Chesapeake Bay RIM Network Nitrogen and Phosphorus Loads and Trends: An Update of Results through WY 2020

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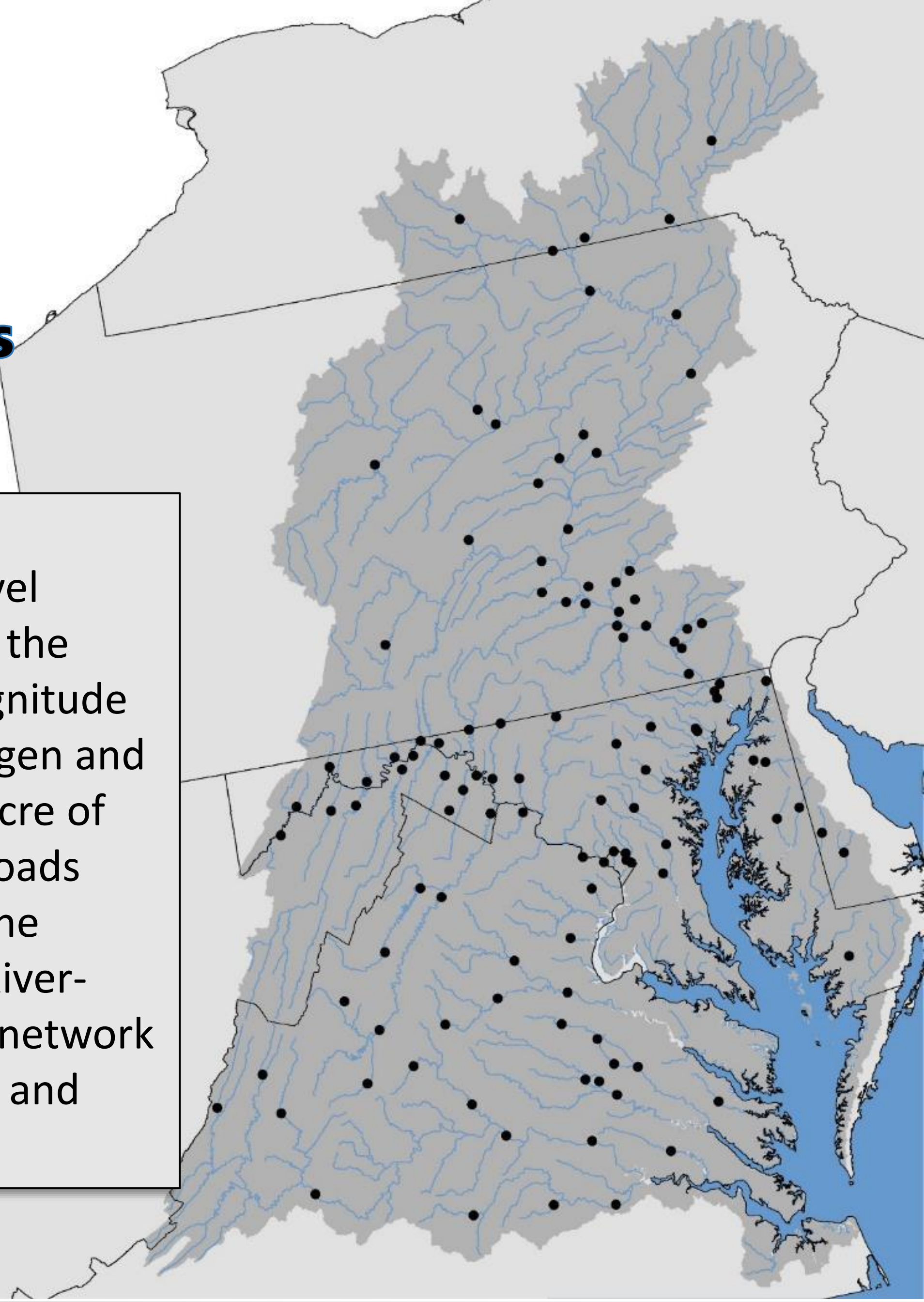
OBJECTIVE:
Communicate novel Kalman loads and the direction and magnitude of change in nitrogen and phosphorus per-acre of flow-normalized loads observed across the Chesapeake Bay River-Input Monitoring network during 1985-2020 and 2011-2020.

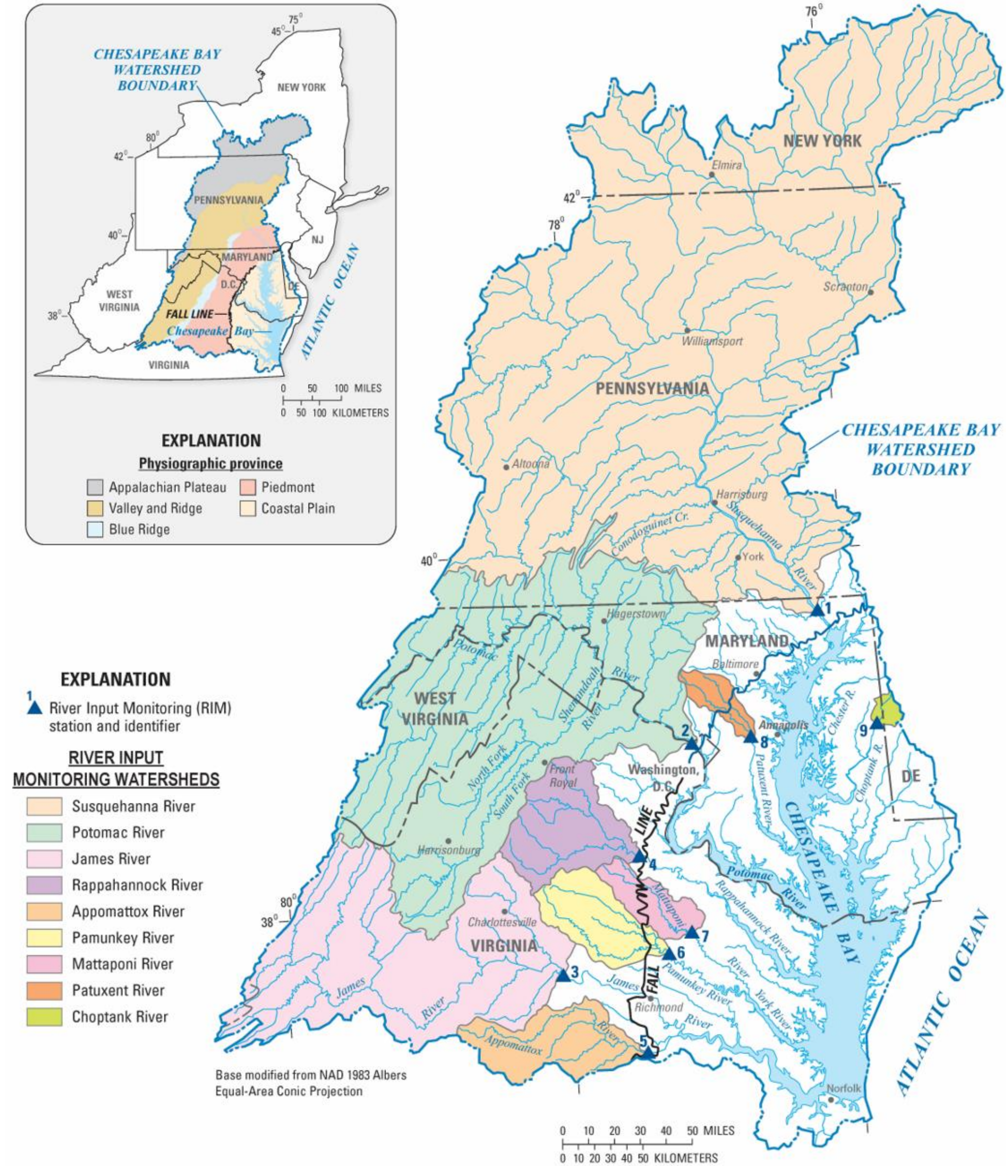


Load and trend results determined from foundation of monitoring data

Our load and trend analyses are based on **water-quality** and **stream-discharge** measurements made across the 123-station nontidal network.

Over **2,400** water-quality samples are collected each year!

RIM (nine stations) represents **~78 percent** of the 64,000 square-mile CBWS



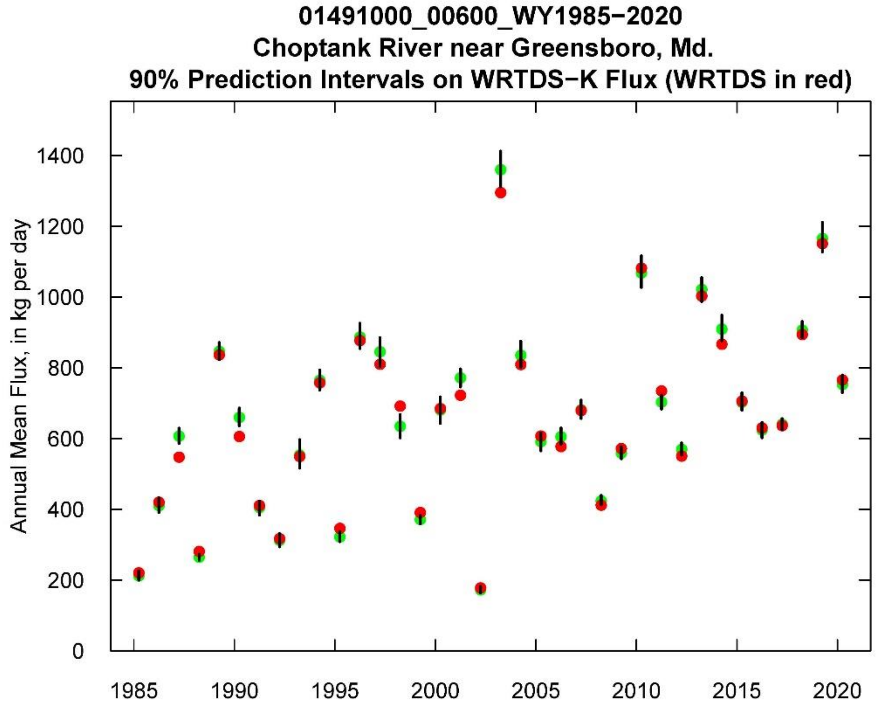
USGS science for a changing world

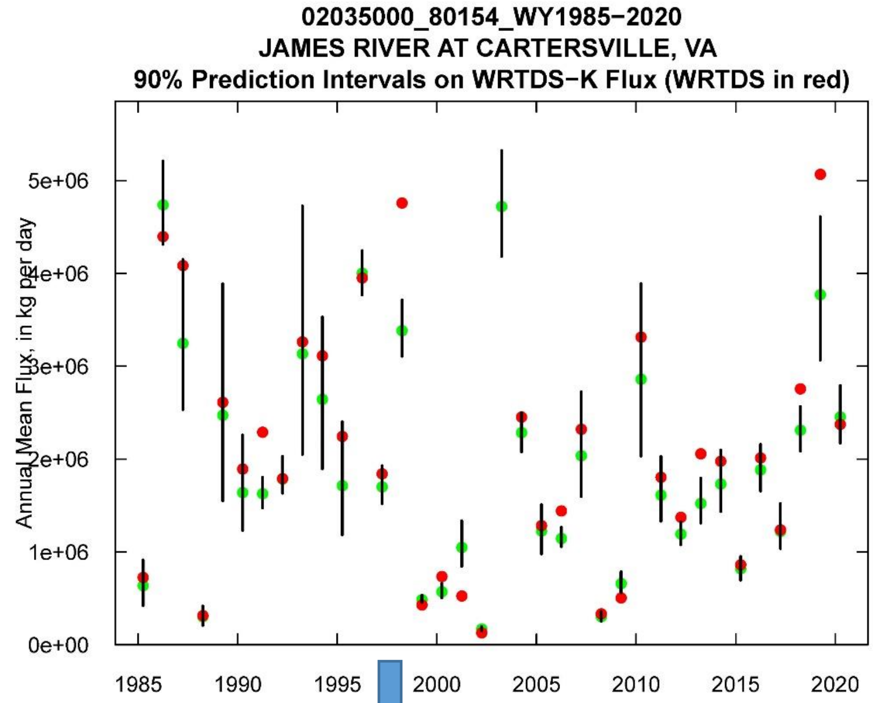
RIM – What is new and what has been done?

- Loads – WRTDS-K
  - Determine effect of Kalman switch
  - Computation of all loads using novel Kalman filter
  - Loads: Annual and Monthly
  - Yields: 5- and 10-year

- Trends – WRTDS – Flow-Normalized
  - Short-term (10-year)
  - Long-term (36-year)

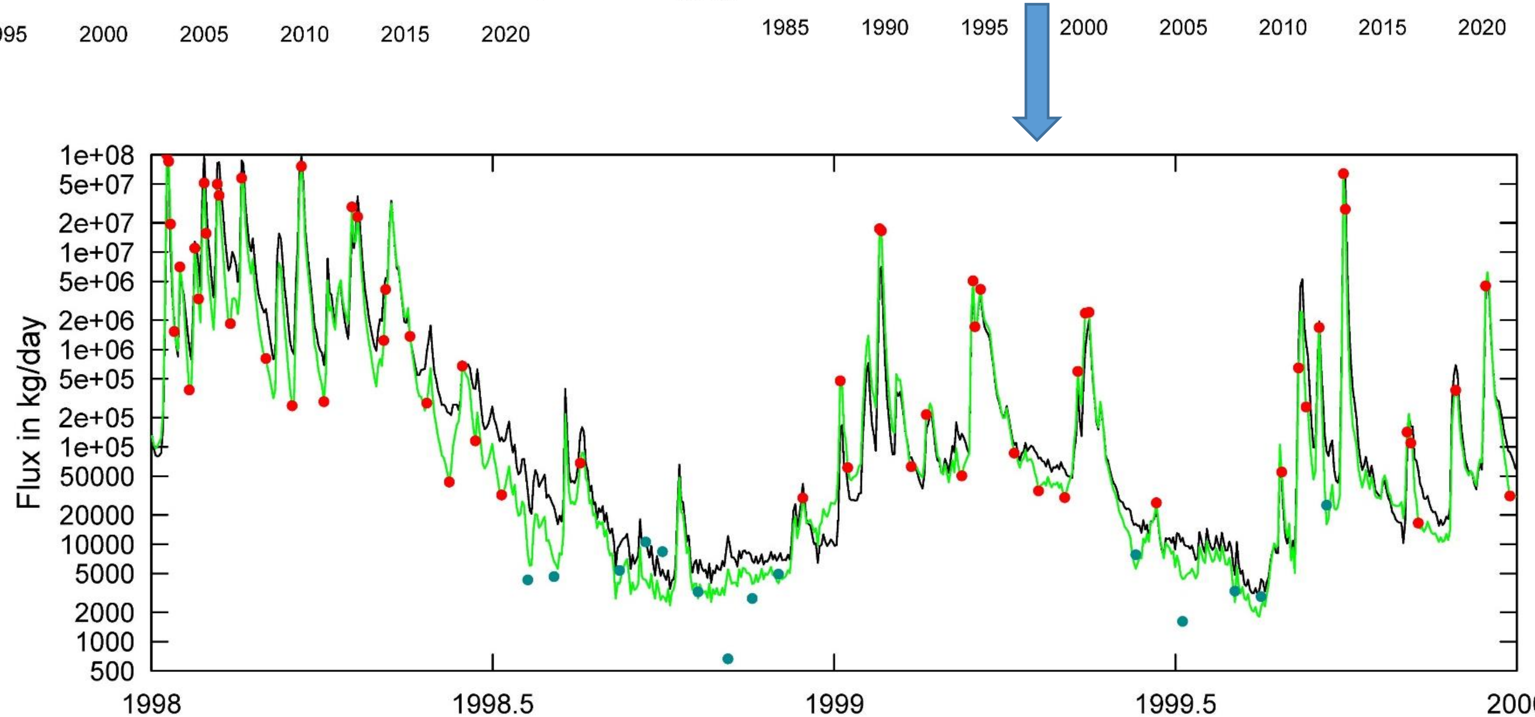
- Published 2020 results in USGS ScienceBase





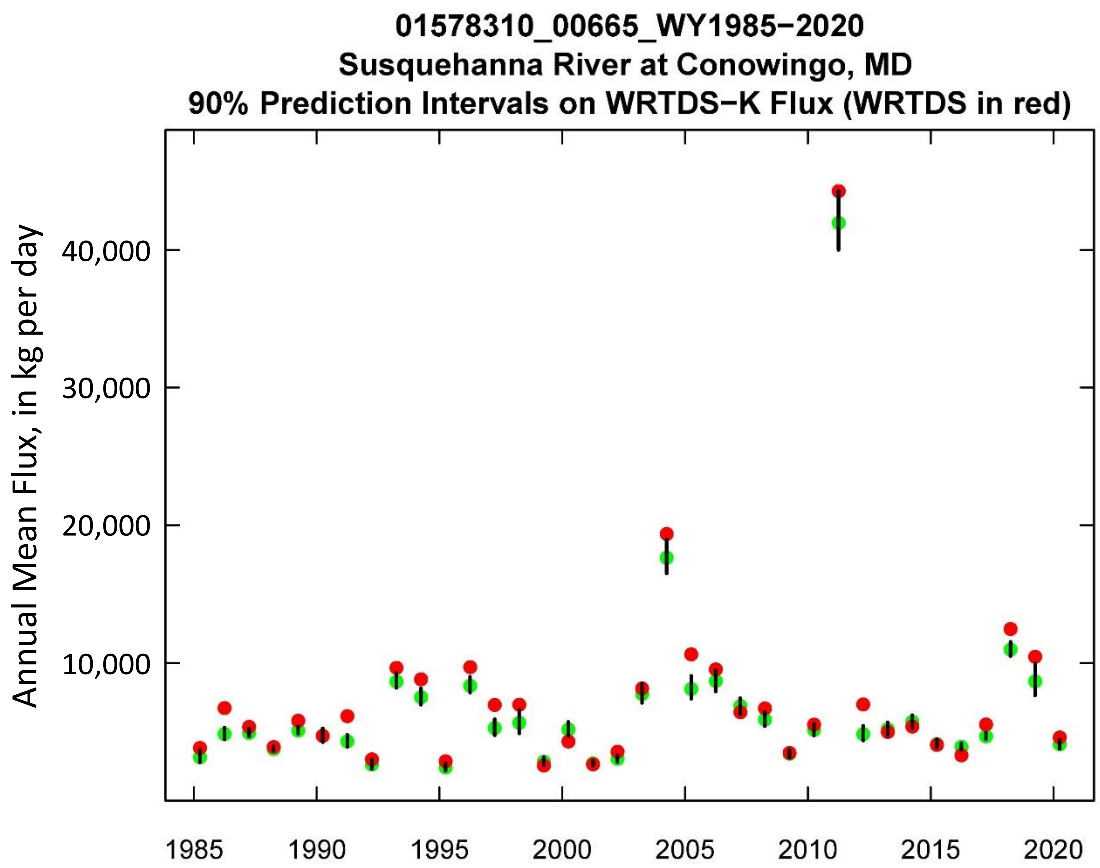
WRTDS-K vs. WRTDS 1985-2020:

Varying shifts



RIM Load and Trend results have been computed through 2020 to provide timely information available for decision making

Load Example:



Load is a measure of the total amount of nutrients or sediment that is mobilized in a given time period (monthly, annually, …); important for understanding receiving water response.

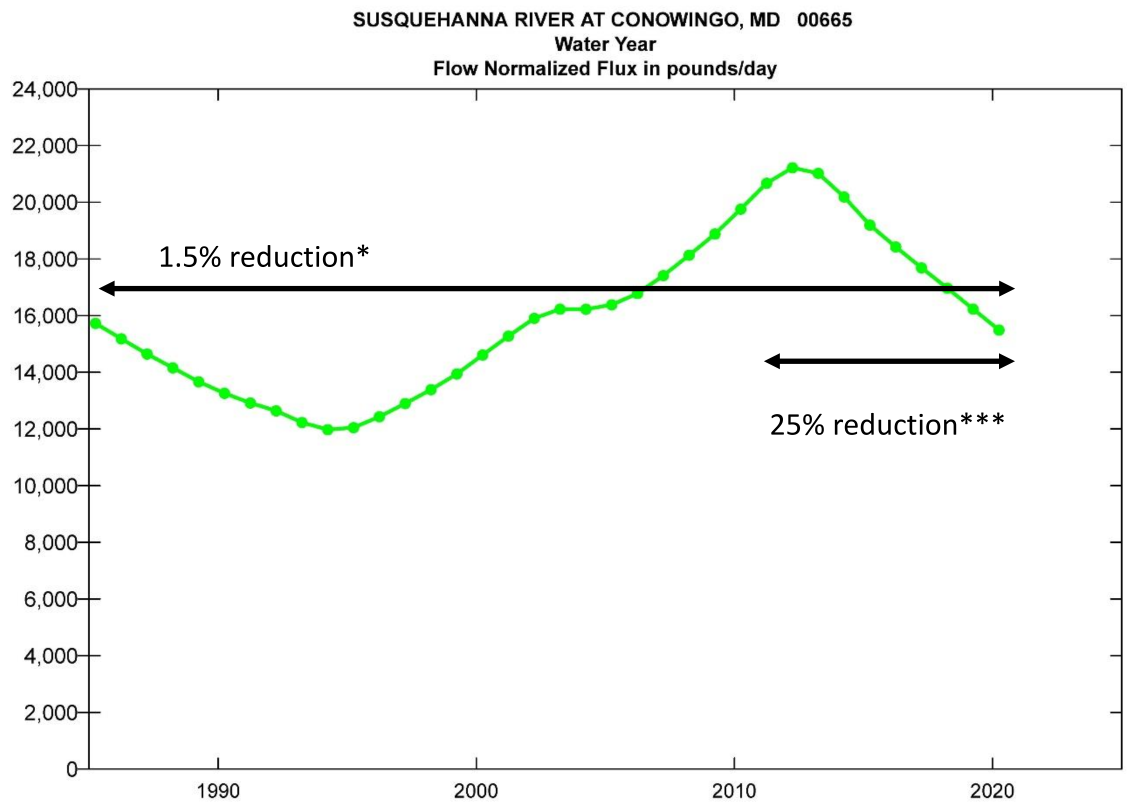
RIM Load and Trend results have been computed through 2020 to provide timely information available for decision making

Flow-normalized loads result by removing most of the hydrologic variability associated with loads. Important for understanding water-quality responses to watershed changes

Trend is reported when the likelihood of a trend existing is greater than 0.67 after 100 bootstraps and a 90% confidence Interval

Trend is considered:
Likely – >=0.67 to <0.90 (*)
Very Likely – >=0.90 to <0.95 (**)
Extremely Likely – >=0.95 to 1.00 (***)

FN Trend Example (long-term and short-term):



Summary of RIM nitrogen and phosphorous trends: 1985-2020 and 2011-2020[1]

Long-term Trends

- Improvements since 1985 in the three rivers that deliver most of the nitrogen and phosphorus to the Chesapeake Bay.
- Susquehanna, Potomac and James
- Patuxent improving for both
- Rappahannock and Mattaponi improving for nitrogen only

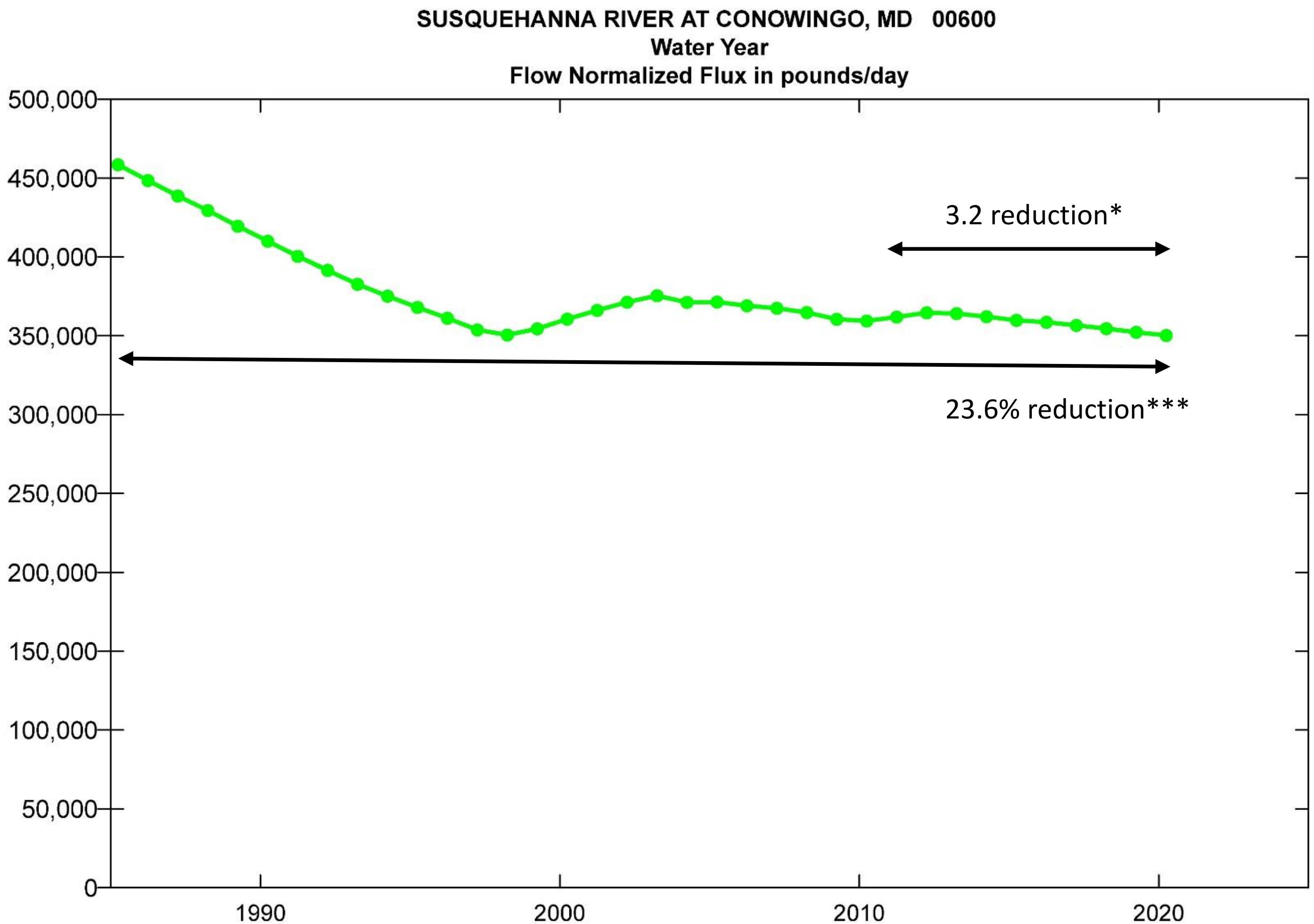
Short-term Trends

- Downward short-term trends, covering the last 10 years, for TN in Susquehanna, Potomac and James
- The Susquehanna and James show improving short-term phosphorus trends
- The Potomac showed no short-term improvement for phosphorus.
- Three of five VA sites show degrading conditions for both TN and TP

[1]Mason and others, 2020

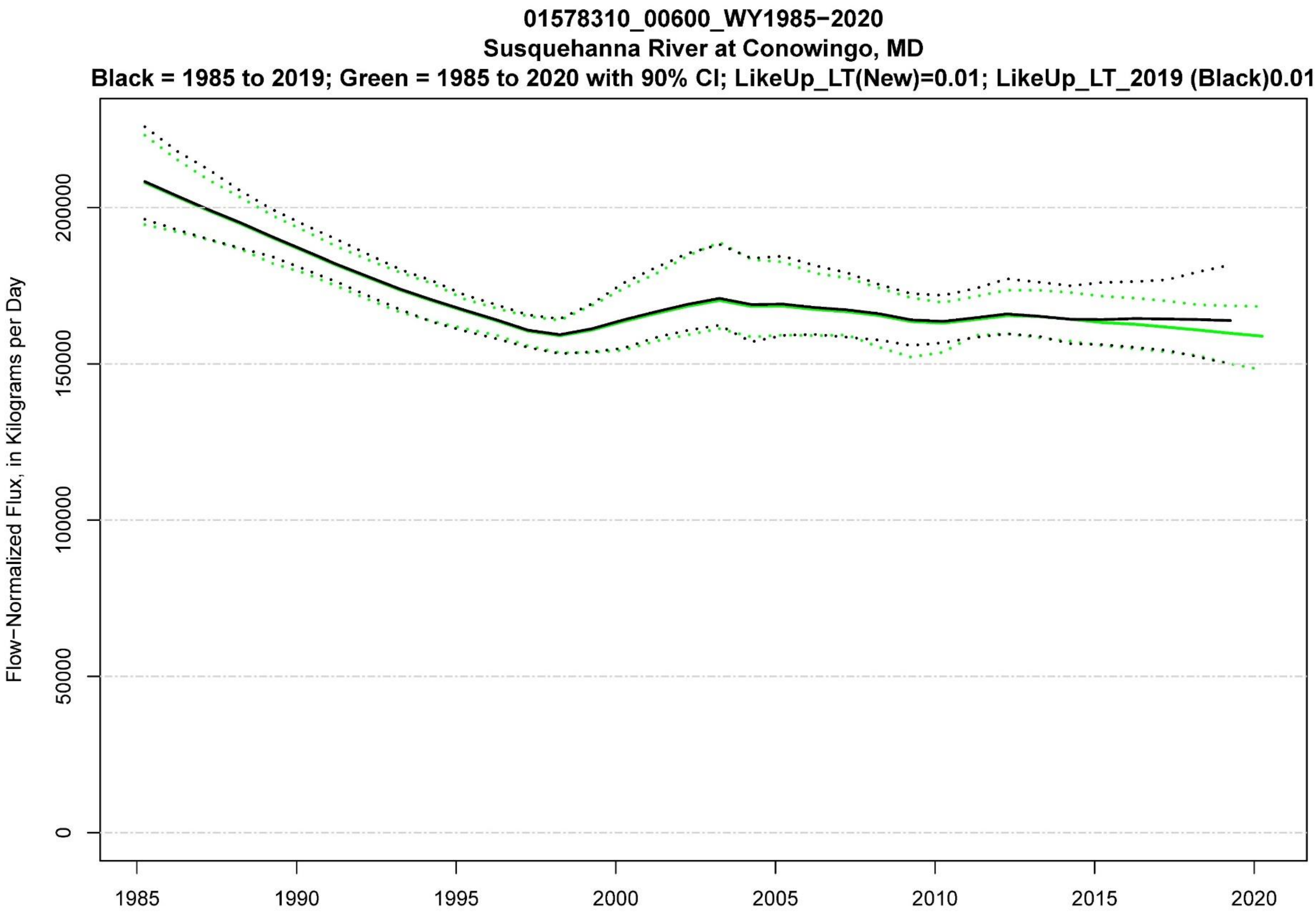
Trends[1] in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Station:



[1]Mason and others, 2020

Internal QA process for all sites/constituents at 90% confidence intervals: current run vs previous run



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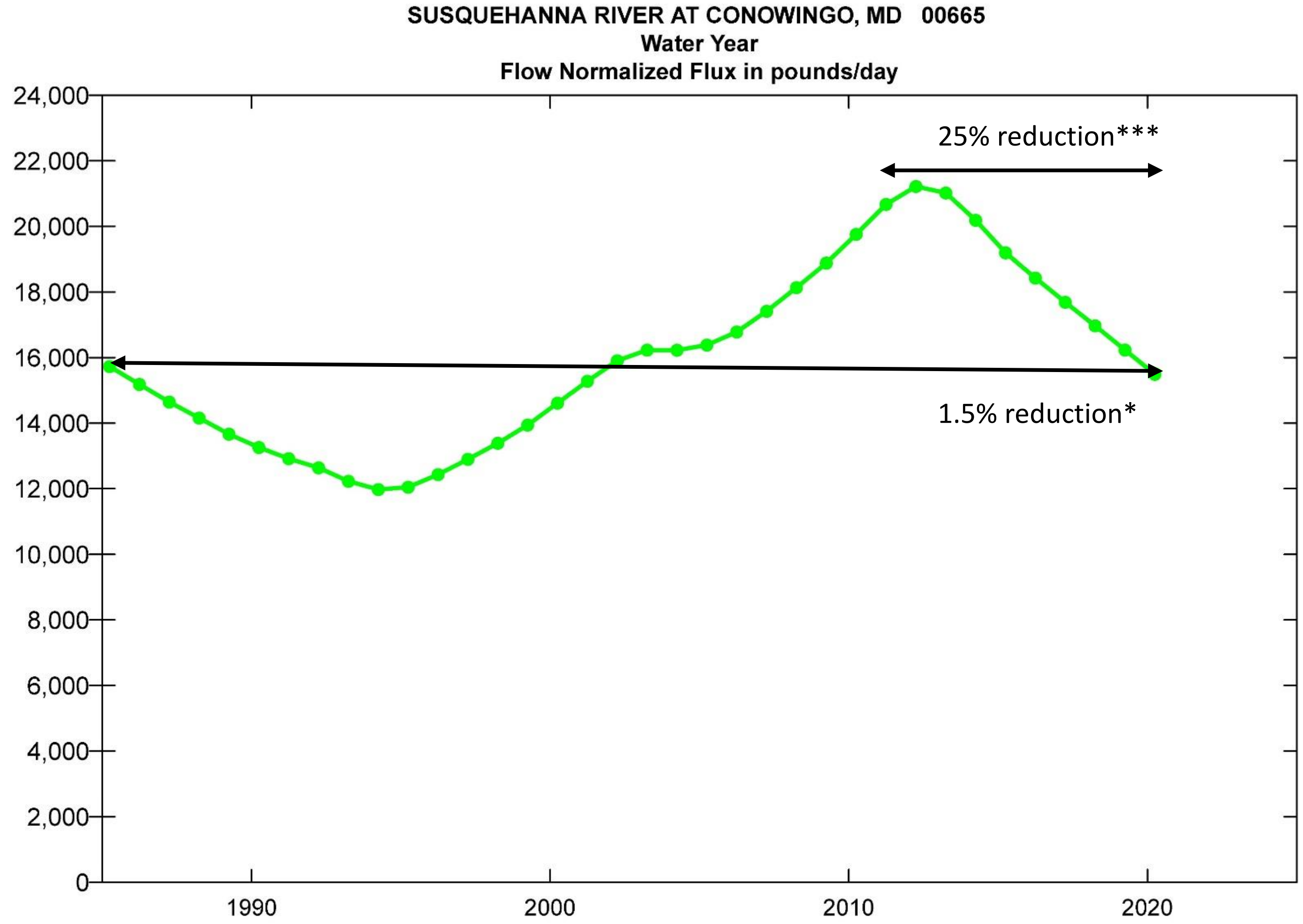

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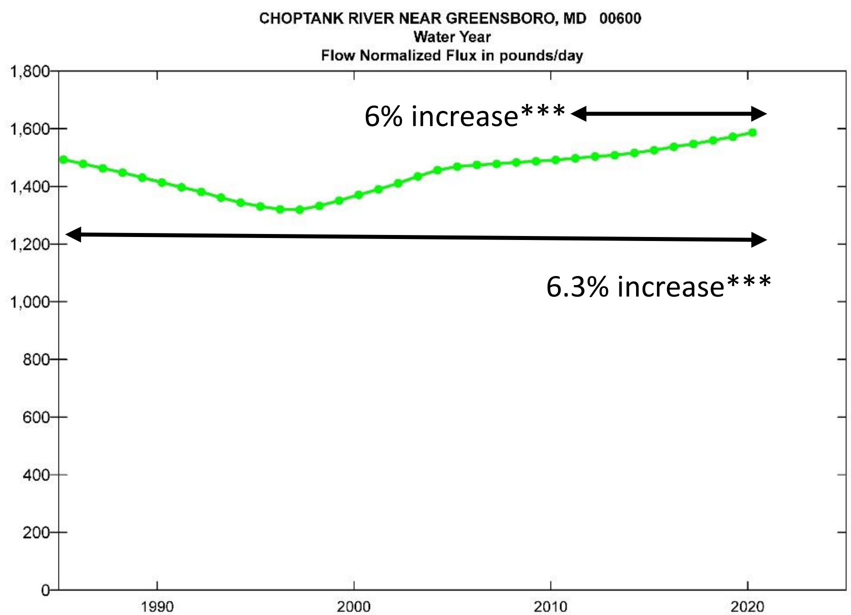
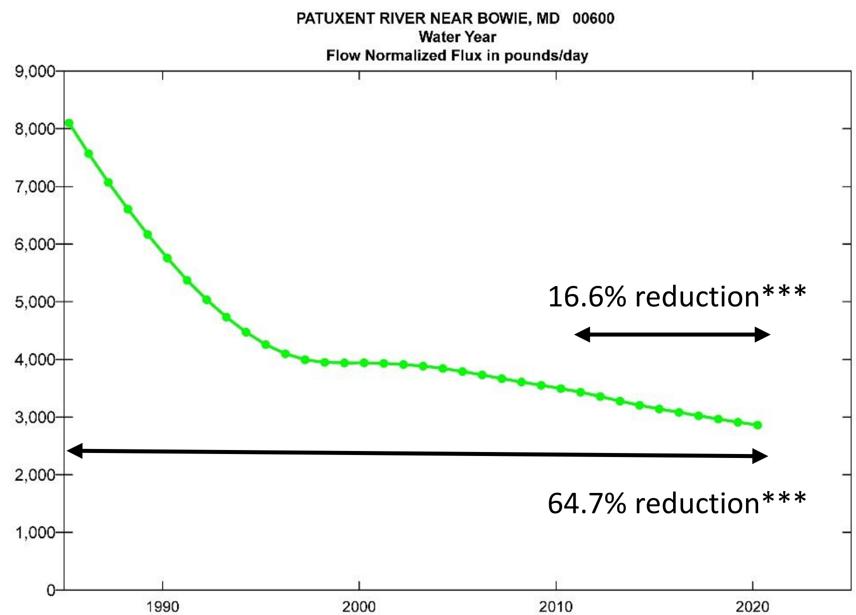
River Input Monitoring Stations:





The Eastern and Western Shore of Maryland

[1]Mason and others, 2020

Trends[1] in phosphorus loads result from changing phosphorus inputs or transport

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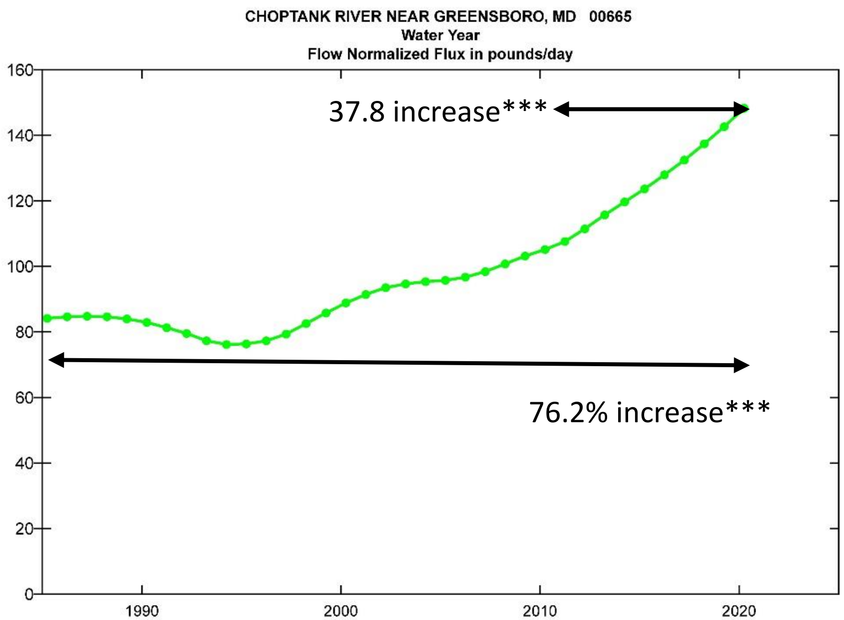

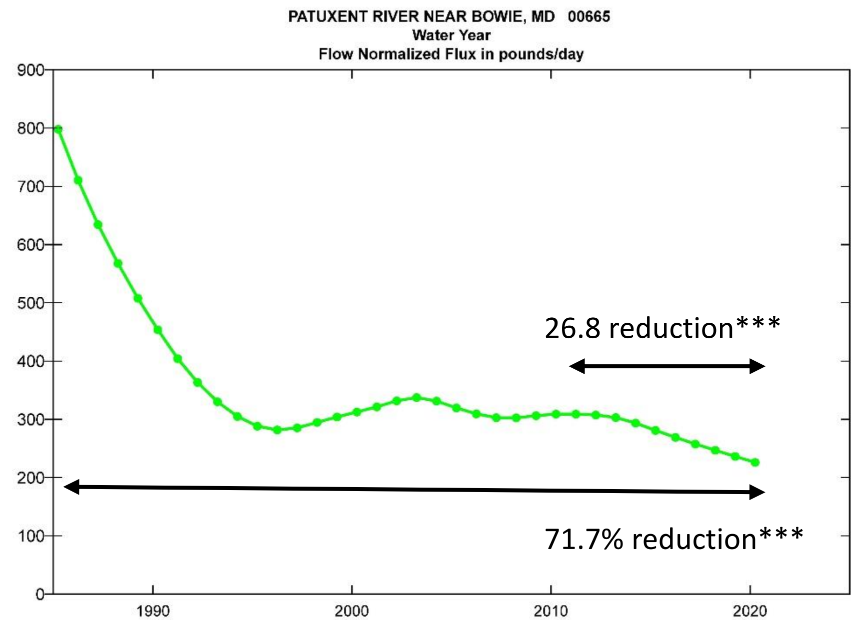

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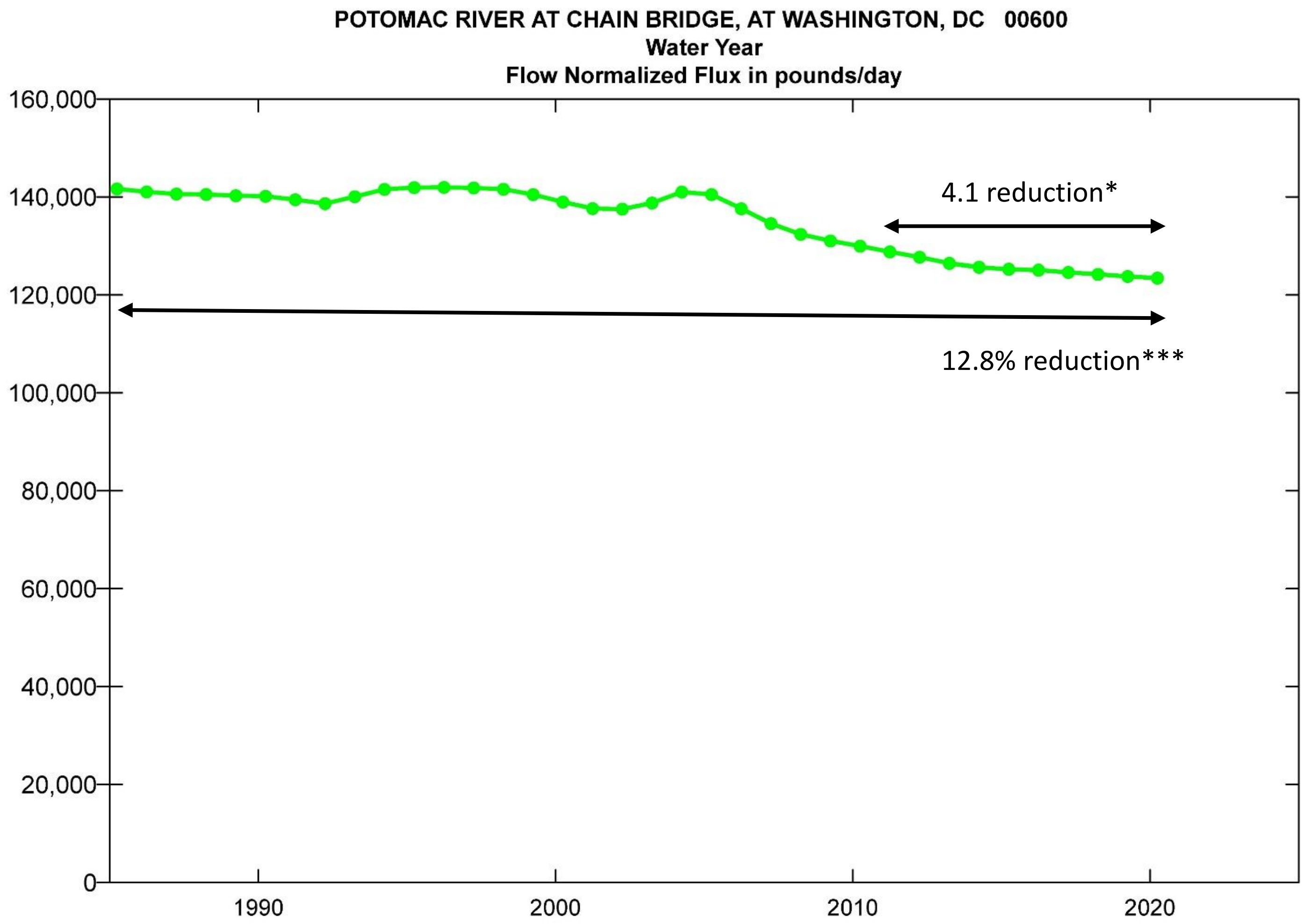

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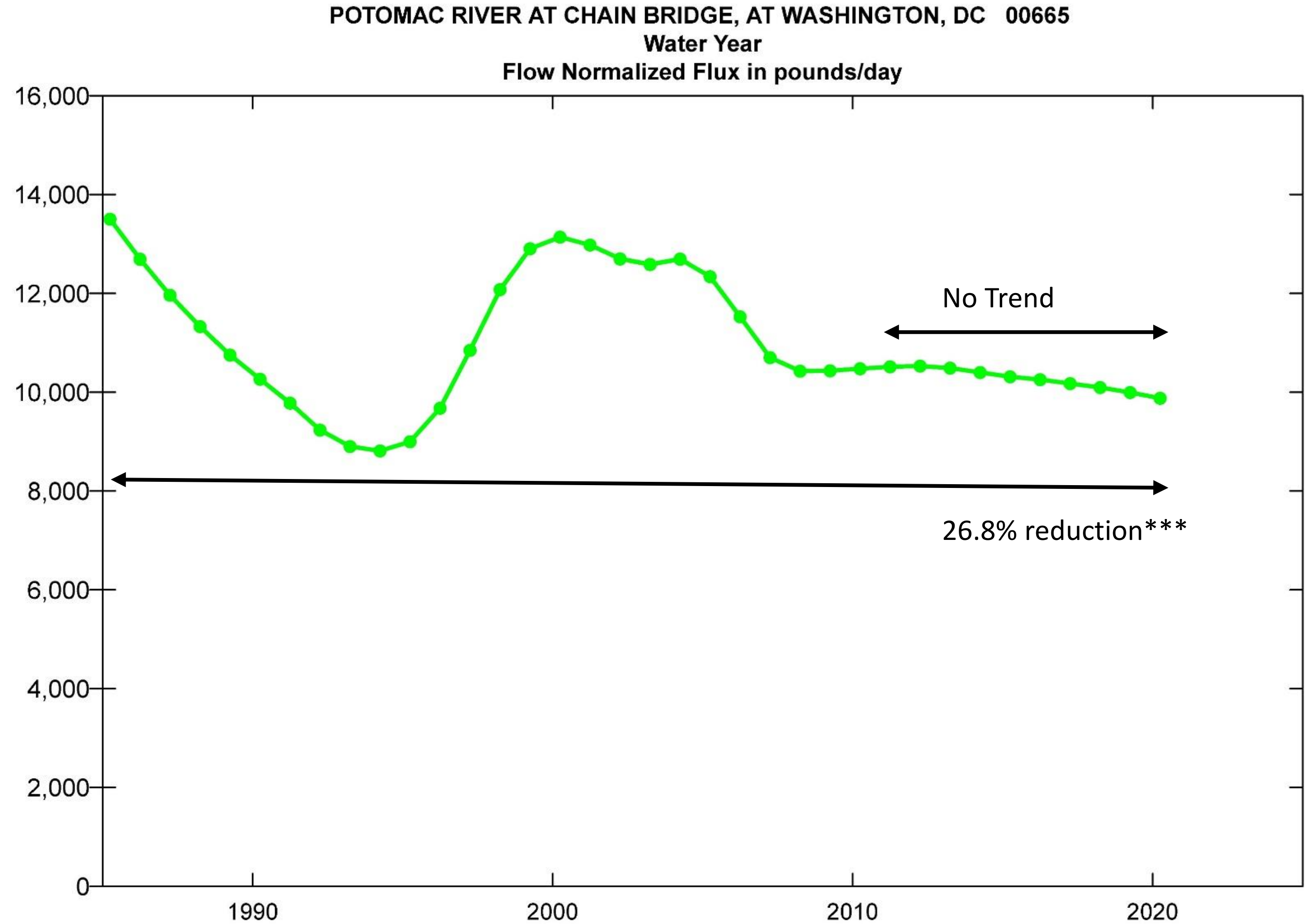

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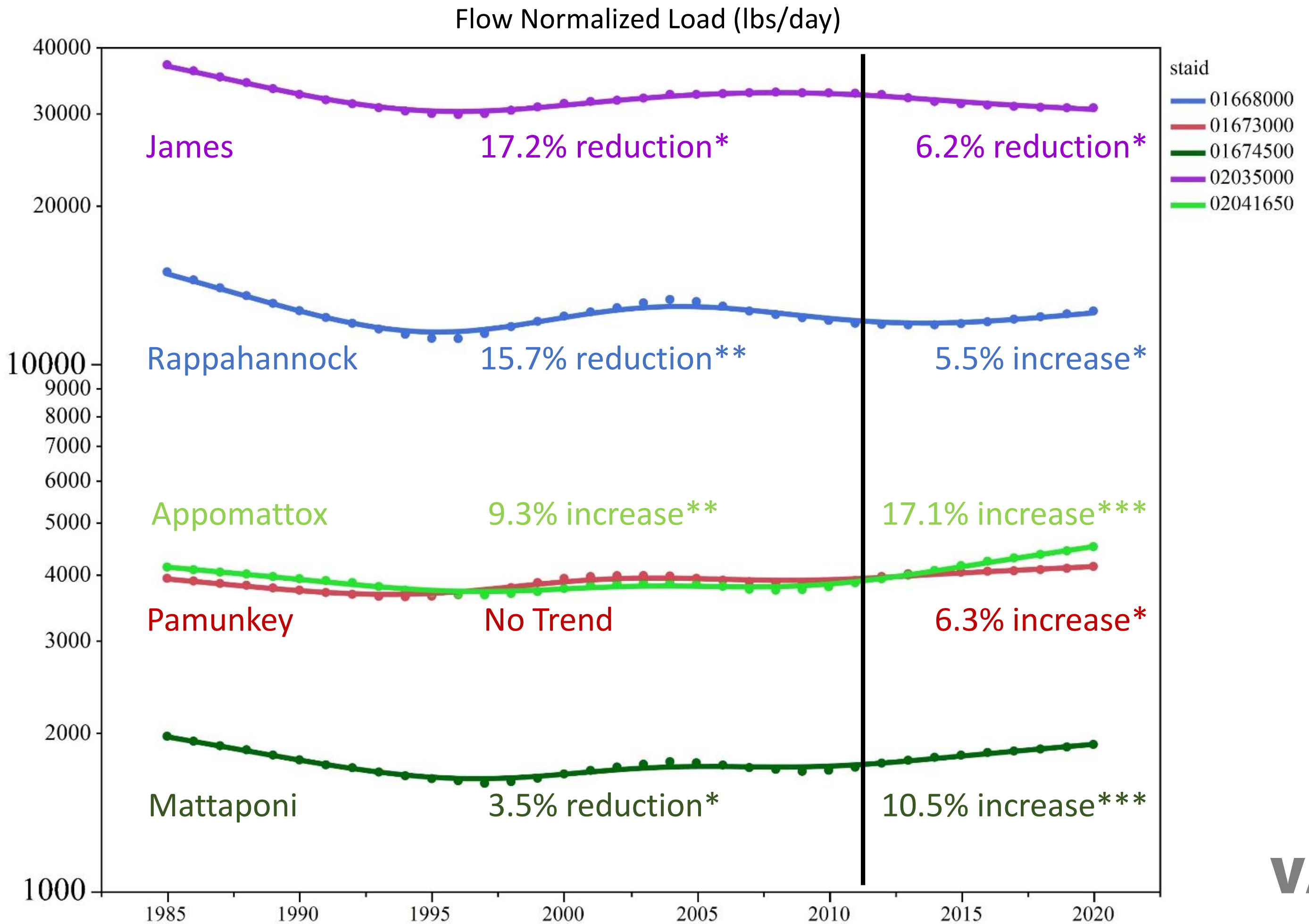

VA sites

[1]Mason and others, 2020

Trends[1] in phosphorus loads result from changing phosphorus inputs or transport

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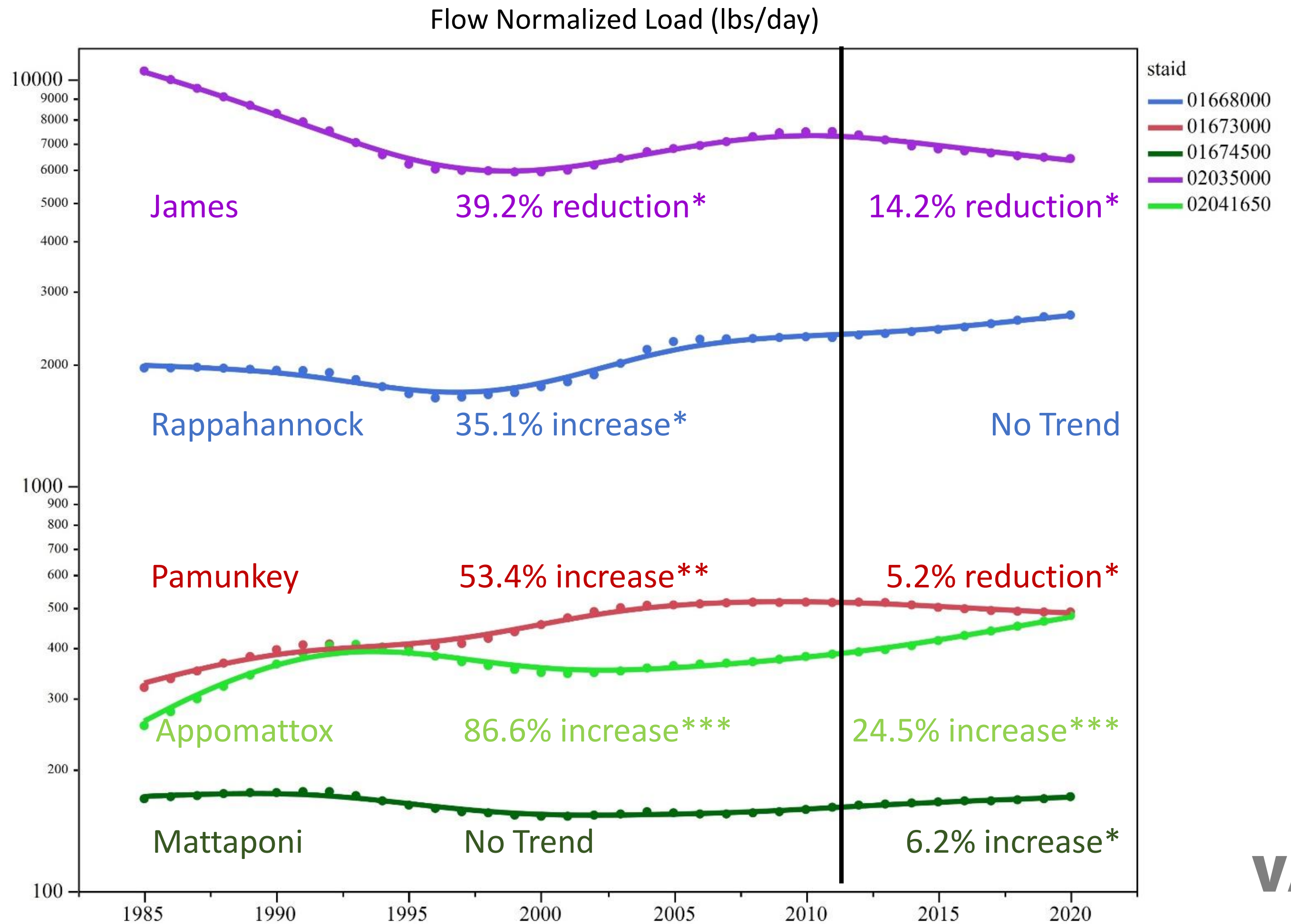
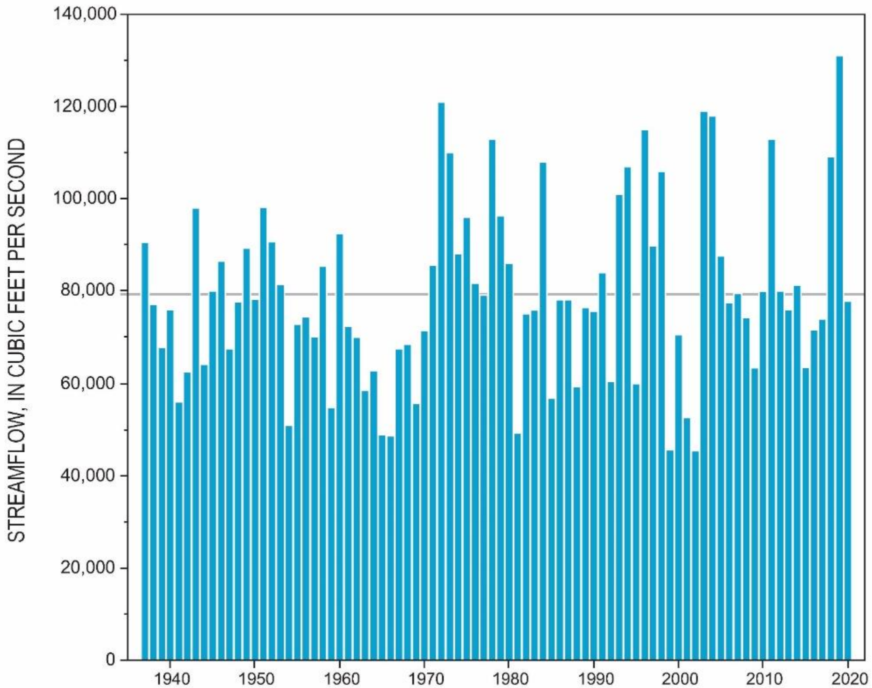


VA sites

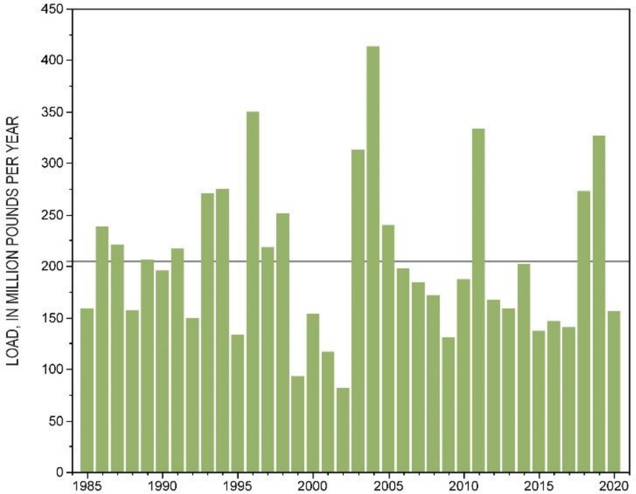
[1]Mason and others, 2020

2020 delivery of freshwater flow and total nitrogen and phosphorus loads

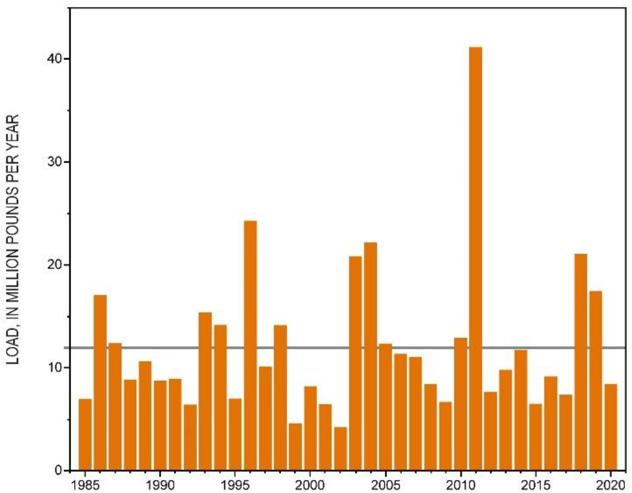
Freshwater



Total Nitrogen



Total Phosphorus



2020 Stats

- An average flow year to the bay since 1937, 2% below LT mean of 79,404 cfs.
- TN load for 2020 was 48 Mlb less than LT mean of 204.
- TP load for 2020 was 3.66 Mlb less than LT mean of 12.07.

[1]Mason and others, 2020

doi.org/10.5066/P93PZGMM

sciencebase.gov/catalog/item/60d37347d34e12a1b0097243

ScienceBase-Catalog   Communities   Help

ScienceBase Catalog → USGS Data Release Products → Nitrogen, phosphorus, and s…

Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay River Input Monitoring stations: Water years 1985-2020

View

Dates

Publication Date : 2021-09-16
Start Date : 1984-10-01
End Date : 2020-09-30

Citation

Mason, C.A., Soroka, A.M., Moyer, D.L., and Blomquist, J.D., 2021, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay River Input Monitoring stations: Water years 1985-2020: U.S. Geological Survey data release, https://doi.org/10.5066/P93PZGMM.

Summary

Nitrogen, phosphorus, and suspended-sediment loads, and changes in loads, in major rivers across the Chesapeake Bay watershed have been calculated using monitoring data from the Chesapeake Bay River Input Monitoring (RIM) Network stations for the period 1985 through 2020. Nutrient and suspended-sediment loads and changes in loads were determined by applying a weighted regression approach called WRTDS (Weighted Regression on Time, Discharge, and Season). The load results represent the total mass of nitrogen, phosphorus, and suspended sediment that was exported from each of the RIM watersheds and were estimated using the WRTDS method with Kalman filtering. To determine the trend in loads, the annual load results are flow normalized to integrate out the year-to-year variability in river discharge. The trend in load is derived from the flow-normalized load timeseries and represents the change in load resulting from changes in sources, delays associated with storage or transport of historical inputs, and (or) implemented management actions. Four data tables are provided that describe nitrogen, phosphorus, and suspended-sediment conditions across the RIM: (1) Annual Loads, (2) Monthly Loads, (3) Trends in Annual Loads, and (4) Average Yield (mass per unit area). Additionally, essential WRTDS Input and Output files are provided.

Map »

Spatial Services

ScienceBase WMS : https://www.sciencebase.gov/catal

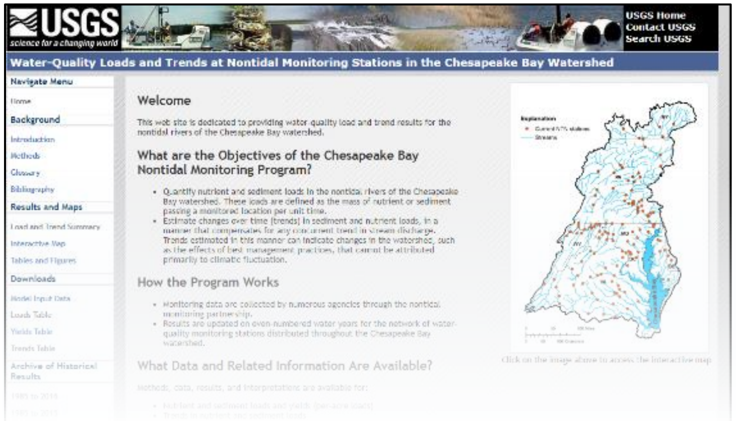
Communities

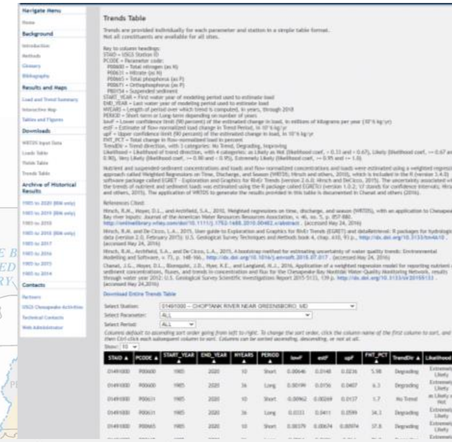
- USGS Data Release Products

Tags

The nontidal monitoring webpage has been updated with 2020 RIM results only

cbrim.er.usgs.gov





Select Station: 01578310 -- SUSQUEHANNA RIVER AT CONOWINGO, MD
Select Parameter: ALL
Select Period: ALL

Columns default to ascending sort order going from left to right. To change the sort order, click the column name of the first column to sort, and then Ctrl-click each subsequent column to sort. Columns can be sorted ascending, descending, or not at all.

Show: 10

STAID	PCODE	START_YEAR	END_YEAR	NYEARS	PERIOD	lowF	estF	upF	FNT_PCT	TrendDir	Likelihood
01578310	P00600	1985	2020	10	Short	-9.04	-1.94	1.89	-3.24	Improving	Likely
01578310	P00600	1985	2020	36	Long	-24.2	-17.9	-11	-23.6	Improving	Extremely Likely
01578310	P00631	1985	2020	10	Short	-2.92	3.1	7.43	7.64	Degrading	Likely
01578310	P00631	1985	2020	36	Long	-8.03	-3.48	2.32	-7.39	Improving	Likely
01578310	P00665	1985	2020	10	Short	-1.75	-0.858	-0.464	-25	Improving	Extremely Likely
01578310	P00665	1985	2020	36	Long	-0.775	-0.0389	1	-1.49	Improving	Likely
01578310	P00671	1985	2020	10	Short	-0.2	-0.0673	0.0466	-14.1	Improving	Likely
01578310	P00671	1985	2020	36	Long	-0.183	-0.0136	0.129	-3.22	No Trend	as Likely as Not
01578310	P80154	1985	2020	10	Short	-1480	-766	-577	-34.4	Improving	Extremely Likely
01578310	P80154	1985	2020	36	Long	-403	363	642	33.1	Degrading	Likely

Showing 10 of 10 records

Pages: Previous 1 Next

Select Station: 02035000 -- JAMES RIVER AT CARTERSVILLE, VA
Select Parameter: P80154 -- Total suspended sediment (mg/L)

Columns default to ascending sort order going from left to right. To change the sort order, click the column name of the first column to sort, and then Ctrl-click each subsequent column to sort. Columns can be sorted ascending, descending, or not at all.

Show: 10

STAID	PCODE	Year	Q	Conc	Load	FNConc	FNLoad	START_YR	END_YR
02035000	P80154	1985	5300.8	19.07	514000000	34.39	1520000000	1985	2020
02035000	P80154	1986	6370.4	29.32	3810000000	34.78	1560000000	1985	2020
02035000	P80154	1987	8817.4	37.96	2610000000	35.11	1610000000	1985	2020
02035000	P80154	1988	4321.9	14.59	245000000	35.49	1650000000	1985	2020
02035000	P80154	1989	7581	43.86	1990000000	35.73	1680000000	1985	2020
02035000	P80154	1990	8569.8	37.82	1320000000	36.08	1720000000	1985	2020
02035000	P80154	1991	8360.9	30.94	1310000000	36.27	1740000000	1985	2020
02035000	P80154	1992	6216.9	26.19	1440000000	36.26	1760000000	1985	2020
02035000	P80154	1993	9269.1	41.31	2520000000	35.39	1720000000	1985	2020
02035000	P80154	1994	8950.6	38.62	2130000000	34.64	1690000000	1985	2020

The website contains load, yield and trend results for Total Nitrogen, Nitrate, Total Phosphorus, Orthophosphorus, and Suspended Sediment at individual monitoring stations in graphical or tabular formats.