01/06/2026

Phase 7 WSM Progress – Moving towards completeness of the Dynamic Watershed Model (DWSM) development

Modeling Workgroup Quarterly Meeting – January 2026

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[1] Penn State, [2] US EPA, [3] VA DEQ – Chesapeake Bay Program Office

Presentation Outline

Phase 7 Dynamic Watershed Model (DWSM)

1. **Dynamic Watershed Model overview**
2. **Review of prior model development progress**
3. **Moving towards completeness of the DWSM**
   - Incorporation of P7 land use
   - Extend the simulation period to 2024 (1985 to 2024, i.e., 40 years!)
   - Monitoring and WRTDS-K data for model calibration & verification
   - Improve trend component of generalized stream network routing
4. **Summary and next steps**

Purpose

NHD Scale Dynamic Watershed Model (DWSM)

- Inputs for the estuarine models (MBM/MTMs)
- Watershed model calibration and scenario applications
- Support research and collaboration activities

Phase 7 Watershed Models and Structure

CAST – Chesapeake Assessment Scenario Tool

CalCAST

Average Load
+
Δ Inputs X Sensitivity
X
BMPs
X
Acres
X
Land to Water
X
River Delivery

Load by NHD catchment and land use

Tool for finding parameters that best match observations

Informs

Phase 7 CAST

Average Load
+
Δ Inputs X Sensitivity
X
BMPs
X
Acres
X
Land to Water
X
<u>River Delivery</u>

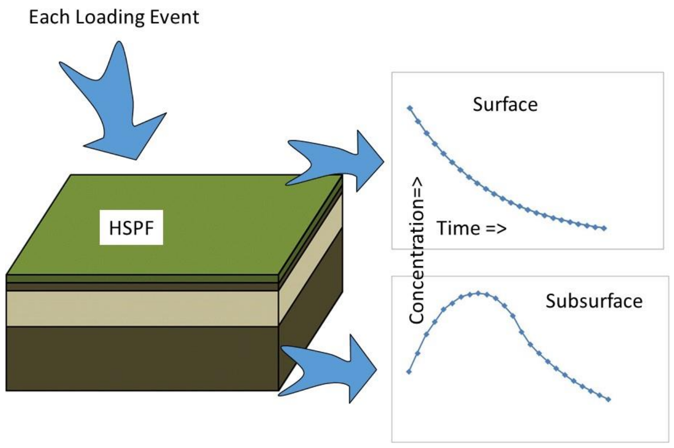
Finalize

Load by land-river segment and land use

CBP management model for running scenarios and supporting decision-making

Constrains

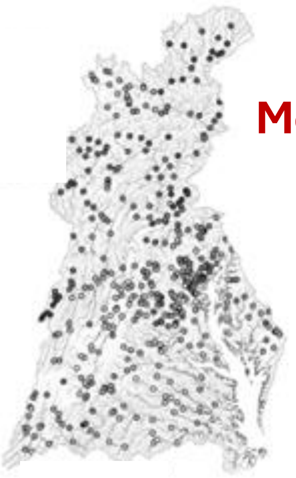
Dynamic Watershed Model (DWSM)



Load by NHD catchment and land use

Tool for loading estuarine models, calibrating against monitoring data, and collaborative projects

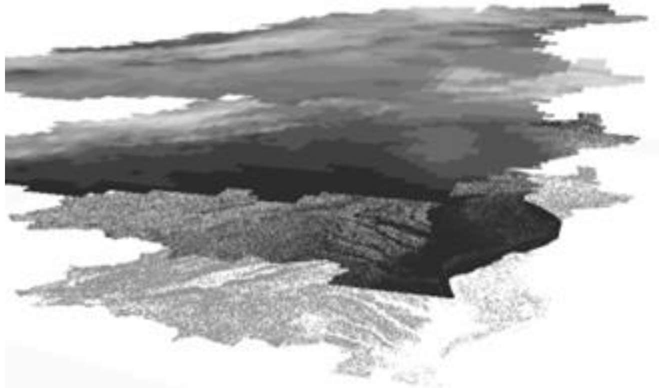
Framework: Statistical Model (CalCAST) → Dynamic Watershed Model (DWSM)



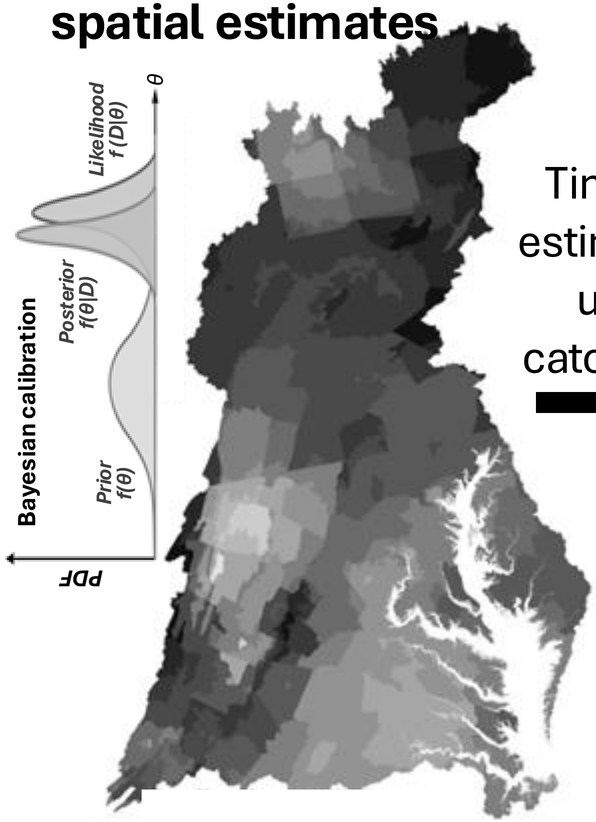
Monitoring Data

\+

Catchment characteristics & inputs



CalCAST statistical spatial estimates

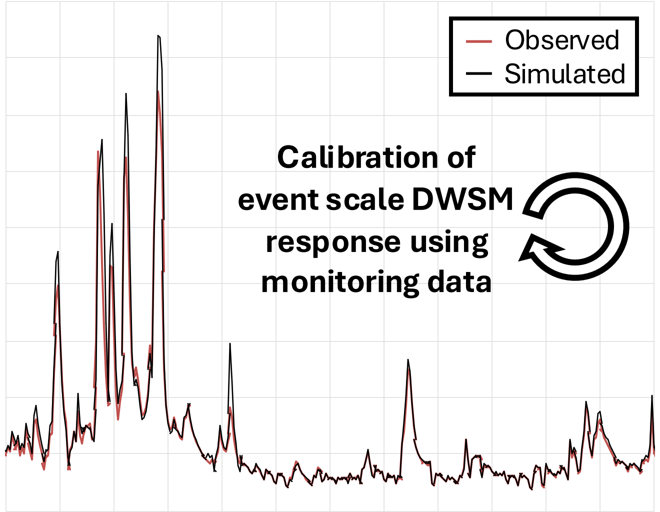


Time averaged estimates at land use & NHD catchment scale

DWSM process-based hourly estimates

Meteorological inputs, DWSM parameters

temporal disaggregation



- Data-driven CalCAST informs DWSM parameters and responses.
- NHD-scale Phase 7 DWSM is using CalCAST <u>average annual</u> (a) total flow, (b) stormflow, (c) sediment erosion and delivery factors, and (d) total nitrogen and total phosphorus loads and delivery factors.

Dynamic Watershed Model (DWSM) Development

- Year 2022: NHD-scale model structure and prototypes for hydrology, sediment, and nutrients.
- Year 2023: Incremental refinements of model prototypes in terms of model segmentation, CalCAST→DWSM linkage, and simulation of the small streams.
- Year 2024: stream water quality routing based on β parameters; refinements of small stream flow and water temperature routing modules; mechanics of riverine water quality calibrations.
- **Year 2025:** Q1: development and testing of DWSM and MBM linkage through beta versions; Q2: stream routing with RF model estimated β parameters, sediment routing, estimation of riverine transport parameters and further refinements of the DWSM calibration; Q3: organic scour in rivers, trend component in stream routing, BMPs, etc. **Q4: P7 land use; extend calibration period to 2024; monitoring data; and GSN trends.**

CY2022
[1] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/progress-in-phase-7-wsm-development-1.4.2022-gopal_bhatt_penn_state.pdf
[2] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/progress_in_phase_7_wsm_development_4.5.2022_-_gopal_bhatt_penn_state.pdf
[3] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/progress_in_phase_7_wsm_development_-_gopal_bhatt_penn_state_7.12.22.pdf
[4] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-10.4.22-v2.pdf
[5] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-1.10.2023.pdf

CY 2023
[1] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/20230404-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2023Q1.pdf
[2] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-6.20.2023.pdf
[3] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-10.17.2023.pdf
[4] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/20240109-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2023Q4.pdf

CY 2024
[1] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-CBPO-4.2.2024.pdf
[2] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Phase-7-WSM-Development-Modeling-WG-July-2024.pdf
[3] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/3_1000_20241008-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2024Q3.pdf
[4] https://www.chesapeakebay.net/files/documents/1035-20250107-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2024Q4.pdf

CY 2025
[1] https://www.chesapeakebay.net/files/documents/1025_20250401-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2025Q1.pdf
[2a] https://www.chesapeakebay.net/files/documents/1010_Phase-7-Model-Review_Gopal-Bhatt.pdf
[2b] https://www.chesapeakebay.net/files/documents/1035_Phase-7-WSM-Development-Dynamic-Model-Development_Gopal-Bhatt.pdf
[3] https://www.chesapeakebay.net/files/documents/1005_Phase-7-Watershed-Model-Progress-Towards-Completeness-of-the-Dynamic-Watershed-Model-Development_Gopal-Bhatt.pdf
[4] … this presentation …

Tidal performance

Zhengui Wang & Wenfan Wu (VIMS)

Table 1: Comparison of Phase 6 and July 2025 Phase 7β watershed loads in main rivers.

Embayment	Ammonia	Nitrate	Phosphate	Nitrogen	Phosphorus	Sediment
Susquehanna	(0.0432,0.0437)	(0.2875,0.2991)	(0.0089,0.0106)	(0.3310,0.3425)	(0.0280,0.0243)	(11.5428,13.6488)
Patuxent	(0.1483,0.1814)	(0.6331,0.9060)	(0.0455,0.0680)	(0.7464,1.1992)	(0.0866,0.1336)	(35.6555,32.6645)
Potomac	(0.0963,0.0931)	(0.5480,0.5792)	(0.1282,0.1275)	(0.7700,0.5674)	(0.0637,0.1044)	(16.6087,14.0334)
Rappahannock	(0.0334,0.0430)	(0.2594,0.3228)	(0.0178,0.0133)	(0.6914,0.5231)	(0.2182,0.1911)	(104.7578,97.1951)
James	(0.0370,0.0414)	(0.2161,0.1410)	(0.0683,0.0488)	(0.3482,0.3166)	(0.1287,0.1314)	(66.3107,73.1921)
Choptank	(0.0424,0.0491)	(0.7703,0.3458)	(0.0272,0.0211)	(0.6864,0.3682)	(0.0919,0.0719)	(20.3460,8.3691)
Mattaponi	(0.0344,0.0404)	(0.1240,0.1050)	(0.0145,0.0215)	(0.3505,0.2198)	(0.0650,0.0682)	(15.3698,17.6690)
Pamunkey	(0.0298,0.0534)	(0.1702,0.1721)	(0.0209,0.0356)	(0.3722,0.2859)	(0.0548,0.0755)	(47.7405,53.3133)
Appomattox	(0.0343,0.0345)	(0.1621,0.1739)	(0.0076,0.0094)	(0.3941,0.2013)	(0.0292,0.0291)	(15.6633,13.1813)

*Data in parenthesis show RMSD of watershed model loads **(Phase 6, July 2025 Phase 7β)** as compared to that of immediately downstream tidal monitoring stations.*

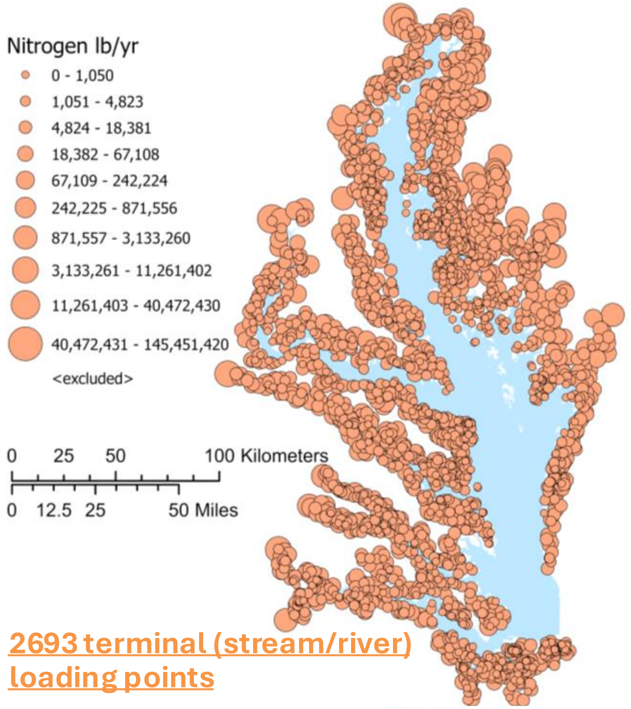
Table 2: Comparison of Phase 6 and July 2025 Phase 7β watershed loads in small embayments.

Embayment	river impact	salinity	Ammonia	Nitrate	Phosphate	Nitrogen	Phosphorus	Sediment
Sassafrass R.	99.5%	1.91	(0.1553,0.1320)	(2.1799,2.7223)	(0.0506,0.0273)	(2.1749,2.6860)	(0.1157,0.0598)	(83.4010,40.3539)
Bush R.	95.9%	0.84	(1.5825,0.8922)	(2.4744,2.3498)	(0.1267,0.1017)	(3.0666,2.5281)	(0.1737,0.1135)	(59.0322,25.8072)
Gunpowder R.	94.7%	1.63	(0.0774,0.0535)	(1.0177,0.6381)	(0.0122,0.0150)	(0.8905,0.4197)	(0.0471,0.0453)	(41.6804,26.4902)
South R.	69.1%	9.84	(0.1297,0.0711)	(3.9673,1.2951)	(0.0467,0.0516)	(3.8474,0.8738)	(0.0784,0.0632)	(72.0014,14.3373)
Piscataway R.	100.0%	10.00	(0.3453,0.4396)	(5.3081,3.3781)	(0.0381,0.0428)	(5.3026,3.7361)	(0.0702,0.0882)	(50.1494,24.6814)
Mattawoman C.	100.0%	10.02	(0.2073,0.0919)	(4.8008,1.5988)	(0.4483,0.0977)	(5.5305,1.3970)	(0.7417,0.1345)	(57.9953,10.7982)
Corrotoman R.	56.6%	14.53	(0.1101,0.0547)	(1.8100,0.7305)	(0.0223,0.0449)	(1.8435,0.5219)	(0.0785,0.0436)	(61.3329,7.3679)
Chickahominy R.	99.7%	1.18	(0.9466,0.0659)	(5.4596,0.1568)	(0.0683,0.0253)	(7.2374,0.4886)	(0.1628,0.0443)	(59.5836,26.0285)
Nanticoke R.	99.8%	0.19	(0.1803,0.0979)	(2.9407,1.4710)	(0.0436,0.0627)	(2.8671,1.2843)	(0.0962,0.0784)	(35.9075,26.7130)
Manokin R.	49.0%	13.87	(1.1536,0.0830)	(3.7258,1.8581)	(0.0762,0.1620)	(4.8577,1.6766)	(0.1603,0.1807)	(43.1494,19.3087)
Big Annemessix R.	47.8%	15.41	(10.0068,0.1772)	(17.8570,2.3882)	(0.4463,0.1897)	(25.9882,2.5141)	(0.8129,0.2241)	(85.0987,11.0865)
Patapsco R.	80.8%	10.42	(3.5302,3.5692)	(2.9920,2.3088)	(0.2444,0.2232)	(6.6460,5.7518)	(0.3410,0.3106)	(55.0892,19.4416)
Anacostia R.	100.0%	50.17	(0.2177,0.3556)	(2.7501,0.3999)	(0.0824,0.0492)	(1.7004,1.2848)	(0.0571,0.0730)	(95.3317,88.8498)
Elizabeth S.	46.9%	19.08	(1.8986,1.0394)	(4.3389,1.9357)	(0.8990,0.9572)	(7.6235,3.0640)	(1.2829,1.3484)	(14.6792,12.2521)
Chester R.	99.3%	0.49	(0.1221,0.0948)	(1.0766,2.3536)	(0.0301,0.0593)	(0.9874,1.8124)	(0.1563,0.1032)	(87.0498,73.3785)
Pocomock R.	100.0%	0.20	(0.2716,0.0690)	(0.7283,1.1817)	(0.0953,0.0947)	(1.1926,1.0027)	(0.1445,0.1363)	(30.9019,14.6002)

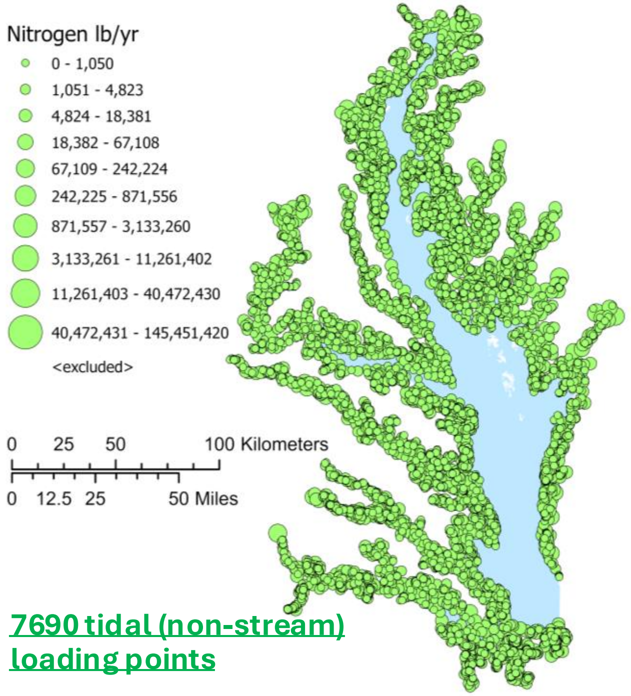
P7 CAST land uses in DWSM

many thanks to Jess, Sarah, and Peter!

- We are working on the incorporation of P7 CAST land use data in the P7 DWSM
  - Pre-BMP land use data for 1985-2024 is replacing the static 2013 P6 data.
  - Land use input is produced at 100K NHD+ catchment and land segment scale.
  - We developed a land use data workflow between P7 CAST and DWSM.
  - DWSM model code and configurations were revised for the new set of P7 land uses.
- We aggregated 51 P7 CAST land uses into 16 core land use types and feed-space
  - Aggregation into 17 land use types provides a computationally efficient model simulation as compared to that with 51 land uses – while maintaining the accuracy of loads at the catchment scale.



2693 terminal (stream/river) loading points



7690 tidal (non-stream) loading points

Proposed aggregation of P7 CAST land uses in DWSM

1. Impervious Roads
- MS4 Roads
- CSS Roads
- Non-Regulated Roads

2. Impervious Non-Roads
- MS4 Buildings and Other
- CSS Buildings and Other
- Non-Regulated Buildings and Other

3. Tree Canopy over Impervious
- MS4 Tree Canopy over Impervious
- CSS Tree Canopy over Impervious
- Non-Regulated Tree Canopy over Impervious

4. Turfgrass
- MS4 Turf Grass
- CSS Turf Grass
- Non-Regulated Turf Grass

5. Tree Canopy Over Turfgrass
- MS4 Tree Canopy over Turf Grass
- CSS Tree Canopy over Turf Grass
- Non-Regulated Tree Canopy over Turf Grass

6. Solar Infrastructure
- MS4 Solar Infrastructure
- CSS Solar Infrastructure
- Non-Regulated Solar Infrastructure

7. Solar Pervious
- MS4 Solar Pervious
- CSS Solar Pervious
- Non-Regulated Solar Pervious

8. Compacted Pervious
- MS4 Compacted Pervious
- CSS Compacted Pervious
- Non-Regulated Compacted Pervious

9. Construction
- Regulated Construction
- CSS Construction

10. Forest
- True Forest
- CSS Forest

11. Harvested Forest
- Harvested Forest
- CSS Harvested Forest

12. Floodplain Wetlands

13. Other Wetlands

14. Cropland
- Full Season Soybeans
- Grain with Manure
- Grain without Manure
- Silage with Manure
- Silage without Manure
- Small Grains and Grains
- Double Cropped Land
- Specialty Crop High
- Specialty Crop Low
- Other Agronomic Crops

15. Pasture and Hay
- Ag Open Space
- Leguminous Hay
- Hay Low
- Pasture Low
- Hay High
- Pasture High

16. Water

17. Feed Space
- Permitted Feeding Space
- Non-Permitted Feeding Space

Thanks to Jess, Sarah, and Pater!

Extending the P7 DWSM simulation period to 2024

… in collaboration with Robert Burgholzer and Connor Brogan (VA DEQ)

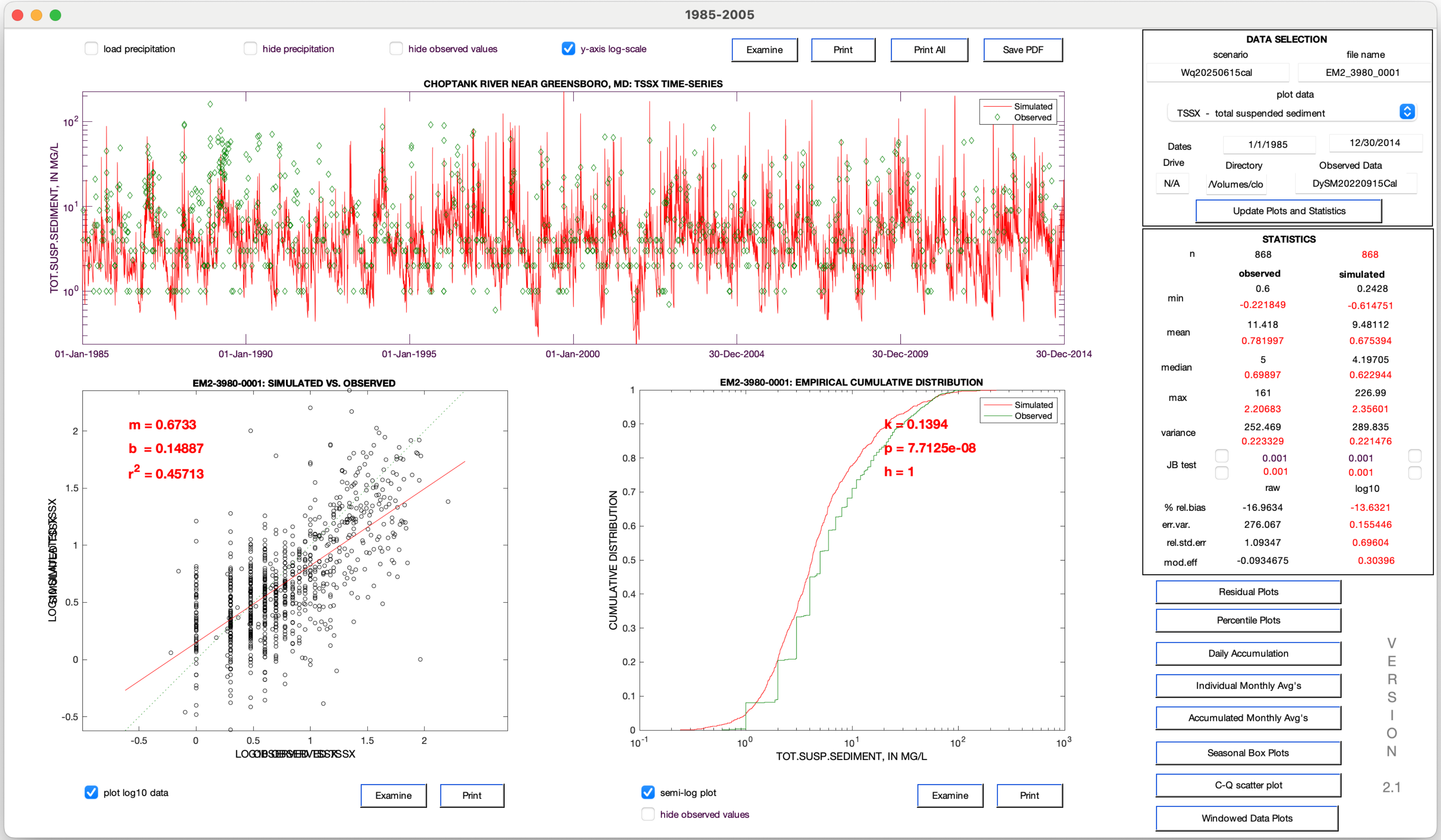
- We are using PRISM precipitation that is disaggregated to hourly time steps based on NLDAS2.
- Meteorological data (i.e., air temperature, potential evapotranspiration, wind speed, solar radiation, dew point temperature, and cloud cover) are based on NLDAS2.
- We adapted our workflow to the transition of NLDAS2 data from GRIB file format to NetCDF.
- We performed extensive QA QC.
- We added P7 atmospheric N-deposition data.

Monitoring and WRTDS-K data for calibration & verification

- FluxMaster data for nitrogen, phosphorus, and sediment at 216, 196, and 146 monitoring stations, respectively, are used in the estimation β2, β3, and β4 GSN routing parameters.
- We are currently calibrating the riverine water quality simulation to both concentrations data and WRTDS loads for the monitoring stations located on river mainstems.
- We have processed the WRTDS-K loads data for calibrating the DWSM, and we are assessing its use in further fine-tuning of GSN routing as well.
- We need to work on processing and incorporation of concentrations data beyond 2014 for (a) riverine water quality calibration, and (b) verification in small streams.

Choptank River Near Greensboro, MD

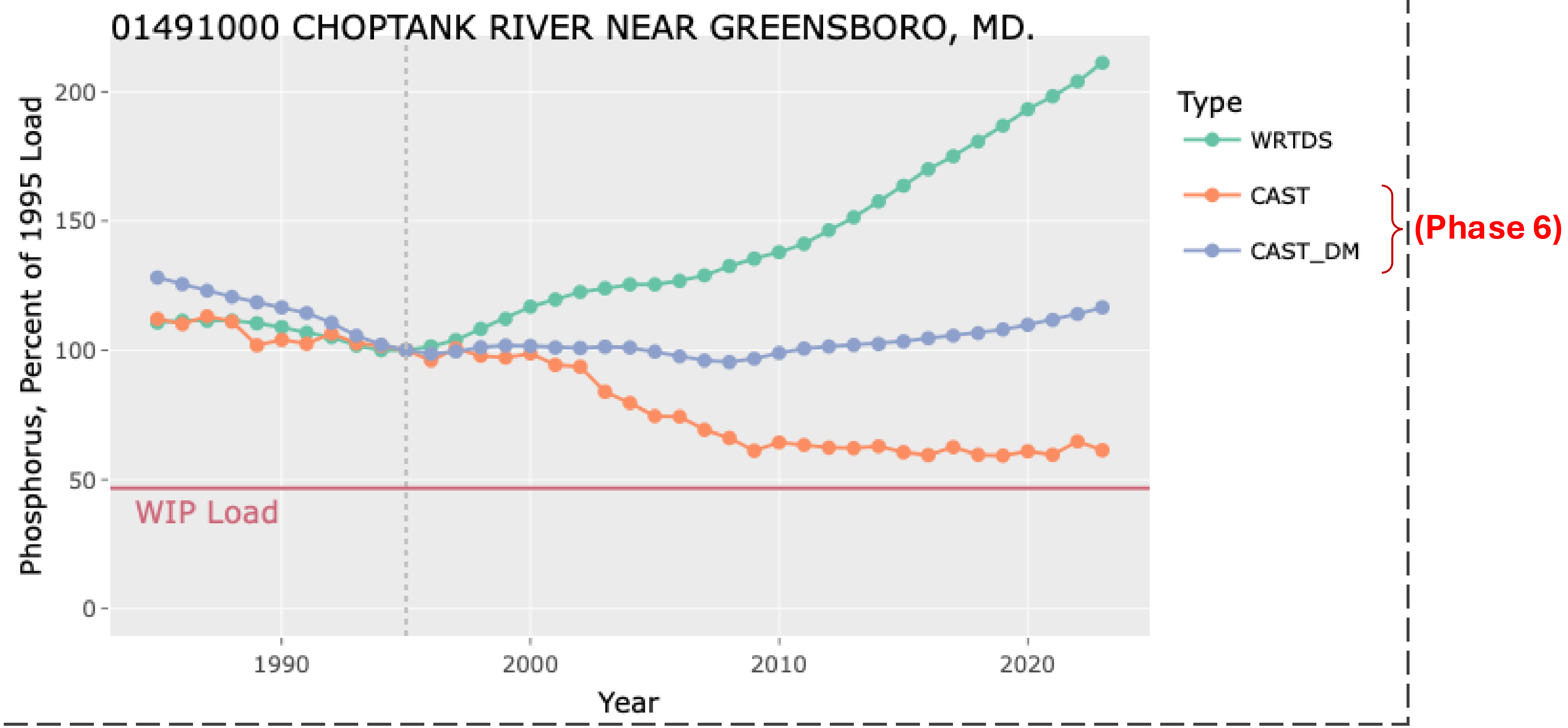
Sediment



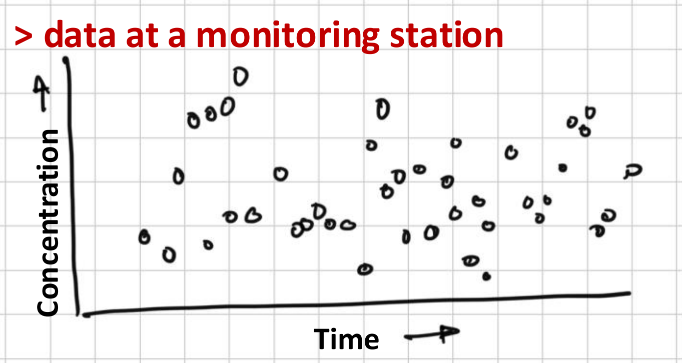
Adding a trend component to generalized stream network routing

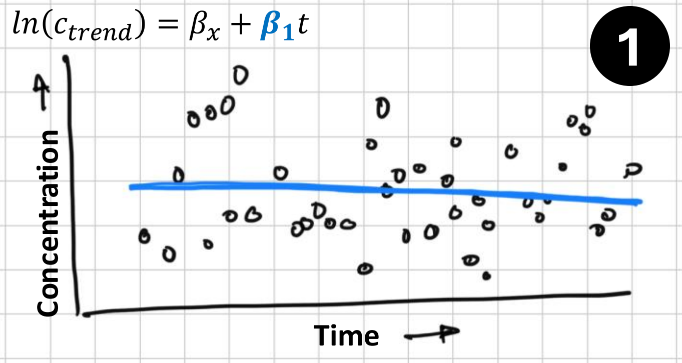
Monitored and **E**xpected **T**otal **R**eduction **I**ndicator for the **C**hesapeake (METRIC)
https://metric.chesapeakebay.net/metric/

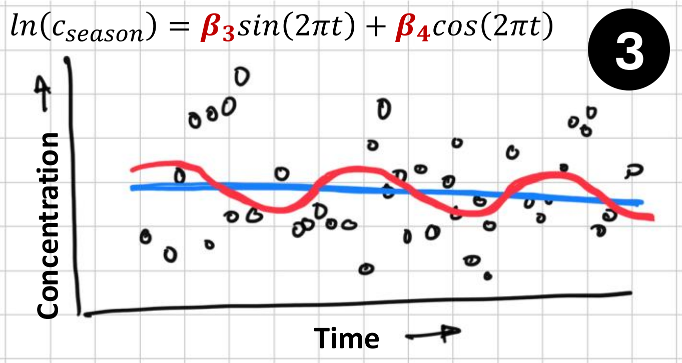
>> for comparing the monitored load trend and CAST-estimated load trend



Adding a trend component to generalized stream network routing







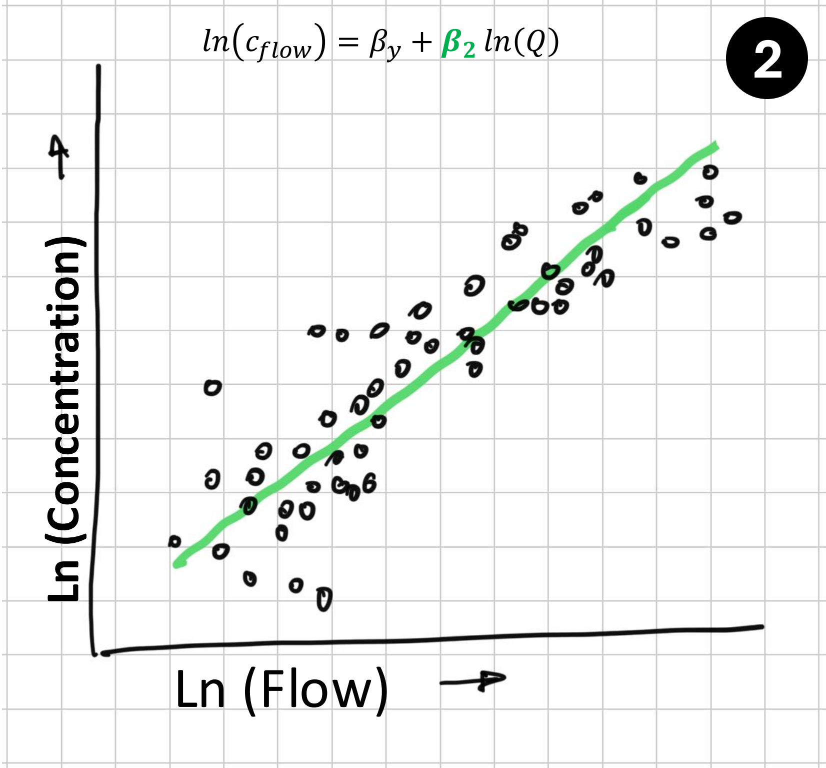
$$ln(c) = \beta_o + \boldsymbol{\beta_1 t} + \boldsymbol{\beta_2} ln(Q) + \boldsymbol{\beta_3} sin(2\pi t) + \boldsymbol{\beta_4} cos(2\pi t) + \varepsilon$$

[FluxMaster]

1 trend

2 flow variability

3 seasonal variability



Random Forest models were developed for explaining variability in β_2, β_2 and β_3 parameters of the monitoring stations and for estimating the same for all NHD streams.

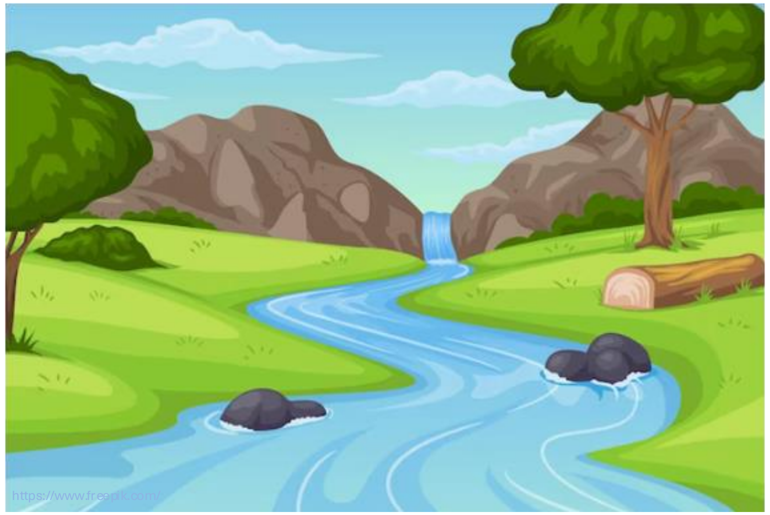
Adding a trend component to generalized stream network routing

HSPF model: <u>hourly</u> surface and groundwater hydrology of land uses

UNEC model: <u>annual</u> surface and groundwater concentrations as a function of input history and estimates of lag-times

agricultural

natural



developed

Biogeochemical processing, Storage/deposition, Scour, etc.
➔ Fate and Transport

$$ln(c) = \beta_o + ln(c_{in,yr} \times STF) + \beta_2 ln(Q) + \beta_3 sin(2\pi t) + \beta_4 cos(2\pi t) + \varepsilon$$

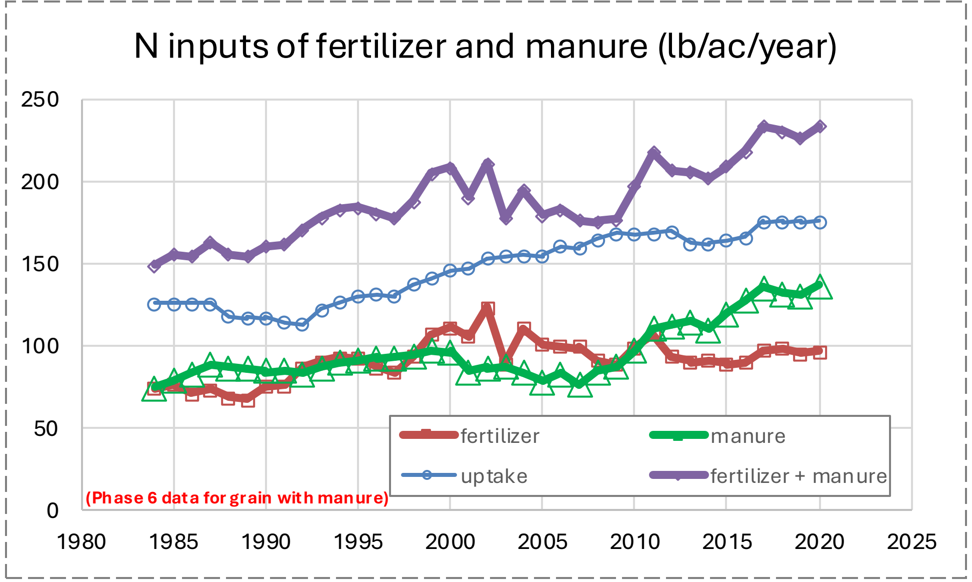
where, $c_{in,yr}$ vary annually, and STF, stream transport factor is estimated in CalCAST

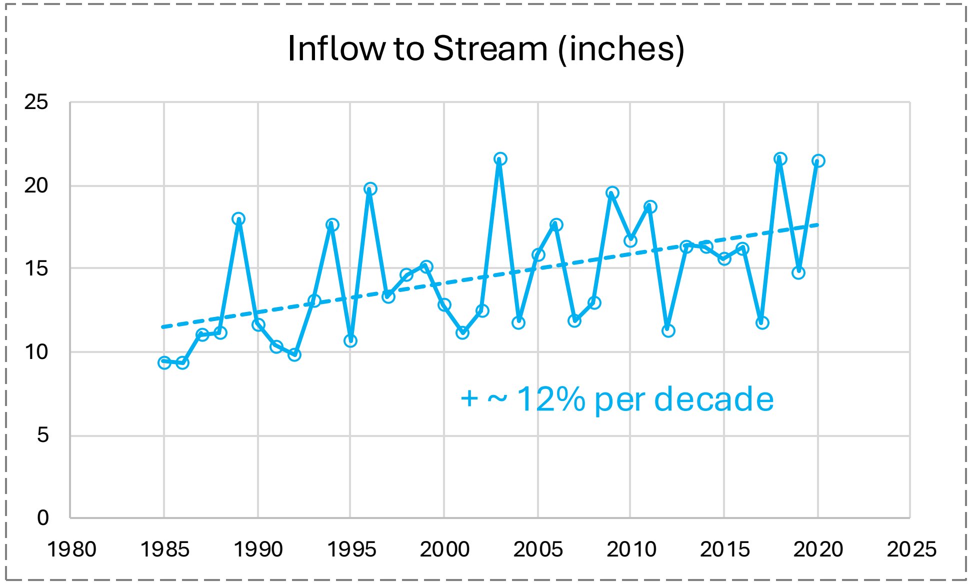
We are testing approaches for best representing the trend component in the GSN routing.

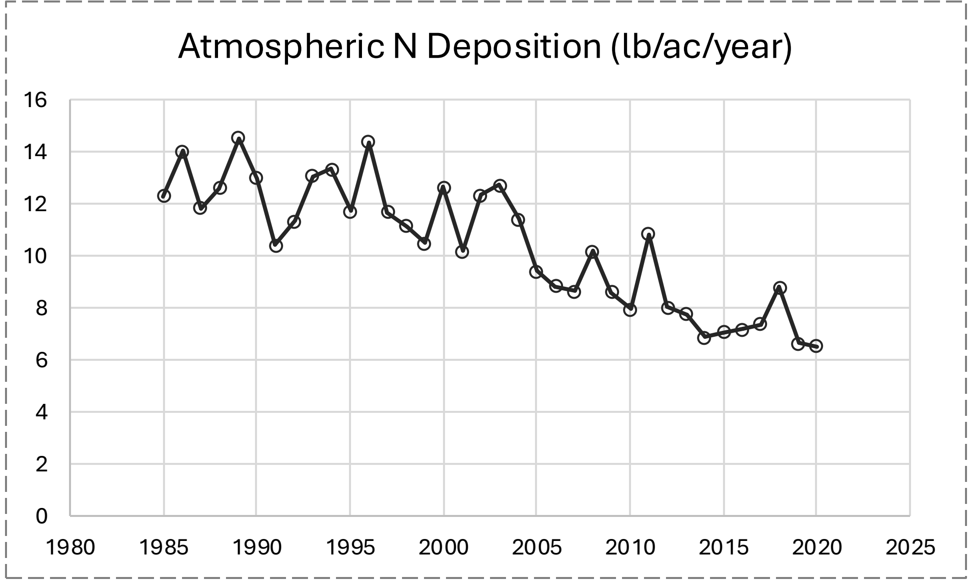
Trend component is linked to trend in inputs to a stream segment (i.e., loads from both EOS and upstream).

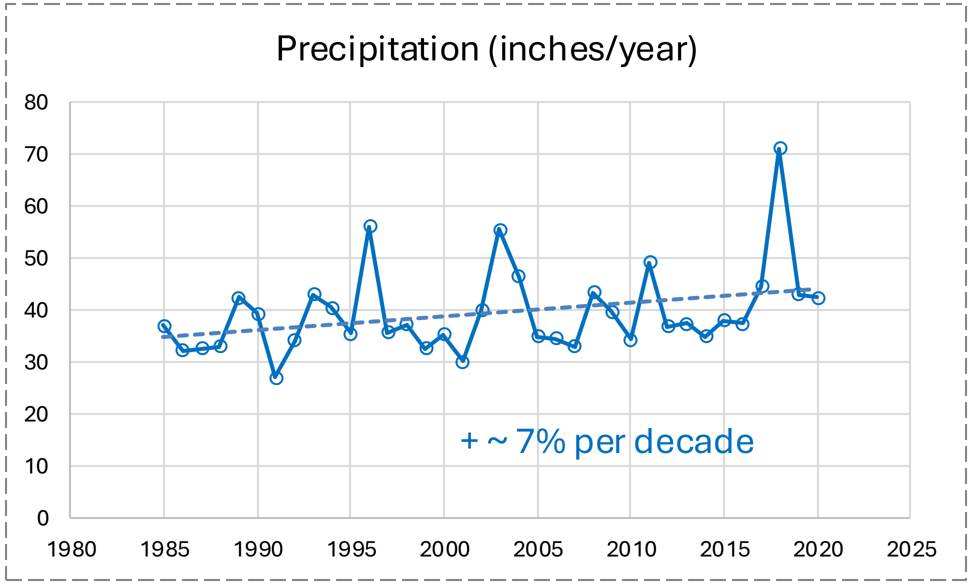
A 1st order NHD MR stream EM2_009405936

(0.6 sq. miles)
(58% Crops)

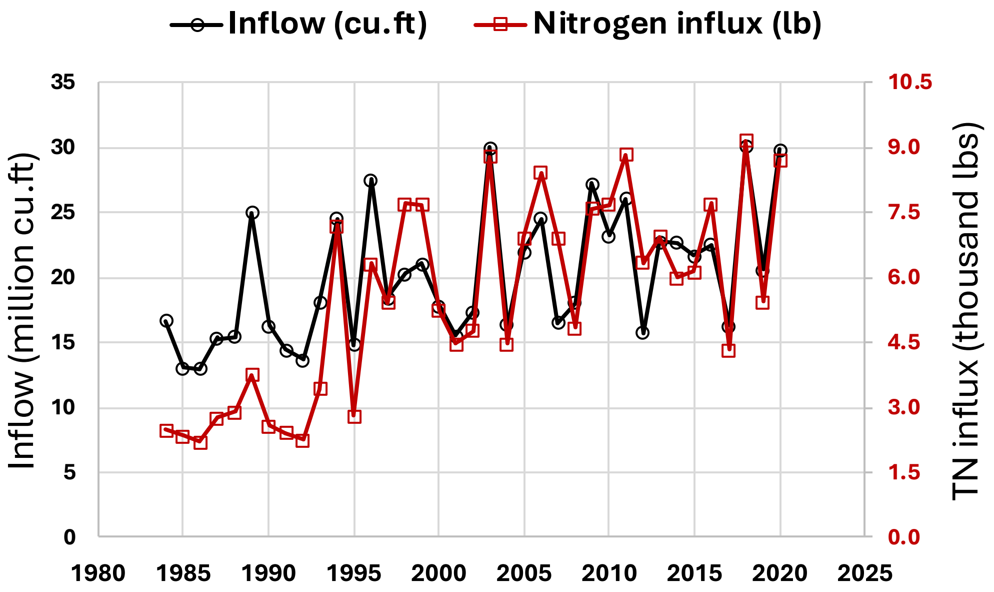


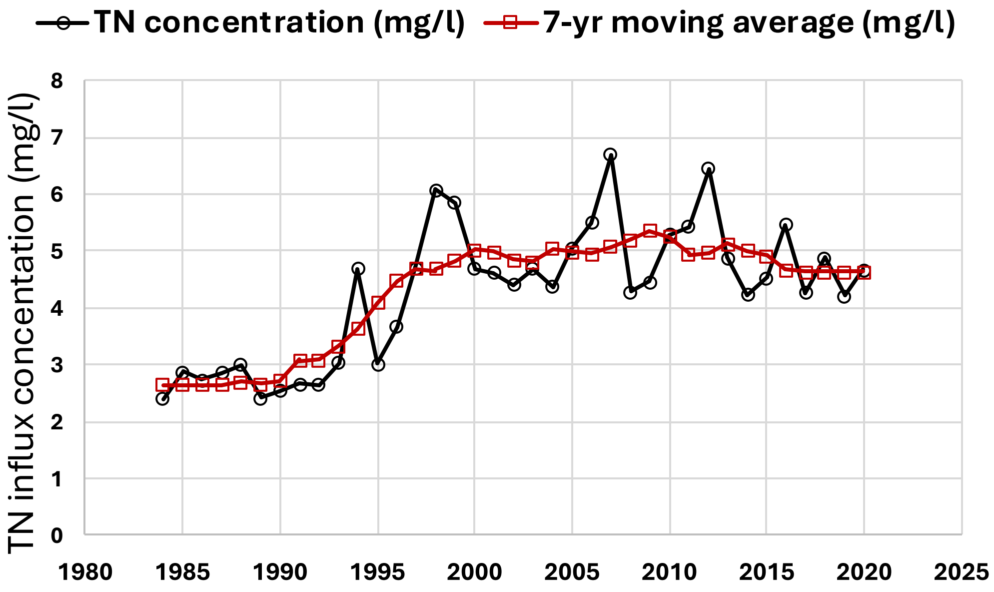




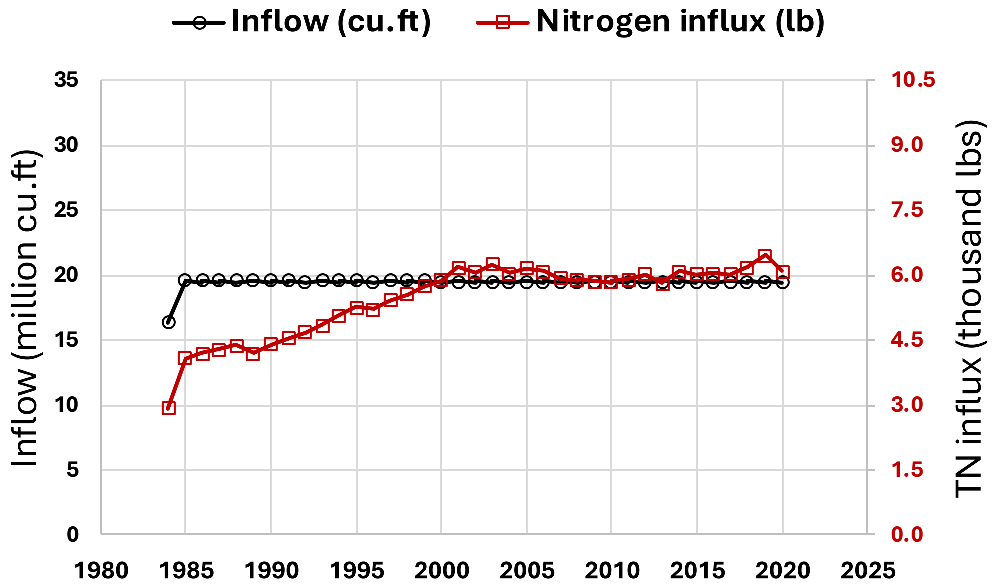


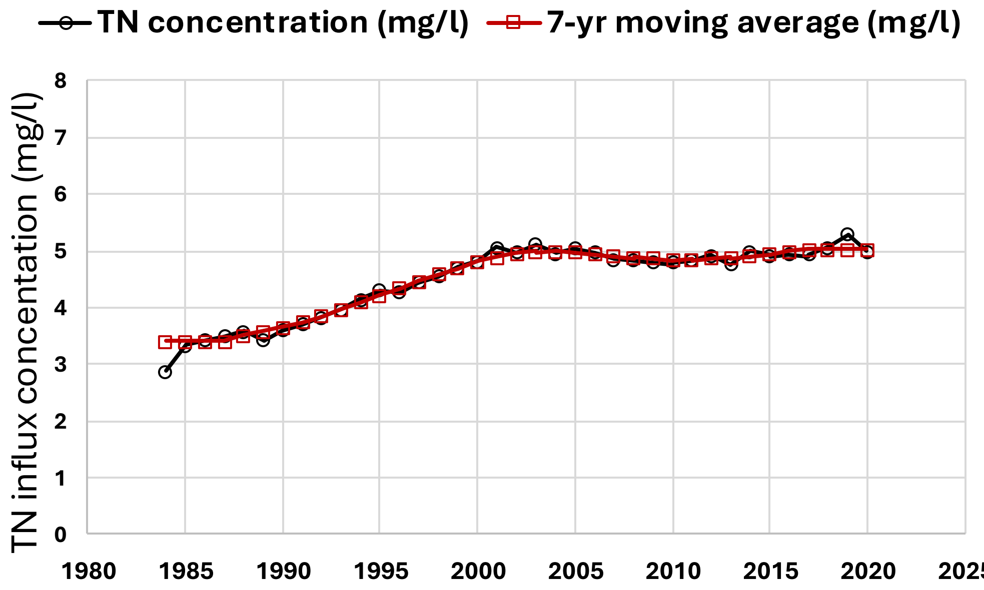
Dynamic Hydrology





~ *steady-state* Hydrology



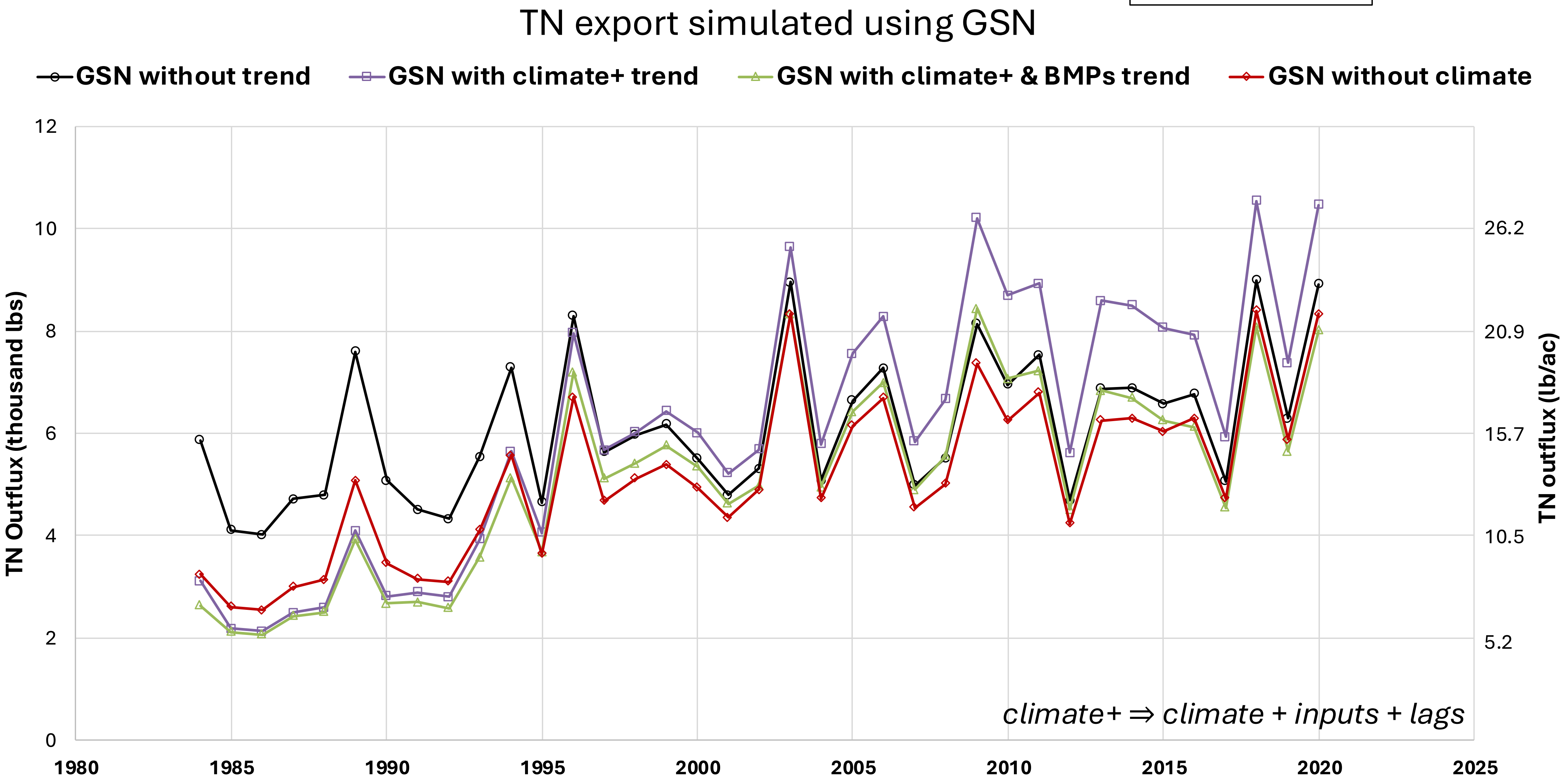


Trend is an integration of history of inputs, sensitivities, lags, climate/hydrology, BMPs, and land use change …

A 1st order NHD MR stream EM2_009405936

(0.6 sq. miles)

(58% Crops)



Trend is an integration of history of inputs, sensitivities, lags, climate/hydrology, BMPs, and land use change ...

RIM stations: Phase 7 Nitrogen loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	^GSN trend	P7 pre-BMP LU
Susquehanna Marietta PA	+00.9% (+0.694)	+01.1% (+0.776)	+01.8% (+0.489)	+02.1% (+0.701)	+03.1% (+0.699)
Potomac Washington, DC	-03.1% (+0.797)	-01.6% (+0.817)	+00.2% (+0.693)	+00.8% (+0.678)	+**.*% (+*.***)
James Cartersville, VA	+00.2% (+0.731)	-01.2% (+0.902)	+00.9% (+0.241)	+00.4% (+0.510)	+00.8% (+0.714)
Patuxent Bowie, MD	+04.1% (+0.721)	-04.0% (+0.300)	+00.1% (+0.619)	+01.0% (+0.678)	+01.1% (+0.528)
Choptank Greensboro, MD	-04.7% (+0.565)	-04.4% (+0.722)	-04.2% (+0.660)	-04.5% (+0.704)	-03.0% (+0.690)

→ some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period

Summary

1. Major elements of the DWSM are now in place.

2. We will investigate what went wrong in our latest run with P7 pre-BMP land use.

3. We will continue making further updates and refinements as P7 inputs become available (including monitoring data updates).

RIM stations: Phase 7 Nitrogen loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	^GSN trend	P7 pre-BMP LU
Susquehanna Conowingo MD	-05.0% (+0.836)	-01.1% (+0.723)	-02.5% (+0.548)	-00.6% (+0.673)	+00.1% (+0.658)
Susquehanna Marietta PA	+00.9% (+0.694)	+01.1% (+0.776)	+01.8% (+0.489)	+02.1% (+0.701)	+03.1% (+0.699)
Potomac Washington, DC	-03.1% (+0.797)	-01.6% (+0.817)	+00.2% (+0.693)	+00.8% (+0.678)	+**.*% (+*.***)
James Cartersville, VA	+00.2% (+0.731)	-01.2% (+0.902)	+00.9% (+0.241)	+00.4% (+0.510)	+00.8% (+0.714)
Rappa. Fredericksburg, VA	+01.1% (+0.595)	-05.8% (+0.854)	-06.4% (+0.813)	-04.6% (+0.860)	-04.6% (+0.843)
Appomattox Matoaca, VA	+03.2% (+0.285)	-12.0% (+0.755)	-13.2% (+0.663)	-11.9% (+0.737)	-11.3% (+0.735)
Pamunkey Hanover, VA	+03.1% (+0.338)	-07.4% (+0.771)	-06.8% (+0.670)	-06.8% (+0.687)	+**.*% (+*.***)
Mattaponi Beulahville, VA	+06.8% (+0.511)	-10.2% (+0.655)	-13.0% (+0.270)	-11.4% (+0.482)	-10.6% (+0.466)
Patuxent Bowie, MD	+04.1% (+0.721)	**-04.0% (+0.300)**	**+00.1% (+0.619)**	+01.0% (+0.678)	+01.1% (+0.528)
Choptank Greensboro, MD	-04.7% (+0.565)	-04.4% (+0.722)	-04.2% (+0.660)	-04.5% (+0.704)	-03.0% (+0.690)

→ some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period

RIM stations: Phase 7 Nitrate loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	^GSN trend	P7 pre-BMP LU
Susquehanna Conowingo MD	+07.1% (+0.496)	+11.3% (+0.501)	+03.7% (+0.183)	+14.3% (+0.258)	+14.5% (+0.270)
Susquehanna Marietta PA	+03.1% (+0.764)	+07.4% (+0.745)	+10.3% (+0.394)	+08.1% (+0.679)	+07.4% (+0.713)
Potomac Washington, DC	-04.6% (+0.846)	+13.7% (+0.771)	+01.2% (+0.856)	+01.1% (+0.857)	-14.3% (+0.726)
James Cartersville, VA	+09.4% (-0.380)	**+36.7% (-0.131)**	+02.4% (+0.427)	+07.6% (+0.460)	+13.4% (+0.325)
Rappa. Fredericksburg, VA	+03.2% (+0.524)	**+32.8% (-0.002)**	+17.1% (+0.385)	+23.7% (+0.297)	+26.9% (+0.105)
Appomattox Matoaca, VA	+10.1% (-0.824)	-07.8% (+0.095)	**-21.1% (+0.252)**	-25.1% (+0.163)	-06.2% (+0.088)
Pamunkey Hanover, VA	+09.0% (+0.067)	**+21.8% (+0.169)**	+11.9% (+0.283)	+11.7% (+0.333)	+**.*% (+*.***)
Mattaponi Beulahville, VA	+11.0% (-1.751)	**+32.7% (-0.751)**	+15.4% (-0.417)	+15.2% (-0.076)	+26.3% (-0.735)
Patuxent Bowie, MD	+00.8% (+0.629)	-03.8% (+0.079)	-07.3% (+0.666)	-02.8% (+0.754)	-11.3% (+0.624)
Choptank Greensboro, MD	-01.9% (+0.437)	+13.6% (+0.637)	+15.0% (+0.487)	+13.5% (+0.604)	+18.1% (+0.440)

→ *some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period*

RIM stations: Phase 7 Phosphorus loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	^GSN trend	P7 pre-BMP LU
Susquehanna Conowingo MD	+02.0% (+0.944)	+02.2% (+0.783)	+02.4% (+0.853)	+03.2% (+0.770)	+03.5% (+0.757)
Susquehanna Marietta PA	+04.2% (+0.858)	+04.4% (+0.840)	+06.0% (+0.641)	+05.1% (+0.861)	+05.5% (+0.882)
Potomac Washington, DC	+01.0% (+0.877)	+06.9% (+0.226)	+06.4% (+0.336)	+08.2% (+0.228)	+**.*% (+*.***)
James Cartersville, VA	-04.7% (+0.558)	+01.9% (+0.850)	+04.1% (+0.481)	+04.2% (+0.608)	+04.5% (+0.710)
Rappa. Fredericksburg, VA	-03.6% (+0.309)	-03.4% (+0.680)	-05.2% (+0.496)	-01.3% (+0.615)	-01.4% (+0.596)
Appomattox Matoaca, VA	-01.5% (+0.678)	-06.2% (+0.739)	-10.2% (+0.039)	-08.6% (+0.658)	-07.1% (+0.615)
Pamunkey Hanover, VA	+00.0% (+0.622)	-02.0% (+0.243)	-00.1% (+0.275)	-00.6% (+0.226)	+**.*% (+*.***)
Mattaponi Beulahville, VA	+01.6% (+0.214)	-07.3% (+0.237)	-11.2% (-0.234)	-08.9% (+0.098)	-09.4% (+0.052)
Patuxent Bowie, MD	+02.5% (+0.688)	-07.0% (-0.015)	-06.0% (-0.058)	-02.7% (+0.189)	-03.5% (+0.064)
Choptank Greensboro, MD	-01.7% (+0.395)	-02.3% (+0.501)	+01.5% (+0.298)	-00.8% (+0.459)	+00.3% (+0.381)

→ some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period

RIM stations: Phase 7 Sediment loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	^GSN trend	P7 pre-BMP LU
Susquehanna Conowingo MD	+08.0% (+0.963)	+04.3% (+0.808)	+06.2% (+0.875)	+05.4% (+0.824)	+05.9% (+0.801)
Susquehanna Marietta PA	-00.9% (+0.833)	+07.9% (-0.047)	+11.7% (-0.903)	+08.6% (-0.025)	+09.0% (+0.053)
Potomac Washington, DC	+03.2% (+0.827)	+10.1% (-0.623)	+09.2% (-0.713)	+10.7% (-0.626)	+08.0% (-0.976)
James Cartersville, VA	+01.1% (+0.384)	+08.0% (-2.613)	+02.9% (-0.674)	+05.6% (-0.550)	+06.4% (-0.700)
Rappa. Fredericksburg, VA	+00.1% (-0.356)	-04.1% (+0.474)	-04.9% (+0.329)	-02.9% (+0.461)	-03.1% (+0.442)
Appomattox Matoaca, VA	+13.8% (-0.567)	-06.4% (+0.449)	-12.3% (-0.181)	-09.7% (+0.477)	-03.8% (+0.304)
Pamunkey Hanover, VA	+01.7% (-1.143)	-02.4% (-0.024)	-02.3% (-0.034)	-02.3% (-0.037)	+**.*% (+*.***)
Mattaponi Beulahville, VA	-00.9% (-0.120)	-09.4% (-0.533)	-11.7% (-0.769)	-09.0% (-0.538)	-09.6% (-0.549)
Patuxent Bowie, MD	+10.3% (+0.678)	-11.0% (-0.134)	-14.0% (-0.283)	-09.4% (+0.039)	-06.7% (+0.280)
Choptank Greensboro, MD	+15.9% (+0.424)	+01.5% (-0.805)	+10.0% (-2.118)	+08.0% (-0.852)	+09.3% (-1.127)

→ *some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period*