

Transitioning from Phase 5 to Phase 6 Modeling Tools

Water Quality Goal Implementation Team
August 11, 2017

Lee Currey, MDE and Dave Montali, Tetra Tech
Chairs, Modeling Workgroup



Chesapeake Bay Program
Science, Restoration, Partnership

“In my new role as Chair of the Principals’ Staff Committee (PSC), I am committed to following through on the necessary decisions and work deliverables on time so we can proceed forward with developing and implementing our Phase III WIPs with the best available information and data. I am asking you as the WQGIT leadership and members to work collectively.... so that you can bring the WQGIT’s recommendations to the October PSC retreat. We cannot afford any further delays in reaching agreement on the models and tools supporting our decision making as well as the needed decisions on how we are going to develop the draft Phase III WIP planning targets.”

*Secretary Ben Grumbles
August 2, 2017*



Midpoint Assessment Priorities Identified in 2012 – The Charge to the Modeling Workgroup

- Update local land use and incorporate high resolution land cover data – DONE
- Update fertilizer and manure application – DONE
- Incorporate new and updated BMP efficiencies – DONE
- Update BMP historical record – DONE for 1985 – 2013; data for 2014-2016 due September 1
- Set overall land use loading rates – DONE
- Revise Modeling Structure – DONE



Midpoint Assessment Priorities Identified in 2012 – The Charge to the Modeling Workgroup

- Revisit watershed model calibration methods – DONE
- Incorporate multiple model estimates for sensitivity to nutrient inputs – DONE
- Provide the capability to simulate groundwater lag times – DONE
- Extend the watershed simulation period – DONE
- Develop an approach to simulate effects due to Conowingo, and develop options for addressing such impacts – DONE
- Develop an approach to simulate effects due to climate change, and develop options for addressing such impacts – DONE



Key Points on 2017 Models

The Phase 6 Watershed model loads have changed because of improved nutrient input data.

The Phase 6 assessments of Water Quality Standard achievement are consistent with Phase 5.3.2. Current estimates are that the WIP2 Level of Effort achieves water quality standards. (Early August version of the WQSTM used.)

The degree of water quality attainment In Deep Channel and Deep Water DO with nutrient reductions are consistent with the 2010 WQSTM Bay Model.



Midpoint Assessment Modeling Peer Reviews

Review Title/Topic	Status	Sponsor
Chesapeake Bay Scenario Builder/Nutrient Input Approach	Complete	Watershed Technical Workgroup
Proposed revised James River chlorophyll <i>a</i> water quality criteria (Part I)	Complete	Criteria Assessment Protocol Workgroup
(Part II)	Finalizing	
Phase 6 Chesapeake Bay Watershed Model	Finalizing	Modeling Workgroup
Chesapeake Bay Water Quality/Sediment Transport Model (WQSTM)	Finalizing	Modeling Workgroup
Approach being taken to factor climate change considerations into the 2017 Midpoint Assessment	Under way	Climate Resiliency Workgroup

Source: Rachel Dixon and Bill Ball - CRC

Phase 6 Chesapeake Bay Watershed Model



Review Charge: Phase 6 is the most recent of a series of increasingly refined versions of the CBWM, and is a major departure from previous deterministic and mechanistic versions. The water quality simulation is an entirely new approach which relies on a structure based on multiple models. The panel is reviewing the Phase 6 Model with particular emphasis on the new multiple model aspects of the watershed simulation

Status: Excellent guidance, recommendations, and advice have been provided by the Phase 6 Watershed Model peer review report and a response to the report is being drafted. No fatal scientific errors identified. Final STAC peer review expected by the end of August.

Source: Rachel Dixon and Bill Ball - CRC

Reviewer	Affiliation
Zach Easton	VT, STAC
Don Scavia	U of Michigan
Doug Smith	USDA-ARS
Andrew Miller	UMBC, STAC
Peter Kleinman	USDA-ARS
Claire Welty	UMBC
Lawrence Band	UNC
Kathy Boomer	TNC, STAC
Rich Alexander	USGS
James Pizzuto	U of Del

Chesapeake Bay Water Quality/Sediment Transport Model (WQSTM)



Review Charge: The 2017 version of the WQSTM is the most recent of a series of coupled hydrodynamic and water quality models. New aspects include improved representation of the bioavailability of particulate organics and ability to simulate Conowingo infill and climate change in tidal waters. Refinements to the shallow water simulation include attenuation of nutrient/sediment loads through tidal wetlands, the representation of shoreline loads, and the explicit representation of oyster aquaculture, sanctuaries, and wild populations.

Source: Rachel Dixon and Bill Ball - CRC

Reviewer	Affiliation
Damian Brady	U of Maine
Joe DePinto	Limnotech (retired)
Marjy Friedrichs	VIMS, STAC
Tom Jordan	SERC
Dominic DiToro	U of Delaware
Steven Chapra	Tufts
Meng Xia	UMES
Matt Gray	UMCES Horn Point

Chesapeake Bay Water Quality/Sediment Transport Model (WQSTM)



Status: An experienced and knowledgeable panel is finalizing peer review for completion by the close of August. No fatal scientific errors identified. Final report from the peer reviewers expected by the end of August.

Reviewer	Affiliation
Damian Brady	U of Maine
Joe DePinto	Limnotech (retired)
Marjy Friedrichs	VIMS, STAC
Tom Jordan	SERC
Dominic DiToro	U of Delaware
Steven Chapra	Tufts
Meng Xia	UMES
Matt Gray	UMCES Horn Point

Phase 6 Fatal Flaw Comments

Partnership Decisions, Status, and
Next Steps

Partnership Decisions on the Phase 6 Fatal Flaw Review Period

The WQGIT approved the Phase 6 model review document on May 8, 2017 which included the following definition of a fatal flaw comment:

- A fatal flaw is defined as a significant impediment, based on a weight of evidence approach, of the ability of the partnership to establish reasonable planning targets or evaluate progress toward achieving the planning targets or meet the conditions of EPA's "Interim Expectations for the Phase III Watershed Implementations Plans," dated January 19, 2017 due to:
 - A calculation or method that does not follow the documented final decisions of the CBP partnership
 - A calculation or method, or combinations thereof, that produce illogical results that result in significant impediment
 - The omission of data submitted by the CBP partnership by established deadlines
 - The overall failure of the model calibration to match observed flows and loads when compared to the level of performance in previous models

Partnership Decisions, continued

- A comment is not considered a fatal flaw if it is:
 - A disagreement with a final decision that has been made by the partnership
 - A disagreement with a scientific or technical method or product in favor of another method or product
 - A failure to match loads for particular monitoring station(s) or constituent(s)
 - A disagreement with a planning target

Current Status

- The Partnership's Phase 6 fatal flaw comment deadline was July 31, 2017.
- The CBPO received 109 comments from the Partnership, with perhaps 80 unique comments (some are duplicates from multiple sources).
- The CBPO is currently working on draft responses to all comments received.
- The Land Use WG and AgWG met on 8/2 and 8/3, respectively, to discuss the comments assigned to their WGs.
- Comments are being addressed through the sector workgroups, here at the WQGIT, and when appropriate, being addressed one-on-one with CBPO.

Next Steps

- 8/14 - WQGIT – Discussion (and decisions) on fatal flaws
- 8/28 - WQGIT – Decisions on fatal flaws
- In the month of August, the CBPO modeling team will continue to follow up with the commenters, the workgroups, and the WQGIT with a proposed response and resolution. Any issues where agreement cannot be reached will be elevated to the WQGIT. Many of these discussions have already taken place and will continue throughout this month.
- If the WQGIT cannot reach consensus on a proposed resolution, the issue is immediately elevated to the Management Board/PSC in order to remain on schedule.
- All Phase 6 comments and their responses will be included as an appendix to the Phase 6 modeling documentation and will be used to guide future efforts.

Binning Phase 6 Comments

- The CBPO modeling team has “binned” the comments by the following groupings:
 - a) Not a fatal flaw
 - b) Fatal Flaw
 - c) Investigating

And actions:

- i. Already changed in draft Phase 6 modeling tools
 - ii. Will be changed in final Phase 6 modeling tools
 - iii. Cannot be changed now, but may be in the future
- Also included are columns on (1) proposed resolution/response; (2) whether the comment needs to be resolved before calibration or if it can be resolved in scenarios; and (3) action needed

Moving Forward

- Latest draft of Phase 6 fatal flaw spreadsheet has been shared – August 11.
- Goal is to resolve these comments to everyone's satisfaction to the extent practicable within the resources available by August 28.
- **Requested Actions for Commenters:**
 - Review the proposed responses and actions in the spreadsheet.
 - Flag comments to the CBPO contact (cc to Gary Shenk) where you don't agree / can't live with the (1) binning; (2) proposed resolution; and/or (3) actions to resolve comment.
 - Where there is disagreement with a proposed resolution and/or action, be prepared to identify options to resolve comment.
 - Identify any comments that were submitted prior to the July 31 deadline but were not captured on the fatal flaw comment spreadsheet.

Next Steps

- 8/14 - WQGIT – Discussion of fatal flaws
- 8/28 - WQGIT – Decisions on fatal flaws
- 9/1 – Revised BMP history (2014-2016) due to CBPO
- If the WQGIT cannot reach consensus on a proposed resolution, the issue is immediately elevated to the Management Board/PSC in order to remain on schedule.



Phase III WIP Planning Target Development

- Draft Phase III WIP planning target development; August 1 – September 30, 2017.
- Key elements of No-Action Scenario, E3 Scenario, and geo-isolation runs are underway along with latest Conowingo infill and climate change analyses.
- Review of preliminary planning targets, Conowingo infill analysis, and climate change influence by WQGIT at September 25-26, 2017 meeting.
- Review of planning targets, Conowingo infill analysis, and climate change influence by PSC at October 2017 meeting.
- Release of draft Phase III WIP planning targets; October 31, 2017 - February 28, 2018 for partnership review.
- PSC approval of final Phase III WIP planning targets with special cases and release - March, 2018.



Phase III WIP Planning Target Development

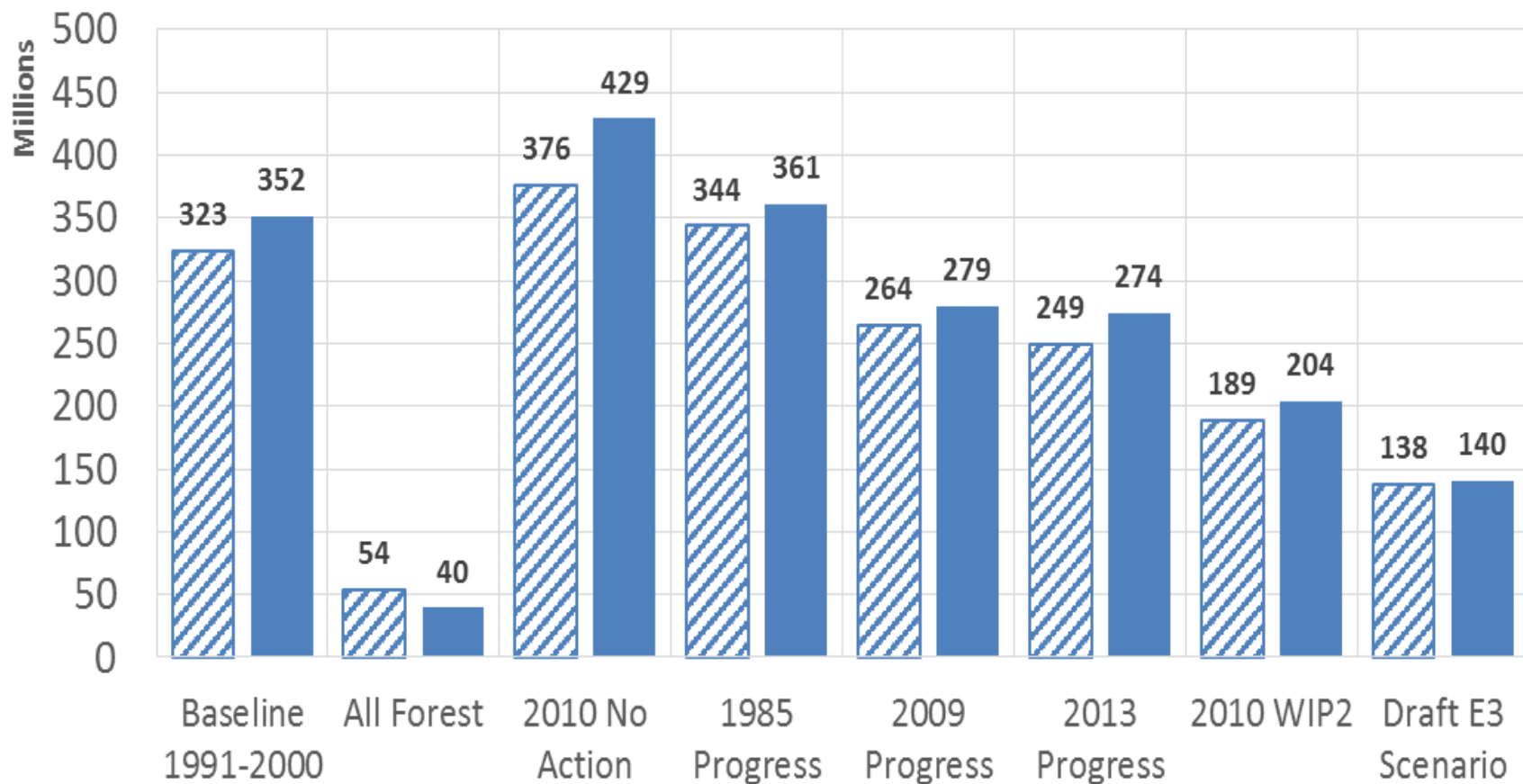
- We'll use the September 10 version of the Watershed Model and WQSTM for the WQSTM F2F meeting on September 25-26. We will be changing the models based on the Phase 6 review, but not recalibrating the models. We need to test to see if recalibration is warranted. (The schedule is based on the WQGIT imposed August 31 deadline for historical BMPs.)
- If there is sufficient change in the model results the models will be recalibrated.
- If a recalibration is needed it will be done in October prior to the PSC Retreat and the final draft planning targets.
- For the September 25-26 meeting the geo scenarios will be done on the same geographic scale as was done in 2011. A more detailed scale will require more time.

**Potential Phase 6 Fatal Flaw
Comments – to be presented by the
AgWG**



The Phase 6 Loads are Consistent with Phase 5.3.2 (With the Exception of Higher Progress and No Action Scenario Loads Because of Improved Historical Inputs)

Draft P6, Total Nitrogen Delivery to the Bay (lbs)



2017 Draft Phase 6 in solid blue bars. Phase 5.3.2 in stippled bars. Units in millions of pounds.



The Phase 6 Assessments of Water Quality Standard Achievement are Consistent with Phase 5.3.2. Current Estimates are that the WIP2 Level of Effort Achieves Water Quality Standards

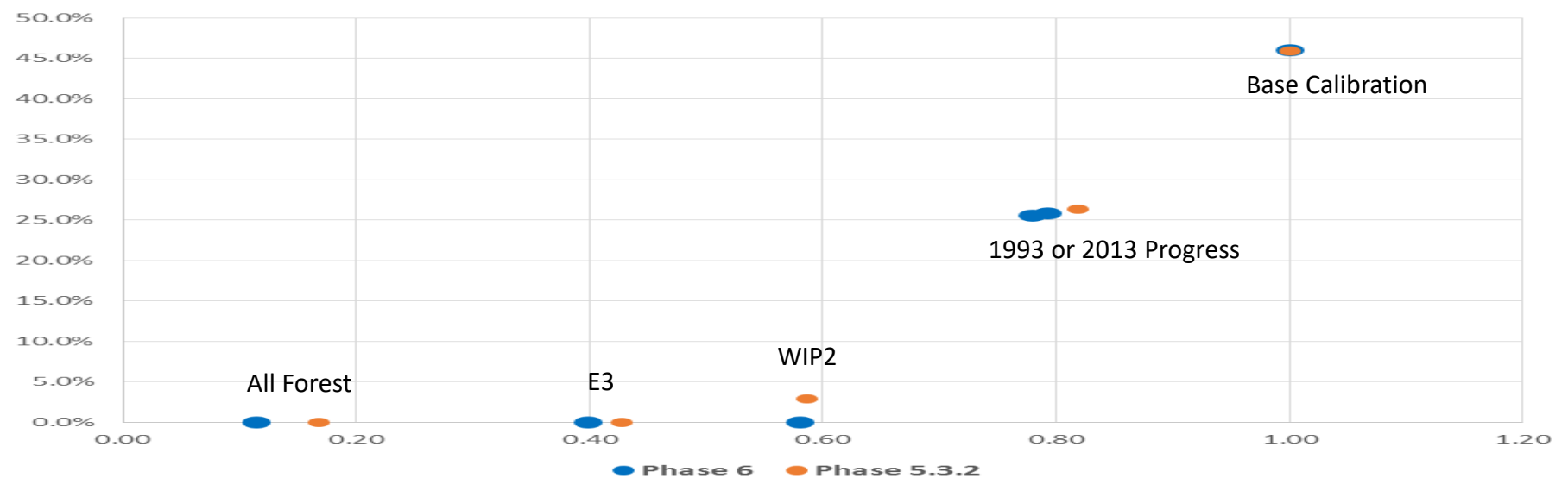
		Base	No Action	1985 Progress	2009 Progress	2013 Progress	WIP2	E3	All Forest
Phase 6		352TN	429TN	361TN	279TN	274TN	204TN	140TN	40TN
8/9/17		22.5TP	44.0TP	30.5TP	17.9TP	17.1TP	12.3TP	7.1TP	2.1TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD	16.0%	10.9%	7.7%	0.6%	0.6%	0.0%	0.0%	0.0%
CB4MH	MD	46.0%	51.6%	45.4%	25.9%	25.6%	0.0%	0.0%	0.0%
CB5MH	MD/VA	14.2%	18.5%	13.5%	0.9%	0.8%	0.0%	0.0%	0.0%
CHSMH	MD	37.4%	25.4%	17.7%	5.6%	5.1%	0.0%	0.0%	0.0%
POTMH	MD/VA	20.2%	20.4%	14.2%	0.0%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	20.6%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	23.9%	13.2%	0.0%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	26.0%	18.8%	12.3%	12.2%	0.6%	0.0%	0.0%
MD5MH	MD	21.7%	25.3%	20.6%	4.3%	4.2%	0.0%	0.0%	0.0%
VA5MH	VA	4.5%	9.6%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	28.5%	26.6%	1.6%	1.0%	0.0%	0.0%	0.0%

		Base	All Forest	No Action	1985 Progress	2009 Progress	WIP2	E3
Phase 5.3.2		323TN	53.6TN	376TN	344TN	264TN	189TN	138TN
		20.6TP	2.6TP	37.9TP	25.7P	18.3TP	13.2TP	10.6TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD	16.0%	0.0%	22.0%	19.2%	7.3%	0.2%	0.0%
CB4MH	MD	46.0%	0.0%	52.8%	49.1%	26.4%	2.9%	0.0%
CB5MH	MD/VA	14.2%	0.0%	20.0%	16.7%	0.6%	0.0%	0.0%
CHSMH	MD	37.4%	0.0%	41.5%	37.4%	35.6%	16.6%	2.3%
POTMH	MD/VA	20.2%	0.0%	27.4%	22.7%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	0.0%	27.6%	22.8%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	0.0%	28.1%	25.1%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	0.0%	35.6%	27.5%	14.0%	1.6%	0.0%
MD5MH	MD	21.7%	0.0%	27.2%	23.8%	3.9%	0.0%	0.0%
VA5MH	VA	4.5%	0.0%	10.7%	7.4%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	0.0%	49.1%	38.2%	11.5%	0.0%	0.0%



The Degree of Water Quality Attainment In Deep Channel and Deep Water DO with Nutrient Reductions are Consistent with the 2010 Model.

Response of 2010 and 2017 WQSTM Deep Channel DO to TN Load Reductions as a Percent of Phase 6 and Phase 5.3.2 Base in CB4MH



Response of 2010 and 2017 WQSTM Deep Water DO to TN Load Reductions as a Percent of Phase 6 and Phase 5.3.2 Base in CB4MH

