



# Real-time sediment and nutrient monitoring in York County, PA



# York County Monitoring Program

- York is 6 of 23 USGS-operated supergauge sites in Pennsylvania (and growing!)
- Multi-level cooperators (local County, State, and Federal)

Sites (in order going south through York):

Fishing Ck at Goldsboro, 17.5 mi<sup>2</sup>

**W. Conewago Ck nr Manchester, 510 mi<sup>2</sup>**

**Codorus Ck. nr. Saginaw, 277 mi<sup>2</sup>**

Kreutz Ck at Strickler, 32.3 mi<sup>2</sup>

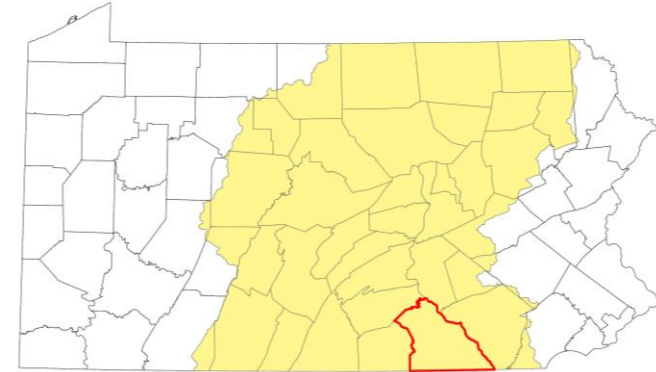
Fishing Ck at Craley, 15.8 mi<sup>2</sup>

**Muddy Ck at Castle Fin, 133 mi<sup>2</sup>**

**Bold = NTN stations**

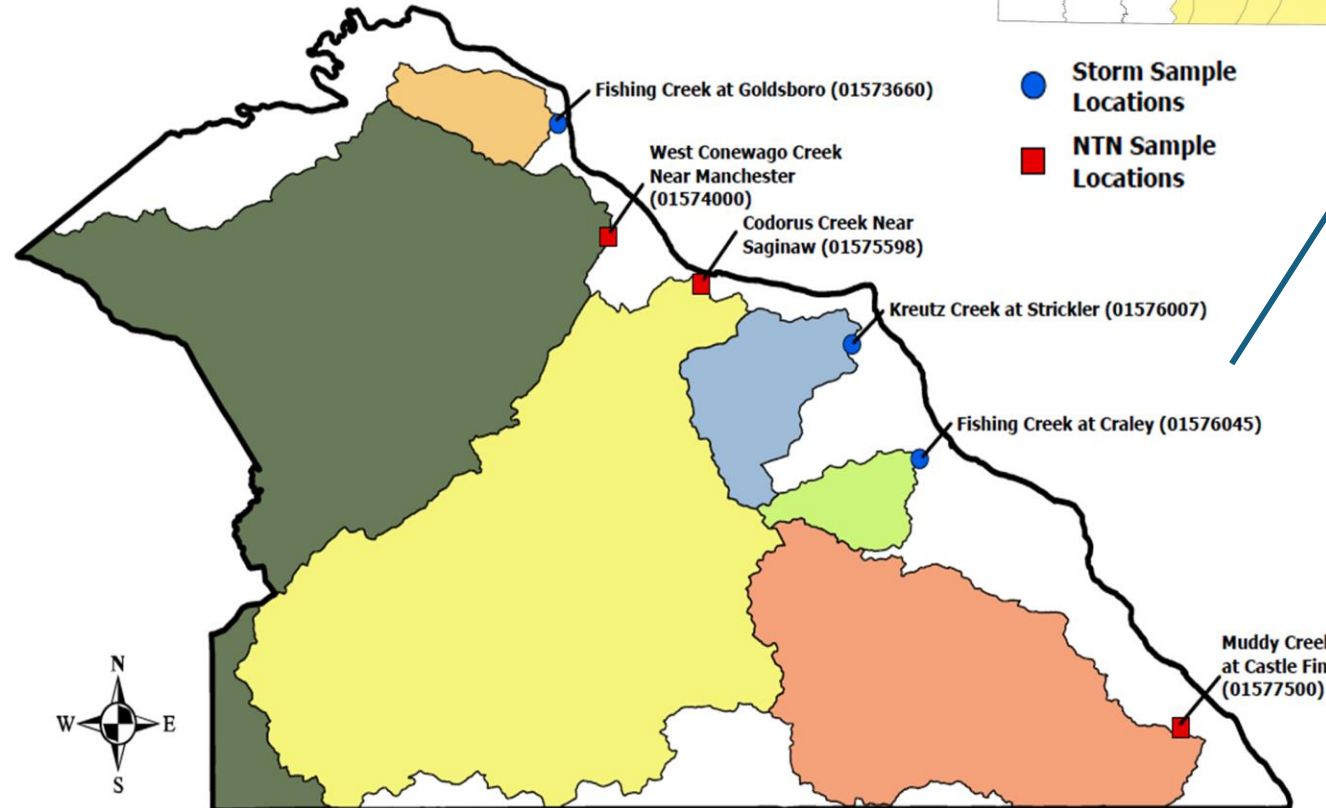


YORK COUNTY  
CONSERVATION DISTRICT



York County

CBay Watershed



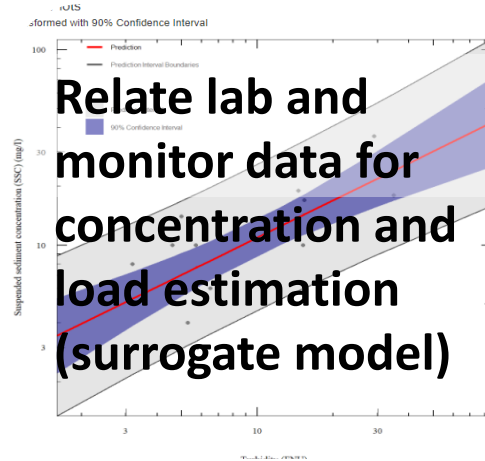
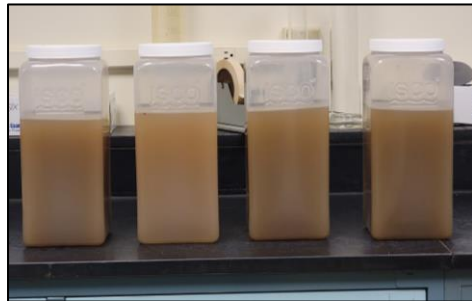
**This monitoring network covers ~80% of York county!**



Monitor



Sample



## Model Archive Summary for Susper, Sediment Concentration at Station 01 West Conewago Creek near Manches [2022 Version]

log10 transformation, turbidity predictor

This model archive summary describes the regression model developed to estimate continuous instantaneous sediment concentrations with data starting since 2019-10-01. This is the first model developed to correlate sediment concentration with streamflow and turbidity data.

Site and Model Information  
U.S. Geological Survey  
Station name: West Conewago Creek near Manches

Date regression model was created: 2022-07-27

Start of data pulled for model: 2019-10-01

Period of data for model calibration: 2019-10-19 - 2022-06-15

All Available Data

Model Statistics, Data, and Plots

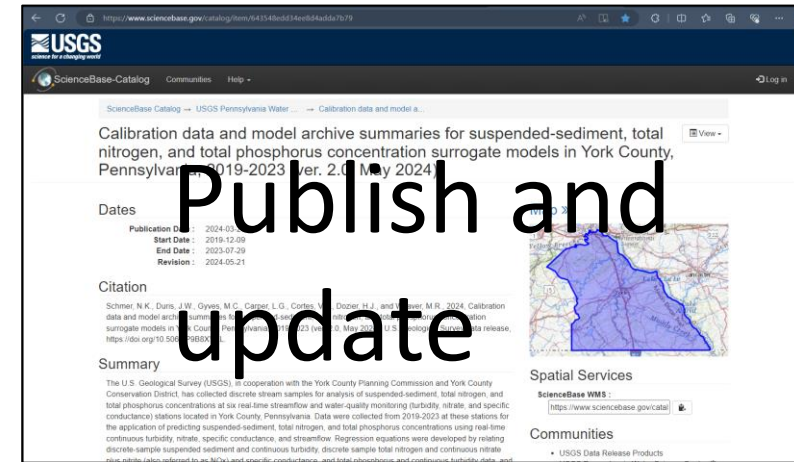
Model

$\log_{10}SSC = +0.575 * \log_{10}TURB + 0.468$

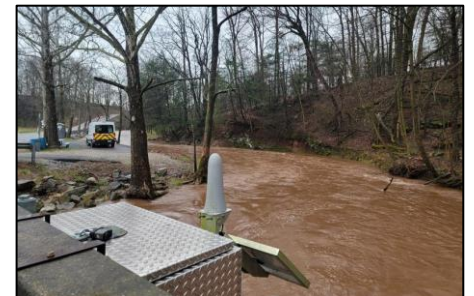
Variable Summary Statistics

# Review

# Publish and Update



Sample



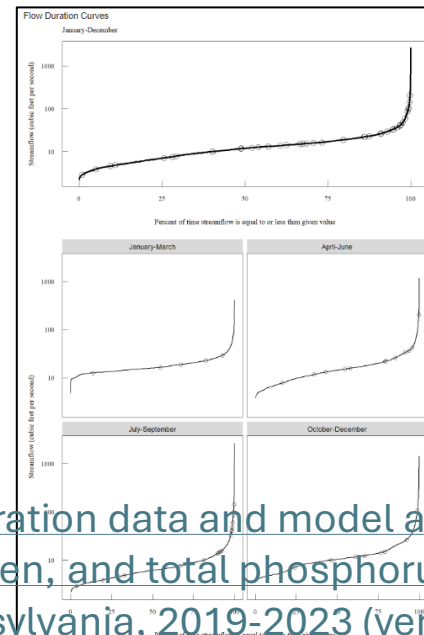
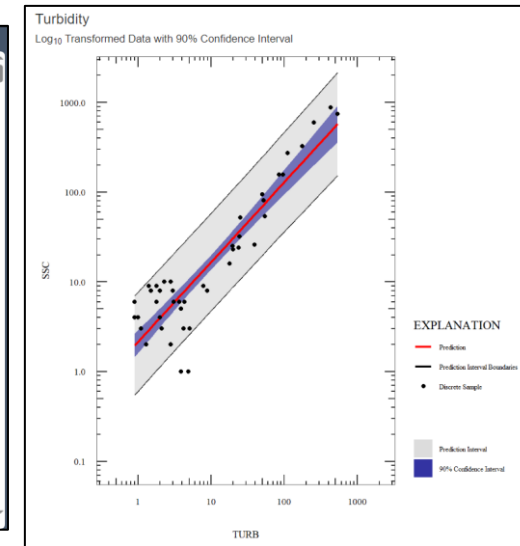
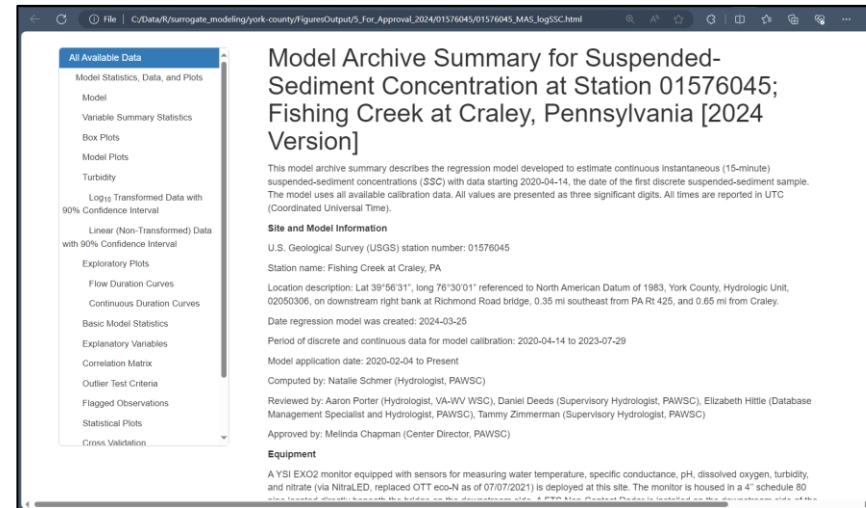
# Products: Surrogate Model Archive Summary

- Published in a publicly accessible USGS database (ScienceBase)
- Done in R Markdown
  - Consistent, reproducible across all projects and sites
  - Can control formatting, produces HTML file that can be opened in a browser for easy document navigation
- Includes

- Formula for the relation of sensor and sample, with statistics and plots that describe the relation
- Relation calibration data (how does sensor relate to sample)
- Once published, applied to data on the web



All data shown is preliminary information and subject to revision. Not for Citation or Distribution



Model-Calibration Data Set											
The "date" column refers to the nearest 15-minute date-time from the continuous (surrogate) measurement on which the sampling pairing is based. The "sample date" column is the exact sample date-time recorded in the sample information, which is not always on the nearest 15-minutes.											
	Copy	CSV	Excel	PDF	Print	Show 10 entries	Search:				
	date	sample date	log10SSC	log10TURB	SSC	TURB	computed log10SSC	computed SSC	residual	normal quantiles	Flagged
	2020-04-14 17:00:00	2020-04-14 17:00:00	0.778	0.633	6	4.3	0.895	9.72	-0.117	-0.339	100
	2020-04-24 19:00:00	2020-04-24 19:00:00	0.699	0.591	5	3.9	0.858	0.91	-0.109	-0.604	100
	2020-05-06 17:30:00	2020-05-06 17:30:00	0.778	0.491	6						
	2020-06-03 16:00:00	2020-06-03 16:00:00	1	0.362	10						
	2020-06-19 14:45:00	2020-06-19 14:45:00	0.778	0.568	6						
	2020-07-16 11:30:00	2020-07-16 11:30:00	1	0.447	10						
	2020-09-15 13:00:00	2020-09-15 13:00:00	0.778	-0.0458	6						
	2020-10-14 17:30:00	2020-10-14 17:30:00	0.778	0.255	6						
	2020-10-15 13:00:00	2020-10-15 13:00:00	0.954	0.188	9						
	2020-11-02 13:00:00	2020-11-02 13:00:00	0.954	0.188	9						
	2020-11-03 13:00:00	2020-11-03 13:00:00	0.954	0.188	9						
	2020-11-04 13:00:00	2020-11-04 13:00:00	0.954	0.188	9						
	2020-11-05 13:00:00	2020-11-05 13:00:00	0.954	0.188	9						
	2020-11-06 13:00:00	2020-11-06 13:00:00	0.954	0.188	9						
	2020-11-07 13:00:00	2020-11-07 13:00:00	0.954	0.188	9						
	2020-11-08 13:00:00	2020-11-08 13:00:00	0.954	0.188	9						
	2020-11-09 13:00:00	2020-11-09 13:00:00	0.954	0.188	9						
	2020-11-10 13:00:00	2020-11-10 13:00:00	0.954	0.188	9						
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## Basic Model Statistics

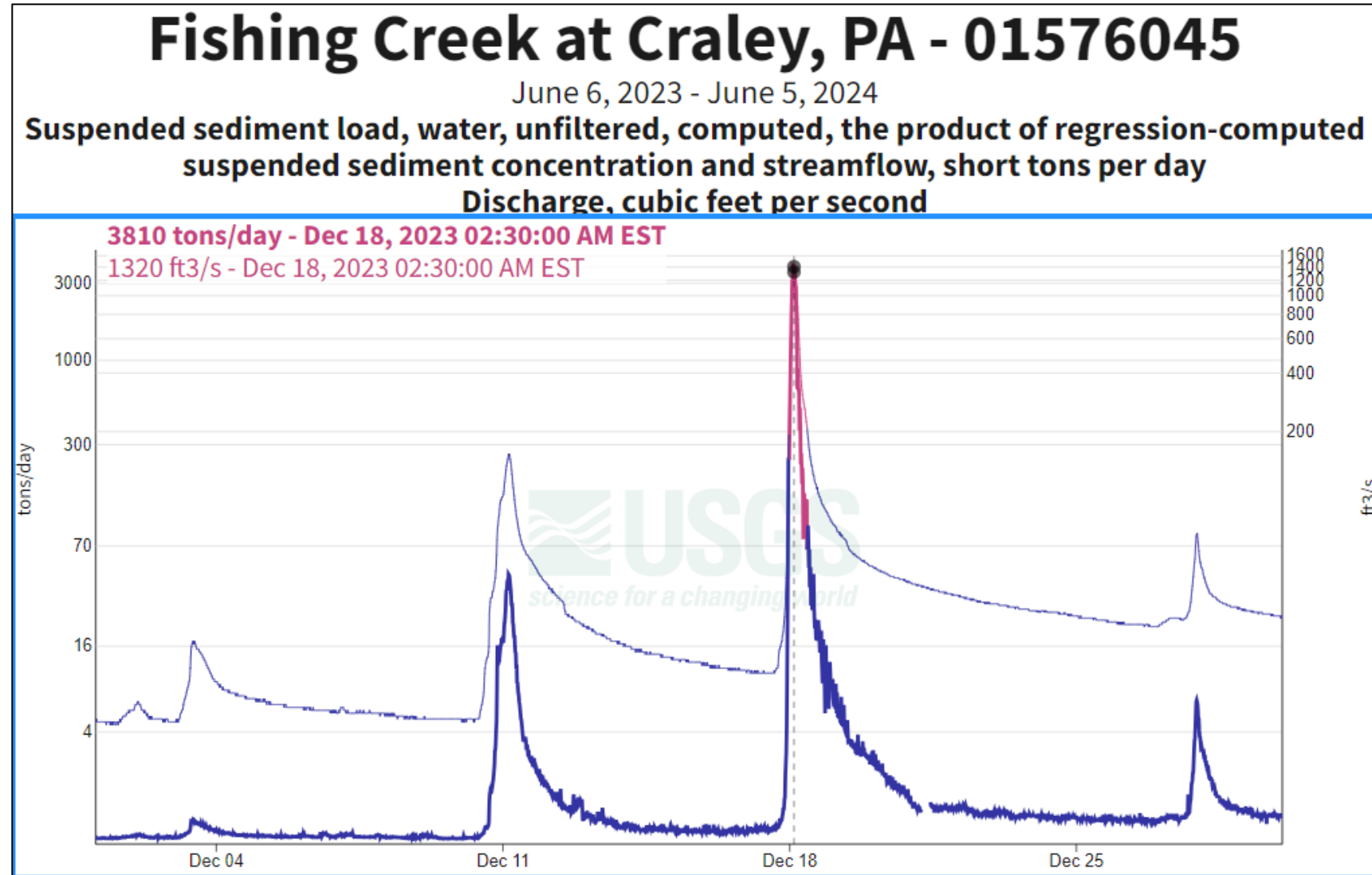
Model	$\log_{10}SSC = + 0.89 * \log_{10}TURB + 0.332$
N	45
Transformation	$\log_{10}$
Intercept	0.332
Slope	0.89
Coefficient of Determination (R <sup>2</sup> )	0.827
Adjusted Coefficient of Determination (Adj. R <sup>2</sup> )	0.823
Root Mean Square Error (RSME)	0.319
Mean Squared Prediction Error (MSPE)	0.301
Predicted Residual Error Sum of Squares (PRESS)	4.73
Duane's Bias Correction Factor (BCF)	1.24

Calibration data and model archive summaries for suspended-sediment, total nitrogen, and total phosphorus concentration surrogate models in York County, Pennsylvania, 2019-2023 (ver. 2.0, May 2024) - ScienceBase-Catalog



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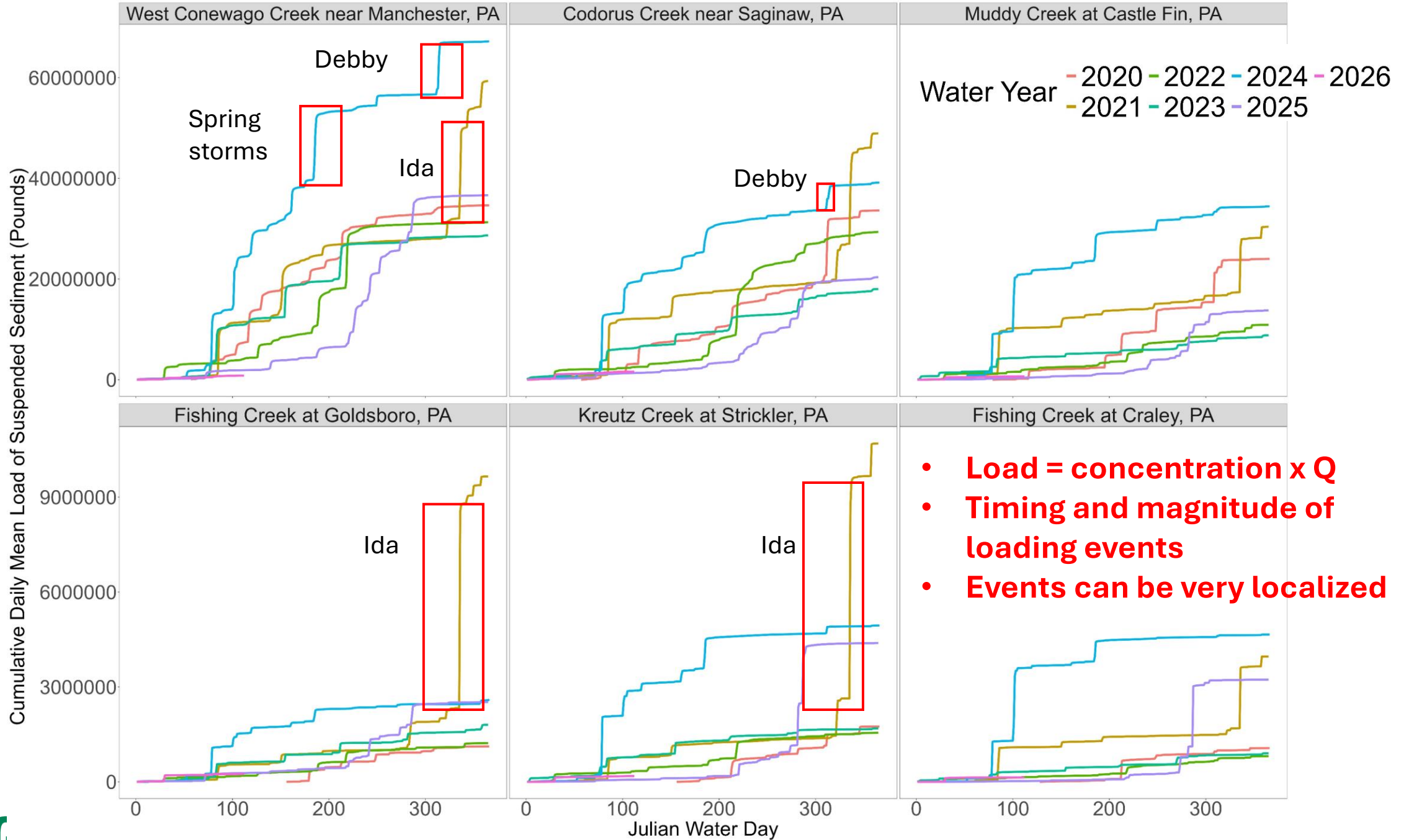
# Loads and Yields Data

# Loads

**Suspended Sediment, Total Nitrogen, Total Phosphorus**

Larger  
basin  
area

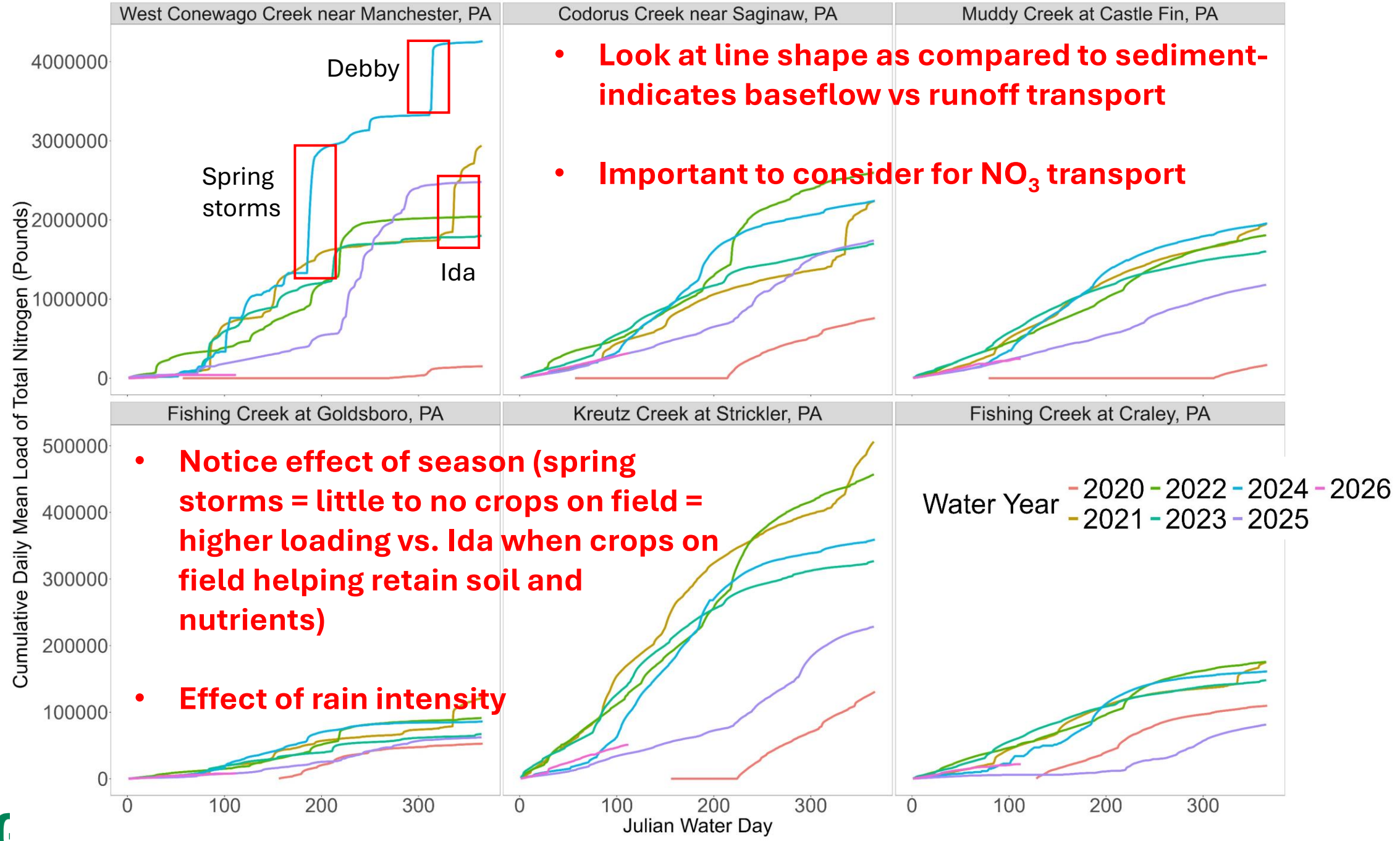
Smaller  
basin  
area





Larger basin area

Smaller basin area



- Look at line shape as compared to sediment- indicates baseflow vs runoff transport
- Important to consider for NO<sub>3</sub> transport

- Notice effect of season (spring storms = little to no crops on field = higher loading vs. Ida when crops on field helping retain soil and nutrients)
- Effect of rain intensity



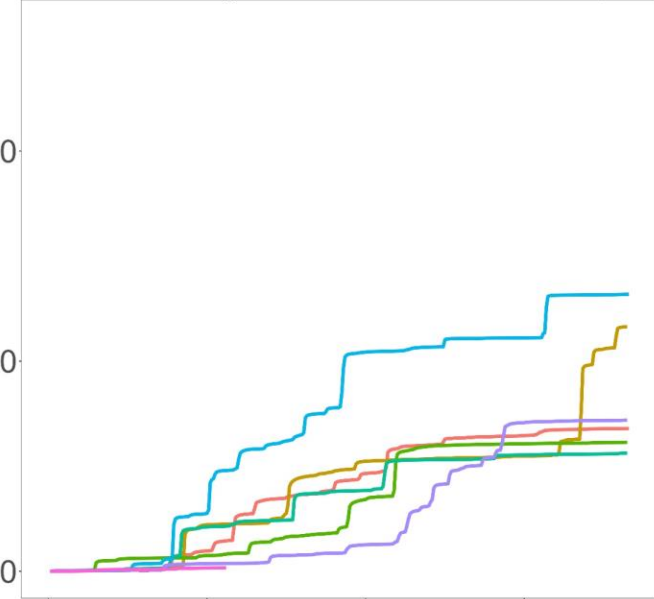
# Yields

**Suspended Sediment, Total Nitrogen, Total Phosphorus**

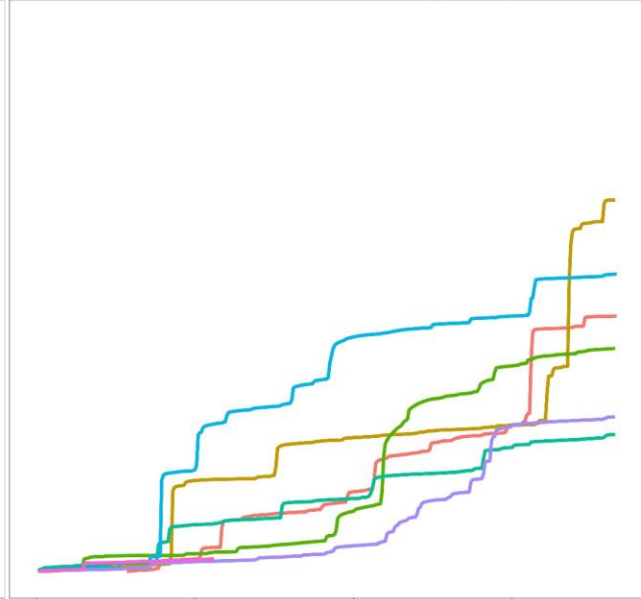
Larger  
basin  
area

Smaller  
basin  
area

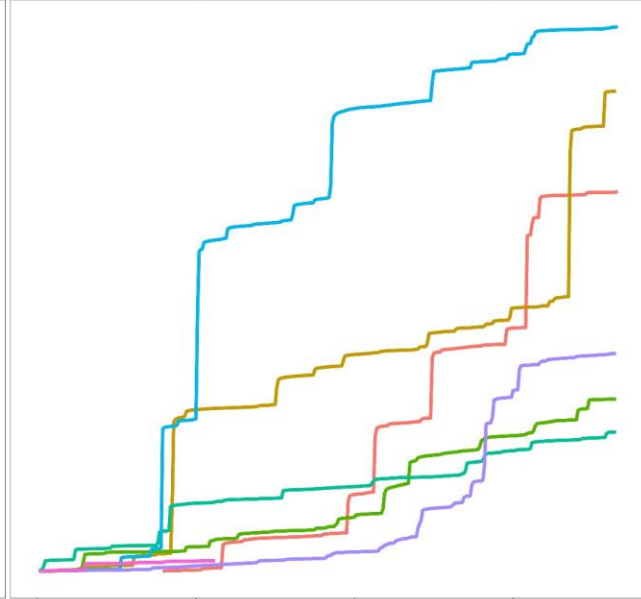
West Conewago Creek near Manchester, PA



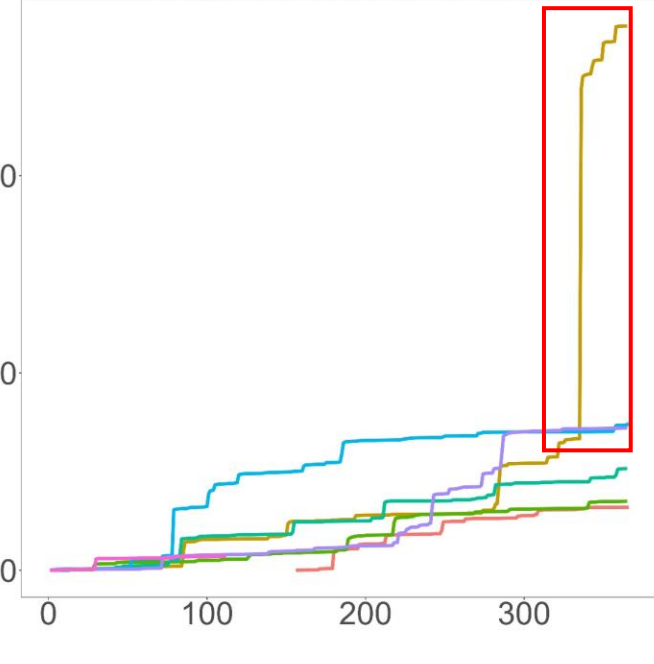
Codorus Creek near Saginaw, PA



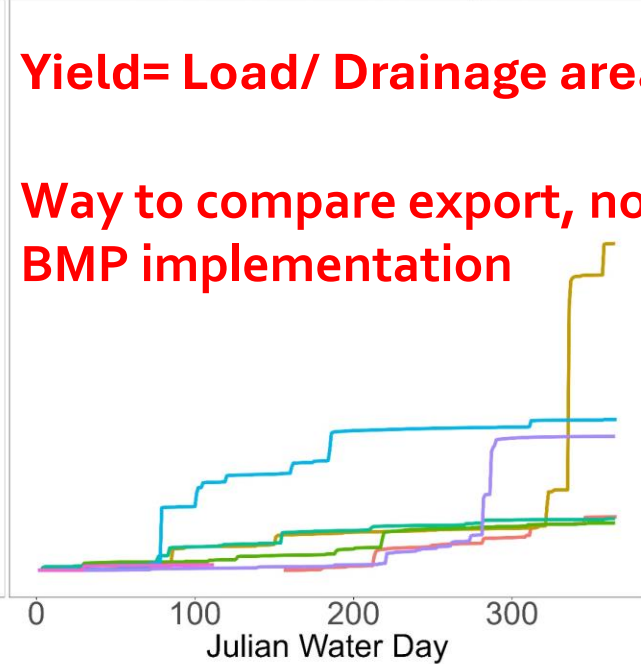
Muddy Creek at Castle Fin, PA



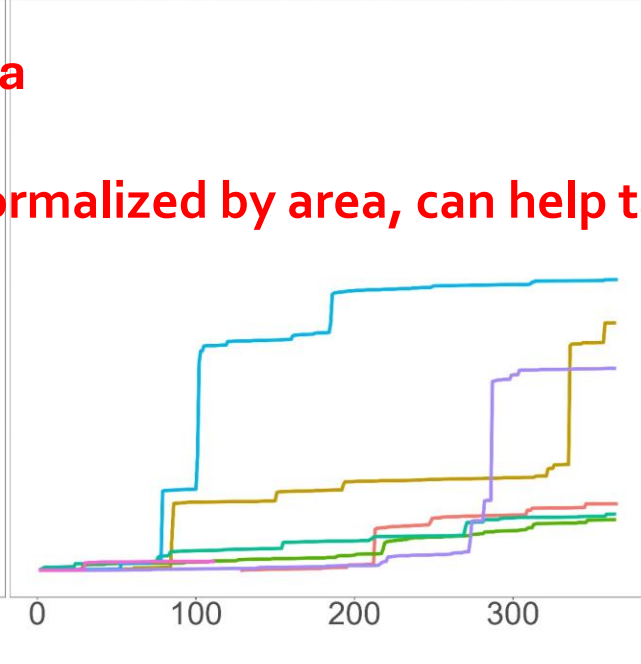
Fishing Creek at Goldsboro, PA



Kreutz Creek at Strickler, PA



Fishing Creek at Craley, PA



**Yield= Load/ Drainage area**

**Way to compare export, normalized by area, can help target BMP implementation**





# Next Steps: Products

- First was publishing Model Archive Summaries in 2024 (presented earlier in this talk)
- Stakeholders needed additional tools and data presentation options besides data releases and reports...
- Specifically, wanted data presented in a way that facilitates their decision-making and offers additional ways of **interaction**. They also want products that are **accessible and easy to understand** for wider audiences....

# Communication Products: Dashboards

- Highly customizable, can include plots, maps, text, links, interactive maps and plots
- Various programs to make them already exist (e.g R Shiny)
- Published March 2025



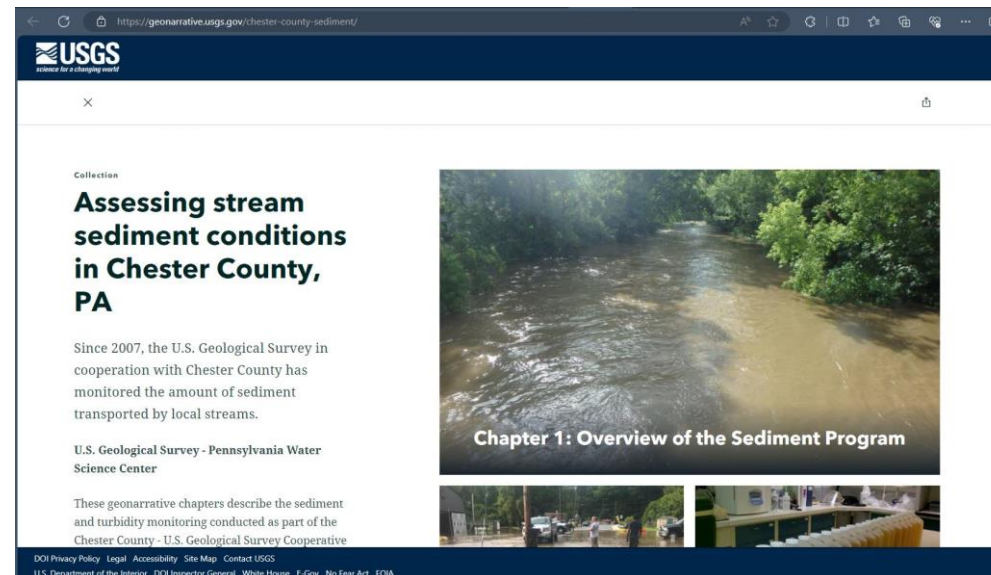
# Communication Products: Geonarratives

- Highly customizable, can include plots, maps, text, links, interactive maps
- Various platforms (e.g. ArcGIS Online)
- Could be more appropriate for educational purposes and a more general audience



[Using Continuous Water Quality to Guide Conservation Efforts](https://geonarrative.usgs.gov/using-continuous-water-quality-to-guide-conservation-efforts/)

<https://geonarrative.usgs.gov/using-continuous-water-quality-to-guide-conservation-efforts/>



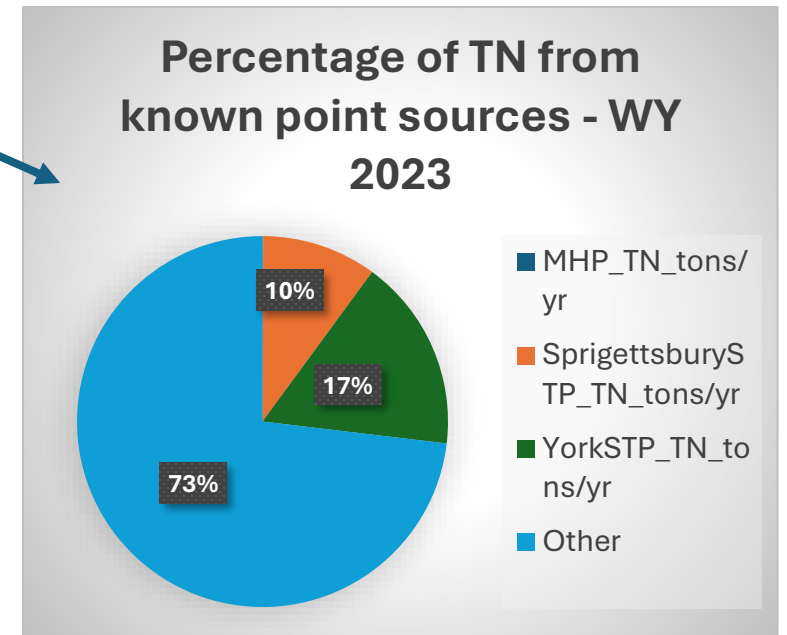
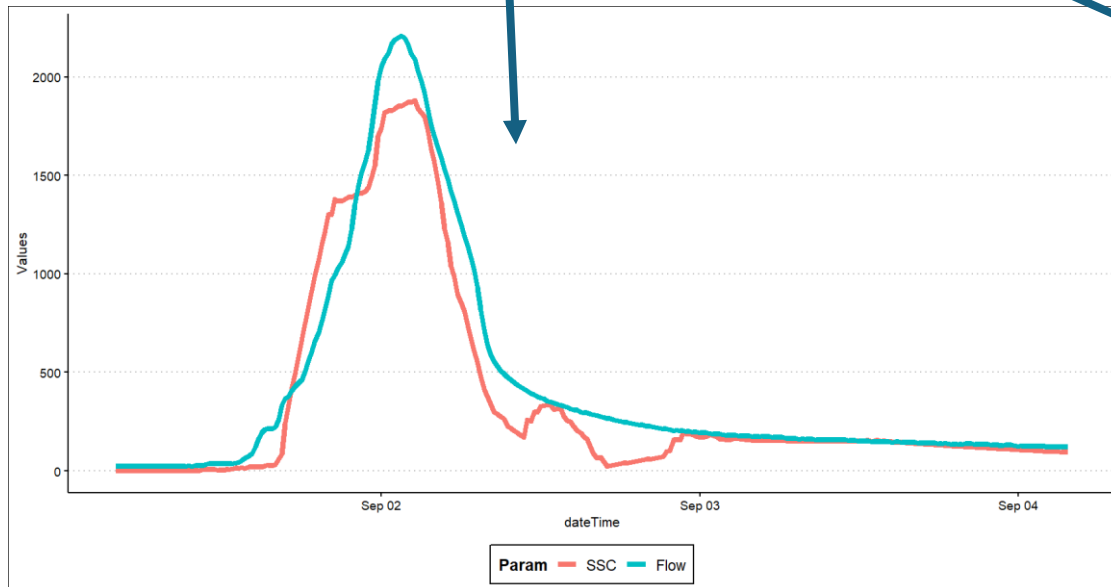
[Assessing stream sediment conditions in Chester County, PA](https://geonarrative.usgs.gov/chester-county-sediment/)

<https://geonarrative.usgs.gov/chester-county-sediment/>



# Communication Products: USGS Interpretive Report

- Data will be represented across various products and integrated in a summary report in 2028. Planned topics include :
  - County loads summary (from USGS surrogate models)
  - Sediment and nutrient sources and transport timing
  - Methods and model result comparison of USGS surrogate vs USGS WRTDS vs Chesapeake Bay Program partnership's Watershed Model
- Potential additional data analysis includes analysis for: how much nutrient load is transported in groundwater, **evaluate transport timing of sediment and nutrients related to streamflow**, and **evaluating known point sources as compared to USGS total loads**.



# Next Steps: Cross-Agency Collaboration

- York County could be used as a calibration or verification point for:
  - NTN Loads via WRTDS and WRTDS-K on the site level as site-specific calculations.
  - Chesapeake Bay Program partnership's Watershed Model on the county-scale (6 sites cover ~80% County drainage).
- Between NTN and CBP Watershed Model, could do direct comparisons of methods and calculated load estimations with York County loads.
- Data integration on this scale would provide a potential collaboration opportunity between USGS, York County, EPA, CBP, and DEP, and allow for potential data analysis expansion to integrate other supergages in the lower Susquehanna operated with EPA and USDA-NRCS.

## Contact:

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Joe Duris [jwduris@usgs.gov](mailto:jwduris@usgs.gov)

## Acknowledgements:

*USGS field samplers and gage operators:* Dylan Baumbach, James Colgin, Victor Cortes, Hilary Dozier, Heather Eggleston, Lee Eicholtz, Cameron Ensor, Cade Reed, Nicholas Santoro, Connor Soucek, Jake Wacker, Mitchell Weaver, Eli Whitehead-Zimmers

*Cooperators:* York County Planning Commission, York County Conservation District

