Modeling Quarterly Review Meeting

January 7th and 8th, 2014

http://www.chesapeakebay.net/calendar/event/21182/

UPCOMING MEETINGS

April Modeling Quarterly Review
Date: April 1st and 2nd, 2013
Time: 10:00AM – 3:00PM
Location: Joe Macknis Memorial Conference Room (Fishshack) CBPO 410 Severn Avenue Annapolis, MD
Conference Line: 1-866-299-3188 code 410-267-5731
Adobe Connect: https://epa.connectsolutions.com/modeling (enter as guest)
Event webpage: http://www.chesapeakebay.net/calendar/event/21418

ANNOUCEMENTS

- The CBP WQGIT would like to announce that the group at VA Tech won the six year RFP on BMP Efficiencies and Modeling. The Modeling Workgroup should provide modeling recommendations to the WQGIT for the panels to work on.

MINUTES JANUARY 7th, 2014

Estimated Susquehanna Flux of TP, TN, and TSS – Hirsch

Attachment A

Bob reviewed WRTDS regression estimates of nutrient and sediment loads from the Susquehanna basin from a period before the current infill of Conowingo Pool and estimates of loads under current conditions.

Study Hypotheses

- As the reservoirs fill, for any given discharge, there is less cross-sectional area, resulting in greater velocity.
- This leads to a decrease in the scour threshold (more frequent scour) and greater amount of scour for a given discharge.
- This also leads to a decrease in the amount of deposition at moderately high discharge.
- For most of the last 80 years, output has been less than input. Ultimately, average output must equal average input.
- Unless there is a dramatic decrease in the inputs, the outputs of particulate N and P, and of SS must rise. That can be through natural mechanisms or by engineering measures to remove it.
- Two things happen as the reservoir fills:
    - The ability of the dam to trap particulates (N, P, and SS) at moderately high discharges will continue to decrease, resulting in greater fluxes to the Bay on about 45 days per year on average.

- The propensity to scour will continue to increase causing a somewhat higher frequency of scour events and a larger amount of scour when it happens. This is a large amount of N, P, and SS, but it only happens about 1.5 days per year on average.

Science Needs

- Continued data collection upstream and downstream of reservoirs.
- Improved temporal resolution of monitoring during high flow events to improved mass balances of N, P, and SS.
- Reservoir models must simulate both the increase in scour and the decrease in deposition.
- Ecosystem models must consider the changing frequency distribution of inputs (not just scour events).

Discussion and Questions

- For the estuary bioavailability is important, so if the particulate loads are driving the increase, is there any indication of the bioavailability of that material?
  - This is not part of the research, but a few comments:
    - Once it is deposits, it is important to note that it is going to be in a very different redox condition than it was scoured from in the reservoir.
    - Need to consider what time of year does it get delivered to the Bay and what affect it will have in transit and once it is deposited.
  - These ecological and chemical questions in the Bay are critical for the evaluation of any plan for dealing with Conowingo.

- Are you considering all of the changing happening upstream of the Conowingo?
  - As practices upstream of the reservoir (land-use changes, best management practices, fertilizer applications rates changes, point source controls, Clean Air Act improvements, etc.) integrate to a point immediately upstream of the reservoir, monitoring can show changes clearly due to practices upstream of the reservoir. The questions is: Is what we are seeing below the reservoir also just a reflection of what is happening above the reservoir or are the loads being transformed by the loss of trap effectiveness. There is a clear role for the activities upstream, but it could be argued that the largest part of the changes being seen in phosphorus and sediment are driven by the effectiveness in trapping effectiveness.

Long-term trends and mass-balance of sediment and nutrient loadings in the Lower Susquehanna River Watershed – Zhang
Attachment B

Qian presented a study on long-term seasonal trends of sediment and nutrient loadings in the Lower Susquehanna River, with estimates of sediment deposition and scour in the Conowingo Reservoir.

Summary

- Sediment and nutrient loading trends were reconstructed at Marietta, Conestoga, and Conowingo using the WRTDS method.
- Downward trends of SS, P (TP, PP, DP), and N (TN, PN, DN) loads were observed for the Susquehanna watershed at Marietta above the reservoir system, indicating effective management controls in the watershed.
- Increasing amounts of SS, PP, and PN are entering the Bay as the result of major loss in reservoir performance, which will pose significant challenges to attainment of TMDL goals for the SRB.
- Scour events have become more frequent, and the extreme scours have become more severe in recent years.
- As the reservoir fills up, deposition has been generally decreasing during not only the highflow events, but also the moderate-flow events.
- WRTDS-derived deposition trajectory seems to match with Conowingo bathymetry results reasonably well (1987-2012).

Progress on Lower Susquehanna Dams – Cerco
Attachment C

Carl described the progress being made on the simulation of the Lower Susquehanna Reservoirs.

Work Completed Thus far

- Effect of a scour event on existing conditions
- Effect of a scour event on TMDL
- Effect of storm timing (season) on TMDL
- Alternate compositions of scoured material
- Potential for sediment management by dredging of Conowingo Reservoir
- Impact of sediment bypassing around Conowingo Dam

Discussion and Questions

- A participant expressed concern about how much information is being presented on the effect of different amounts of dredging when there hasn't been any demonstration that we are accurate on being able to predict what is happening in the reservoir.
    - The documentation of the ADH model should help elevate some of the concerns.

- Considering this study and the studies previously discussed at this meeting, what is the analysis to date on the increased frequency of scour events?
    - It is difficult to say there will be an increased scour threshold. The take home is that less deposition at more moderate events. Likely, more scour at a higher frequency, but there is currently no way to quantify that.

- This study is considering an unusual event (rain on snow event). Need to keep this in mind when analyzing this study and the unusual sediment composition.

- Relative effect of the storm if it had occurred in June vs. January? The absolute impact is considerably worse.

- The dredging of "3 million cubic yards" is currently misleading. This study is showing 3 million cubic yards dredged from the 2011 bathymetry. In order to achieve the benefits, must dredge enough to maintain the 2011 bathymetry minus 3 million every year. This should decrease due to the TMDL.

- Consider modeling Conowingo explicitly in the CBP Watershed Model.

Input and Output Loads to the Conowingo Pool – Yactayo-Bhatt
Attachment D

Documentation of the scenarios and associated nutrient loads of scenarios used to examine the influence of Conowingo infill on Chesapeake Bay water quality were presented.

Study Conclusions

- The WSM Phase 5.3.2 infill scenarios results suggest that there is enough total suspended sediment coming in to the reservoir system to support h the finding of 100% increase of TSS load from Conowingo under current reservoir infill conditions (Hirsch, 2012).
- The WSM Phase 5.3.2 infill scenarios results suggest that there is just enough total phosphorus coming in to the reservoir system to support the finding of 50% increase of TP load from Conowingo under current reservoir infill conditions (Hirsch, 2012).
- The Conowingo infill scenario loads from the Susquehanna increased Deep Channel DO and Deep Water DO levels of nonattainment for both 2010 Progress and TMDL scenarios.

Discussion and Questions

- What is the effect of the decoupling of the phosphorous and sediment in the P532 WSM?
    - Clarification: In the P5.3.2 calibration, there are basins where when the calibrated phosphorus load decreased and calibrated sediment load increased or vice versa, but they are not decoupled, when sediment settles or scours it carries phosphorous and best management practices such as the Conowingo the loads are directly related because their functions are linked.

Extension of the WQSTM to 2011 and Shallow Water Assessment Plans – Cerco
Attachment E

Extending the WQSTM to 2012 in order to incorporate, for the first time, the shallow water monitoring observations into CBP model calibration was discussed.

Discussion and Questions

- **ACTION**: Future Activities slide 14 – Regions of the Bay indicate periodic pulses of solids and solid forms of nutrients that are not supported by observations. These are related to loads. Is there a process (e.g. wetland interaction) that is modifying these loads? Modeling Team will analyze these cells in the CBP Watershed Model also.

Review of CB Shallow Water Monitoring – Trice
Attachment F

Mark Trice reviewed the entire mix of shallow water monitoring (SWM) sites from tidal fresh, mesohaline, polyhaline, with or without SAV, and with identification of high or low energy shore, and with the identification of sand or other substrate where possible. The objective is to use the SWM sites to calibrate proposed multiple models of shallow tidal water.

Discussion and Questions

- Upon request Mark Trice can provide a spread sheet of all stations, sample years, and what was sampled.

- Does not include toxic containment sampling. Should contact Greg Allen and Scott Phillips for more information on this topic.

Atmospheric Deposition and Forest Loads - Eshleman
Attachment G

Keith described his recently published work (ES&T October 2013) of more than two decades of observations of atmospheric deposition of nitrogen on Chesapeake forested watersheds and the forest's response to reduced atmospheric deposition loads.

Study Conclusions

- Decreasing surface water nitrate-N concentrations and yields are a largely untold CB "success story"
- "Good news", but the "where" and "why" are important
    - Forested headwaters of the basin
    - "Co-benefit" of 1990 CAAA, not Clean Water Act
    - Responses to atmospheric S and N deposition reductions similar
    - Unknown importance relative to land management actions

- Must account for forest N dynamics in TMDL process (N yields from atmospheric deposition previously considered "uncontrollable")
- Additional water quality improvements likely with > N deposition control
- In-stream N processing can be neglected
- Lag time of forest N response appears to be relatively short (< a year or so), suggesting that a significant portion of atmospheric N bypasses the soil
- Preventing future degradation of forested subwatersheds (i.e., "doing nothing") may be very cost-effective relative to restoring highly degraded parts of the watershed
    - Greater forest protection and preservation
    - Local water quality and recreational benefits

Discussion and Questions

- Highly urbanized watersheds? The large declines in total nitrogen or inorganic nitrogen deposition aren't being seen as much in the eastern part of the basin. This may be due to a couple things, one being higher ammonia deposition over the study period. Rationally, with impervious surface we should see the same kind of bypassing of the soil that has been seen in these setting, but difficult to tease out.

- Others are working to use the stable isotope in nitrogen to tease out the differences between soil and air deposition.

- The may be other tools to consider for other land-uses. NADP was specifically designed to stay away from cities that could disrupt the acid rain signals. But the WSM has county level dry deposition from CMAQ. If that information is useful, it can be provided.

MINUTES JANUARY 8th, 2014

Center for Nutrient Solutions (CNS) – Shortle
Attachment H

Jim described the newly established Center for Nutrient Solutions at Penn State. A recent initial kick off meeting that outlined the next 3 years of activity of the Center will be reviewed. A major objective of the Center is to improve the understanding and simulation of the fate and transport of nutrients in watersheds.

Discussion and Questions

- The Modeling WG and Team at CBPO will discuss where this research can applied. The Modeling WG will invite CNS back to future Modeling Quarterly Meetings.

- Contact in MD for Manokin River – Dr. Arthur Allen (University of Maryland Eastern Shore) and Ray Bryant (Penn State Agricultural Research Service).

APLE Phosphorus Model – Mulkey
Attachment I

Alisha described the APLE model, how it was developed, and where it has been validated. The Modeling Workgroup will consider how the APLE Model could be used as a component of the Phase 6 Model.

Discussion and Questions

- APEL will underestimate the subsurface flow. There are many different organizations working on this issue, but the science is not currently there to model the subsurface flow.

- APEL is sensitive to surface runoff, but there is a lot of debate on what surface runoff is. Is this all storm flow or specifically surface runoff? At the development site, calibration sites, and validation sites how did they measure the surface runoff?
    - Alisha Mulkey will look into this question and get back to Gary Shenk and the Modeling Team.

- APEL could be useful for BMP Panels in estimating efficiencies of BMPs.

- If the STAC Phosphorus Panel and Modeling WG approve APEL, it can be incorporated into the CBPO Models.

James Chlorophyll – Butt
Attachment K

The status of the James River chlorophyll analysis was reviewed.

Discussion and Questions

- Linker and Butt will be in contact offline to discuss boundary conditions.

- How is the new model from Andrew Parker going to be incorporated into this study?
    - Compare the new and old model loads and their effect on the WQ Model.

James WSM - Parker
Attachment J

Andrew reviewed the variant of the Phase 5.3.2 Watershed Model that's been developed to support the James River chlorophyll analysis.

Discussion and Questions

- The Modeling WG suggested comparing the rainfall data used in this study to the NLDAS data.

- Does the calibration process maintaining consistent parameters across the four zones?
    - No, the four zones provide a basis for variation in the parameters assigned to each of the land-uses. Calibration points were selected throughout the watershed to check for calibration consistency.

- When calibrating 1990 – 2013, are there different land-uses data sets for each year? Use 1992, 2001, 2006 land-use time series and interpolate between the time series.

- Is the effect of BMPs implementation of reported BMPs considered in this study? Representation of BMP is considered implicitly in the calibration, but the framework is there to do any assignment of BMPs moving forward with the scenarios.
    - If the BMP simulation is implicit and therefore we do not know the impact, how do will you assess the impact of additional BMPs? Use other parallel studies or work. Ideal situation is to represent the BMPs in the calibration, but the data would need to be provided. Matt Johnston is the contact for the CBPO BMP data.

- In dealing with small scale TMDLs, many are calibrated as this model is calibrated (implicit BMPs): there is an accounting of BMPs, but there isn't an explicit reduction to the loads, they assume that the water quality monitoring encompasses BMPs that have been implemented. Then, in the implementation plan, they consider the area that has already been implemented verses the area that needs implementation and only apply reductions and use the efficiencies on area that needs implementation to produce the reduction scenarios. But this may not be feasible on the scale of the entire James River watershed.

Climate Change Impact Assessment – de Mooy
Attachment L

Jennifer presented an overview of Delaware's Climate Change Impact Assessment trends and projections including estimated potential impacts to various resources including agriculture.

Discussion and Questions

- Jennifer de Mooy will provide the Modeling WG links to the reports when they are released.

- The Modeling WG is interested in many aspects of this report, particularly longer growing season, irrigation, and volatilization of manure.

- Discussing what we can and cannot quantify when dealing with climate change is helpful.

- Delaware Division of Energy and Climate is working with the University of Delaware to provide a web portal with the study data. Modeling Team suggestions, ideas, or questions about how this data might be useful, how it could be best accessed, or what kinds of queries you might want to run or different projects you're working on would be useful. Please contact Jennifer de Mooy.

Modeling Laboratory Action Team Update – Bennett
Attachment M – MLAT Presentation
Attachment N – MLAT Draft Report

Mark presented the Modeling Laboratory Action Team Management Board presentation for comments and recommendations.

Discussion and Questions

- Also, consider how research such as what CNS discussed yesterday and what will be done in the National Water Center in Alabama.
    - The Modeling Laboratory could be a way to partner with others and focus the research.

- The report doesn't address the idea of the Watershed Model being used as a regulatory model. This was outside of the purview of the Action Team. The Action Team did discuss how the laboratory could be used to define uncertainty, appropriate scale of use, and other issues.

Spatial Distribution of Estimated Climate Change Influence in the Chesapeake Watershed – Pruzinsky
Attachment O

An initial look at an analysis that will examine estimated climate change influences at the Watershed Model land-segment scale was presented.

Discussion and Questions

- Modeling WG members suggested adding total load and delivered load to the analysis, considering a state-basin scale, and showing the coefficient of variation instead of the standard deviation.

- This model study should be seen as a proof of concept study. It will likely be repeated as the global models improve and the CBP Watershed Model changes.

Analysis of SPARROW Sensitivities – Yactayo
Attachment P

Guido described an analysis of SPARROW nutrient export sensitivities to input loads and provide an initial look at an equivalent SWAT analysis.

Discussion and Questions

- For the comparison of fertilizer inputs for the year 2002, Robin Dennis suggested also comparing at the EPIC Model.

- Although SPARROW is only using wet deposition for the atmospheric calculations, they are also computing internal to the model based on the spatial regression, a multiplier. Should contact them to determine what the multiplier is to actually understand what they are assuming the total deposition is.

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