

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 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 special case load allocations of 3 million pounds of nitrogen and 100,000 pounds of phosphorus.

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 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 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.

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

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.

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 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 Bay TMDL allocation methodology were based on the Partnership's equity principles spelled out in the 2010 Bay TMDL⁴ and the recognition that the headwater states do not directly benefit from a cleaner Bay.⁵

During the December 19-20, 2017 PSC meeting, West Virginia asked that its original draft Phase III WIP planning target for nitrogen be increased by 2 million pounds. The underlying rationale was that West Virginia is much more challenged in reaching its nitrogen loading goal versus its phosphorus loading goal. And phosphorus load reductions provide much more direct local water quality benefits compared with nitrogen load reductions in West Virginia. Therefore, West Virginia asked that their original additional 200,000 pounds of phosphorus provided for in the 2010 Bay TMDL be exchanged into nitrogen using the Phase 5 exchange ratio for converting phosphorus loads into nitrogen loads. Therefore, 200,000 pounds of phosphorus x 10 = 2 million pounds of nitrogen.

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.

Following the December 19-20, 2017 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 WIP, making significant progress towards those goals since the 2010 Bay TMDL.

Therefore, West Virginia DEP, with support from the Chesapeake Bay Program Office in Annapolis, has taken steps to translate its Phase II WIP, 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 planning target as a good representation of addressing its equity concerns originally expressed as part of the 2010 Bay TMDL. This 1.5 million pound increase in its 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.

West Virginia asks for EPA's continued commitment to work with West Virginia into the future and, in the face of changing understanding of the effectiveness of BMPs, the effects of climate change on watershed loads, or other similar changes in model estimated loads, EPA will continue to expect West Virginia to fully carry out its commitment to a level of effort originally reflected in their Phase II WIP.

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 can come from three sources:

- 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 the 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 the December 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 Modeling Team ran additional scenarios to determine if the Bay could accept

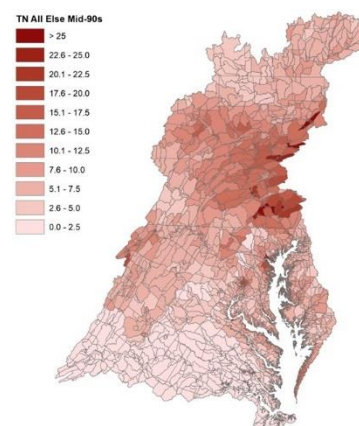
additional nitrogen and phosphorus loads without increasing Maryland mainstem Bay segment CB4's deep channel 6% restoration variance for dissolved oxygen. The Modeling Team found that the Bay could withstand an additional 1 million pounds of nitrogen from the Potomac River watershed, 500,000 pounds of nitrogen from the Susquehanna, and 50,000 pounds of phosphorus from the Susquehanna River watershed and still meet water quality standards within the same 6% restoration variance (see table below). However, these additional loads did not add up to total loads the PSC committed to provide 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 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 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 two pounds of nitrogen reduction from the Rappahannock River watershed, seven pounds



⁶ Chesapeake Bay Program Office staff followed up with EPA's Office of Air Quality Planning and Standards 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 did not include reductions that will take place to achieve the 2015 National Ambient Air Quality Standards as the states have not developed implementation plans to reach the new 70 ppb 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 influence the current 2030 estimated additional nitrogen load reductions to tidal waters.

of nitrogen reduction from the James River watershed, or half a pound of phosphorus reduction from the Patuxent 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 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 falls short of the additional pounds the PSC committed to provide to West Virginia.

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 further reduction of 800,000 pounds of nitrogen reaching the Bay. The atmospheric deposition reductions expected by 2030 is expected to reduce runoff loads from the seven jurisdictions as shown in the table to the right. These reductions are in addition to previously estimated 2025 reductions from air emission regulations and are in addition to management actions by the jurisdictions.

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 planning targets is lower. However, applying the expected reduction in atmospheric deposition 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.

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 in planning target 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.