

CBP Modeling Workgroup Response to PSC Requests for Further Analyses of the Bay's Assimilative Capacity and Future Estimates of Nitrogen Atmospheric Deposition

Briefing Paper for the Principals' Staff Committee in Preparation for their March 2, 2018 Meeting

Background

At its December 19-20, 2017 meeting, the Chesapeake Bay Program Partnership's Principals' Staff Committee (PSC) agreed that the "draft Phase III Planning Targets for West Virginia and New York reflect the same adjustments provided during the establishment of the 2010 Chesapeake Bay TMDL allocations." The PSC also stated its commitment "to providing those same adjustments in the final Phase III Planning Targets."¹ Therefore, the revised draft Phase III Watershed Implementation Plan (WIP) planning targets approved by the PSC provide an additional 1 million pounds of nitrogen and 100,000 pounds of phosphorus to New York, and an additional 2 million pounds of nitrogen to West Virginia. The total draft Phase III WIP planning targets summed up across the Bay watershed are 201.25 million pounds of nitrogen and 14.17 million pounds of phosphorus, which includes all the additional allocations of 3 million pounds of nitrogen and 100,000 pounds of phosphorus to New York and West Virginia.

The Chesapeake Bay Program Partnership's Modeling Workgroup and its Modeling Team at the Chesapeake Bay Program Office in Annapolis, in coordination with the Water Quality Goal Implementation Team, conducted further analyses of the Bay's assimilative capacity and the projected nitrogen atmospheric deposition loads to the Bay's tidal waters as well as the surrounding watershed by 2030. These analyses were conducted in order to fulfill the PSC decision of providing New York and West Virginia additional pounds as part of their draft Phase III WIP planning targets. These analyses were directed towards determining the total nitrogen and phosphorus loads to the Bay's tidal waters which would still achieve all Chesapeake Bay water quality standards with the inclusion of a 6 percent restoration variance for Maryland's CB4MH Deep Channel segment.

Confirmation of New York's Additional Loads

As part of the 2010 Chesapeake Bay Total Maximum Daily Load (TMDL), EPA agreed to increase New York's nitrogen allocation by 1 million pounds and their phosphorus allocation by 100,000 pounds. These increases in loads over New York's original allocation determined through the Chesapeake Bay TMDL allocation methodology were based on the Partnership's equity principles spelled out in the 2010 Chesapeake Bay TMDL.² In the case of New York, their relative lack of population growth since 1985, when compared with the growth observed in

¹ The Chesapeake Bay Program Partnership Principals' Staff Committee December 19-20, 2017 meeting summary of decisions and actions accessible at:

https://www.chesapeakebay.net/what/event/principals_staff_committee_meeting_december_2017.

² See page 6-16 in the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment*. Established by the U.S. Environmental Protection Agency. December 29, 2010.

the other six Chesapeake Bay watershed jurisdictions, was the source of their concern about the inequity in the original proposed 2010 Chesapeake Bay TMDL allocations.

To confirm that New York's equity-based concerns were still being fully addressed and as a follow up to the December 19-20 PSC meeting, the Chesapeake Bay Program Office staff re-ran the PSC approved allocations methodology using the Partnership's Phase 6 suite of models factoring in a 1985 No Action base year versus a 2010 No Action base year. This scenario would essentially translate the additional pounds provided to New York under the 2010 Chesapeake Bay TMDL using the Phase 5 suite of models into the equivalent pounds now working with the Partnership's approved Phase 6 suite of models.

The resulting scenario generated very similar additional nitrogen and phosphorus loads—1.14 million pounds of nitrogen and 100,000 pounds of phosphorus with the Phase 6 suite of models—as provided to New York under the 2010 Chesapeake Bay TMDL—1 million pounds of nitrogen and 100,000 pounds of phosphorus with the Phase 5 suite of models.

The follow through scenario analysis validates the PSC's decision to provide New York with 1 million pounds of nitrogen and 100,000 pounds of phosphorus on top of their original draft Phase III WIP planning targets. Therefore, the Partnership has continued to honor the original commitment in the 2010 Chesapeake Bay TMDL³ to recognize and account for the inequity in population growth between New York and the rest of the Chesapeake Bay watershed jurisdictions since 1985.

Updated Assessment of West Virginia's Additional Loads

As part of the 2010 Chesapeake Bay TMDL, EPA agreed to increase West Virginia's phosphorus allocation by 200,000 pounds. These increases in loads over West Virginia's original allocation determined through the Chesapeake Bay TMDL allocation methodology were based on the Partnership's equity principles spelled out in the 2010 Chesapeake Bay TMDL⁴ and the recognition that the headwater states do not benefit from a cleaner Bay, that the allocation methodology does not take into account absolute loads, and that it was biased against headwater states that had grown at a slower rate.⁵ At the time, West Virginia was offered the equivalent of 2 million pounds of nitrogen to be taken any way that the jurisdiction chose. At the December 19-20 meeting, the PSC agreed with a West Virginia request to be provided a 2 million pound nitrogen adjustment to the draft Phase III WIP planning targets.

Following the December 19-20 PSC meeting, EPA and West Virginia Department of Environmental Protection (DEP) teamed up to further assess West Virginia's additional loads provided by the PSC decisions. West Virginia has long committed to the level of effort contained within its Phase II Watershed Implementation Plan, making significant progress

³ See page 6-38 in the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment*. Established by the U.S. Environmental Protection Agency. December 29, 2010.

⁴ See page 6-16 in the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment*. Established by the U.S. Environmental Protection Agency. December 29, 2010.

⁵ See pages 6-38 and 6-39 in the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment*. Established by the U.S. Environmental Protection Agency. December 29, 2010.

towards those goals since the 2010 Chesapeake Bay TMDL. Follow-up actions were initiated to determine if the Phase 6 model estimation of delivered nutrient loads resulting from West Virginia's Phase II level of effort would allow a lower allocation for West Virginia at this time and, thereby, lessen the burden on other watershed jurisdictions in the planning target process.

West Virginia DEP, with support from the Chesapeake Bay Program Office, has taken steps to translate its Phase II Watershed Implementation Plan, developed using the Phase 5 suite of models, into a similar level of effort under the Partnership's Phase 6 suite of models. Based on these scenario analyses, West Virginia is willing to agree to a 1.5 million pound increase in its nitrogen Phase III WIP planning target as a good representation of equity. At this time, the 1.5 million pound increase in West Virginia's nitrogen load will, with the concurrence of the PSC, replace the original 2 million pound increase agreed to by the PSC at its December 19-20, 2017 meeting for the purpose of finalizing planning targets for the jurisdictions' Phase III WIPs.

“In the event that model revisions occur that increase the loads resulting from West Virginia's Phase II level of effort (ex. revised BMP efficiencies), or new directives are initiated to increase Partnership level of effort (ex. climate change, Conowingo), the remaining 500,000 pounds of nitrogen provided to West Virginia for equity would be made available for accommodation. West Virginia asks for the Partnership's commitment to return the unused equity allocation to West Virginia, if necessary.” *Language requested by West Virginia pending PSC approval.*

Determination of the Sources of the Additional Pounds

The sources of these additional pounds, which have been added to New York's and West Virginia's original draft Phase III WIP planning targets, came from three sources:

- Determination of additional Bay assimilative capacity to receive additional nitrogen and phosphorus loads and still achieve the states' Bay water quality standards calculated beyond the initial estimate presented to the PSC at their December 19-20, 2017 meeting;
- Accounting for estimated reductions in atmospheric deposition of nitrogen to the tidal surface waters of Chesapeake Bay and its tidal tributaries and embayments between 2025 and 2030; and
- Accounting for estimated reductions in atmospheric deposition of nitrogen to the Chesapeake Bay watershed between 2025 and 2030.

At its December 19-20, 2017 meeting, the PSC requested that “EPA, in coordination with the Partnership's Water Quality Goal Implementation Team and Modeling Workgroup, conduct further analyses to determine the source(s) of those additional nitrogen and phosphorus pounds, and any impacts to the Bay's assimilative capacity.”

Assimilative Capacity Additional Pounds

Under the direction of and with review by the Modeling Workgroup, the Chesapeake Bay Program Office's Modeling Team ran additional scenarios to determine if the Bay could accept additional nitrogen and phosphorus loads without increasing Maryland's mainstem Bay segment

CB4's deep channel 6% restoration variance for dissolved oxygen. The Modeling Team found that the Bay could withstand an additional 1 million pounds of nitrogen (N) from the Potomac River watershed as well as 500,000 pounds of nitrogen and 50,000 pounds of phosphorus (P) from the Susquehanna River watershed and still meet the Bay's water quality standards within the same 6% restoration variance (see Table 1 below). However, these additional loads did not add up to total loads the PSC committed to provide to New York and West Virginia.

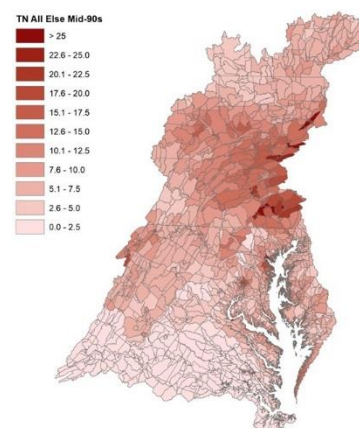
Table 1. Source and level of pounds provided to New York and West Virginia.

Source of Pounds	New York	West Virginia	Extra Available
Bay Assimilative Capacity Evaluation	500,000 N /50,000 P	1 million N	0
+ Atmos. Dep. to Tidal Waters by 2030	1 million N /100,000 P	1.18 million N	0
+ Atmos. Dep. to Watershed by 2030	-	1.5 million N	390,000 N

Atmospheric Deposition to Tidal Waters

Airshed modeling performed by EPA shows that we can expect to see an additional 800,000 pound decrease in atmospheric deposition of nitrogen to the surface tidal waters of Chesapeake Bay by 2030 with the regulations currently in place⁶. This reduction is in addition to what was already estimated to occur by 2025 and has already been factored into the draft Phase III WIP planning targets agreed to by the PSC. However, these additional nitrogen load reductions cannot be directly translated to an additional 800,000 pound increase in a planning target because loads originating from different areas have different effects on dissolved oxygen in the Bay.

One of the principles used by the Partnership to allocate the Chesapeake Bay TMDL loads in 2010 and the Phase III WIP planning targets in 2017 is that state-basins that contribute the most pollution must achieve the highest reductions. This applies both to areas that have high sources and watersheds that are naturally situated, through geology and geography, to have a high impact on Chesapeake dissolved oxygen (see map at right). The calculation of high impact areas provides a basis for exchange ratios between basins and between nitrogen and phosphorus. For example, a pound of nitrogen reduction from the Susquehanna River watershed has about the same effect as one and a half pounds of nitrogen reduction from the Potomac River watershed, two pounds



⁶ Chesapeake Bay Program Office staff followed up with U.S. EPA's Office of Air Quality Planning and Standards in Research Triangle Park, North Carolina, and confirmed that the state and federal Clean Air Act regulatory programs resulting in the estimated additional total nitrogen reductions were in place and being implemented prior to 2025. Two exceptions were noted. The emissions used in the 2030 scenario included estimated reductions from the Clean Power Plan, currently under review by EPA. However, these same emissions in the 2030 scenario did not include reductions that will take place to achieve the 2015 National Ambient Air Quality Standards as the states have not yet developed implementation plans to reach the 70 ppb ozone standard. Recognizing that the emission reductions necessary to achieve the 2015 National Ambient Air Quality Standards will likely be higher than those estimated for the Clean Power Plan, these two exceptions should not adversely influence the current 2030 estimated additional nitrogen load reductions to tidal waters.

of nitrogen reduction from the Rappahannock River watershed, and seven pounds of nitrogen reduction from the James River watershed.

Using these ratios, we can convert the extra assimilative capacity in the Bay to absorb more nutrient loads or the additional load reductions in other sources (e.g., atmospheric deposition) into increased Phase III WIP planning targets for any state-basin. Therefore, the expected reduction in nitrogen atmospheric deposition to the surface of the Chesapeake Bay's tidal waters can be translated to an additional 500,000 pounds of nitrogen from the Susquehanna River watershed, 50,000 million pounds of phosphorus from the Susquehanna River watershed, and 180,000 pounds of nitrogen from the Potomac River watershed. By adding the loads from atmospheric deposition to the tidal watershed to the additional loads from the Bay's revised assimilative capacity, we fully address the additional pounds the PSC committed to provide to New York, but we still fall short of the additional pounds the PSC committed to provide to West Virginia (see Table 1 above).

Atmospheric Deposition to the Bay Watershed

The same air emission reductions that result in nitrogen atmospheric deposition reductions for the surface of the Bay's tidal waters will also reduce atmospheric deposition loads of nitrogen to the Bay's watershed. By 2030, EPA estimates this will also result in the further reduction of 800,000 pounds of nitrogen reaching the Bay. The atmospheric deposition reductions projected by 2030 is expected to reduce runoff loads to the Bay's tidal waters from the seven jurisdictions as shown in Table 2 to the right. These reductions are in addition to previously estimated 2025 reductions from air emission regulations which have already been factored into the draft Phase III WIP planning targets approved by the PSC.

Table 2. Watershed atmos. deposition reductions.

State	Pounds N
DC	0
DE	20,000
MD	210,000
NY	40,000
PA	280,000
VA	220,000
WV	30,000
Total	800,000

Since this nitrogen reaches the Bay in forms and from locations that are not as effective as the nitrogen atmospheric deposition direct to the Bay's tidal waters, the overall potential load increase in the Phase III WIP planning targets is lower. However, applying 320,000 pounds of the expected reduction in atmospheric deposition of nitrogen to the watershed specifically to West Virginia's Phase III WIP planning target will enable the partners to fulfill the PSC's commitment to providing West Virginia with their now requested 1.5 million pounds, with an additional 390,000 pounds left over (see Table 1 above).

Additional Pounds Remaining

The additional 390,000 million pounds of nitrogen is the amount that could be increased from the Potomac River watershed above Washington DC. This increase could be transferred to other state-basins or converted to phosphorus using Partnership-approved Phase 6 exchange ratios. For example, these remaining pounds could become 330,000 pounds of nitrogen if applied in the Susquehanna River watershed. Given the PSC's final decisions on the Phase III WIP planning targets are not scheduled until its May 2018 meeting, it is recommended that these additional pounds be held in reserve awaiting future PSC decision making.