Chesapeake Bay Eutrophication Units

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Acronyms

- EU – Eutrophication Units
- E3 – Everything, Everywhere, by Everyone theoretical max scenario
- TN – Total Nitrogen
- TP – Total Phosphorus
- AFL – Above the Fall Line
- BFL – Below the Fall Line
- DO – Dissolved Oxygen2
- VA – Commonwealth of Virginia
- PSC – Principals' Staff Committee
- EOT – Edge of Tide
- CC – Climate Change
- WIP – Watershed Implementation Plan
- CAST – Chesapeake Assessment and Scenario Tool

Origination – an equitable allocation process

Appendix K – Chesapeake Bay TMDL

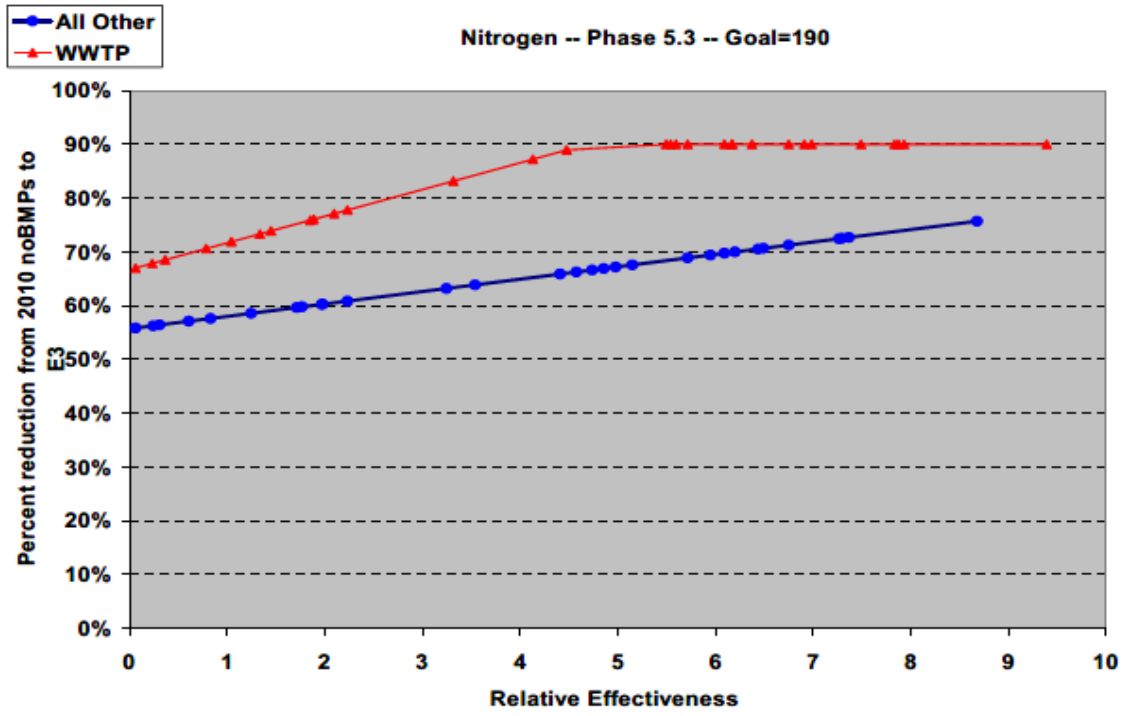
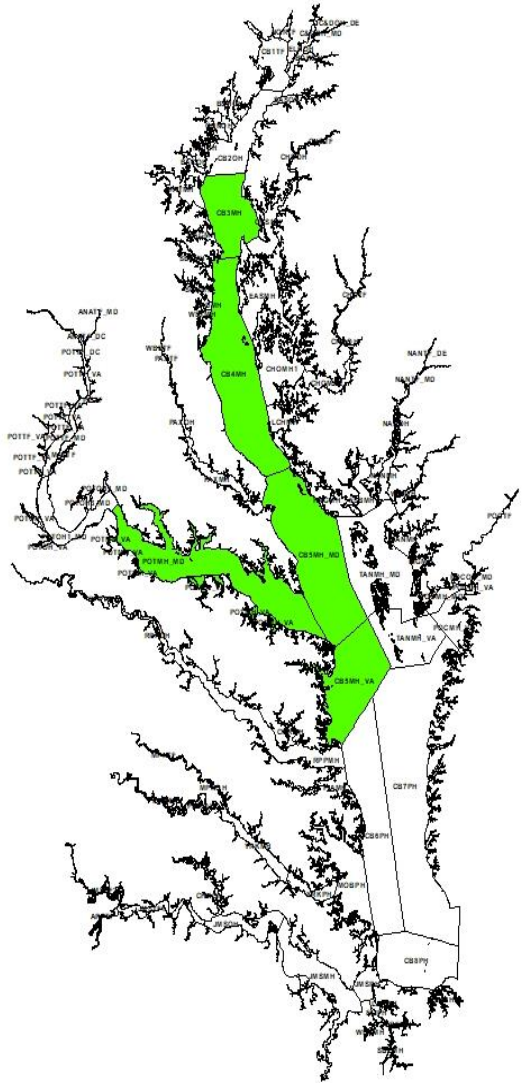


Figure K-2. Allocation methodology example showing the hockey stick and straight line reductions approaches, respectively, to wastewater (red line) and all other sources (blue line).



Quartile Factors calculated

	Quartile change* per 1,000,000 lbs TN or TP	
Virginia Basin		
	N	P
Potomac AFL	14.045	22.210
Potomac BFL	13.201	22.165
Rappahannock AFL	8.065	11.765
Rappahannock BFL	9.278	15.453
York AFL	4.630	9.111
York BFL	5.165	8.681
James AFL	2.647	7.673
James BFL	2.351	7.434
Virginia Eastern Shore	15.214	20.404

*Micrograms per liter (ug/l) increase in the 25th percentile level of DO per million pounds of TN or TP reduced.

Eutrophication Units (EU)

- Single number derived from TN and TP loadings multiplied by respective quartile values for each tributary basin - the higher the loadings the larger the EU number (higher eutrophication) the lower the DO
- Related to the level of eutrophication or equivalent remaining DO level in the critical Bay segments by the combined effect of both nutrients loading and tributary basin of origin
- Acceptable DO is the actual partnership goal EU translates nutrient loadings into the currency of DO
- PSC-established targets calculate to a single EU number

Eutrophication Units (EU) – Example Calculations

VA Eastern Shore loadings in millions of pounds

2018 PSC TN Target 1.4345 X 15.2139 = 21.824 EU from Nitrogen

2018 PSC TP Target 0.16437 X 20.40395 = 3.354 EU from Phosphorus

2018 PSC VA E. Shore EU total Target = 25.178 EU

2021 Progress TN 2.1486 X 15.2139 = 32.6886 EU from Nitrogen

2021 Progress TP 0.1684 X 20.40395 = 3.436 EU from Phosphorus

2021 Progress E. Shore total EU = 36.1246

Targets

State Basin	Initial 2018 Planning Targets			2018 PSC Planning Targets			2019 Targets with Exchanges		
	TN	TP	EU	TN	TP	EU	TN	TP	EU
VA Eastern Shore	1.42	0.164	24.996	1.43	0.164	25.178	1.83	0.15	30.894
VA James	26.01	2.758	84.969	25.92	2.731	84.556	21.81	2.24	70.709
VA Potomac	15.98	1.867	260.296	16.00	1.892	261.070	16.51	1.82	266.663
VA Rappahannock	6.86	0.840	70.858	6.85	0.849	70.847	7.09	0.82	72.498
VA York	5.54	0.557	32.446	5.52	0.556	32.330	5.71	0.55	33.217
Total	55.82	6.186	474	55.73	6.192	474	52.95	5.58	474

Notes:
1. TN and TP Loads are in millions of pounds.

Adjustments

State Basin	2018 Climate Adjustments			2020 Climate Adjustments		
	TN	TP	EU	TN	TP	EU
VA Eastern Shore	0.11	0.005	1.771	0.01	0.000	0.109
VA James	0.48	0.059	1.659	0.30	0.143	1.831
VA Potomac	0.62	0.082	10.435	0.56	0.073	9.342
VA Rappahannock	0.31	0.027	3.042	0.54	0.102	6.081
VA York	0.20	0.014	1.131	0.17	0.018	1.012
Total	1.72	0.19	18	1.59	0.337	18

Notes:

1. TN and TP Loads are in millions of pounds.

Adjusted Targets

State Basin	2018 PSC Targets with 2018 CC			2018 PSC Targets with 2020 CC			2022 Targets with CC		
	TN	TP	EU	TN	TP	EU	TN	TP	EU
VA Eastern Shore	1.31	0.159	23.224	1.42	0.164	25.068	1.82	0.152	30.784
VA James	25.53	2.698	83.311	25.62	2.588	82.725	21.51	2.097	68.878
VA Potomac	15.36	1.785	249.861	15.43	1.819	251.728	15.95	1.750	257.321
VA Rappahannock	6.55	0.813	67.816	6.31	0.747	64.766	6.54	0.717	66.417
VA York	5.34	0.543	31.315	5.35	0.538	31.318	5.54	0.530	32.205
Total	54.00	6.006	456	54.14	5.86	456	51.37	5.25	456

Notes:

1. TN and TP Loads are in millions of pounds.

Eutrophication Units (EU)

Scenario	Eutrophication Units
VA's PSC 2018 Target	474
VA's 2020 CC Target	456
VA's WIP 3 CAST 17	**439**
VA's WIP 3 CAST 19	**440**
VA's WIP 3 CAST 21	**448**
VA's 2021 Progress	**516**

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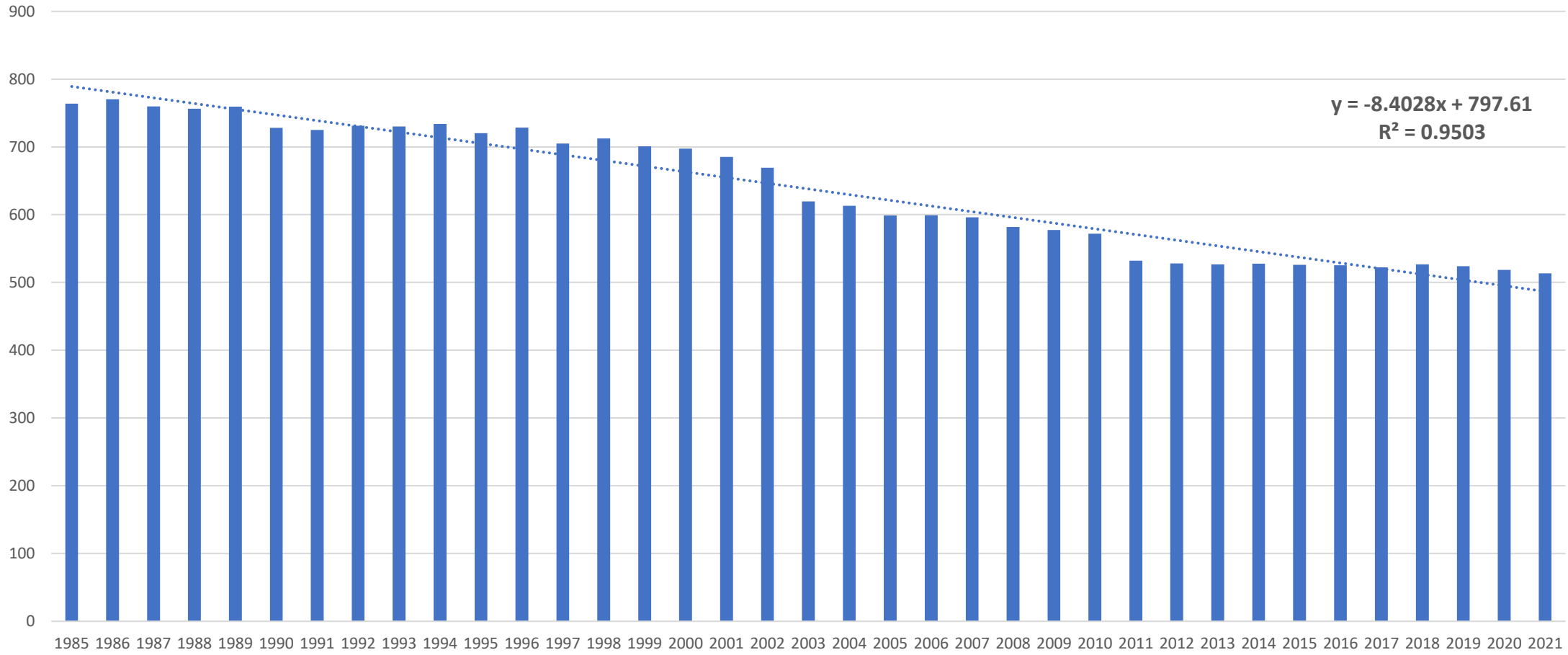
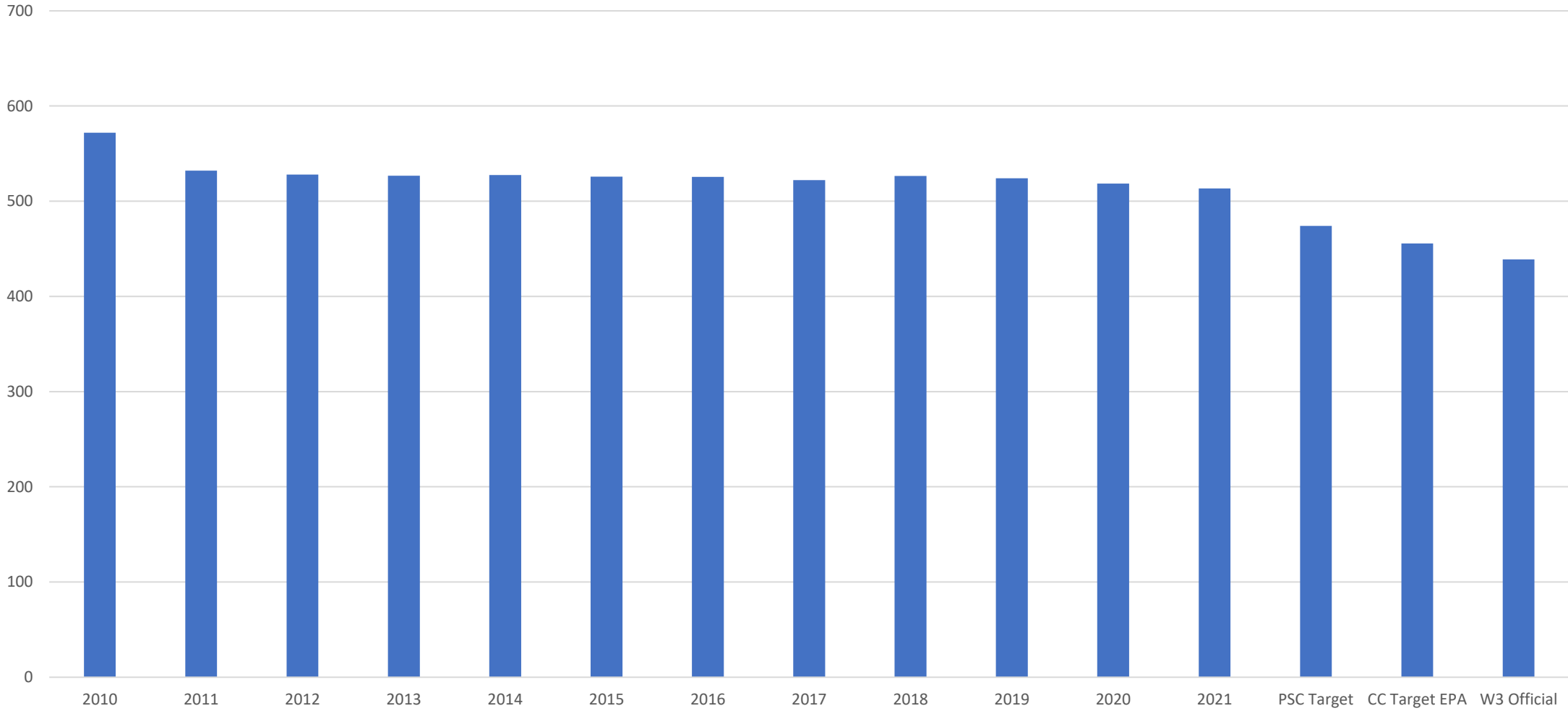
VA Eutrophication Units 1985 to 2021



Example using weighted average quartile values

VA DO Eutrophication Units



Example using weighted average quartile values

2021 Progress

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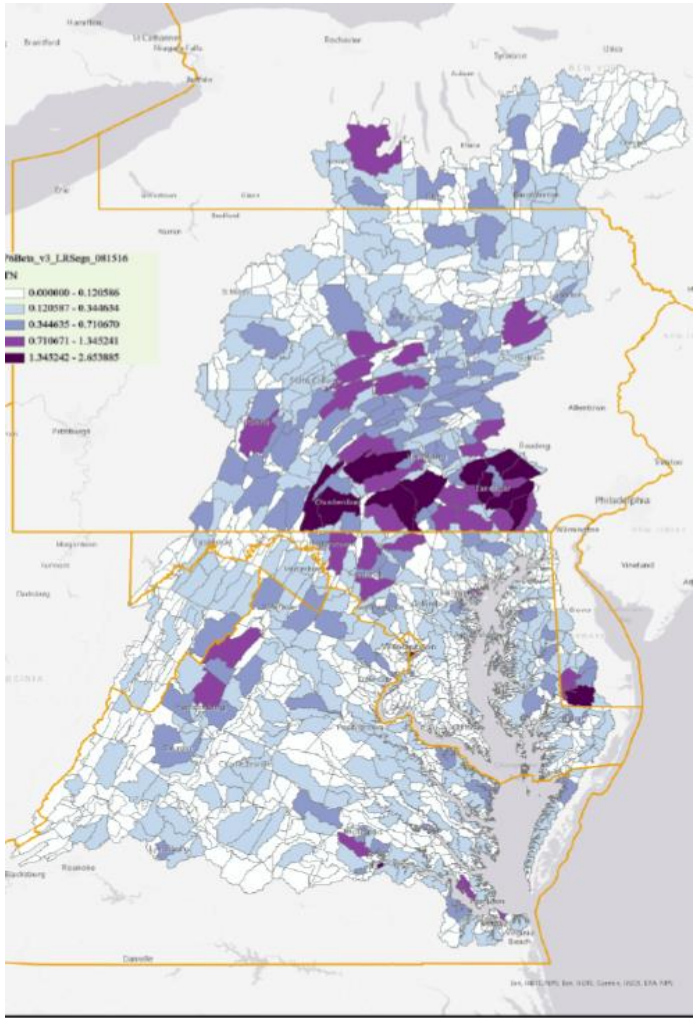
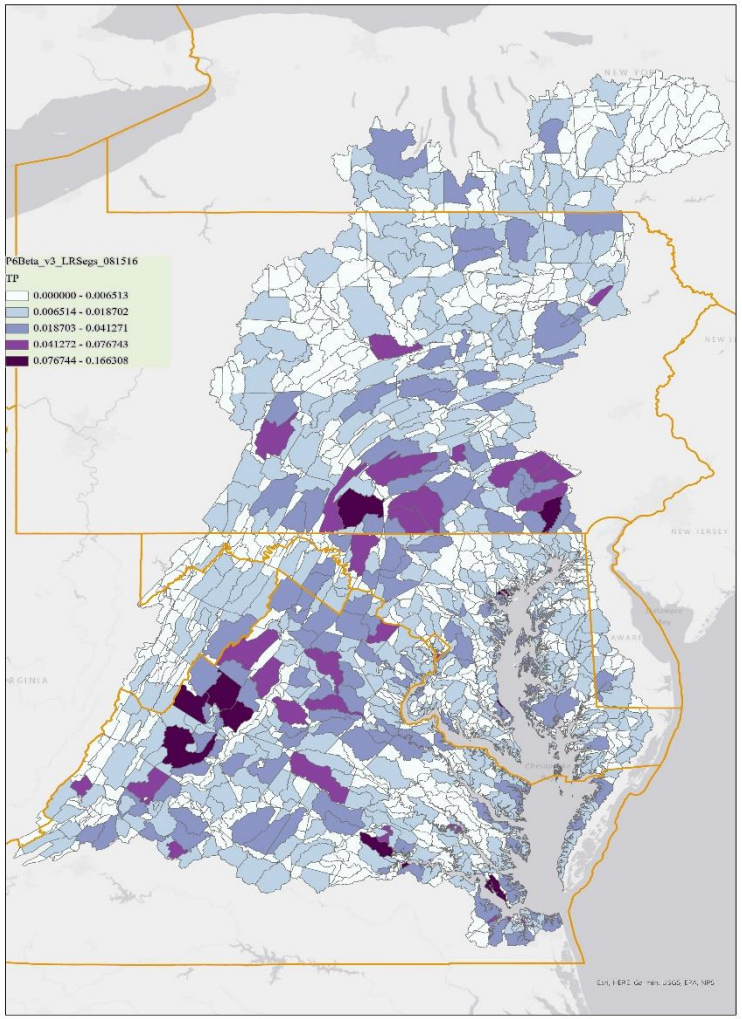
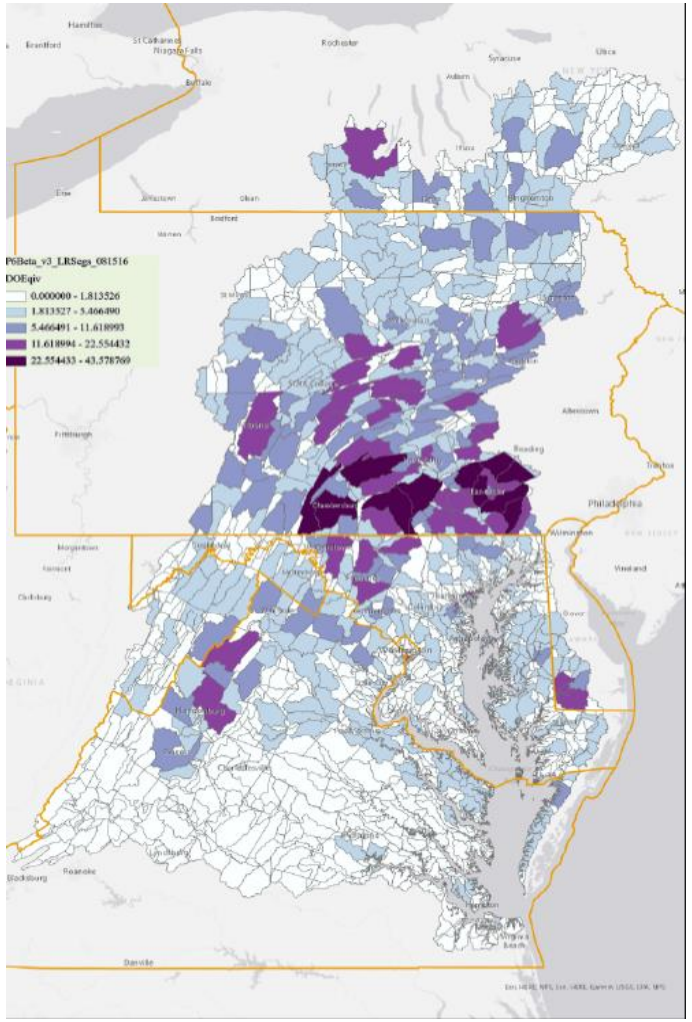
TN EOT Loads



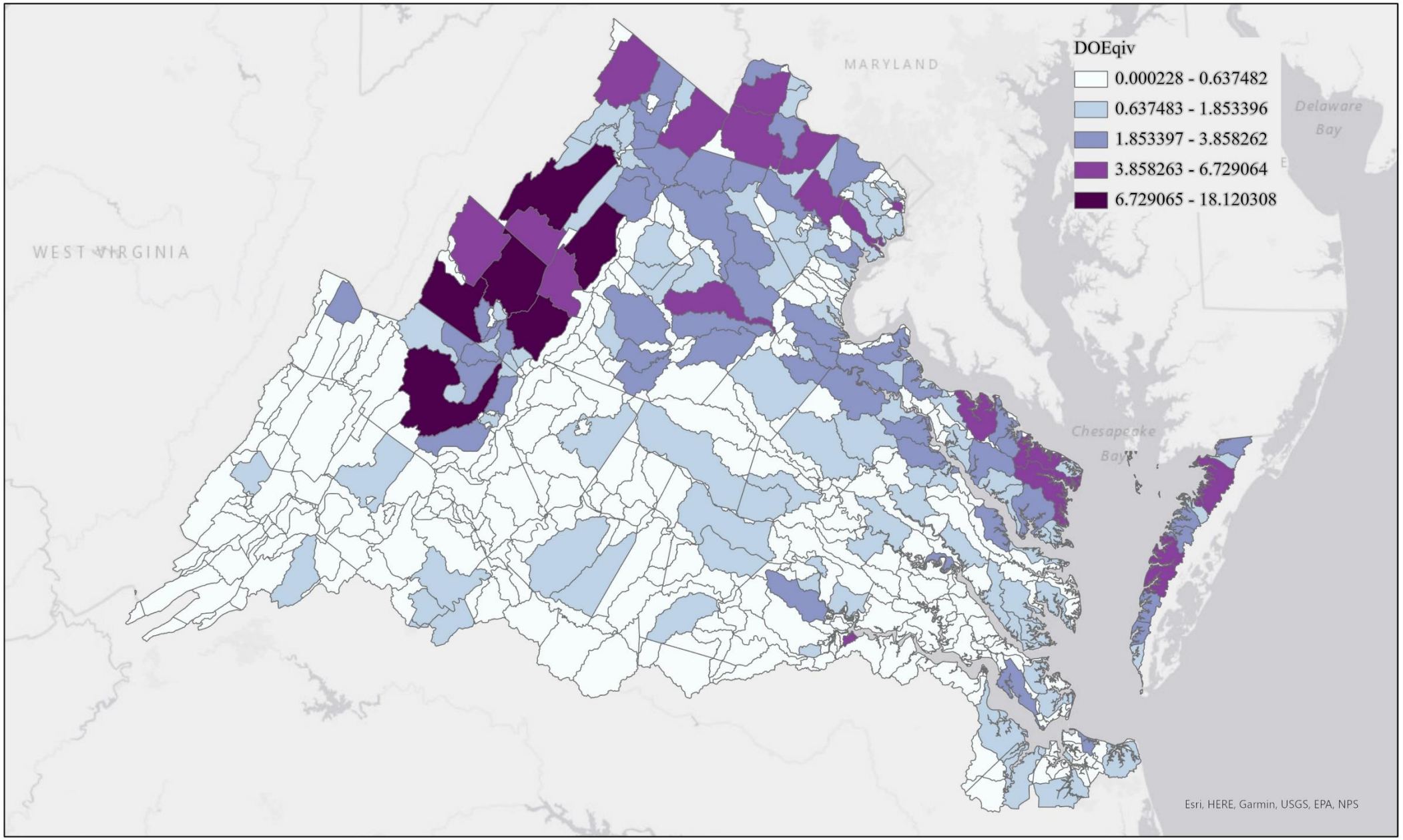
TP EOT Loads



EU



Eutrophication Units



Eutrophication Units (EU)

Assessing the Environment in Outcome Units (AEIOU): Using Eutrophying Units for Management

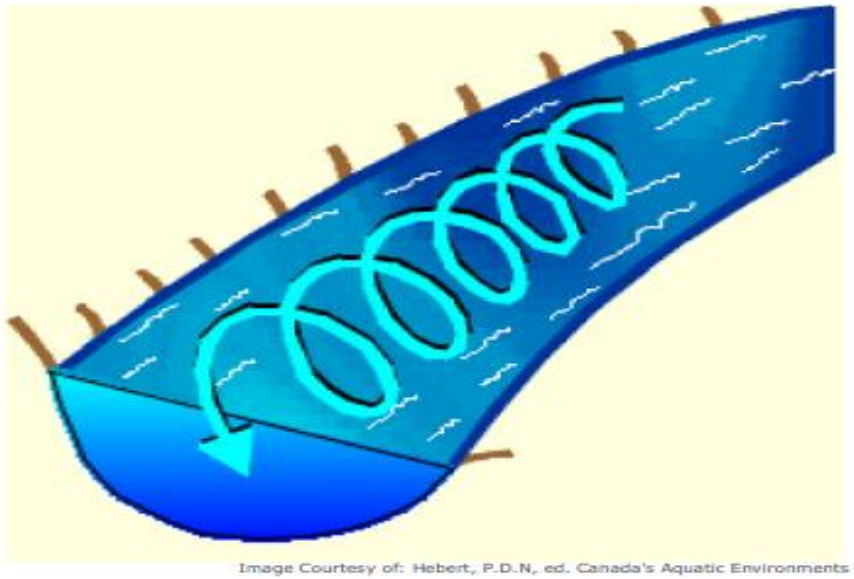


Image Courtesy of: Hebert, P.D.N, ed. Canada's Aquatic Environments

STAC Workshop Report
March 20- March 21, 2019
Annapolis, MD

STAC Publication 20-003

Eutrophication Units – Technical Implications

- For multiple tributary jurisdictions it distills targets and scenario results into a single number and easily conveys if a scenario met, exceeded, or is falling short of the target DO value or EU
- Target watershed areas thought to be most impacting DO or for local WQ improvements
- Can be calculated for any model segment or tributary basin
- Another way to evaluate the need for exchanges within and between basins
- Allows an additional visualization of the combined impacts of TN and TP
- Adding EU calculator to CAST by 12/31/2023

Discussion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