

Nitrogen, Phosphorus, and Suspended Sediment:

Loads and Trends Measured from the Chesapeake Bay River Input Monitoring (RIM) Network

An update through water year 2024

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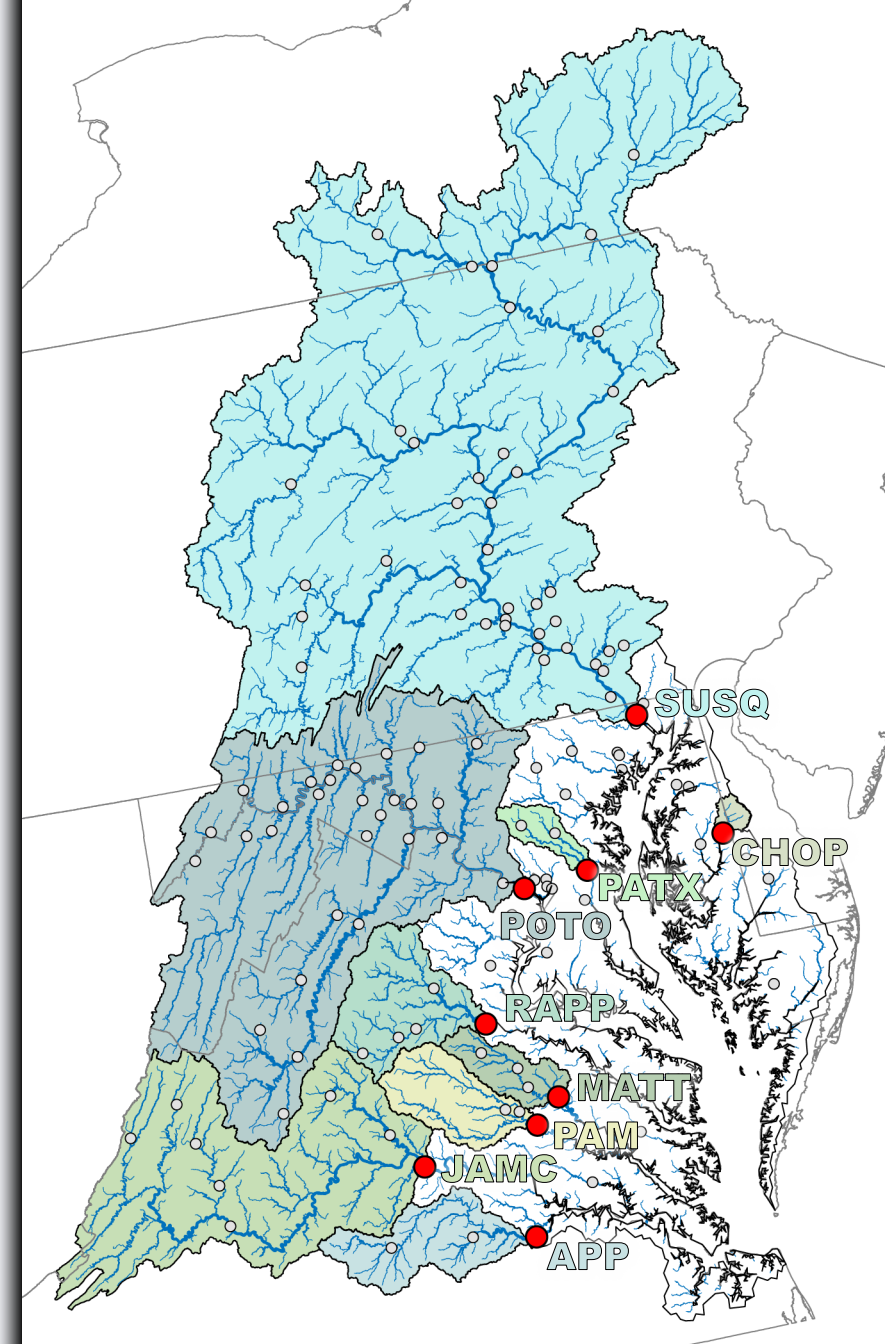
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RIM loads and trends have been computed from
monitoring data through water-year 2024¹.

This presentation will summarize the most recent
RIM nutrient and sediment loads and trends.

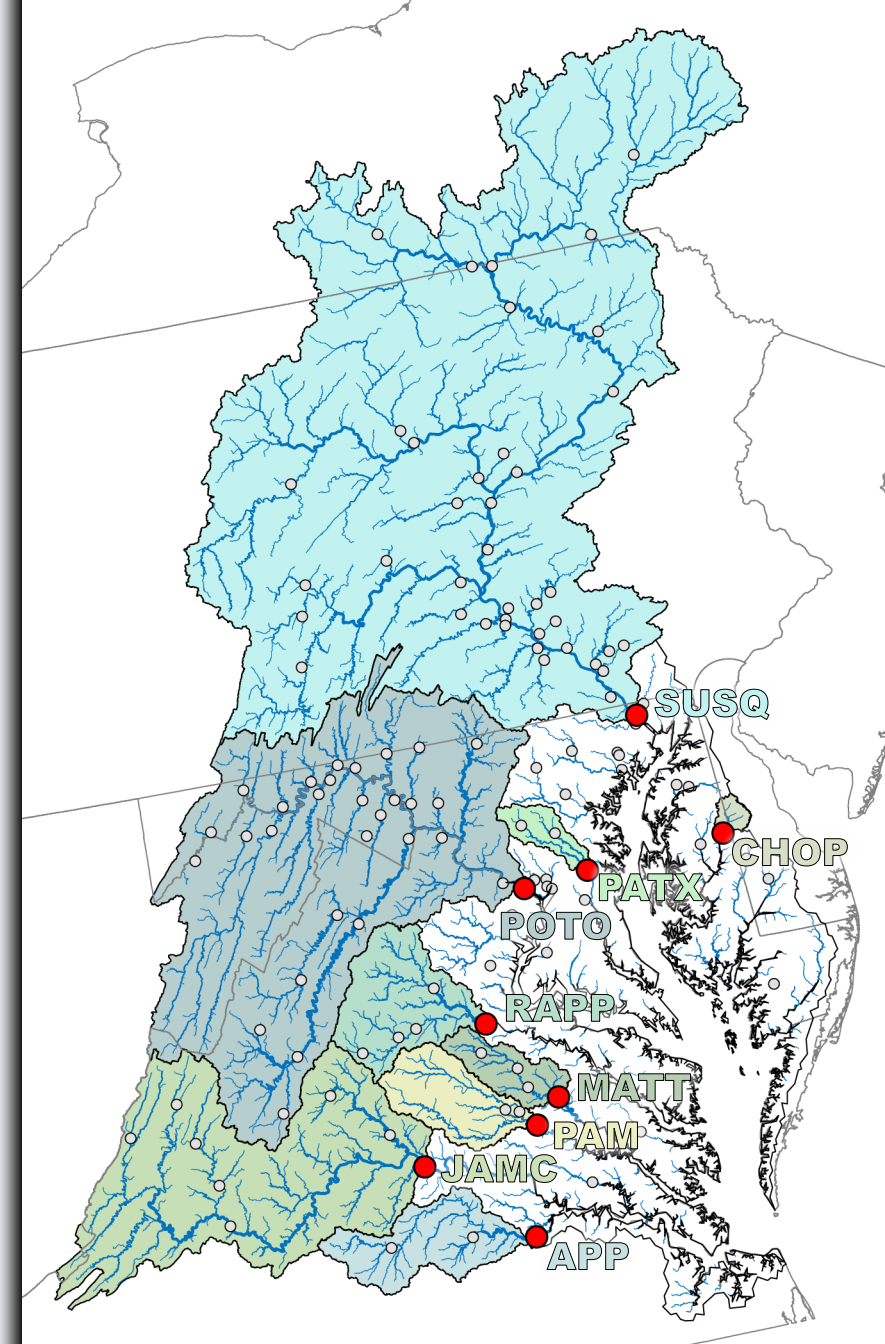


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1. Overview of the RIM network
2. Per-Acre Loads (“Yields”) at the RIM stations
3. Trends at the RIM stations
4. Resources to learn more



Overview of the RIM network

The RIM network is used to assess water-quality conditions in the Chesapeake Bay watershed to inform management decisions

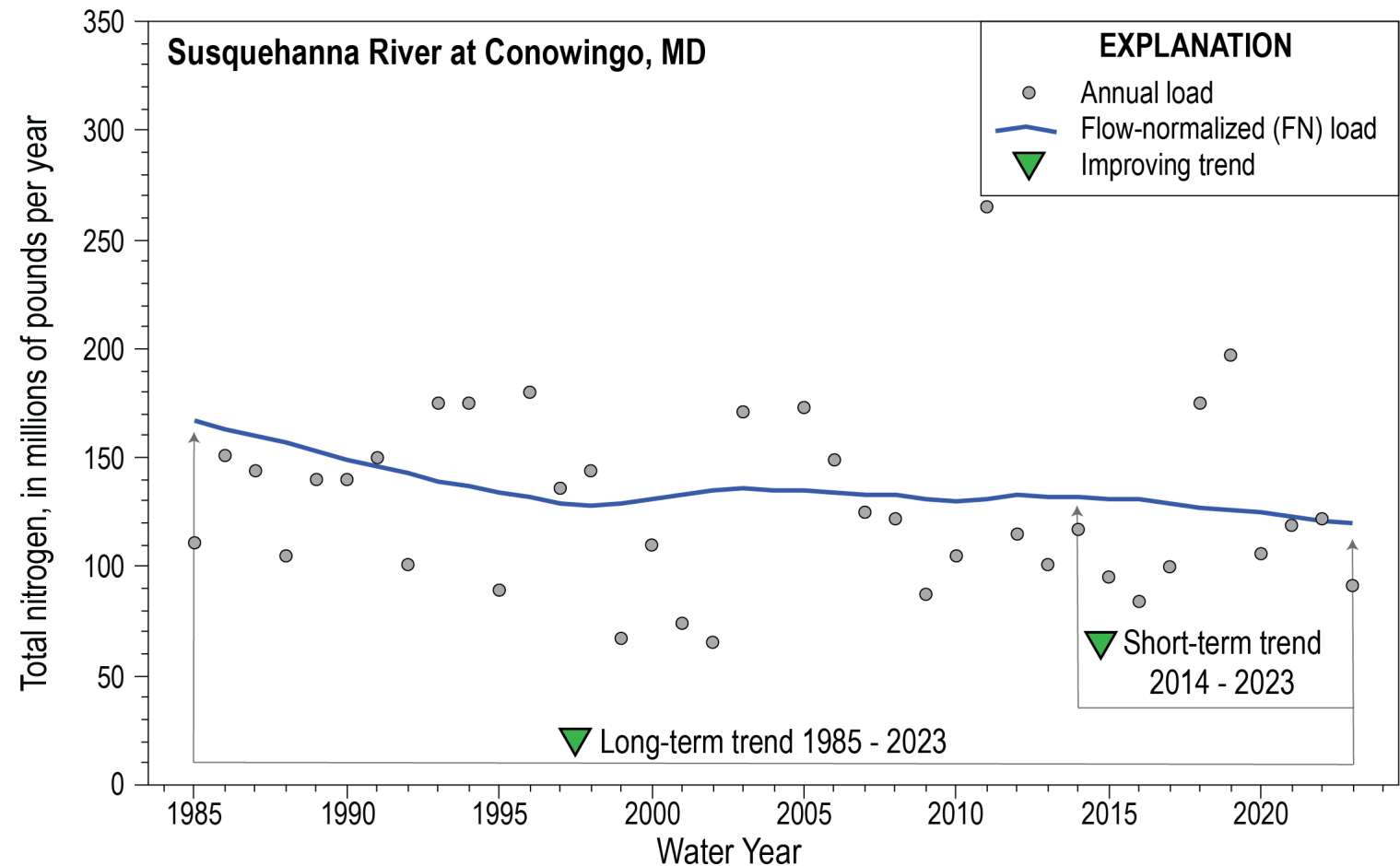
The goal of the RIM network is to compute the **load** and **trend**¹ of nitrogen, phosphorus, and suspended sediment delivered from 9 of the largest watershed tributaries to the Chesapeake Bay.

Load is the total amount of nutrients or sediment that is delivered over a time period (annually).

Flow-normalized (FN) loads remove most of the hydrologic variability associated with loads.

Trends are changes in FN load over time.

- **“Improving”** = a decrease over time
- **“Degrading”** = an increase over time
- **“No trend”** = no meaningful change over time



Monitoring data are used to compute water-quality load and trends

The USGS collects monthly and storm-targeted water-quality samples from the 9-station RIM network.

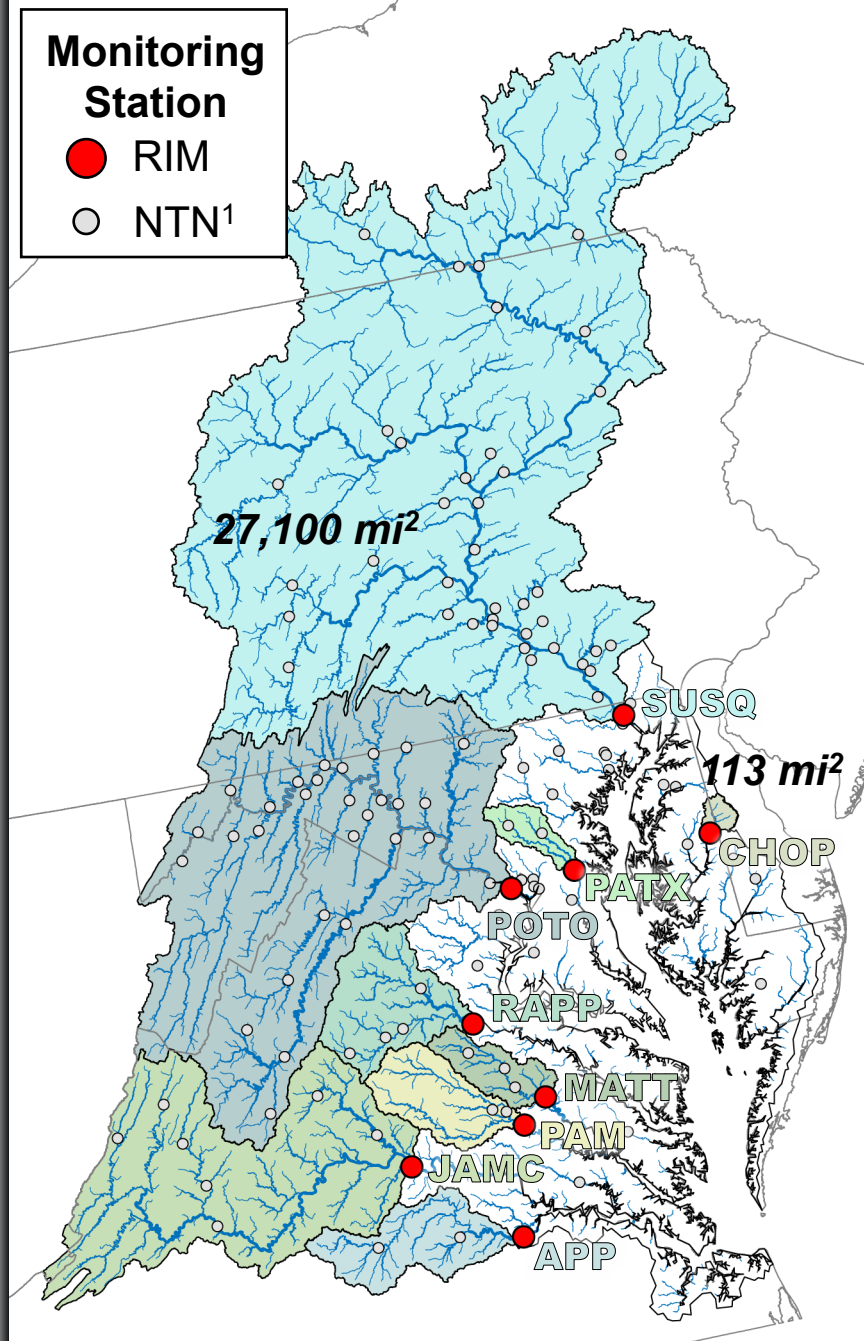
RIM stations represent about 78% of the Chesapeake Bay watershed area

Maryland

- **SUSQ**: Susquehanna River at Conowingo
- **CHOP**: Choptank River nr Greensboro
- **PATX**: Patuxent River nr Bowie
- **POTO**: Potomac River at Chain Bridge

Virginia

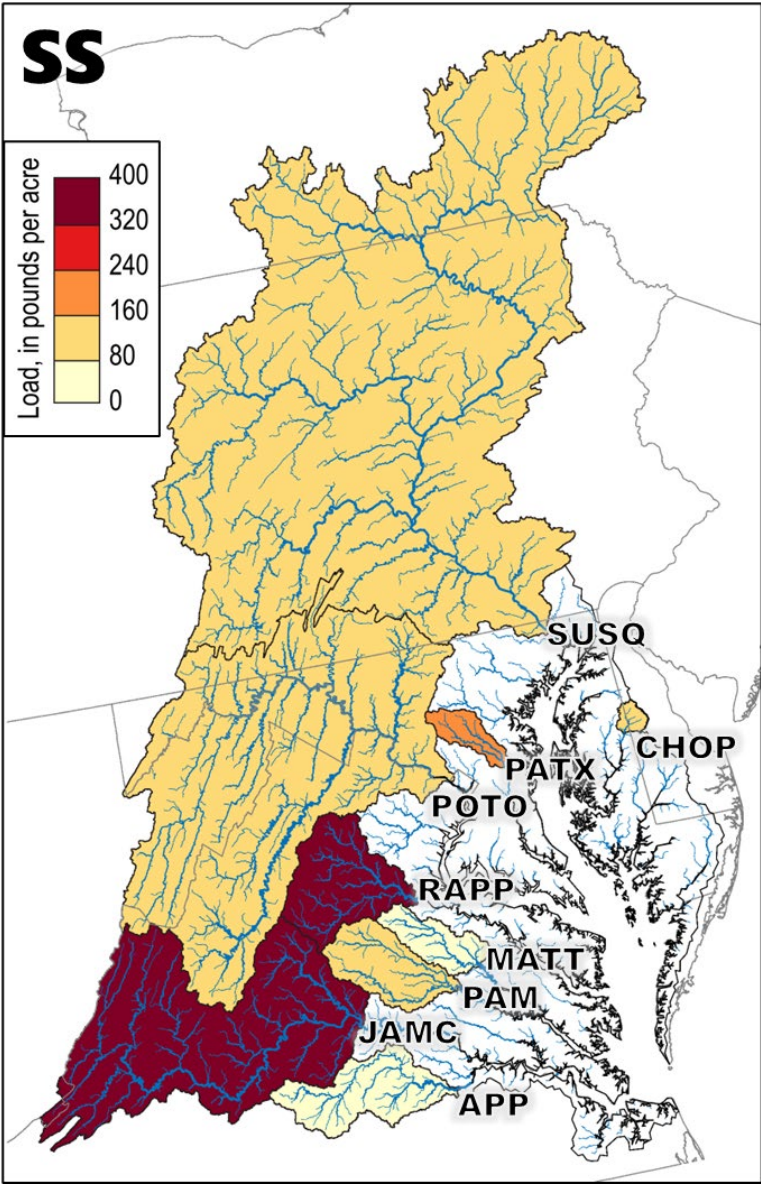
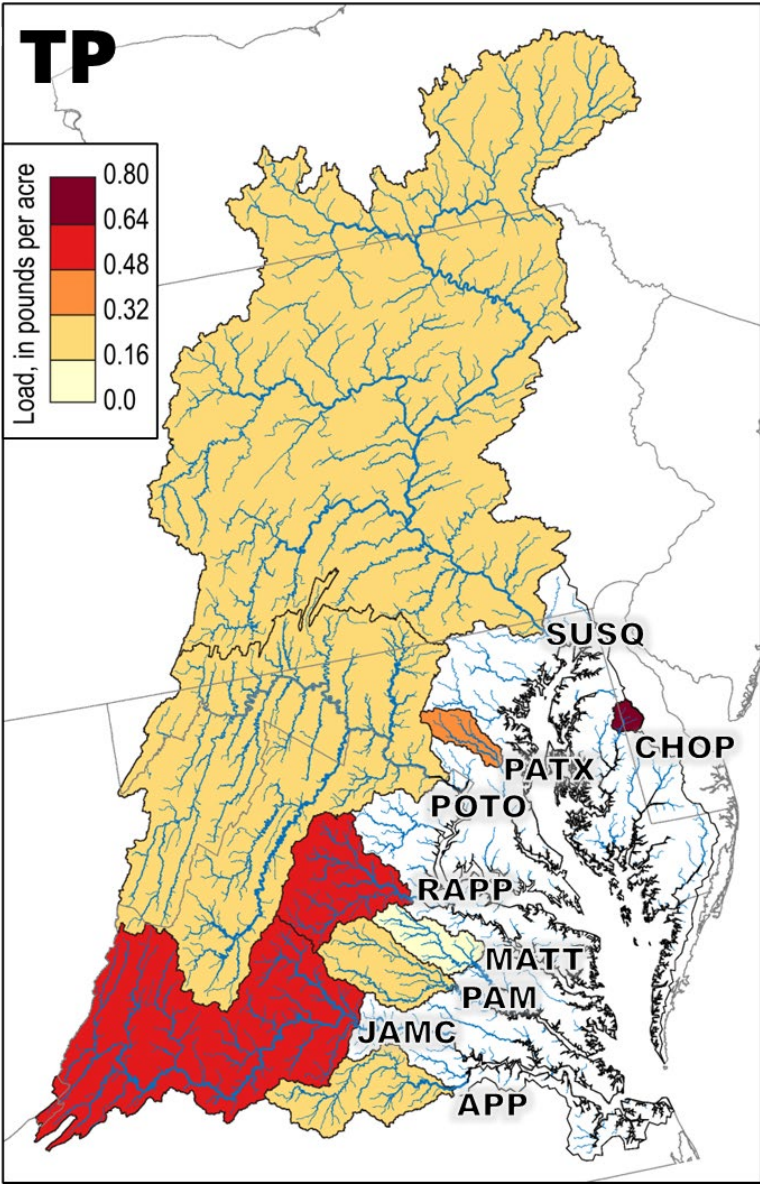
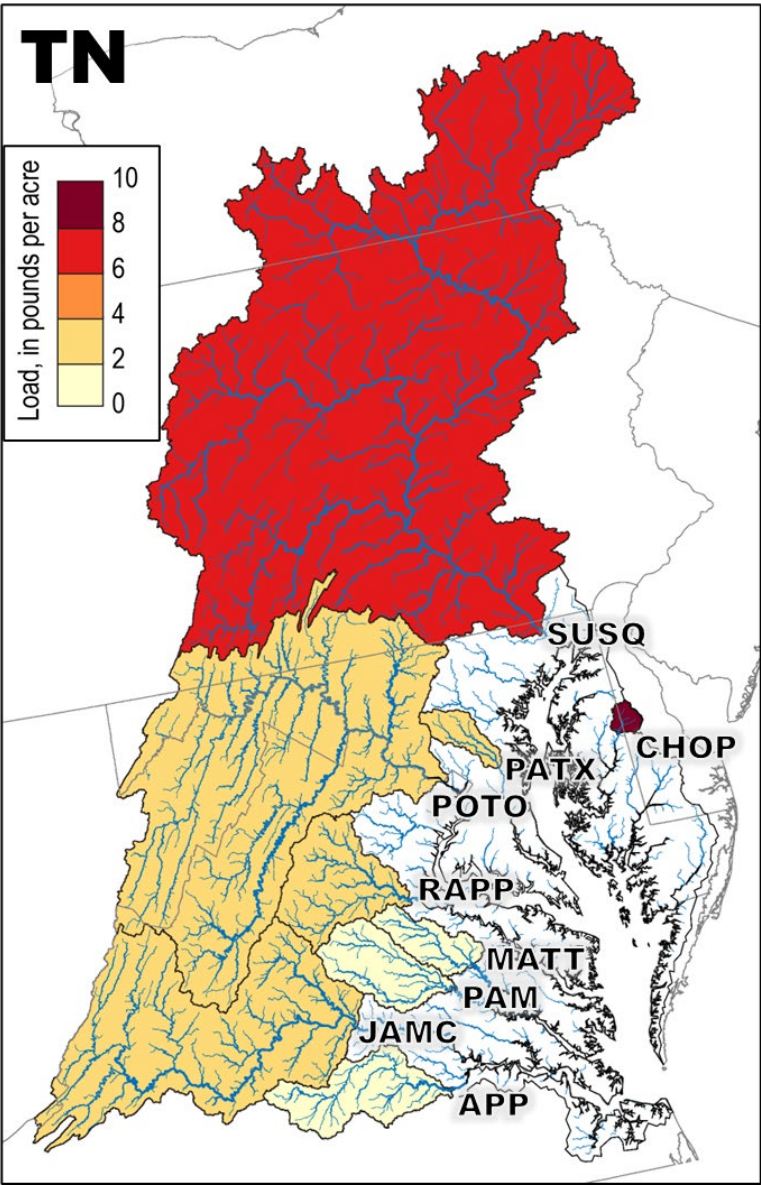
- **RAPP**: Rappahannock River nr Fredricksburg
- **MATT**: Mattaponi River nr Beulahville
- **PAM**: Pamunkey River nr Hanover
- **JAMC**: James River at Cartersville
- **APP**: Appomattox River at Matoaca





Per-acre loads (yields) at the RIM stations

Per-Acre Loads: 2020 – 2024 Average (most recent 5 years of data)

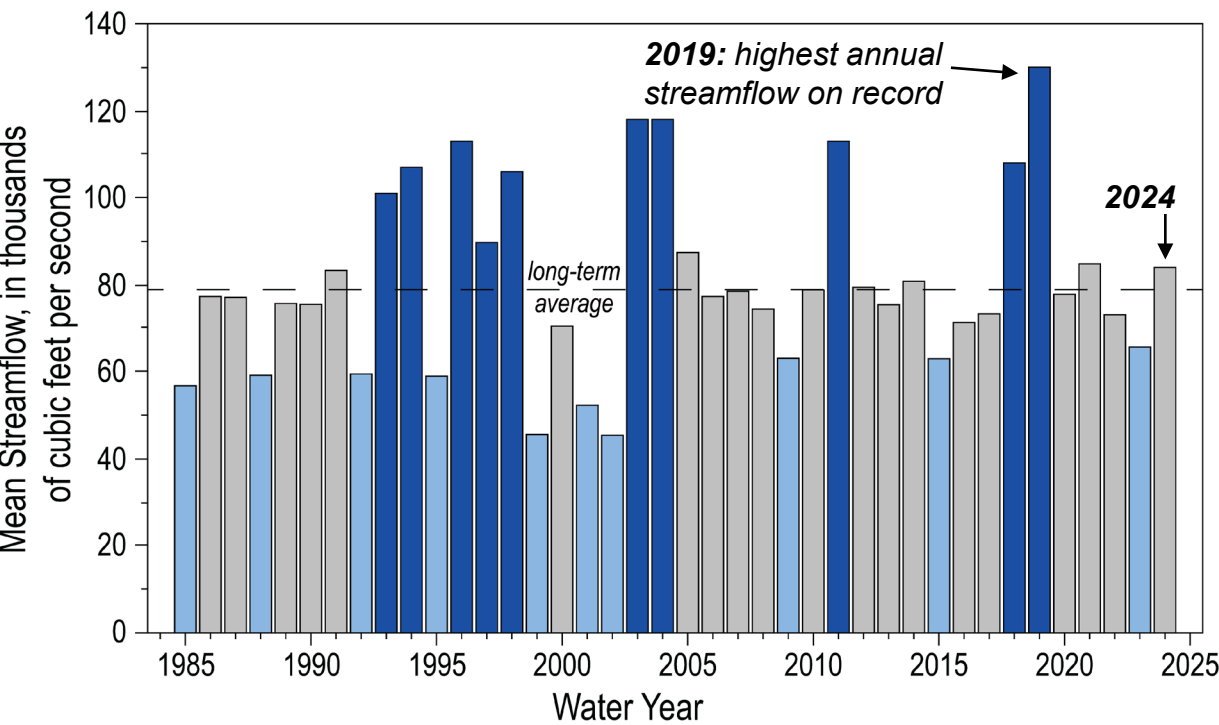


A wide-angle photograph of a river at sunrise. The sun is a bright, glowing orb in the upper left, casting a long, shimmering reflection down the center of the water. The sky is a pale, hazy orange. The riverbanks are lined with bare, dark trees. In the lower right foreground, a stone structure, possibly a dam or bridge pier, is partially submerged. The water is calm with gentle ripples.

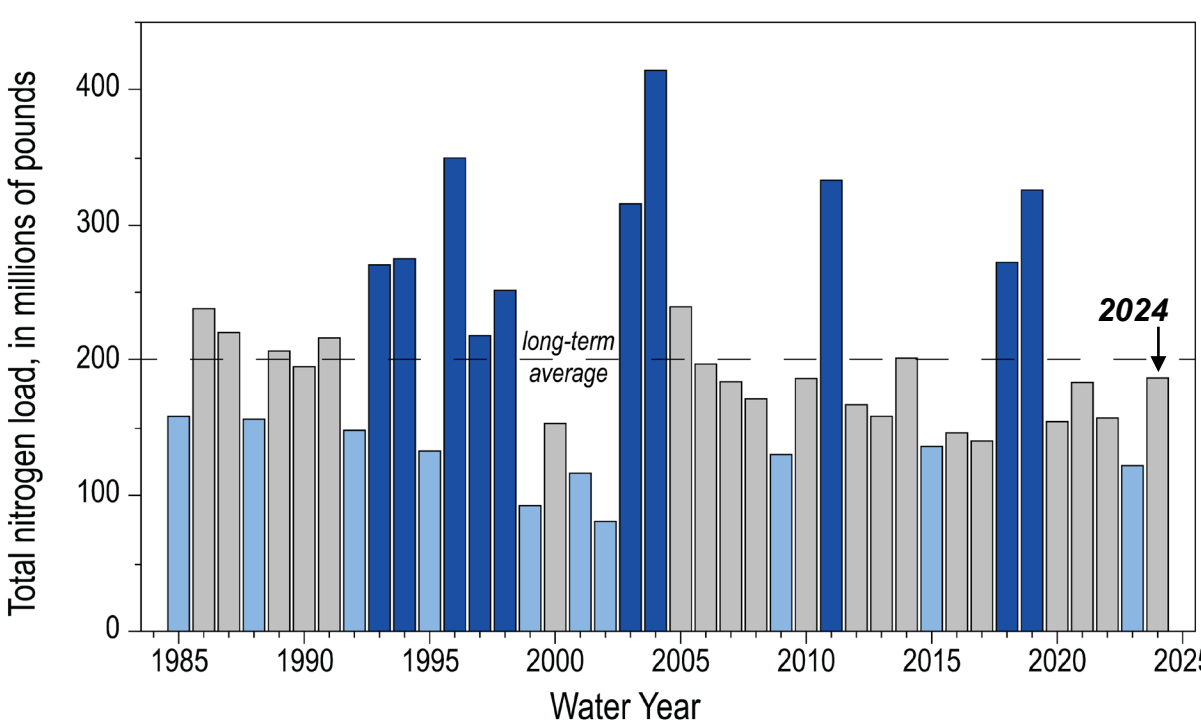
Trends at the RIM stations

In 2024, above average streamflow delivered below-average loads

The estimated annual-mean streamflow entering the Bay¹ in water year 2024 was about **4% higher** than the long-term average².



Loads of TN, NOx, TP, PO4, and SS from the RIM watershed in 2024 were **less** than long-term average² loads.



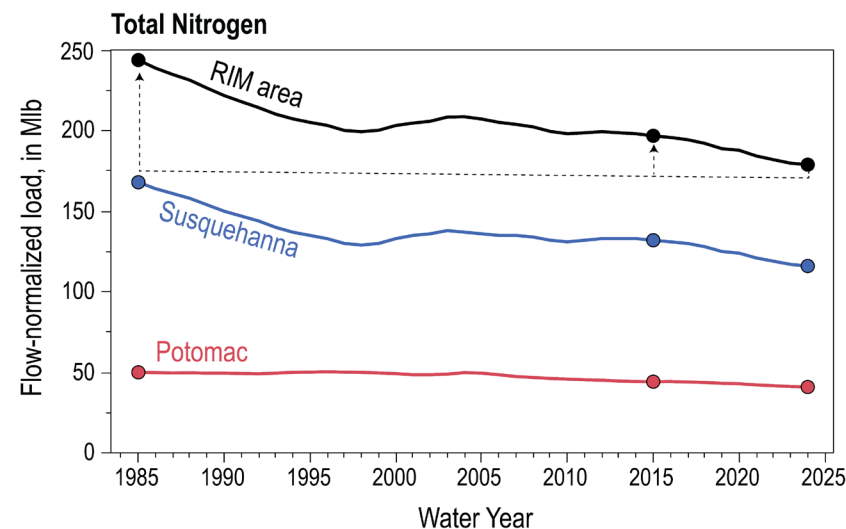
EXPLANATION

- Below 25th percentile of all annual observations
- Between 25th and 75th percentiles of all annual observations
- Above 75th percentile of all annual observations

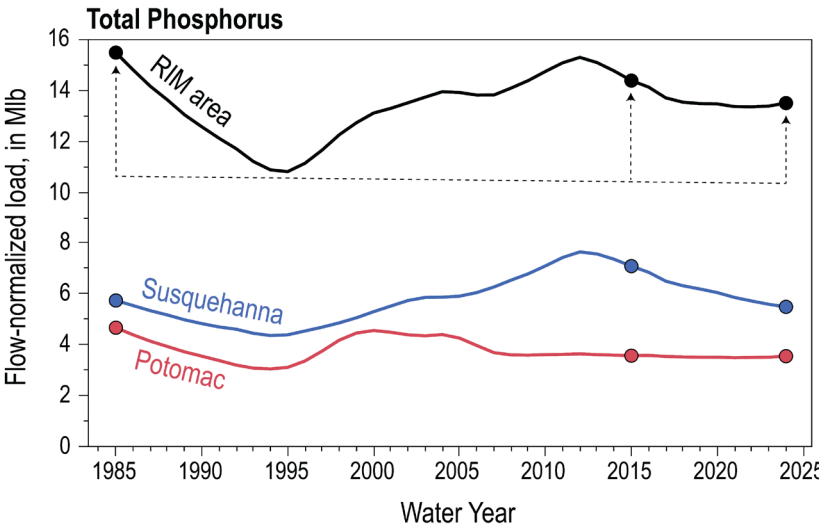
¹Streamflow entering the Bay estimated from monitored and unmonitored watershed area:
www.usgs.gov/centers/chesapeake-bay-activities/science/freshwater-flow-chesapeake-bay

²Long-term average = 1985 – 2024.

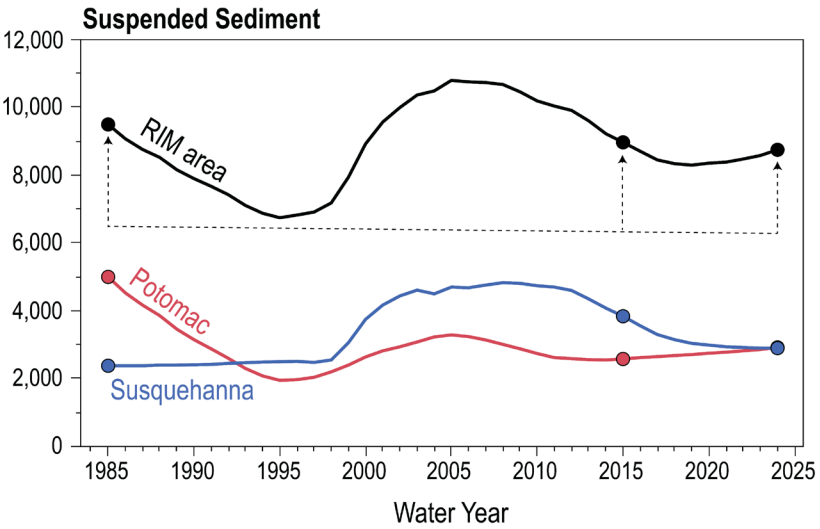
FN nutrient and sediment loads have decreased from the RIM watershed area over time



RIM FN total nitrogen loads
-9% from 2015 – 2024
-33% from 1985 – 2024



RIM FN total phosphorus loads
-6% from 2015 – 2024
-14% from 1985 – 2024



RIM FN suspended sediment loads
-3% from 2015 – 2024
-8% from 1985 – 2024

The Susquehanna and Potomac are the largest RIM watersheds. FN loads from these two stations typically represent 70 – 90% of the total RIM FN load.

The RIM network has a similar number of improving and degrading trend results

Trend Summary

- 13 trends have improved and 11 have degraded since 1985.
- 8 trends have improved and 12 have degraded since 2015.

Good News

- All trends improved at Susquehanna since 2015.
- TN trends improved at all MD RIM stations since 2015.

Concerns

- The Choptank has the highest TP per-acre load and a large TP increase since 2015.
- Other than the Pamunkey, loads were higher in 2024 than 2015 at all Virginia RIM stations.

		RIM Monitoring Station	Long term: 1985 - 2024			Short term: 2015 - 2024		
			TN	TP	SS	TN	TP	SS
Maryland	RIM stations	SUSQ	-31.2%	-4.6%	+21.5%	-12.4%	-22.8%	-24.8%
		CHOP	-2.5%	+77.4%	-34.3%	-4.5%	+20.2%	-7.5%
		PATX	-69.5%	-66.8%	-44.0%	-21.0%	-5.5%	-4.5%
		POTO	-18.4%	-24.3%	-41.7%	-7.6%	-1.0%	+13.1%
Virginia	RIM stations	RAPP	-15.6%	+31.2%	+50.0%	+7.3%	+7.6%	+1.7%
		MATT	-6.4%	+6.4%	+8.6%	+1.7%	+8.9%	+26.9%
		PAM	-1.3%	+59.2%	+36.3%	-3.9%	+1.0%	-9.9%
		JAMC	-8.0%	-22.1%	+40.3%	+11.2%	+25.8%	+20.9%
		APPO	+6.4%	+99.5%	+44.2%	+5.4%	+23.4%	+38.9%

Trend Direction

Improving

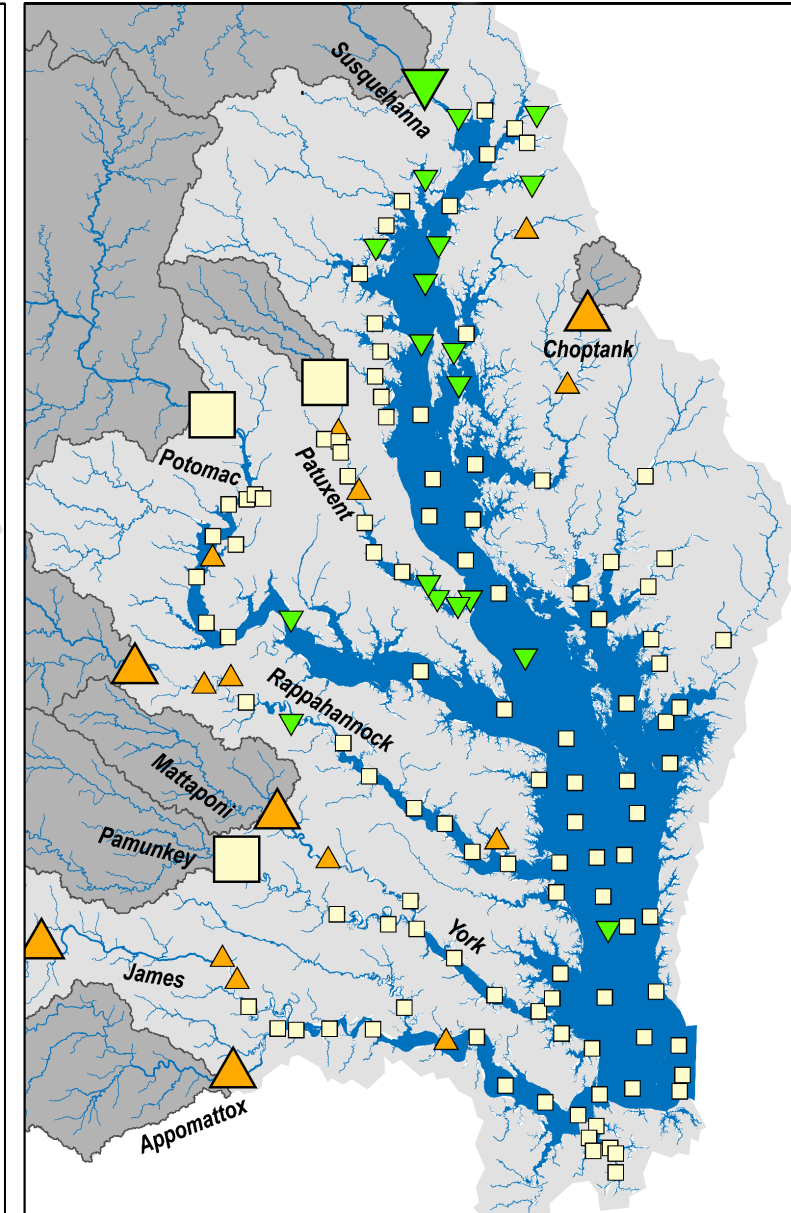
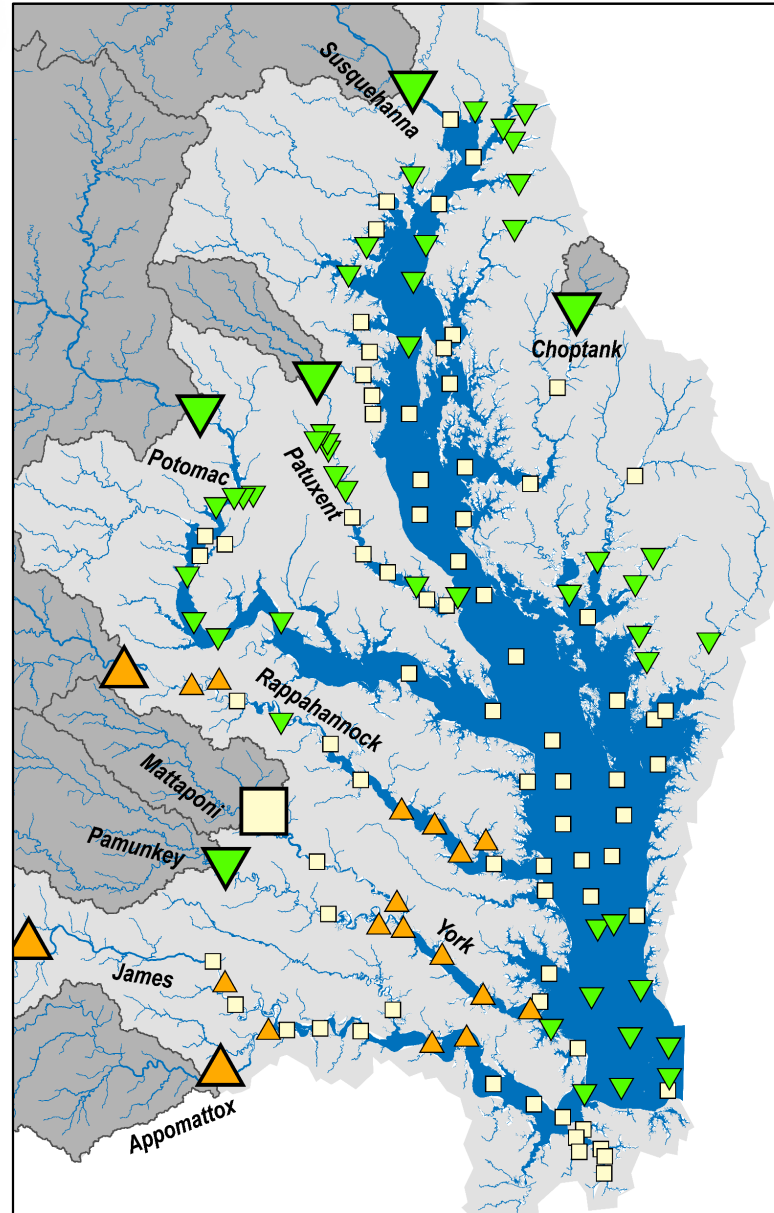
Degrading

No trend

Watershed loads likely explain some tidal trends

Total Nitrogen

Total Phosphorus



Watershed Area

- RIM Watershed
- Chesapeake Bay

RIM Trend: Load

2015 – 2024

Flow Normalized

- Increase
- Decrease
- No Trend

Tidal Trend: Surface Concentration

2015/16 – 2023/24

Non-linear with Flow Adjustment

- Significant increase
- Significant decrease
- Possible or unlikely change

Resources to learn more

Resources are available to learn more about these results

The project website includes access to the most recent data¹ and a summary of results: www.usgs.gov/CB-wq-loads-trends



The USGS works with Chesapeake Bay partners to evaluate and explain water-quality monitoring data.

What has caused the recent water-quality improvements in the Susquehanna?

Why are phosphorus loads high and increasing in the Choptank?

Why are sediment loads high and increasing in the James and Rappahannock?

Are management practices reducing water-quality loads?

Has reservoir scouring and infill affected loads in the Susquehanna and Appomattox?

We want to hear from you. Your questions inform our research!

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Doug Moyer, dlmoyer@usgs.gov

¹Mason, C.A., and Soroka, A.M., 2025, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay River Input Monitoring stations: Water years 1985-2024: U.S. Geological Survey data release, <https://doi.org/10.5066/P14CG4D8>.