Briefing to the WQGIT: 2016 Phase 6 Modeling Review Period

Lee Currey and Dave Montali

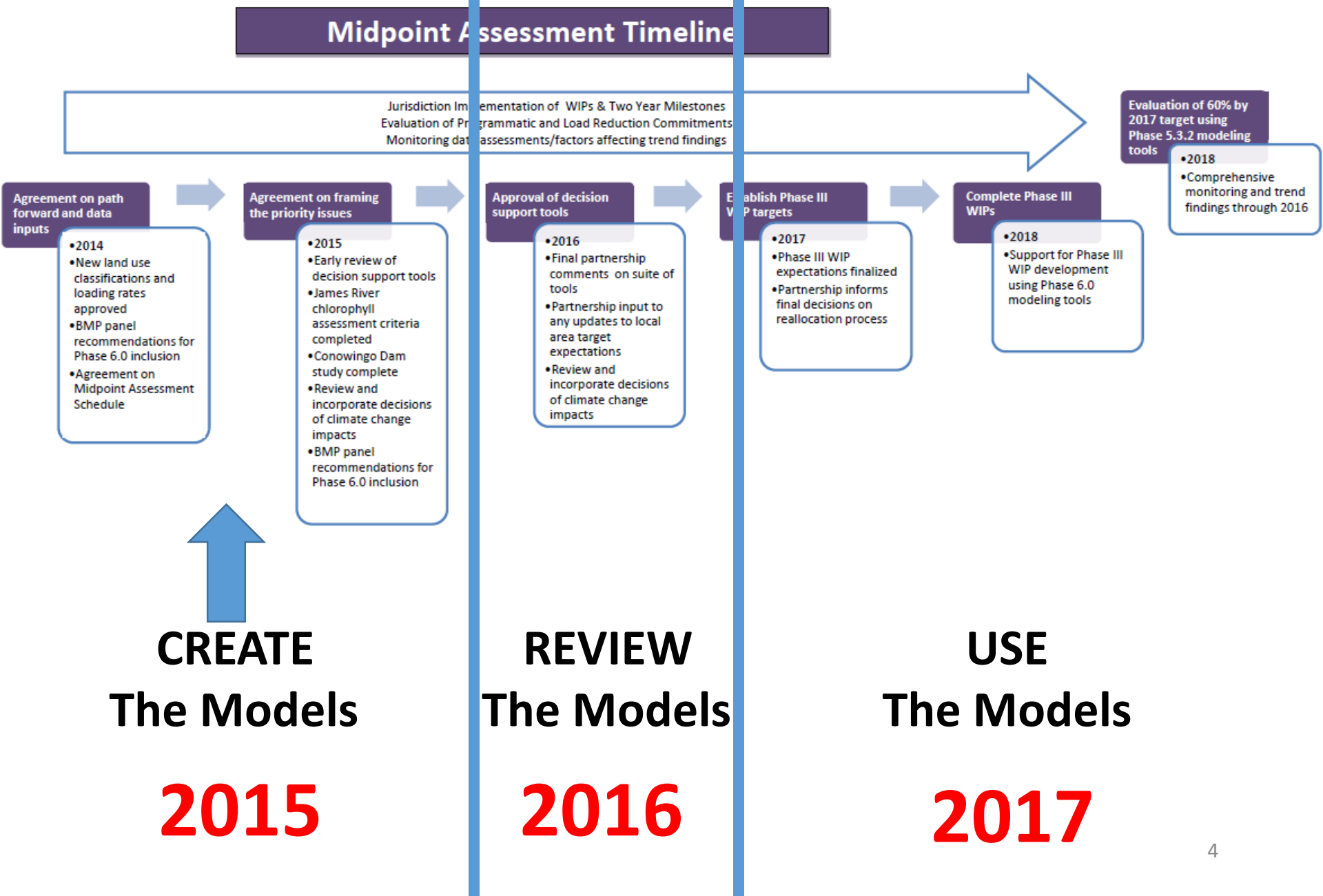
WQGIT F2F
December 14 -15, 2015

Overview

- Review of PSC Charge
- Background on Phase 6
- Elements of the Review Period
- 2016 Quarterly Schedule and Expectations

Acknowledgements

- Modeling Team
- Modeling Workgroup
- WQGIT workgroups


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

Review of PSC Charge

Summary of PSC high level Midpoint Assessment priorities

- **Incorporate better model input data from local partners, particularly for current, historic and future land uses and their associated pollution loading rates**
- **Revisit model calibration methods and assumptions so modeling results better align with monitoring data**
- **Includes accounting for decreased trapping capacity behind dams, though this is not just a modeling issue**
- **Make CBP models more transparent, easier to understand, and better decision-support tools**
- **Ultimately, enhance decision support and assessment tools to enable successful engagement of local partners**

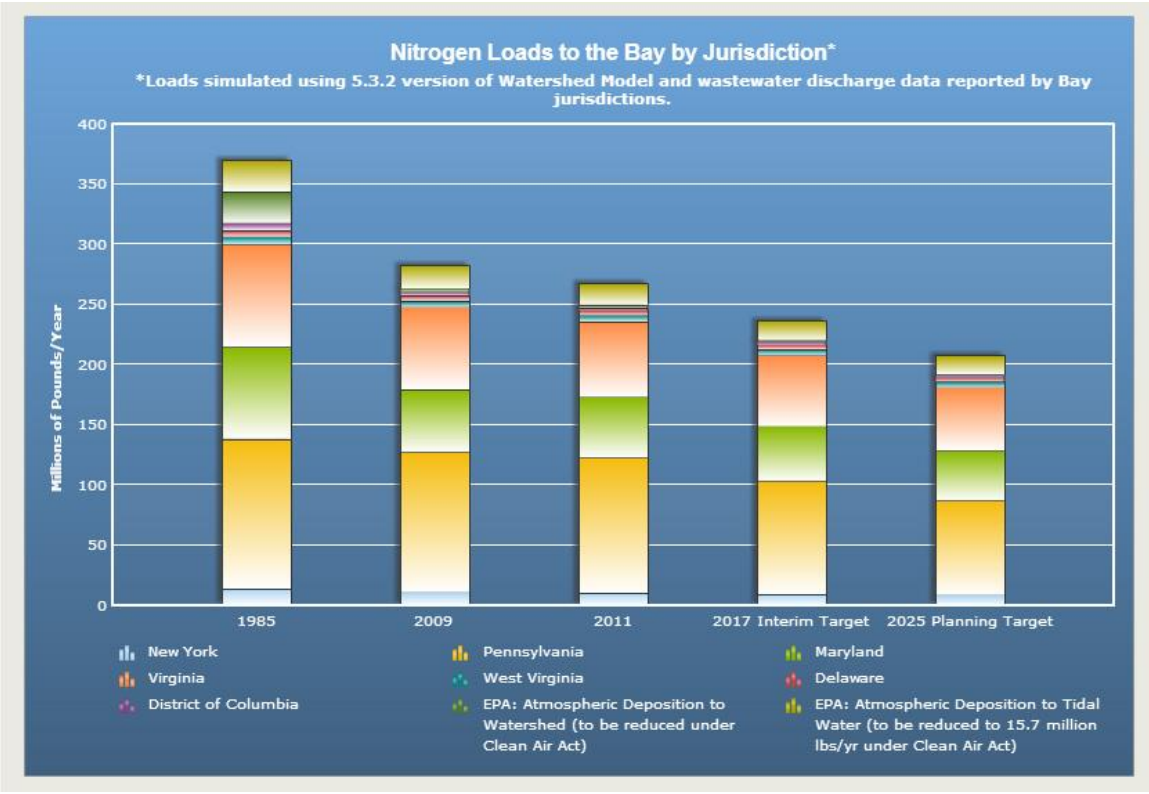
Bottom Line for Meeting 2025 Goal

- **Partnership needs to be able to engage local partners in order to get practices on the ground**
- **The 2010 suite of modeling tools was pushing partners away , but Phase 6 changes to model inputs, assumptions, and structure will allow us to better work with key partners.**
- **A healthy step toward increased adaptive management.**

Background on Phase 6

- Built upon historic modeling within the Bay Partnership and incorporates new science as needed through a multiple model approach.
- Many of the fundamental modeling processes have remained the same but have been improved with better, and more recent, input information. In some cases the modeling processes have changed, such as the simulation of phosphorus transport or have been simplified to make them more transparent such as the simulation of nitrogen.
- The improvements are to provide increased confidence in Bay restoration decision making. This is accomplished through extending the models in time to include the most recent monitoring information, increasing the transparency of the modeling tools, improving the resolution of land use and watershed transport processes, and by leveraging the strength of multiple models within the Bay watershed.

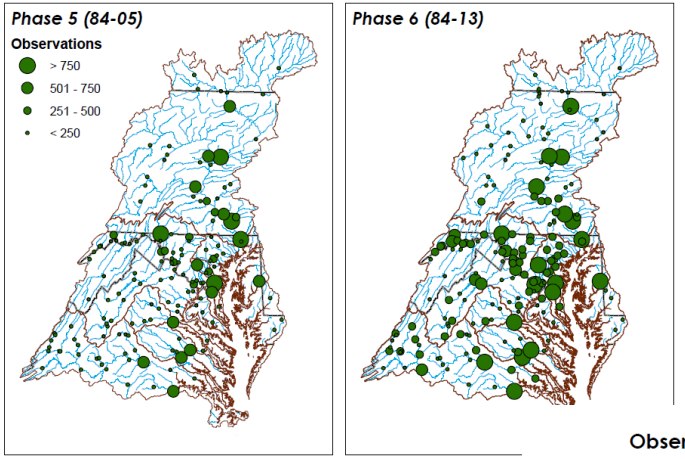
History of Bay Partnership Watershed Model Development



Year	1983	1990	1994	1997	2003	2010	2011	2017
Phase	0	1	2	4.1	4.3	5.3	5.3.2	6
Segments	30	63	63	89	94	1956	2365	1976
Simulation Years	2	4	4	8	8	22	22	~30
land uses	5	7	9	9	9	24	30	~40
Purpose	Split NPS/PS	Refine NPS	1992 "40%" agreement	Confirmation of 40% goals	Re-allocation in 2003	TMDL	Phase 2 WIP development	Phase 3 WIP development

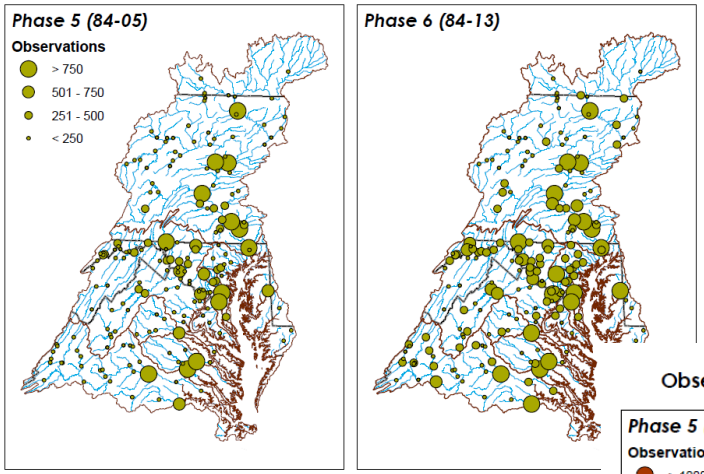
Extending the Watershed Model Time Series

Observed Total Nitrogen - Number of Observations

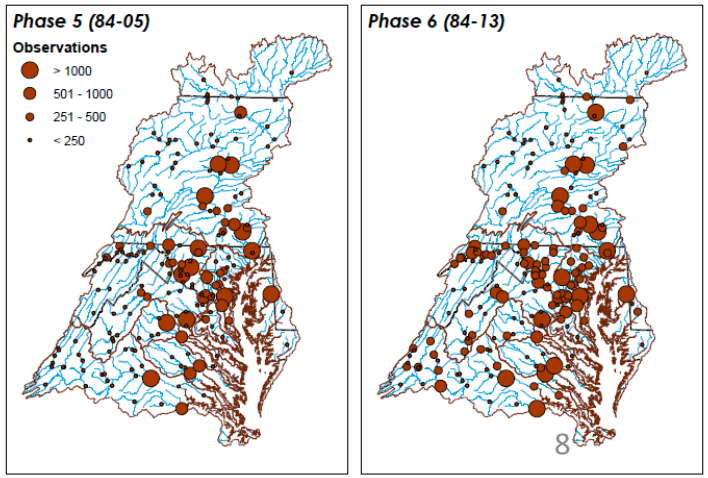


Parameter	Number of Records in Phase 5.3.2 (1984 to 2005)	Number of Records in Phase 6 (1984 to 2013)	% Change
TOTN	30,197	54,926	82%
TOTP	48,946	62,505	28%
TSSX	68,893	70,799	3%
FLOW	2,141,306	3,415,525	60%

Observed Total Phosphorus - Number of Observations



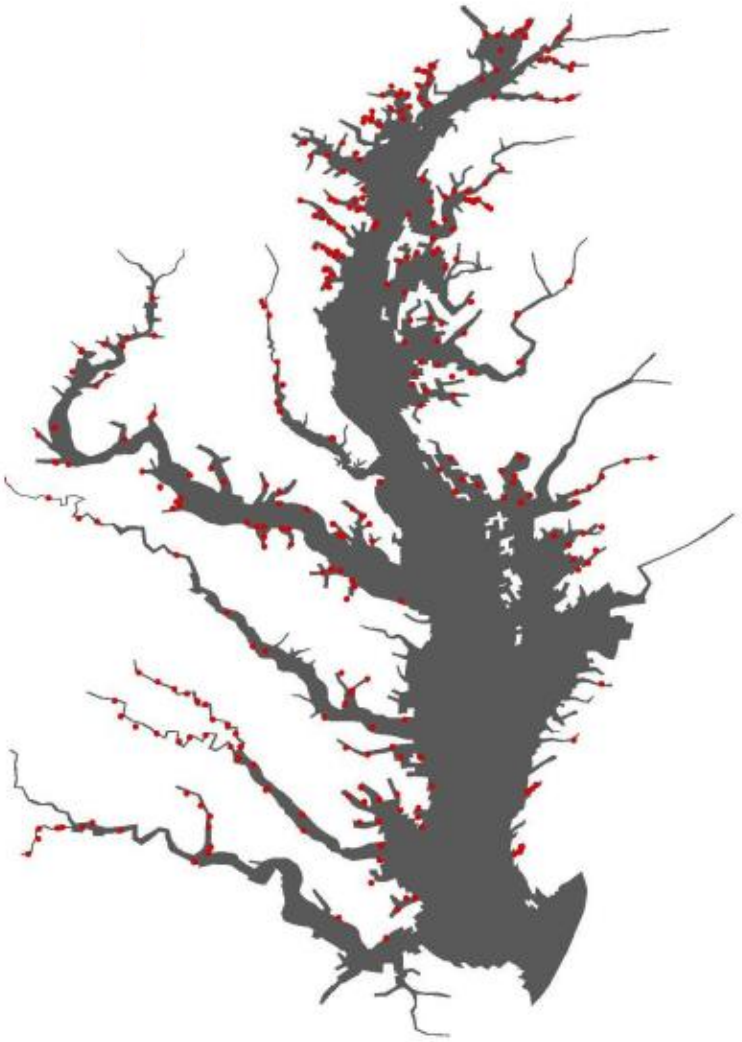
Observed Total Suspended Sediment - Number of Observations



Parameter	Number of Calibrated River Segments in Phase 5.3.2	Number of Calibrated River Segments in Phase 6	% Change
TOTN	152	181	19%
TOTP	191	196	3%
TSSX	182	187	3%
FLOW	287	287	

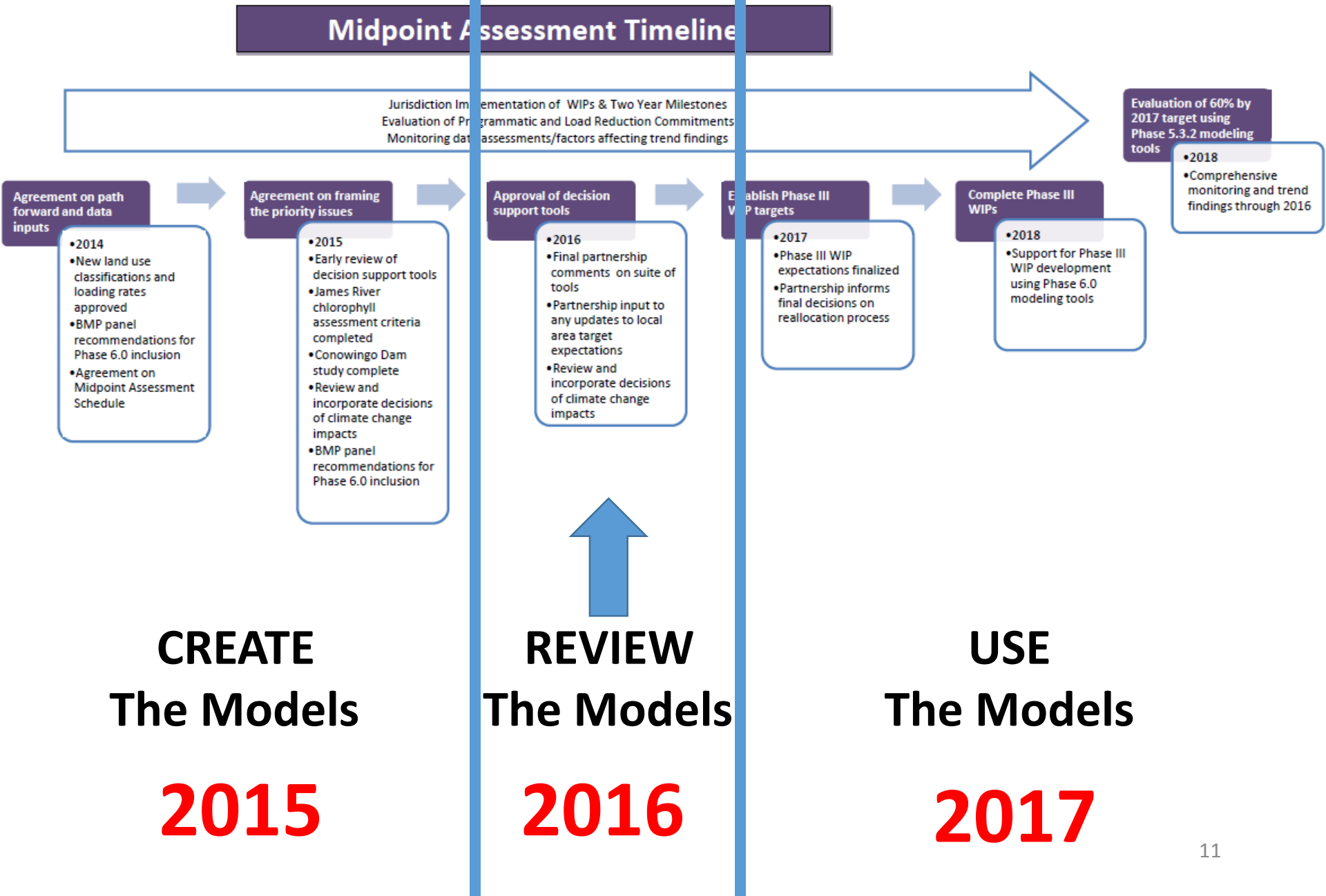
Extending the WQSTM

- Extending the time series allows the shallow water data to be used
- Adds about 84,000 observations
- Performance of model evaluated for 1991 - 2000 and now also 2002 - 2011



More Details on Phase 6 Later

- In January 2016 the Modeling WG would like to provide the WQGIT a more detailed overview of Phase 6 to kick off the review period.
  - Lines of evidence that drove changes and key changes
  - Where they occurred: Land to river, river to Bay, within Bay
  - Decision points


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

Purpose and Importance of the 2016 Phase 6 Review Period

- The review period provides the partnership with the opportunity to review the inputs, outputs, and processes of the Phase 6 Model; to run key scenarios; and to make further refinements as needed.
- The Phase 6 Watershed Model will be calibrated multiple times during 2016, so the partnership will be able to see incremental changes as new inputs and processes are added.
- The review period allows the partnership to set the priorities for changes to be incorporated into the final version of the Phase 6 Watershed Model.

Model Versioning Timeline

- January 1, 2016: CBPO Modeling Team, on behalf of the Modeling Workgroup and WQGIT, releases Phase 6 Beta 1
- April-May 2016: Probable release of Phase 6 Beta 2 if changes warrant
- September 30, 2016: Deadline for all partnership input. Data and recommendations can be submitted at any time prior to this date.
- October 2016: Phase 6 Beta 3 if changes warrant
- January 1, 2017: CBPO Modeling Team, on behalf of the Modeling Workgroup and WQGIT, releases Phase 6.0

Beta Version to Final Phase 6

- The similarity of the January 2016 model compared to the final model applied in the Phase III WIP is going to be largely dependent upon the following items
  - Comments by WQGIT
  - The differences in input information the WQGIT provided to the Modeling Workgroup between September 2015 and September 2016
  - The STAC reviews and workshop input
  - The outcomes of expert panels and products of other WGQIT workgroups

Key Changes to be aware of through 2016

- Conowingo – both watershed and Water Quality Sediment Transport Model (Spring)
- Land use
- Outcome of nutrient management expert panel (Spring)
- BMP verification
- Loading rates for land uses

More On Modeling: Conowingo

- In September, Exelon proposed to develop a more sophisticated model of the Conowingo Pond that could be integrated into the Bay Partnerships Midpoint Assessment modeling framework.
- The approach was presented at the November modeling workgroup quarterly review and Modeling Workgroup agreed on the following parallel approach as a path forward.
  - 1) The Phase 6 Model will move forward under the current plan, absent the Exelon model, and adhere to all agreed delivery milestones and
  - 2) The Exelon model proposed embraces the multiple model concept, could add technical value and skill, but for consideration it would need to align with the Phase 6 schedule and be included in the full Phase 6 peer review process.
- The January STAC workshop will be a driver to determine the extent at which the Exelon model, as well as other information, will be used to inform the Bay models.
- A key element is ensuring that any contribution from Exelon undergoes the same review and provides the same transparency as Phase 6. All parties agreed to the need for transparency and complete review and approval by the CBP partnership, the Water Quality Goal Implementation Team (WQGIT)and the public. Exelon's Conowingo modeling work must be completed by May 2016.
- In addition, and as part of the Exelon contract, Maryland requested a third party peer review of the the Exelon developed model and its integration into Phase 6

More on Modeling: Phosphorus

- Theory has changed
  - Shallow subsurface is important transport mechanism
  - Soil test is the driving factor
- Amount of information has changed
  - Phosphorus symposium
  - USGS report
  - Soil test data available
  - UMCES delivering new coastal plain monitoring data.
- Strategies
  - Application rate changes only affect long term loads
  - Other BMPs only affect short term loads

What will be Available for Review in the Phase 6 Beta Version?

- Inputs, such as atmospheric deposition, land use, animal numbers, etc.
- Outputs – all outputs of the phase 6 Beta including:
  - Scenario builder outputs such as Manure, fertilizer, Land use, BMP implementation and effectiveness, etc.
  - Watershed model outputs such as Loads by land use, Loads by basin, and Multiple key scenarios
  - Water Quality Sediment Transport Model (WQSTM) output – stoplight charts
- Documentation – some examples of topics covered in the documentation:
  - Scenario Builder documentation
    - Manure and fertilizer calculation and distribution
    - BMP processing
    - Land use acres
  - Watershed Model documentation
    - Target loads
    - Calibration methods
    - Lag time implementation
  - Water Quality Sediment Transport Model documentation

Prioritizing Changes - Who

- Partnership Reviewers
  - WQGIT and Modeling Workgroup
    - All substantive comments by the above groups will be addressed by the CBPO modeling team.
    - All recommendations made by these groups will be implemented subject to feasibility constraints.
  - STAC
    - All comments will be addressed by CBPO modeling team through the Modeling Workgroup
    - The implementation of any recommendations will be subject to review by the WQGIT or Modeling Workgroup as appropriate.
  - Other reviews by the partnership or external groups are welcome and will be responded to as time allows. Implementation of these recommendations will be at the discretion of the WQGIT and Modeling Workgroup.

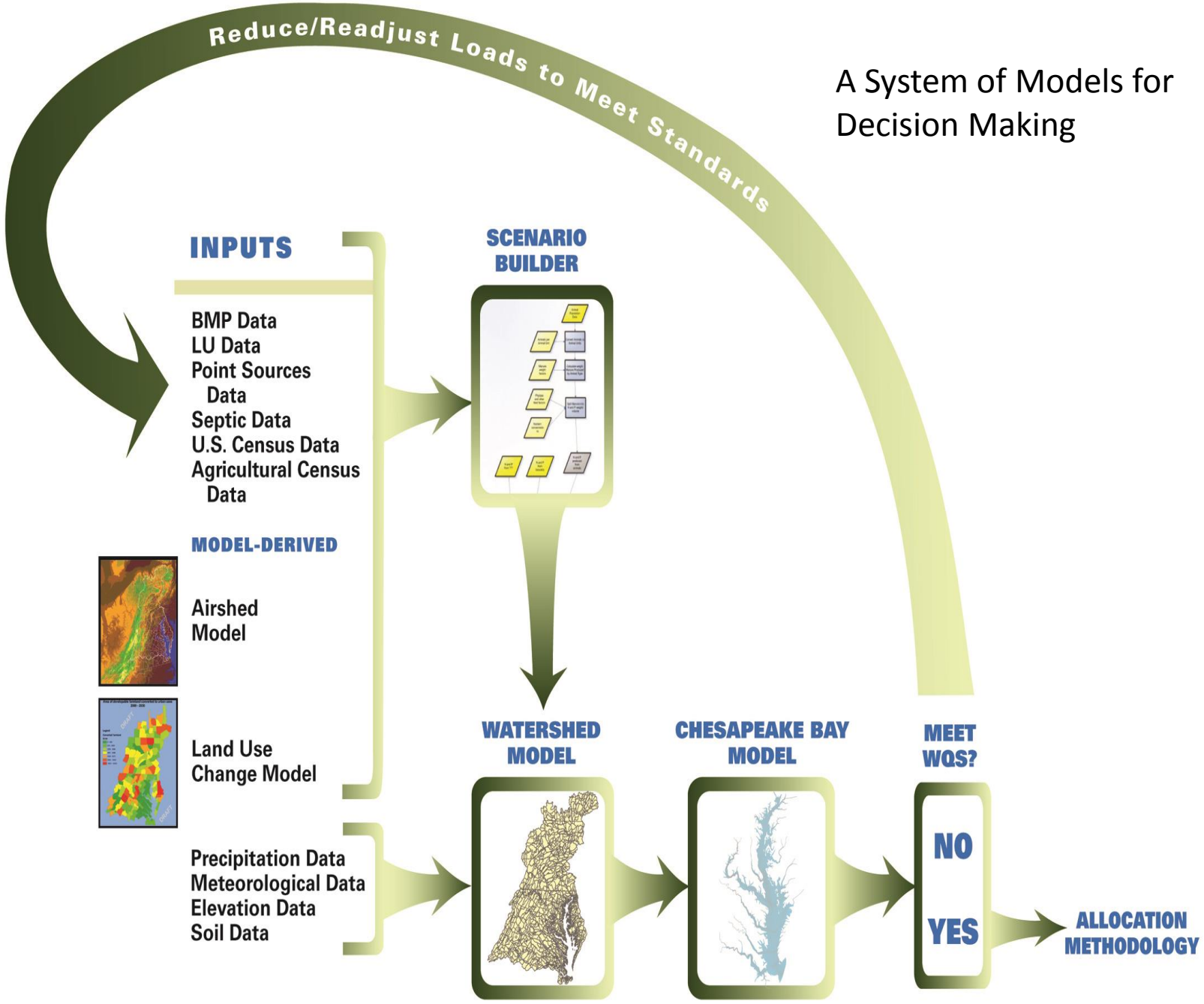
Prioritizing Changes - How

- Issues identified as “Fatal Flaws” by the WQGIT or the Modeling Workgroup will be the top priority. Other recommendations will be judged by their feasibility and the following three factors:
  - Complexity – Any change that is a simple update to a value in a table (BMP efficiency, land use load ratio, etc.) can be implemented in a few minutes and will not be subject to this constraint. A complex change to BMP reporting or the way that fertilizer and manure are calculated would take more time to implement.
  - Timing – a recommendation submitted in April, 2016 has a greater chance of being implemented than one submitted on September, 2016, all else being equal.
  - Competing priorities – Just about any change can be accommodated, but the partnership may have to choose between multiple priorities given the available time.

Communication Framework Phase 6 Review

- The partnership can access data, documentation, and outputs through the Modeling Workgroup's webpage. Links will be sent to the Modeling Workgroup and WQGIT members and interested parties when the information is available.
- Results will be presented at the Modeling Workgroup and WQGIT meetings. For efficiency, the modeling WG suggests scheduling WQGIT F2F 2-weeks following modeling Quarterly review.
- The modeling team will work directly with STAC during the reviews.
- Partnership groups can submit feedback to the modeling team through the WQGIT or Modeling Workgroup.
- Documentation of feedback, prioritization and status will be maintained by the modeling coordinator.

A System of Models for Decision Making



A Cautionary Note on Comparing Versions of Models During the Review Period

- In comparing the Phase 6 version of the model to previous versions of the modeling tools, history has shown that a common question is to understand the level of implementation effort required to meet water quality goals. The Bay models are a suite of models and ultimately must be applied as a complete system to understand how model revisions impact on implementation levels.
- Beta versions must not be used to inform final Bay Restoration policy decisions. They can provide insights into expected changes but only the final version can be used to inform official policy.

Q1: December 2015 – March 2016

- Release of Beta 1 Version (Jan 2016)
- Very preliminary findings on the Bay and watershed effects from climate change
- STAC Workshop on Conowingo modeling approach with Phase 6 WM and WQSTM (Jan 13-14)
- STAC Workshop on approach to climate change in Phase 6 WM (March)
- STAC Peer Review of Phase 6 Watershed Model begins (Feb)
- STAC peer review of proposed James River chlorophyll-a criteria assessment procedures (Jan - March)

Q2: April 2016 – July 2016

- Phase 6 Beta 2 model calibration w/ data updates (April Modeling Quarterly)
- Initial findings from key Phase 6 model scenarios – No Action (2010), All Forest, 1985 Progress, 2009 Progress, 2014 Progress, E3, and Phase II WIPs (April Modeling Quarterly)
- Maryland led peer review of Conowingo modeling (May)
- STAC Workshop on model uncertainty (Spring)
  - Possible uncertainty analysis following STAC Workshop
- STAC peer review of WQSTM (June)

Q2: April 2016 – July 2016

- Model analysis of James chlorophyll-a (Summer)
- Updated assessment of Conowingo (July)
- Phase 6 Model calibration w/ data updates (July Modeling Quarterly)
- Final decisions on loading rates, e.g. tree canopy (April)
- Decisions on BMP efficiencies, onsite system attenuation
- Incremental landuse updates

Q3: August 2016 – November 2016

- Phase 6 Beta 3 model calibration w/ data updates (October Modeling Quarterly)
- STAC peer review of climate change modeling approach (Aug)
- Final high resolution land use data (Sept)
- Approval of updates to land uses for Phase 6 (Sept)
- Deadline for all final data inputs to Phase 6 modeling tools for final calibration (Sept)

Q4+: December 2016 – March 2017

- Final calibration of Phase 6 modeling tools (January Modeling Quarterly)
- Phase 6 Watershed Model final (January 1, 2017)
- Preliminary/Limited Phase 6 linked Watershed and Estuarine Model scenarios presented (Jan-Feb 2017)
- All Phase 6 linked Watershed and Estuarine Model runs complete (March 2017)

Q4+: December 2016 – March 2017

- WQGIT decision on climate change assessment findings and implications (Jan - Feb 2017)
- WQGIT decision on final assessment of Conowingo and implications (Jan – Feb 2017)
- MB & PSC decision on climate change assessment findings and implications (March 2017)
- MB & PSC decision on final assessment of Conowingo and implications (March 2017)

More on Modeling: Climate Change

- Preliminary climate change scoping scenarios have already been undertaken by the Modeling Team and presented to the larger Workgroup.
- Guidance will again be provided by STAC as to how to proceed in the choice and implementation of climate projections for the Chesapeake Bay and its watershed.
- Climate integration into Phase 6 will be vetted by the Modeling Workgroup and then provided to the WQGIT, MB, and PSC for approval.

Thank You!

Questions and Discussion