

# Using Flood History, Surveys, and Frequency Studies to Determine Flood Risk

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*October 20, 2016*

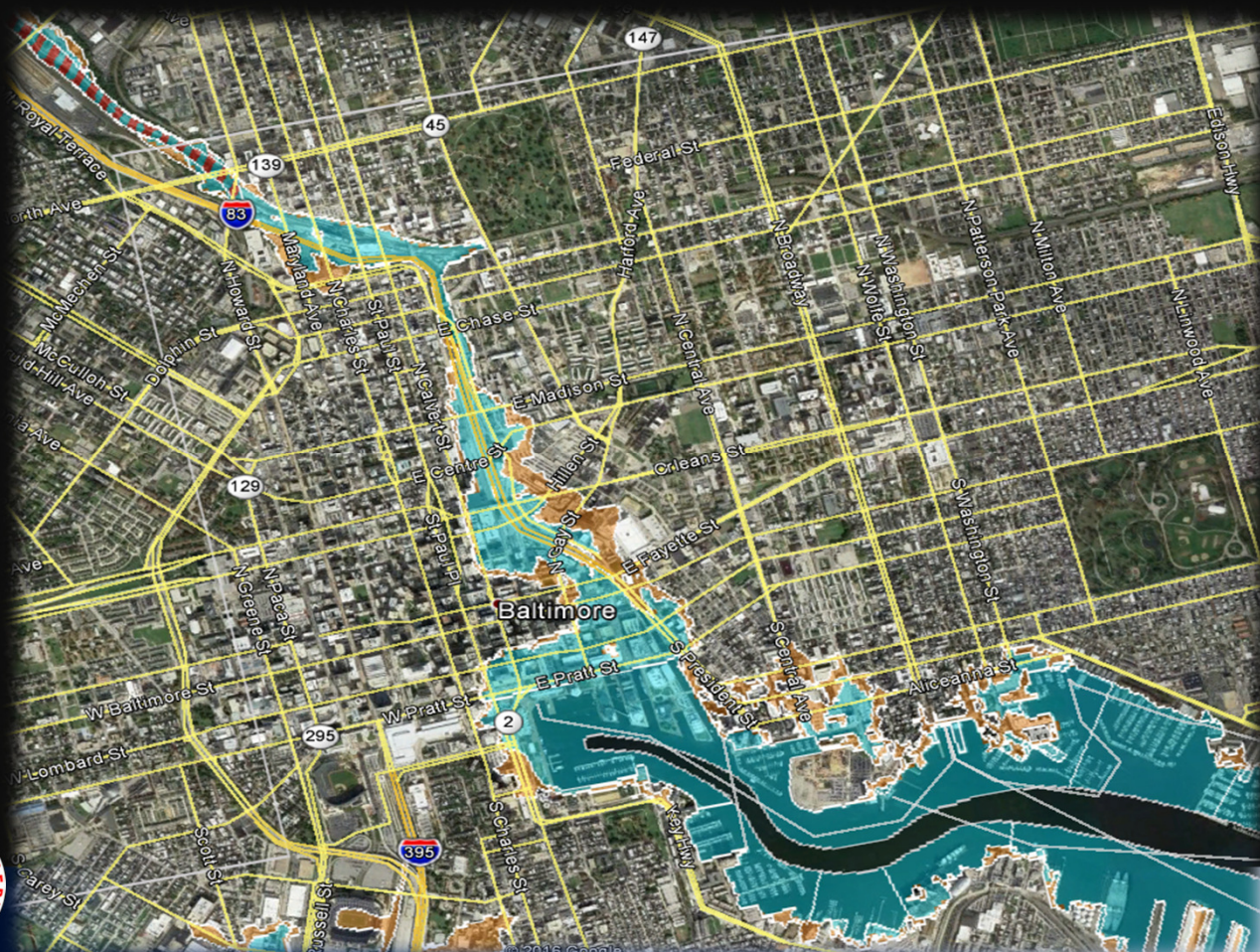
*Maryland Association of Floodplain and Stormwater Managers*





# Background

- ▶ Traditionally, flood risk is viewed in terms of the FEMA Flood Maps – zones, floodplains, etc.



# National Weather Service Mission

- ▶ The National Weather Service (NWS) provides weather, **hydrologic**, and climate **forecasts and warnings** for the United States, its territories, adjacent waters and ocean areas, **for the protection of life and property** and enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.



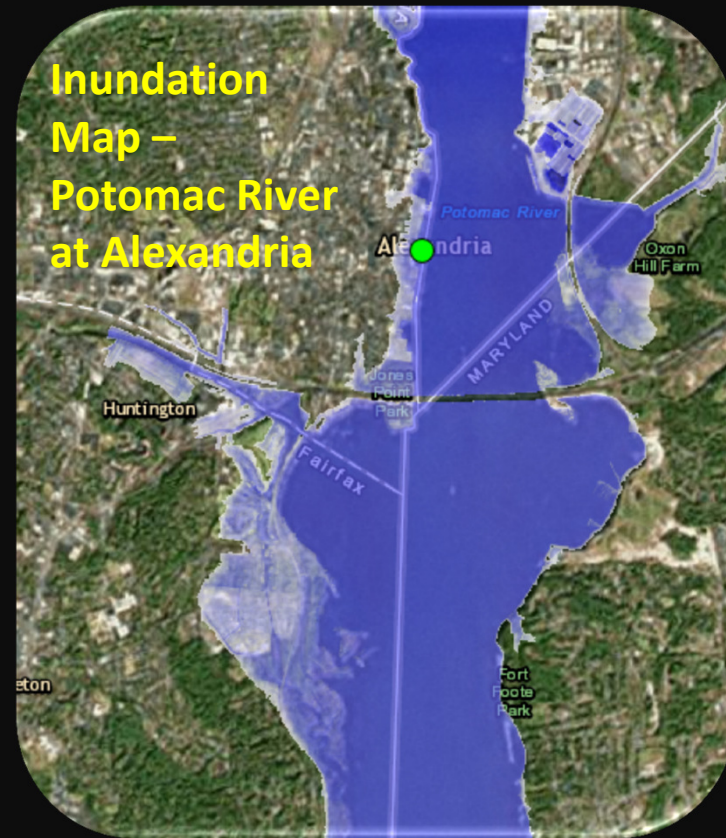
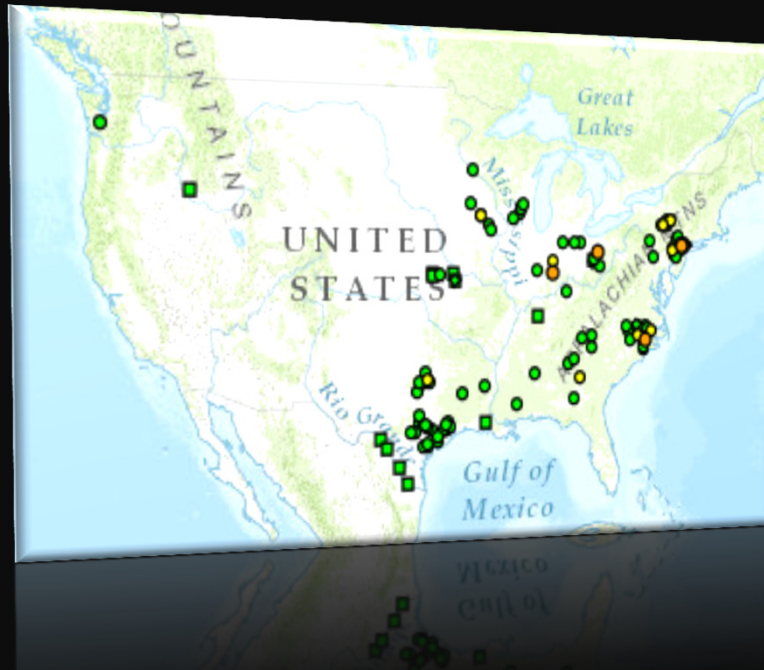
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# Motivation

- ▶ How do we tell the story of flood risk in real time with respect to the NWS mission, and convey that risk relative to the locations for which we forecast/warn?



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# Methodology

- ▶ Using stream gauge locations:
  - Obtain Gauge History
  - Obtain Flood History
  - Conduct an on-site survey

} USGS



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# Methodology

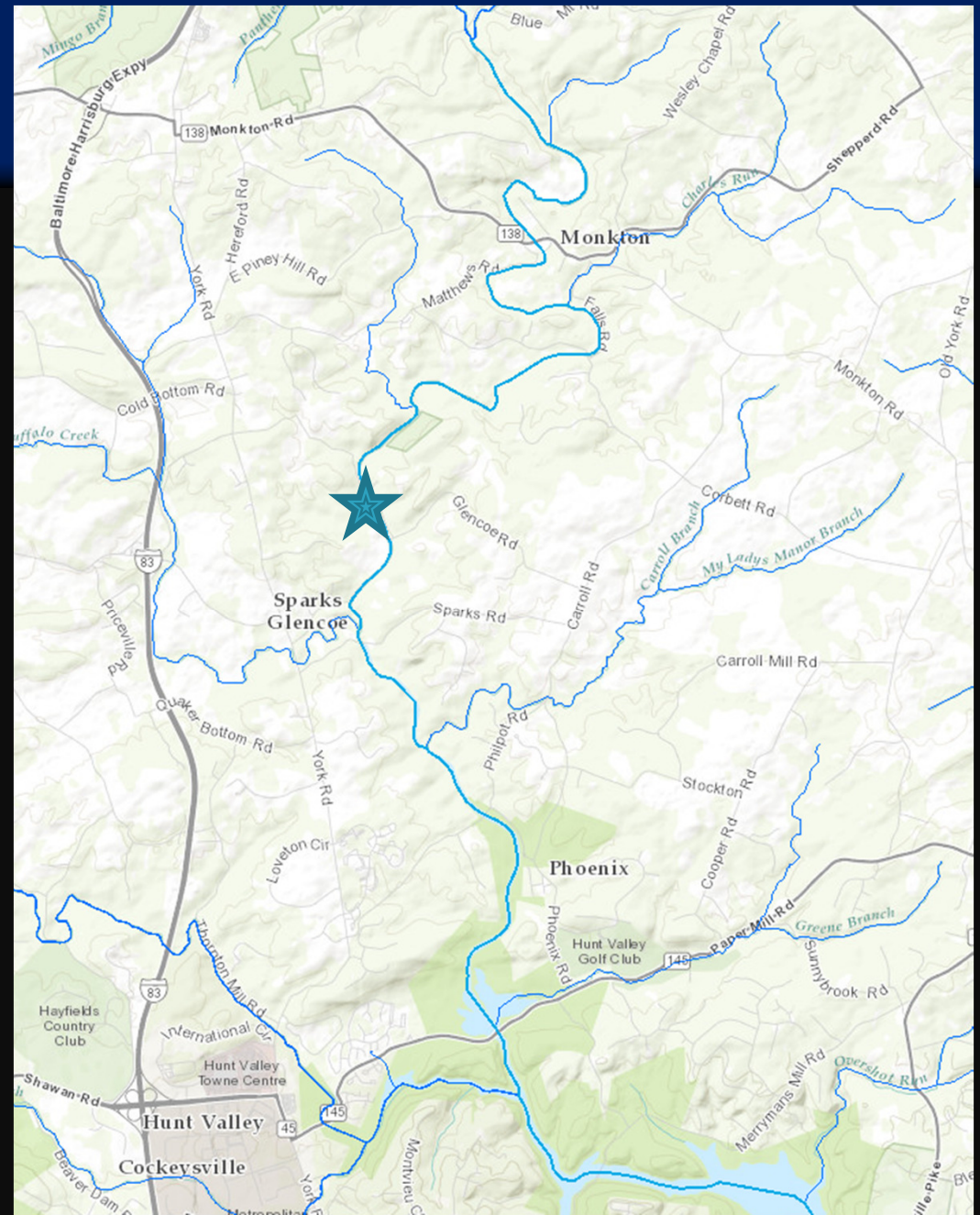
- ▶ Use FEMA Flood Maps & especially FIS data, where available
- ▶ Determine a **Flood Stage** and what is impacted at that flood stage
  - NWS Flood Stage is not bankfull (unless something is immediately impacted upon going overbank)
- ▶ Perform Flood Frequency Analysis based on all the collected data





# Example

- ▶ Gunpowder Falls at Glencoe, MD



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# Example

## ▶ Gunpowder Falls – Sparks Road

North County residents and businesses got a brutal lesson in the power of that fast-moving water.

In Sparks, about 20 rolls of heavy plastic that line landfills floated from a storage yard at Hallaton Inc. on Sept. 7. Each roll weighs 3,000 pounds, is 23 feet long and is 2 1/2 feet in diameter.

The rolls floated across Sparks Road, through the parking lot for Bike & Hike Trail, over a wooden fence and ended up in the woods.

Hallaton employees and their families spent the next two days hauling the plastic liners out of the woods where front-end loaders picked them up and brought them back to the storage yard.

They also cleaned up the environmental service business that had 4 feet of water in its first floor.

"We moved things upstairs for Hurricane Irene, but then brought everything back down," said Todd Harman, president. "We thought the worst was over."

Hallaton has been in Sparks for five years, in a former creamery that was renovated and enlarged.

Across the road, volunteers and Department of Natural Resources personnel emptied the Sparks Nature Center of rugs, cabinets, shelves, books and displays that were muddy and wet.

The Nature Center is housed in the former Sparks State Bank building. A recently painted mural depicting life in and on the Gunpowder was not damaged, but many of the taxidermy animals displayed under the mural were under water.



more/Washington

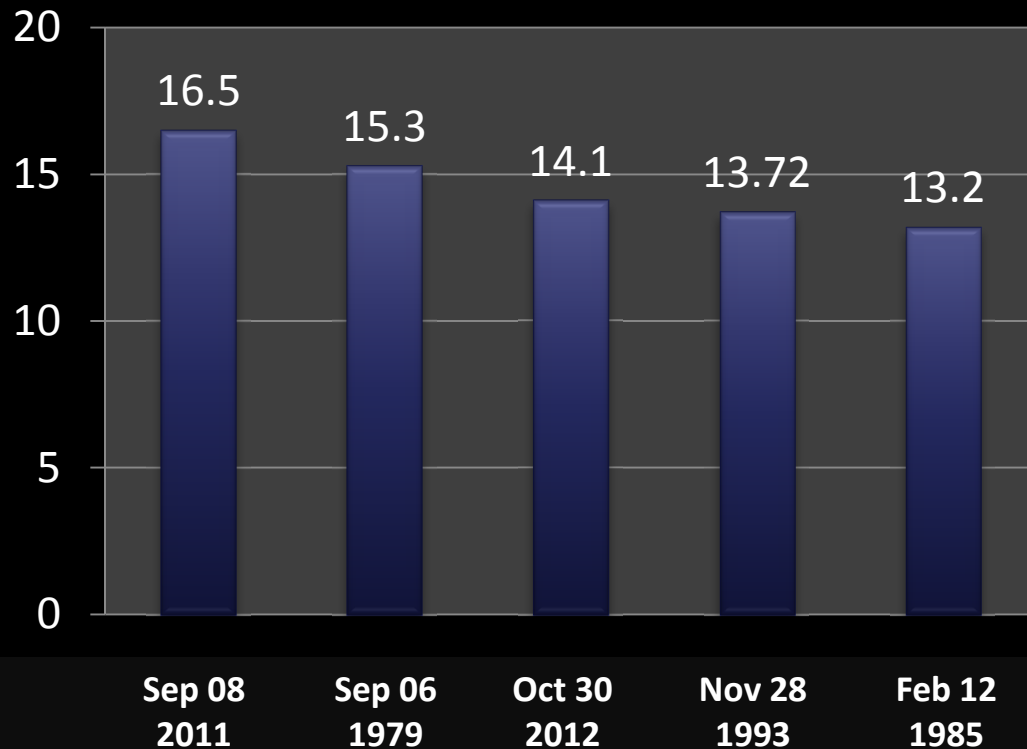




# Example

## ▶ Gunpowder Falls at Glencoe, MD

- 12 Several feet of water is in buildings off Sparks Road, with numerous roads flooded in the area.
- 10.5 Portions of the NC RR Trail begin to flood near Glencoe.
- 10 Water enters buildings off Sparks Road, and portions of Home Road begin to flood.
- 9 Sparks Road begins to flood.
- 7 Portions of Upper Glencoe Road and Lower Glencoe Road begin to flood.



Top 5 historical floods



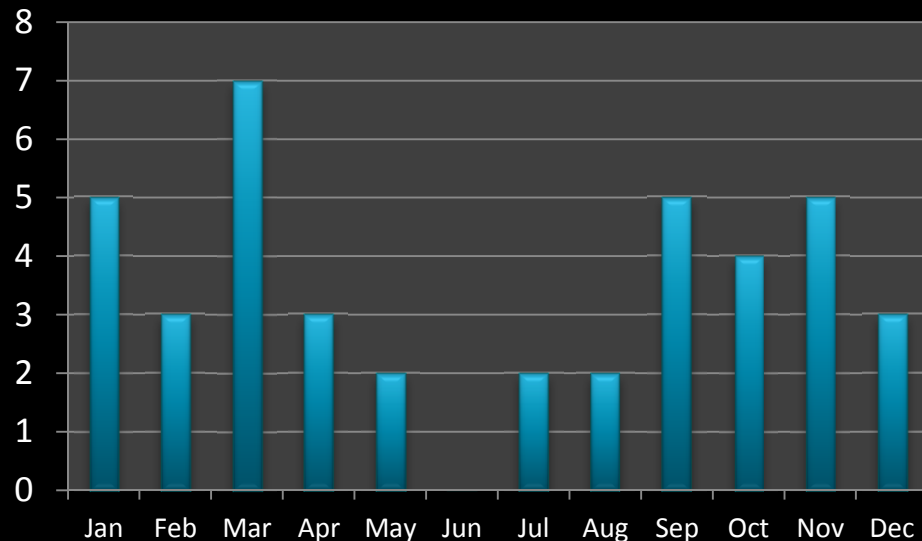
# Example

## ▶ Gunpowder Falls at Glencoe, MD

### March Floods:

**2015 (3 times!), 2014, 2011, 2010, 1994, and 1993**

**Last September or November flood: 2011**



GUNPOWDER FALLS AT GLENCOE						
Period of Record:		1981	2015			
# of Years:			34			
Count Above Action Stage -->	5	58	1.705882		1.705882	TIMES PER YEAR
Count Above Flood Stage -->	7	41	1.205882		1.205882	TIMES PER YEAR
Count Above Mod Flood -->	10	17	0.5	EVERY	2	YEARS
Count Above Major Flood -->	12	10	0.294118	EVERY	3.4	YEARS
Flood of Record		16.5	Sep 8 2011			



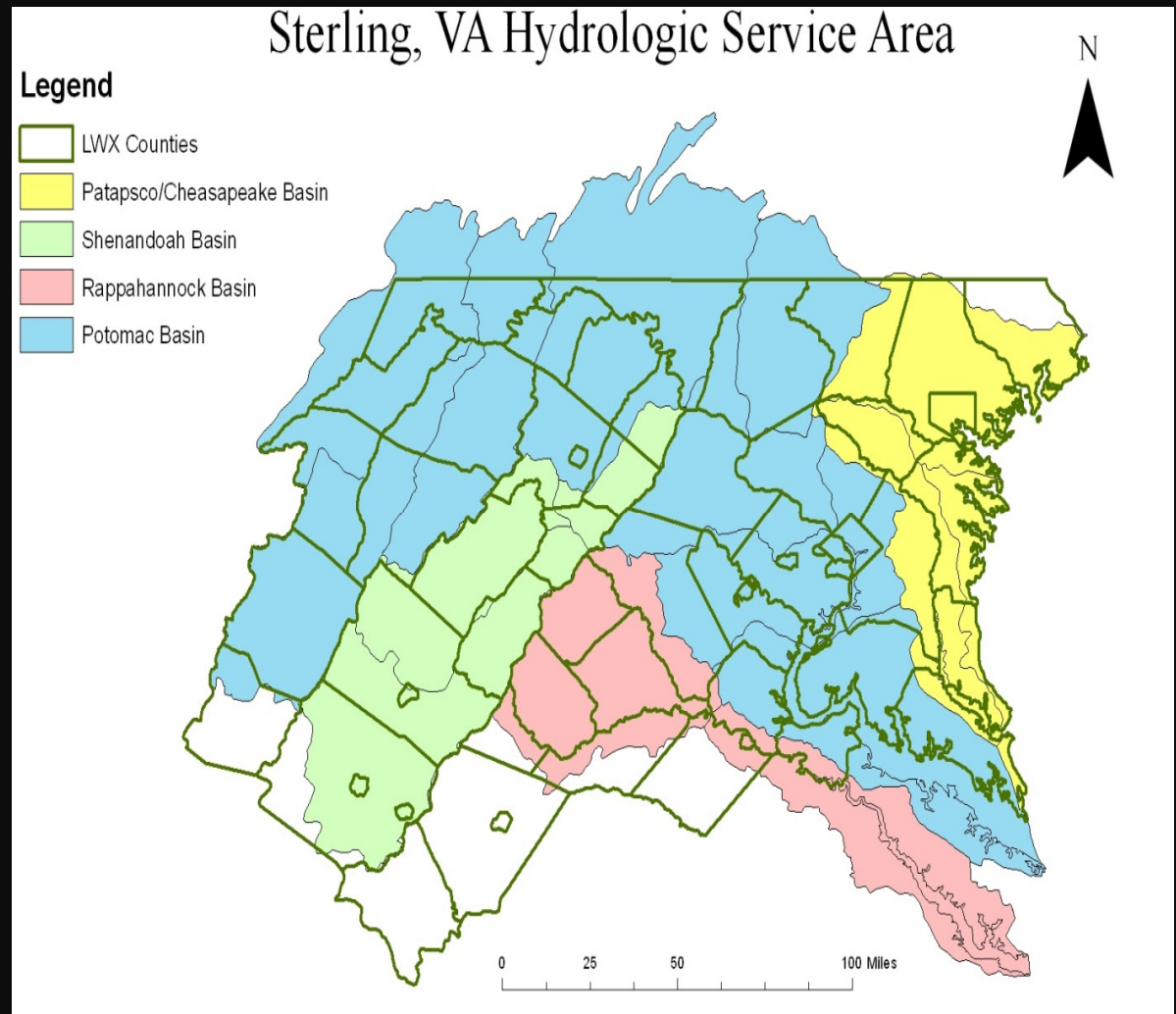
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# Study Area

- ▶ Includes all of Maryland west of the Chesapeake Bay, except for western Garrett County.
- ▶ Shenandoah, Potomac, Patuxent, Patapsco, and Rappahannock basins.

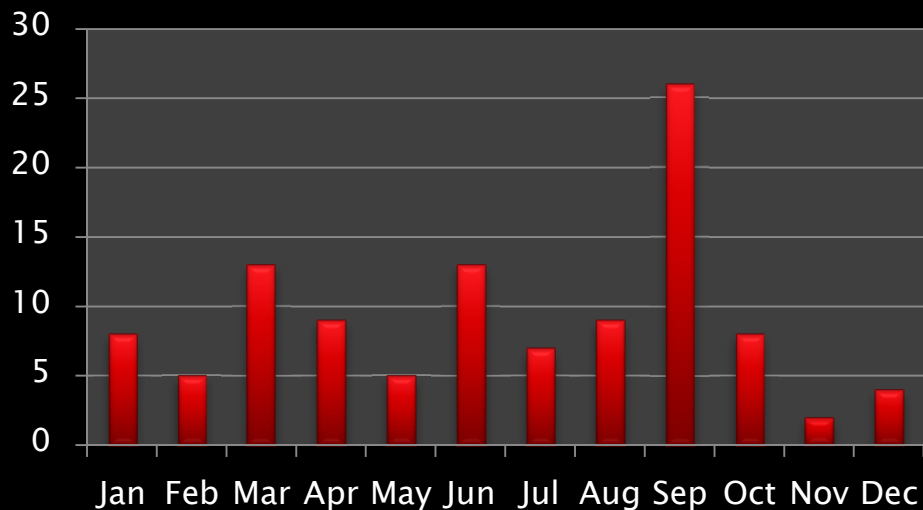


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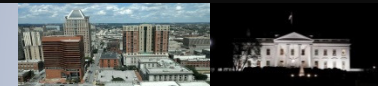
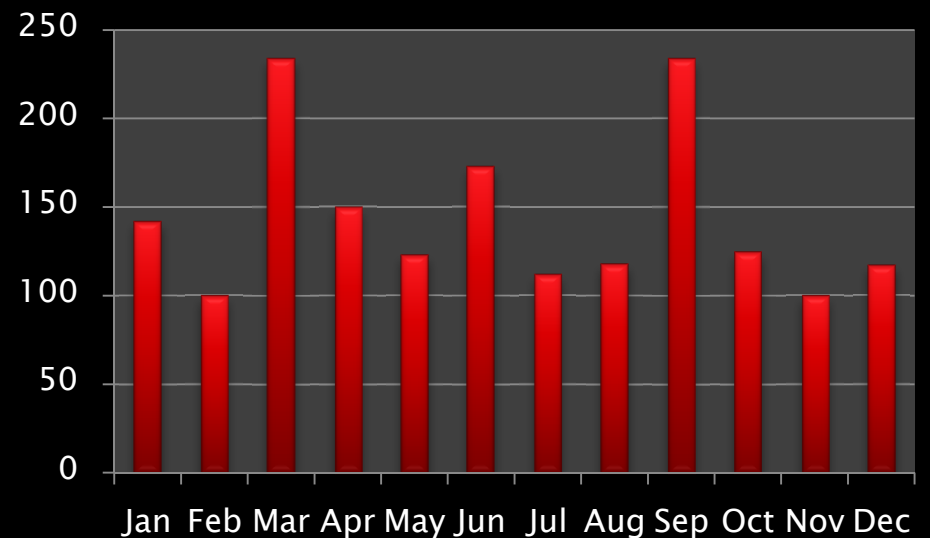
# Overall Results – Maryland

- ▶ In what months are flooding favored?



**At Left:** Subjective based on monthly frequency at individual sites (more than one month can be “favored” at each location).

**At Right:** Objective based on total occurrences at all sites combined (total number of sites = 67)

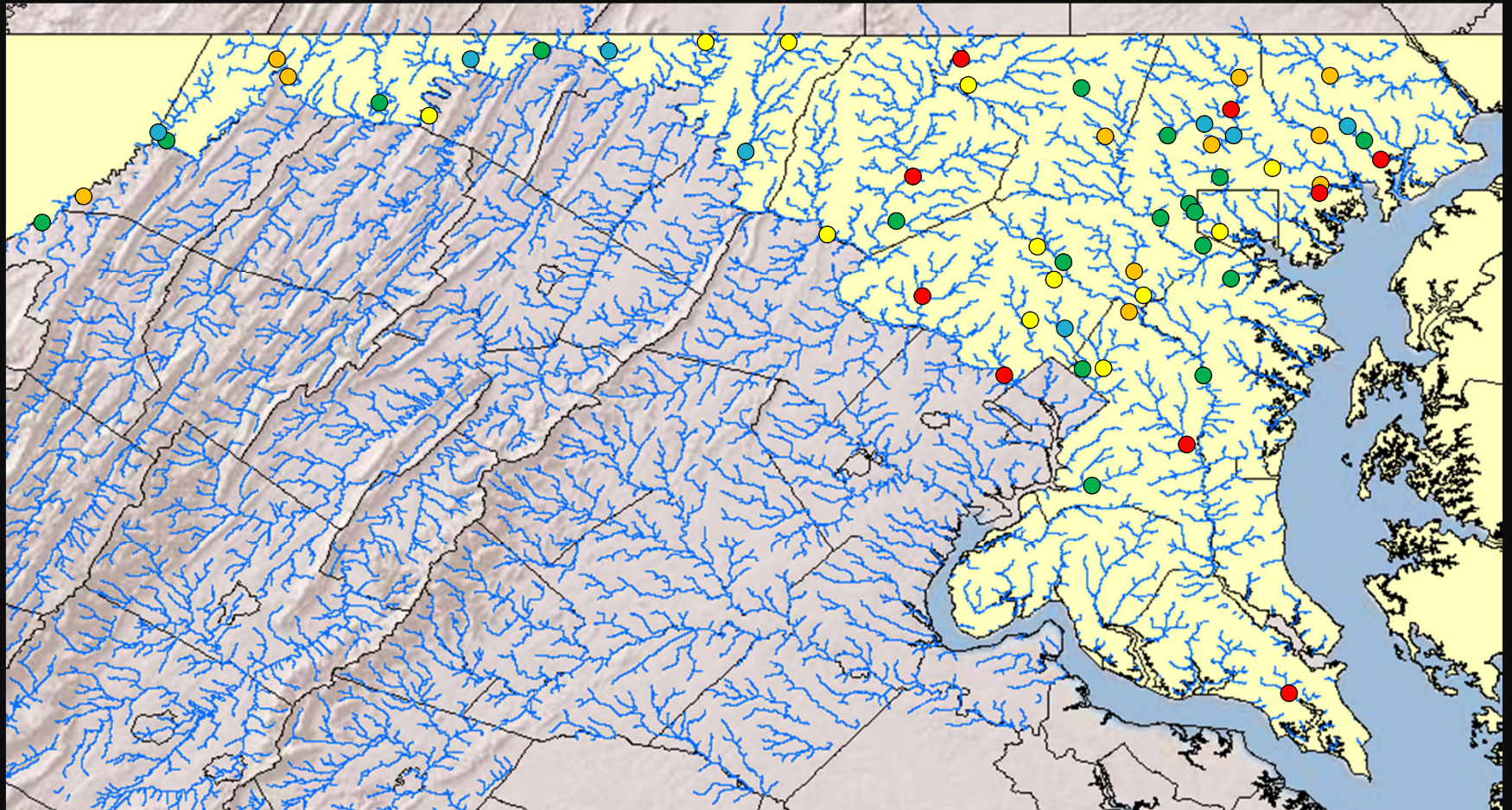




# Overall Results – Maryland

▶ What is the average flood frequency?

- More than once/year
- Every 1-2 years
- Every 2-3 years
- Every 3-5 years
- Every 5+ years
- Other\*



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# Overall Results – Maryland

- ▶ How quickly do the streams typically reach flood crest?
  - Smaller (headwater) streams can reach flood crest in as little as an hour or two
    - Examples: Minebank Run, Honeygo Run
  - Medium-sized watersheds typically reach flood crest in 6-12 hours
    - Examples: Patapsco River, Deer Creek, Upper Patuxent, St. Mary's River
  - Larger or flatter watersheds take 12 hours up to 3 days
    - Examples: Potomac, Monocacy, Lower Patuxent, Western Branch



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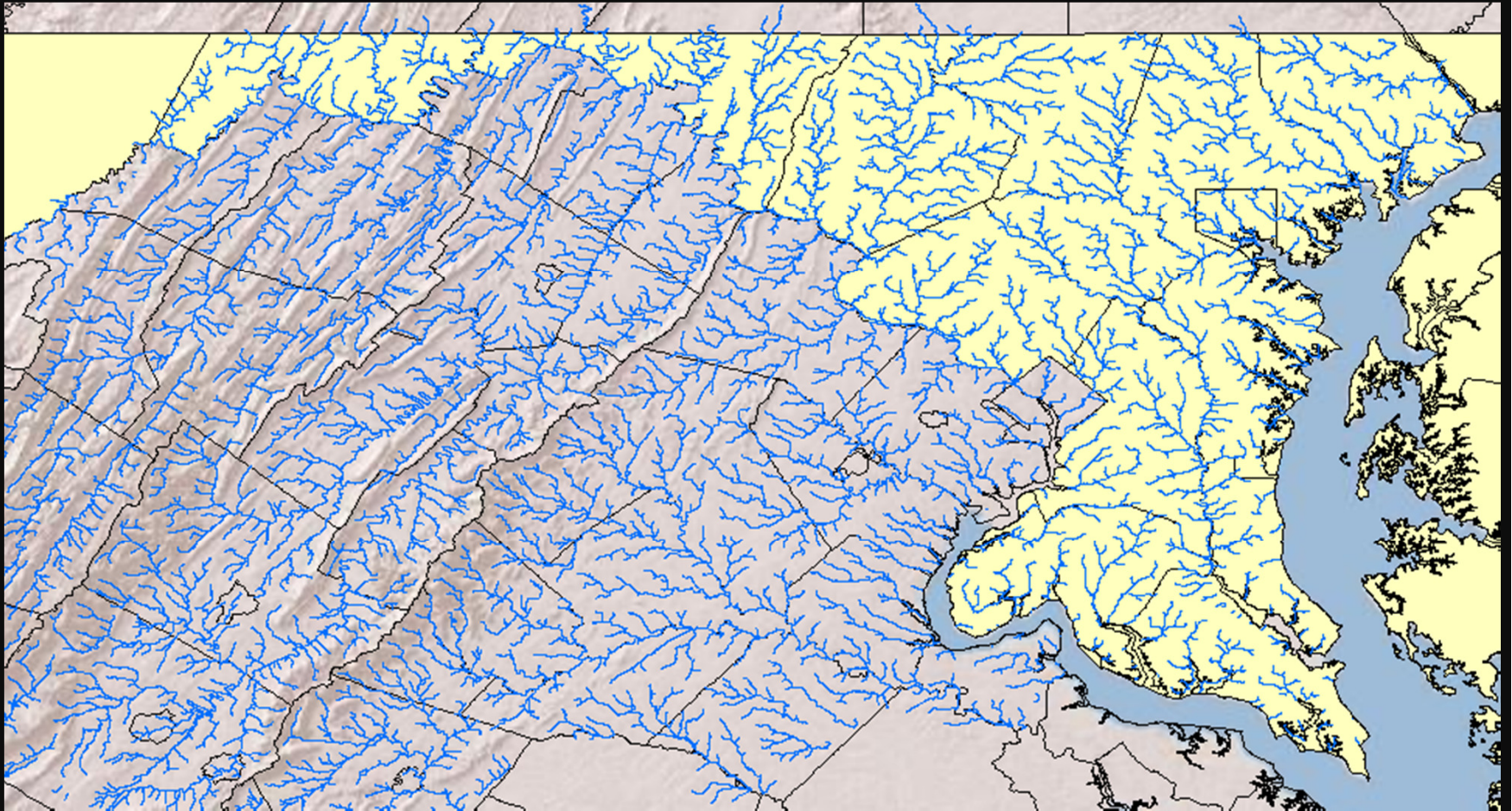




# Overall Results – Maryland

- 6 hours or less
- 6-12 hours
- 12-24 hours
- 24-48 hours
- 48+ hours
- Other\*

▶ How quickly do the streams typically reach flood crest?



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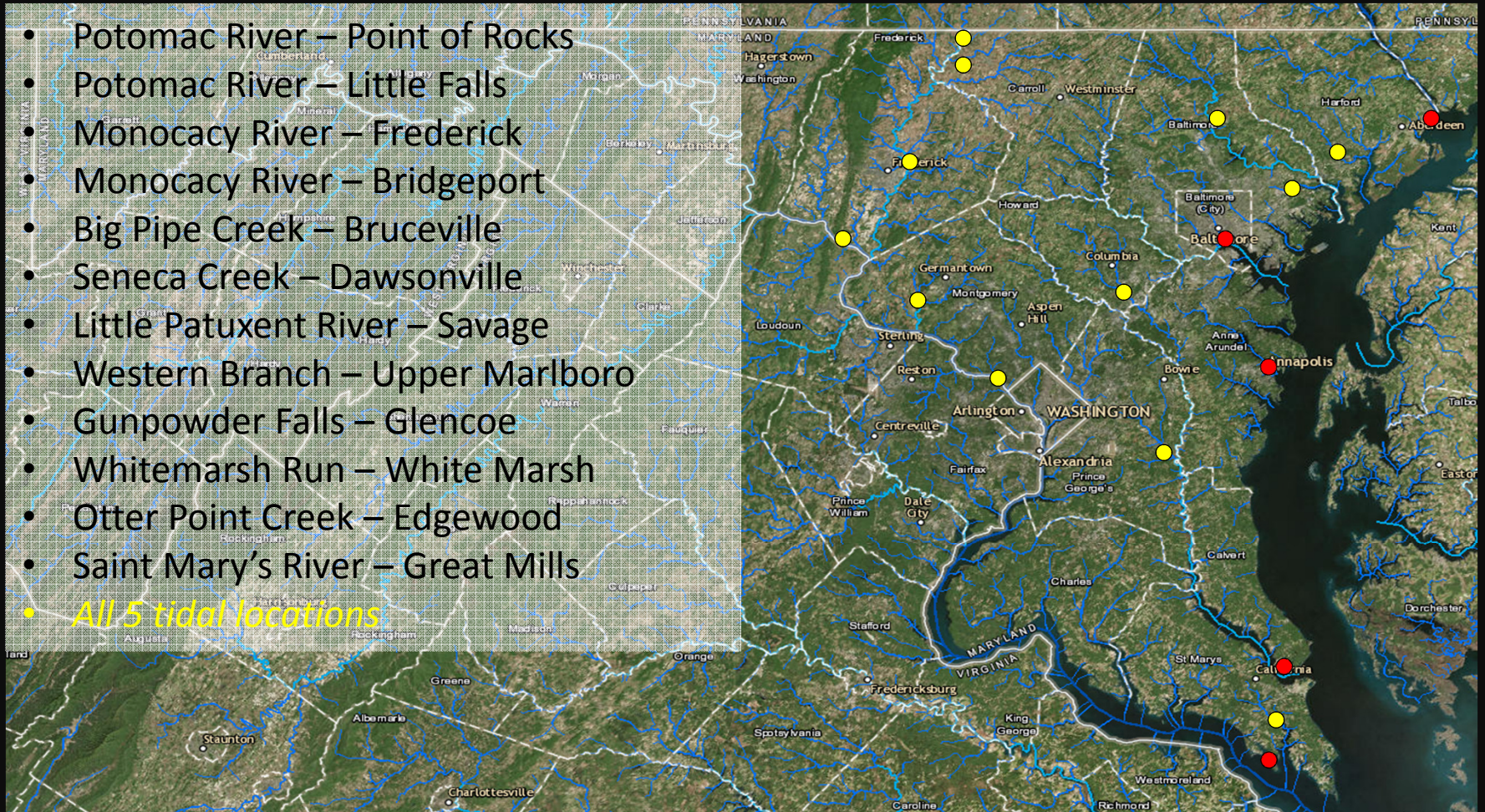




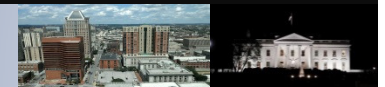
# Overall Results – Maryland

## ► 17 locations flood, on average, at least once per year:

- Potomac River – Point of Rocks
- Potomac River – Little Falls
- Monocacy River – Frederick
- Monocacy River – Bridgeport
- Big Pipe Creek – Bruceville
- Seneca Creek – Dawsonville
- Little Patuxent River – Savage
- Western Branch – Upper Marlboro
- Gunpowder Falls – Glencoe
- Whitemarsh Run – White Marsh
- Otter Point Creek – Edgewood
- Saint Mary's River – Great Mills
- *All 5 tidal locations*



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# Overall Results – Maryland

## ▶ Major Flood Frequency

- On major rivers (Potomac / Monocacy), every 7-11 years
  - **But it hasn't happened in 20 years!**

<u>Location &amp; Stream</u>	<u>Frequency</u>	<u>Last Major</u>
◦ Cumberland (NB Potomac)	Every 11 years	1996
◦ Paw Paw (Potomac)	Every 7 years	1996
◦ Hancock (Potomac)	Every 11 years	1996
◦ Point of Rocks (Potomac)	Every 7 years	2010*
◦ Little Falls (Potomac)	Every 7 years	1996
◦ Frederick (Monocacy)	Every 11 years	1996

- On most smaller rivers, major = Agnes (1972).

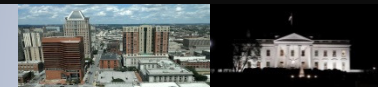


# Conclusions

- ▶ With these study results, NWS forecasters will know which locations flood more frequently and in which months those floods are most likely to occur.
- ▶ This information can be used to prioritize the plethora of data which a warning meteorologist must consider, and monitor where no river forecasts exist.
- ▶ Knowing sites where flooding has never been observed is also useful for not wasting effort monitoring a location where no impacts will occur.
- ▶ This study is being finalized now and a subset of the data will be available on our website when fully complete.



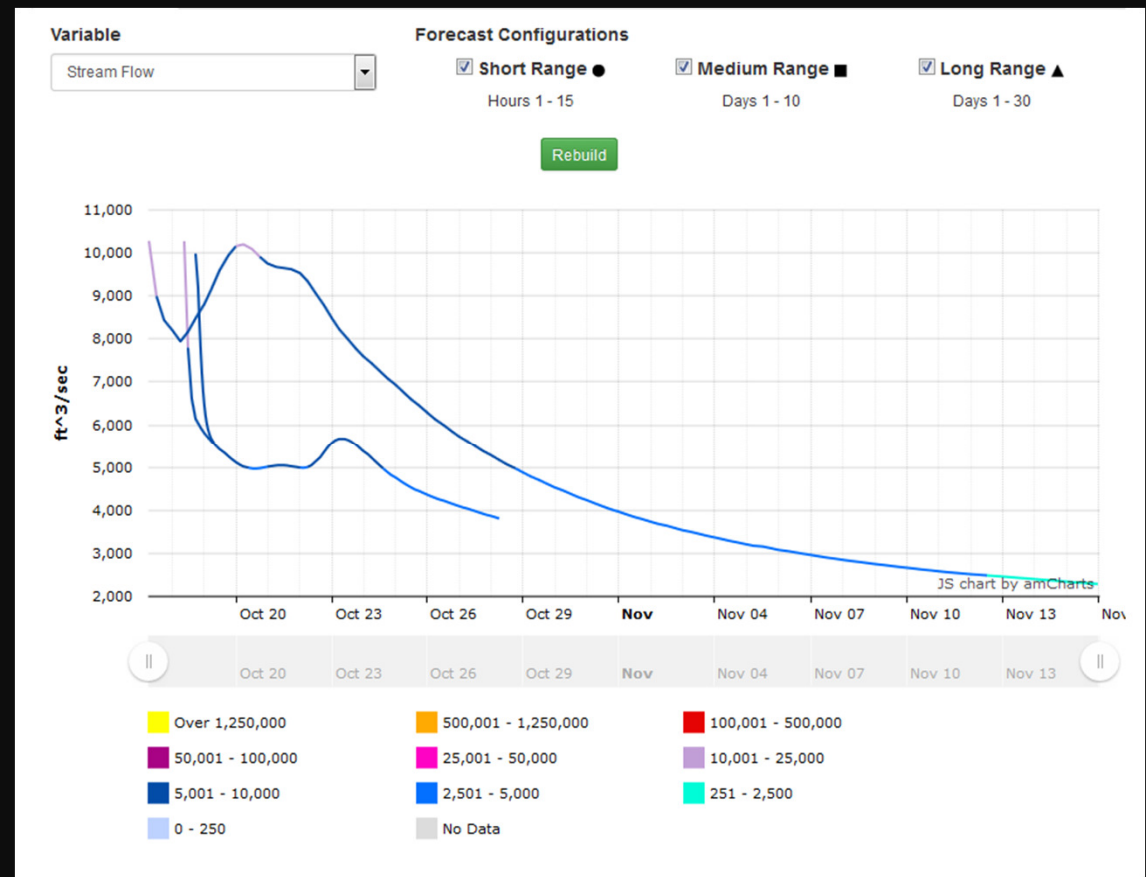
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# Future Uses

- ▶ NWS launched the National Water Model (NWM) in fall 2016. While not a forecast, the NWM gives information about how expected meteorological conditions may effect streamflow.
- ▶ Still under evaluation with enhancements expected in 2017.



# Advanced Hydrologic Prediction Service (AHPS)

<http://water.weather.gov>

Zoomed to DC metro:

<http://go.usa.gov/4vxY>

National Weather Service  
Advanced Hydrologic Prediction Service

Home News Organization

National Observations WFO Observations

ALERT! A Air Quality Alert is in effect for portions of the area.

View all valid statements/warnings or choose a specific point or river to get the details for that location.

Weather Forecast Office (Baltimore/Washington) Sterling, VA Middle Atlantic River Forecast Center

River Observations River Forecasts Experimental Long-Range Flood Risk Precipitation Download

Auto Refresh: OFF Print this map Permalink BOOKMARK

349 total gauges 0 gauges in flood

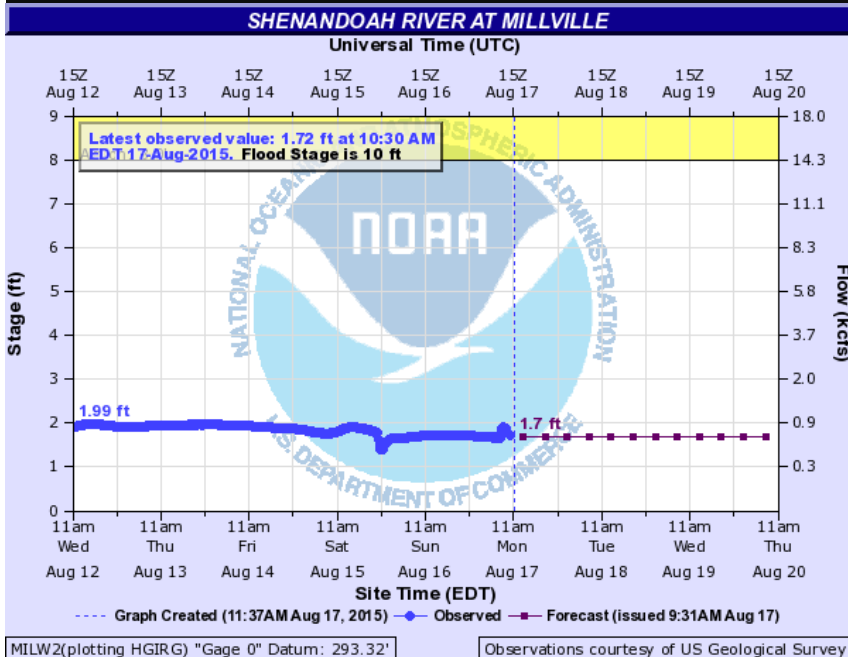
Legend:  
Forecast available  
Probability and forecasts available  
Observations only available  
Major Flooding  
Moderate Flooding  
Minor Flooding  
Near Flood Stage  
No Flooding  
Observations Are Not Current  
Out of Service  
Flood Category Not Defined  
At or Below Low Water Threshold

Last map update: 08/17/2015 at 11:36:17 am EDT 08/17/2015 at 15:36:17 UTC

What is UTC time? Map Help Disclaimer

WHEN FLOODED TURN AROUND DON'T DROWN

FLOODSMART.GOV  
USGS  
USA.gov





# Questions?

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