Scenario Builder and Watershed Model Progress toward the MPA

Gary Shenk Modeling Workgroup 7/22/14



Midpoint Assessment Timeline

BMP panel
recommendations for
Phase 6.0 inclusion

Evaluation of 60% by Jurisdiction Implementation of WIPs & Two Year Milestones 2017 target using Evaluation of Programmatic and Load Reduction Commitments Phase 5.3.2 modeling Monitoring data assessments/factors affecting trend findings tools •2018 Comprehensive monitoring and trend Approval of decision Complete Phase III Agreement on framing Establish Phase III Agreement on path findings through 2016 support tools WIP targets WIPs forward and data the priority issues inputs •2018 •2017 •2016 •2015 2014 Support for Phase III Phase III WIP Final partnership · Early review of New land use WIP development expectations finalized comments on suite of decision support tools classifications and using Phase 6.0 tools Partnership informs loading rates James River modeling tools final decisions on Partnership input to approved chlorophyll any updates to local reallocation process assessment criteria BMP panel area target completed recommendations for expectations Conowingo Dam Phase 6.0 inclusion Review and study complete Agreement on incorporate decisions Midpoint Assessment Review and of climate change Schedule incorporate decisions impacts of climate change impacts

Midpoint / ssessment Timeline Evaluation of 60% by Jurisdiction Im ementation of WIPs & Two Year Milestones 2017 target using Evaluation of Pr rammatic and Load Reduction Commitments Phase 5.3.2 modeling Monitoring dat assessments/factors affecting trend findings •2018 Comprehensive monitoring and trend Approval of decision Agreement on path Agreement on framing ablish Phase III Complete Phase III findings through 2016 support tools P targets WIPs forward and data the priority issues •2017 •2018 •2016 •2014 •2015 Support for Phase III Phase III WIP Final partnership · Early review of New land use WIP development expectations finalized comments on suite of decision support tools classifications and using Phase 6.0 tools Partnership informs loading rates James River modeling tools final decisions on Partnership input to approved chlorophyll any updates to local reallocation process assessment criteria BMP panel area target recommendations for completed expectations Phase 6.0 inclusion Conowingo Dam Review and study complete Agreement on incorporate decisions Midpoint Assessment Review and of climate change incorporate decisions Schedule impacts of climate change impacts BMP panel recommendations for Phase 6.0 inclusion

CREATE The Models

REVIEW The Models

USE The Models

Draft Modeling Schedule for MPA

Dec 20, 2016 - All models are final. The partnership decision-making process begins to discuss how these new models will be used in the WIP3 process

September 2016 – Final comments on the draft Phase 6 model

REVIEW
The Models

Dec 20, 2015 - Phase 6 draft model is complete. Evaluation followed by fine tuning during this year

Oct 20, 2015 – All inputs are final and delivered to the WSM by the scenario builder team for the final calibration run

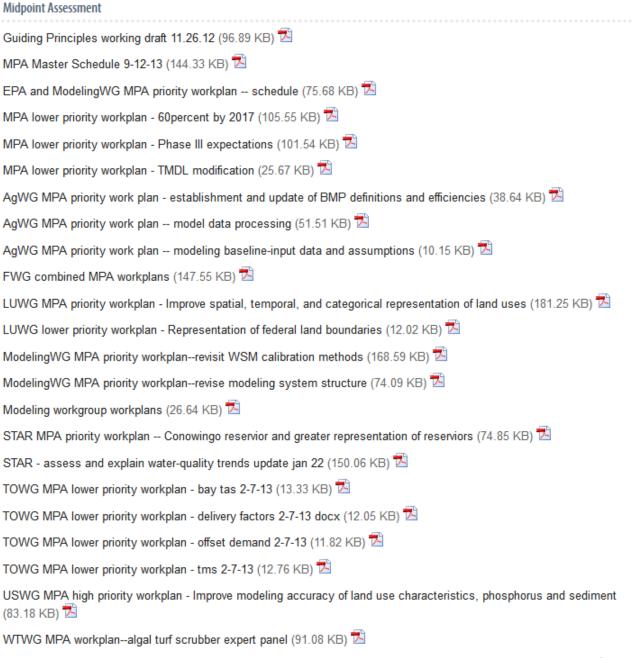
March 20, 2015 – All major partnership decisions are made on changes to scenario builder processing and data. Scenario builder final modifications begin.

Oct 20, 2014 – Rough Draft of major changes to nutrient processing in Scenario Builder will need to be complete. (Examples: land use types and manure application rules)

CREATE The Models



Already Here, but Partnership needs to be able to get the whole picture "at a glance"



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Watershed Model Development and Code Versioning

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Not Quite "At a glance"

Major Topics - WQGIT

- Land use
- Fertilizer and Manure Applications
- BMP effectiveness
- BMP implementation accounting
- Scenario Builder Development and Code Versioning

Major Topics – Modeling WG

- Watershed Model Development and Code Versioning
- Calibration Methodology
- Land use Loading Rates (with WQGIT and WGs)
- Sensitivities to inputs
- Fine Scale Processes (with LUWG)
- Lag Time
- Atmospheric Data
- Climate Change
- Conowingo and other Reservoirs

BMP effectiveness

CBP Oversight: WQGIT

Lead: Jenn Volk, James Davis-Martin, Brian Benham

CBPO Contact: Lucinda Power

Midpoint Assessment Priorities:

establishment and update of BMP definitions and efficiencies: AgWG

Component Efforts:

None

Brief Description:

The WQGIT is evaluating new BMPs, and improving their definitions and associated effectiveness values through the partnership approved BMP protocol process.

Progress:

The panels have been very active and continue to deliver BMP recommendations to the partnership. A consortium of universities under the leadership of Virginia Tech has received funding to help coordinate BMP expert panels as a supplement to the CBP process. In addition, Tetra Tech is providing technical and logistical support.

Completed panel reports are listed on ChesapeakeStat.

A separate web page for BMP panel reports is being prepared.

Documents: WQGIT BMP Review Protocol

Presentations:

Next Steps:

Expected Completion Date: Oct 1, 2015

Summary

- Document / Web site being prepared to keep the Partnership up-to-date on model development
- Hierarchical structure allows
 - At-a-glance overview
 - Drill down to detailed information
- Continual updates
- Your name is on the page
 - You own the content.

Major Topics – Modeling WG

- Watershed Model Development and Code Versioning
- Calibration Methodology
- Land use Loading Rates (with WQGIT and WGs)
- Sensitivities to inputs
- Fine Scale Processes (with LUWG)
- Lag Time
- Atmospheric Data
- Climate Change
- Conowingo and other Reservoirs

Watershed Model Development and Code Versioning

CBP Oversight: Modeling Workgroup Lead: Lee Currey and Dave Montali

CBPO Contact: Gopal Bhatt, Gary Shenk

Priorities:

Revise Modeling Structure: MWG

Cross-cutting priority as necessary for all changes to the modeling structure

Description:

Make incremental changes to the watershed model code as data or processes from other parallel paths become available. A new calibration will be performed for each version to see the resulting incremental changes in model results.

Progress:

Phase 5.3.2

NLDAS rainfall data set rather than the XYZ data set. Available past 2005

Made changes to the calibration routine to make the winter and summer bias better behaved Land Sediment Calibration

Modified the calibration method to go to a four-parameter optimization versus 2-parameter

PQUAL-only simulation

PQUAL with draft sensitivities (7/2014)

Presentations:

Modeling Work Group 6/24/14

Modeling Work Group Gopal Bhatt 4/1/14

Modeling Work Group Gopal Bhatt 7/23/13

Next Steps:

PQUAL run with draft sensitivities

Expected Completion Date: Oct 1, 2015

Calibration Methodology

CBP Oversight: Modeling Workgroup

Lead: Lee Currey, Dave Montali, and Ross Mandel

CBPO Contact: Gopal Bhatt, Gary Shenk

Priorities:

Revisit watershed model calibration methods: MWG

Description:

Work to improve the calibration process, particularly in the area of PQUAL calibration and regional factors.

Progress:

Improvements in hydrology and land sediment processes – Gopal

Incremental changes have been made to the calibration procedures that produce better seasonal balance with the new rainfall data set in use for phase 6.

Complete:

Presented at MWG MM/YYYY

PQUAL calibration methods – Ross and Gopal

Calibration method exists from previous phases of the WSM. Possible improvements include using baseflow-separated in-stream observations to set seasonal variations in concentration, and basing seasonal variability on application and uptake schedules.

Next Steps:

Investigate concentrations relative to monitoring data

Develop Method of relating input timing to output concentration

Expected Completion Date:

Oct 1, 2015

River calibration method - Ross

Modifications to the calibration routines to take flow into account rather than matching the CFD

Next Steps:

Coding of trial calibration methods

Expected Completion Date:

Oct 1, 2015

Regional Factors - Ross

Working on methods to reduce or eliminate regional factors by using *a priori* data in setting land use target loading rates. The USGS Sparrow team is running targeted analyses that may be used in this effort.

Next Steps:

Investigation of sparrow output

Expected Completion Date:

Calibration Methodology page 1

CBP Oversight: Modeling Workgroup

Lead: Lee Currey, Dave Montali, and Ross Mandel

CBPO Contact: Gopal Bhatt, Gary Shenk

Priorities:

Revisit watershed model calibration methods: MWG

Description:

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Progress:

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Incremental changes have been made to the calibration procedures that produce better seasonal balance with the new rainfall data set in use for phase 6.

Complete:

Modeling Work Group Gopal Bhatt 4/1/14

PQUAL calibration methods – Ross and Gopal

Calibration method exists from previous phases of the WSM. Possible improvements include using baseflow-separated in-stream observations to set seasonal variations in concentration, and basing seasonal variability on application and uptake schedules.

Next Steps:

Investigate concentrations relative to monitoring data

Develop Method of relating input timing to output concentration

Expected Completion Date:

Calibration Methodology page 2

CBP Oversight: Modeling Workgroup

Lead: Lee Currey, Dave Montali, and Ross Mandel

CBPO Contact: Gopal Bhatt, Gary Shenk

Priorities:

Revisit watershed model calibration methods: MWG

Description:

Work to improve the calibration process,

Progress:

River calibration method - Ross

Modifications to the calibration routines to take flow into account rather than matching the CFD

Presentations:

Modeling Work Group Ross Mandel 4/1/14
Modeling Work Group Ross Mandel 12/11/13

Regional Factors - Ross

Working on methods to reduce or eliminate regional factors by using *a priori* data in setting land use target loading rates. The USGS Sparrow team is running targeted analyses that may be used in this effort.

Next Steps:

Investigation of sparrow output

Expected Completion Date:

Land Use Loading Rates

CBP Oversight: Modeling Workgroup Lead: Lee Currey and Dave Montali CBPO Contact: Tetra Tech, Gary Shenk

Priorities:

Improve Spatial, temporal, and categorical representation of land uses: LUWG

Revisit watershed model calibration methods: MWG

Improve modeling accuracy of land use characteristics land uses: USWG

Description:

Land use loading targets will be based on multiple lines of evidence. Different types of modeling and monitored information will be incorporated from many sources. The MWG will oversee the process, but will welcome input from the WQGIT and its workgroups, particularly for relationships between different sub-classes within a large class. TetraTech will oversee the process as follows:

Set overall loading ratios between different broad land use types using large scale analyses.

Develop relationships between land use sub-classifications using literature and modeling

Apply relationships developed through other tracks

Sensitivity to inputs

Regional delivery differentiation

Small scale effects

Final adjustments through Calibration to water quality data

Presentations:

Modeling Work Group 6/24/14

Progress:

Broad Scale Analysis - USGS

The USGS will be using the Sparrow model with the CBP land use classifications to determine the overall ratio of loading rate between different large land use classifications in the Chesapeake Bay Watershed.

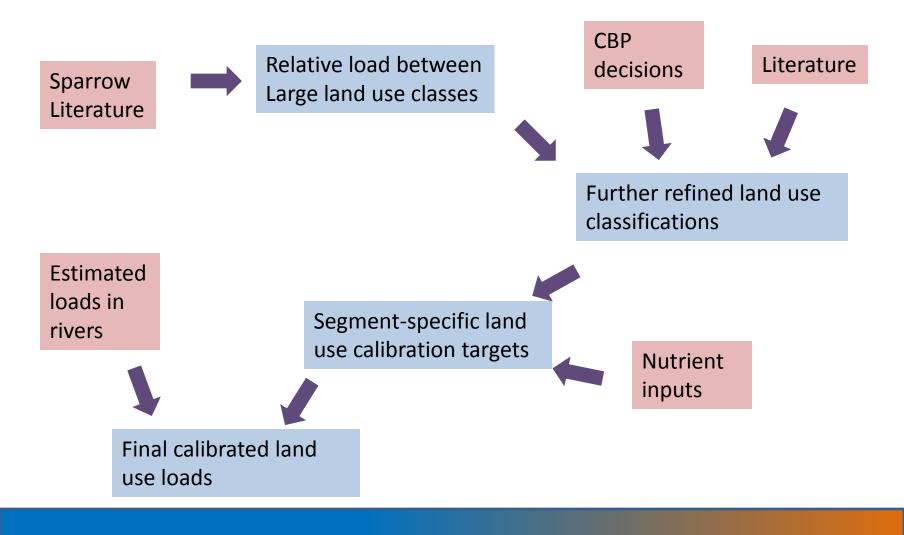
Literature reviews - TetraTech

TetraTech has already completed a literature review of urban land uses and will be conducting one on agricultural land uses. Several literature reviews already exist, which should be incorporated as well.

Peculiarities of Pervious Workshop - STAC

17

Land Use Load Decisions – Phase 6





Sensitivities to inputs

CBP Oversight: Modeling Workgroup

Lead: Lee Currey and Dave Montali

CBPO Contact: Guido Yactayo

Priorities:

Revise Modeling Structure: MWG

Description:

The major structural change to phase 6 is the incorporation of multiple model estimates for sensitivity to nutrient inputs. Rather than relying on a single model estimate of load response to changes in inputs of atmospheric deposition, fertilizer, and manure, the phase 6 model will use evidence from multiple sources, including HSPF and other mechanistic models, sparrow and other statistical methods, and literature.

Progress:

Draft documentation is available on the source will be described with relative merits weighed.

Next Steps:

Continue to bring new information to each modeling quarterly review and update the documentation

Expected Completion Date:

Fine-scale Processes

CBP Oversight: Land Use Workgroup and Modeling Workgroup

Lead: Jenny Tribo and Karl Berger CBPO Contact: Peter Claggett

Priorities:

Revisit watershed model calibration methods: MWG

Improve Spatial, temporal, and categorical representation of land uses: LUWG

Description:

Increasingly, research is showing that sources and transport mechanisms of nutrients and sediment have high variability at fine spatial scales. The scale of the watershed model segmentation is coarse relative to hillslope and small-order stream processes. Efforts are underway to describe fine-scale effect in ways that can be applied at the scale of the CBP partnership's watershed model.

Progress:

Progress is occurring along several parallel tracks. Implementation of the findings of these efforts in the Phase 6 watershed model is likely to improve the model, however not all areas of active research may be available in time for incorporation.

Small-stream delivery – Center for Watershed Protection

Streams contribute to the loading from the watershed as both a source and a sink. Generally at the size of a CBP segment, the stream network acts as a net sink. The CBP partnership has expressed interest in modifying the current method of attributing the entire delivered sediment load to land-based sources. **The CWP will make recommendations for**

considering both land and in-stream sources with the in-stream sink terms applying to both sources.

Small-Scale processes - Land Data Team

The CBP Land Data Team, led by Peter Claggett, are investigating methods to map and evaluate the nutrient and sediment effects of impervious surface connectivity, urban stream corridors, riparian forests, riverine wetlands, and urban tree canopy. Incorporating stream corridors (channel, banks, and floodplains) as sources and sinks for nutrients and sediments has potential for addressing the issue of impervious surface connectivity. Research conducted by Matt Baker (UMBC) and Don Weller (SERC) is under review to parameterize the nutrient effects of riparian forests. Researchers at West Virginia University, operating under a grant from USGS, are investigating options for mapping floodplains and parameterizing their sediment deposition potential. The US Forest Services' iTree Hydro program is being evaluated for parameterizing the hydrologic effects of urban tree canopy. If these factors can be adequately described, they may be utilized to differentiate loading effects between land uses within a segment, or from segment to segment.

Next Steps:

•••

Lag Time – Gopal Bhatt

CBP Oversight: Modeling Workgroup Lead: Lee Currey and Dave Montali

CBPO Contact: Gopal Bhatt and Gary Shenk

Priorities:

Revisit watershed model calibration methods: MWG

Description:

Groundwater lag times may be simulated for calibration through a simple Continuously Stirred Tank Reactor model. To parameterize this model, the lag time will have to be estimated from outside sources for all areas of the watershed. More sophisticated models may be generated through collaboration with academic partners. STAC has asked the CBP to include this capability on multiple occasions, notably:

Incorporating Lag-Times Into the Chesapeake Bay Program

Understanding "Lag Times" Affecting the Improvement of Water Quality in the

Chesapeake Bay

<u>Chesapeake Bay Watershed Model Phase Five Review</u>

Progress:

None to date

Next Steps:

Coding of groundwater module

Expected Completion Date:

Atmospheric Data

CBP Oversight: Modeling Workgroup Lead: Lee Currey and Dave Montali

CBPO Contact: Lewis Linker and Gopal Bhatt

Priorities:

Revisit watershed model calibration methods: MWG Shallow Water Simulation and Conowingo Refinement

Description:

The Phase 5 precipitation, meteorology, and atmospheric deposition data covered the period 1984-2005. In order to take advantage of the intensive shallow water estuarine data, new watershed stations, and recent Conowingo data with, the watershed simulation will need to be extended.

Progress:

Precipitation and meteorology

Gopal Bhatt has shown that the NLDAS-2 data set calibrates the WSM hydrology as well as the previous USGS XYZ data set. NLDAS-2 is preferred because of longer term availability. An automated download method has been created so that these data can be updated each year.

Atmospheric Deposition – Lewis Linker

The CBPO will look for a reanalysis of rainfall, NADP, CASTNET and other data sources. It is likely that this will be done externally.

Next Steps:

Expected Completion Date: Jan 1, 2015

Climate Change

CBP Oversight: Modeling Workgroup Lead: Lee Currey and Dave Montali

CBPO Contact: Lewis Linker, Climate Change Coordinator (to be hired)

Priorities:

Influence of climate Change on WQS and TMDL

Description:

The partnership has agreed to address climate change during the 2017 MPA. The motivation is expressed in the 2014 Bay Agreement, 2011 and 2008 STAC workshops, 2010 TMDL, and the 2009-2010 executive order and accompanying strategy. In order to effectively evaluate the influence of climate in the MPA, climate change must be included within the partnership's suite of models.

Progress:

The CBP will be hiring a climate change coordinator to head the climate change workgroup under STAR. Climate change is already being addressed in the modeling through several collaborative efforts already underway.

Several collaborative studies have been completed with more on the way.

Presentations:

Modeling Workgroup Sarah Ahmed et al 7/23/13

Modeling Workgroup Susan Julius 7/23/13

Modeling Workgroup Maria Herrmann 7/23/13

Modeling Workgroup Dano Wilusz 7/23/13

Modeling Workgroup Robin Dennis 7/23/13

Next Steps:

Expected Completion Date: Oct 1, 2015

Conowingo and other Reservoirs

CBP Oversight: Modeling Workgroup

Lead: Lee Currey and Dave Montali

CBPO Contact: Lewis Linker

Priorities:

Conowingo reservoir and greater representation of reservoirs

Description:

There are three primary objectives:

Develop and assess options for addressing increased amounts of sediment and nutrients from the Lower Susquehanna Reservoirs

Better characterize trapping of sediment in reservoirs

Develop an approach to simulate effect of impoundments in the Bay watershed.

Progress:

The Conowingo reservoir is being studied through the Lower Susquehanna River Watershed Assessment, led by the Corps of Engineers and MDE.

Next Steps:

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Expected Completion Date:

Summary

- Document / Web site being prepared to keep the Partnership up-to-date on model development
- Hierarchical structure allows
 - At-a-glance overview
 - Drill down to detailed information
- Continual updates
- Your name is on the page
 - You own the content.

Phase 6

