrient Solutions at Penn State

Incorporating Lag-Times Into The Chesapeake Bay Program

- *Developing and applying a **conceptual framework** needs to be developed that encompasses the interactions between **floodplains, stream channels, and sediment storages.***
- Phase 6 watershed model has created the room for this structure
 - Sparrow
 - CBPO Land Data Team
 - Center for Watershed Protection.
- ... but lags are likely not part of this first cut

Incorporating Lag-Times Into The Chesapeake Bay Program

- ***Developing guidance for new **monitoring efforts to explicitly evaluate hypotheses** needed to guide restoration, BMP implementation, and land planning in a holistic manner. An expanded dialogue is needed between the scientists who assess water quality and modelers, both to improve calibration of the models and to improve the understanding of the changes taking place in the watershed.***
- Component of the Midpoint Assessment
- Management Effects on Water Quality Trends workshop
- STAR workgroup
- Dedicated USGS coordinator for this effort

Incorporating Lag-Times Into The Chesapeake Bay Program

- *Developing and applying educational materials to explain the presence of lag-times in all natural systems and that they vary widely for different practices. **Improved communication** with the public is needed to distinguish between BMPs that may be expected to show relatively immediate water quality benefits and those whose impact may not be seen for some time. Additional ecosystem system benefits, beyond those anticipated in the Bay itself, need to be highlighted as well.*
- Concept of lag times communicated in:
 - Director's Blog 2013
 - 2014 New Insights report
- Still working on the science so a little early to communicate many of these issues.

Incorporating Lag-Times Into The Chesapeake Bay Program

- ***Recognize that the failure to account for lag times in point/nonpoint **trading programs**, either through forward markets or trading eligibility rules, could lead to a degradation of water quality.***
- Programs are still under development and this point is a useful consideration during this process.
- EPA is asking for consideration of lag time in its series of Trading Technical Memoranda under development by EPA and review by the CBP's Trading and Offsets Workgroup

Incorporating Lag-Times Into The Chesapeake Bay Program

- CBP understands the issues
- Data starting to be gathered
- Tools starting to be built

Multiple Models for Management in the Chesapeake Bay

- *The CBP should implement a **multiple modeling** strategy for **each** major decision-making **model** of the Bay (airshed, land use, watershed, and estuary) and analyze the output to quantify skill, advance knowledge, and inform adaptive management.*

Multiple Models for Management in the Chesapeake Bay

- ***Airshed*** – done!
- CMAQ identified in the report as an example of M3
- Modular modeling
- Formal process for community developing, testing, and selecting processes models

Multiple Models for Management in the Chesapeake Bay

- ***Land Use*** –
- Report had no specific recommendations.
- Will compare results with several other land use models
 - Landscape Change, Assessment and Design (LCAD) model for south of Harrisburg PA by mid-2016
 - Maryland Department of Planning (MDP) updated urban growth model by mid 2015
 - SLEUTH urban growth model in the Delaware River watershed

Multiple Models for Management in the Chesapeake Bay

- ***Watershed*** –
- The nutrient loading response of the watershed to changes in external loading will be made by an ensemble of models
 - CBP Phase 5 model, Sparrow, Apex, APLE
- BMP effectiveness estimates developed in panels use multiple lines of evidence
- Precipitation and meteorology data sets representing climate change.

Multiple Models for Management in the Chesapeake Bay

- ***Watershed*** –
- Estimates of the nutrient and sediment dynamics of small streams and watersheds
 - Sparrow
 - Land change team following 2012 ‘Natural Landscapes’ STAC workshop
 - Stream mass balance
 - Wetland and buffer watersheds
 - Center for Watershed Protection
- Scenario Builder development is community based
 - multiple lines of evidence, multiple data sets, and multiple algorithms
 - Modular design – trying different algorithms suggested by the community

Multiple Models for Management in the Chesapeake Bay

- ***Estuarine*** –
- Four teams of researchers developing shallow water models.
- Chesapeake Bay hydrodynamic model intercomparison presented at the workshop
- The CBPO Modeling Team actively collaborates on proposals involving the development of new estuarine models
 - NSF Water Climate and Sustainability
 - VIMS

Multiple Models for Management in the Chesapeake Bay

- *The CBP should exercise the multiple model systems developed under Recommendation 1 to quantify model **uncertainty** and confidence in key predictions used in decision-making.*
- Vote for the uncertainty workshop!

Multiple Models for Management in the Chesapeake Bay

- *The CBP should estimate and better communicate the **appropriate levels of spending** on monitoring, modeling, and research relative to the costs of implementation and the cost of poor decision-making.*
- Not easy to estimate total costs of implementation based on this tool or the total cost of modeling
 - Marginal costs?
- We're ready to collaborate.

Multiple Models for Management in the Chesapeake Bay

- ***The CBP should implement ways to better **communicate** modeling, uncertainty, and multiple model results to partners, decision makers, and the public.***
- We agree that communication is a crucial part of effective science-based management.
- Uncertainty will be communicated when it is developed.
- Partners and decision-makers are already effectively covered in the CBP participatory process.
 - WQGIT and its workgroups
 - STAR and its workgroups.
- Public will be brought in as M3 influences decisions

Multiple Models for Management in the Chesapeake Bay

- CBP making progress on M3
 - Different M3 implementation methods
 - In-house and partnering
- Need help with application to uncertainty and appropriate spending
- Agree with recommendation to communicate