

**Initial Meeting for the
Stream, Rainfall, and Water Quality Gauging Analysis
Rappahannock River Basin, VA
Germana Riverside Center, Fredericksburg, VA
August 2, 2012**

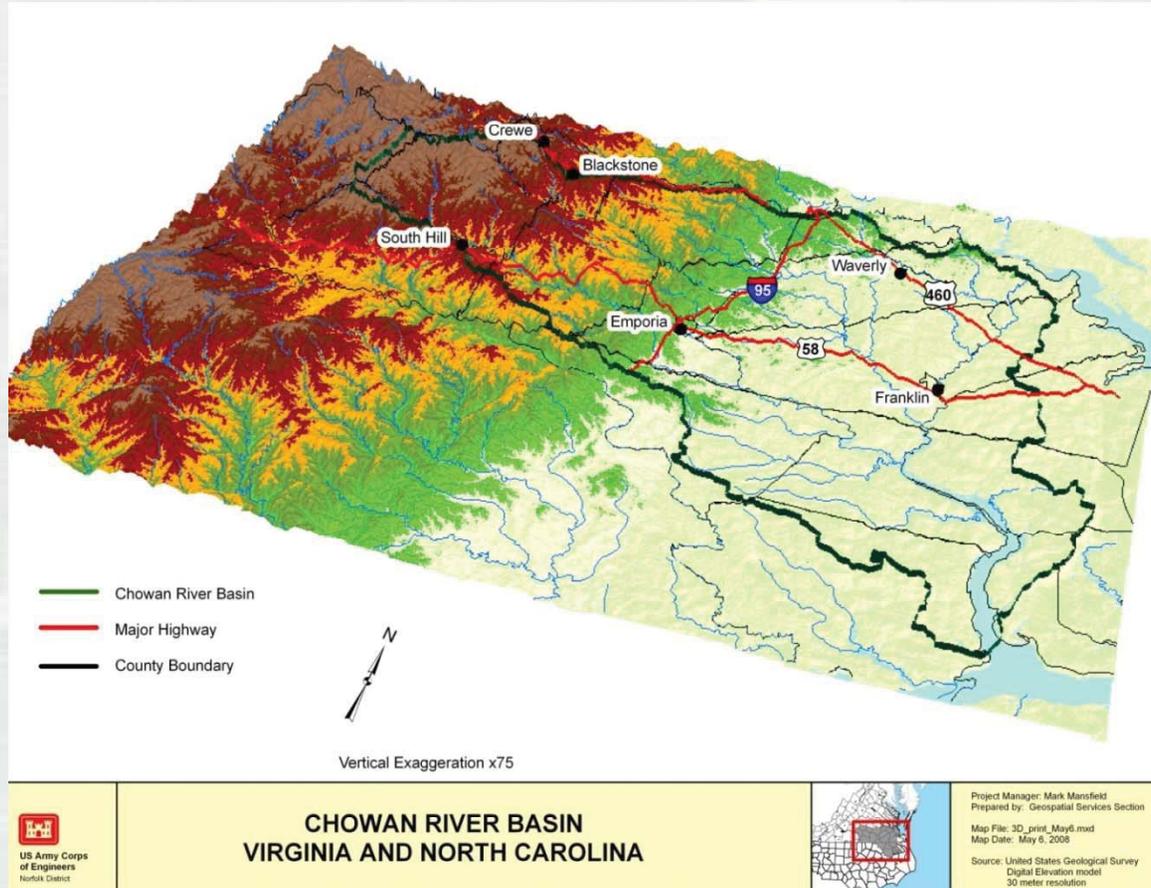
- 9:30 am Introduction**
 -Overview of Study Purpose
 -Background Information
 -Chowan River Basin Gauging Study
Holly Carpenter, USACE Norfolk District
Eldon James, RRBC Staff
- 10:00 am USGS Gauging Options for the Rappahannock River Basin**
Shaun Wicklein, Virginia Water Science Center, USGS
- 10:20 am Rappahannock Basin and Gauging Overview**
Jason Elliott, Weather Forecast Office Baltimore/Washington, NWS
- 10:50 am Discussion of Gauging Needs in the Basin**
- 11:20 am Meeting Closing Comments, Schedule of Next Meeting**

Rappahannock River Basin Gaging Analysis

2 August 2012



Chowan River Basin



CHOWAN RIVER BASIN VIRGINIA AND NORTH CAROLINA



Technical Advisory Committee*

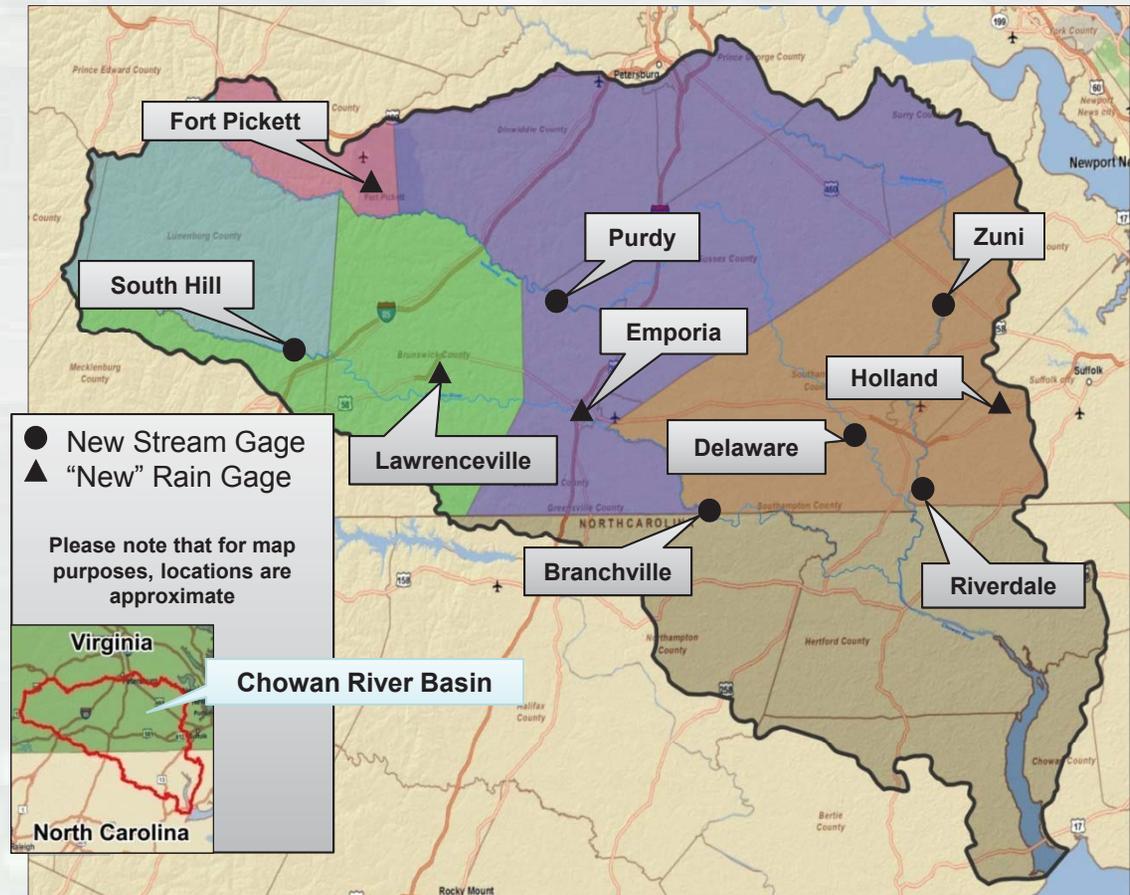
- **City of Emporia**
- **City of Franklin**
- **Greensville County**
- **Isle of Wight County**
- **Southampton County**
- **Surry County**
- **Sussex County**
- **VDEM**
- **VDEQ**
- **VDGIF**
- **VDOF**
- **NWS**
- **USGS**
- **ACOE**
- **FEMA**



Chowan River Basin

Rainfall/Stream Integrated Gaging Network

- Significant flooding has occurred with recurring frequency
- Hurricane Floyd was the flood of record in 1999
- Six new stream gages are recommended for installation: South Hill, Branchville, Purdy, Delaware, Zuni, and Riverdale
- Four existing rain gages are recommended for upgrading: Fort Pickett, Lawrenceville, Emporia, and Holland
- The new gages would much improve the system and allow forecasting of flooding in a more effective way
- The impact would be that citizens can be evacuated and property rearranged before floodwaters become an issue



Network System Cost Estimates

Implementation Costs:

- ✓ **Stream Gages (\$160K)**
 - Real time
 - Actual & Forecast
 - Stage Discharge
 - Index Velocity

- ✓ **Rainfall Gages (\$75K)**
 - Rainfall
 - Wind
 - Barometric pressure
 - Temperature

Operations and Maintenance Costs:

- ✓ **Stream Gages (\$96.8K)**

- ✓ **Rainfall Gages (Minimal)**





U.S. Geological Survey Monitoring for the Rappahannock River Basin

Shaun Wicklein
Hydrologist
U.S. Geological Survey



USGS Mission and Roles

The USGS is a science organization that provides impartial information on:

- Health of the nations ecosystems and environment
- Natural hazards
- Natural resources
- Climate and land-use change
- Core Science

Monitoring and analysis tools

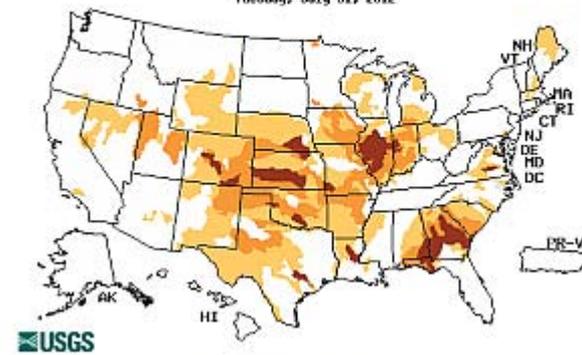
Current Streamflow

Thursday, August 02, 2012 00:30ET



Drought

Tuesday, July 31, 2012



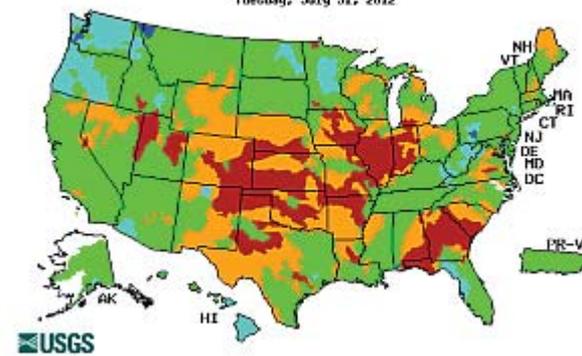
Flood

Thursday, August 02, 2012 05:30ET



Past Flow/Runoff

Tuesday, July 31, 2012



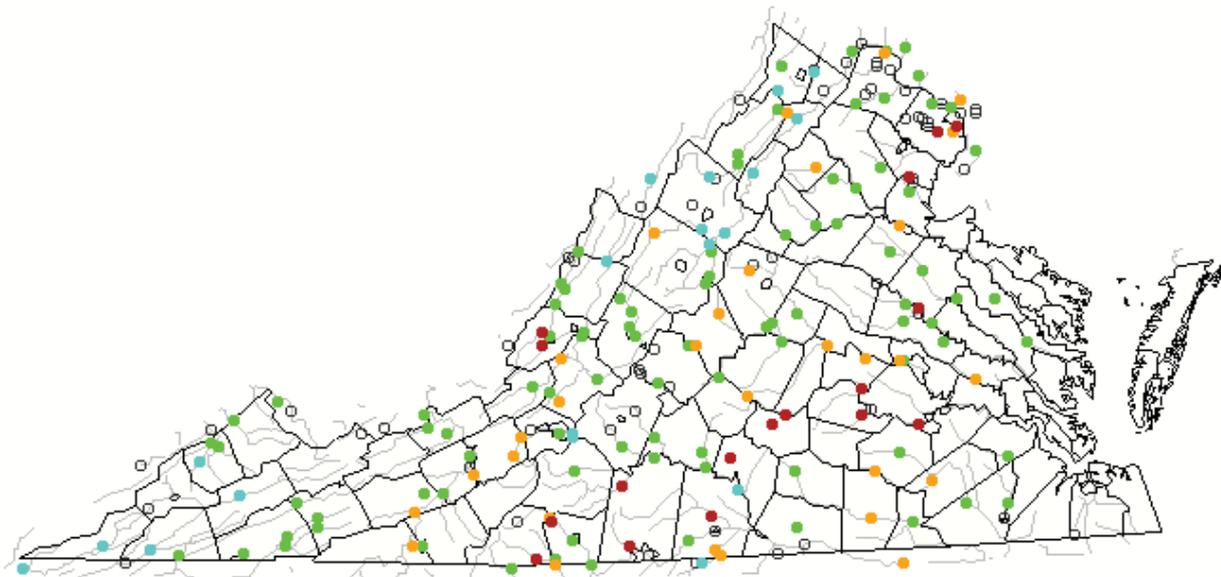
Streamflow monitoring for Virginia

Network Co-operated with VA Dept. of Environmental Quality

Map of real-time streamflow compared to historical streamflow for the day of the year (Virginia)

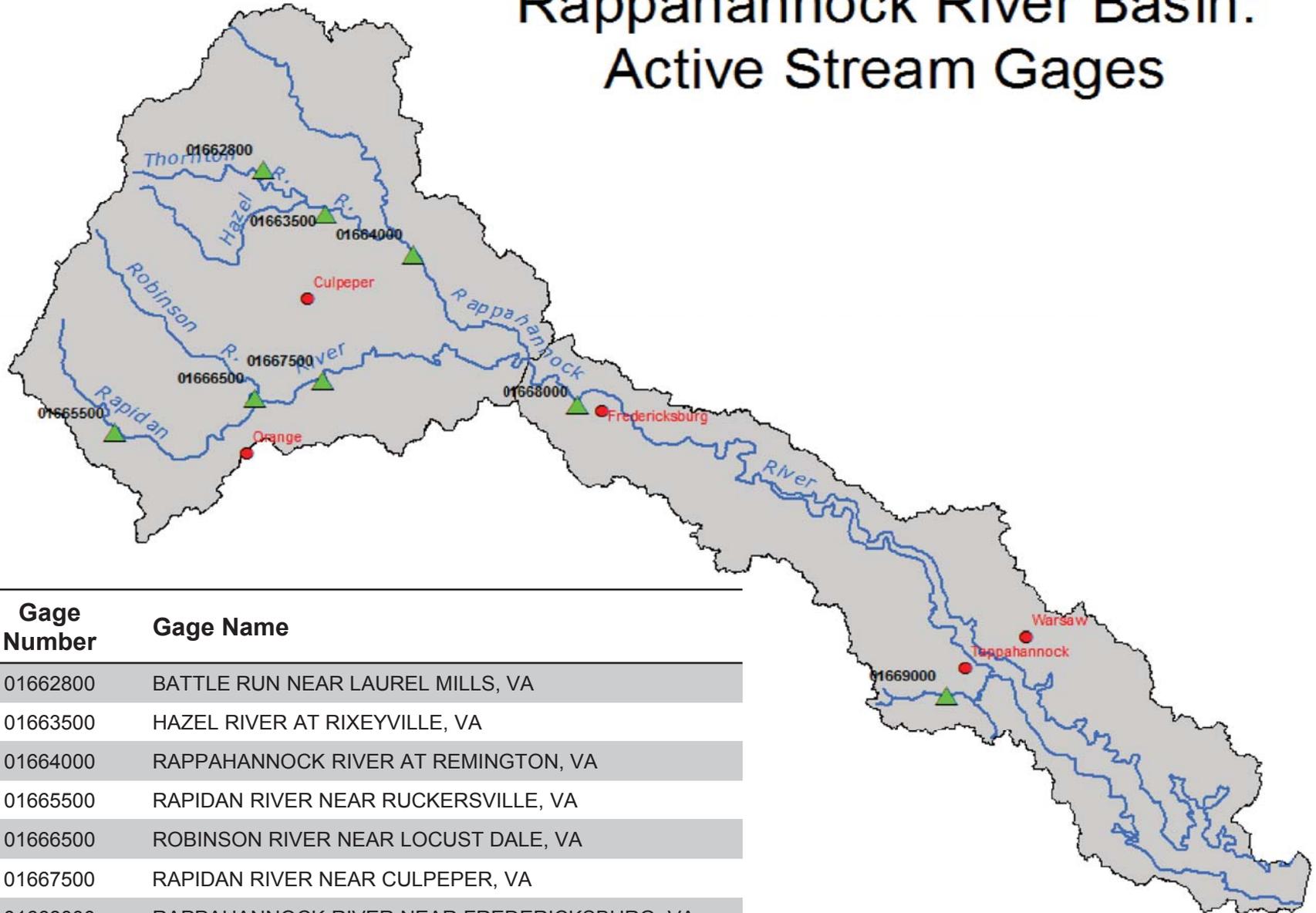
Virginia or Water-Resources Regions

Thursday, August 02, 2012 06:30ET





Rappahannock River Basin: Active Stream Gages



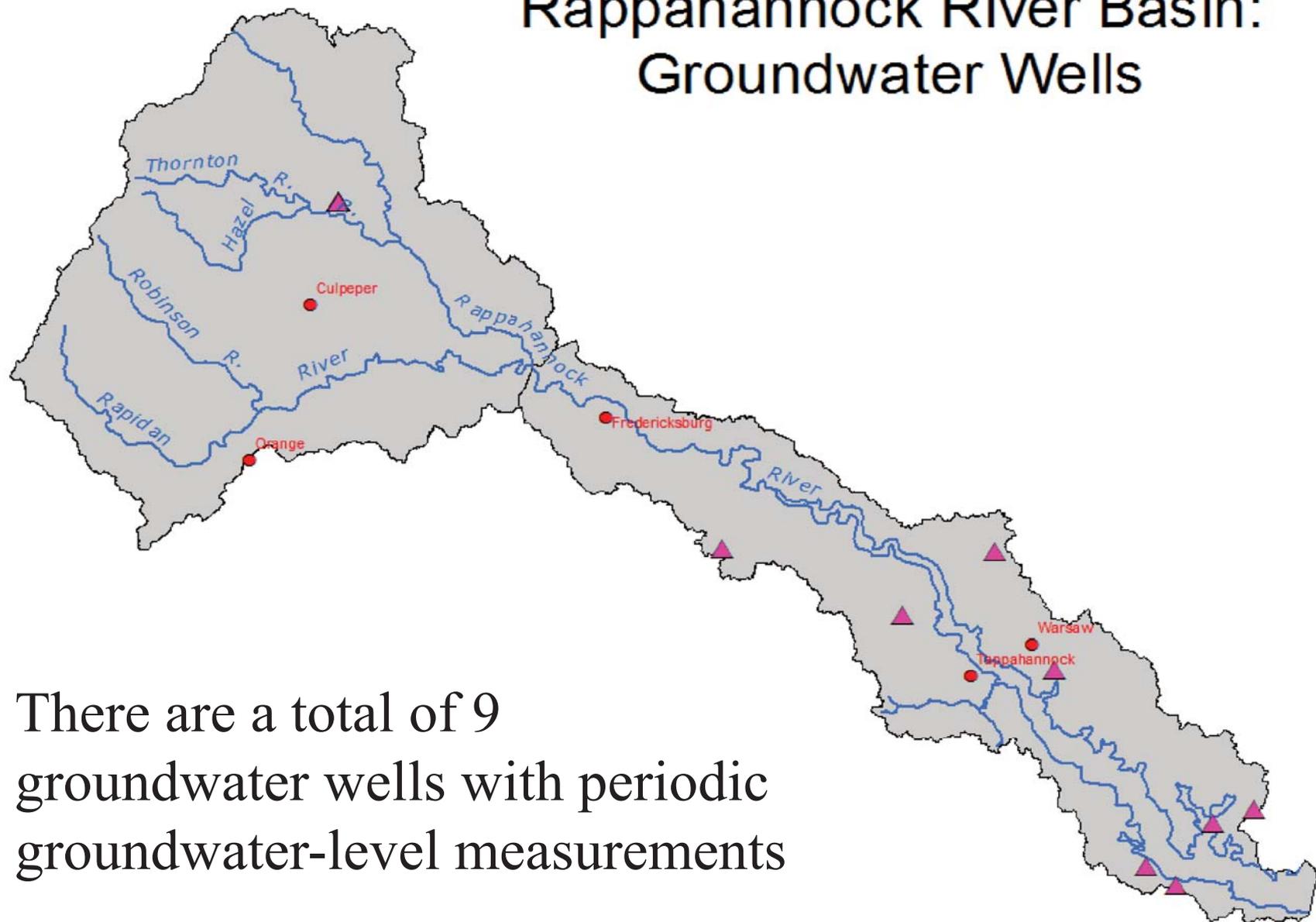
Gage Number	Gage Name
-------------	-----------

01662800	BATTLE RUN NEAR LAUREL MILLS, VA
01663500	HAZEL RIVER AT RIXEYVILLE, VA
01664000	RAPPAHANNOCK RIVER AT REMINGTON, VA
01665500	RAPIDAN RIVER NEAR RUCKERSVILLE, VA
01666500	ROBINSON RIVER NEAR LOCUST DALE, VA
01667500	RAPIDAN RIVER NEAR CULPEPER, VA
01668000	RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA
01669000	PISCATAWAY CREEK NEAR TAPPAHANNOCK, VA

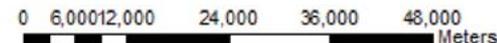
0 6,000 12,000 24,000 36,000 48,000 Meters



Rappahannock River Basin: Groundwater Wells

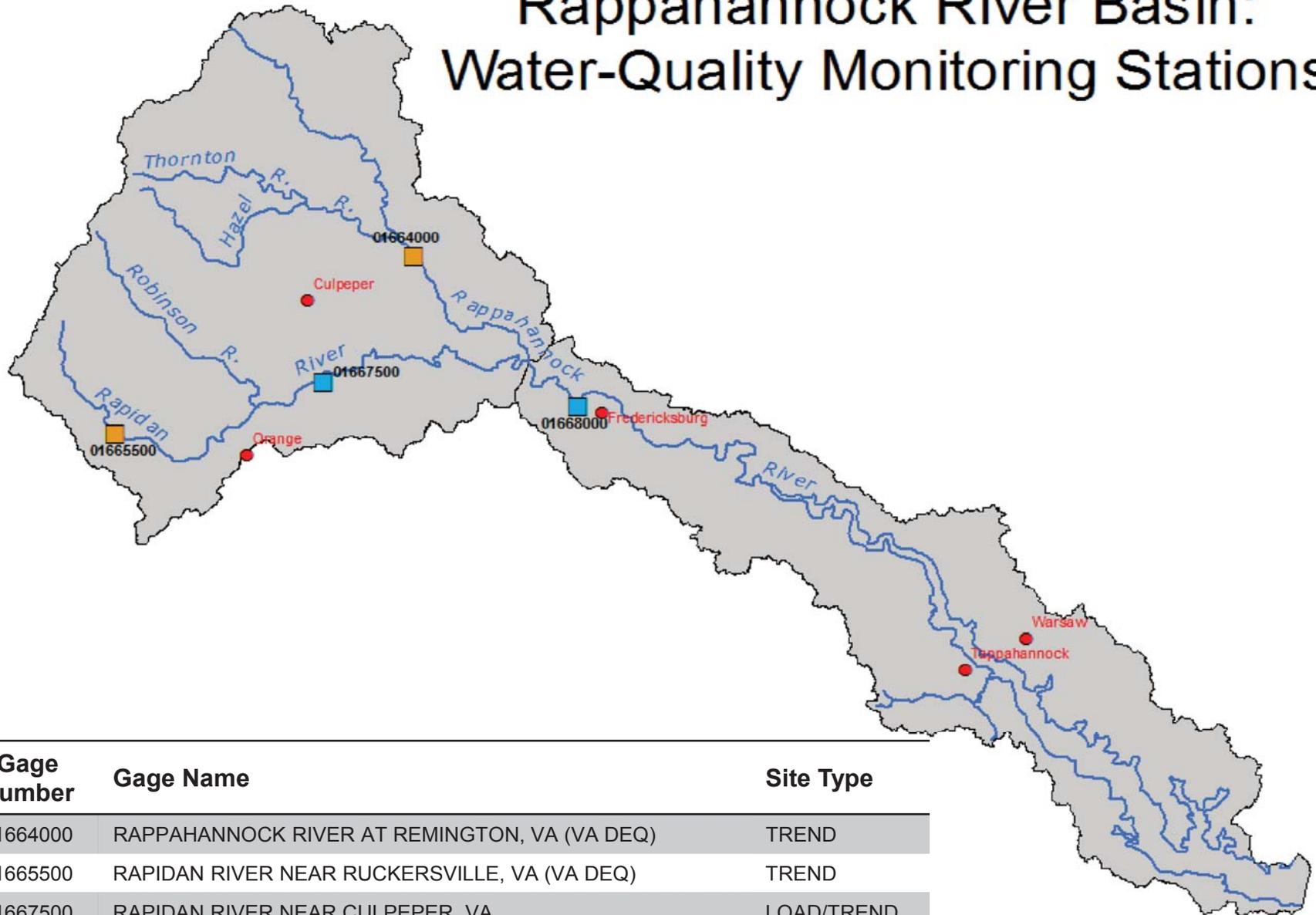


There are a total of 9
groundwater wells with periodic
groundwater-level measurements

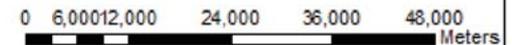




Rappahannock River Basin: Water-Quality Monitoring Stations



Gage Number	Gage Name	Site Type
01664000	RAPPAHANNOCK RIVER AT REMINGTON, VA (VA DEQ)	TREND
01665500	RAPIDAN RIVER NEAR RUCKERSVILLE, VA (VA DEQ)	TREND
01667500	RAPIDAN RIVER NEAR CULPEPER, VA	LOAD/TREND
01668000	RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	LOAD/TREND



Chesapeake Bay Program

- Much of the Chesapeake Bay is listed as impaired waters due to
 - Low dissolved oxygen
 - Poor water clarity
 - Algal blooms
- Impairments are related to elevated levels of sediment and nutrients
- Key program goals
 - Reduce sediment input to improve water clarity
 - Reduce nutrient delivery
 - Removal from the impaired water list

USGS Role in the Chesapeake Bay

- USGS serves as the principal technical agency by providing watershed science to support the Chesapeake Bay Program
- In Virginia, the USGS, in partnership with VA DEQ, performs nutrient and sediment water-quality monitoring, load/trend computation, as well as data analysis/interpretation for the entire nontidal water-quality monitoring network

Chesapeake Bay Nontidal Network:

Monitoring: (85-sites)

- Maryland
- Virginia
- West Virginia
- Pennsylvania
- West Virginia
- New York
- Delaware
- SRBC
- USGS

Approach:

- Consistent sampling and analytical methods

Analysis and Reporting

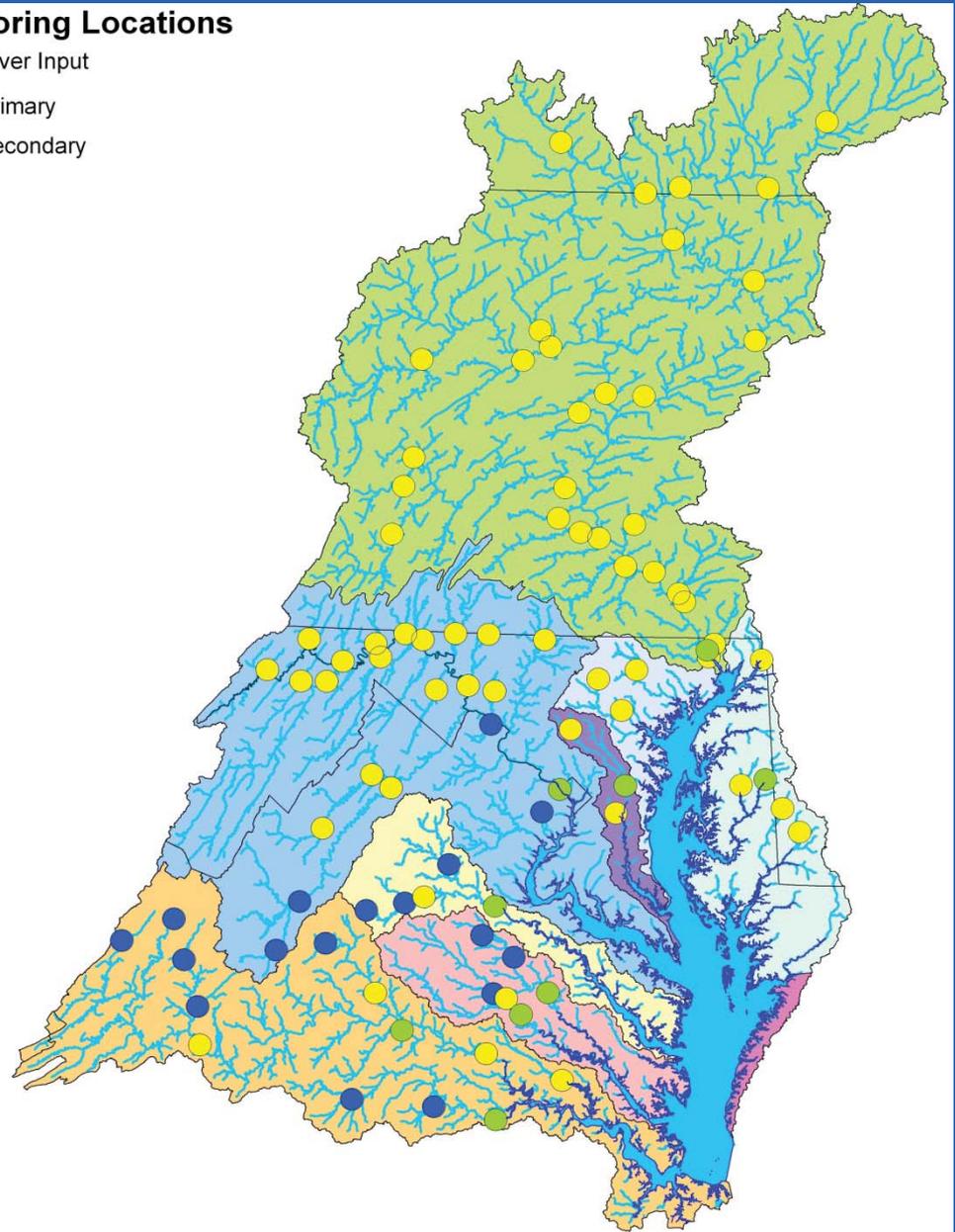
- Trends
- Loads
- Streamflow

Annual communication:

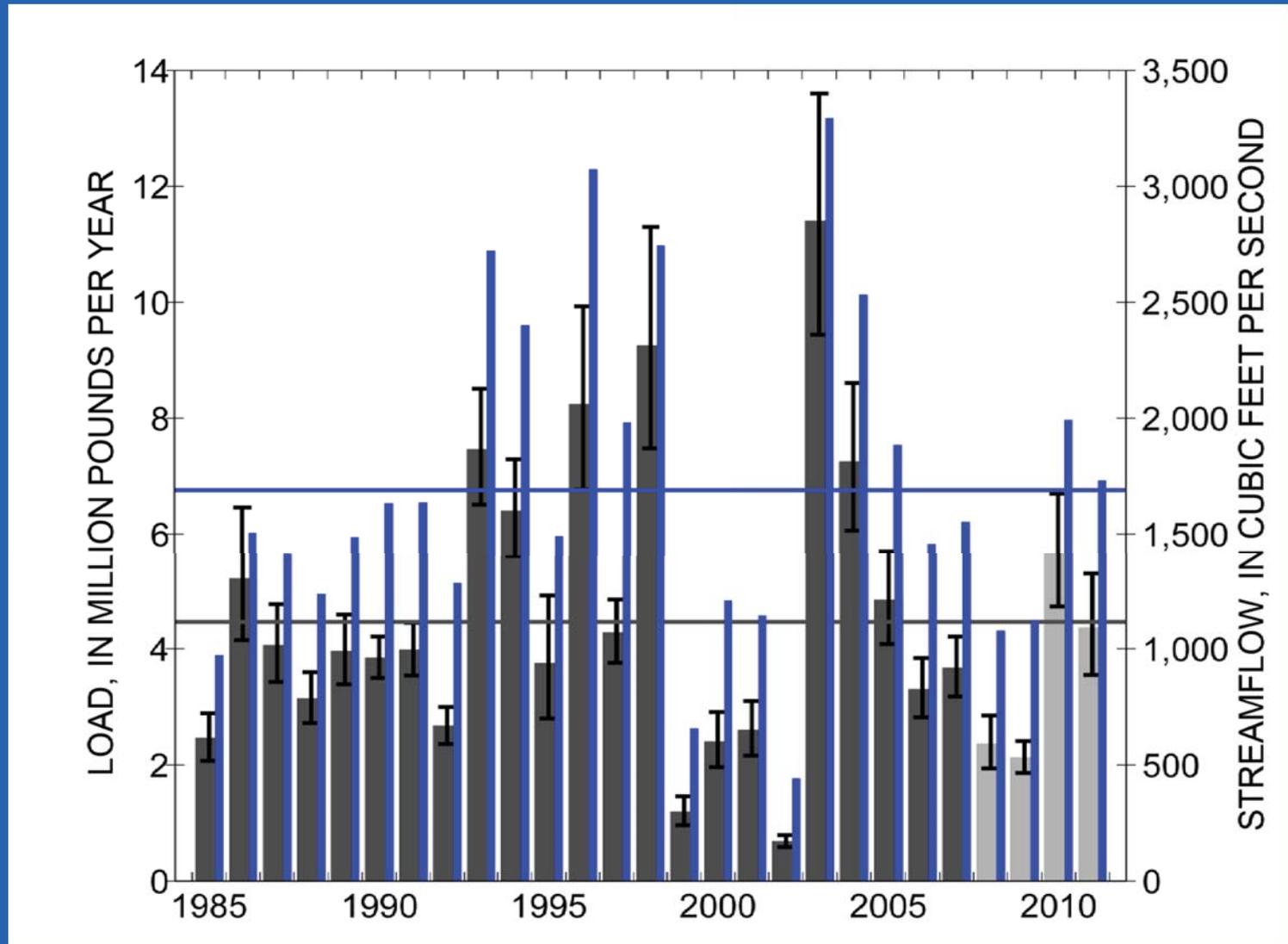
- Science Community
- Management Community
- Public

Monitoring Locations

- River Input
- Primary
- Secondary



Rappahannock River total nitrogen load



Loads also computed for: Nitrate, Total Phosphorus, Orthophosphorus, and Suspended Sediment

Long-term Trends: Total Phosphorus 1985-2009

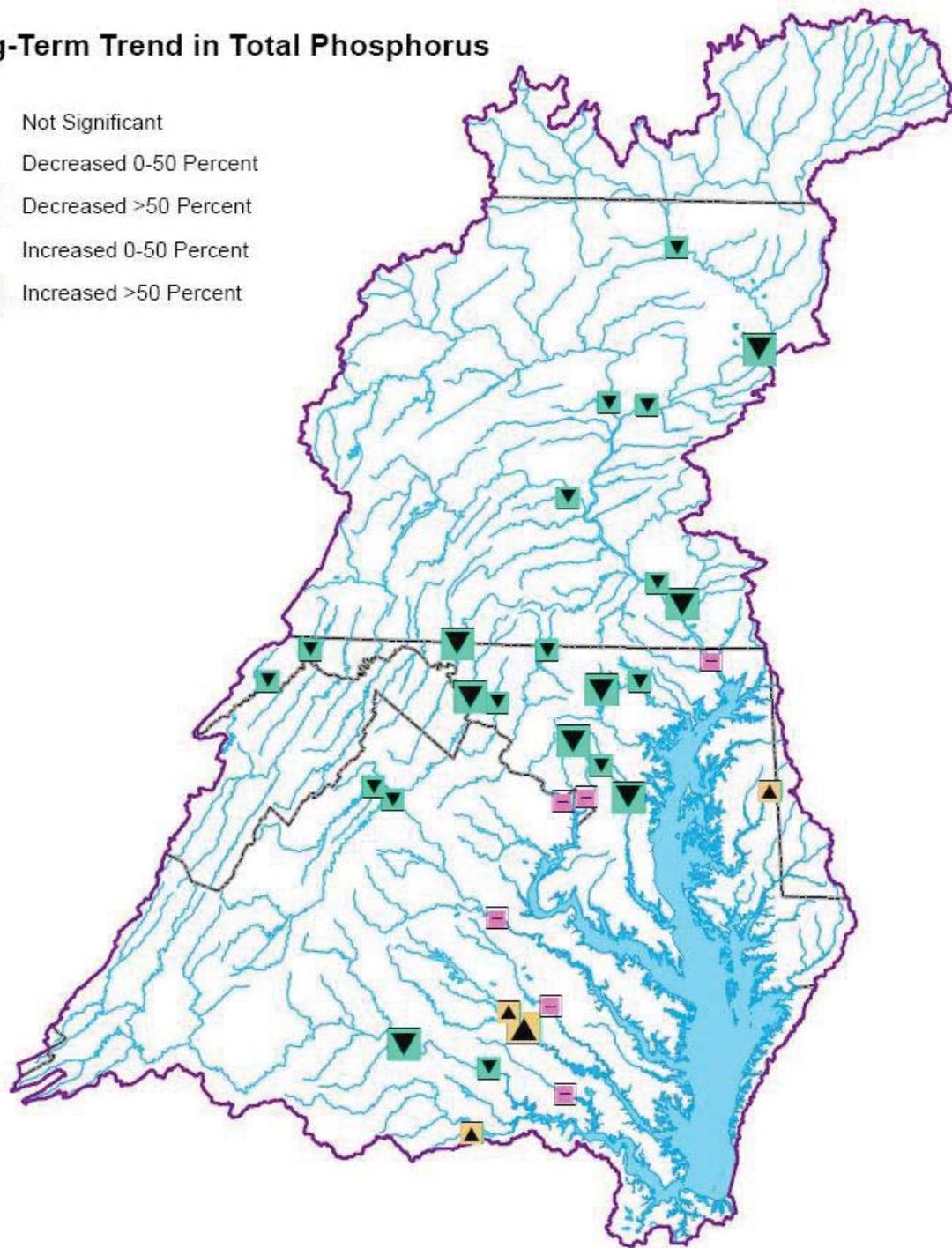
- Flow-adjusted concentration trend

Notes:

-  = Improving water quality/decreasing nitrogen levels
-  = No trend detected in either the up or down direction
-  = Degrading water quality/increasing nitrogen levels

Long-Term Trend in Total Phosphorus

-  Not Significant
-  Decreased 0-50 Percent
-  Decreased >50 Percent
-  Increased 0-50 Percent
-  Increased >50 Percent



USGS Publication

Report is available on the
Web at:

<http://pubs.usgs.gov>

Key word: 2012-5093

Authors:

Mike Langland
Joel Blomquist
Doug Moyer
Ken Hyer



Nutrient and Suspended-Sediment Trends, Loads, and Yields and Development of an Indicator of Streamwater Quality at Nontidal Sites in the Chesapeake Bay Watershed, 1985–2010

Scientific Investigations Report 2012–5093

U.S. Department of the Interior
U.S. Geological Survey



New USGS Web page for Water-Quality Loads and Trends in the Chesapeake Bay Watershed

Changes in Streamflow and Water Quality in Selected Nontidal Basins in the Chesapeake Bay Water - Windows Internet Explorer

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

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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- Interactive Map

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- Load Tables
- Yield Table
- Trend Results Table

Contacts

- Partners
- USGS Chesapeake Activities
- Technical Contacts
- Web Administrator

Water Quality Loads and Trends Information

Welcome to the USGS website dedicated to providing water quality trend and load results for the nontidal rivers of the Chesapeake Bay Watershed.

The objectives of this 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 Data Provided

The data utilized for these analyses are collected by numerous agencies through the Chesapeake Bay Program watershed water-quality monitoring partnership. Results are presented for the 2010 water year at a network of 80 water quality monitoring stations distributed throughout the Chesapeake Bay Watershed.

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

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

Click on the image above to access the interactive map

Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: <http://cbrim.er.usgs.gov/index.html>
Page Contact Information: [Web Administrator](#)
Page Last Modified: Friday, 29-Jun-2012 17:32:01 EDT

USA.gov TAKE PRIDE IN AMERICA

Trusted sites | Protected Mode: Off

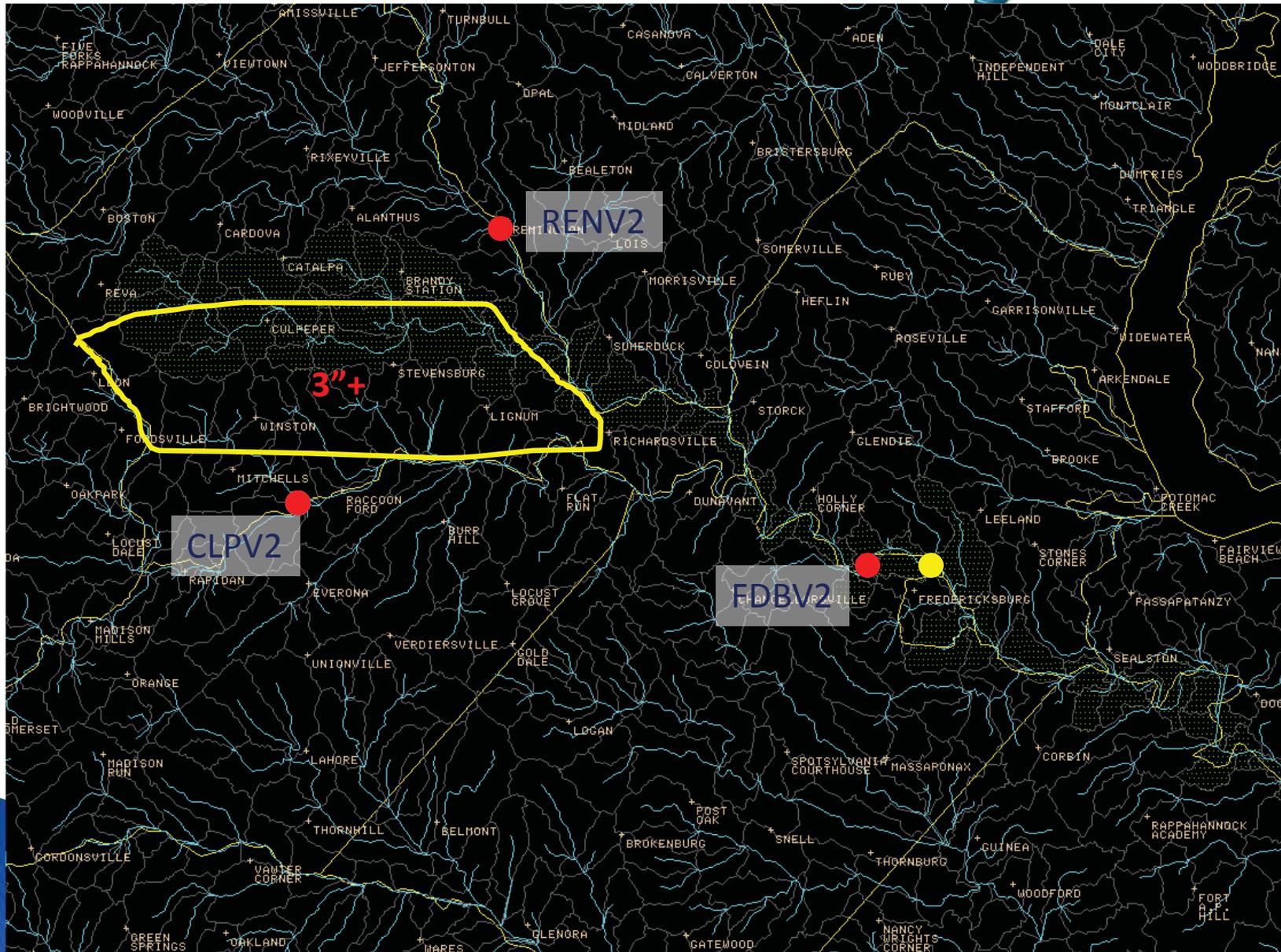


<http://cbrim.er.usgs.gov/index.html>

Rappahannock Basin & Gauging Overview

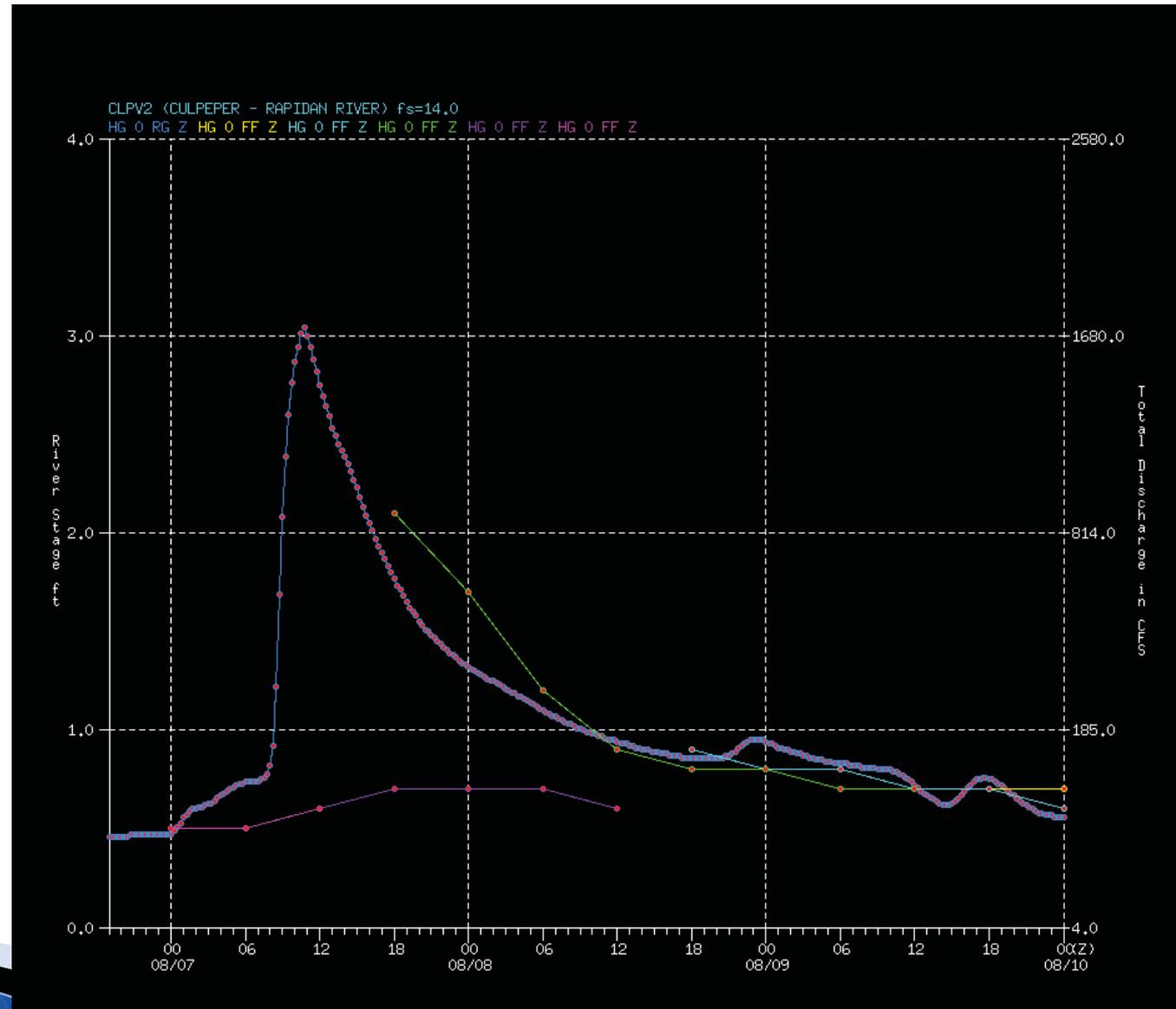
Jason Elliott
August 2, 2012

This all started last August...



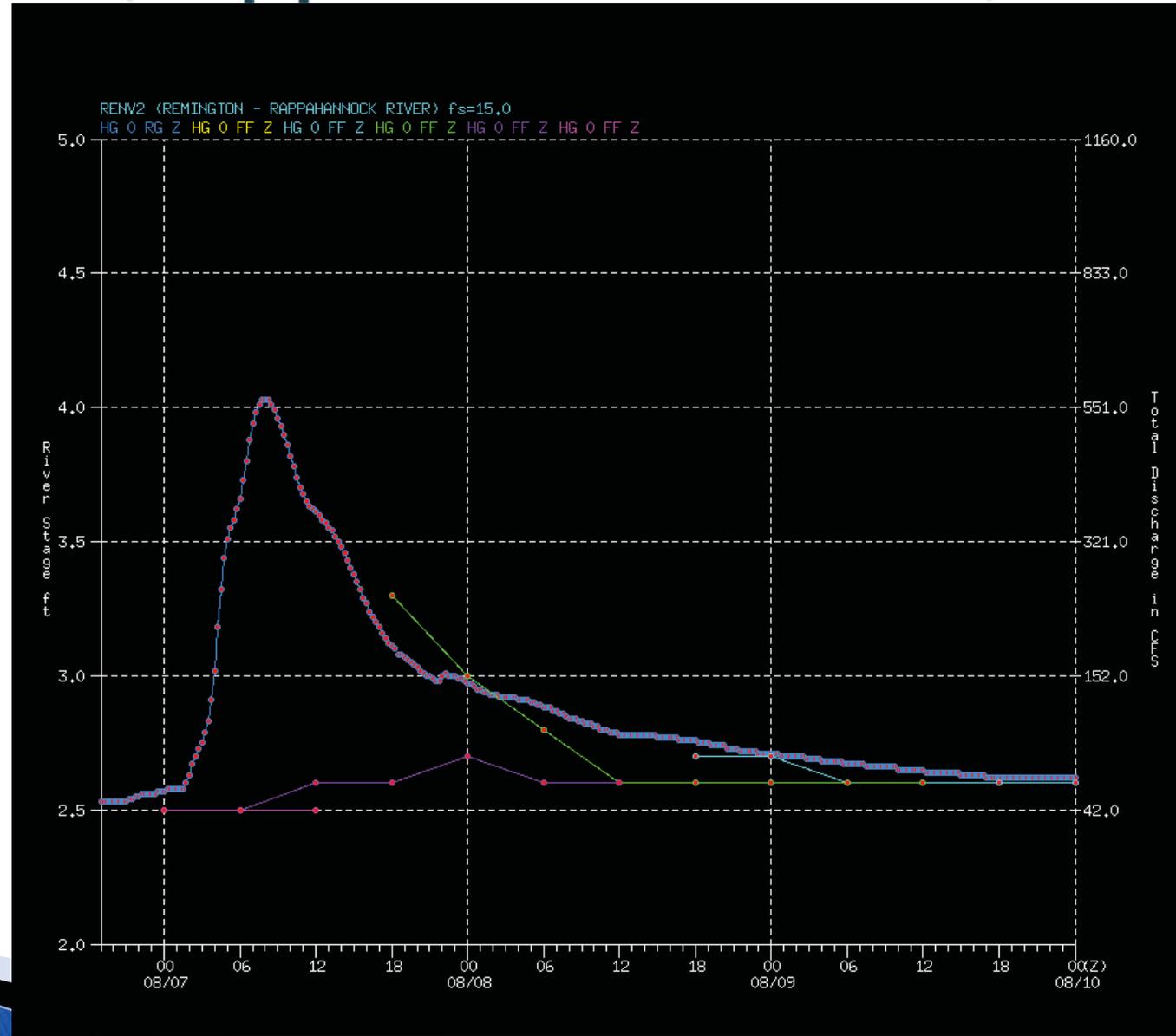
Culpeper (Rapidan River)

Peak flow:
1716 cfs
1045 UTC
08/07
(3.04 feet)



Remington (Rappahannock River)

Peak flow:
566 cfs
0815 UTC
08/07
(4.03 feet)



Above Fredericksburg (Rappahannock)

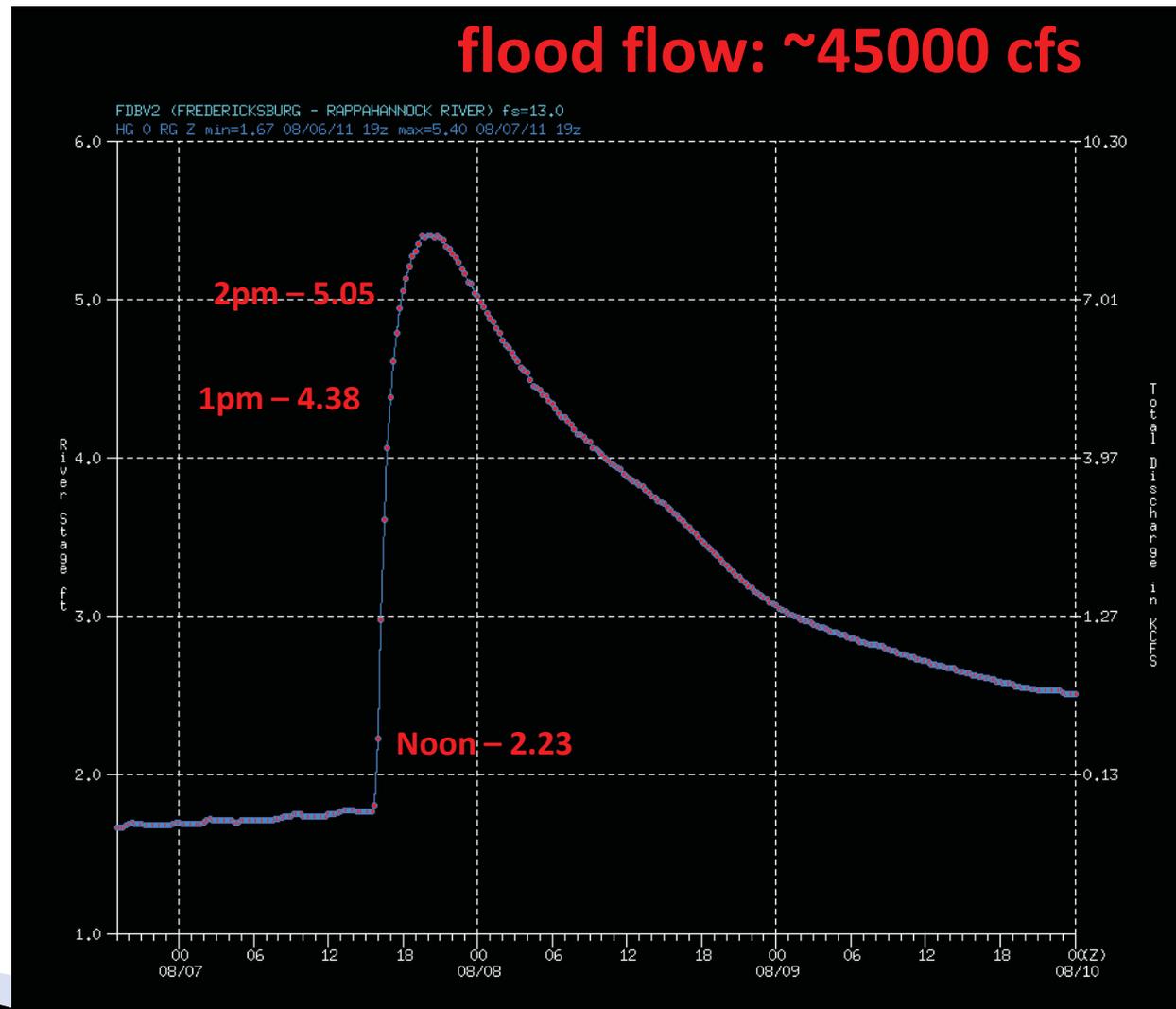
Peak flow:

8880 cfs

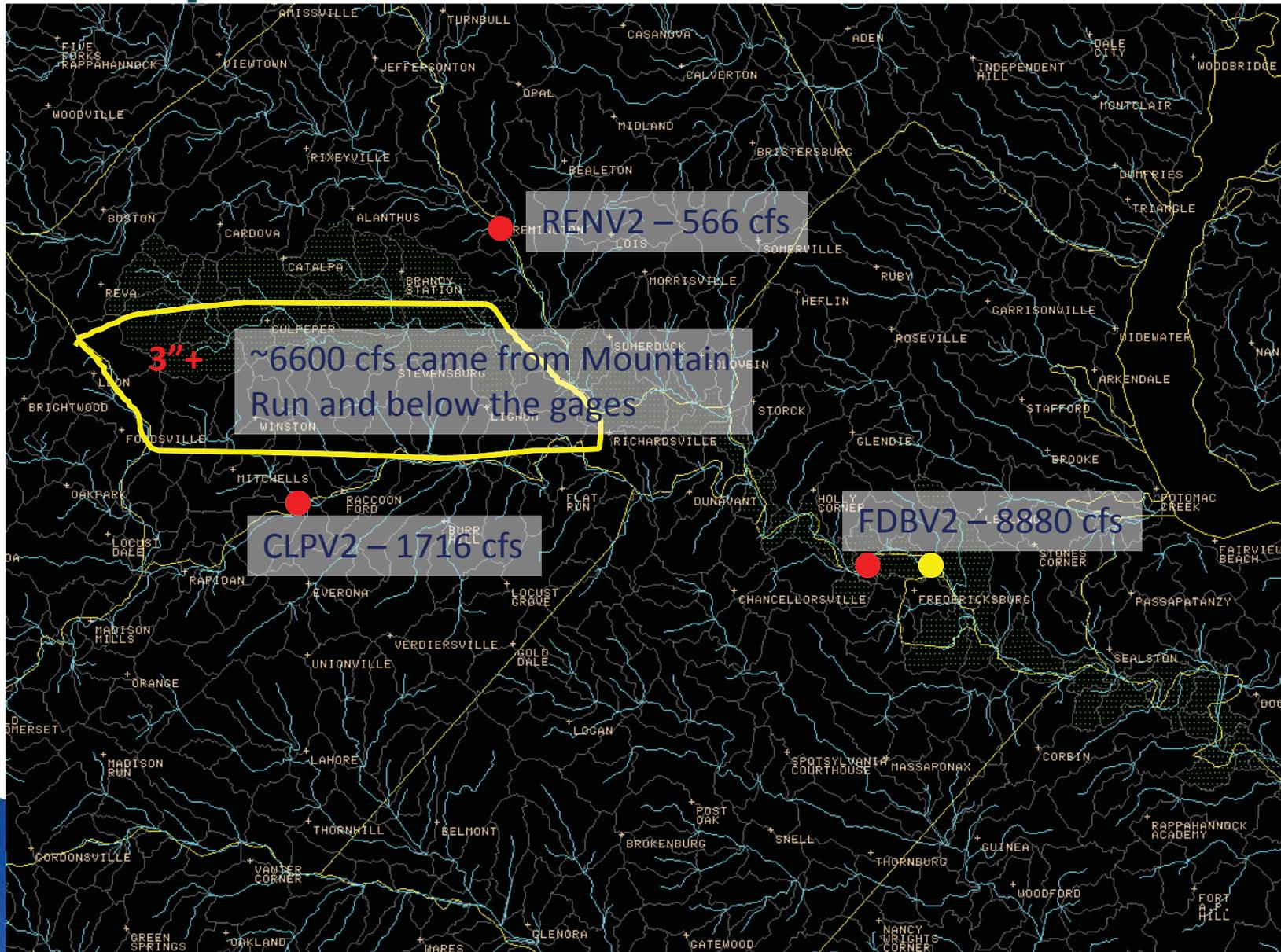
1930-2045

UTC 08/07

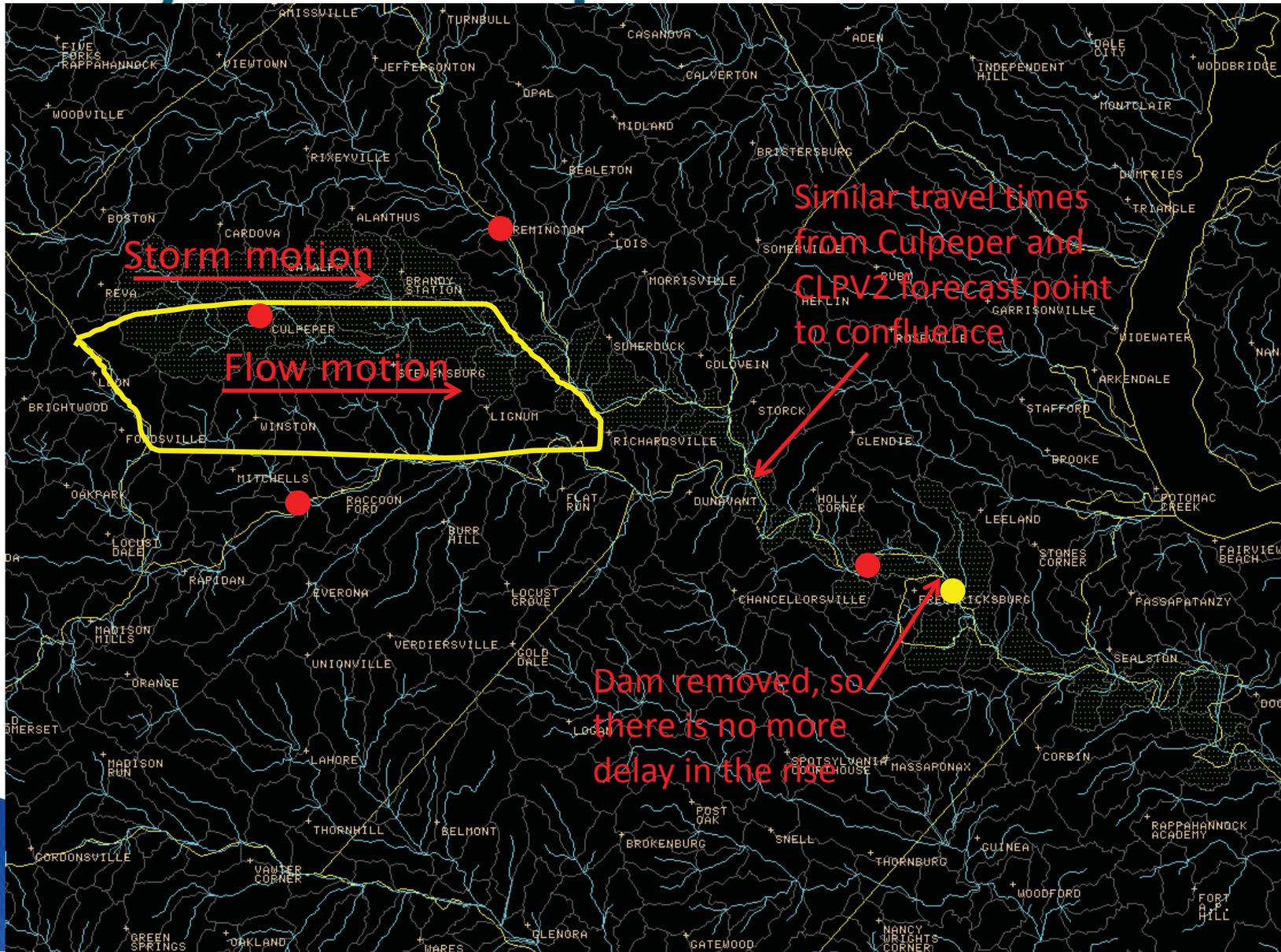
(5.40 feet)



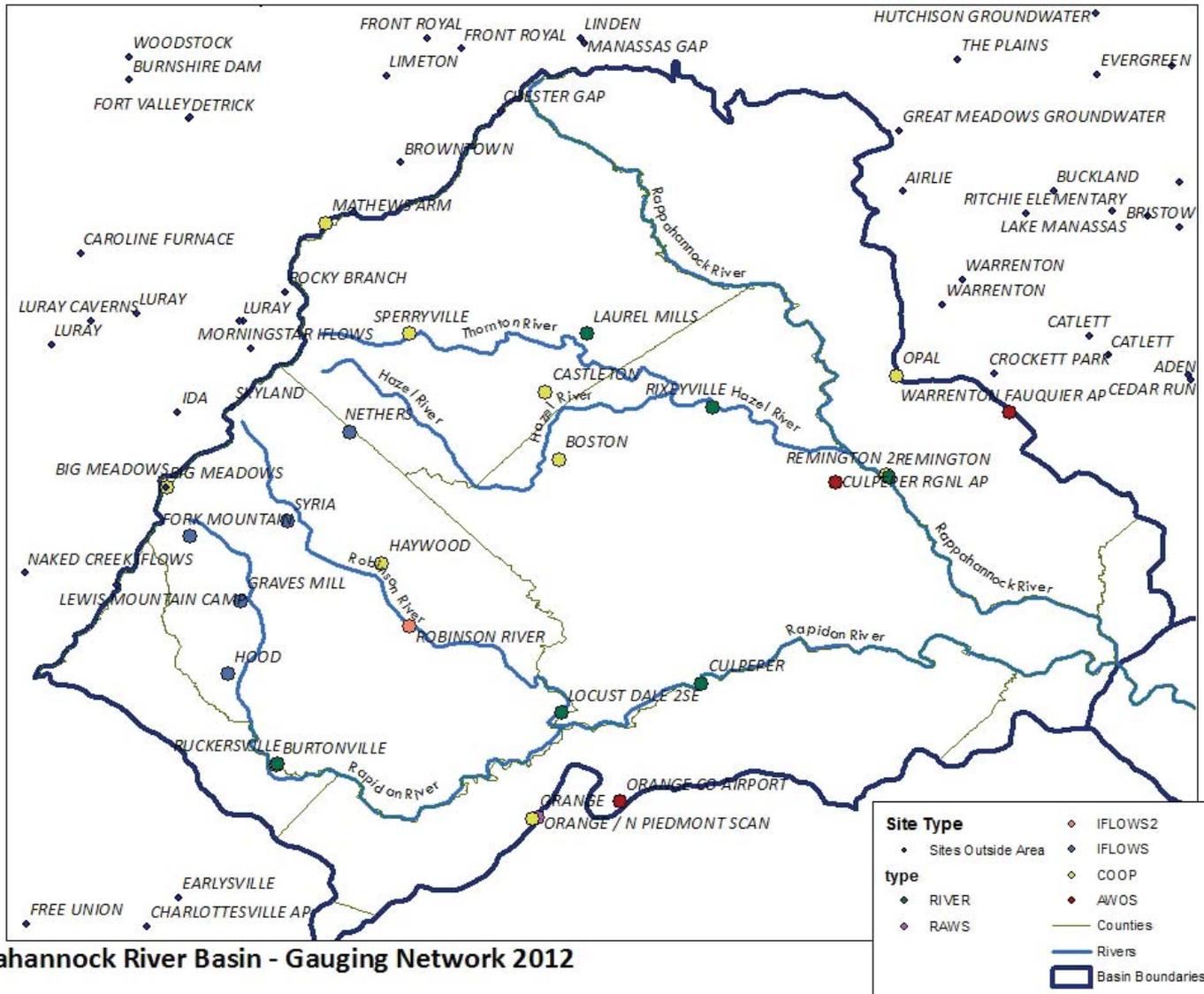
Not present and accounted for...



Why the sharp rise?

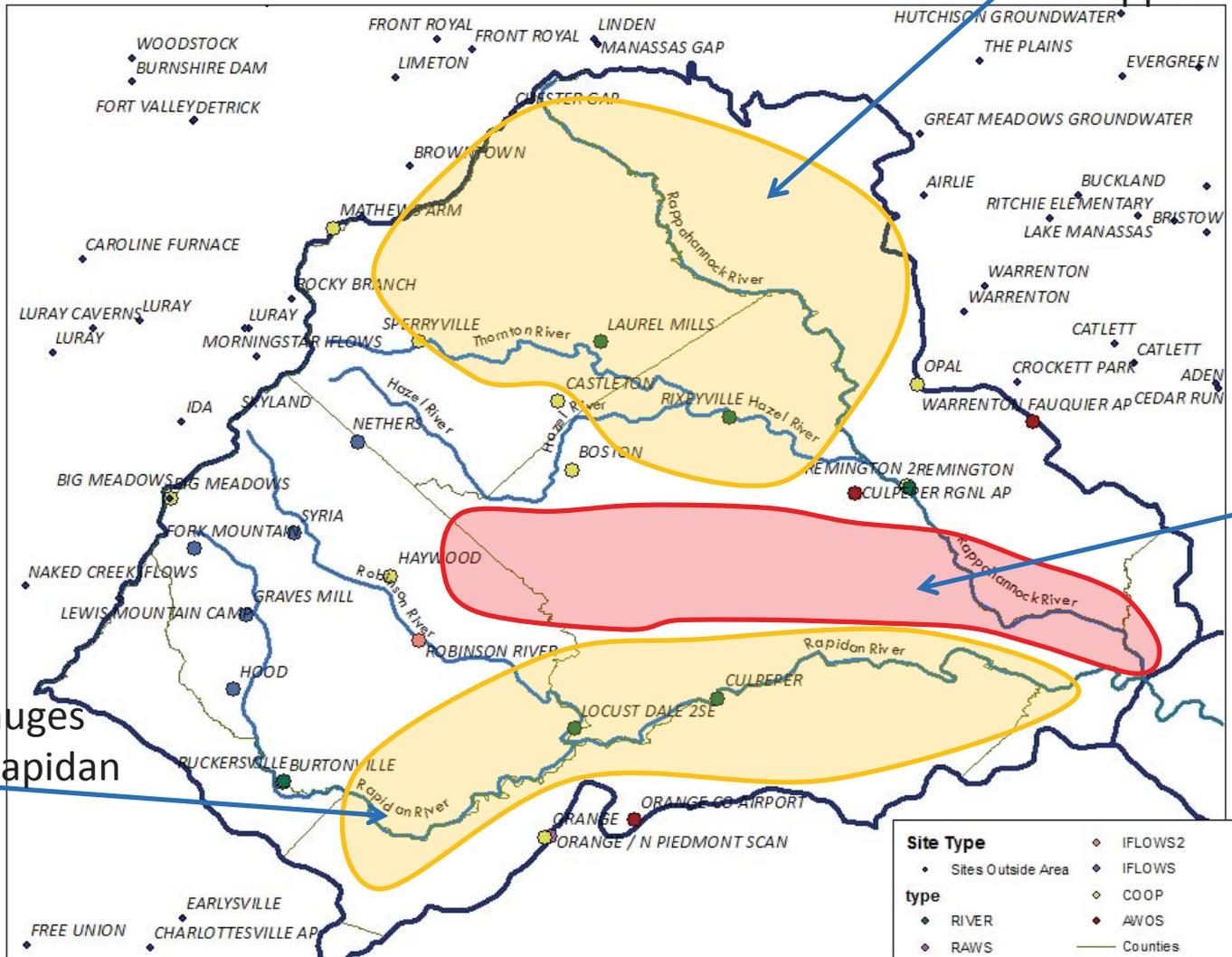


Existing Gauge Network



Where are the gaps?

No rain or river gauges in uppermost Rappahannock



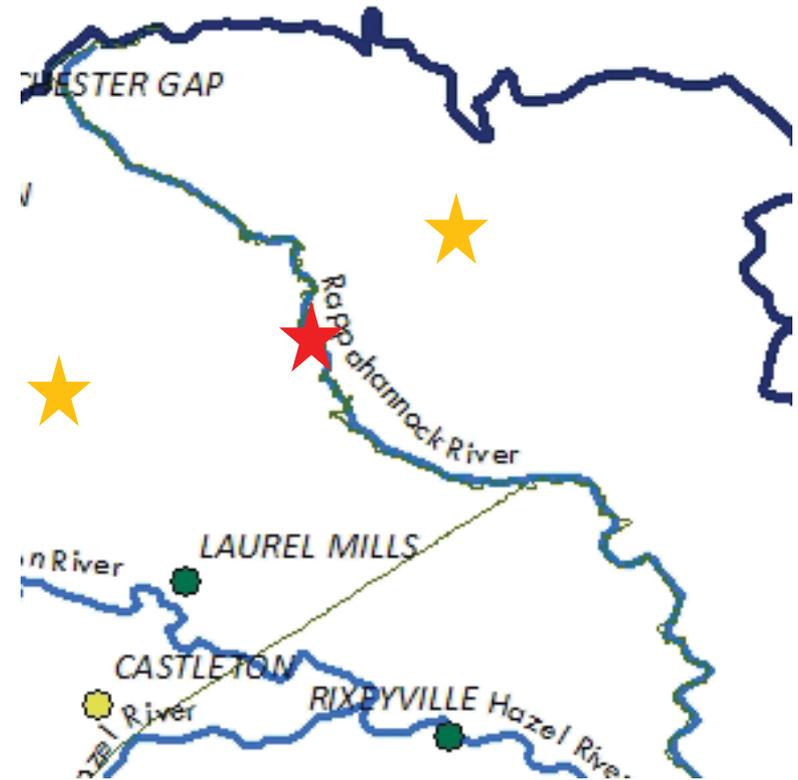
Absolutely nothing in Mountain Run (Culpeper)

No rain gauges in lower Rapidan

Rappahannock River Basin - Gauging Network 2012

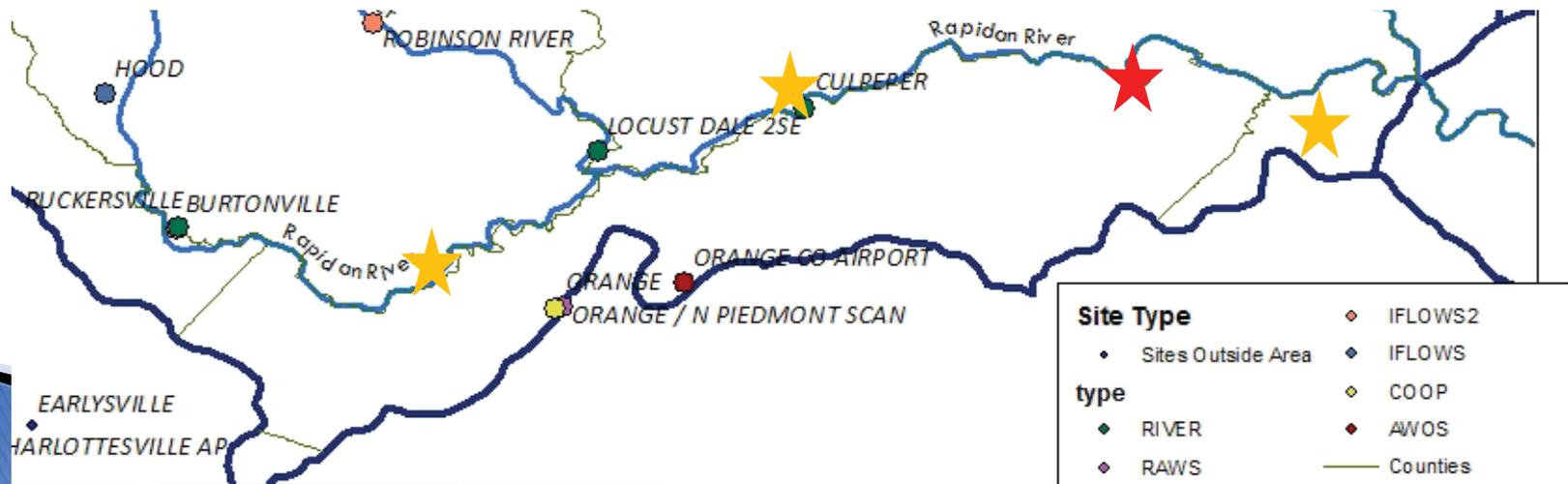
What can be done to fill gaps?

- ▶ Multiple rain gauges needed in this part of the basin
- ▶ Stream gauge on upper Rappahannock (Cresthill Rd or below to capture flow from Jordan River)



What can be done to fill gaps?

- ▶ Stream levels fairly well represented in the Rapidan
 - Perhaps something downstream of US 522?
- ▶ Almost no rain data in this section
 - Rain gauges desperately needed from Ruckersville eastward



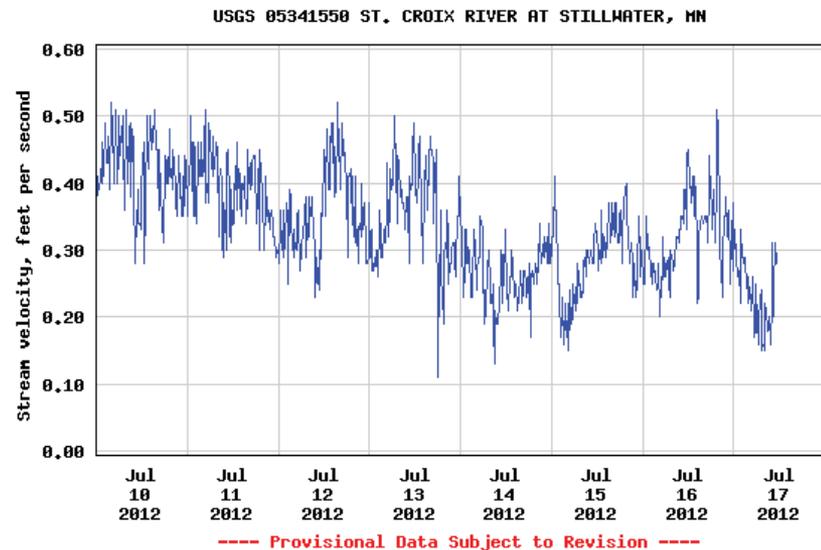
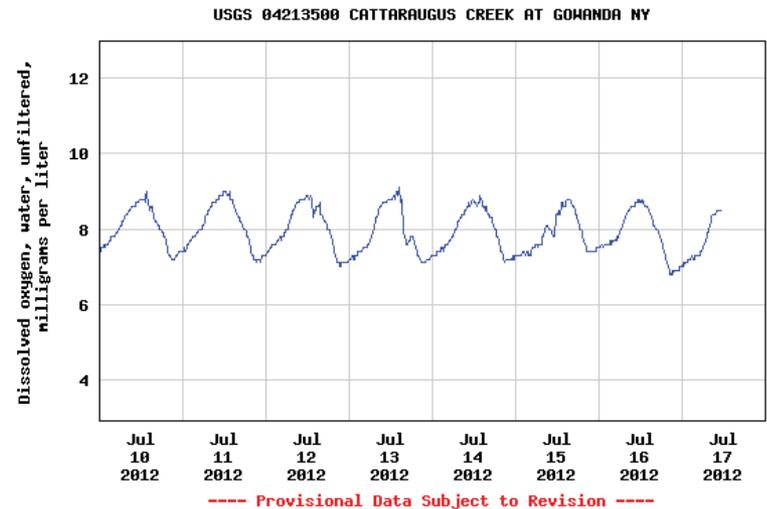
What can be done to fill gaps?

- ▶ No monitoring exists in Mountain Run basin
- ▶ Town of Culpeper left very vulnerable
- ▶ Also area on the Rappahannock downstream of Mountain Run mouth



Key Equipment Needs

- ▶ Real-Time Data
 - Better radar interpretation
 - Ingest into computer modeling
 - Forecast verification
- ▶ Stream Measurements
 - In addition to flow, elements like temperature (air & water?), water quality, even velocity can be important



Key Equipment Needs

- ▶ Rain Measurements
 - Need a heatable/winterized equipment set
 - Otherwise...it is no good in winter
 - Weighing rain gauges are preferred

