Exhibit 18

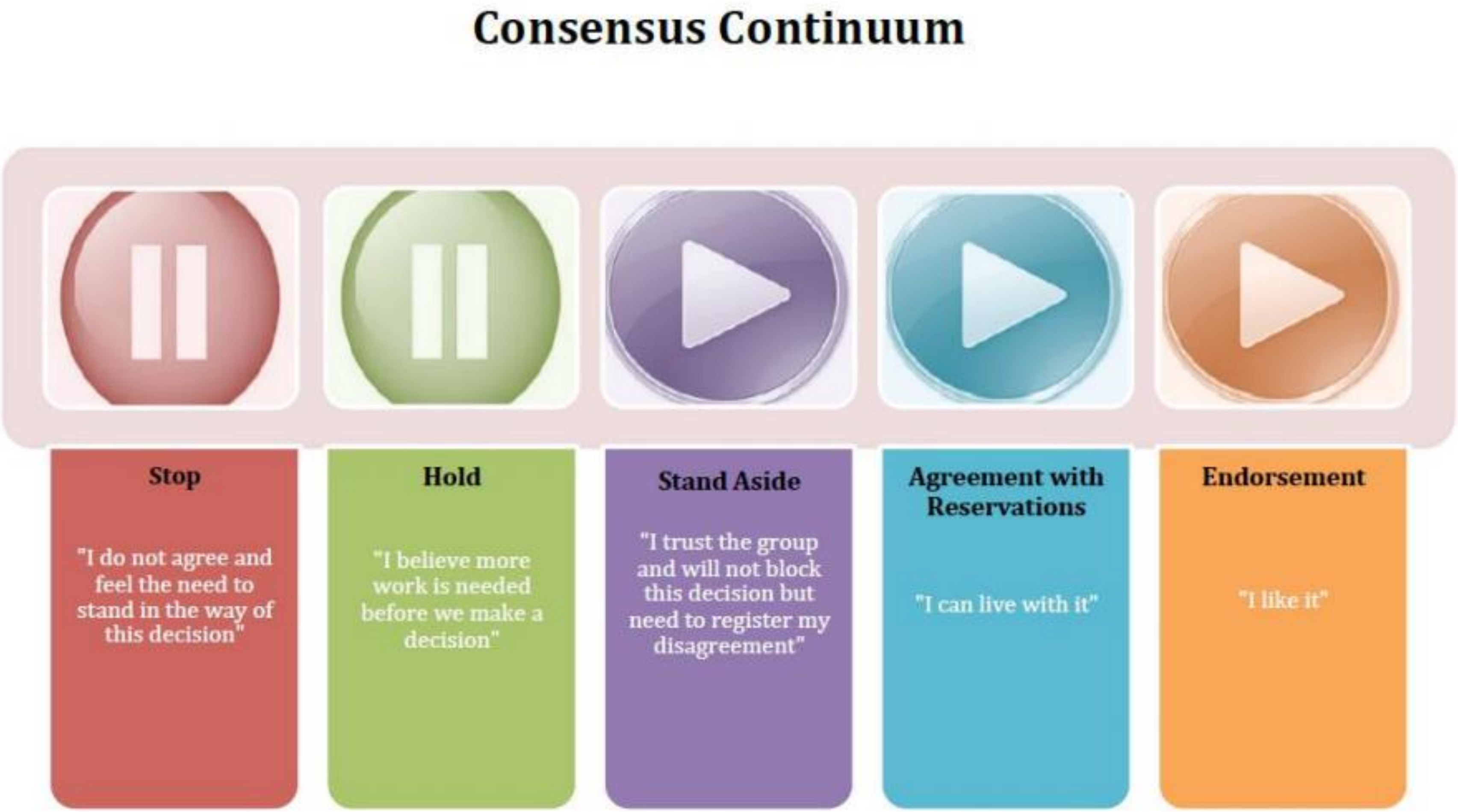
Chesapeake Bay 2017 Midpoint Assessment— Policy Issues for Partnership Decisions

Water Quality Goal Implementation Team Meeting
December 4-5, 2017

Overview of Meeting and Requested WQGIT Policy Recommendations to the PSC

James Davis-Martin, CBP Water Quality Goal Implementation Team Chair

Working Towards Consensus



WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

Adoption of the Phase 6 suite of modeling tools for management application in the Phase III WIPs and 2-year milestones through 2025

- August 28, 2017 WQGIT Conference Call: Approval of the proposed resolutions to fatal flaw comments on the Phase 6 modeling tools (soil phosphorus data resolved separately)

Approval of Draft Phase III WIP planning targets, including the Bay's assimilative capacity and the Partnership's 4-month review process

- December 13, 2016 PSC Meeting: Agreement on the Phase III WIP planning targets methodology

WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

Accounting for Growth

- **Sept 25-26 WQGIT Recommendation to the PSC**:
  - Use 2025 growth projections as base conditions for the Phase III WIPs.
  - Update the growth projections every 2 years with the best available data to inform the development of the two-year milestones.

WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

Conowingo Infill

- **Sept 25-26 WQGIT Recommendation to the PSC**:
  - There is a need to address Conowingo now, as it's already a changed condition and Partnership decisions could inform the CWA 401 certification discussions between Maryland and Exelon.
  - Remove the options of "All Basins" and "Susquehanna + MD + VA" assuming responsibility for addressing Conowingo Dam.

WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

Conowingo Infill

- **Sept 25-26 WQGIT Recommendation to the PSC**:
  - Maintain the "Susquehanna basin only" option for PSC consideration.
  - Present the "Susquehanna + most effective basins" option for PSC consideration.

WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

Conowingo Infill

- **Sept 25-26 WQGIT Recommendation to the PSC**:
  - Assign the loads associated with Conowingo infill as local planning goal(s), separate from the jurisdictions' Phase III WIP planning targets.
  - Consider a letter from the PSC on expectations for addressing increased loads associated with Conowingo infill.

WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

<u>Climate Change</u>

- **Sept 25-26 WQGIT Recommendation to the PSC**:
  - Approved policy approach to guide jurisdictions' development and implementation of their Phase III WIPs.
  - Did not reach consensus on adopting the numeric policy component.
  - Did not reach consensus on adopting programmatic policy component Element B and Element C, as further discussions are needed – pros and cons and other language changes requested.

WQGIT Recommendations to PSC

Over the course of these two days, strive for consensus building and collective decision-making on policy recommendations to PSC:

<u>**Climate Change**</u>

- **Sept 25-26 WQGIT Recommendation to the PSC**:
  - If the level of effort to achieve the numeric reductions are relatively low, consider adopting the numeric component in addition to any programmatic component with the possibility of post-2025 implementation.
  - Provide jurisdictions with the flexibility to also address climate change numerically in the Phase III WIPs and 2-year milestones, if the Partnership adopts only the programmatic policy component.

Proposed Phase III Planning Targets and Accounting for Changed Conditions: Nitrogen

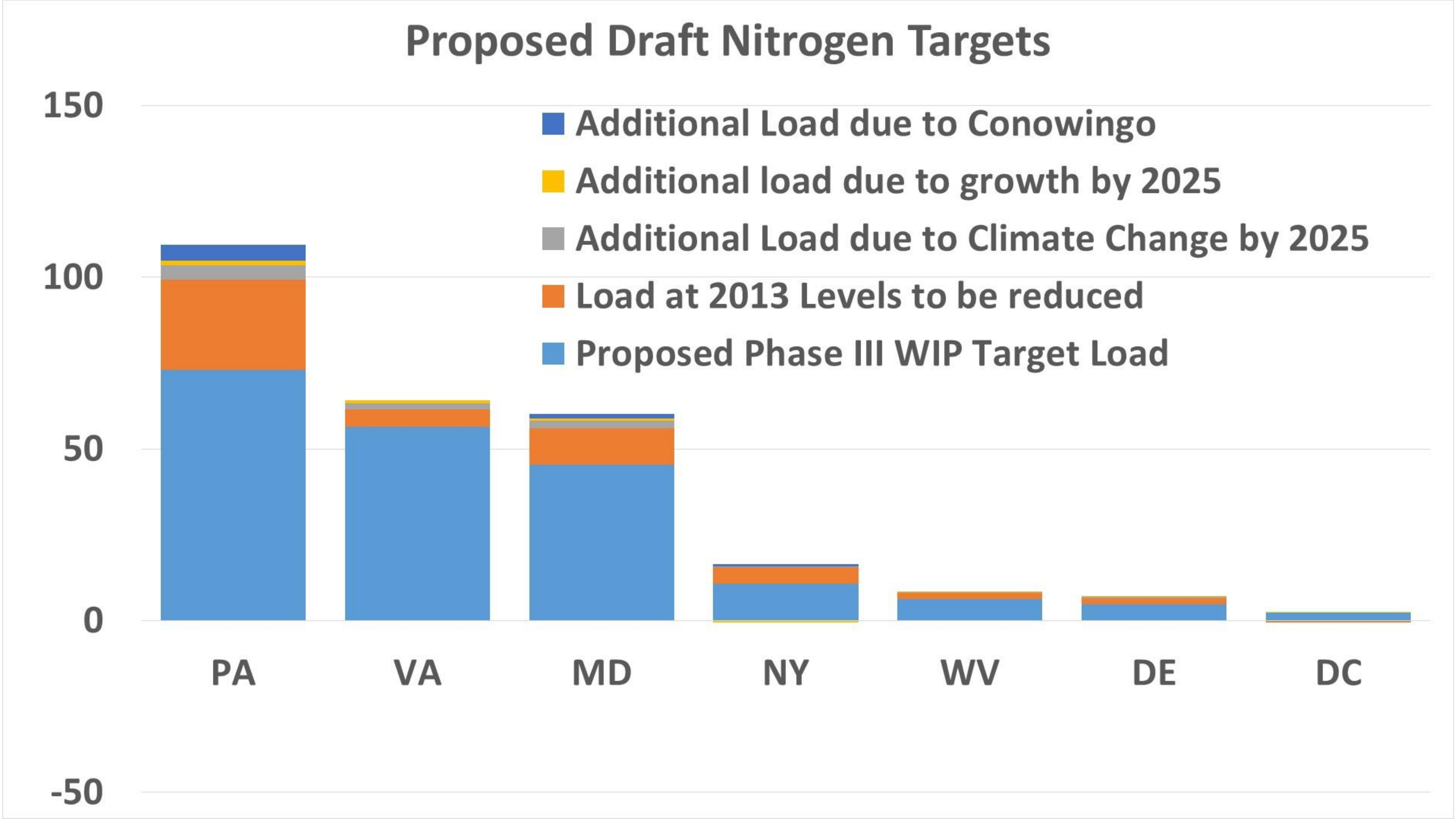
Jurisdiction	1985 Baseline	2013 Progress	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +	Phase III Planning Target
NY	18.71	15.44					
PA	122.41	99.28					
MD	83.56	55.89					
WV	8.73	8.06					
DC	6.48	1.75					
DE	6.97	6.59					
VA	84.29	61.53					
Basinwide	331.15	248.54					

*Units: millions of pounds

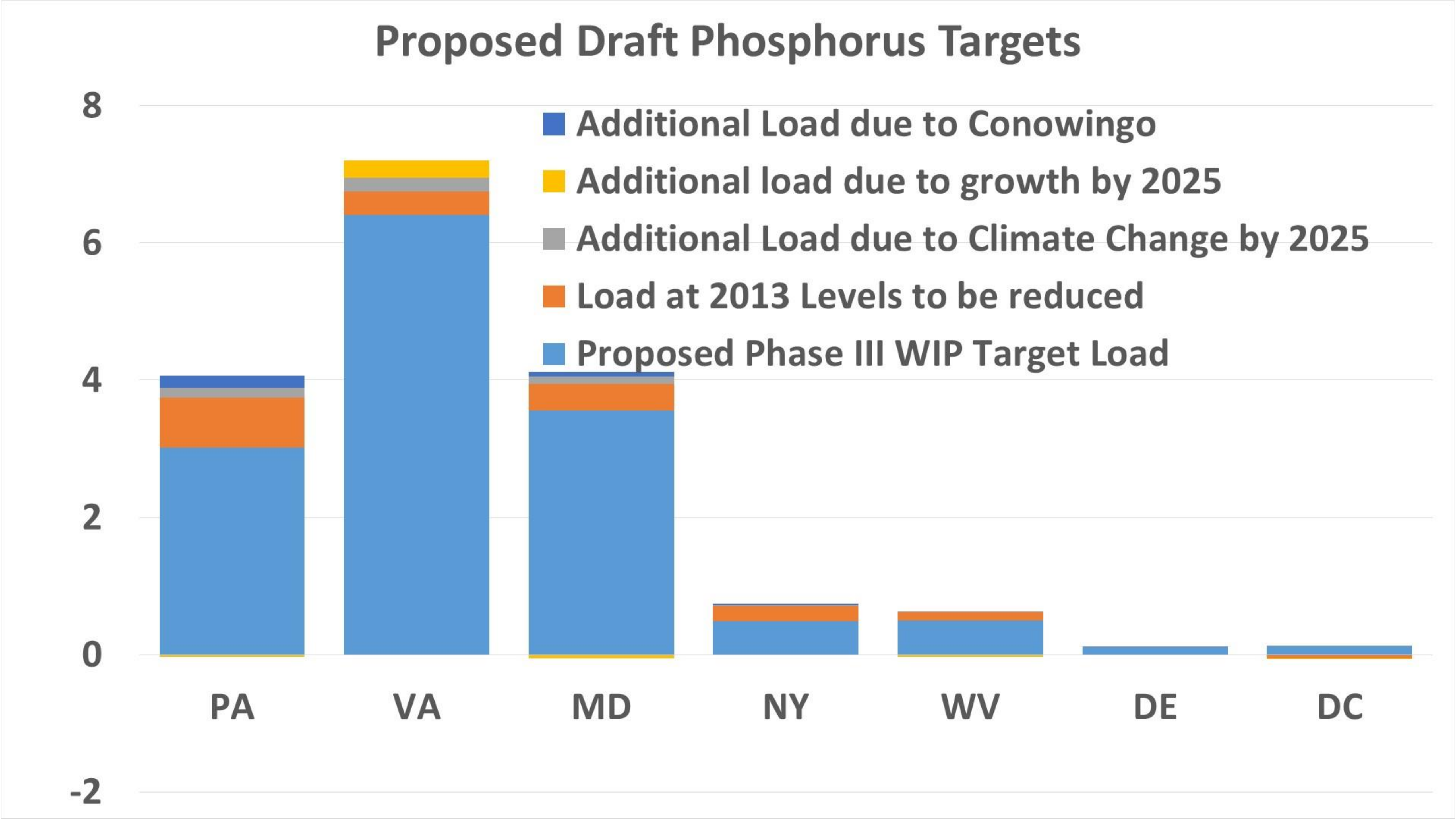
Proposed Phase III Planning Targets and Accounting for Changed Conditions : Phosphorus

Jurisdiction	1985 Baseline	2013 Progress	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +	Phase III Planning Target
NY	1.198	0.710					
PA	6.282	3.749					
MD	7.495	3.942					
WV	0.902	0.617					
DC	0.090	0.062					
DE	0.225	0.116					
VA	14.244	6.751					
Basinwide	30.44	15.95					

*Units: millions of pounds



Proposed Draft Nitrogen Targets
150
100
50
0
-50
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC


Proposed Draft Phosphorus Targets
8
6
4
2
0
-2
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC

Cautions About Comparisons Back to Phase II WIPs

Be cautious with comparing the proposed draft Phase III planning targets with the jurisdictions' Phase II WIP loads

- Different watershed models – more BMPs, different land uses and loading rates
- State-driven changes between Phase II and Phase III
- Phase II WIP planning targets were not derived using the Bay TMDL allocation methodology—they were based on a similar level of effort to the Phase I WIPs

What's Changed, the Implications, and Our Improved Models

Lee Currey, MDE, CBP Modeling Workgroup Co-Chair

What's Changed, Why, and Implications

A lot has changed since 2010 and our Phase I and Phase II WIPs

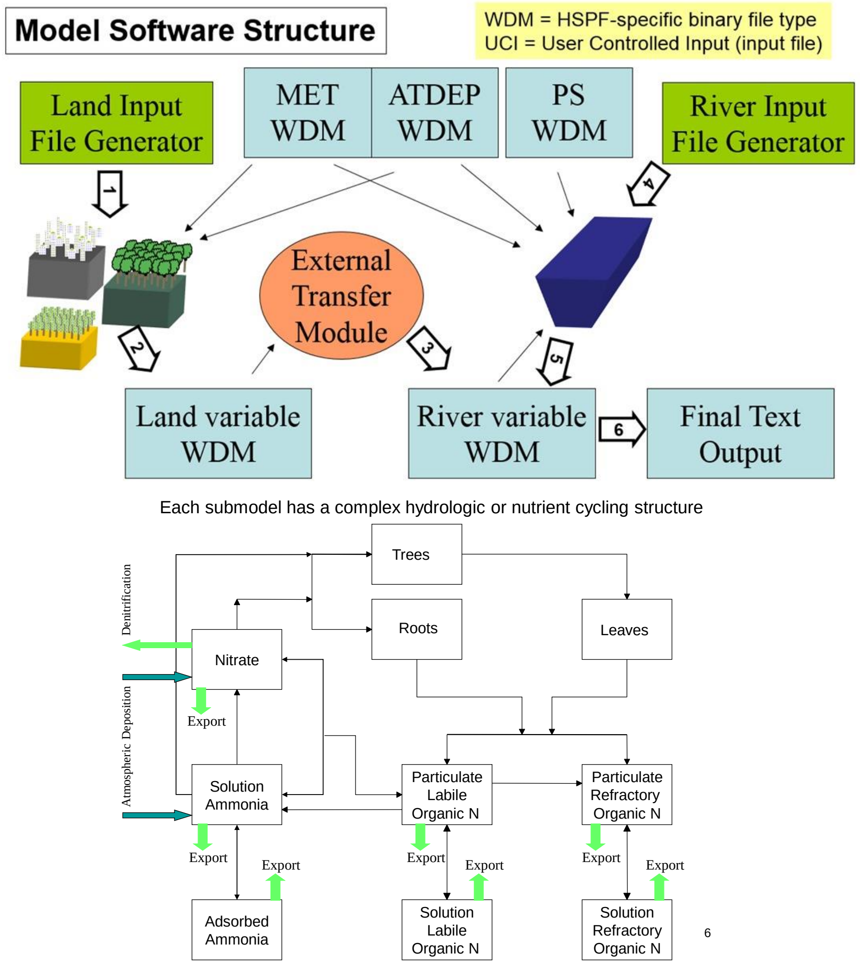
- Much improved modeling and other decision support tools
- High resolution land cover data for entire watershed
- Hundreds more BMPs available for crediting
- Significant data gathered from local agricultural and municipality partners incorporated into our models and other decision support tools

Improved Partnership Models

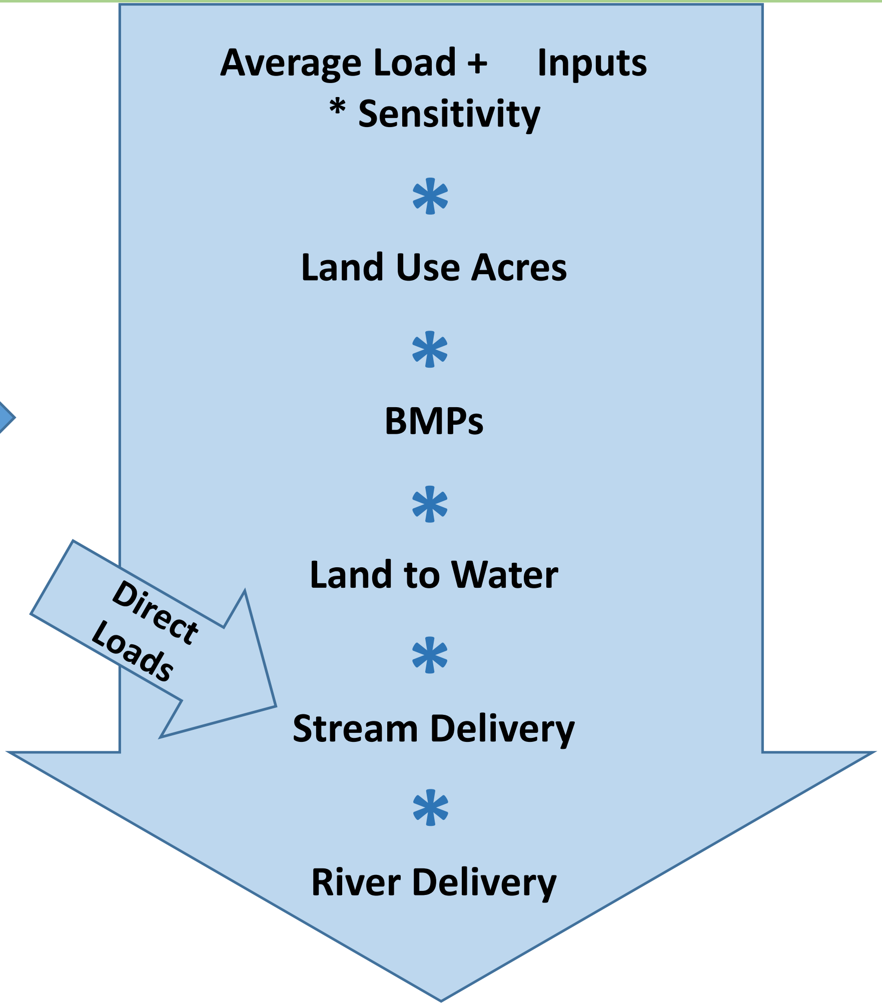
- 5 years of Partnership decision-making
- STAC sponsored technical workshops from soil phosphorus to Conowingo
- Independent scientific peer reviews of every Partnership model
- Comprehensive fatal flaw review and issue resolution

Phase 6 Bay Watershed Model

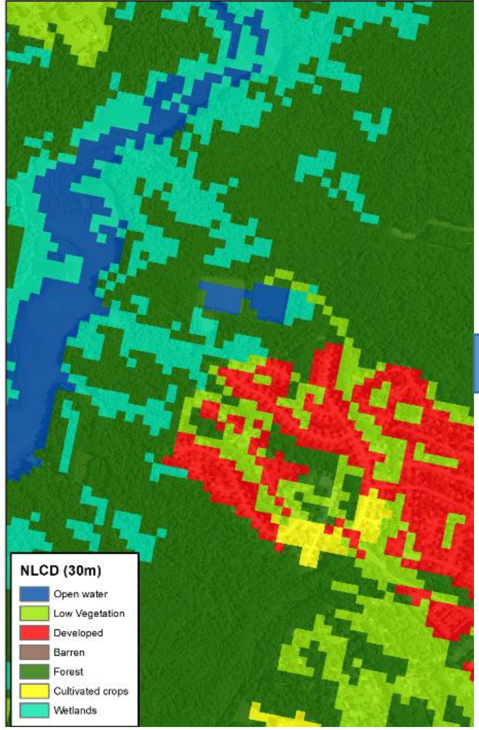
Prior Bay Watershed Models

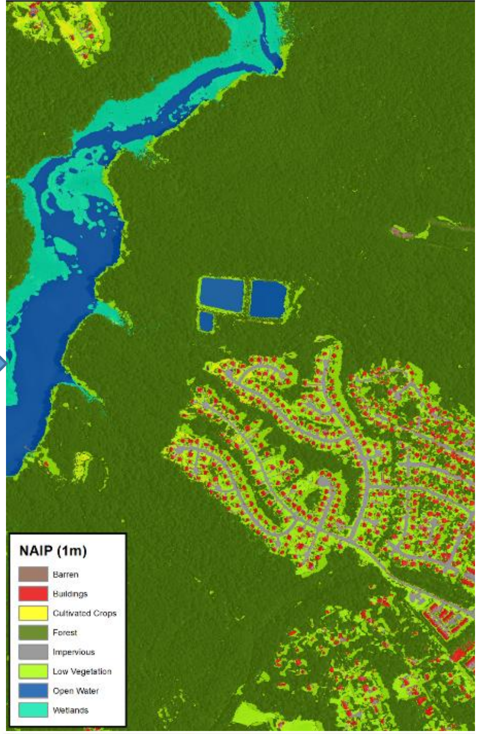


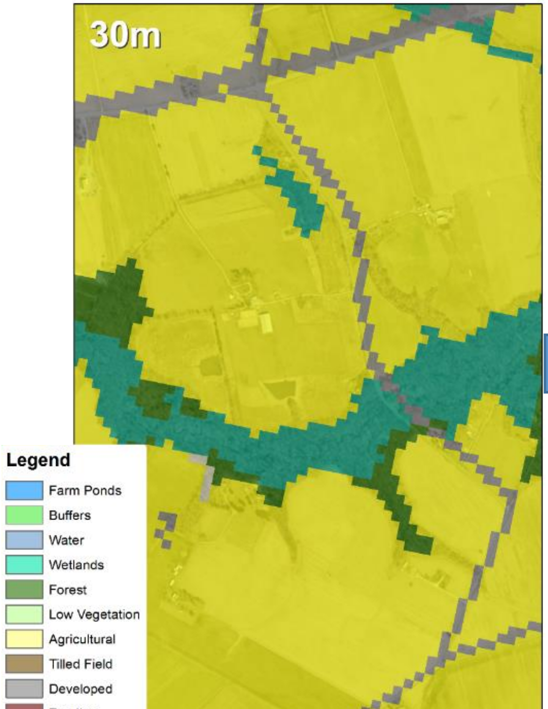
Phase 6 Watershed Model

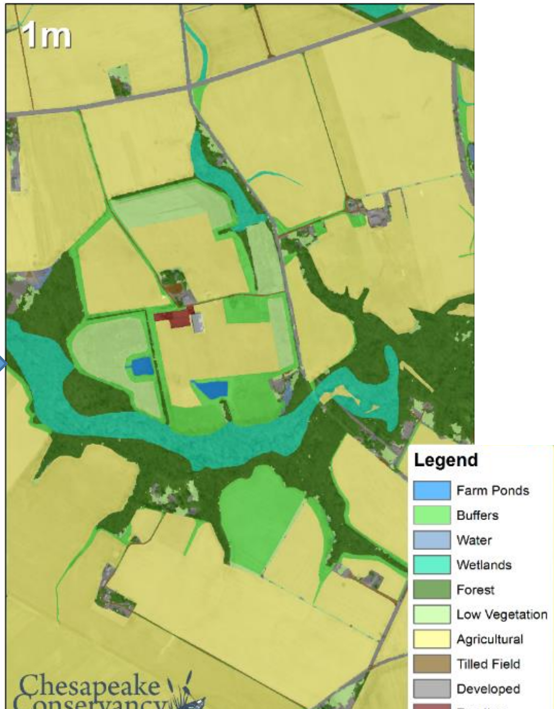


Phase 5 30-Meter Resolution Land Use/Land Cover Data









Phase 6 1-Meter Resolution Land Use/Land Cover Data

Hundreds More BMPs

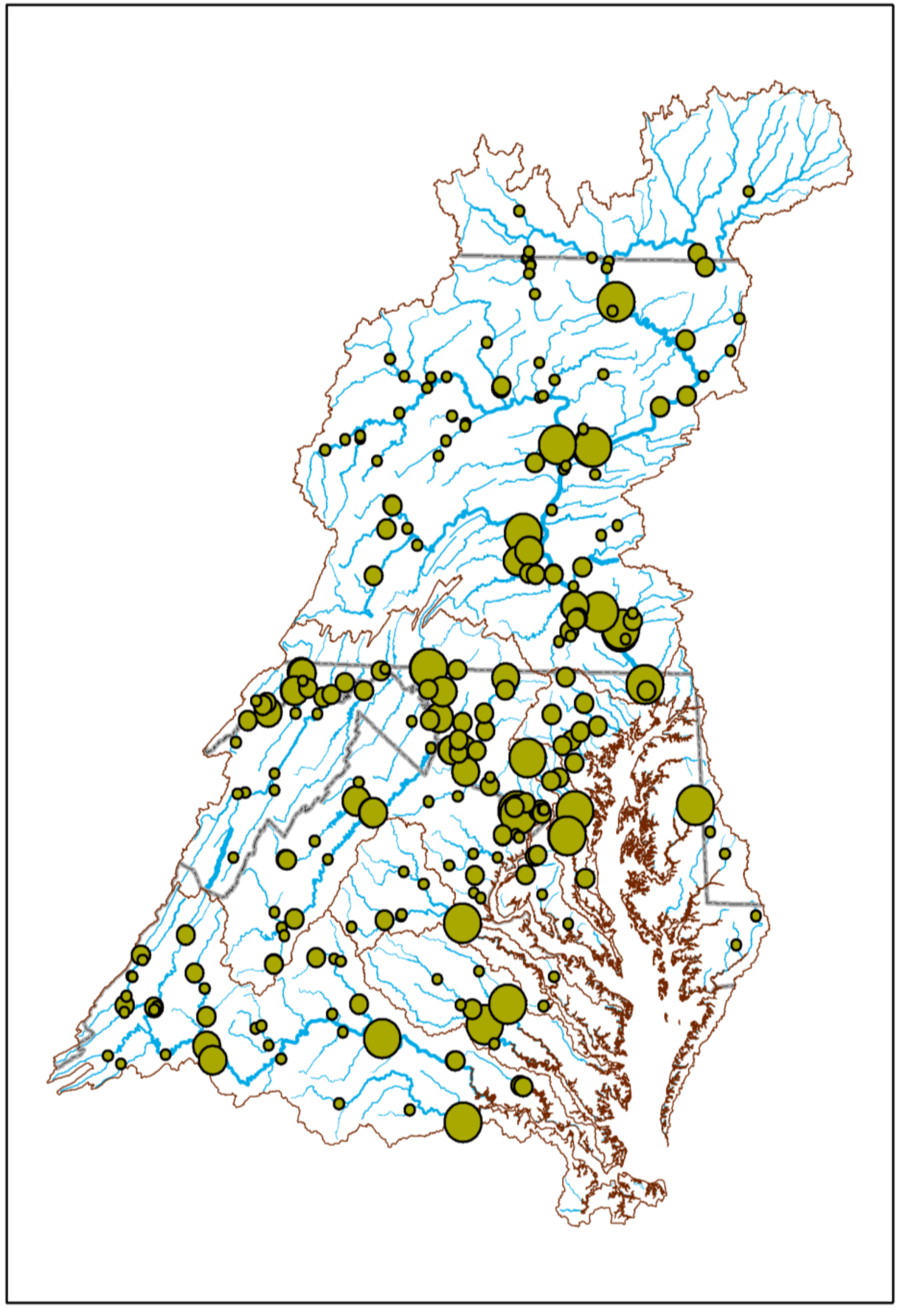
Advanced Grey Infrastructure Nutrient Discovery Program	Dry Waste Storage Structure RI	Headwater Wetland Gains - Reestablished	Nutrient Management P Placement	Stream Restoration Urban	Waste Treatment - Dairy	Cover Crop Traditional - FED	Cover Crop Traditional - NutRND
Ag Shoreline Management	Dry Well	Headwater Wetland Restoration	Nutrient Management P Rate	Streambank and Shoreline Protection	Waste Treatment - Horse	Cover Crop Traditional - FEO	Cover Crop Traditional - NutRNO
Ag Shoreline Non-Vegetated	Erosion & Sediment Control	High Residue Tillage Management	Nutrient Management P Timing	Streambank Restoration	Waste Treatment - Layer	Cover Crop Traditional - FPEA	Cover Crop Traditional - NutTED
Ag Shoreline Vegetated	Erosion and Sediment Control Level 1	Horse Pasture Management	Pasture and Hay Planting	Streambank Stabilization	Waste Treatment - Other Cattle	Cover Crop Traditional - FPED	Cover Crop Traditional - NutTEO
Alternative Crop/Switchgrass RI	Erosion and Sediment Control Level 2	Hydrodynamic Structures	Permanent wildlife habitat, non-easement	Street Cleaning Practice 1	Waste Treatment - Poultry	Cover Crop Traditional - FPEO	Cover Crop Traditional - NutTLD
Alternative Crops	Erosion and Sediment Control Level 3	IFAS	Permeable Pavement - NoSVNoUDAB	Street Cleaning Practice 2	Waste Treatment - Pullet	Cover Crop Traditional - FPND	Cover Crop Traditional - NutTLO
Alternative Water System	Establishment of permanent introduced grasses and legumes	IFAS Elevated Mound	Permeable Pavement - NoSVUDAB	Street Cleaning Practice 3	Waste Treatment - Swine	Cover Crop Traditional - FPNO	Cover Crop Traditional - NutTND
Amendments for the Treatment of Agricultural Waste	Exclusion Fence with Forest Buffer	IFAS Shallow Pressure	Permeable Pavement - NoSVUDCD	Street Cleaning Practice 4	Waste Treatment - Turkey	Cover Crop Traditional - LEA	Cover Crop Traditional - NutTNO
Animal Compost Structure RI	Exclusion Fence with Forest Buffer RI	IMF	Permeable Pavement - SVNoUDAB	Street Cleaning Practice 5	Waste Treatment Lagoon	Cover Crop Traditional - LED	Cover Crop Traditional - NutWED
Animal Mortality Facility	Exclusion Fence with Grass Buffer	IMF Elevated Mound	Permeable Pavement - SVUDAB	Street Cleaning Practice 6	Wastewater Treatment Strip	Cover Crop Traditional - LEO	Cover Crop Traditional - NutWEO
Animal Trails and Walkways	Exclusion Fence with Grass Buffer RI	IMF Shallow Pressure	Permeable Pavement - SVUDCD	Street Cleaning Practice 7	Water Control Structure	Cover Crop Traditional - LGHEA	Cover Crop Traditional - NutWLD
Animal Waste Management Systems (All Types)	Exclusion Fence with Narrow Forest Buffer	Impervious Disconnection	Prescribed Grazing	Street Cleaning Practice 8	Water Control Structure RI	Cover Crop Traditional - LGHED	Cover Crop Traditional - NutWLO
Barnyard Clean Water Diversion RI	Exclusion Fence with Narrow Forest Buffer RI	Infiltration Basin	Proprietary Ex Situ	Street Cleaning Practice 9	Watering Facility	Cover Crop Traditional - LGHEO	Cover Crop Traditional - NutWND
Barnyard Runoff Controls	Exclusion Fence with Narrow Grass Buffer	Infiltration Practices	Proprietary Ex Situ Elevated Mound	Street Cleaning Practice 10	Watering Trough RI	Cover Crop Traditional - LGHND	Cover Crop Traditional - NutWNO
Biofiltration	Exclusion Fence with Narrow Grass Buffer RI	Infiltration Trench	Proprietary Ex Situ Shallow Pressure	Street Cleaning Practice 11	Wet Extended Detention	Cover Crop Traditional - LGHNO	Cover Crop Traditional - OHEA
Bioretention - A/B soils, no underdrain	Extension of CREP Watering System	Land Reclamation, Abandoned Mined Land	Rain Garden	Street Sweeping	Wet Pond	Cover Crop Traditional - LGLEA	Cover Crop Traditional - OHED
Bioretention - C/D soils, underdrain	Feed Management	Land Retirement to Mixed Open	Reduced Tillage	Structure for Water Control	Wet Ponds & Wetlands	Cover Crop Traditional - LGLED	Cover Crop Traditional - OHEO
Bioswale	Field Border	Land Retirement to Pasture	Reduction of Impervious Surface	Surface Sand Filter	Wet Swale	Cover Crop Traditional - LGLEO	Cover Crop Traditional - OHND
Channel Bed Stabilization	Filter Strip	Loafing Lot Management System	Reforestation of Erodible Crop and Pastureland	Tidal Algal Flow-way	Wetland Creation	Cover Crop Traditional - LGLND	Cover Crop Traditional - OHNO
Cisterns & Rain Barrels	Filtering Practices	Manure Incorporation High Disturbance	Regenerative Stormwater Conveyance	Tree Planting	Wetland Functional Gains - Enhanced	Cover Crop Traditional - LGLNO	Cover Crop Traditional - OKEA
Composter Facilities	Filtration	Manure Incorporation High Disturbance Immediate	Retirement of Highly Erodible Land	Tree/Shrub Establishment	Wetland Gains - Established	Cover Crop Traditional - LND	Cover Crop Traditional - OKED
Conservation Cover	Floating Treatment Wetland 1	Manure Incorporation High Disturbance Late	Retrofit Runoff Reduction	Underground Infiltration System	Wetland Gains - Reestablished	Cover Crop Traditional - LNO	Cover Crop Traditional - OKEO
Conservation Plans	Floating Treatment Wetland 2	Manure Incorporation Low Disturbance	Retrofit Stormwater Treatment	Urban Filter Strip Runoff Reduction	Wetland Rehabilitation	Cover Crop Traditional - NutARED	Cover Crop Traditional - REA
Conservation Tillage	Floating Treatment Wetland 3	Manure Incorporation Low Disturbance Immediate	Ridge Tillage	Urban Filter Strip Stormwater Treatment	Wetland Restoration	Cover Crop Traditional - NutAREO	Cover Crop Traditional - RED
Constructed Wetland	Floating Treatment Wetland 4	Manure Incorporation Low Disturbance Late	Riparian Forest Buffer	Urban Forest Buffer	Windbreak/Shelterbelt Establishment	Cover Crop Traditional - NutARND	Cover Crop Traditional - REO
Constructed Wetland Elevated Mound	Floating Treatment Wetland 5	Manure Injection	Riparian Herbaceous Cover	Urban Forest Planting	Woodland Buffer Filter Area	Cover Crop Traditional - NutARNO	Cover Crop Traditional - RLD
Constructed Wetland Septic	Forest Buffer on Watercourse RI	Manure Transport	RMF	Urban Infiltration Practices	Commodity Cover Crop - Early	Cover Crop Traditional - NutBED	Cover Crop Traditional - RLO
Constructed Wetland Shallow Pressure	Forest Buffers	Monitored Non-Tidal Algal Flow-way	RMF Elevated Mound	Urban Nutrient Management Plan	Commodity Cover Crop - Standard	Cover Crop Traditional - NutBEO	Cover Crop Traditional - RND
Conversion to Hayland RI	Forest Conservation	Monitored Tidal Algal Flow-way	RMF Shallow Pressure	Urban Nutrient Management Plan - MDCA	Cover Crops	Cover Crop Traditional - NutBND	Cover Crop Traditional - RNO
Conversion to Pasture RI	Forest Harvesting Practices	Mulch Tillage	Roof runoff management	Urban Nutrient Management Plan - MDDIY	CoverCropComLate	Cover Crop Traditional - NutBNO	Cover Crop Traditional - TEA
CREP Riparian Forest Buffer	Forest Nutrient Exclusion Area on Watercourse Narrow RI	Narrow Forest Buffers	Roof Runoff Structure	Urban Nutrient Management Plan - PlanHR	Cover Crop Traditional - AREA	Cover Crop Traditional - NutBRED	Cover Crop Traditional - TED
CREP Wetland Restoration	Forest Stand Improvement	Narrow Urban Forest Buffer	Rotational Grazing RI	Urban Nutrient Management Plan - PlanLR	Cover Crop Traditional - ARED	Cover Crop Traditional - NutBREO	Cover Crop Traditional - TEO
CREP Wildlife Habitat	Grass Buffer on Watercourse RI	New Runoff Reduction	SCWQP	Urban Shoreline Management	Cover Crop Traditional - AREO	Cover Crop Traditional - NutFPED	Cover Crop Traditional - TLD
Critical Area Planting	Grass Buffer Strip	New Stormwater Treatment	Septic Connections	Urban Shoreline Non-Vegetated	Cover Crop Traditional - ARND	Cover Crop Traditional - NutFPEO	Cover Crop Traditional - TLO
D&G Road - E&S Control and Outlets	Grass Buffers	No Tillage	Septic Denitrification	Urban Shoreline Vegetated	Cover Crop Traditional - ARNO	Cover Crop Traditional - NutFPND	Cover Crop Traditional - TND
D&G Road - Outlets Only	Grass Filter Strips	Non-Tidal Algal Flow-way	Septic Effluent Elevated Mound	Urban stream restoration	Cover Crop Traditional - BEA	Cover Crop Traditional - NutFPNO	Cover Crop Traditional - TNO
D&G Road - Surface Aggragate and Rasied Roadbed	Grass Nutrient Exclusion Area on Watercourse Narrow RI	NSF 40	Septic Effluent Shallow Pressure	Vegetated Open Channels	Cover Crop Traditional - BED	Cover Crop Traditional - NutOHED	Cover Crop Traditional - WEA
Dead Bird Composting Facility	Grassed Waterway	NSF 40 Elevated Mound	Septic Tank Advanced Treatment	Vegetated Treatment Area	Cover Crop Traditional - BEO	Cover Crop Traditional - NutOHEO	Cover Crop Traditional - WED
Default - Bioretention - A/B soils, underdrain	Grazing Land Protection	NSF 40 Shallow Pressure	Septic Tank Pumpout	Waste Control Facilities	Cover Crop Traditional - BND	Cover Crop Traditional - NutOHND	Cover Crop Traditional - WEO
Disconnection of Rooftop Runoff	Green Roofs	Nutrient Management Core N	Solid/Liquid Waste Separation Facility	Waste Storage Facility	Cover Crop Traditional - BNO	Cover Crop Traditional - NutOHNO	Cover Crop Traditional - WLD
Dry Detention Ponds	Hardwood tree planting	Nutrient Management Core P	Storm Drain Cleaning	Waste Storage Pond	Cover Crop Traditional - BREA	Cover Crop Traditional - NutRED	Cover Crop Traditional - WLO
Dry Detention Ponds & Hydrodynamic Structures	Headwater CREP Wetland Restoration	Nutrient Management N Placement	Stream Channel Stabilization	Waste Storage Structure	Cover Crop Traditional - BRED	Cover Crop Traditional - NutREO	Cover Crop Traditional - WND
Dry Extended Detention Ponds	Headwater Wetland Creation	Nutrient Management N Rate	Stream Improvement for Fish Habitat	Waste Treatment - Beef	Cover Crop Traditional - BREO	Cover Crop Traditional - NutRLD	Cover Crop Traditional - WNO
Dry Swale	Headwater Wetland Gains - Established	Nutrient Management N Timing	Stream Restoration Ag	Waste Treatment - Broiler	Cover Crop Traditional - FEA	Cover Crop Traditional - NutRLO	

Local Agricultural and Municipality Data

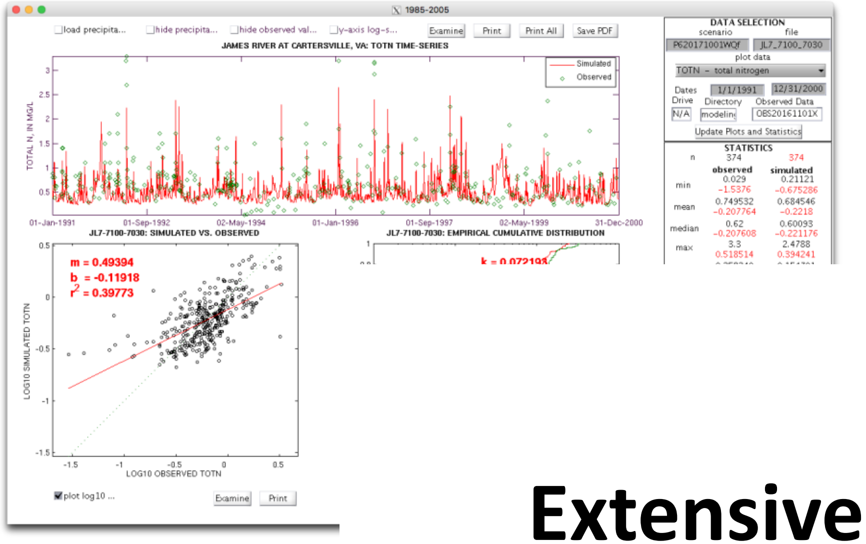
- Municipal Separate Storm Sewer Systems
- Combined Sewer Systems
- Sewer Service Areas
- Land Cover
- Land Use
- Parcels
- Roads
- Beaches
- Institutional lands
- Federal lands
- Golf courses
- Surface mines
- Landfills
- Protected lands
- Streams
- Wetlands
- Tidal zones
- Floodplains
- Frequently flooded soils
- Livestock populations
- Poultry populations
- Crop, hay and pasture acreages
- Crop yields
- Soil P concentrations
- BMPs

Our Models are Tested using Decades of Monitoring Data

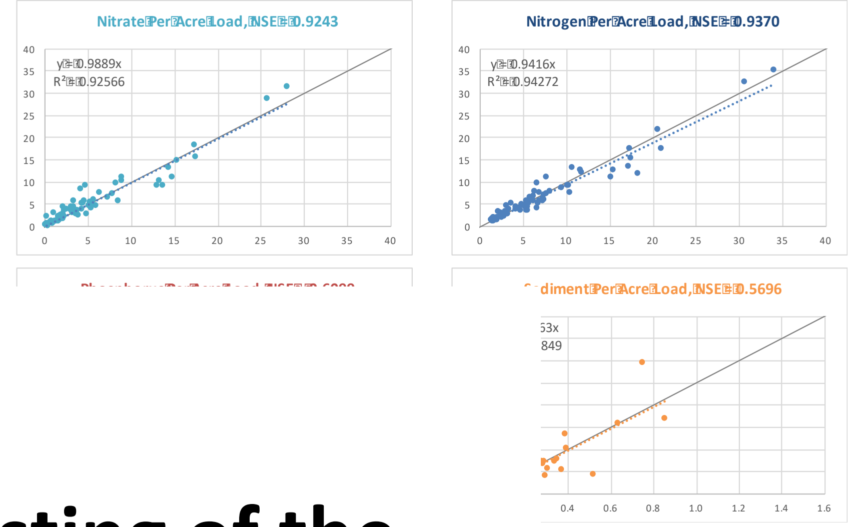
- Hundreds of thousands of water quality monitoring data points
- Hundreds of monitoring stations
- Nitrogen, phosphorus, and sediment
- Data records lasting up to 3 decades



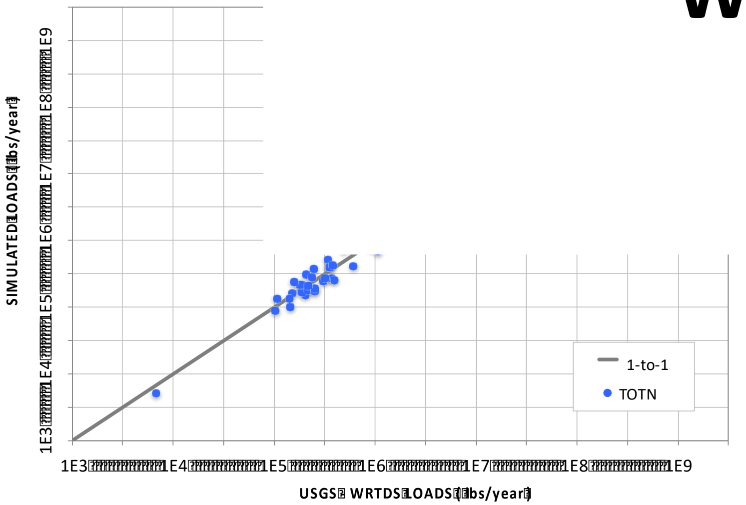
Extensive Testing of the Models Throughout the Watershed



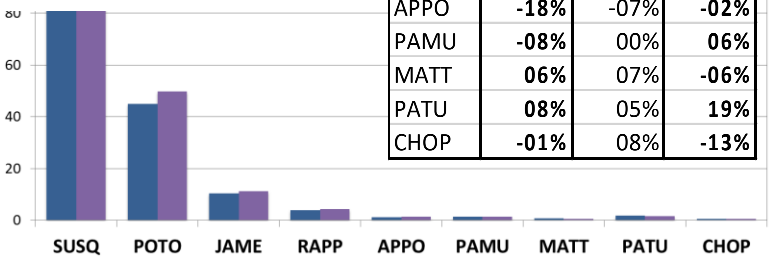
[1] Model calibration is mad



Geographic Efficiencies



[3] Simulated vs. WRTDS loads

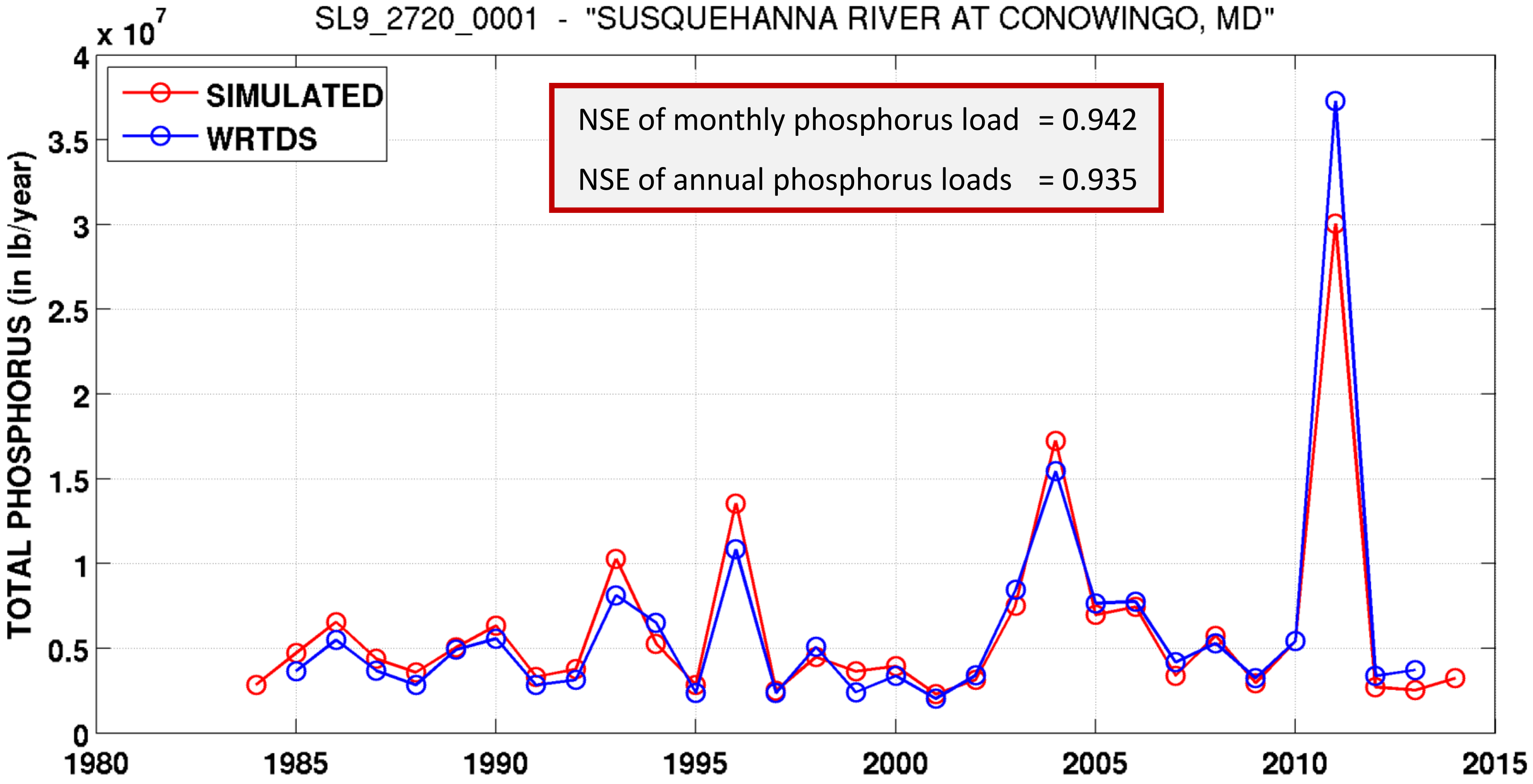


BASIN	Sept	June	Phase 5
SUSQ	-01%	-03%	-01%
POTO	-09%	-09%	-22%
JAME	-09%	-02%	-07%
RAPP	-11%	-07%	-10%
APPO	-18%	-07%	-02%
PAMU	-08%	00%	06%
MATT	06%	07%	-06%
PATU	08%	05%	19%
CHOP	-01%	08%	-13%

[4] Agreement between the simulated and WRTDS loads at the RIM sites

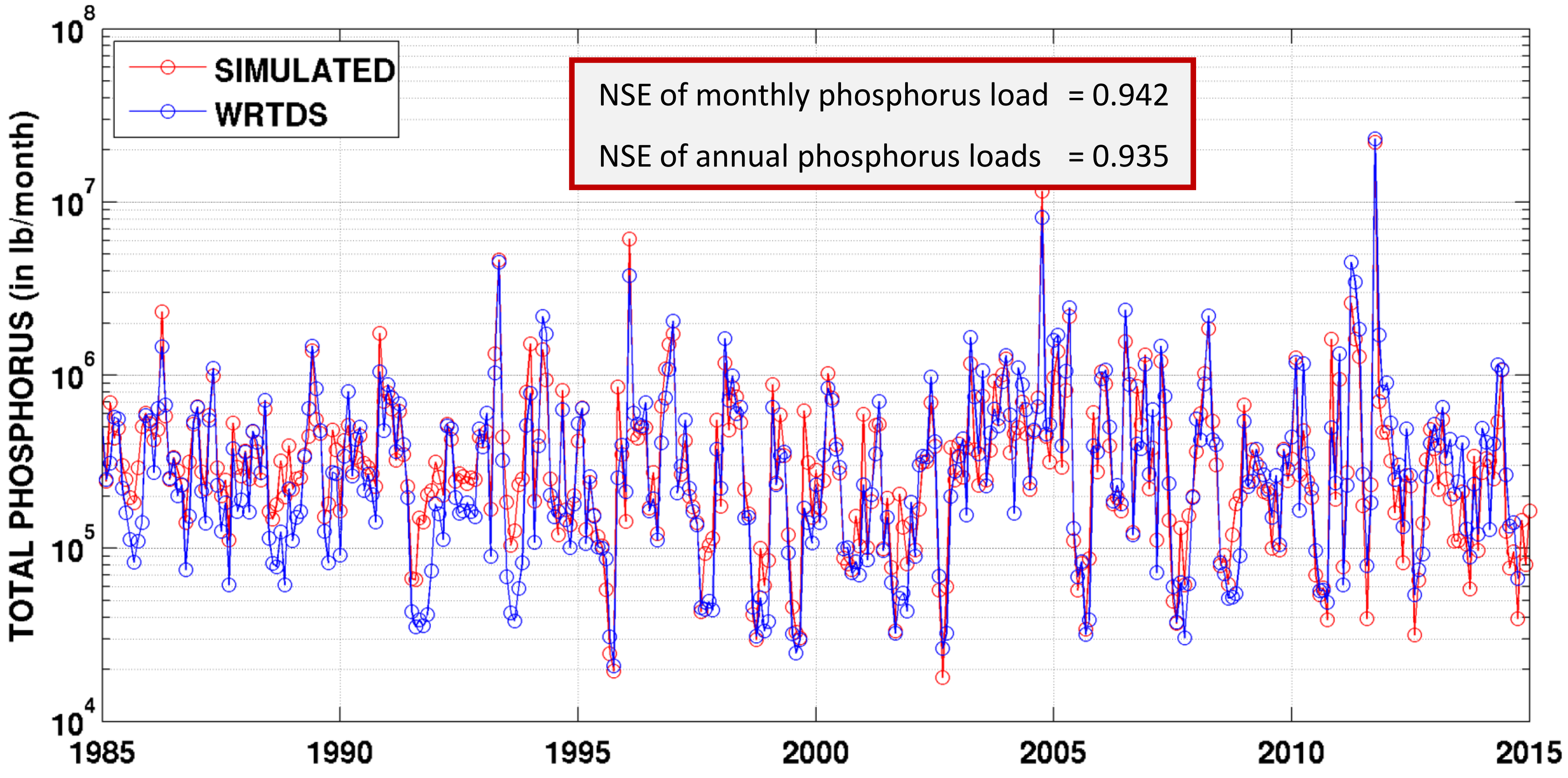
Best Match with Monitoring Data Ever!

Conowingo Phase 6 Simulation Compared to Annual WRTDS Loads



Best Match with Monitoring Data Ever!

Conowingo Phase 6 Simulation Compared to Monthly WRTDS Loads



Tomorrow's Requested WQGIT Policy Recommendation

Adoption of the Partnership's Phase 6 suite of modeling tools for management application in the development and implementation of each jurisdiction's Phase III WIPs and two-year milestones through 2025

New Phase 6 Results Informing Planning Target Development

Gary Shenk, USGS, CBP Phase 6 Watershed Model Coordinator

Three Partnership Principals

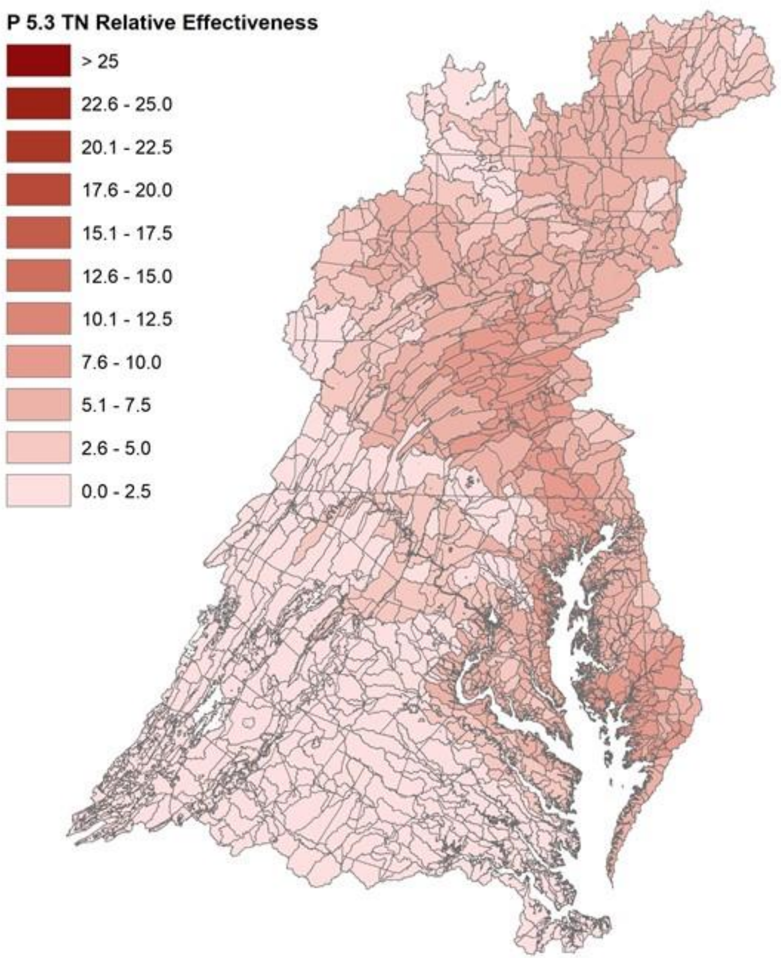
- Allocated loads must result in achievement of the states' Bay water quality standards

- Major river basins that contribute the most to Bay water quality problems must do the most to resolve those problems

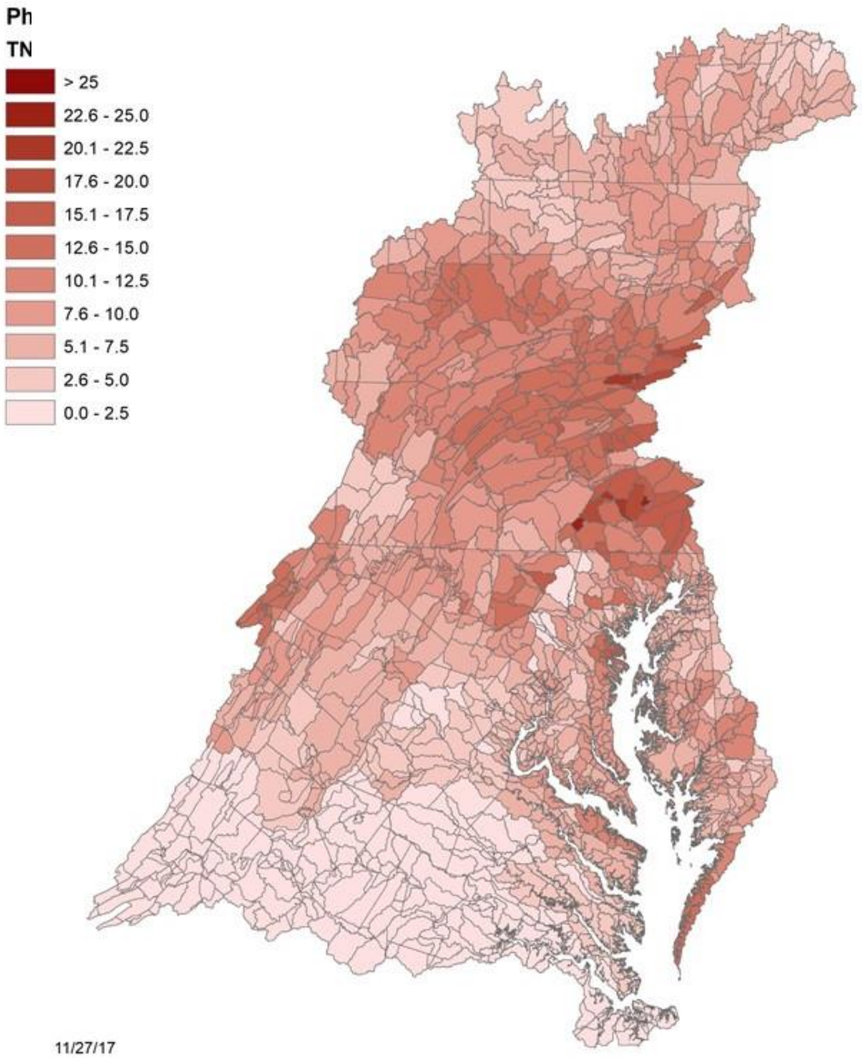
- All tracked and reported reductions in loads are credited toward achieving assigned loads

More Impact, Do More

Ph5 Nitrogen

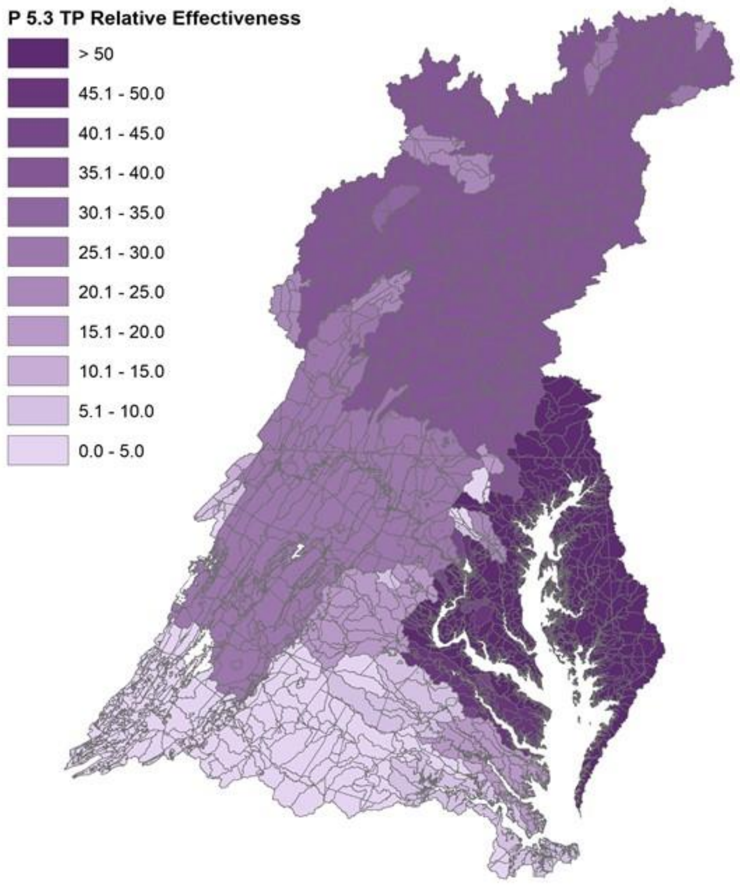


Ph6 Nitrogen

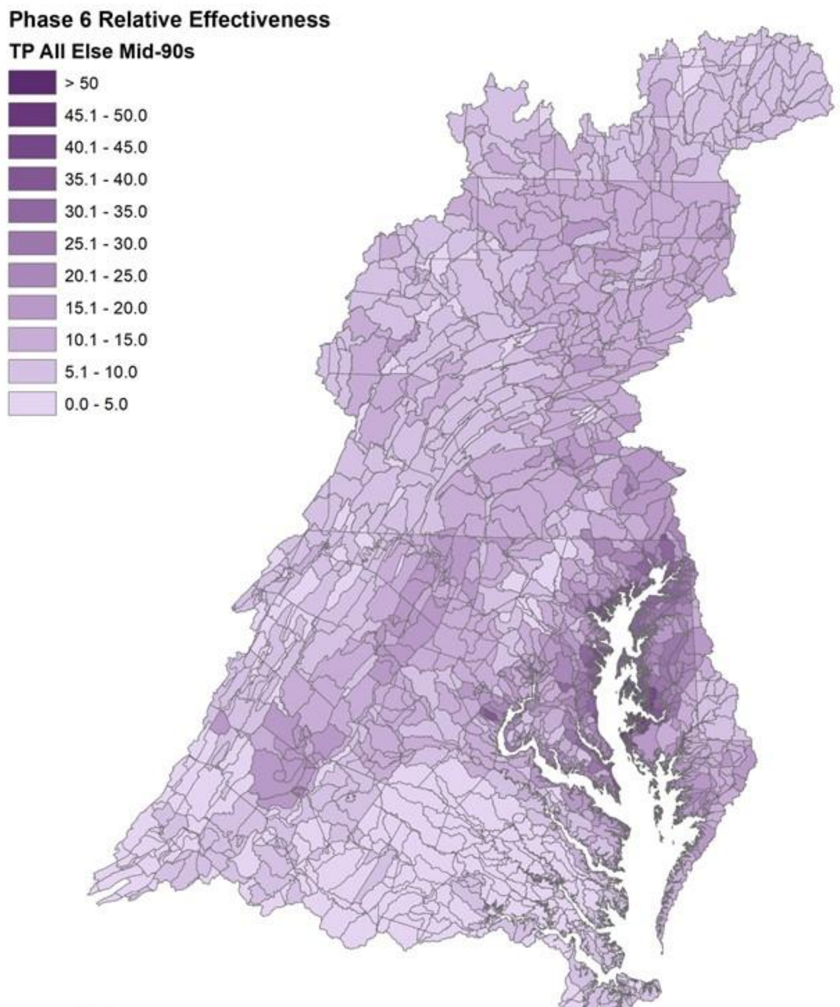


More Impact, Do More

Ph5 Phosphorus



Ph6 Phosphorus



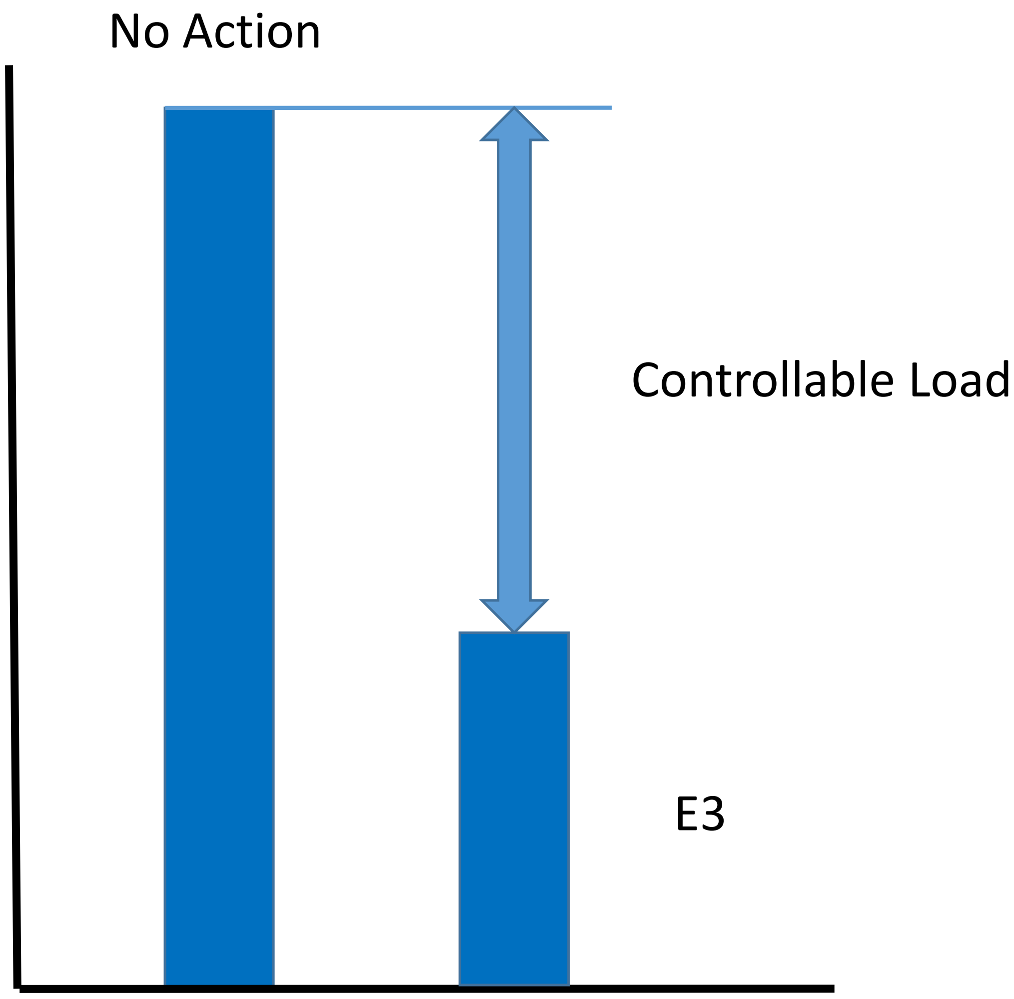
Defining the Controllable Load

No Action:

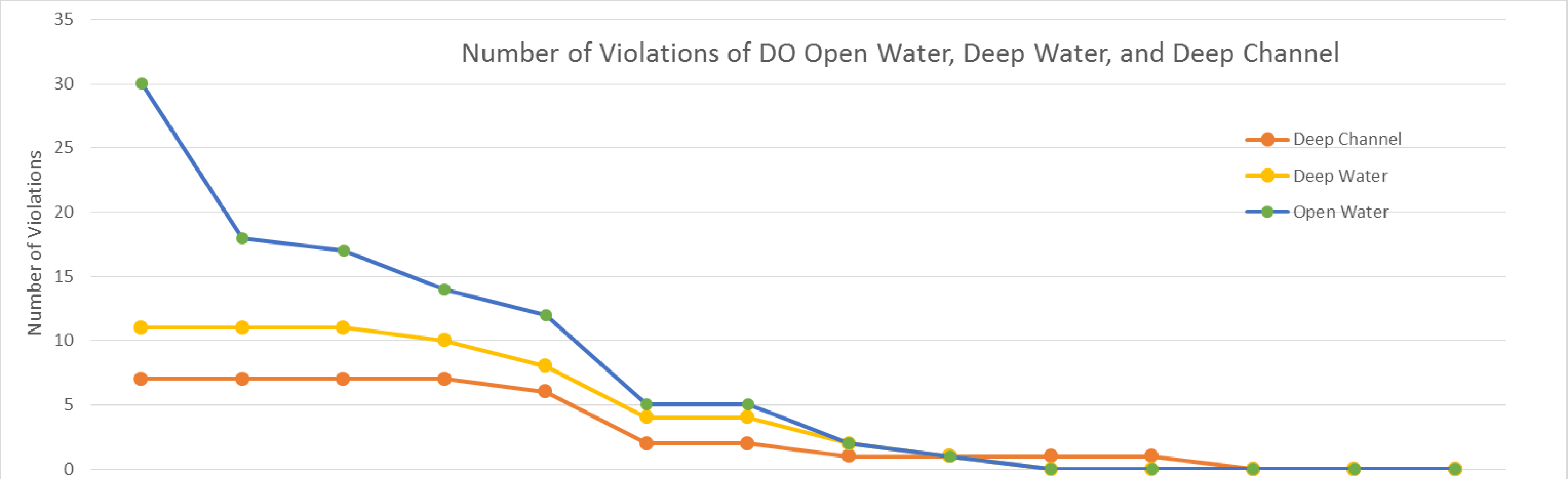
- Watershed conditions with minimal to no controls on load,
- Wastewater at primary treatment

E3 or "Everything by Everyone, Everywhere":

- Watershed conditions with maximum controls on loads, regardless of cost
- Wastewater at high level of nutrient control
  - 3mg/l TN,   0.1 mg/l TP



Determining the Bay's Ability to Absorb Pollutants



No Action	1985 Progress	1990 Progress	1993 Progress	2000 Progress	2010 Progress	2013 Progress	WIP+18%TN & +12%TP	WIP+6%TN & +4%TP	WIP2	WIP-6%TN & -8%TP	WIP-11%TN & -16%TP	E3	All Forest
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

Allowing for Special Cases

- Previously agreed to consider special cases put forth by jurisdictions
- Consideration of special cases factored into four-month review process
- CBPO will provide support to jurisdictions considering special cases
- Final decisions on allowance of special cases will be made by the PSC in April 2018

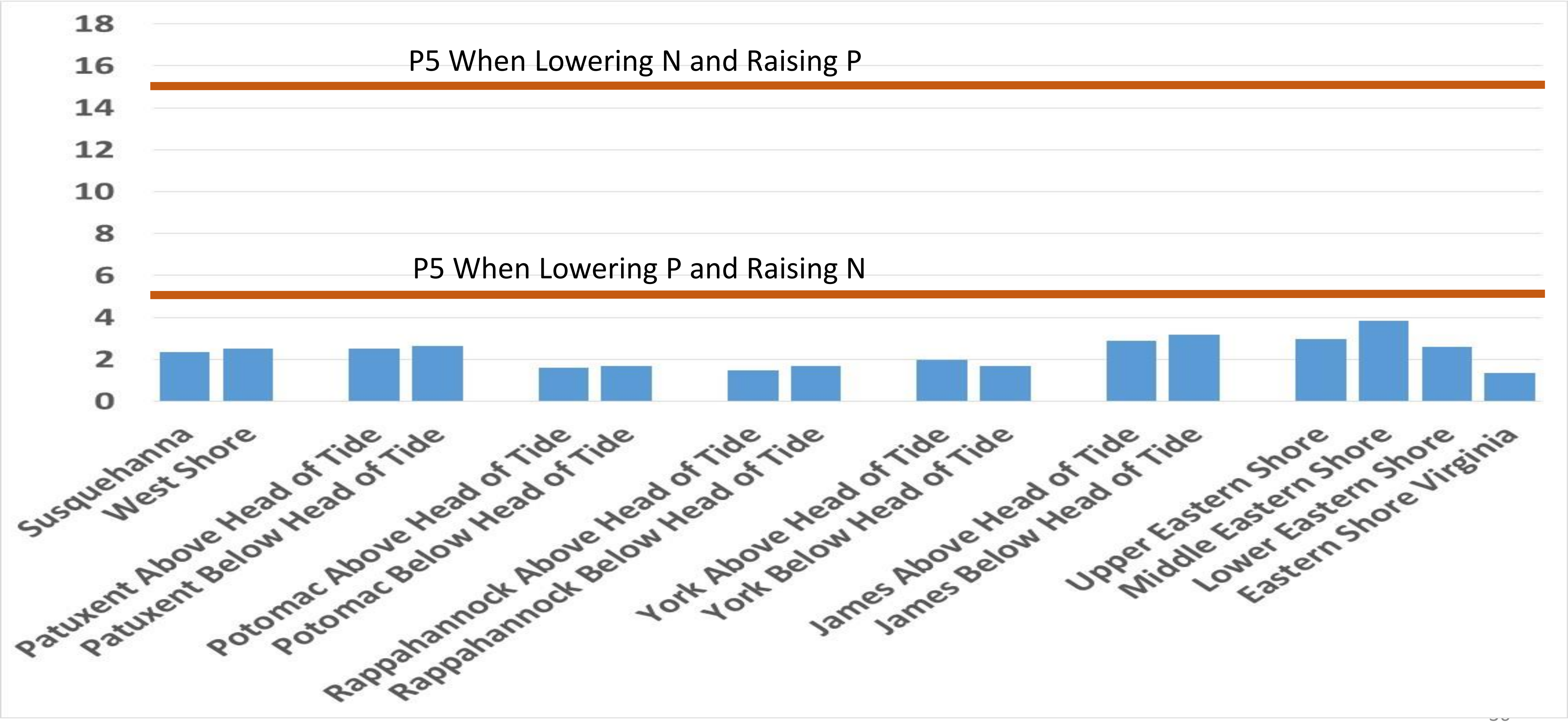
Nitrogen and Phosphorus Exchanges

- Science supports exchanges in nitrogen and phosphorus load reductions

- Better science has resulted in changes to our existing exchange ratios
  - Better simulation of observed nutrient limitation in the Bay
  - Inclusion of new P sources from Conowingo and Shoreline makes each pound of P less important

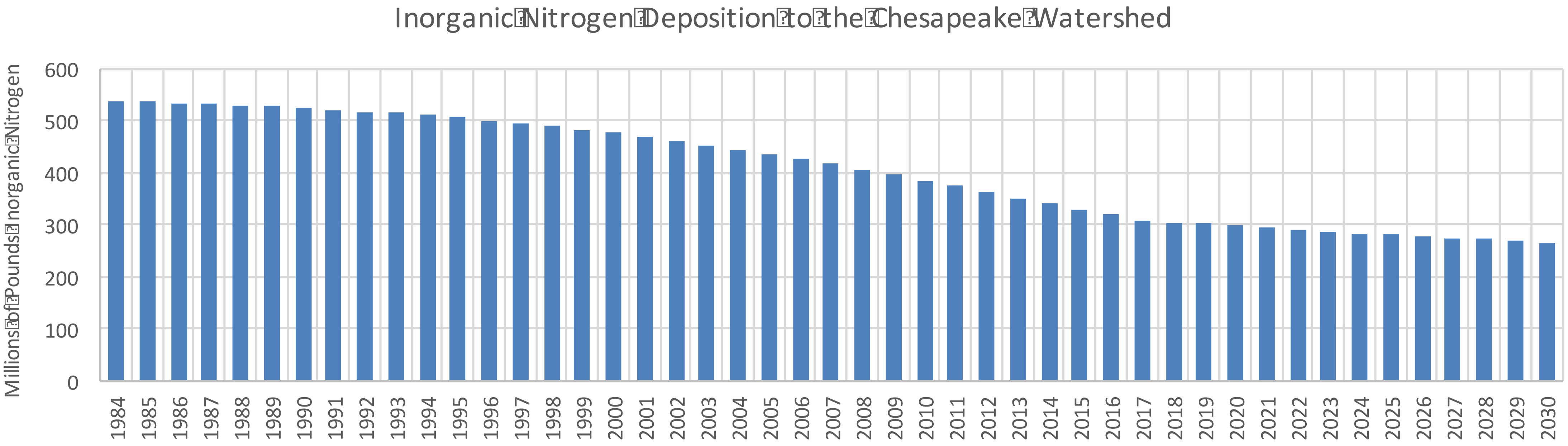
	Phase 5	Phase 6
Nitrogen for Phosphorus:	5	1.34 – 3.84
Phosphorus for Nitrogen:	0.067	0.26 – 0.75

Nitrogen and Phosphorus Exchanges



Accounting for Nitrogen Air Deposition to Bay Watershed

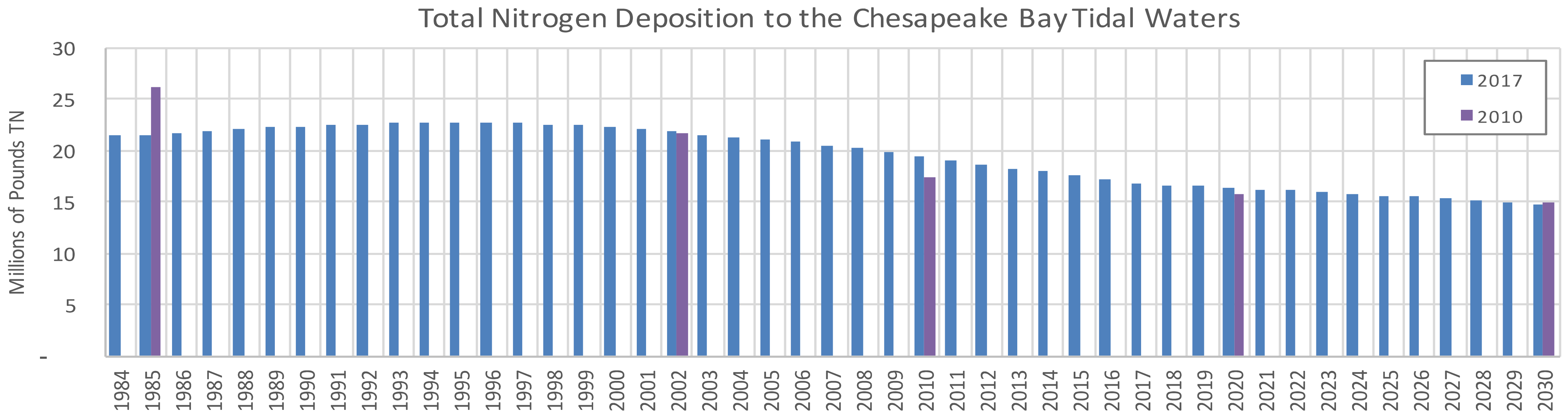
- Updated estimated benefits to Bay and watershed from clear air actions.
- From 1985 through 2025, the jurisdictions will receive an estimated 254 million lbs. less nitrogen on their lands and rivers.



Accounting for Nitrogen Air Deposition to Bay Tidal Waters

- From 1985 through 2025, loads will be reduced from 21.5 to 15.6 million lbs.

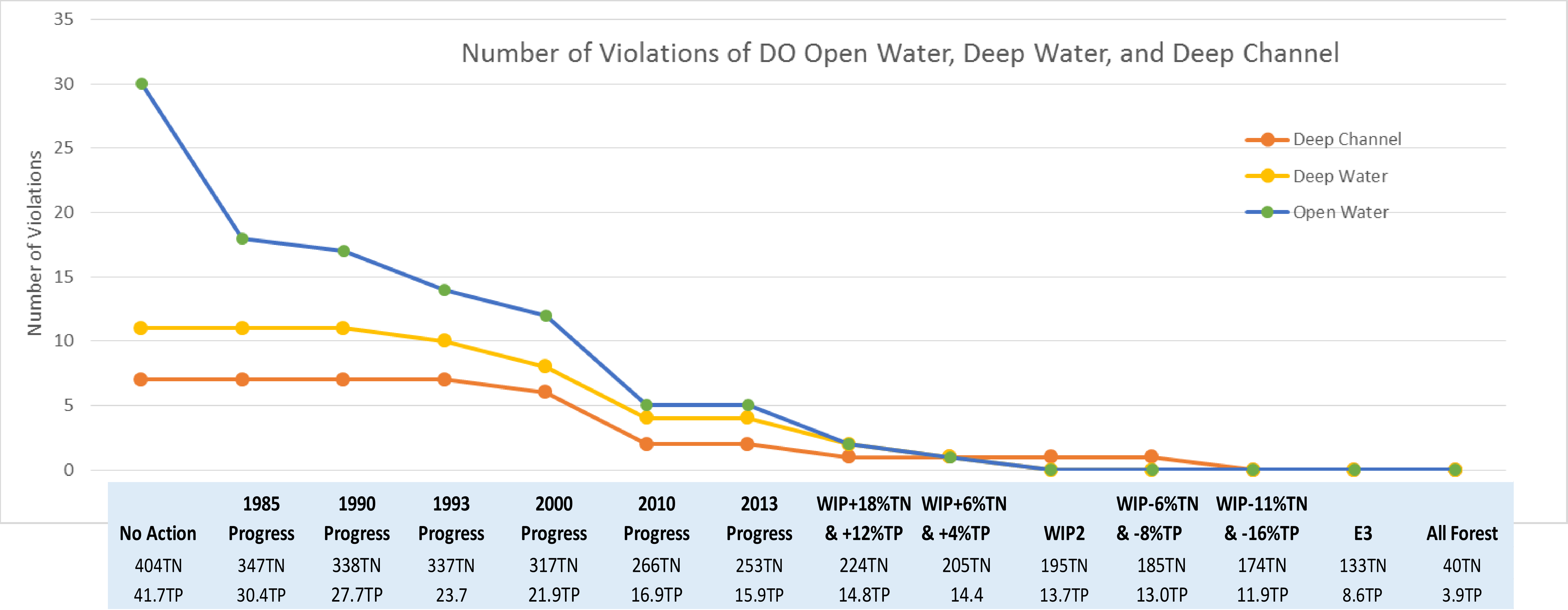
- By 2030, load drops to 14.9 millions lbs., 0.8 million pounds below EPA's Bay TMDL allocation (15.7 million lbs.)



Determining the Bay's Ability to Absorb Pollutants (Assimilative Capacity)

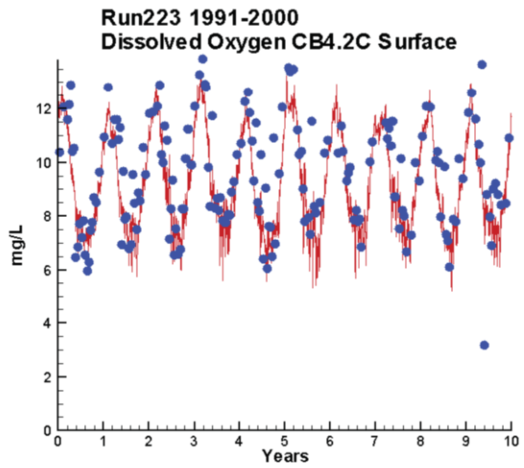
Dave Montali, WV, CBP Modeling Workgroup Co-Chair
and
Rich Batiuk, U.S. EPA CBPO Associate Director for Science, Analysis and Implementation

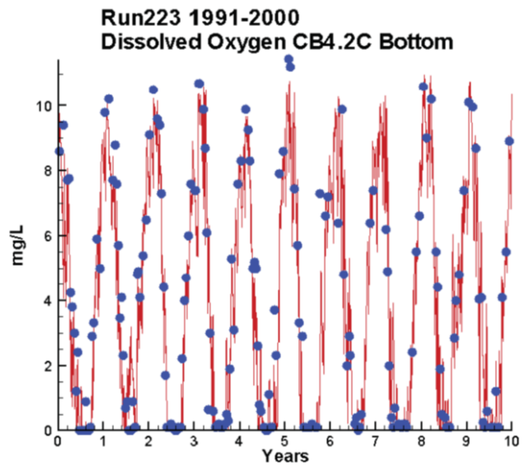
Here's Where We Want to Get to

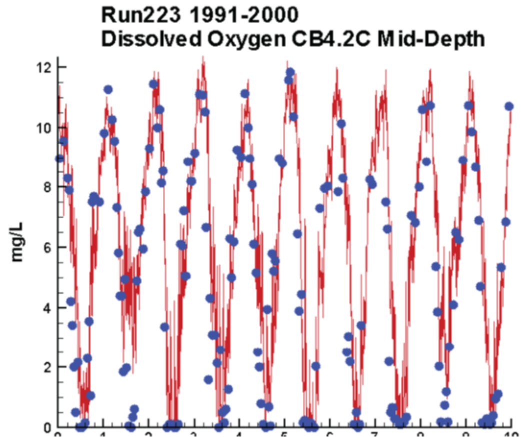


What’s Changed and the Implications

An improved Water Quality and Sediment Transport Model (WQSTM) is providing a better simulation of dissolved oxygen in the tidal Bay affording higher confidence in implementation planning for 2025.





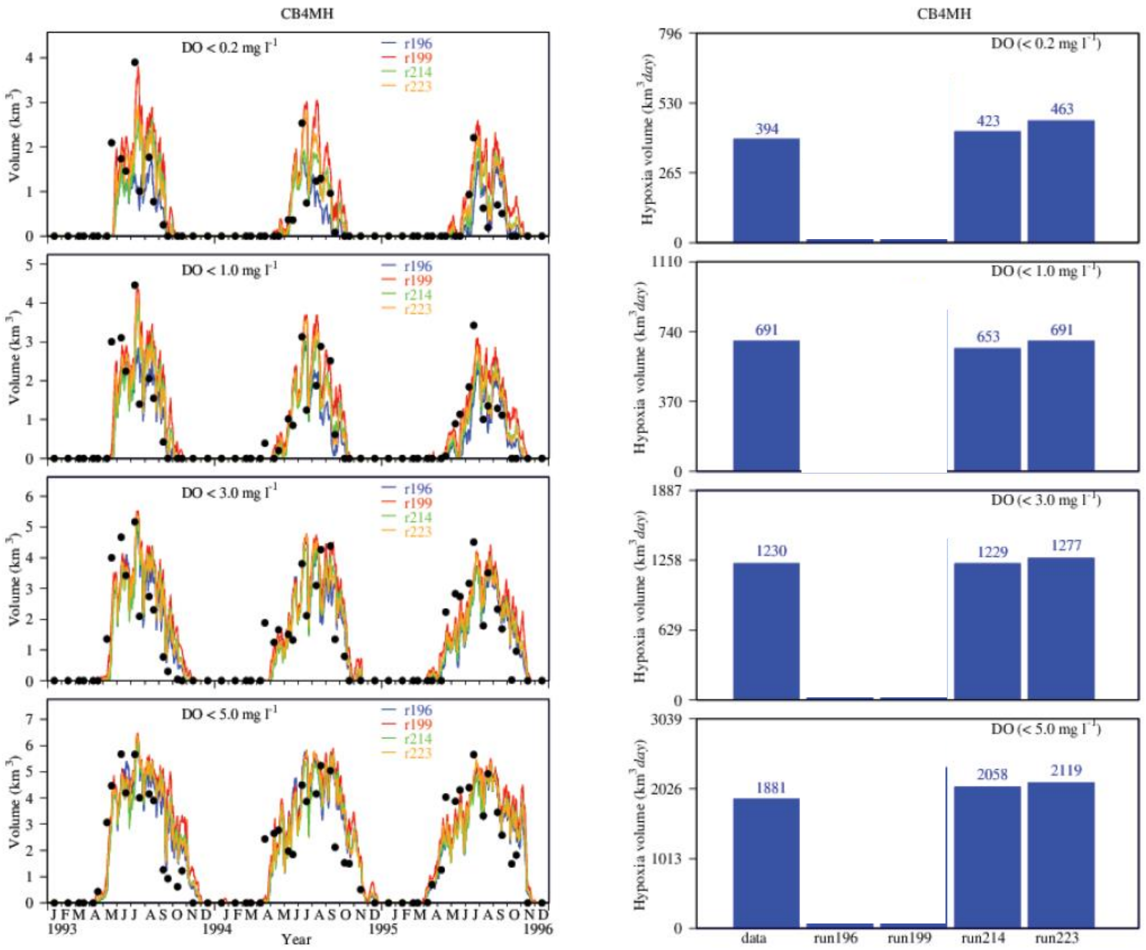


	Mean Difference	Absolute Mean Differen
Top DO	-0.5205	0.9002
Mid DO	1.0038	1.4866
Bot DO	-0.4165	0.9393

Good simulation of DO concentrations of Open Water, Deep Water, and Deep Channel (CB4 shown here)

What's Changed and the Implications

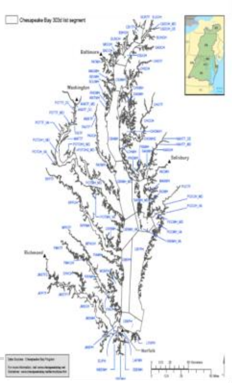
An improved Water Quality and Sediment Transport Model (WQSTM) is providing a better simulation of dissolved oxygen in the tidal Bay affording higher confidence in implementation planning for 2025.

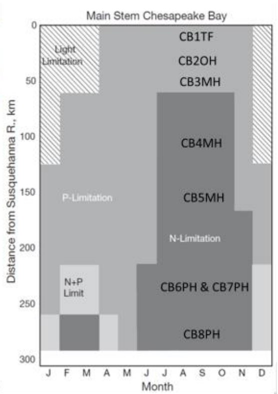


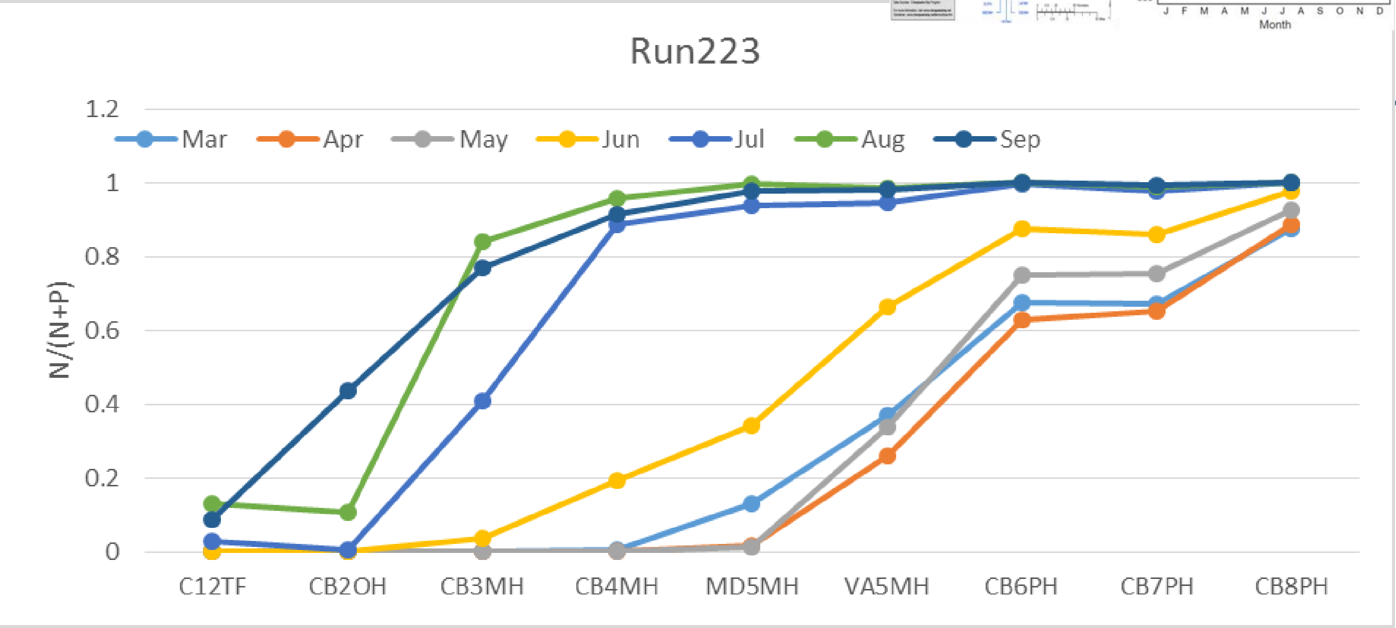
High fidelity of the model representation of hypoxia to observations (CB4 shown here)

What’s Changed and the Implications

An improved Water Quality and Sediment Transport Model (WQSTM) is providing a better simulation of dissolved oxygen in the tidal Bay affording higher confidence in implementation planning for 2025.



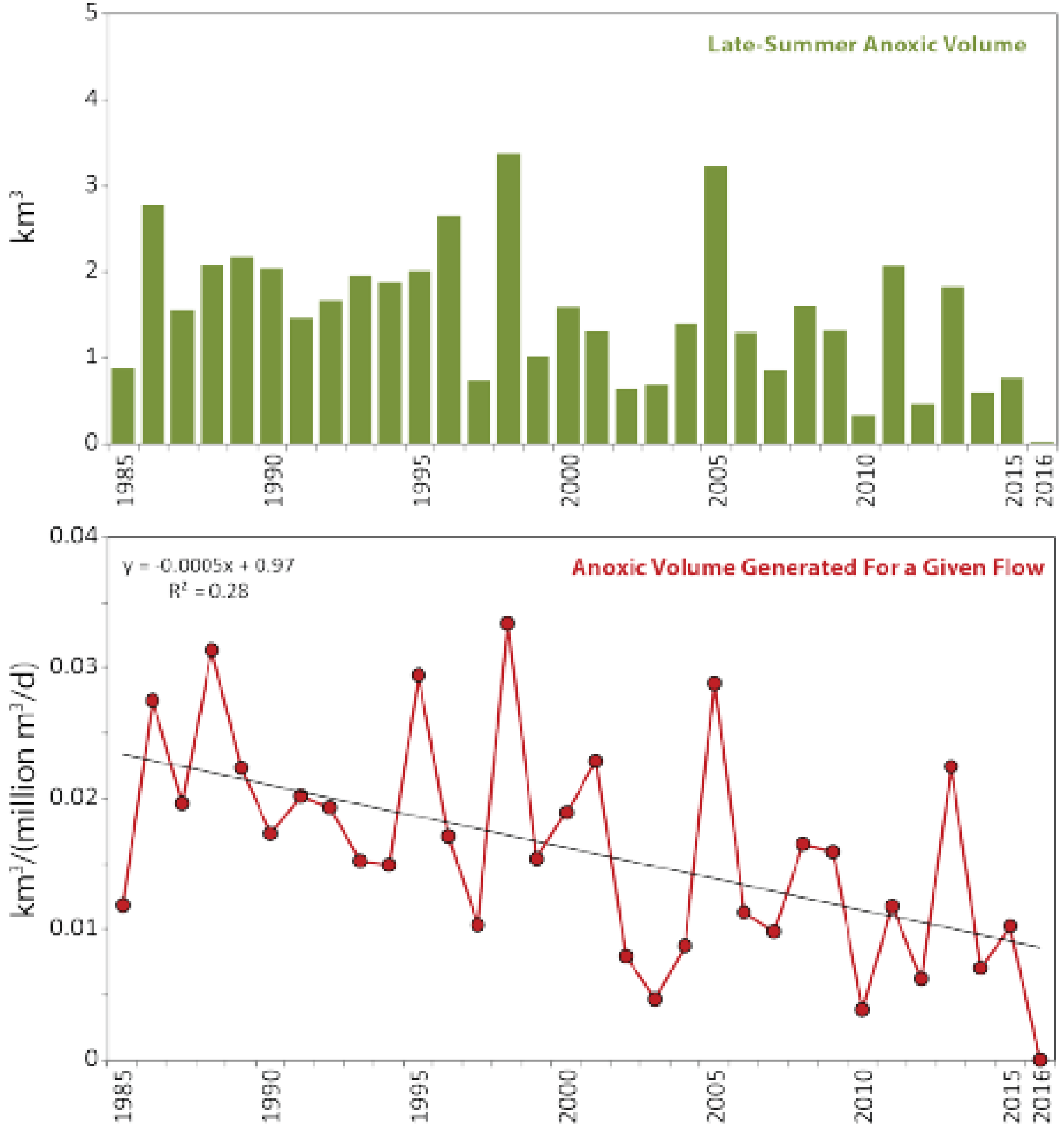




Simulated nutrient limitation throughout the Bay is better than in any previous model

What’s Changed and the Implications

The Chesapeake Bay’s summertime dead zone is decreasing in size!



Source: Testa et al. 2017

What Hasn't Changed

Delaware, District of Columbia, Maryland and Virginia's Chesapeake Bay water quality standards regulations have <u>not</u> changed since 2012

- Five tidal habitat-based designated uses
- Dissolved oxygen, SAV, water clarity and chlorophyll *a* criteria to protect those uses
- Fully consistent criteria attainment assessment procedures
- How we use model output to assess criteria attainment under model-simulated load conditions

Determining the Bay's Assimilative Capacity

- Run a series of scenarios, spanning no action and E3, which assess Bay dissolved oxygen water quality standard attainment at incrementally reduced nitrogen and phosphorus loads

- Apply existing restoration variances

- Apply the 1% rule from the Bay TMDL

- Identify and remove problem segments

Maryland's Restoration Variances

Definition

" 'Restoration variance' means a temporary exception to the water quality standards allowing nonattainment of designated uses granted in situations where no enforcement action will be taken if the nonattainment is due to the existence of one or more of the justifications in 40 CFR §131.10(g). Restoration variances will be reviewed every 3 years at a minimum as required by the Clean Water Act and EPA regulations."

Source: Code of Maryland Title 26 Subtitle 08, Chapter 2, Section 3

Maryland’s Restoration Variances

Definition (Continued)

“The percentage of allowable exceedance for restoration variances is based on water quality modeling and incorporates the best available data and assumptions. The restoration variances are temporary, and will be reviewed at a minimum every three years, as required by the Clean Water Act and EPA regulations. The variances may be modified based on new data or assumptions incorporated into the water quality model.”

Source: Code of Maryland Title 26 Subtitle 08, Chapter 2, Section 3

Maryland's Restoration Variances

Existing Restoration Variances

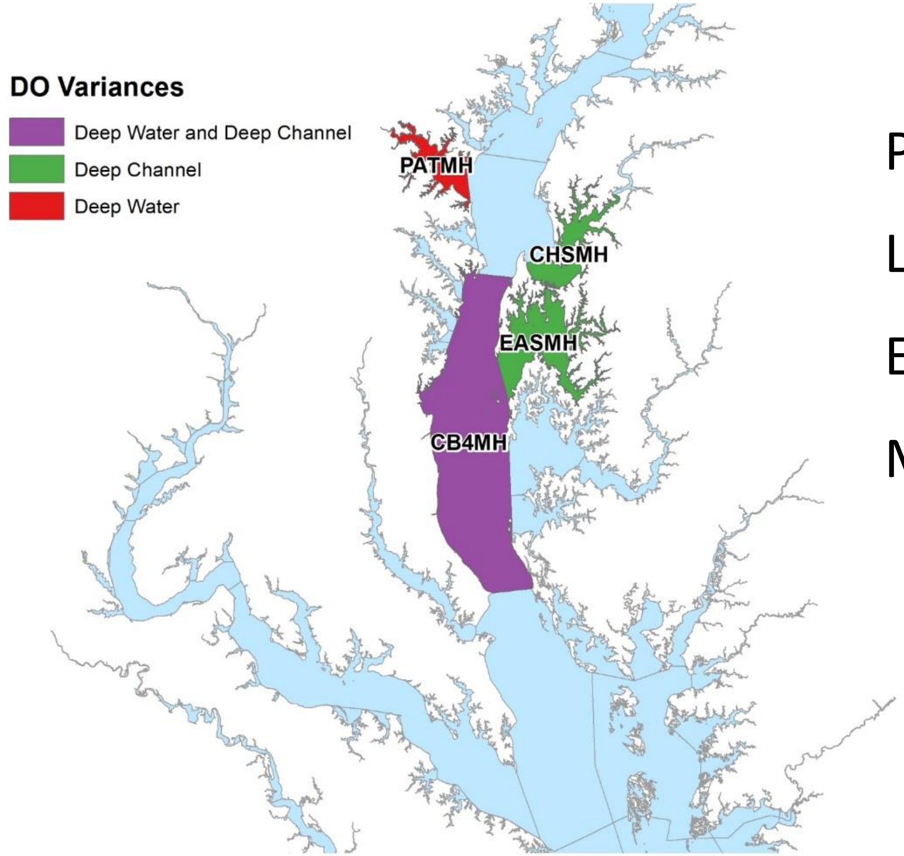
- Middle Ches. Bay Mainstem (CB4MH): 7% for deep-water use[1]
- Middle Ches. Bay Mainstem (CB4MH): 2% for deep-channel use[1]
- Patapsco River (PATMH): 7% for deep-water use[1]
- Lower Chester River (CHSMH): 16% for deep-channel use[2]
- Eastern Bay (EASMH): 2% for deep-channel use[3]

1. Promulgated into MD's WQS regulations in 2010 based on the Chesapeake Bay TMDL allocations.
2. Originally promulgated into MD's WQS regulations in 2010 at 14%, but changed to 16% in 2012 based on the Phase II WIP targets.
3. Promulgated into MD's WQS regulations in 2012 based on the Phase II WIP targets.

Source: Code of Maryland Title 26 Subtitle 08, Chapter 2, Section 3

Maryland's Restoration Variances

Maryland's water quality standards regulations still contain restoration variances agreed to by the Partners/approved by EPA in 2010 and updated in 2012



Patapsco River Deep-water 7%

Lower Chester River Deep-channel 16%

Eastern Bay Deep-channel 2%

Middle Central Chesapeake Bay

- Deep-water 7%
- Deep-channel 2%

Addressing Persistent <1% Non-attainment

- 2010 Bay TMDL addressed a pattern of persistent non-attainment percentages at and less than 1% over large spans of model simulated load reductions[1]

Cbseg	State	Base Open Water	No Action Open Water	1985 Progress Open Water	1990 Progress Open Water	1993 Progress Open Water	2000 Progress Open Water	2010 Progress Open Water	2013 Progress Open Water	N & +12%TP Open Water	WIP+6%T N & +4%TP Open Water	WIP2 Open Water	6%TN & -8%TP Open Water	WIP-11%TN & -16%TP Open Water	E3 Open Water	All Forest Open Water
CB7PH	VA	5%	7%	6%	6%	6%	5%	3%	3%	1%	1%	0%	0%	0%	0%	0%

- For development of the Bay's assimilative capacity and the Phase III WIP planning targets, recommending non-attainment percentages less than 1% be considered in attainment, consistent with the Bay TMDL

1. 2010 Chesapeake Bay TMDL Report Appendix I

Addressing Problem Segments

- 2010 Bay TMDL addressed a limited number of Chesapeake Bay segments for which the model simulated results remained in non-attainment even at high levels of nutrient reductions[1]

Cbseg	State	Base Open Water	No Action Open Water	1985 Progress Open Water	1990 Progress Open Water	1993 Progress Open Water	2000 Progress Open Water	2010 Progress Open Water	2013 Progress Open Water	N & +12%TP Open Water	WIP+6%T N & +4%TP Open Water	WIP2 Open Water	6%TN & -8%TP Open Water	WIP-11%TN & -16%TP Open Water	E3 Open Water	All Forest Open Water
WBEMH	VA	11%	15%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	3%	0%

- For development of the Bay's assimilative capacity and the Phase III WIP planning targets, recommending documenting a similar set of problems segments and removing them from the decision making process

1. 2010 Chesapeake Bay TMDL Report Appendix N

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

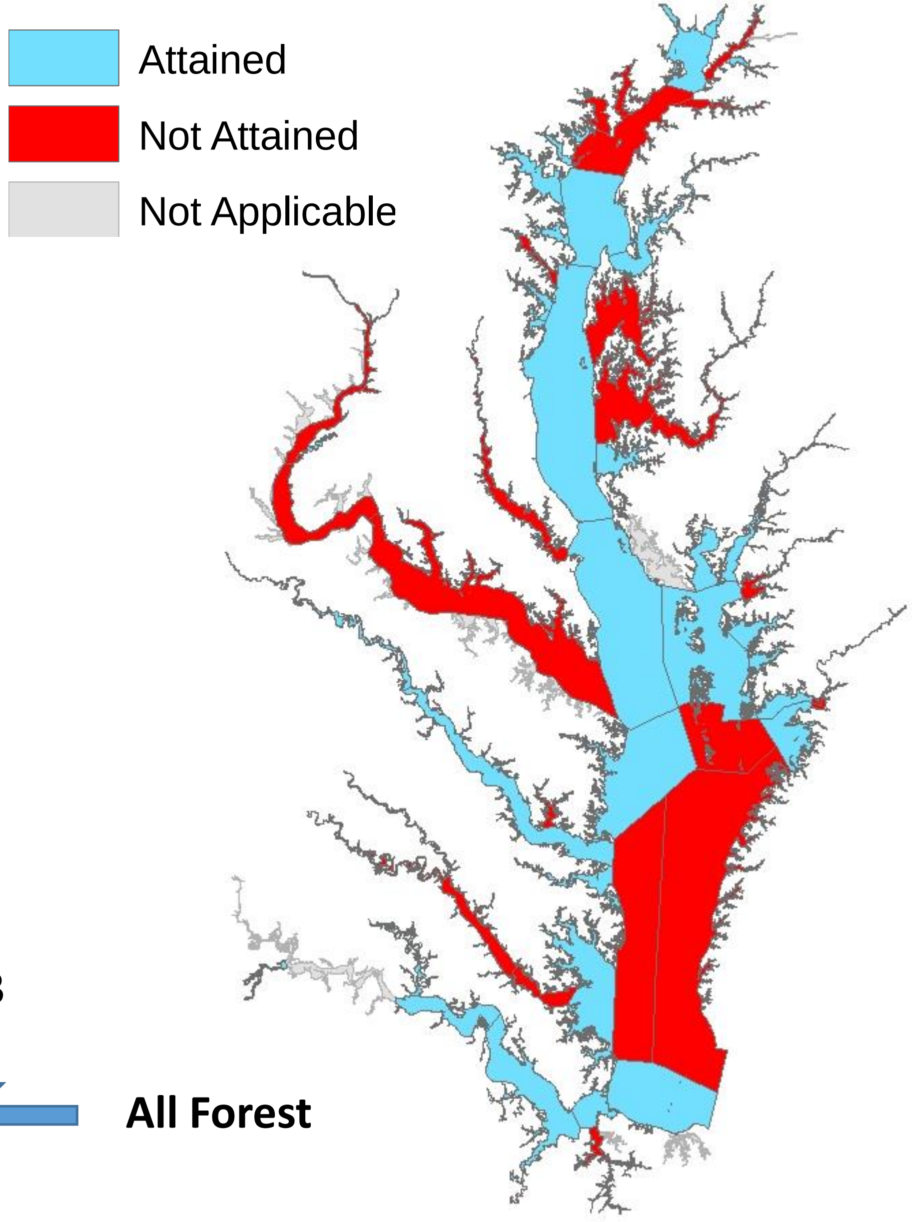
- CB2OH
- CB6PH
- CB7PH
- BSHOH
- GUNOH
- SEVMH
- PAXTF
- WBRTF
- PAXOH
- PAXMH
- POTTF_DC
- POTTF_MD
- ANATF_DC
- ANATF_MD
- PISTF
- POTOH1_MD
- POTOMH_MD
- CRRMH
- PMKTF
- PMKOH
- YRKMH
- YRKPH
- WBEMH
- SBEMH
- EBEMH
- ELIPH
- C&Dcanal
- ELKOH
- SASOH
- EASMH
- CHOTF
- CHOOH
- CHOMH2
- CHOMH1
- WICMH
- POCTF
- POCOH_MD
- POCOH_VA
- TANMH_VA

2010 No Action

E3

All Forest

404 TN
41.7 TP



2010 No Action

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

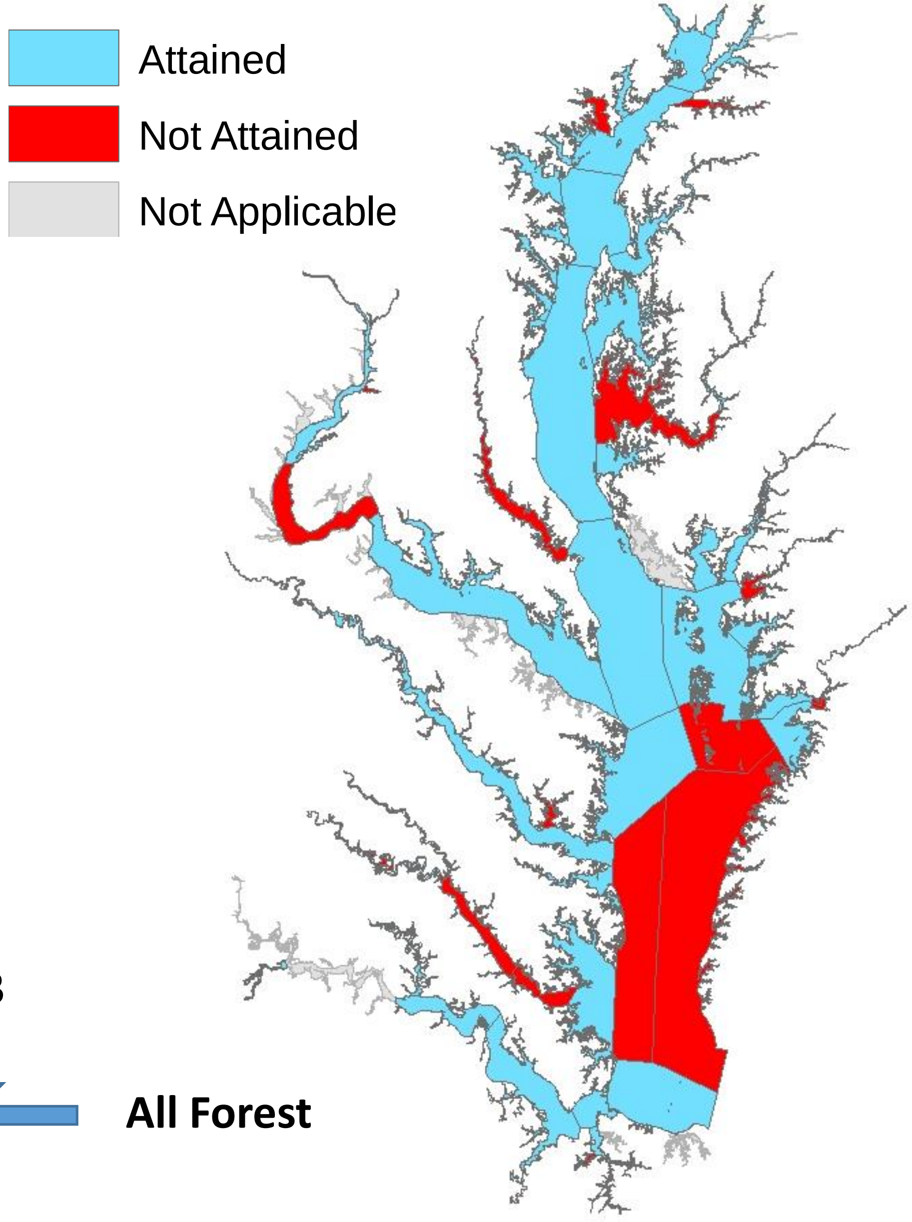
- CB6PH
- CB7PH
- GUNOH
- PAXTF
- WBRTF
- PAXOH
- PAXMH
- ANATF_DC
- ANATF_MD
- PISTF
- POTOH1_MD
- CRRMH
- PMKTF
- YRKMH
- YRKPH
- WBEMH
- SBEMH
- EBEMH
- C&Dcanal
- SASOH
- CHOMH2
- CHOMH1
- WICMH
- POCTF
- POCOH_MD
- POCOH_VA
- TANMH_VA

1985 Progress

E3

All Forest

347 TN
30.4 TP



1985 Progress

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

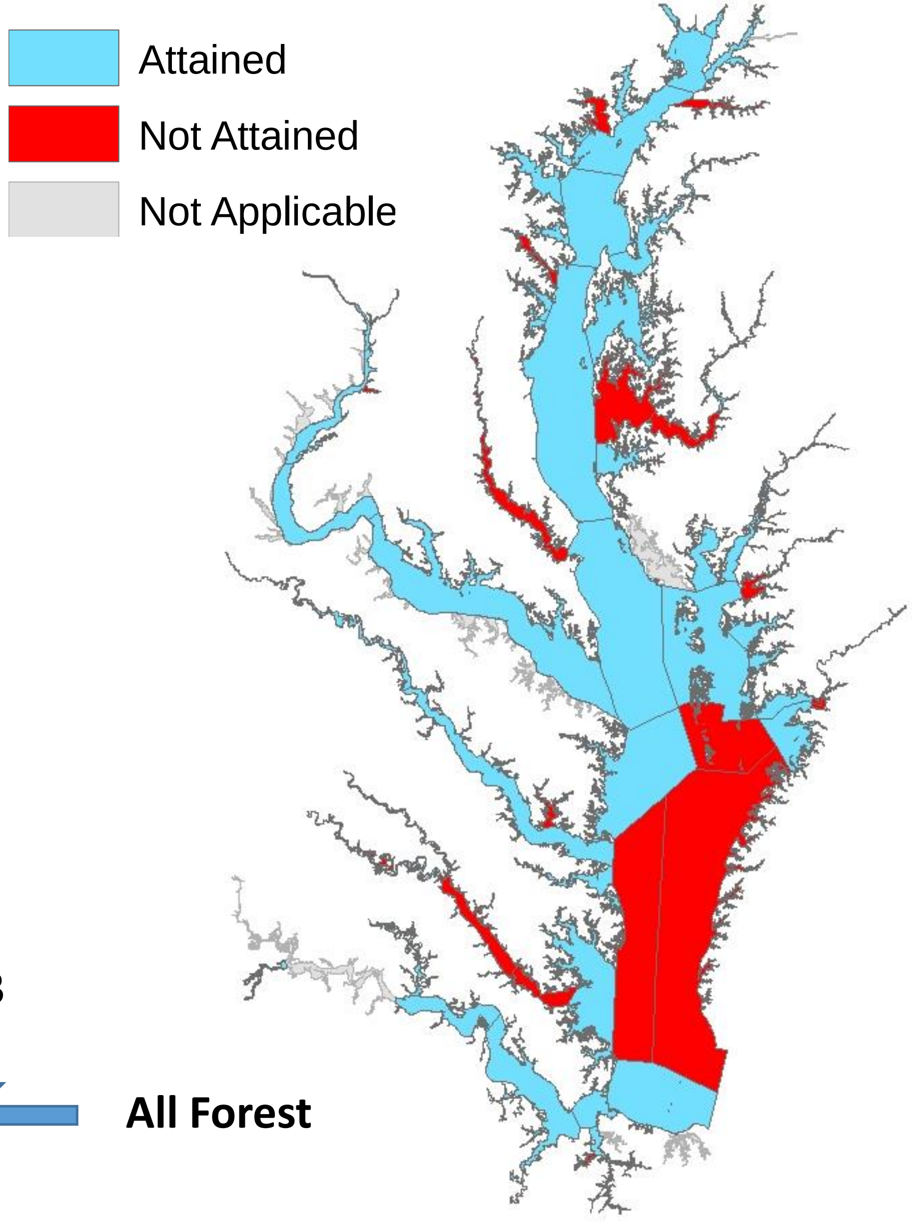
- CB6PH
- CB7PH
- GUNOH
- SEVMH
- PAXTF
- PAXOH
- PAXMH
- ANATF_DC
- ANATF_MD
- PISTF
- CRRMH
- PMKTF
- YRKMH
- YRKPH
- WBEMH
- SBEMH
- EBEMH
- SASOH
- CHOMH2
- CHOMH1
- WICMH
- POCTF
- POCOH_MD
- POCOH_VA
- TANMH_VA

1990 Progress

337 TN
23.7 TP

E3

All Forest

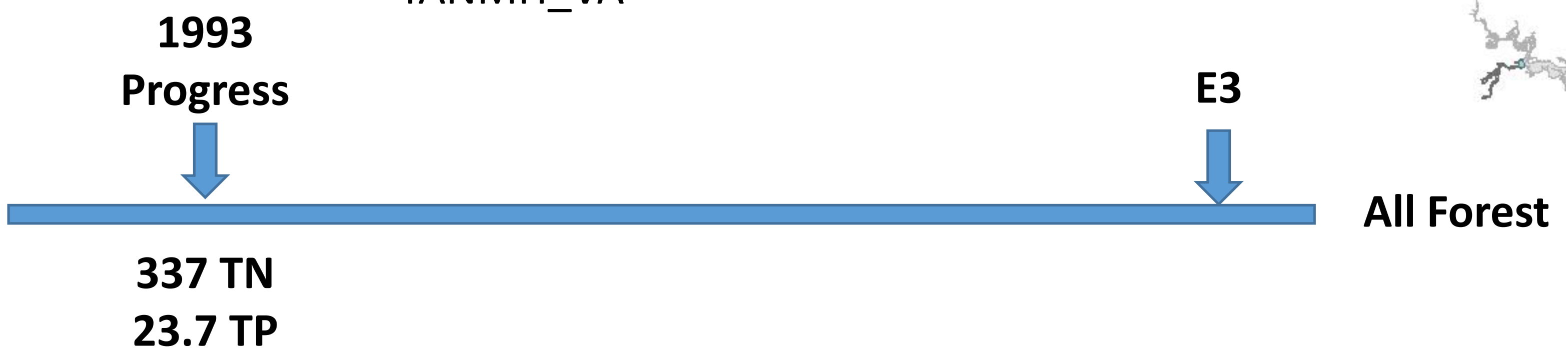


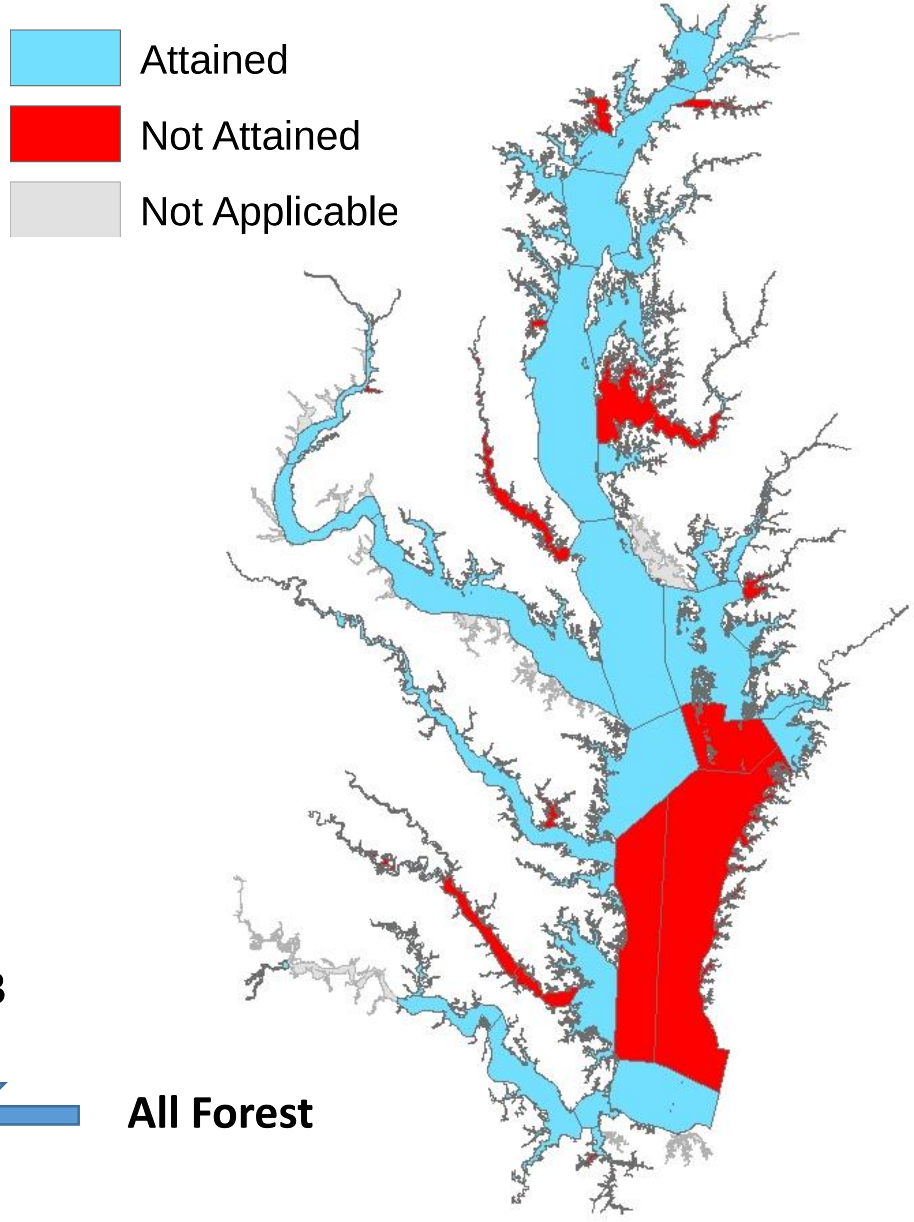
1990 Progress

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

- CB6PH
- CB7PH
- GUNOH
- WSTMH
- PAXTF
- WBRTF
- PAXOH
- PAXMH
- ANATF_DC
- ANATF_MD
- PISTF
- CRRMH
- PMKTF
- YRKMH
- YRKPH
- WBEMH
- SBEMH
- EBEMH
- SASOH
- CHOMH2
- CHOMH1
- WICMH
- TANMH_VA



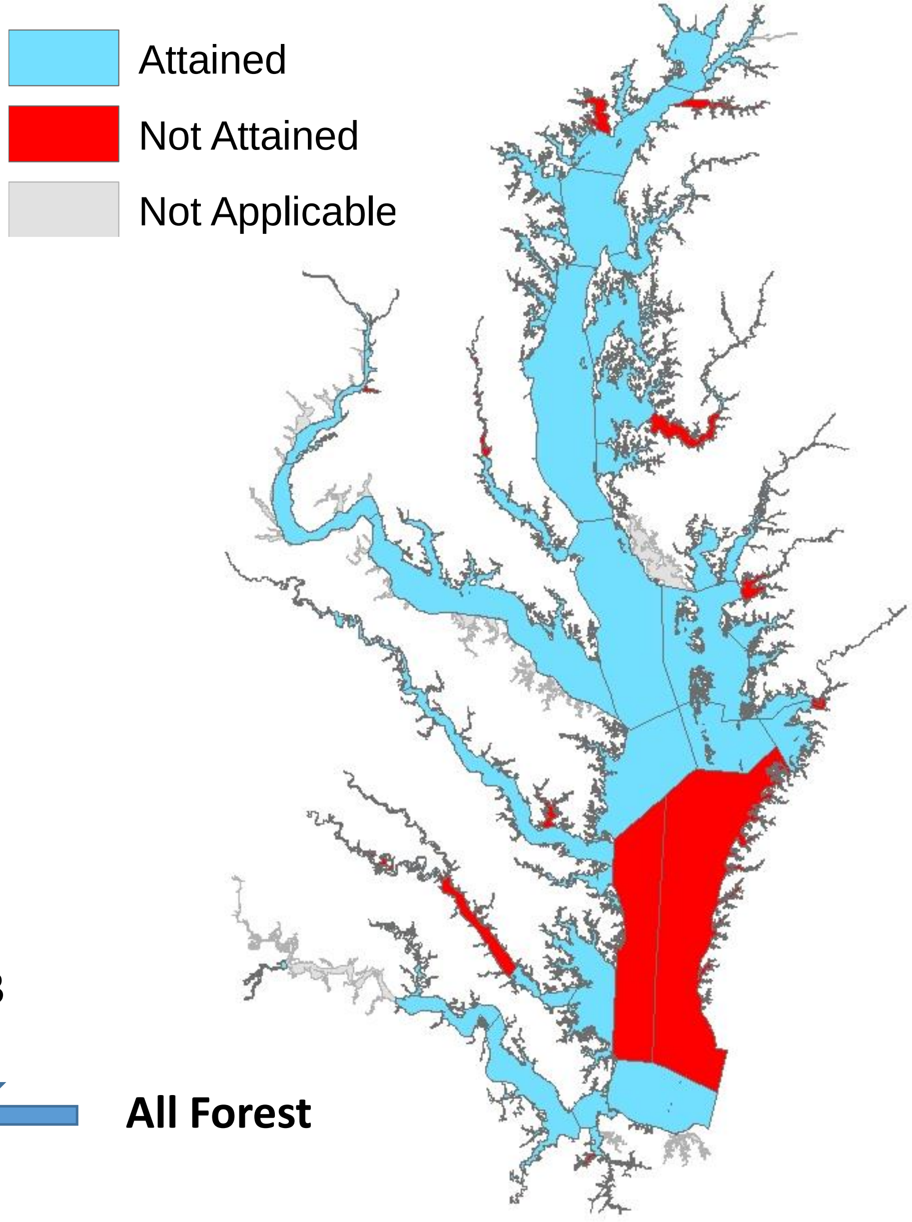


1993 Progress

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

- CB6PH
- CB7PH
- GUNOH
- PAXTF
- WBRTF
- PAXOH
- ANATF_DC
- ANATF_MD
- PISTF
- CRRMH
- PMKTF
- YRKMH
- WBEMH
- SBEMH
- EBEMH
- SASOH
- CHOMH2
- WICMH
- POCTF
- POCOH_MD
- POCOH_VA



2000 Progress

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

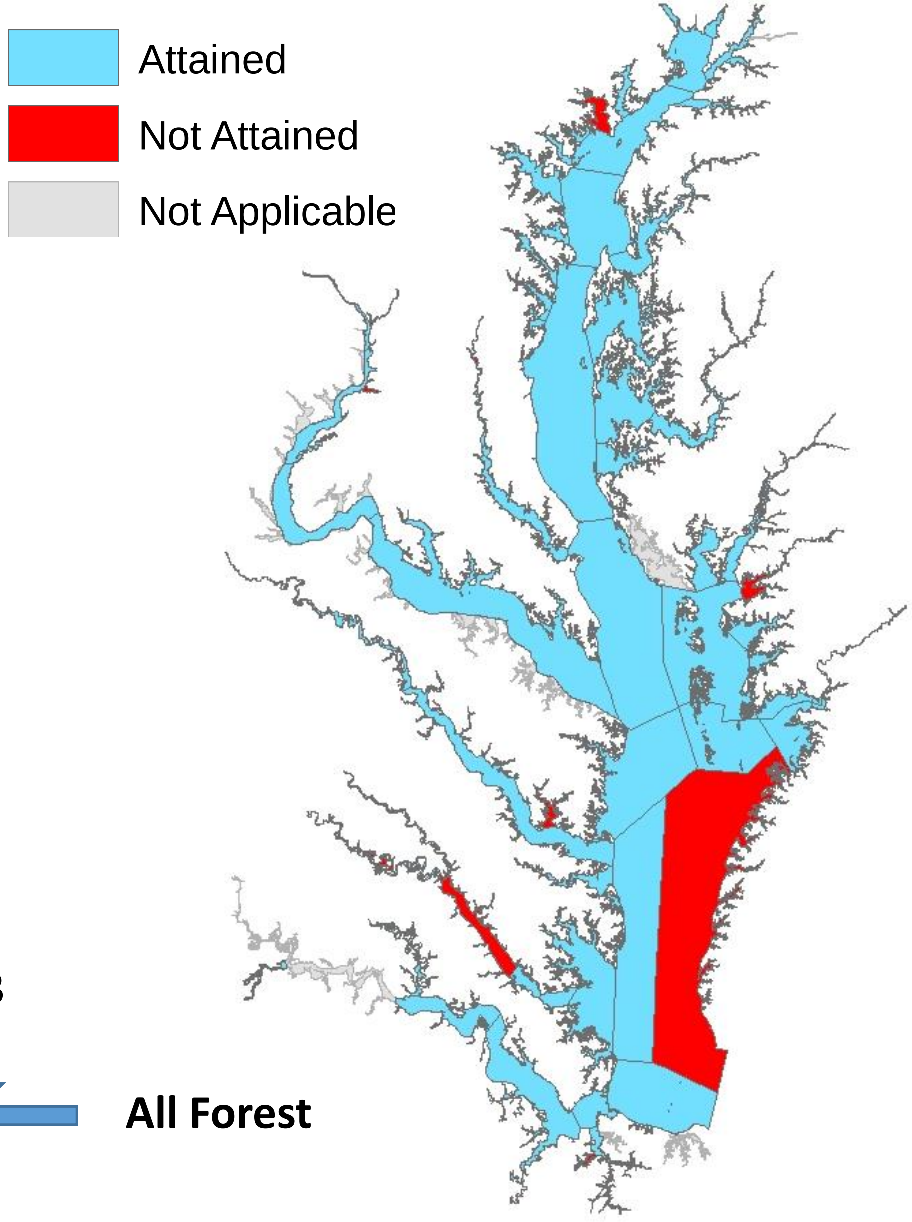
- CB7PH
- GUNOH
- PAXTF
- ANATF_DC
- ANATF_MD
- PISTF
- CRRMH
- PMKTF
- YRKMH
- WBEMH
- SBEMH
- EBEMH
- WICMH

2010 Progress

E3

All Forest

266 TN
16.9 TP



2010 Progress

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

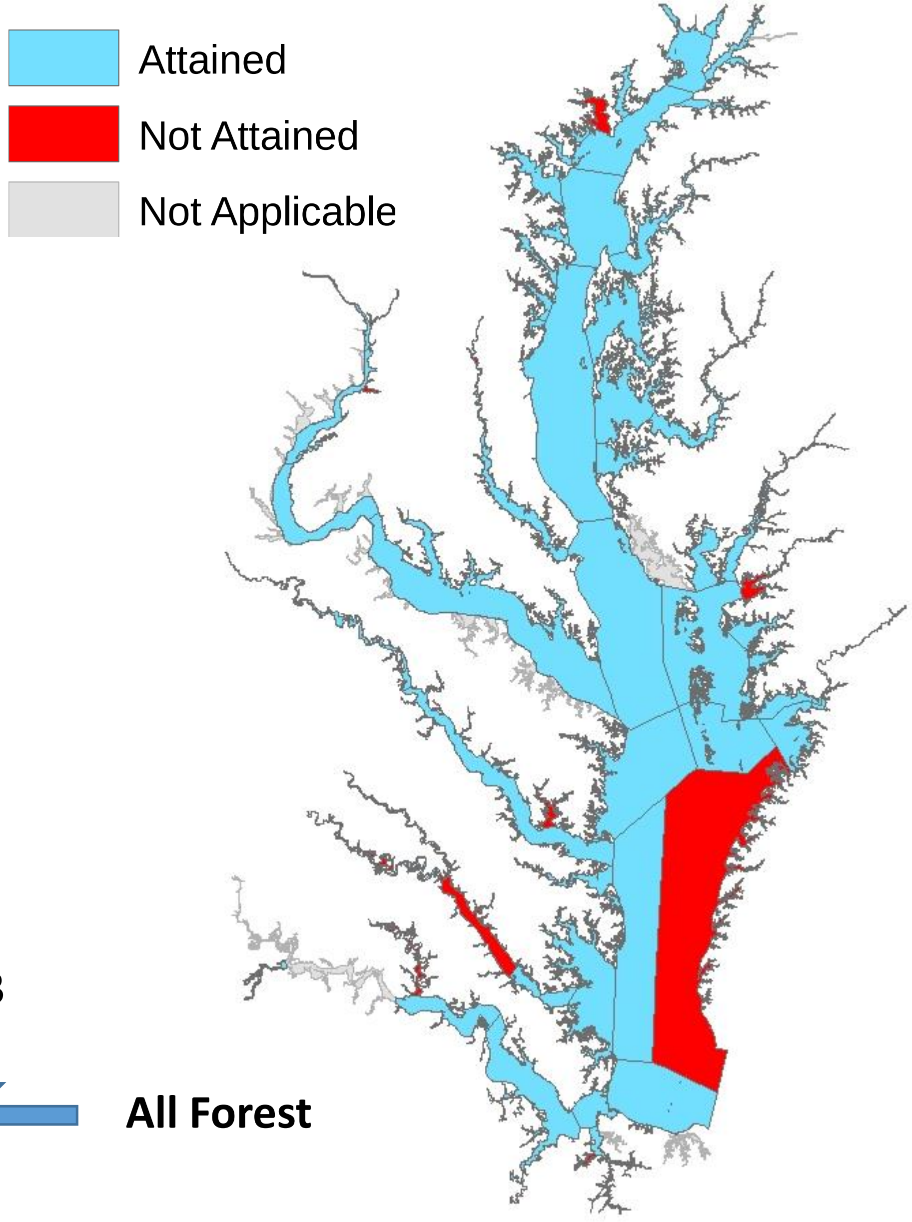
- CB7PH
- GUNOH
- PAXTF
- WBRTF
- ANATF_DC
- ANATF_MD
- PISTF
- CRRMH
- PMKTF
- YRKMH
- CHKOH
- WBEMH
- SBEMH
- EBEMH
- WICMH

2013 Progress

E3

All Forest

253 TN
15.9 TP

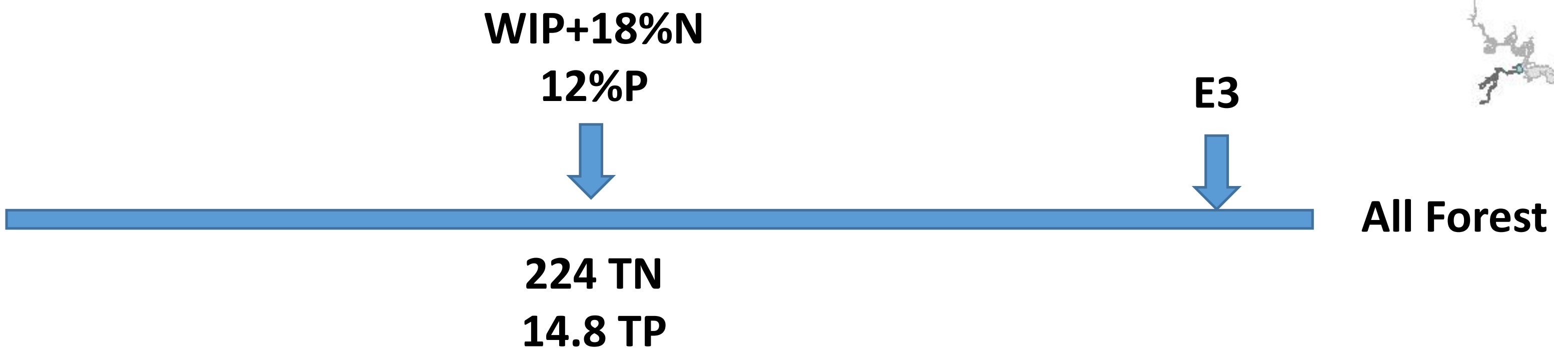


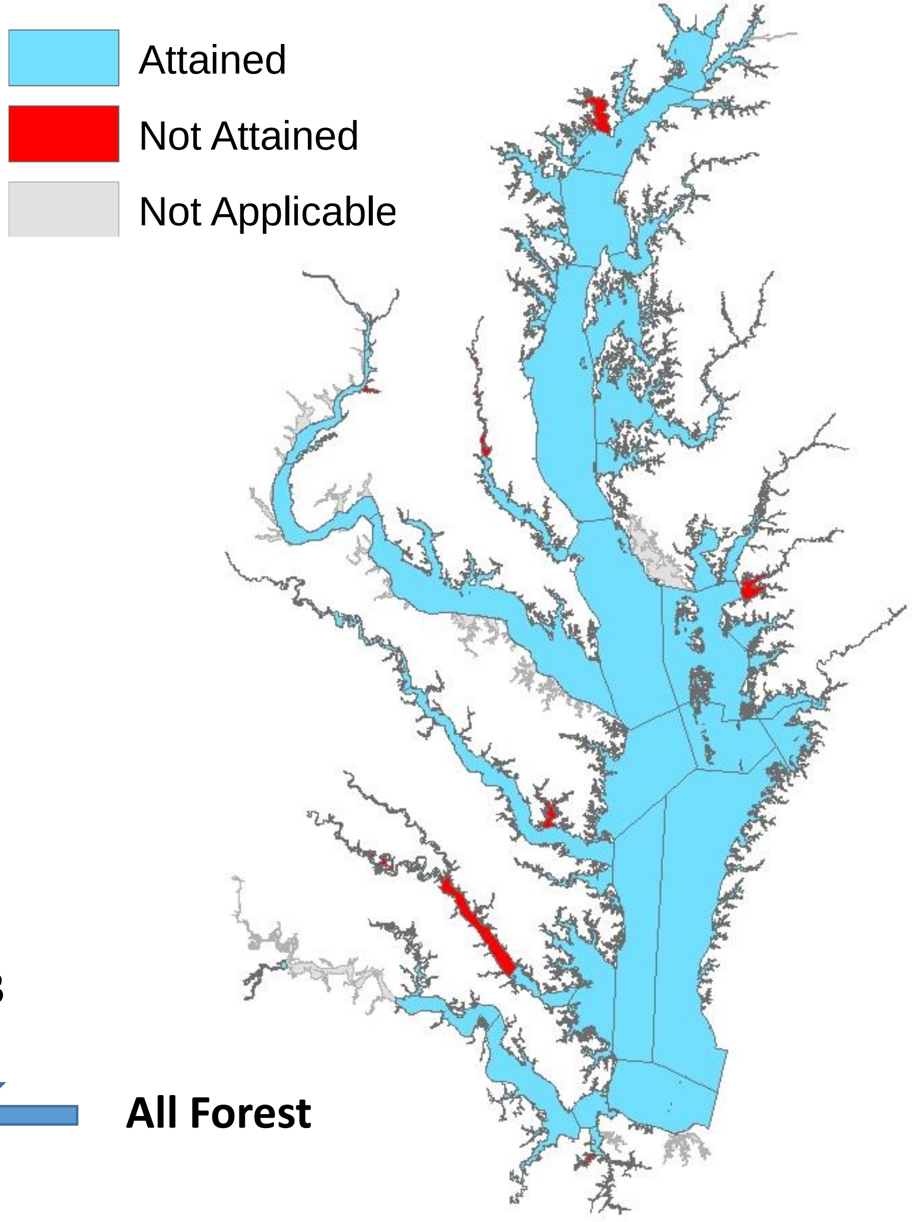
2013 Progress

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

- GUNOH
- PAXTF
- PAXOH
- ANATF_DC
- ANATF_MD
- PISTF
- CRRMH
- PMKTF
- YRKMH
- WBEMH
- SBEMH
- EBEMH
- WICMH





WIP+18% N12%P

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

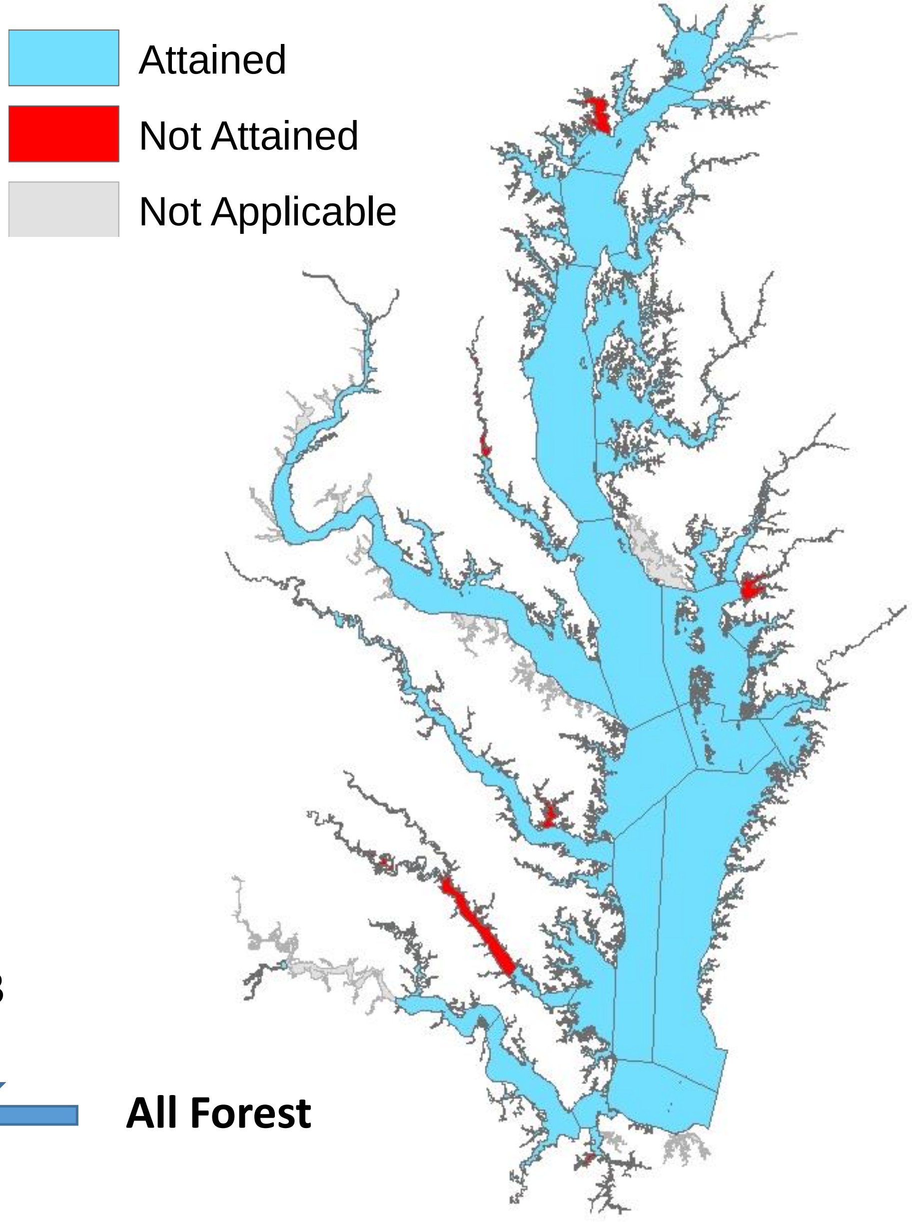
- GUNOH
- PAXTF
- PAXOH
- ANATF_MD
- ANATF_DC
- CRRMH
- PMKTF
- YRKMH
- WBEMH
- SBEMH
- EBEMH
- WICMH

WIP+6%N
4%P

E3

All Forest

205 TN
14.0 TP

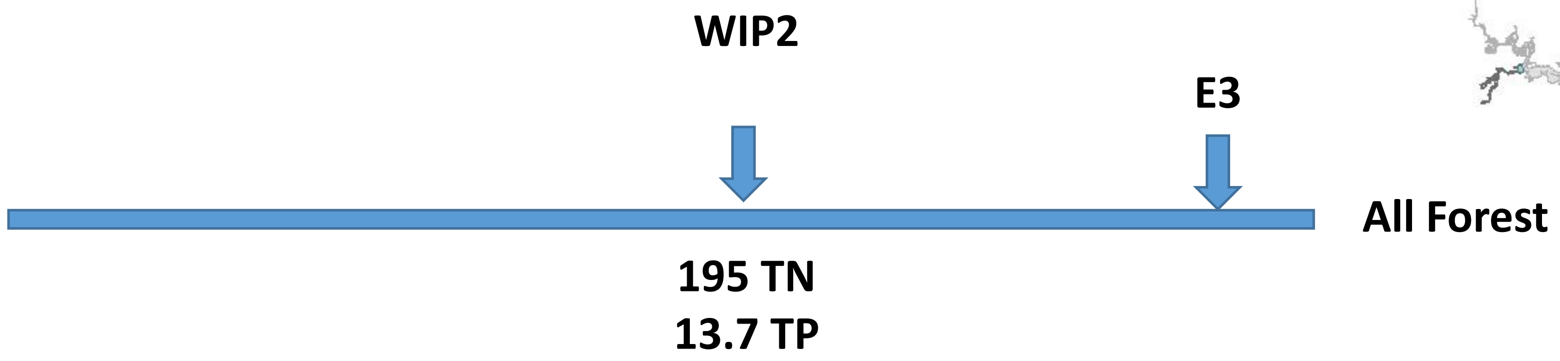


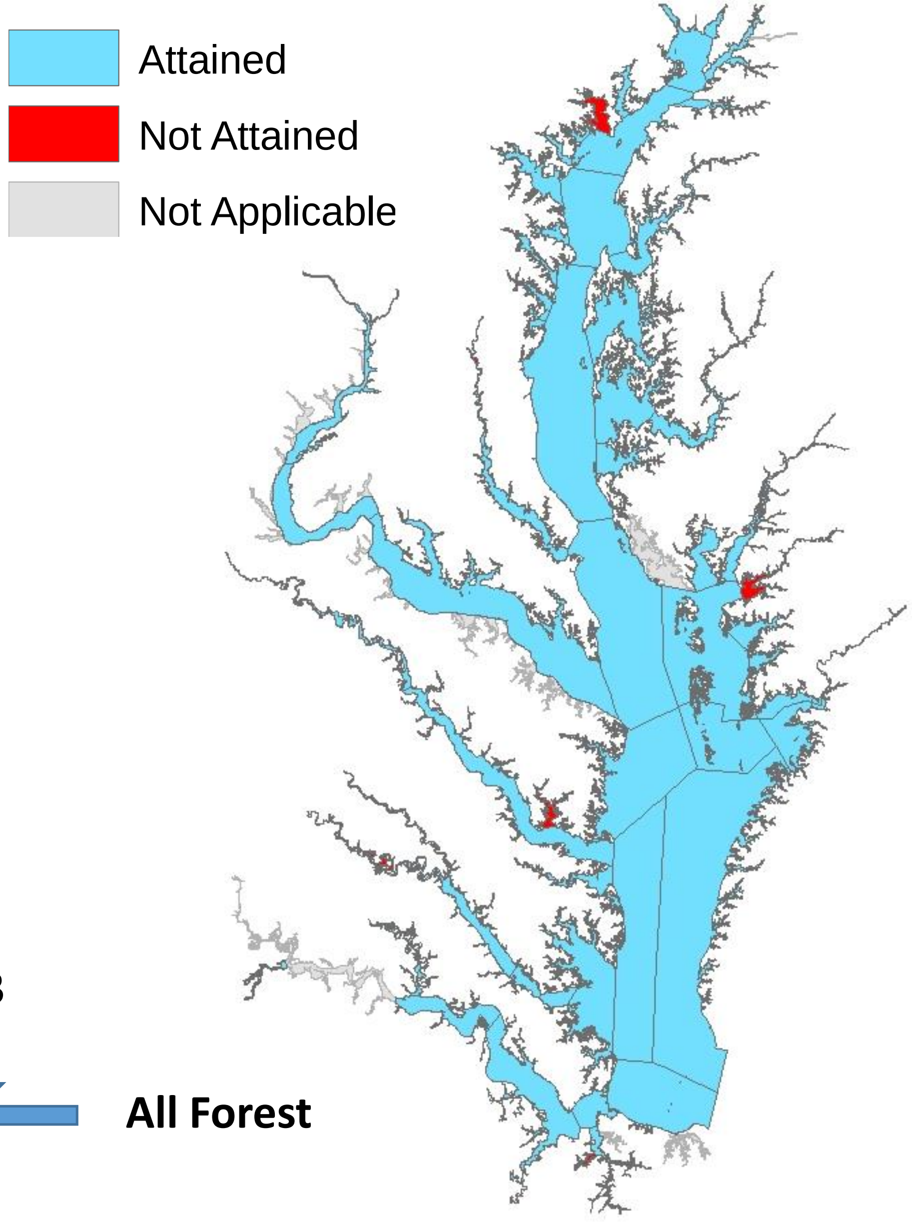
WIP+6% N4%P

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

- GUNOH
- PAXTF
- WBRTF
- CRRMH
- PMKTF
- WBEMH
- SBEMH
- EBEMH
- WICMH





WIP2

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

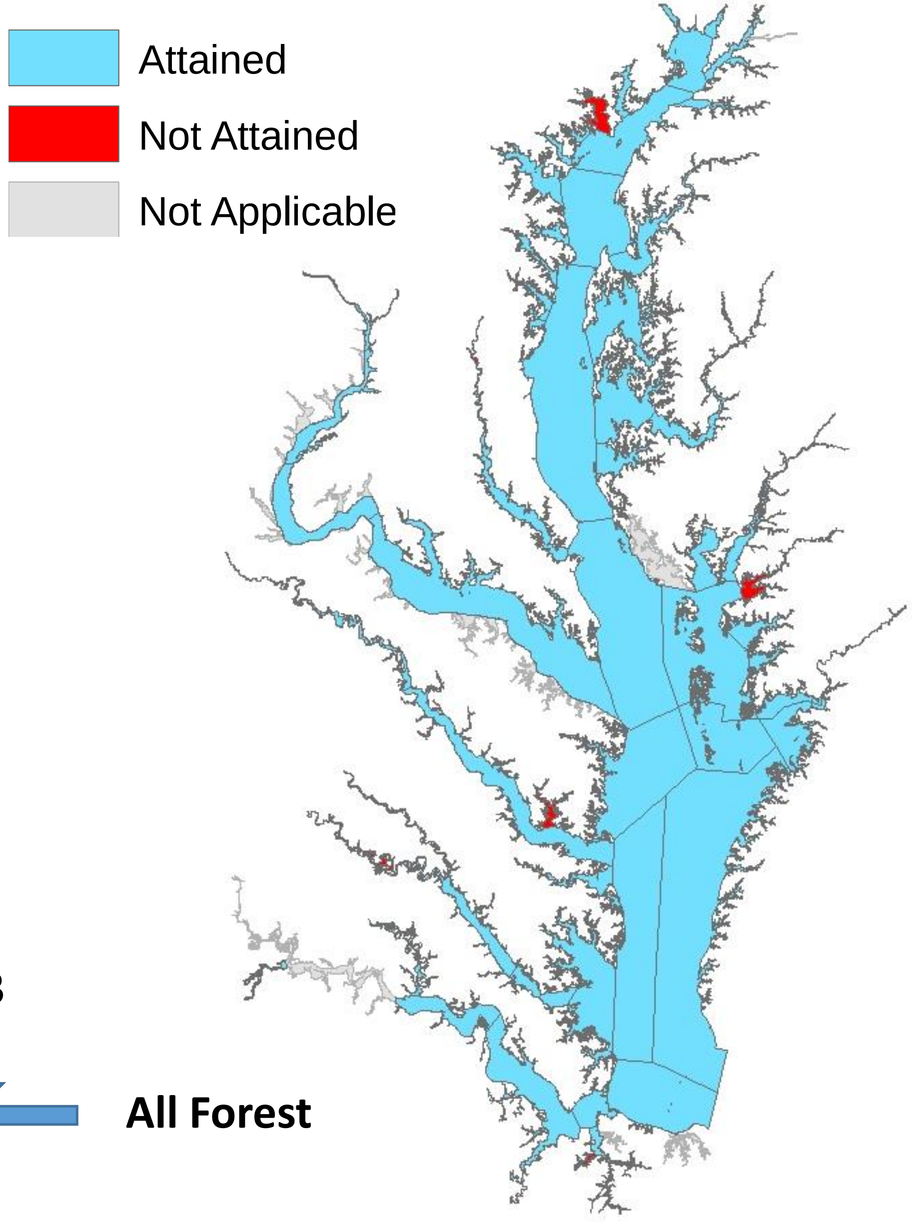
- GUNOH
- PAXTF
- WBRTF
- CRRMH
- PMKTF
- WBEMH
- SBEMH
- EBEMH
- WICMH

WIP - 6%N
8%P

E3

All Forest

185 TN
12.8 TP

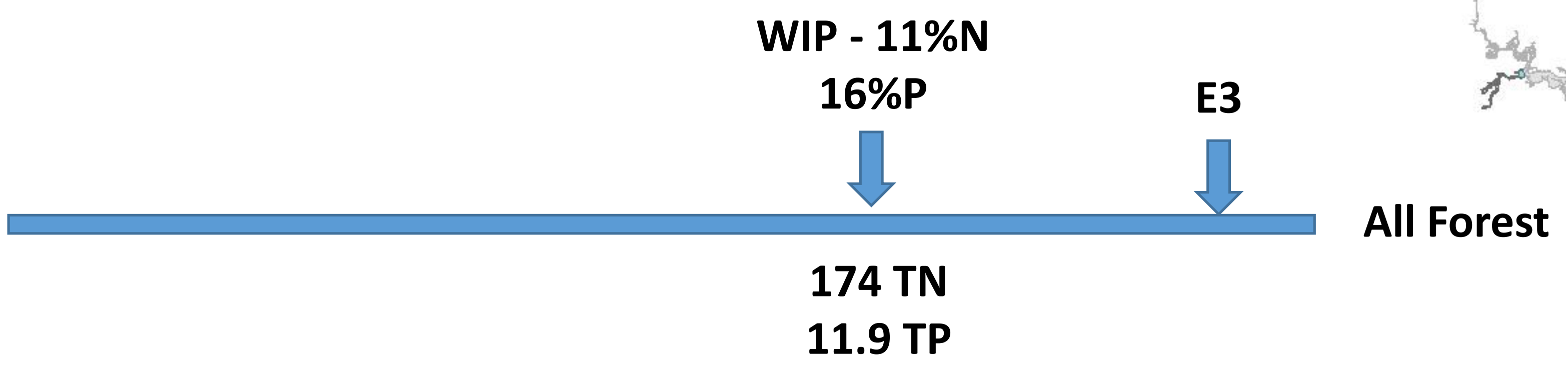


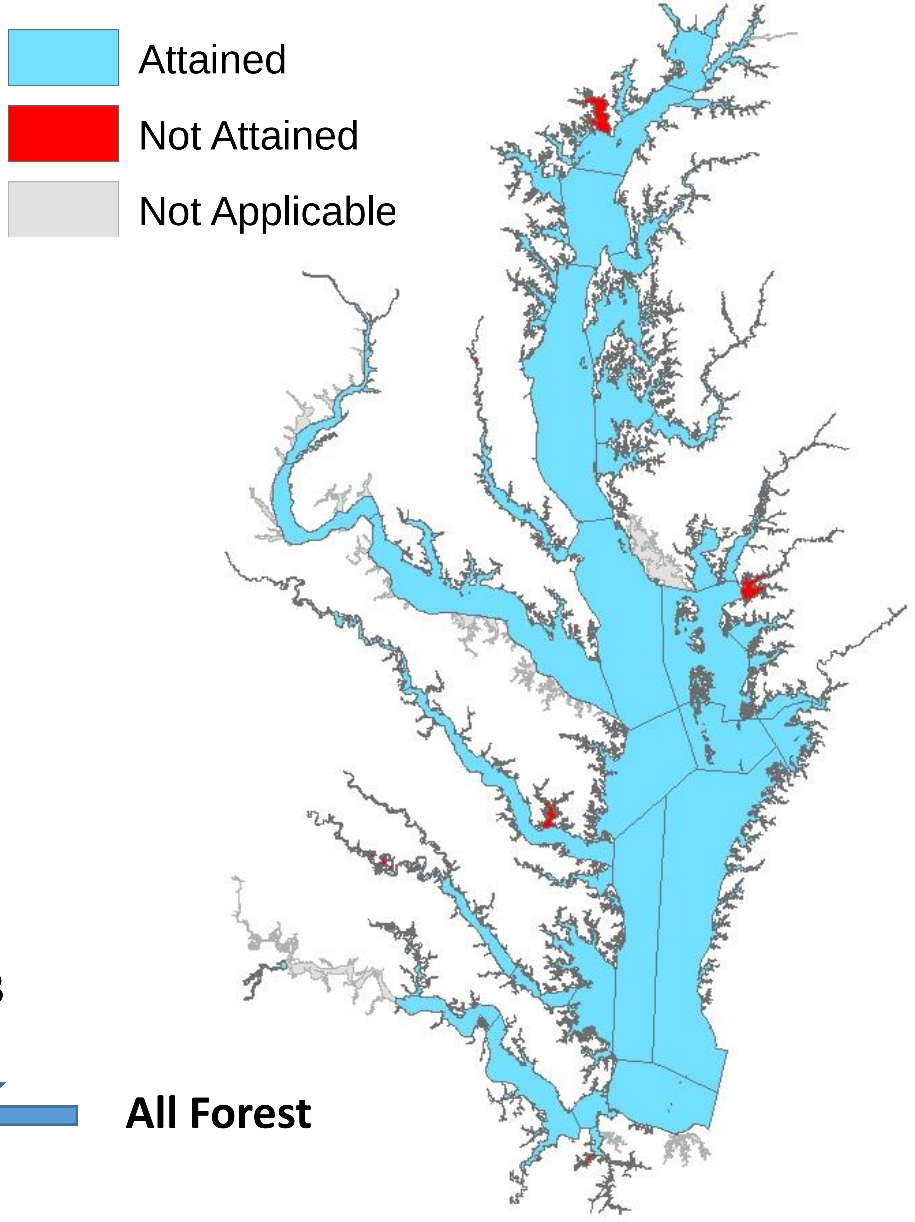
WIP -6%N 8%P

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

- GUNOH
- PAXTF
- WBRTF
- CRRMH
- PMKTF
- WBEMH
- SBEMH
- EBEMH
- WICMH





WIP -11%N 16%P

Segments Attaining Oxygen Standards: Open-Water Use

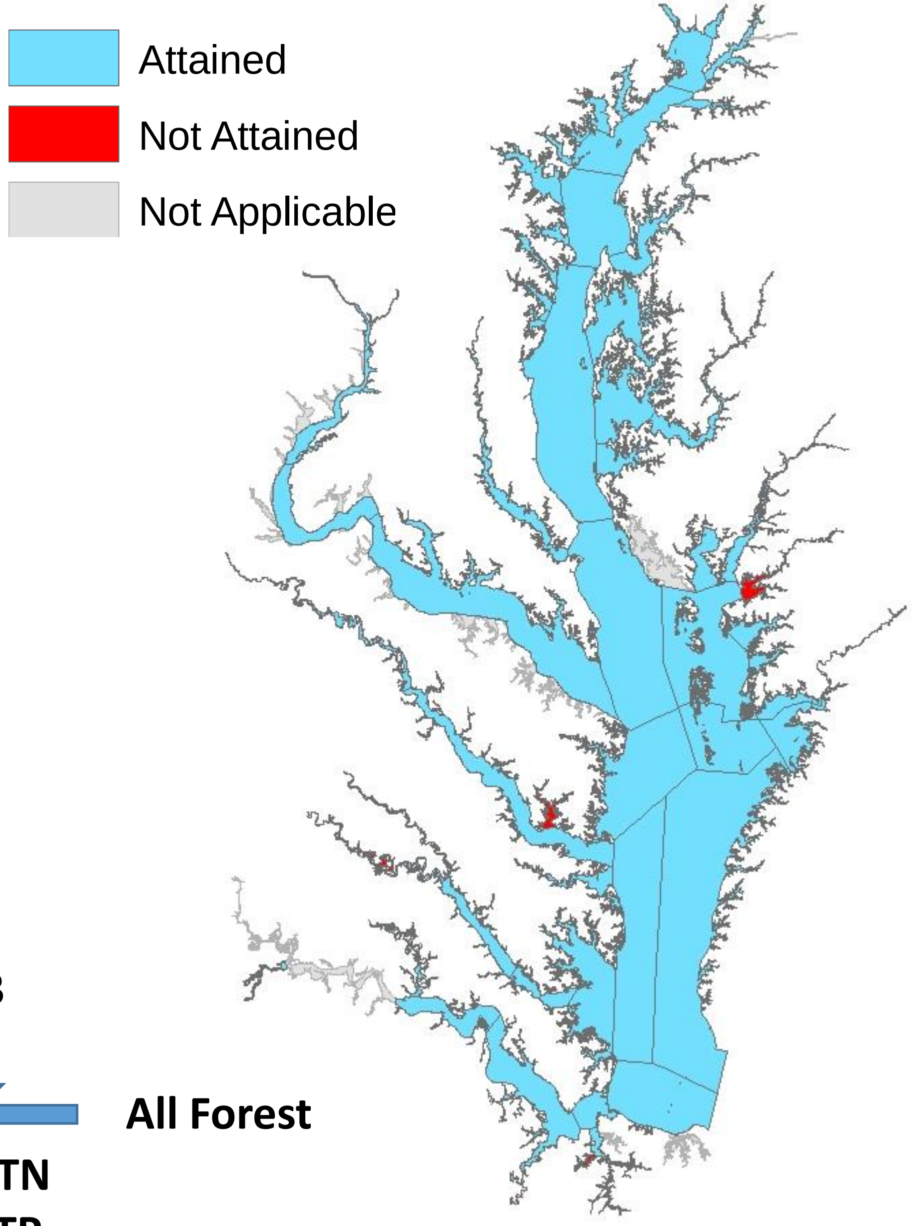
Segments NOT in Attainment

- CRRMH
- PMKTF
- WBEMH
- SBEMH
- WICMH

E3

133 TN
8.6 TP

All Forest

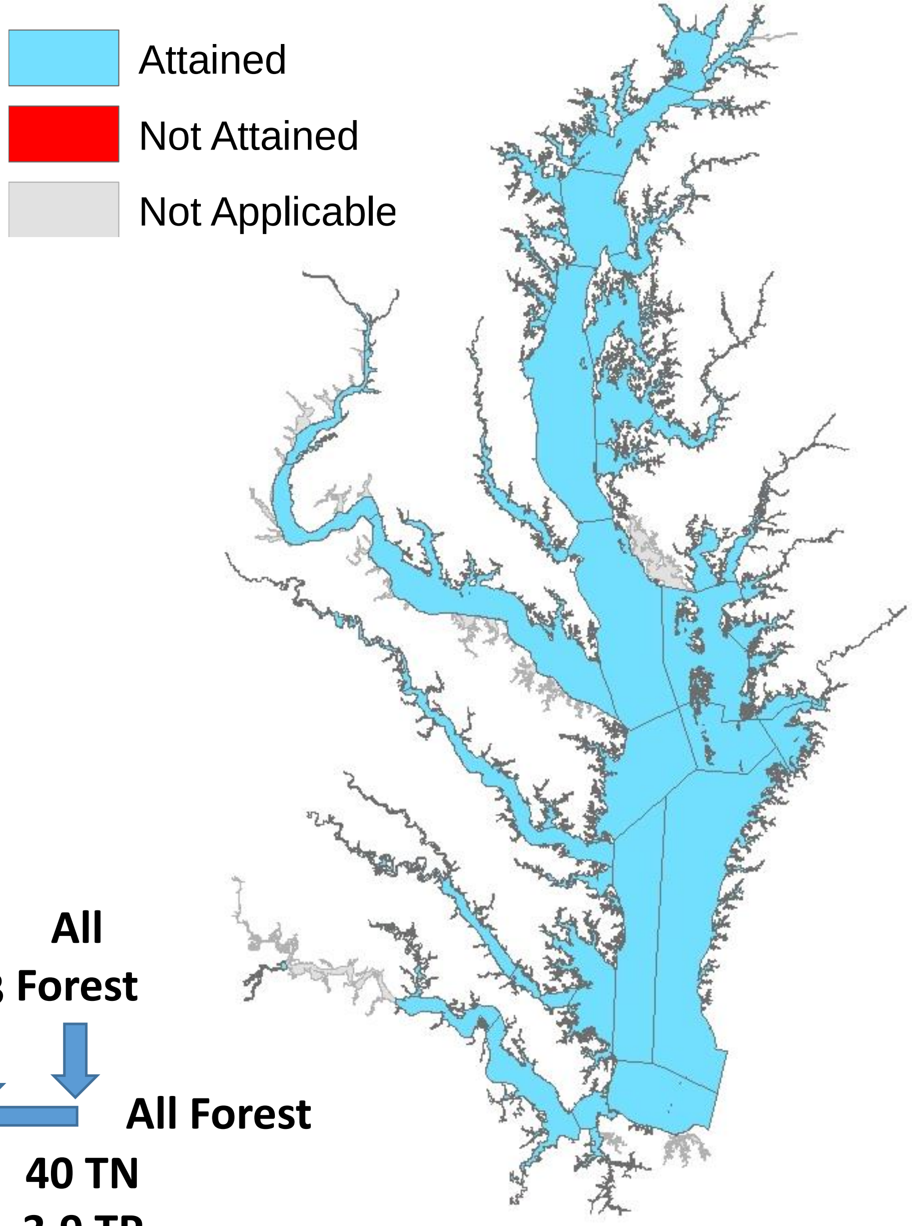


E3

Segments Attaining Oxygen Standards: Open-Water Use

Segments NOT in Attainment

- WBRTF
- SBEMH



All Forest

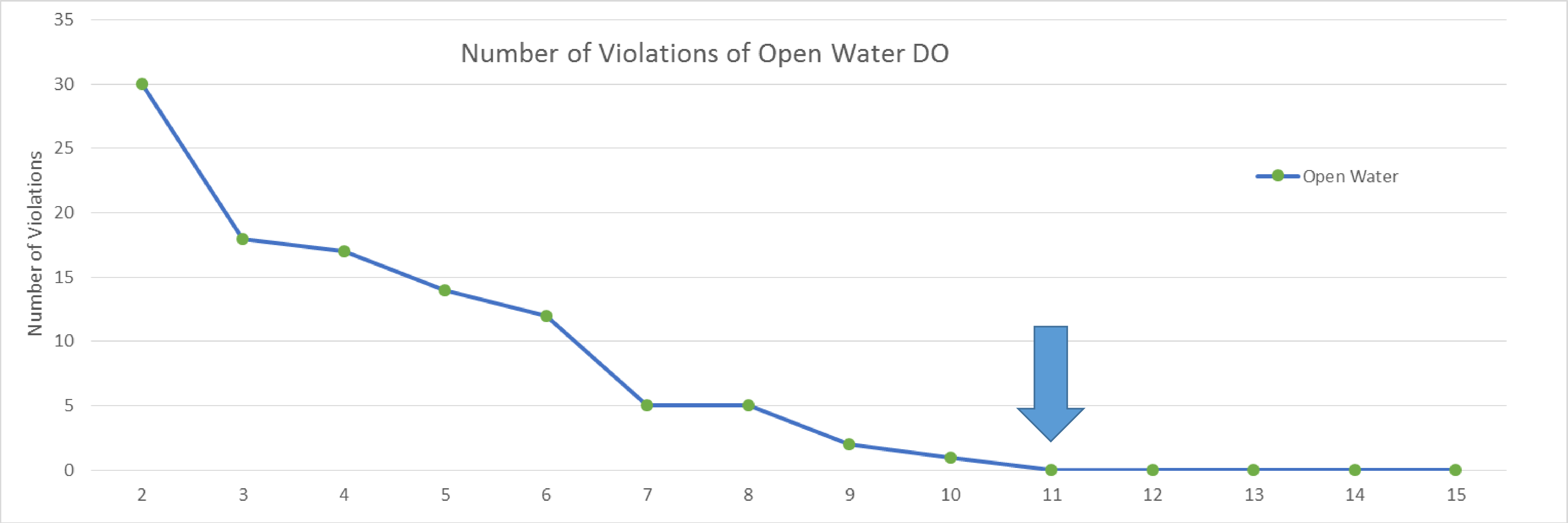
Addressing Open-Water Problem Segments

Segment Name	Segment Code	Bay TMDL[1]	Rationale for Designation as Problem Segment[2]
Gunpowder River	GUNOH	Yes	Not well represented in WQSTM, non-responsive to load reductions
Upper Patuxent River	PAXTF	No	Extensive tidal wetlands, non-responsive to load reductions
Western Branch Patuxent River	WBRTF	No	Not well represented in WQSTM, non-responsive to load reductions
Upper Pamunkey River	PMKTF	Yes	Extensive tidal wetlands, non-responsive to load reductions
Corrotoman River	CRRMH	No	Not well represented in WQSTM, non-responsive to load reductions
East Branch Elizabeth River	EBEMH	No	Not well represented in WQSTM, non-responsive to load reductions
South Branch Elizabeth River	SBEMH	No	Not well represented in WQSTM, non-responsive to load reductions
West Branch Elizabeth River	WBEMH	Yes	Not well represented in WQSTM, non-responsive to load reductions
Wicomico River	WICMH	Yes	Not well represented in WQSTM, non-responsive to load reductions

1. Chesapeake Bay segment previously identified and documented in the 2010 Chesapeake Bay TMDL report as a problem segment, defined as a segment where changes in model simulated water quality standards non-attainment are essentially non-responsive to significant changes in nitrogen and phosphorus load reductions over a very wide range of loads.

2. More detailed documentation on the rationale for identification of these specific nine segments as problem segments and why they were not considered in calculation of the Bay's assimilative capacity will be provided in the Partnership's Midpoint Assessment report in spring 2018.

Segments Attaining Oxygen Standards: Open-Water Use



	1985	**1990**	**1993**	**2000**	**2010**	**2013**	**WIP+18%TN**	**WIP+6%TN**		**WIP-6%TN**	**WIP-11%TN**		
No Action	**Progress**	**Progress**	**Progress**	**Progress**	**Progress**	**Progress**	**& +12%TP**	**& +4%TP**	**WIP2**	**& -8%TP**	**& -16%TP**	**E3**	**All Forest**
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

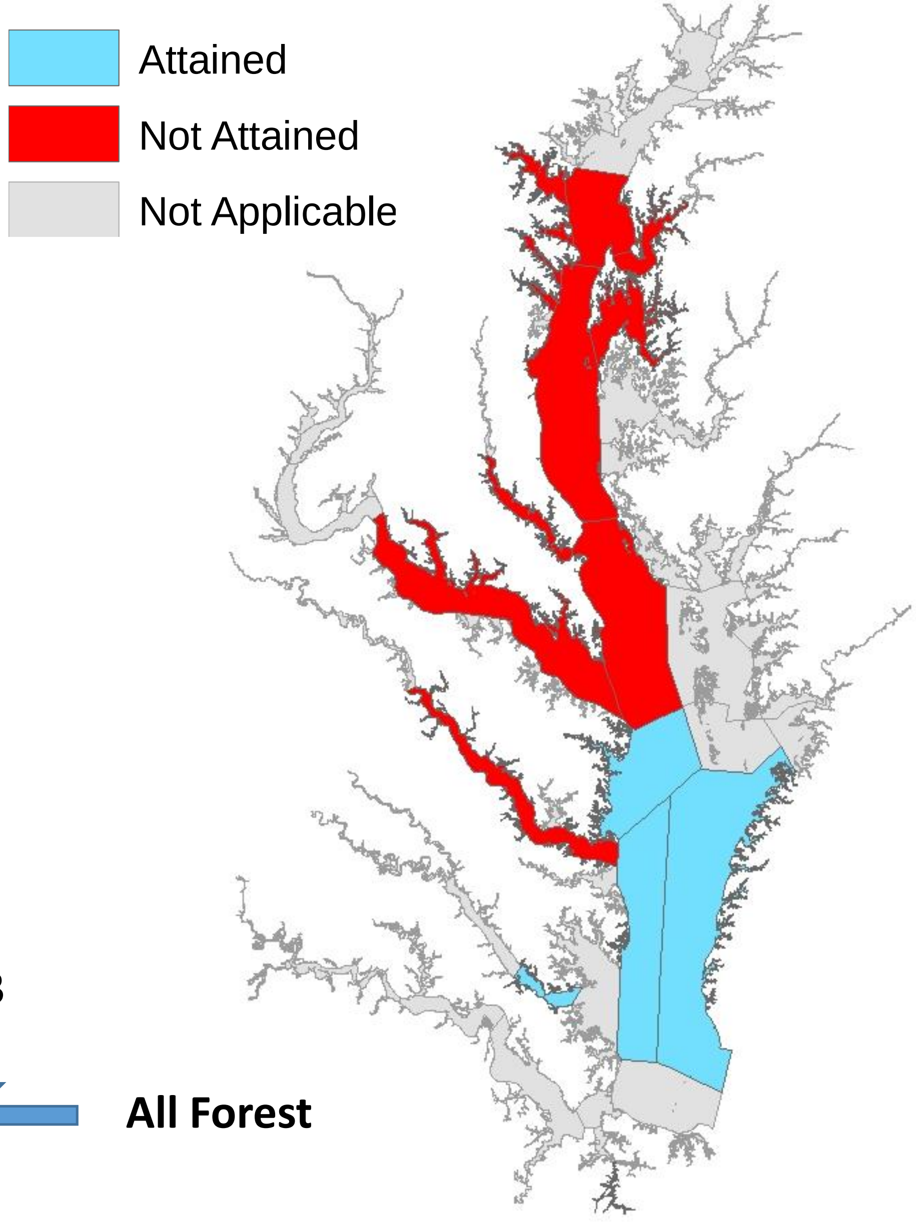
- CB3MH
- CB4MH
- CB5MH_MD
- PATMH
- MAGMH
- SOUMH
- SEVMH
- PAXMH
- POTMH
- RPPMH
- CHSMH
- EASMH

2010 No Action

E3

All Forest

404 TN
41.7 TP



2010 No Action

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

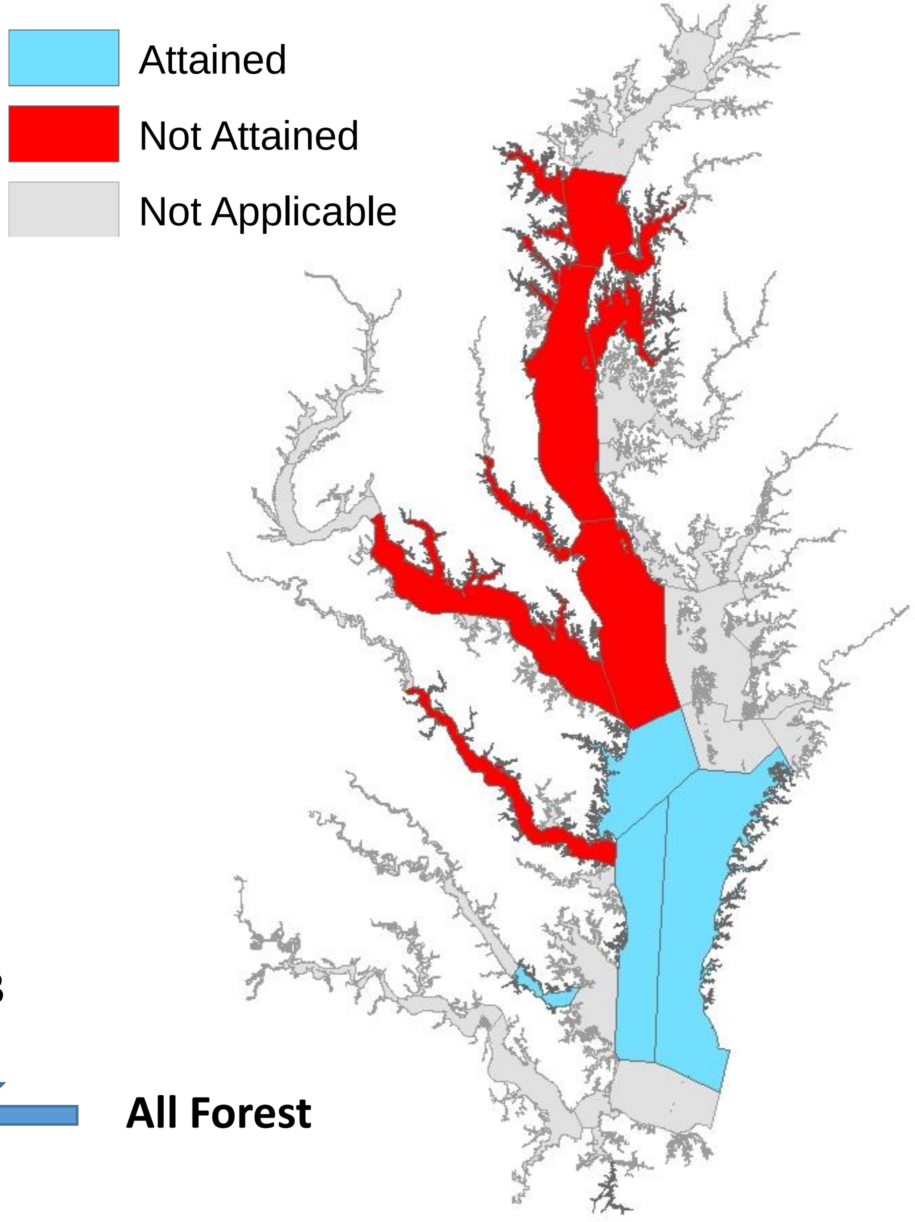
- CB3MH
- CB4MH
- CB5MH_MD
- PATMH
- MAGMH
- SOUMH
- SEVMH
- PAXMH
- POTMH
- RPPMH
- CHSMH
- EASMH

1985 Progress

E3

All Forest

347 TN
30.4 TP



1985 Progress

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

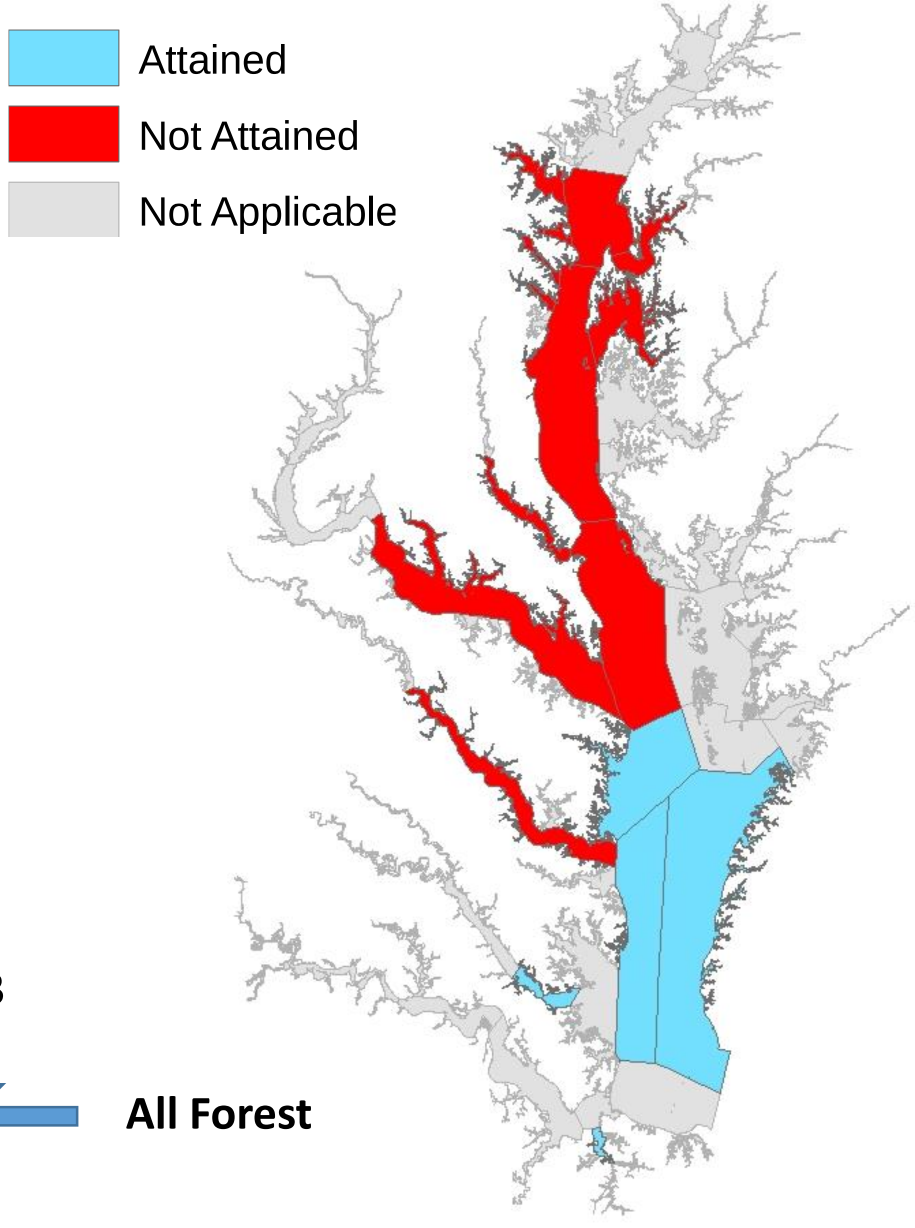
- CB3MH
- CB4MH
- CB5MH_MD
- PATMH
- MAGMH
- SOUMH
- SEVMH
- PAXMH
- POTMH
- RPPMH
- CHSMH
- EASMH

1990 Progress

E3

All Forest

338 TN
27.7 TP



1990 Progress

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

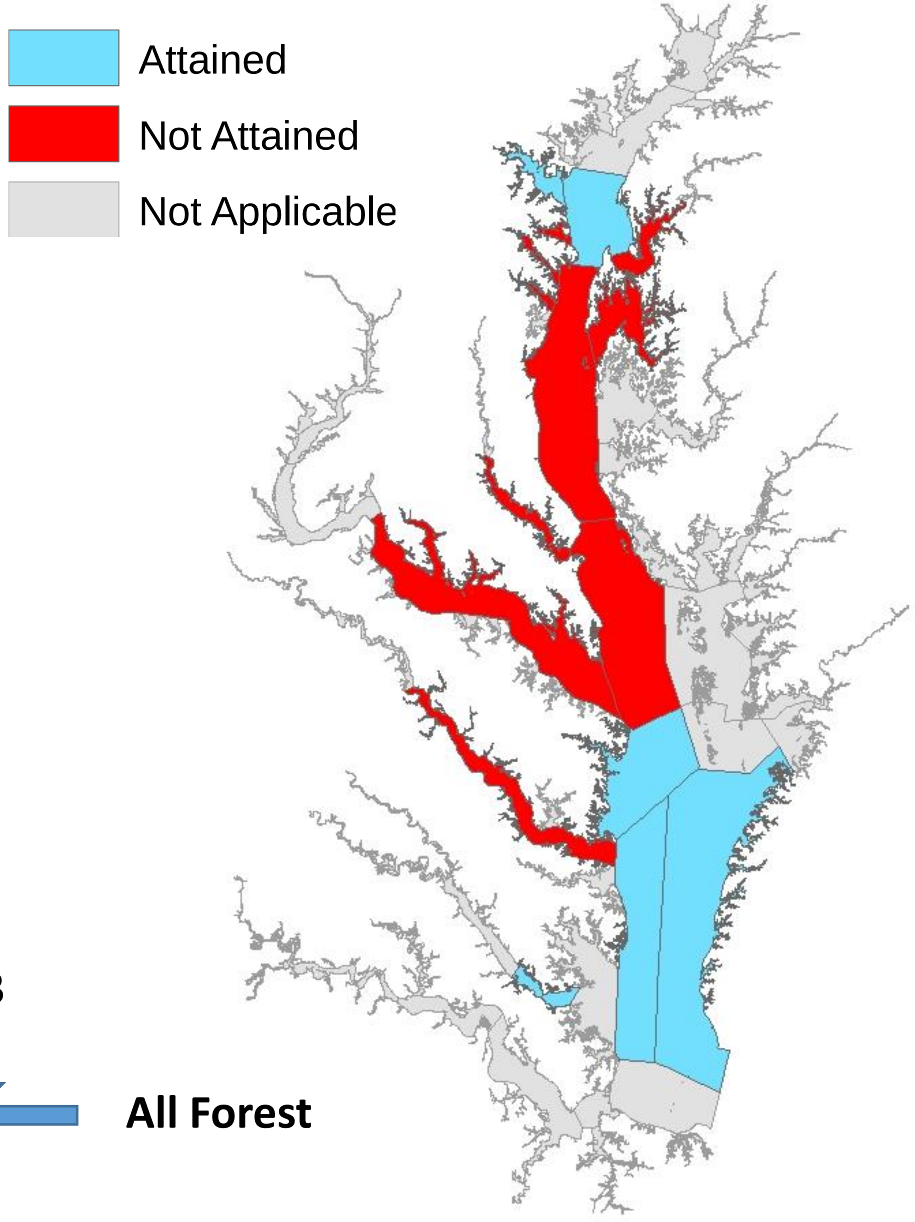
- CB4MH
- CB5MH_MD
- PATMH
- MAGMH
- SOUMH
- SEVMH
- PAXMH
- POTMH
- RPPMH
- CHSMH
- EASMH

1993 Progress

E3

All Forest

337 TN
23.7 TP



1993 Progress

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

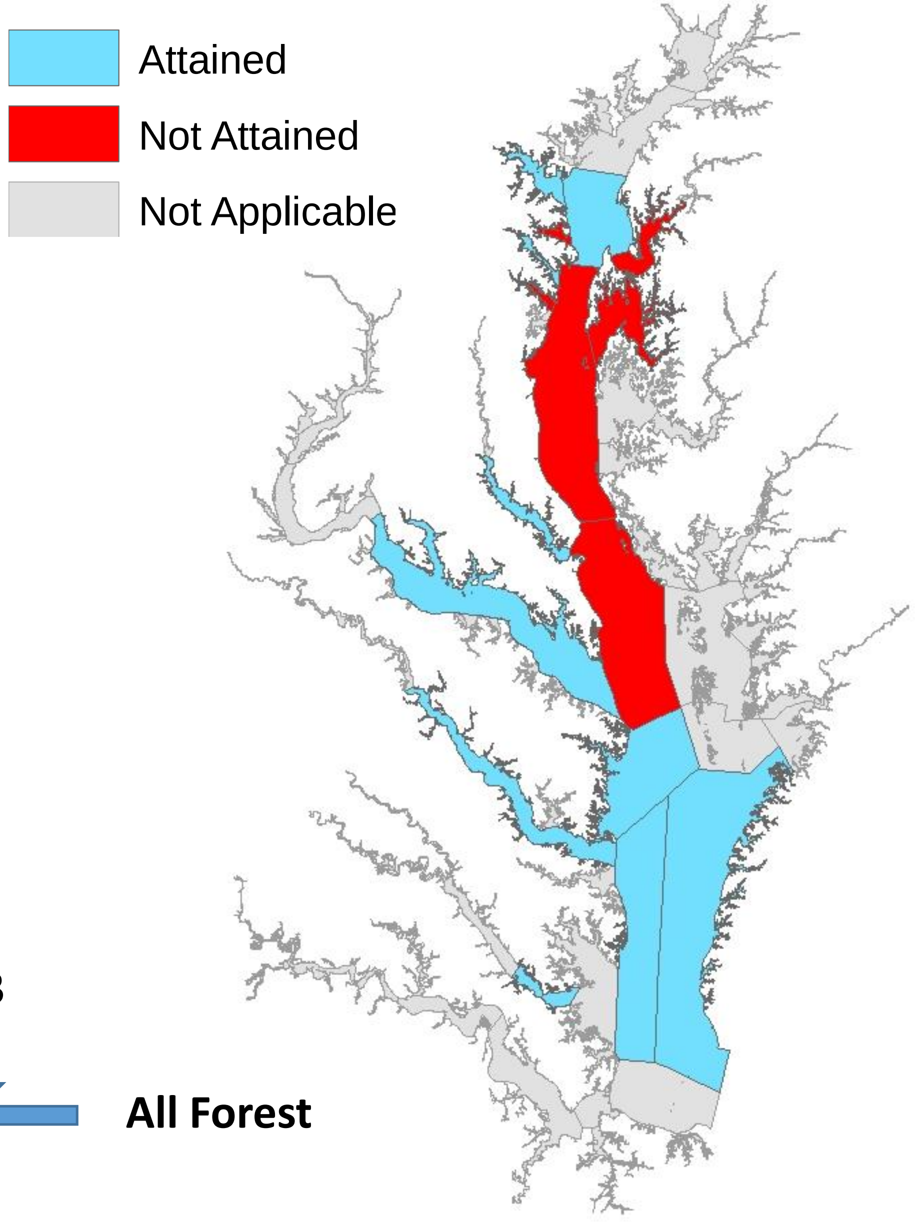
- CB4MH
- CB5MH_MD
- PATMH
- MAGMH
- SOUMH
- PAXMH
- POTMH
- RPPMH
- CHSMH

2000 Progress

E3

All Forest

317 TN
21.9 TP

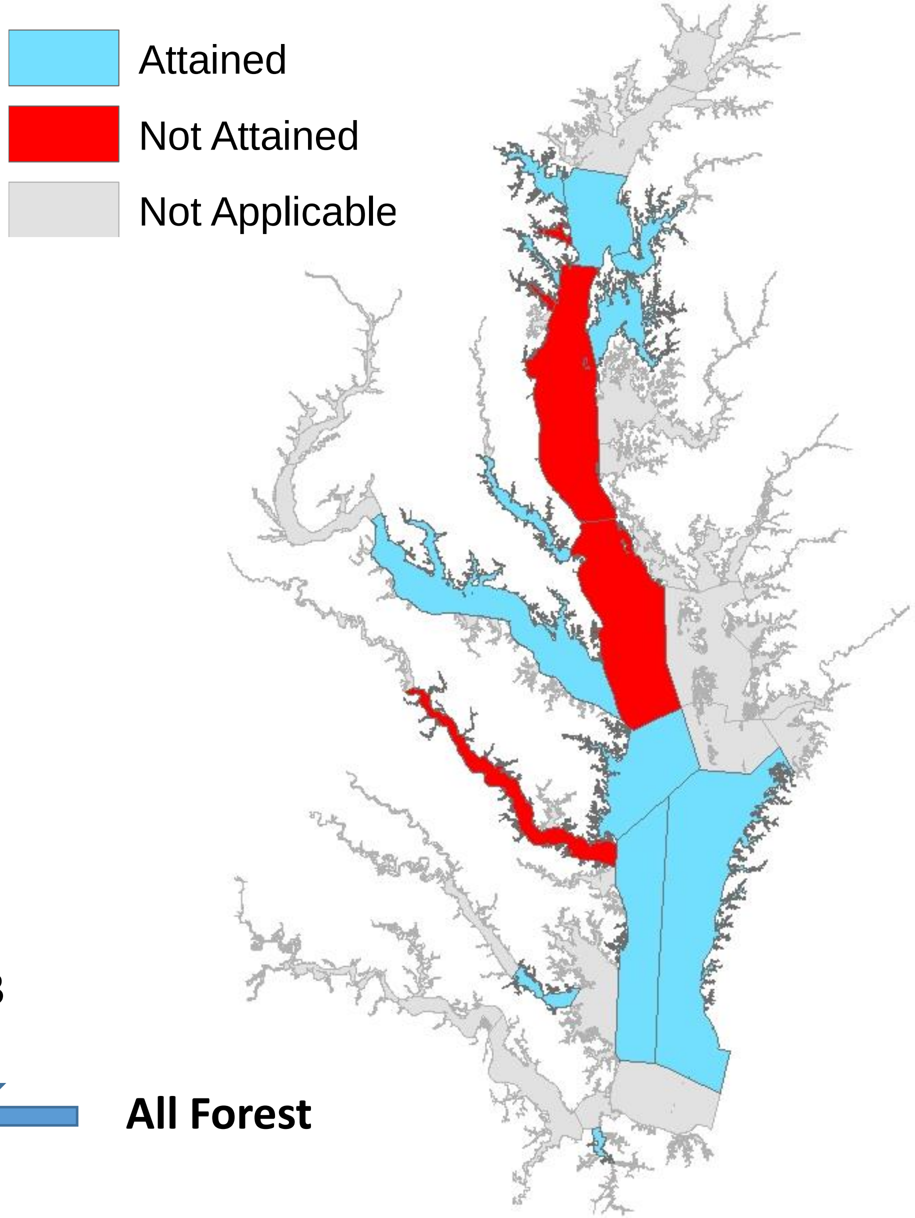


2000 Progress

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

- CB4MH
- CB5MH_MD
- MAGMH
- SOUMH
- RPPMH



2010 Progress

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

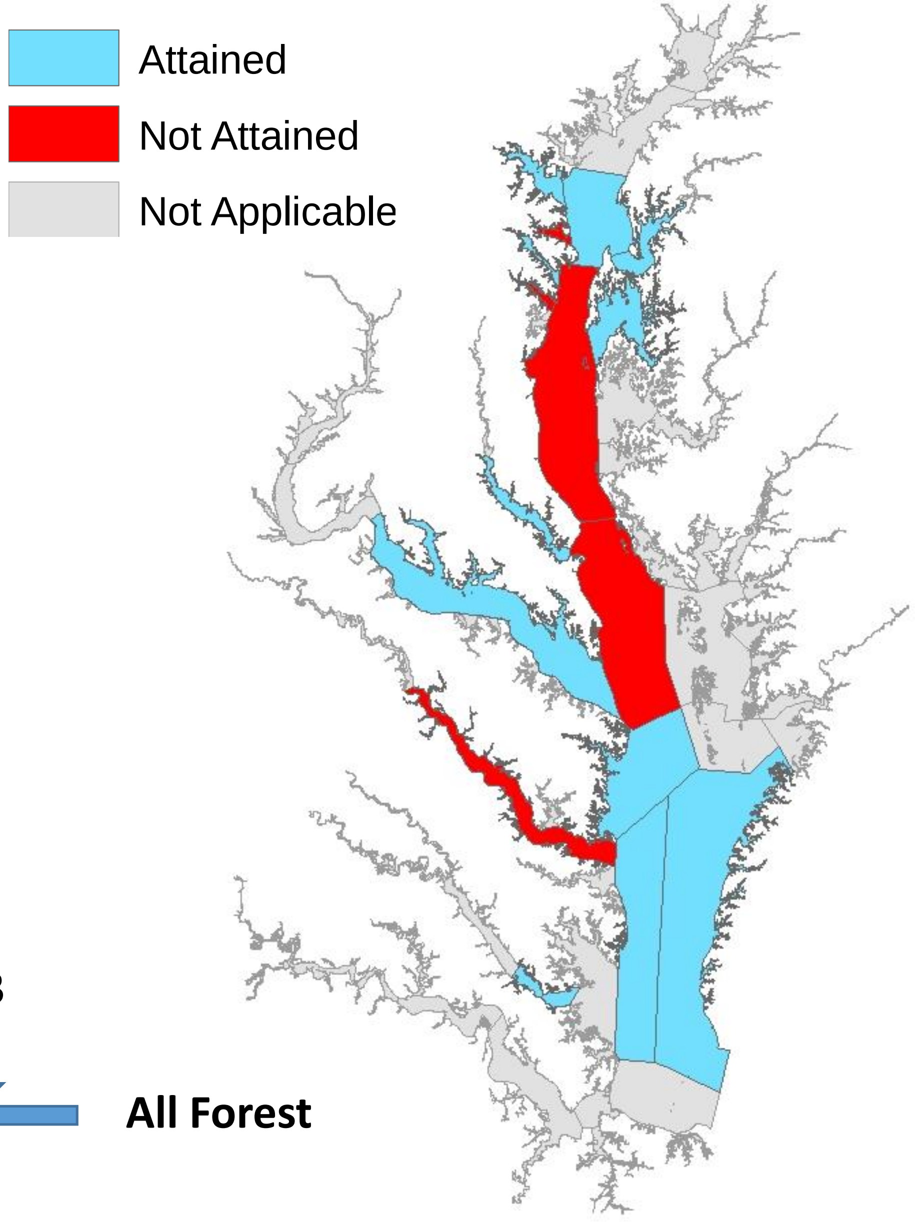
- CB4MH
- CB5MH_MD
- MAGMH
- SOUMH
- RPPMH

2013 Progress

E3

All Forest

253 TN
15.9 TP

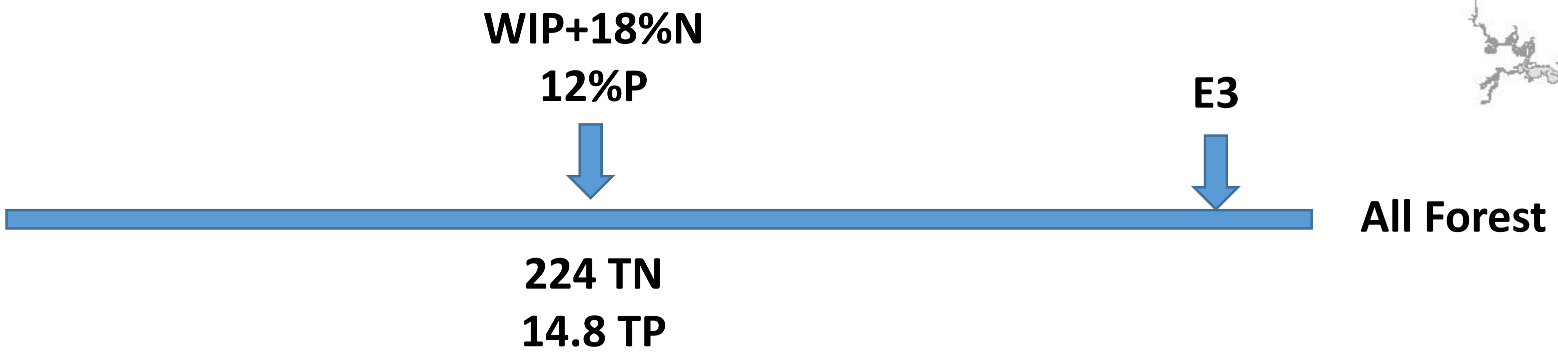


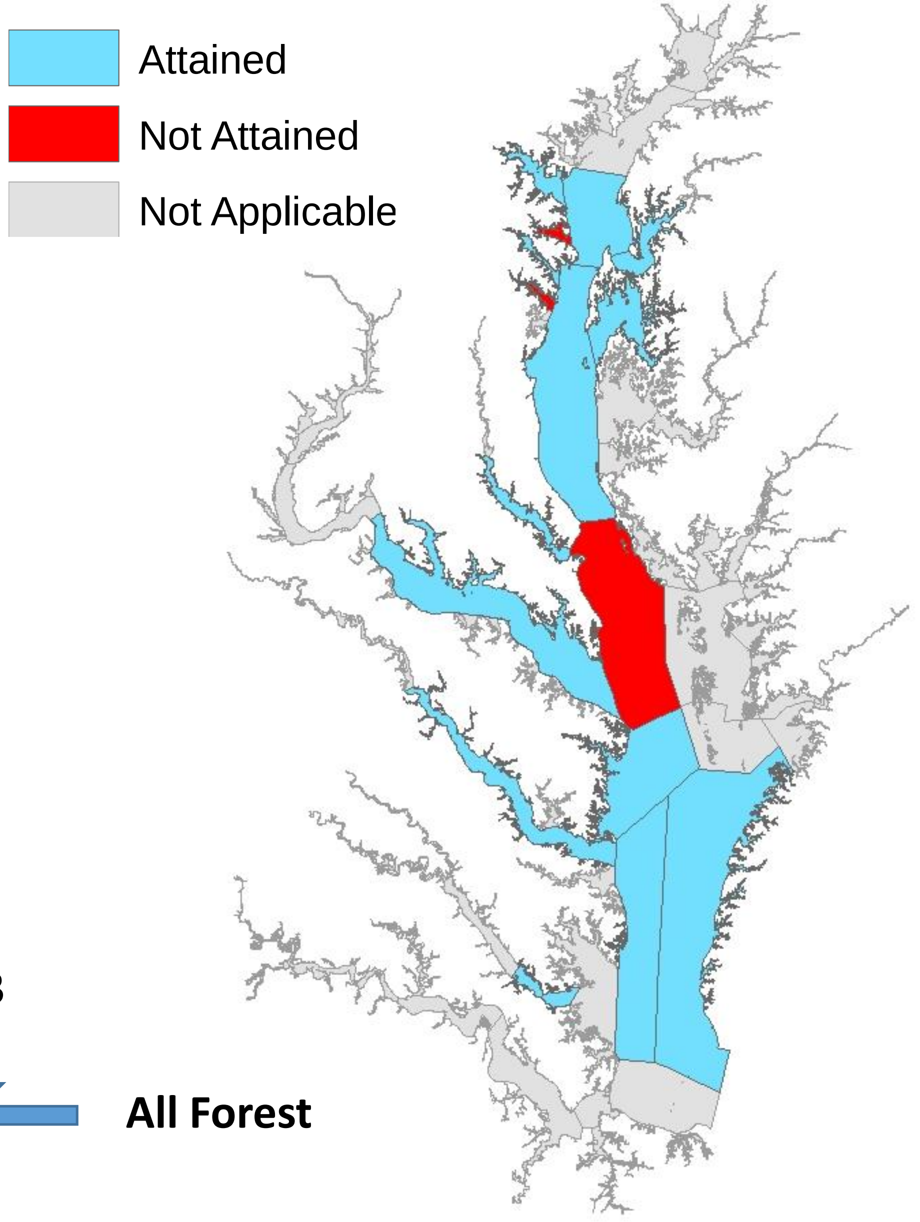
2013 Progress

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

- CB5MH_MD
- MAGMH
- SOUMH



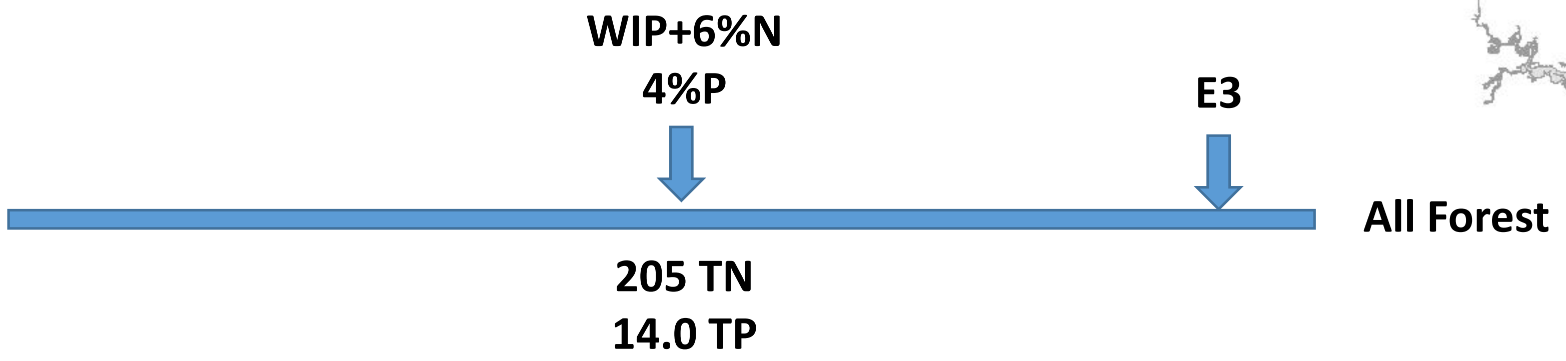


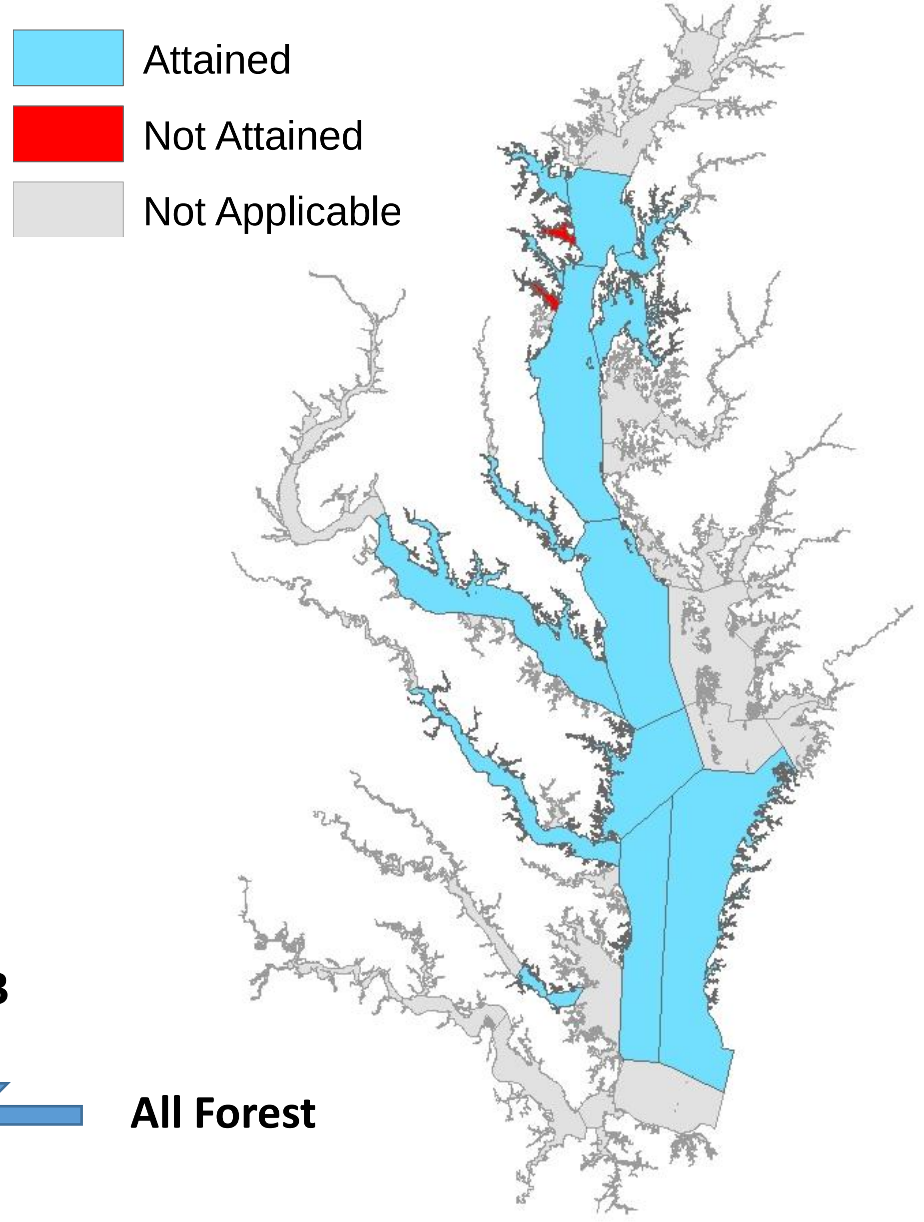
WIP+18%N 12%P

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

- MAGMH
- SOUMH



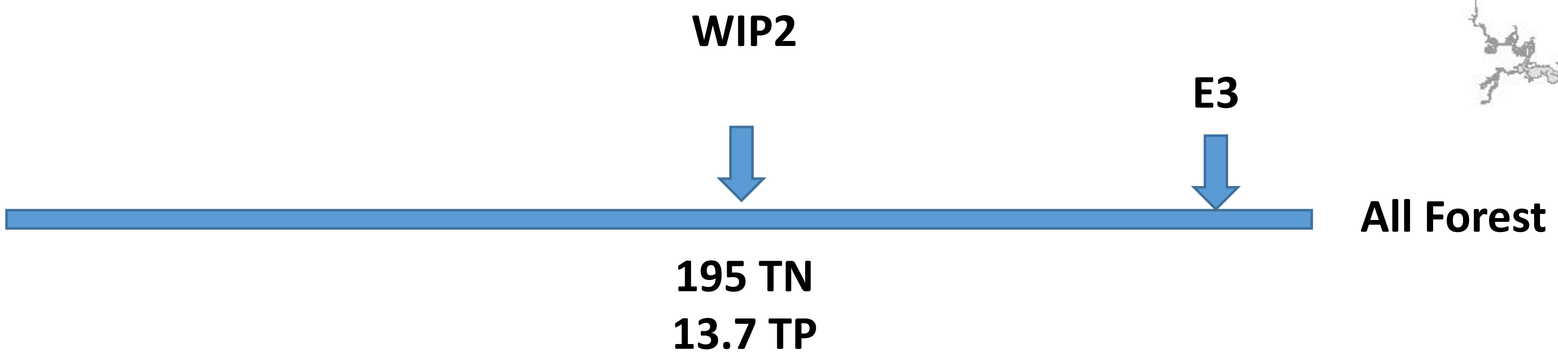


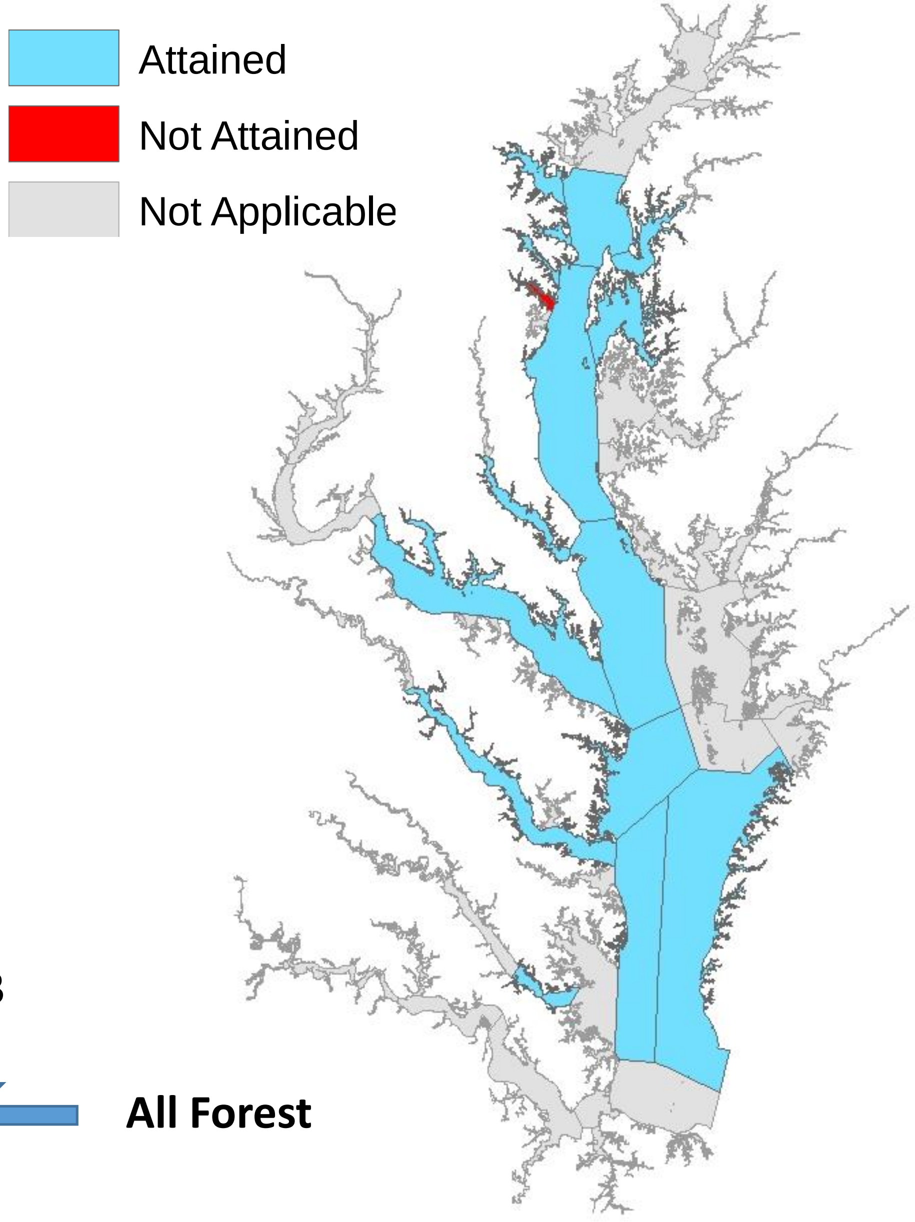
WIP+6%N 4%P

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

- SOUMH



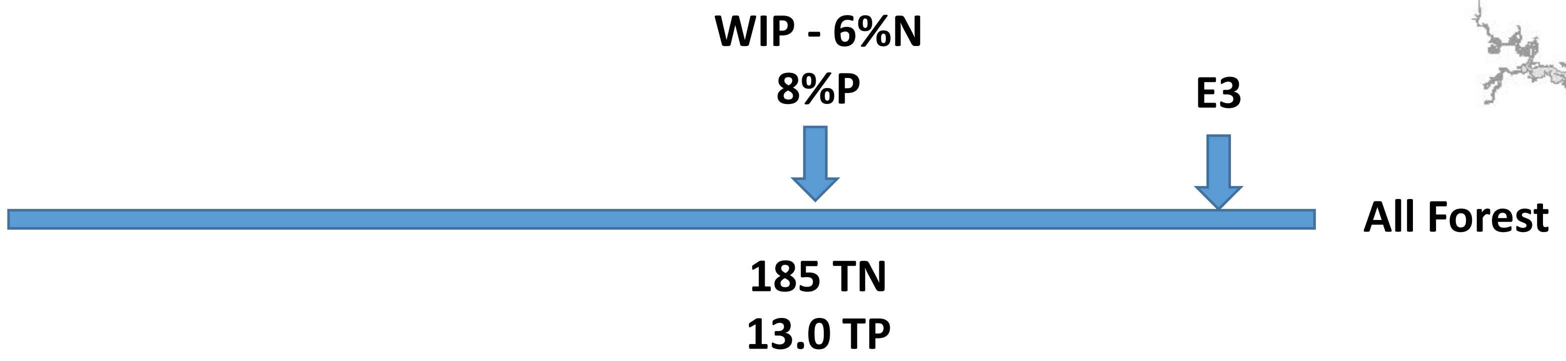


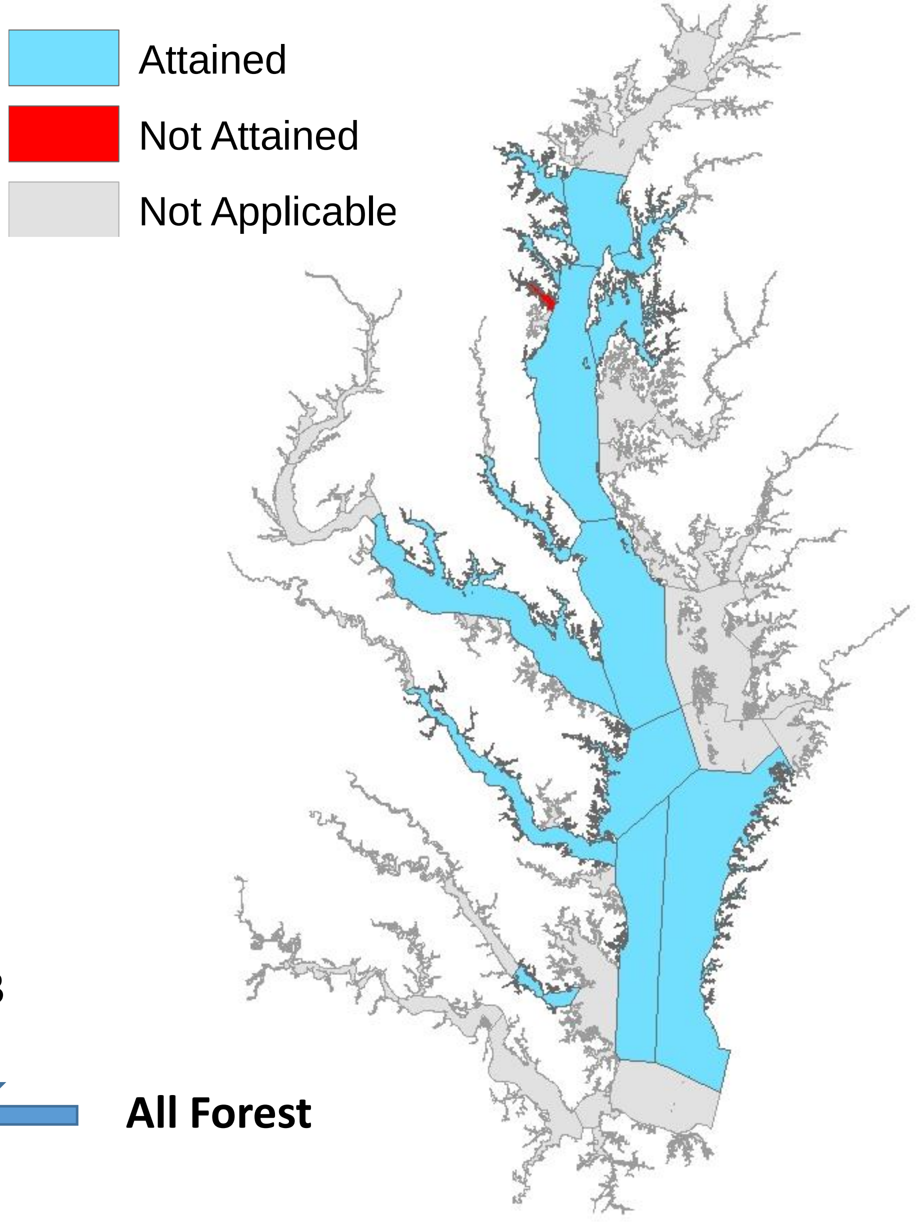
WIP2

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

- SOUMH



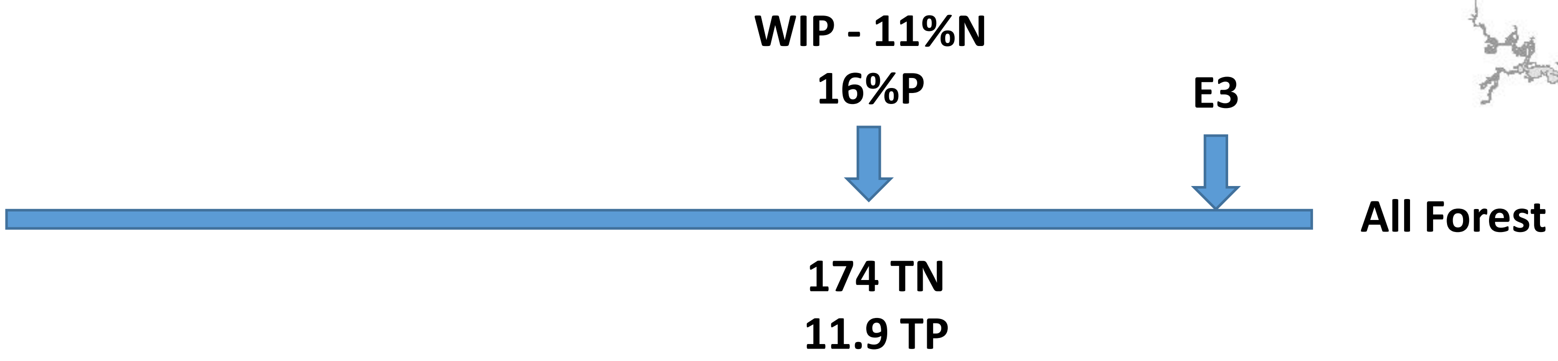


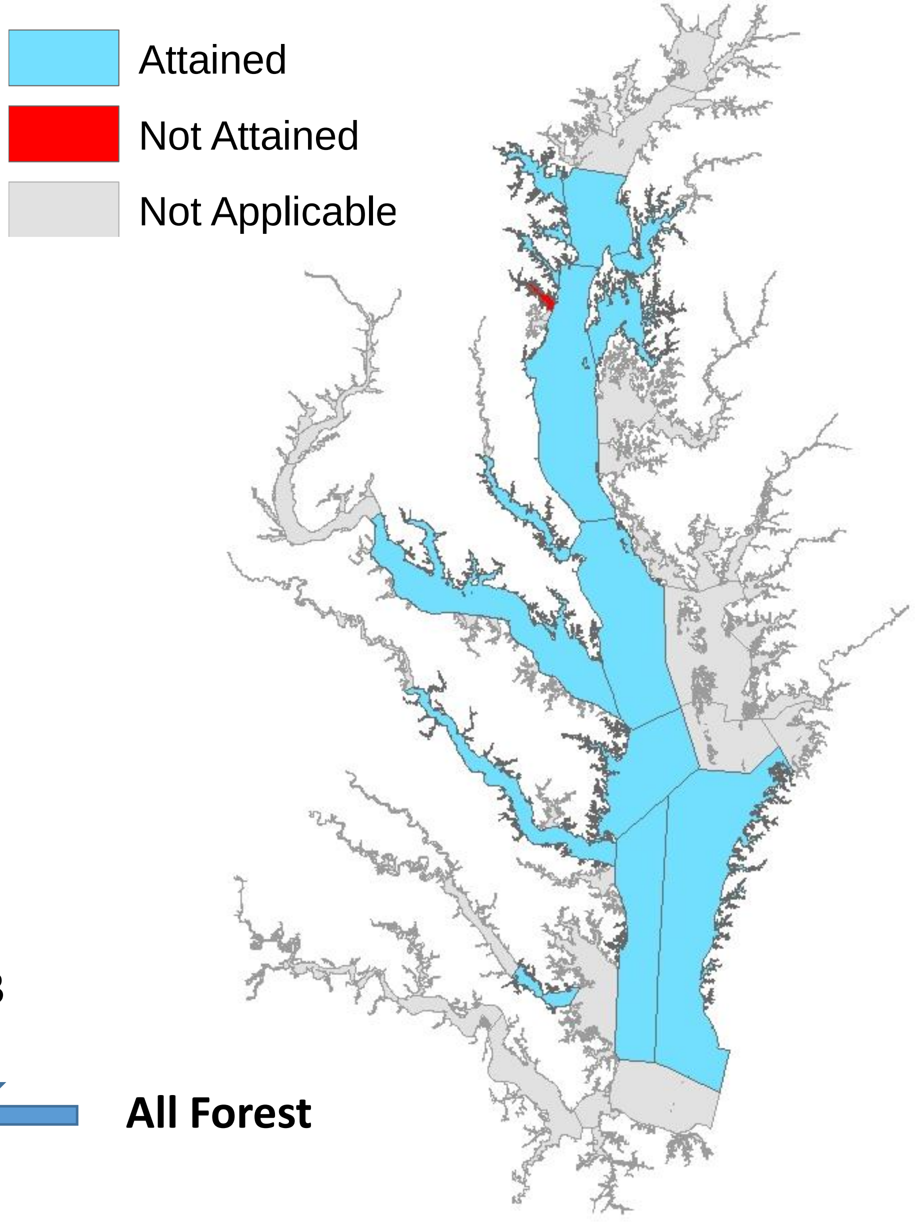
WIP -6%N 8%P

Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

- SOUMH





WIP -11%N 16%P

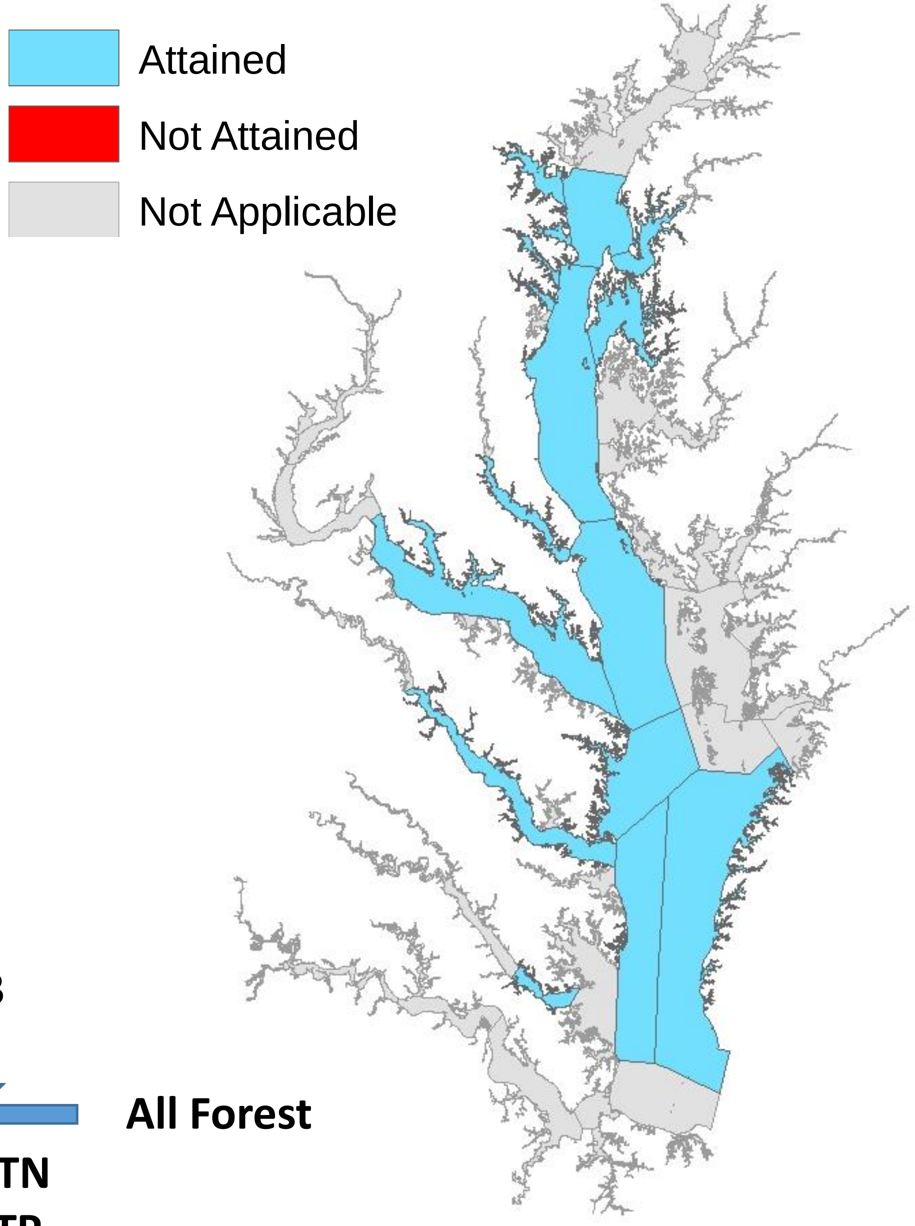
Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment

E3

All Forest

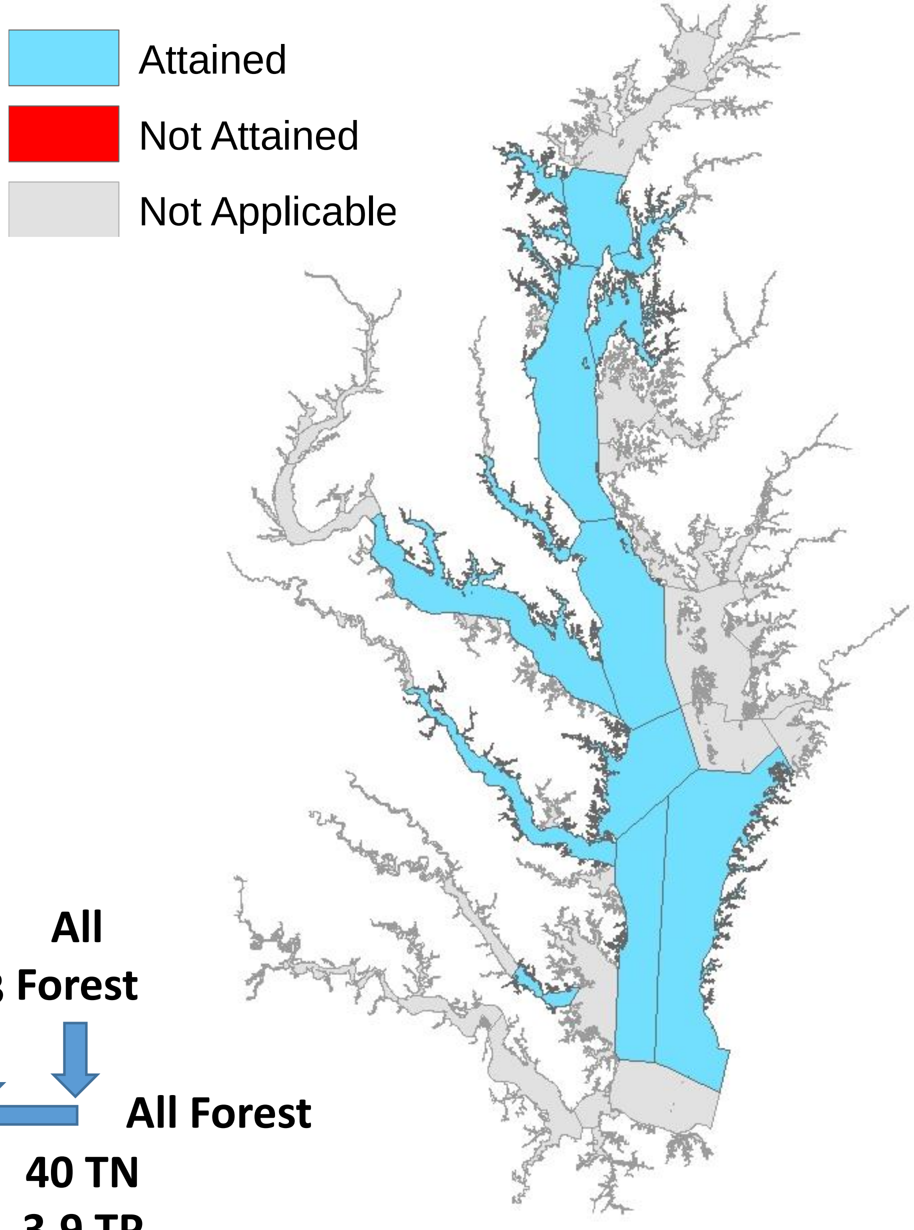
133 TN
8.6 TP



E3

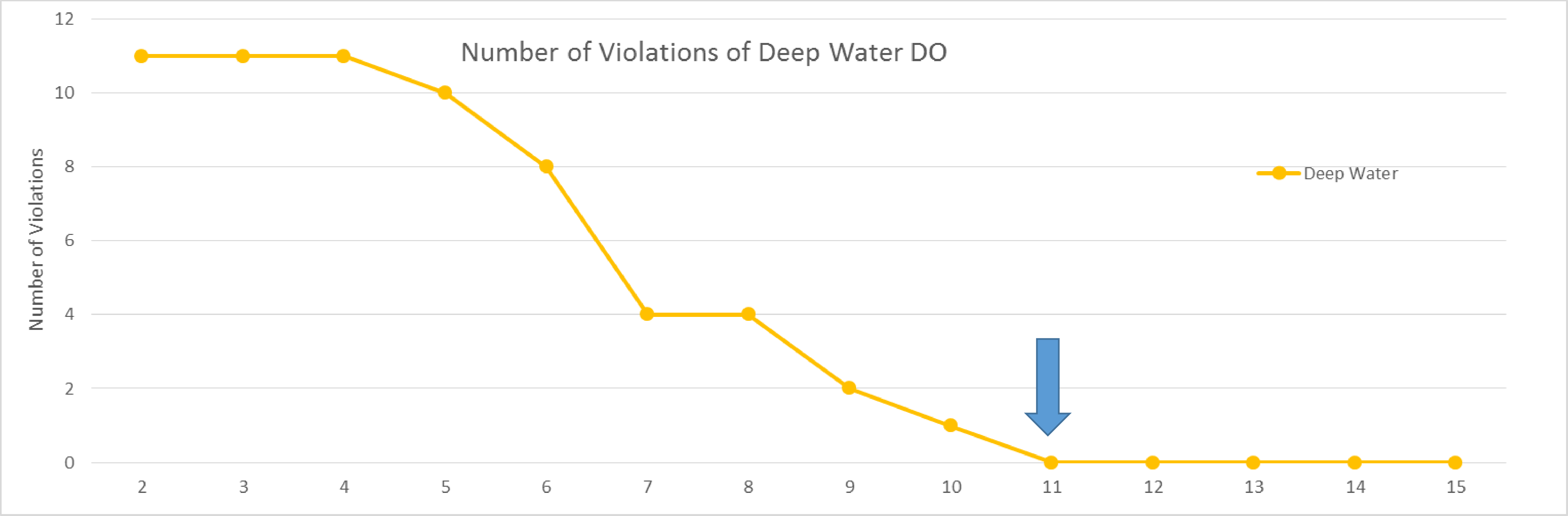
Segments Attaining Oxygen Standards: Deep-Water Use

Segments NOT in Attainment



All Forest

Segments Attaining Oxygen Standards: Deep-Water Use

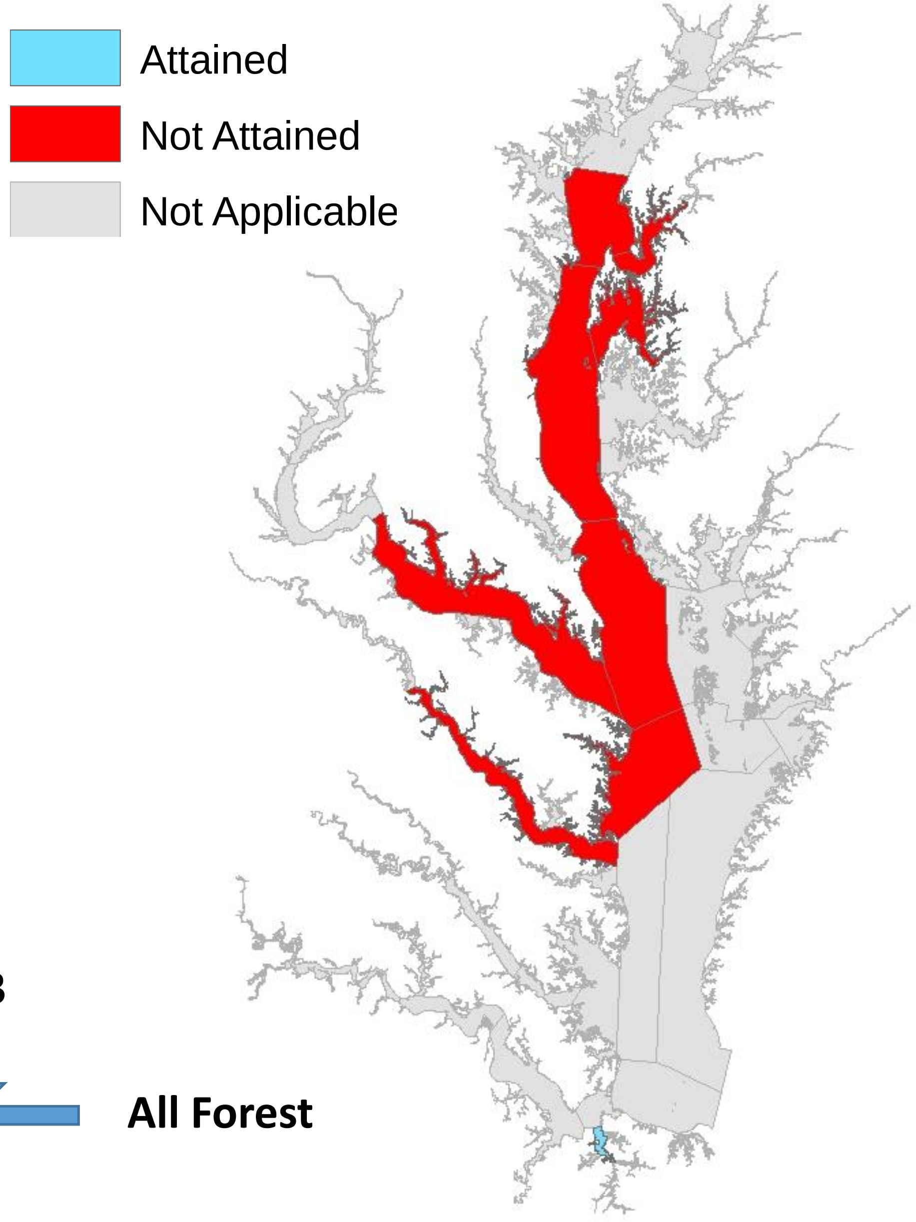


No Action	1985 Progress	1990 Progress	1993 Progress	2000 Progress	2010 Progress	2013 Progress	WIP+18%TN & +12%TP	WIP+6%TN & +4%TP	WIP2	WIP-6%TN & -8%TP	WIP-11%TN & -16%TP	E3	All Forest
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

- CB3MH
- CB4MH
- CB5MH_MD
- CB5MH_VA
- POTMH
- RPPMH
- CHSMH
- EASMH

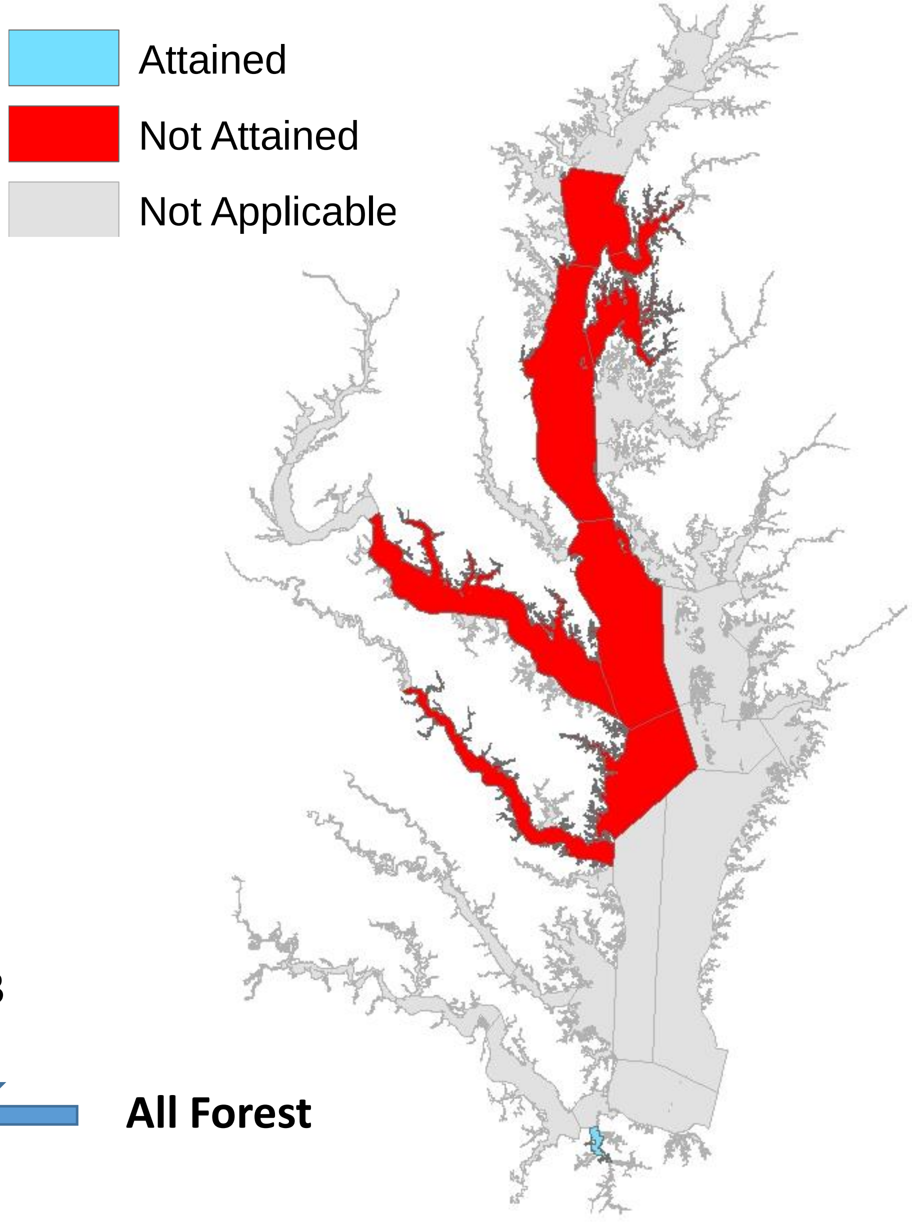


2010 No Action

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

- CB3MH
- CB4MH
- CB5MH_MD
- CB5MH_VA
- POTMH
- RPPMH
- CHSMH
- EASMH



1985 Progress

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

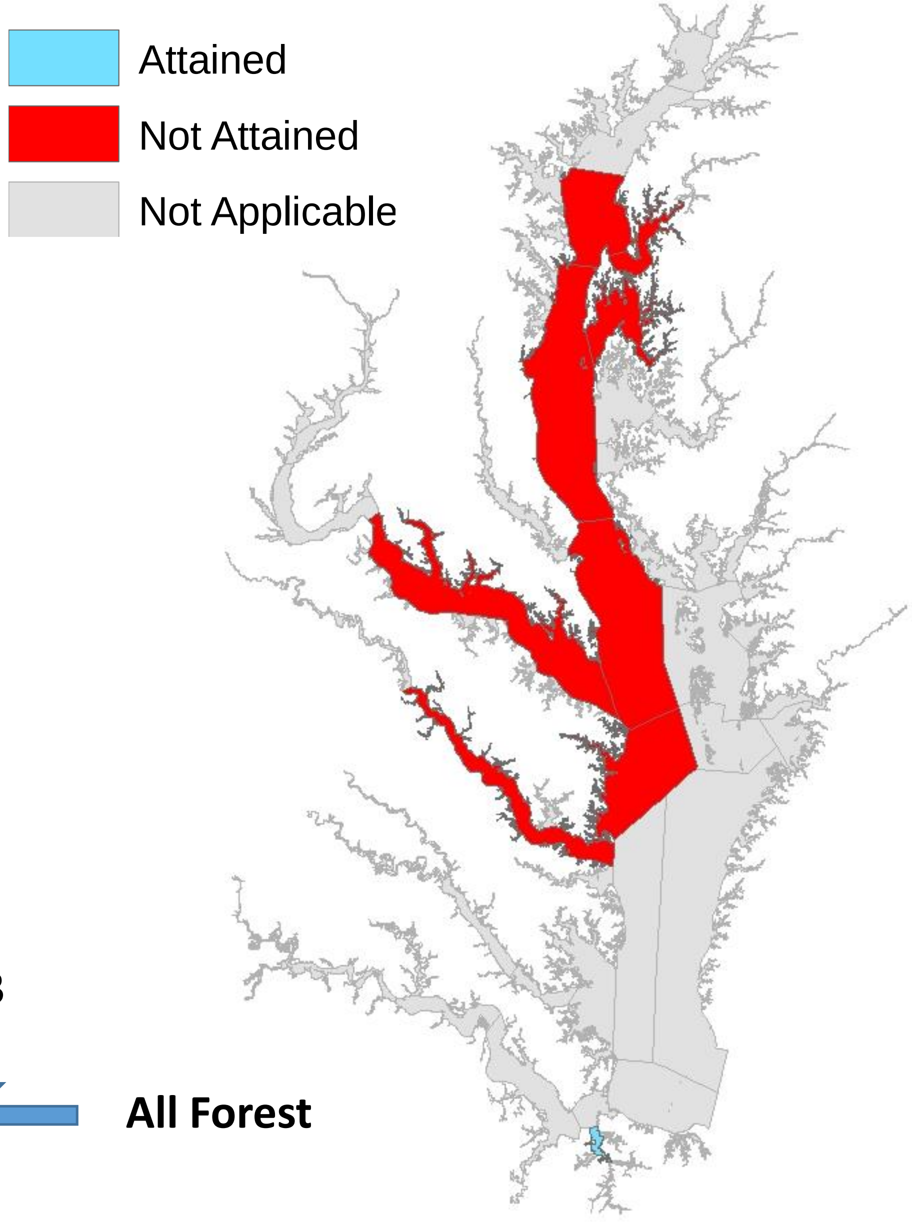
- CB3MH
- CB4MH
- CB5MH_MD
- CB5MH_VA
- POTMH
- RPPMH
- CHSMH
- EASMH

1990 Progress

E3

All Forest

338 TN
27.7 TP



1990 Progress

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

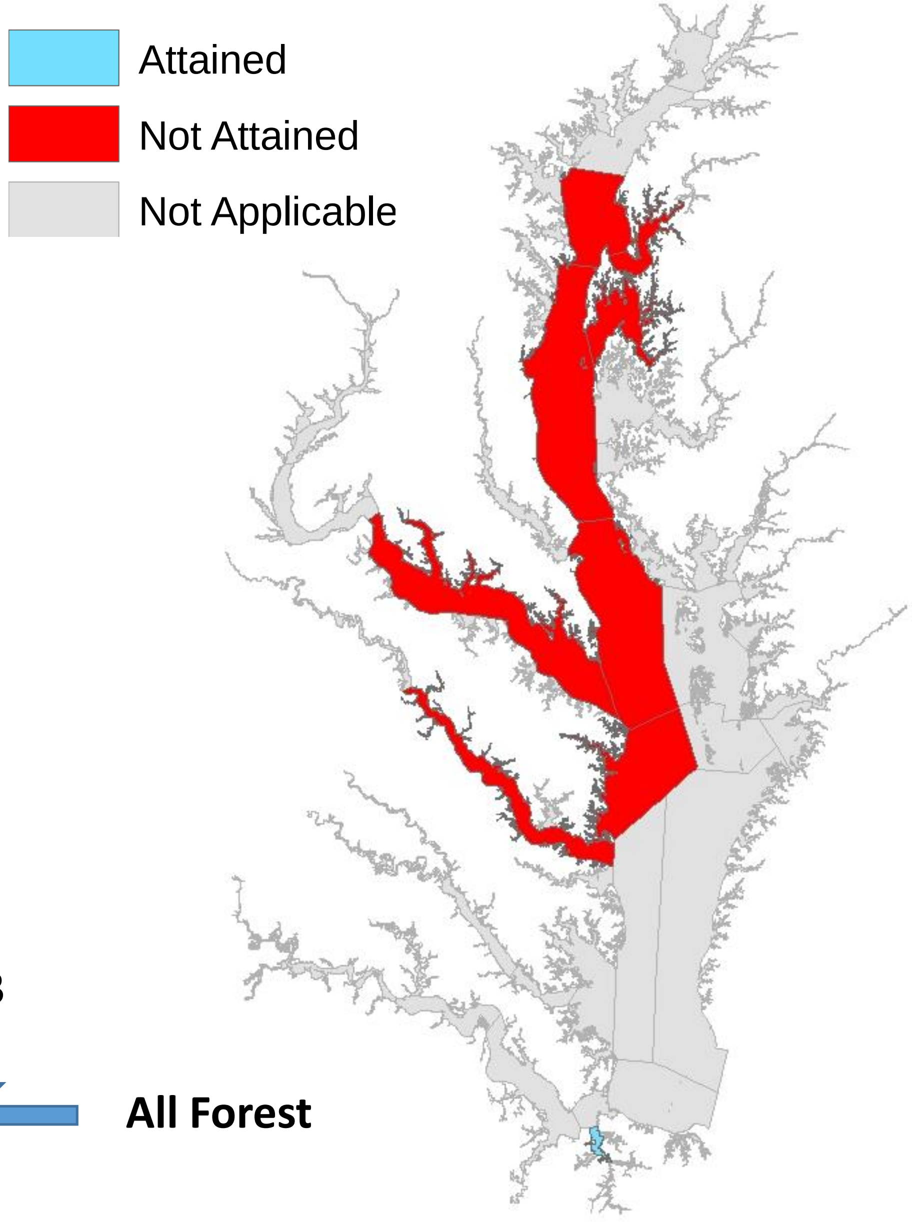
- CB3MH
- CB4MH
- CB5MH_MD
- CB5MH_VA
- POTMH
- RPPMH
- CHSMH
- EASMH

1993 Progress

E3

All Forest

337 TN
23.7 TP

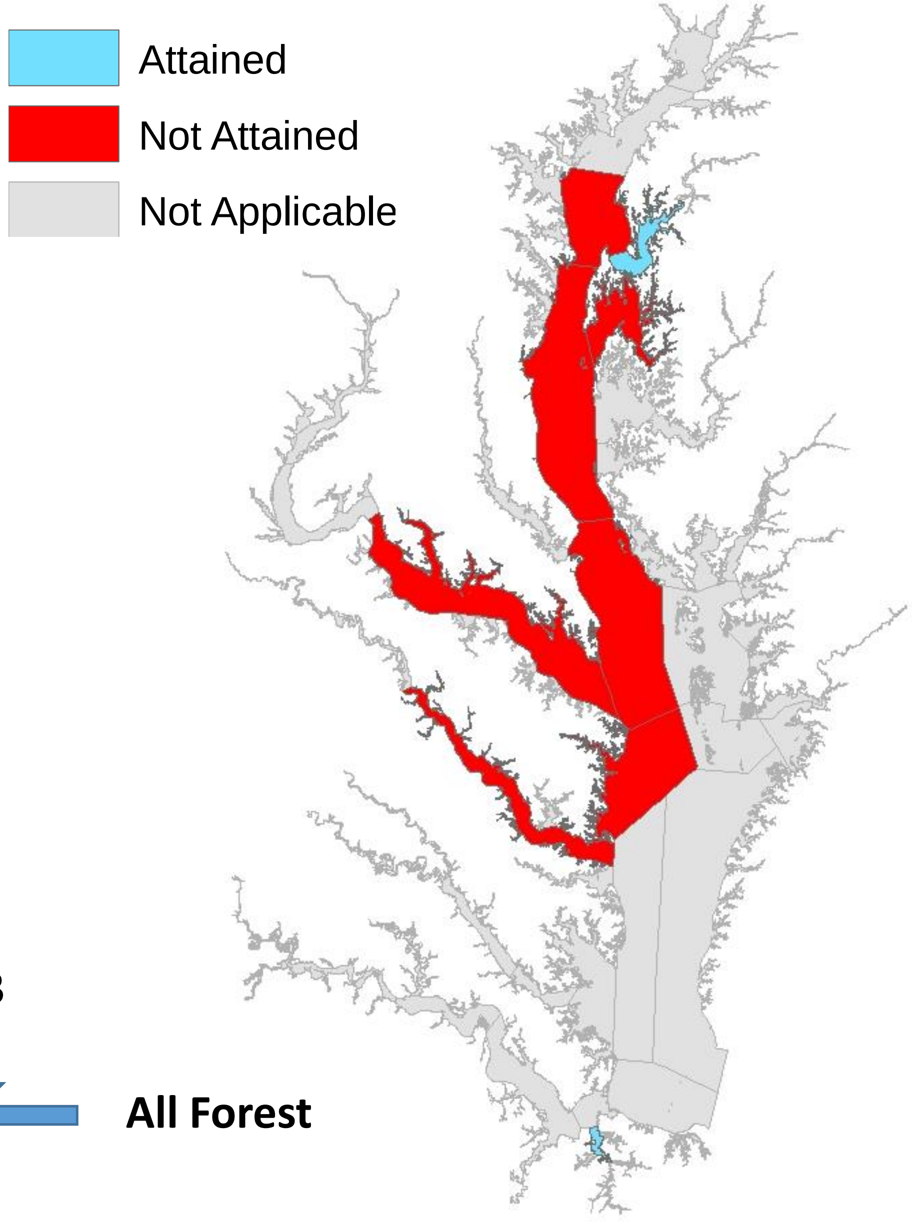


1993 Progress

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

- CB3MH
- CB4MH
- CB5MH_MD
- CHSMH
- EASMH
- POTMH
- RPPMH



2000 Progress

2000 Progress

E3

All Forest

317 TN
21.9 TP

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

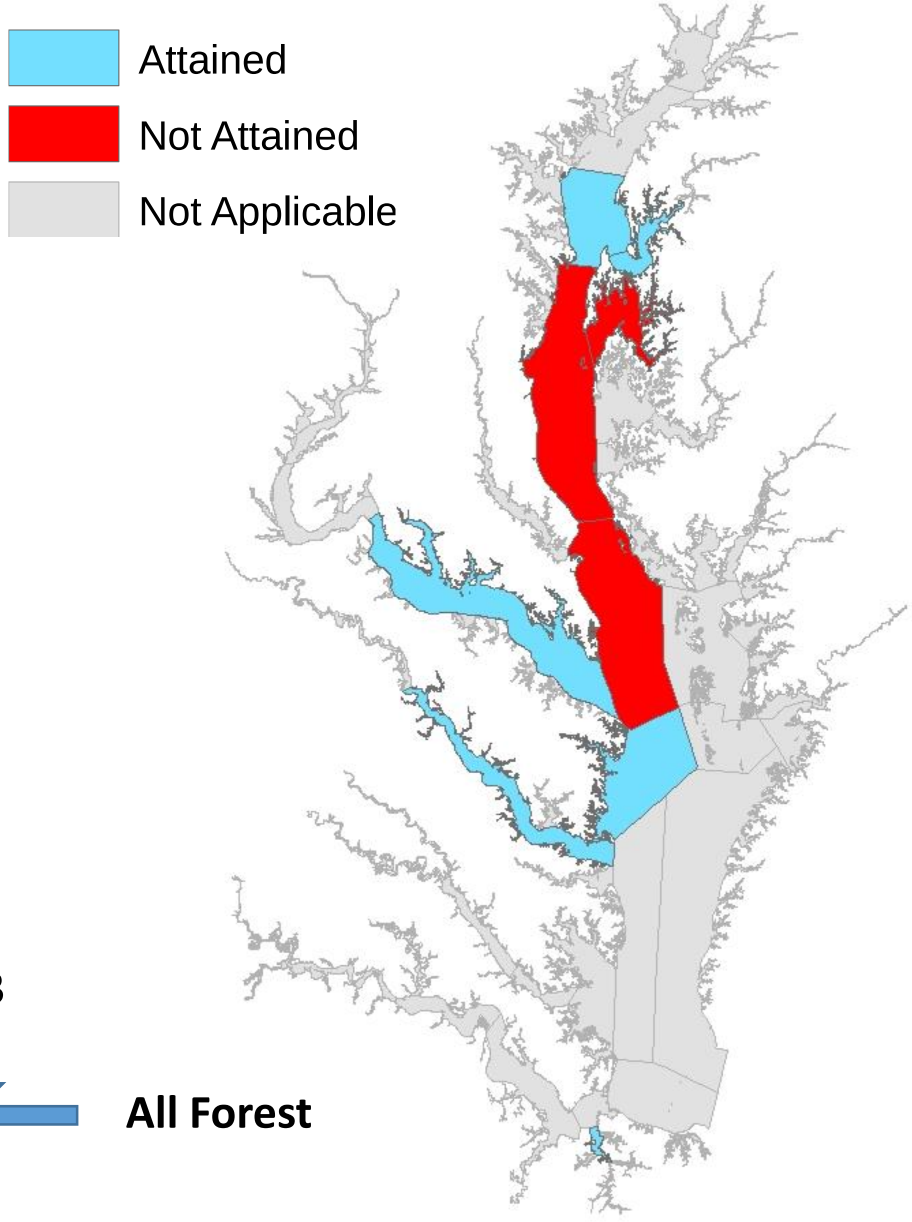
- CB4MH
- CB5MH_MD
- EASMH

2010 Progress

E3

All Forest

266 TN
16.9 TP



2010 Progress

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

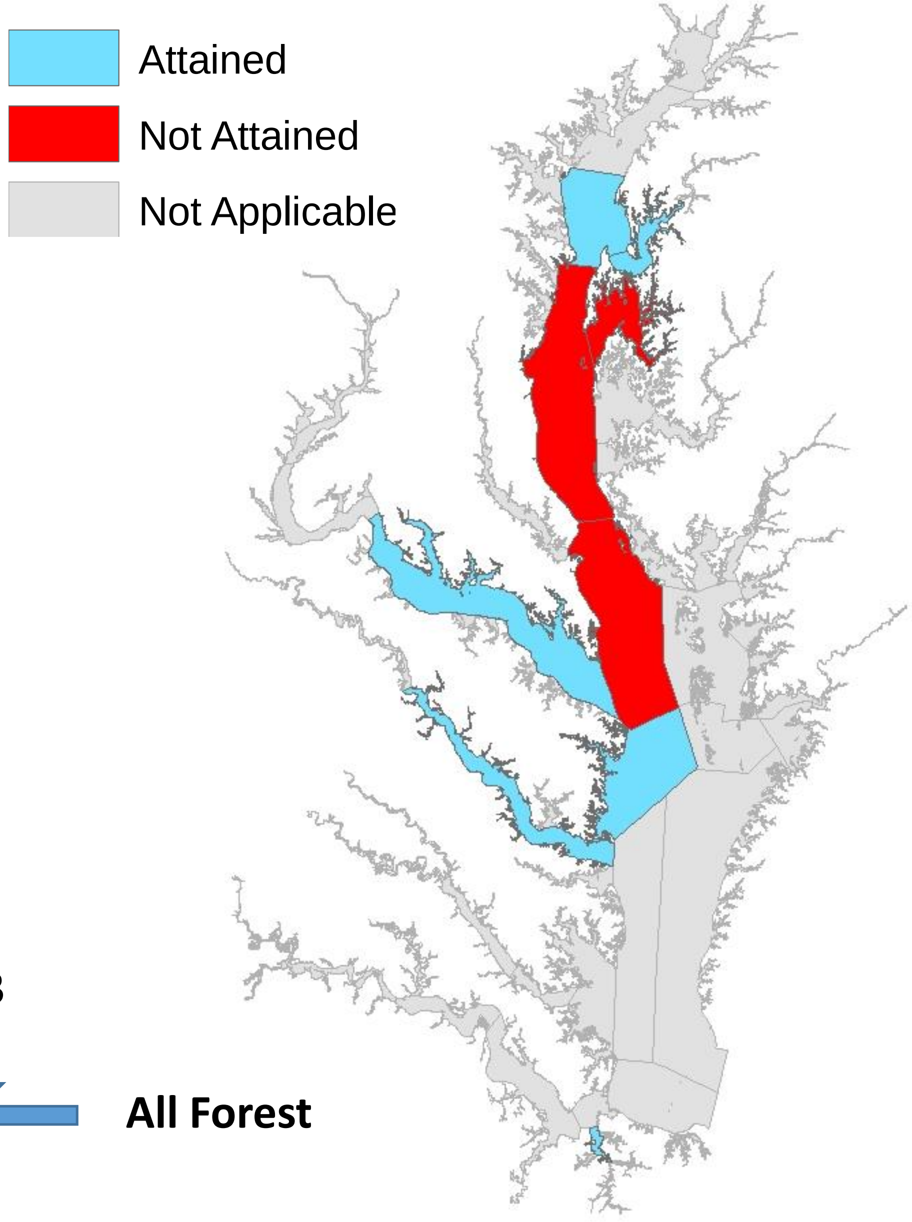
- CB4MH
- CB5MH_MD
- EASMH

2013 Progress

E3

All Forest

253 TN
15.9 TP

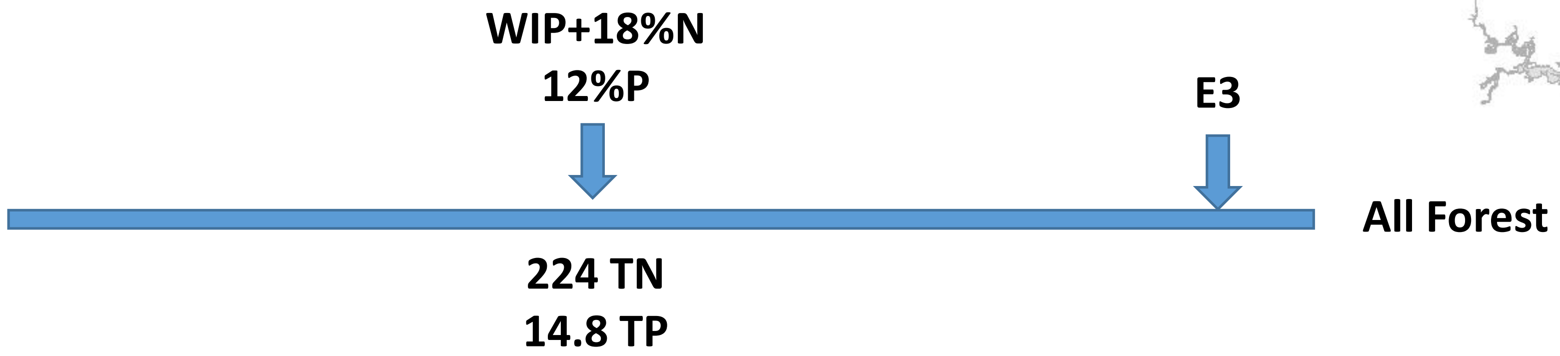


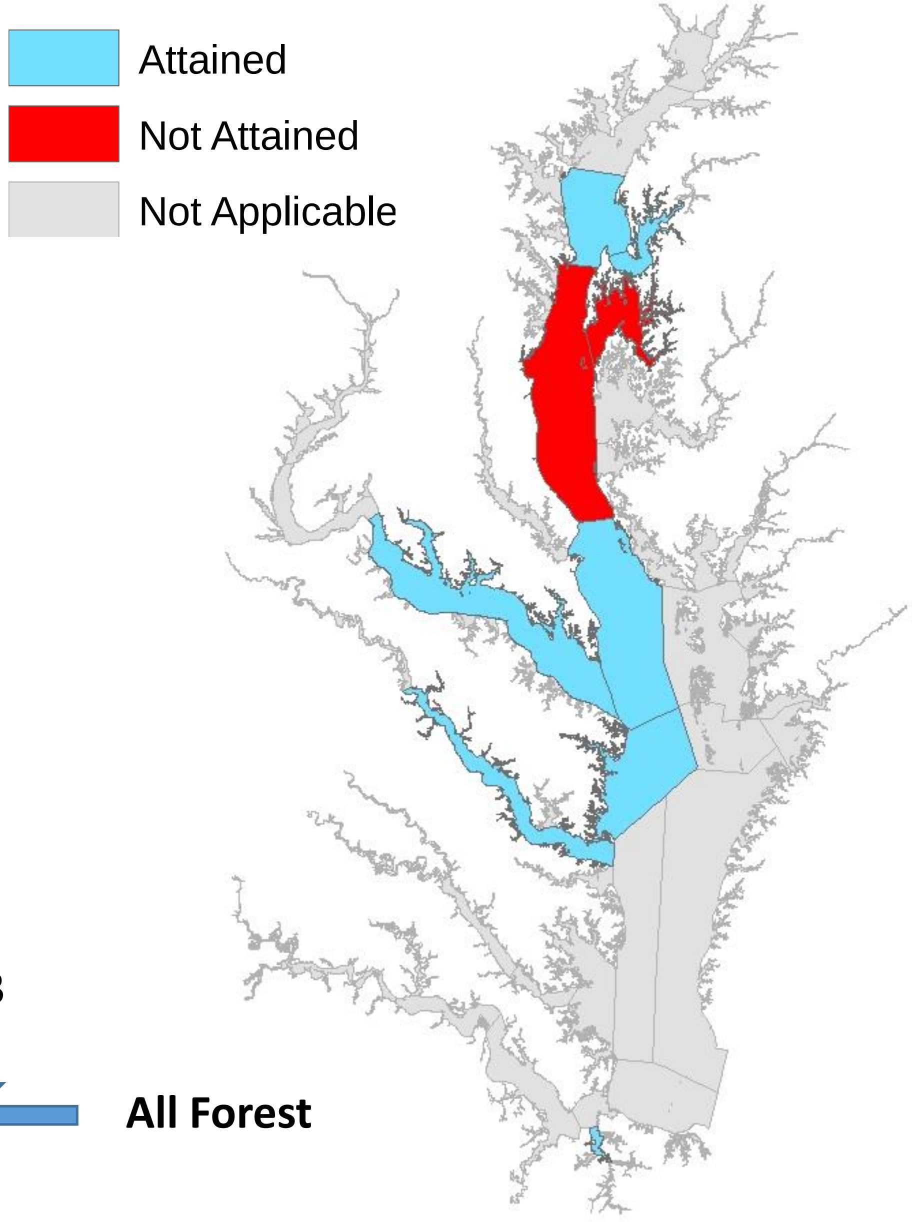
2013 Progress

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

- CB4MH
- EASMH



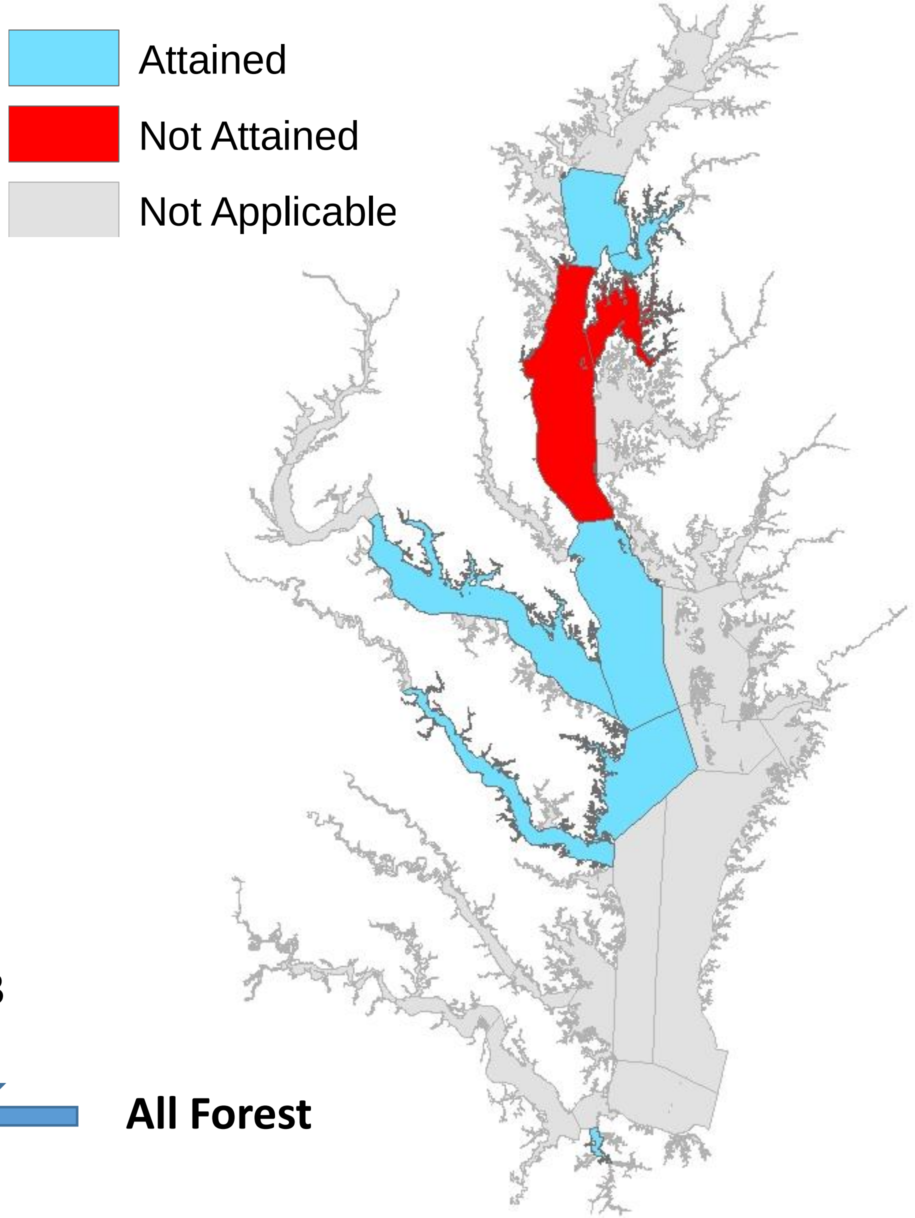


WIP+18% N12%P

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

- CB4MH
- EASMH



WIP+6% N4%P

WIP+6%N
4%P

E3

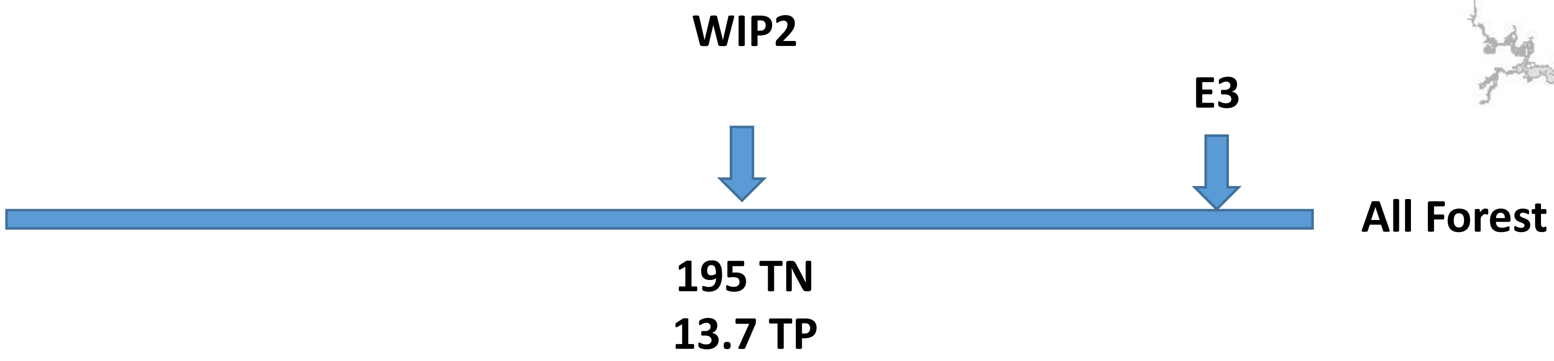
All Forest

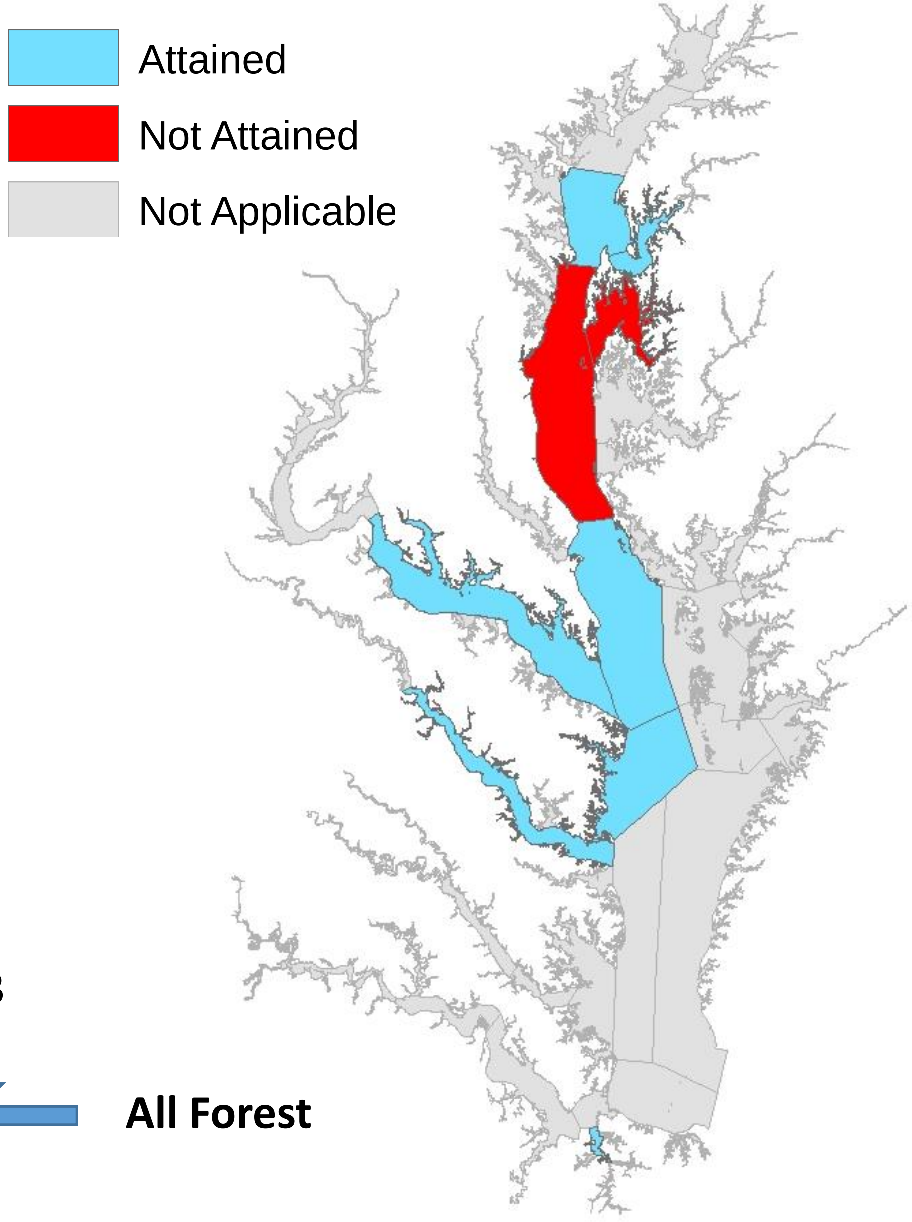
205 TN
14.0 TP

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

- CB4MH
- EASMH





WIP2

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

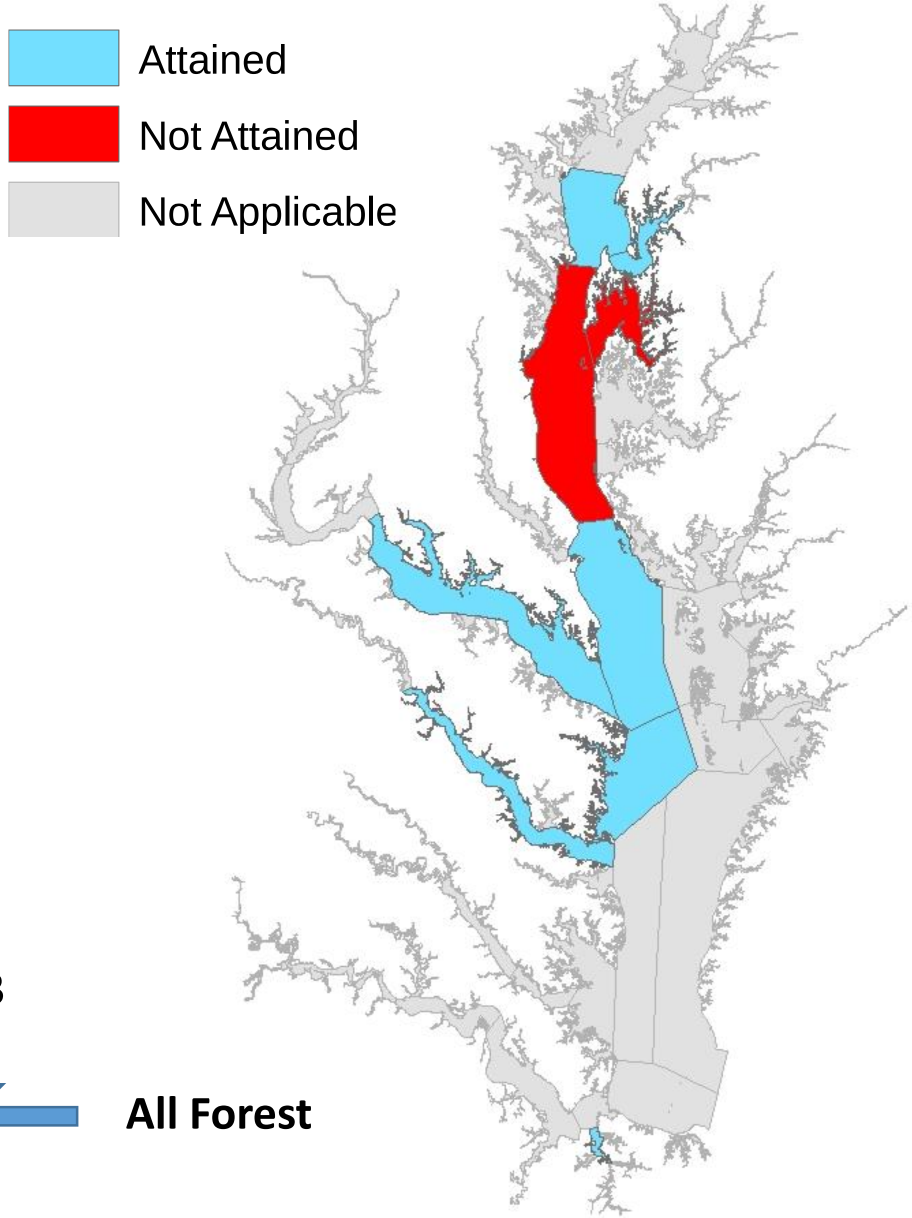
- CB4MH
- EASMH

WIP - 6%N
8%P

E3

All Forest

185 TN
12.8 TP

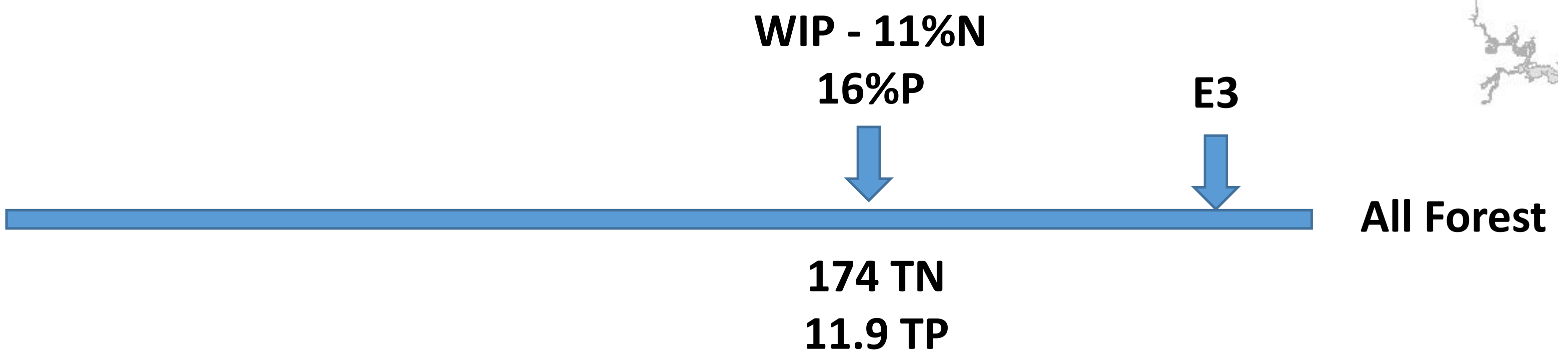


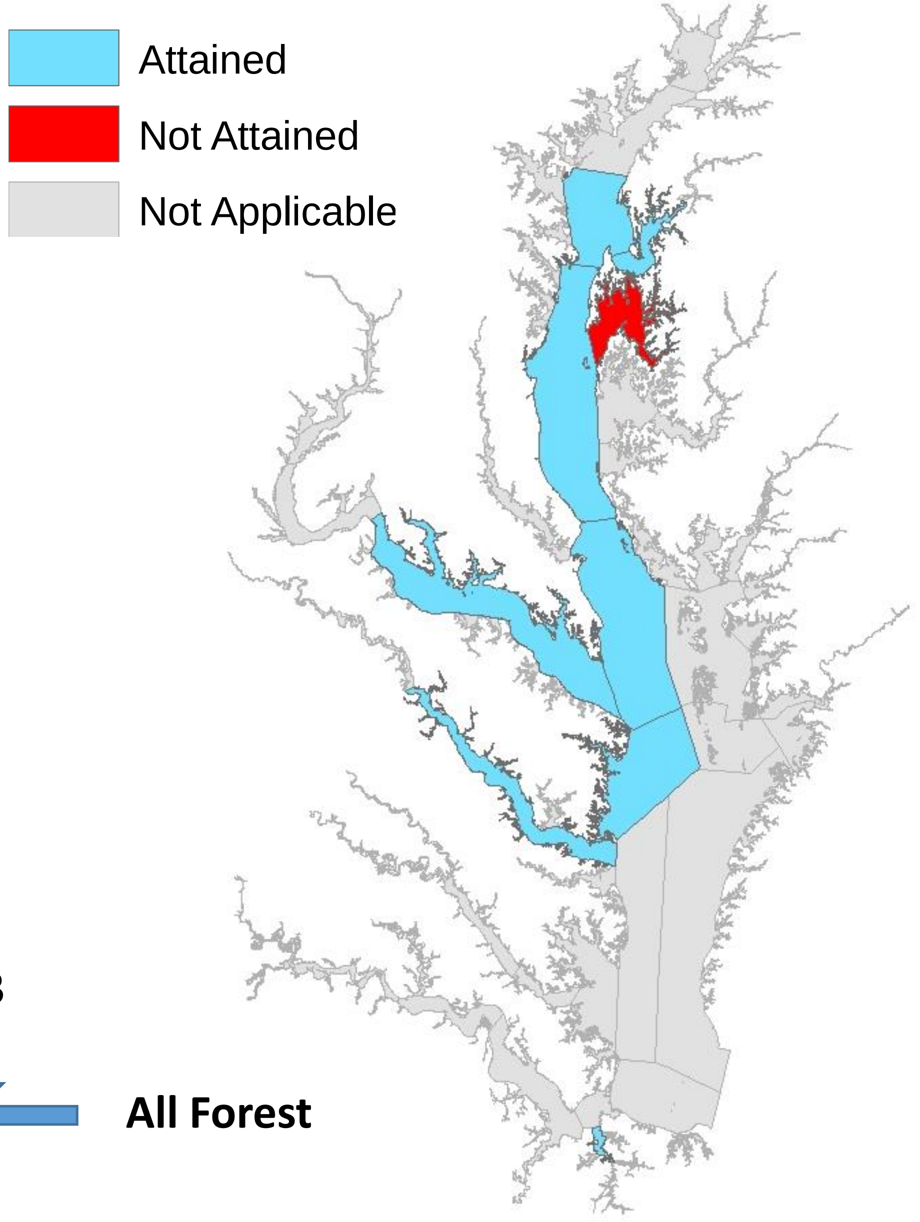
WIP -6%N 8%P

Segments Attaining Oxygen Standards: Deep-Channel Use

Segments NOT in Attainment

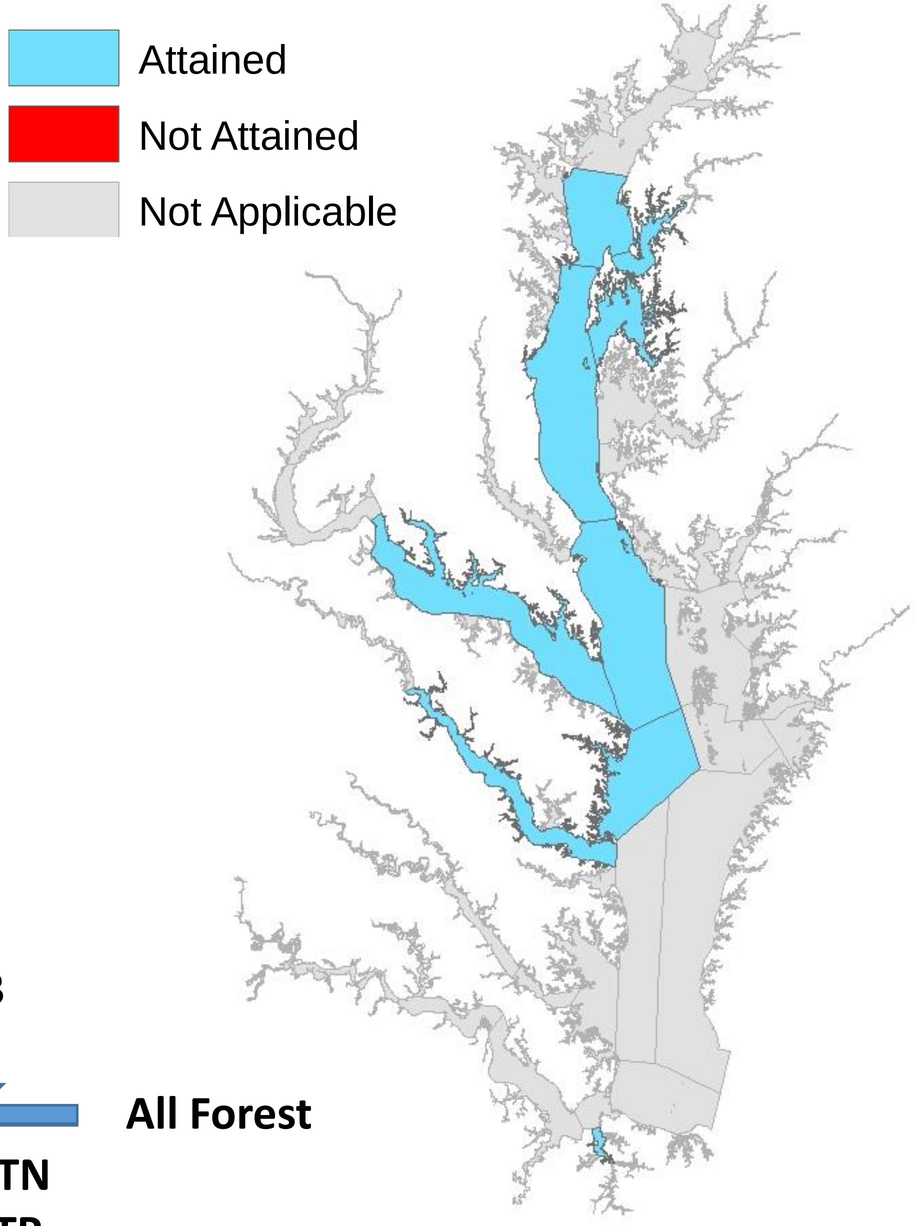
- EASMH





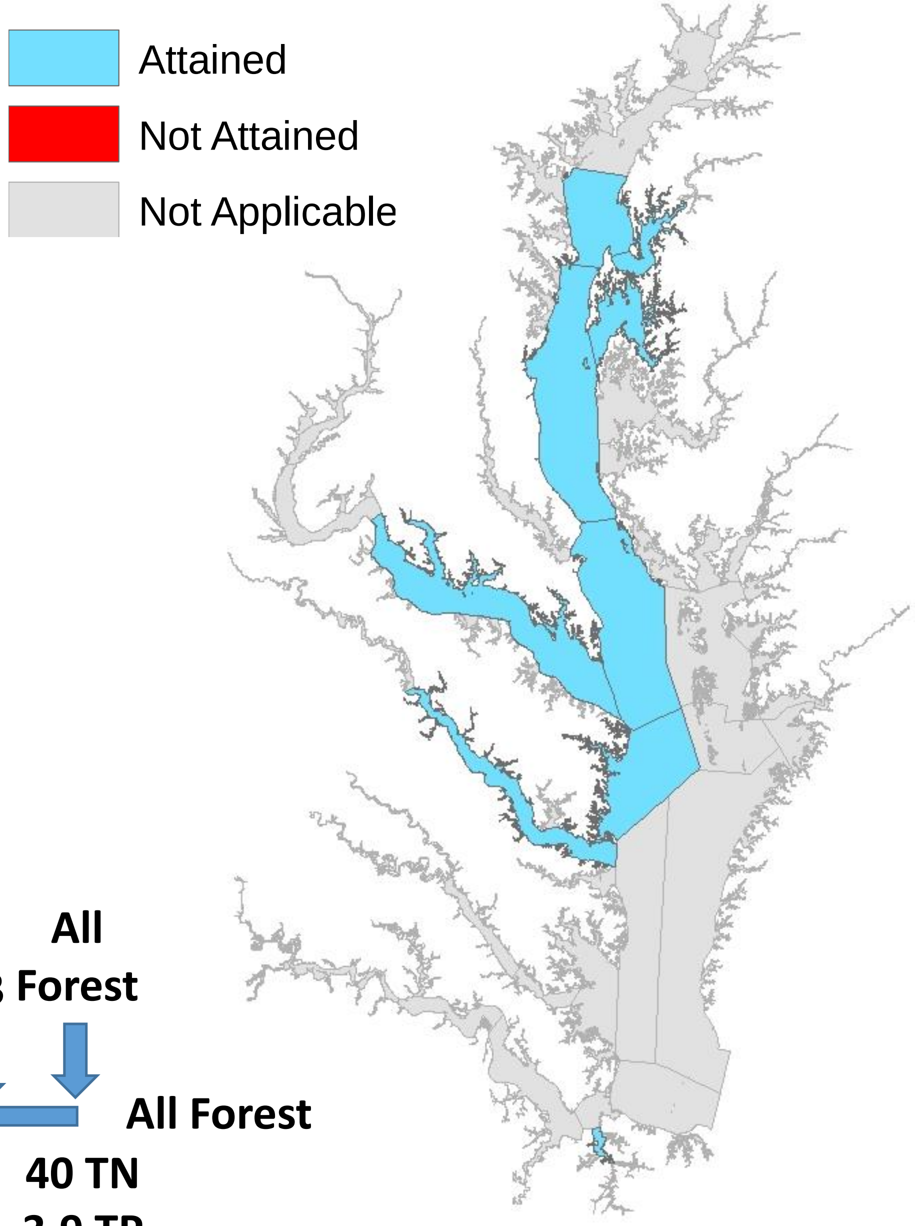
WIP -11%N 16%P

Segments Attaining Oxygen Standards: Deep-Channel Use



E3

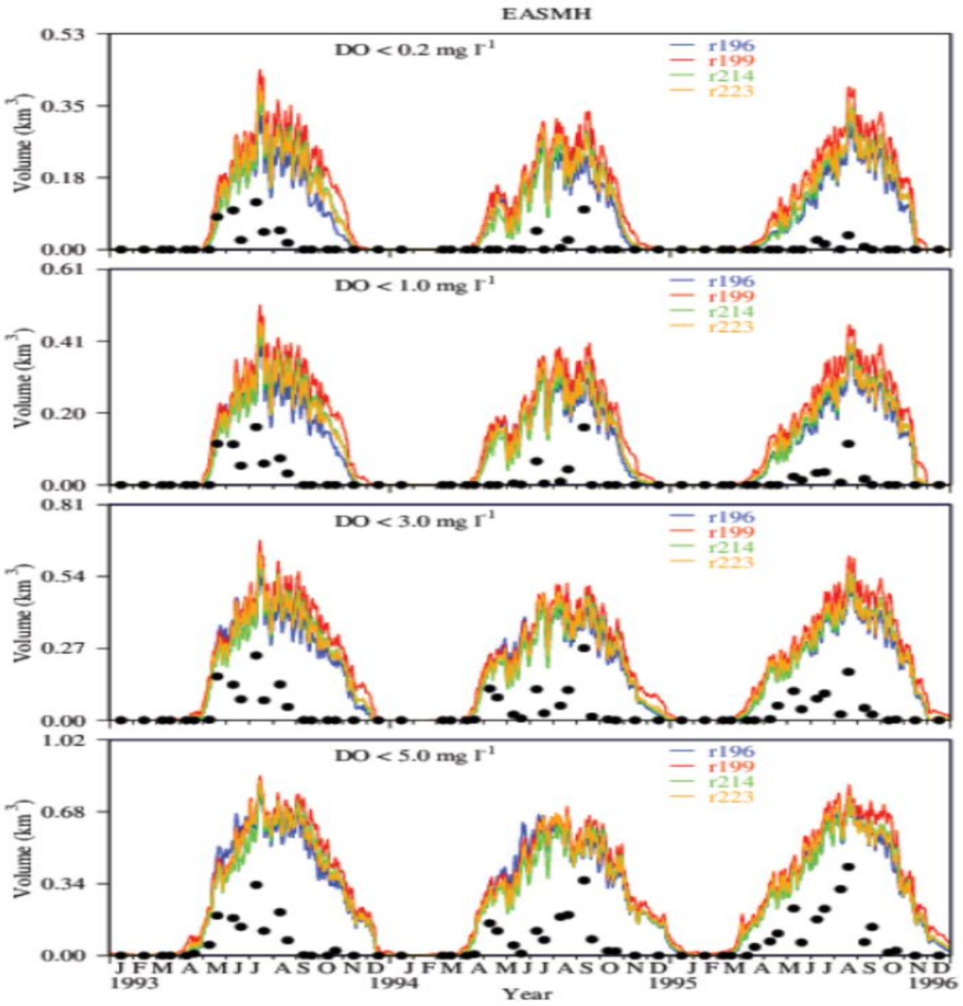
Segments Attaining Oxygen Standards: Deep-Channel Use



All Forest

Model Over-simulates Eastern Bay's Observed Low Oxygen Conditions

Observed DO = black circles Simulated DO = colored lines



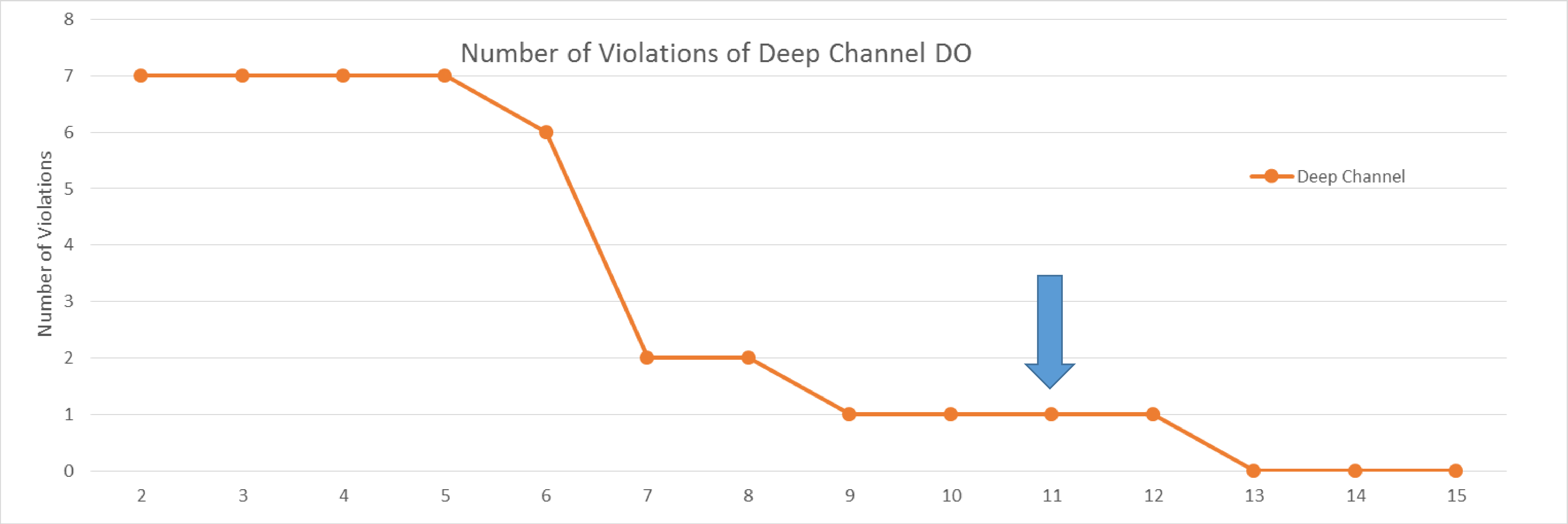
At a dissolved oxygen (DO) concentration of less than 0.2 mg/l the model overestimates the Eastern Bay hypoxia 10 fold.

At a dissolved oxygen (DO) concentration of less than 1 mg/l (Deep Channel DO criterion) the model overestimates the Eastern Bay hypoxia by a factor of 7.

At a dissolved oxygen (DO) concentration of less than 3 mg/l (Deep Water DO criterion) the model overestimates the Eastern Bay hypoxia by a factor of 6.

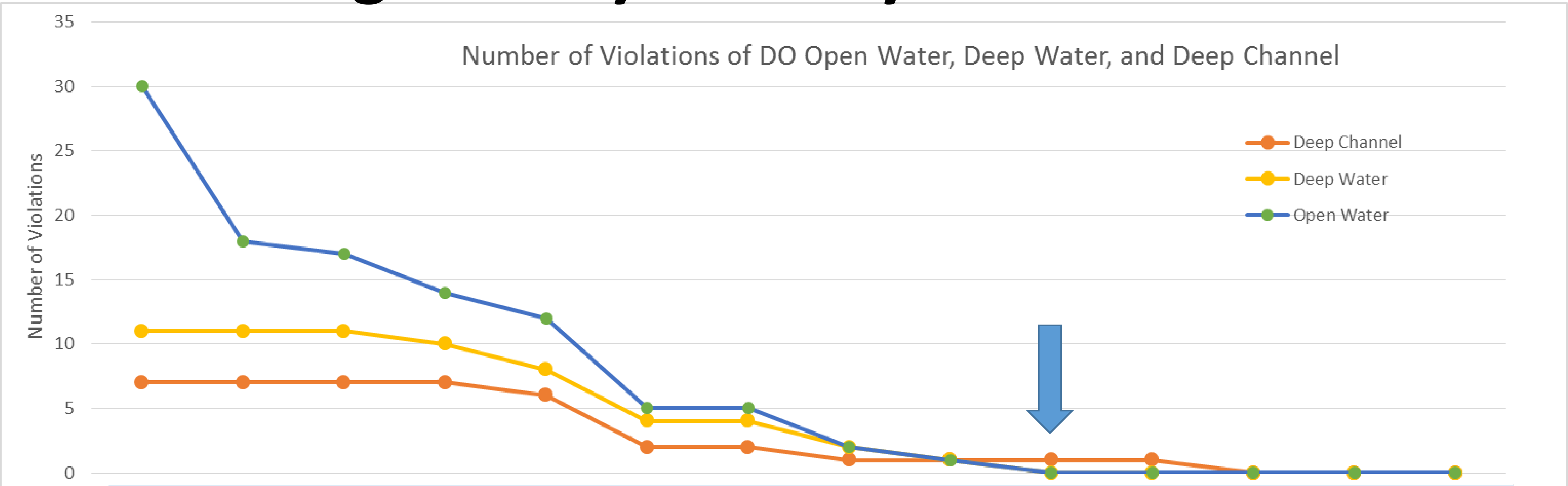
At a dissolved oxygen (DO) concentration of less than 5 mg/l (Open Water DO criterion) the model overestimates the Eastern Bay hypoxia by a factor of 4.

Segments Attaining Oxygen Standards: Deep-Channel Use



No Action	1985 Progress	1990 Progress	1993 Progress	2000 Progress	2010 Progress	2013 Progress	WIP+18%TN & +12%TP	WIP+6%TN & +4%TP	WIP2	WIP-6%TN & -8%TP	WIP-11%TN & -16%TP	E3	All Forest
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

Determining the Bay's Ability to Absorb Pollutants



No Action	1985 Progress	1990 Progress	1993 Progress	2000 Progress	2010 Progress	2013 Progress	WIP+18%TN & +12%TP	WIP+6%TN & +4%TP	WIP2	WIP-6%TN & -8%TP	WIP-11%TN & -16%TP	E3	All Forest
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

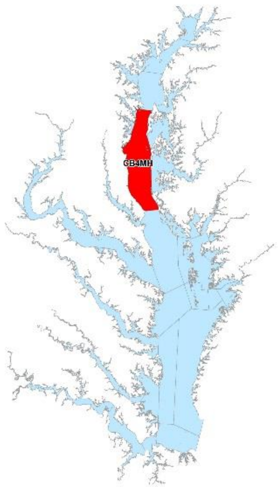
Rationale for Pollutant Loads Bay Can Absorb

- Clear monitoring-based evidence of reductions on volumes of low/no oxygen in deeper waters observed in Bay and tidal tributaries

- At 195 million lbs. nitrogen and 13.7 million lbs. phosphorus, we reach:
  - Loading levels where all segments' designated uses, except CB4 deep-channel, come into attainment
  - Point of diminishing returns for the increased level of reductions approaching E3

Diminishing Return for Additional Reductions

										WIP2 +19M lbs TN	WIP2 +10M lbs TN		WIP2 - 9M lbs TN	WIP2 -21M lbs TN		
		Base	No Action	1985 Progress	1990 Progress	1993 Progress	2000 Progress	2010 Progress	2013 Progress	WIP+18%TN & +12%TP	WIP+6%TN & +4%TP	WIP2	WIP-6%TN & -8%TP	WIP-11%TN & -16%TP	E3	All Forest
Run 223		325TN	404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
11/29/17		21.9TP	41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP
CAST Loads		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB4MH	MD	46%	53%	48%	47%	46%	43%	30%	27%	16%	9%	6%	3%	1%	0%	0%



Scoping Scenarios to explore water quality attainment at loads around the WIP2 level of effort.

Proposed Path Forward

- Support Maryland updating their water quality standards regulations' existing restoration variances
  - Change CB4 deep-channel from 2 percent to 6 percent
  - Change CB4 deep-water from 7 percent to 5 percent
  - No change to the Eastern Bay restoration variance of 2 percent
  - Remove the lower Chester River deep-channel restoration variance of 16 percent
  - Remove the Patapsco River deep-water restoration variance of 7 percent

Proposed Path Forward

- Agreement to a common set of Partnership communication messages
  - Reflects application of an additional decade of new data and scientific understanding along with improved models
  - Approach followed is fully consistent with approach taken during development of the 2010 Bay TMDL
  - Fully consistent with Maryland's existing water quality standards regulations requirement for regular check-ins and modifications based on new data or assumptions incorporated into the Partnership's Chesapeake Bay water quality model

Requested WQGIT Policy Recommendations

Approval of the Bay's assimilative capacity in terms of nitrogen (195) and phosphorus (13.7)

Approval of the resultant necessary adjustments to Maryland's water quality standards regulations restoration variances

Approval of Partnership's public communication messages

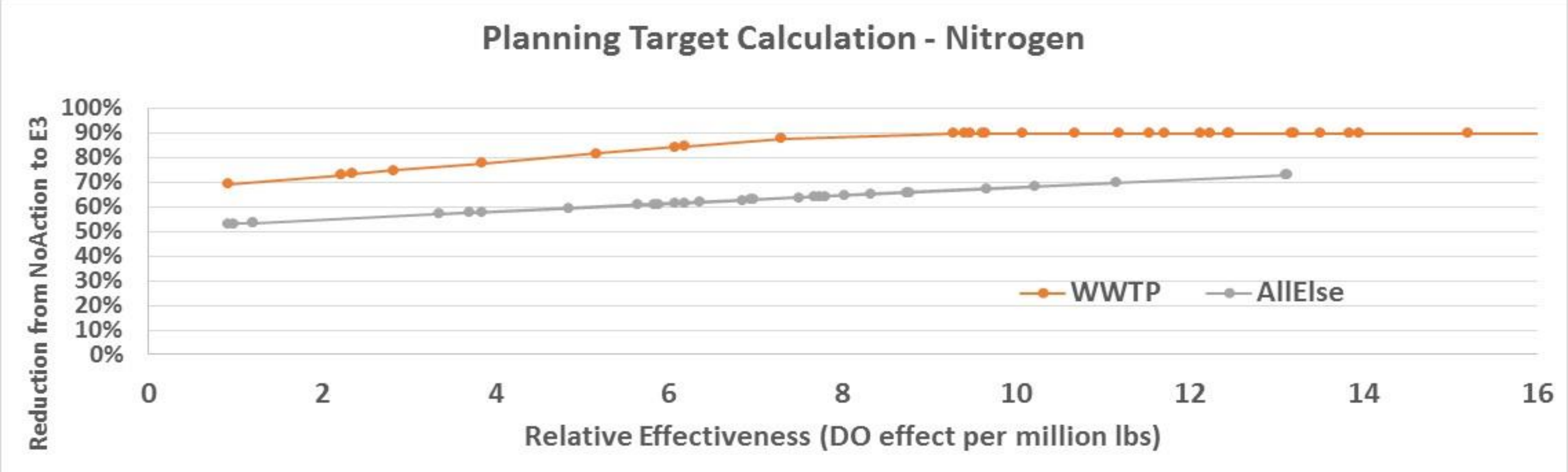
Proposed Draft Phase III Planning Targets

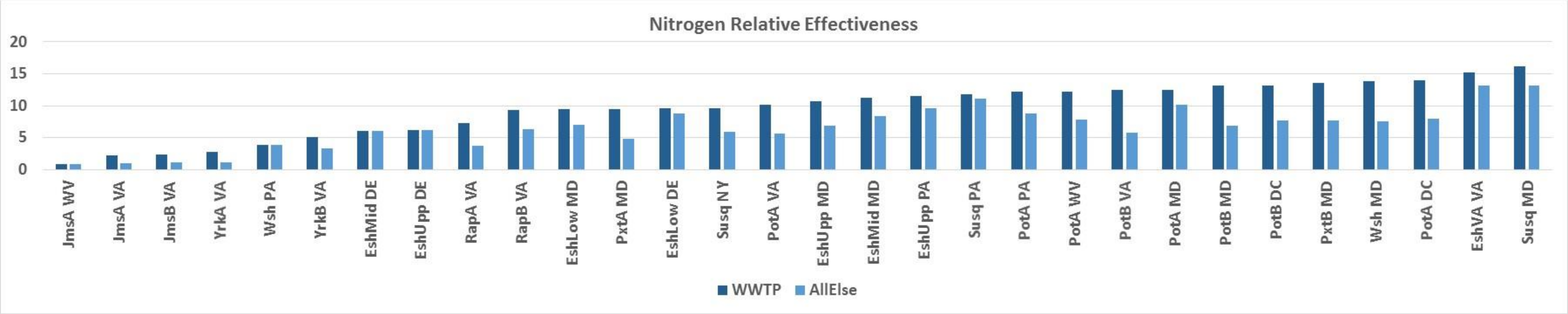
Gary Shenk, USGS, CBP Phase 6 Watershed Model Coordinator

We Have All the Necessary Components

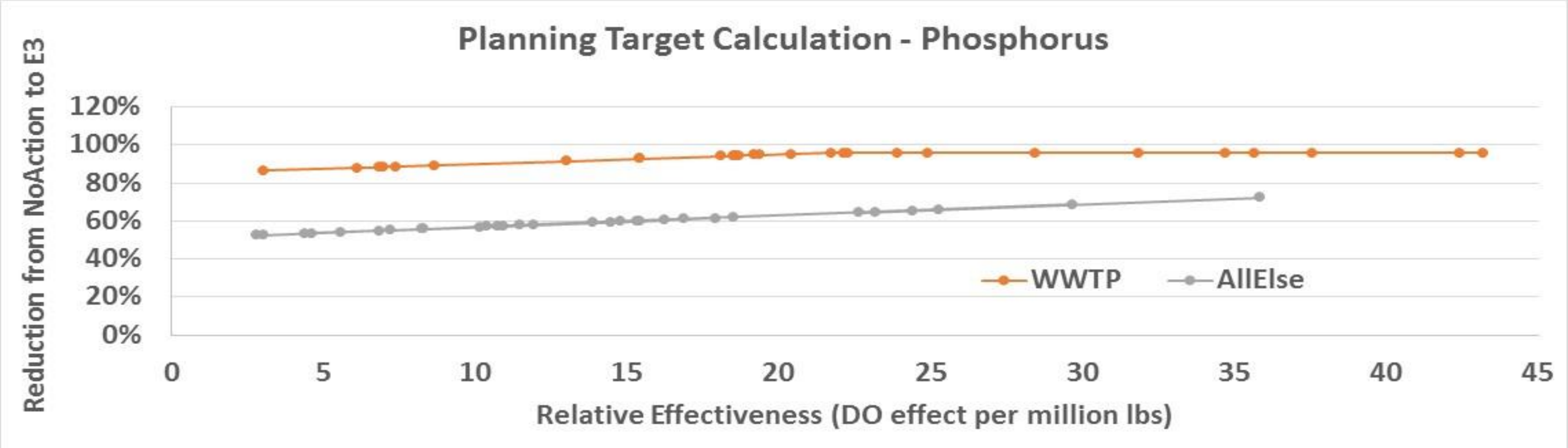
- ✓ Agreed-to methodology
- ✓ No Action scenario
- ✓ E3 scenario
- ✓ Watershed and estuarine relative effectiveness
- ✓ (Proposed) Bay’s assimilative capacity
- ✓ Accounting for projected atmospheric deposition load reductions

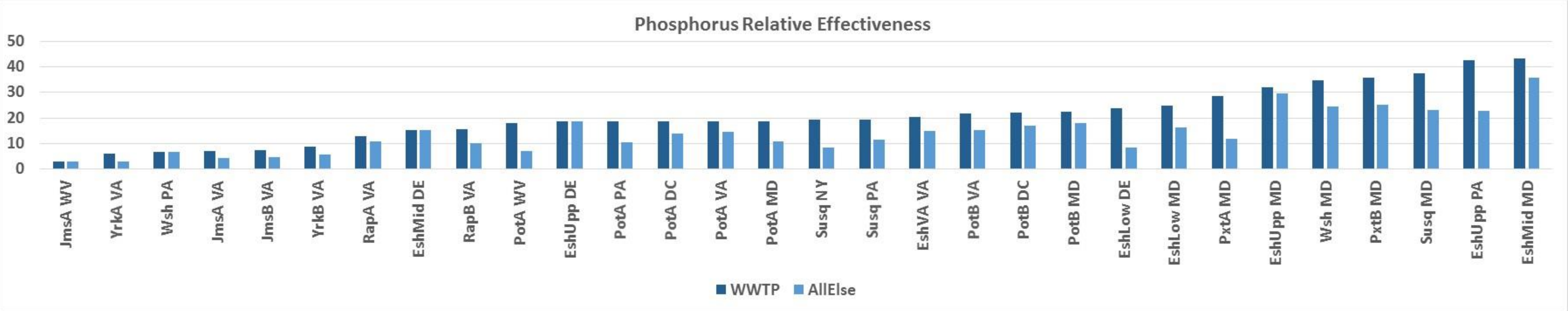
Deriving the Draft Phase III Planning Targets: Nitrogen





Deriving the Draft Phase III Planning Targets: Phosphorus





Proposed Draft Phase III Planning Targets: Nitrogen

Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	18.71	15.44					10.62
PA	122.41	99.28					72.99
MD	83.56	55.89					45.39
WV	8.73	8.06					6.36
DC	6.48	1.75					2.25
DE	6.97	6.59					4.66
VA	84.29	61.53					56.37
BasinWide	331.15	248.54					198.64

*Units = millions of pounds

Proposed Draft Phase III Planning Targets: Phosphorus

Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	1.198	0.710					0.491
PA	6.282	3.749					3.012
MD	7.495	3.942					3.553
WV	0.902	0.617					0.493
DC	0.090	0.062					0.120
DE	0.225	0.116					0.116
VA	14.244	6.751					6.411
BasinWide	30.44	15.95					14.20

*Units = millions of pounds

Proposed Draft Phase III Planning Targets: Nitrogen

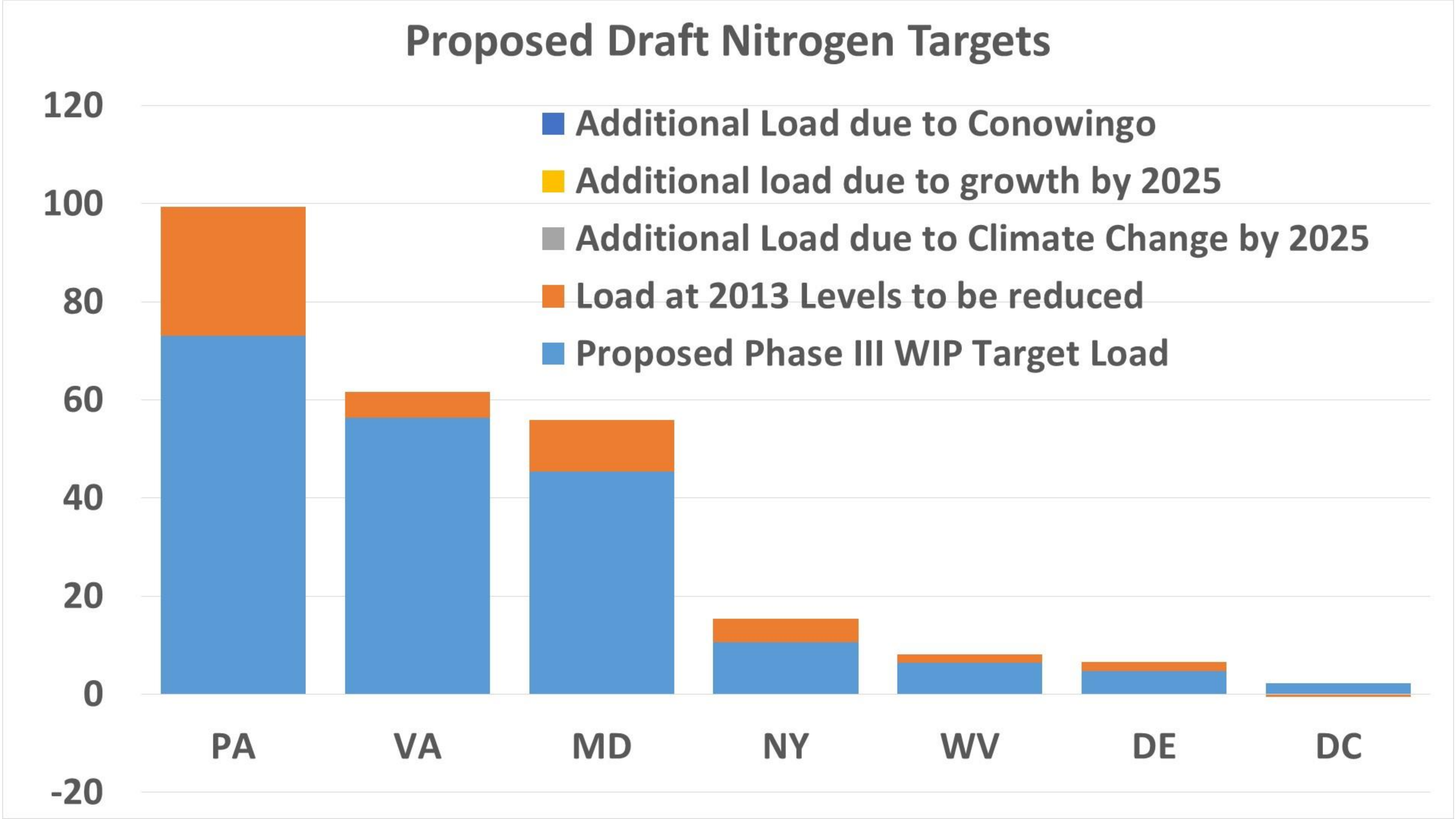
Jurisdiction	1985 Baseline	2013 Progress			Special Case	With Special Cases	Phase III Planning Target
NY	18.71	15.44			1.00	11.62	10.62
PA	122.41	99.28			-0.58	72.41	72.99
MD	83.56	55.89			-0.31	45.08	45.39
WV	8.73	8.06			-0.03	6.33	6.36
DC	6.48	1.75			0.00	2.24	2.25
DE	6.97	6.59			-0.06	4.61	4.66
VA	84.29	61.53			-0.24	56.13	56.37
BasinWide	331.15	248.54			-0.22	198.41	198.64

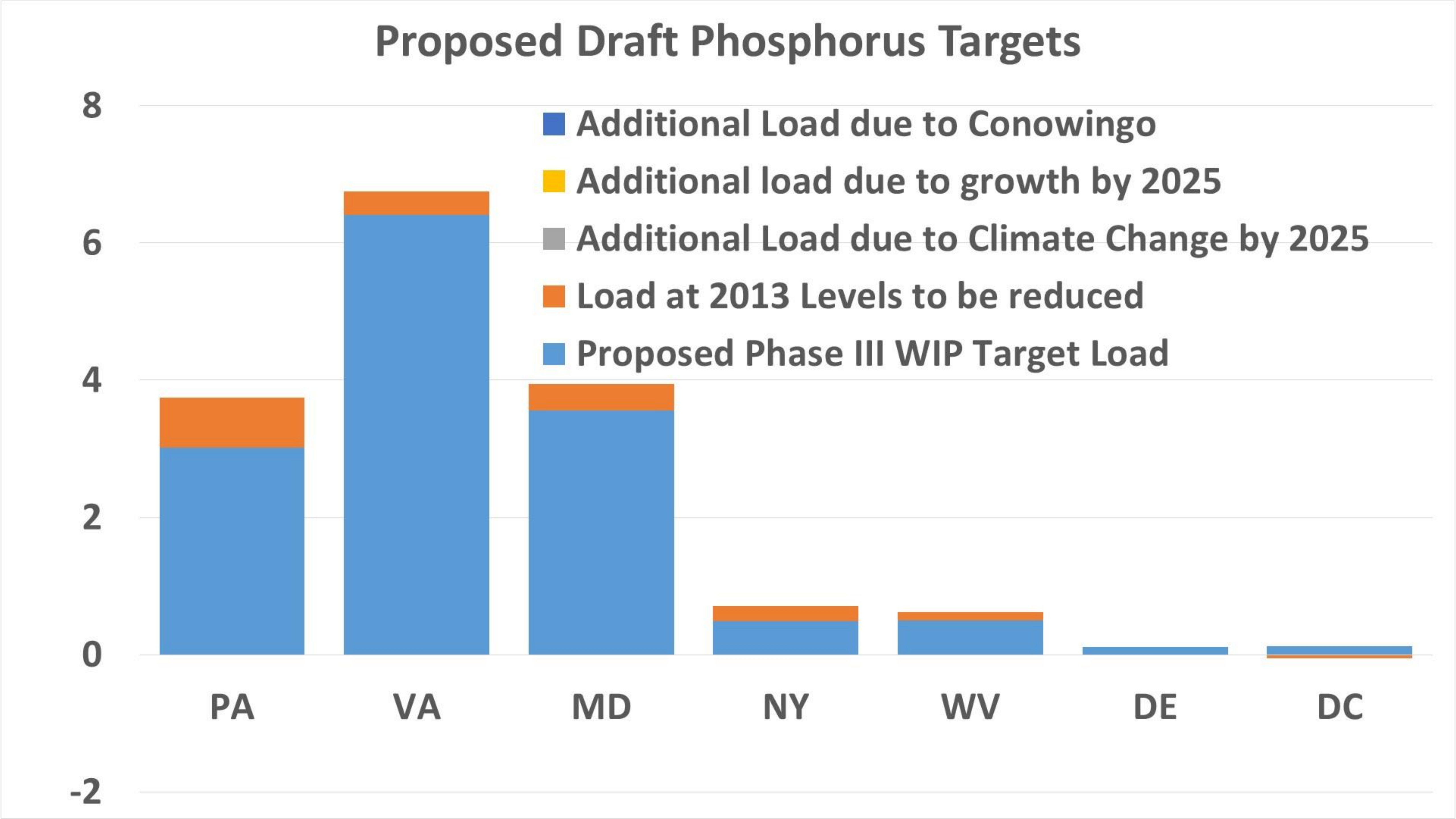
*Units = millions of pounds

Proposed Draft Phase III Planning Targets: Phosphorus

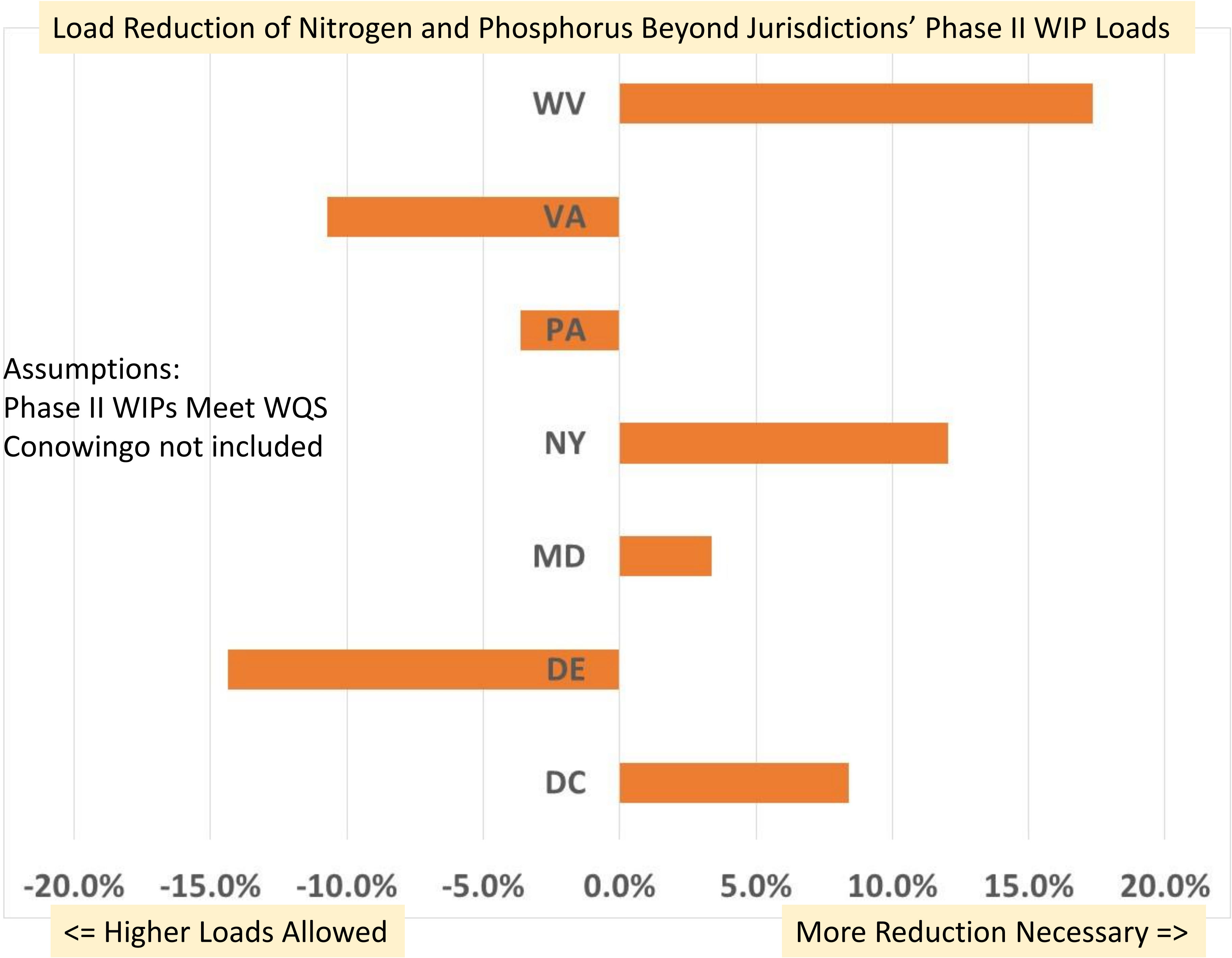
Jurisdiction	1985 Baseline	2013 Progress			Special Case	With Special Cases	Phase III Planning Target
NY	1.198	0.710			0.100	0.591	0.491
PA	6.282	3.749			-0.101	2.911	3.012
MD	7.495	3.942			-0.081	3.472	3.553
WV	0.902	0.617			0.200	0.693	0.493
DC	0.090	0.062			-0.001	0.120	0.120
DE	0.225	0.116			-0.004	0.112	0.116
VA	14.244	6.751			-0.138	6.273	6.411
BasinWide	30.436	15.947			-0.025	14.17	14.20

*Units = millions of pounds


Proposed Draft Nitrogen Targets
120
100
80
60
40
20
0
-20
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC



Proposed Draft Phosphorus Targets
8
6
4
2
0
-2
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC


Load Reduction of Nitrogen and Phosphorus Beyond Jurisdictions’ Phase II WIP Loads
WV
VA
PA
NY
MD
DE
DC
Assumptions:
Phase II WIPs Meet WQS
Conowingo not included
-20.0%
-15.0%
-10.0%
-5.0%
0.0%
5.0%
10.0%
15.0%
20.0%
<= Higher Loads Allowed
More Reduction Necessary =>

Jurisdiction-Specific Planning Target Profiles

Gary Shenk, USGS, CBP Phase 6 Watershed Model Coordinator and
Jeff Sweeney, CBP EPA

PA Draft Phase III WIP Planning Targets + Reference Loads

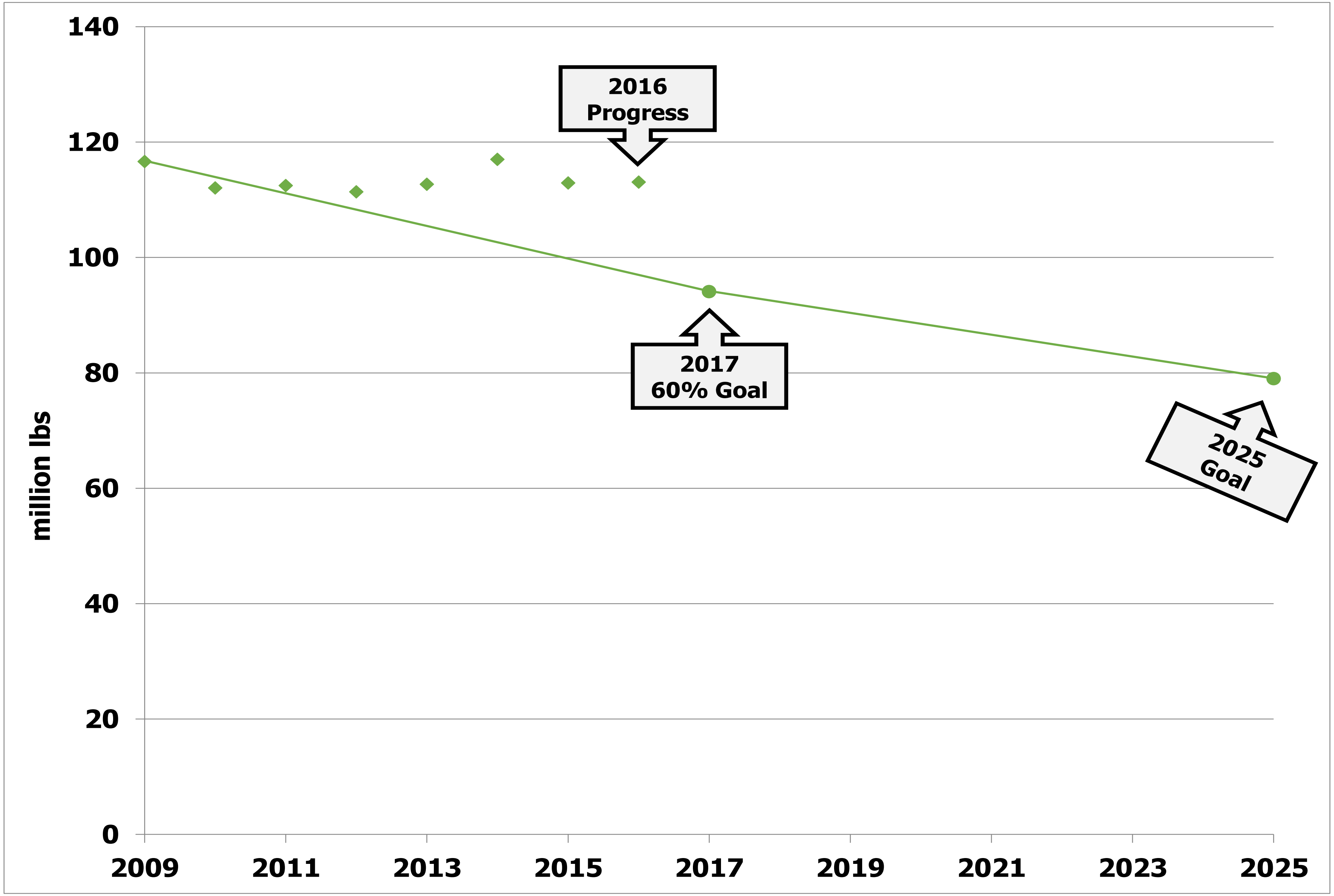
Nitrogen Load

	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
PA Eastern Shore	0.81	0.29	0.63	0.43	0.46
PA Potomac	10.39	3.96	8.11	5.39	5.96
PA Susquehanna	125.57	47.42	90.51	63.99	66.55
PA Western Shore	0.04	0.01	0.03	0.02	0.02
PA Total	136.82	51.69	99.28	69.83	72.99

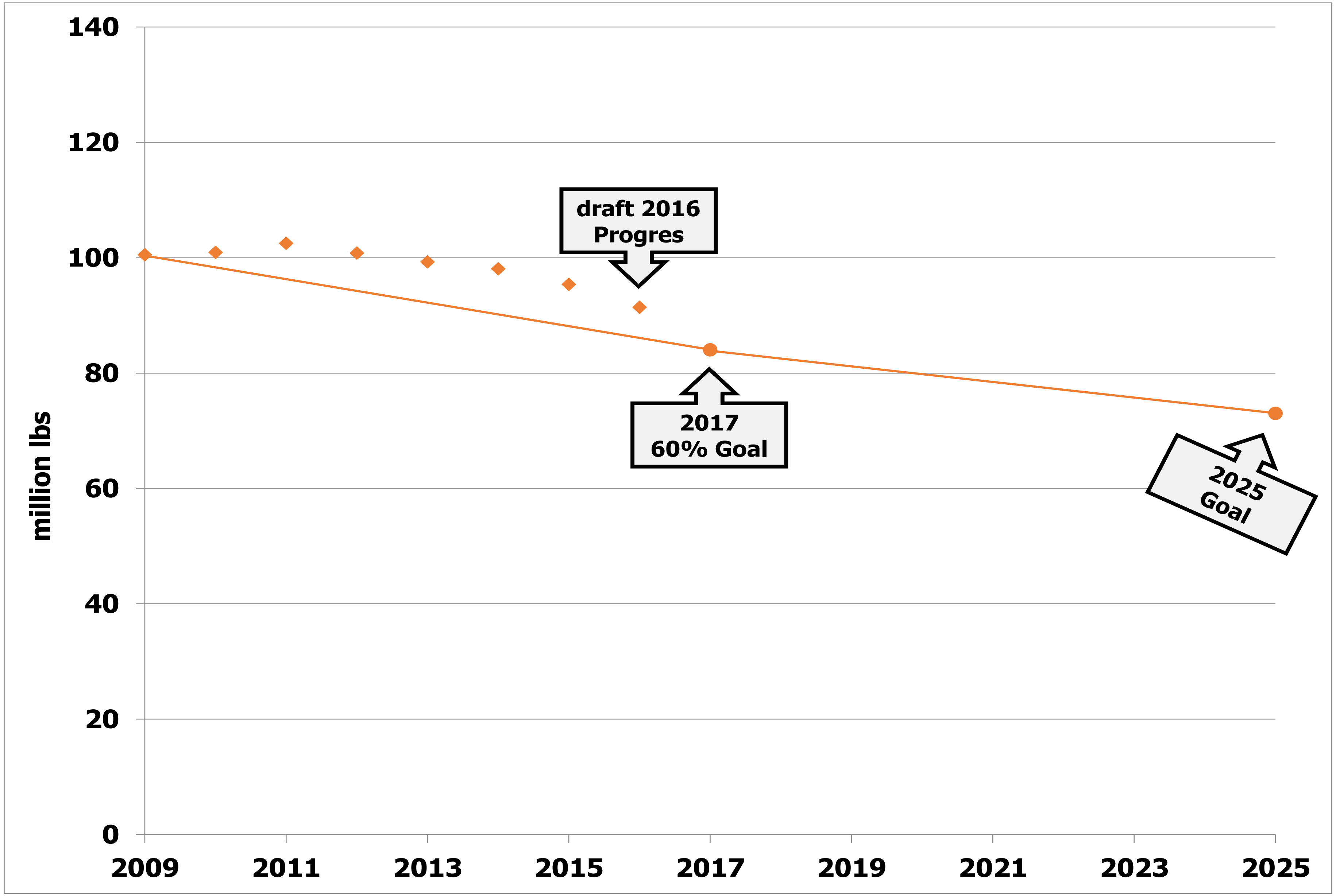
Phosphorus Load

	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
PA Eastern Shore	0.045	0.016	0.027	0.020	0.025
PA Potomac	0.640	0.185	0.398	0.317	0.332
PA Susquehanna	6.628	1.478	3.323	2.803	2.654
PA Western Shore	0.002	0.000	0.001	0.001	0.001
PA Total	7.315	1.679	3.749	3.140	3.012

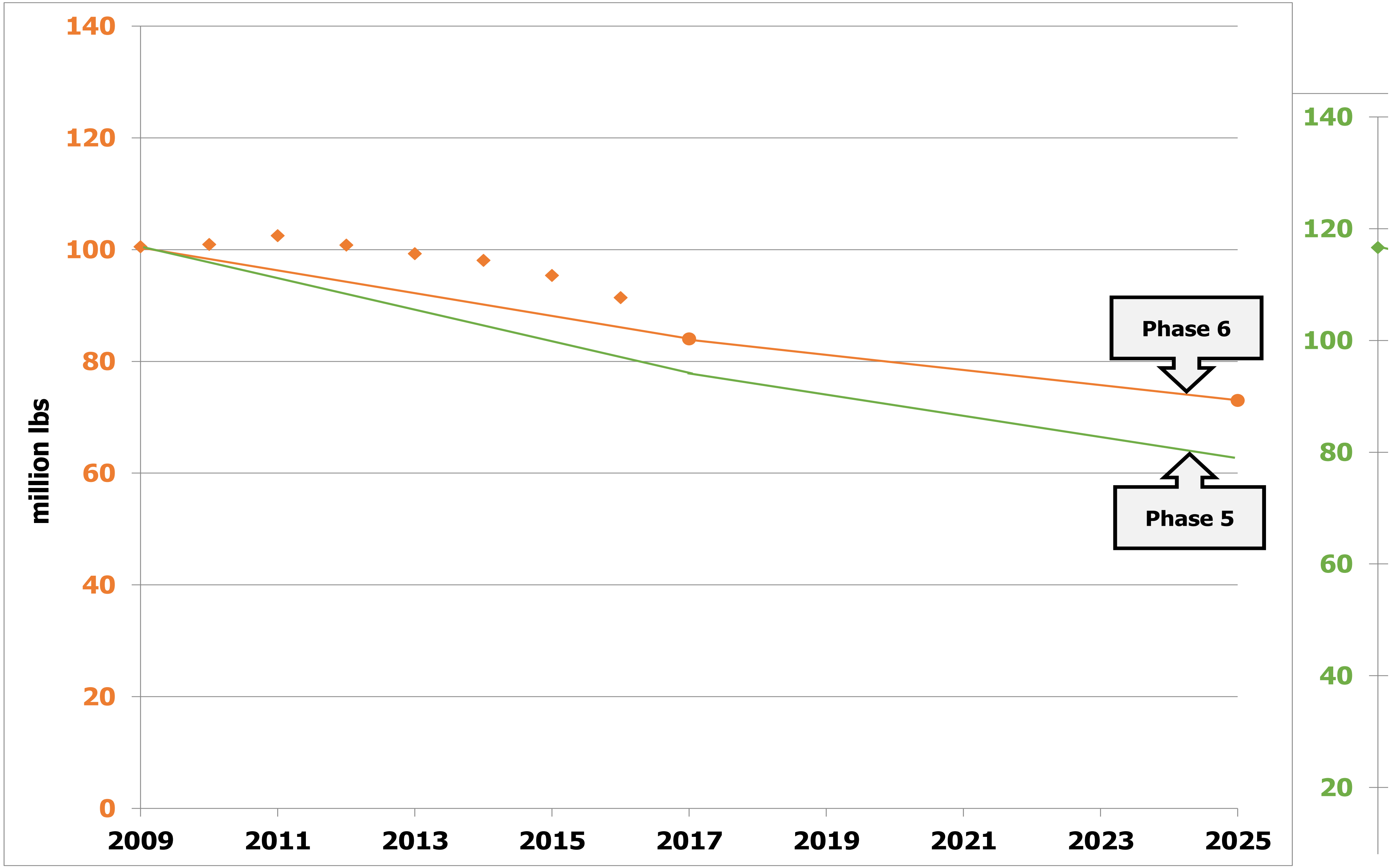
PA Nitrogen Loads-Goals, Phase 5.3.2



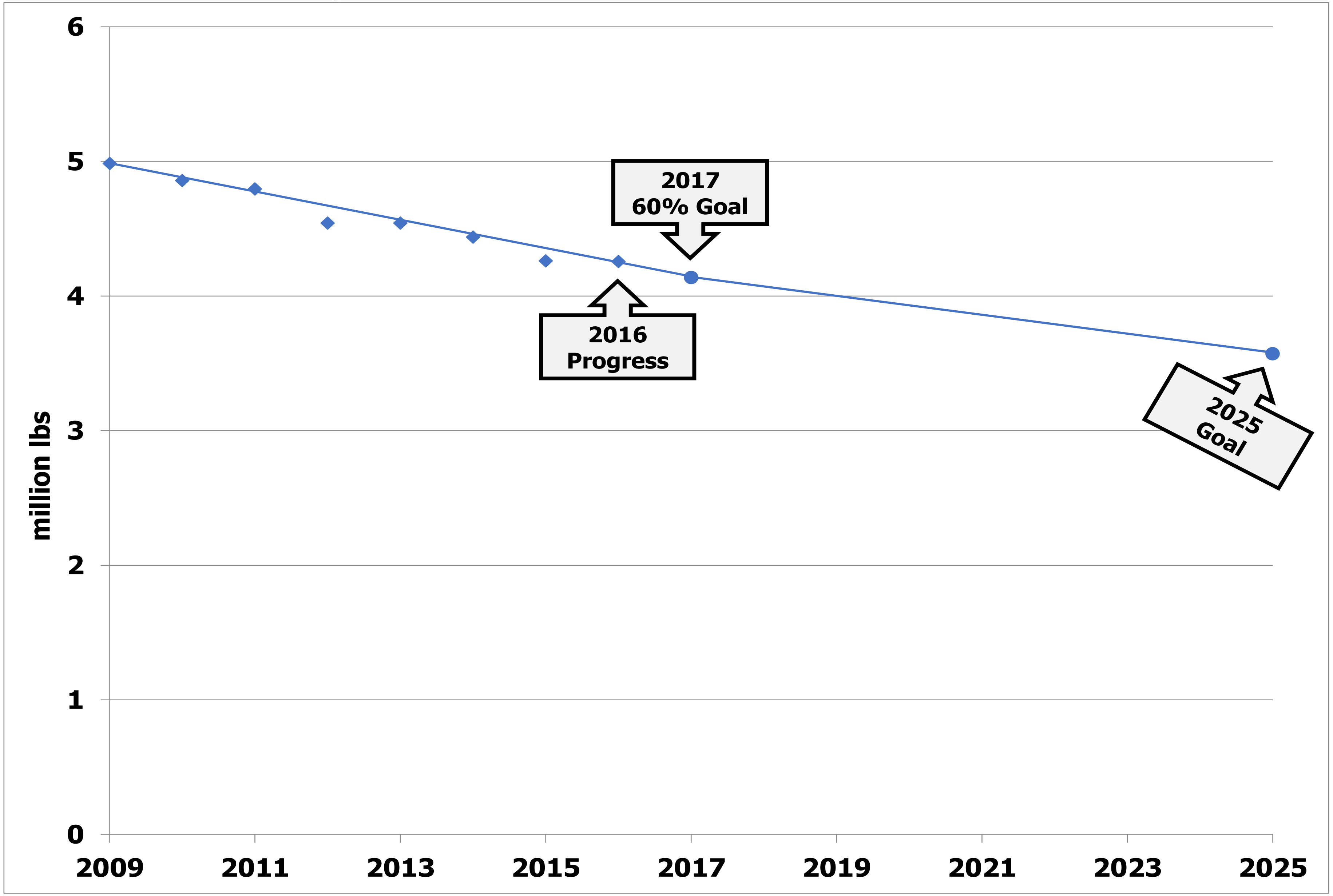
PA Nitrogen Loads-Goals, Phase 6



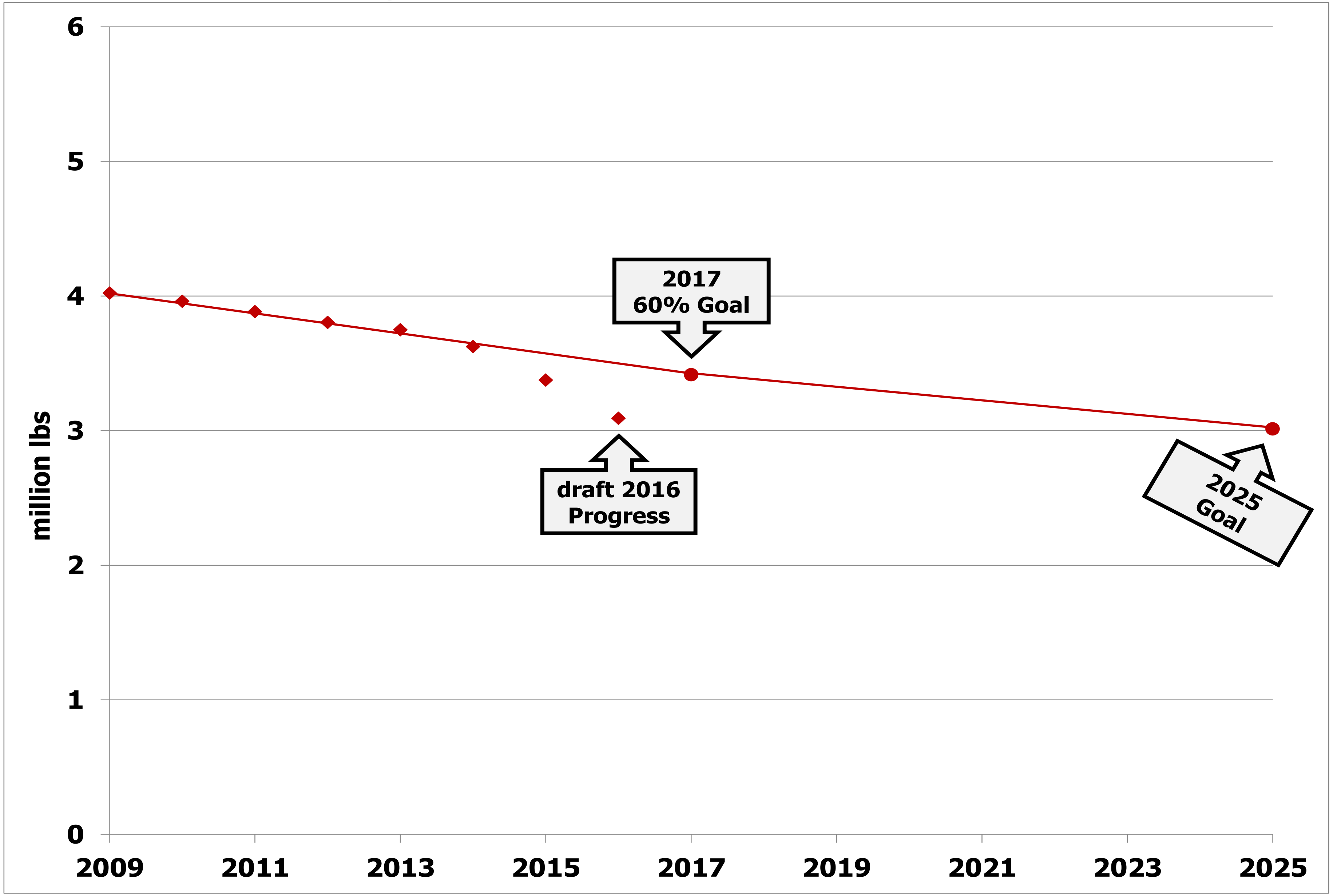
PA Nitrogen Change in LOE



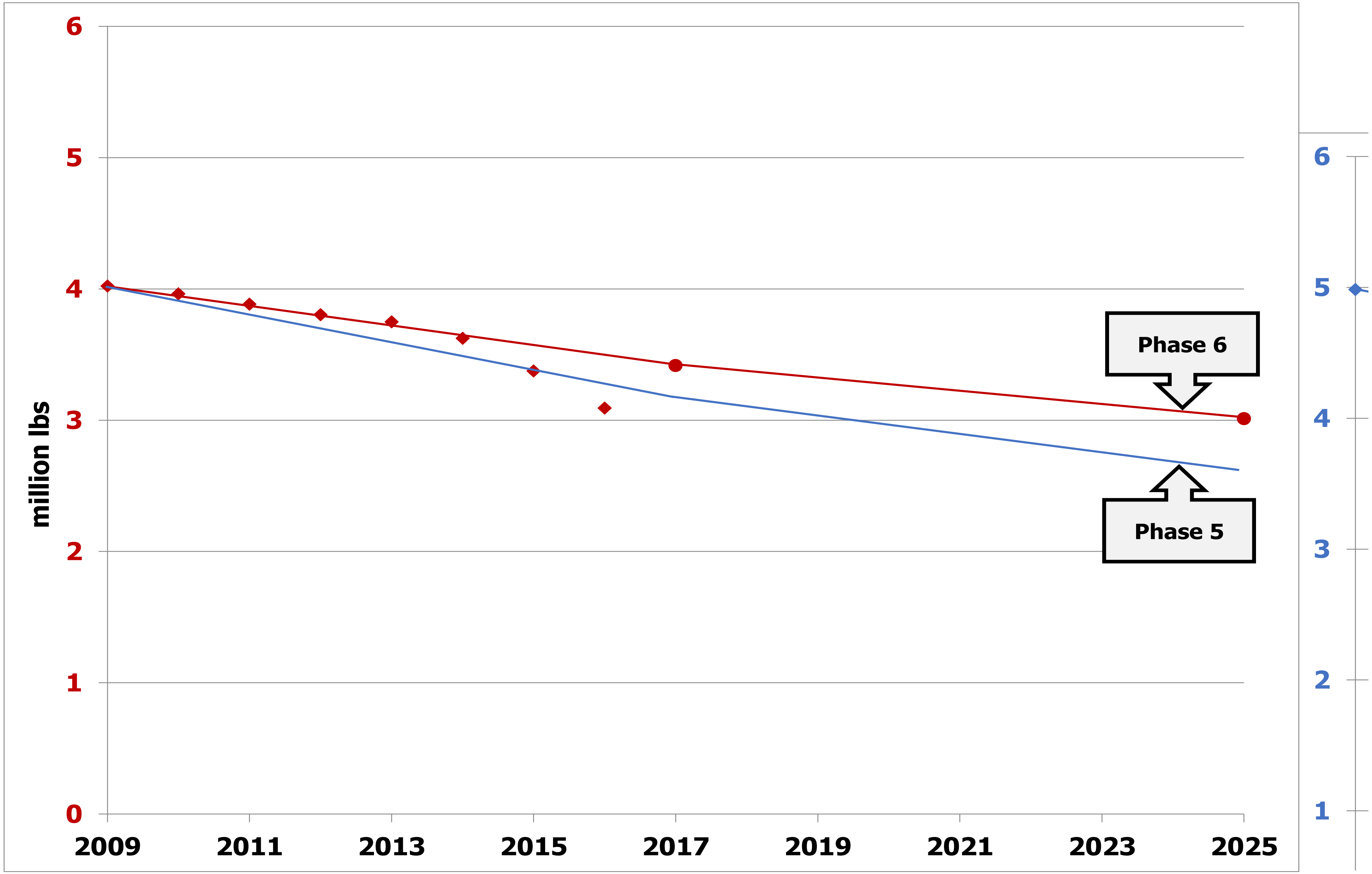
PA Phosphorus Loads-Goals, Phase 5.3.2



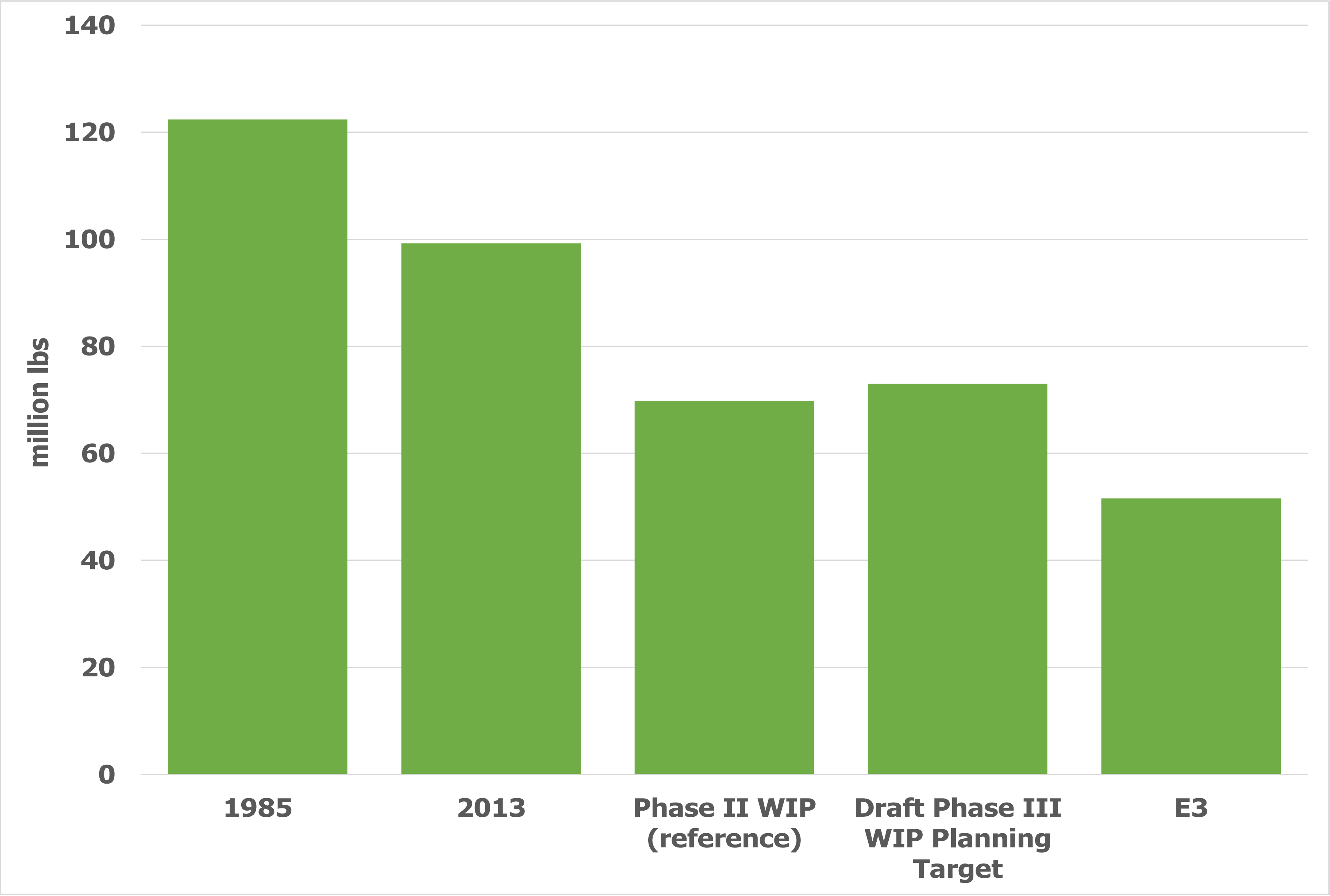
PA Phosphorus Loads-Goals, Phase 6



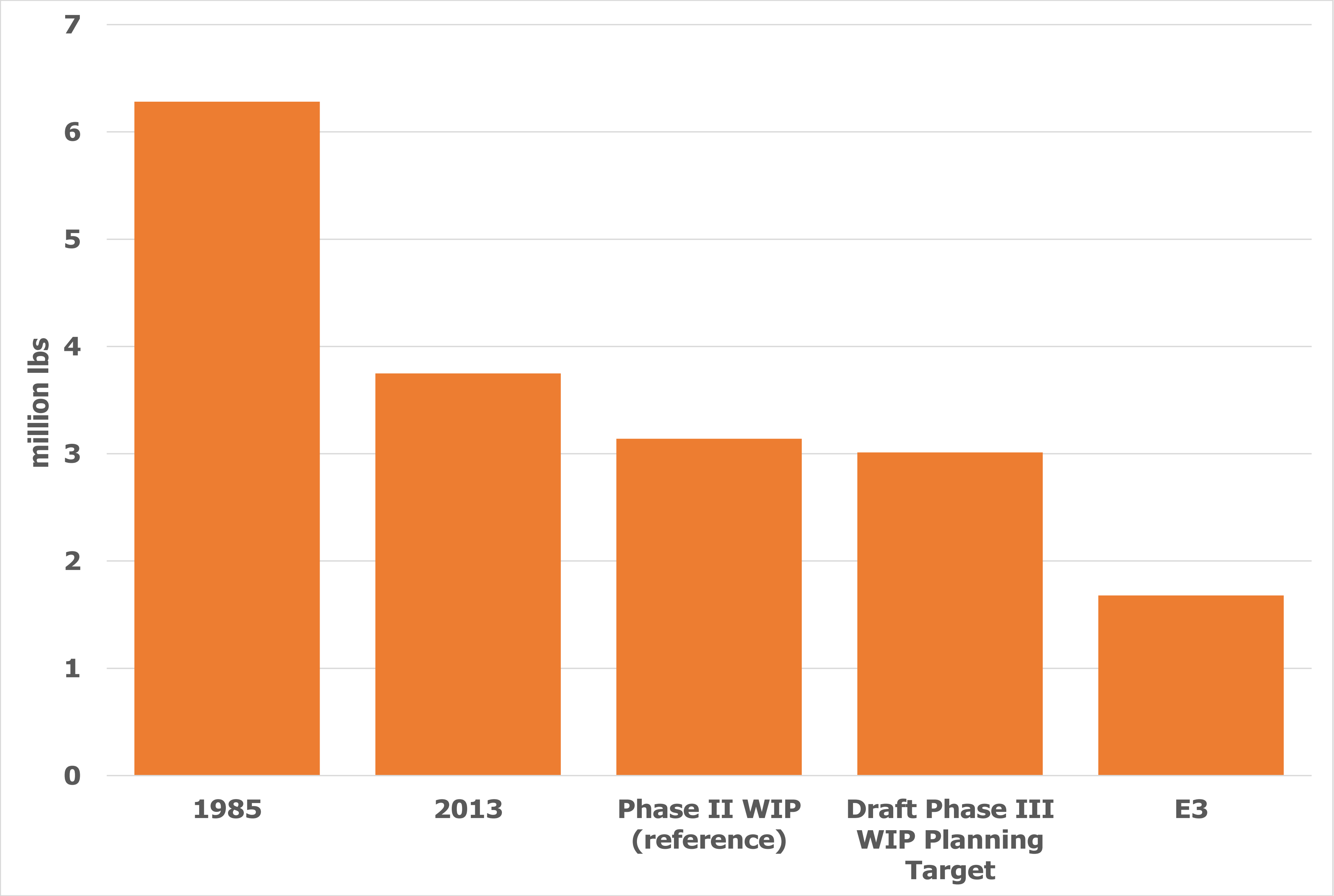
PA Phosphorus Change in LOE



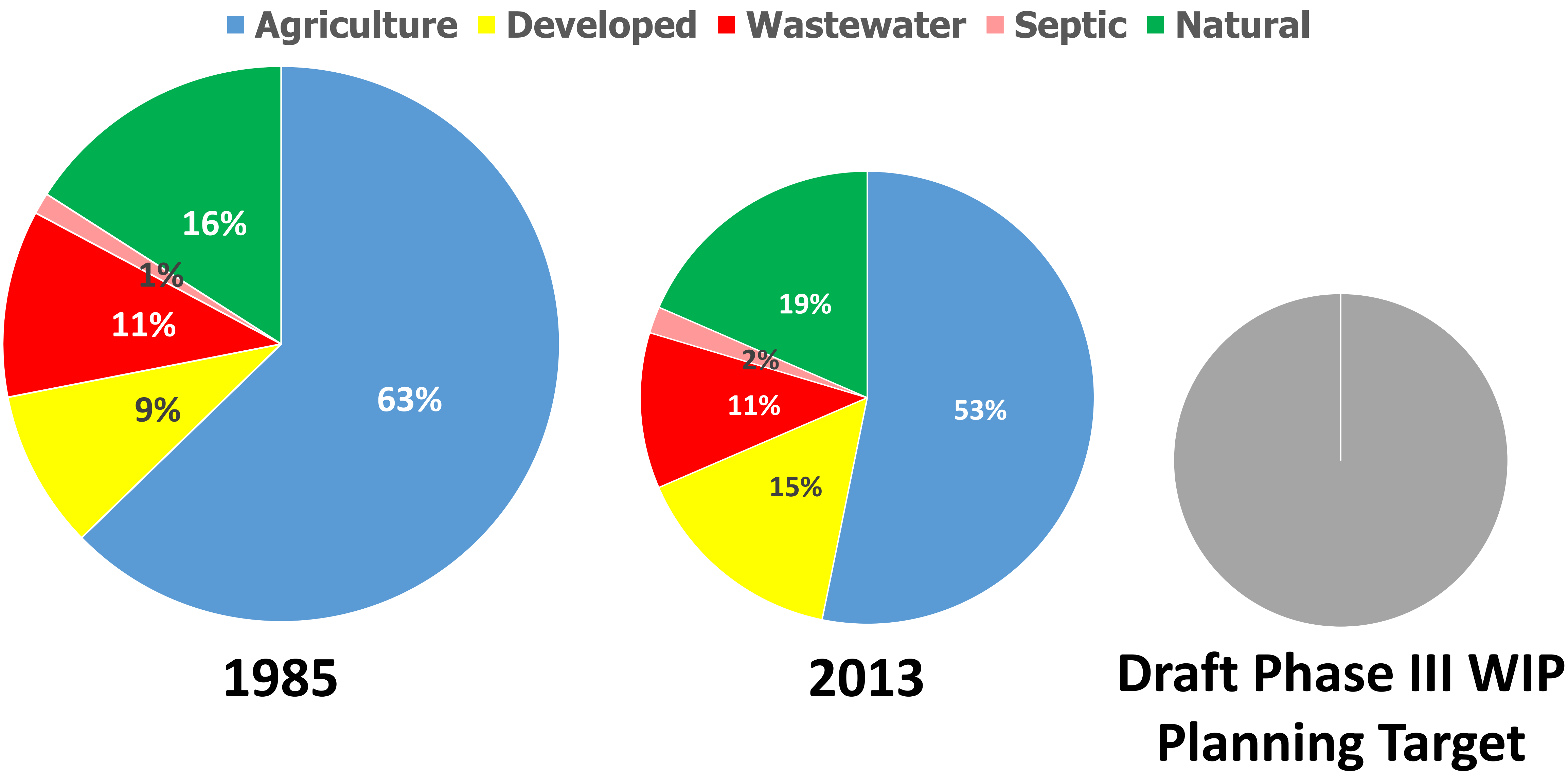
PA Nitrogen Loads, Reference Scenarios, and Target



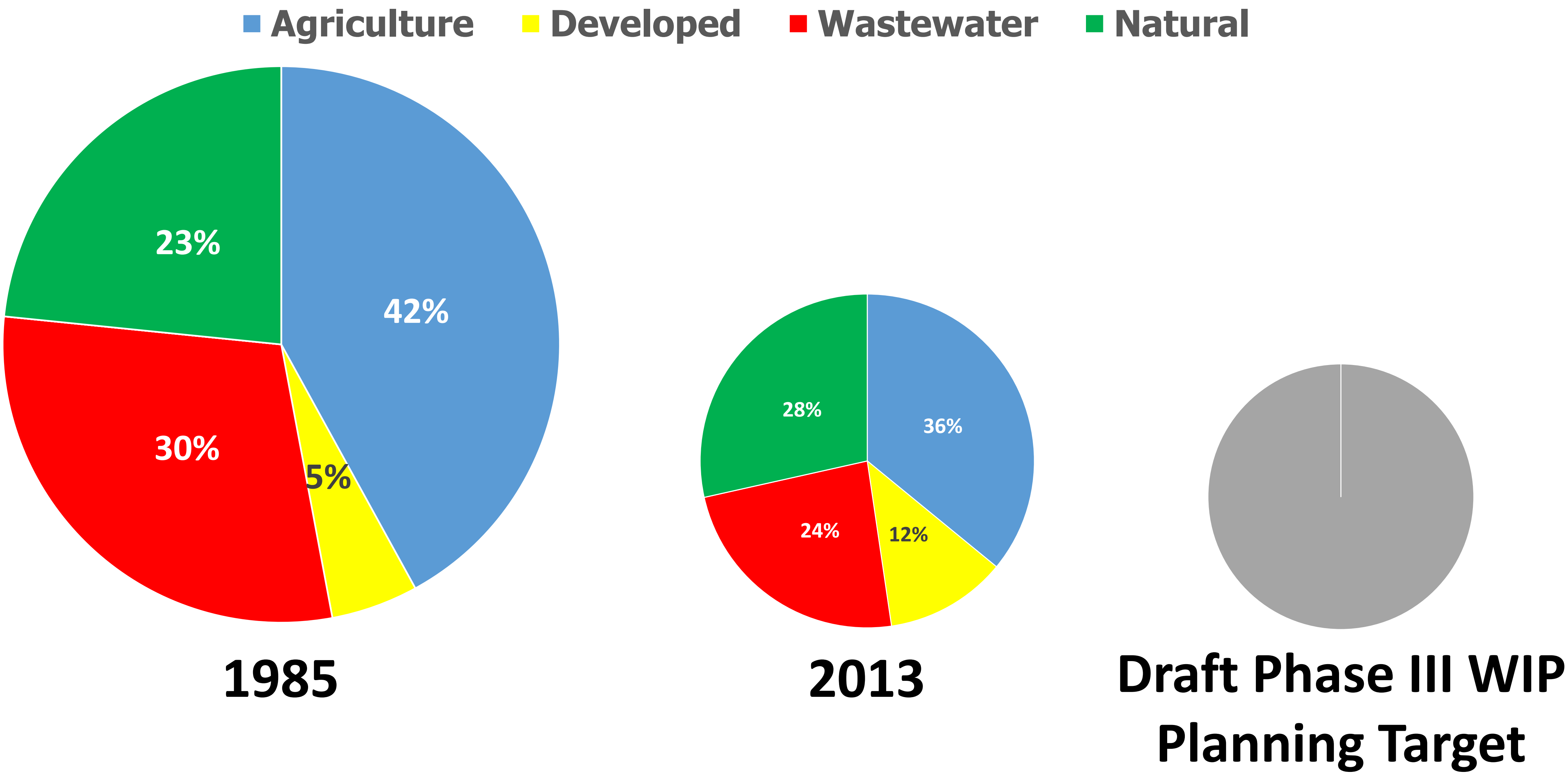
PA Phosphorus Loads, Reference Scenarios, and Target



PA Nitrogen Loads and Target

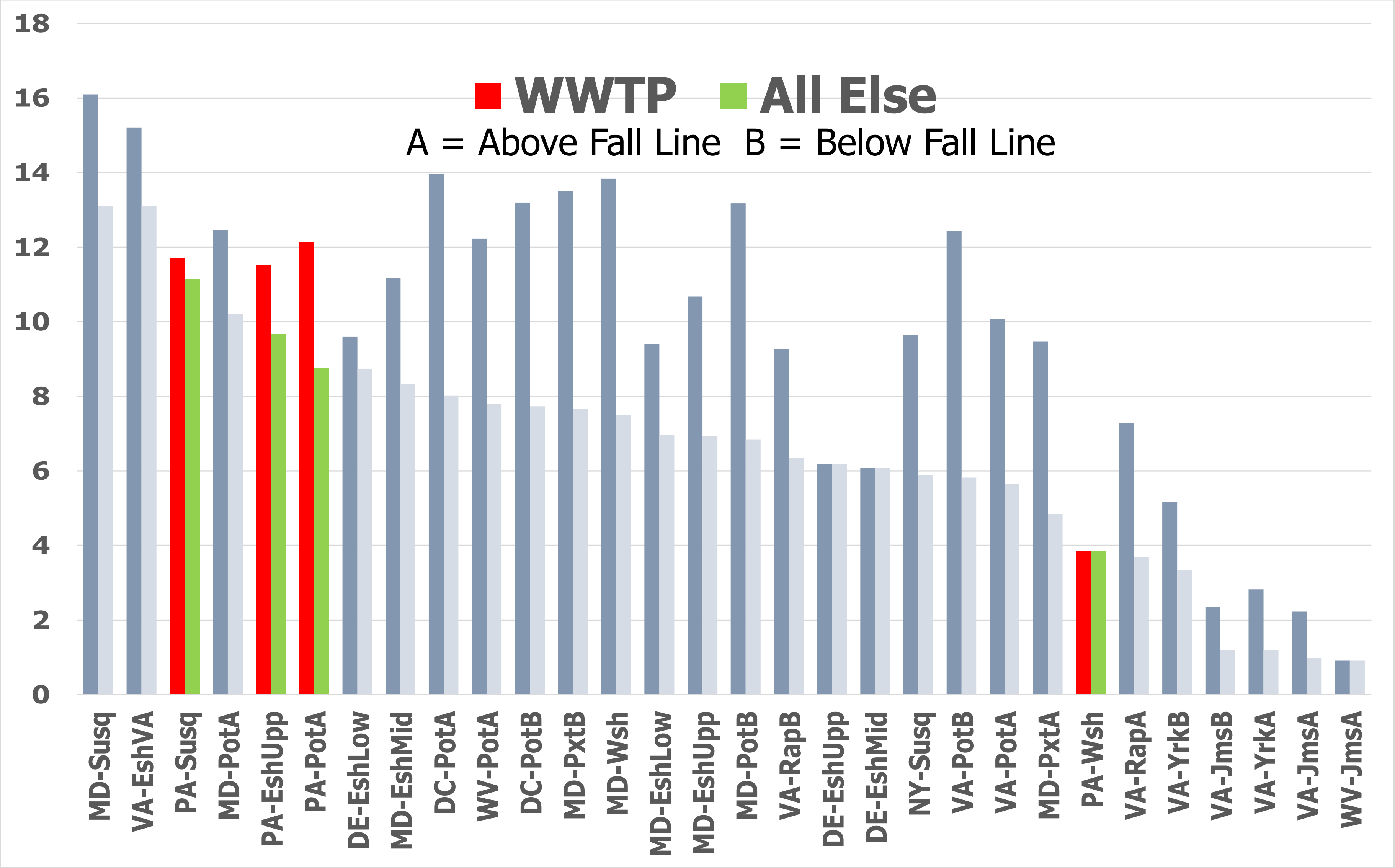


PA Phosphorus Loads and Target



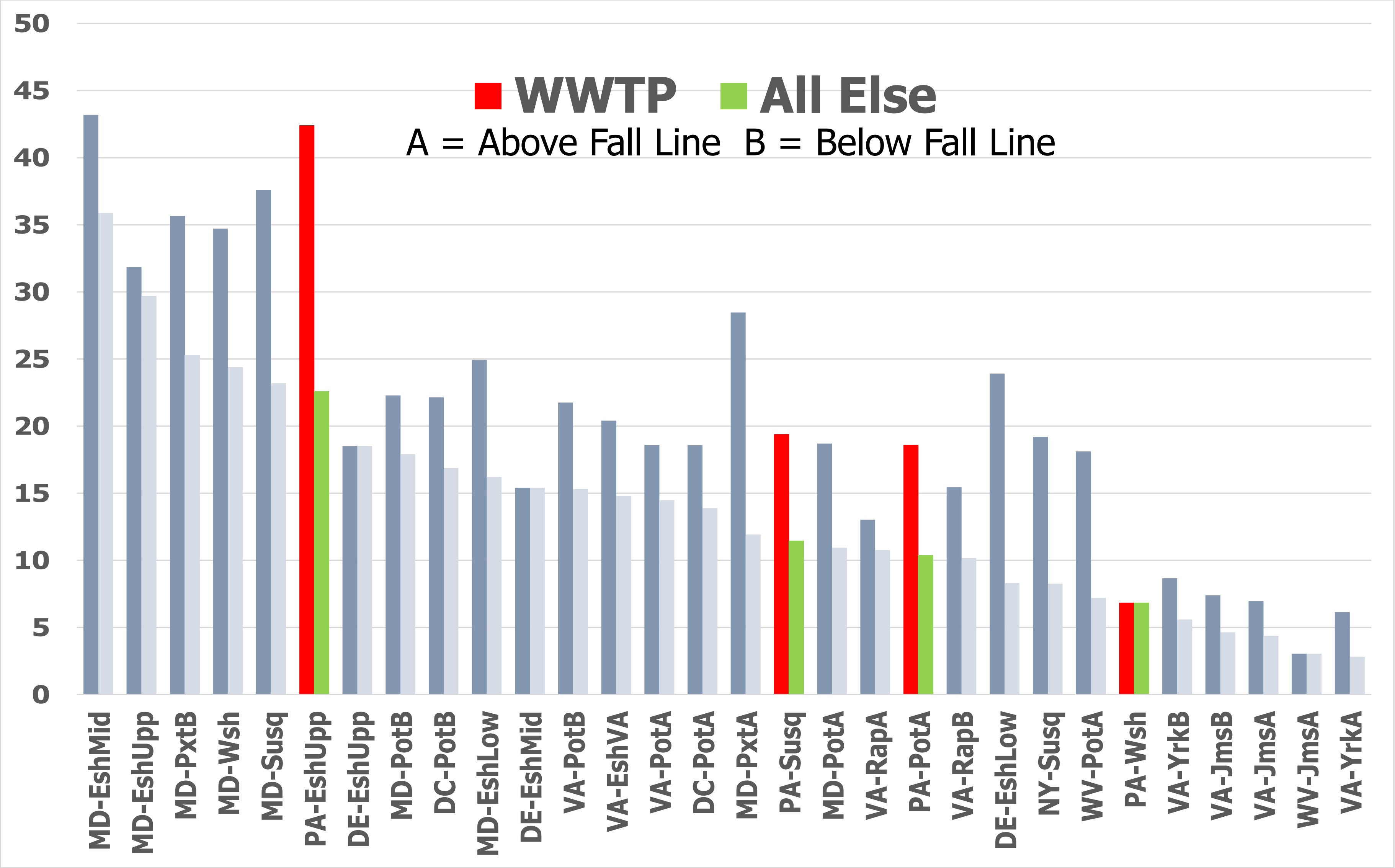
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



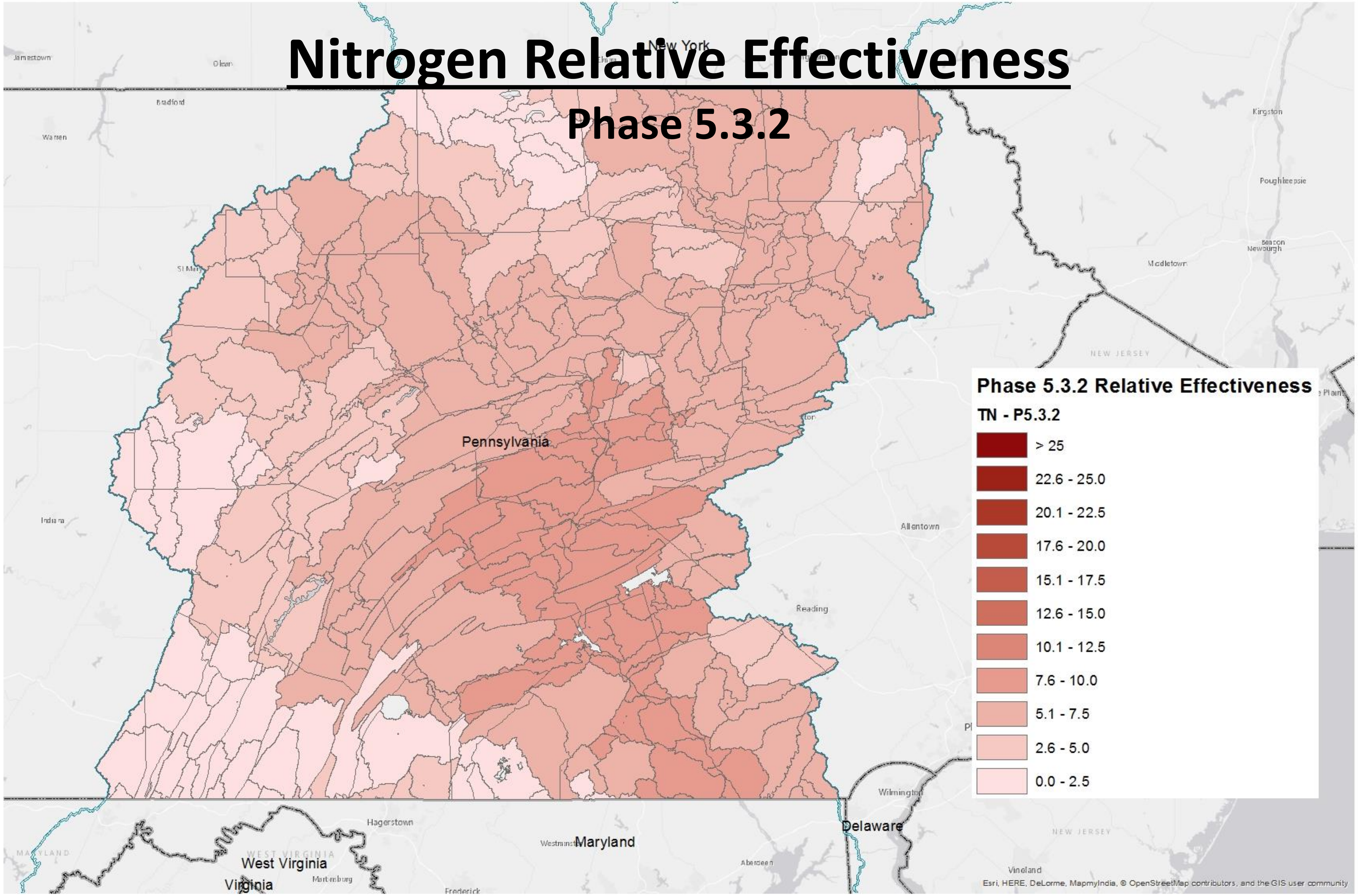
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



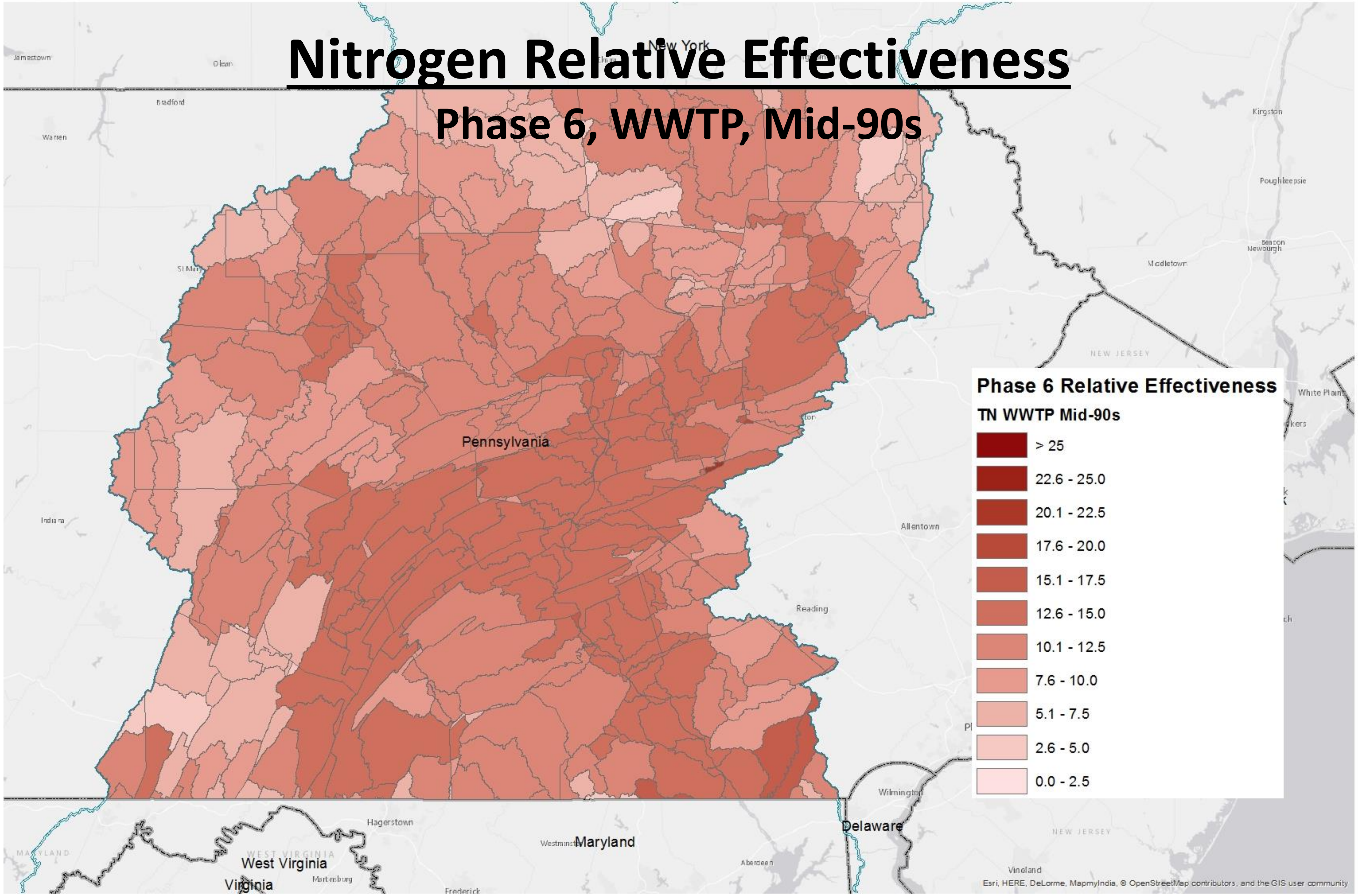
Nitrogen Relative Effectiveness

Phase 5.3.2



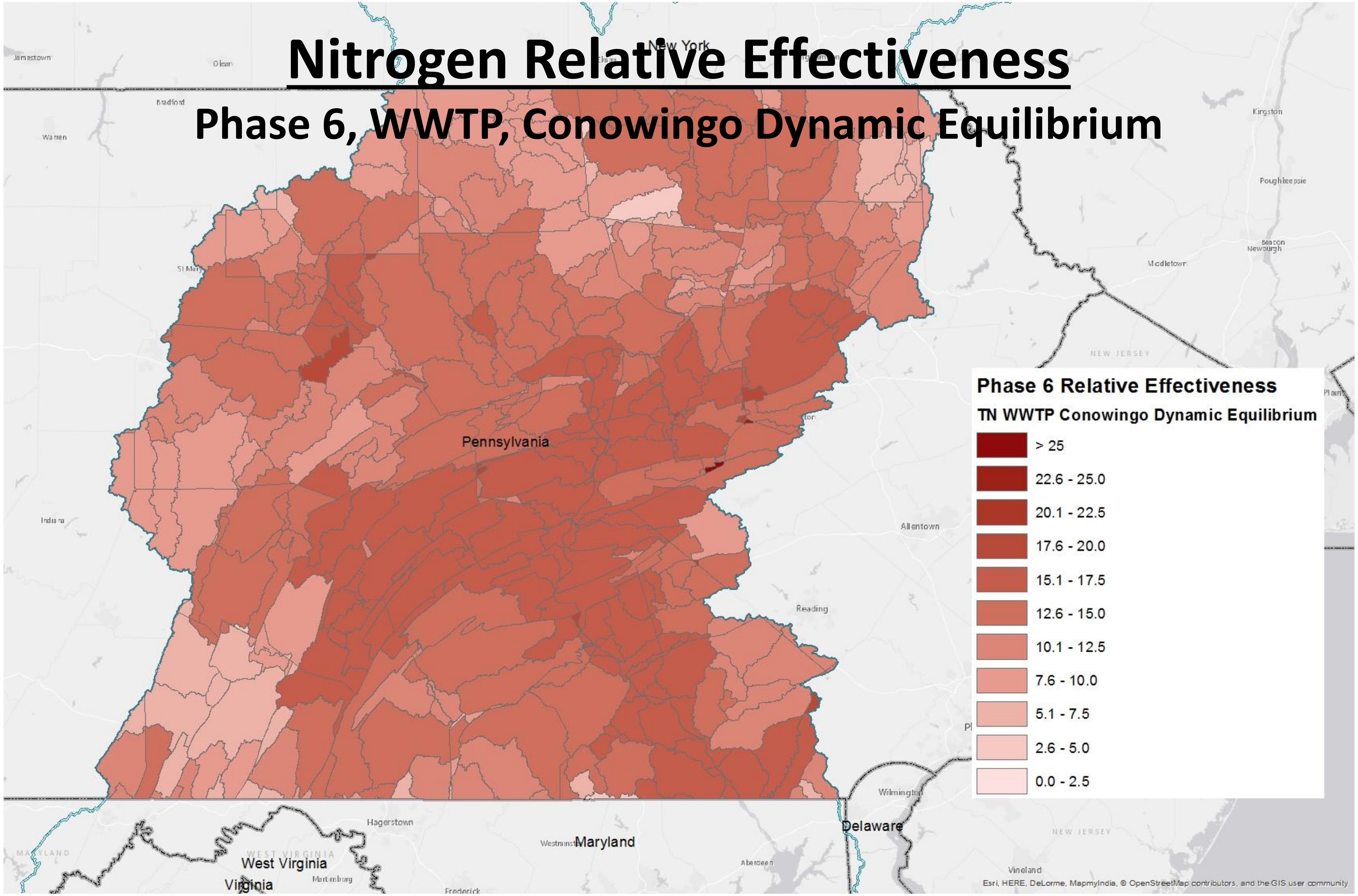
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



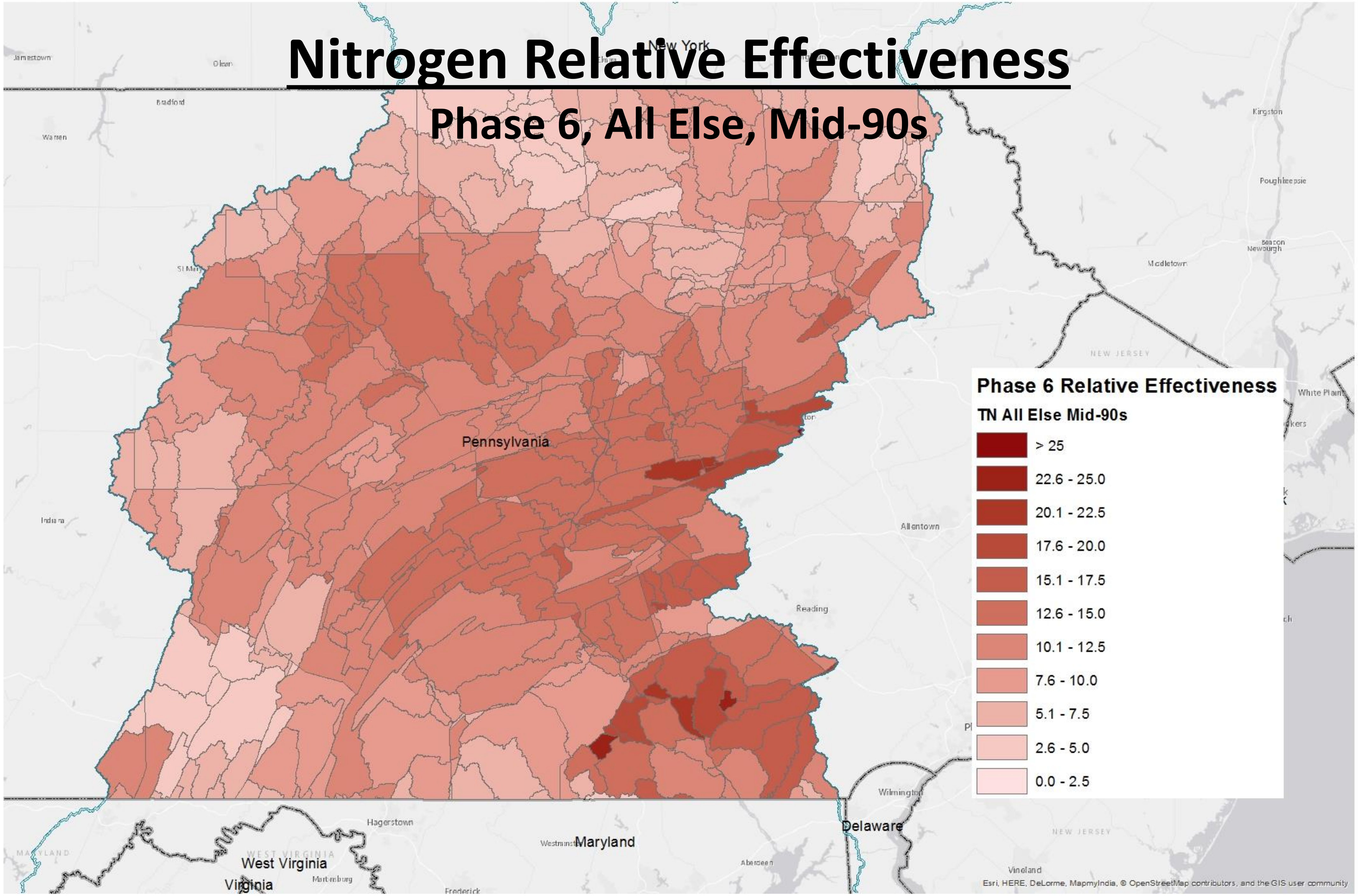
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



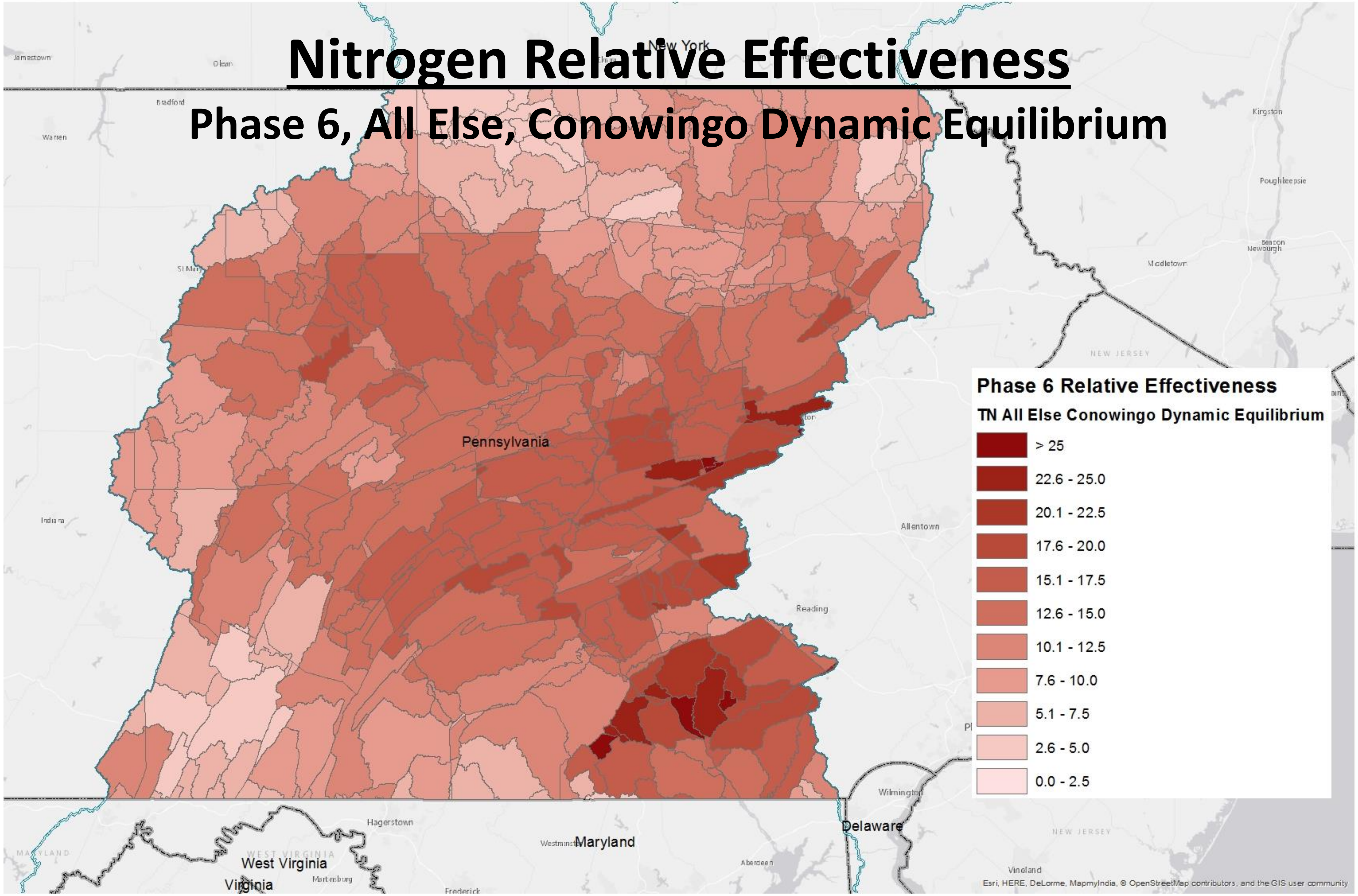
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



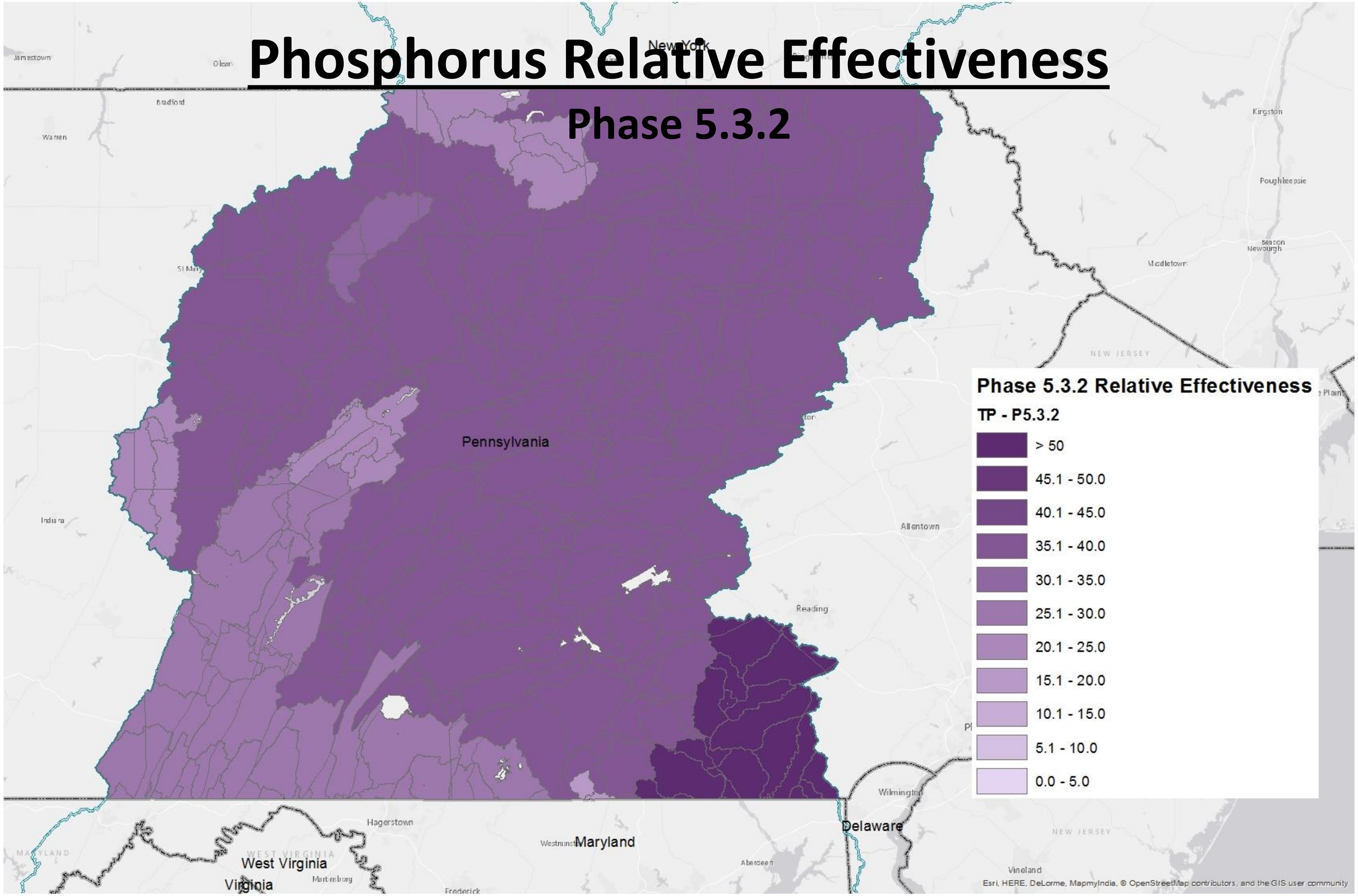
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



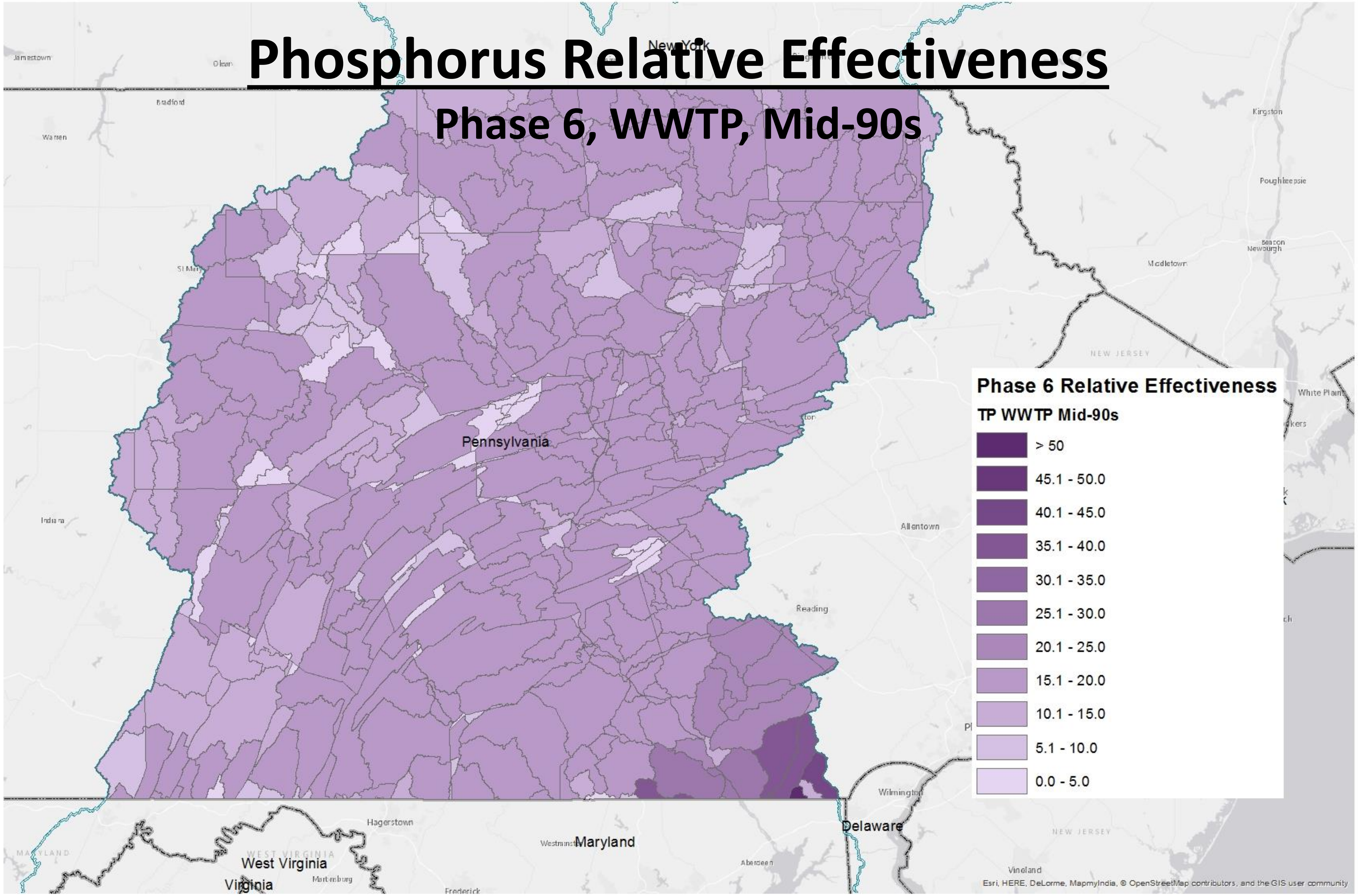
Phosphorus Relative Effectiveness

Phase 5.3.2



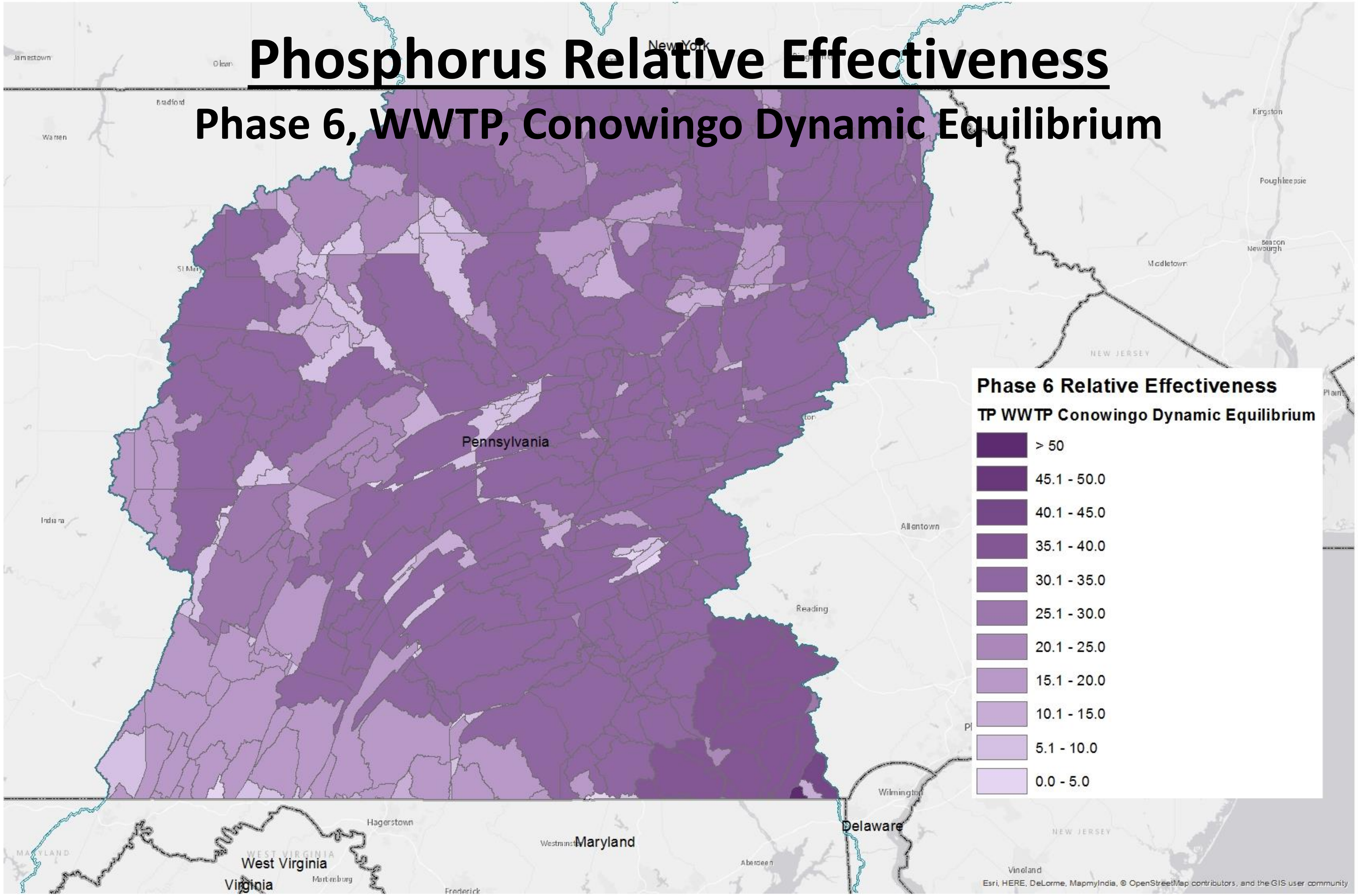
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



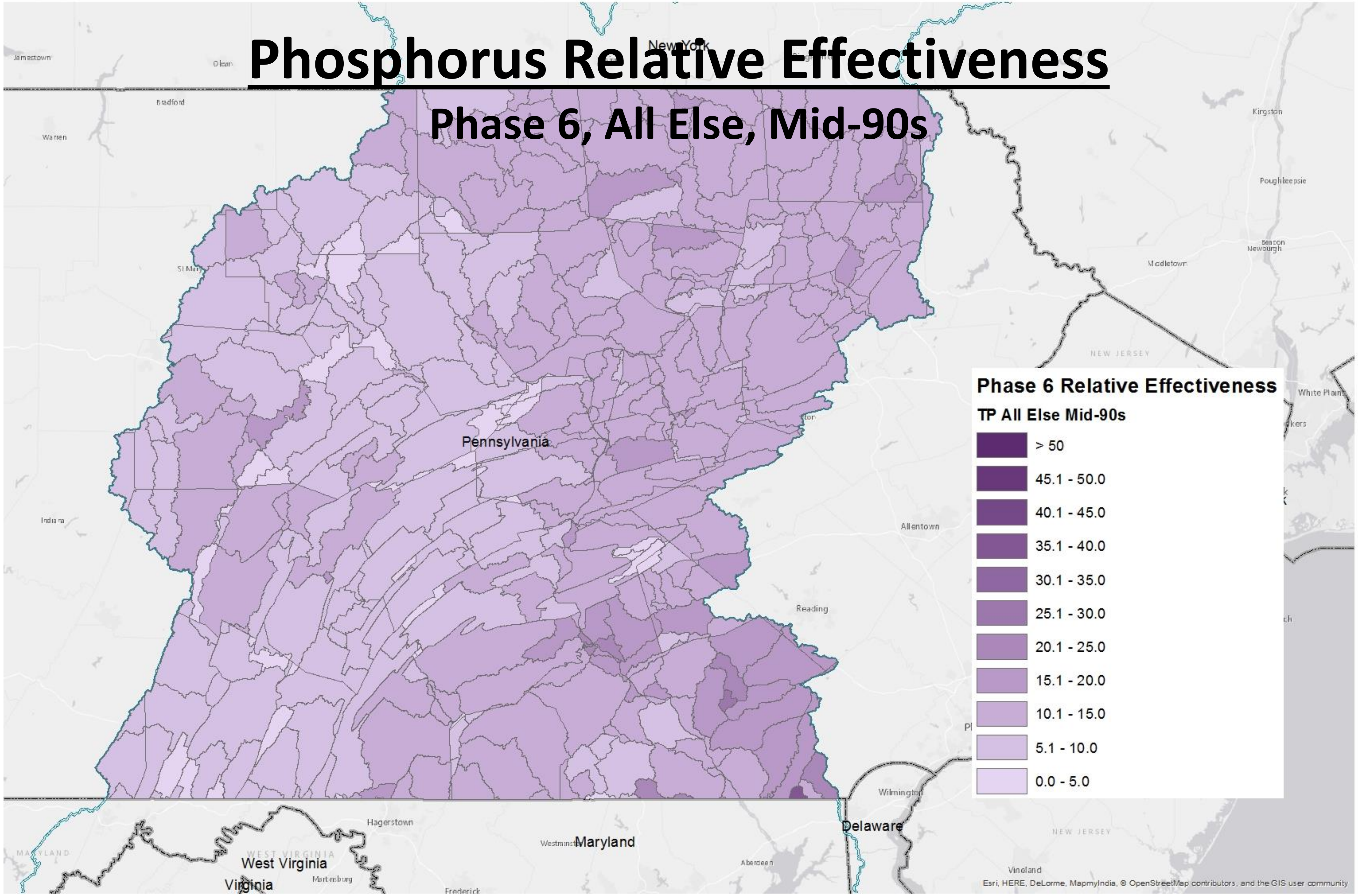
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



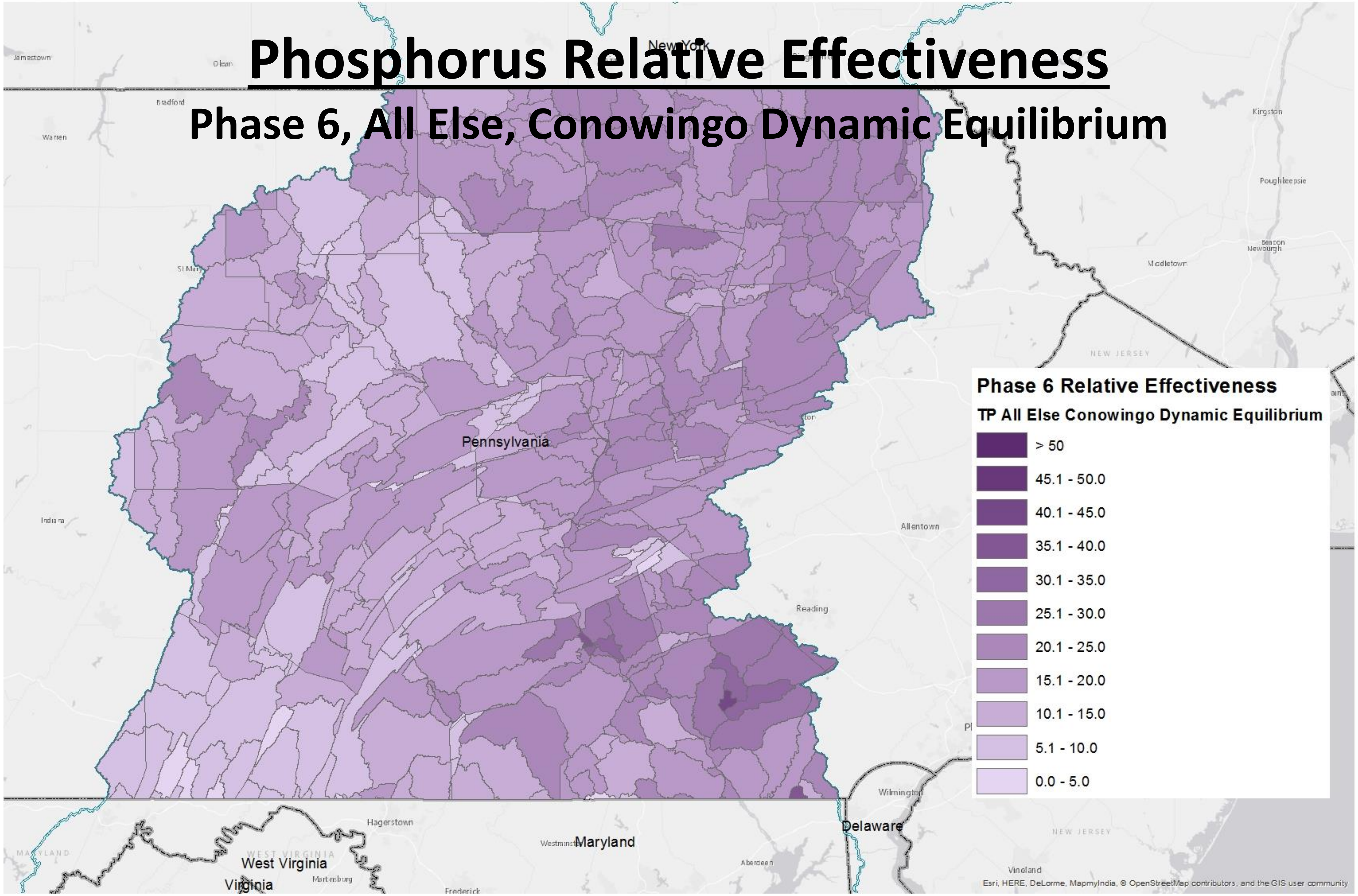
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium

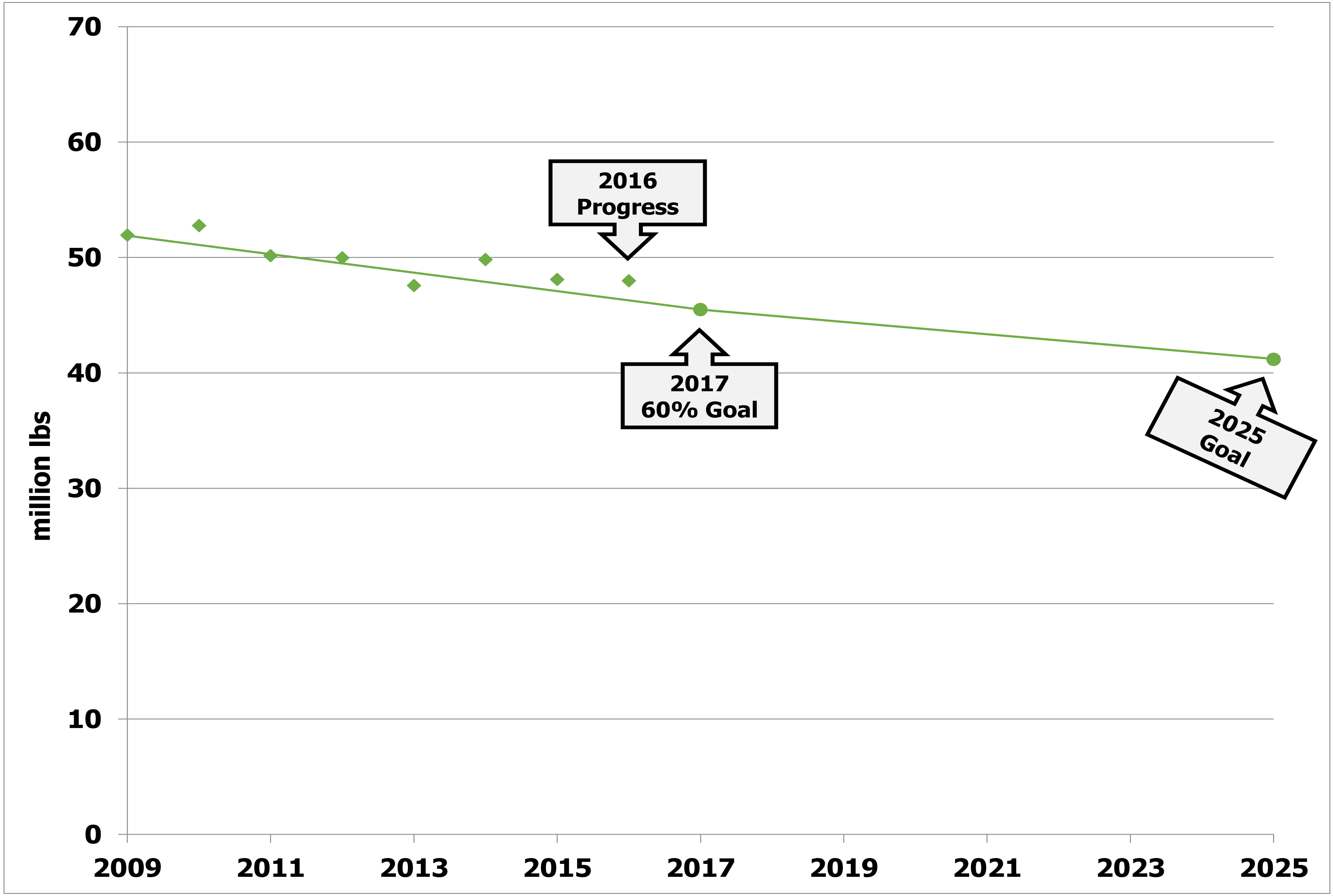


MD Draft Phase III WIP Planning Targets + Reference Loads

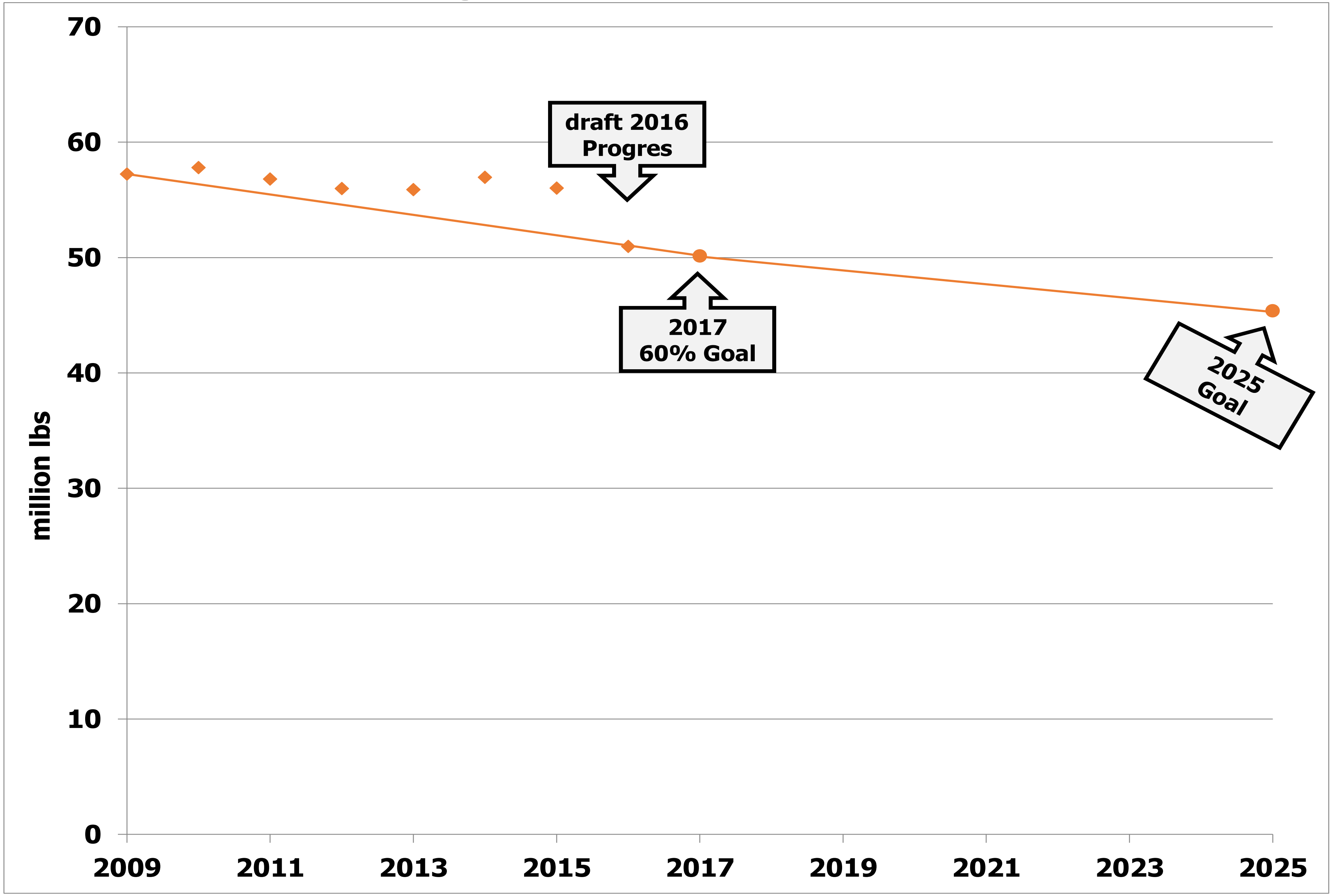
Nitrogen Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
MD Eastern Shore	27.84	8.85	18.60	15.48	15.13
MD Patuxent	7.47	2.19	3.46	3.34	3.21
MD Potomac	35.84	10.53	17.19	17.12	15.29
MD Susquehanna	2.15	0.82	1.78	1.44	1.17
MD Western Shore	37.44	6.58	14.86	9.91	10.58
MD Total	110.74	28.96	55.89	47.29	45.39

Phosphorus Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
MD Eastern Shore	2.206	0.904	1.301	1.198	1.226
MD Patuxent	1.155	0.168	0.302	0.282	0.290
MD Potomac	4.077	0.624	0.985	1.039	1.066
MD Susquehanna	0.086	0.031	0.063	0.051	0.050
MD Western Shore	4.088	0.695	1.291	1.015	0.922
MD Total	11.612	2.422	3.942	3.585	3.553

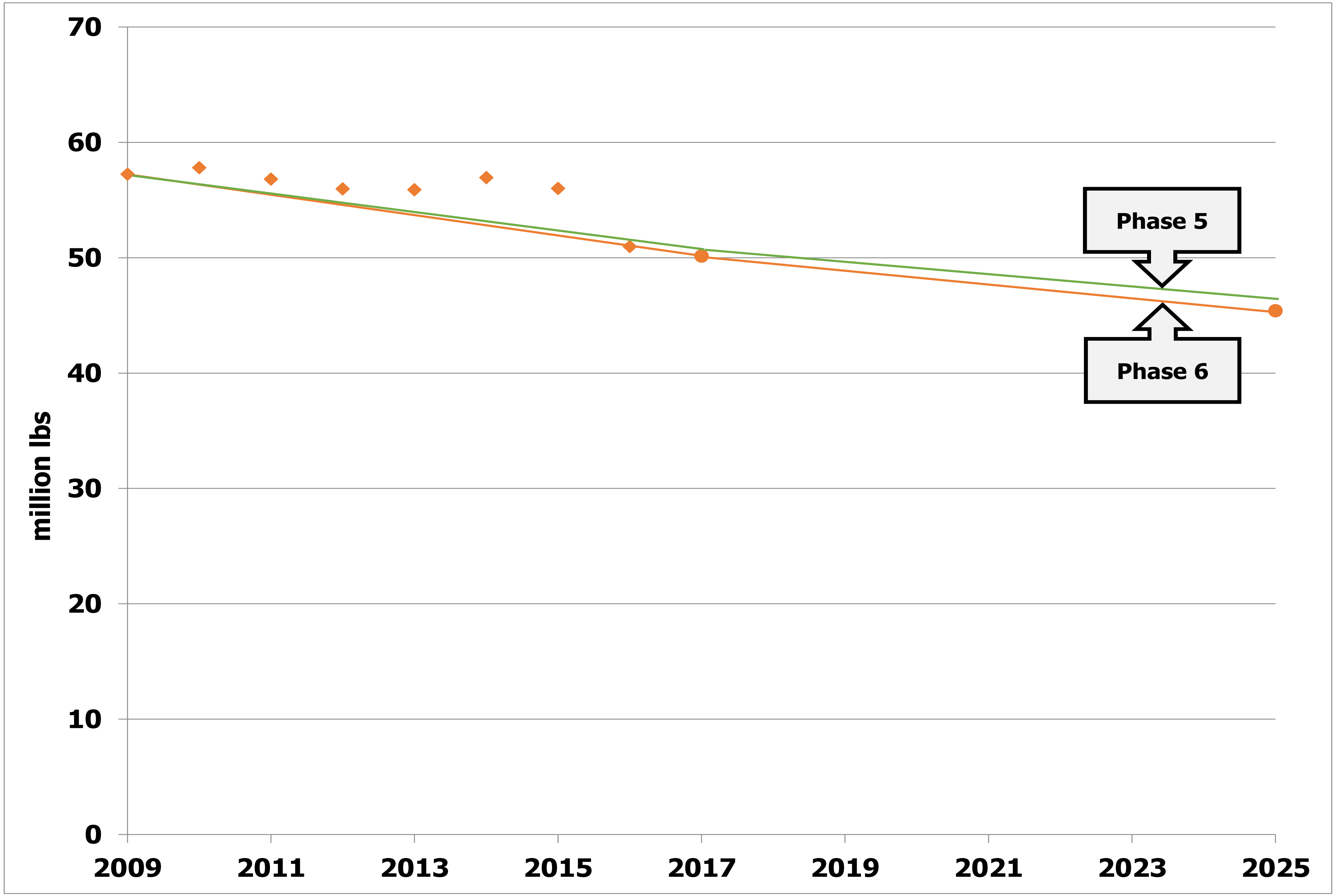
MD Nitrogen Loads-Goals, Phase 5.3.2



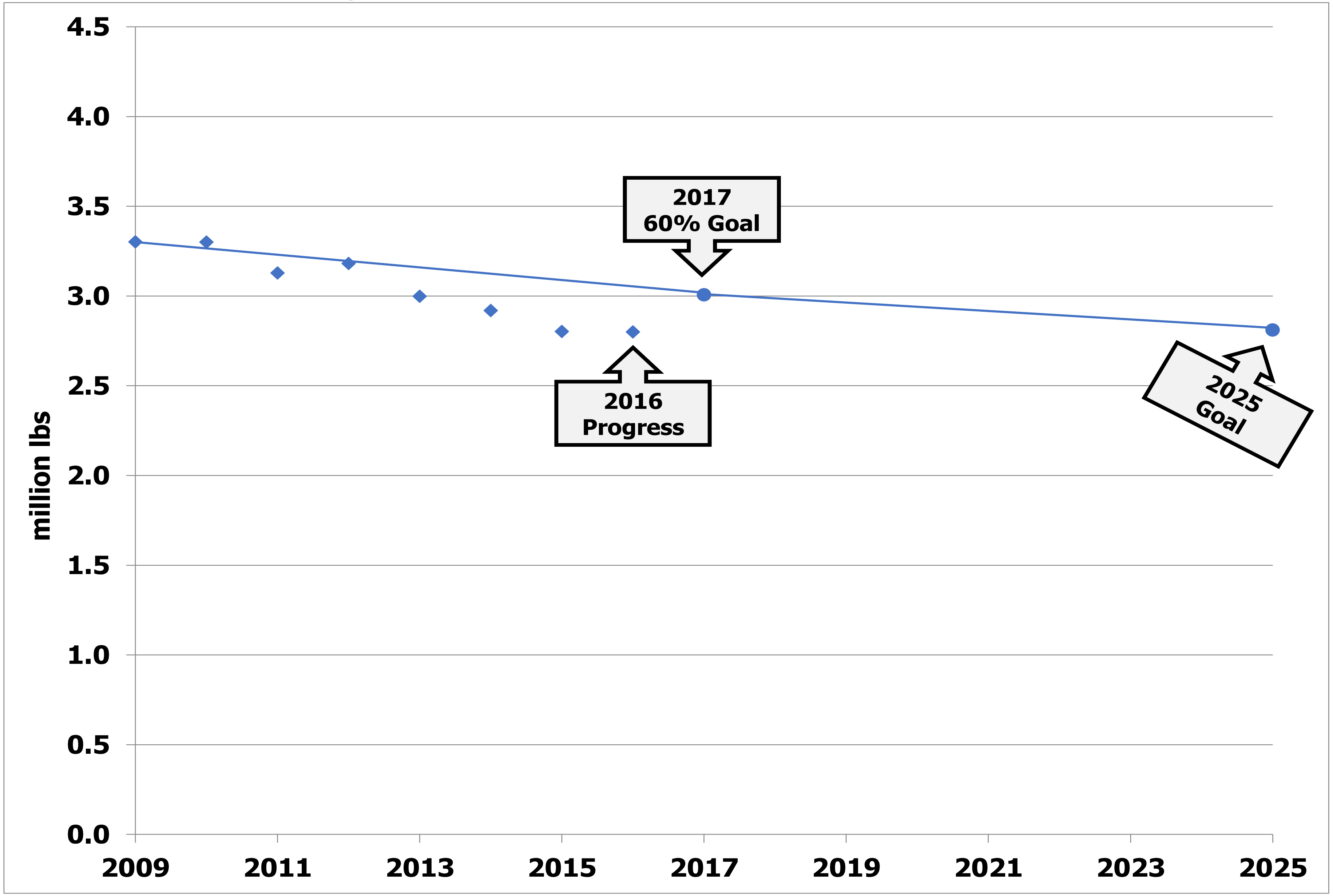
MD Nitrogen Loads-Goals, Phase 6



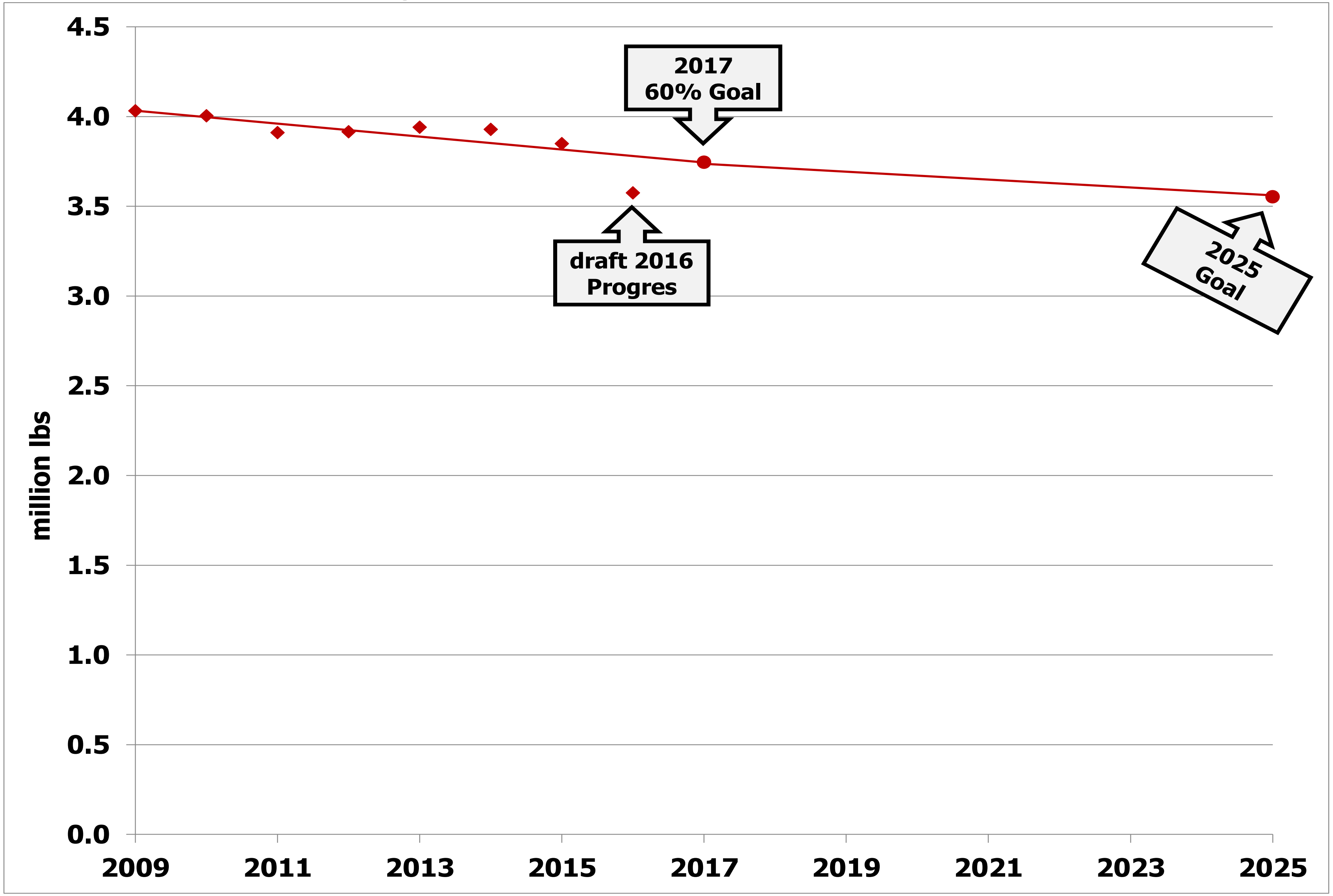
MD Nitrogen Change in LOE



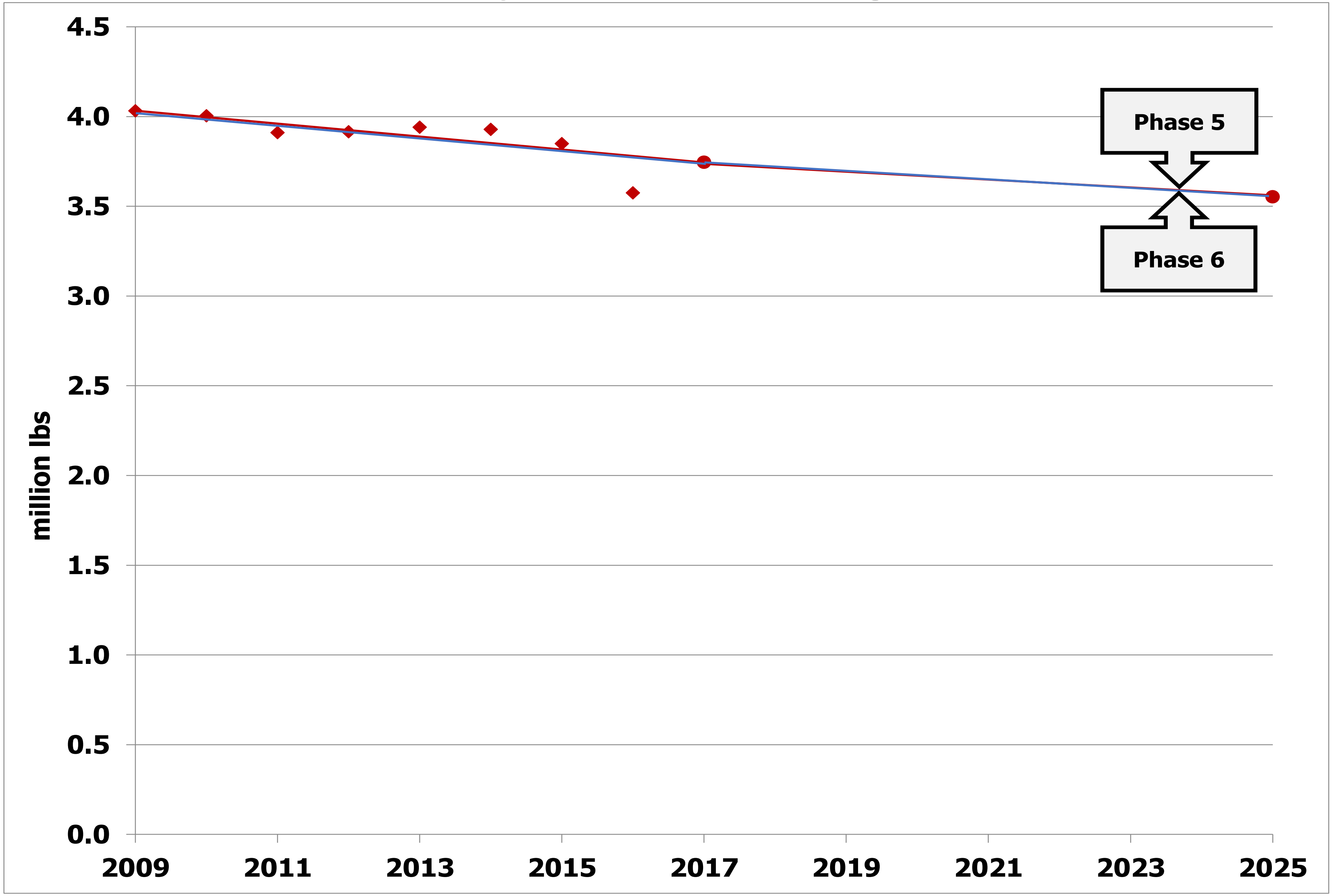
MD Phosphorus Loads-Goals, Phase 5.3.2



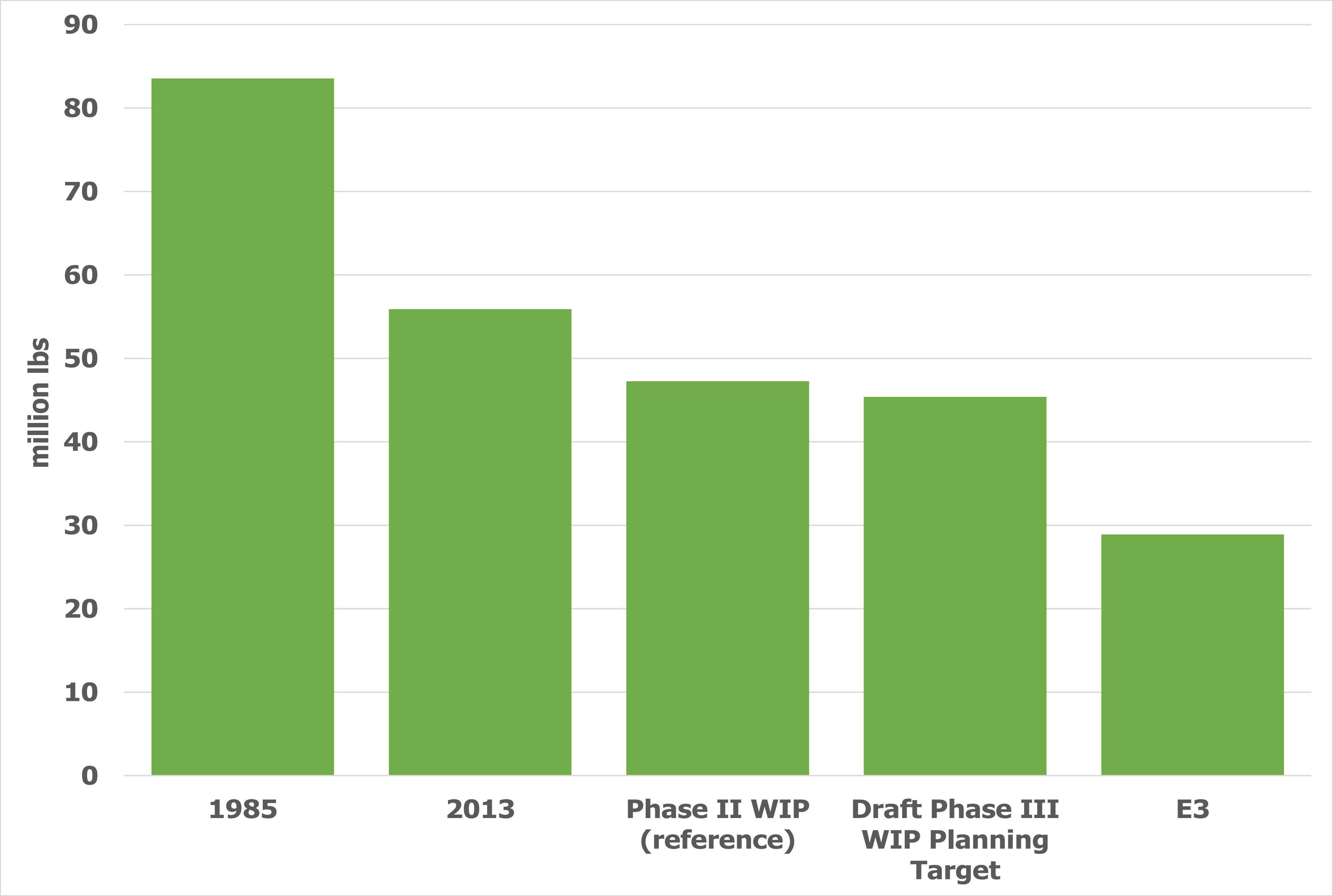
MD Phosphorus Loads-Goals, Phase 6



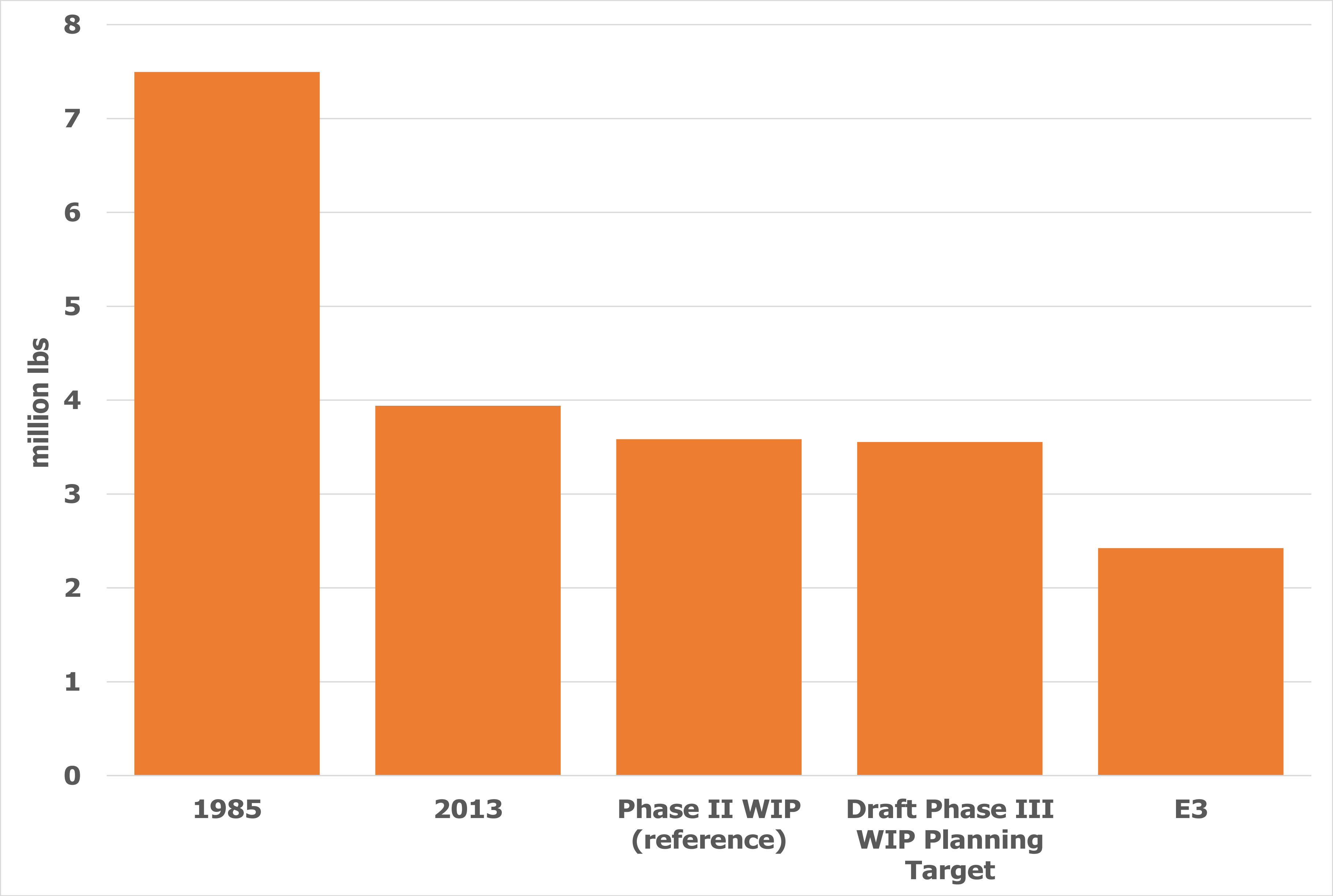
MD Phosphorus Change in LOE



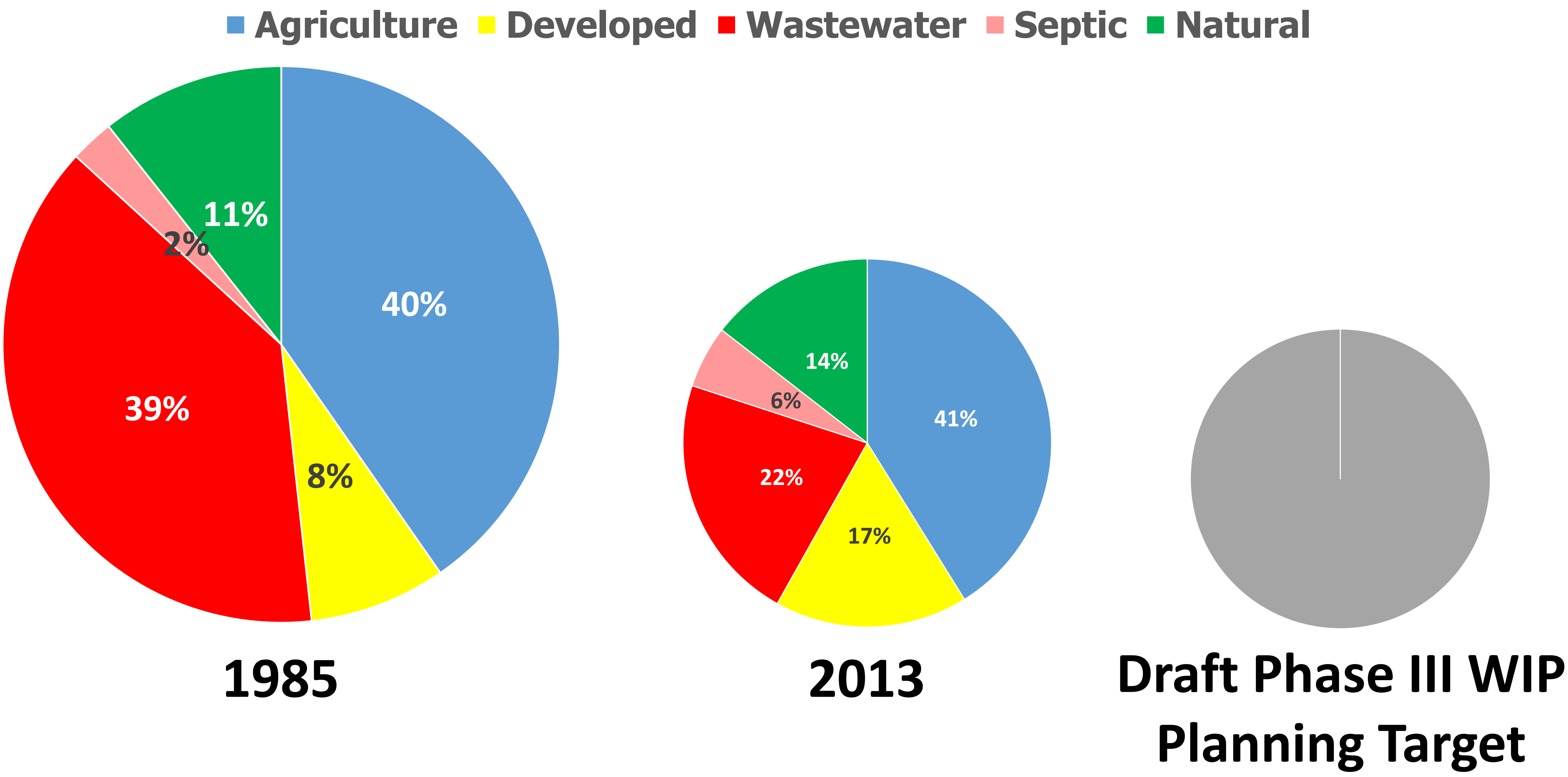
MD Nitrogen Loads, Reference Scenarios, and Target



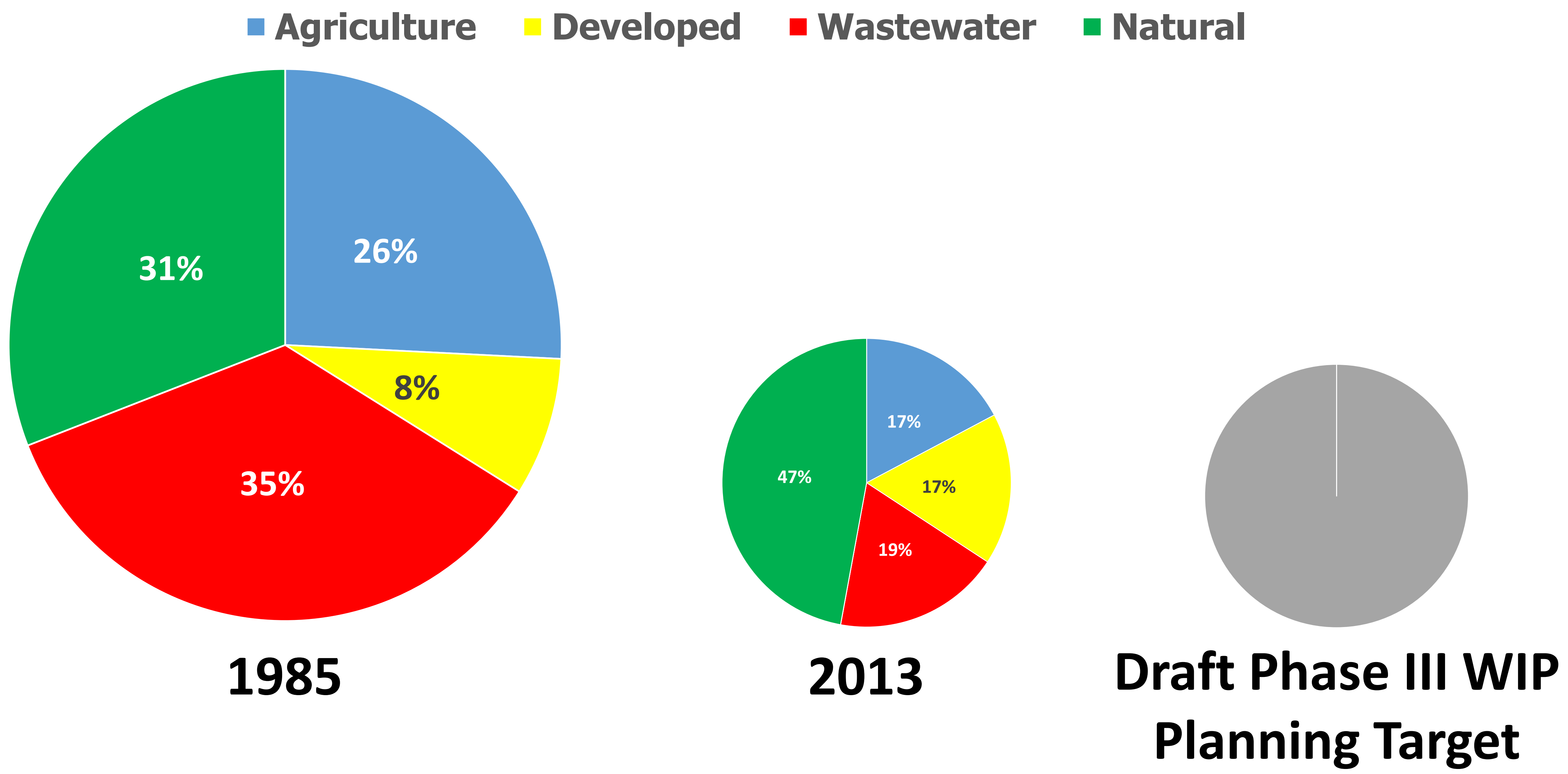
MD Phosphorus Loads, Reference Scenarios, and Target



MD Nitrogen Loads and Target

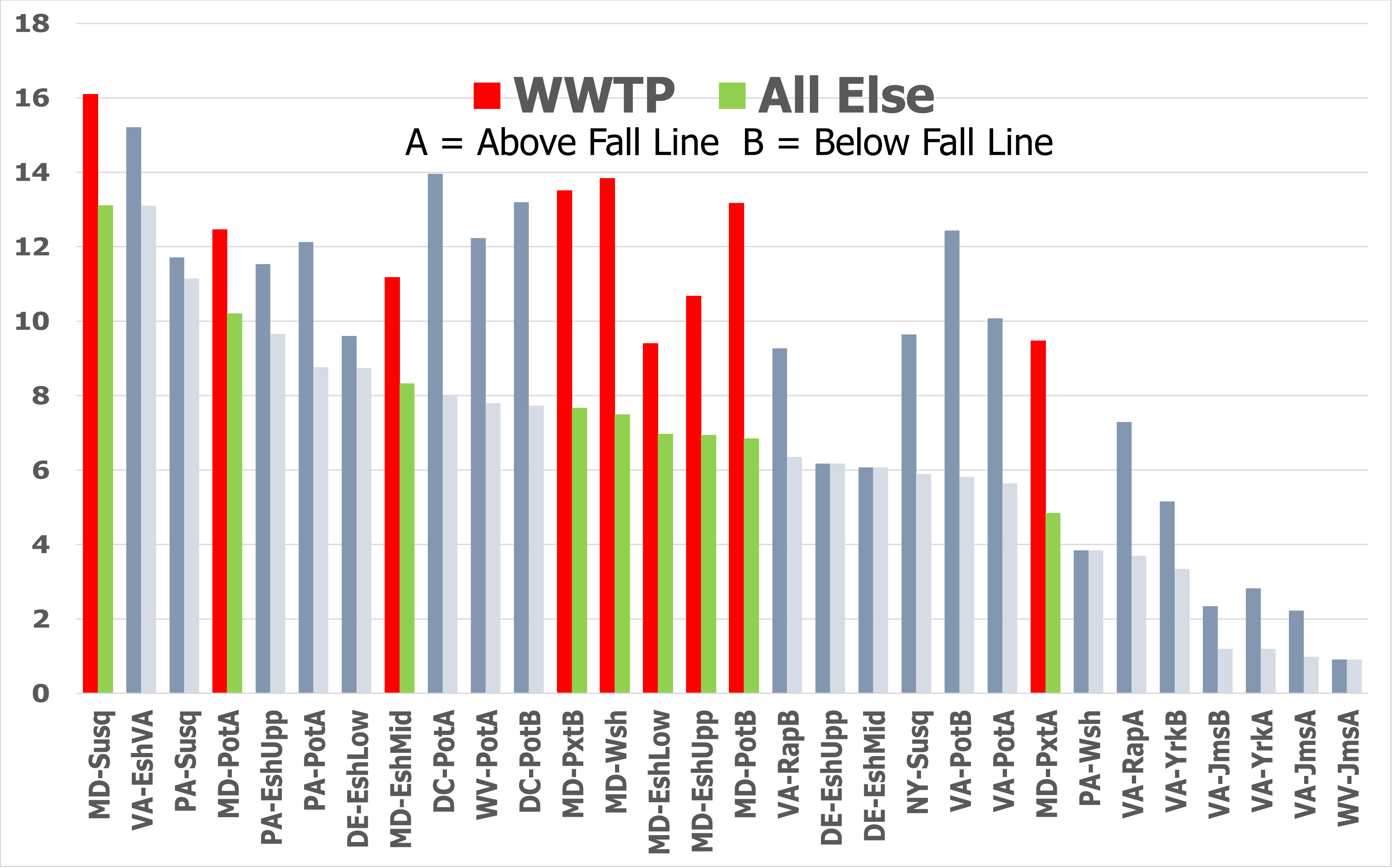


MD Phosphorus Loads and Target



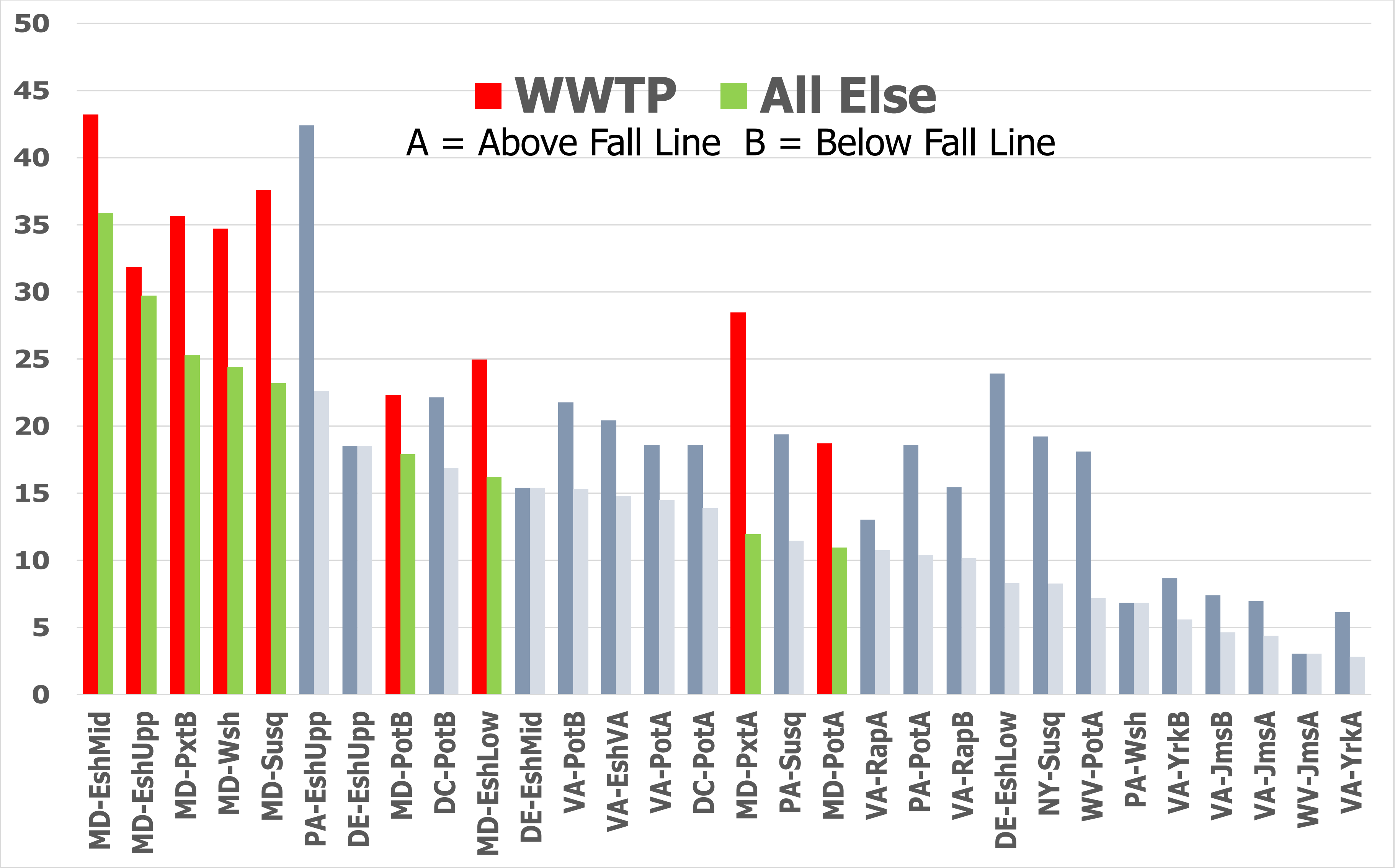
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



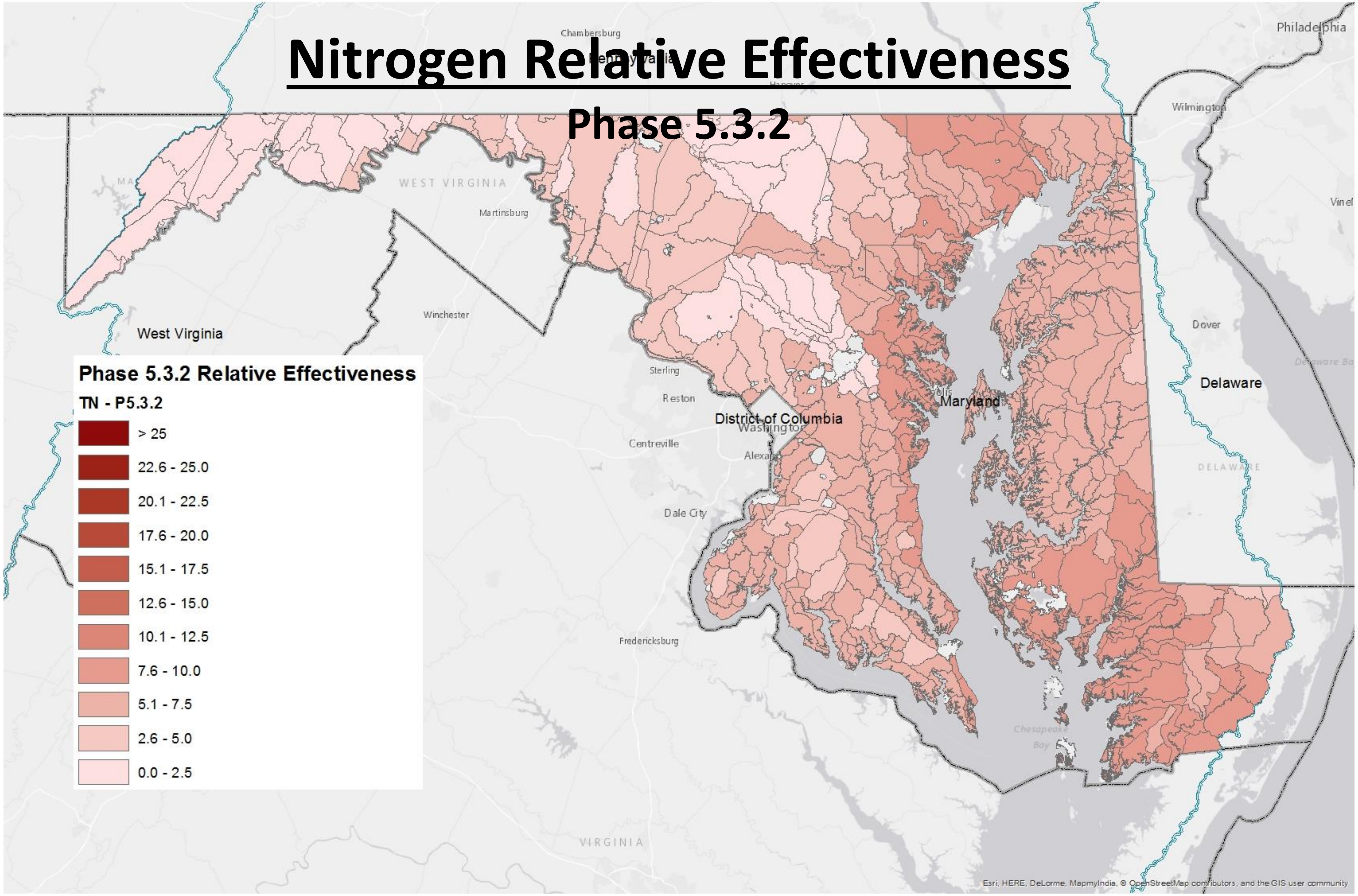
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



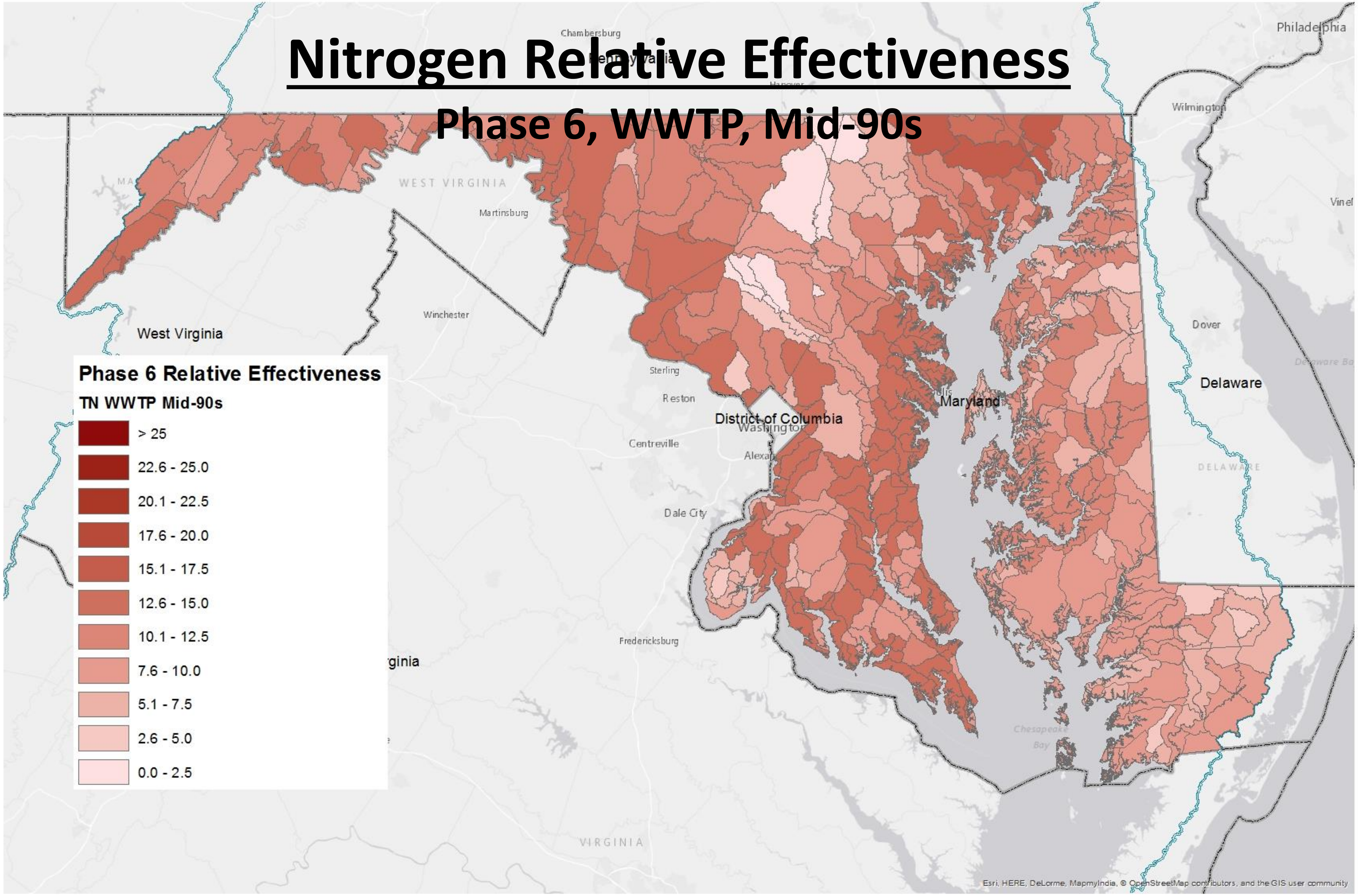
Nitrogen Relative Effectiveness

Phase 5.3.2



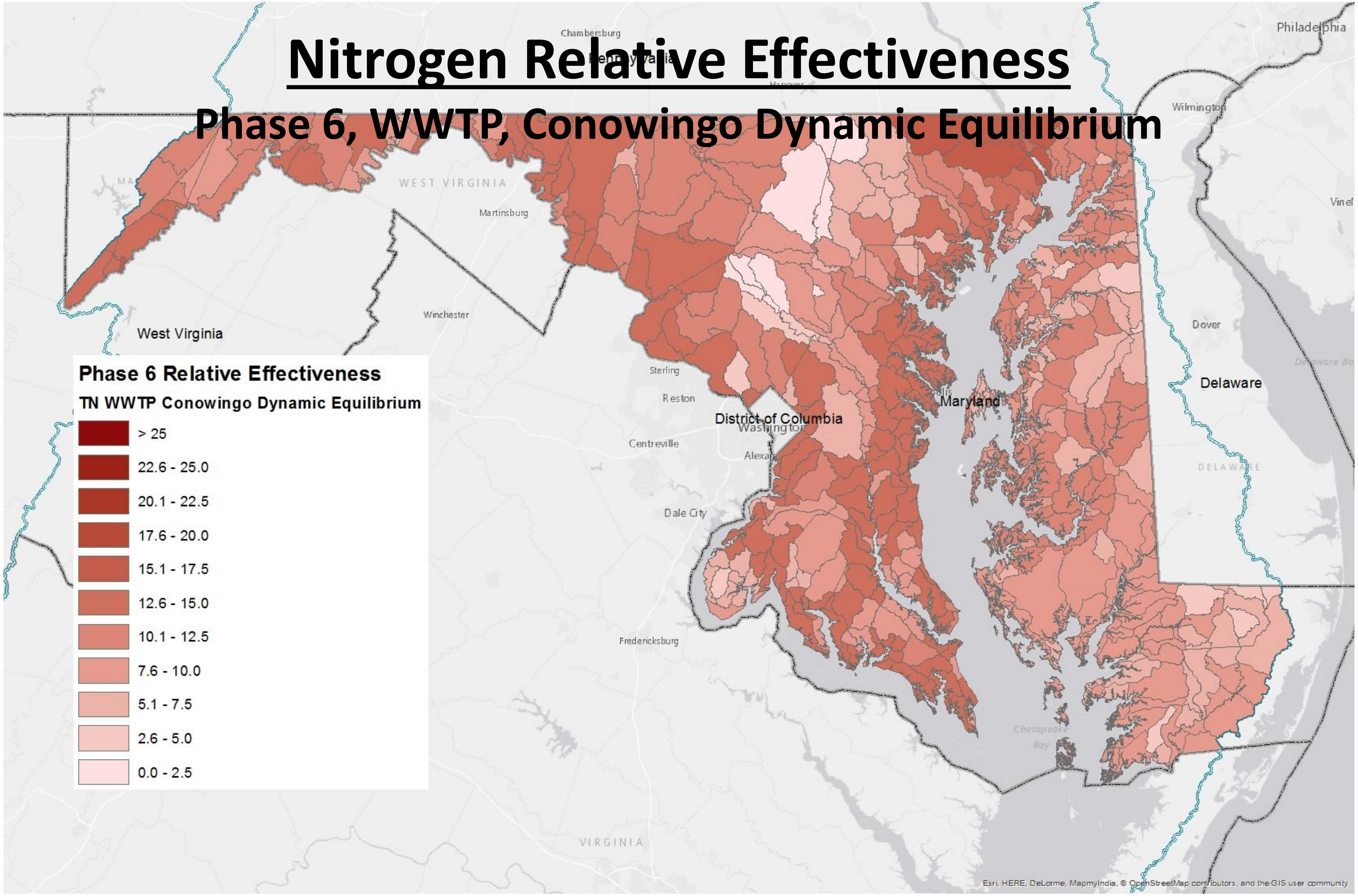
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



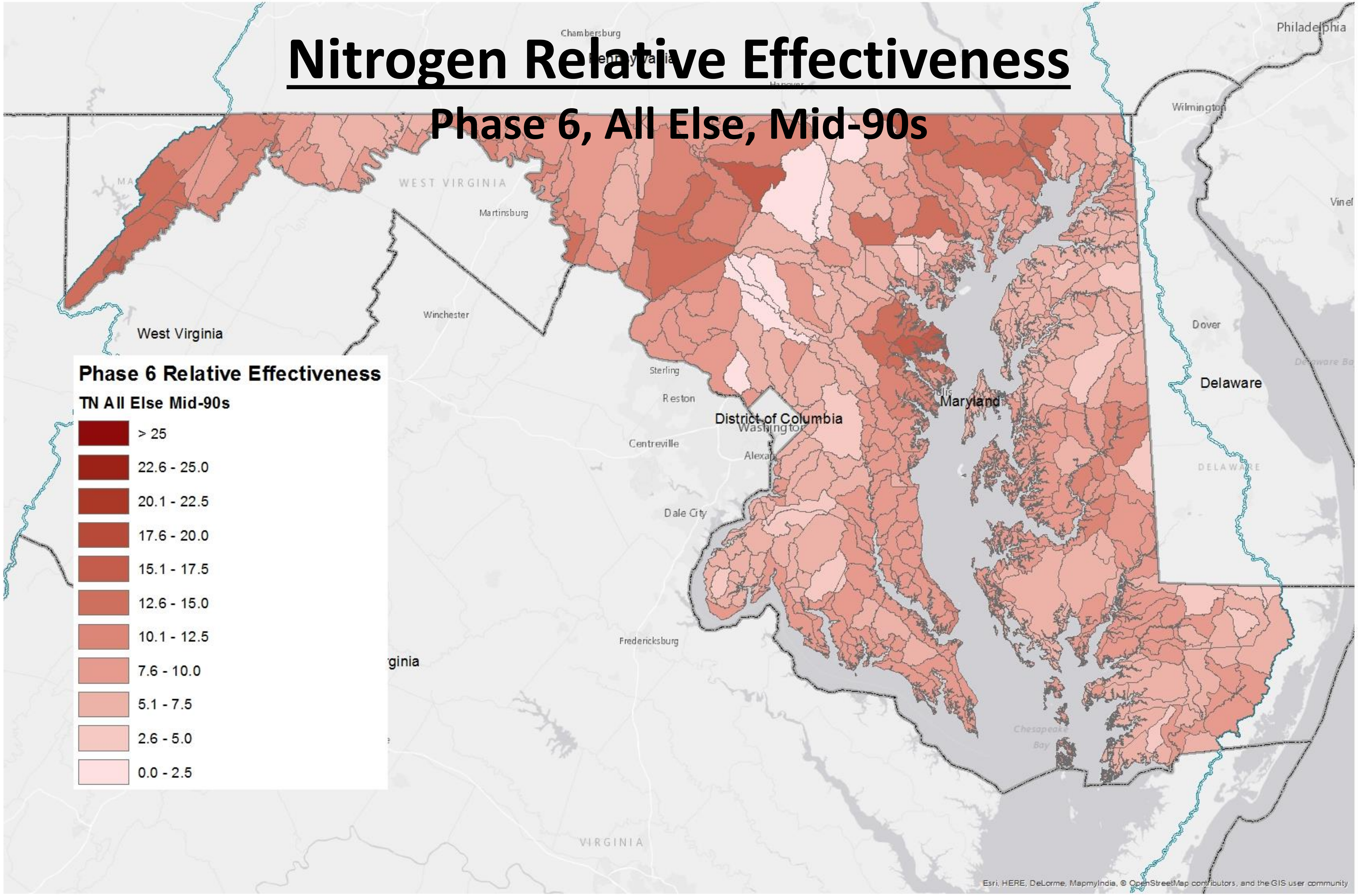
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



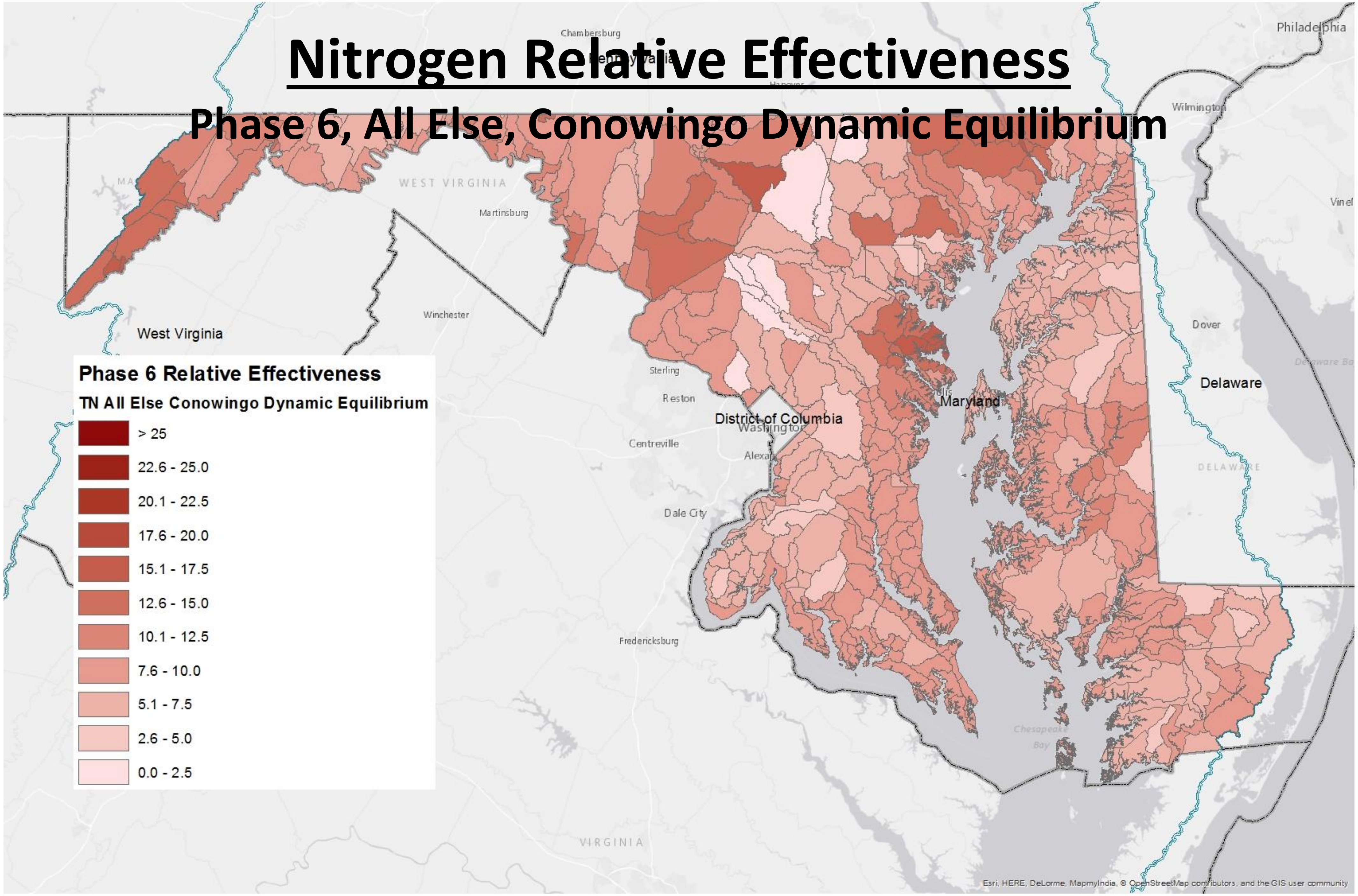
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



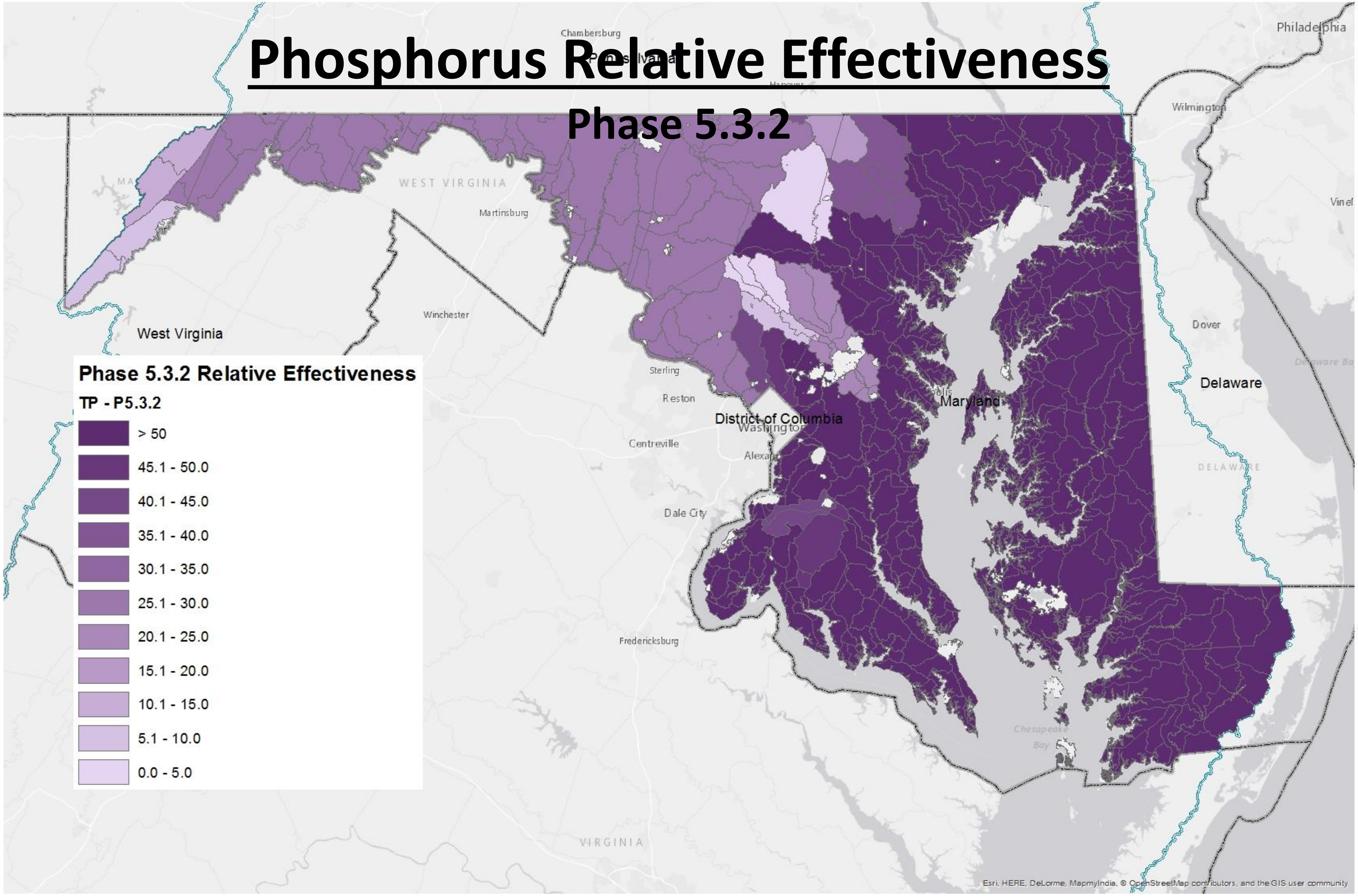
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



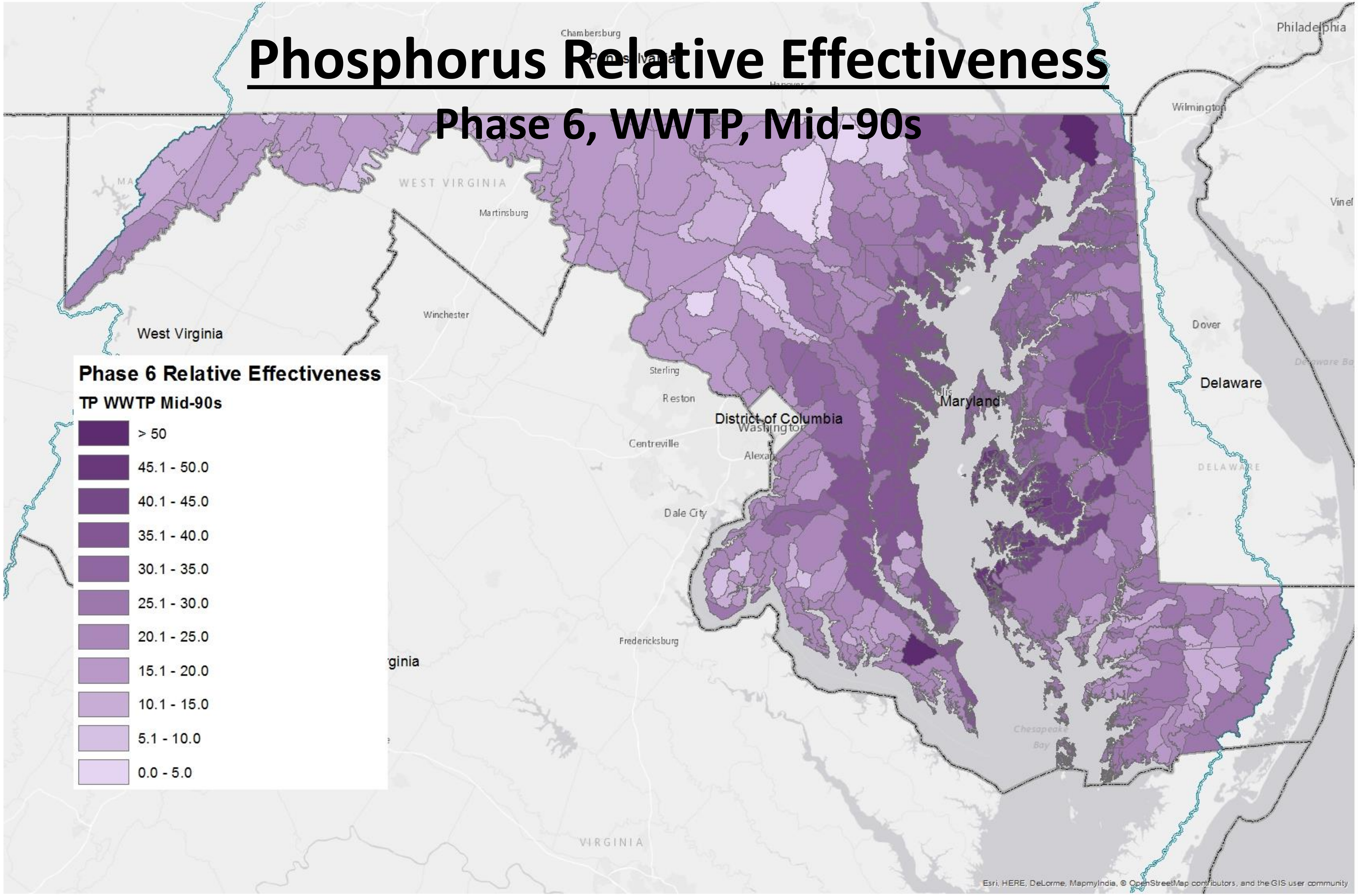
Phosphorus Relative Effectiveness

Phase 5.3.2



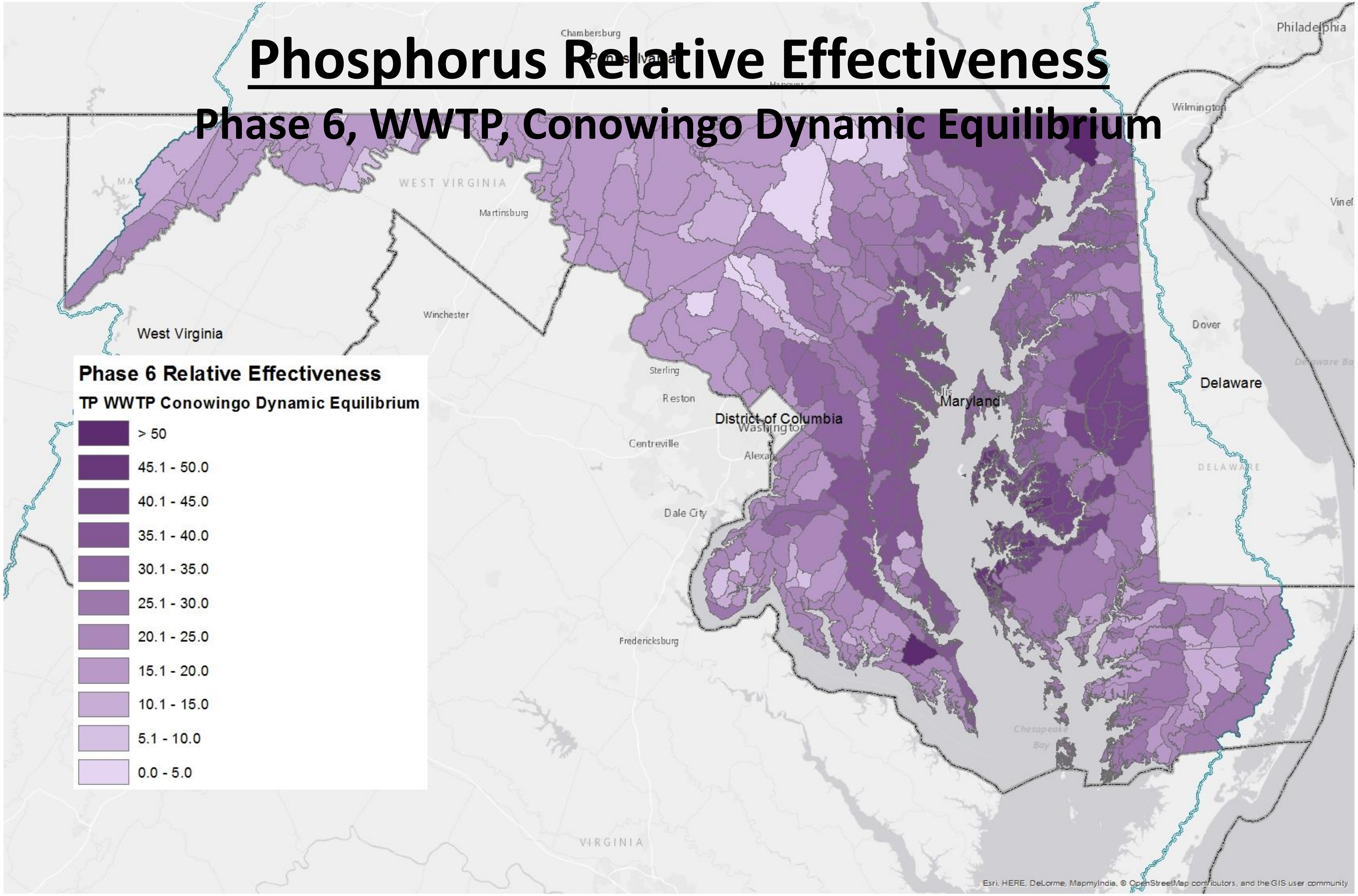
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



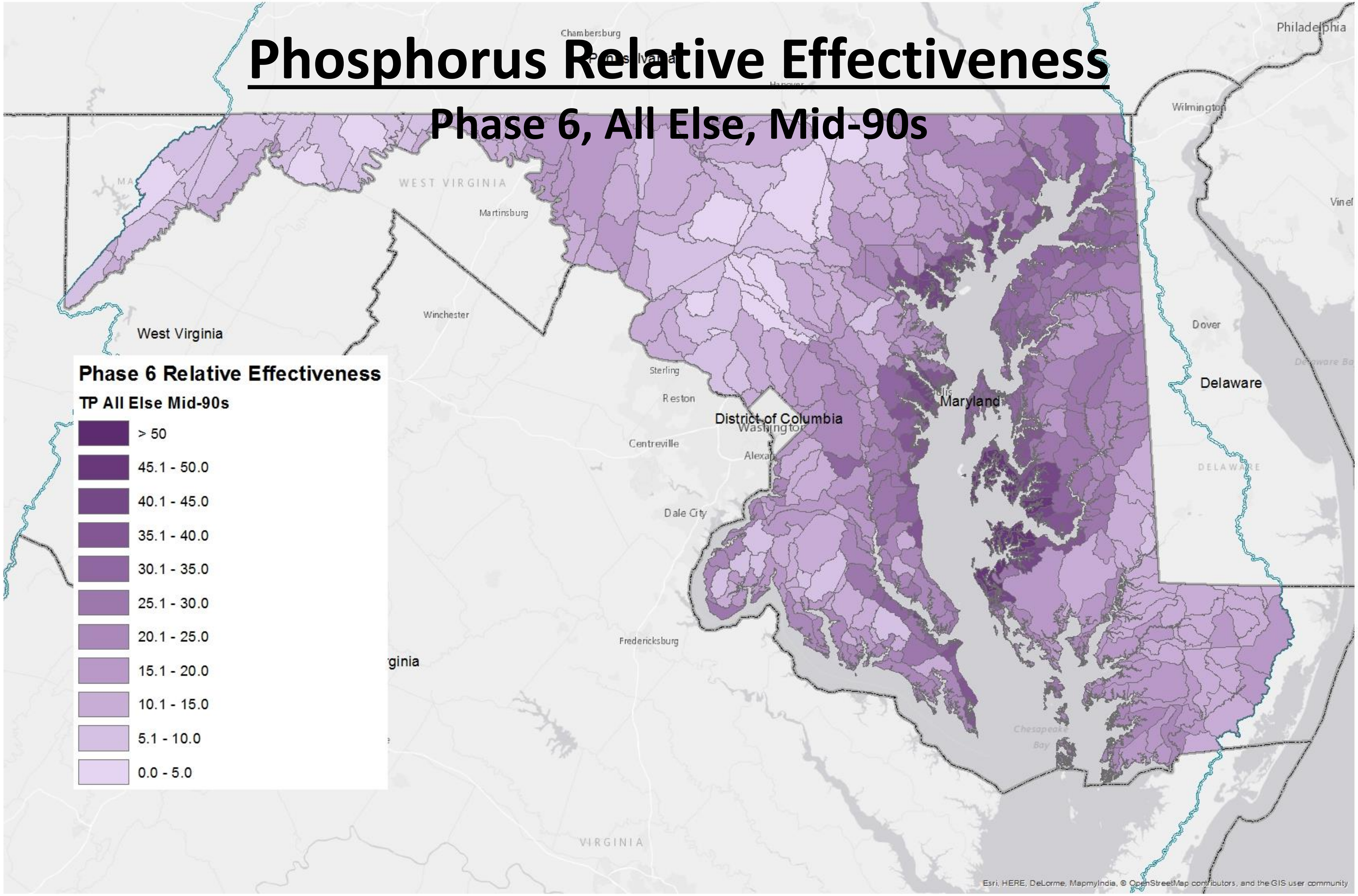
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



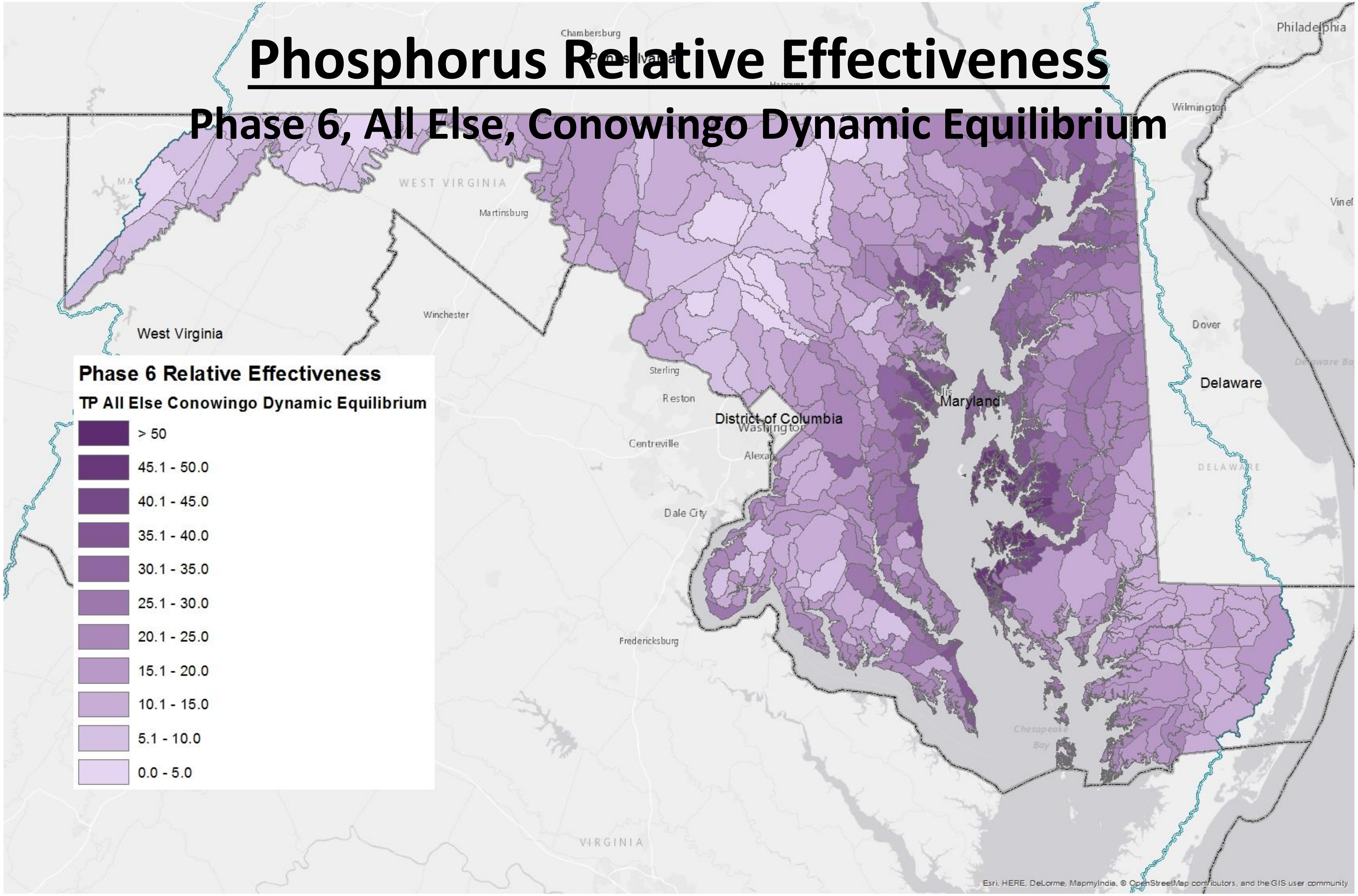
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium

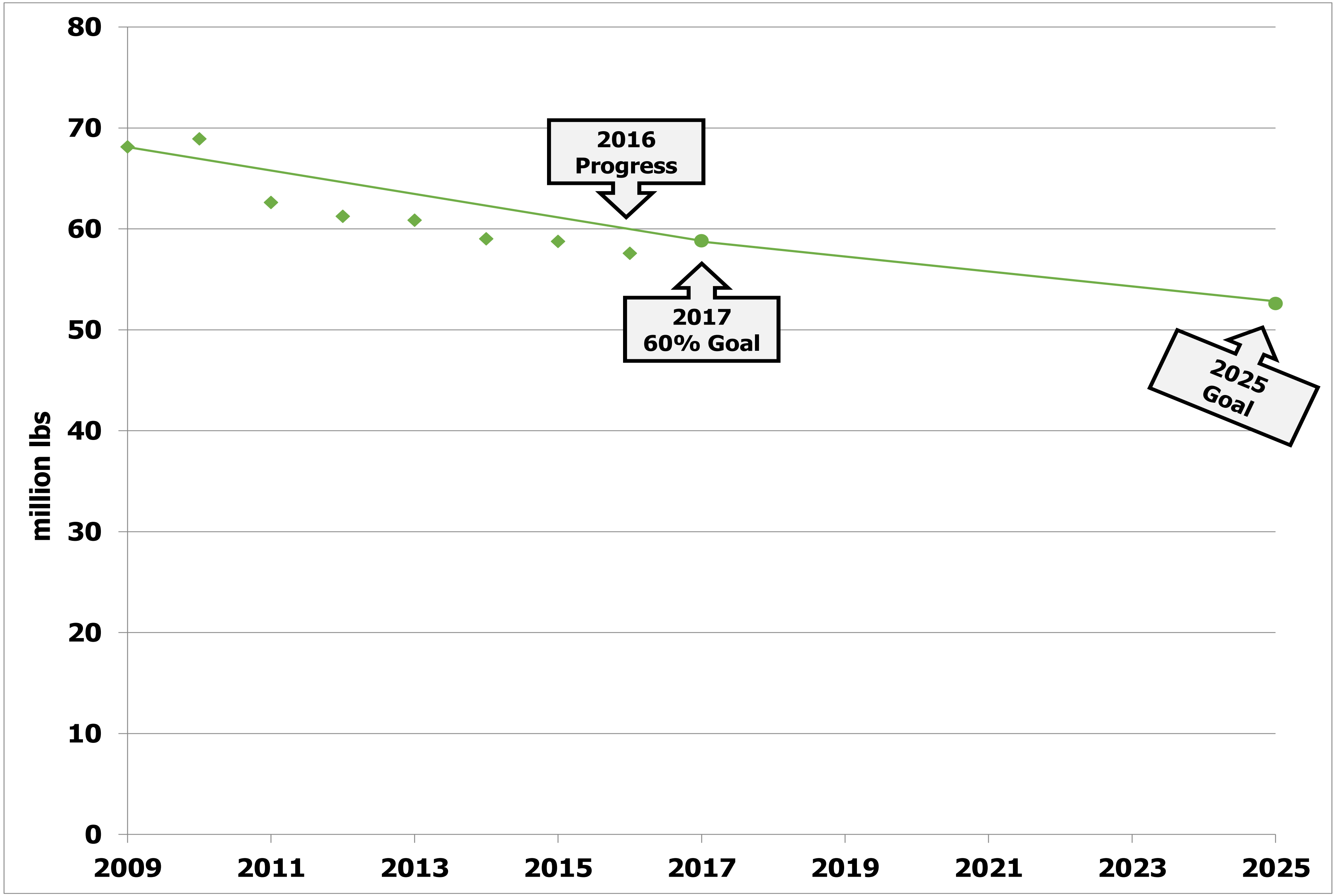


VA Draft Phase III WIP Planning Targets + Reference Loads

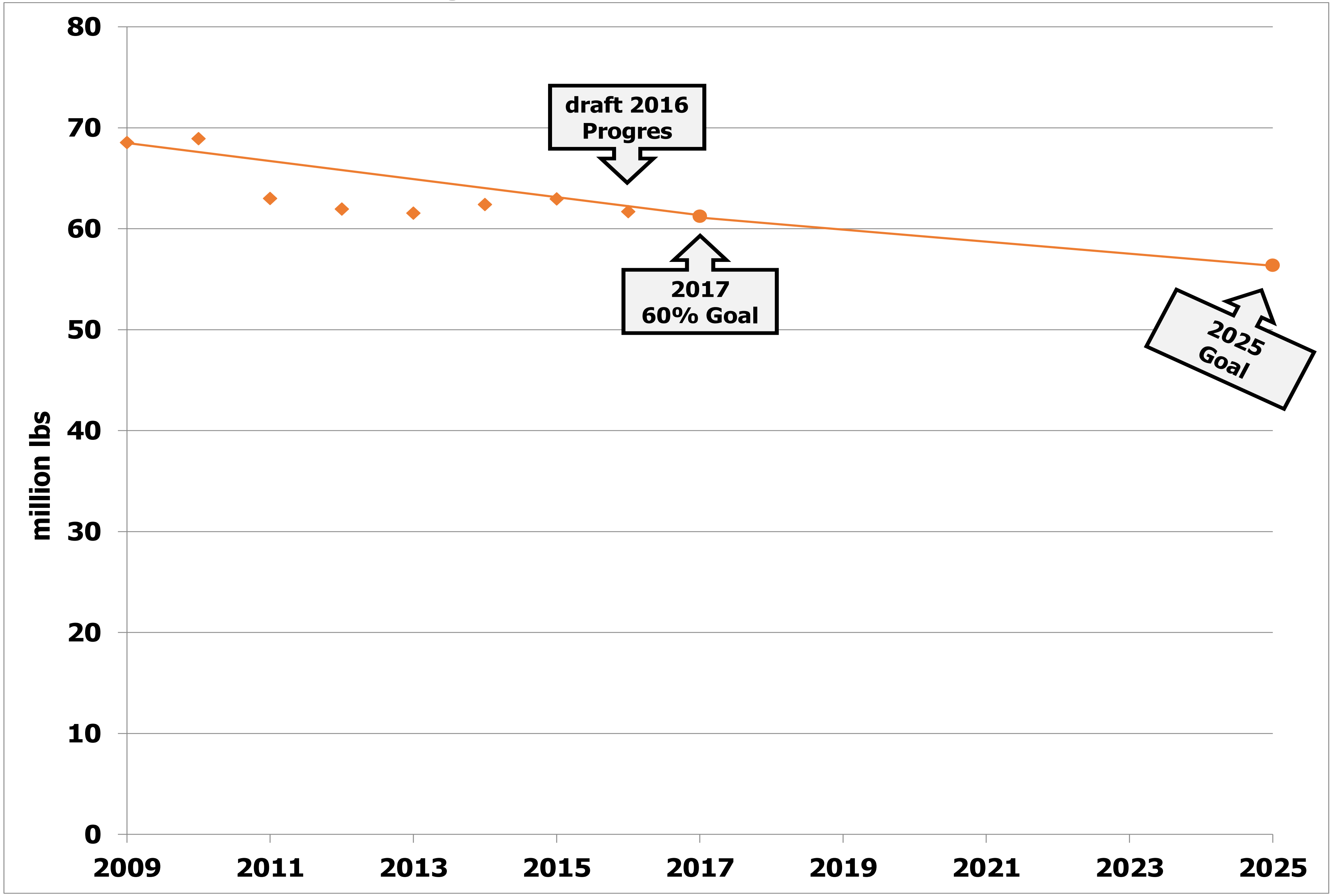
Nitrogen Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
VA Eastern Shore	2.99	0.96	2.29	1.55	1.45
VA James	51.58	15.22	26.86	22.07	26.33
VA Potomac	36.81	10.76	17.57	15.38	16.09
VA Rappahannock	11.57	4.84	8.37	6.84	6.93
VA York	9.01	3.78	6.43	5.63	5.58
VA Total	111.96	35.56	61.53	51.47	56.37

Phosphorus Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
VA Eastern Shore	0.272	0.124	0.180	0.156	0.161
VA James	10.029	1.424	2.781	2.302	2.829
VA Potomac	6.117	1.141	2.204	1.780	1.991
VA Rappahannock	1.548	0.612	0.999	0.863	0.878
VA York	1.132	0.374	0.587	0.565	0.551
VA Total	19.099	3.674	6.751	5.666	6.411

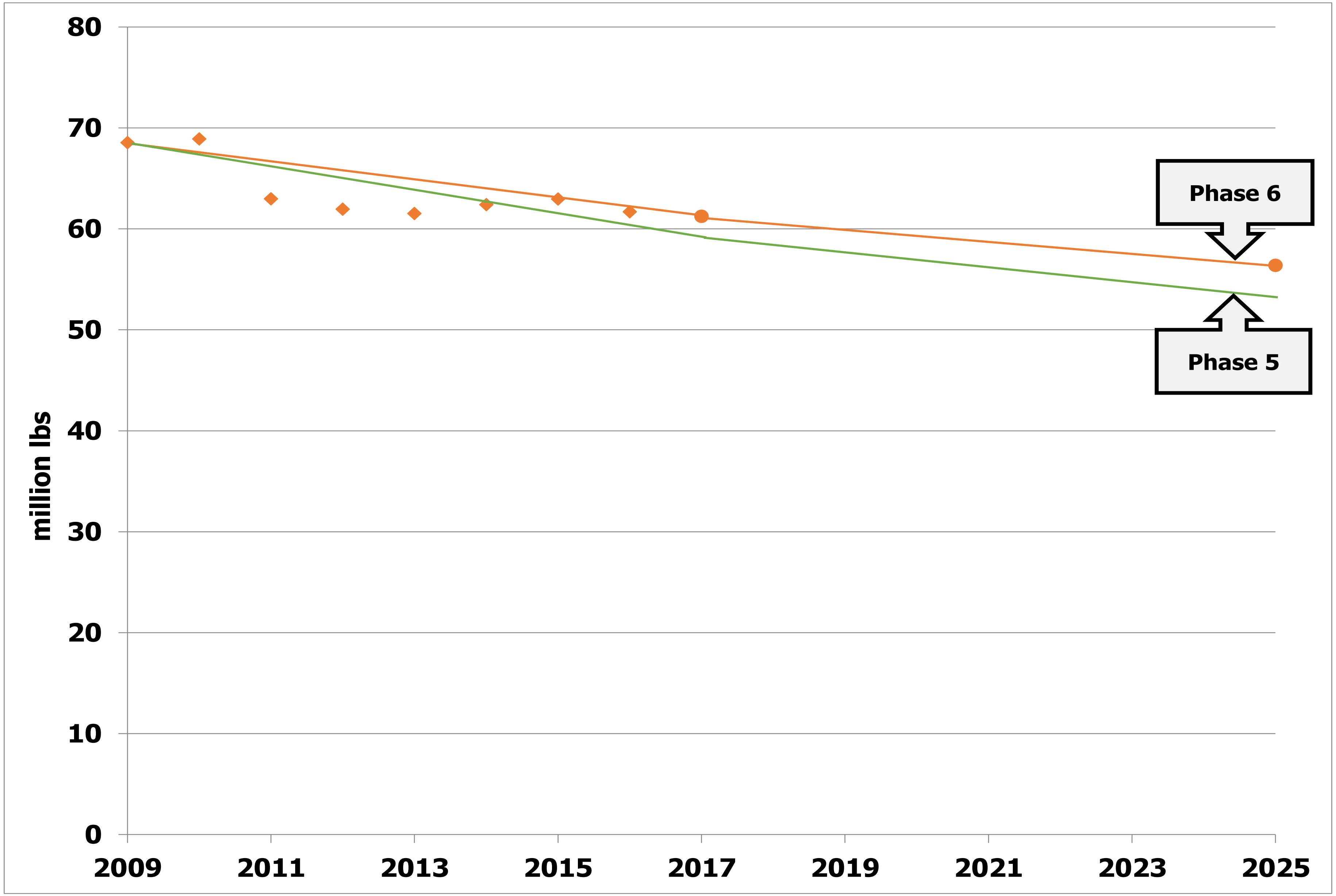
VA Nitrogen Loads-Goals, Phase 5.3.2



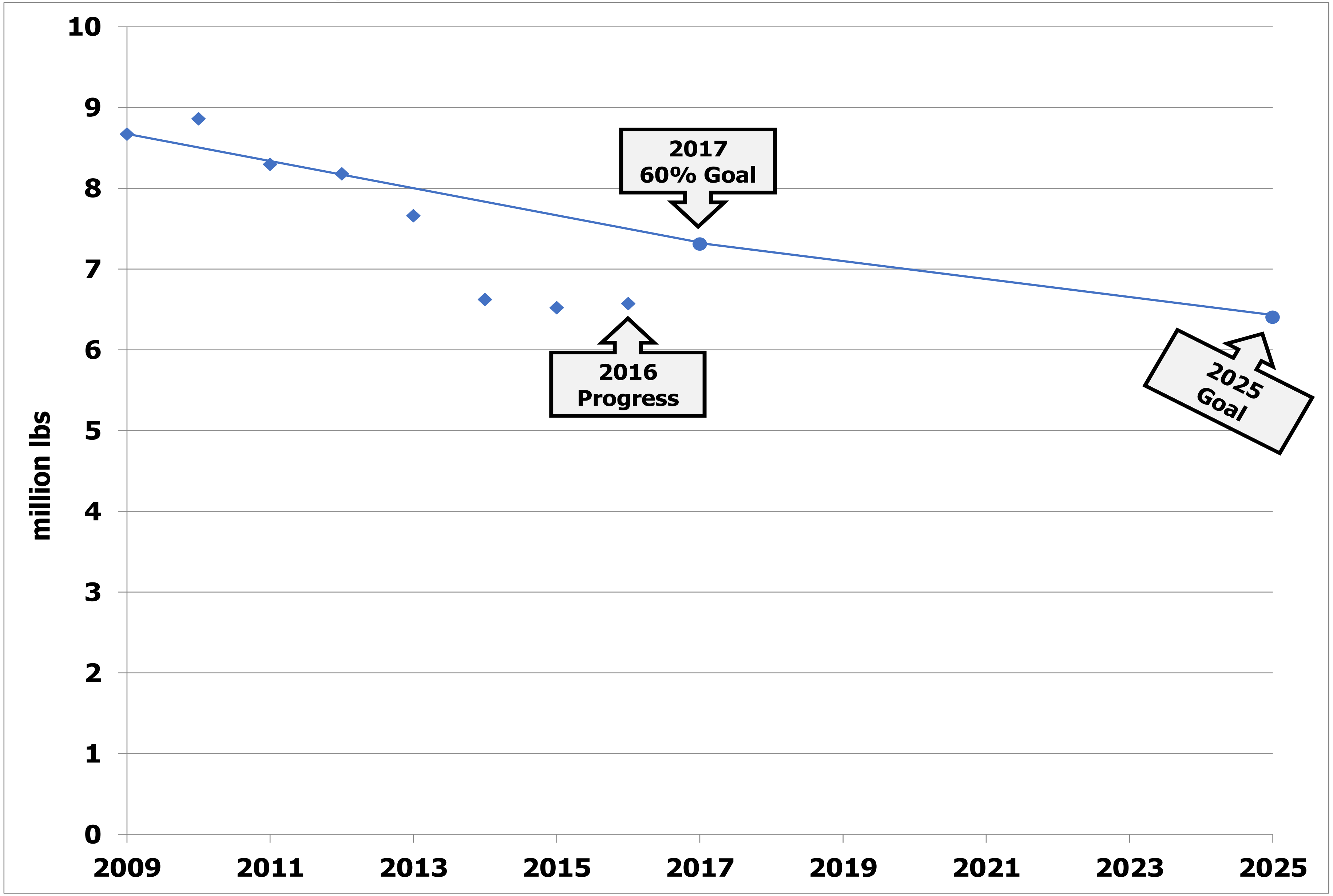
VA Nitrogen Loads-Goals, Phase 6



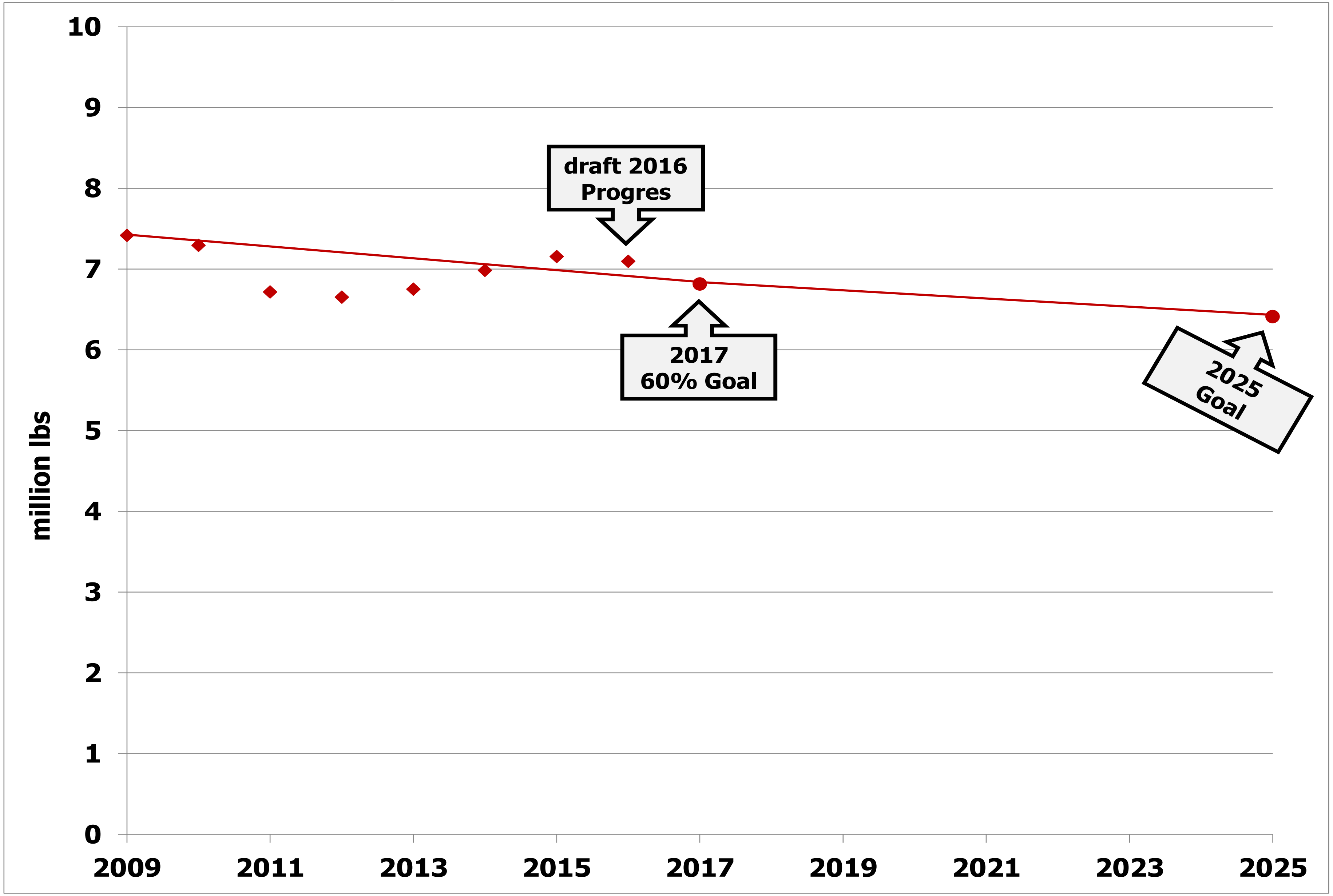
VA Nitrogen Change in LOE



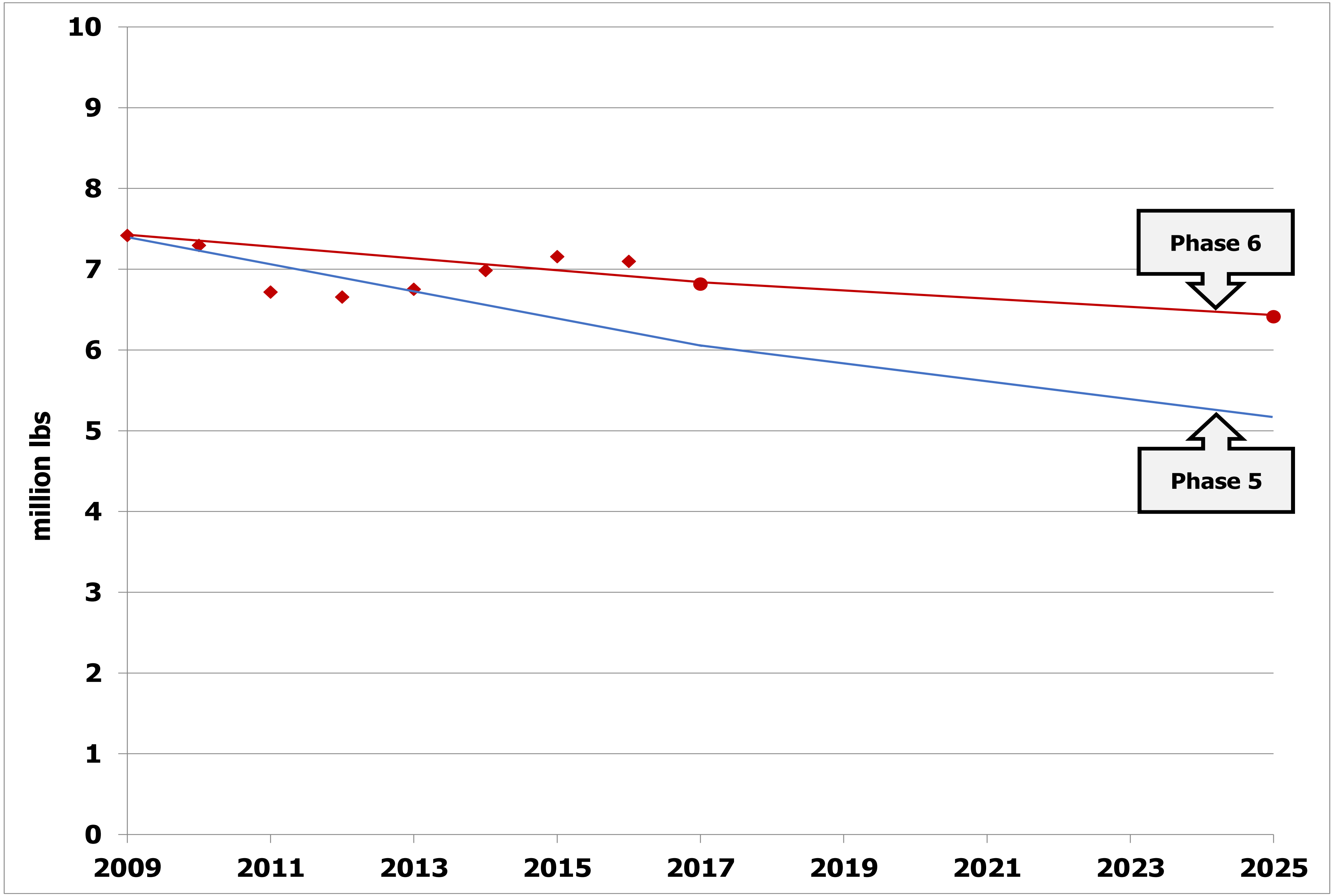
VA Phosphorus Loads-Goals, Phase 5.3.2



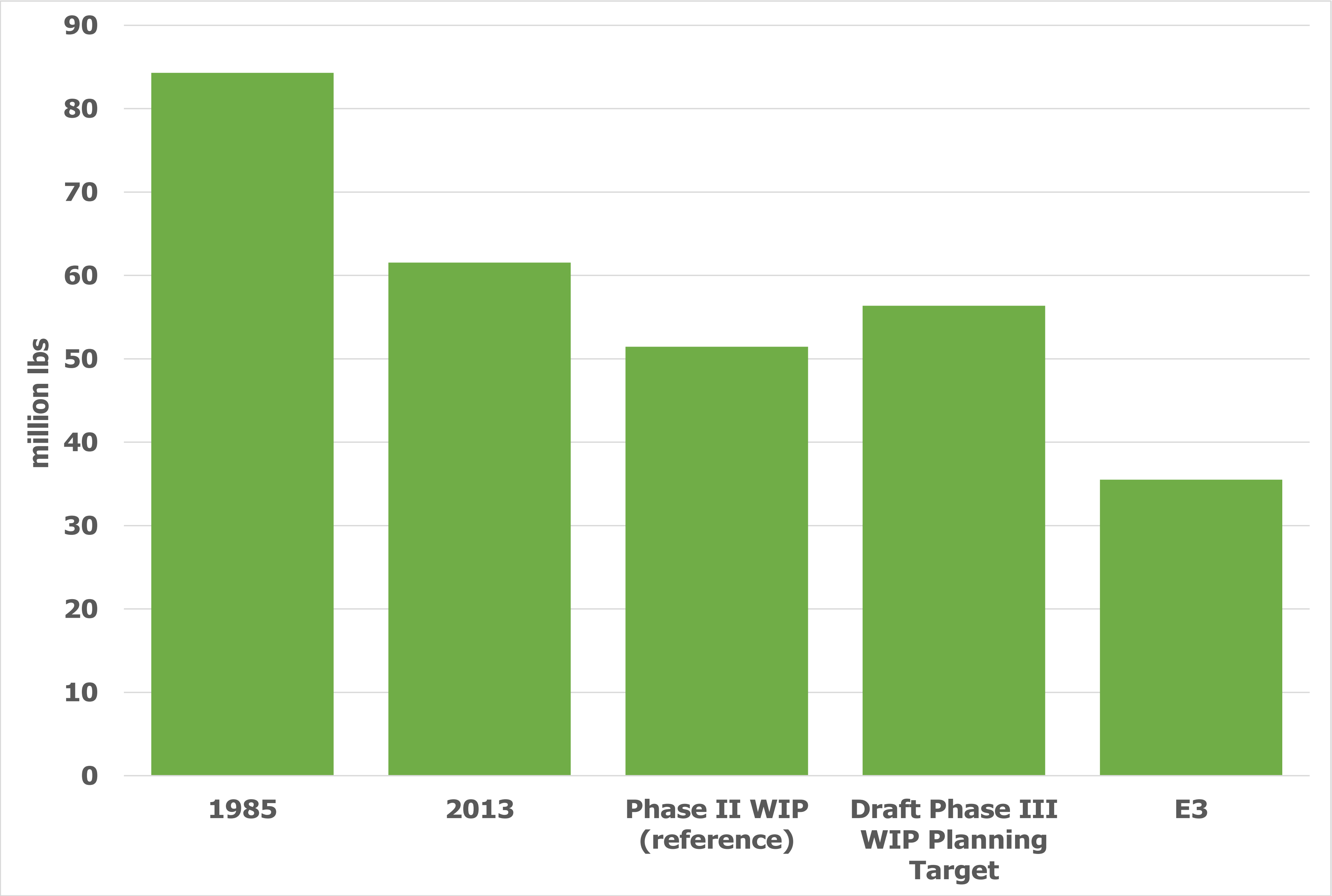
VA Phosphorus Loads-Goals, Phase 6



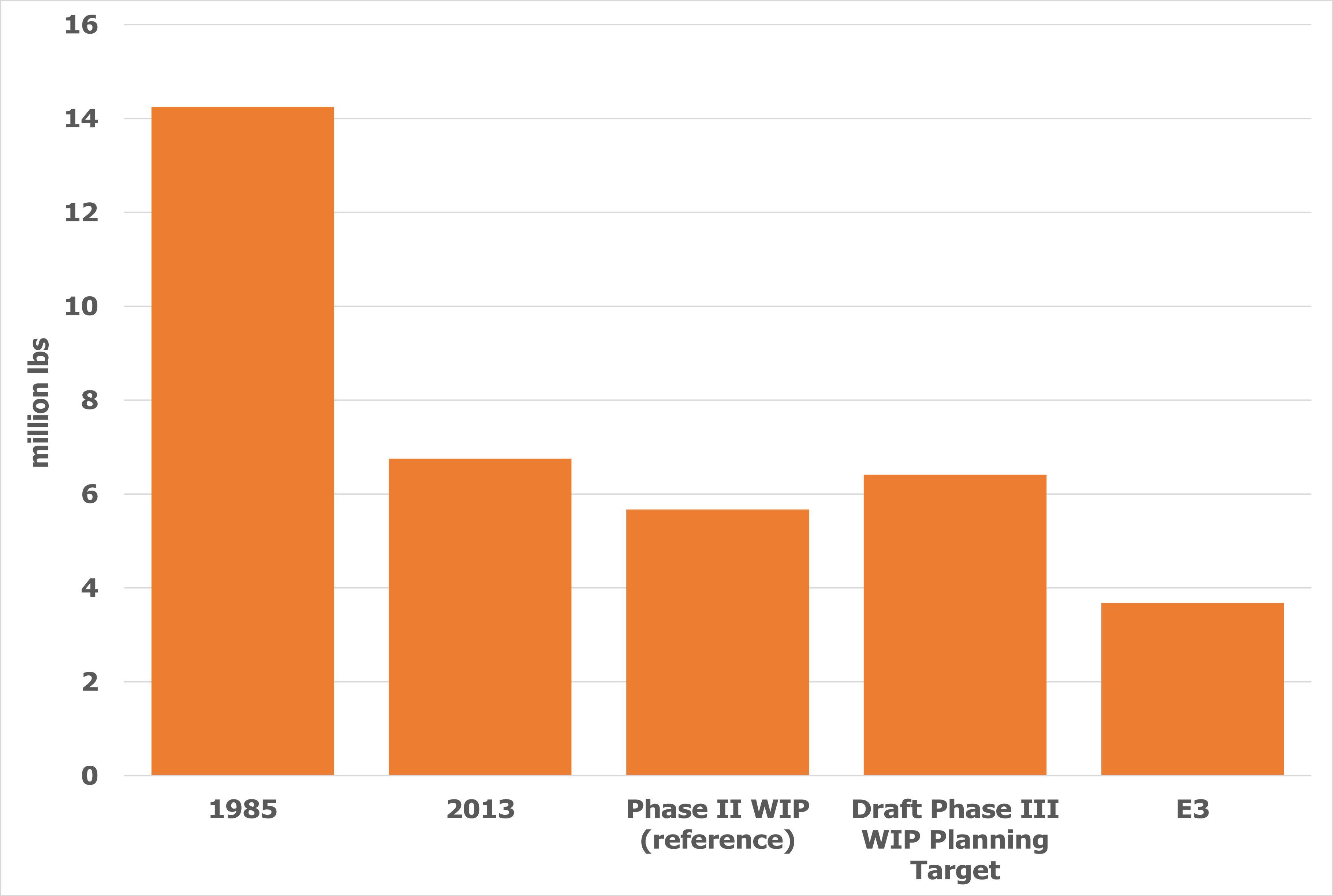
VA Phosphorus Change in LOE



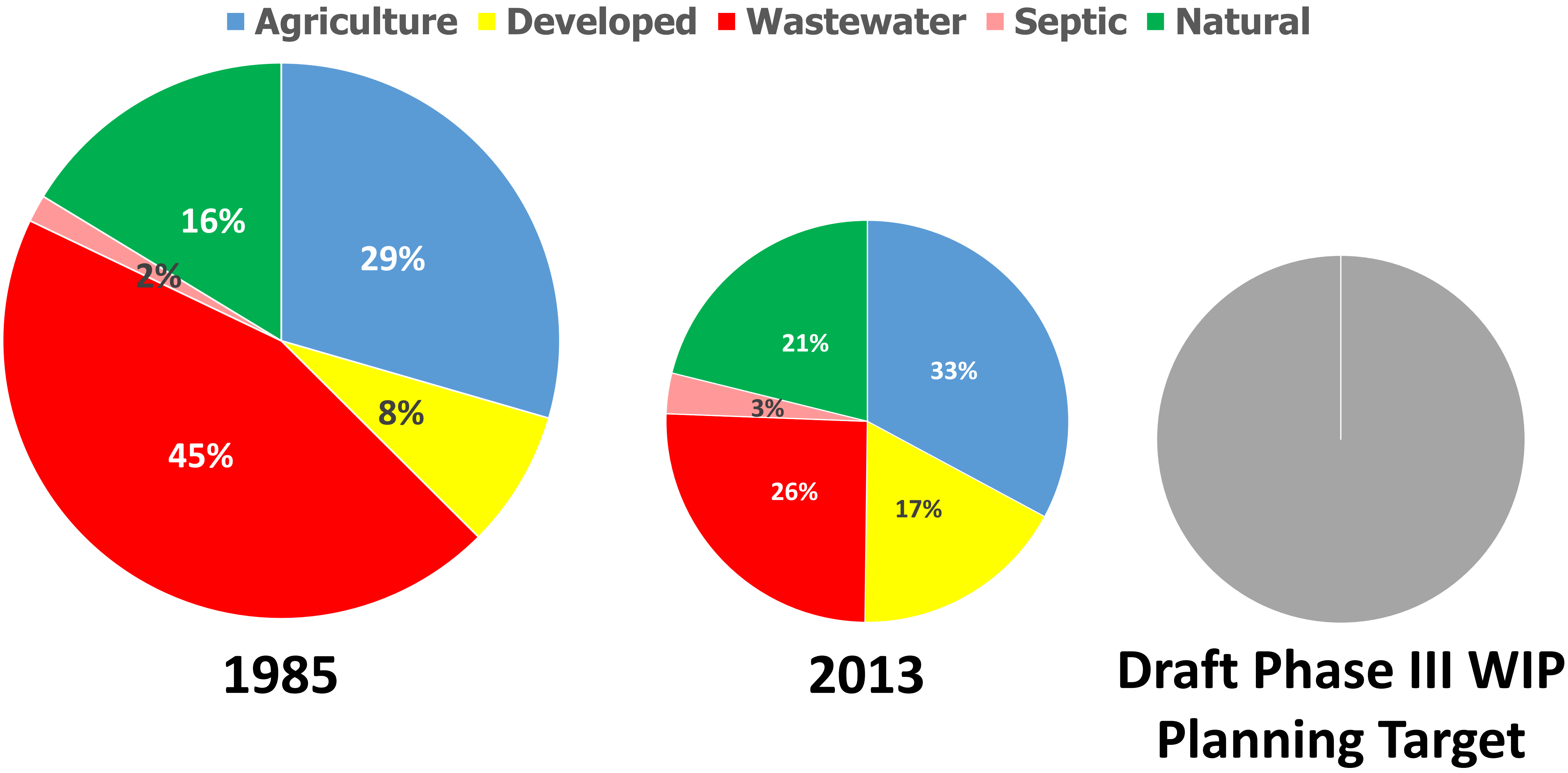
VA Nitrogen Loads, Reference Scenarios, and Target



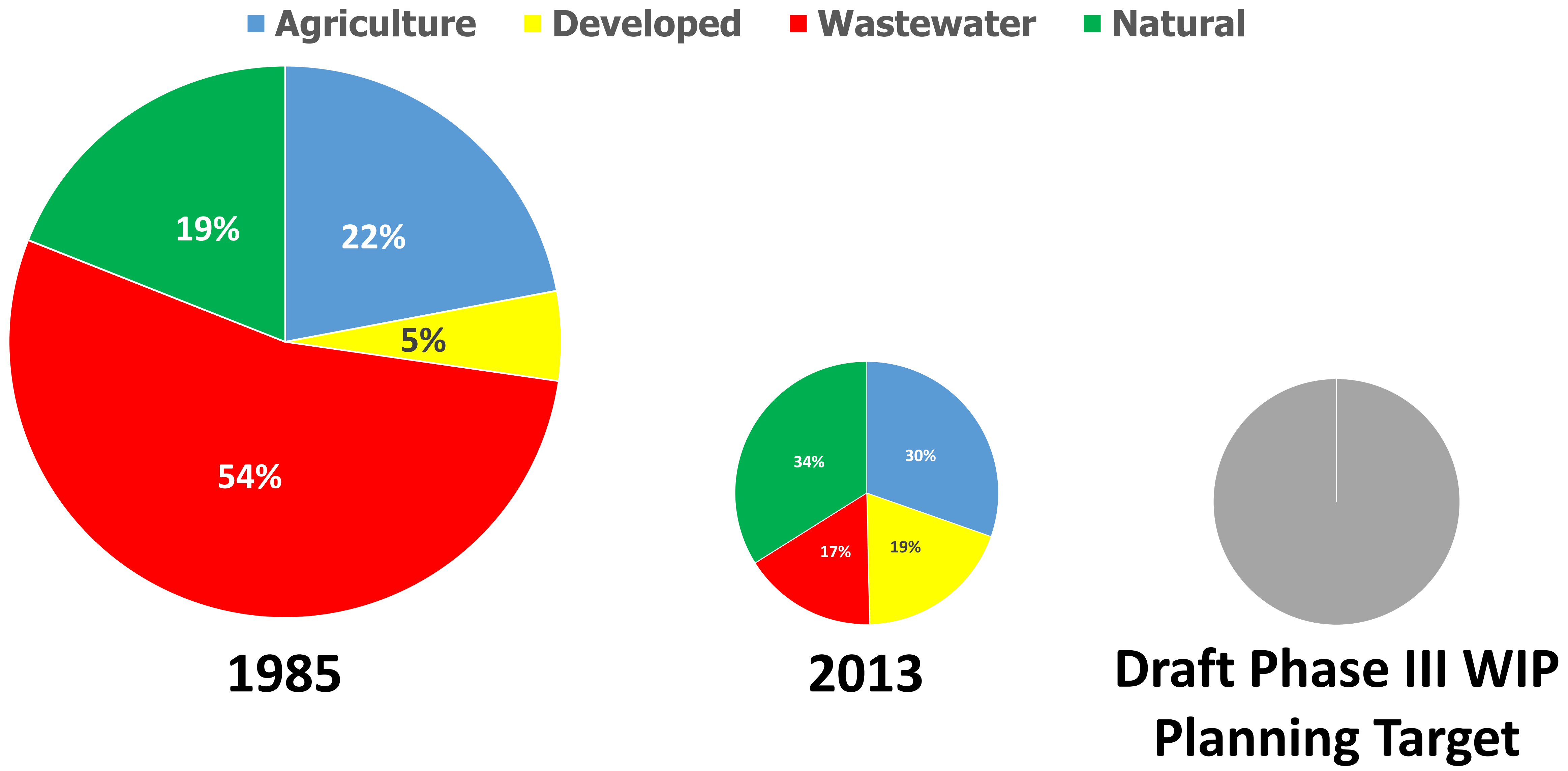
VA Phosphorus Loads, Reference Scenarios, and Target



VA Nitrogen Loads and Target

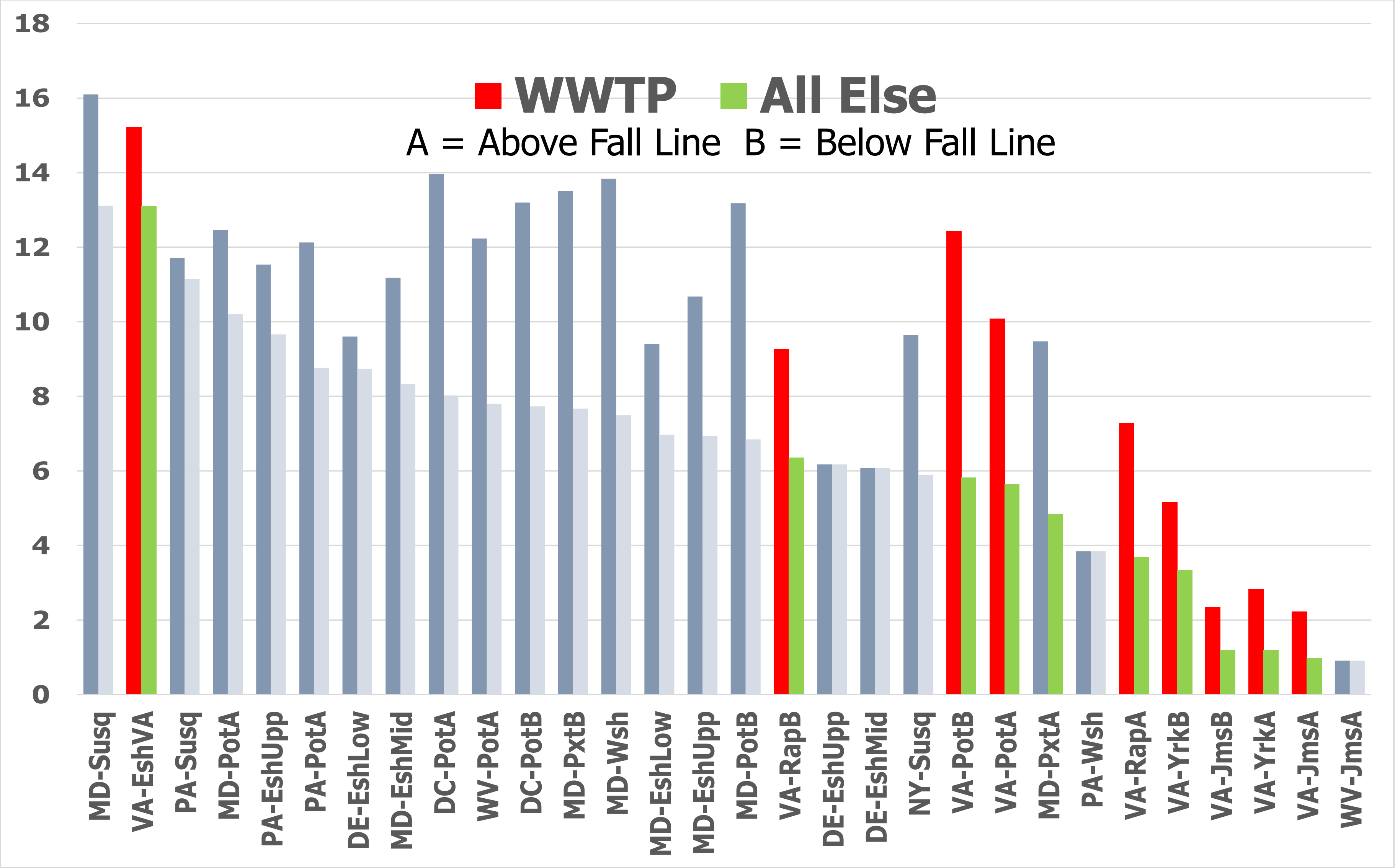


VA Phosphorus Loads and Target



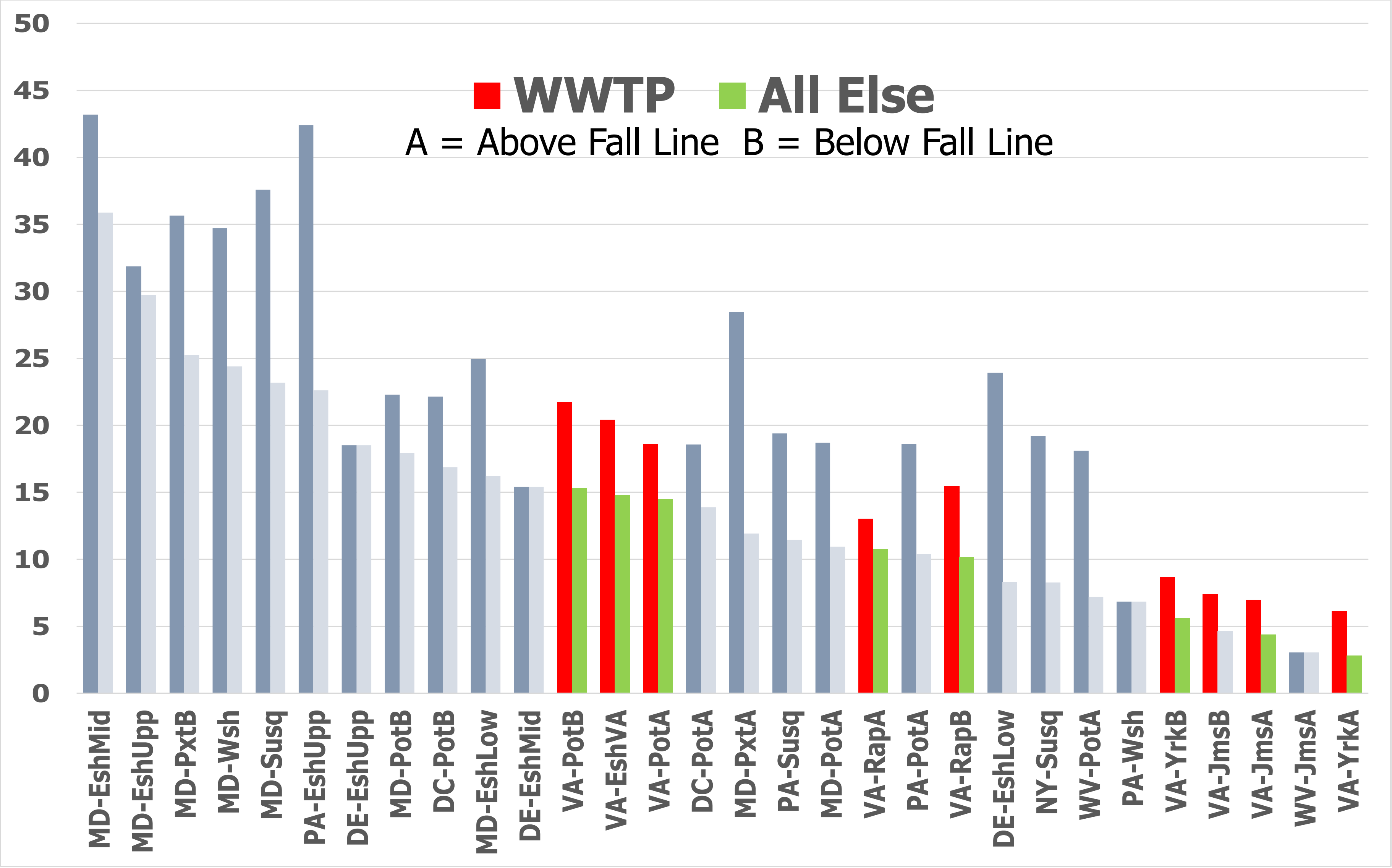
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



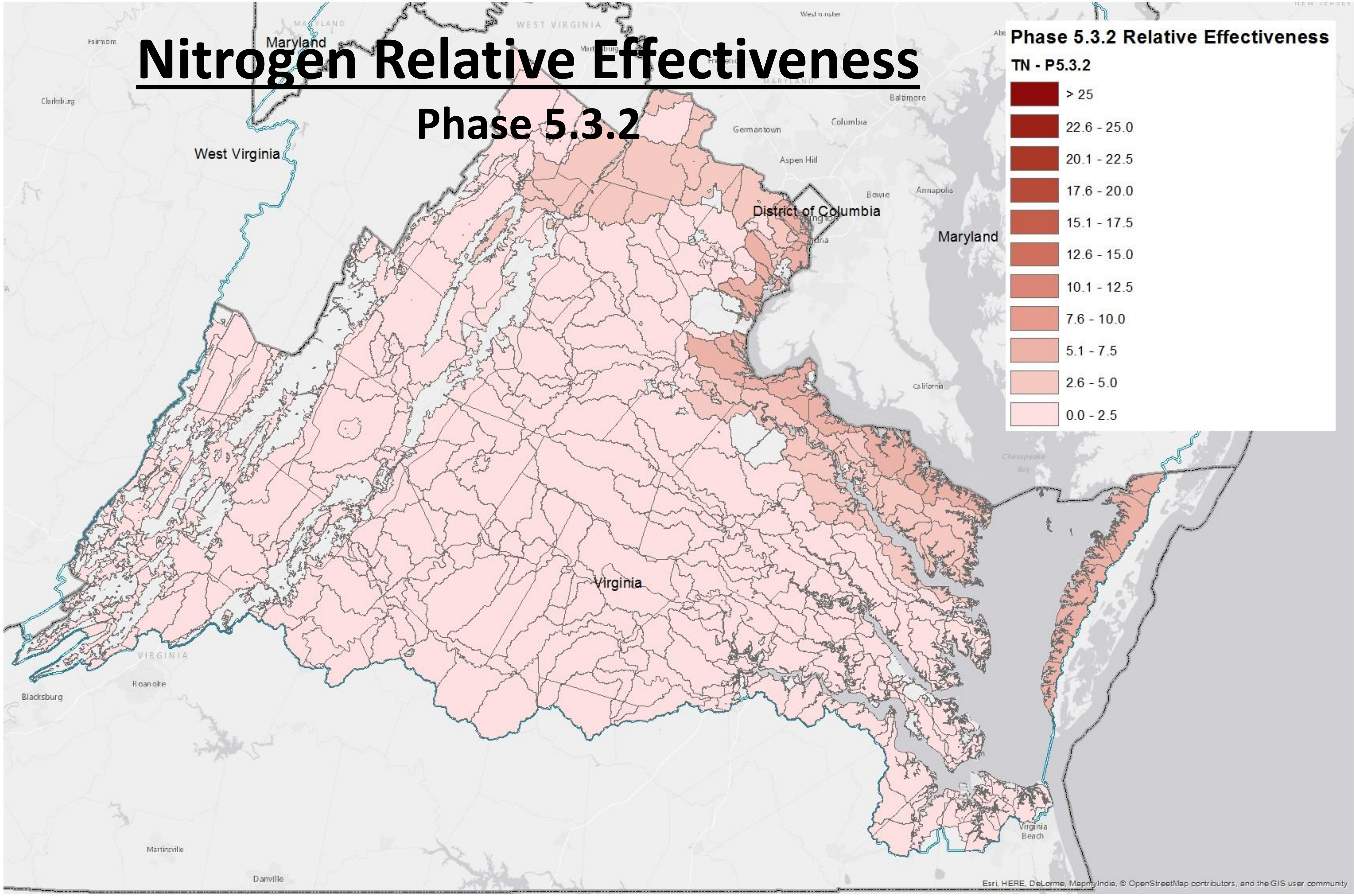
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



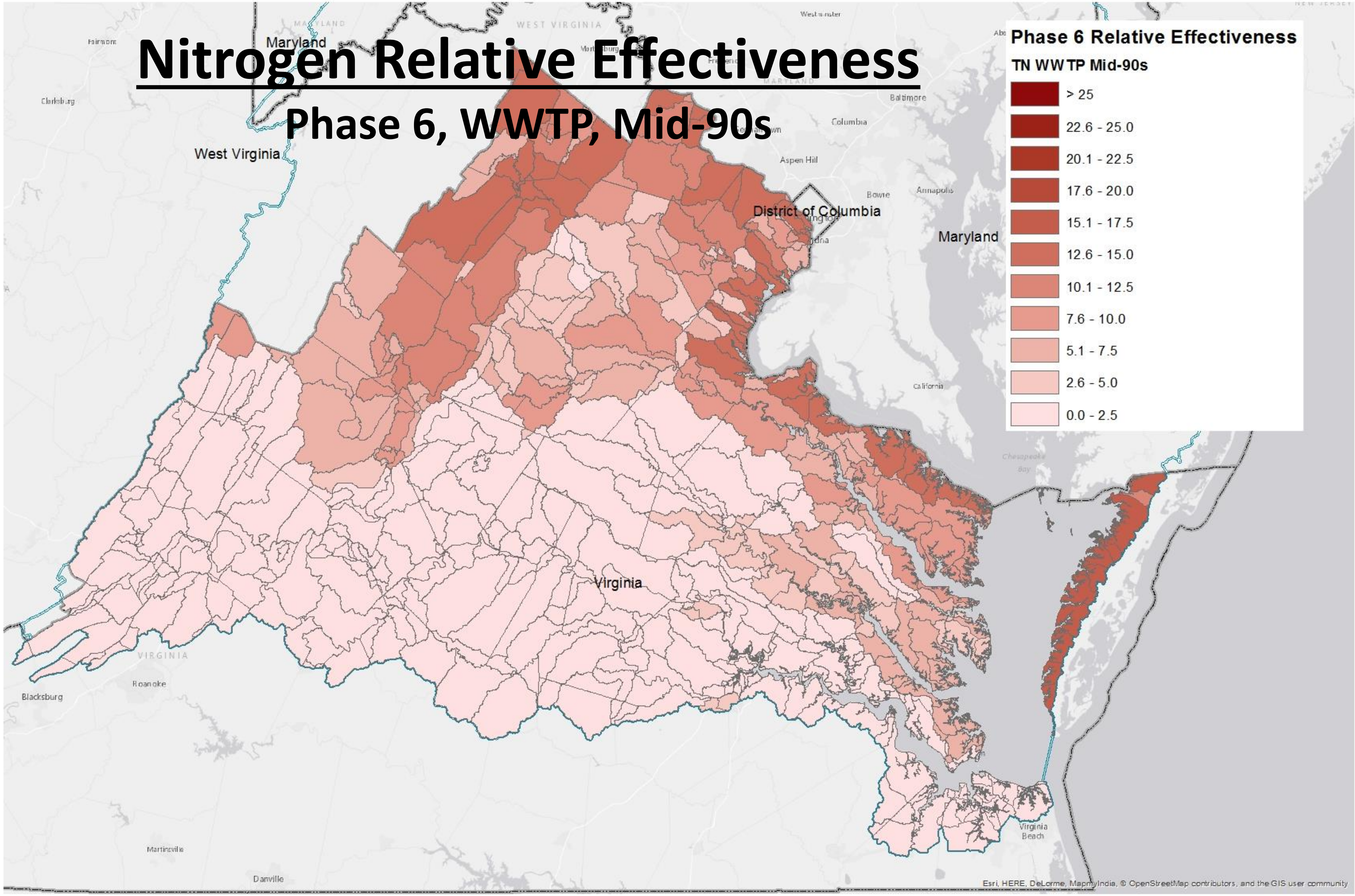
Nitrogen Relative Effectiveness

Phase 5.3.2



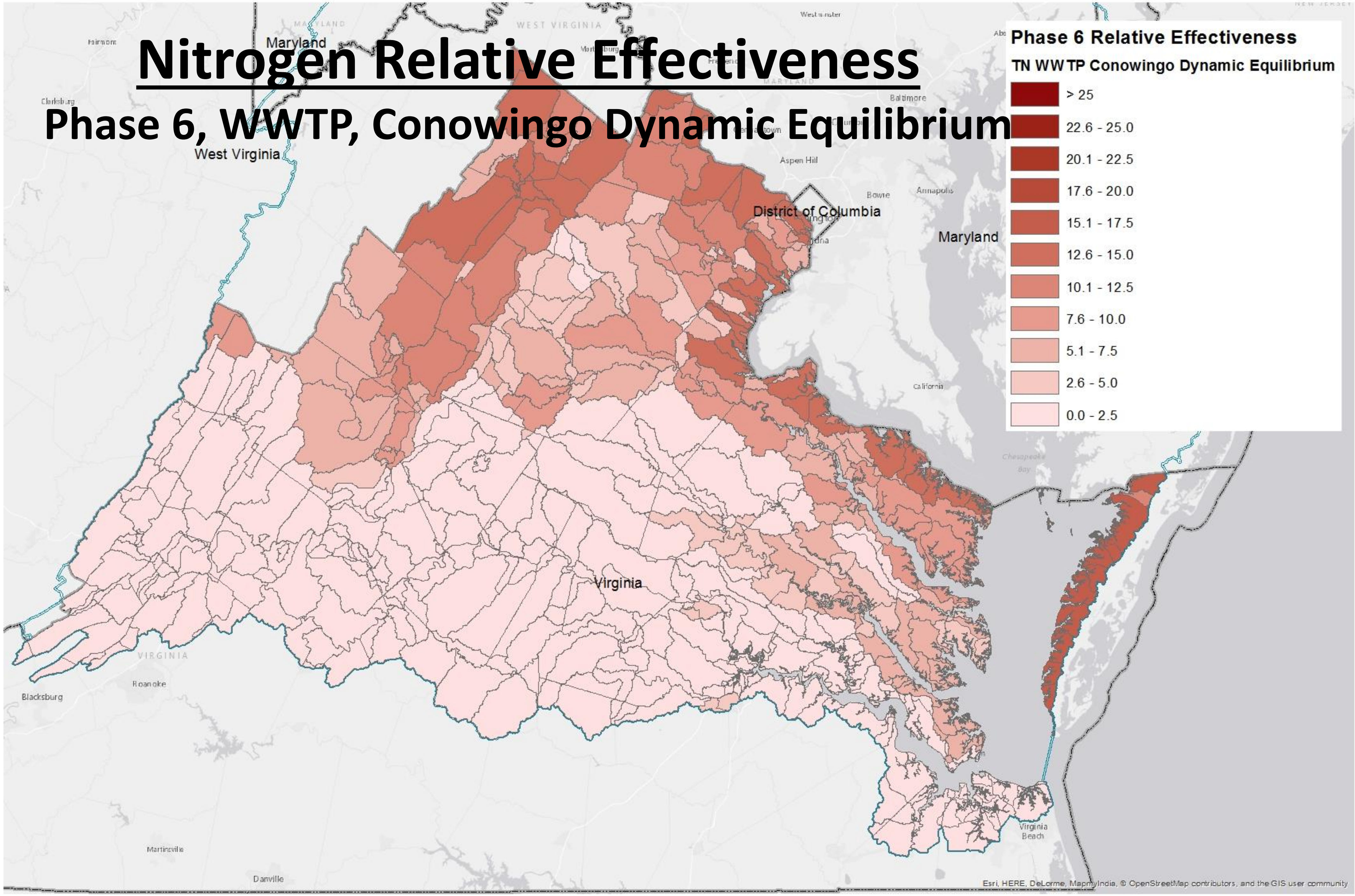
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



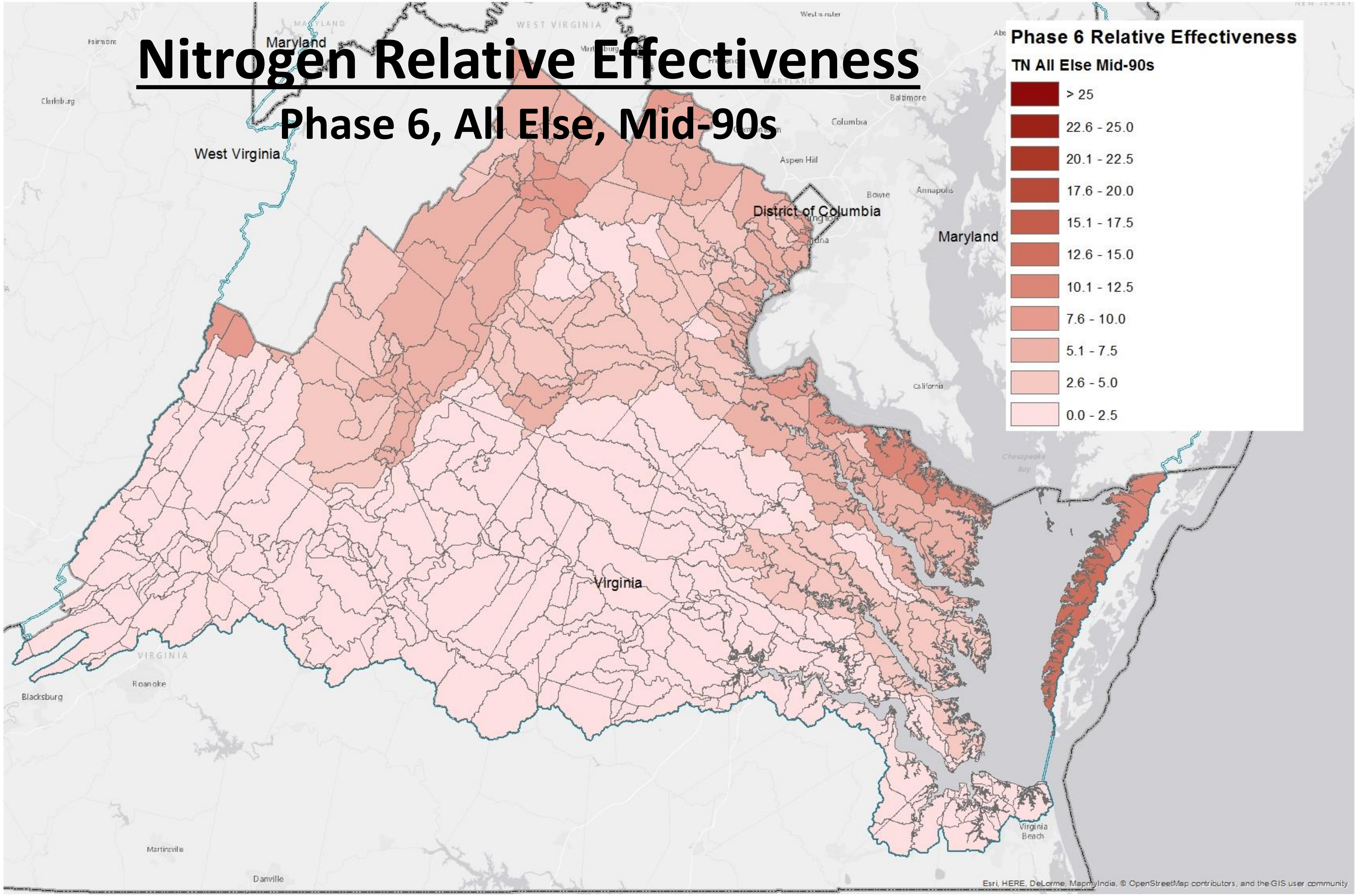
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



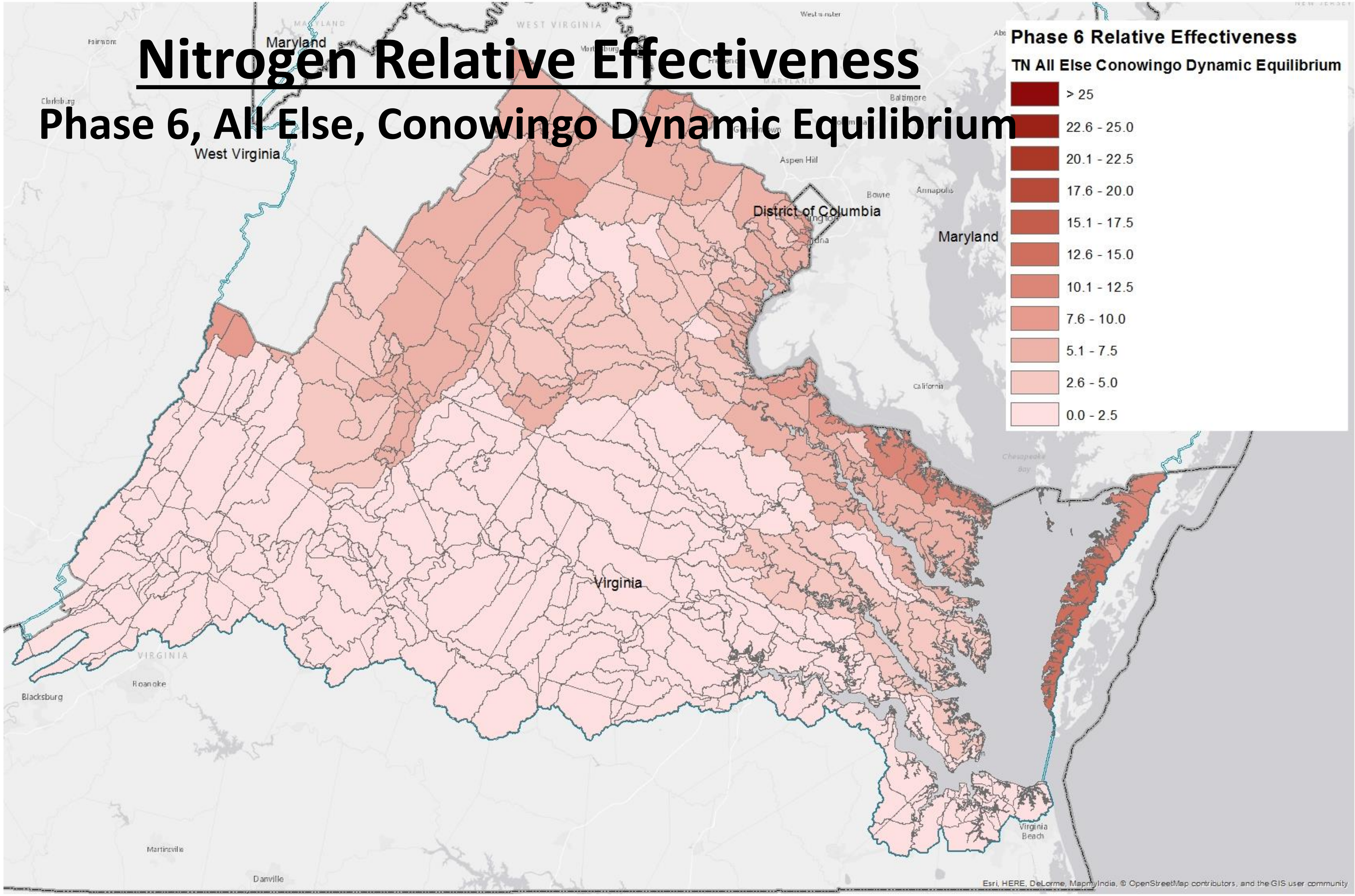
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



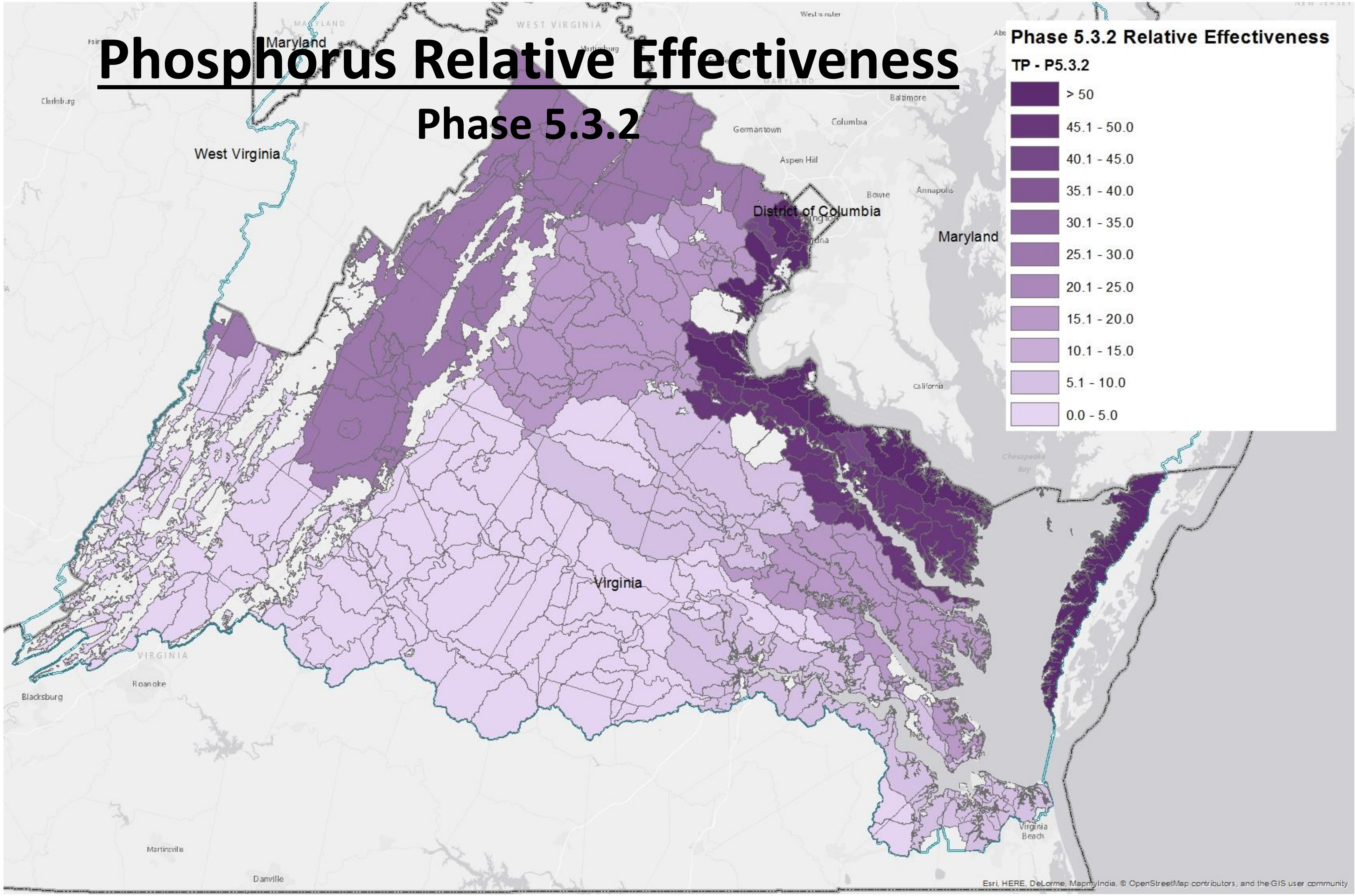
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



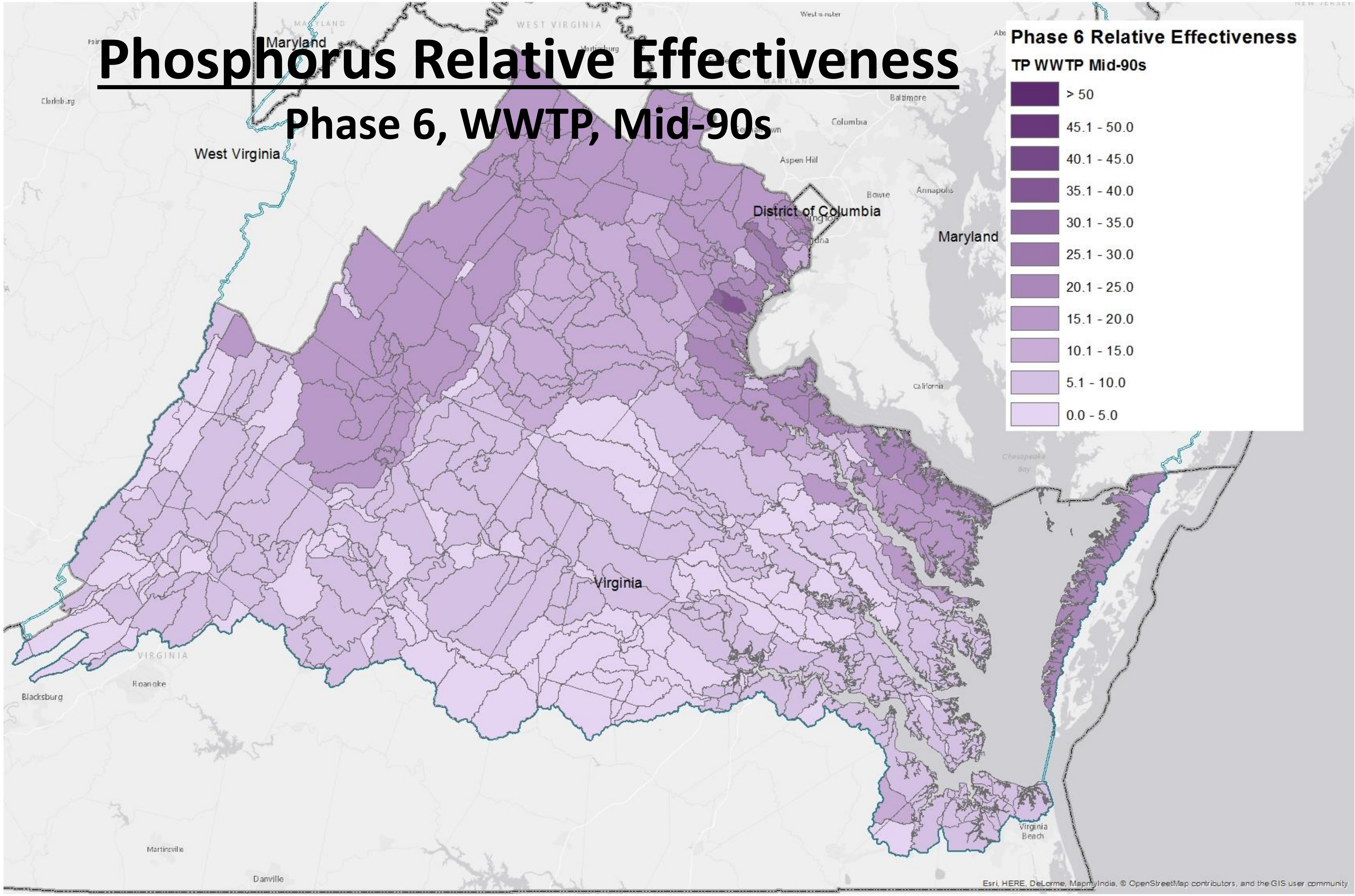
Phosphorus Relative Effectiveness

Phase 5.3.2



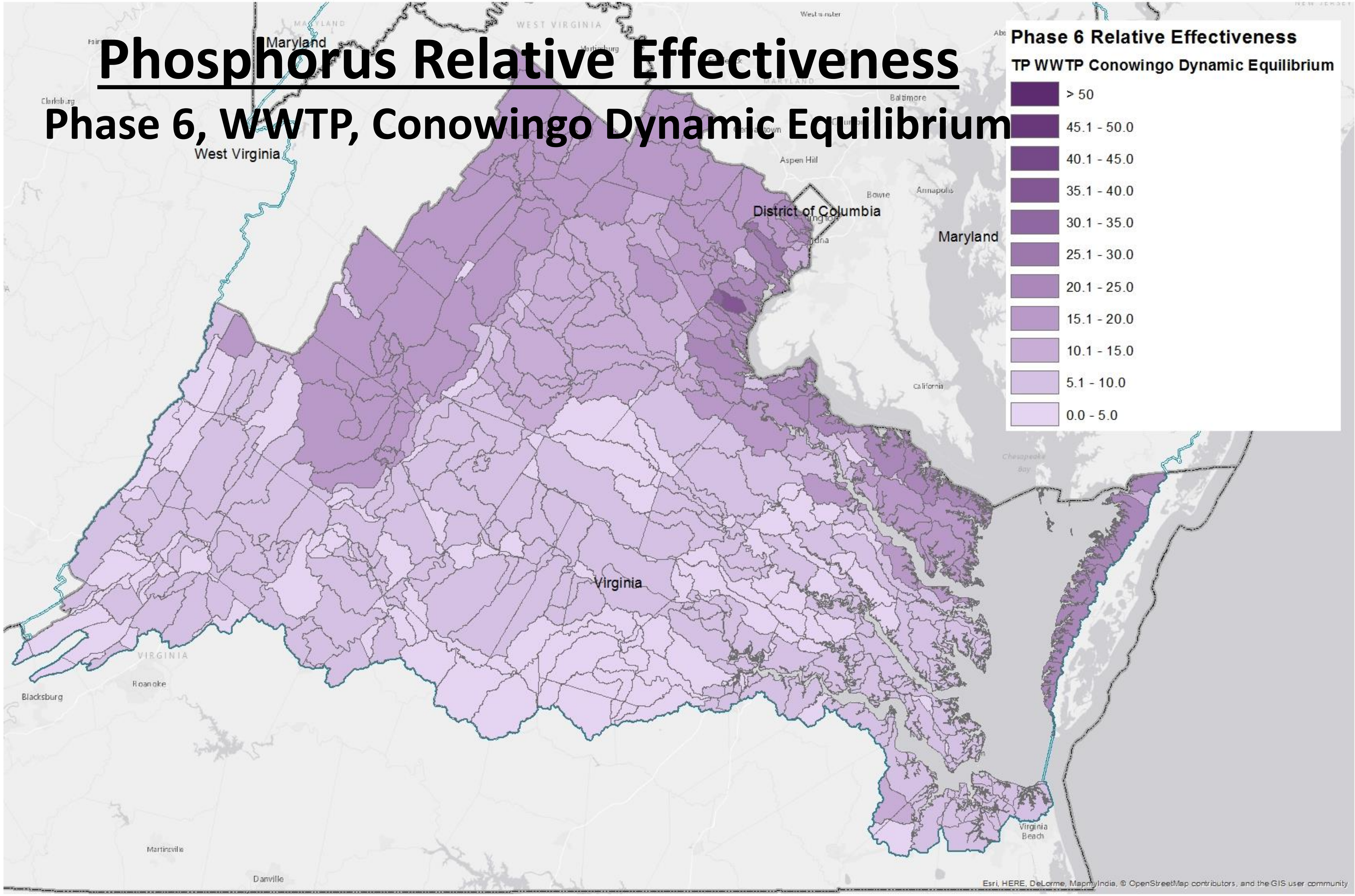
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



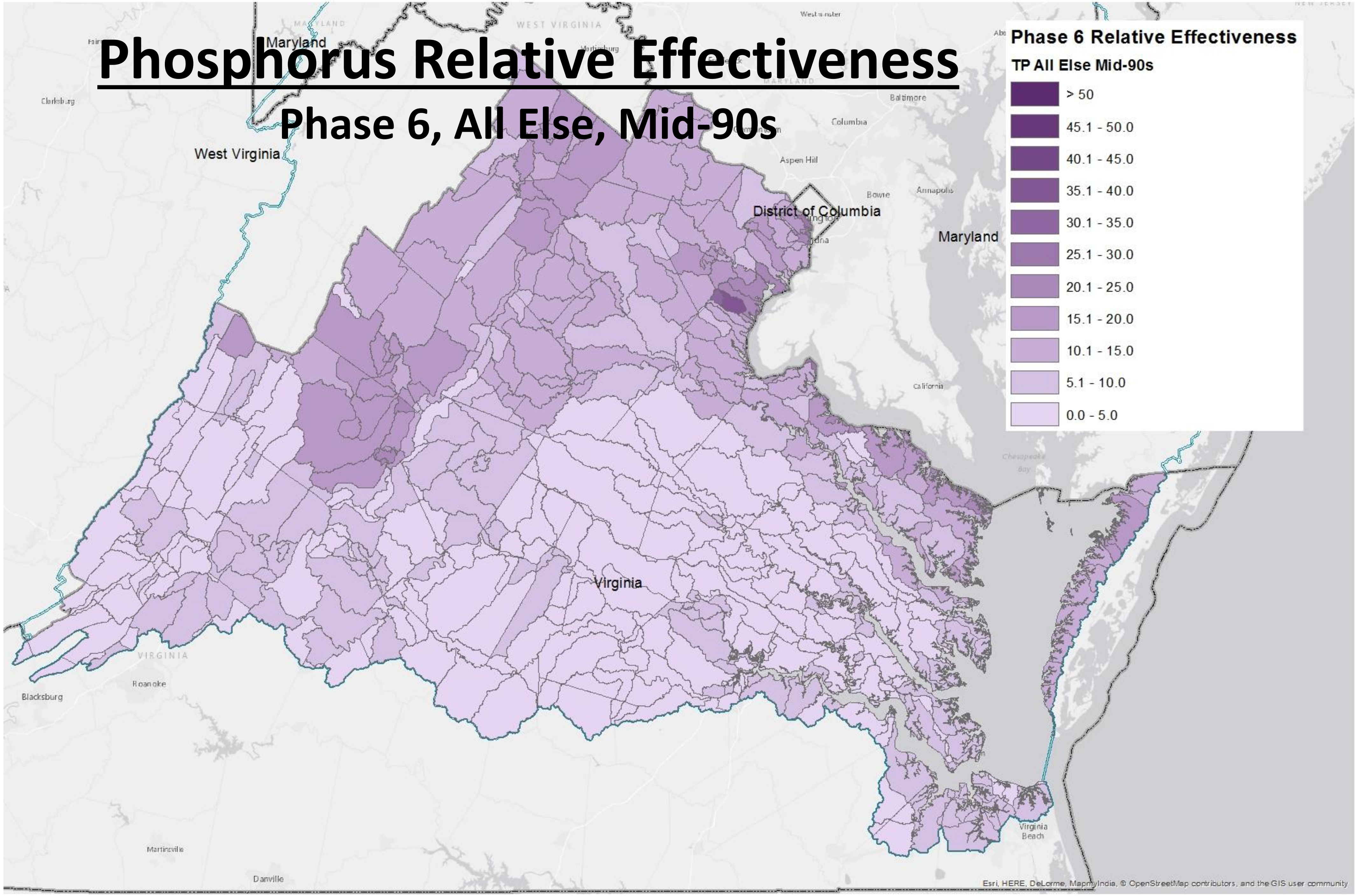
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



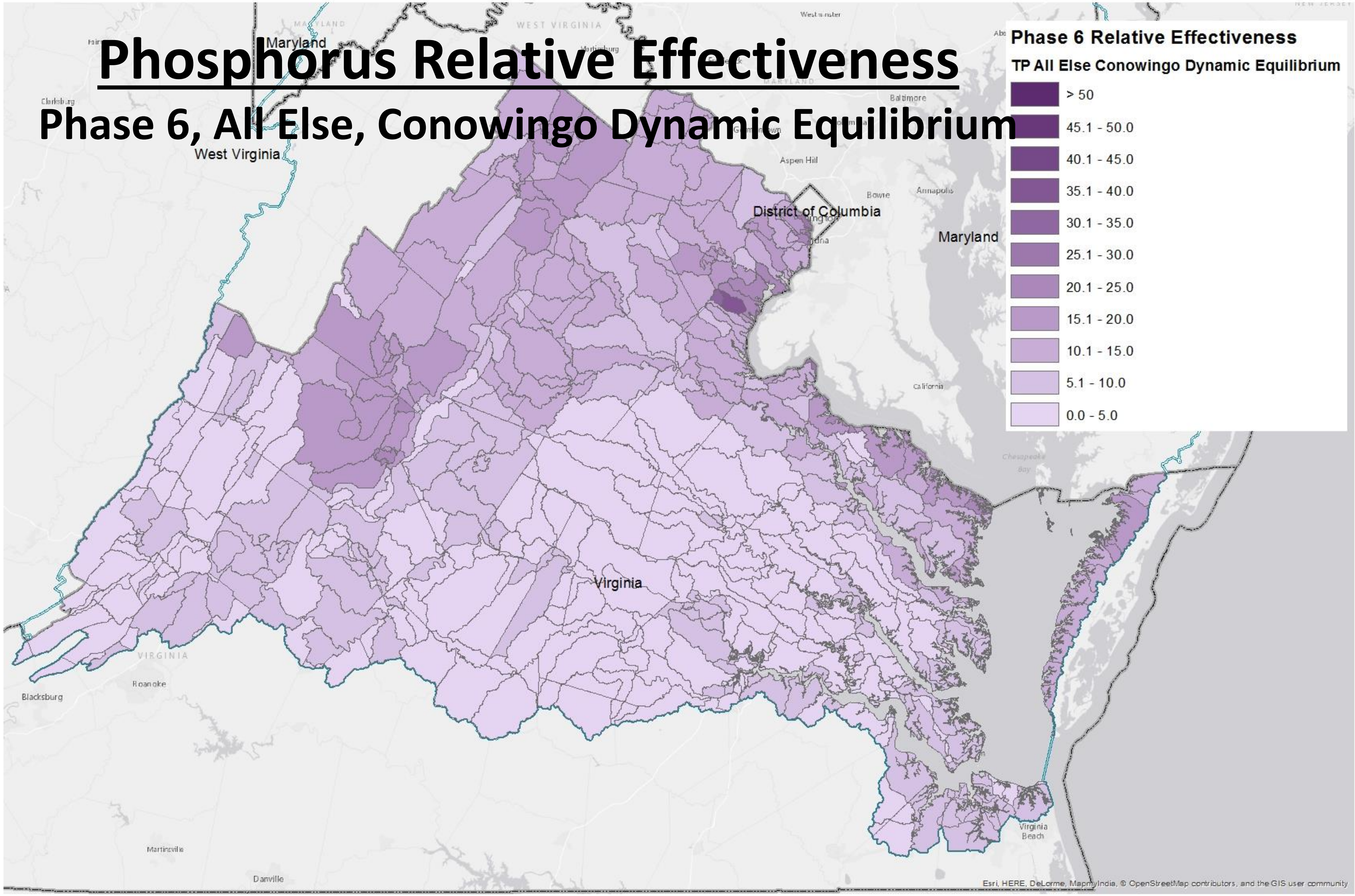
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



WV Draft Phase III WIP Planning Targets + Reference Loads

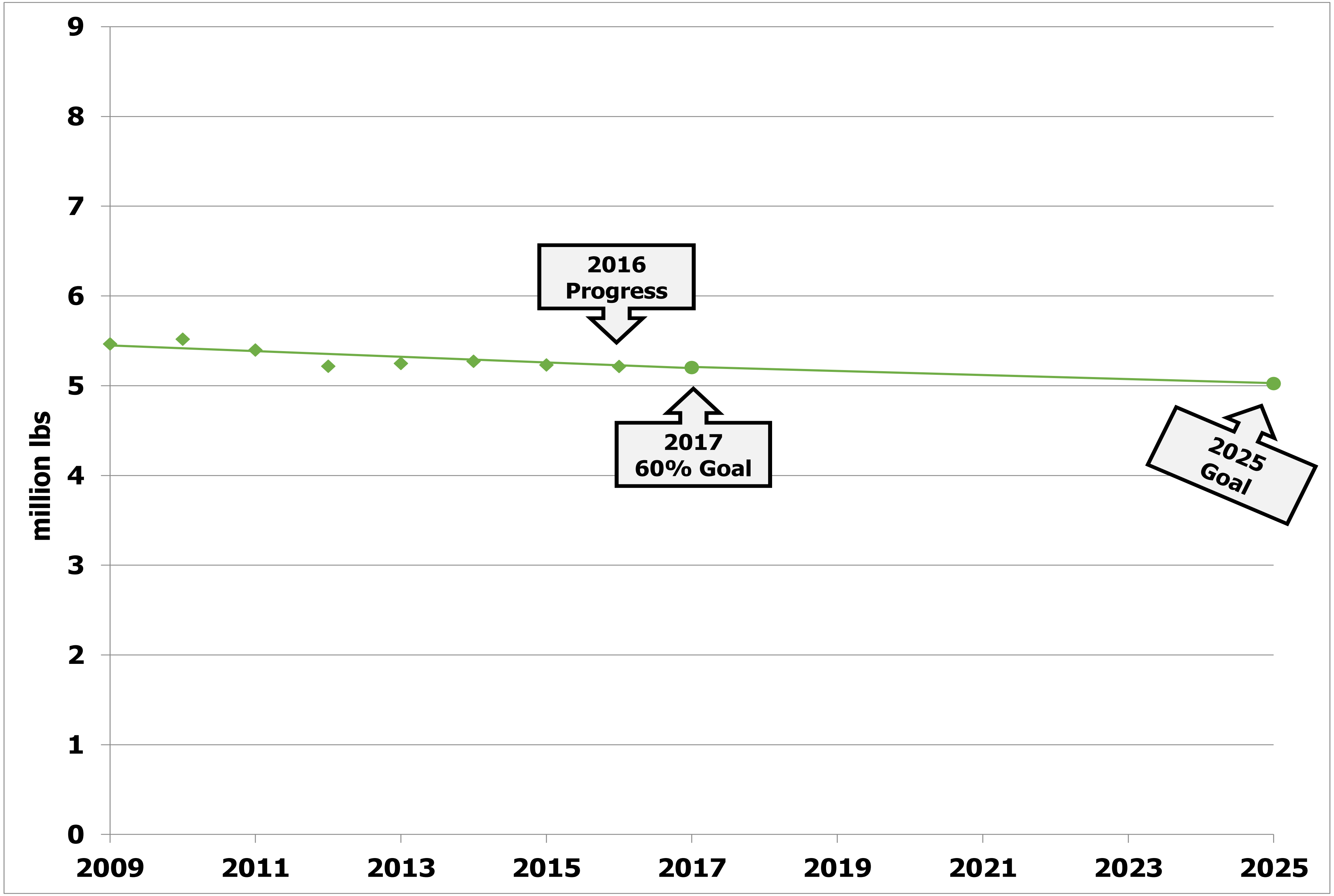
Nitrogen Load

	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
WV James	0.05	0.04	0.05	0.05	0.04
WV Potomac	9.79	4.93	8.01	7.78	6.32
WV Total	9.84	4.96	8.06	7.82	6.36

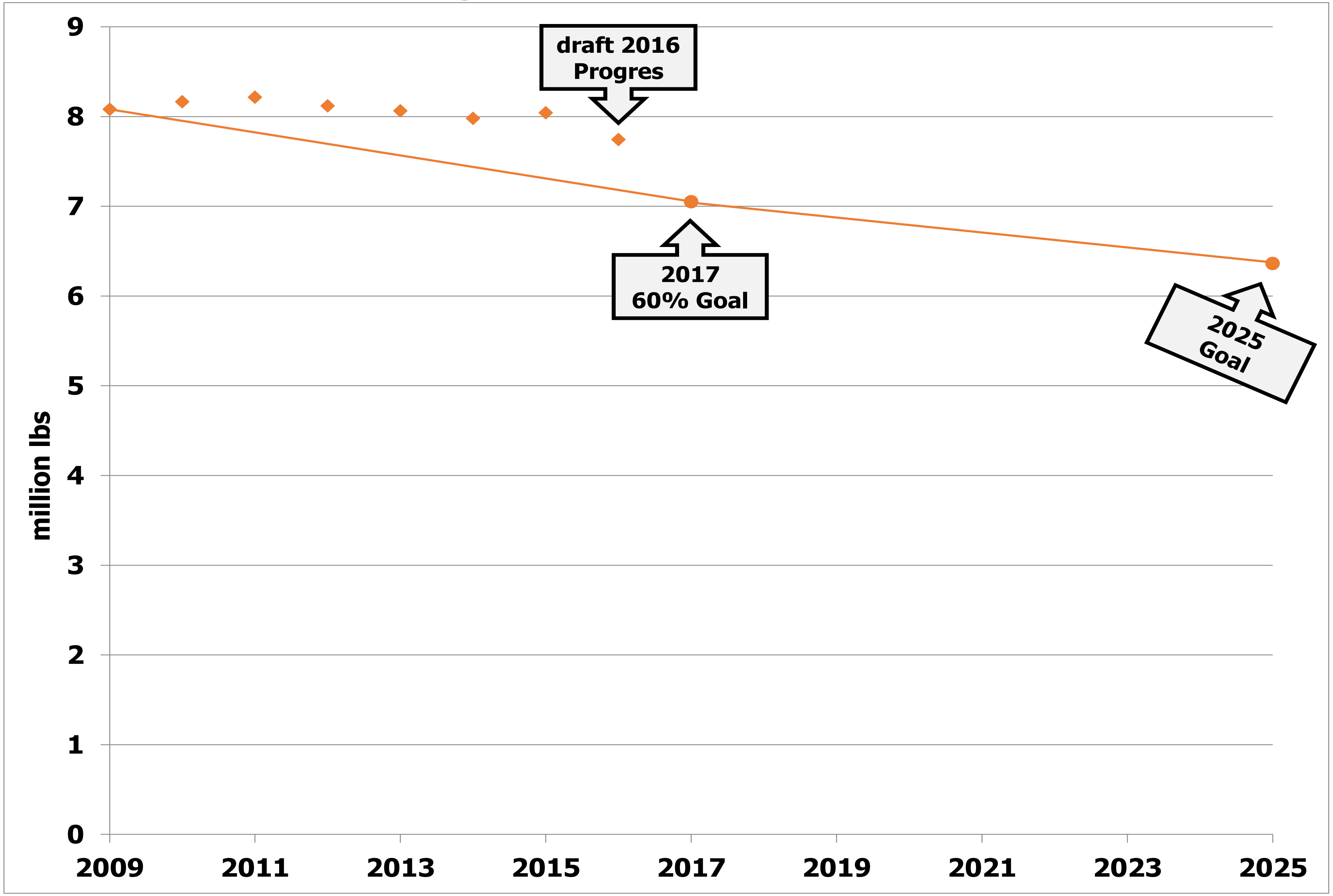
Phosphorus Load

	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
WV James	0.005	0.004	0.005	0.005	0.005
WV Potomac	0.974	0.301	0.612	0.511	0.489
WV Total	0.980	0.305	0.617	0.516	0.493

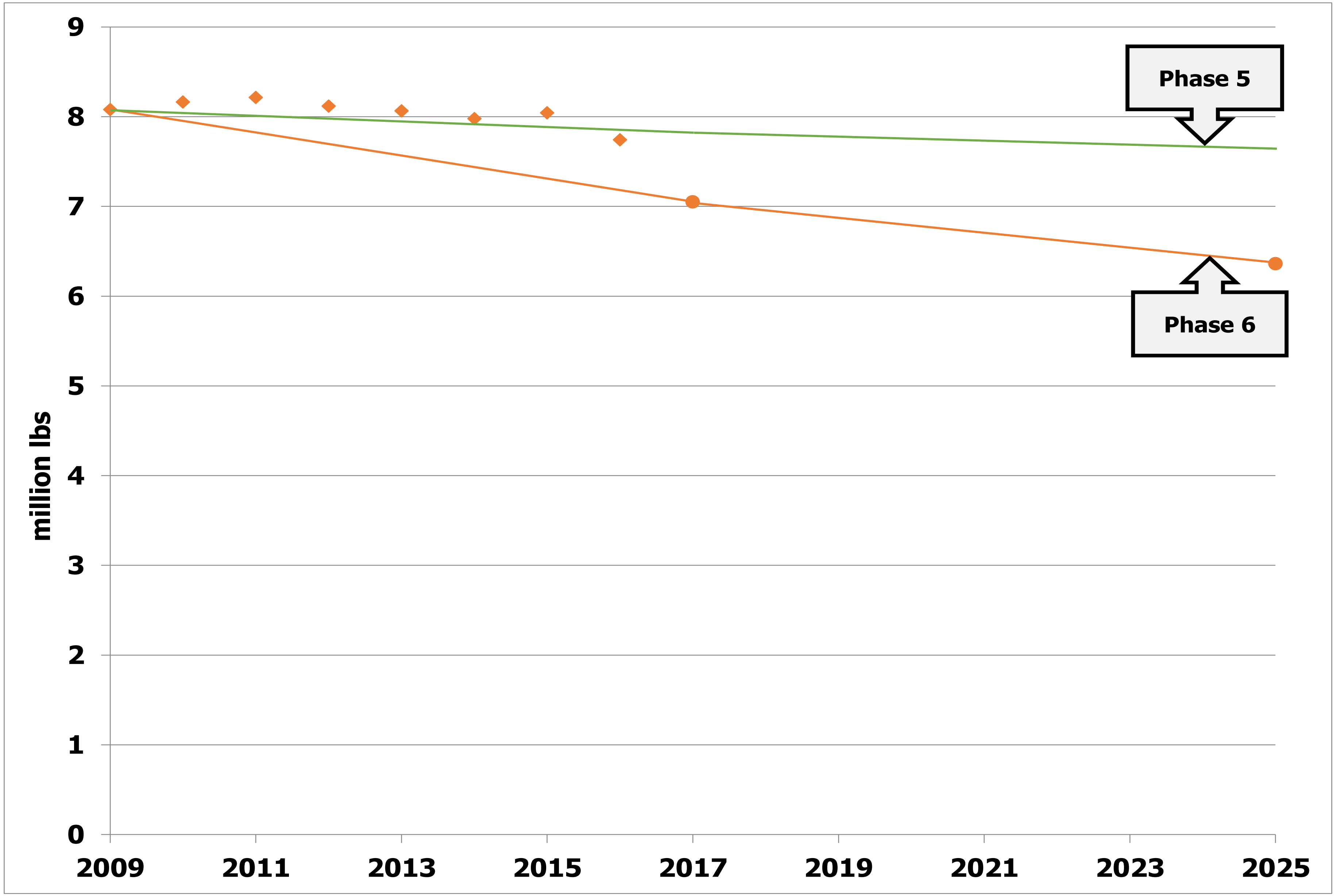
WV Nitrogen Loads-Goals, Phase 5.3.2



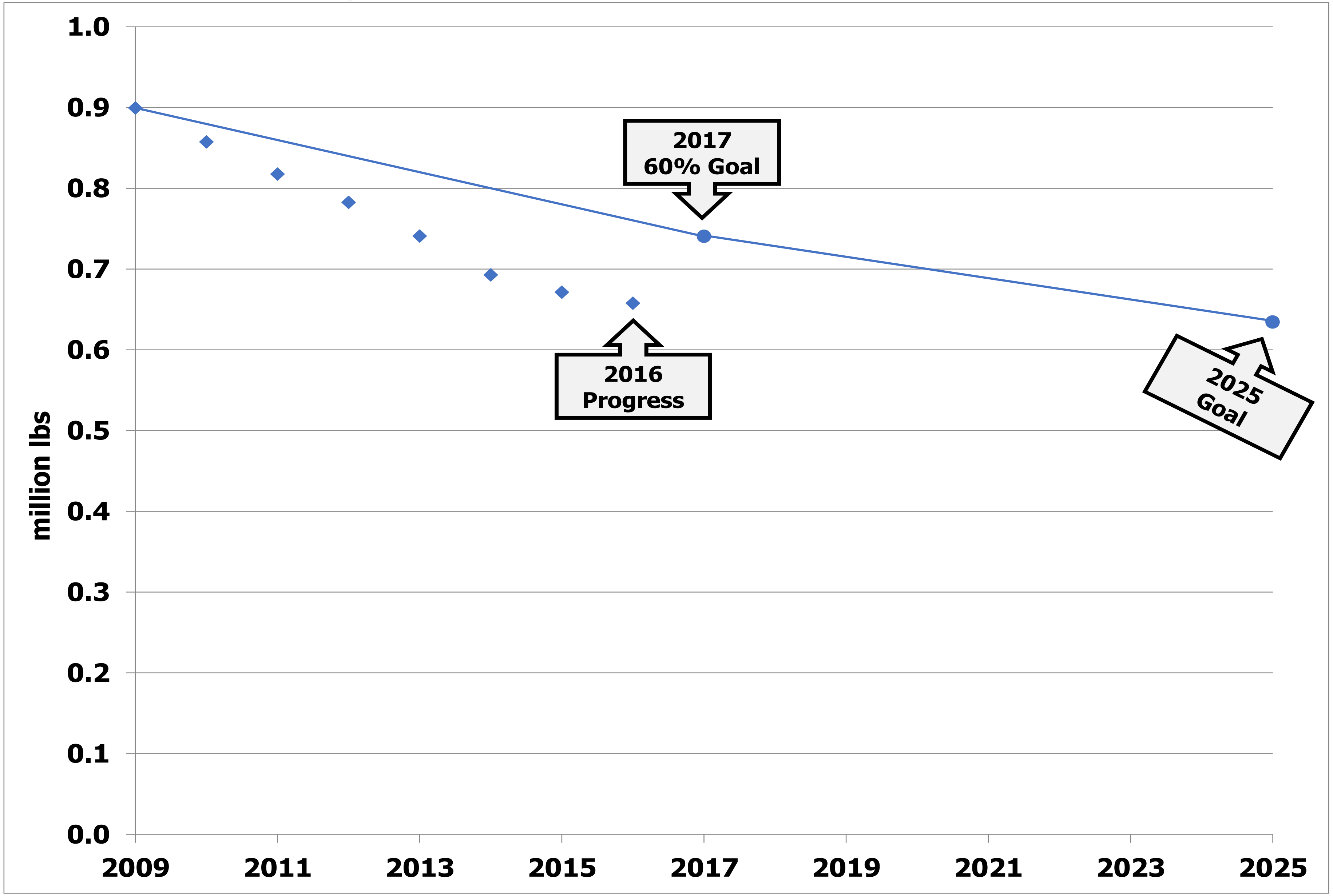
WV Nitrogen Loads-Goals, Phase 6



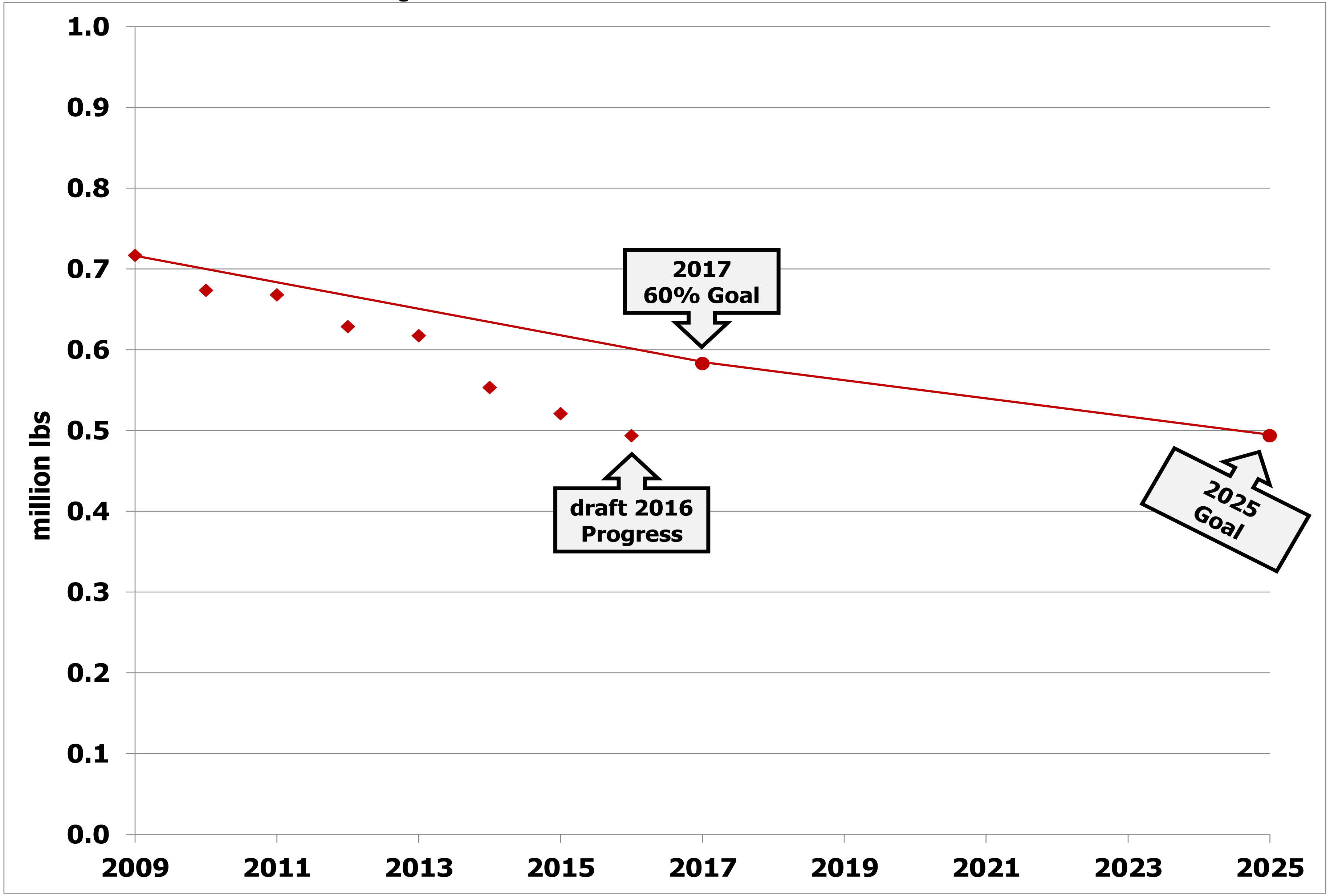
WV Nitrogen Change in LOE



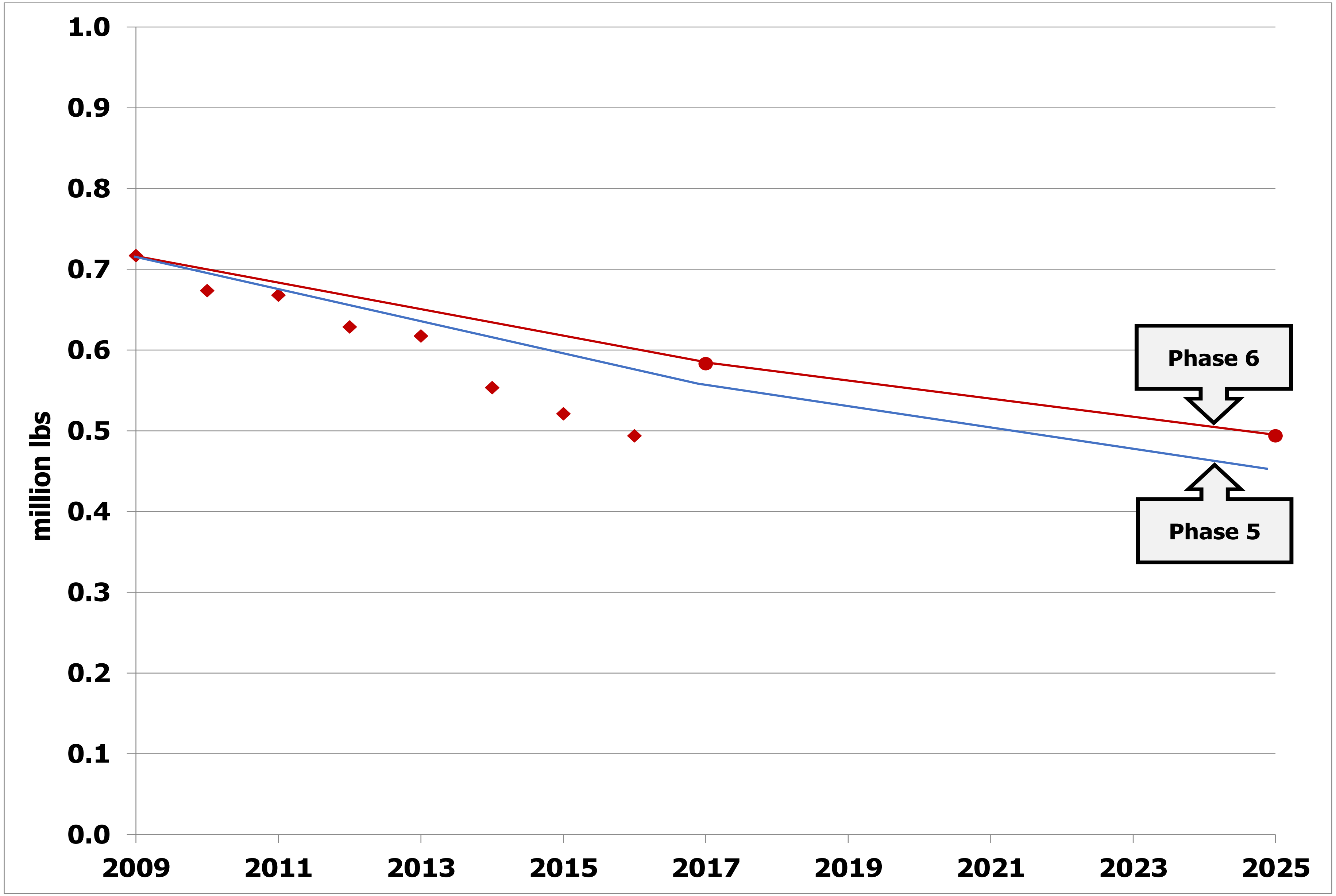
WV Phosphorus Loads-Goals, Phase 5.3.2



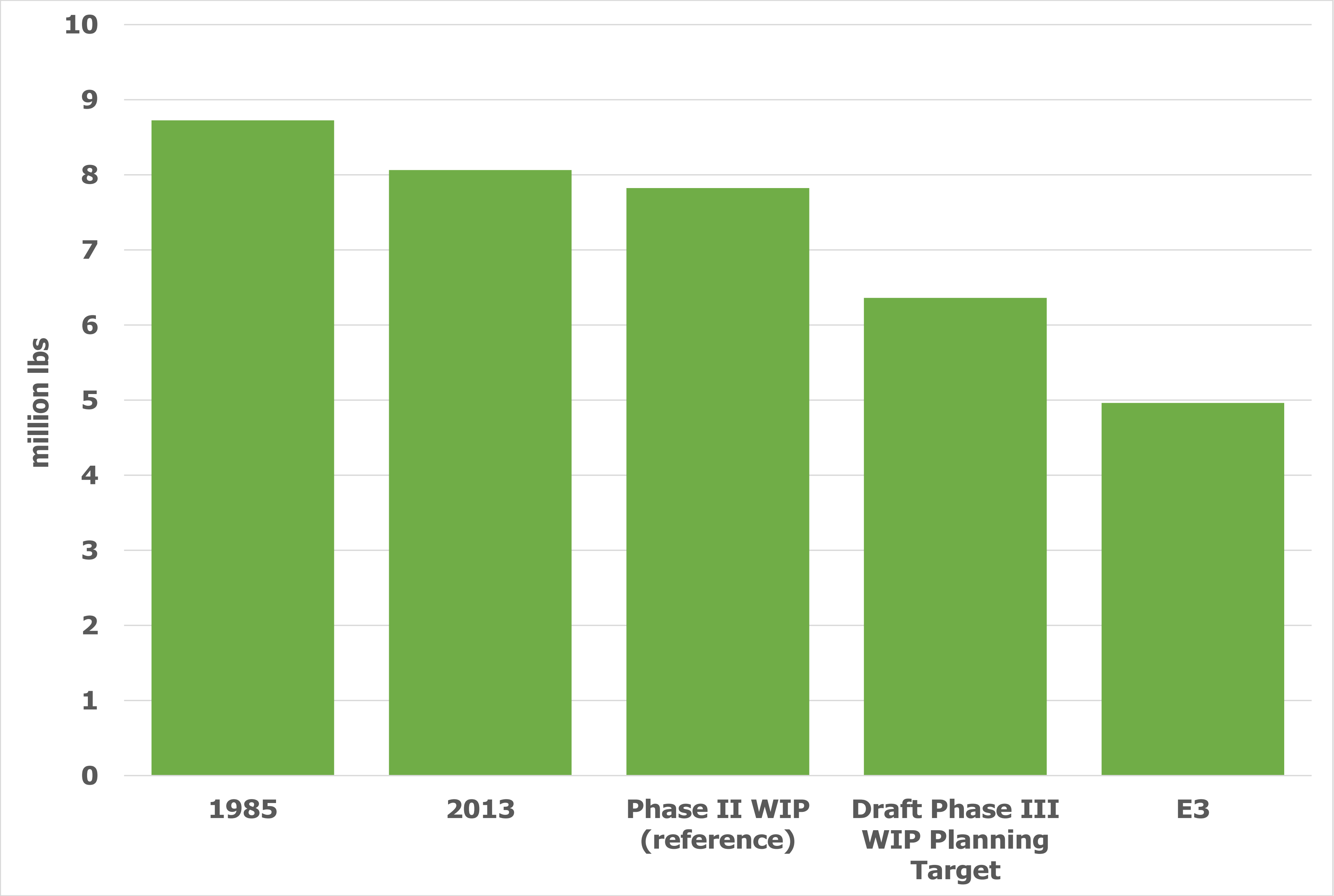
WV Phosphorus Loads-Goals, Phase 6



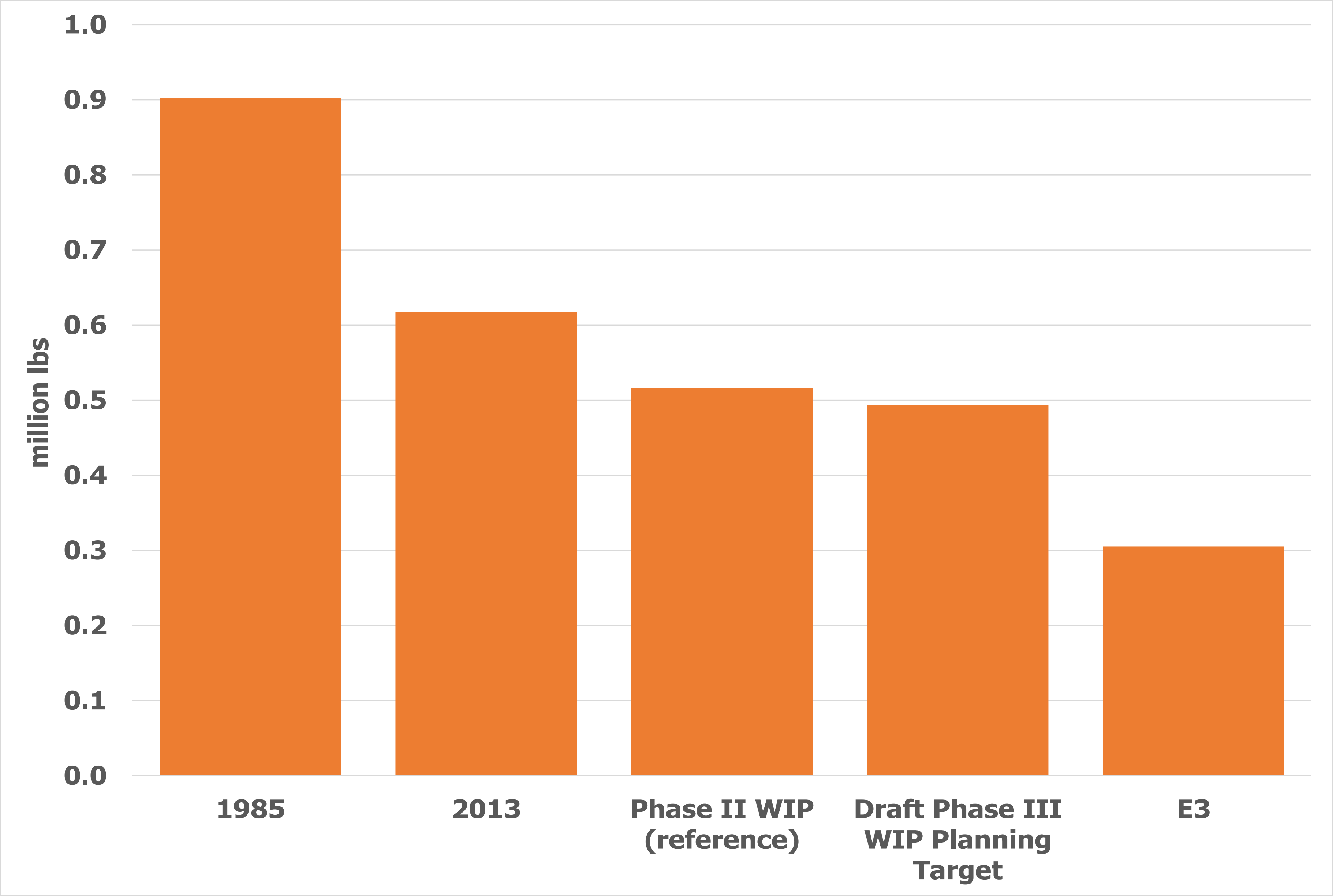
WV Phosphorus Change in LOE



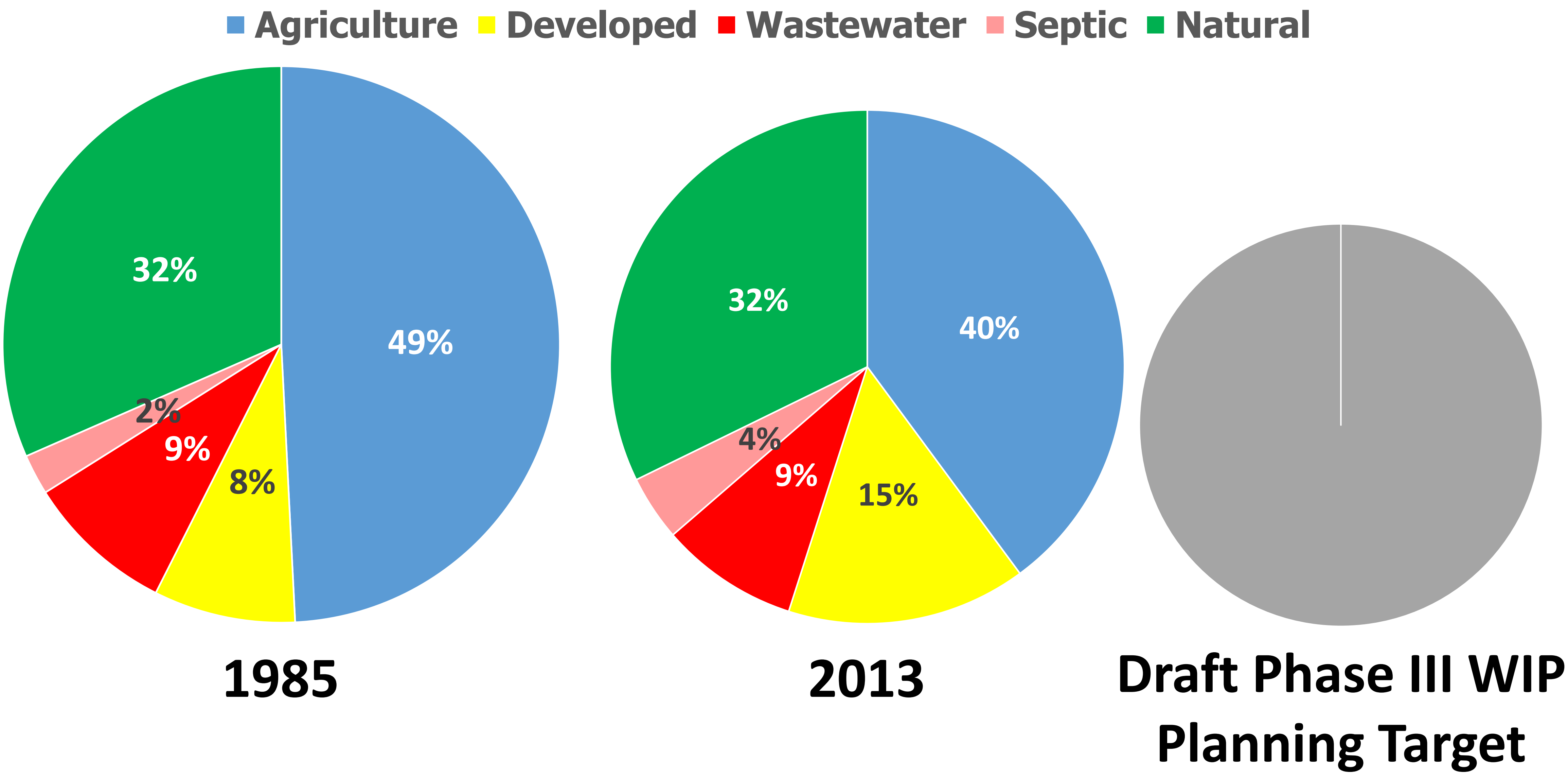
WV Nitrogen Loads, Reference Scenarios, and Target



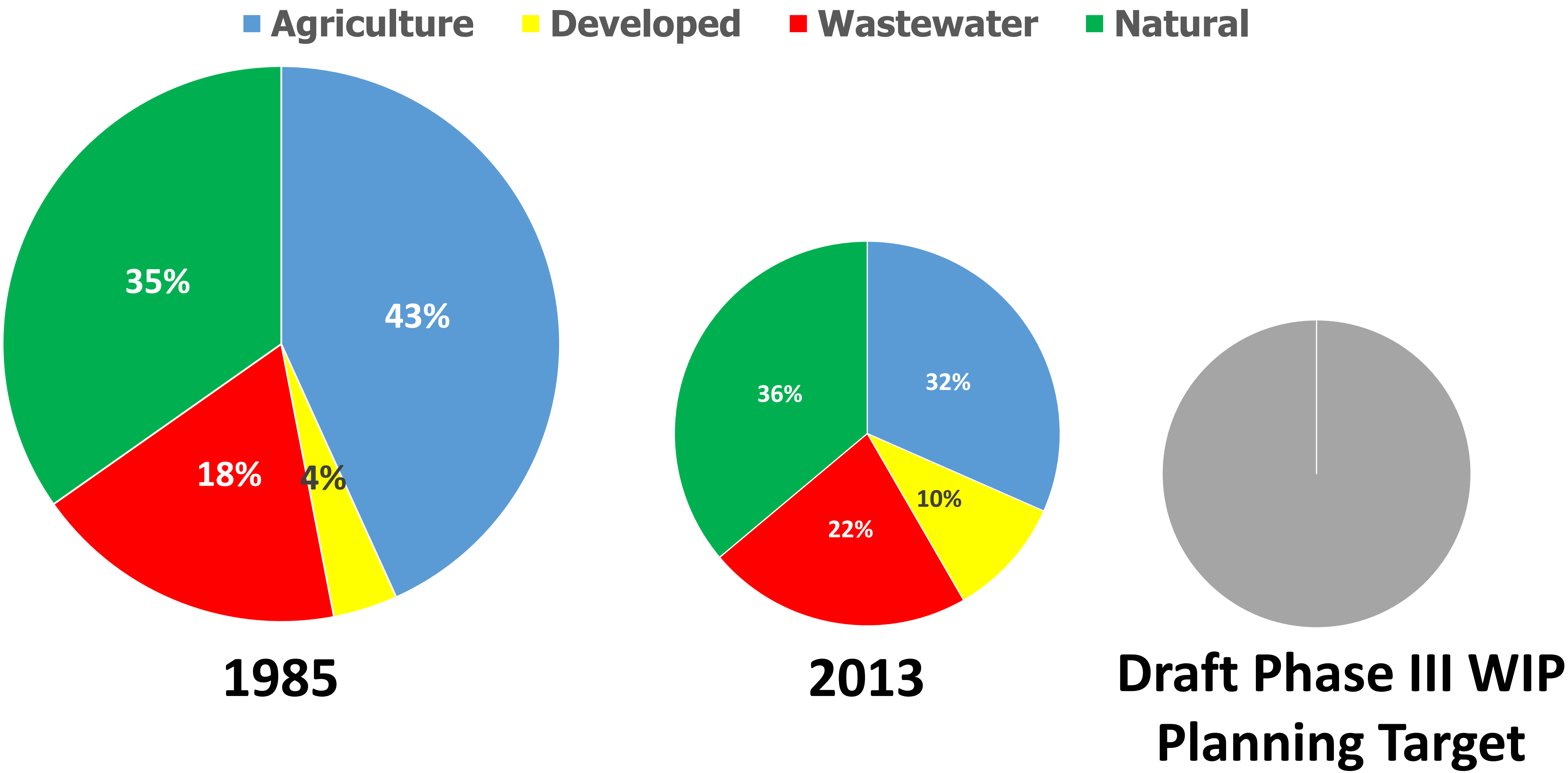
WV Phosphorus Loads, Reference Scenarios, and Target



WV Nitrogen Loads and Target

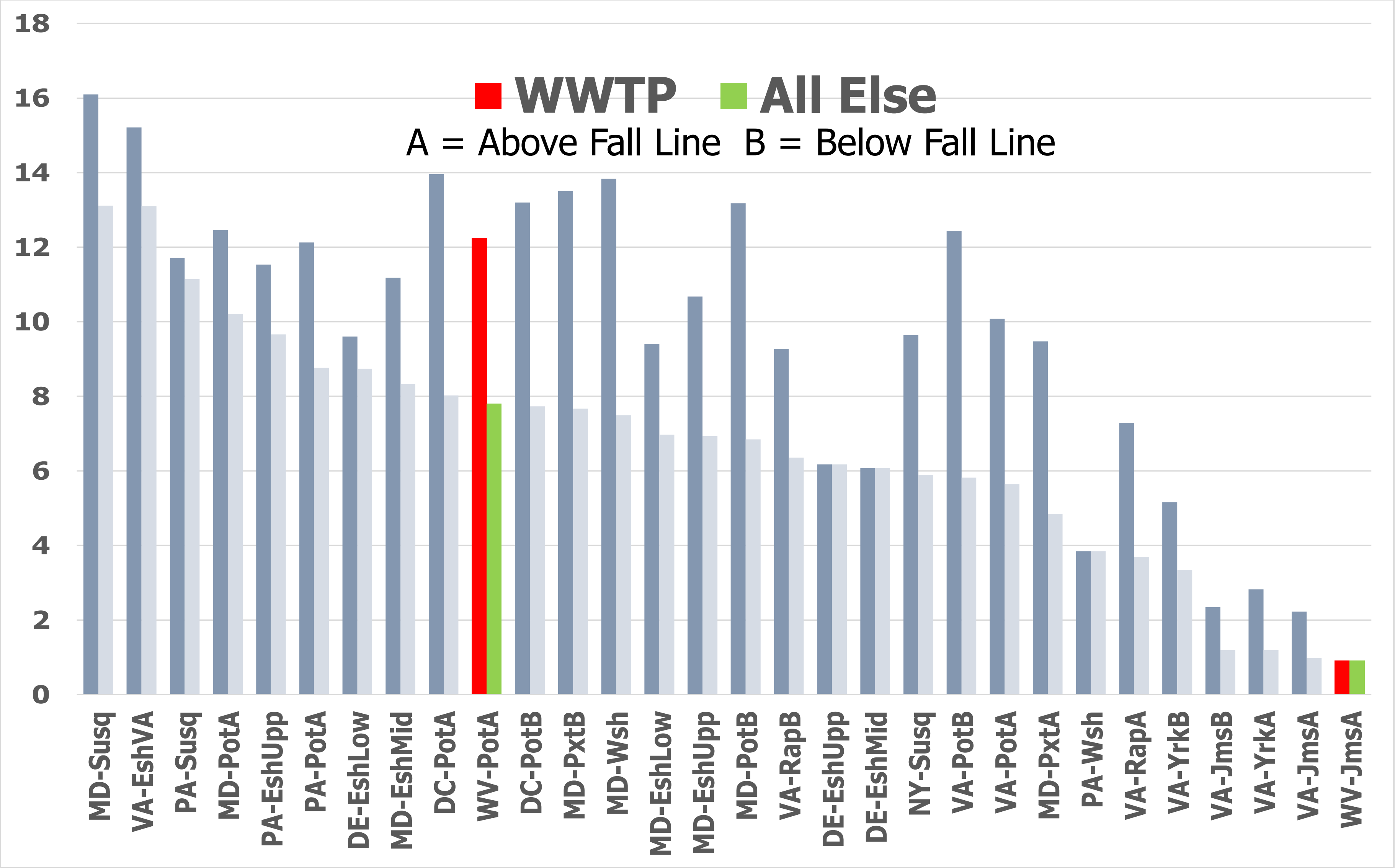


WV Phosphorus Loads and Target



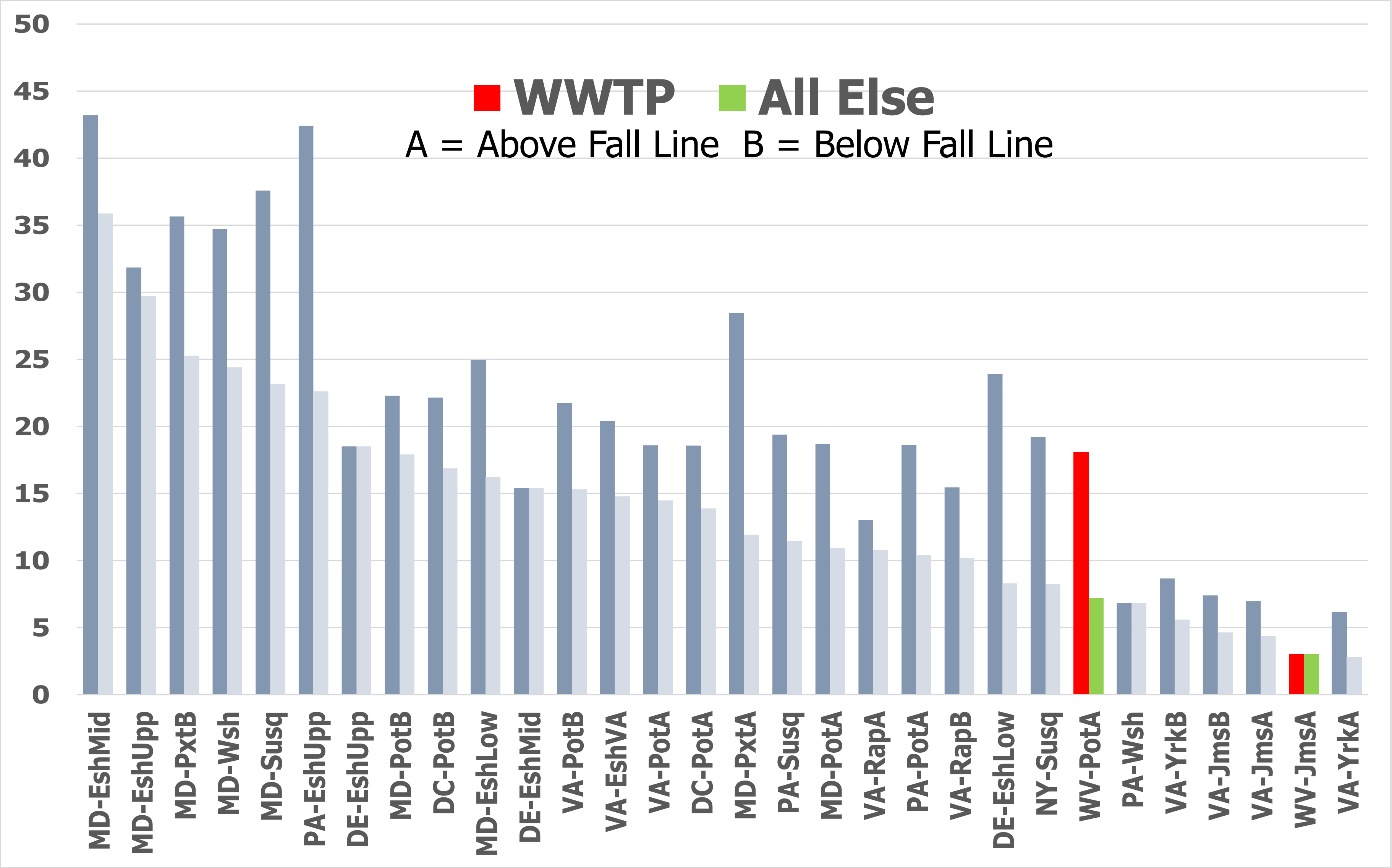
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



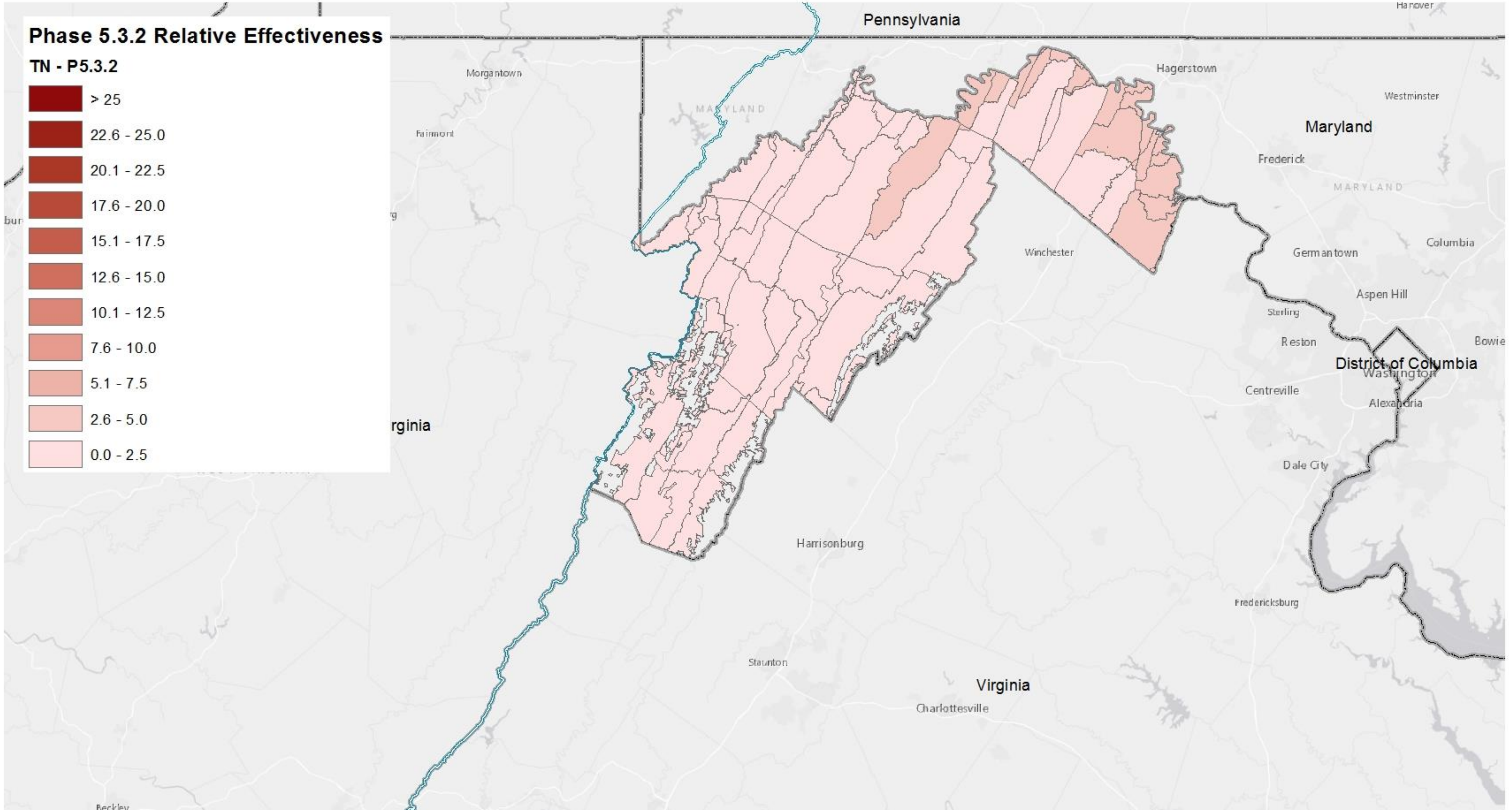
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



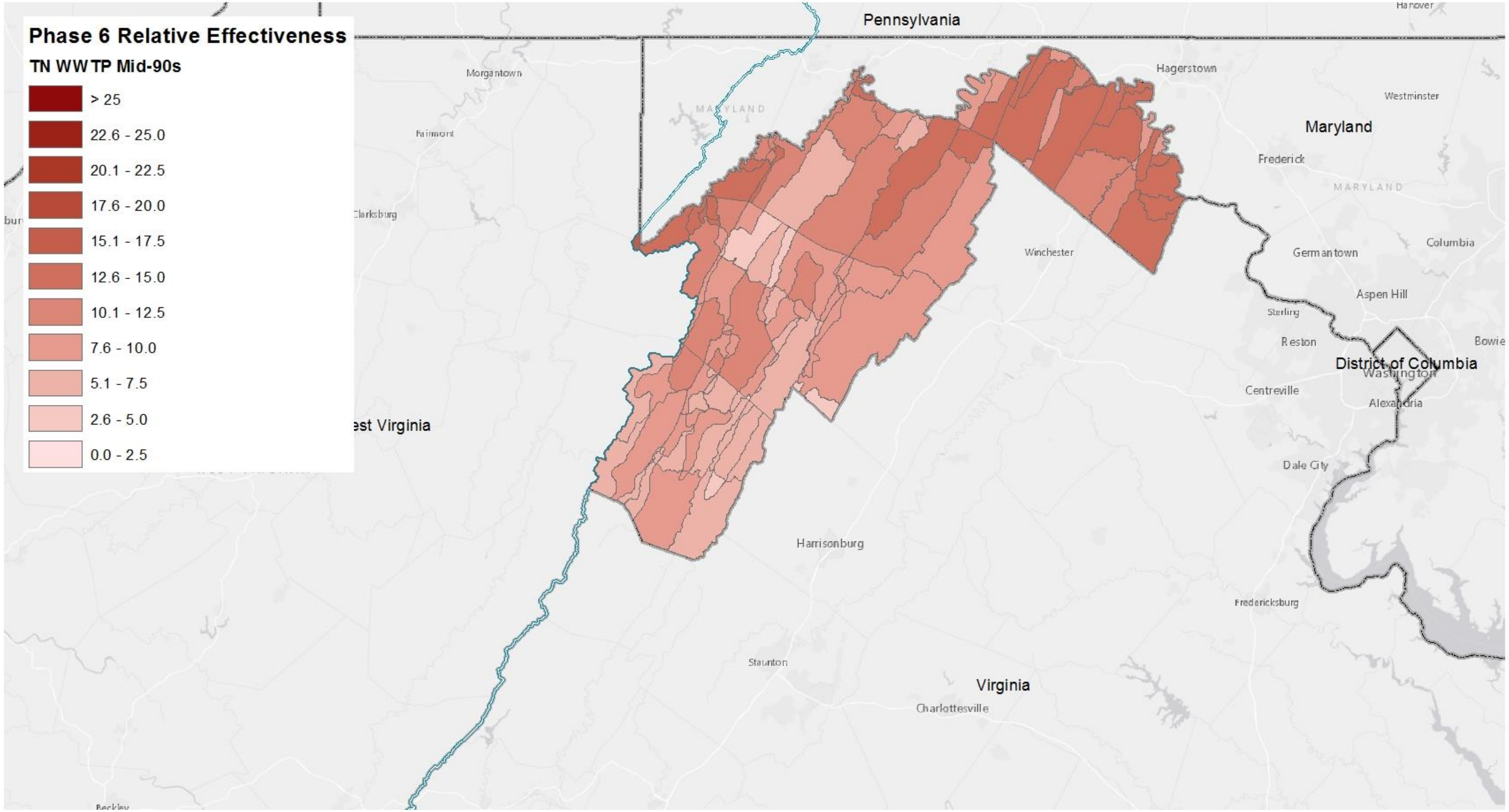
Nitrogen Relative Effectiveness

Phase 5.3.2



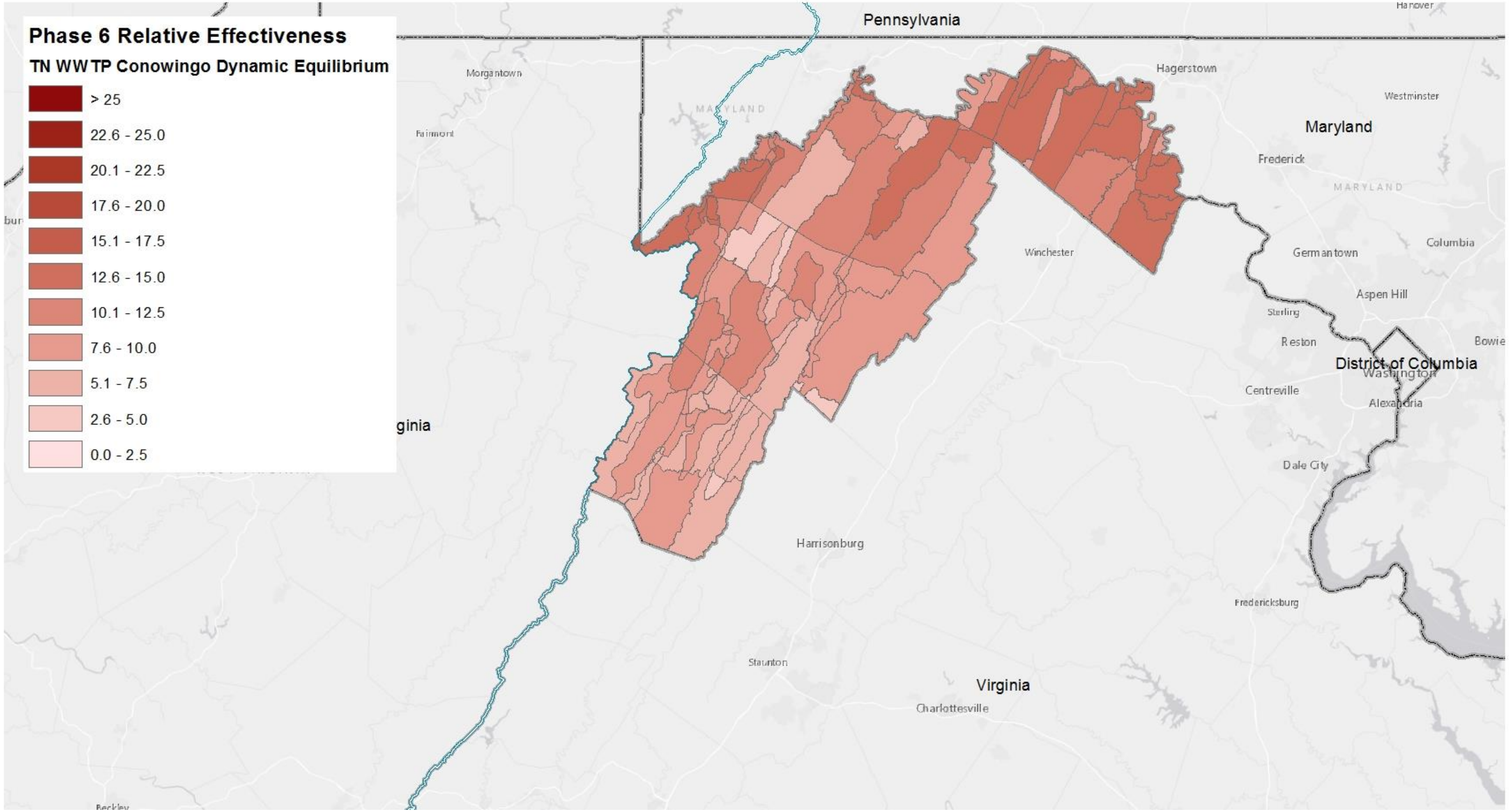
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



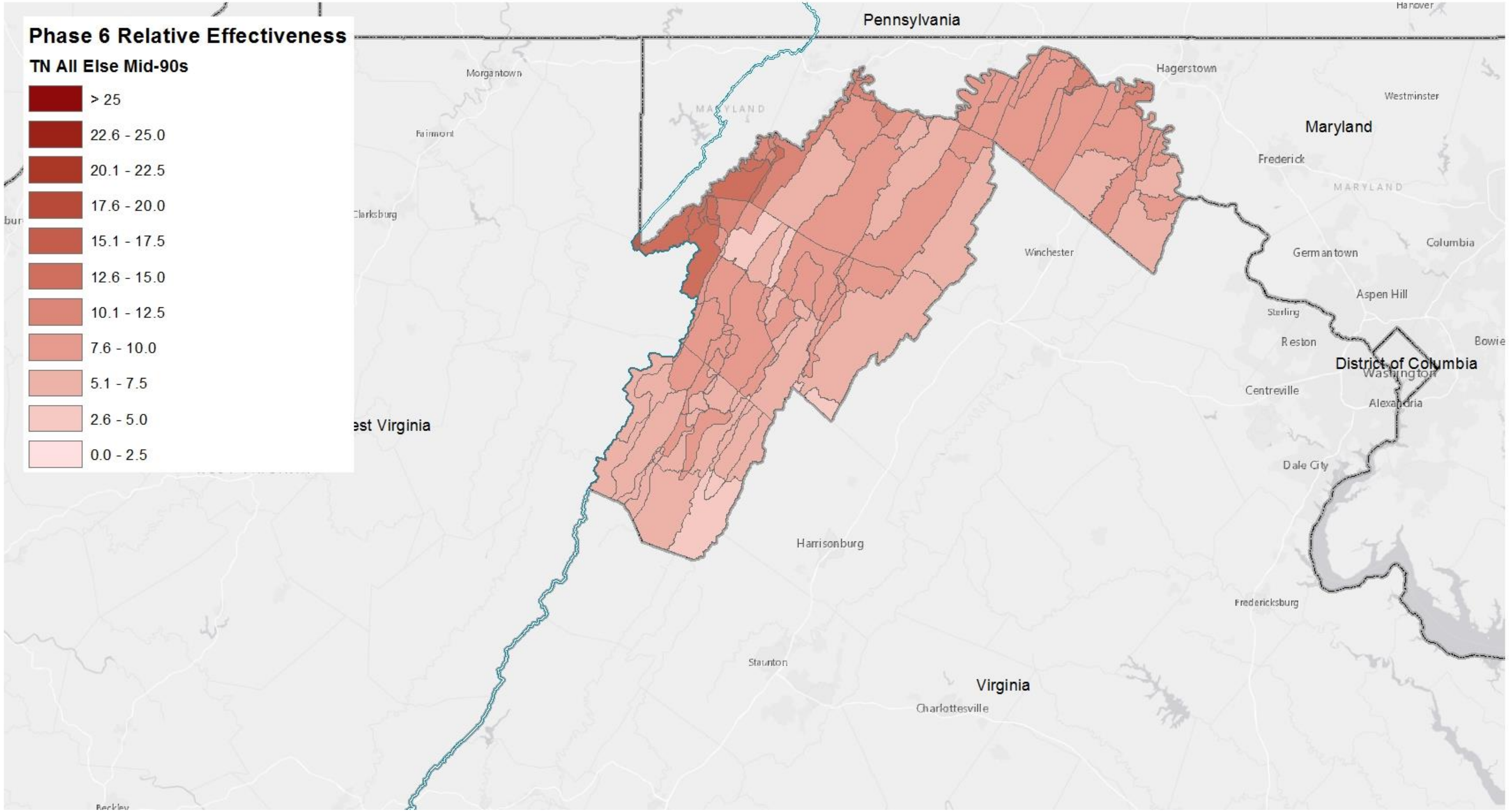
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



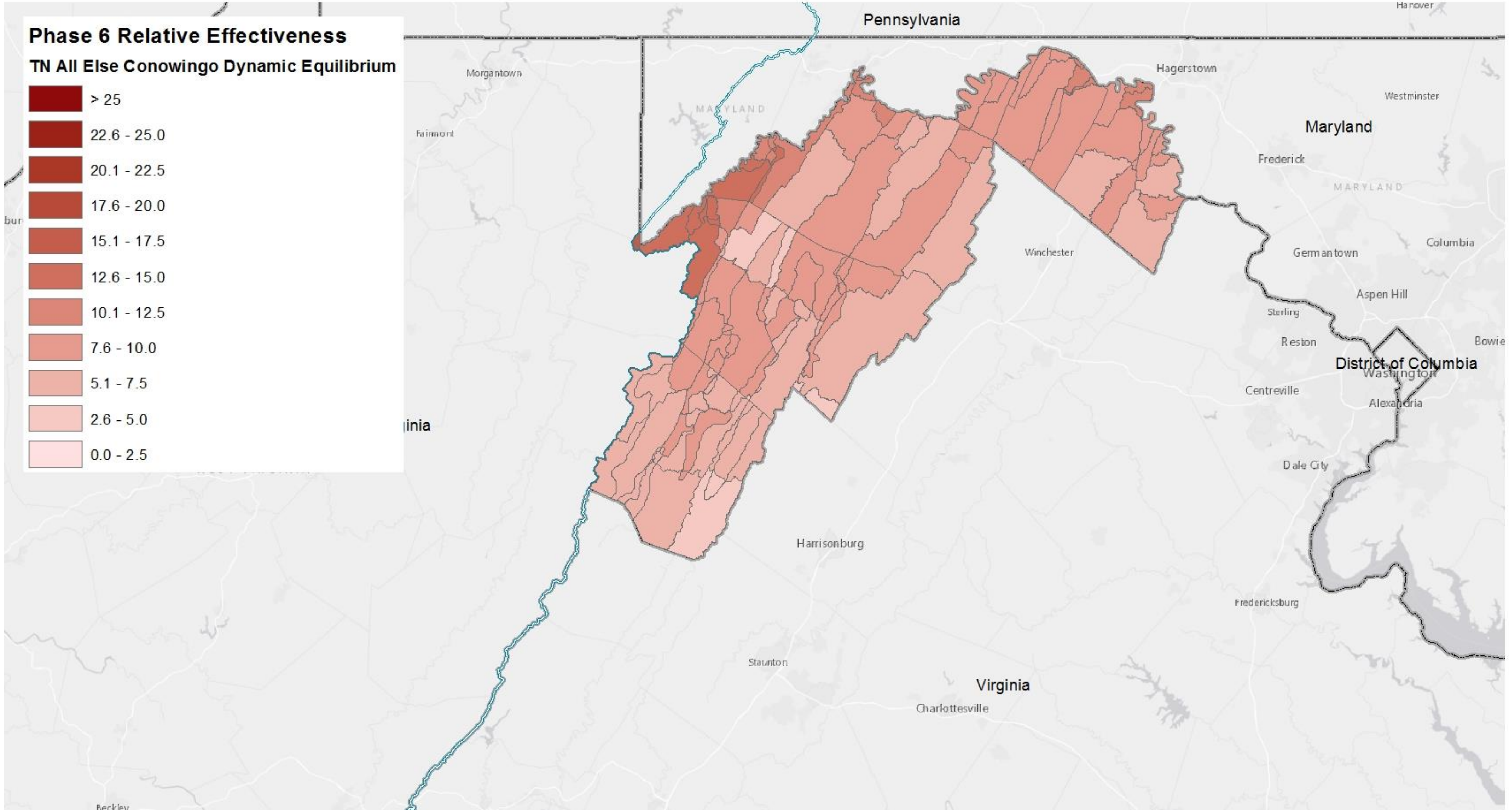
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



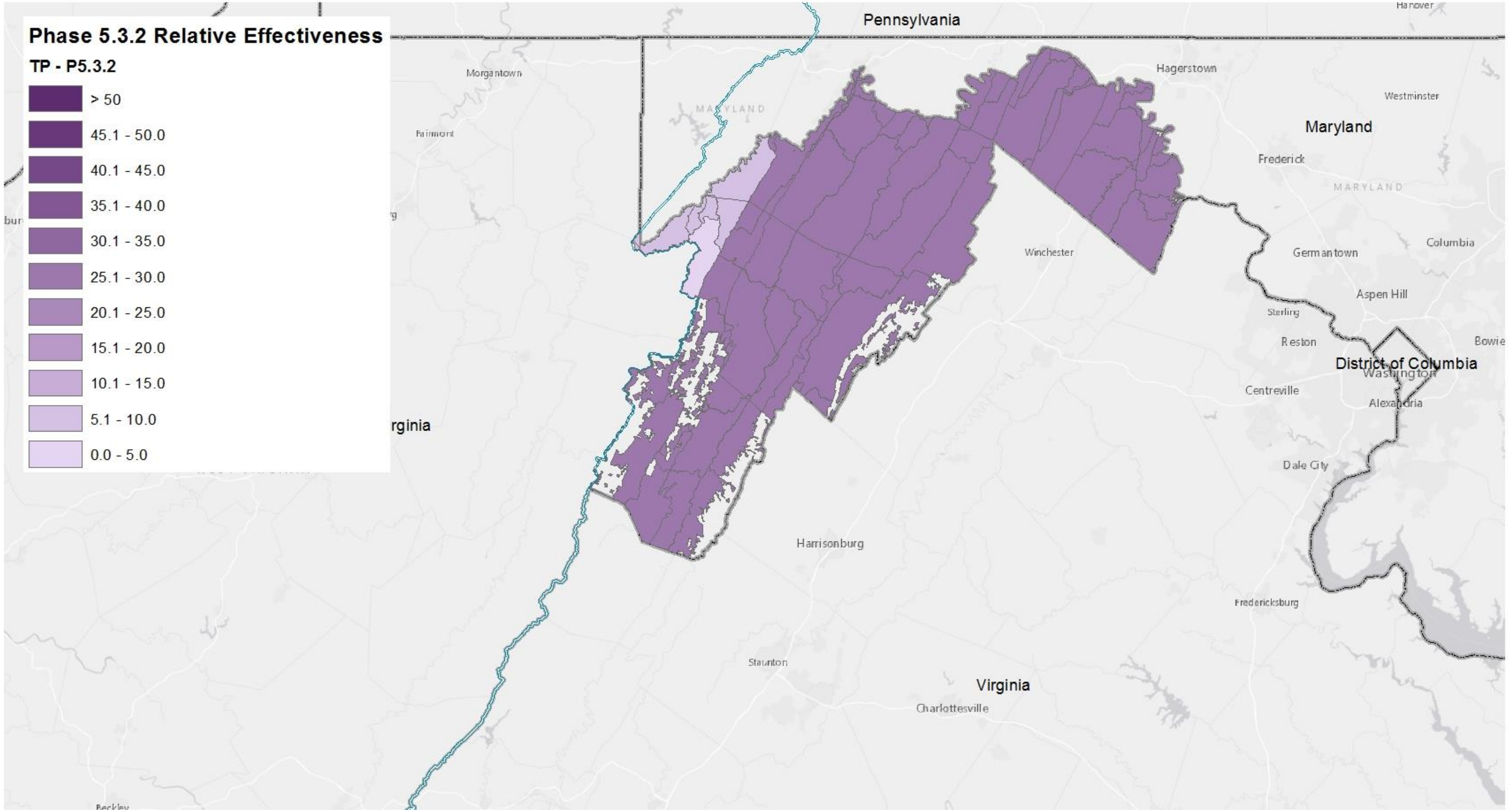
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



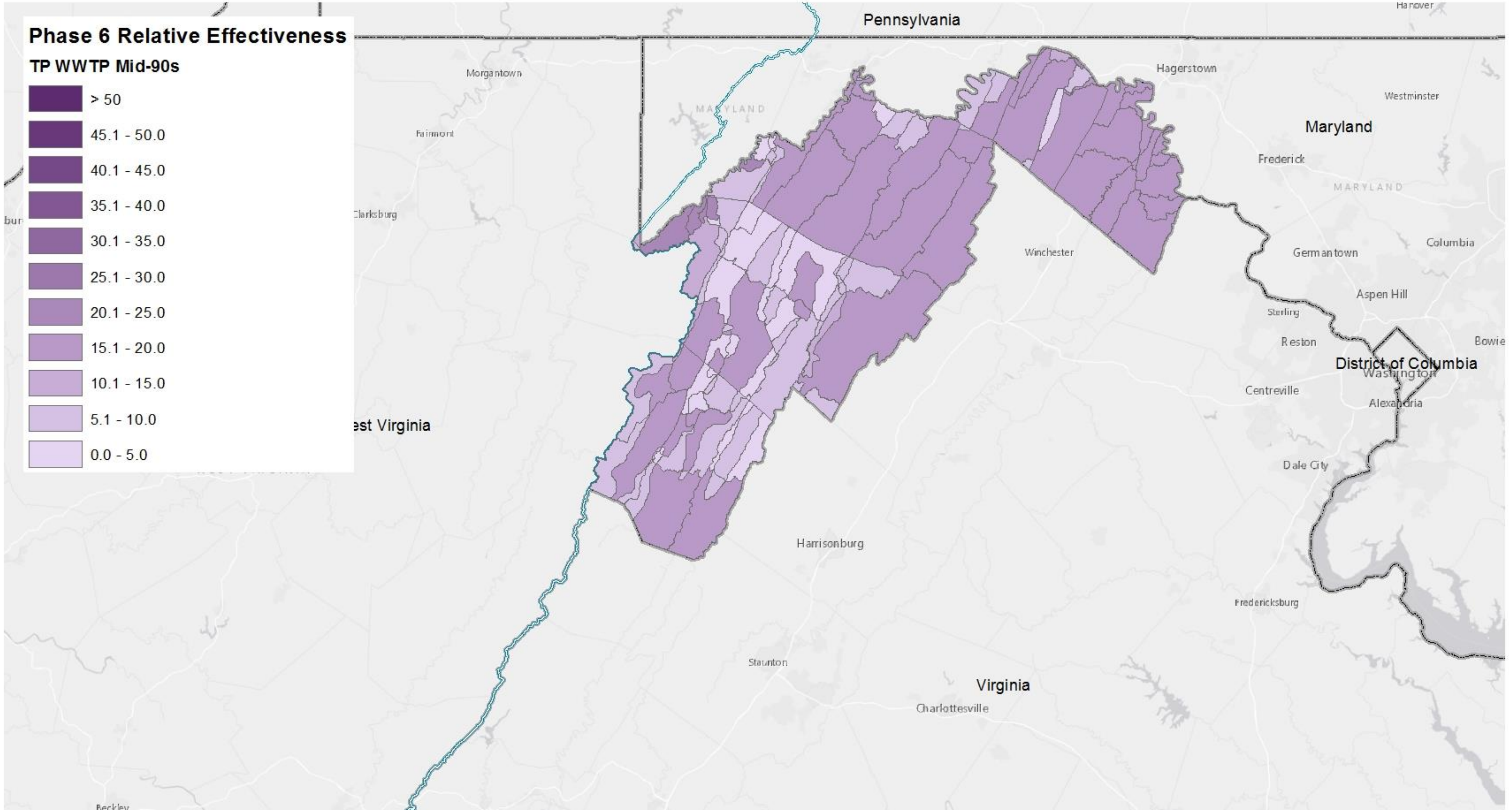
Phosphorus Relative Effectiveness

Phase 5.3.2



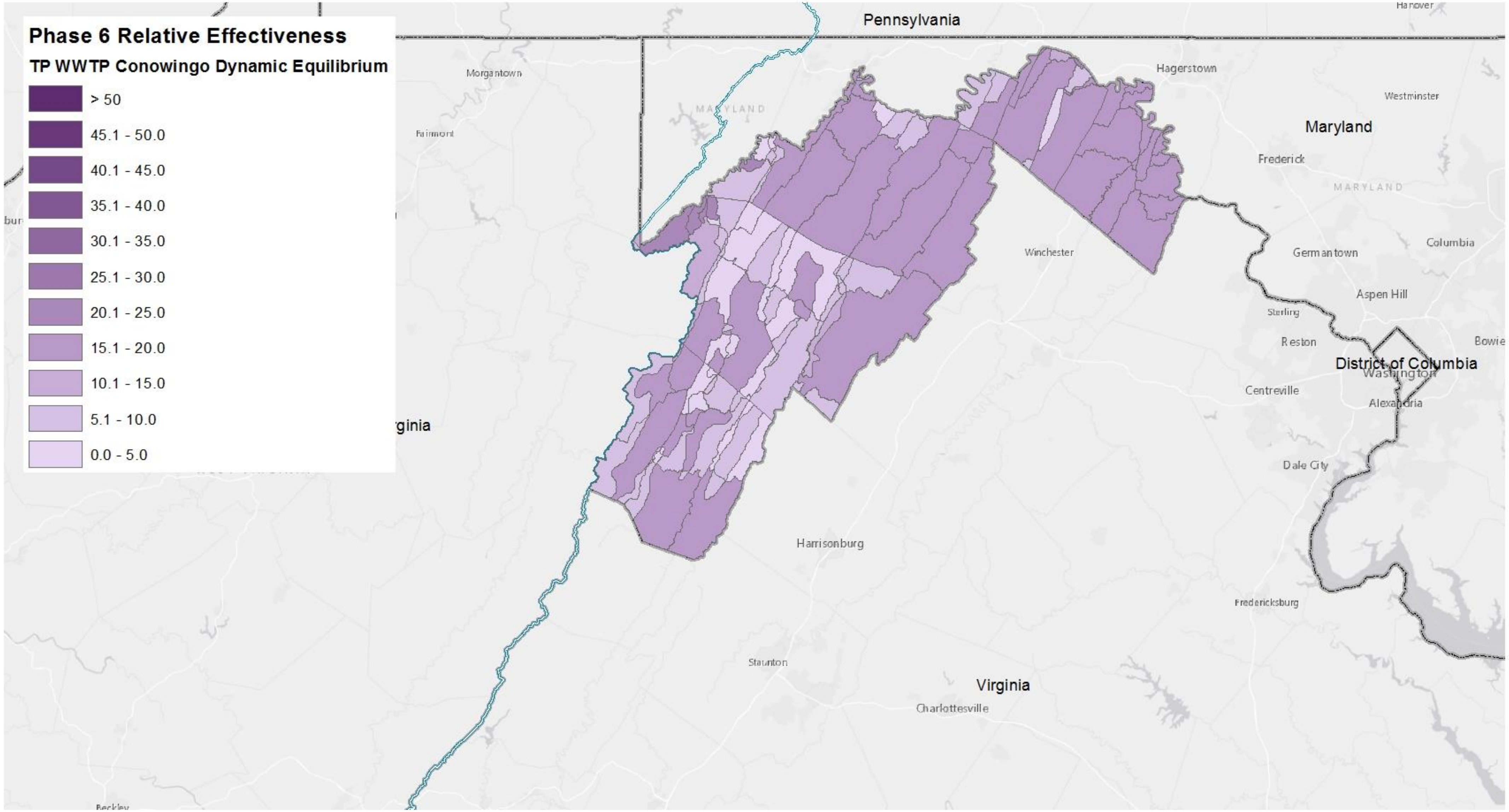
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



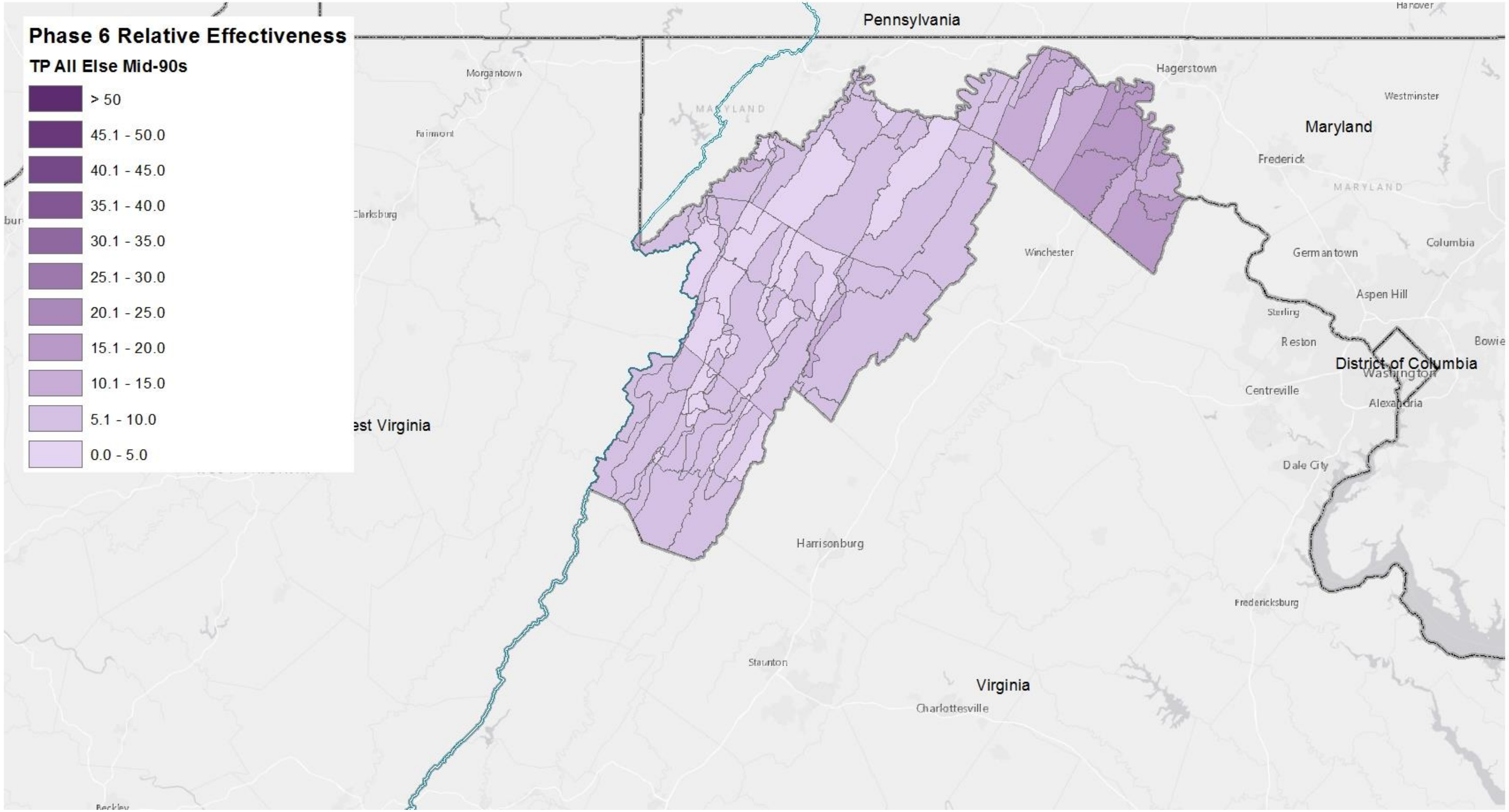
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



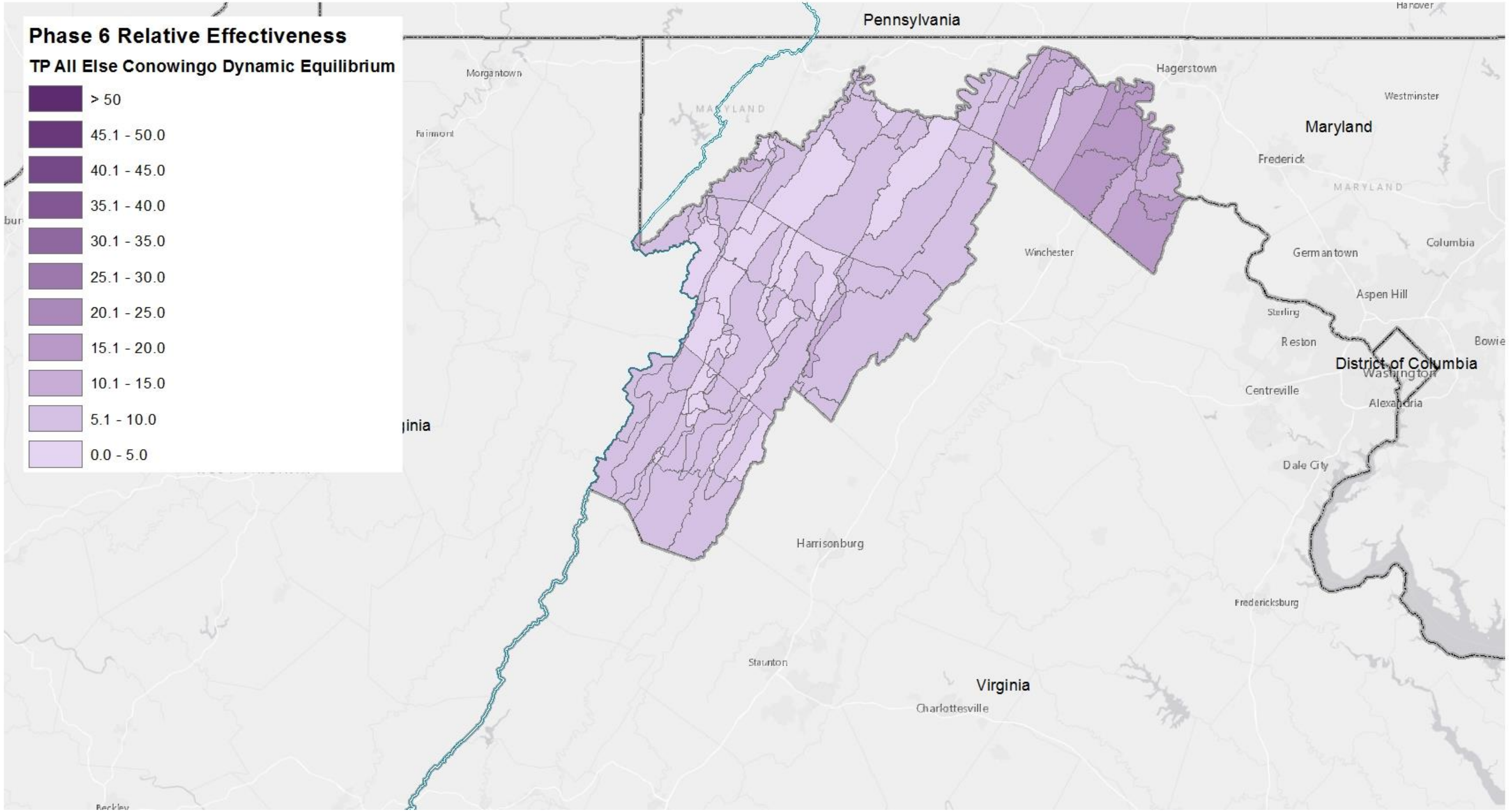
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium

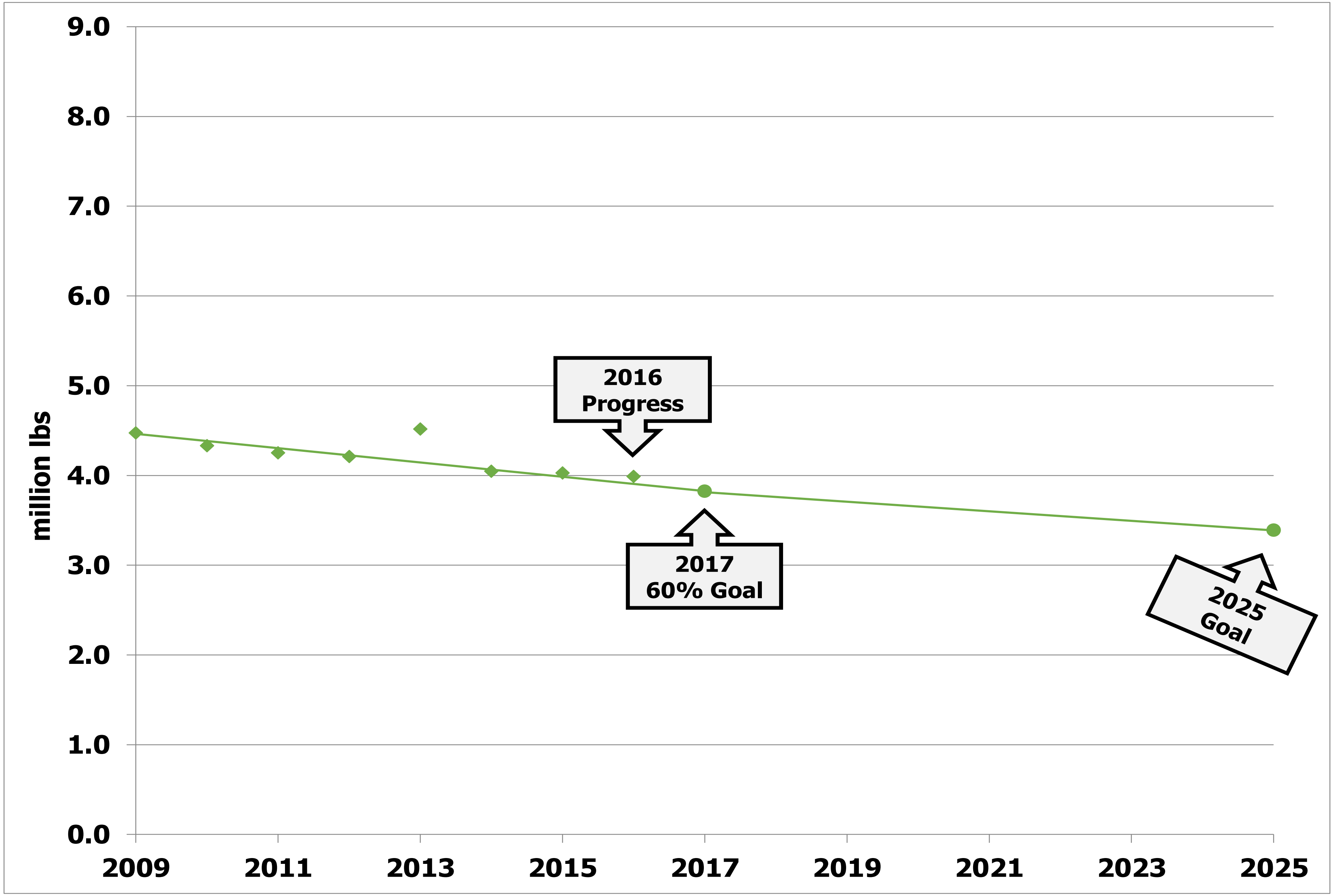


DE Draft Phase III WIP Planning Targets + Reference Loads

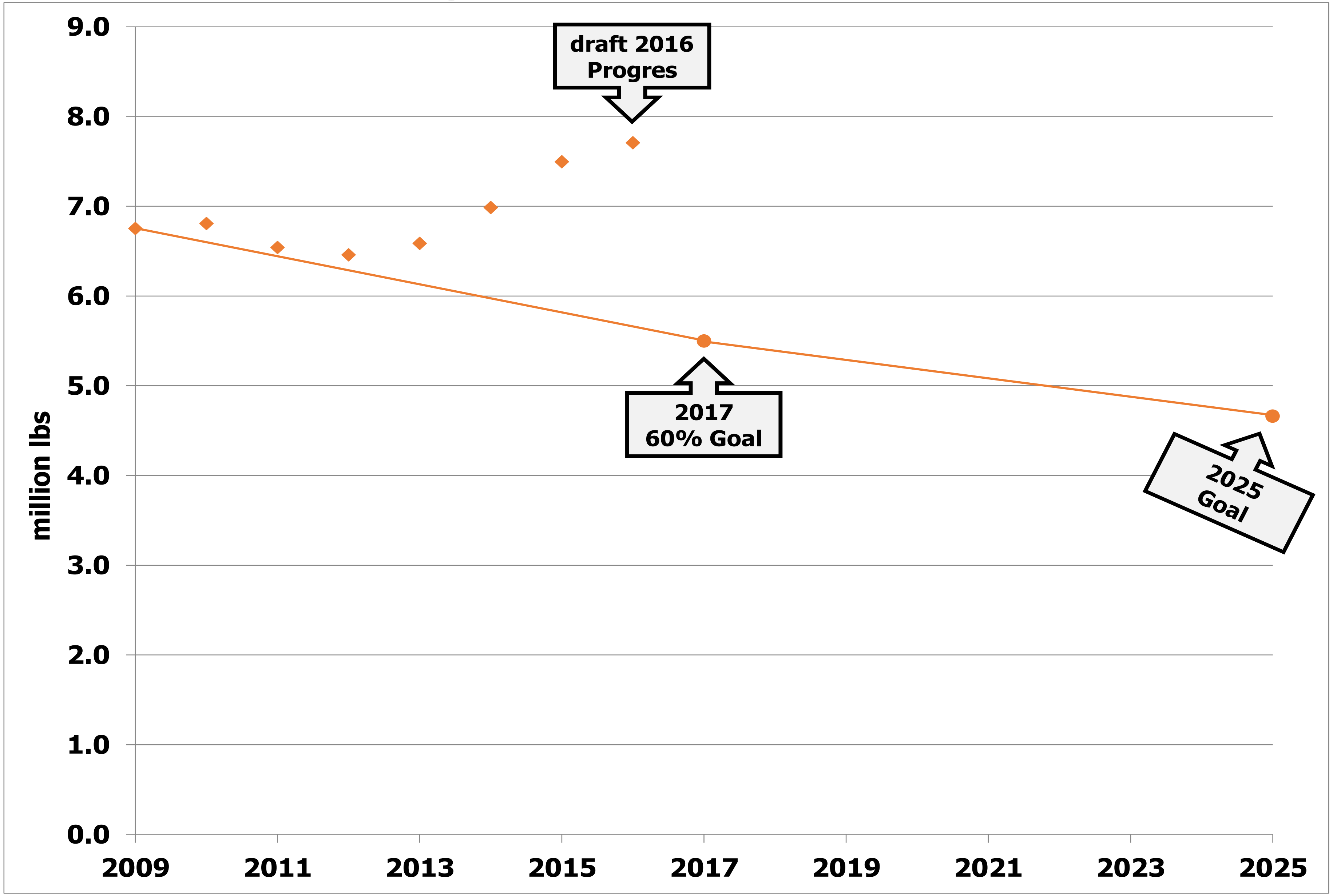
Nitrogen Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
DE Eastern Shore	8.60	2.59	6.59	4.11	4.66

Phosphorus Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
DE Eastern Shore	0.207	0.064	0.116	0.086	0.116

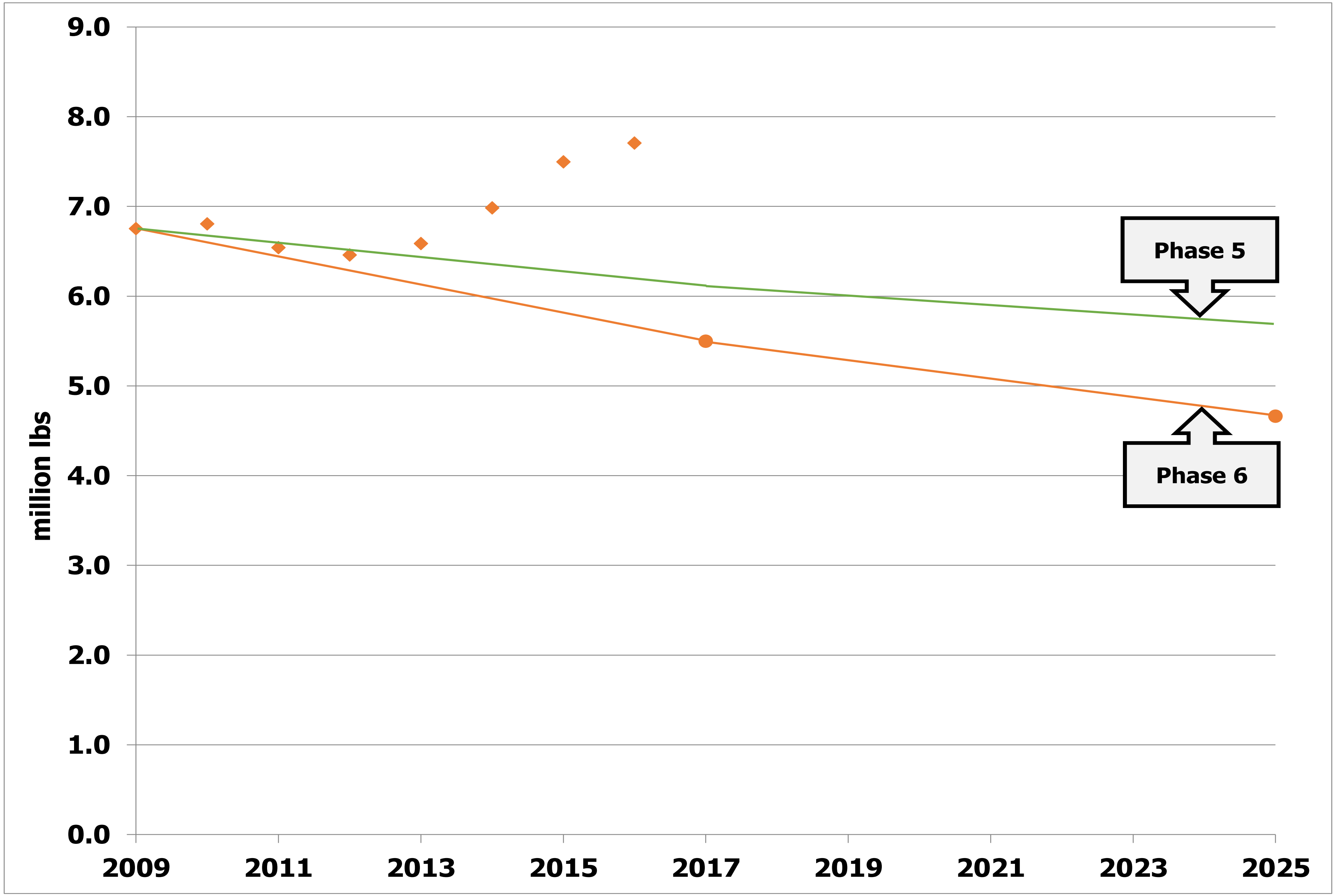
DE Nitrogen Loads-Goals, Phase 5.3.2



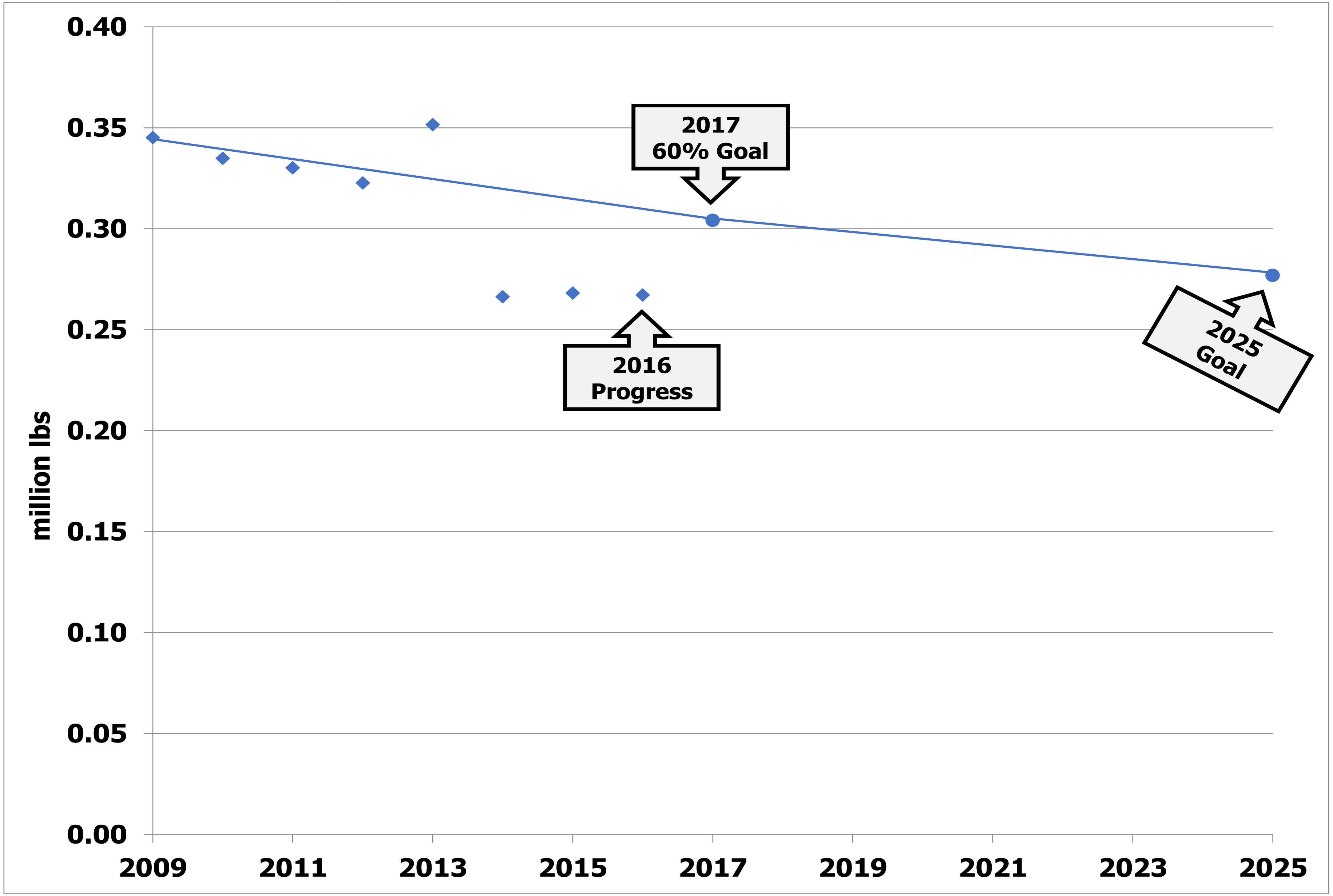
DE Nitrogen Loads-Goals, Phase 6



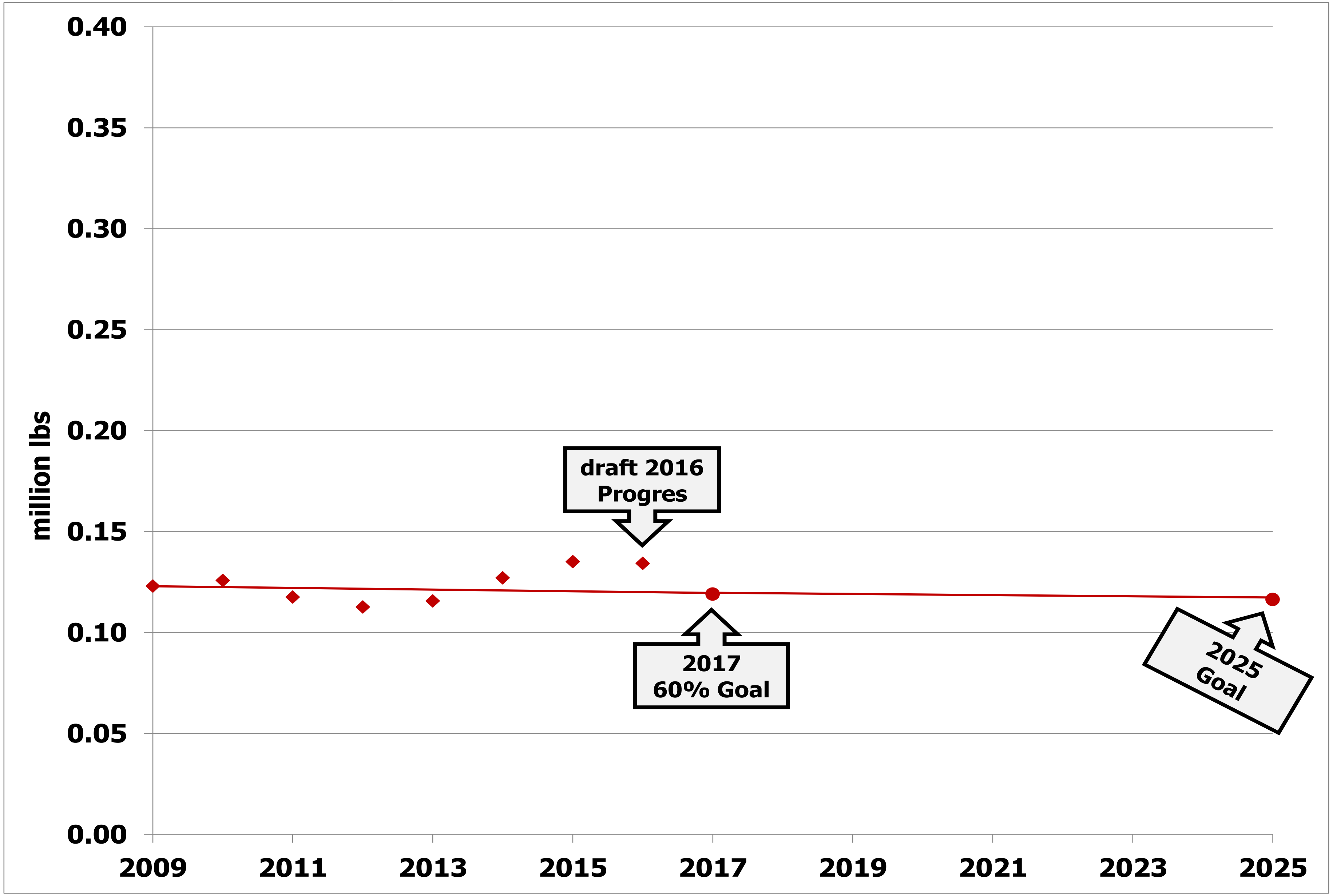
DE Nitrogen Change in LOE



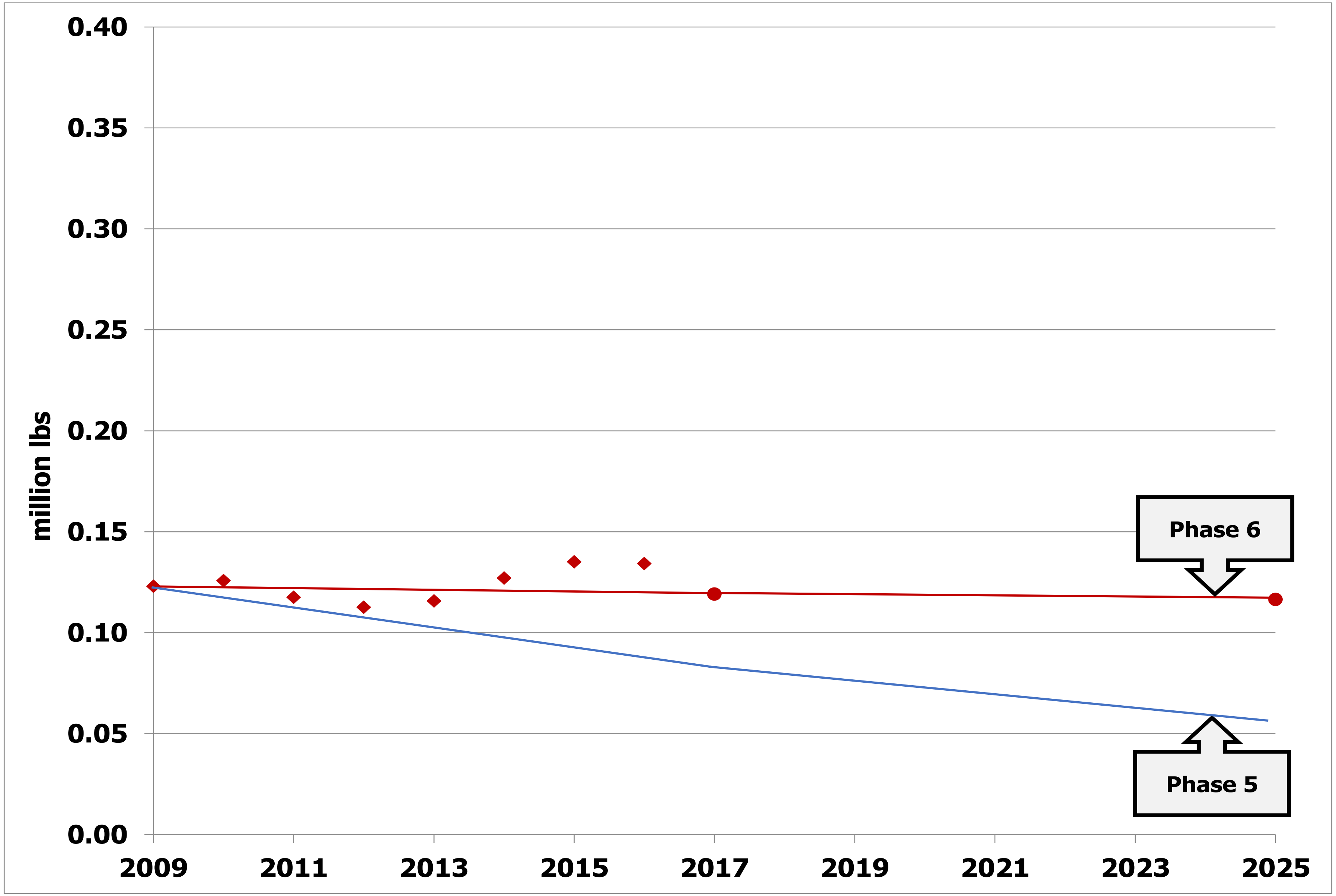
DE Phosphorus Loads-Goals, Phase 5.3.2



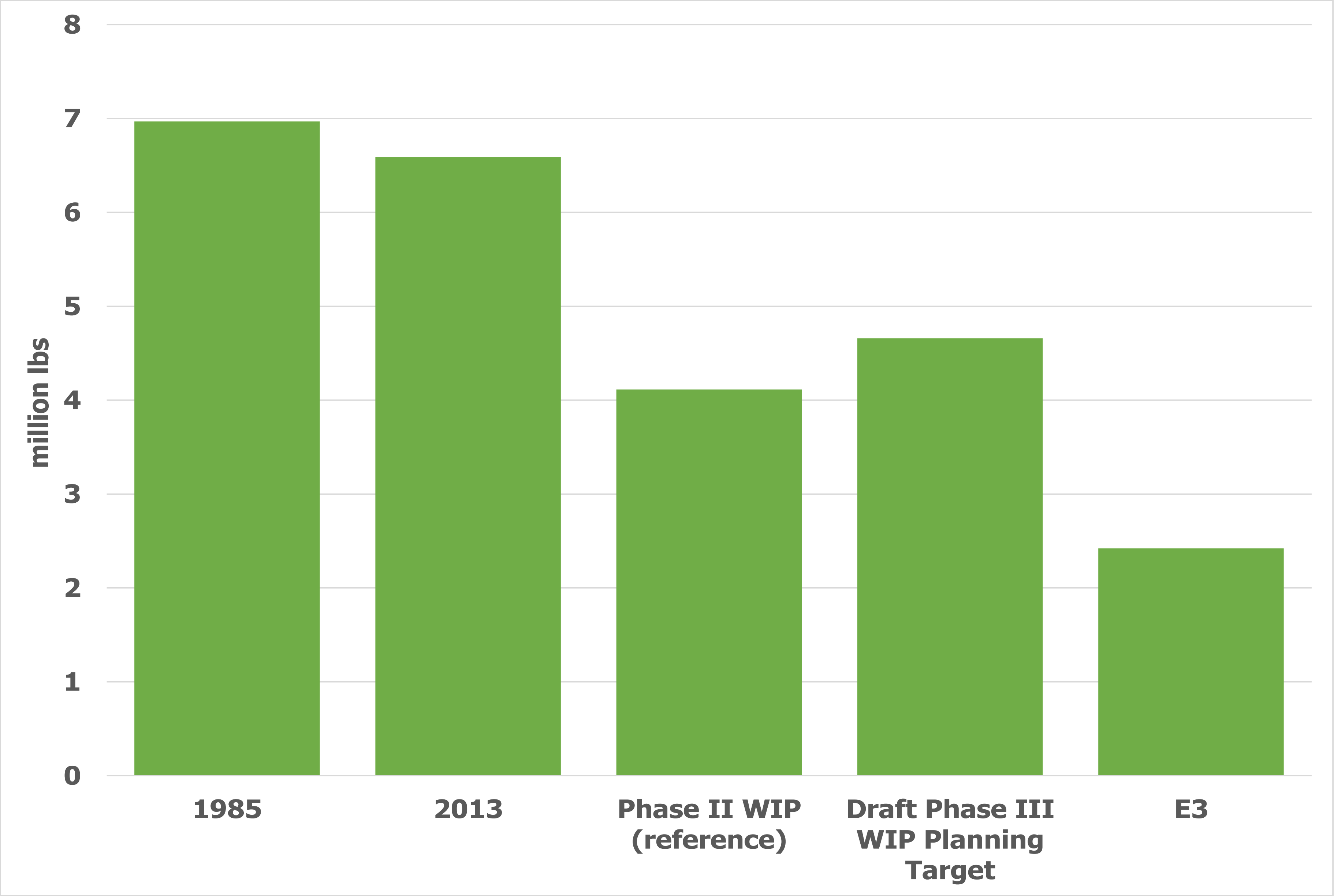
DE Phosphorus Loads-Goals, Phase 6



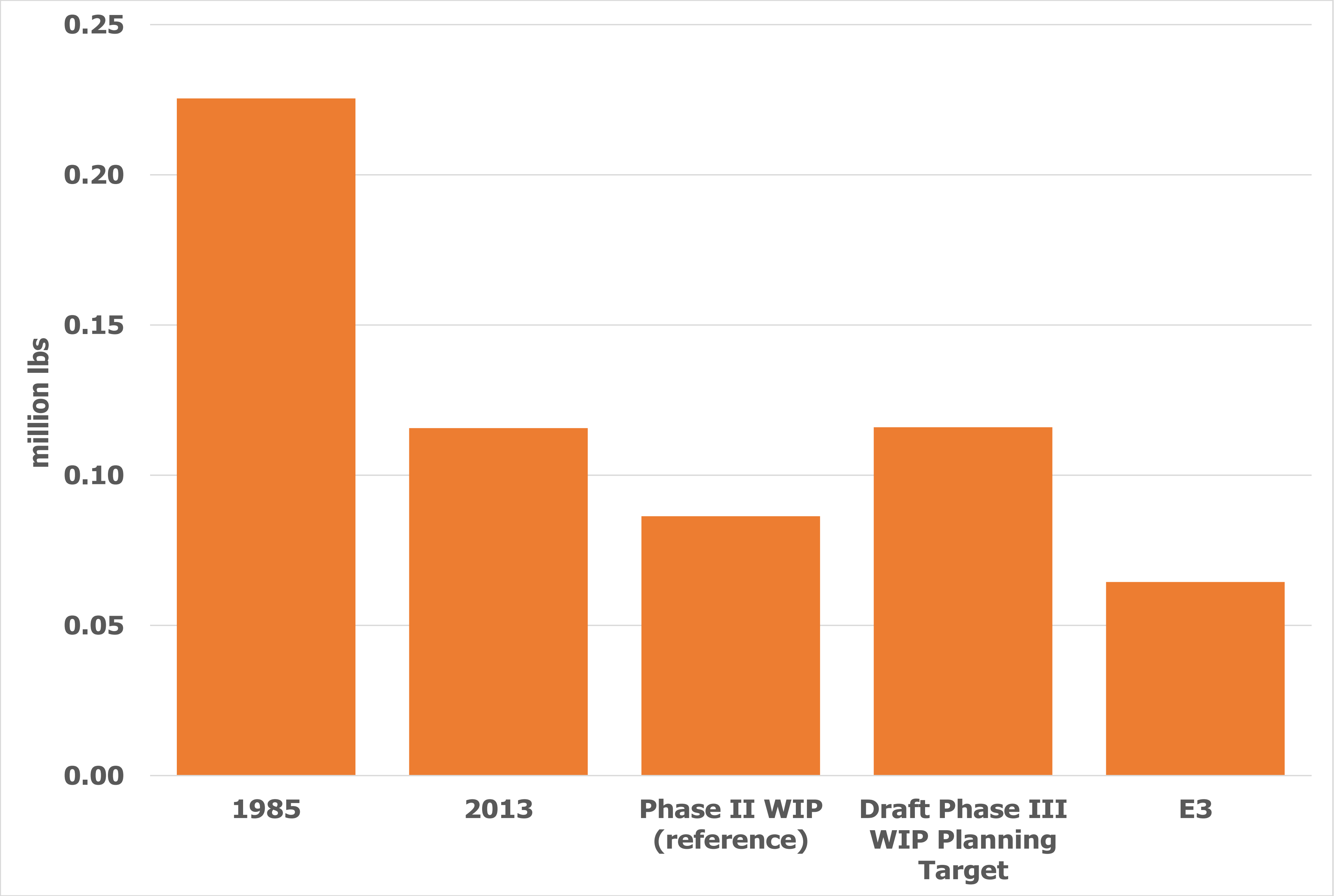
DE Phosphorus Change in LOE



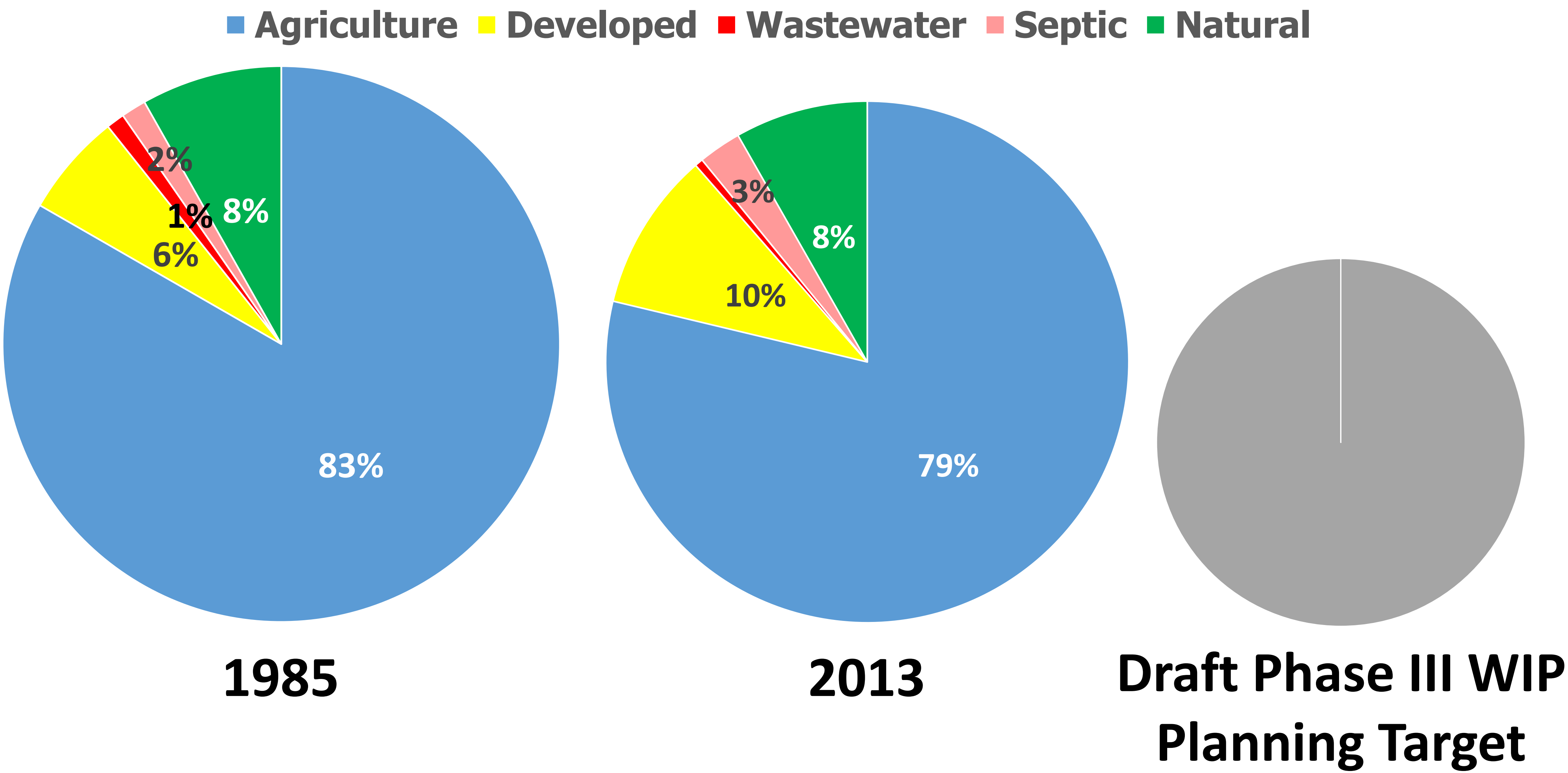
DE Nitrogen Loads, Reference Scenarios, and Target



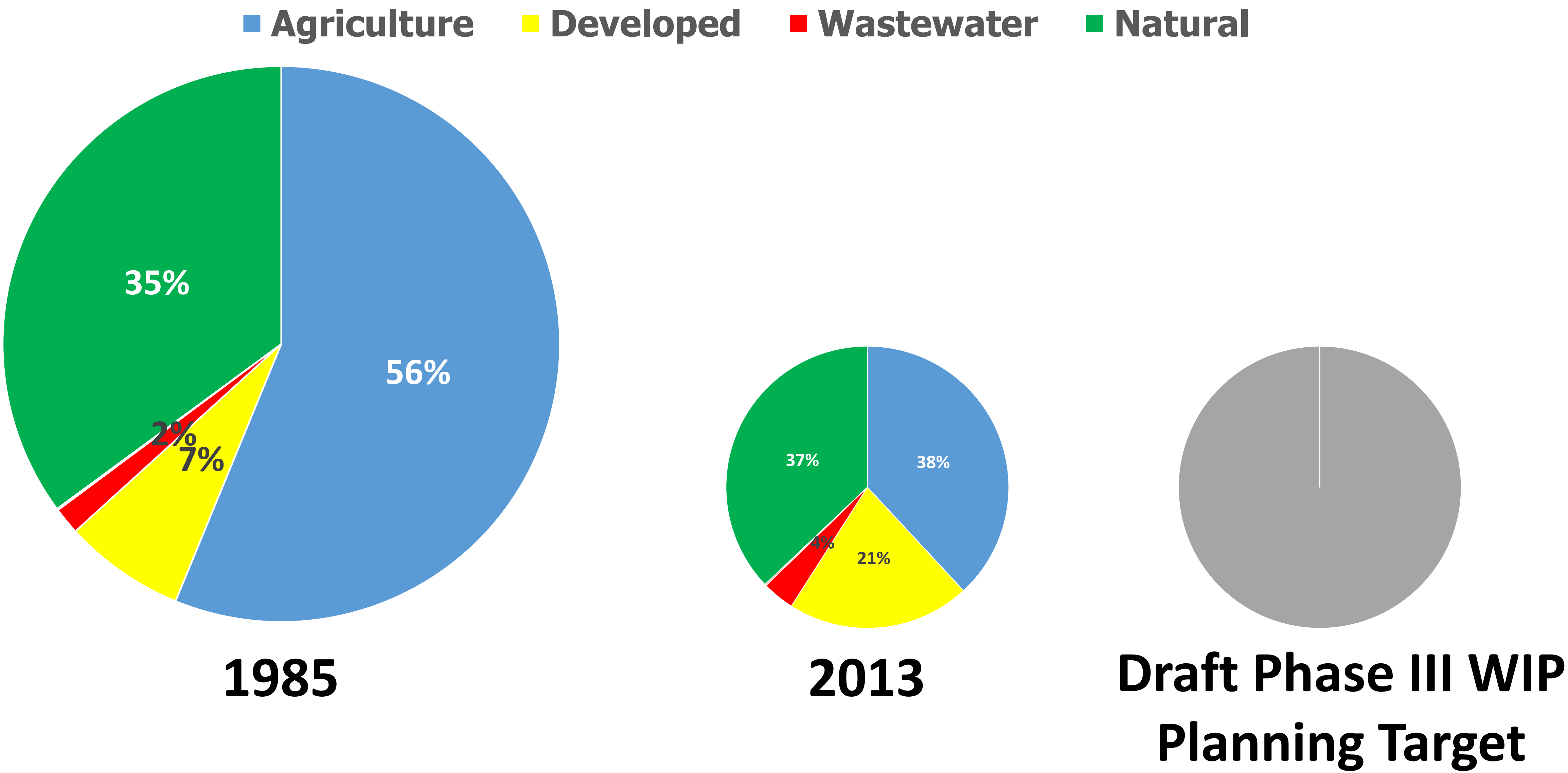
DE Phosphorus Loads, Reference Scenarios, and Target



DE Nitrogen Loads and Target

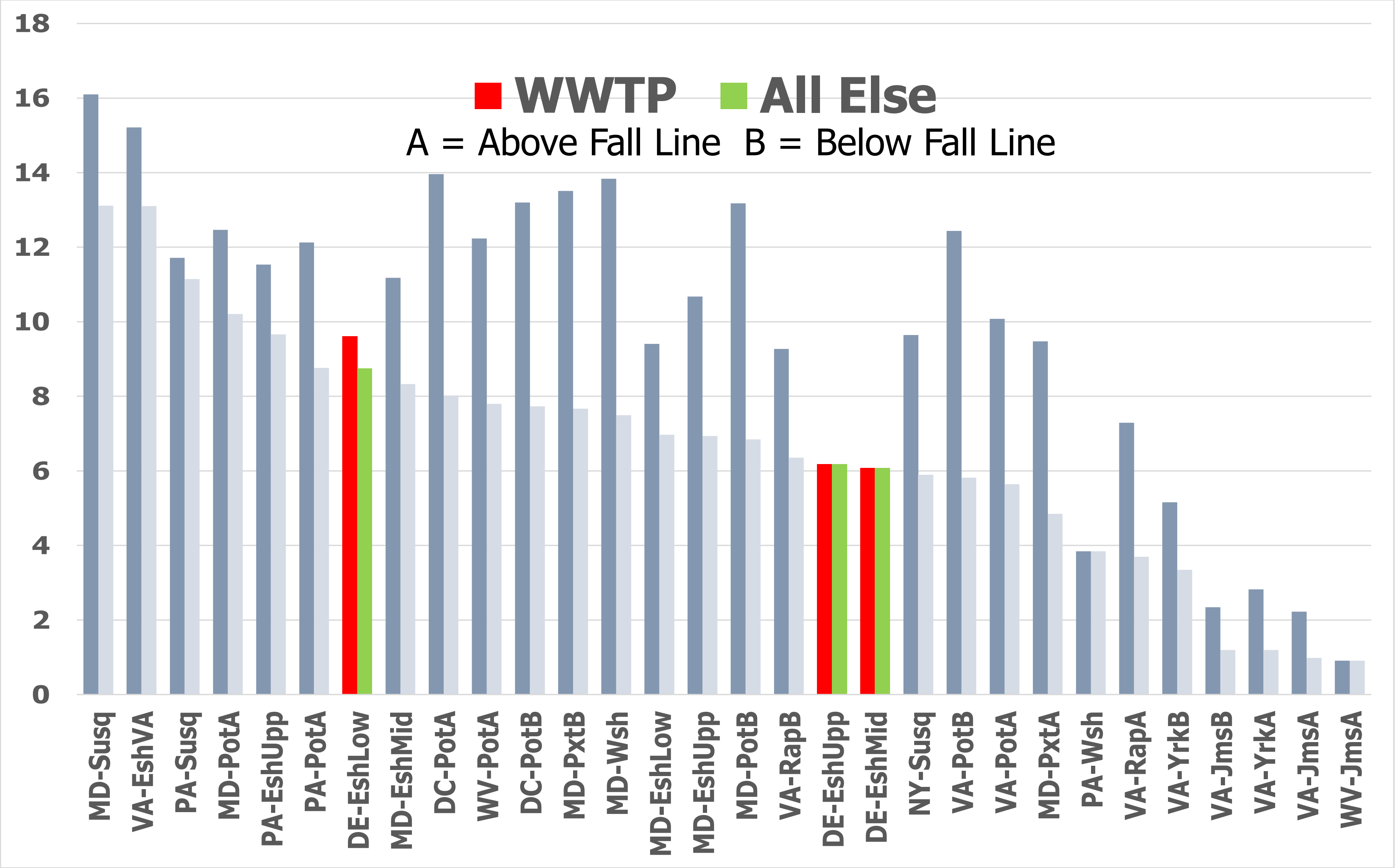


DE Phosphorus Loads and Target



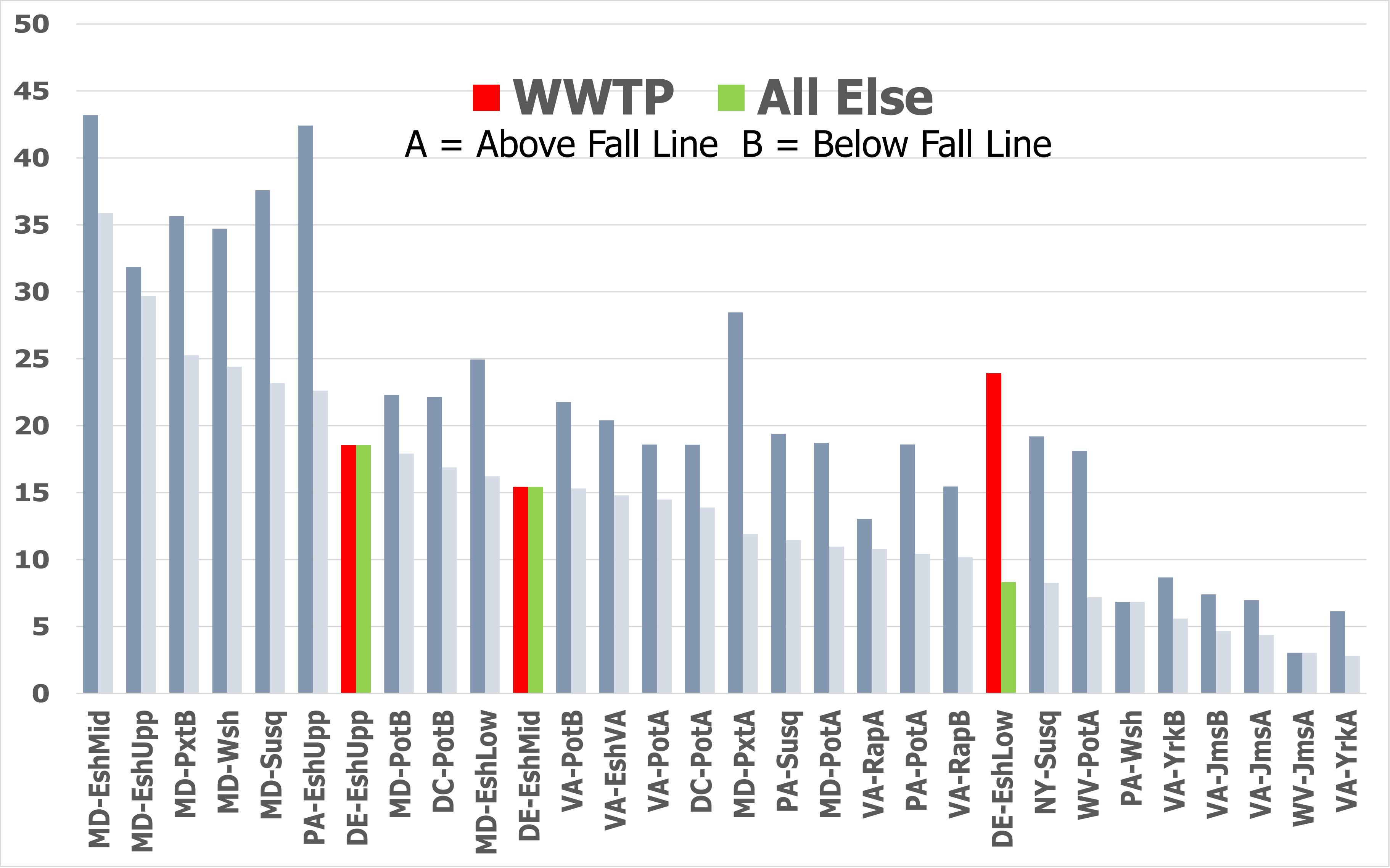
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



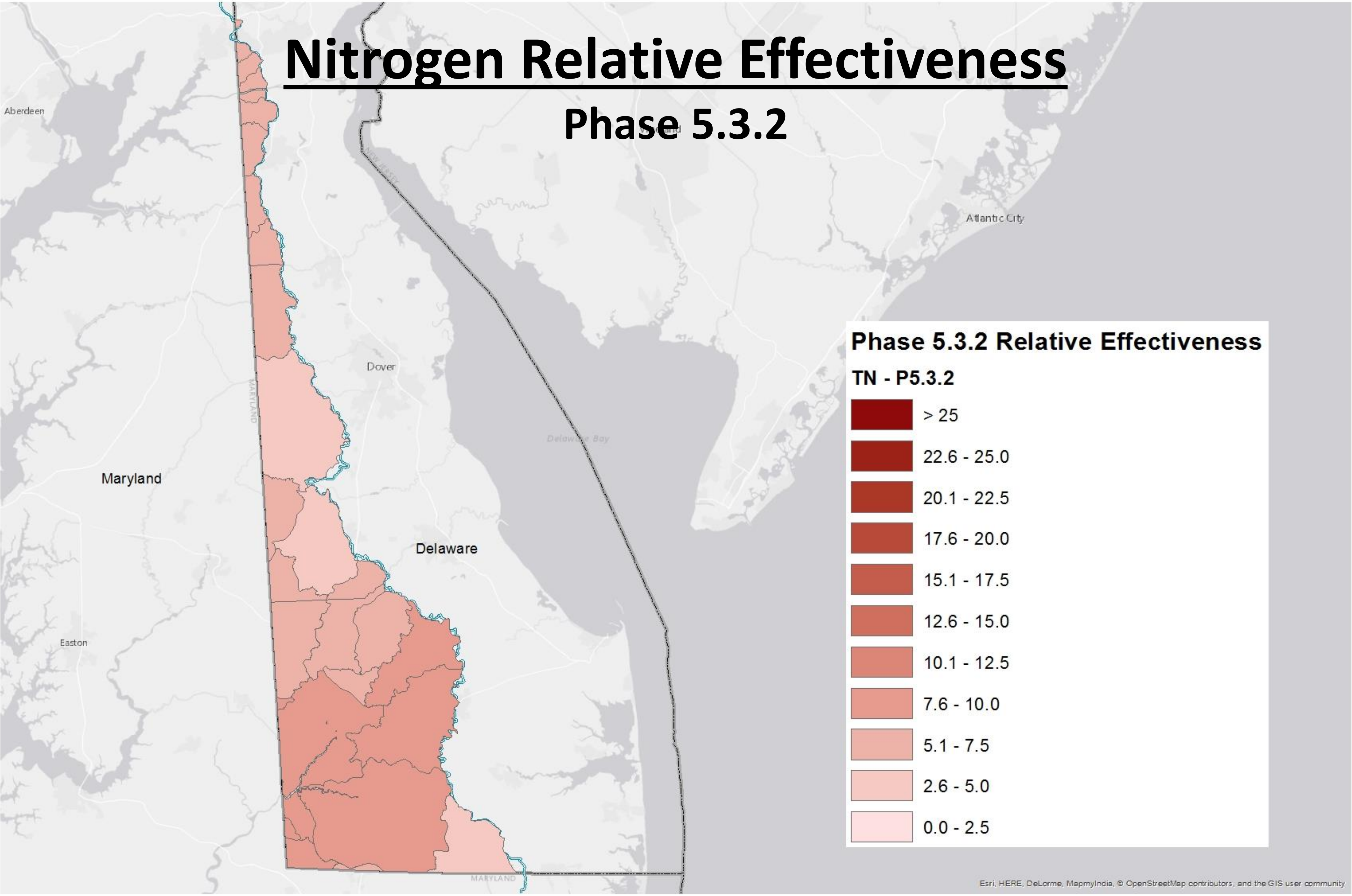
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



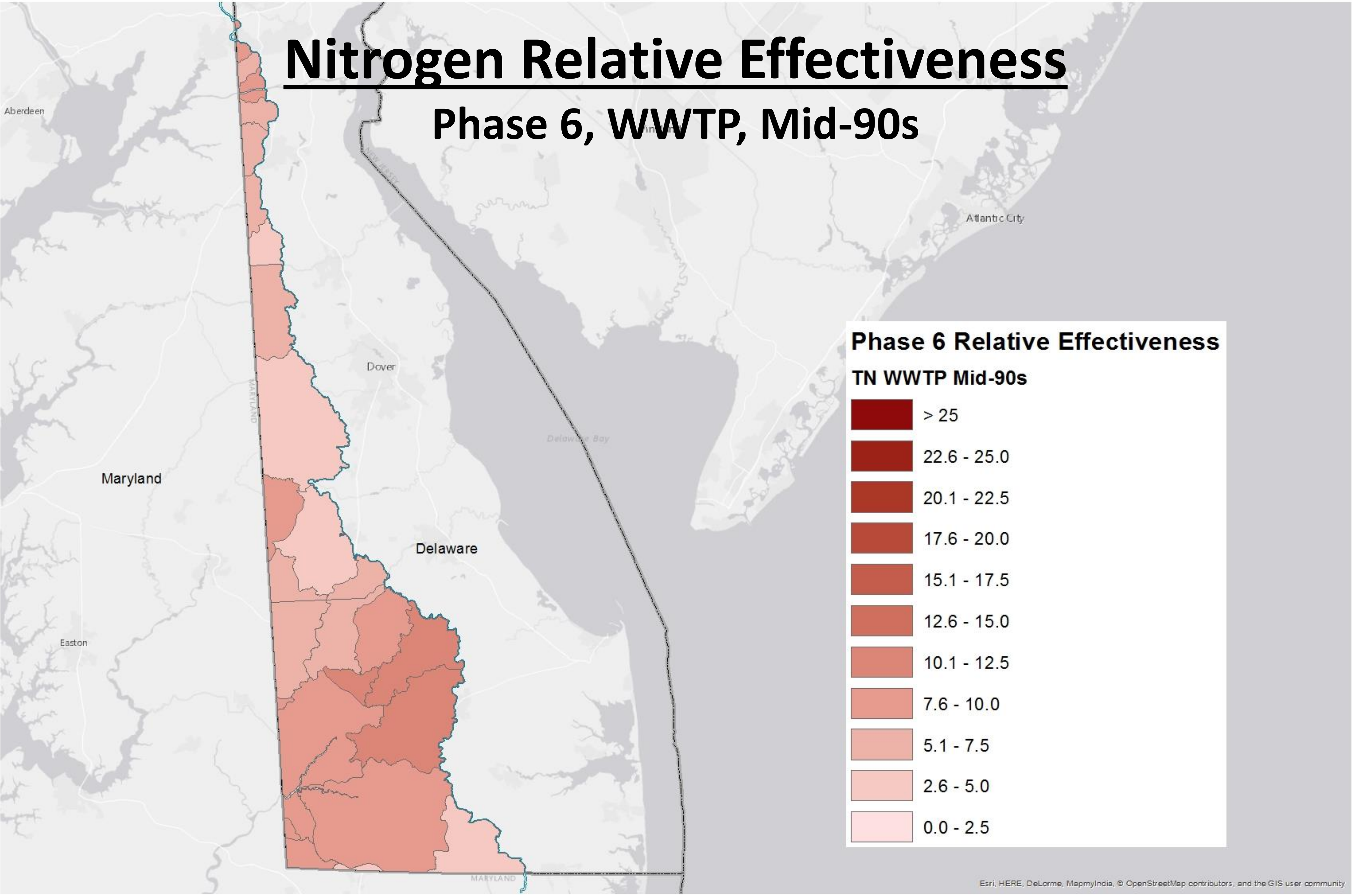
Nitrogen Relative Effectiveness

Phase 5.3.2



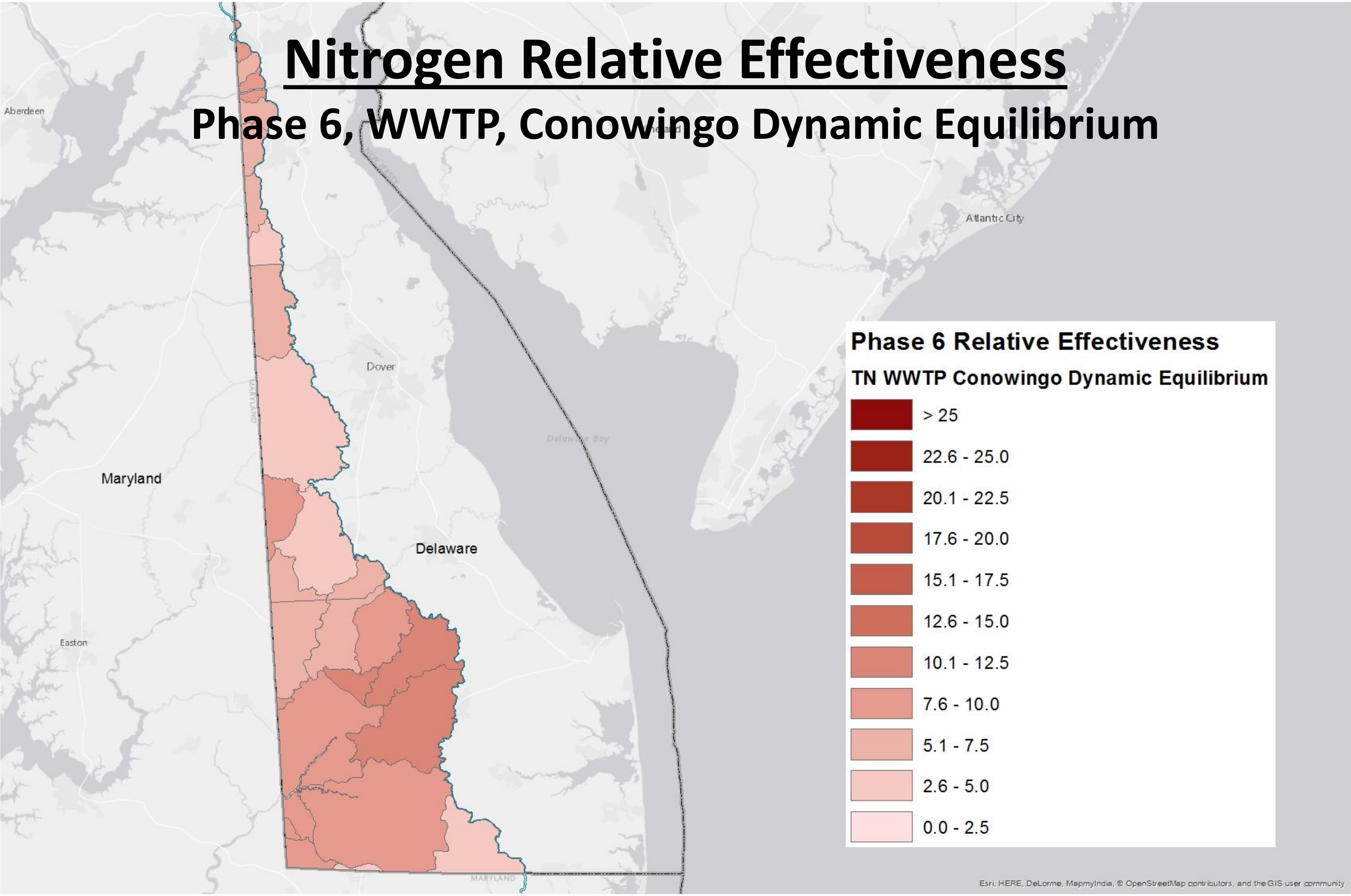
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



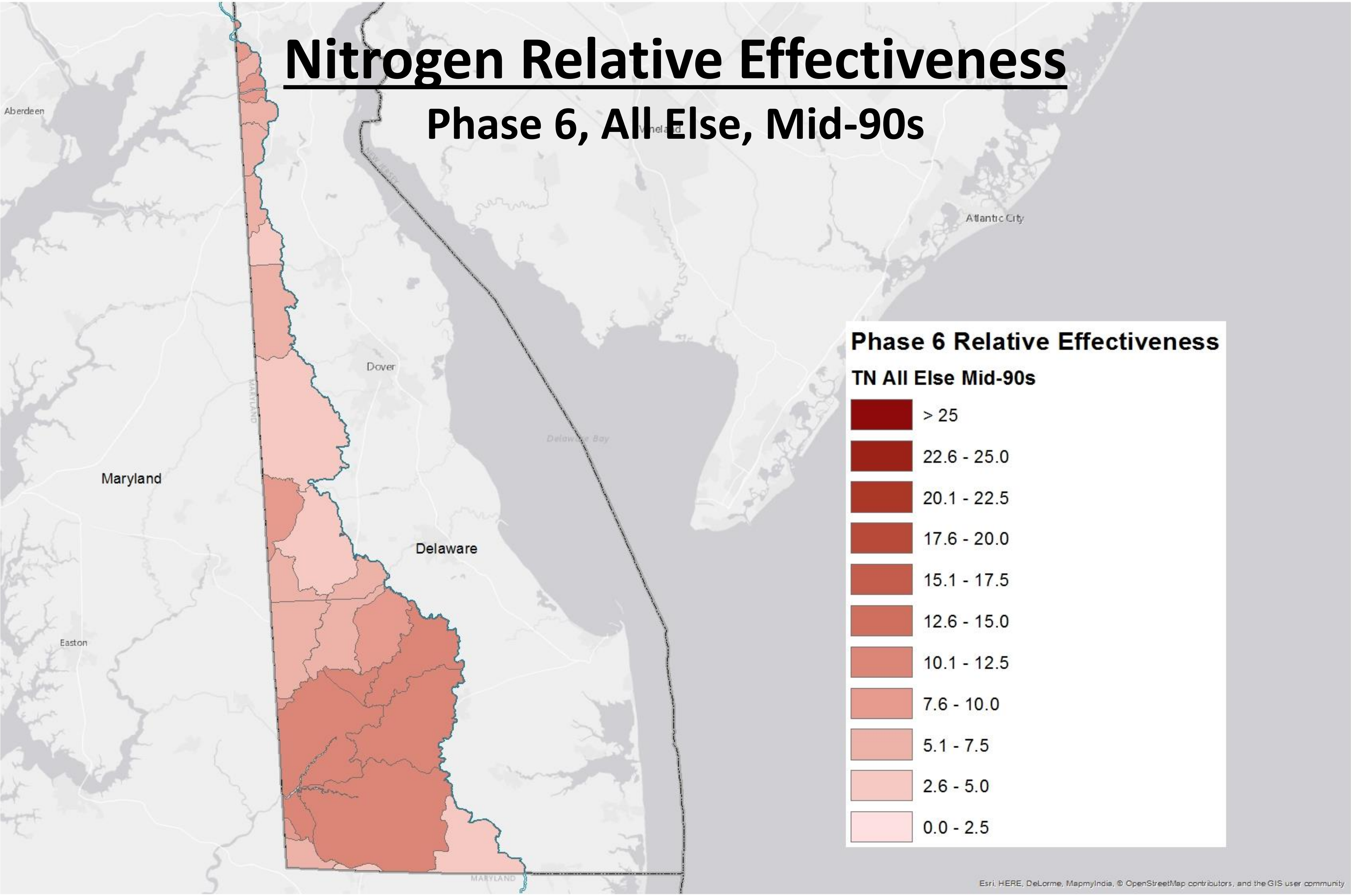
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



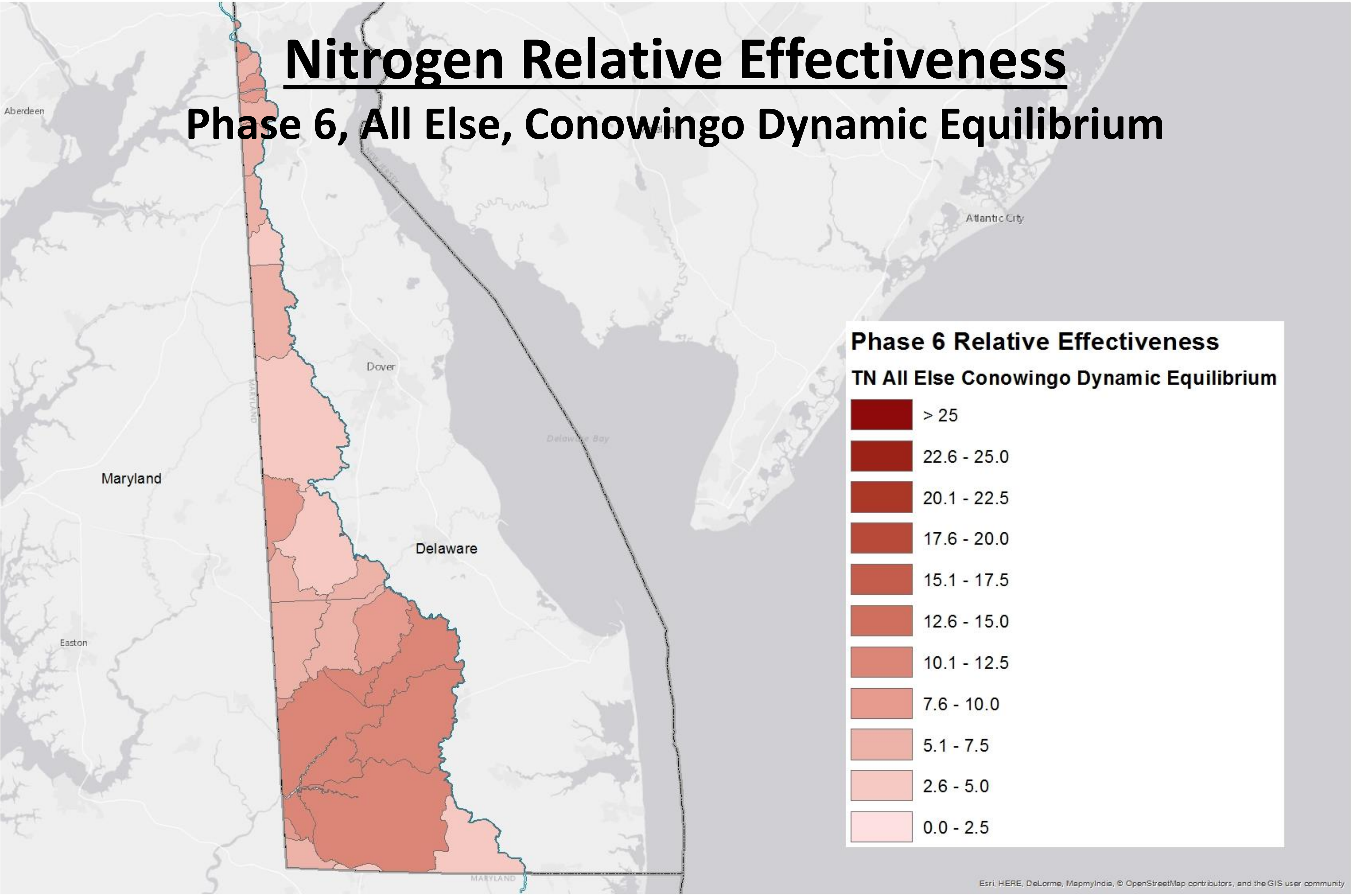
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



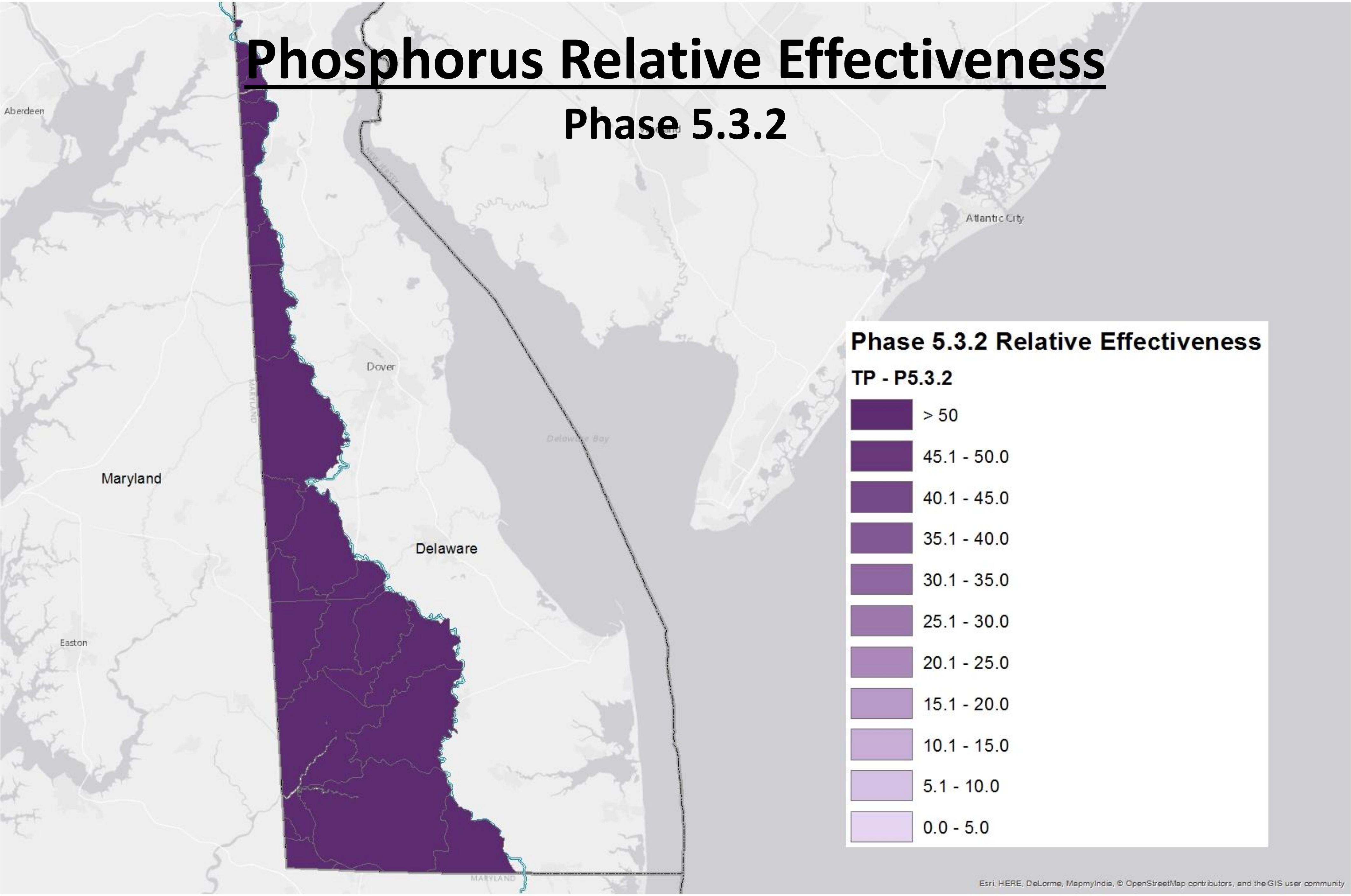
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



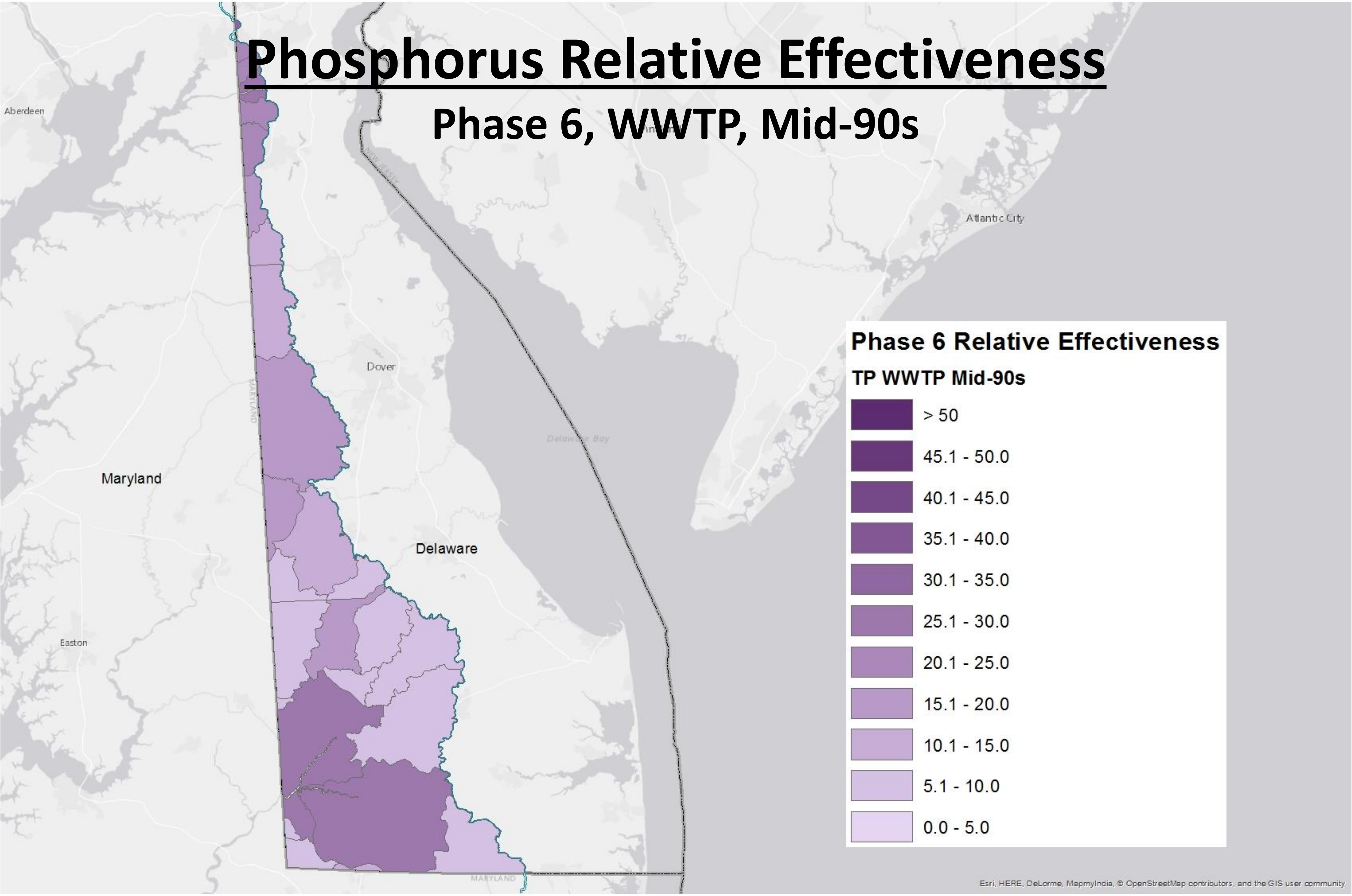
Phosphorus Relative Effectiveness

Phase 5.3.2



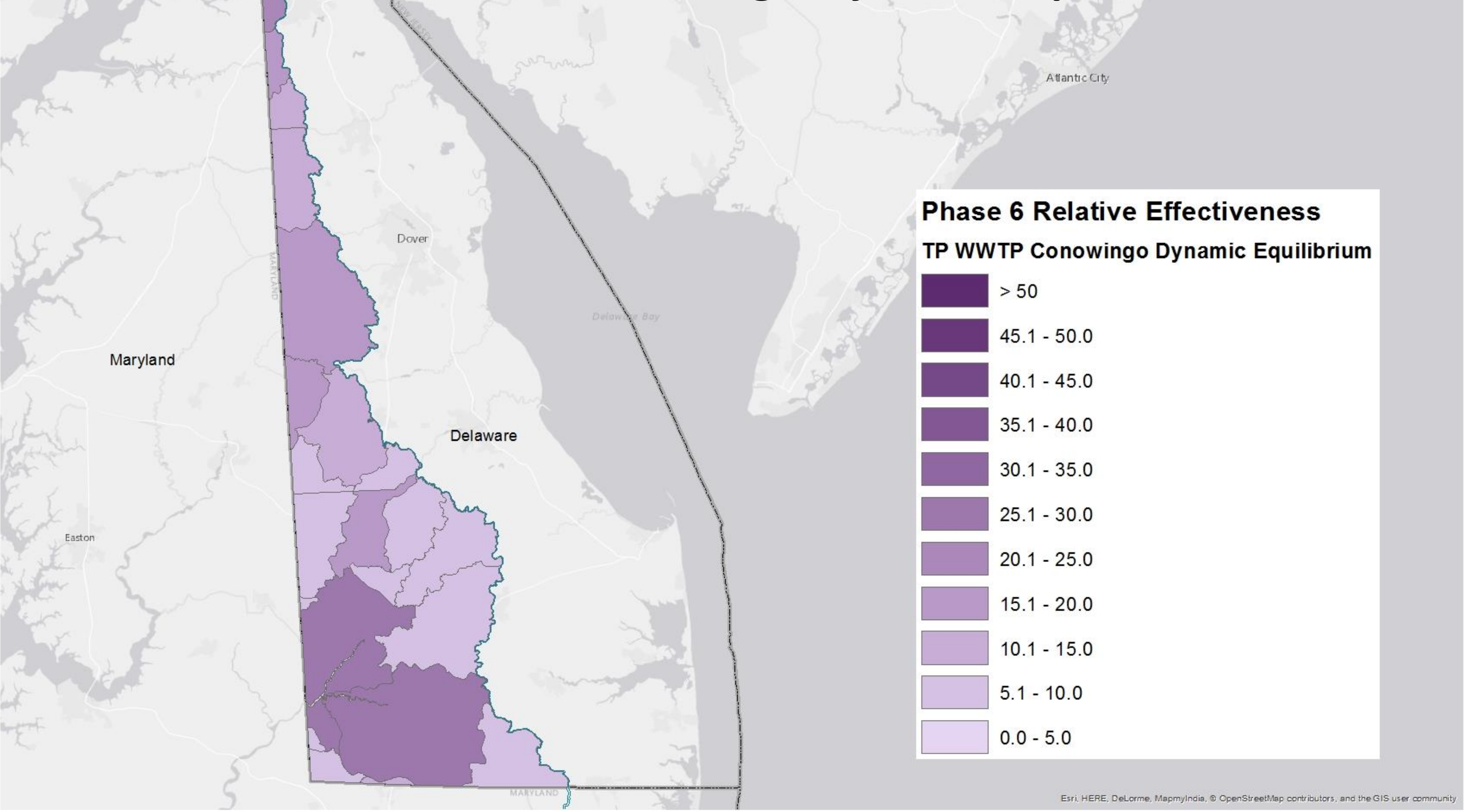
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



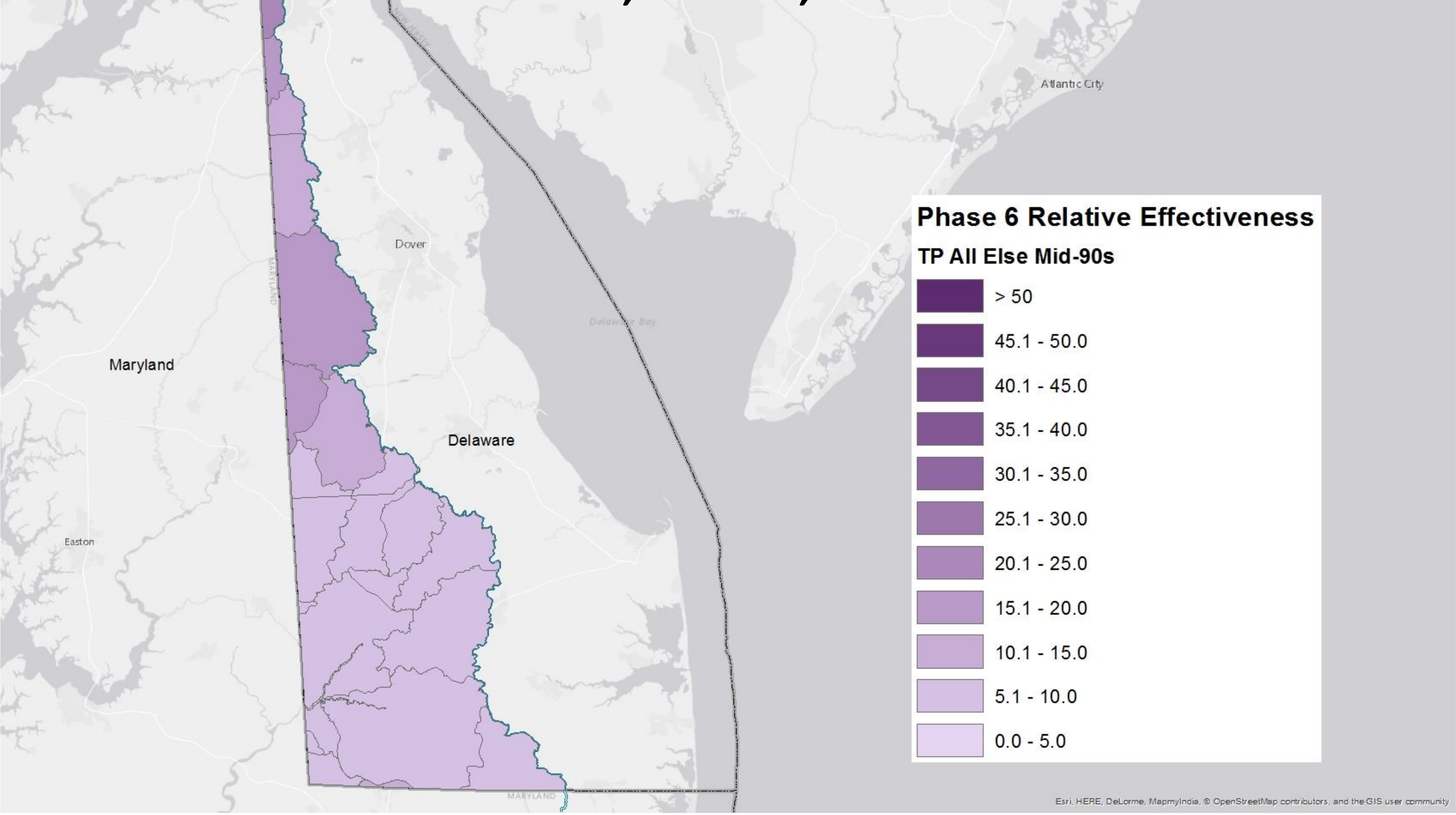
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



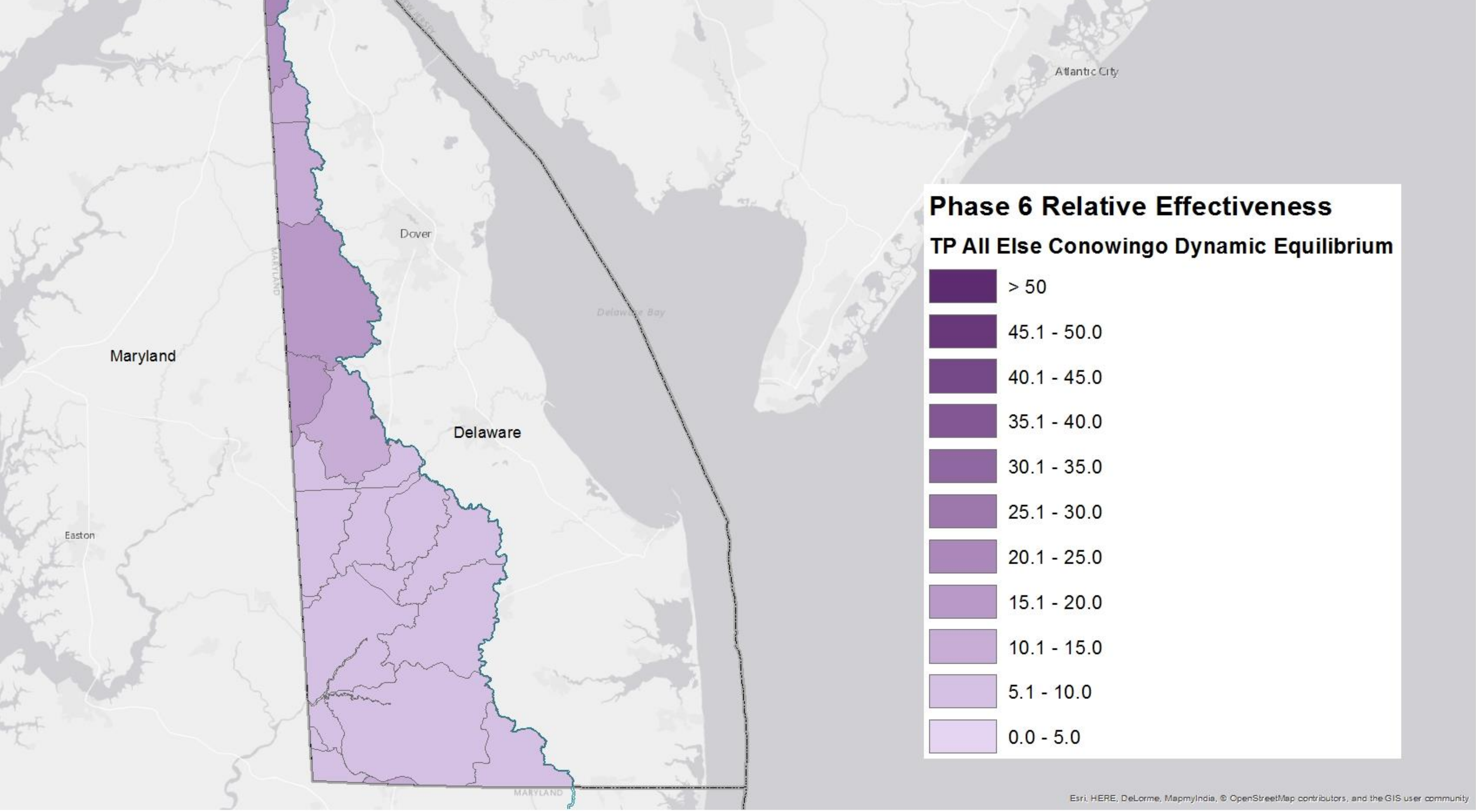
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium

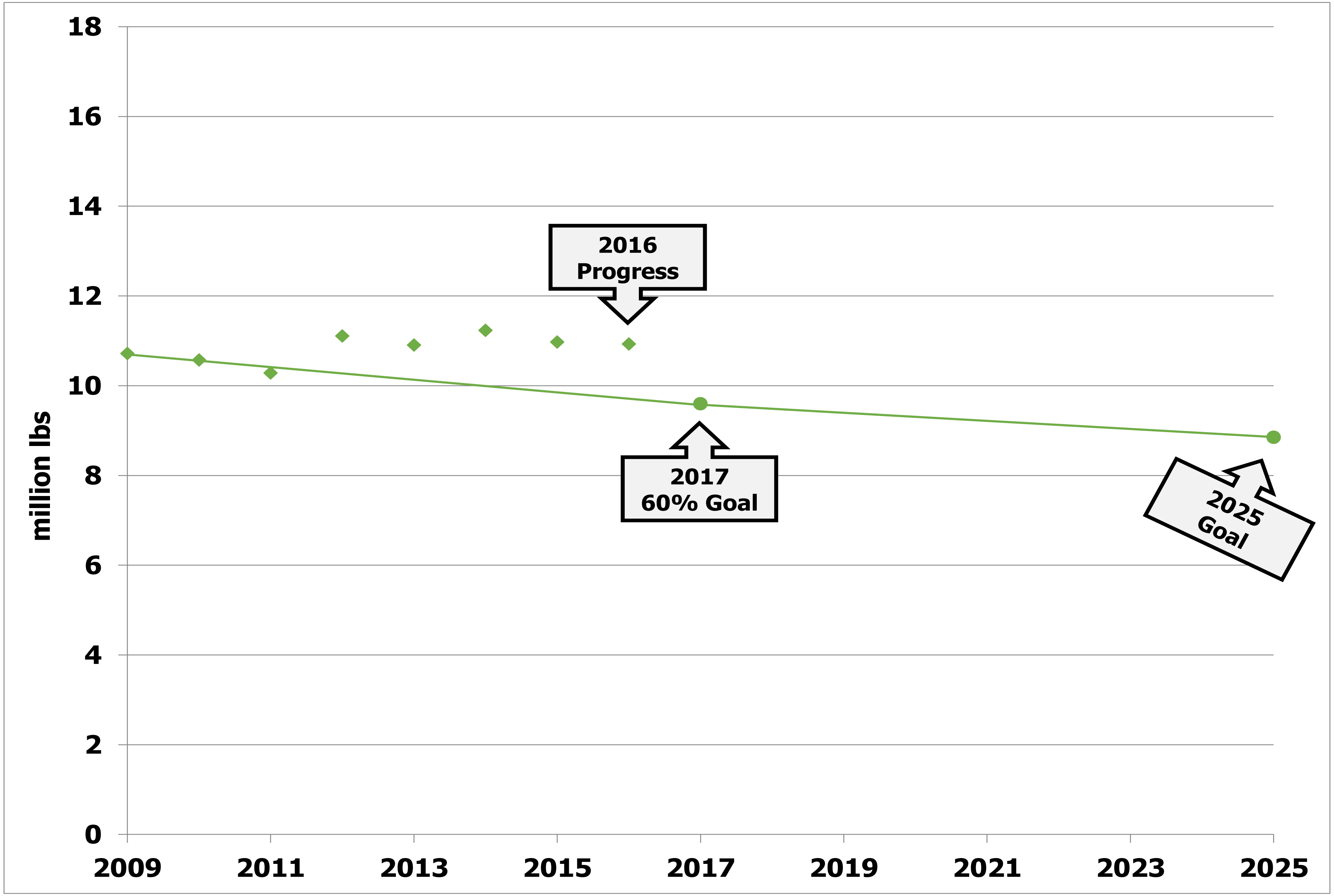


NY Draft Phase III WIP Planning Targets + Reference Loads

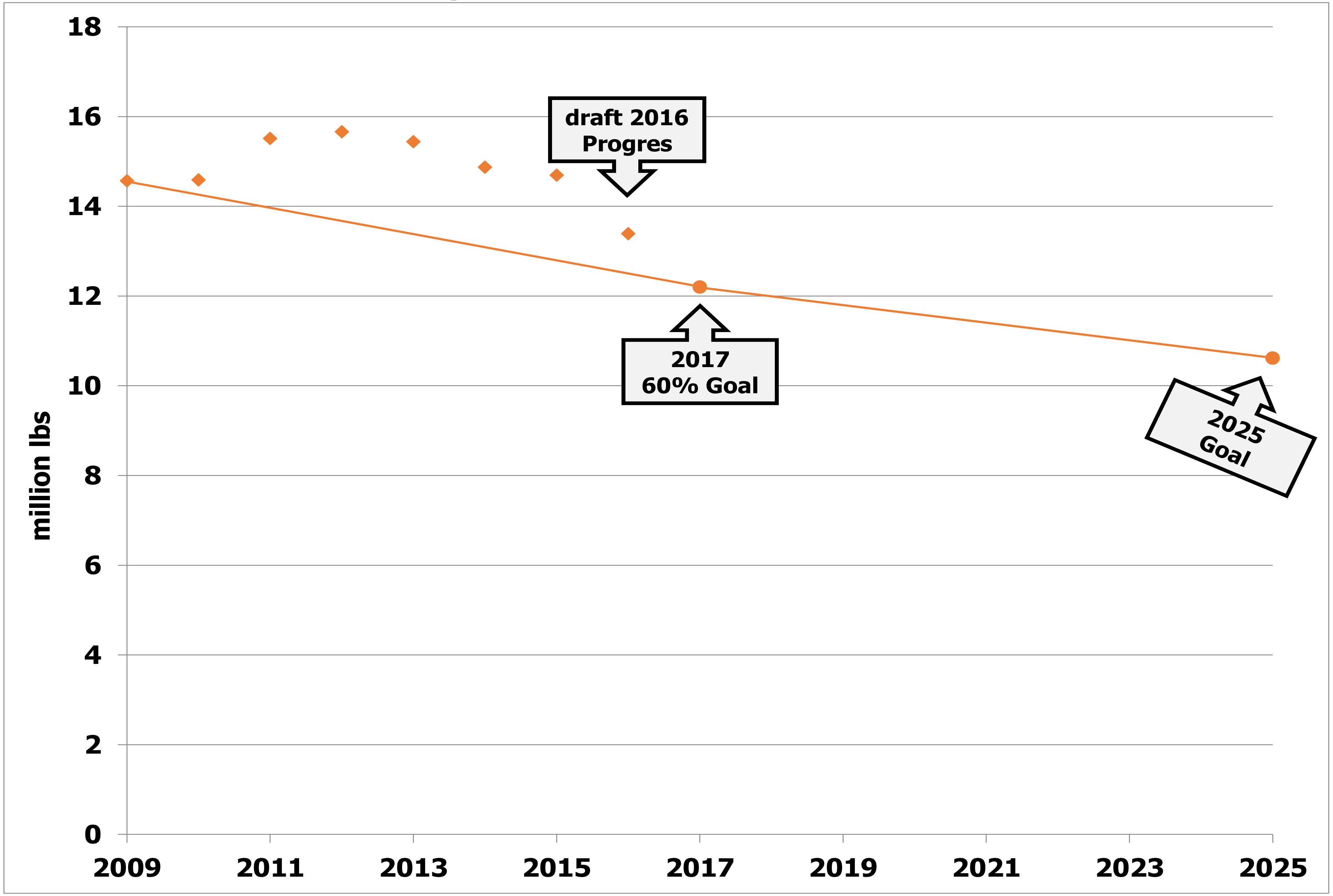
Nitrogen Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
NY Susquehanna	17.38	7.94	15.44	12.14	10.62

Phosphorus Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
NY Susquehanna	1.083	0.343	0.710	0.528	0.491

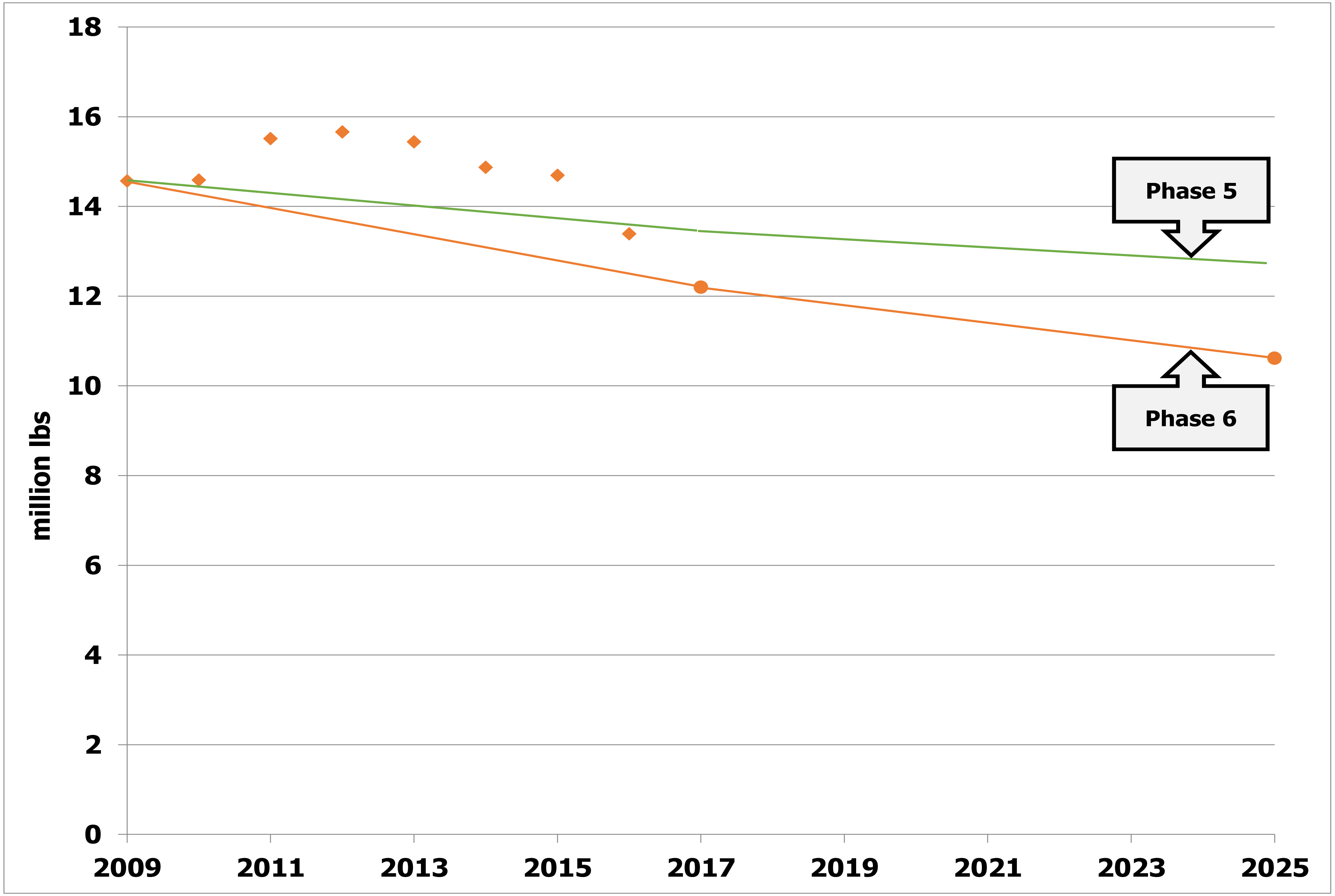
NY Nitrogen Loads-Goals, Phase 5.3.2



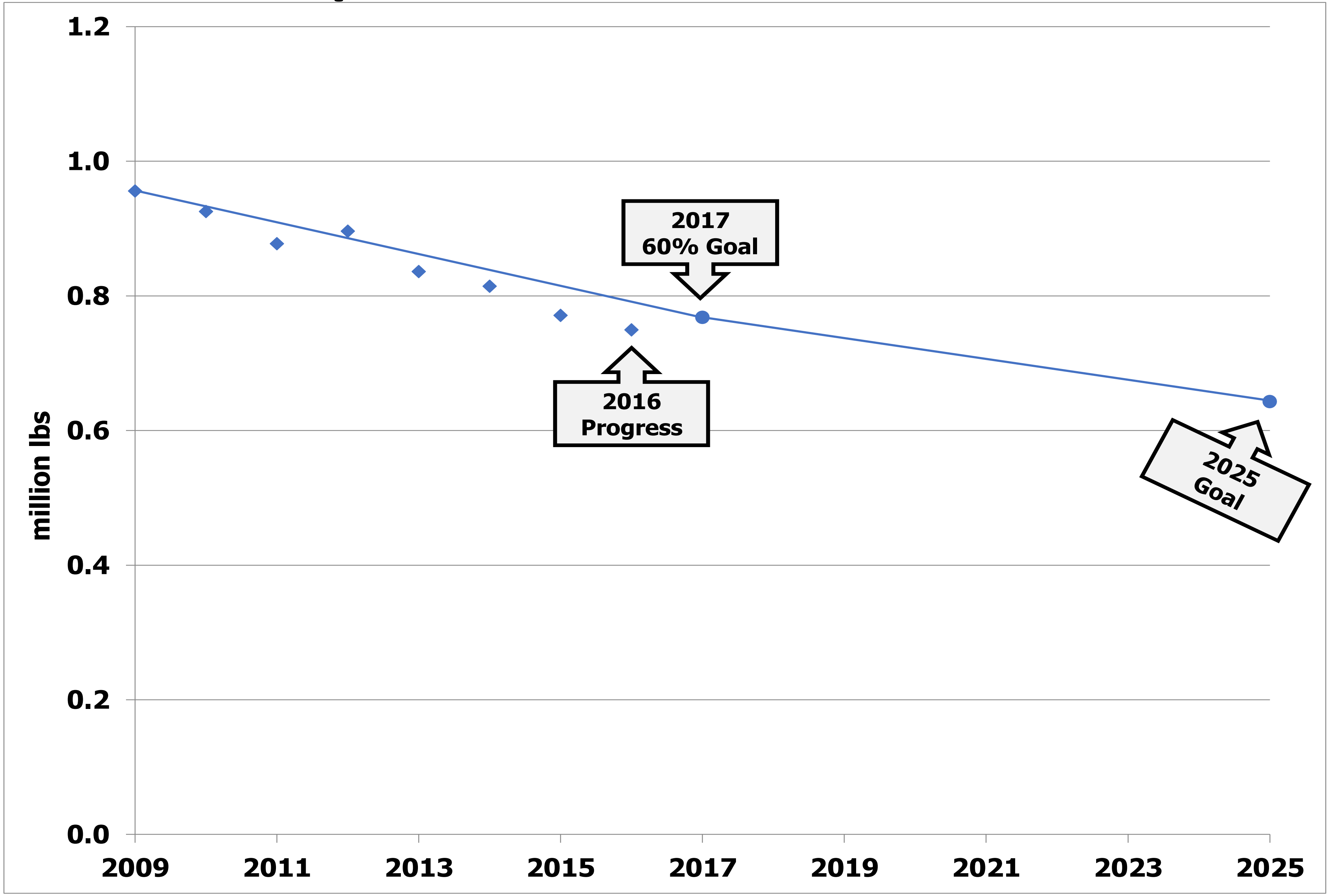
NY Nitrogen Loads-Goals, Phase 6



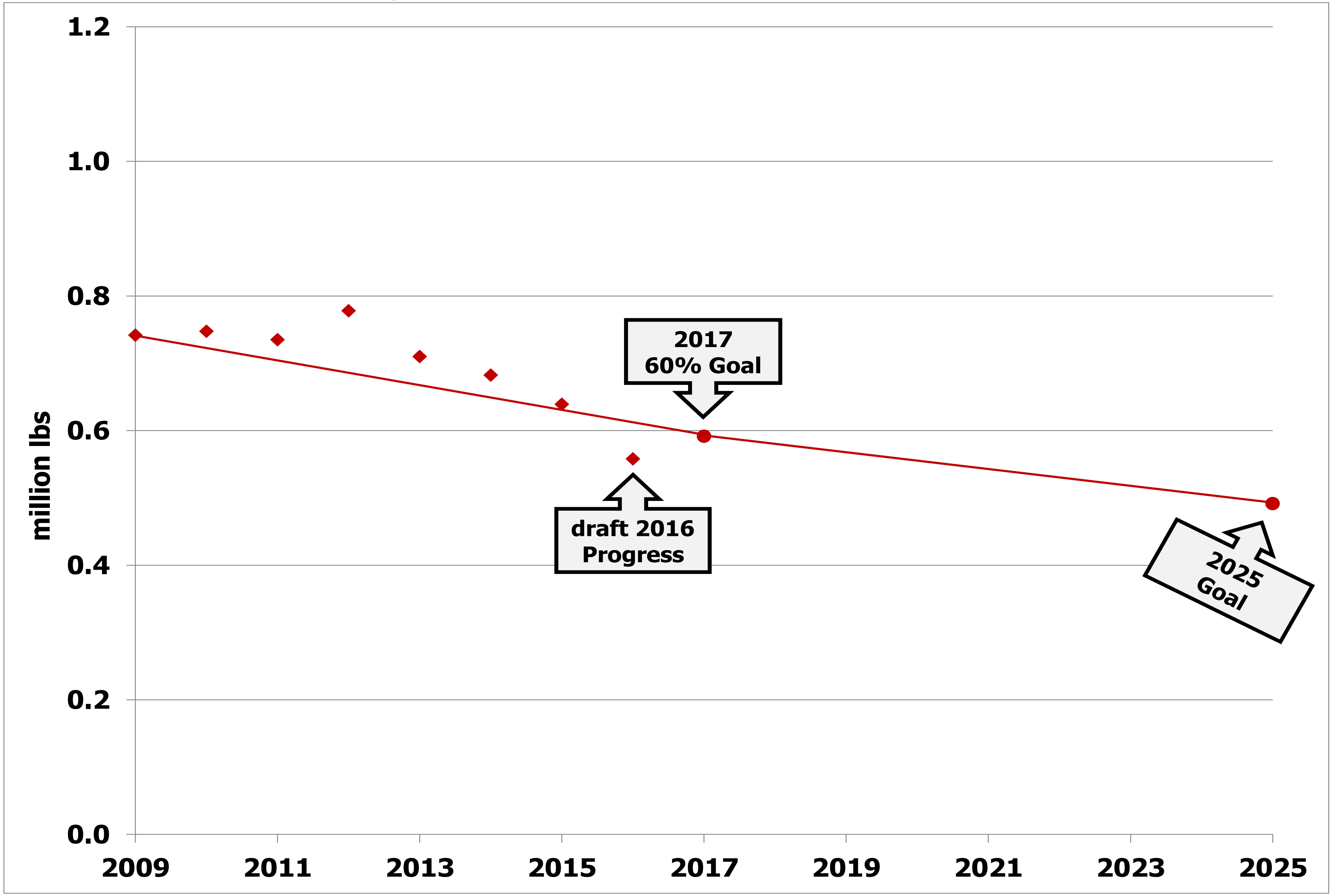
NY Nitrogen Change in LOE



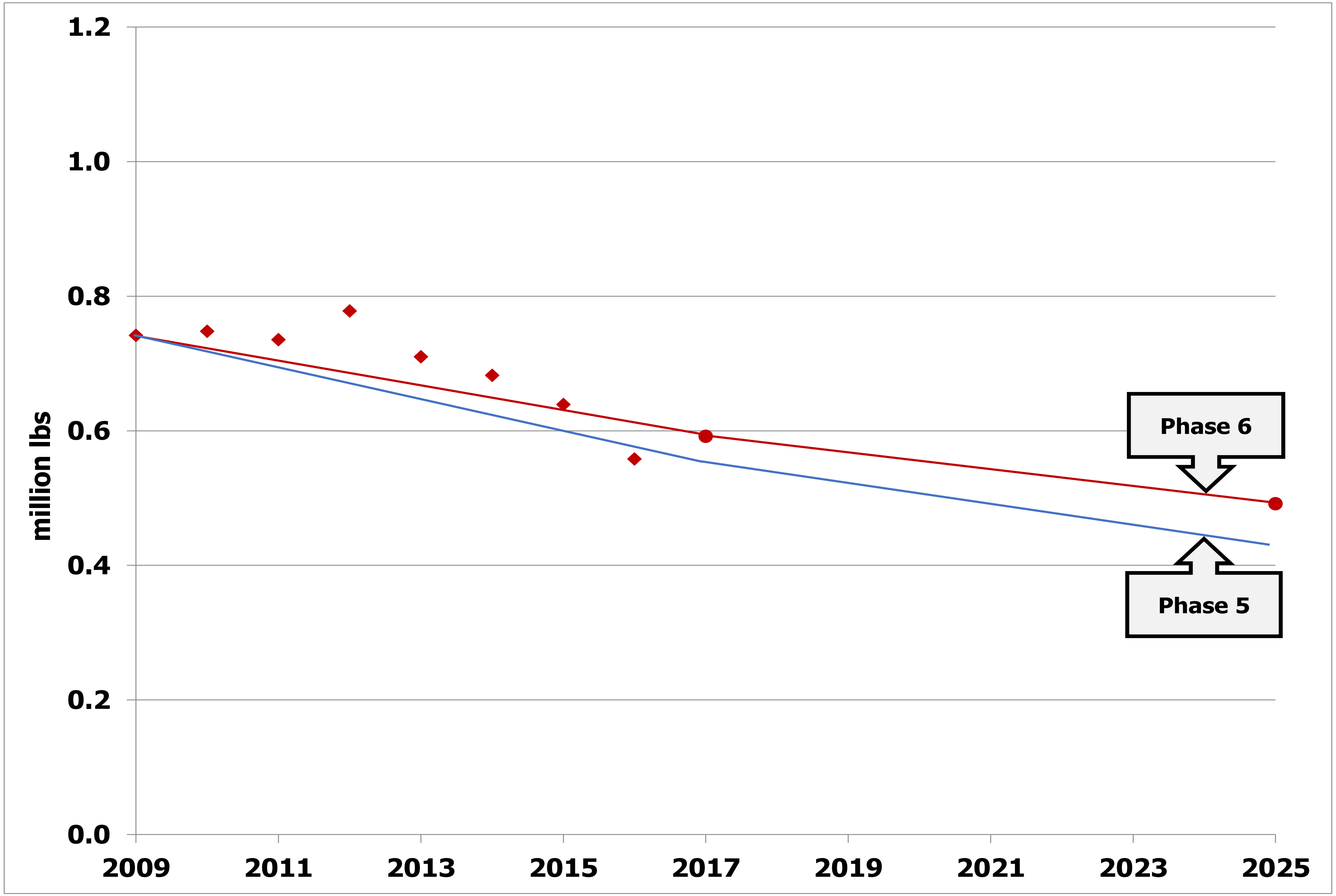
NY Phosphorus Loads-Goals, Phase 5.3.2



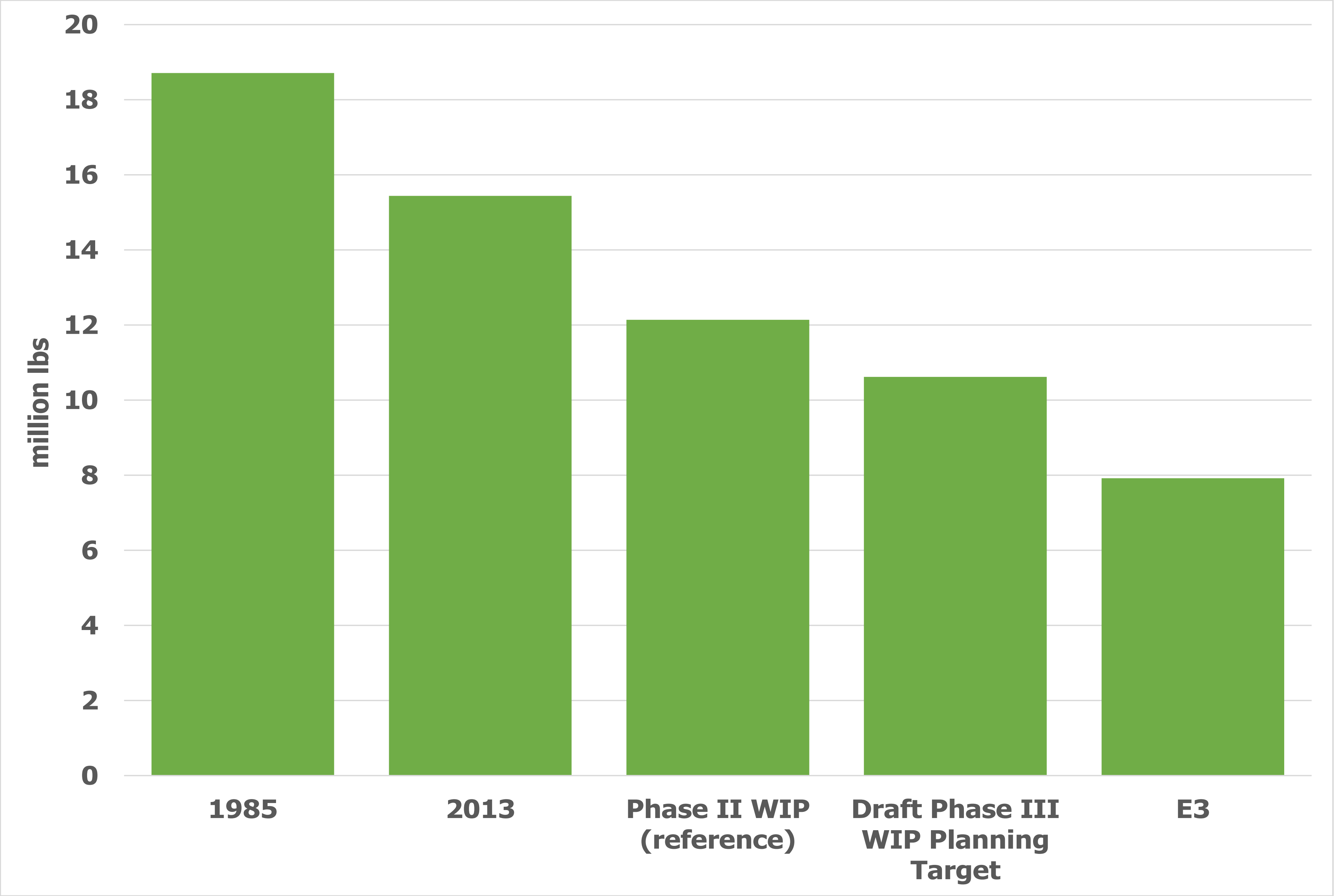
NY Phosphorus Loads-Goals, Phase 6



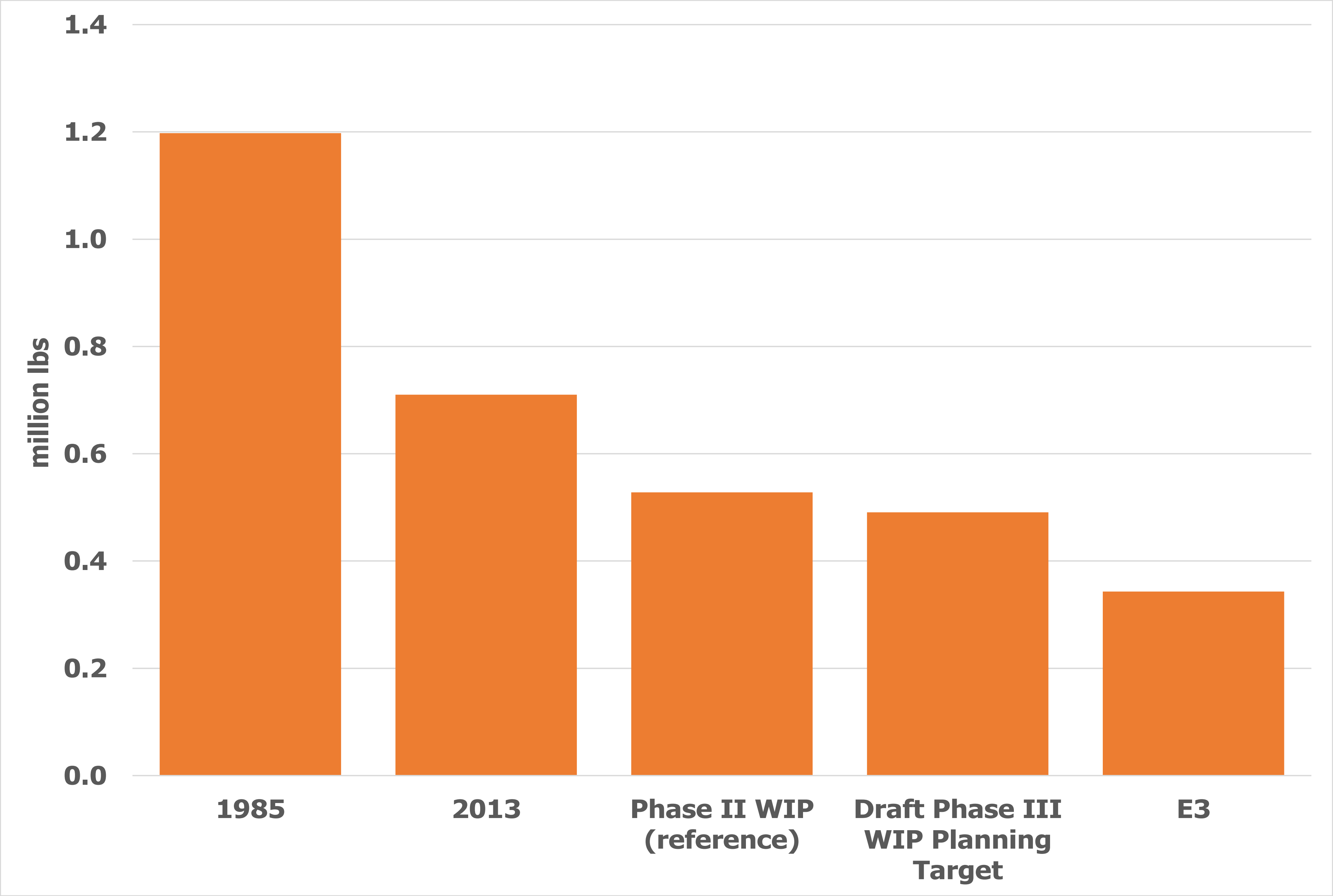
NY Phosphorus Change in LOE



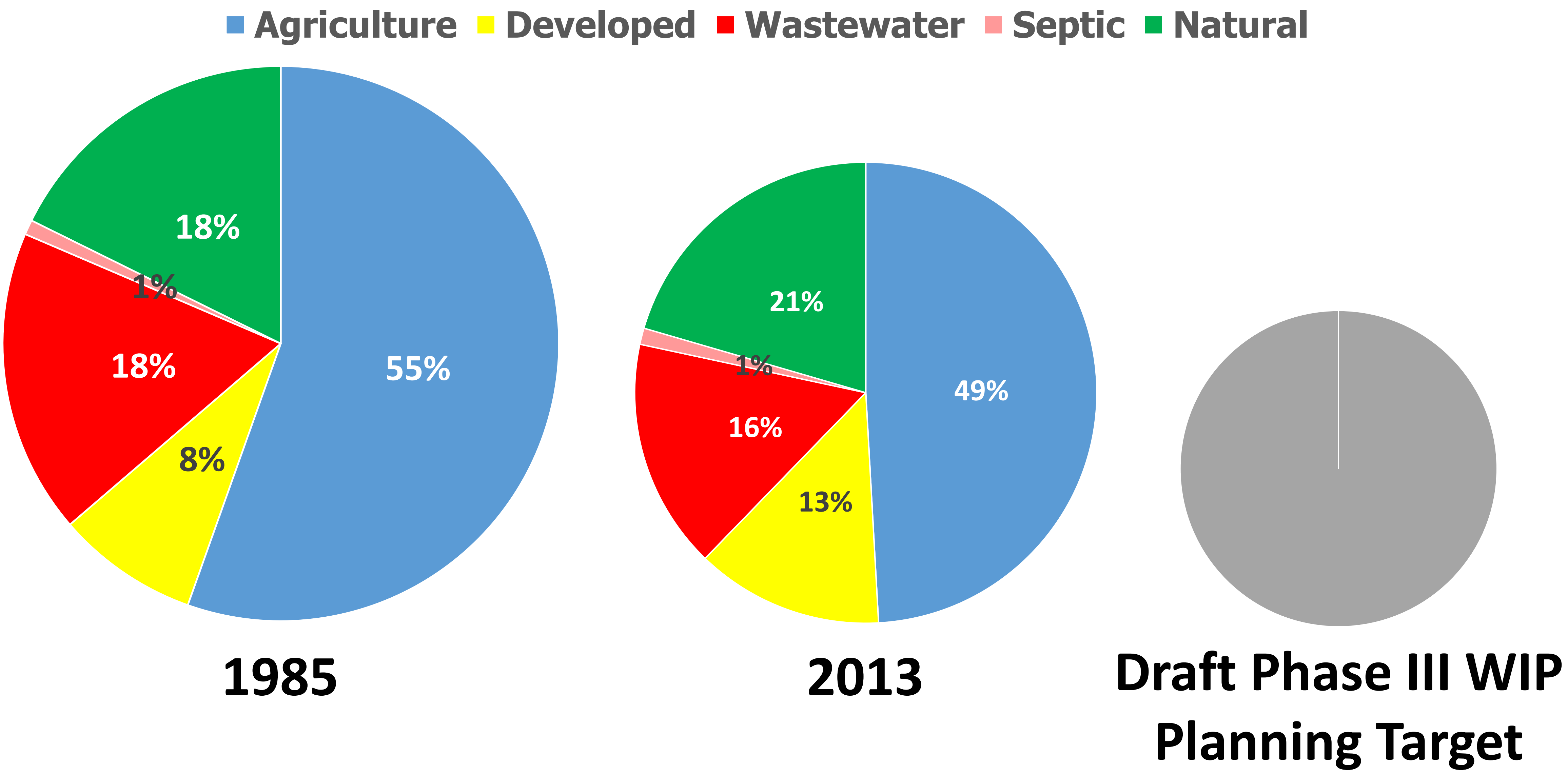
NY Nitrogen Loads, Reference Scenarios, and Target



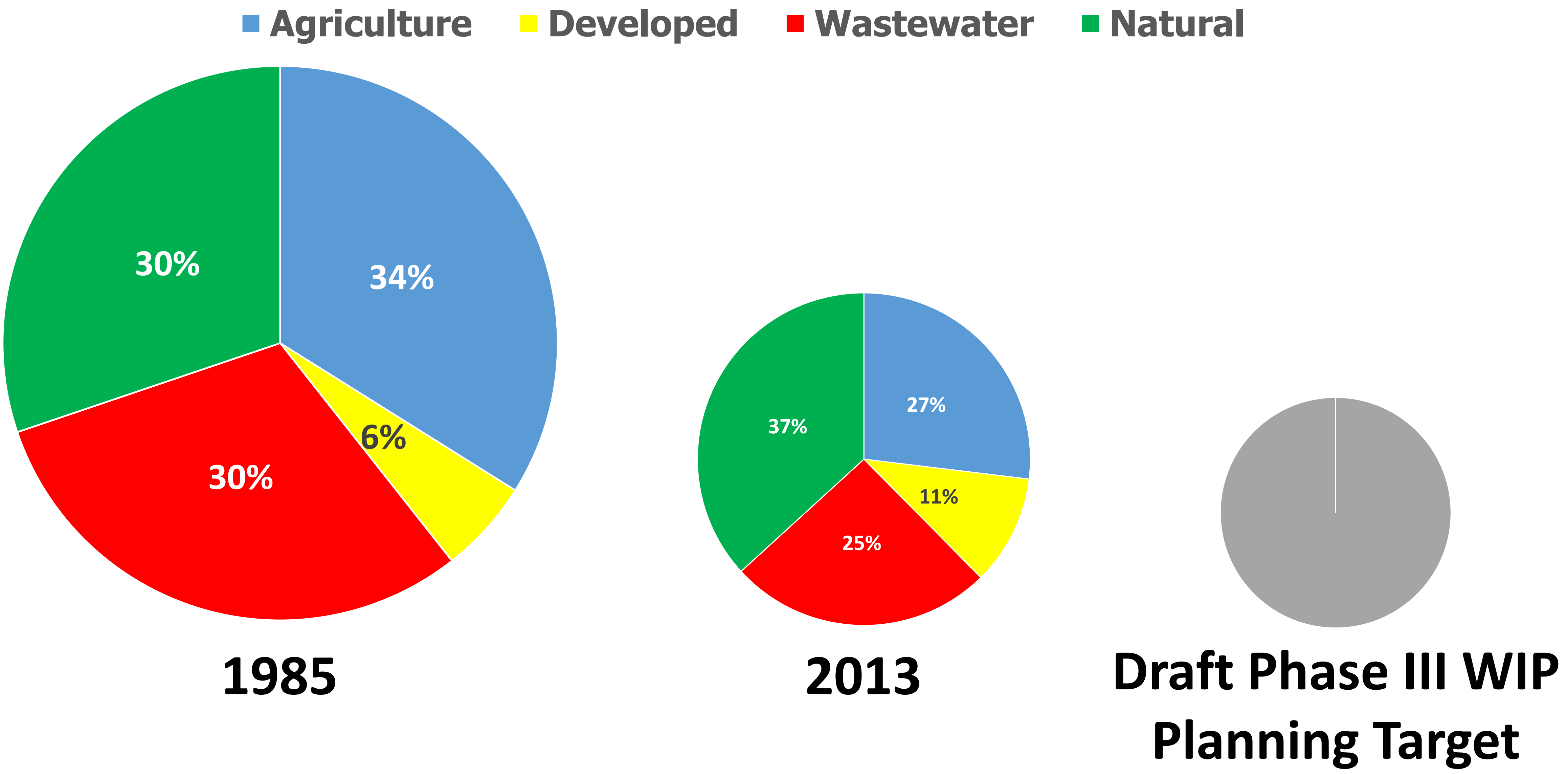
NY Phosphorus Loads, Reference Scenarios, and Target



NY Nitrogen Loads and Target

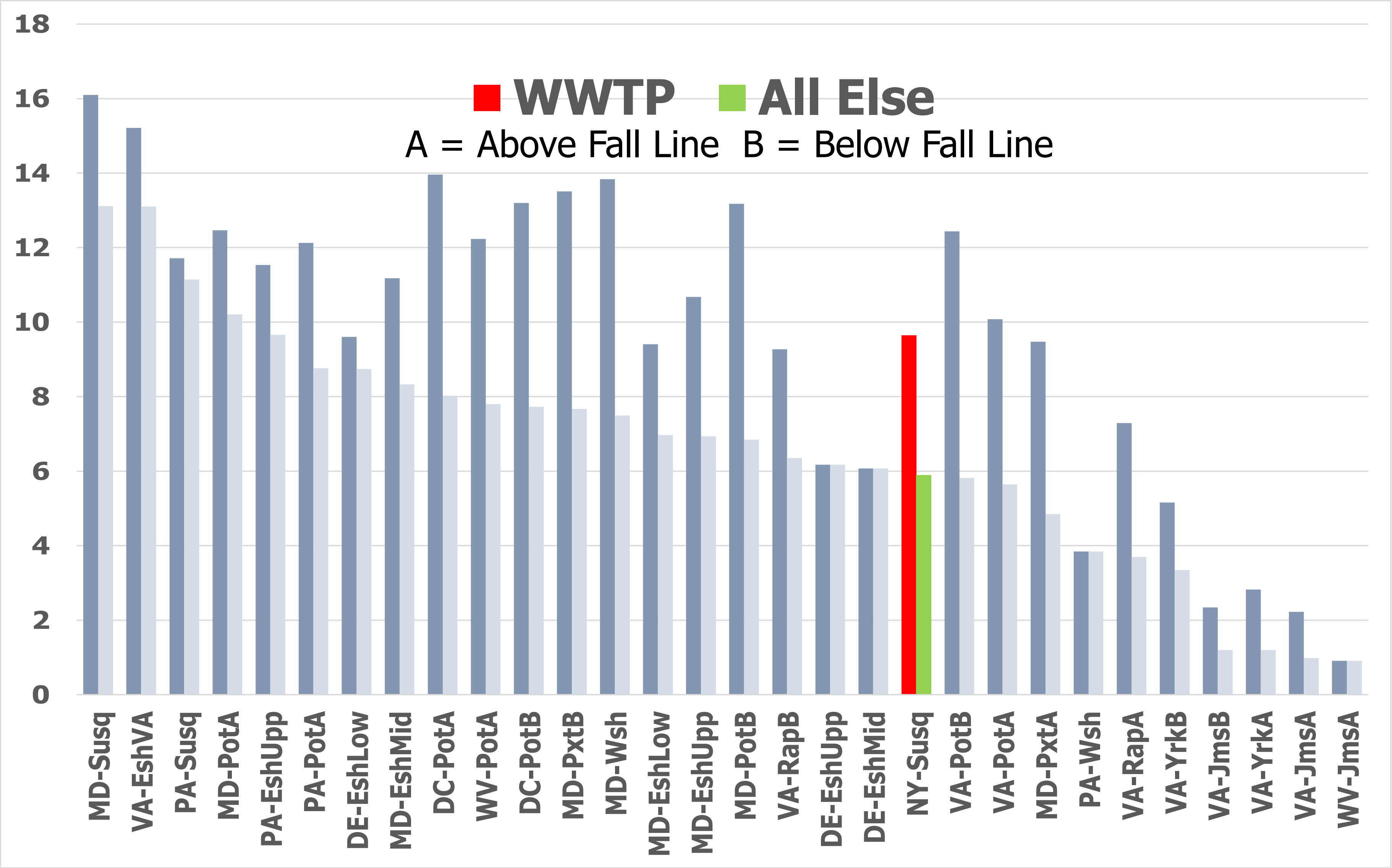


NY Phosphorus Loads and Target



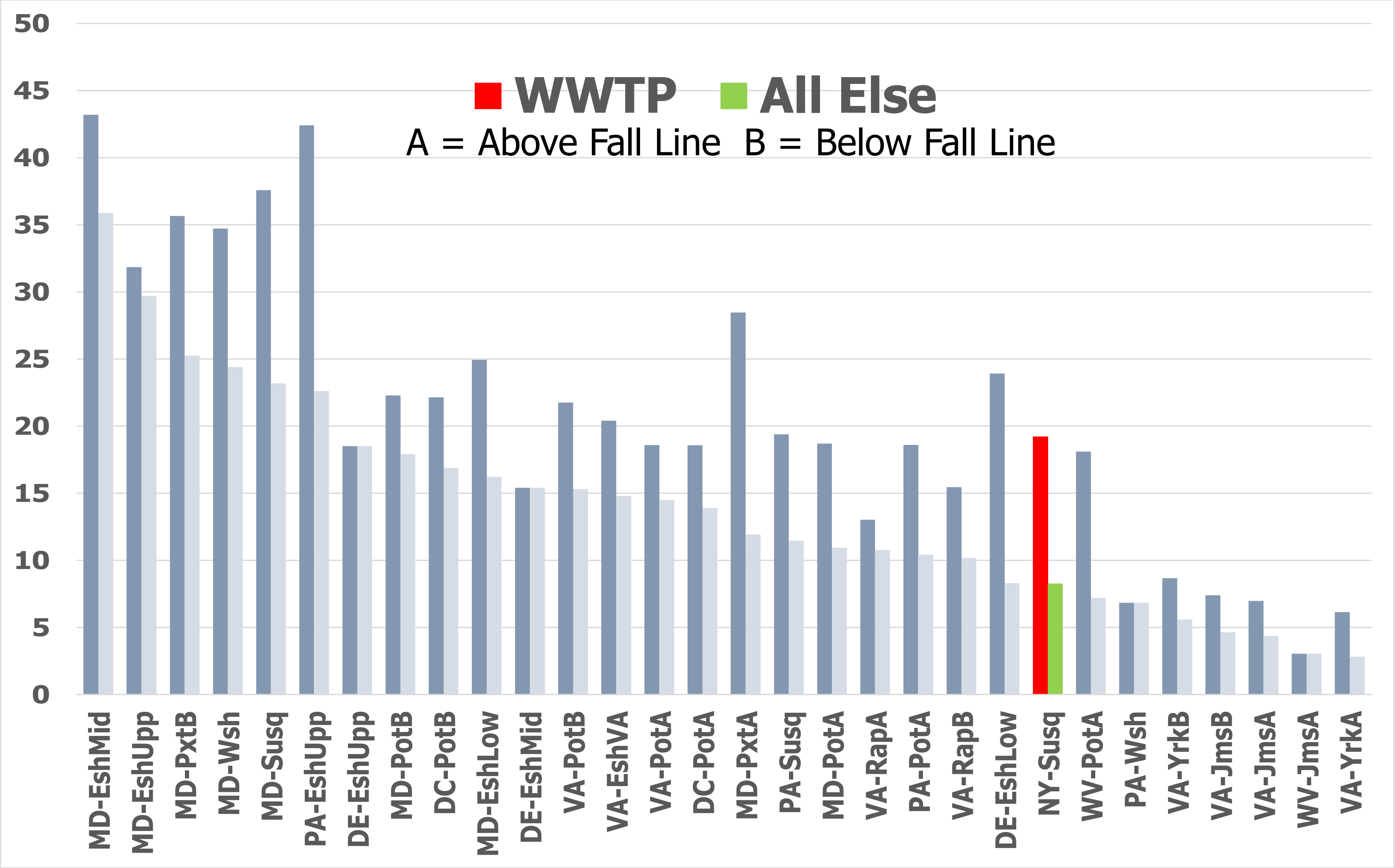
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



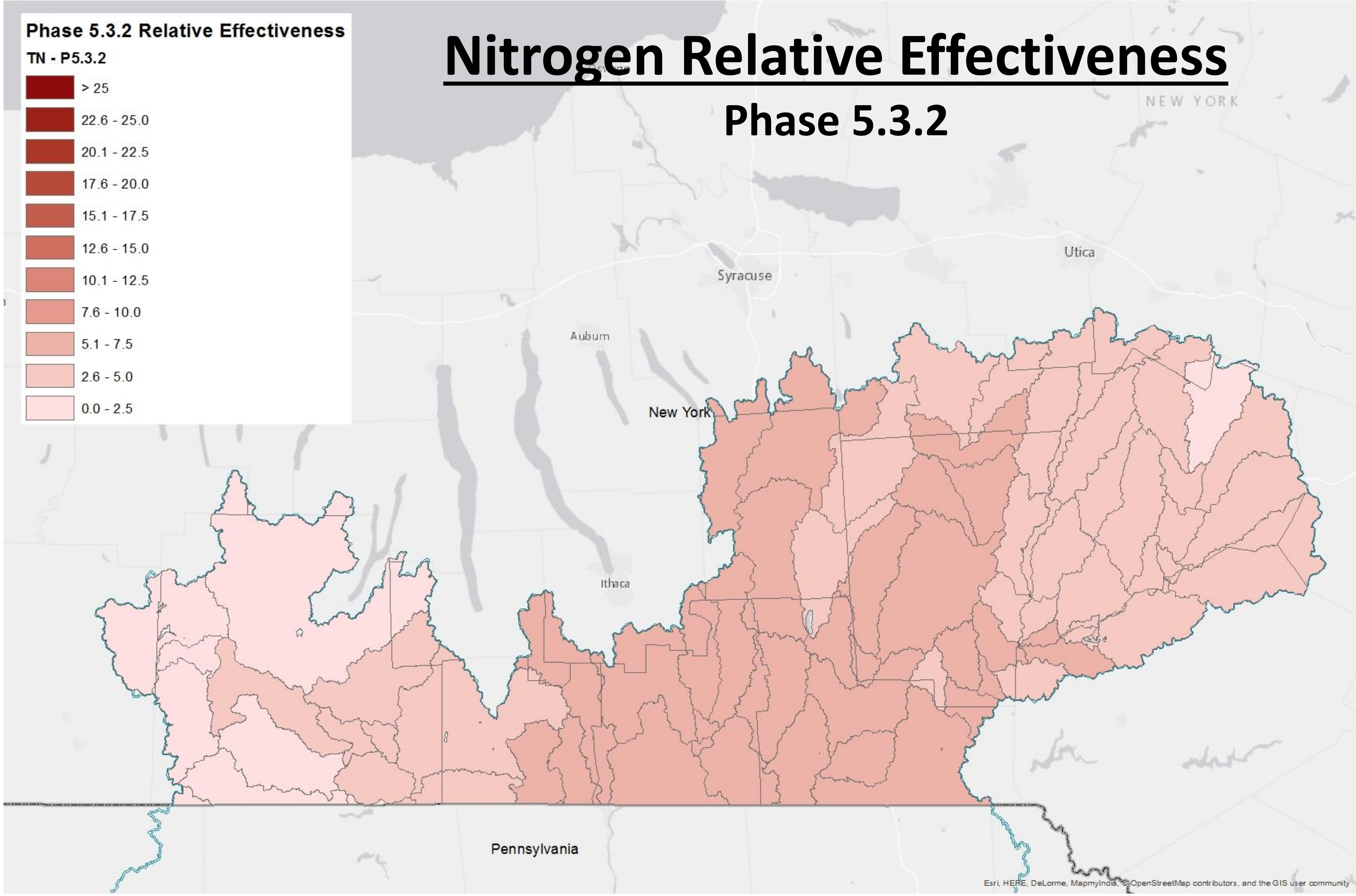
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



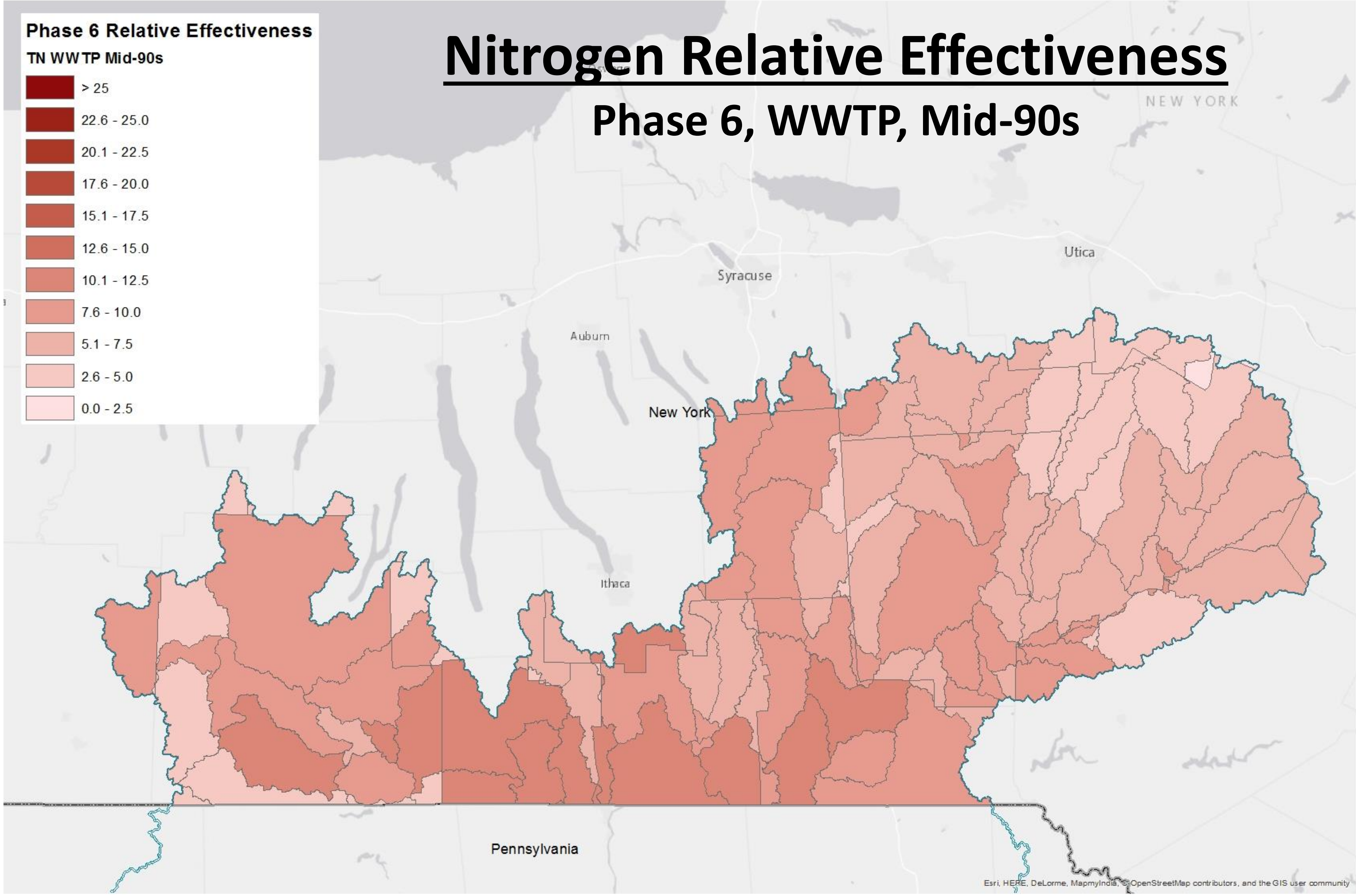
Nitrogen Relative Effectiveness

Phase 5.3.2



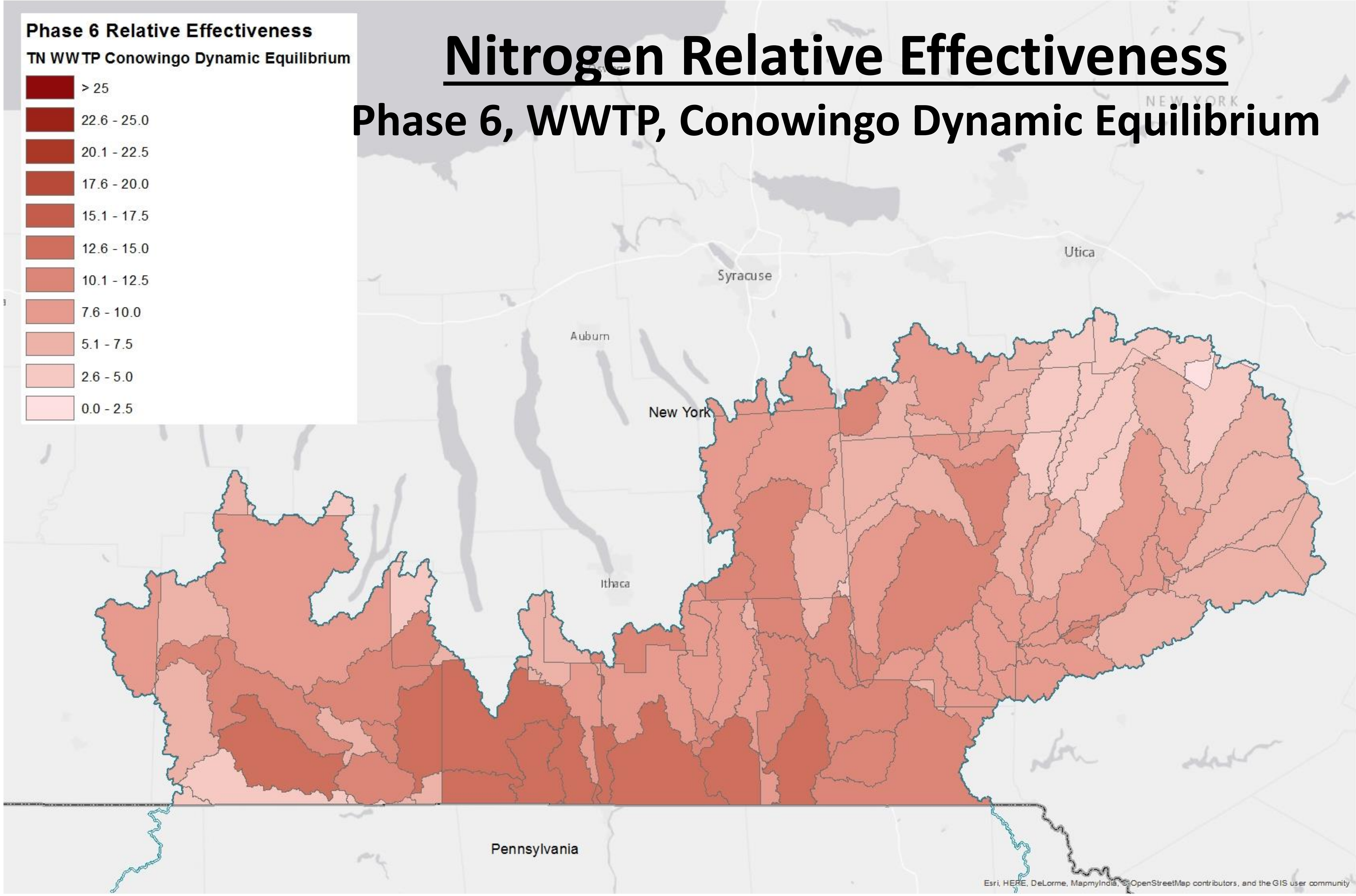
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



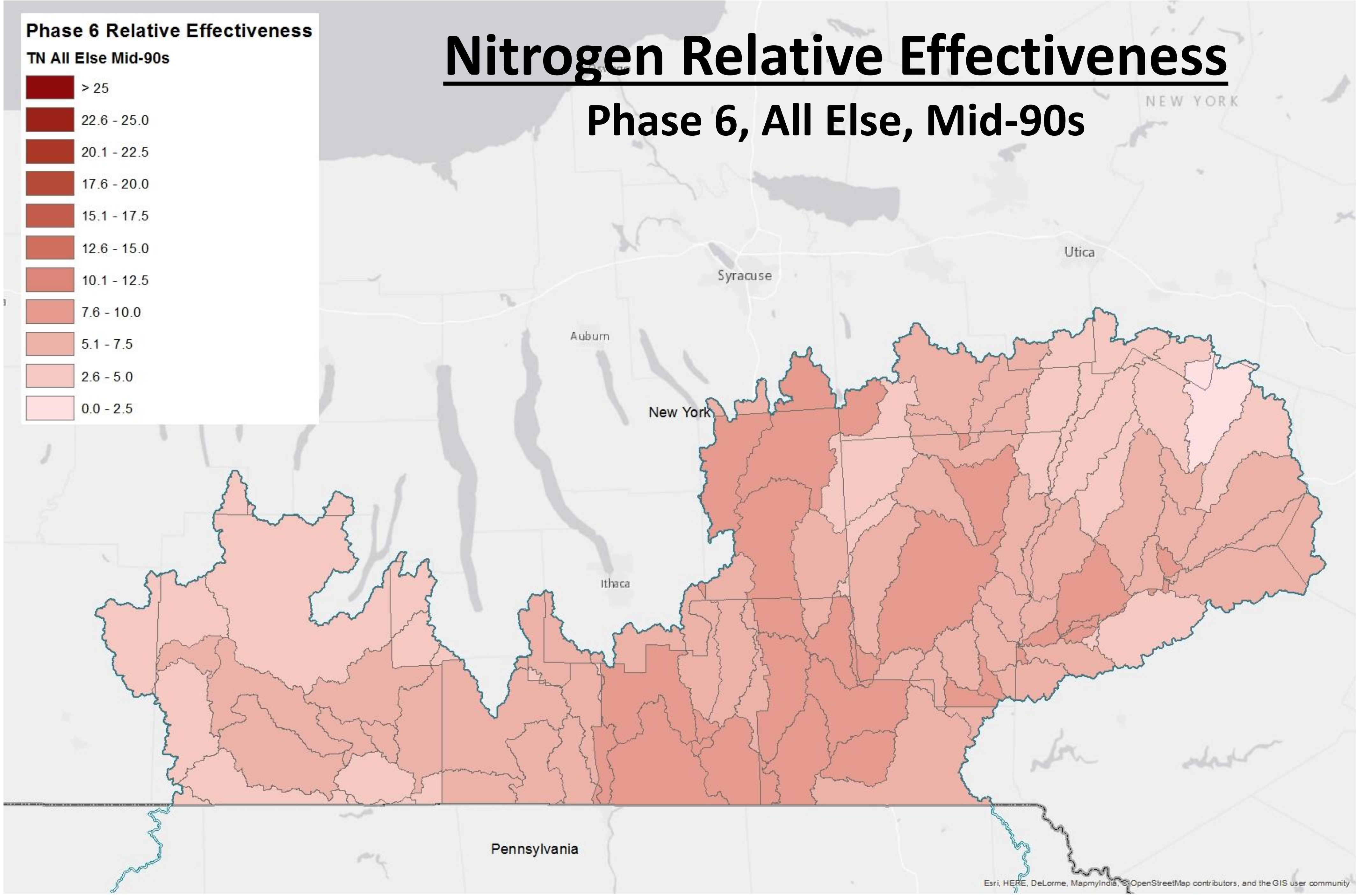
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



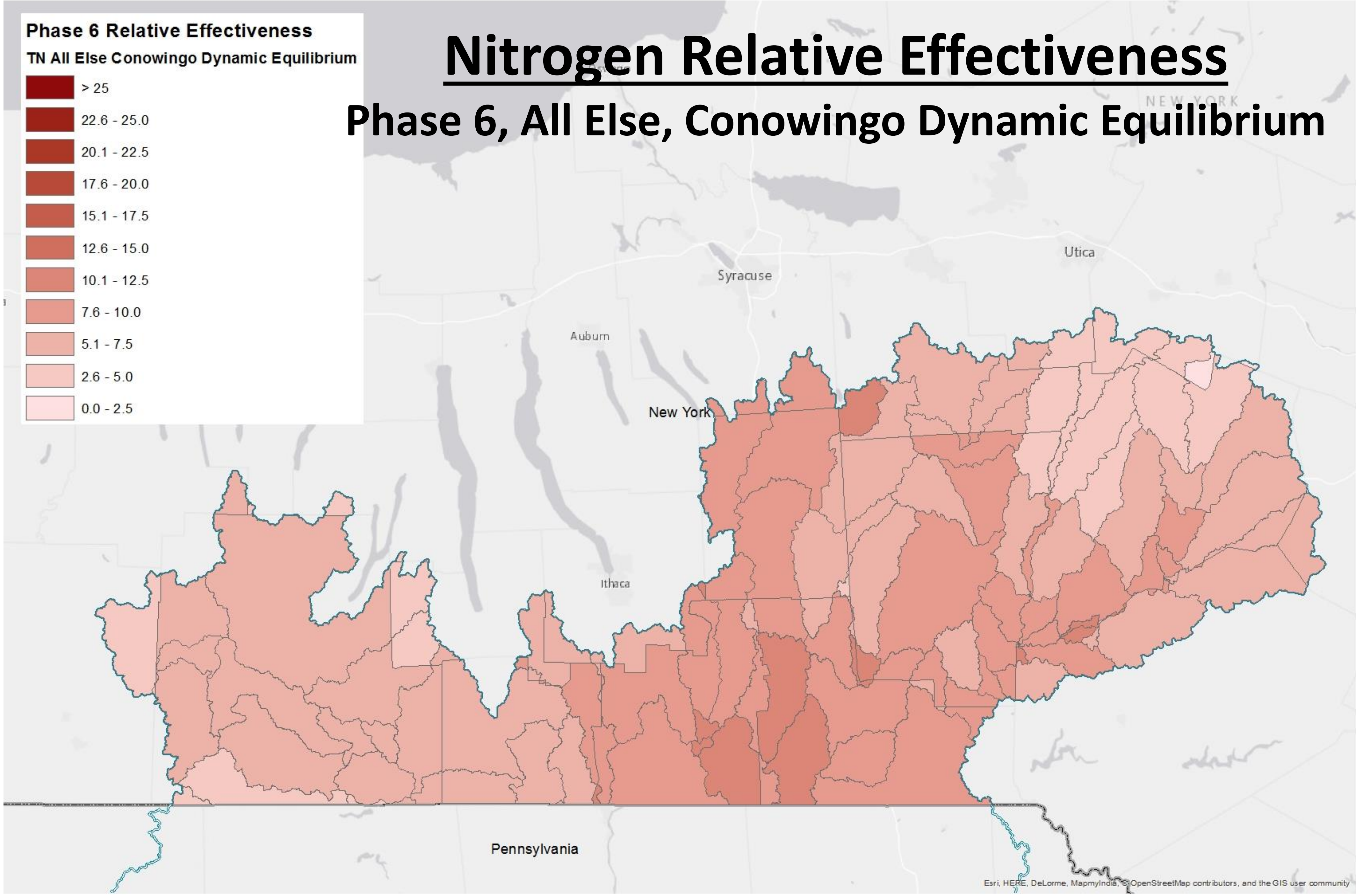
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



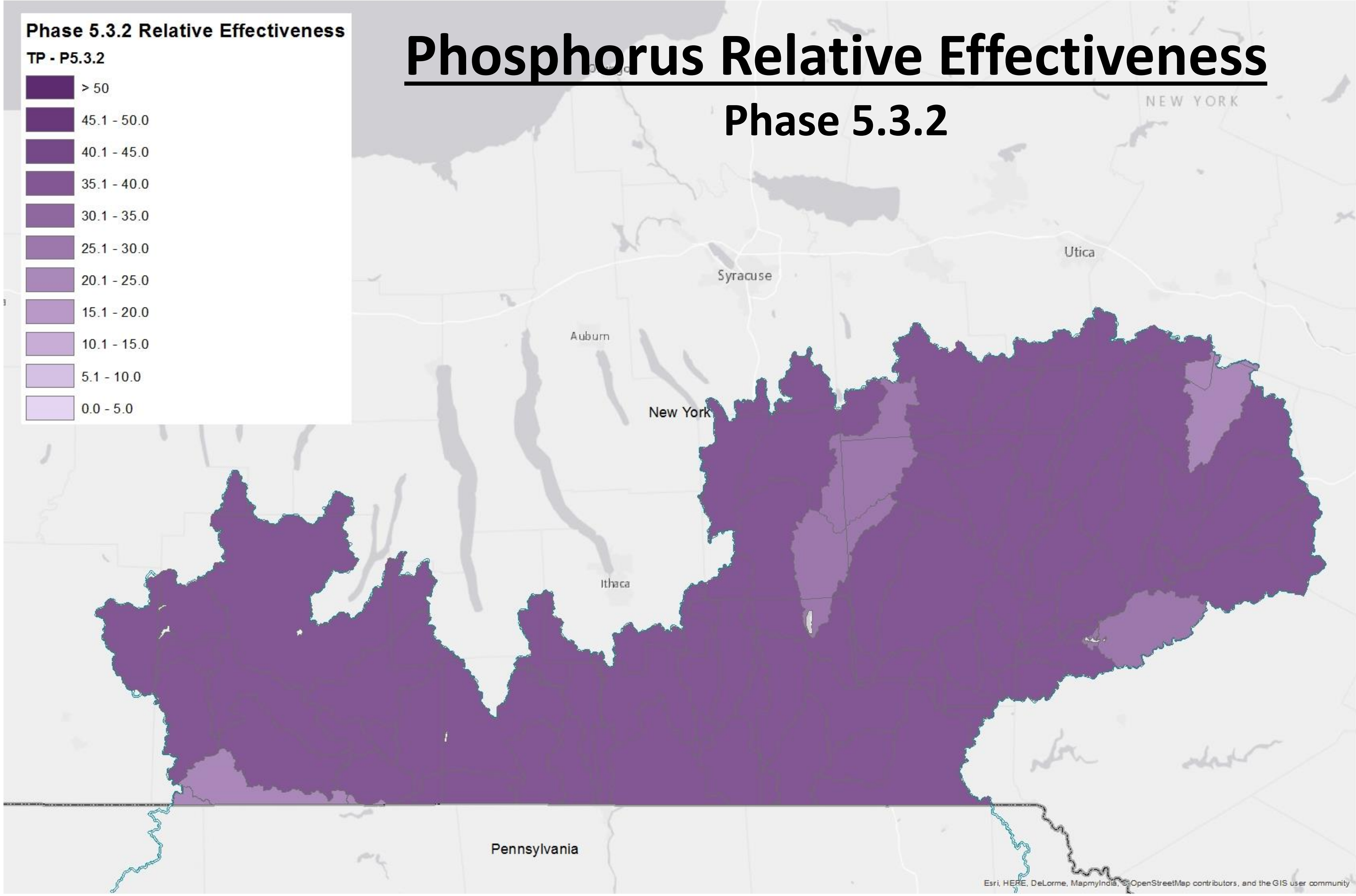
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



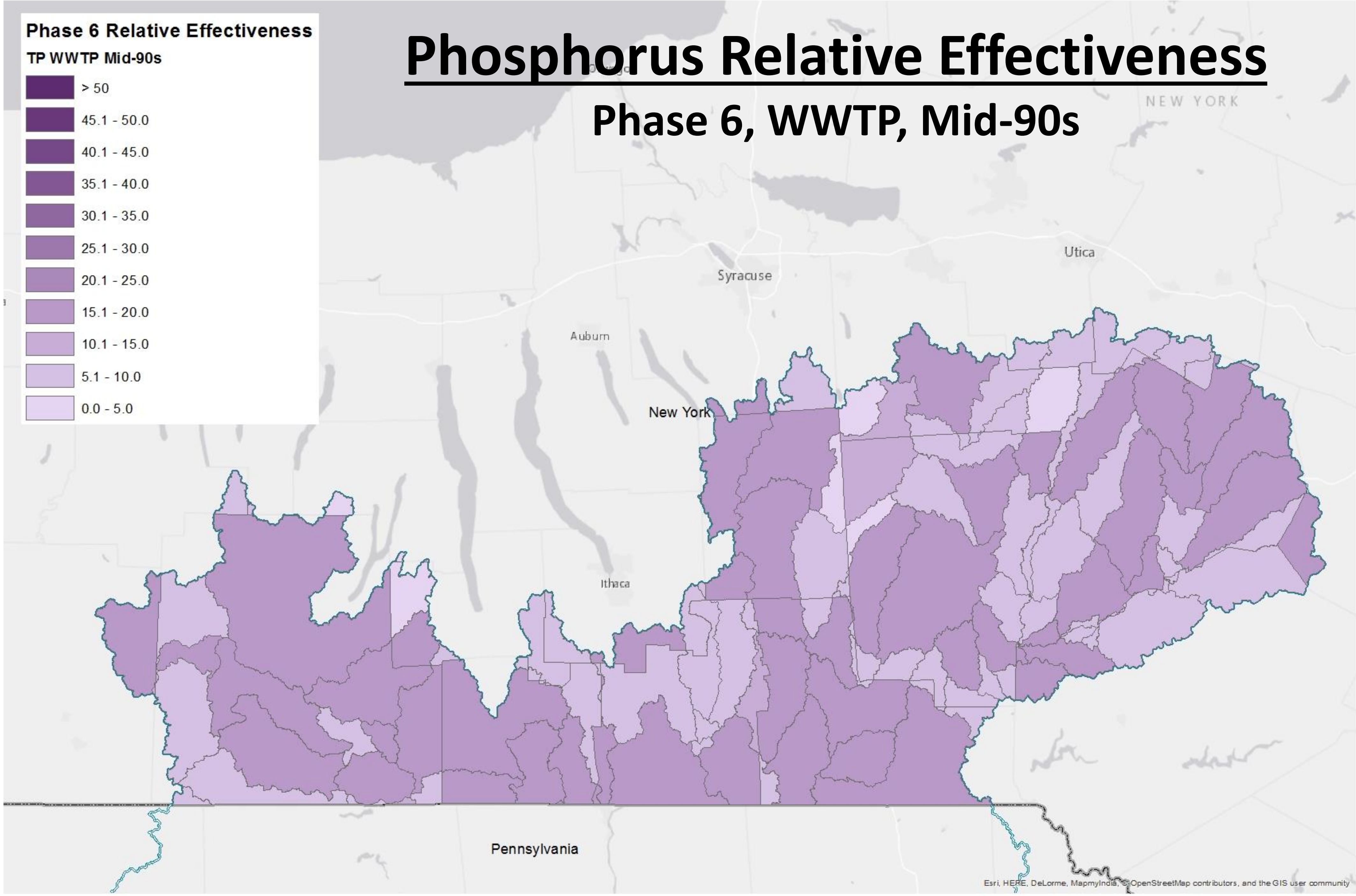
Phosphorus Relative Effectiveness

Phase 5.3.2



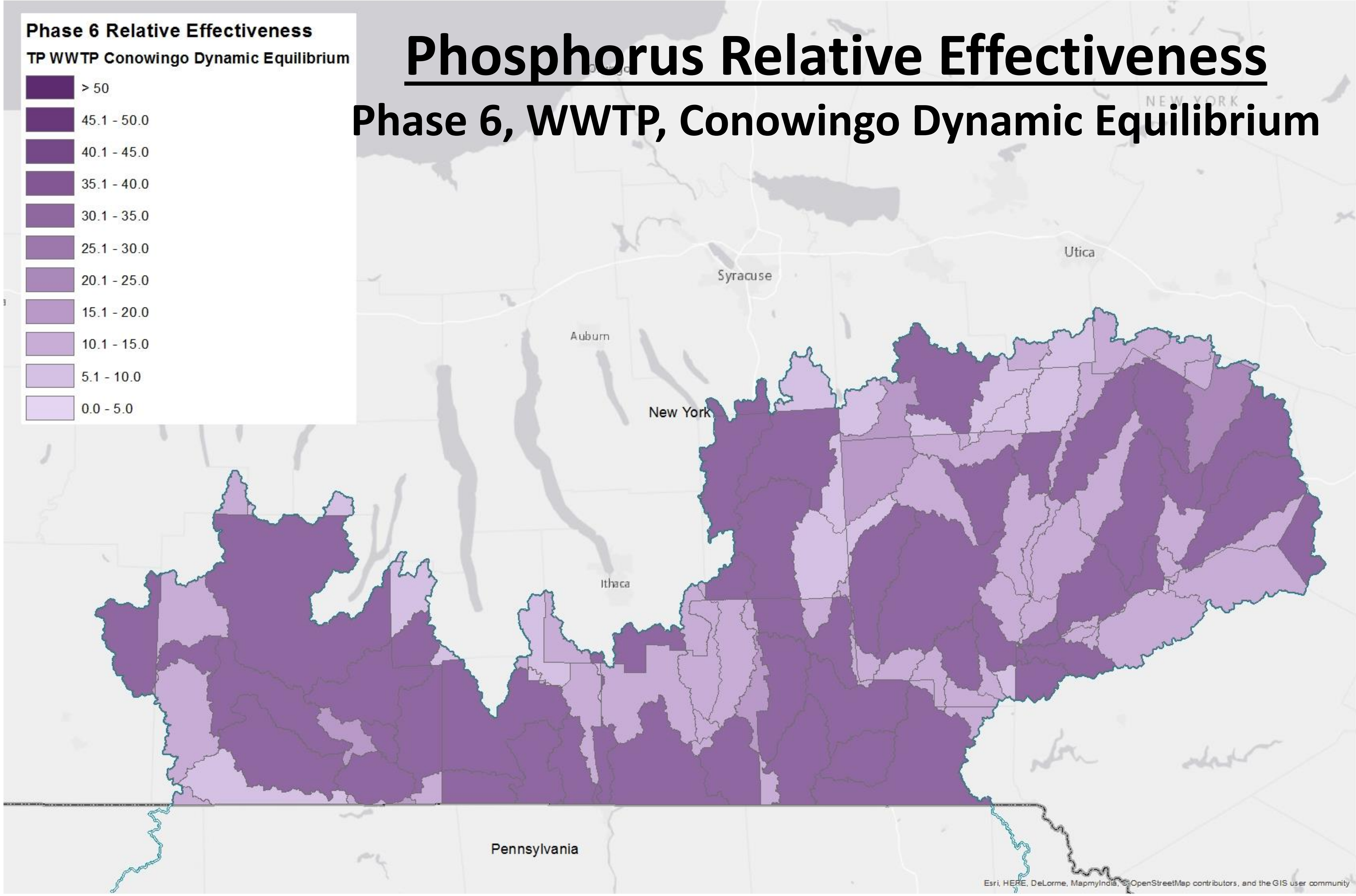
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



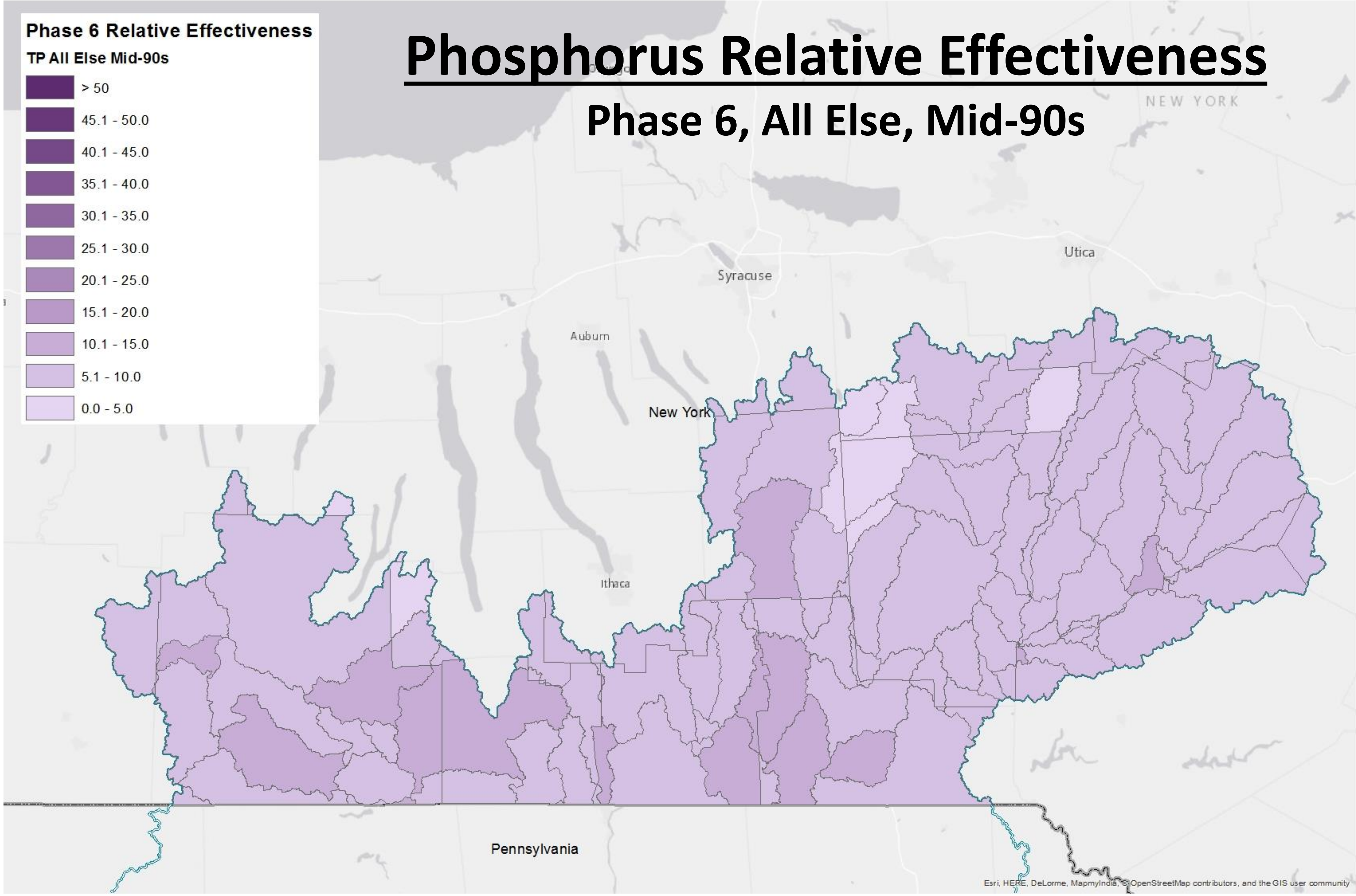
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



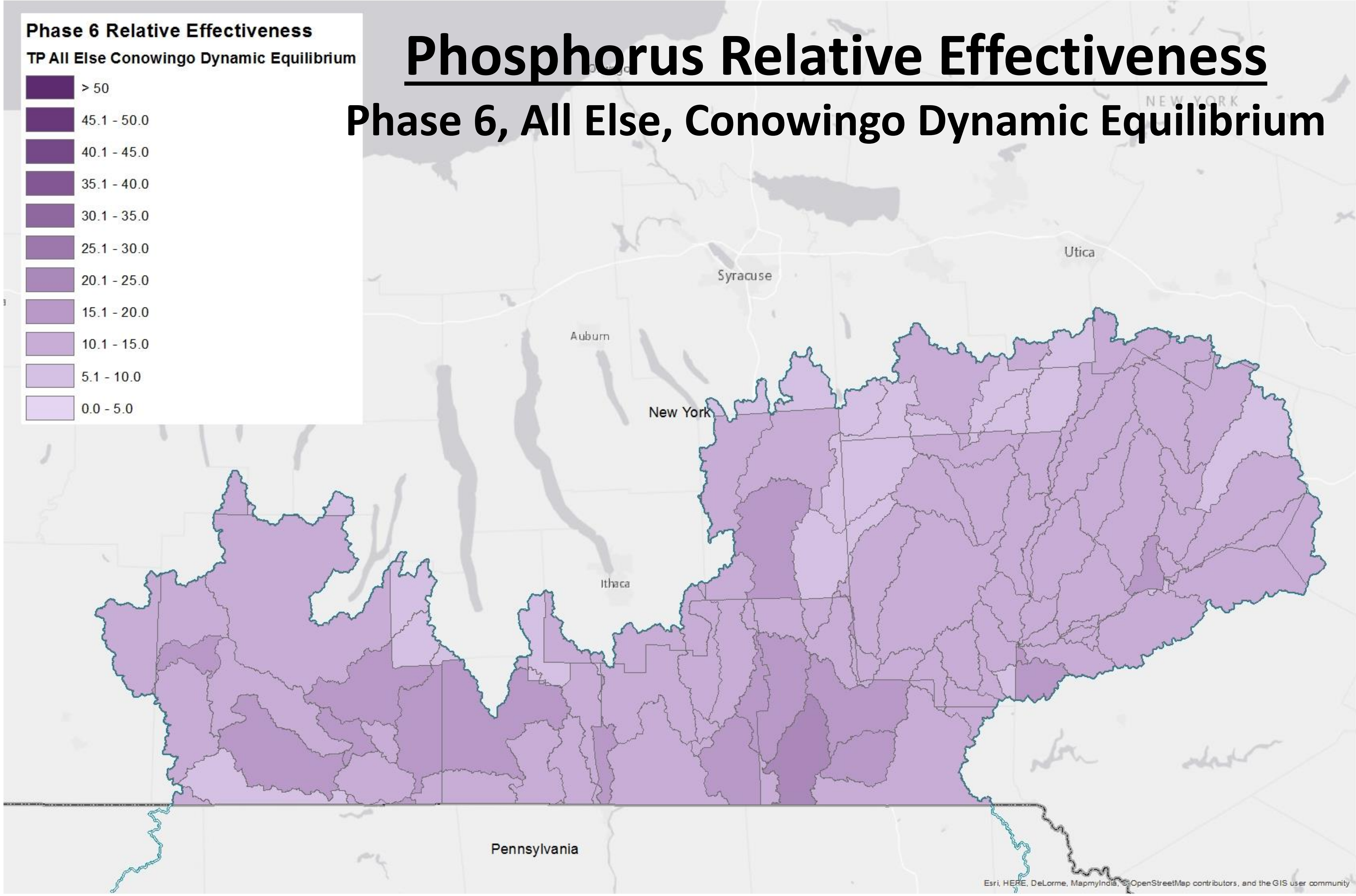
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium

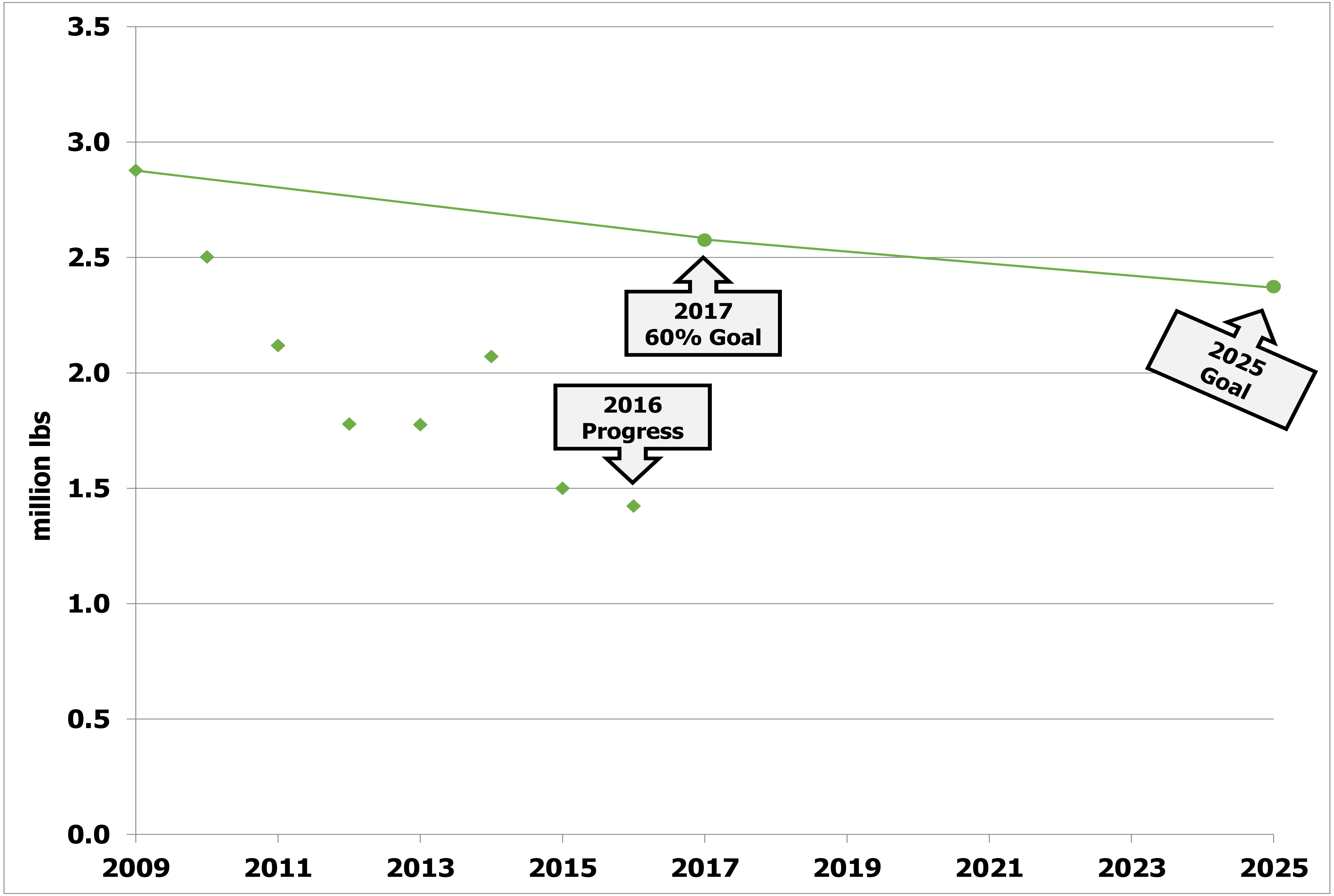


DC Draft Phase III WIP Planning Targets + Reference Loads

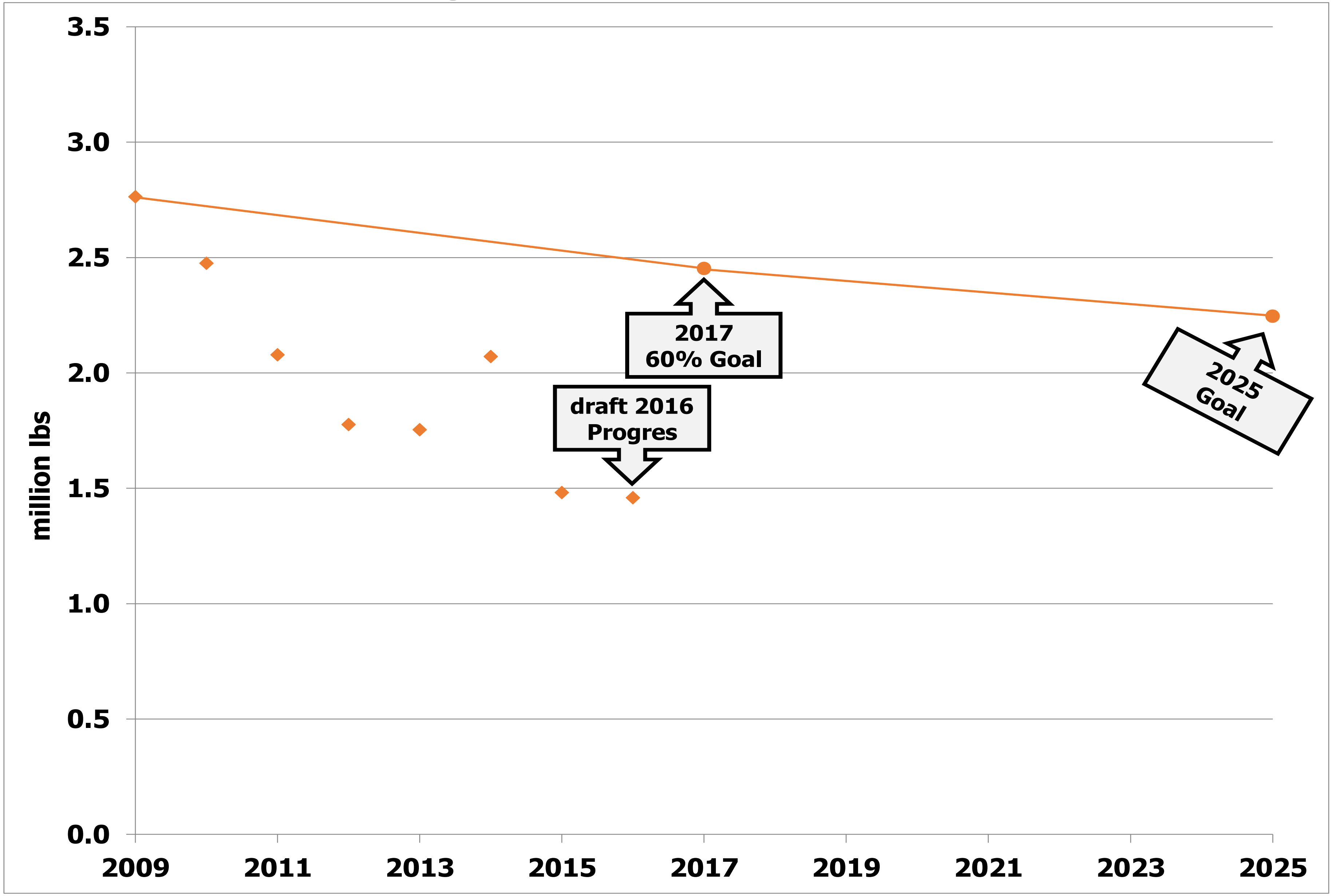
Nitrogen Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
DC Potomac	8.66	1.51	1.75	2.43	2.25

Phosphorus Load					
	No-Action (M lbs)	E3 (M lbs)	2013 Progress (M lbs)	Phase II WIP (reference) (M lbs)	Draft Phase III WIP Planning Target (M lbs)
DC Potomac	1.444	0.056	0.062	0.143	0.120

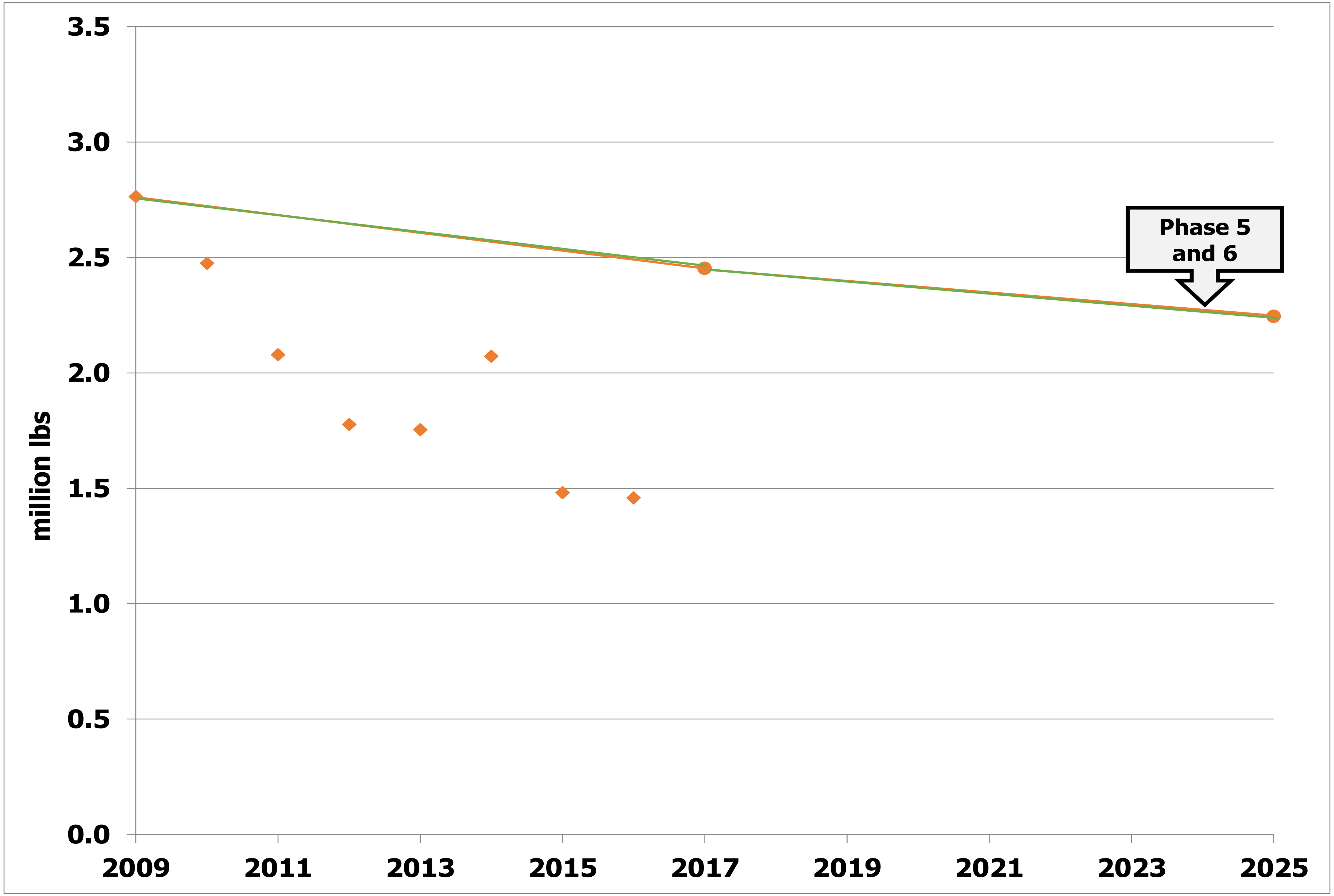
DC Nitrogen Loads-Goals, Phase 5.3.2



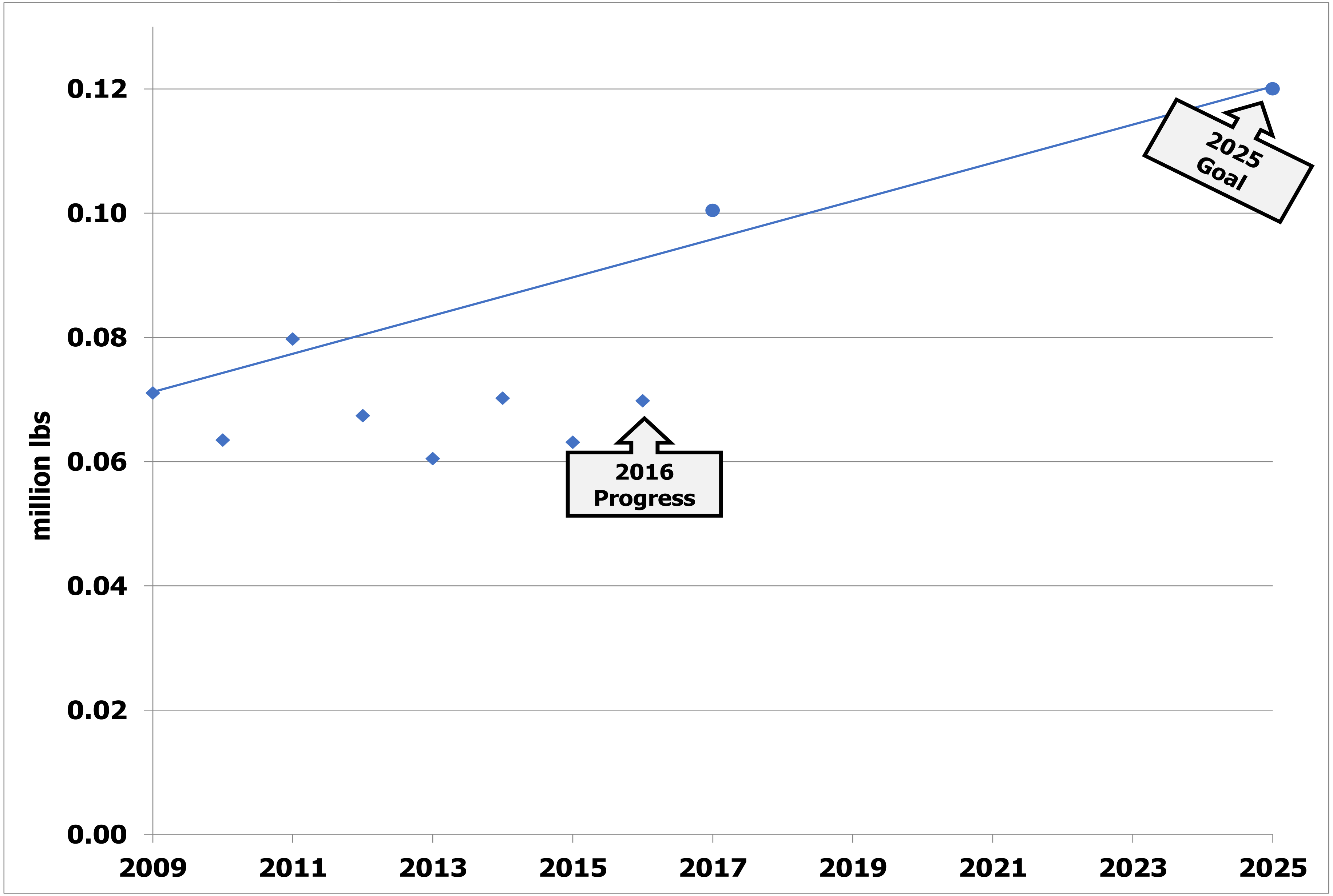
DC Nitrogen Loads-Goals, Phase 6



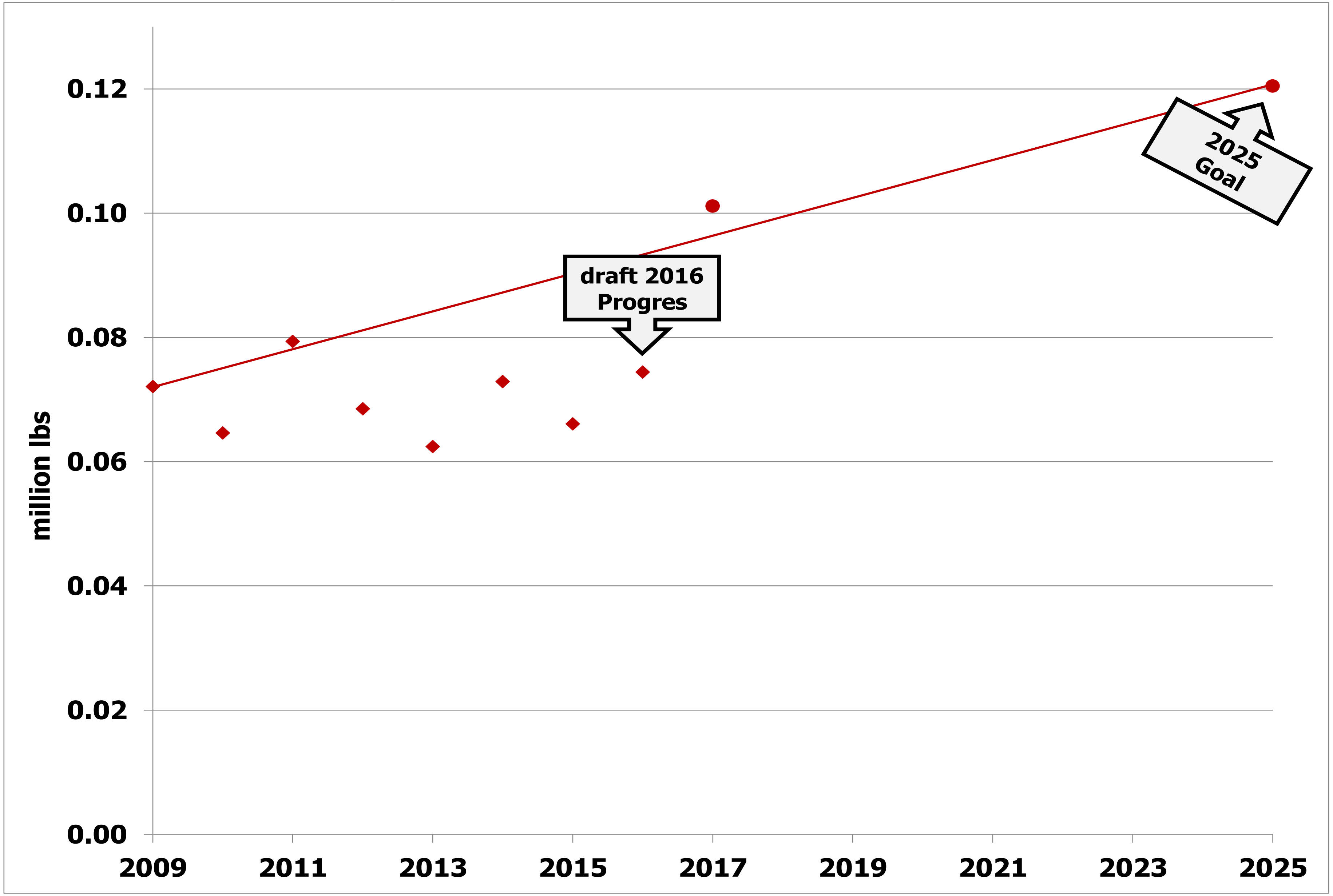
DC Nitrogen Change in LOE



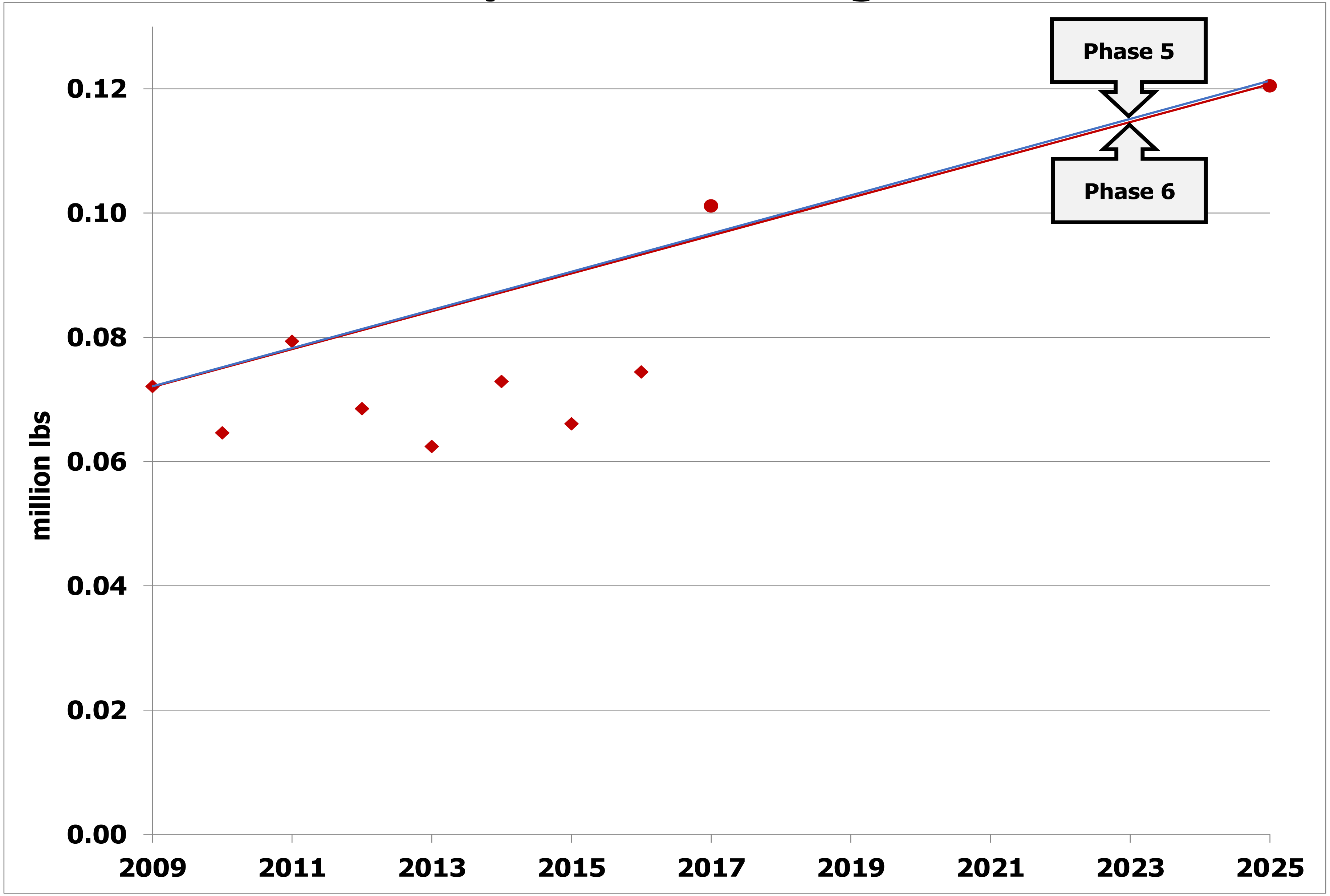
DC Phosphorus Loads-Goals, Phase 5.3.2



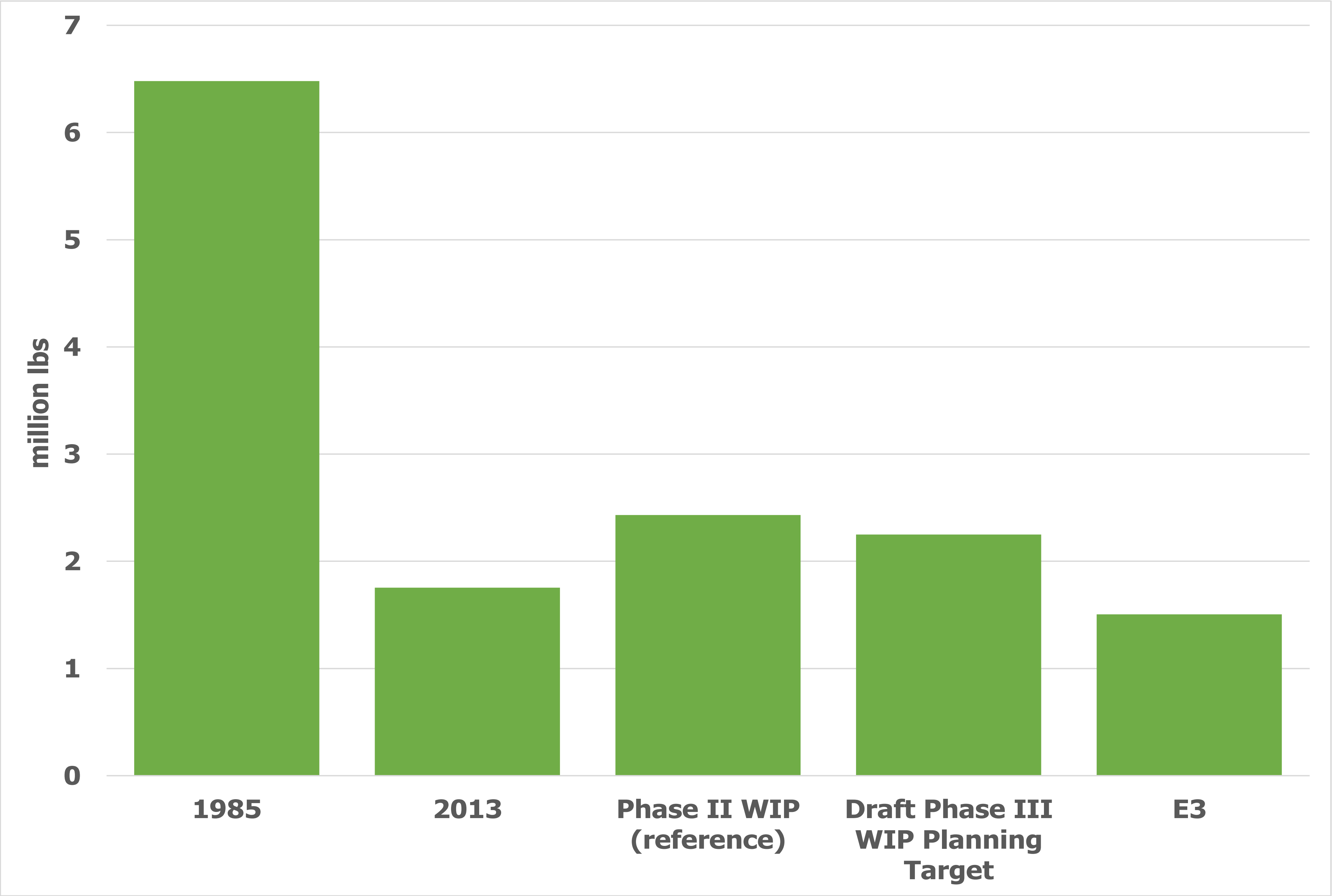
DC Phosphorus Loads-Goals, Phase 6



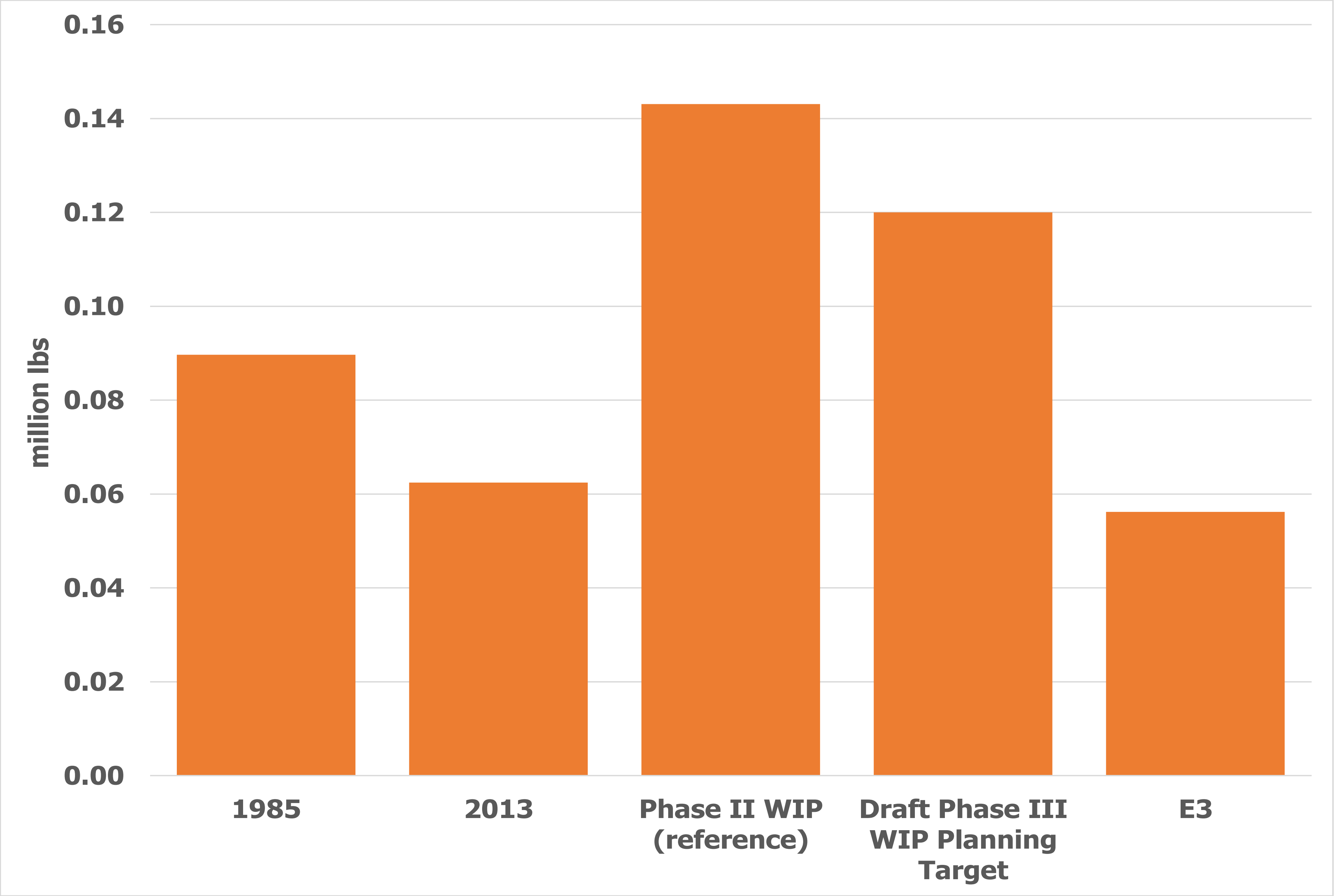
DC Phosphorus Change in LOE



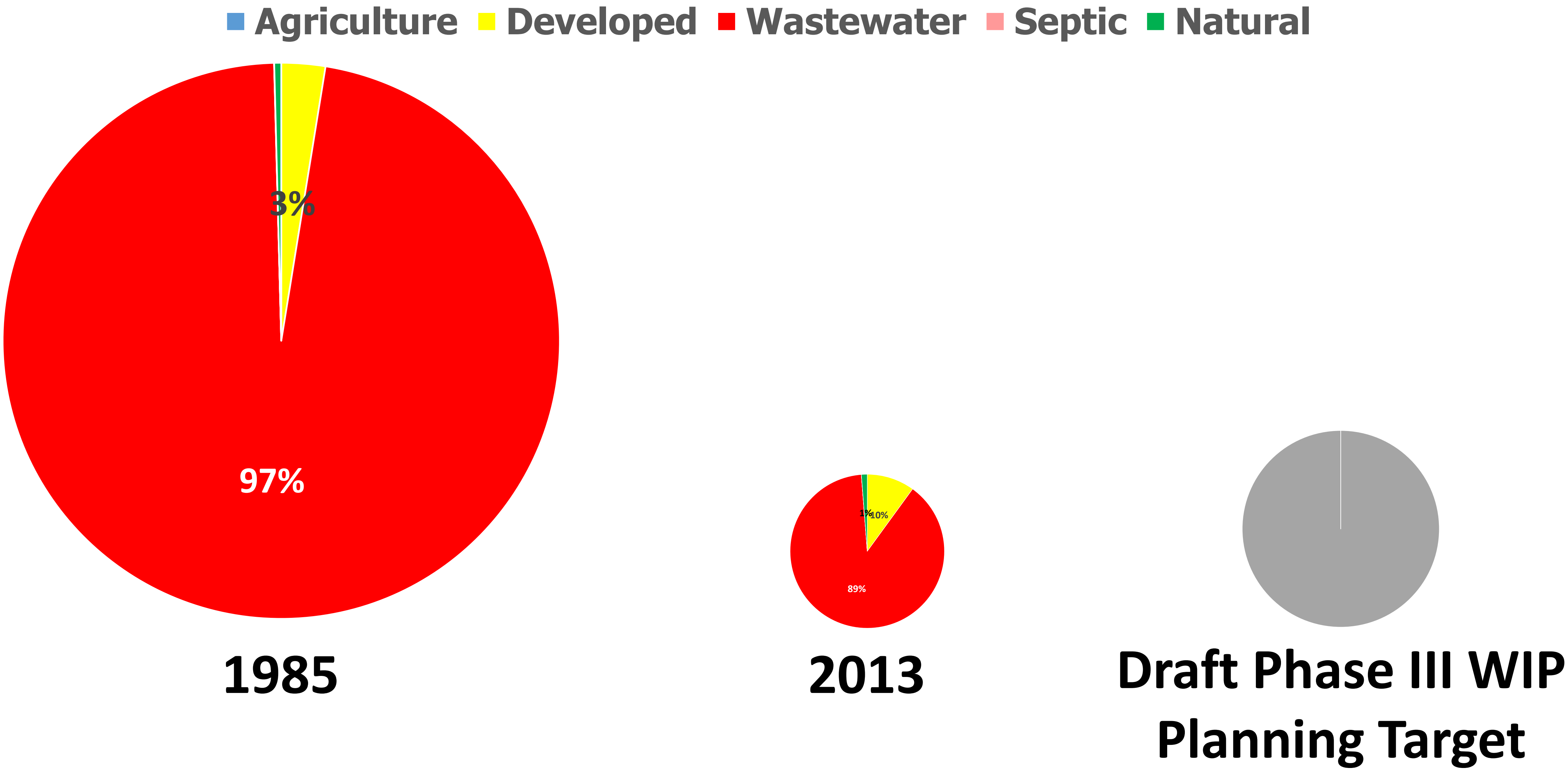
DC Nitrogen Loads, Reference Scenarios, and Target



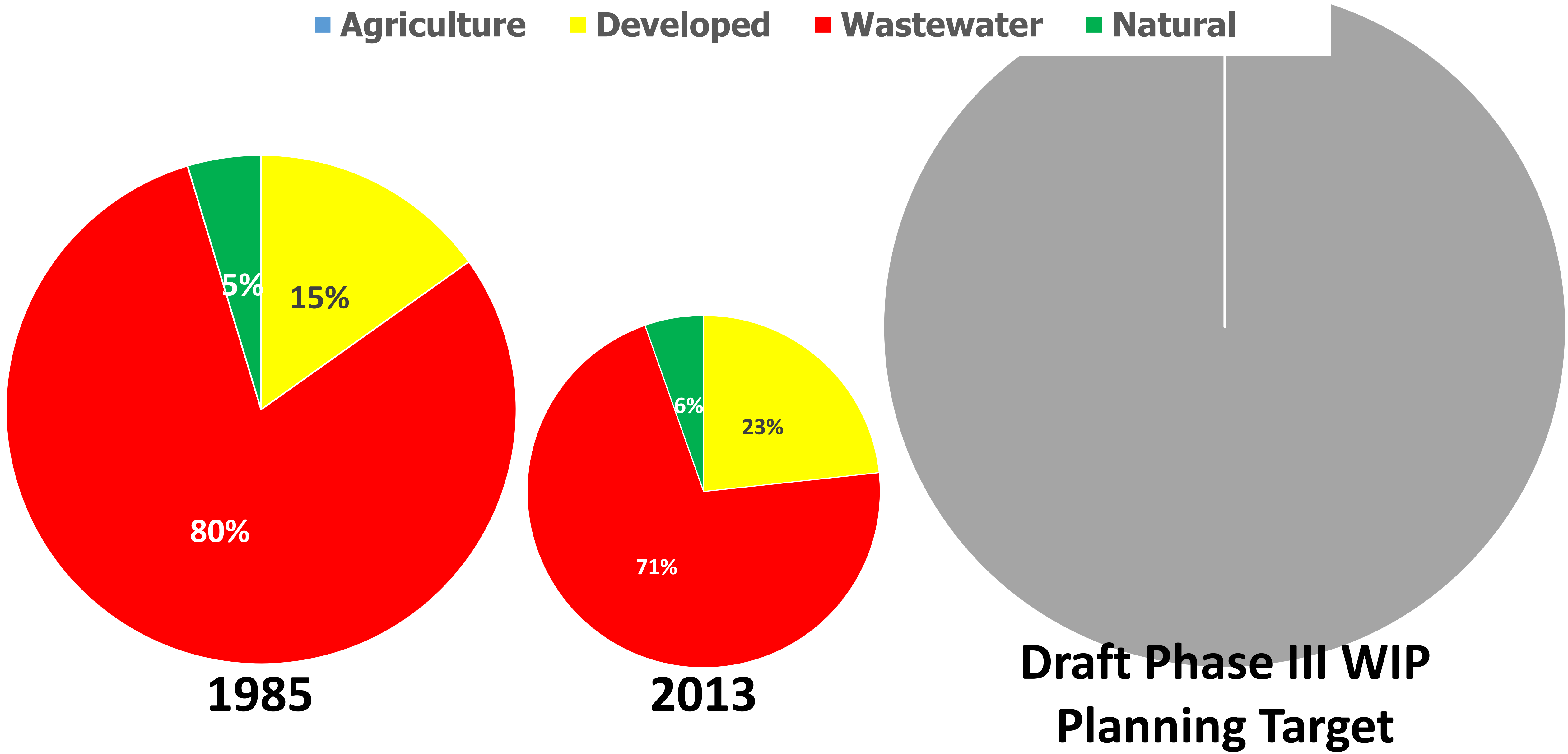
DC Phosphorus Loads, Reference Scenarios, and Target



DC Nitrogen Loads and Target

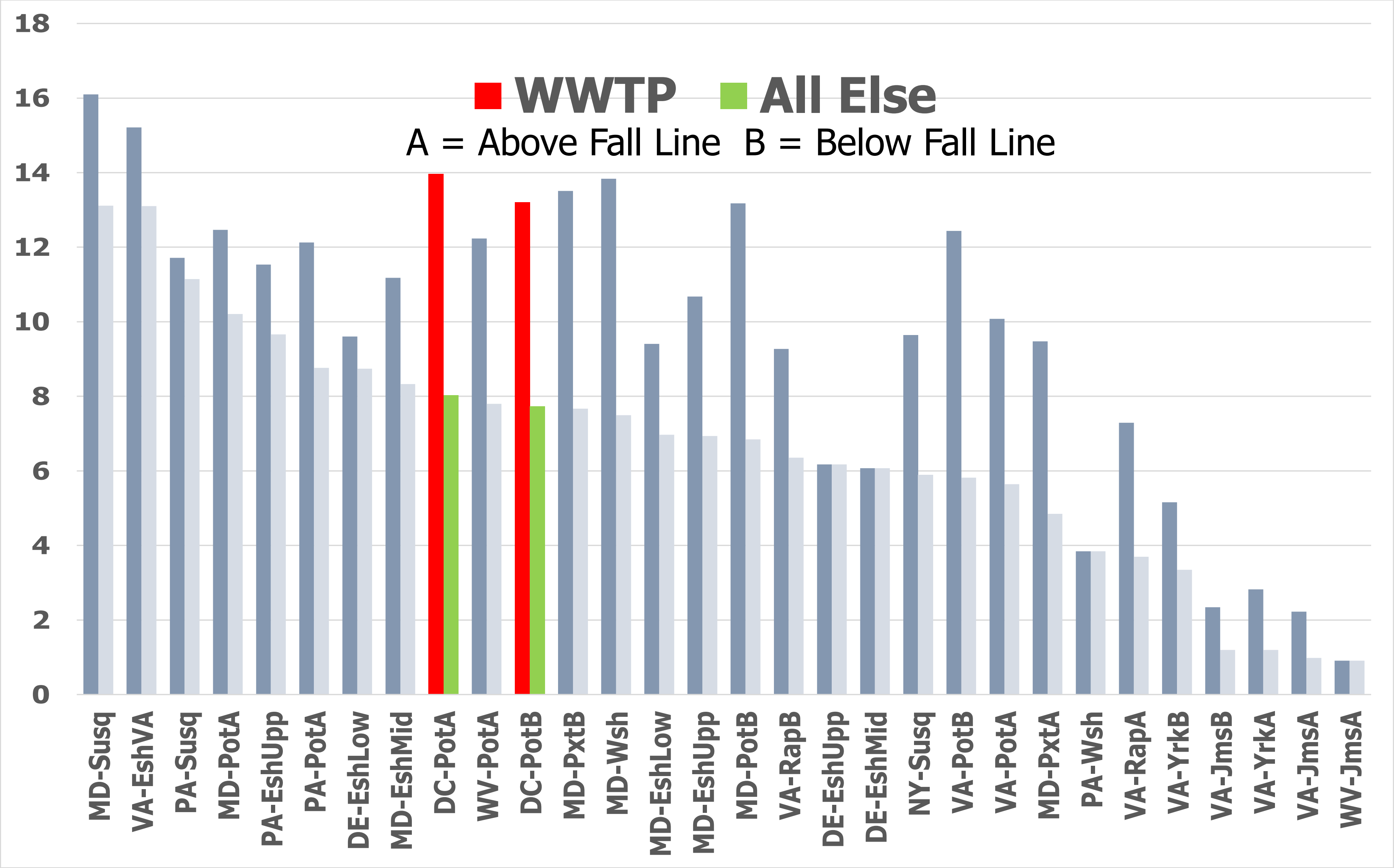


DC Phosphorus Loads and Target



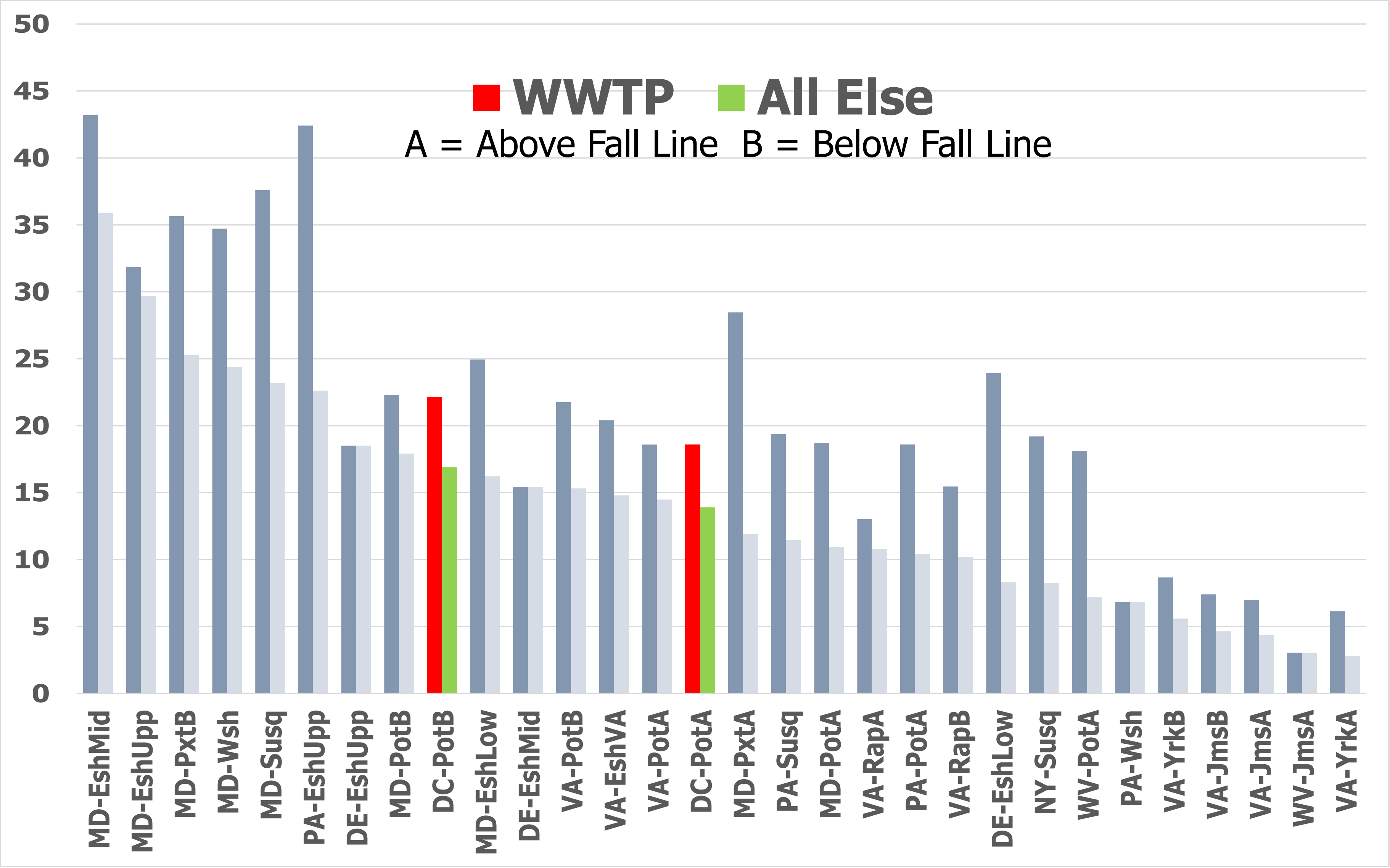
Nitrogen Relative Effectiveness

Effect of Nitrogen Load Reduction on WQ Standard Attainment



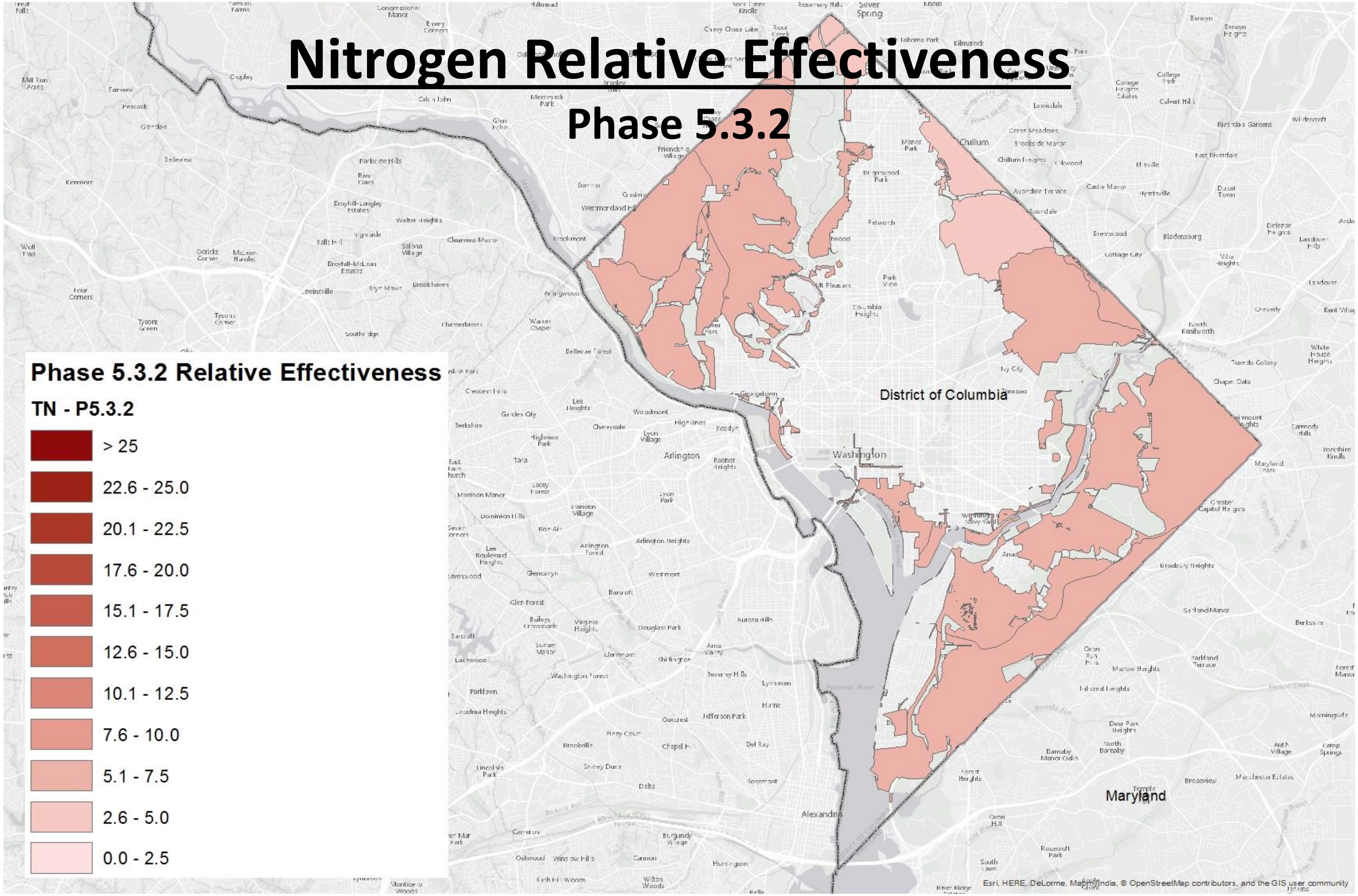
Phosphorus Relative Effectiveness

Effect of Phosphorus Load Reduction on WQ Standard Attainment



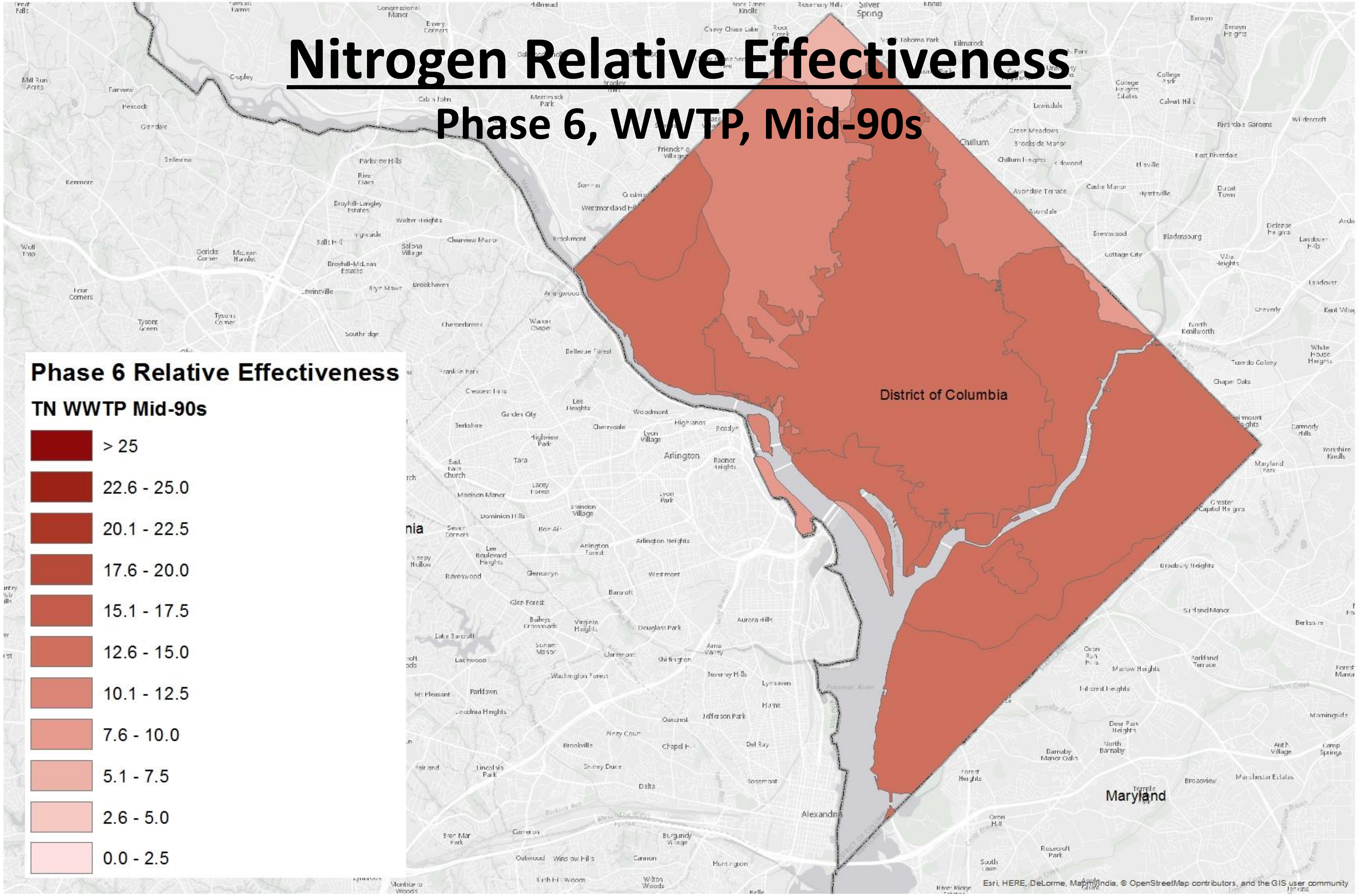
Nitrogen Relative Effectiveness

Phase 5.3.2



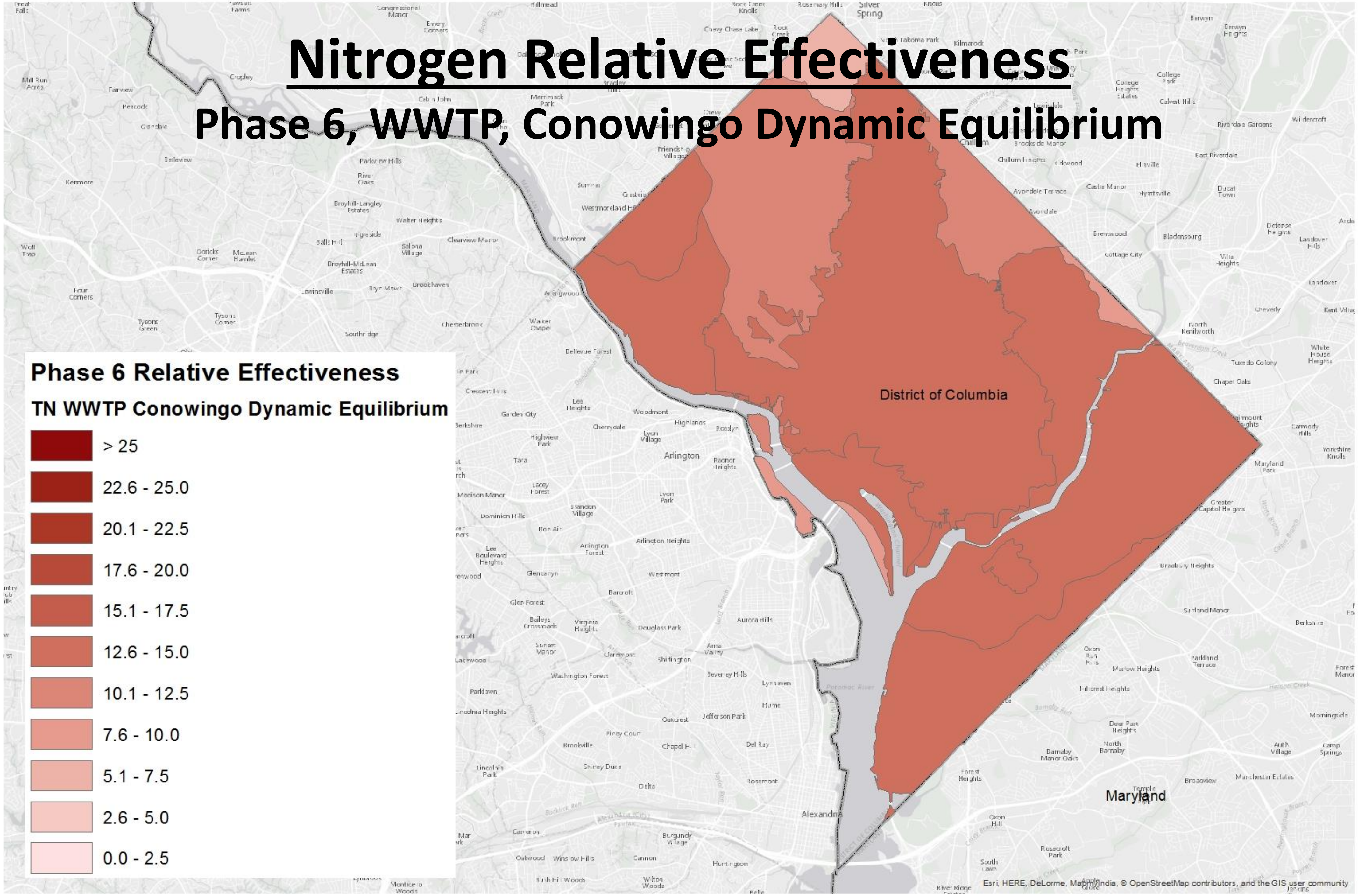
Nitrogen Relative Effectiveness

Phase 6, WWTP, Mid-90s



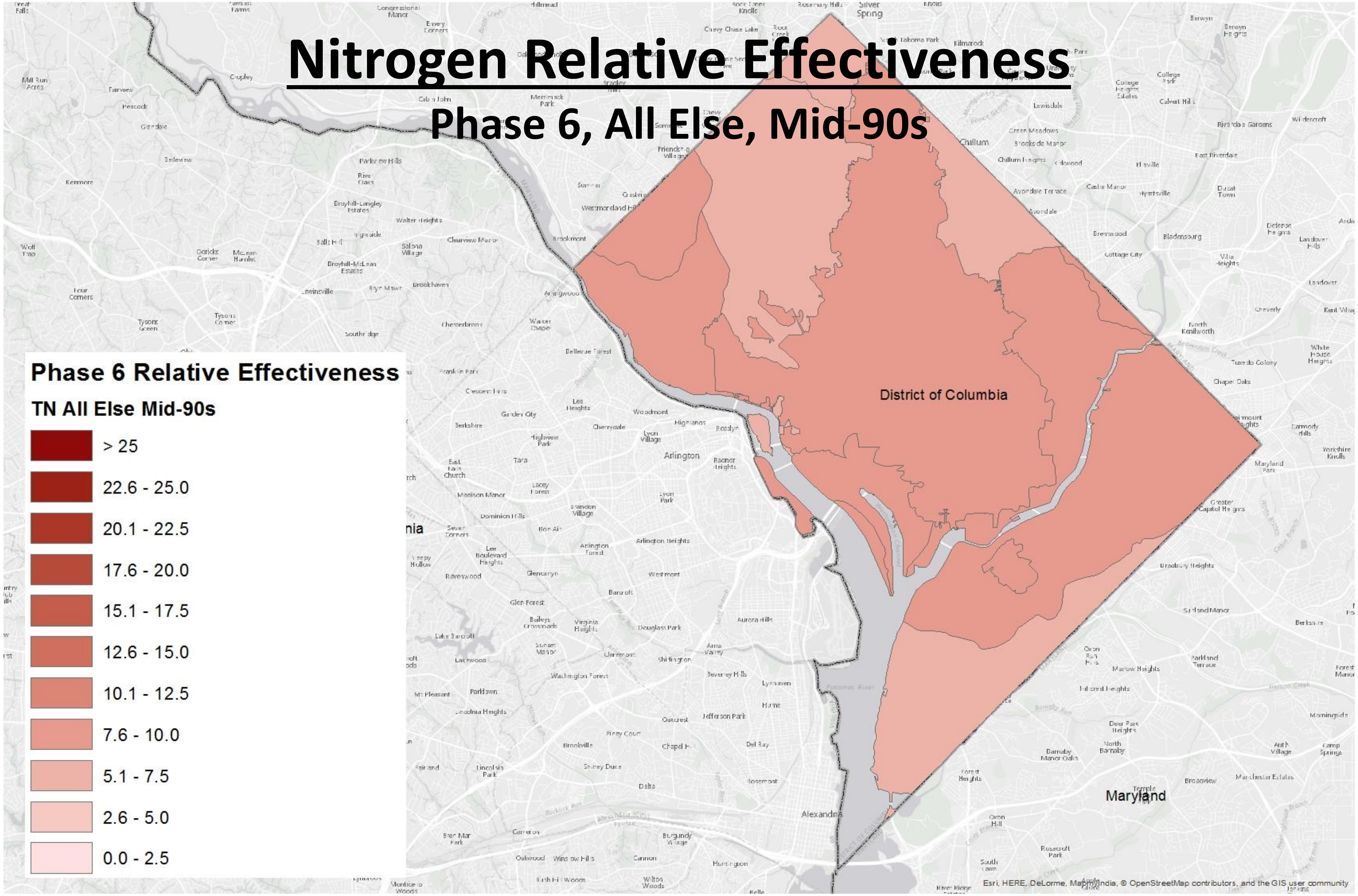
Nitrogen Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



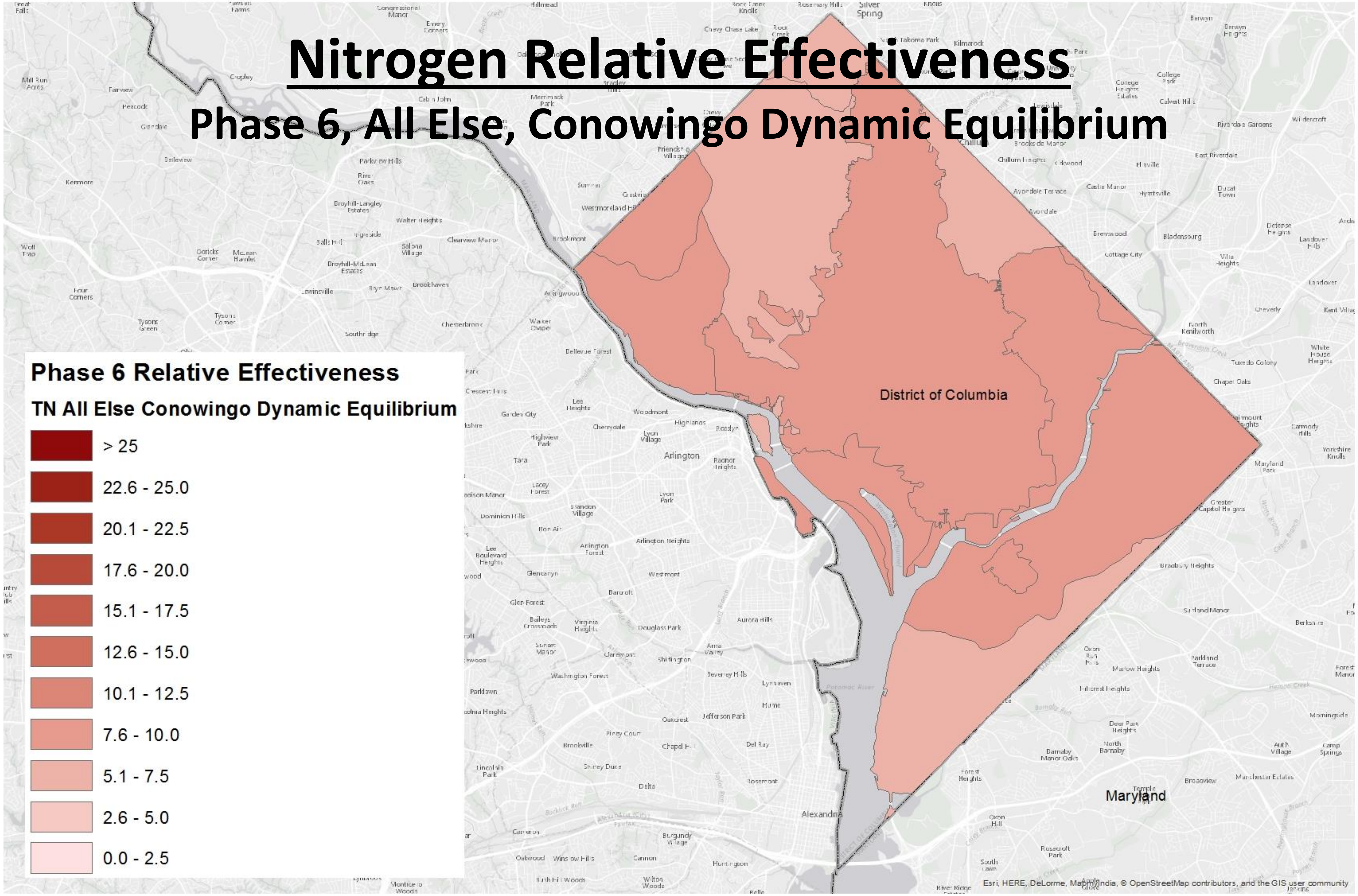
Nitrogen Relative Effectiveness

Phase 6, All Else, Mid-90s



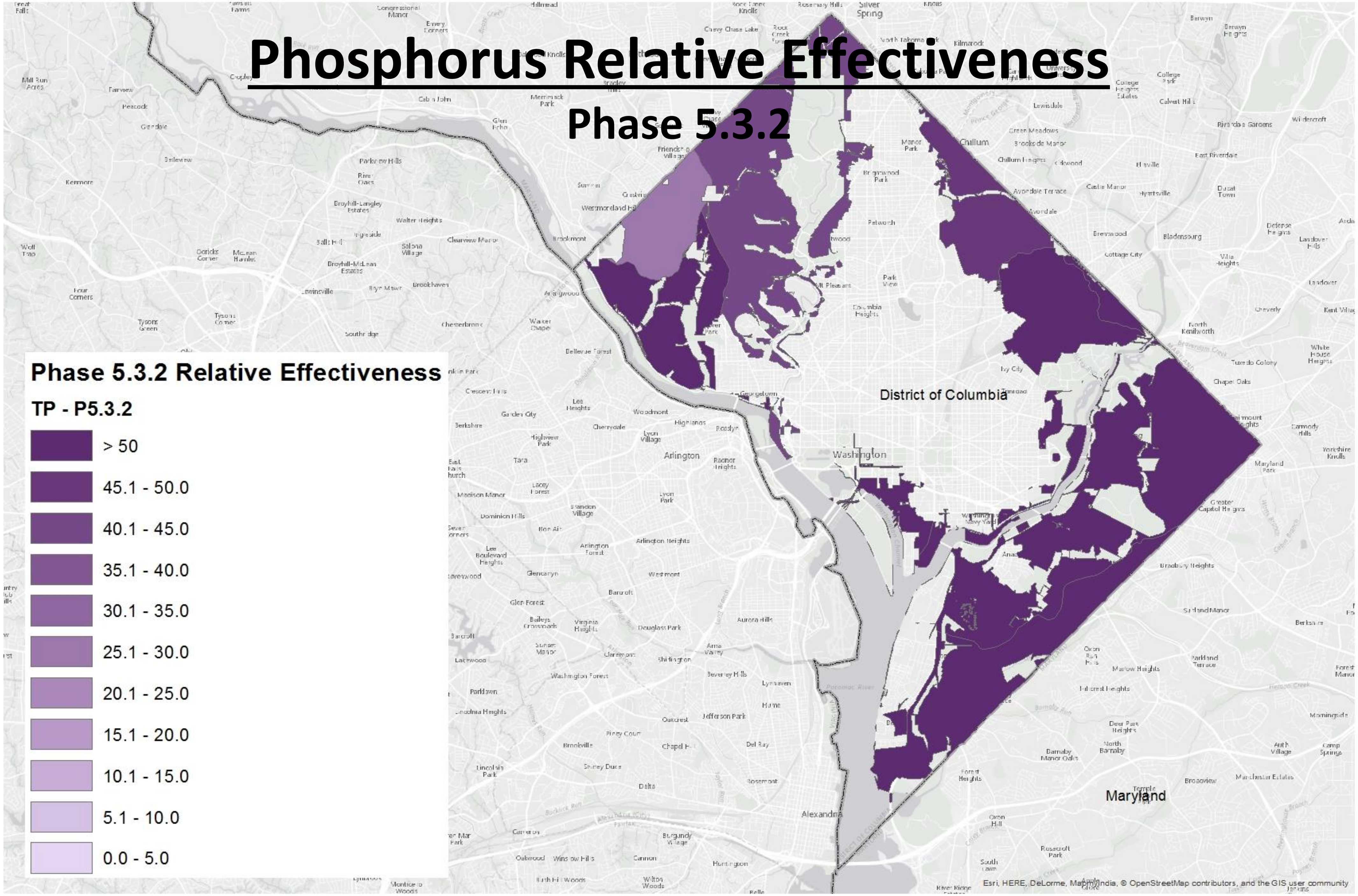
Nitrogen Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



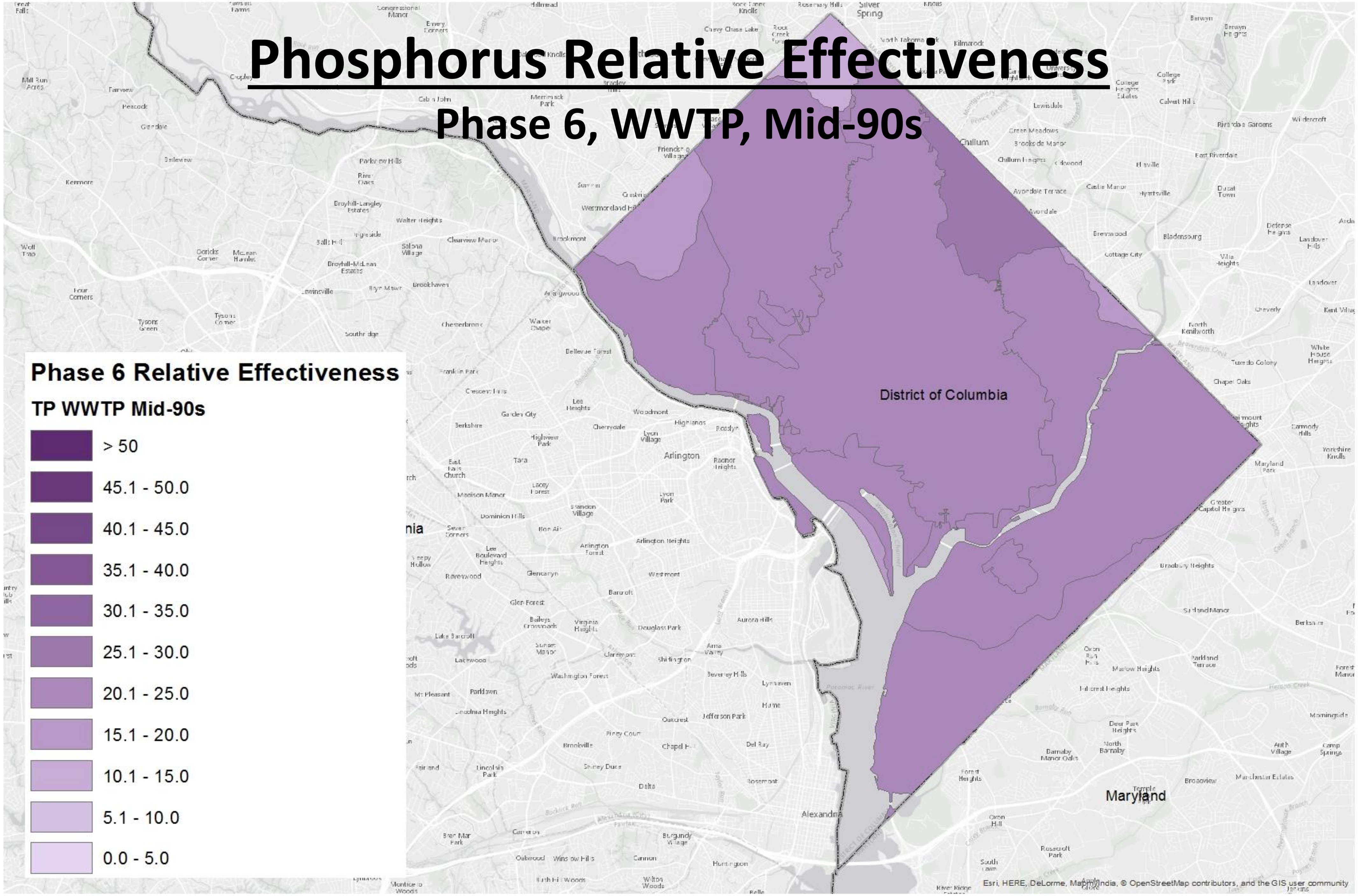
Phosphorus Relative Effectiveness

Phase 5.3.2



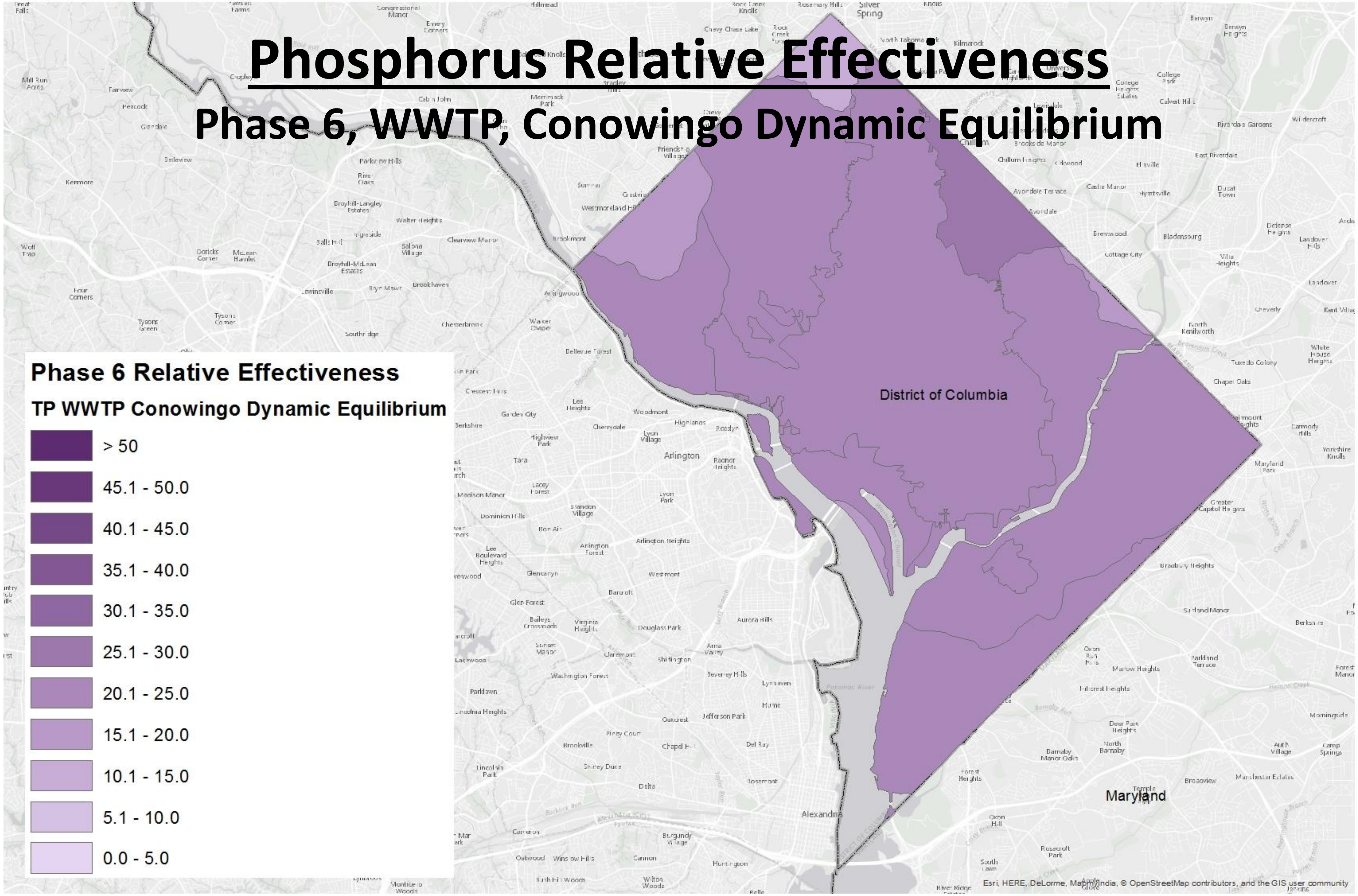
Phosphorus Relative Effectiveness

Phase 6, WWTP, Mid-90s



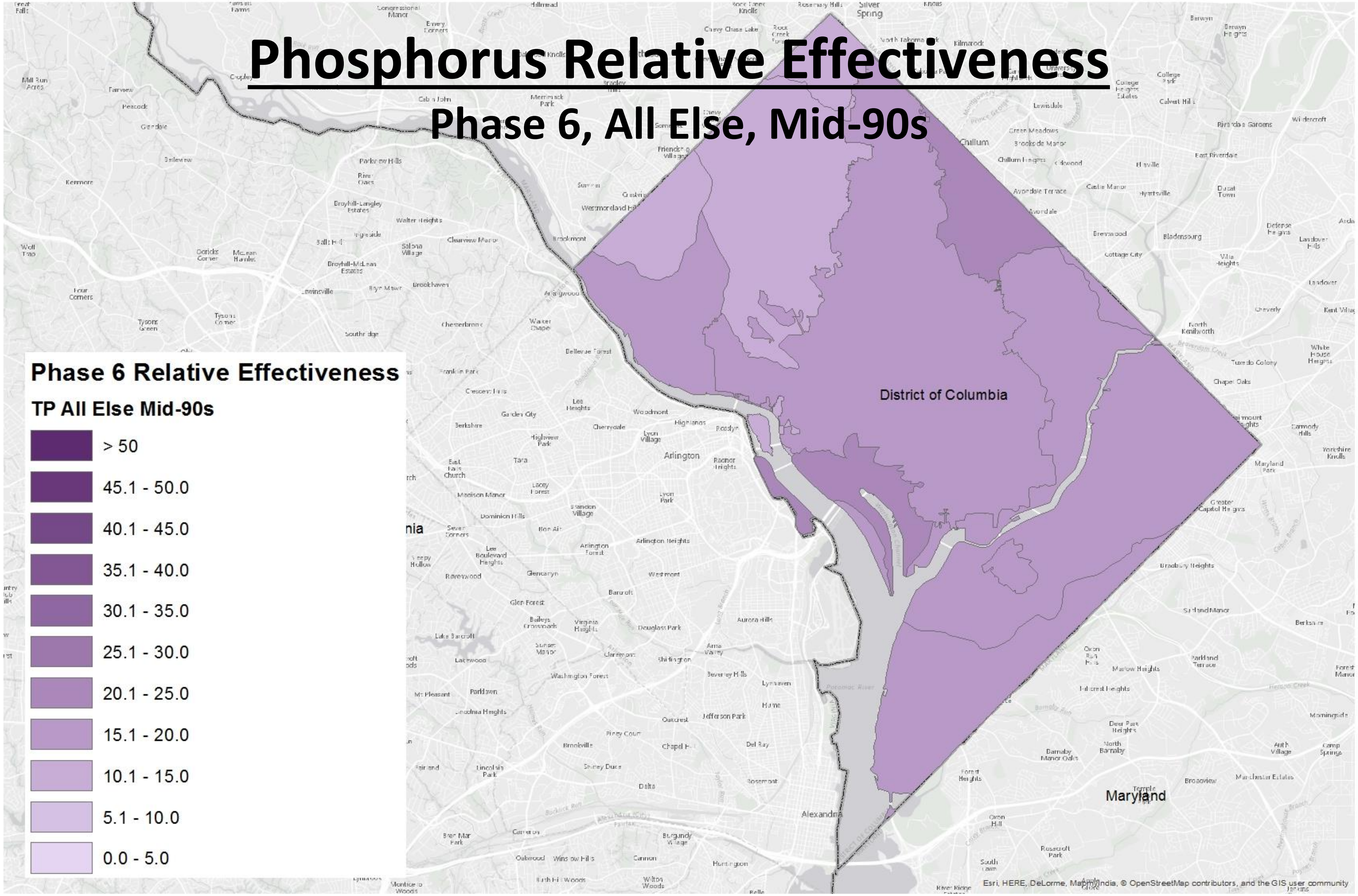
Phosphorus Relative Effectiveness

Phase 6, WWTP, Conowingo Dynamic Equilibrium



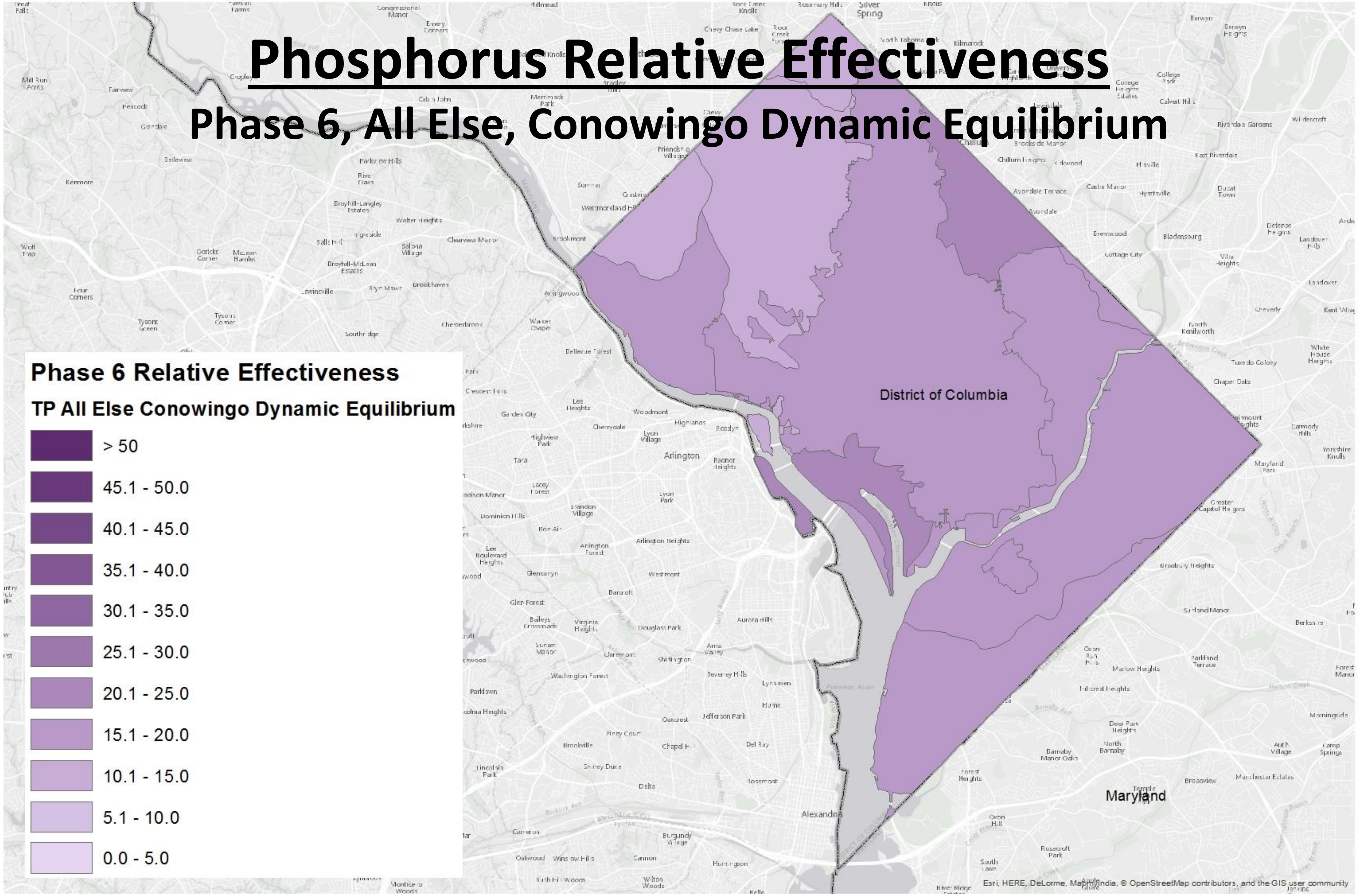
Phosphorus Relative Effectiveness

Phase 6, All Else, Mid-90s



Phosphorus Relative Effectiveness

Phase 6, All Else, Conowingo Dynamic Equilibrium



Proposed Process and Schedule for 4-Month Review Period

Lucinda Power, U.S. EPA, CBP Water Quality Goal Implementation Team Coordinator

PSC Approved Schedule

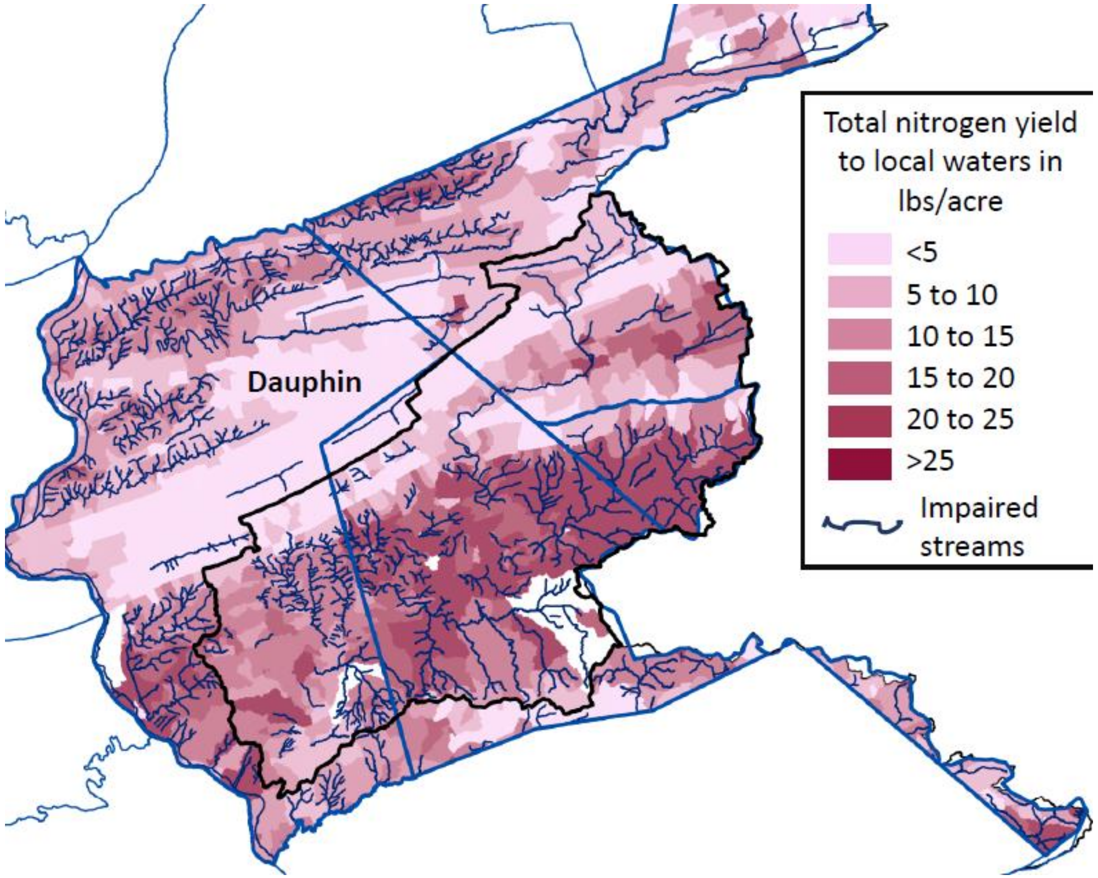
- **December 19-20, 2017**: PSC 2-day retreat and decision making
- **December 22, 2017**: Release of draft Phase III WIP planning targets
- **December 22, 2017 – April 20, 2018**: Partnership's review of the draft Phase III WIP planning targets
- **Late April/Early May 2018**: PSC approval of the final Phase III WIP planning targets with any agreed-to special cases
- **May 7, 2018**: Release of the final Phase III WIP planning targets

During the 4-Month Review Period

- Analyze level of effort to achieve the draft planning targets
- Evaluate effects of accounting for growth, Conowingo infill, and climate change on level of effort
- Assess the need for exchanges of nitrogen and/or phosphorus loads between a jurisdiction’s major river basins
- Assess the need for exchanges of nitrogen for phosphorus or phosphorus for nitrogen within a jurisdiction’s major river basin
- Determine if any special cases are needed

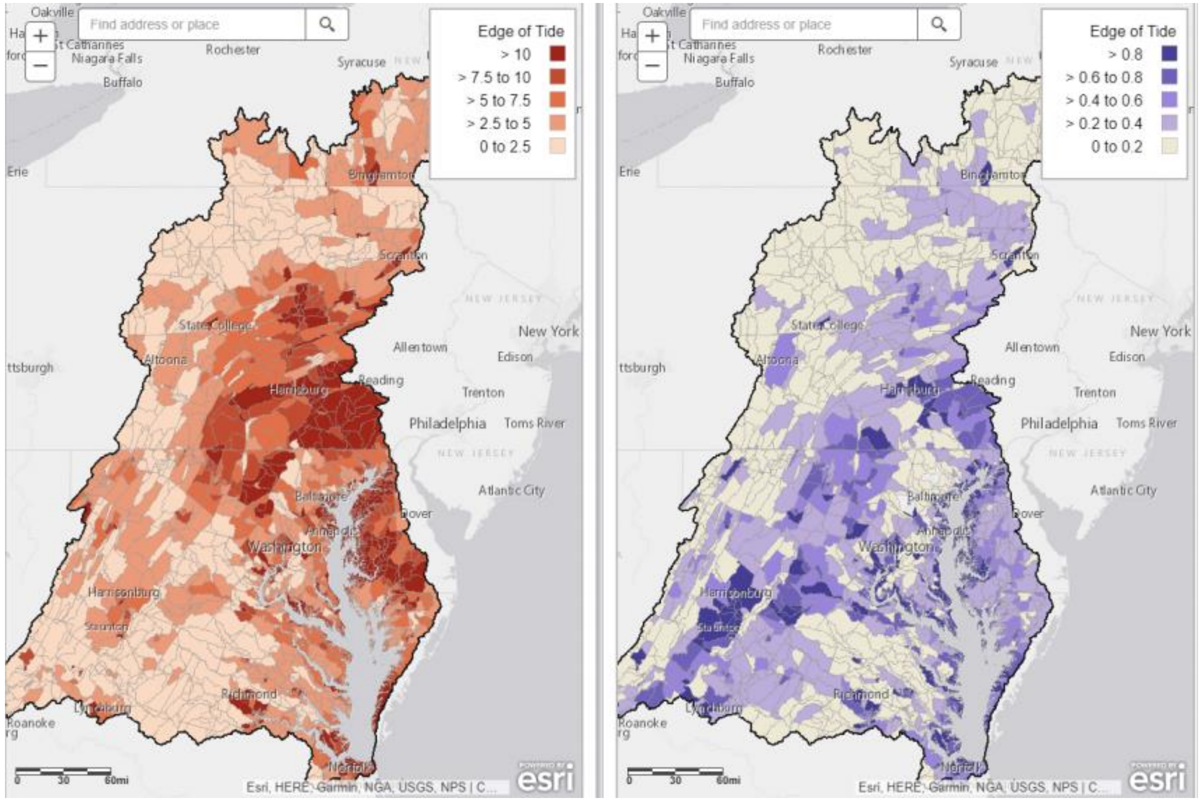
Further Analyses for Consideration

- Testing out preliminary development of measurable, local planning goals below the major state-basin level



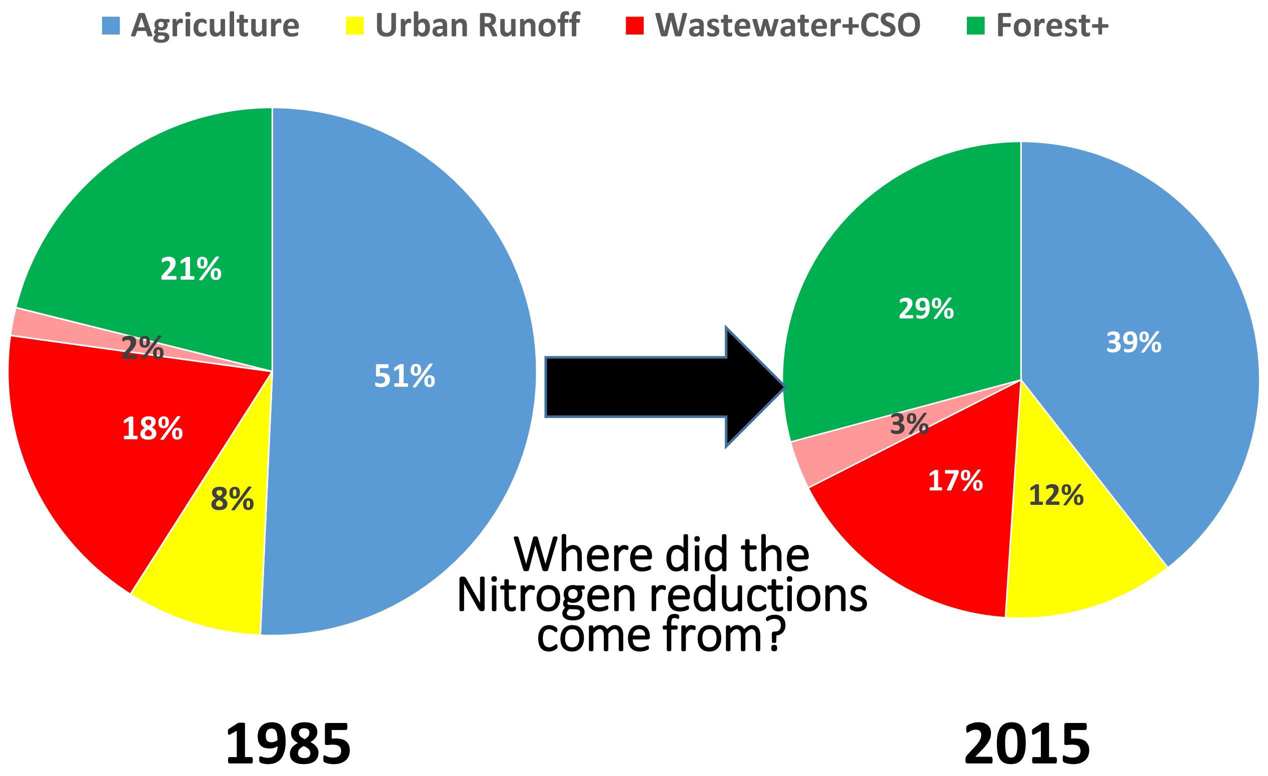
Further Analyses for Consideration

- Apply the results of the geographic isolation runs to help inform implementation planning and targeting



Further Analyses for Consideration

- Evaluate potential changes needed to a jurisdiction's Phase I and Phase II WIP source sector goals



Support to Jurisdictions During their Reviews

- The Partnership Office in Annapolis can support the jurisdictions by helping:
  - Test out possible N for P and P for N exchanges
  - Test out possible basin to basin exchanges
  - Test for possible water quality/load reduction impacts on upstream and down tide jurisdictions
  - Think through and help test possible approaches to developing local area planning goals
  - Evaluate feasibility of achieving the draft planning targets and what are the opportunities for further reductions by source sector, geography

Possible Changes Between Now and April 2018

- Requests for special conditions
- Conducting basin to basin exchanges of N, P, and sediment loads
- Conducting significant N for P and P for N exchanges
- Virginia's decisions on N and P reductions needed to achieve their existing or revised chlorophyll *a* criteria and water quality standards for the tidal James River

What are Special Cases?

Special cases are requests by the jurisdictions for any:

1) Changes to their draft Phase III WIP planning targets

2) Changes to the methodology used to establish the draft Phase III WIP planning targets

Who Can Submit a Special Case Request?

- Any one of the seven Bay watershed jurisdictions to the CBP Water Quality Goal Implementation Team (WQGIT) Chair and the CBP WQGIT Coordinator

- Requests for special cases from non-jurisdictional partners must be submitted through their respective WQGIT jurisdictional representative

Notification of Special Case Requests

February 28, 2018

Deadline for notifying WQGIT jurisdictional representatives and EPA of a jurisdiction's intent to submit special case requests

March 16, 2018

Final deadline for submitting the special case request(s), along with the justification and associated nutrient and basin exchanges, to the Partnership for consideration

Process for Addressing Special Cases

1. CBPO staff will work with the jurisdictions to address and identify potential resolutions for special cases during the 4-month review period

2. For transparency, updates will be provided to the WQGIT during each conference call during the 4-month review period communicating:

- Who has submitted special case requests
- Proposed options for resolving the special case request(s)

Requested WQGIT Policy Recommendation

Approval of proposed process for the Partnership's 4-month review of the draft Phase III WIP planning targets, including addressing special case requests

Factoring in Climate Change into the Jurisdictions’ Phase III WIPs

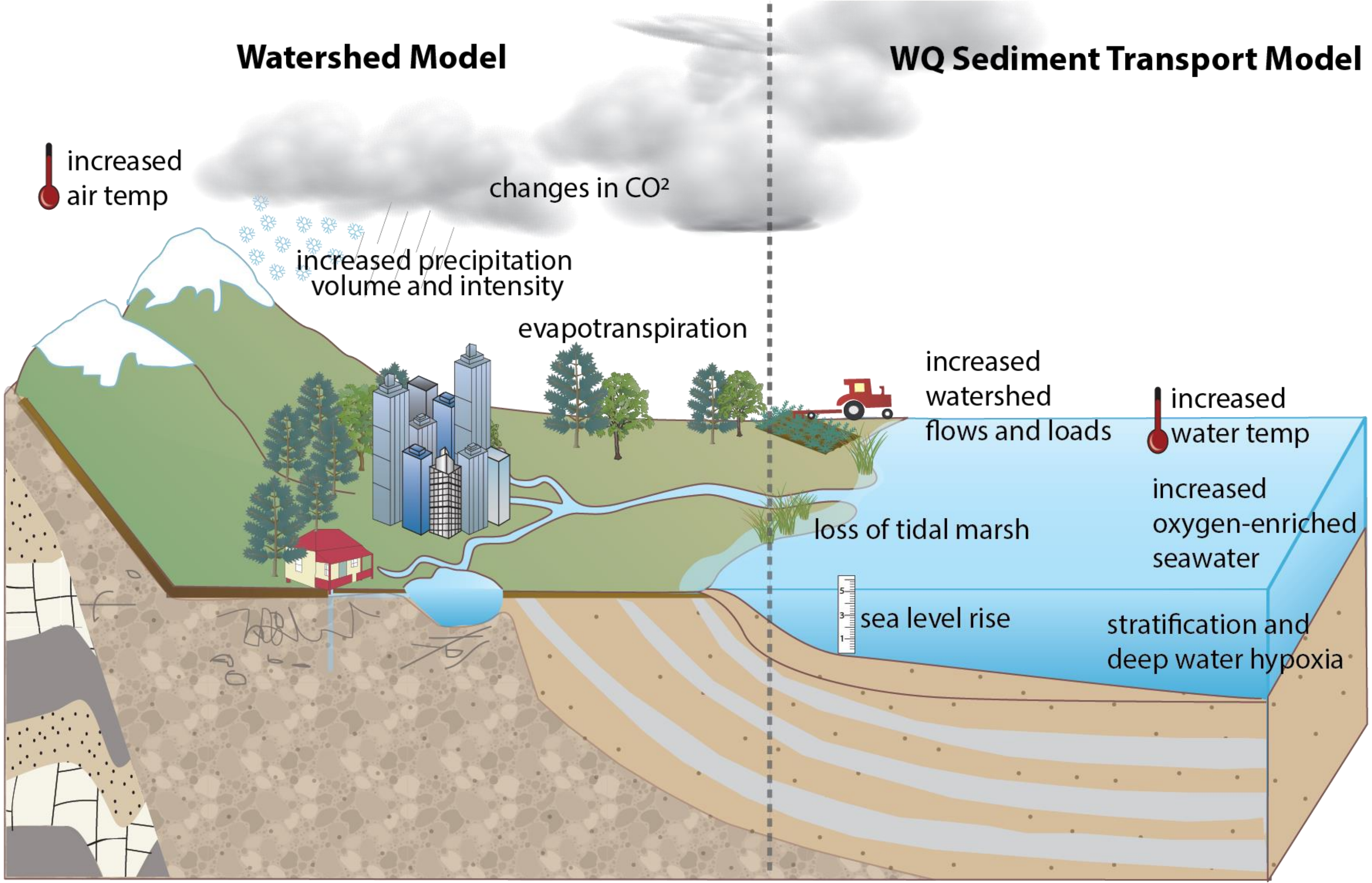
Mark Bennett, USGS, CBP Climate Resiliency Workgroup Chair

Accounting for the Changing Conditions

- The Climate Resiliency Workgroup and the Modeling Workgroup have been working with the Partnership's Scientific and Technical Advisory Committee to account for changing conditions occurring in the watershed and the Bay's tidal waters in a scientifically defensible manner

- The Water Quality Goal Implementation Team recommends that the Partnership take into account the <u>cumulative</u> responses of climate change (watershed and estuary) and not view impacts separately or in isolation

Accounting for Changing Conditions



Impact of Changing Conditions on Bay and Watershed Increase Through Time

- Based on STAC guidance[1], the Partnership is using projections for 2025 that have a high level of confidence
  - Selection of projections for sea level rise and precipitation change were based on past records of observed climatic and resultant river flow conditions.
  - There is less uncertainty in downscaled temperature projections for 2025.
- According to the National Climate Assessment[2], impacts associated with precipitation, temperature and sea level are all expected to increase beyond 2025

1. CBP Scientific and Technical Advisory Committee. 2016. The Development of Climate Projections for Use in Chesapeake Bay Program Assessments. March 2016 Workshop.
2. 4th National Climate Assessment (November 2017)

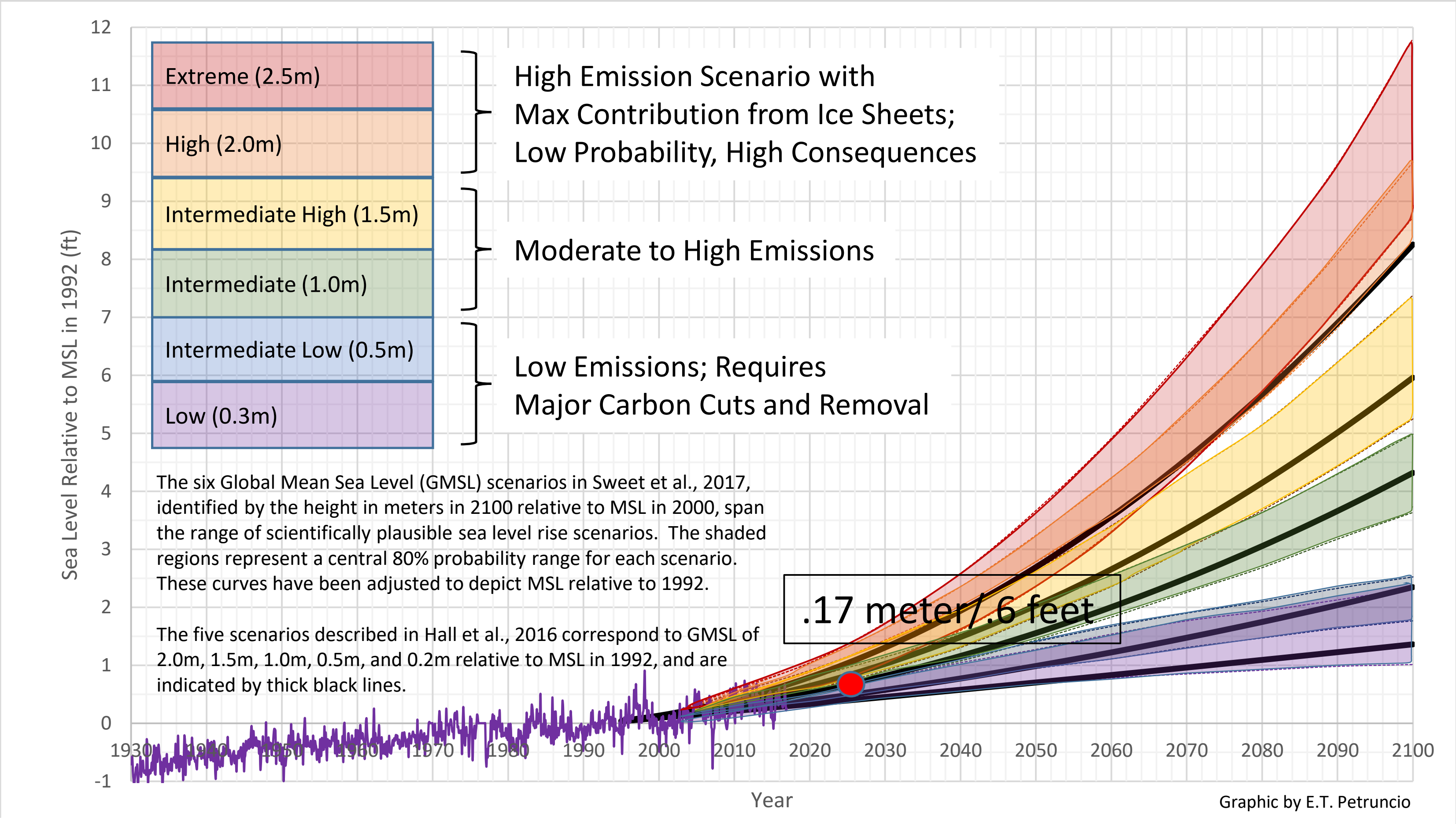
Impact of Changing Conditions on Bay and Watershed Increase Through Time

- “The Chesapeake Bay Watershed is already experiencing impacts associated with sea level rise (e.g., coastal storm impacts and nuisance flooding) as well as heavy precipitation events[1]”

- “Heavy precipitation events in most parts of the United States have increased in both intensity and frequency since 1901 (high confidence). There are important regional differences in trends, with the largest increases occurring in the northeastern United States (high confidence).[2]”

1. CBP Scientific and Technical Advisory Committee. 2016. The Development of Climate Projections for Use in Chesapeake Bay Program Assessments. March 2016 Workshop.
2. 4th National Climate Assessment (November 2017)

Relative Sea Level Rise



Relative Sea Level Rise Scenarios for Annapolis
with Annapolis Monthly Mean Sea Level Data for 1930-2016

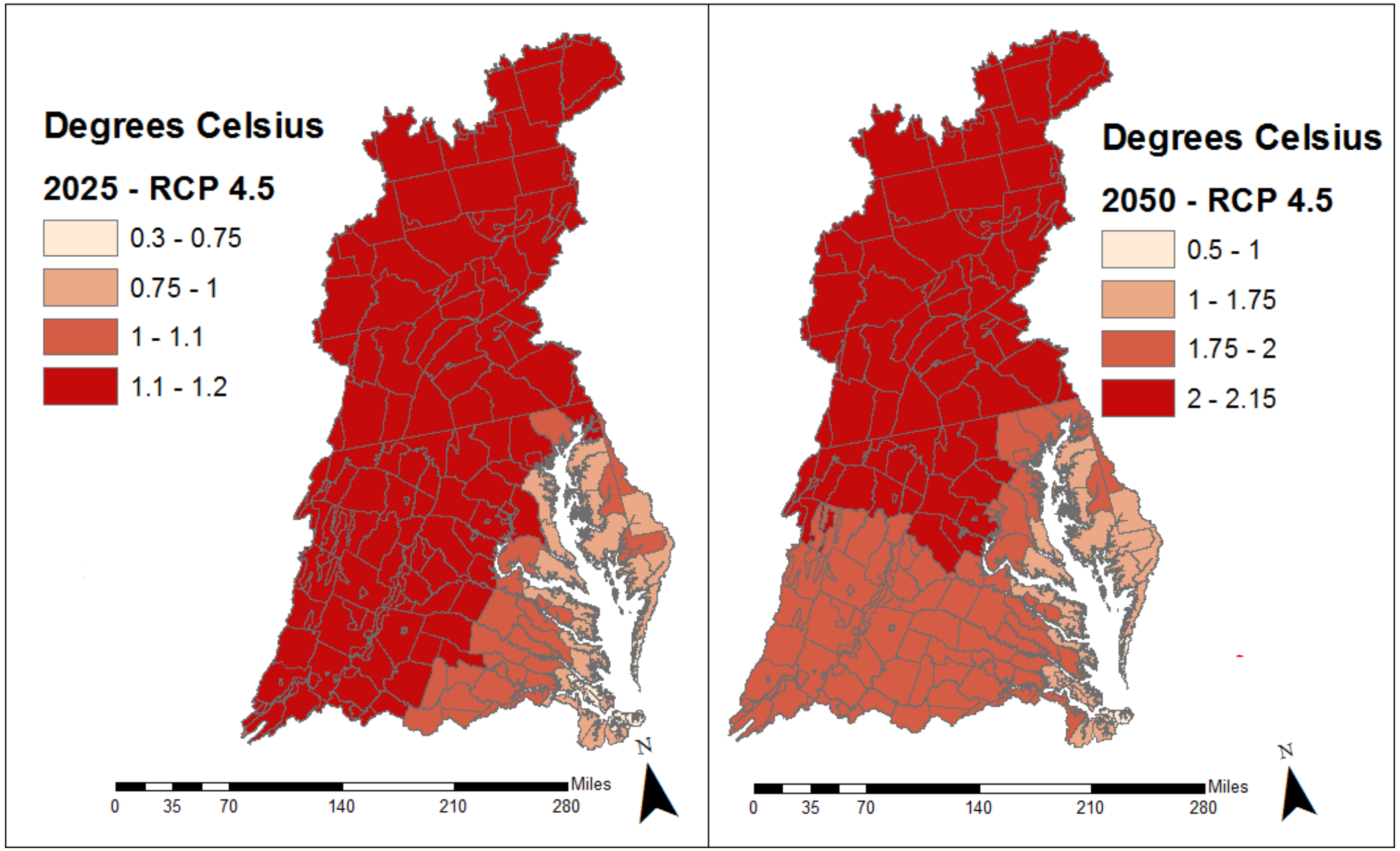
CBP Climate Resiliency Workgroup recommended 2025 projection: .17 meter/.6 feet

Sources: Hall et al. (2016) and Sweet et al. (2017)

Temperature Change

2025/2050 STAC Recommended Projections

1995-2025 | 1995-2050



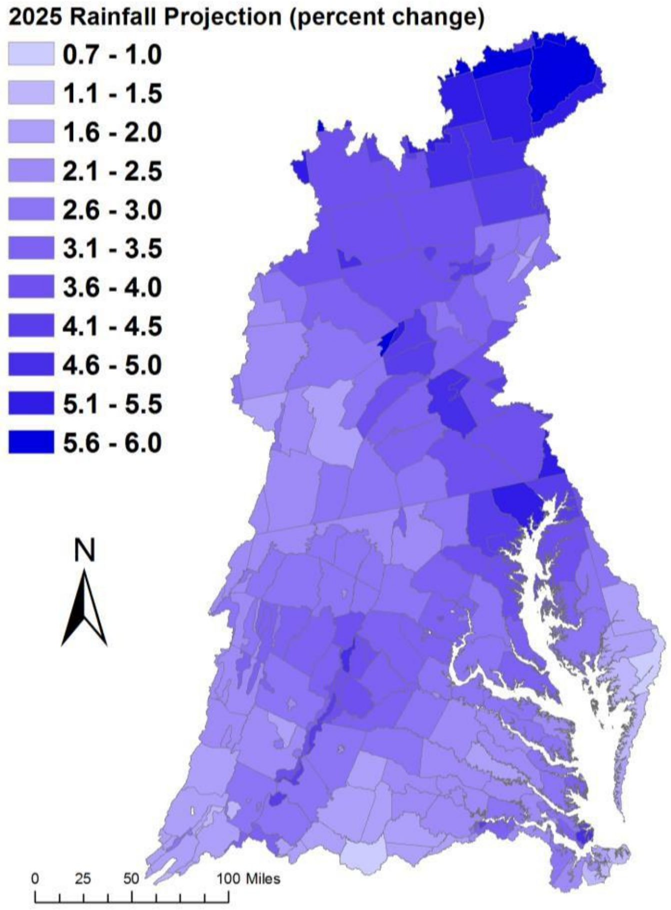
1.98° F / 1.1° C Increase in Average Annual Temp

3.5° F / 1.94° C Increase in Average Annual Temp

Source: Kyle Hinson, CRC/CBPO

Precipitation Change

2025 STAC Recommended Projection: Trends in 88-years of annual PRISM[1] data



Change in Rainfall Volume
2021-2030 vs. 1991-2000

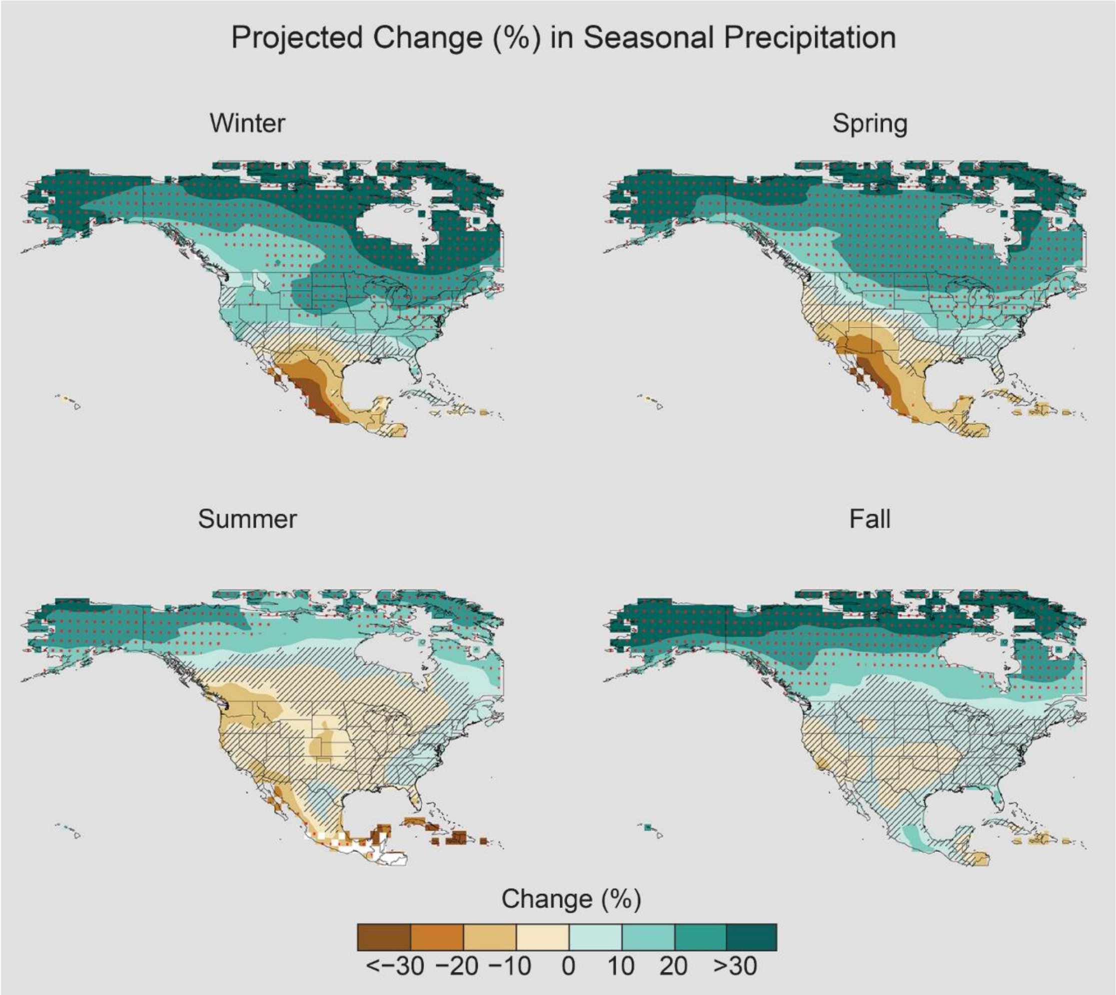
Major Basins	PRISM Trend
Youghiogheny River	2.1%
Patuxent River Basin	3.3%
Western Shore	4.1%
Rappahannock River Basin	3.2%
York River Basin	2.6%
Eastern Shore	2.5%
James River Basin	2.2%
Potomac River Basin	2.8%
Susquehanna River Basin	3.7%
Chesapeake Bay Watershed	**3.1%**

Source: Kyle Hinson, CRC/CBPO

[1] Parameter-elevation Relationships on Independent Slopes Model

Precipitation Change

4th NCA Future Seasonal Patterns (2070 – 2099)

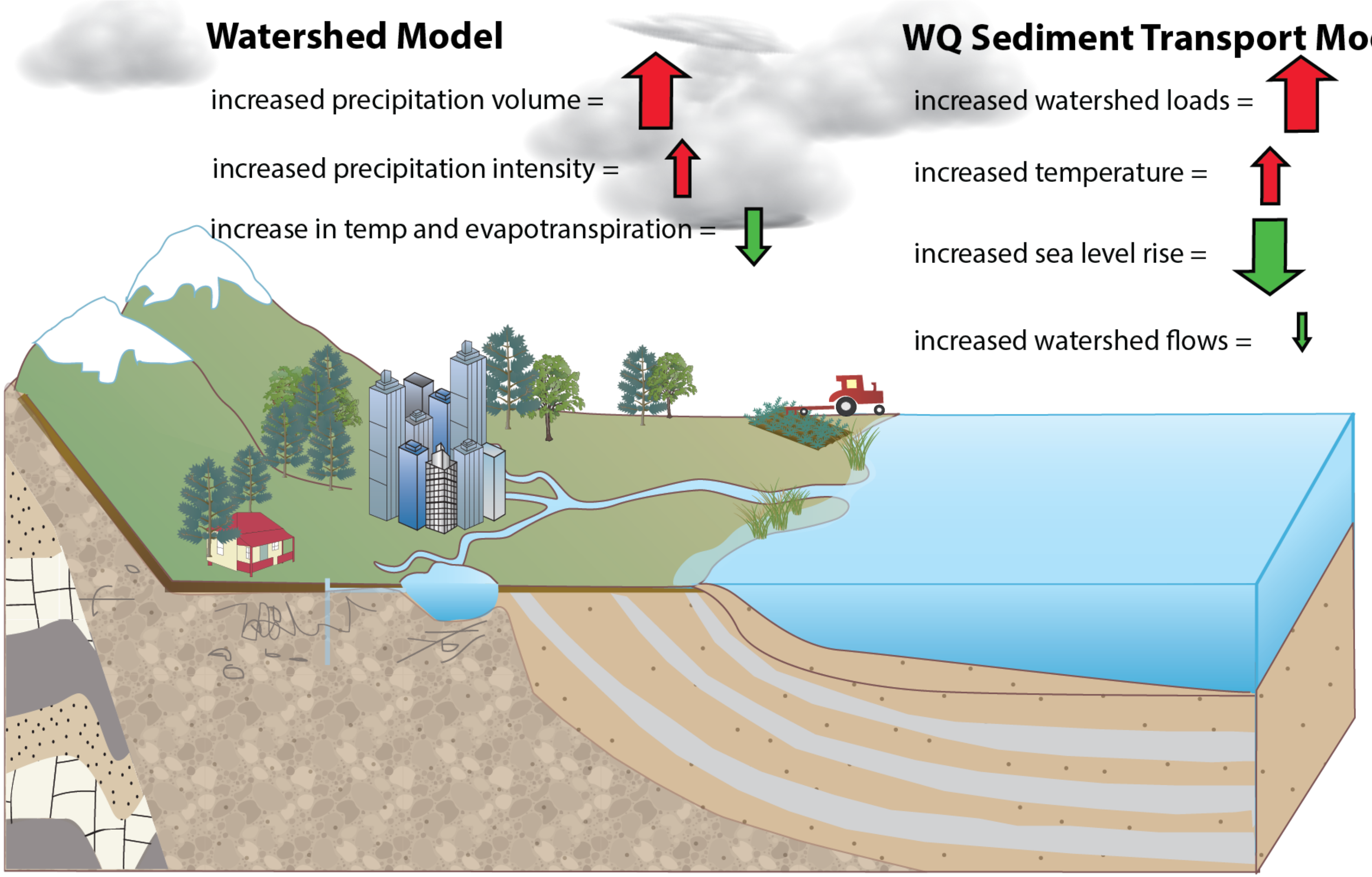


Projected change (%) in total seasonal precipitation from CMIP5 simulations for 2070–2099. The values are weighted multimodel means and expressed as the percent change relative to the 1976–2005 average. These are results for the higher scenario (RCP8.5).

Source: NOAA NCEI (NCA 2017)

Accounting for Changing Conditions

Cumulative Assessment of Bay Low Dissolved Oxygen Impacts



Bay Water Quality Responses to 2025 Climate Change Conditions

Changes in estimated 2025 dissolved oxygen criteria attainment for Deep Channel, Deep Water, and Open Water due to observed temperature and precipitation changes since 1991-2000 (years of average Bay hydrology).

Run 223		**WIP2**	**WIP2 + Cono Infill**	**WIP2 + Cono Infill + CC**
11/30/17		195TN	208TN	210TN
		13.7TP	15.4TP	15.3TP
CAST Loads		1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD		0%	0%
CB4MH	MD	6%	8%	10%
CB5MH	MD	0%	0%	0%
CB5MH	VA	0%	0%	0%
POTMH	MD	0%	0%	0%
RPPMH	VA	0%	0%	0%
ELIPH	VA	0%	0%	0%
CHSMH	MD	0%	0%	4%
EASMH	MD	6%	7%	8%

Deep Channel nonattainment increases by 2% in CB4MH

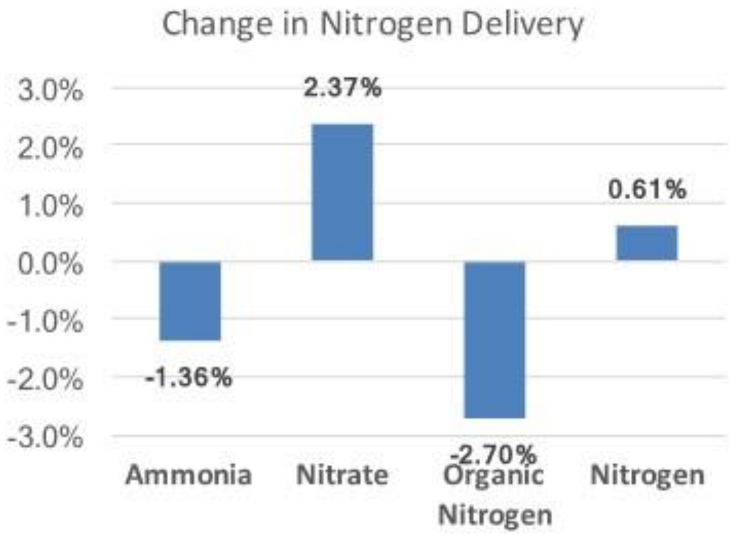
Run 223		**WIP2**	**WIP2 + Cono Infill**	**WIP2 + Cono Infill + CC**
11/30/17		195TN	208TN	210TN
		13.7TP	15.4TP	15.3TP
CAST Loads		1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Water	Deep Water	Deep Water
CB4MH	MD	5%	6%	7%
CB5MH	MD	1%	1%	2%
CB5MH	VA	0%	0%	0%
CB6PH	VA	0%	0%	0%
CB7PH	VA	0%	0%	0%
PATMH	MD	1%	2%	3%
MAGMH	MD	1%	5%	5%
SOUMH	MD	3%	8%	7%
SEVMH	MD	0%	0%	0%
PAXMH	MD	0%	0%	0%
POTMH	MD	0%	0%	0%
RPPMH	VA	0%	0%	0%
YRKPH	VA	0%	0%	0%
ELIPH	VA	0%	0%	0%
CHSMH	MD	0%	0%	0%
EASMH	MD	0%	0%	0%

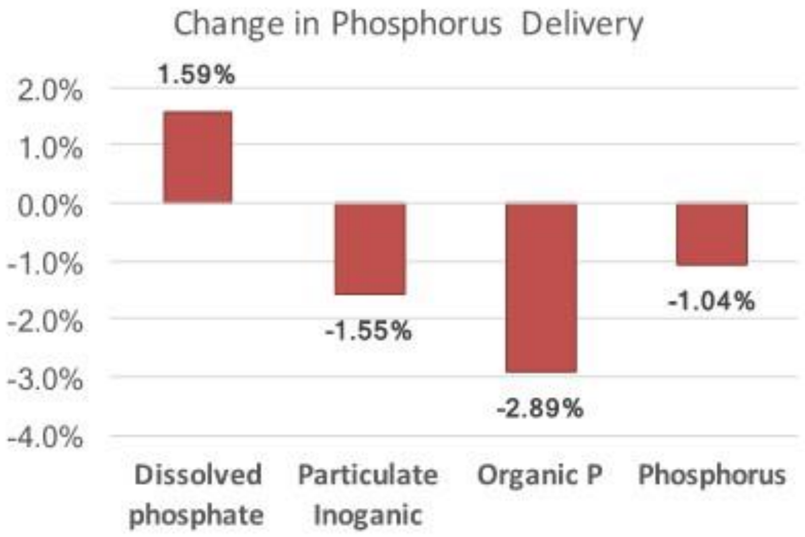
Deep Water nonattainment increases by 1% in CB5MH

Procedures for assessing Open Water attainment under climate change conditions are being developed.

Estimated Changes in Watershed and Bay Loads by 2025 Due to Climate Change

- Inorganic nutrients are increased with climate change
- Organic nutrients are decreased
- Inorganic nutrients have a higher effect on dissolved oxygen



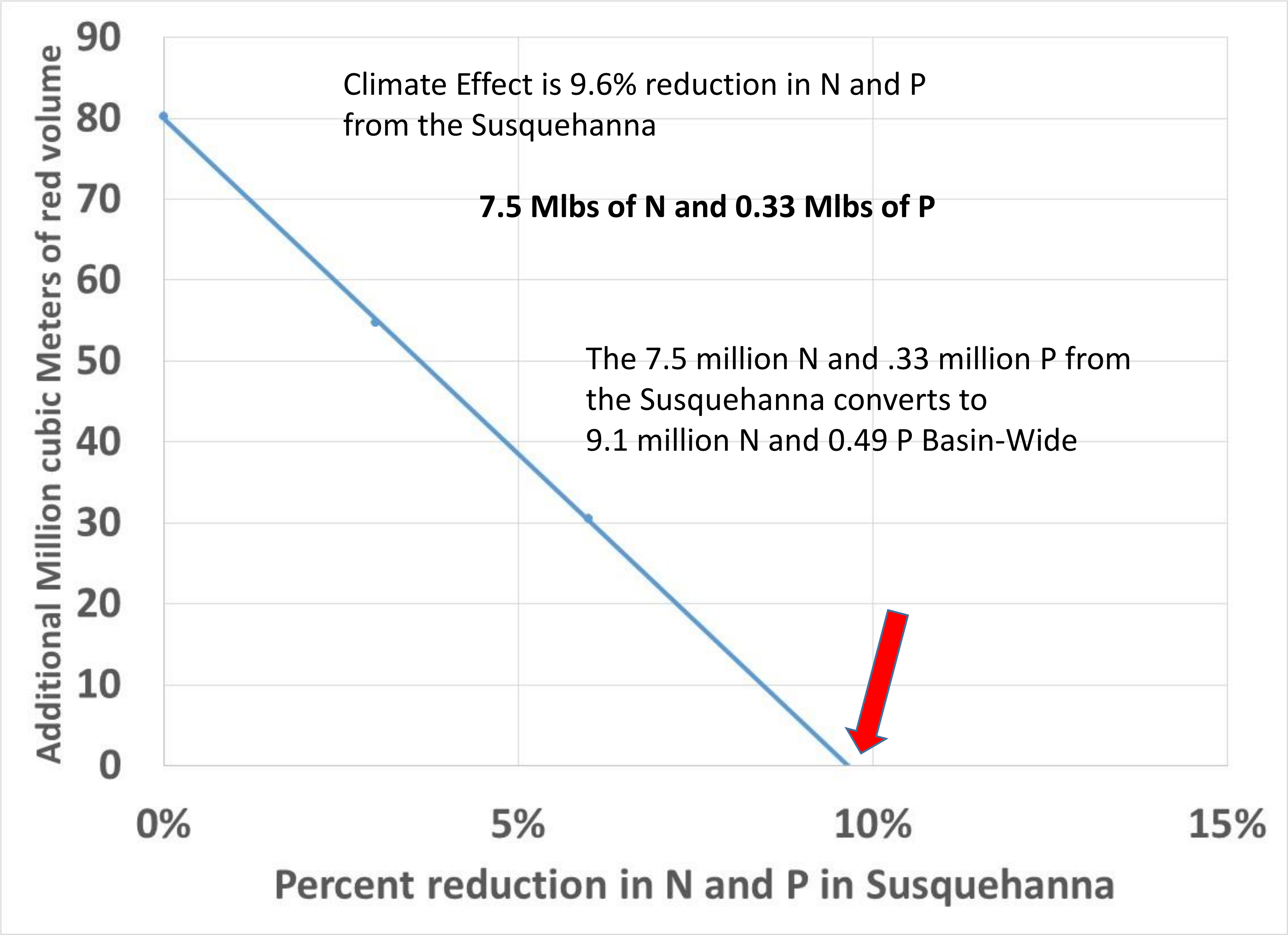


Calculate Climate Effect

CB Seg	Designated Use	Designated Use Total Volume	Red Percent WIP + Conow	Red Volume WIP + Conow	Red Percent WIP + Conow + CC	Red Volume WIP + Conow + CC
CB3MH	DW	864	0.05%	0	0.05%	0
CB4MH	DW	2854	5.52%	158	6.50%	186
MD5MH	DW	2097	1.09%	23	1.51%	32
VA5MH	DW	1605	0.00%	0	0.00%	0
POMMH	DW	1839	0.00%	0	0.00%	0
CB3MH	DC	390	0.00%	0	0.00%	0
CB4MH	DC	2126	8.04%	171	10.09%	215
MD5MH	DC	2875	0.00%	0	0.00%	0
VA5MH	DC	1848	0.00%	0	0.00%	0
				352		432
					CC Difference	**80**

Volume Weighted means a ‘red area’ increase of 80 million cubic meters

Ran Scenarios with 3% and 6% reduction in Susquehanna N and P



Climate Change Loads: Nitrogen

Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	18.71	15.44	0.400			15.84	10.62
PA	122.41	99.28	4.135			103.41	72.99
MD	83.56	55.89	2.194			58.09	45.39
WV	8.73	8.06	0.236			8.30	6.36
DC	6.48	1.75	0.006			1.76	2.25
DE	6.97	6.59	0.397			6.98	4.66
VA	84.29	61.53	1.722			63.25	56.37
BasinWide	331.15	248.54	9.09			257.63	198.64

*Units: millions of pounds

Climate Change Loads: Nitrogen

Jurisdiction	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +
NY			3.8%	3.8%
PA			5.7%	5.7%
MD			4.8%	4.8%
WV			3.7%	3.7%
DC			0.3%	0.3%
DE			8.5%	8.5%
VA			3.1%	3.1%
BasinWide			4.6%	4.6%

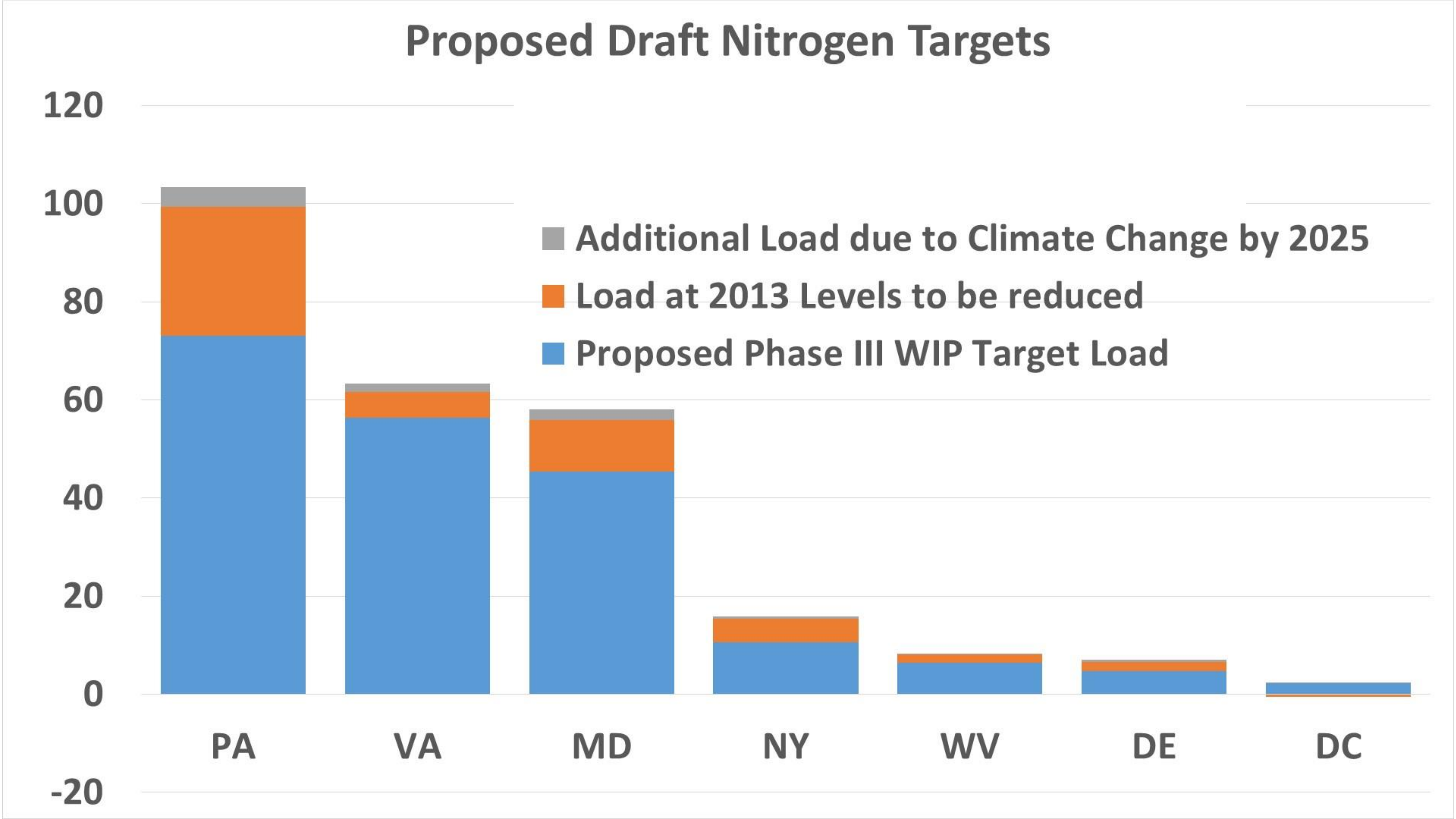
Climate Change Loads: Phosphorus

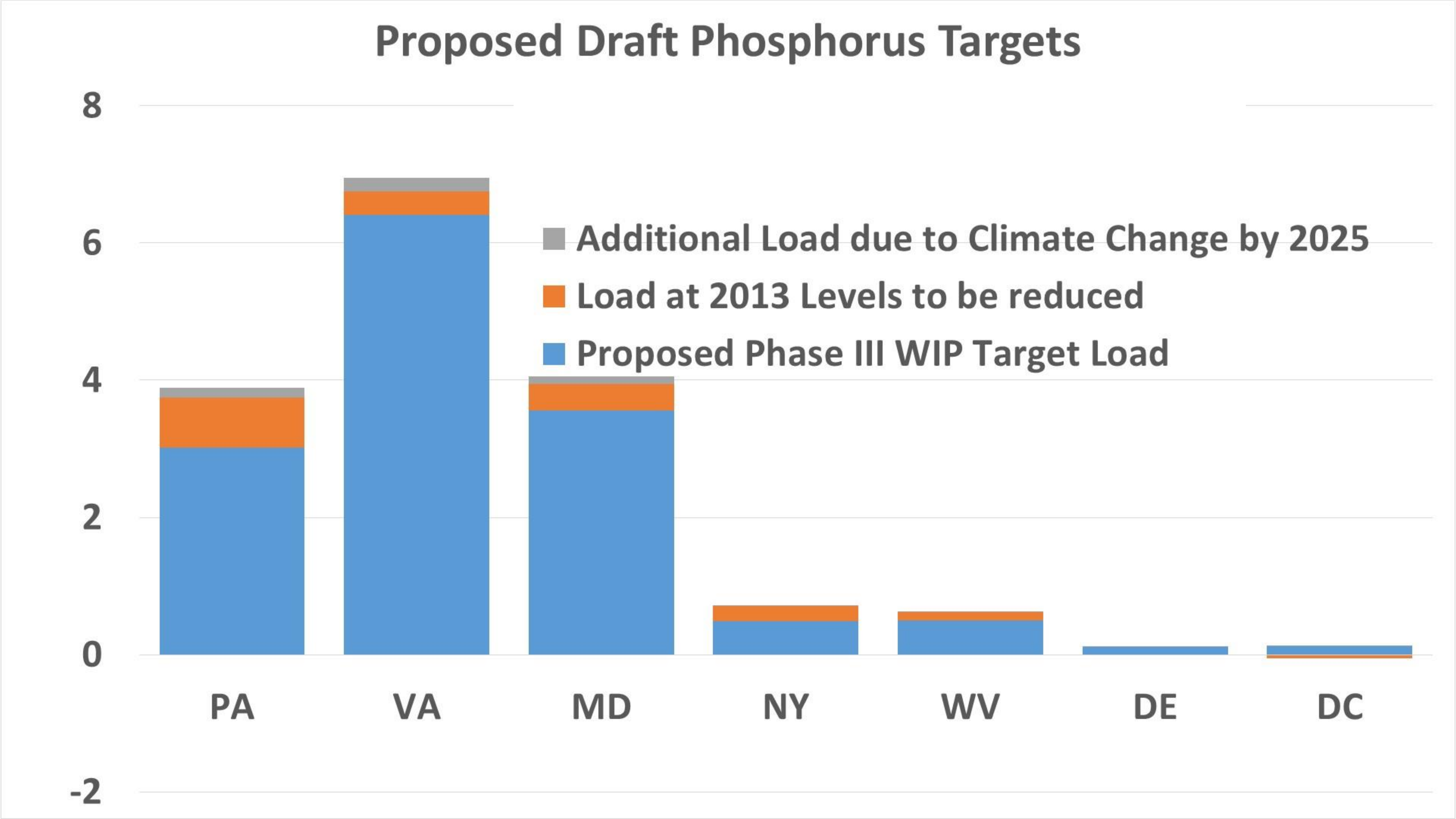
Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	1.198	0.710	0.014			0.724	0.491
PA	6.282	3.749	0.141			3.891	3.012
MD	7.495	3.942	0.114			4.056	3.553
WV	0.902	0.617	0.019			0.637	0.493
DC	0.090	0.062	0.001			0.063	0.120
DE	0.225	0.116	0.006			0.122	0.116
VA	14.244	6.751	0.193			6.944	6.411
BasinWide	30.44	15.95	0.489			16.436	14.20

*Units: millions of pounds

Climate Change Loads: Phosphorus

Jurisdiction	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +
NY			2.9%	2.9%
PA			4.7%	4.7%
MD			3.2%	3.2%
WV			3.9%	3.9%
DC			0.8%	0.8%
DE			5.1%	5.1%
VA			3.0%	3.0%
BasinWide			3.4%	3.4%


Proposed Draft Nitrogen Targets
120
100
80
60
40
20
0
-20
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC



Proposed Draft Phosphorus Targets
8
6
4
2
0
-2
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC

Policy Options for Accounting for Climate Change in the Jurisdictions' Phase III WIPs

Mark Bennett, USGS, CBP Climate Resiliency Workgroup Co-Chair

Two Policy Approaches

Numeric

and/or

Programmatic

Numerical Approach

- A quantitative, numerical approach will result in a very small changed level of effort necessary to meet water quality standards
- Account for the increased pollutant loads to each jurisdiction's portion of the Bay watershed
- Accounts for feedbacks to the Bay's assimilative capacity
- This approach would treat the estimated cumulative effect of changed conditions due to climate change similarly to the approach being taken to account for growth
- Jurisdictions would develop Phase III WIPs which account for the estimated increased pollutant loads

Numerical Approach: Pros & Cons

Pros	Cons
• Comprehensive, straight-forward approach • Demonstrates Partnership's commitment to Chesapeake Bay Agreement Climate Resiliency Goal • Small level of increased effort necessary • Near-term response • Implemented in sequence with development of Phase III WIPs	• Potential change in the level of effort required to meet water quality standards • If implemented in isolation (w/o the programmatic approach), would not address the anticipated impacts of climate change on BMPs

Programmatic Approach

- An “adaptive management approach” that would be implemented through the two-year milestone process
- Would not change a jurisdictions' planning targets
- Directs the Partnership to collect and consider new information on the performance of BMPs, including the contribution of seasonal, inter-annual climate variability, and weather extremes.
  - Jurisdictions would assess this information and adjust plans, over-time, to better mitigate anticipated changes in loads and impacts on the performance of BMPs.
- Would require the inclusion of a narrative strategy in Phase III WIPs, describing a jurisdictions’ programmatic commitments to address climate change.
  - A sample “*narrative strategy*” would be provided to jurisdictions to guide implementation.

Programmatic Approach: Pros & Cons

Pros	Cons
• Adaptively managing for long-term change • Allows for use of local expertise and knowledge • Provides for learning across jurisdictions about methods and results • Allows for flexibility in jurisdictions' approaches to addressing climate change • Provides standard elements to be addressed	• If implemented in isolation (w/o numeric approach), delays substantive action to address climate change in the near-term • Lack of specific technical understanding to guide implementation • Requires additional monitoring and assessment efforts • Inconsistency in implementation across jurisdictions

Requested WQGIT Policy Recommendation

- Recommend a numerical and/or programmatic approach to guide jurisdictions’ development and implementation of Phase III Watershed Implementation Plans.

- Recommend the level of flexibility among jurisdictions, as well as commitments for CBP programmatic support (e.g., guidance, data, funding, etc.), for implementation of climate change policies that exceed the Partnership approved policy.

Accounting for Growth in the Jurisdictions' Phase III WIPs

Karl Berger, MWCOG, CBP Land Use Workgroup Chair
and
Peter Claggett, USGS, CBP Land Use Workgroup Coordinator

Accounting for Growth Equitability Across Jurisdictions

1. Watershed population is increasing by over 1 million persons/decade
   - Population change from 2010 -2025 = 2.0 million persons

2. The Partnership's Chesapeake Bay Land Change Model estimates land use and wastewater impacts of future population growth.
   - Parameterized uniquely for every county/city in the Bay watershed
   - Accounts for uncertainty at sub-county scales

3. Partnership approval of all future land use scenarios reflecting a range of planning and conservation efforts

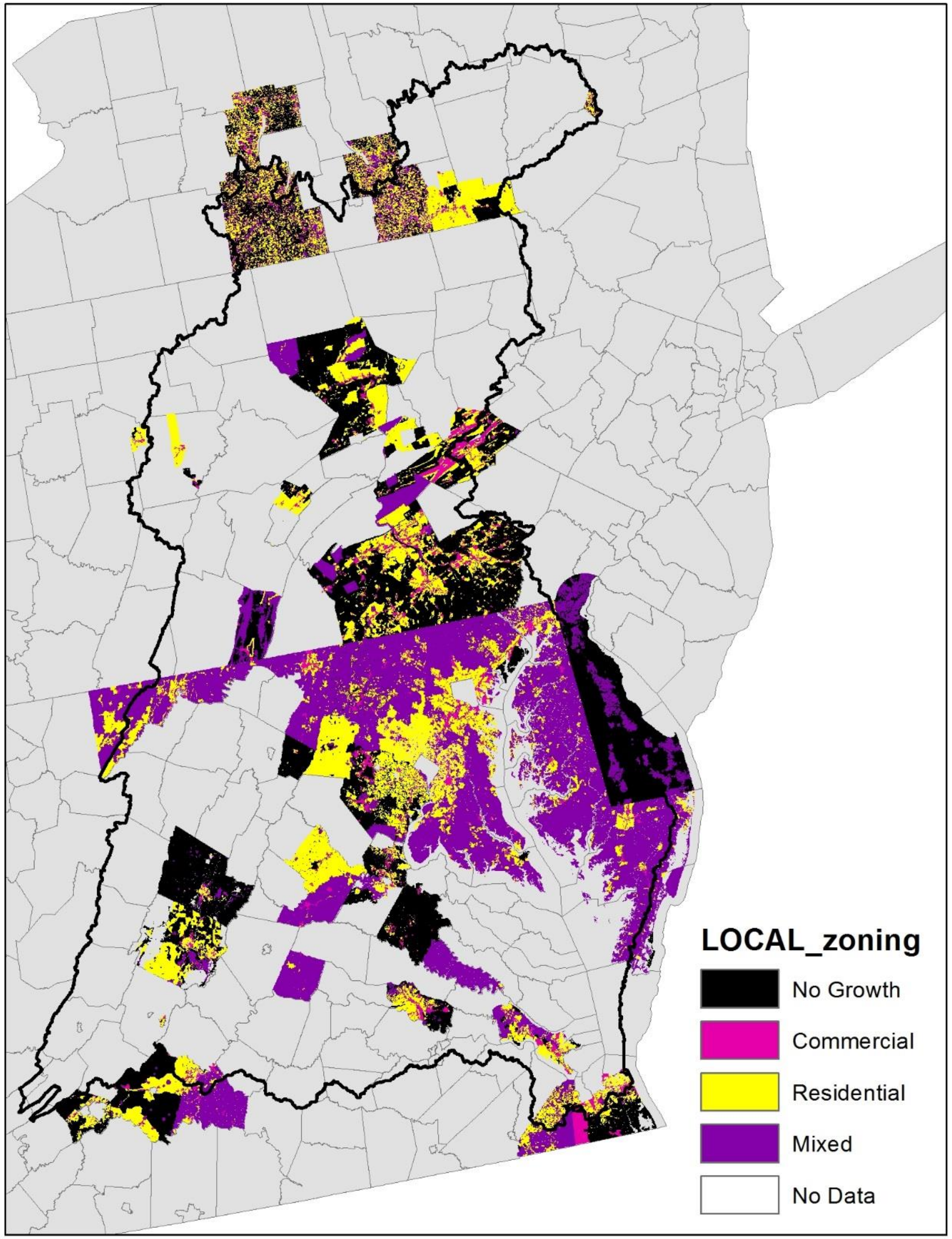
4. Developing the WIPs on 2025 land use conditions enable the use and crediting of planning and conservation efforts to help "account for growth"

Future Growth Scenarios

1. **Current Zoning**: continuation of historic trends constrained by existing local zoning. Includes the best available regional and local data representing current conditions

2. **Conservation Plus**: continuation of historic trends constrained by local zoning, aggressive land conservation, accelerated infill/redevelopment, densification of urban areas, avoidance of riparian areas, 100-year floodplains, frequently flooded soils, areas subject to sea-level rise and storm surge, and soils unsuitable for on-site septic systems

Extent of Local Zoning Data



Collected by CBP from local and state agencies, 2013 - 2017

Land Use Planning and Conservation in CAST

- Loading impacts from individual or combinations of components of the Conservation Plus scenario, e.g., land conservation, floodplain protection, incentives for infill, will be evaluated with the Partnership models to quantify the water quality benefits of each particular action or collection of actions.

- Users of CAST will be able to select a subset of policy and conservation actions as components of their WIPs. To inform their selection, supplementary information will be provided about the potential local loading effects of policy and conservation actions.

- Planning and conservation actions will be simulated as changes in land use against which, CAST users can add other BMPs and estimate loads.

WQGIT Recommendations and Decisions to Account for Growth in the Jurisdictions' Phase III WIPs

Karl Berger, MWCOG, CBP Land Use Workgroup Chair

2025 Growth Projections

September 25-26, 2017 WQGIT Decision

- Use the CBLCM and MD Land Use Model to establish growth projections, with the opportunity to provide data or alternative modeling approaches in future years, which will be vetted through the Partnership approval process (starting with the Land Use Workgroup).

September 25-26, 2017 WQGIT Decision

- Drop the Historical Trends scenario and instead focus on the Current Zoning scenario, as zoning decisions have shaped historical trends and local jurisdictions are more likely to accept a scenario that includes their zoning information.

2025 Growth Projections

September 25-26, 2017 WQGIT Decision

- Implement minor refinements to the CBLCM that were recommended by the LUWG by October 31, 2017, coordinating with the USWG, WWTWG and AgWG.
  - State and local partners will review the tabular and spatial data by October 31, 2017 so the LUWG can discuss at their first November meeting and deliver the dataset to the CBPO modeling team by November 15, 2017.
  - Historical Trends scenario data will be in CAST by October 2, 2017.
    - State and local jurisdictions can begin running Phase III WIP scenarios on Historical Trends by October 2, 2017.
  - Current Zoning scenario data will be in CAST by January 15, 2018.

2025 Growth Projections

September 25-26, 2017 WQGIT Decision

- The LUWG will continue working on alternative future scenarios identified during the Local Government Forum – e.g., Conservation Plus (formerly "Utopian") scenario.

- The LUWG will continue investigating ways to incorporate the Conservation Plus scenario into CAST to allow users to pick and choose which components of that scenario to use.

- Priority is to get the Conservation Plus scenario done by January 15, 2018. It will then go into the modeling system six weeks after that date (so it will be available in CAST by March 2018).

2025 Growth Projections

September 25-26, 2017 WQGIT Recommendation to the PSC

- Use 2025 growth projections (Current Zoning + animal numbers and crop mix) as base conditions for the Phase III WIPs.
  - This approach explicitly accounts for growth in the Phase III WIPs.
  - States can use 2017 (current) as a baseline and run the Phase III WIPs on 2025 growth projections to understand what's changing in each source sector as a result of forecasted growth.
  - This current baseline will help inform the description in the Phase III WIPs of the policies, BMPs and/or programs in place to address that growth.

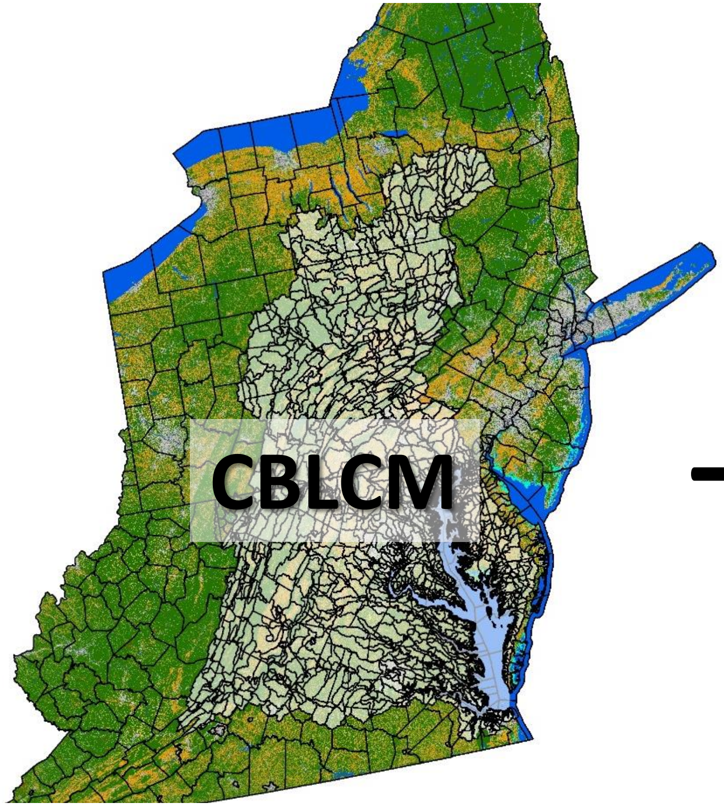
September 25-26, 2017 WQGIT Recommendation to the PSC

- Update the growth projections every 2 years with the best available data to inform the development of the two-year milestones.
  - Allows for adaptive management to changing growth patterns and trends as we approach 2025.
  - Need to be clear about what new data has been incorporated into the projections on this two-year basis, and what has changed as a result of incorporating this new data.

Estimated Changes in Land Use and Loads Through 2025

Peter Claggett, USGS, CBP Land Use Workgroup Coordinator

Year 2025 Land Use



+

Reported County-level Construction Acres

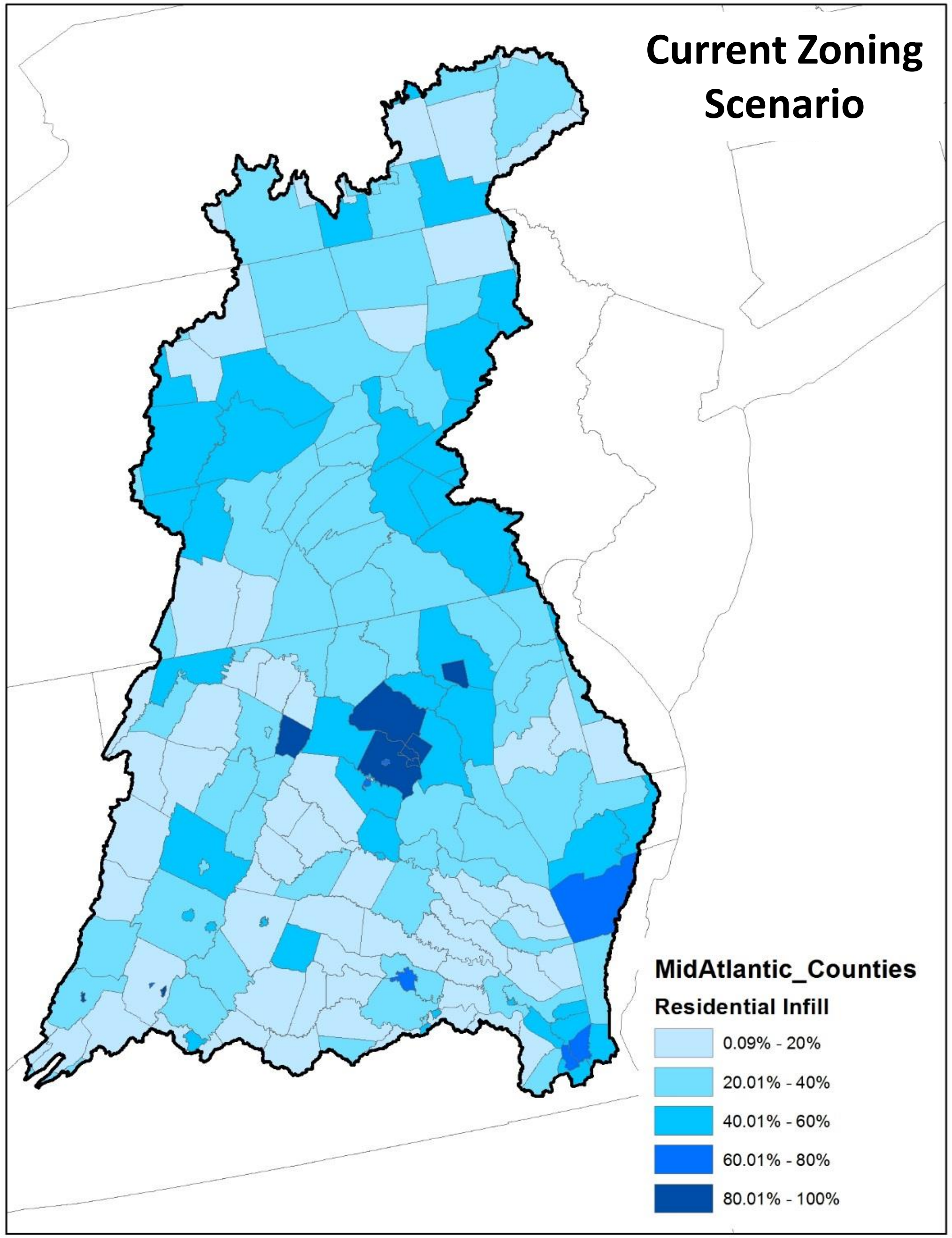
Extrapolated

CENSUS OF AGRICULTURE

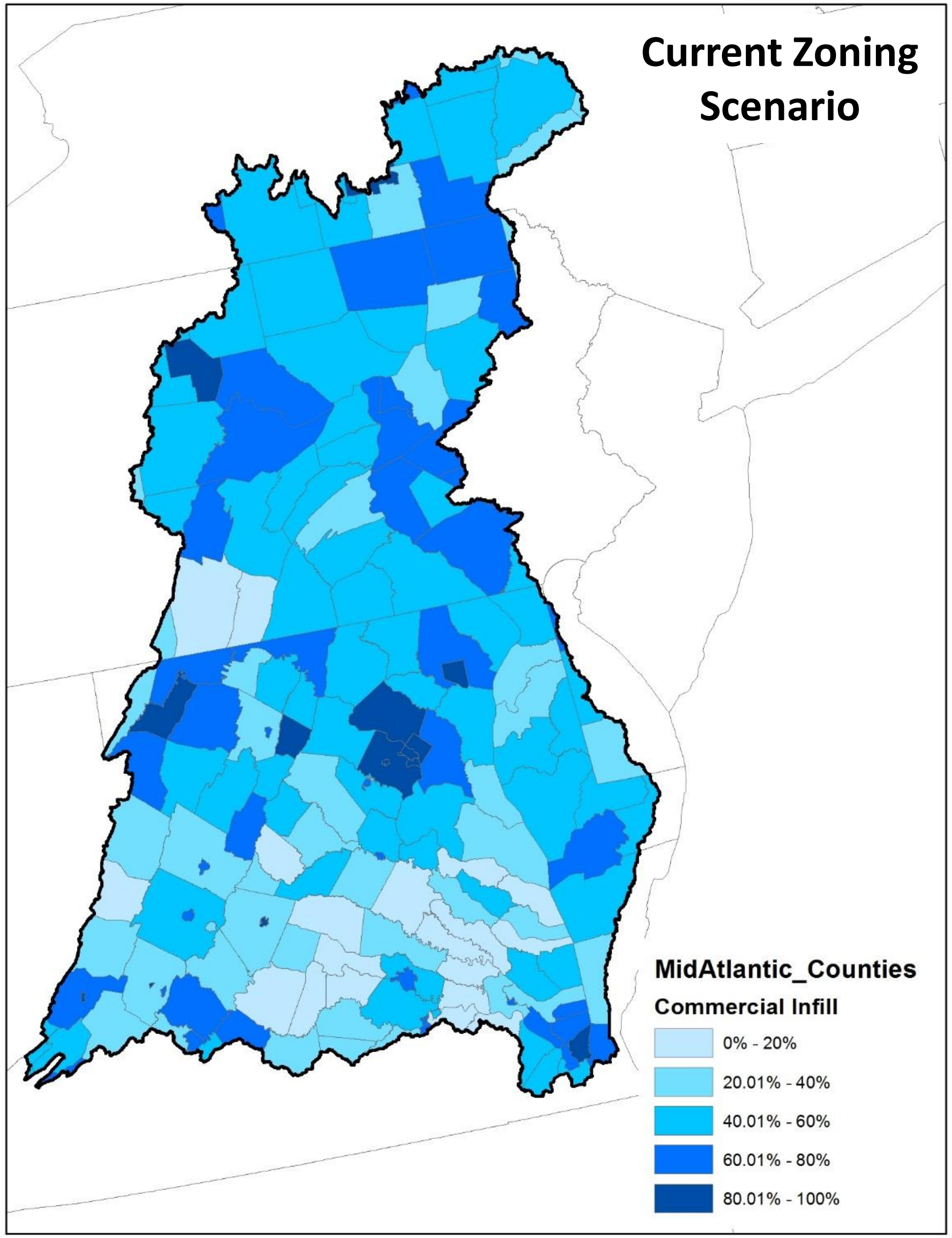
True-Up Process

Phase 6 2025 Land Use Dataset

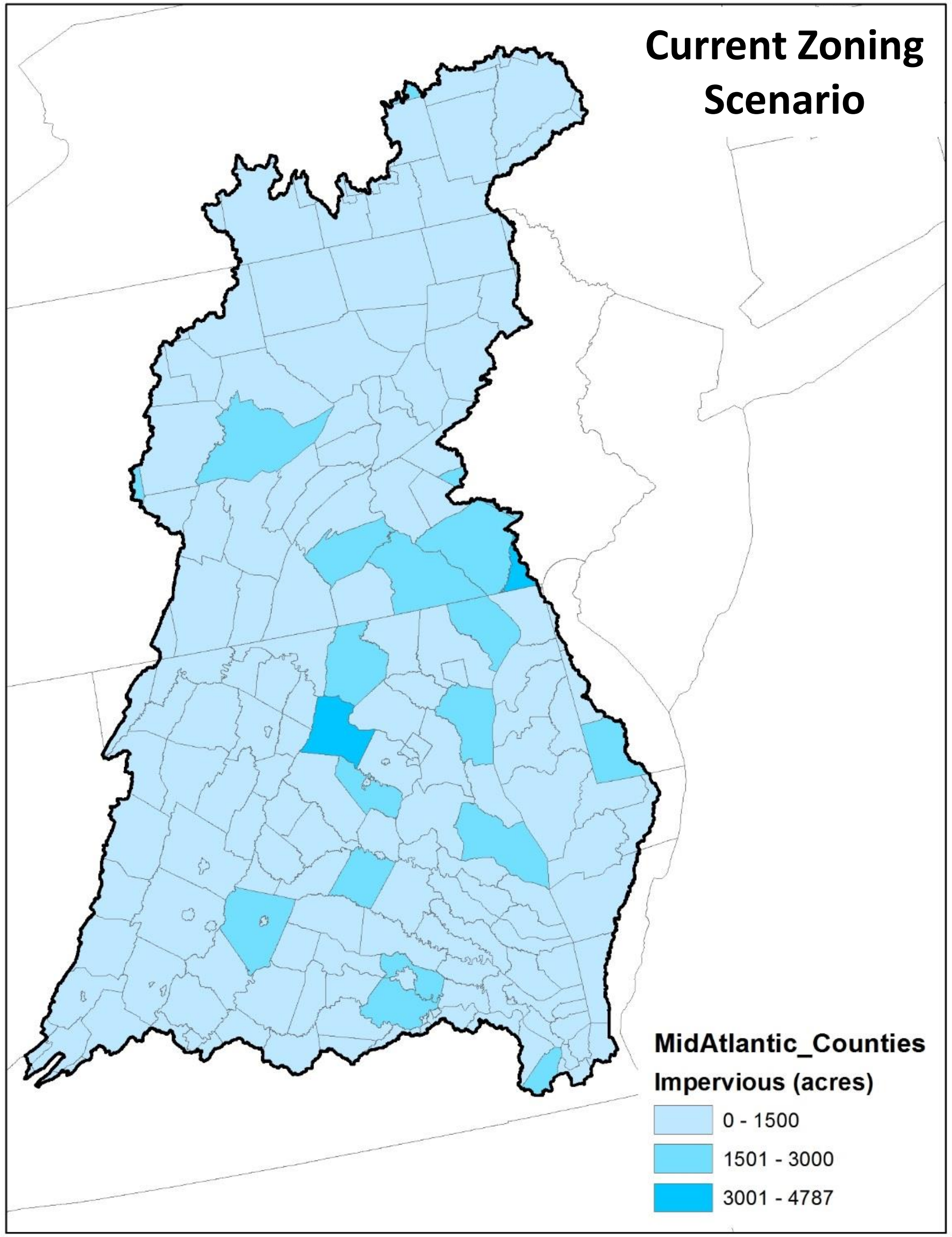
Residential Infill/Redevelopment



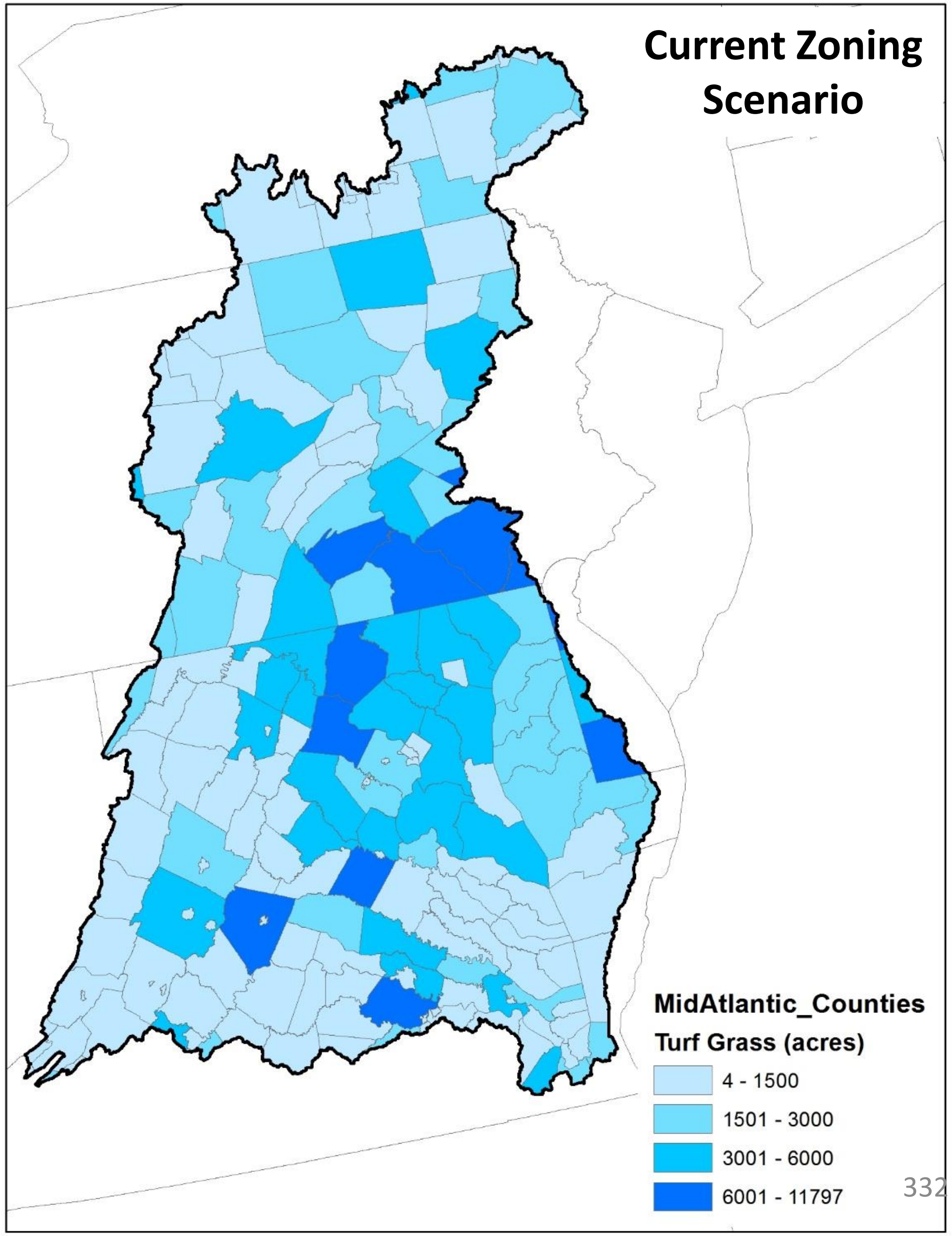
Commercial Infill/Redevelopment



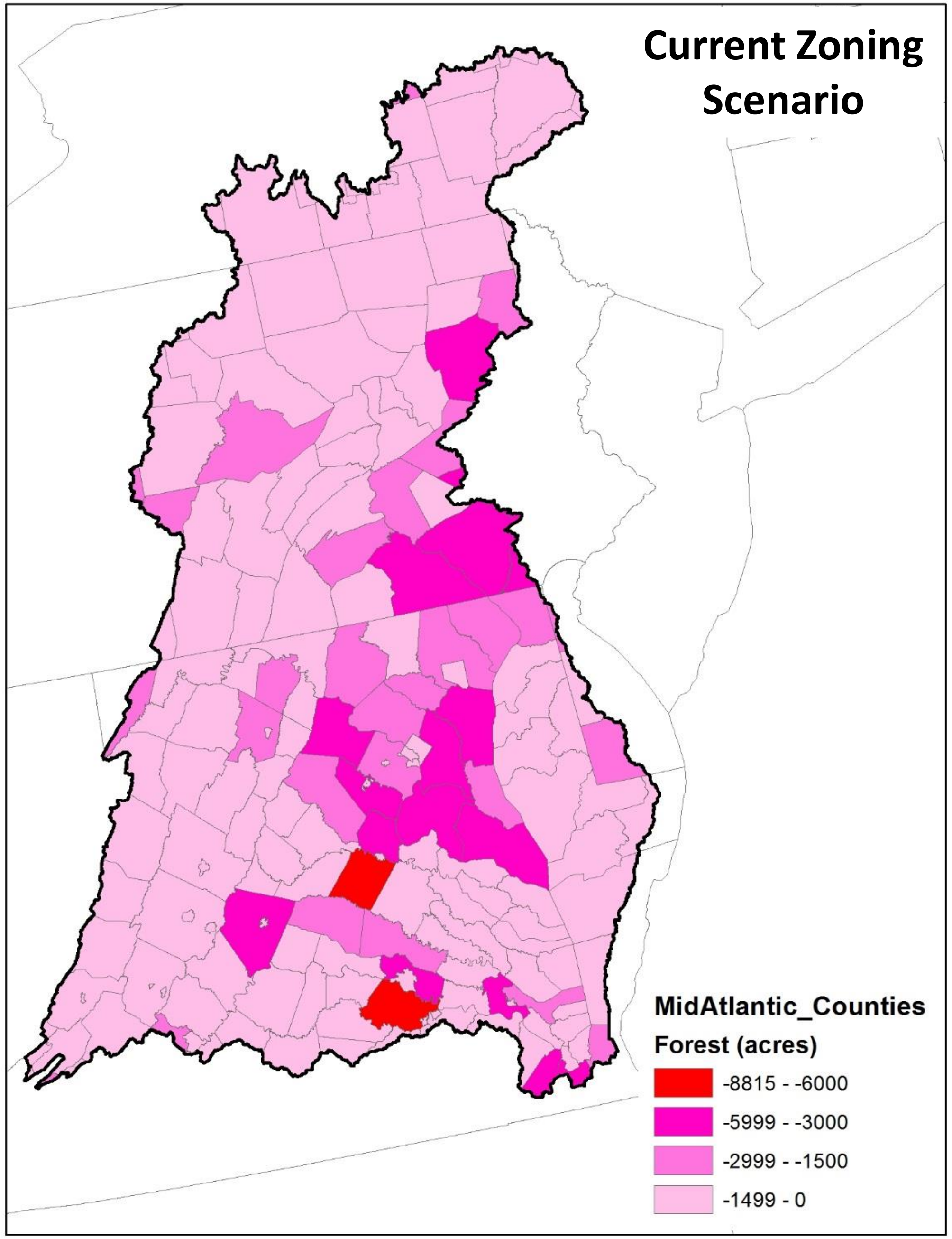
Increase in Impervious Surfaces



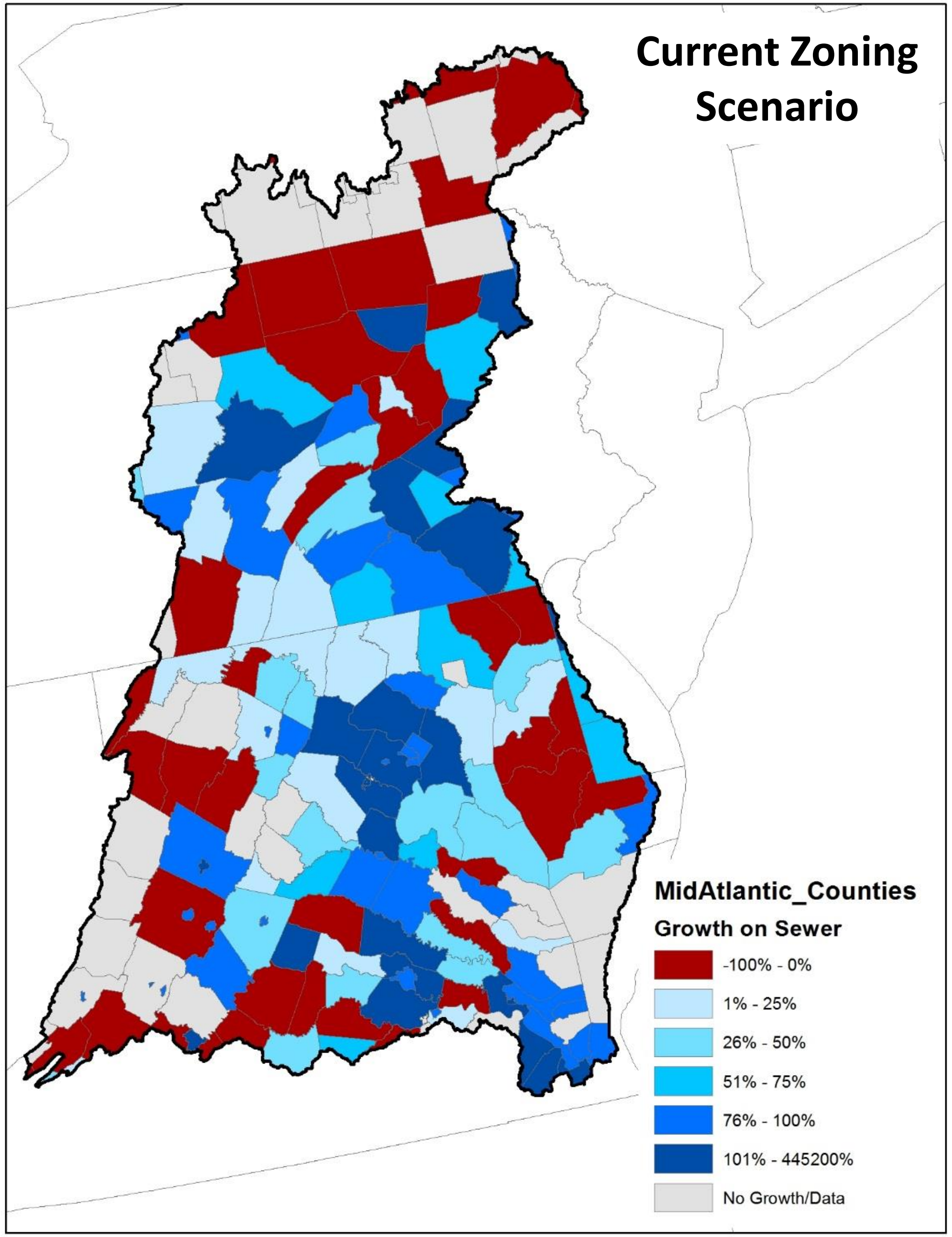
Increase in Turf Grass

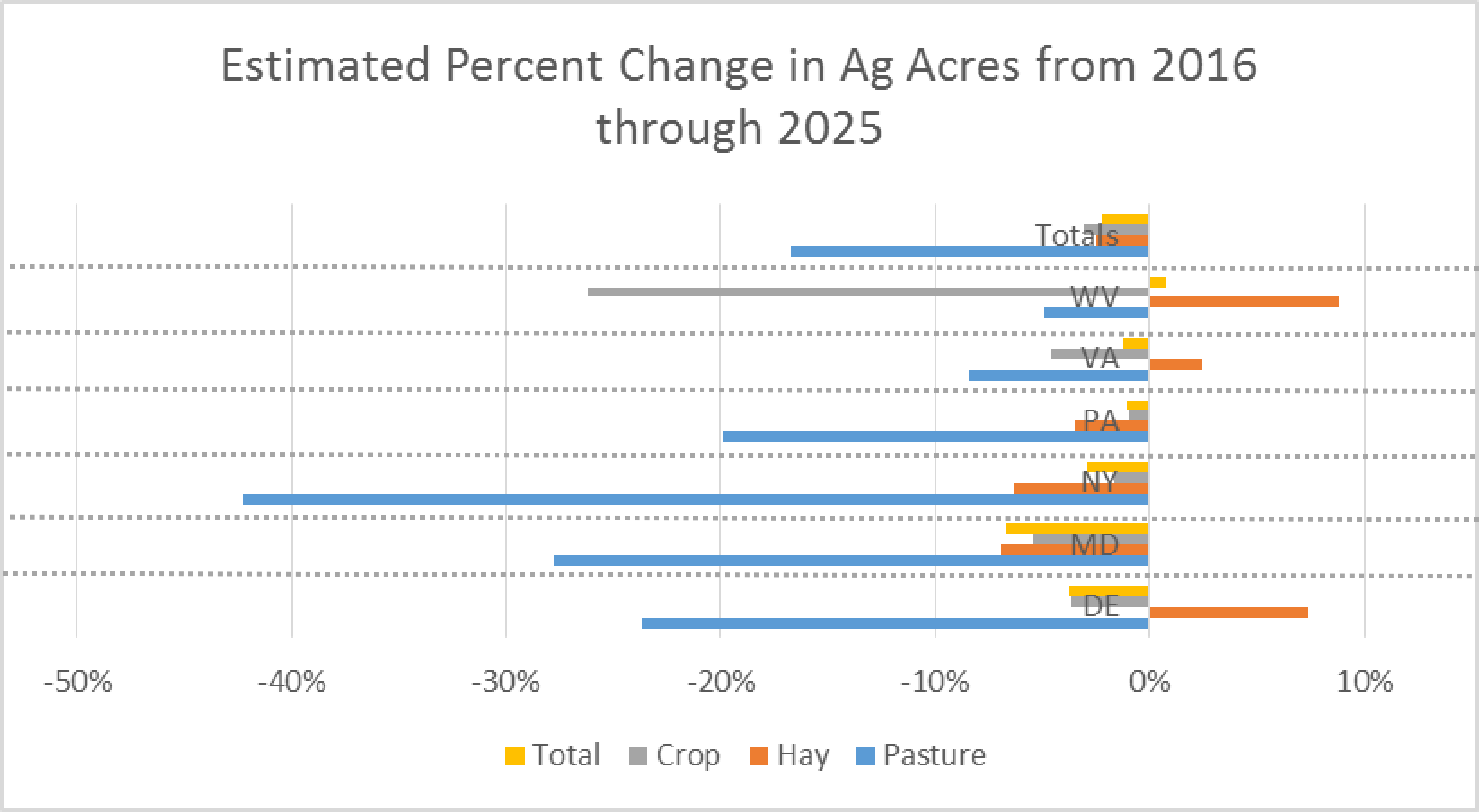


Forest Conversion to Development

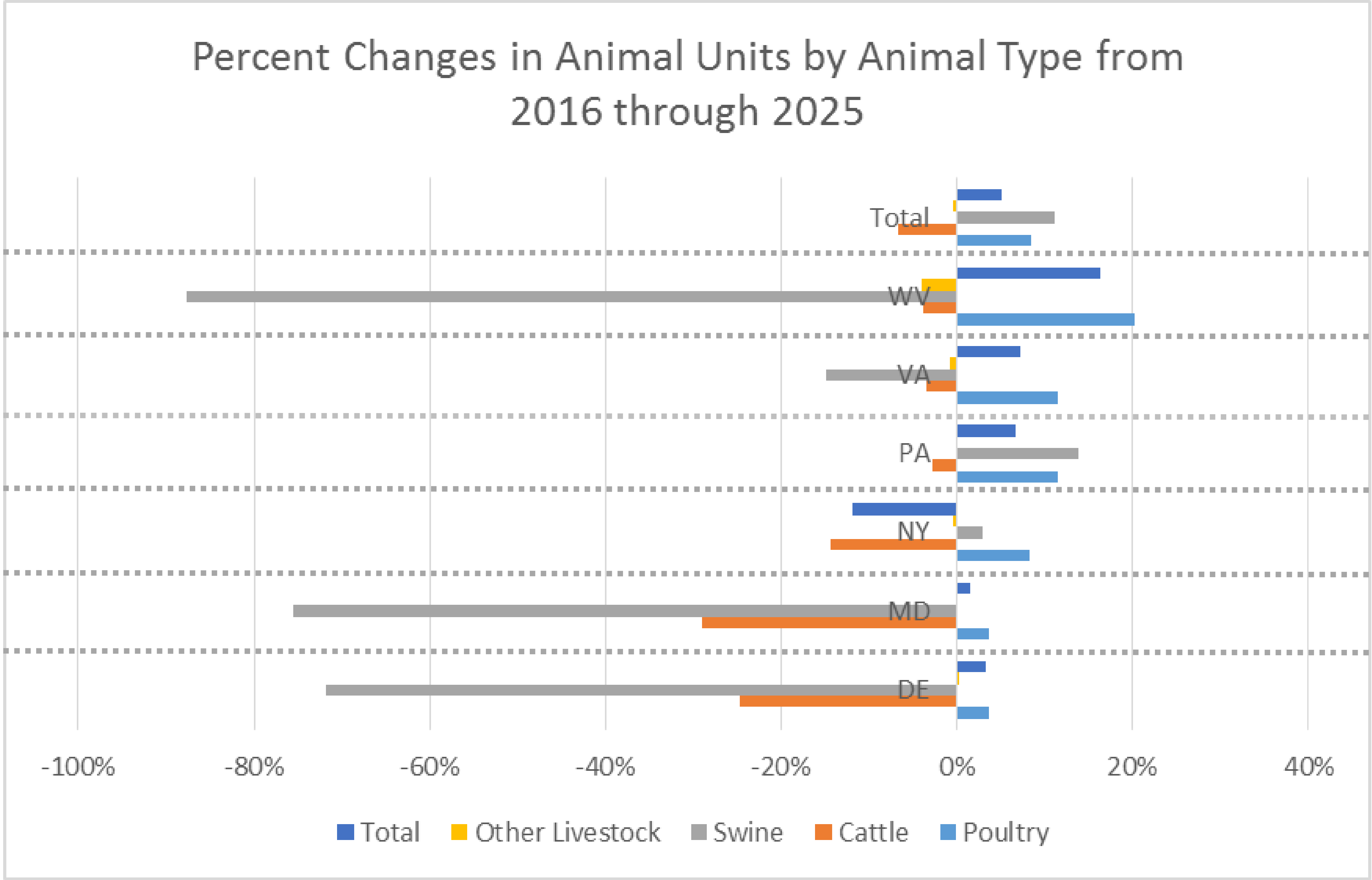


Growth on Sewer and Septic

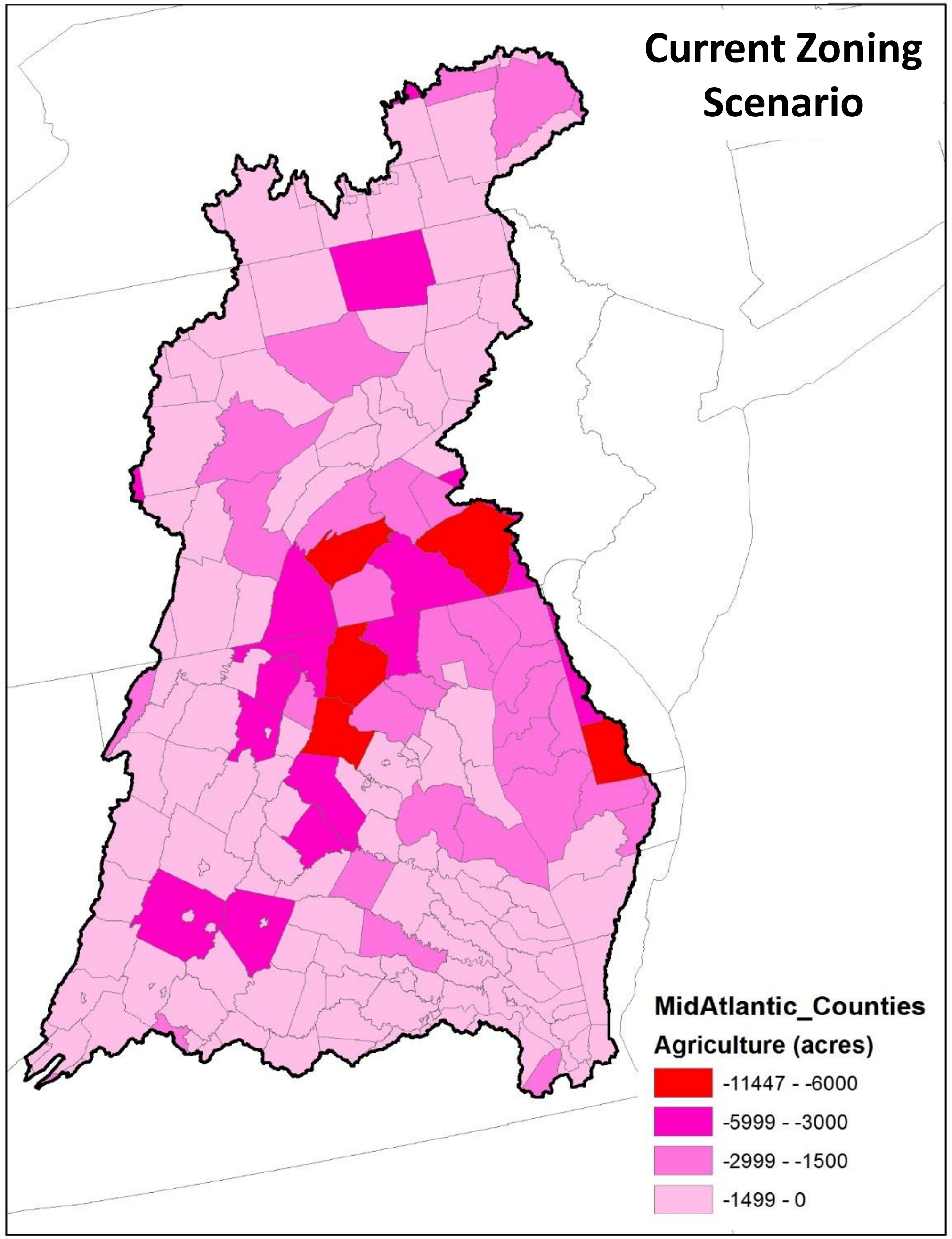




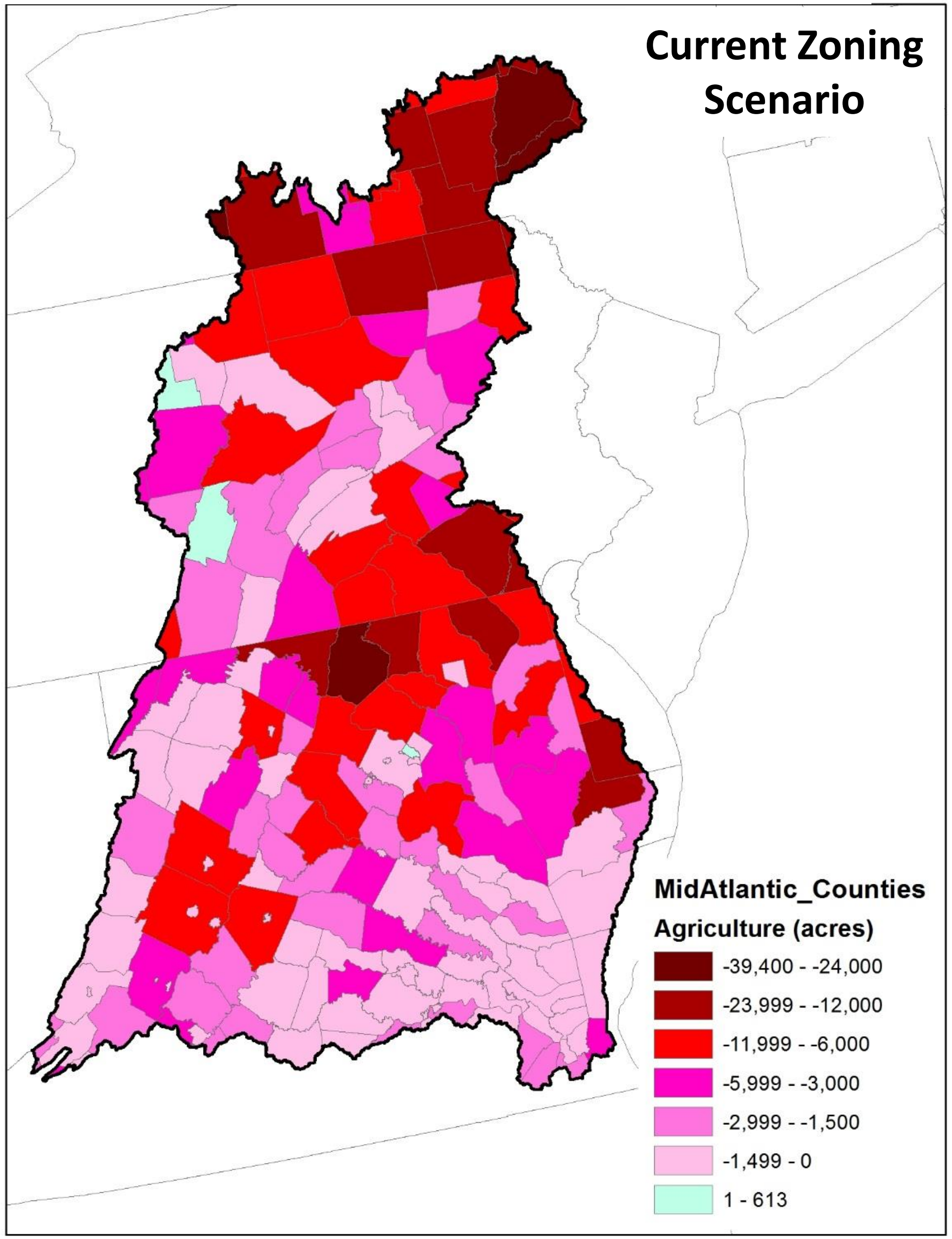
Estimated Percent Change in Ag Acres from 2016 through 2025
Totals
WV
VA
PA
NY
MD
DE
-50%
-40%
-30%
-20%
-10%
0%
10%
Total
Crop
Hay
Pasture


Percent Changes in Animal Units by Animal Type from 2016 through 2025
Total
WV
VA
PA
NY
MD
DE
-100%
-80%
-60%
-40%
-20%
0%
20%
40%
Total
Other Livestock
Swine
Cattle
Poultry

Farmland Conversion to Development



Farmland Conversion + Land Retirement



Growth Loads: Nitrogen

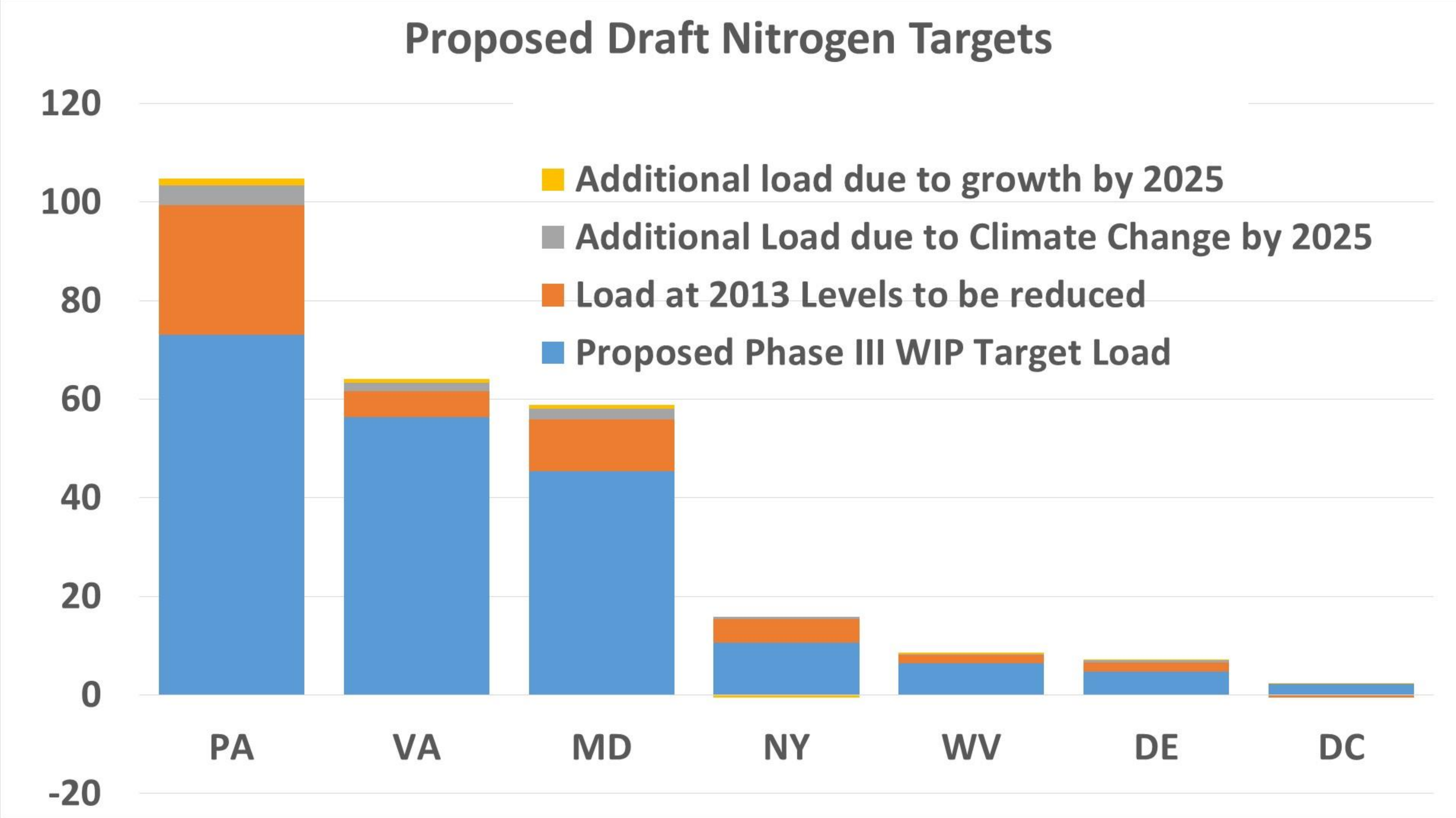
Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	18.71	15.44	0.400	-0.52		15.32	10.62
PA	122.41	99.28	4.135	1.38		104.79	72.99
MD	83.56	55.89	2.194	0.76		58.85	45.39
WV	8.73	8.06	0.236	0.20		8.50	6.36
DC	6.48	1.75	0.006	0.00		1.76	2.25
DE	6.97	6.59	0.397	0.22		7.21	4.66
VA	84.29	61.53	1.722	0.86		64.11	56.37
BasinWide	331.15	248.54	9.09	2.91		260.54	198.64

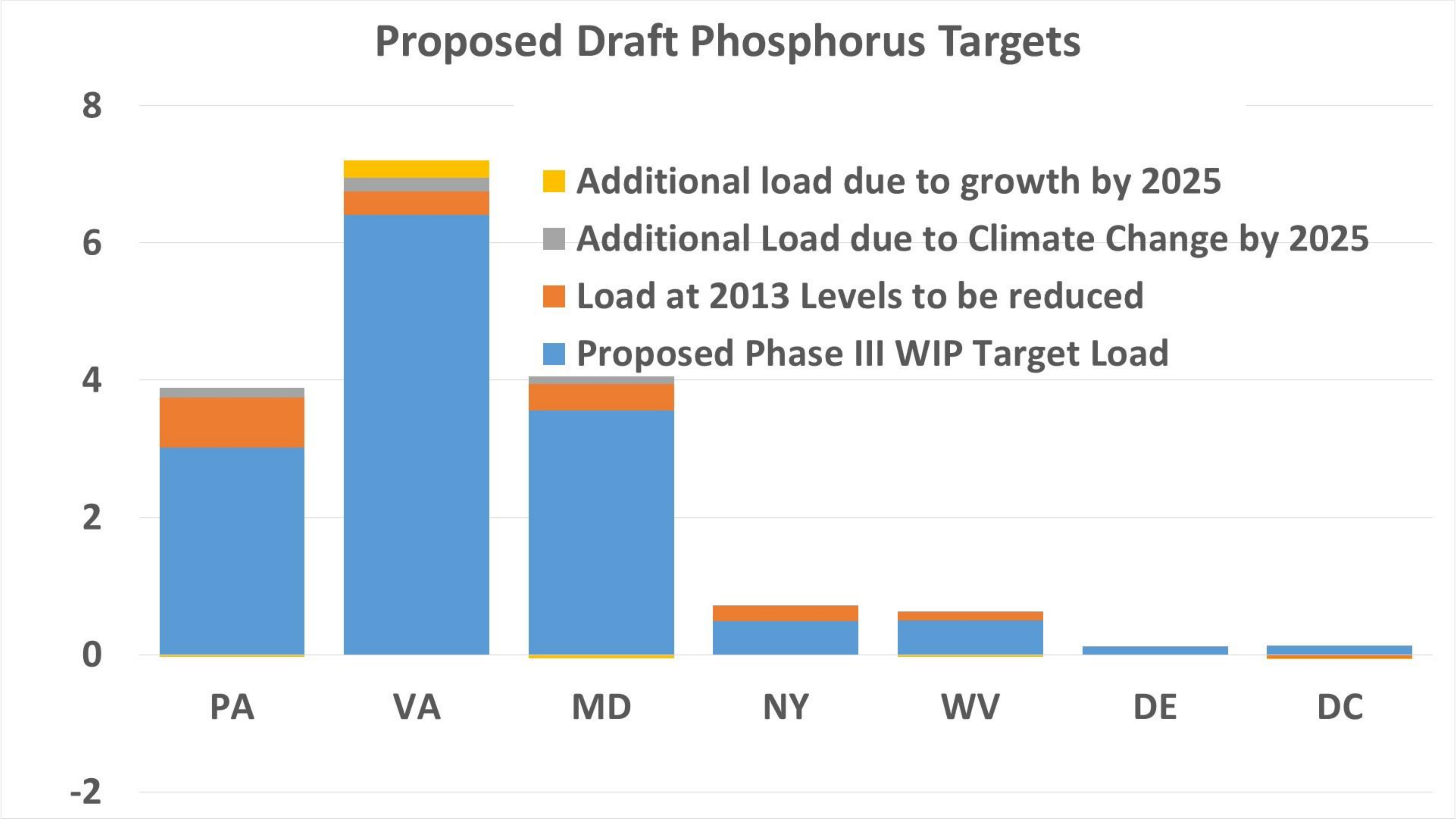
*Units: millions of pounds

Growth Loads: Phosphorus

Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	1.198	0.710	0.014	-0.010		0.714	0.491
PA	6.282	3.749	0.141	-0.034		3.857	3.012
MD	7.495	3.942	0.114	-0.053		4.002	3.553
WV	0.902	0.617	0.019	-0.027		0.610	0.493
DC	0.090	0.062	0.001	-0.001		0.063	0.120
DE	0.225	0.116	0.006	-0.004		0.117	0.116
VA	14.244	6.751	0.193	0.254		7.198	6.411
BasinWide	30.44	15.95	0.489	0.125		16.561	14.20

*Units: millions of pounds


Proposed Draft Nitrogen Targets
120
100
80
60
40
20
0
-20
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC


Proposed Draft Phosphorus Targets
8
6
4
2
0
-2
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC

September 24-25 WQGIT Policy Recommendation to the PSC

Approval of the use of 2025 to account for growth in the jurisdictions' Phase III WIPs with the option for each jurisdiction to select the most applicable scenario for projecting their 2025 growth

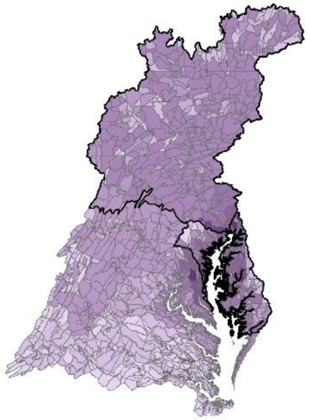
Conowingo Dam Infill: How Much, Who, How, and By When

Lee Currey, MDE, CBP Modeling Workgroup Co-Chair

How to Offset the Additional Loads Due to Conowingo Dam Infill

How much?

Who?



How?

Allocation equity rules used in the Bay TMDL

Assign additional load as local planning goal

When?

By 2025

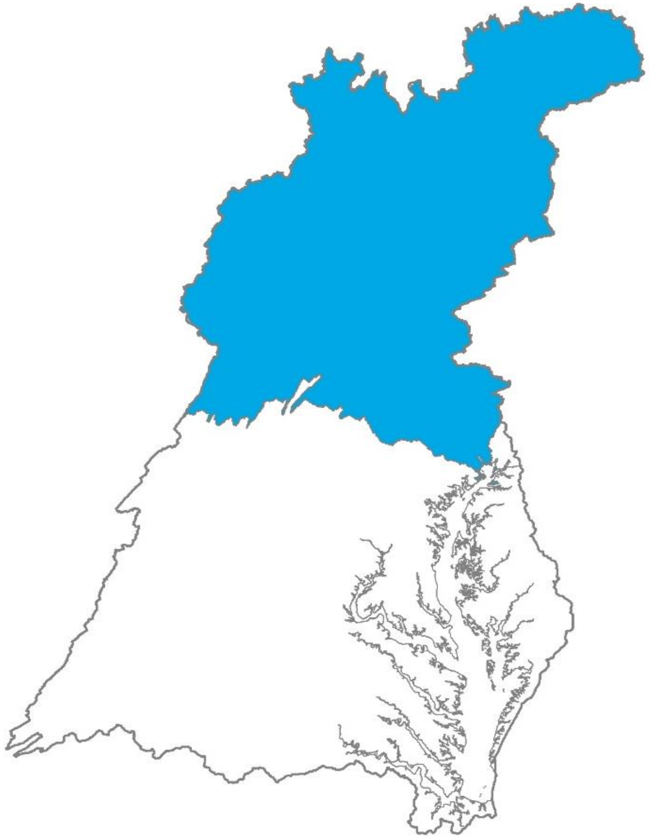
Post-2025 with agreed-upon date

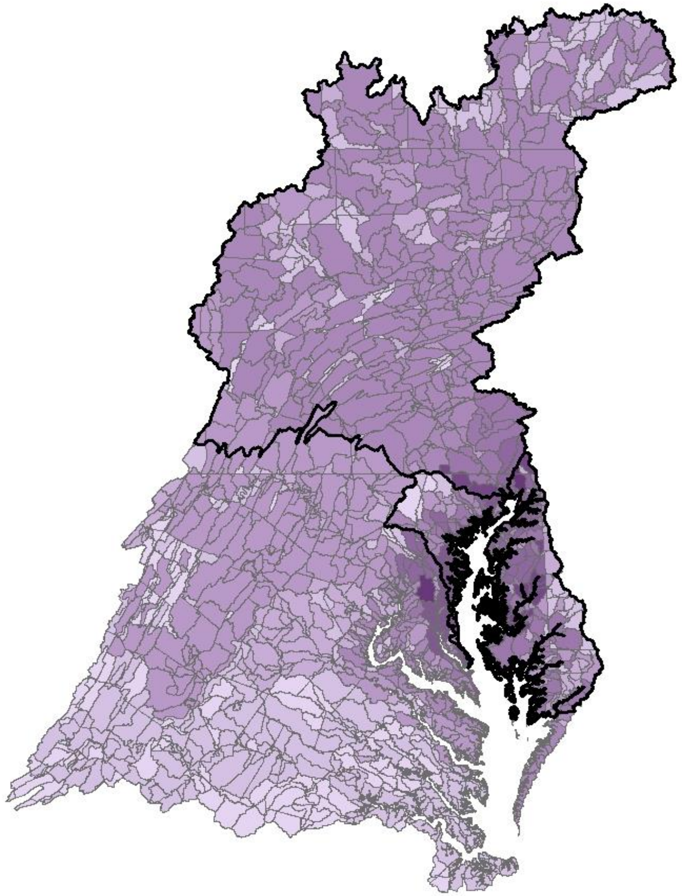
Beyond 2025 – no future date identified

Conowingo Dam Infill

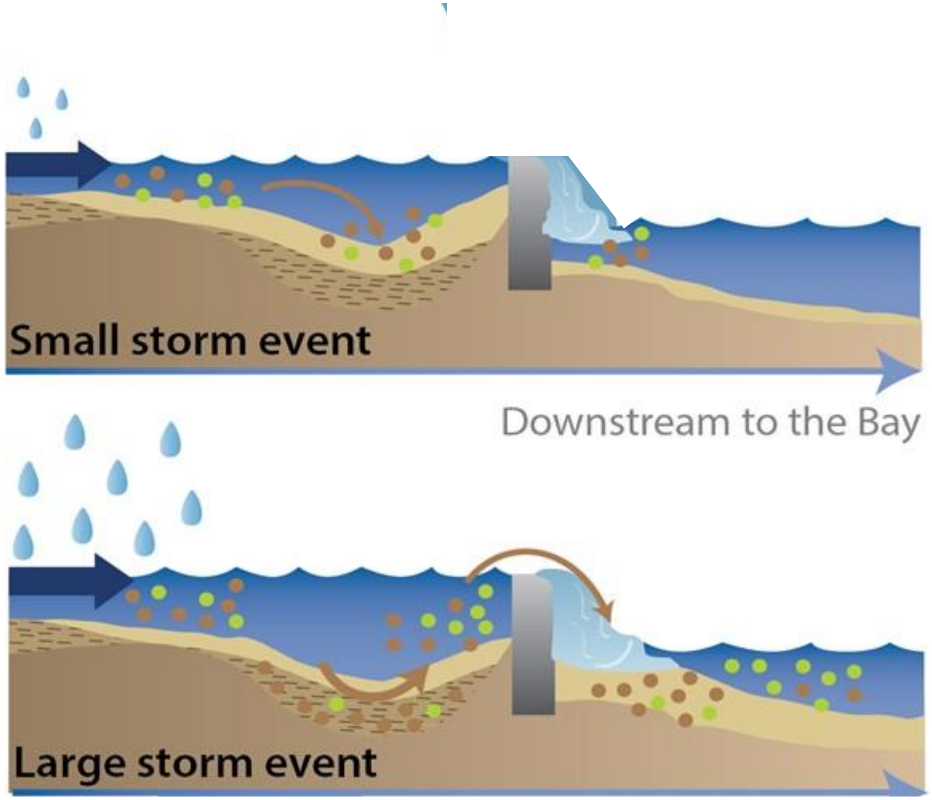
October 3, 2017 PSC Decisions

PSC agreed to add the "Susquehanna + most effective basins" option for final PSC decision.





Estimated Loads to the Bay with Conowingo Dam and Reservoir at Infill Conditions

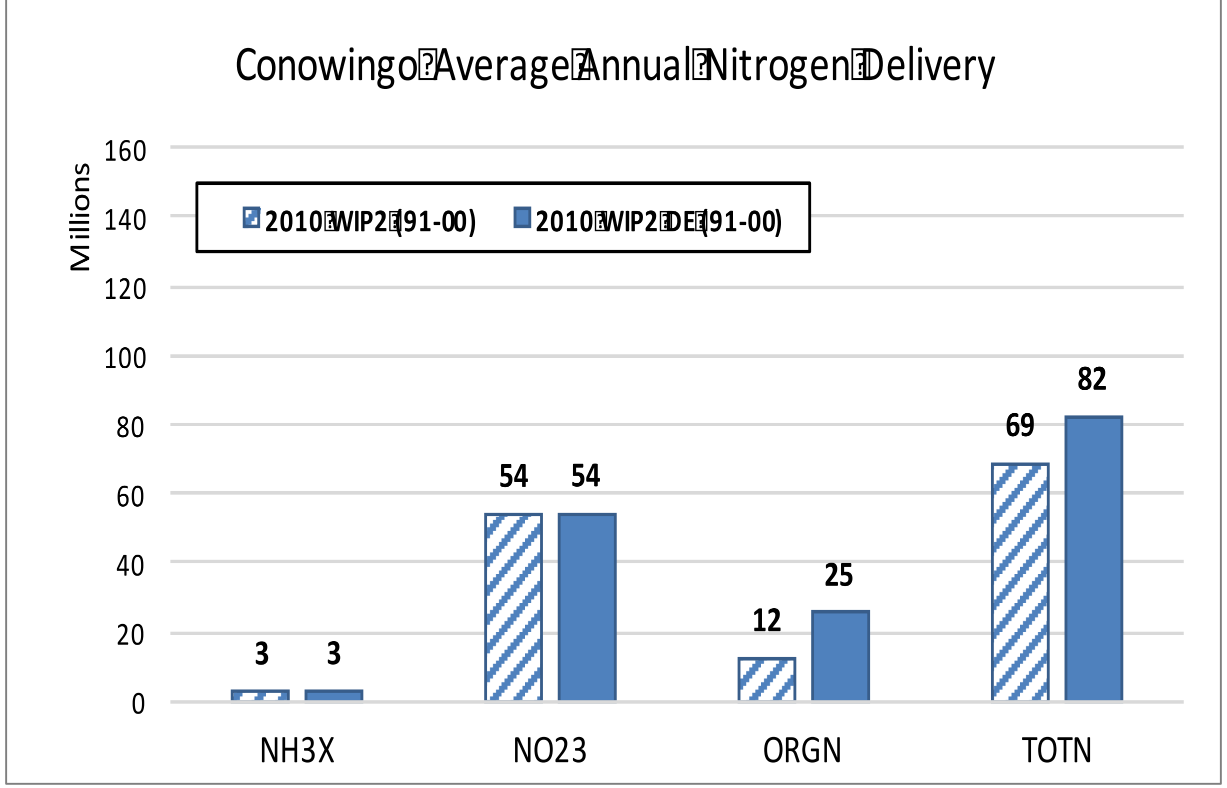


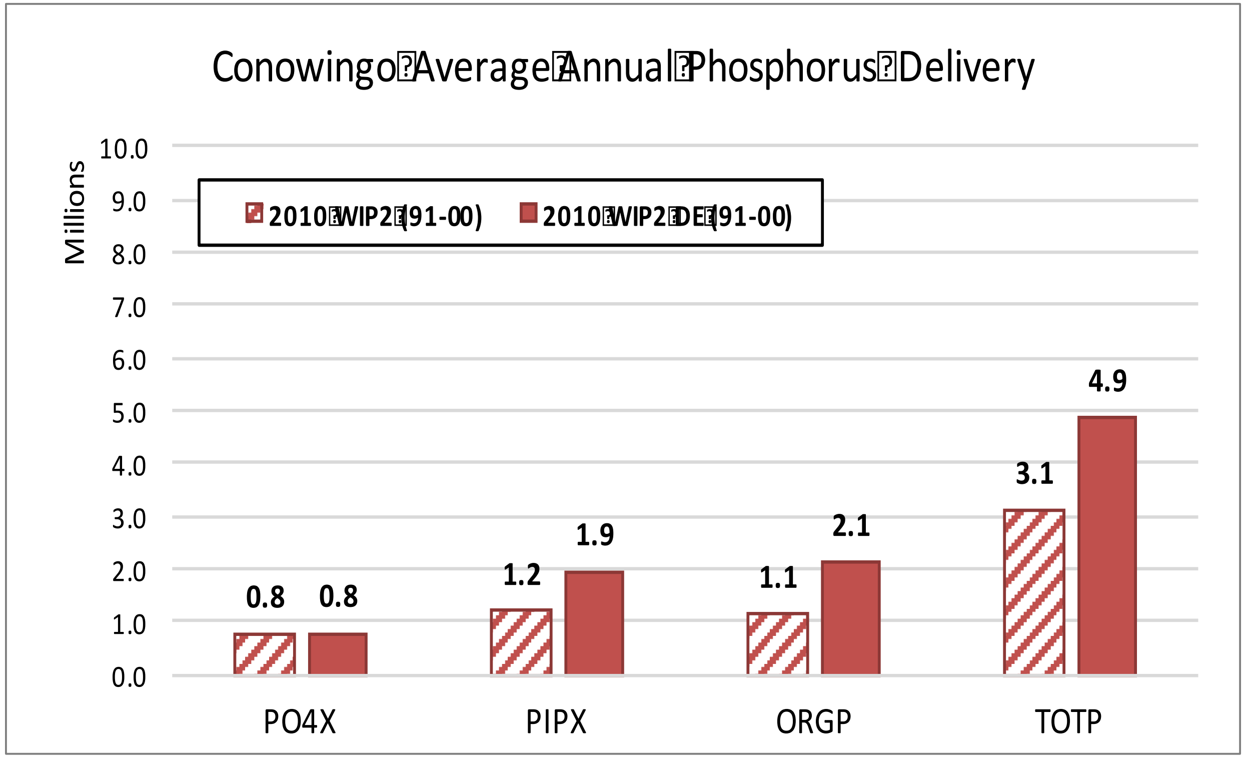
- Almost all of the nutrients are from upstream sources
- Much of the nutrients are biologically available to algae when they enter tidal waters

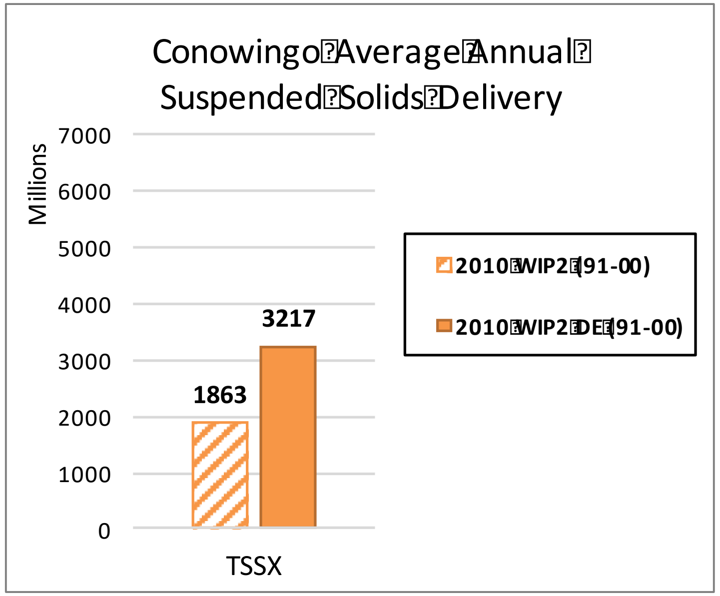
- Some of the nutrients are scoured from the bottom sediments behind the dam
- Much of these scoured nutrients are not biologically available to algae when they enter tidal waters

Therefore, the determination of nutrient loads to be reduced to account for Conowingo infill must factor in the type of nutrients and the timing of delivery

Conowingo Effect on Loads at the WIP2 condition







Estimated Loads to the Bay with Conowingo Dam and Reservoir at Infill Conditions

Recommendations

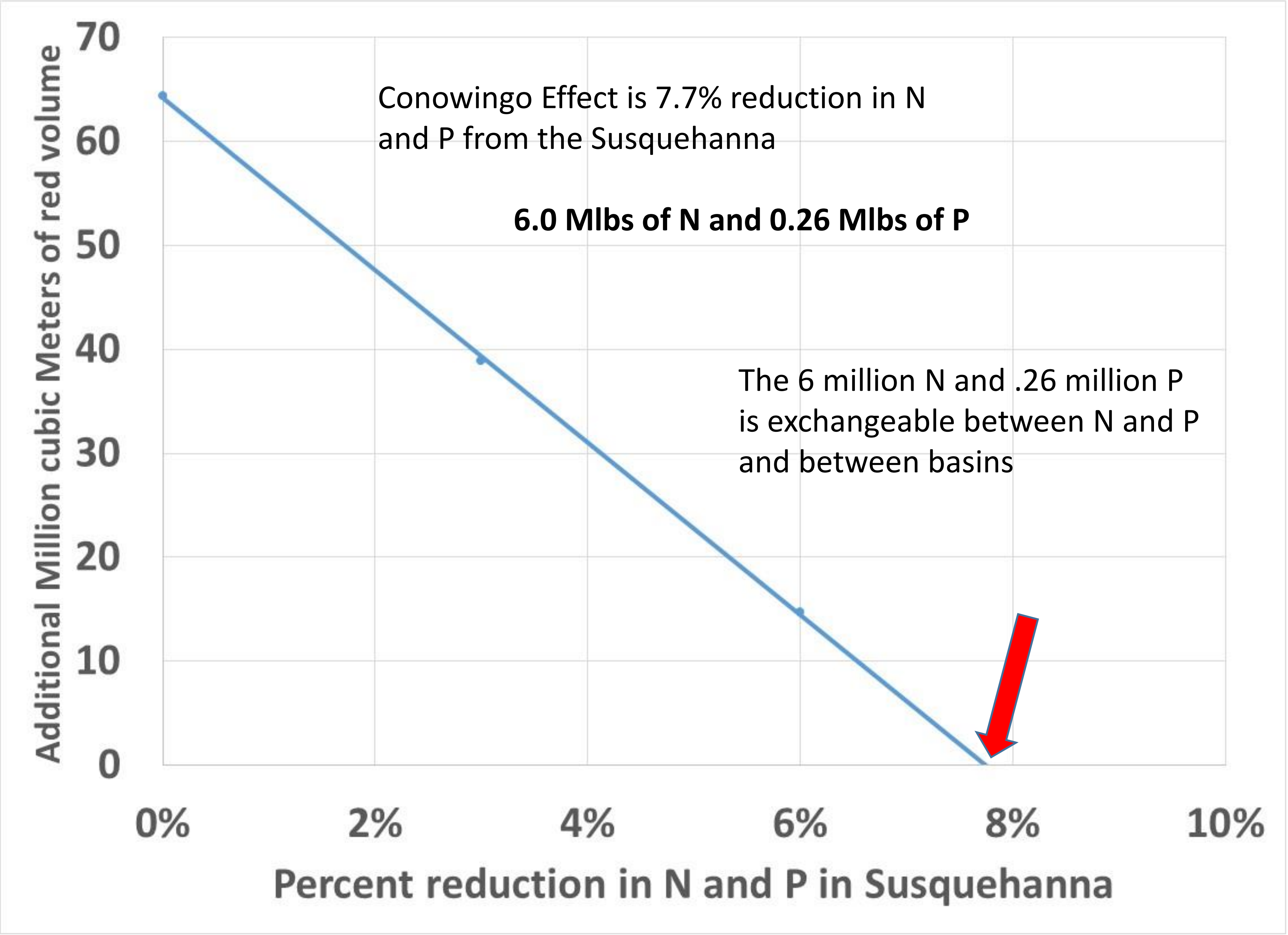
- Keep the focus on nutrients
- Assume necessary sediment load reductions will occur as the result of implementation of practices needed to achieve nutrient load reductions

Calculate Conowingo Effect

Deep Water	Designated Use	Volume	WIP Red Percent	WIP red volume	WIP + Conowingo	WIP+C red volume
CB3MH	DW	864	0.05%	0	0.05%	0
CB4MH	DW	2854	5.00%	143	5.52%	158
MD5MH	DW	2097	0.94%	20	1.09%	23
VA5MH	DW	1605	0.00%	0	0.00%	0
POMMH	DW	1839	0.00%	0	0.00%	0
CB3MH	DC	390	0.00%	0	0.00%	0
CB4MH	DC	2126	5.87%	125	8.04%	171
MD5MH	DC	2875	0.00%	0	0.00%	0
VA5MH	DC	1848	0.00%	0	0.00%	0
				288		352
					Conowingo Difference	**64**

Volume Weighted means a 'red area' increase of 64 million cubic meters

Ran Scenarios with 3% and 6% reduction in Susquehanna N and P

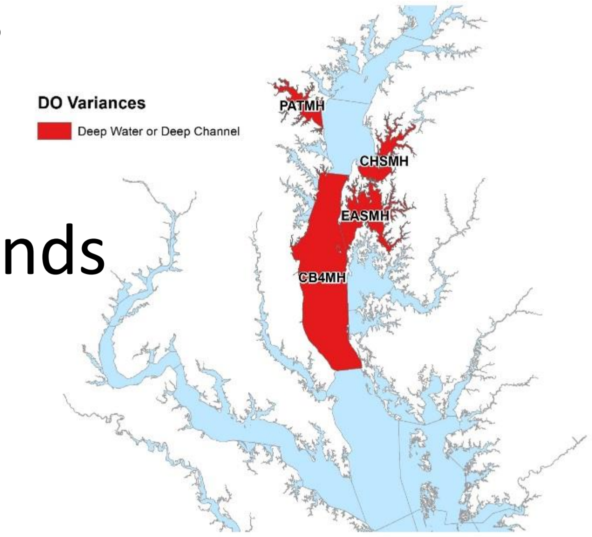


Estimated Loads to the Bay with Conowingo Dam and Reservoir at Infill Conditions

Additional Nitrogen Load: 13 million pounds

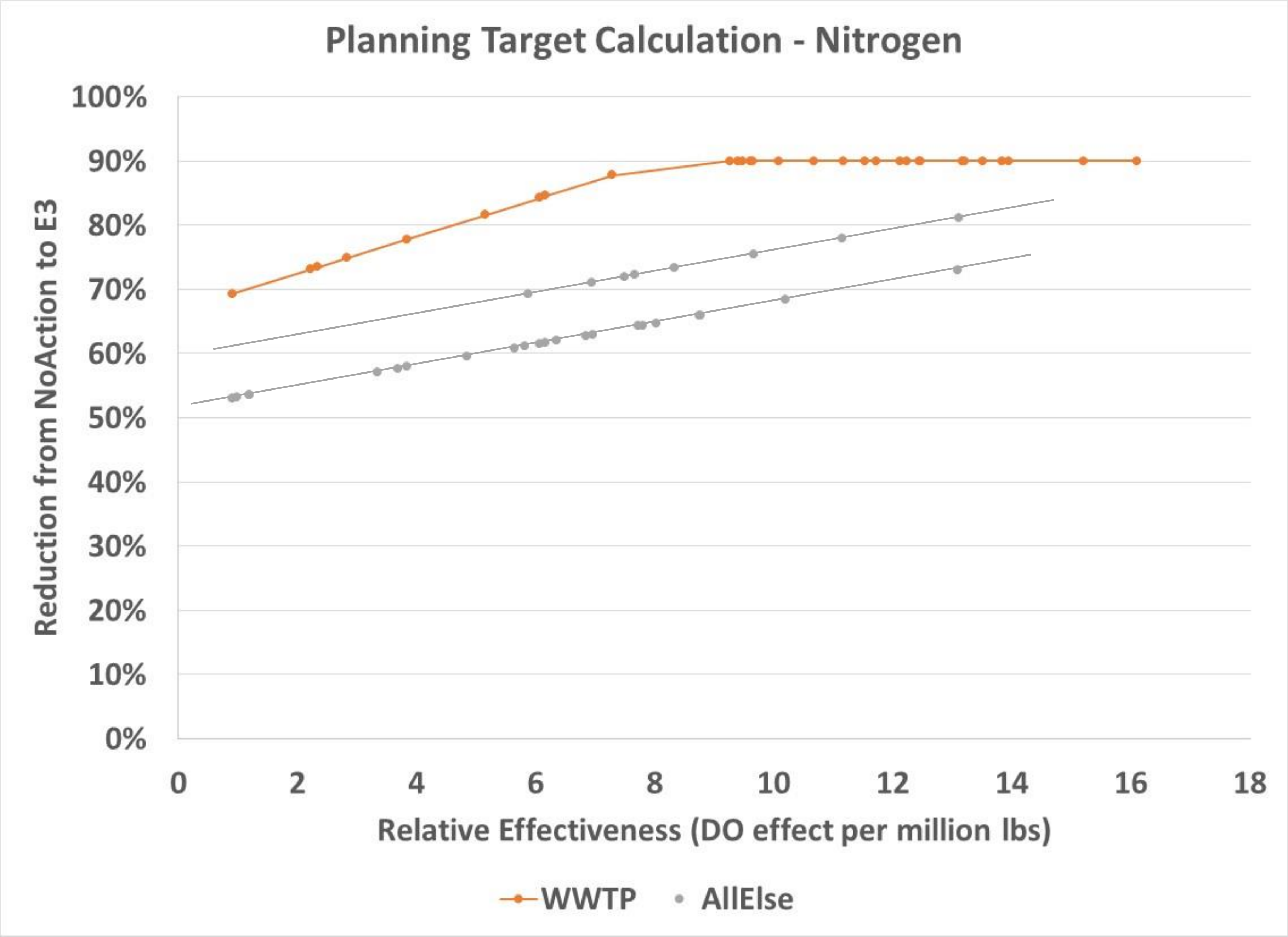
+

Additional Phosphorus Load: 1.8 million pounds

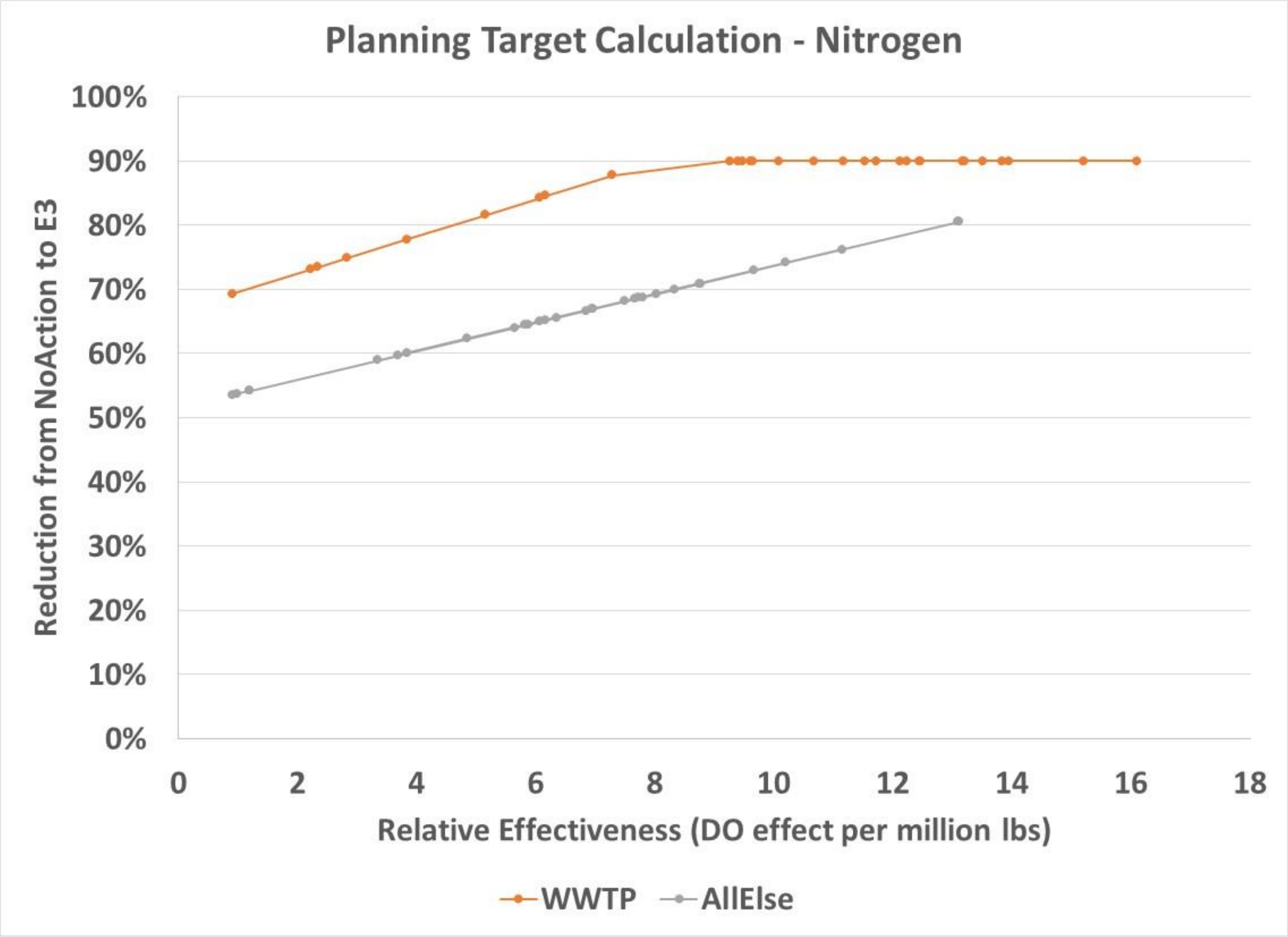


HOWEVER: These are less bioavailable nutrients and its delivery to Bay is dependent on large storm events. Therefore, only a smaller than expected (2 percent increase) in non-attainment in Middle Central Chesapeake Bay Deep-Channel. Equivalent to 6 million pounds of Nitrogen and 0.26 million pounds of Phosphorus

Some basins on higher line to make up for the Conowingo effect



New proposal:
Increase slope of the line to account for Conowingo



Estimated Additional Nitrogen Reductions Required Under the Five Options

Jurisdiction	Susquehanna Only	Susquehanna plus effective basins	Susquehanna plus MD and VA	Entire Watershed	Increased Slope
NY	5.4%	4.6%	3.4%	3.0%	1.9%
PA	7.3%	6.2%	4.6%	4.5%	5.3%
MD	0.3%	2.9%	4.3%	3.9%	3.4%
WV	0.0%	0.0%	0.0%	3.0%	2.5%
DC	0.0%	0.0%	0.0%	0.2%	0.2%
DE	0.0%	0.0%	0.0%	6.8%	6.2%
VA	0.0%	0.0%	2.7%	2.4%	1.2%

Estimated Additional Nitrogen Reductions Required Under the Five Options

Jurisdiction	Susquehanna Only	Susquehanna plus effective basins	Susquehanna plus MD and VA	Entire Watershed	Increased Slope
NY	0.57	0.49	0.36	0.32	0.20
PA	5.31	4.56	3.34	3.31	3.88
MD	0.12	1.30	1.97	1.76	1.55
WV	0.00	0.00	0.00	0.19	0.16
DC	0.00	0.00	0.00	0.00	0.00
DE	0.00	0.00	0.00	0.32	0.29
VA	0.00	0.00	1.54	1.38	0.65
Basinwide	6.01	6.34	7.21	7.28	6.74

*Units: millions of pounds

Estimated Additional Phosphorus Reductions Required Under the Five Options

Jurisdiction	Susquehanna Only	Susquehanna plus effective basins	Susquehanna plus MD and VA	Entire Watershed	Increased Slope
NY	5.4%	4.1%	2.5%	2.3%	1.3%
PA	7.7%	5.9%	3.6%	3.8%	3.0%
MD	0.1%	1.9%	2.8%	2.6%	3.7%
WV	0.0%	0.0%	0.0%	3.1%	1.6%
DC	0.0%	0.0%	0.0%	0.7%	0.8%
DE	0.0%	0.0%	0.0%	4.1%	2.7%
VA	0.0%	0.0%	2.6%	2.4%	1.7%

Estimated Additional Phosphorus Reductions Required Under the Five Options

Jurisdiction	Susquehanna Only	Susquehanna plus effective basins	Susquehanna plus MD and VA	Entire Watershed	Increased Slope
NY	0.026	0.020	0.012	0.011	0.007
PA	0.231	0.177	0.108	0.113	0.092
MD	0.005	0.069	0.099	0.091	0.131
WV	0.000	0.000	0.000	0.015	0.008
DC	0.000	0.000	0.000	0.001	0.001
DE	0.000	0.000	0.000	0.005	0.003
VA	0.000	0.000	0.168	0.155	0.112
Basinwide	0.262	0.266	0.388	0.392	0.353

*Units: millions of pounds

Conowingo Loads: Nitrogen

Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	18.71	15.44	0.400	-0.52	0.49	15.80	10.62
PA	122.41	99.28	4.135	1.38	4.56	109.35	72.99
MD	83.56	55.89	2.194	0.76	1.30	60.15	45.39
WV	8.73	8.06	0.236	0.20	0.00	8.50	6.36
DC	6.48	1.75	0.006	0.00	0.00	1.76	2.25
DE	6.97	6.59	0.397	0.22	0.00	7.21	4.66
VA	84.29	61.53	1.722	0.86	0.00	64.11	56.37
BasinWide	331.15	248.54	9.09	2.91	6.34	266.89	198.64

*Units: millions of pounds

Conowingo Loads: Nitrogen

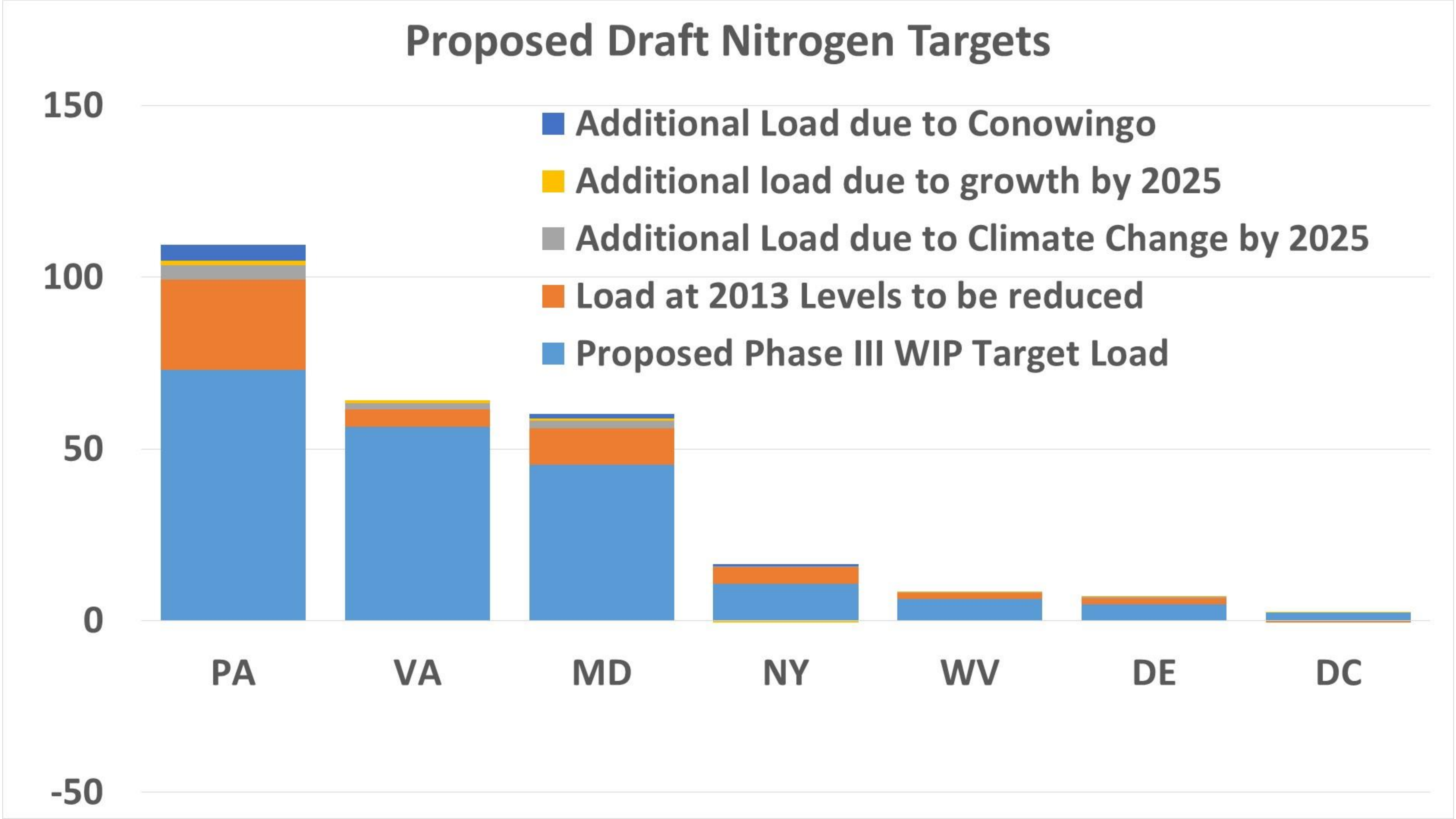
Jurisdiction	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +
NY	-4.9%	4.6%	3.8%	3.4%
PA	1.9%	6.2%	5.7%	13.8%
MD	1.7%	2.9%	4.8%	9.4%
WV	3.1%	0.0%	3.7%	6.8%
DC	0.1%	0.0%	0.3%	0.3%
DE	4.8%	0.0%	8.5%	13.3%
VA	1.5%	0.0%	3.1%	4.6%
BasinWide	1.5%	3.2%	4.6%	9.2%

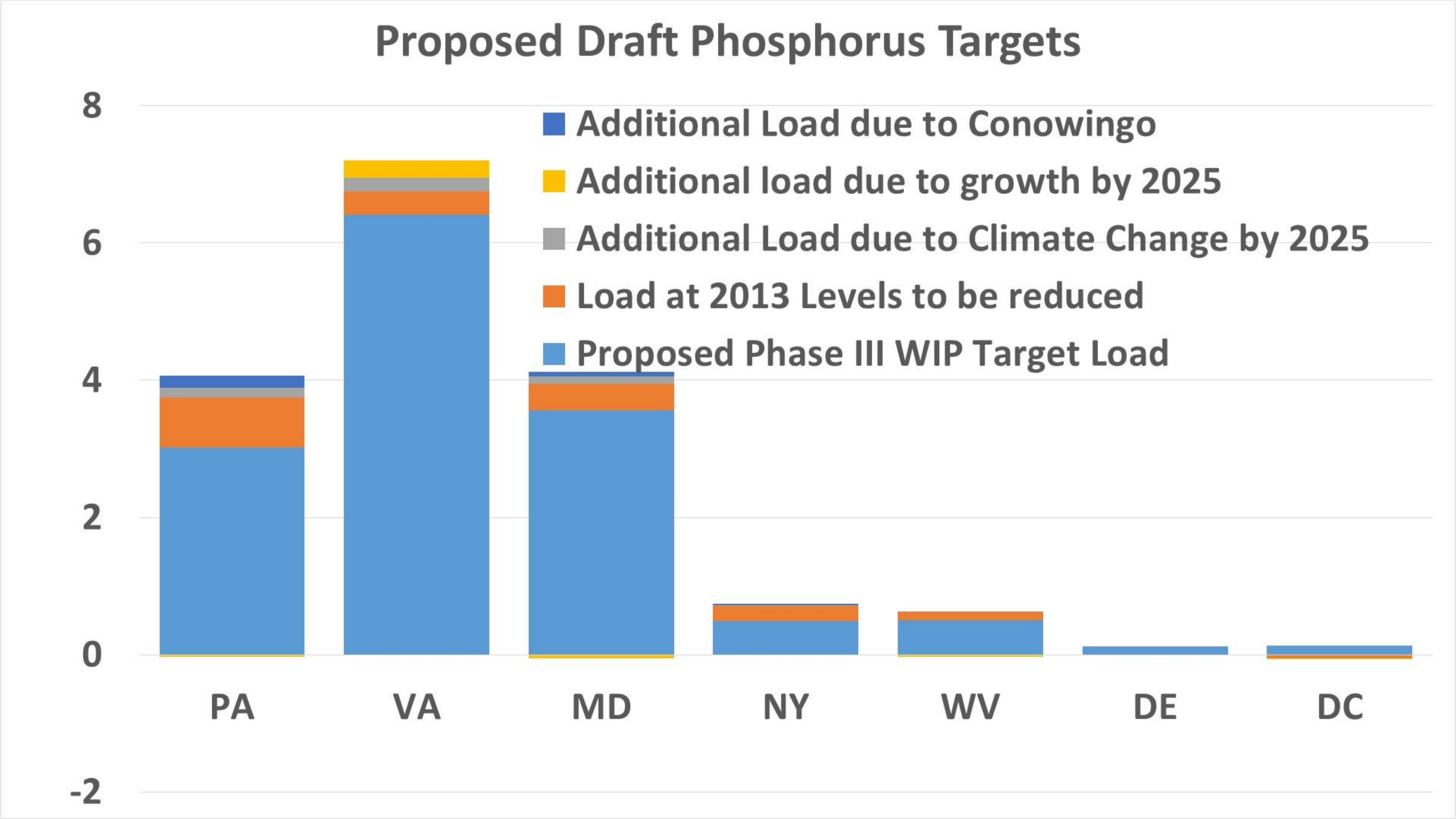
Conowingo Loads: Phosphorus

Jurisdiction	1985 Baseline	2013 Progress	Climate Change	Growth in Load to 2025	Conowingo Load Responsibility	2013 Progress +	Phase III Planning Target
NY	1.198	0.710	0.014	-0.010	0.020	0.734	0.491
PA	6.282	3.749	0.141	-0.034	0.177	4.034	3.012
MD	7.495	3.942	0.114	-0.053	0.069	4.071	3.553
WV	0.902	0.617	0.019	-0.027	0.000	0.610	0.493
DC	0.090	0.062	0.001	-0.001	0.000	0.063	0.120
DE	0.225	0.116	0.006	-0.004	0.000	0.117	0.116
VA	14.244	6.751	0.193	0.254	0.000	7.198	6.411
BasinWide	30.44	15.95	0.489	0.125	0.266	16.827	14.20

Conowingo Loads: Phosphorus

Jurisdiction	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +
NY	-2.1%	4.1%	2.9%	4.8%
PA	-1.1%	5.9%	4.7%	9.5%
MD	-1.5%	1.9%	3.2%	3.6%
WV	-5.4%	0.0%	3.9%	-1.5%
DC	-0.6%	0.0%	0.8%	0.2%
DE	-3.6%	0.0%	5.1%	1.5%
VA	4.0%	0.0%	3.0%	7.0%
BasinWide	0.9%	1.9%	3.4%	6.2%


Proposed Draft Nitrogen Targets
150
100
50
0
-50
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC


Proposed Draft Phosphorus Targets
8
6
4
2
0
-2
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC

Requested WQGIT Policy Recommendation

Approval of which jurisdictions will be responsible for addressing the additional nutrient and sediment loads delivered to the Bay due to the Conowingo infill

Approval of how the additional nutrient and sediment loads will be assigned to the jurisdictions responsible for addressing those loads

Approval of the timeframe by which the jurisdictions have to address the additional nutrient and sediment loads

WQGIT's Conowingo Infill Recommendations

Narrative, description of the WQGIT's recommendations

Jurisdiction	
New York	
Pennsylvania	
Maryland	
Virginia	
District of Columbia	
Delaware	
West Virginia	

Accounting for Growth, Conowingo, and Climate Change in the Jurisdictions' Phase III WIPs

Teresa Koon, WV DEP, CBP Water Quality Goal Implementation Team Vice Chair
and
Lee Currey, MDE, CBP Modeling Workgroup Co-Chair

Summary of “All the Numbers”: Nitrogen

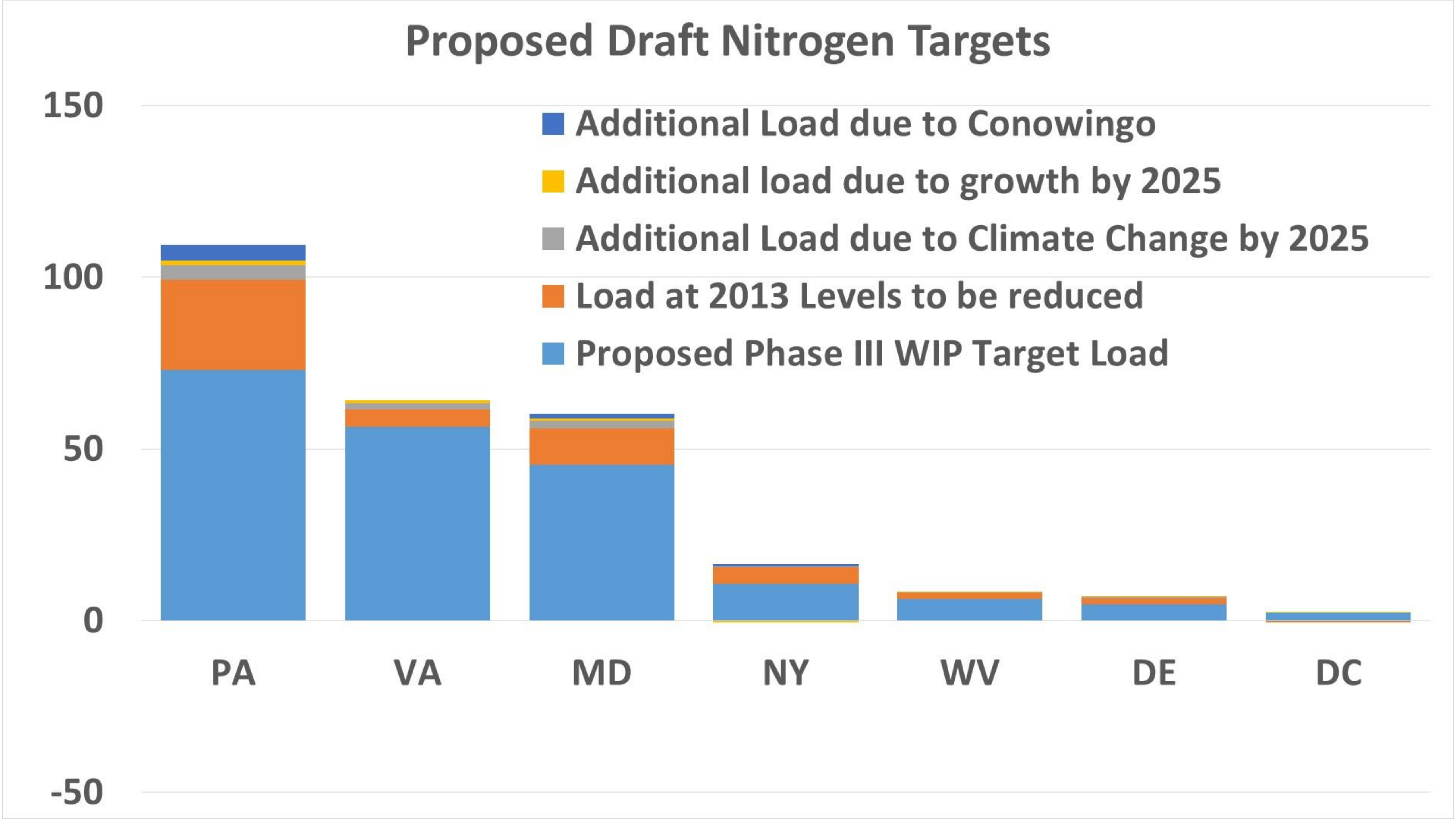
Jurisdiction	1985 Baseline	2013 Progress	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +	Phase III Planning Target
NY	18.71	15.44	-0.52	0.49	0.400	15.80	10.62
PA	122.41	99.28	1.38	4.56	4.135	109.35	72.99
MD	83.56	55.89	0.76	1.30	2.194	60.15	45.39
WV	8.73	8.06	0.20	0.00	0.236	8.50	6.36
DC	6.48	1.75	0.00	0.00	0.006	1.76	2.25
DE	6.97	6.59	0.22	0.00	0.397	7.21	4.66
VA	84.29	61.53	0.86	0.00	1.722	64.11	56.37
BasinWide	331.15	248.54	2.91	6.34	9.09	266.89	198.64

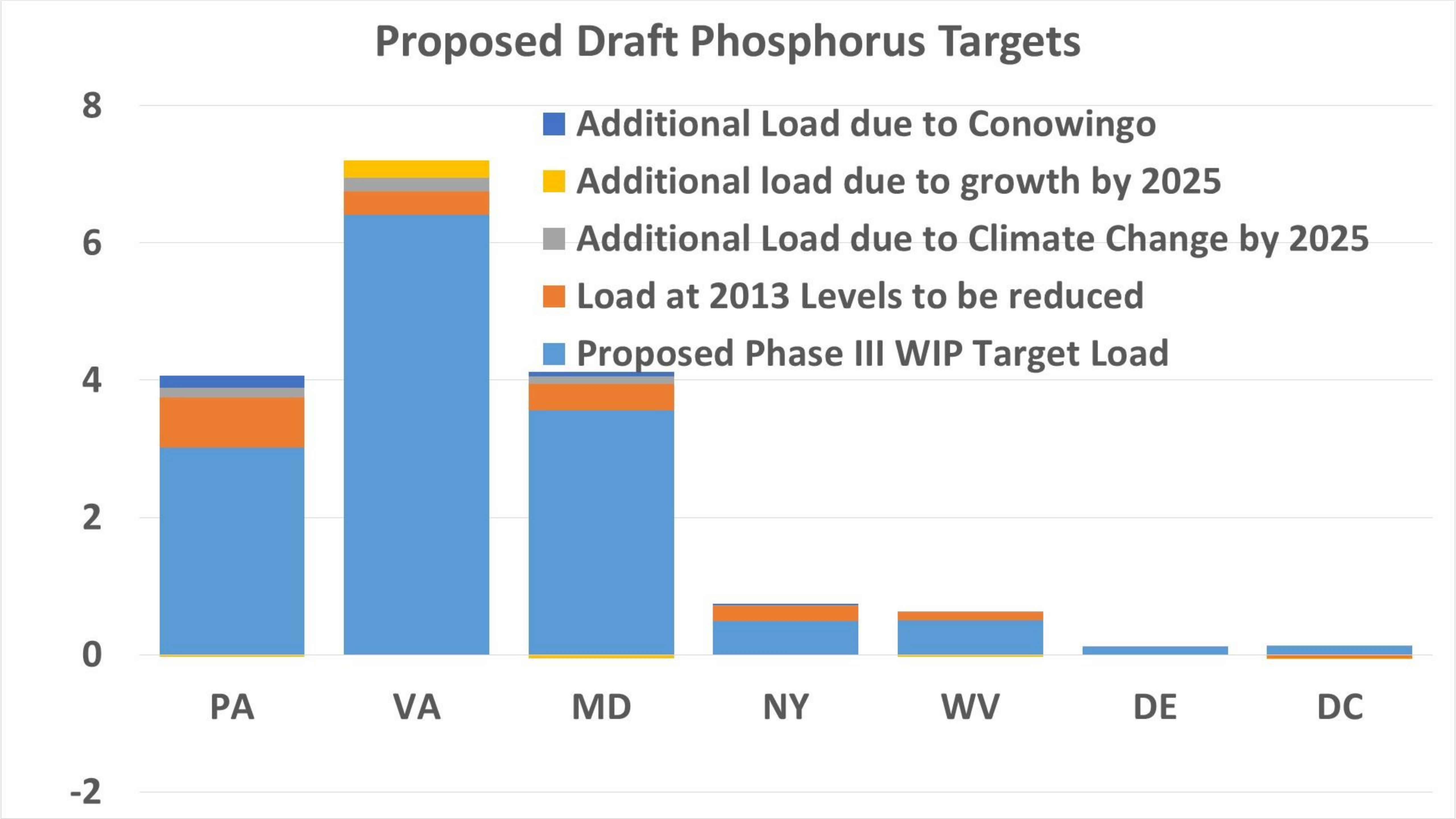
*Units: millions of pounds

Summary of “All the Numbers”: Phosphorus

Jurisdiction	1985 Baseline	2013 Progress	Growth in Load to 2025	Conowingo Load Responsibility	Climate Change	2013 Progress +	Phase III Planning Target
NY	1.198	0.710	-0.010	0.020	0.014	0.734	0.491
PA	6.282	3.749	-0.034	0.177	0.141	4.034	3.012
MD	7.495	3.942	-0.053	0.069	0.114	4.071	3.553
WV	0.902	0.617	-0.027	0.000	0.019	0.610	0.493
DC	0.090	0.062	-0.001	0.000	0.001	0.063	0.120
DE	0.225	0.116	-0.004	0.000	0.006	0.117	0.116
VA	14.244	6.751	0.254	0.000	0.193	7.198	6.411
BasinWide	30.44	15.95	0.125	0.266	0.489	16.827	14.20

*Units: millions of pounds


Proposed Draft Nitrogen Targets
150
100
50
0
-50
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC



Proposed Draft Phosphorus Targets
8
6
4
2
0
-2
Additional Load due to Conowingo
Additional load due to growth by 2025
Additional Load due to Climate Change by 2025
Load at 2013 Levels to be reduced
Proposed Phase III WIP Target Load
PA
VA
MD
NY
WV
DE
DC

Requested WQGIT Policy Recommendations

Adoption of the Partnership’s Phase 6 suite of modeling tools for management application in the development and implementation of each jurisdiction’s Phase III WIPs and 2-year milestones through 2025

Approval of the seven Bay watershed jurisdictions’ draft Phase III Planning Targets as the starting point for the Partnership’s 4-month review process