Mapping Tools: USGS Interactive Maps for Better Visualization of Nutrient and Sediment Loads and Trends

Doug Moyer
Supervisory Hydrologist
USGS, Richmond, Va.
dlmoyer@usgs.gov
804-261-2634

How is the USGS Supporting the Mid-Point Assessment and Phase III Watershed Improvement Plan Development?

Using observed water-quality data:

(1) Compute Nutrient and Sediment loads

- *Identify problem areas /"hot spots"*

(2) Quantify the change in loads

- *Where have we seen improvements?*

(3) Identify management actions/environmental changes that are governing the trends in loads

(4) Enhance the Chesapeake Bay Watershed Model

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Questions Addressed

- Load – The amount of nitrogen, phosphorus, or sediment delivered to a downstream receiving body over a given time period. *(Load = Concentration * Stream Discharge)*
- What are the observed loads in Nitrogen, Phosphorus, and Sediment across the bay watershed?
- How have the loads in nitrogen, phosphorus, and sediment changed as a result of watershed activities? (focus time period 2005 -2014)
- What factors are governing measured trends in nitrogen, phosphorus, and sediment loads?

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USGS "Mapping" Tool

http://cbrim.er.usgs.gov/

USGS science for a changing world

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Water Quality Loads and Trends at Nontidal Monitoring Stations in the Chesapeake Bay Watershed

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Model Input Data
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Trend Results Table

Welcome to the USGS web site dedicated to providing water-quality trend and load results for the nontidal rivers of the Chesapeake Bay watershed.

The objectives of the Chesapeake Bay nontidal monitoring program are to:

- Quantify sediment and nutrient loads in the nontidal rivers of the Chesapeake Bay watershed.
- Estimate changes over time (trends) in sediment and nutrient concentrations that are related to the implementation of Best Management Practices, or other anthropogenic factors.

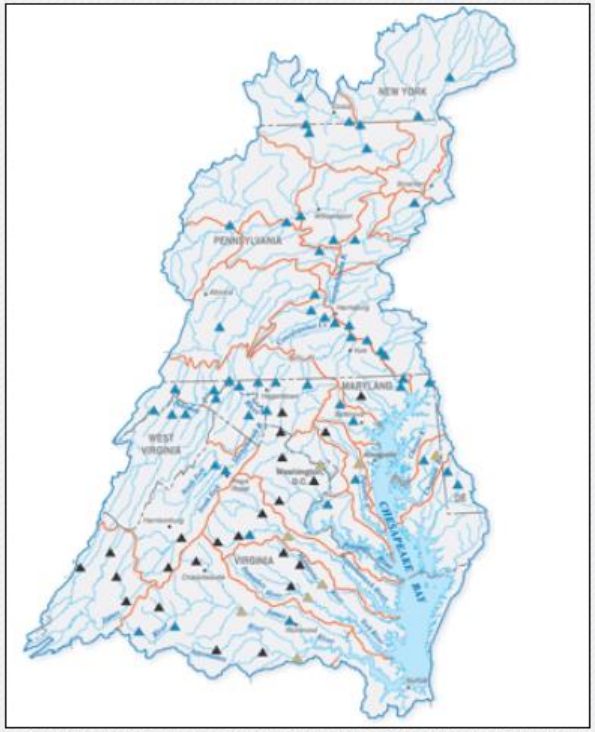
The monitoring data are collected by numerous agencies through the nontidal monitoring partnership. Results are updated each water year for the network of water quality monitoring stations distributed throughout the Chesapeake Bay watershed.

Methods, data, results, and interpretations are available for:

- Sediment and nutrient loads and yields
- Sediment and nutrient trends in concentration
- In-stream sediment and nutrient concentration data
- Stream discharge

Water Year 2013 load and trend results are only available for the following 9 major rivers with the longest water-quality records:

- Choptank River near Greensboro, Md, (01491000)
- Susquehanna River at Conowingo, Md. (01578310)
- Patuxent River near Bowie, Md. (01594440)
- Potomac River at Chain Bridge at Washington, D.C. (0164580)



Click on the image above to access the interactive map

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Online Communication Products

http://cbrim.er.usgs.gov/

- Download Results
  - Estimated Loads and Concentrations
  - Flow-Normalized Loads and Concentrations
  - Trend in Flow-Normalized Loads
- Interactive Map - display per acre loads and trends
- Static Maps
  - Per Acre Loads
  - Trend in Per Acre Loads
  - Combined Per Acre Loads and Trends
- Load and Trend Summaries
- Available January 2016

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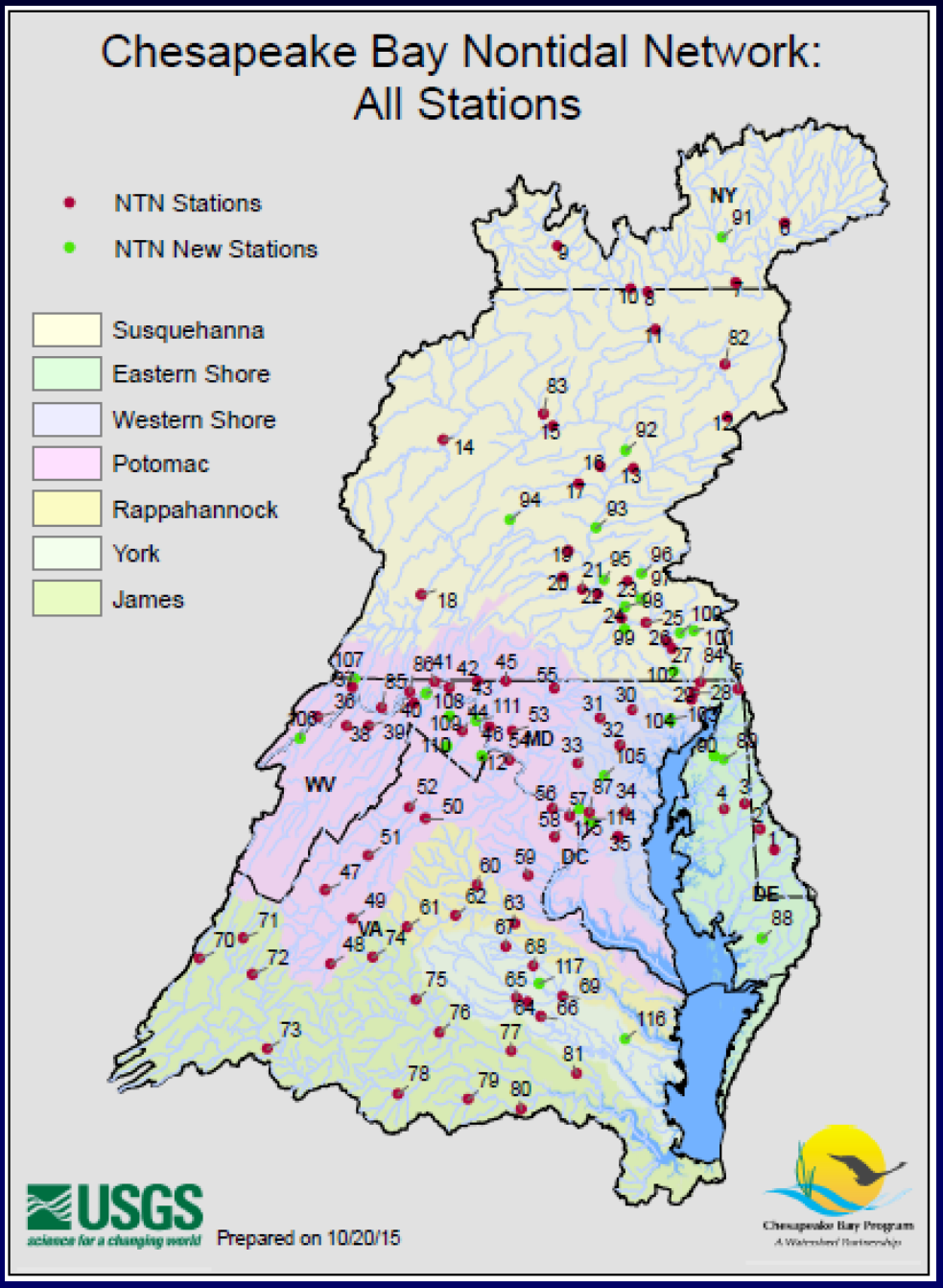

Chesapeake Bay Nontidal Monitoring Network

Monitoring Stations (117 Stations)

- 1985 - 9-RIM and 21-Long-term
- 2004 - PSC Agreement – 57 stations
- 2011 - TMDL Enhancement 30 stations
- Drainage areas range from 1 to 27,100 mi^2

Monitoring:

Six States, D.C., SRBC, EPA and USGS

Cost:

$6M Annually - $50K per site

Summary of Stations by State

State	Stations with Reported Loads and/or Trends	New Stations with Monitoring Only	Total
Virginia	32	2	34
Pennsylvania	20	11	31
Maryland	23	7	30
West Virginia	4	6	10
New York	5	1	6
Washington D.C.	1	3	4
Delaware	2	0	2
TOTAL	**87**	**30**	**117**

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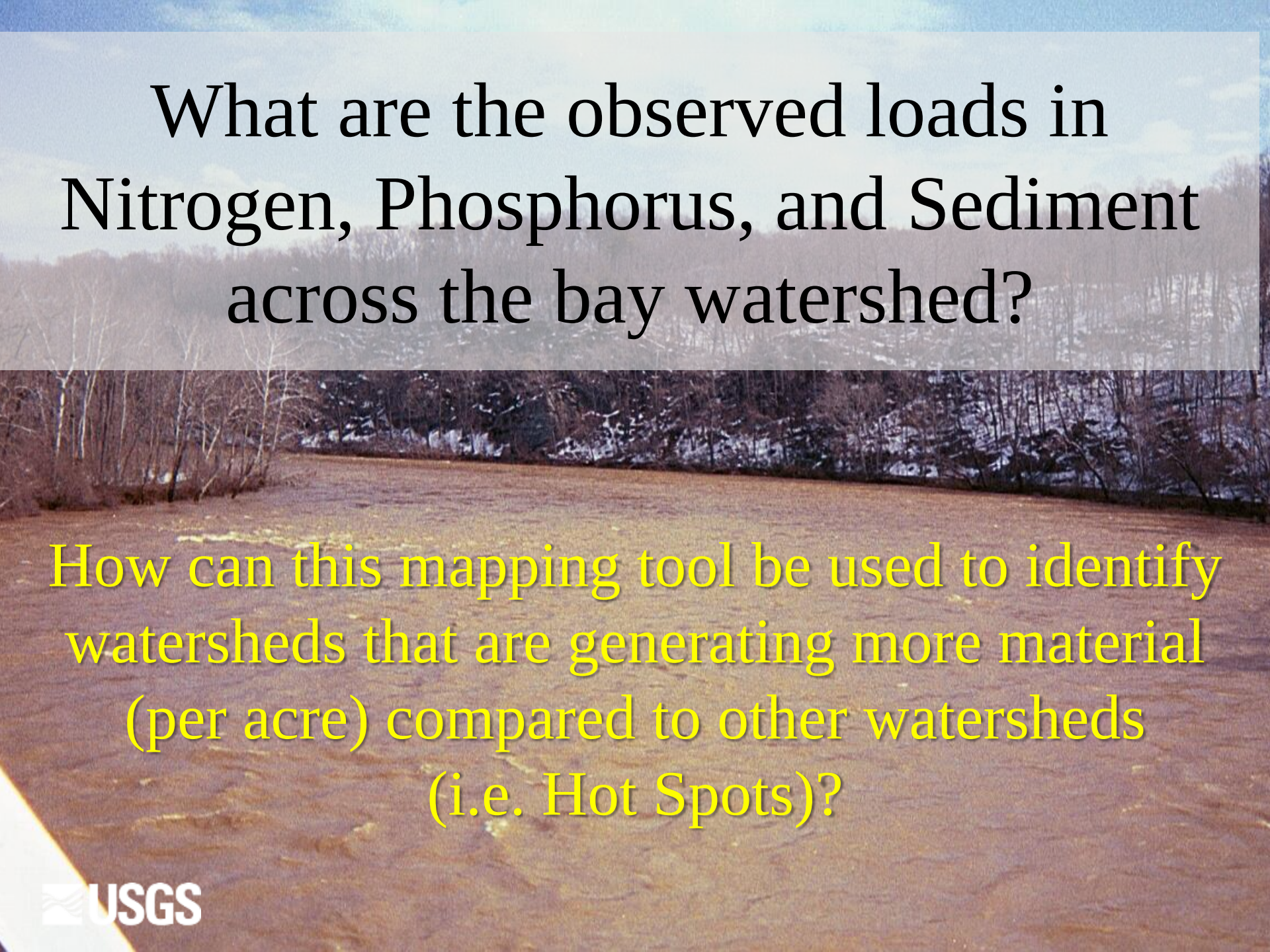

What are the observed loads in Nitrogen, Phosphorus, and Sediment across the bay watershed?

How can this mapping tool be used to identify watersheds that are generating more material (per acre) compared to other watersheds (i.e. Hot Spots)?

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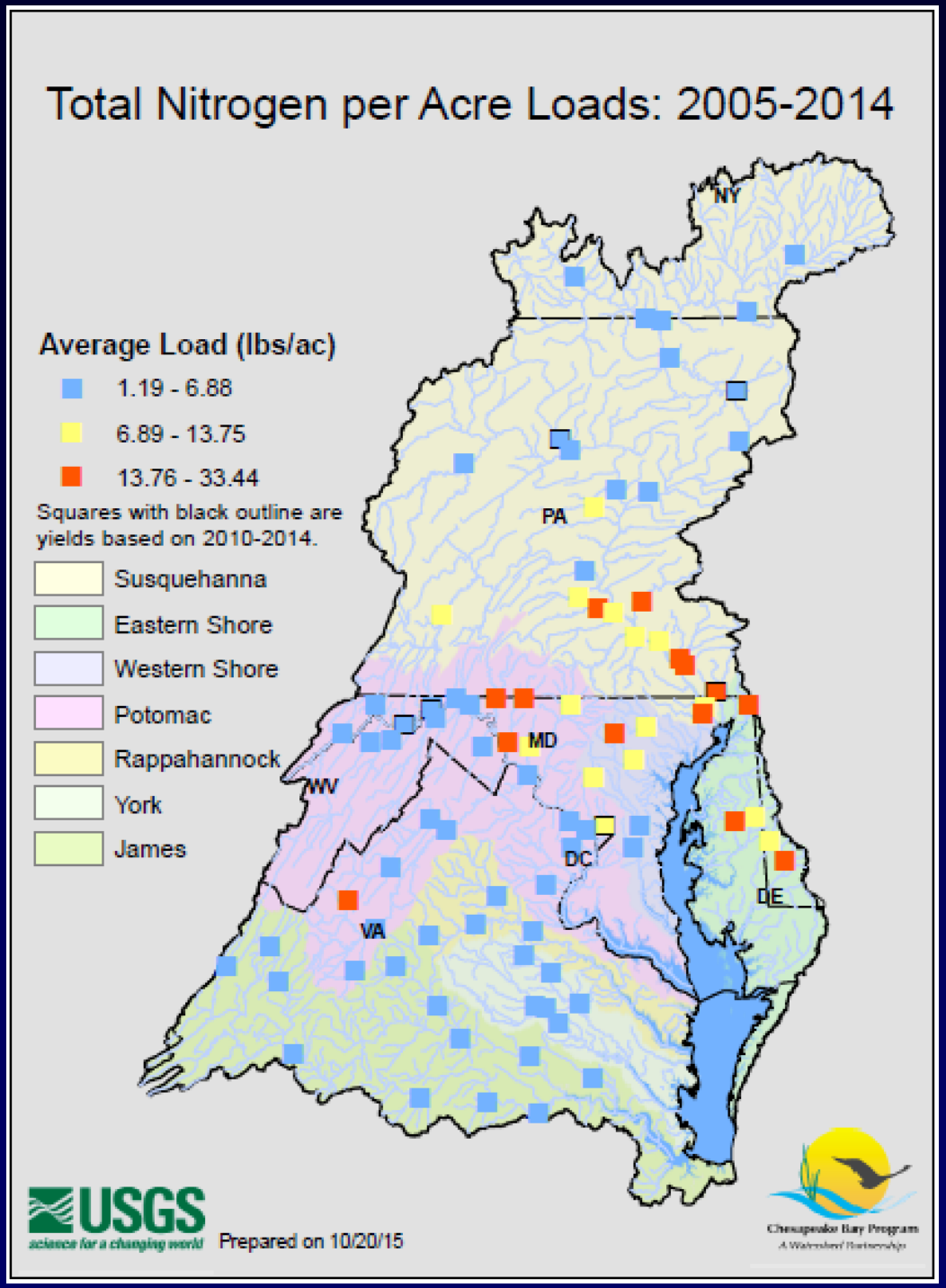
Total Nitrogen per Acre Loads

3 Categories of per Acre Loads:

(1) Low =
≤ 6.88 lbs/ac
52 of 81 stations

(2) Medium =
> 6.88 to ≤ 13.75
15 of 81 stations

(3) High Yields = ≥ 13.76
14 of 81 stations



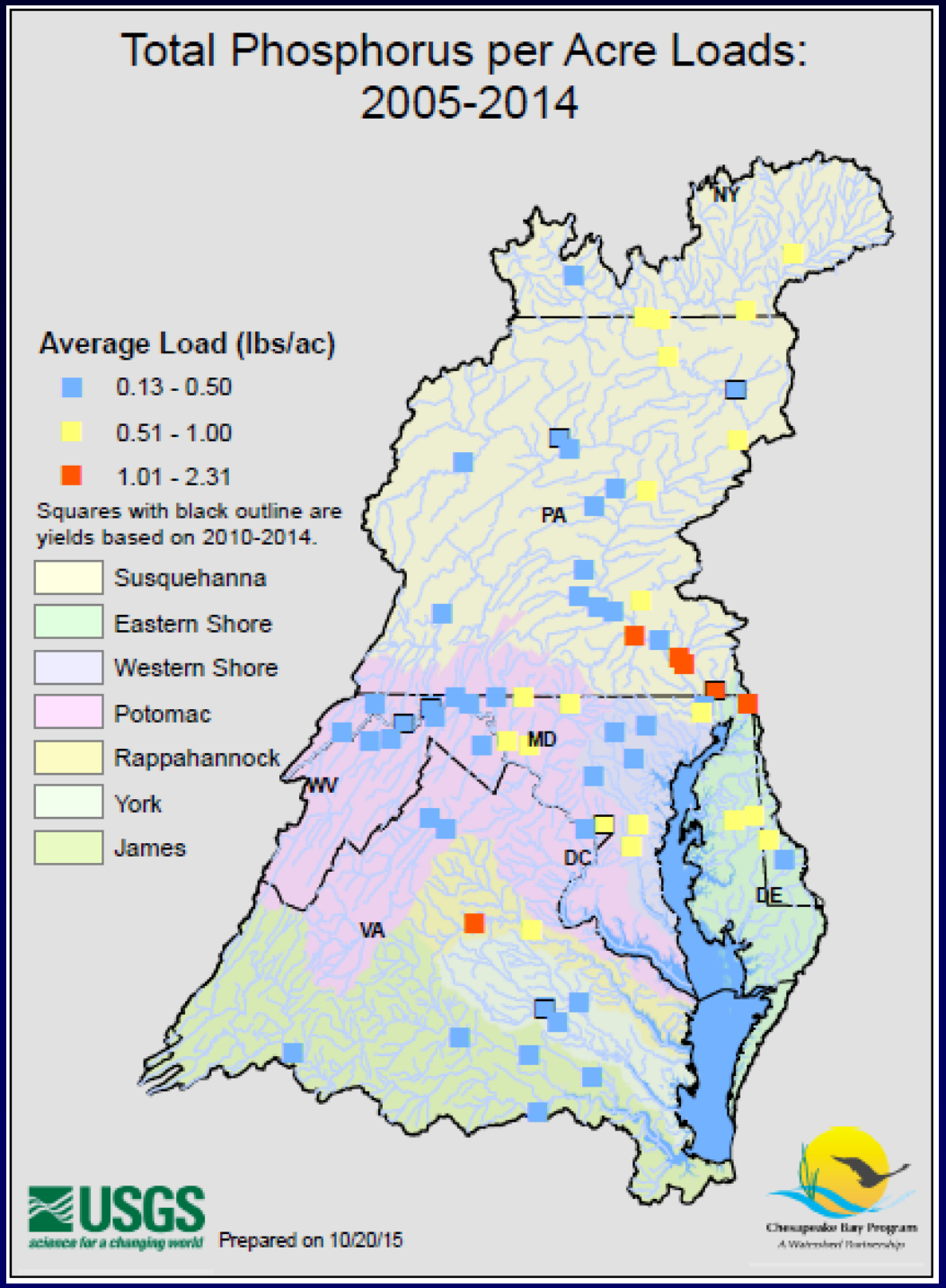
Total Phosphorus per Acre Loads

3 Categories of per Acre Loads:

(1) Low =
≤ 0.50 lbs/ac
40 of 66 stations

(2) Medium =
≥ 0.51 to ≤ 1.00
20 of 66 stations

(3) High Yields = ≥ 1.01
6 of 66 stations




How have the loads in Nitrogen, Phosphorus, and Sediment changed as a result of watershed activities?
How can this mapping tool be used to identify where have we seen the greatest improvement/degradation?
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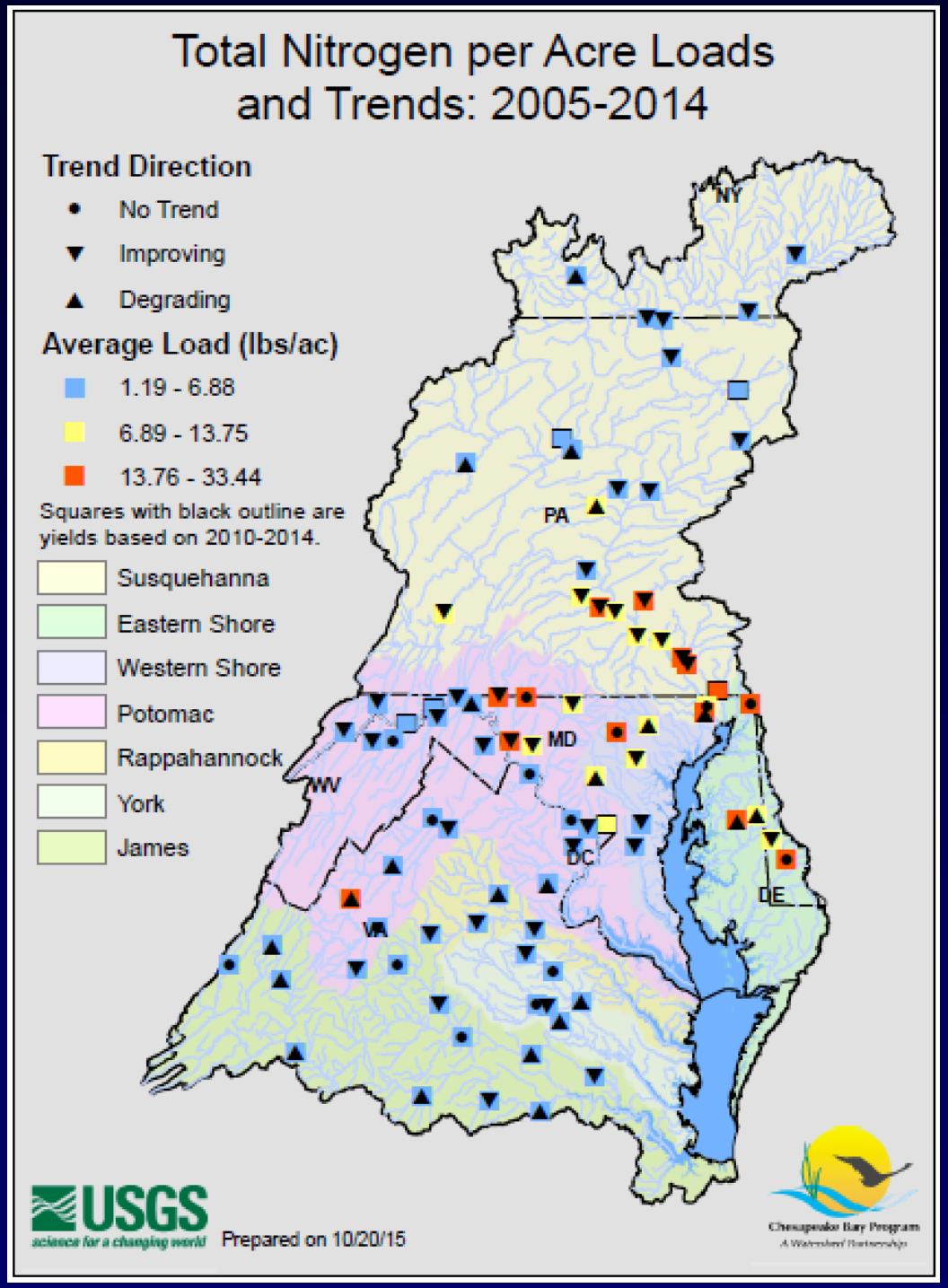
Total Nitrogen per Acre Loads and Trends: 2005-2014

Of the 14 stations with the highest per acre loads for Total Nitrogen:

- 6 have improving trends
- 3 have degrading trends
- 4 have no trends
- 1 has insufficient data for trends



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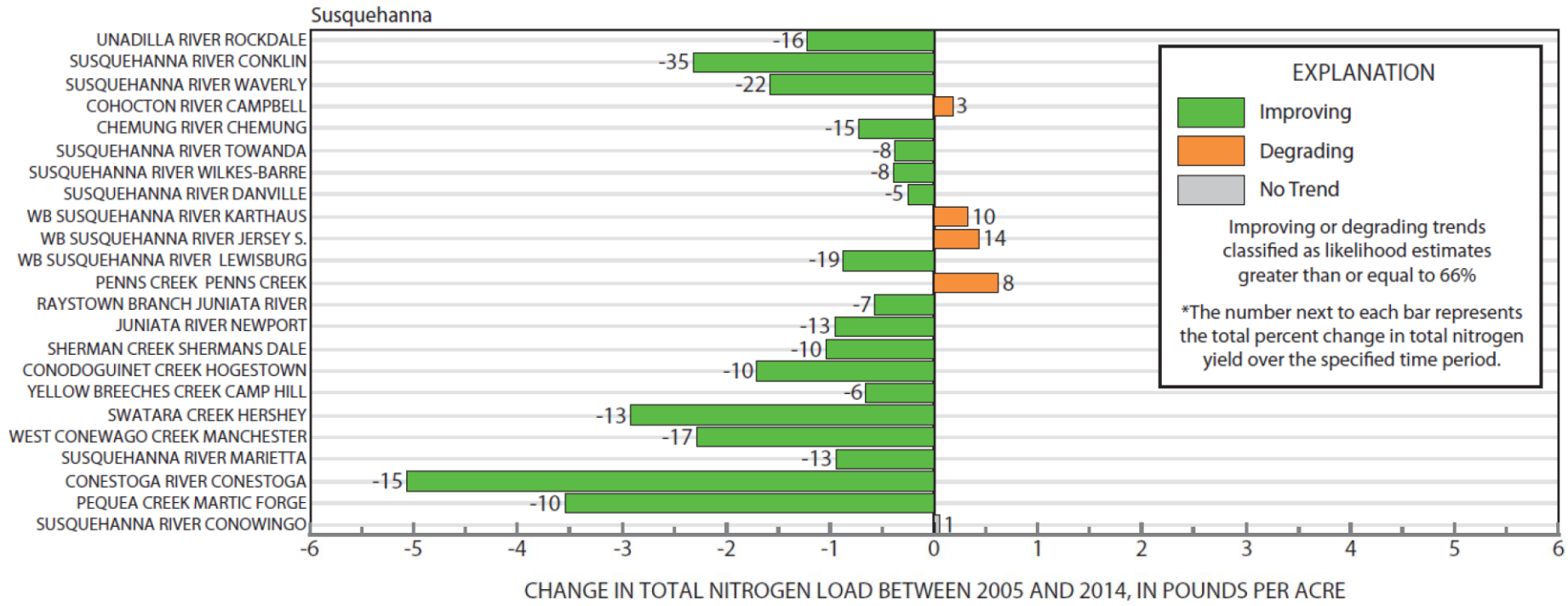
Changes in Nitrogen per Acre Loads: 2005-2014

Example from the Susquehanna Watershed



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Changes in Nitrogen per Acre Loads: 2005-2014

Trend in load network is the first of its kind

44 of 81 (54%) Stations Improving
Average Improvement = 0.99 lbs/ac
Average Percent Reduction = 12%

22 of 81 (27%) Stations Degrading
Average Degradation = 0.41 lbs/ac
Average Percent Reduction = 10%

15 of 81 (19%) Stations No Change

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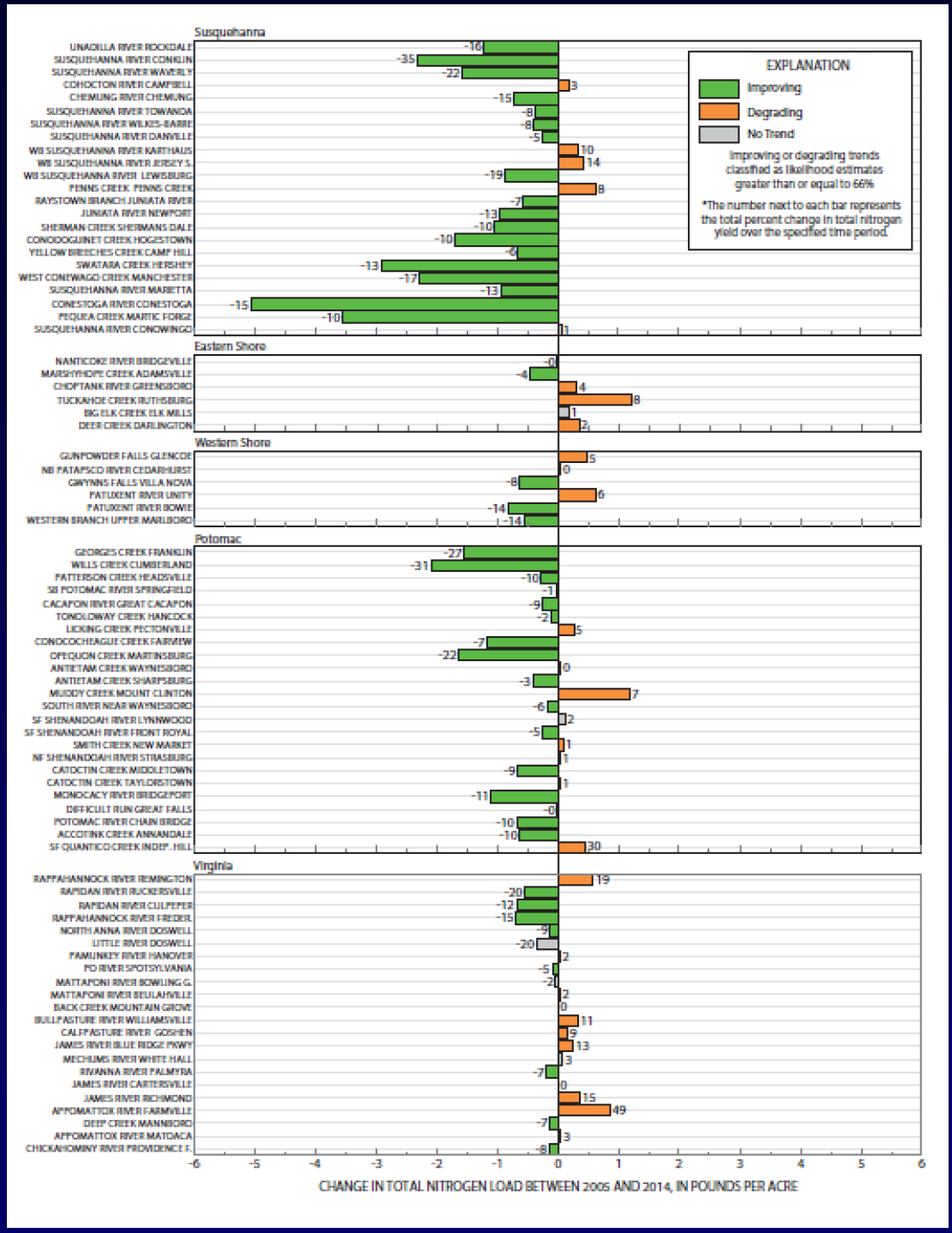

Changes in Phosphorus per Acre Loads: 2005-2014

Marked improvement in total phosphorus loads (yields) for the period 2005-2014 compared to 2003-2012 *(40% Improving and 48% Degrading)*.

41 of 60 (68%) Stations Improving
Average Improvement = 0.17 lbs/ac
Average Percent Reduction = 27%

12 of 60 (20%) Stations Degrading
Average Degradation = 0.11 lbs/ac
Average Percent Reduction = 19%

7 of 60 (12%) Stations No Change

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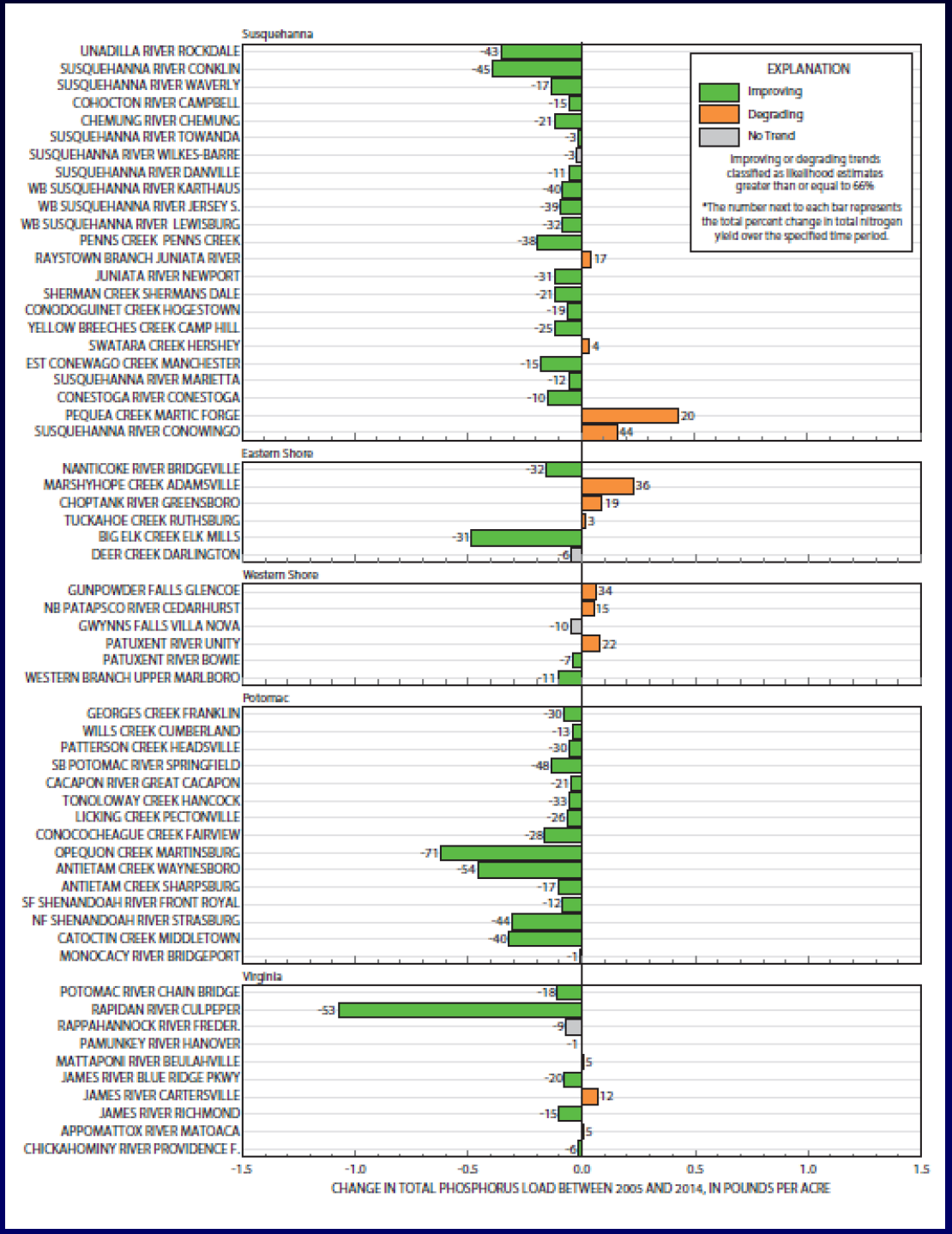

What factors are governing measured trends in Nitrogen, Phosphorus, and Sediment loads?

How can this mapping tool be used to help identify the pattern of change at a given station?

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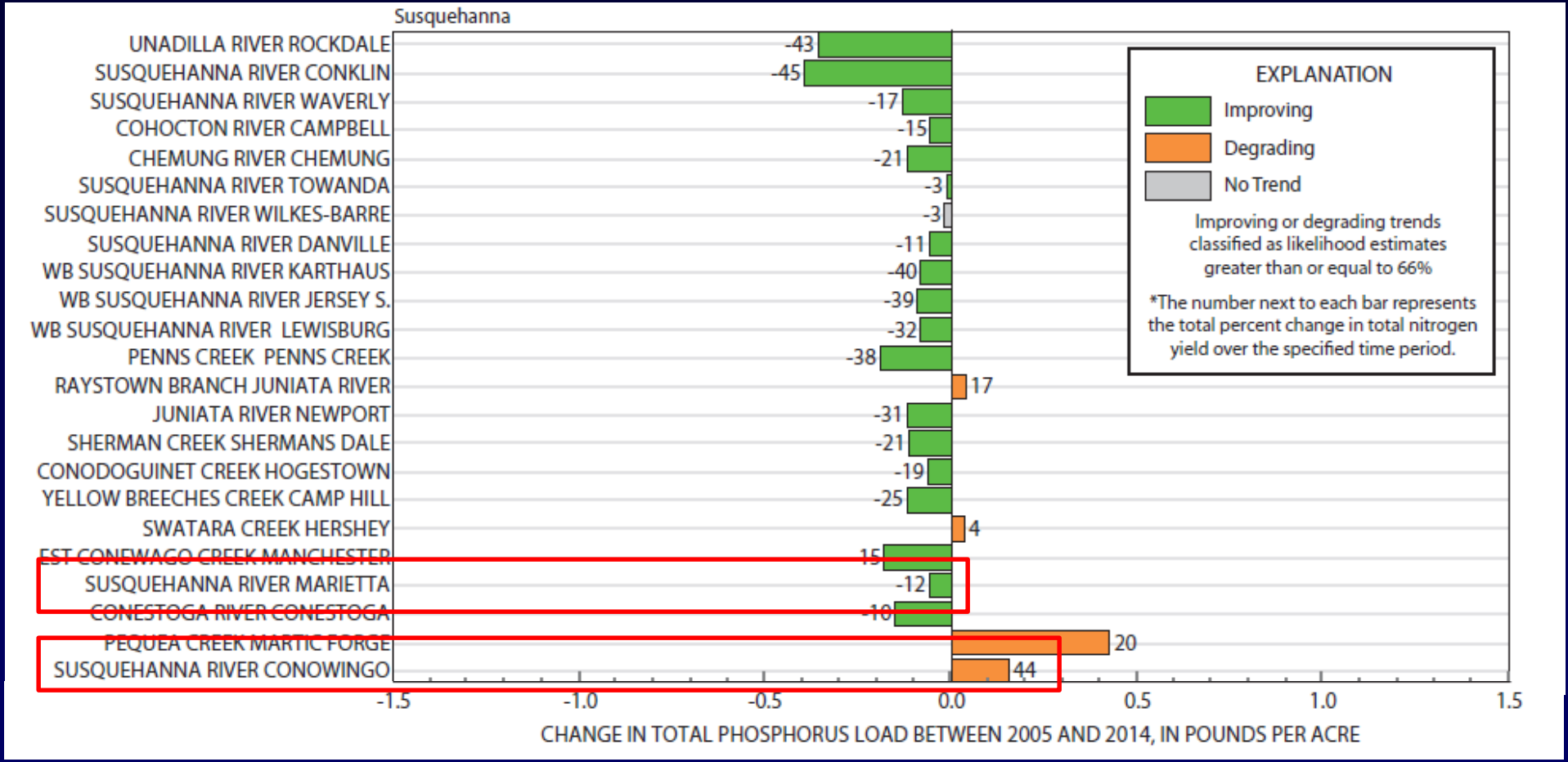
Changes in Phosphorus per Acre Loads: 2005-2014

Example from the Susquehanna Watershed



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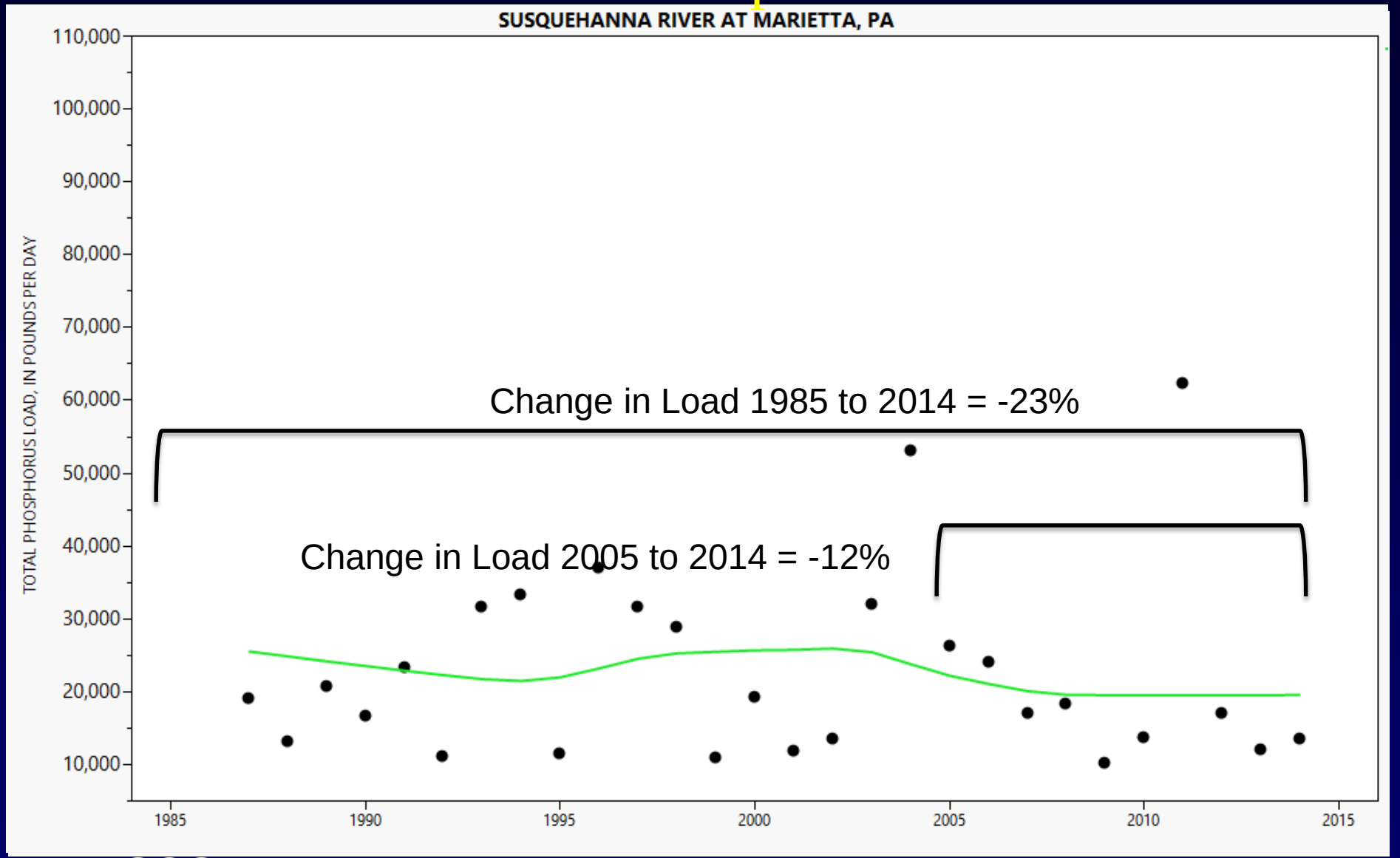
Susquehanna River at Marietta: Total Phosphorus



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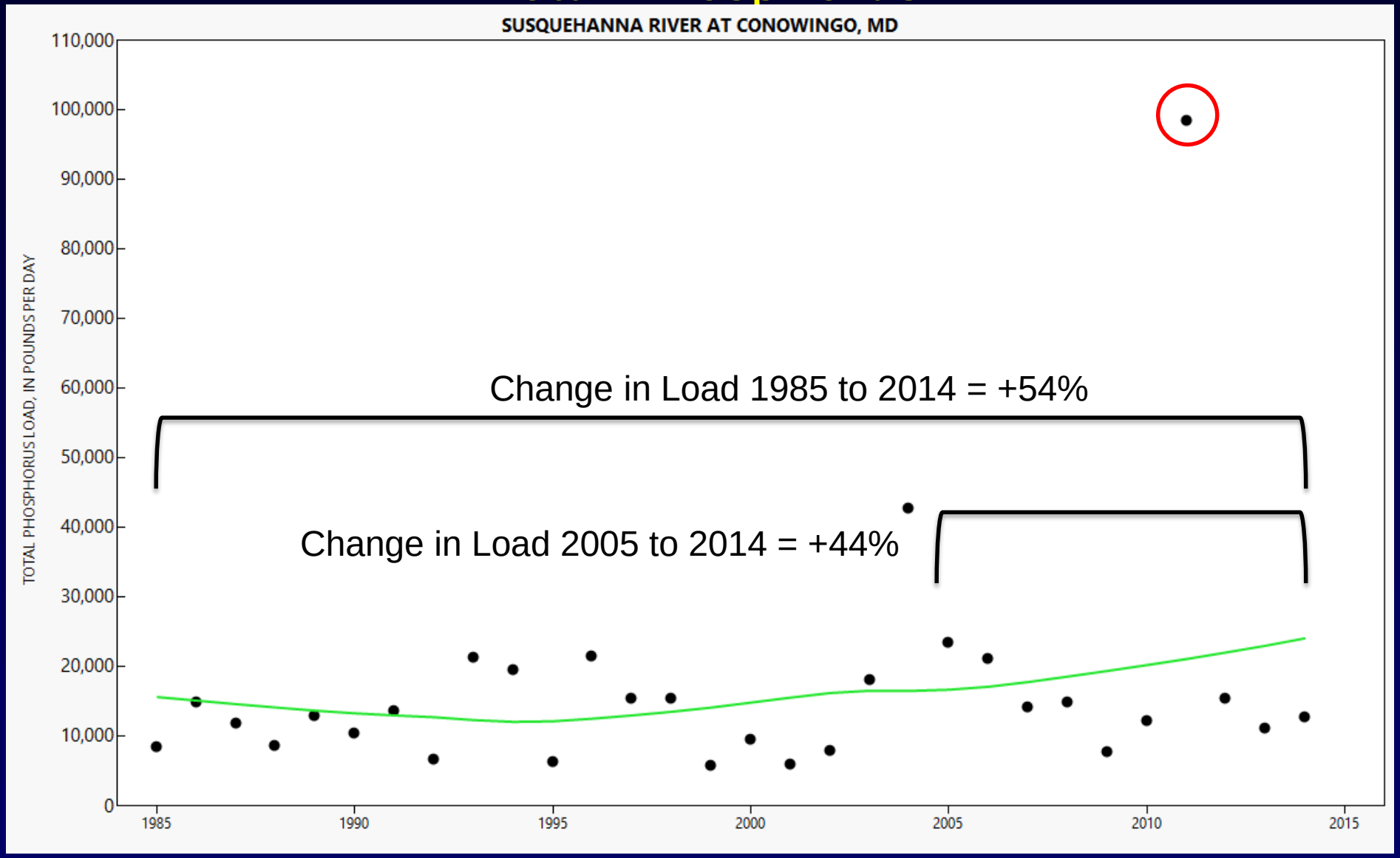
Susquehanna River at Conowingo: Total Phosphorus



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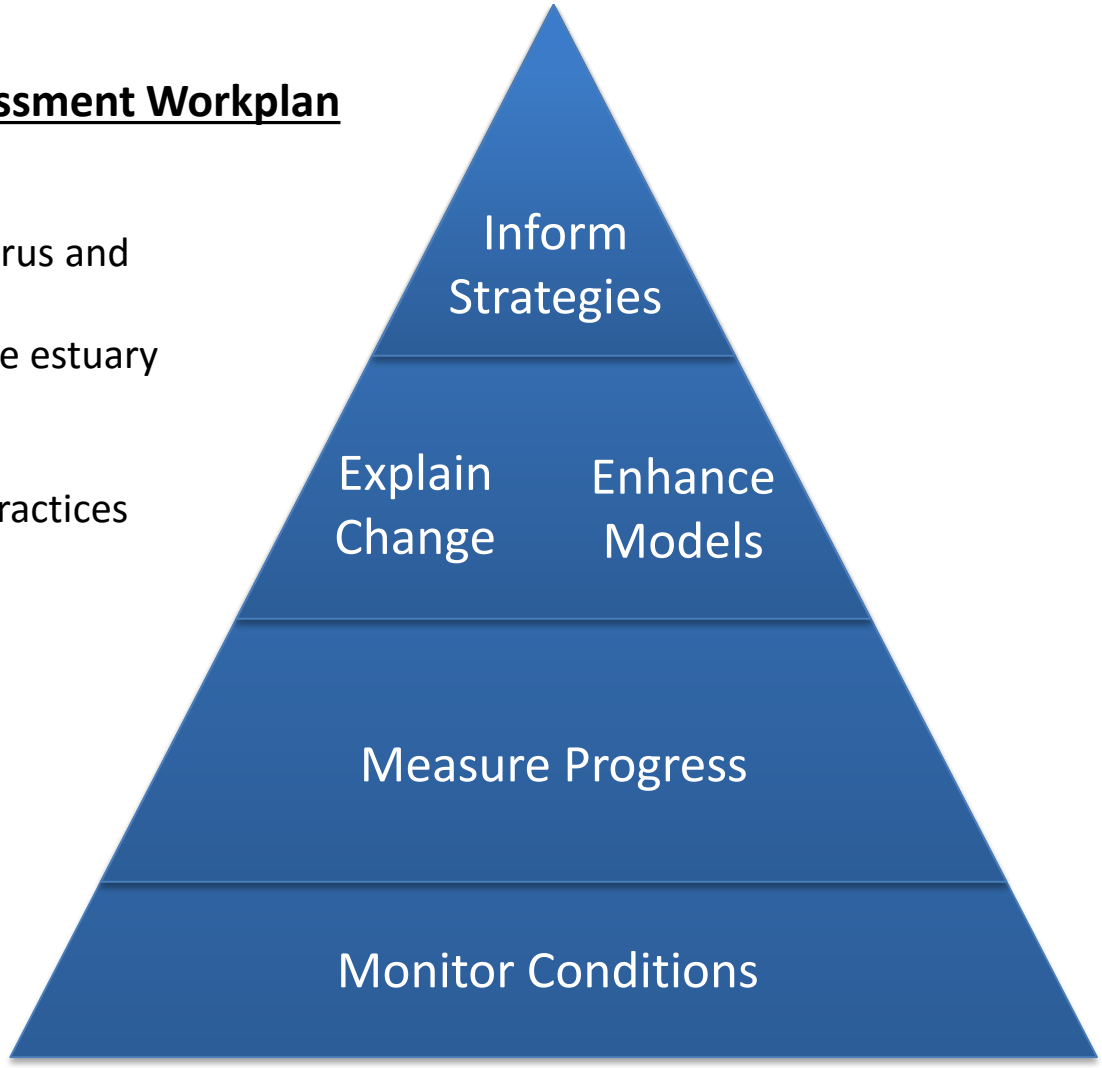
Using Monitoring Data To Measure Progress and Explain Change

Overview: STAR Workplan Elements

Elements of STAR Mid-Point Assessment Workplan

1. Measure progress
   - Trends of nitrogen, phosphorus and sediment in the watershed.
   - Trends of water quality in the estuary
2. Explain water-quality changes
   - Response to management practices
3. Enhance CBP models
   1. WSM
   2. SPARROW
4. Inform management strategies
   - WIPs
   - Water-quality benefits



Questions for the Commission

- Are there other ways that would be usefull to display this load and trend information?
- What would be the best ways to inform your constituency of our load and trend results?

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