Conowingo Dam Update

Presented to the WQGIT

D. Lee Currey
Co-Chair CBP Modeling Workgroup
Acting Director, Water Management Administration
Maryland Department of the Environment

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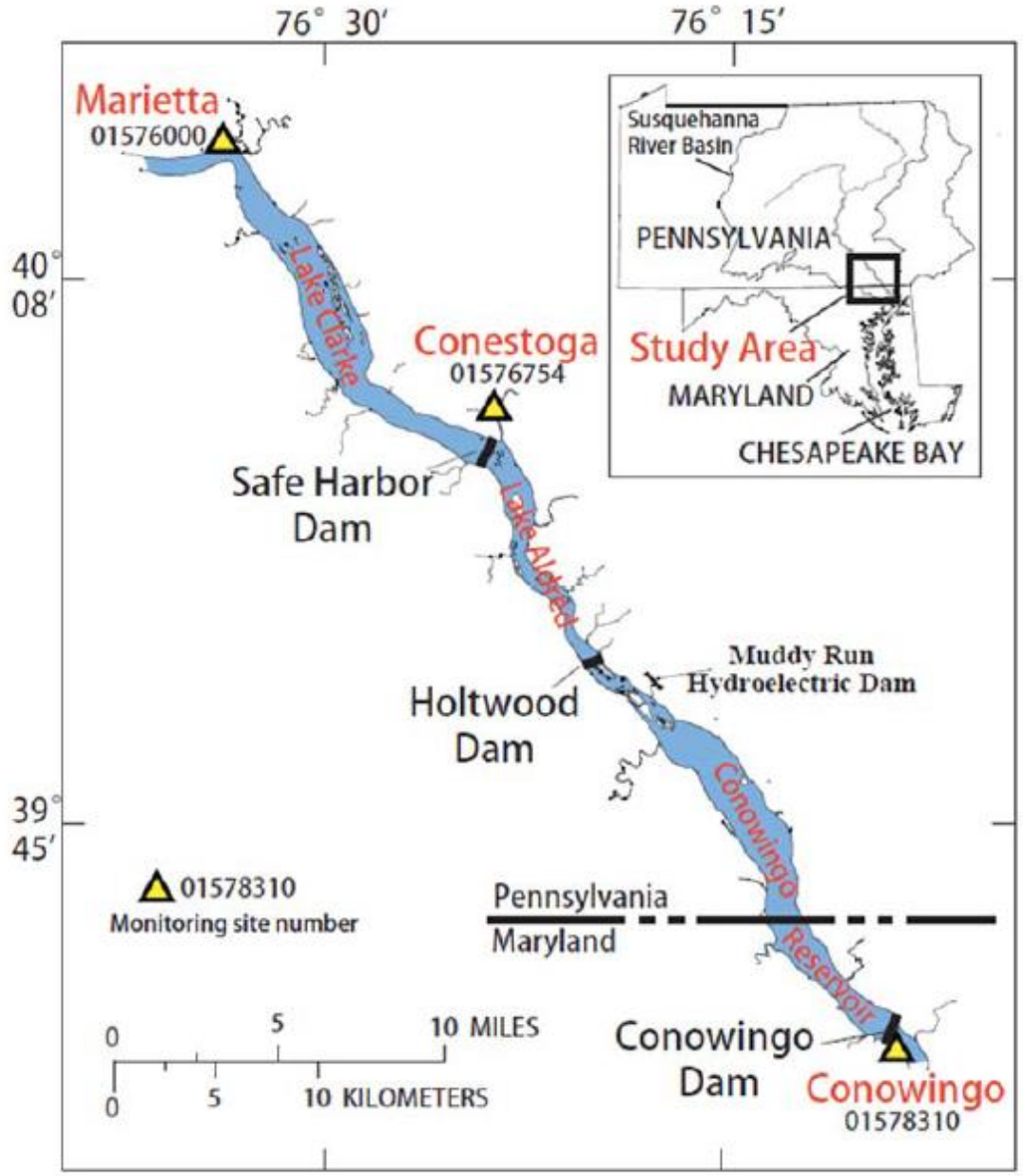
Lower Susquehanna River Reservoirs

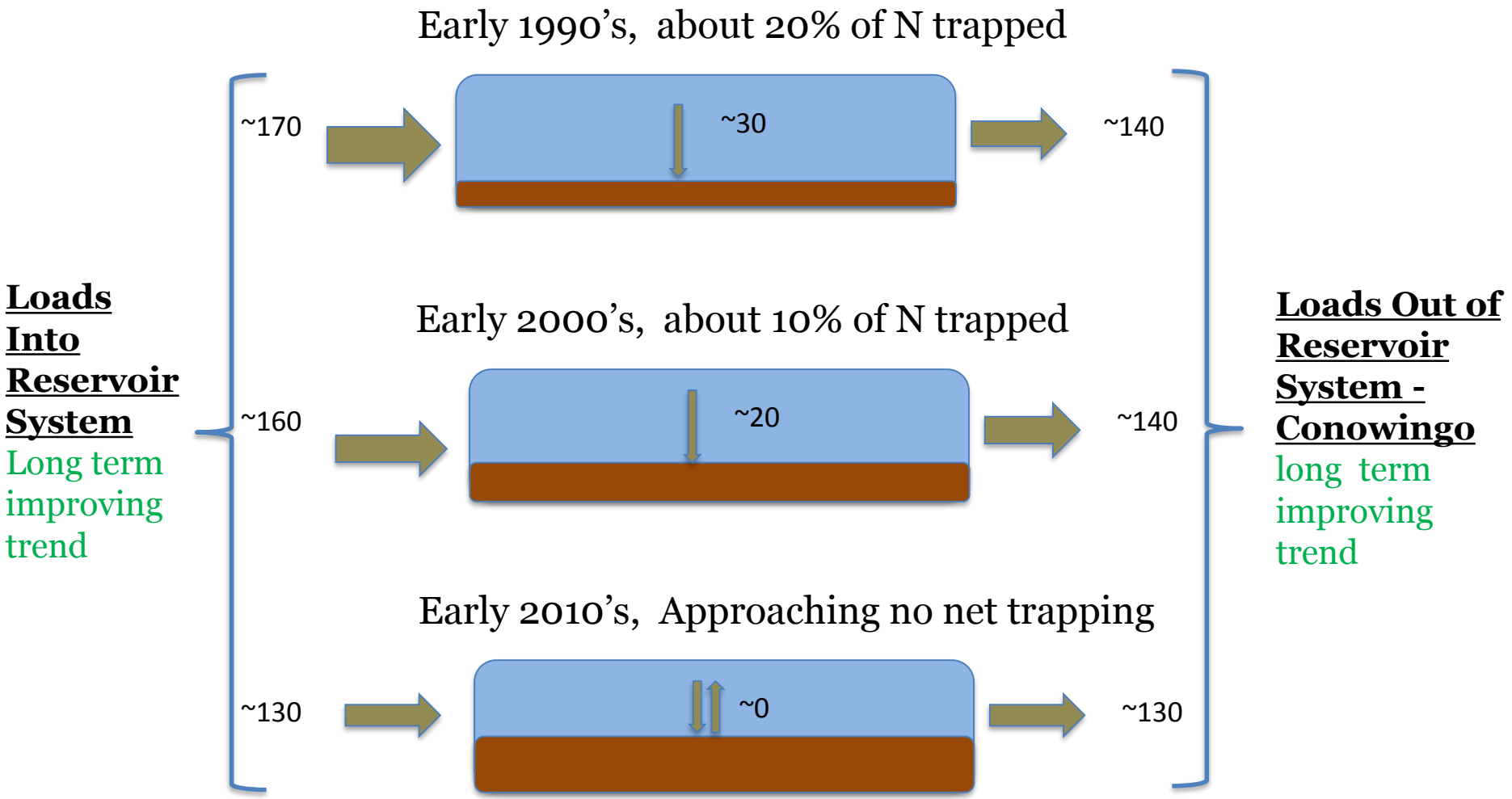


Sources: Langland, USGS, Bay Journal, Lower Susquehanna River Keeper

Significant New Monitoring And Research Since 2011 Indicate <u>Conditions have Changed</u>

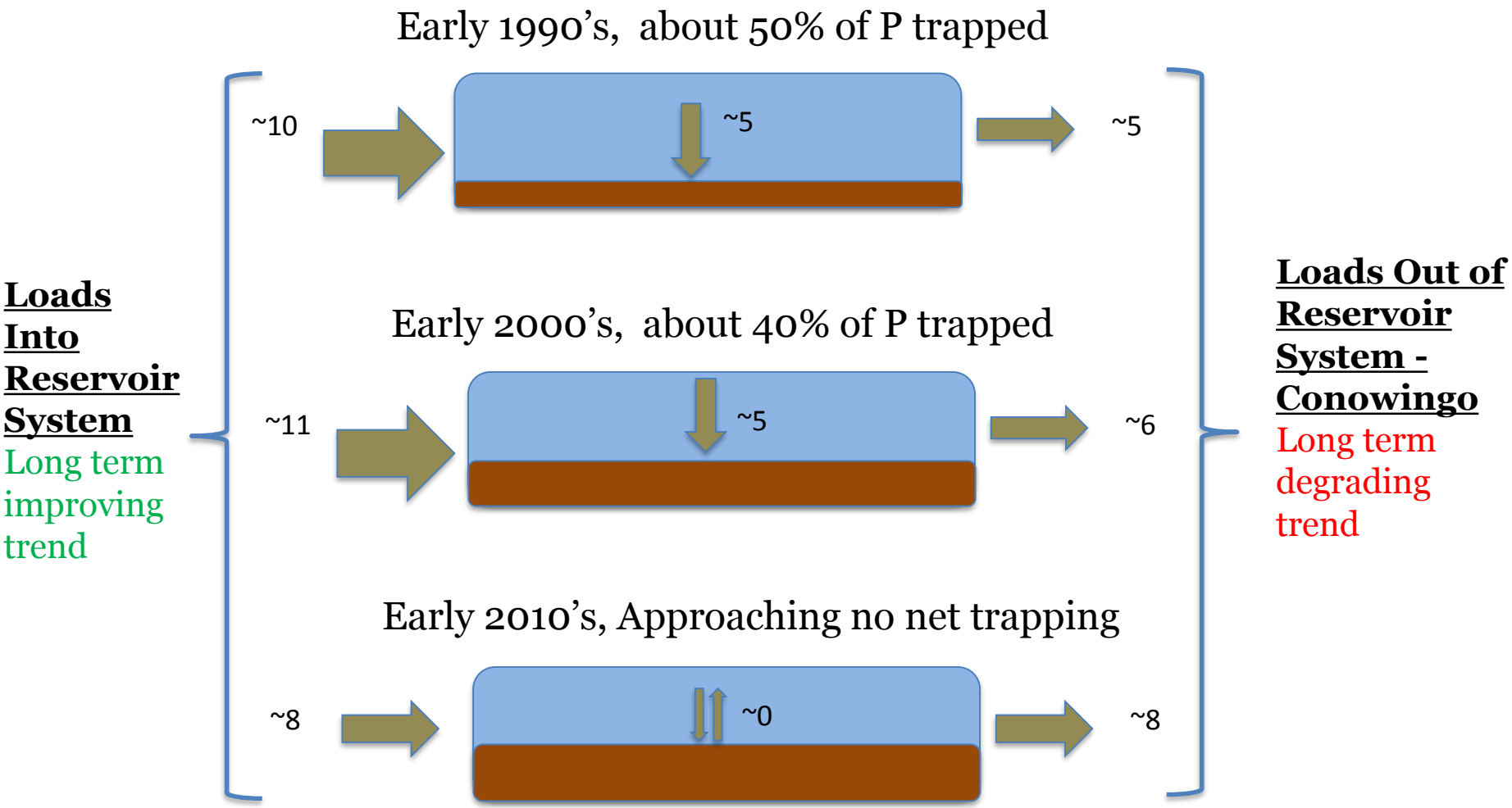
- U.S. Geological Survey (USGS) (2012, 2014, 2015)
- U.S. Army Corps of Engineers (2015)
- Johns Hopkins University (2013, 2015, 2016)
- CBP Scientific and Technical Advisory Committee (2014, 2016)
- Enhanced Monitoring and Modeling funded by Exelon and conducted by Gomez and Sullivan, University of Maryland and USGS (2014-2016)

Nitrogen Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s



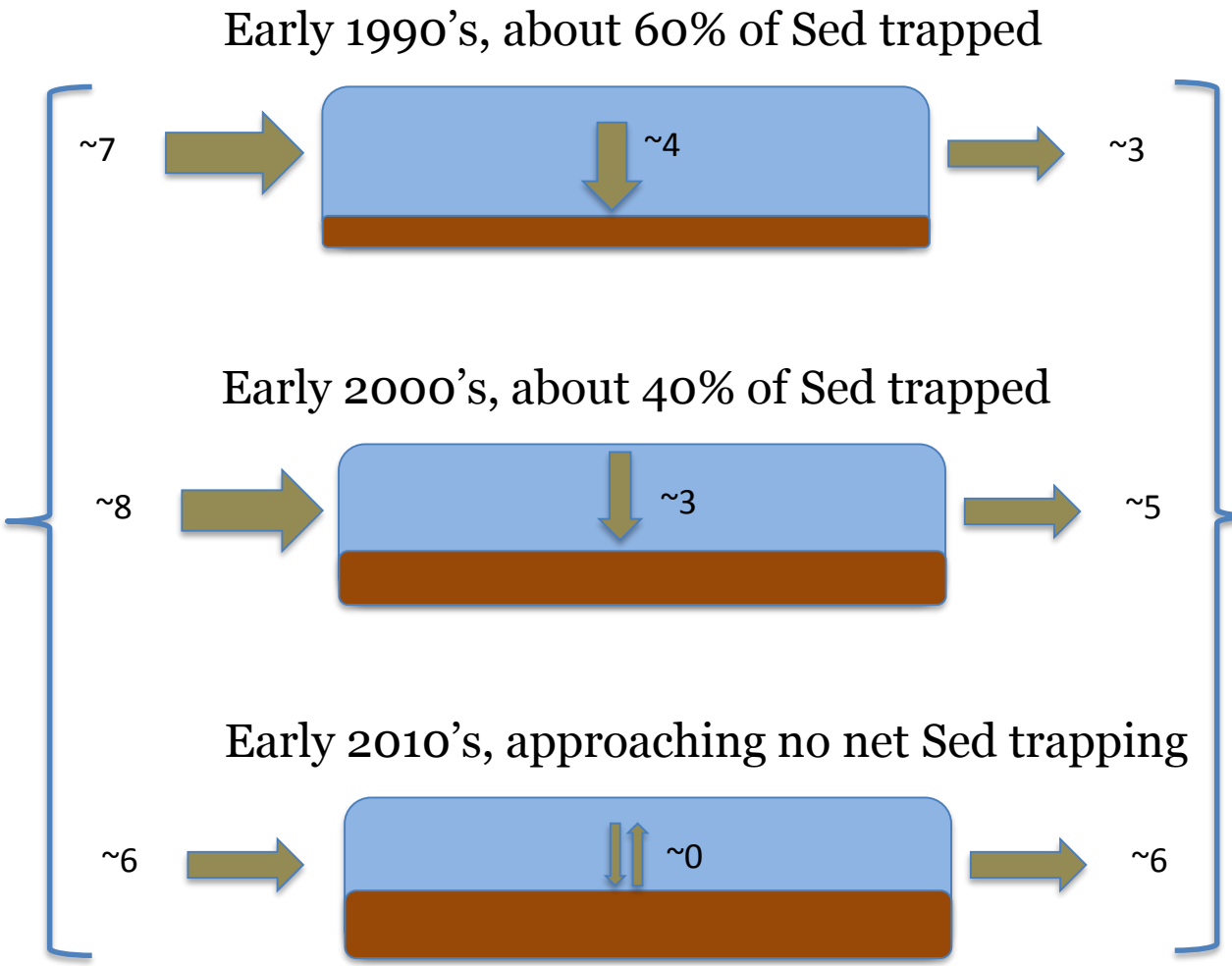
Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year using estimates for 1992, 2002, and 2012

Phosphorus Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s



Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year using estimates for 1992, 2002, and 2012

Sediment Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s



Loads Into Reservoir System
Long term improving trend

Loads Out of Reservoir System - Conowingo
Long term degrading trend

Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of billion lbs/year using estimates for 1992, 2002, and 2012

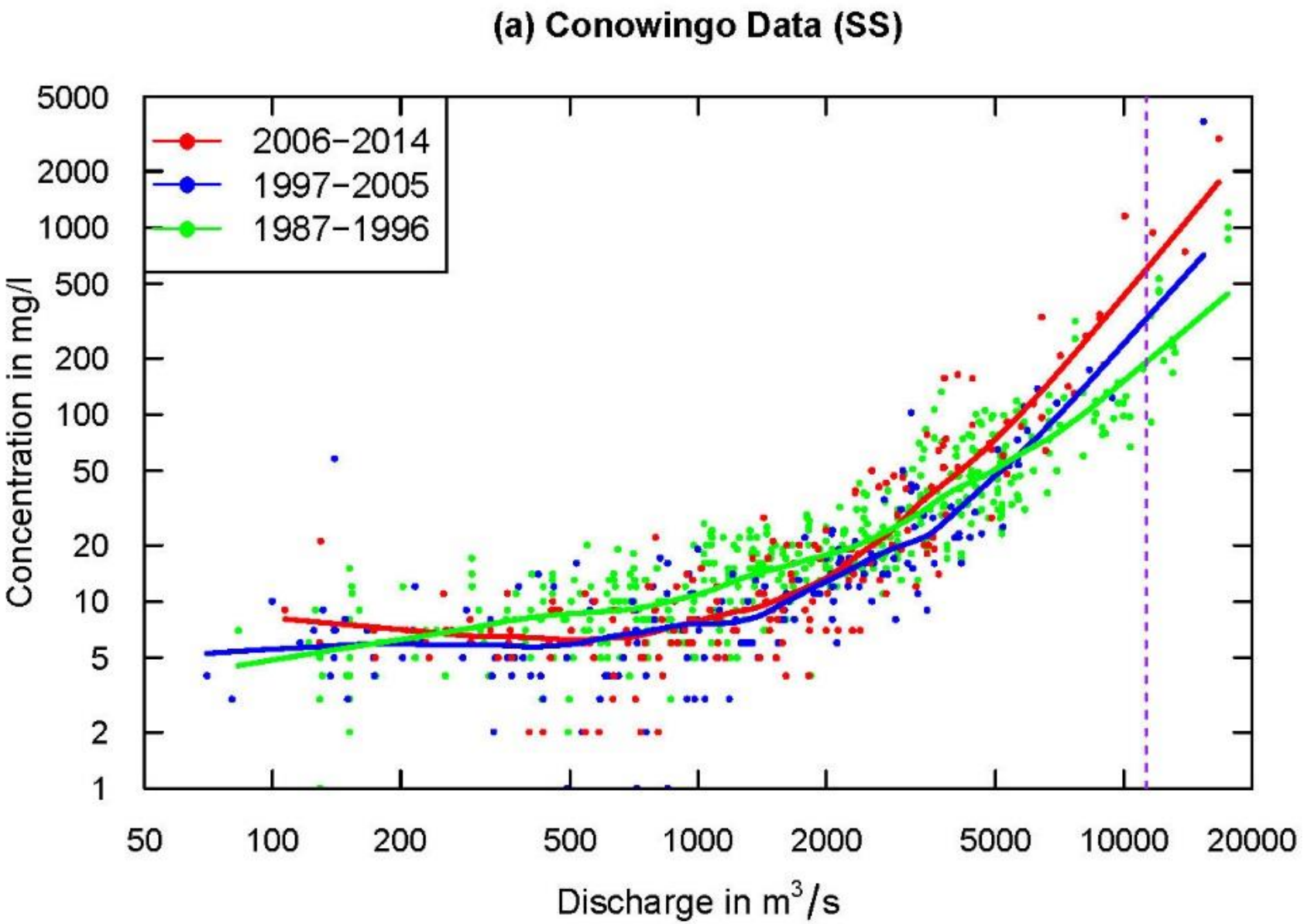
Questions

- What is the current state of the Conowingo Pool?
- How does the scour and deposition change with time?
- How does the Output/Input ratio change with nutrient reductions?
- Are scoured organics less bio-available?

Multiple models and lines of evidence

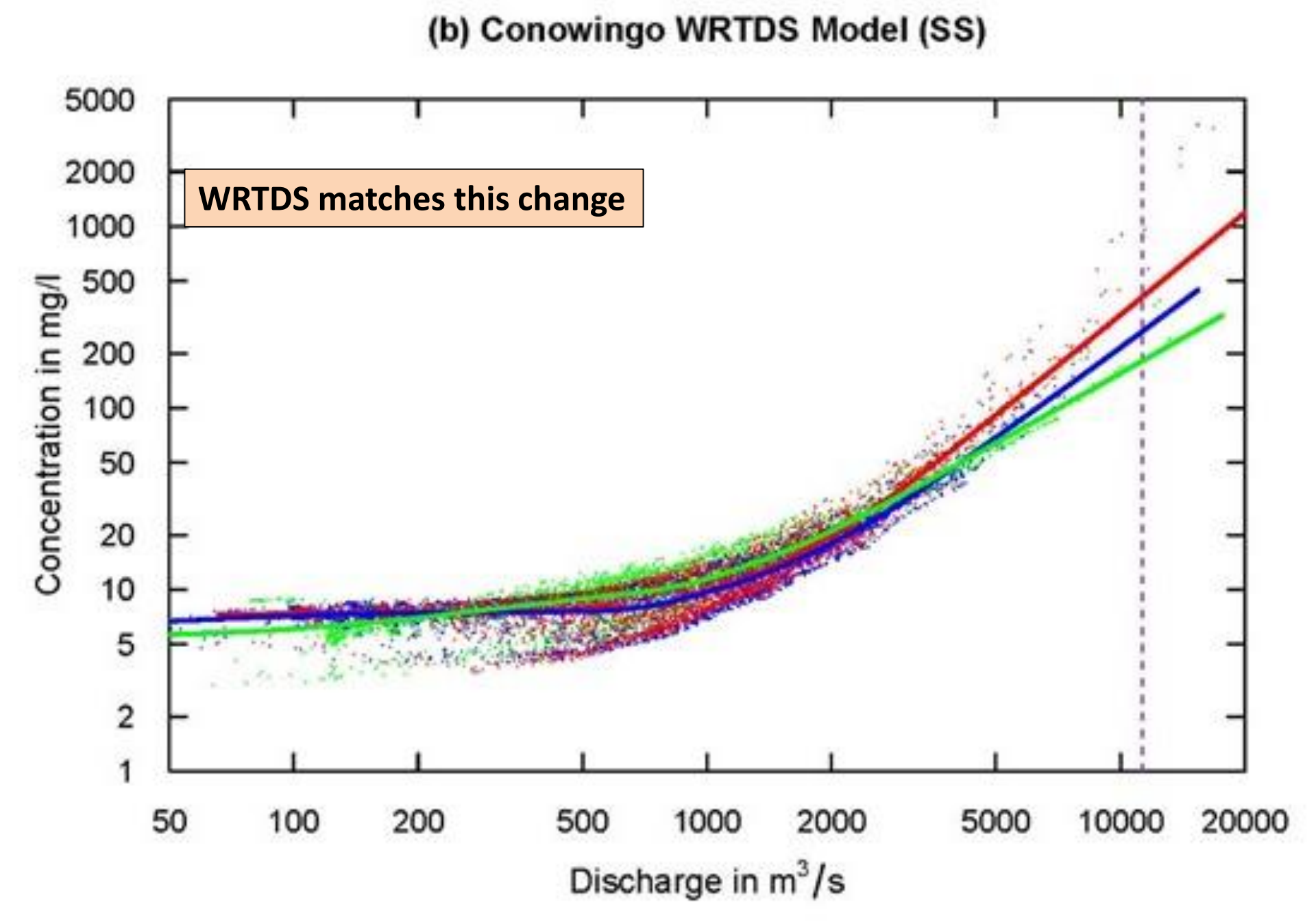
- Direct Use
  - HDR / Gomez & Sullivan / Exelon Model
  - WRTDS Statistical Analysis
- Supporting Evidence
  - Langland studies
  - LSRWA
  - Observations
  - STAC publications

Analysis by Qian Zhang, UMCES/CBPO

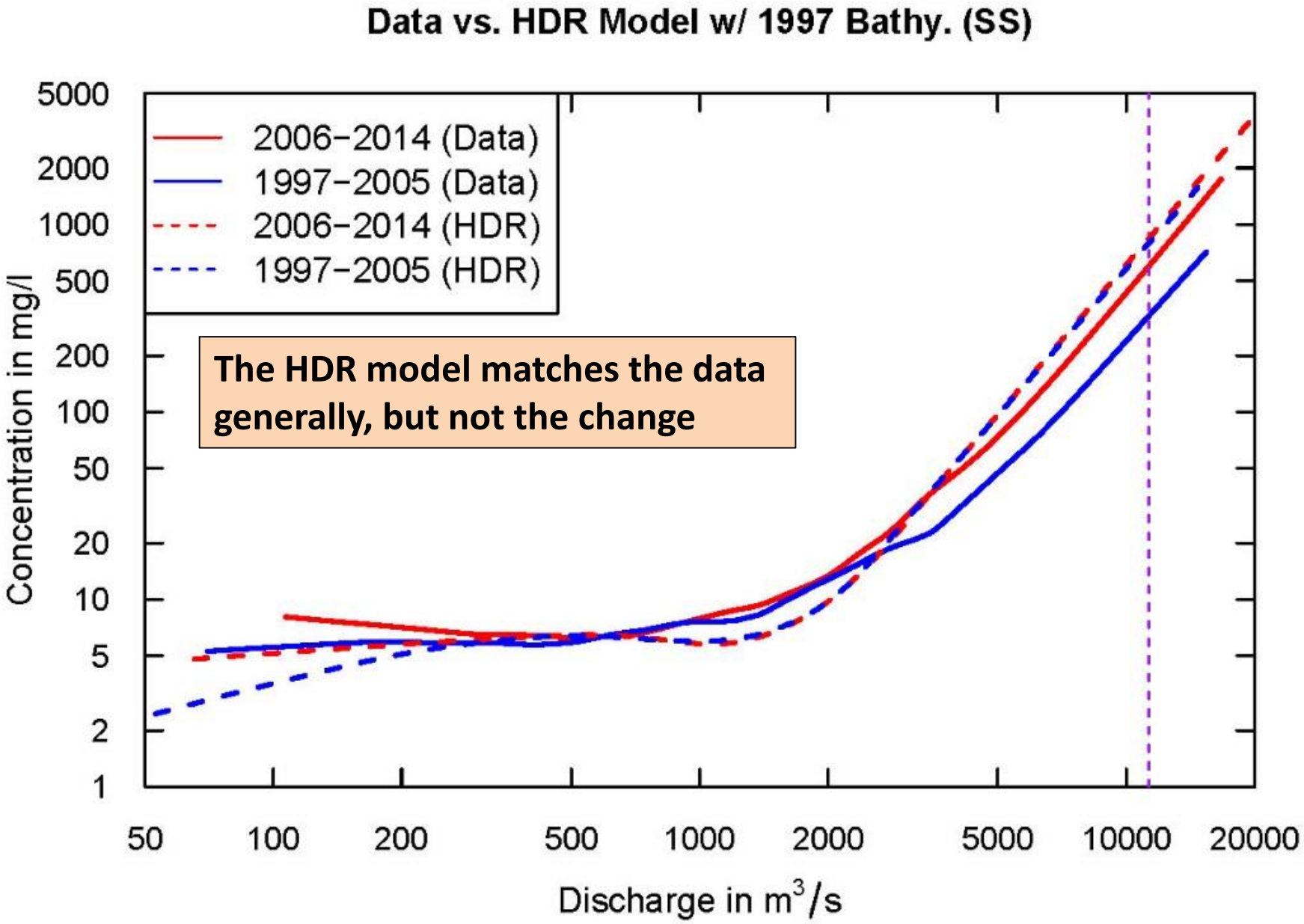


The high flow concentrations have been increasing over time

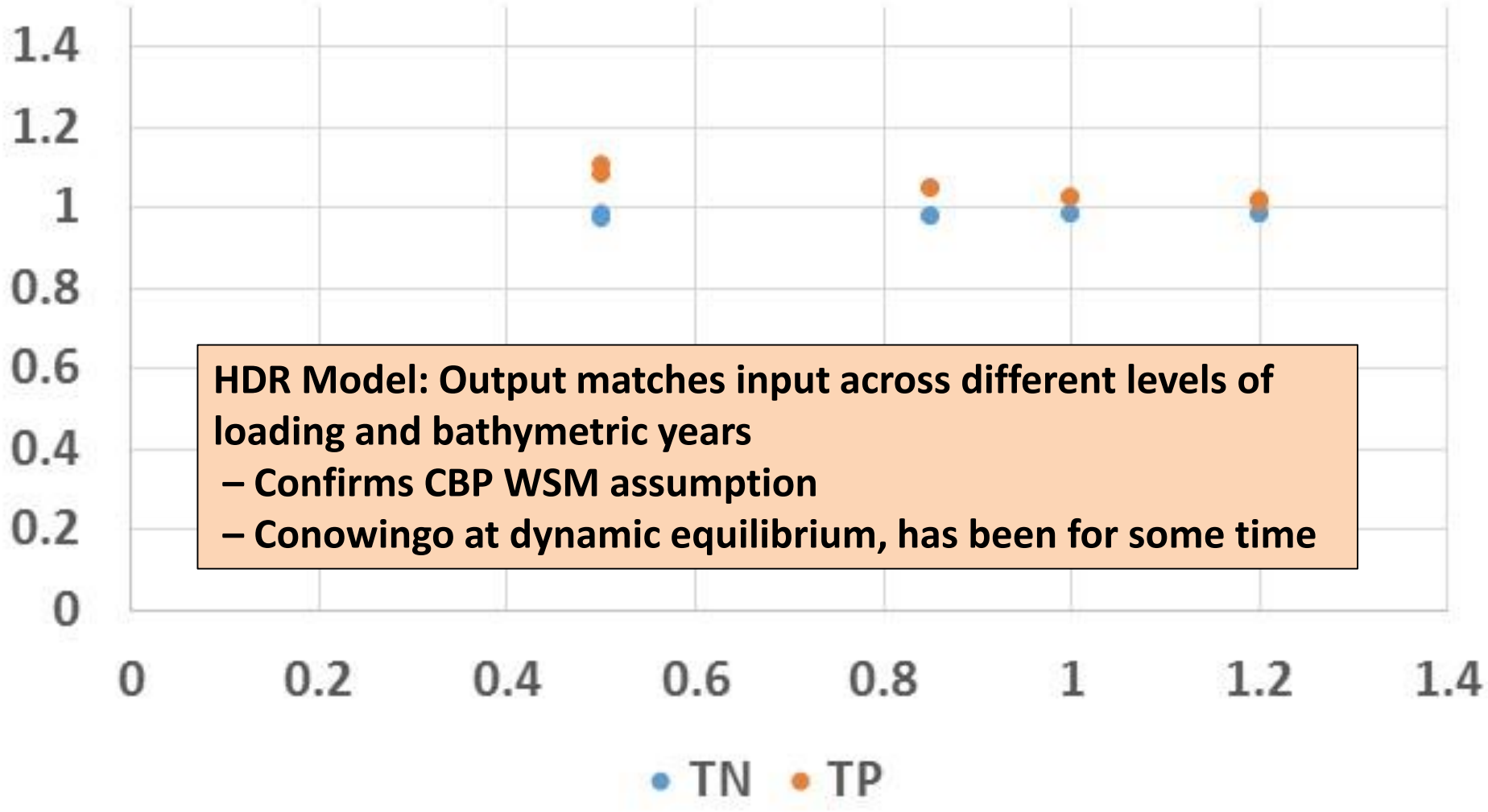
Analysis by Qian Zhang, UMCES/CBPO



Analysis by Qian Zhang, UMCES/CBPO

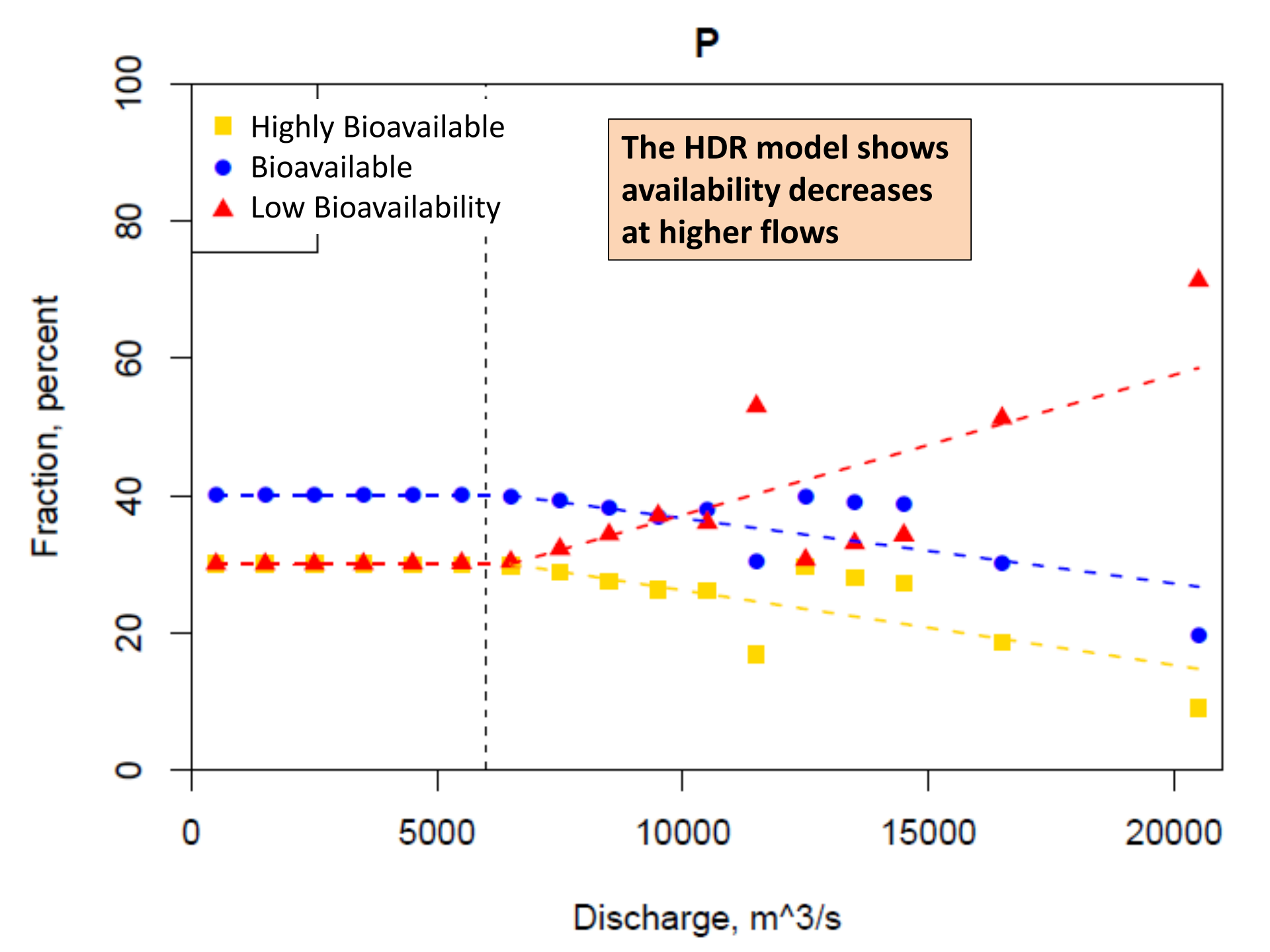


Ratio of Output to Input -- HDR Model Runs



HDR Model: Output matches input across different levels of loading and bathymetric years
– Confirms CBP WSM assumption
– Conowingo at dynamic equilibrium, has been for some time

Note: ratio greater than one is not possible over the long term and is due to short spin-up time


P
Highly Bioavailable
Bioavailable
Low Bioavailability
The HDR model shows availability decreases at higher flows
Fraction, percent
0
20
40
60
80
100
0
5000
10000
15000
20000
Discharge, m^3/s

MWG Decisions

- What is the current state of the Conowingo Pool?
  - There is overwhelming evidence that the Conowingo Pool is in dynamic equilibrium
    - HDR Model
    - WRTDS
      - USGS
      - Johns Hopkins
    - LSRWA
    - STAC workshop and review of LSRWA

MWG Decisions

- How does the scour and deposition change with time?
  - The Phase 6 watershed model can be calibrated to WRTDS annual loads, since WRTDS matches the observed change in the reservoir behavior over time

MWG Decisions

- How does the Output/Input ratio change with nutrient reductions?
  - HDR model confirms long-standing CBP assumption that the ratio is constant across reduction scenarios.
- Are scoured organics less bio-available?
  - HDR model quantifies this effect. Still need to bring analysis back to MWG

Summary

- We know the state of the Conowingo now and we know what the assumption was for the TMDL so we can calculate the difference.
- We have analyses to help us model the Conowingo
  - Variable trapping through time
  - Constant trapping across reduction scenarios
  - Reduction in availability in high flow events

Next Steps

- Simulation underway
- Documentation in progress
- STAC review in March (question)/April (expected response)

- Back to WQGIT to discuss use in planning targets

Framing the Policy Questions

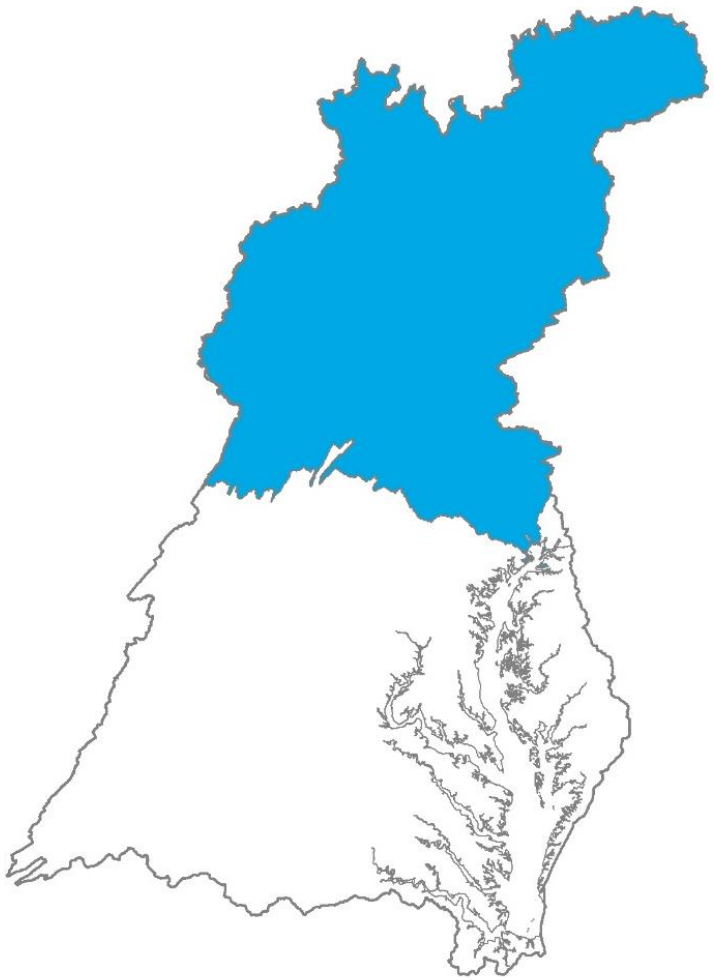
- **Who** is responsible for additional load reductions?
  - Susquehanna watershed only
  - Susquehanna watershed + Maryland and Virginia
  - All Chesapeake Bay watershed jurisdictions

- **How** will responsibility assigned?
  - Allocation equity rules used in the Bay TMDL
  - Most cost effective practices and locations

- **When** will the additional reductions be required to be met?
  - Allocate additional loads into Phase III Planning Targets and address by 2025
  - Allocate additional loads into Phase III Planning Targets, but establish timeframe beyond 2025 to address Conowingo infill loads
  - Quantify impacts due to Conowingo infill but allocate and address necessary load reductions post-2025

Source: December 2016 PSC Meeting

Susquehanna Watershed Only

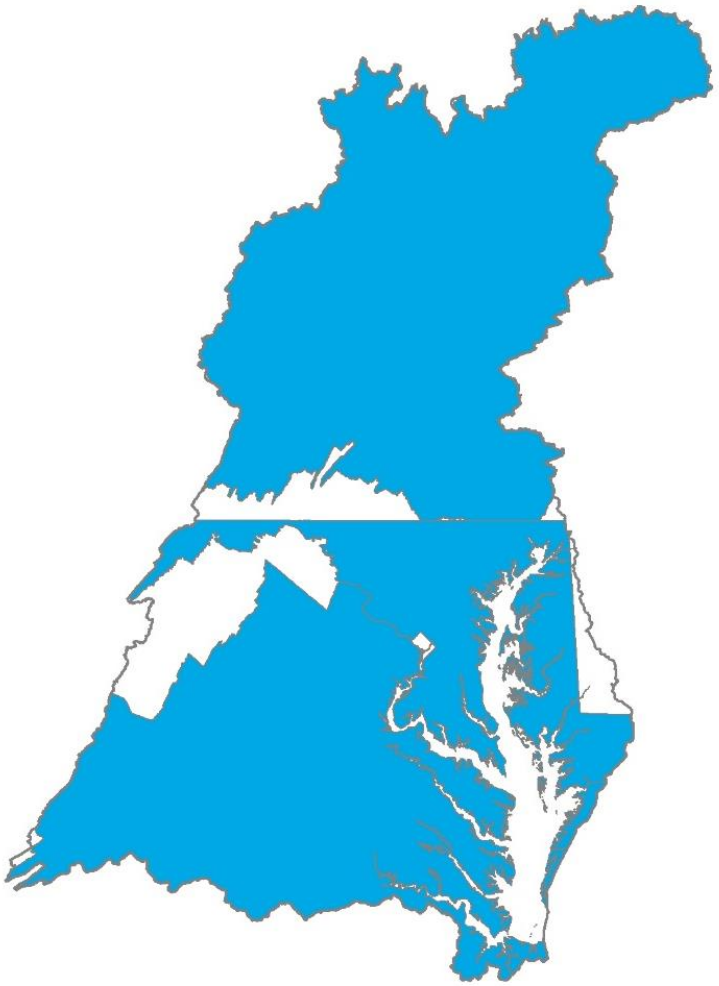


Potential Range of Percent Increase in Phosphorus Load Above Each Jurisdiction's Phase II WIP Load

NY:	10 - 21
PA:	12 - 25
MD:	1 - 1
VA:	0 - 0
DE:	0 - 0
DC:	0 - 0
WV:	0 - 0

Source: December 2016 PSC Meeting, results are preliminary

Susquehanna Watershed + Maryland & Virginia

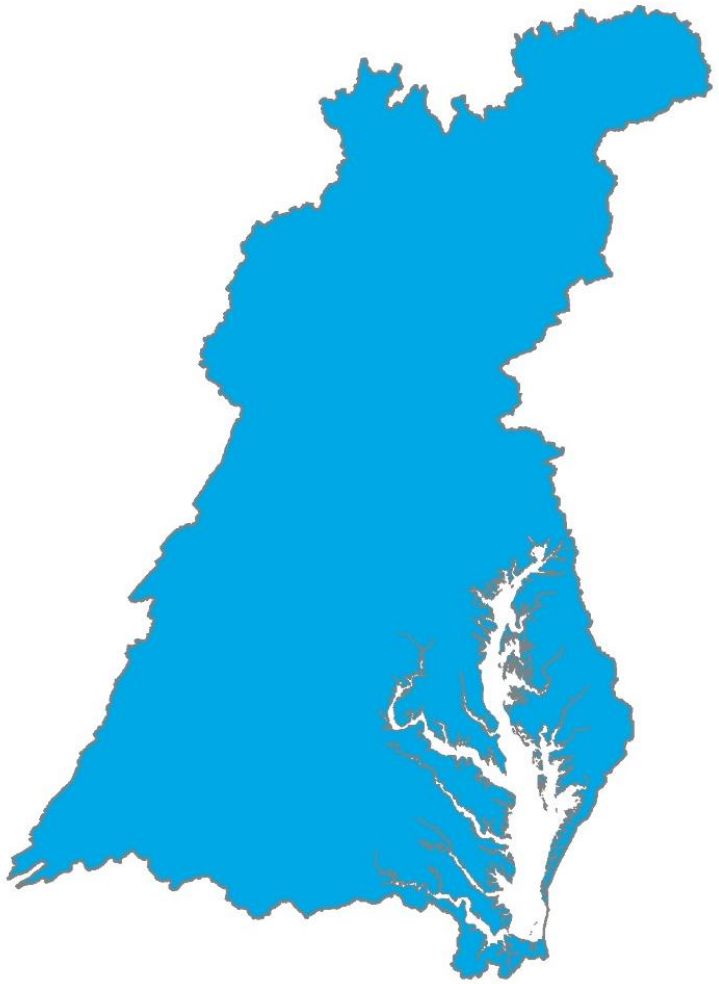


Potential Range of Percent Increase in Phosphorus Load Above Each Jurisdiction's Phase II WIP Load

NY:	6 - 11
PA:	7 - 14
MD:	7 - 16
VA:	4 - 9
DE:	0 - 0
DC:	0 - 0
WV:	0 - 0

Source: December 2016 PSC Meeting , results are preliminary

All Chesapeake Bay Watershed Jurisdictions



Potential Range of Percent Increase in Phosphorus Load Above Each Jurisdiction's Phase II WIP Load

NY:	5 - 10
PA:	7 - 14
MD:	6 - 14
VA:	4 - 8
DE:	9 - 20
DC:	1 - 3
WV:	5 - 11

Source: December 2016 PSC Meeting , results are preliminary

Timeline for 2017 Midpoint Assessment Decisions

- **December 2016**: Framework for determining which jurisdictions will be responsible for addressing the additional nutrient and sediment loads resulting from infill of the Conowingo Reservoir
- **May 2017**: Determine how much additional nutrient and sediment loads must be addressed resulting from infill of the Conowingo Reservoir and decide upon allocation rules
- **June 2017**: Draft Phase III WIP planning targets fully reflect best understanding of additional loads from infill of the Conowingo Reservoir
- **December 2017**: Final Phase III WIP planning targets fully reflect best understanding of additional loads from infill of the Conowingo Reservoir

Source: December 2016 PSC Meeting