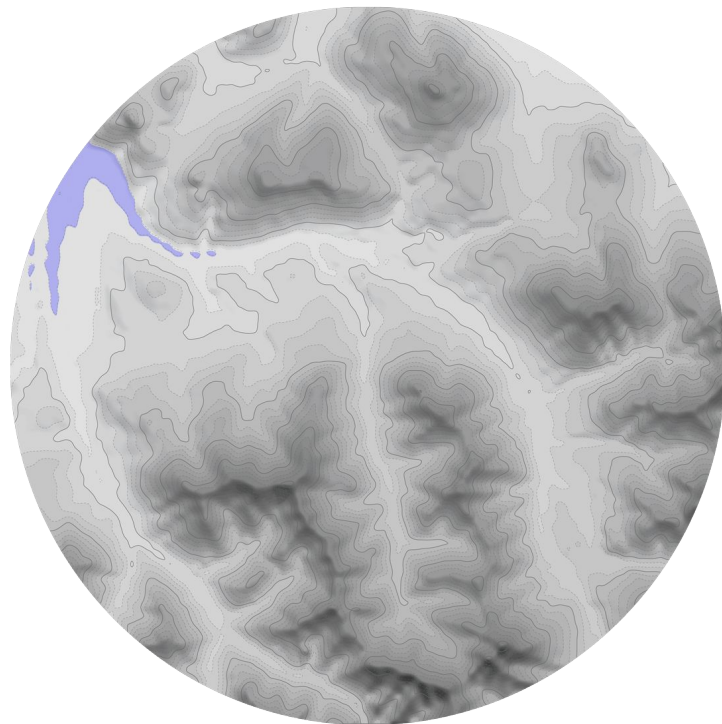


# NWS River Webpage Changes

## NWS Flood Inundation Mapping

### *2024 WV Floodplain Managers Association Conference*

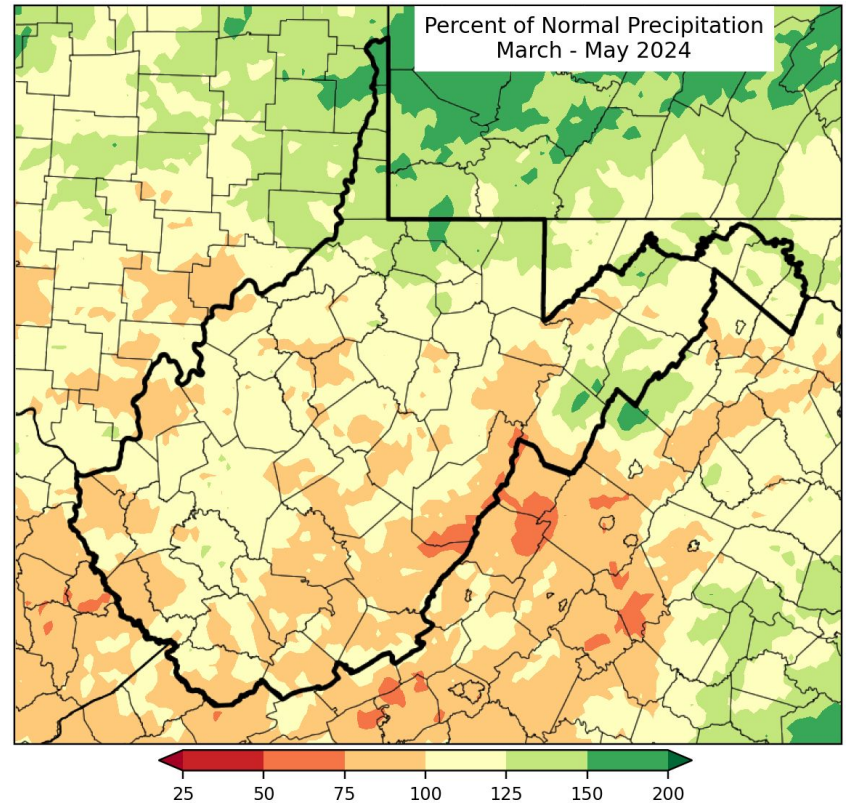
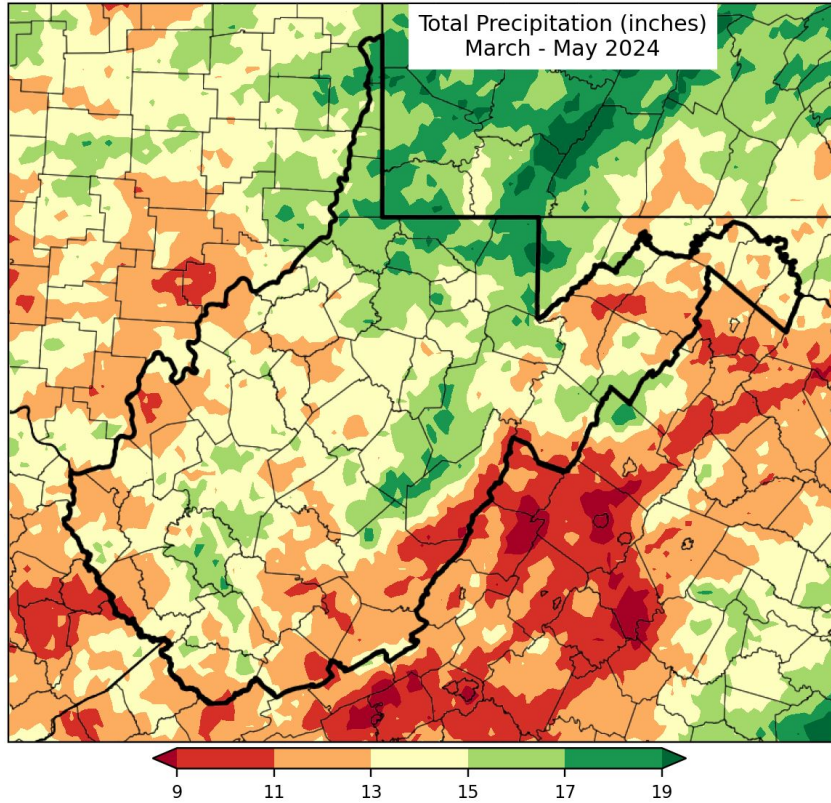
Nick Webb  
Senior Service Hydrologist/Meteorologist  
NWS Charleston WV



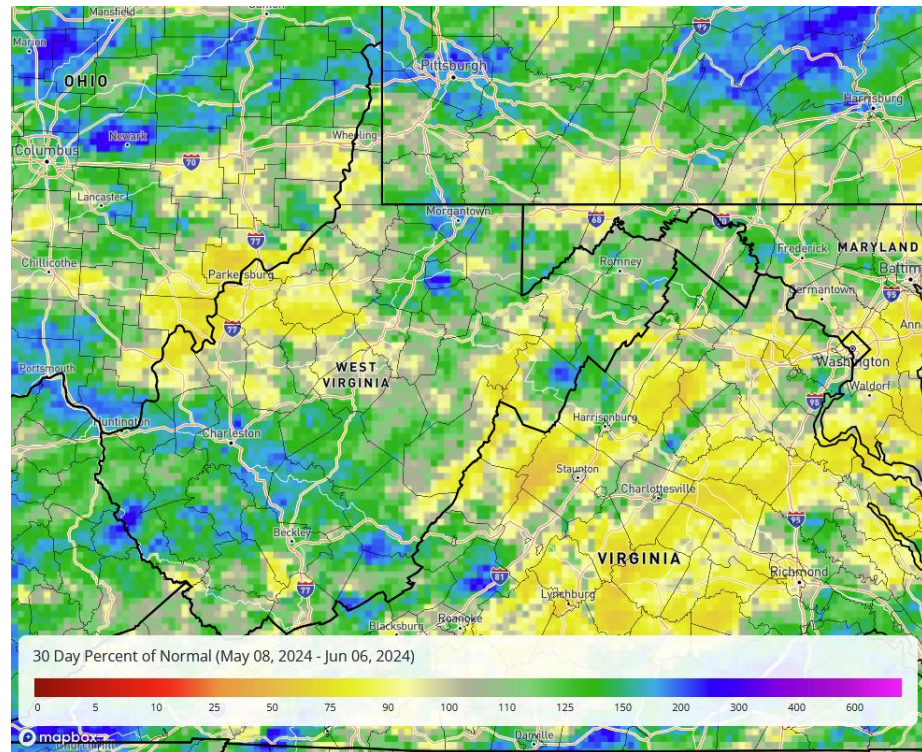
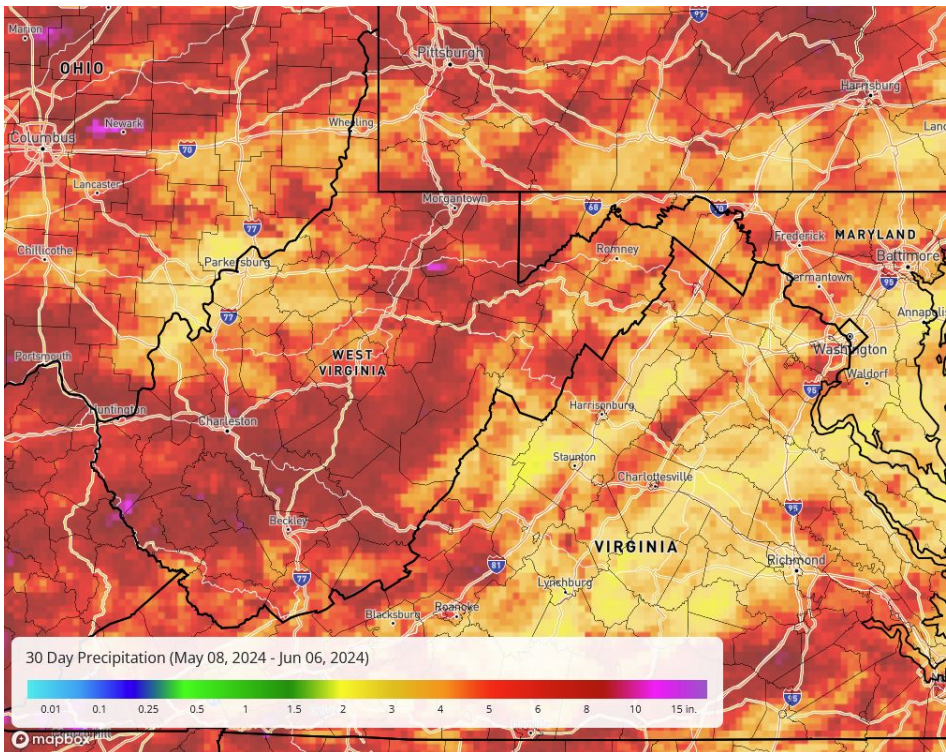
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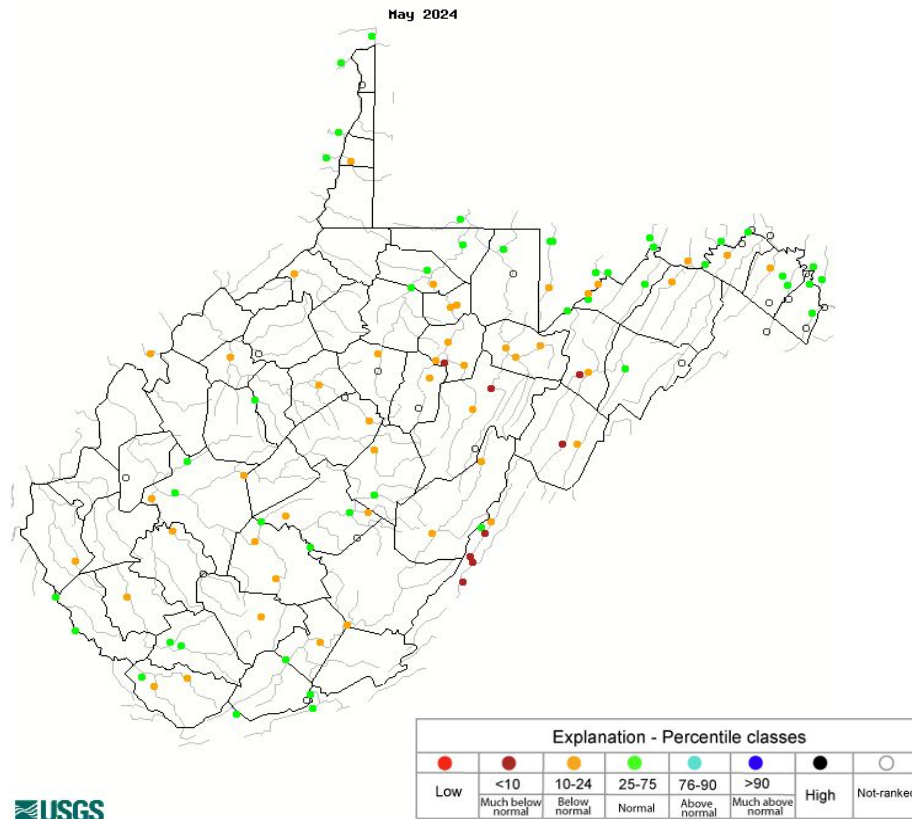
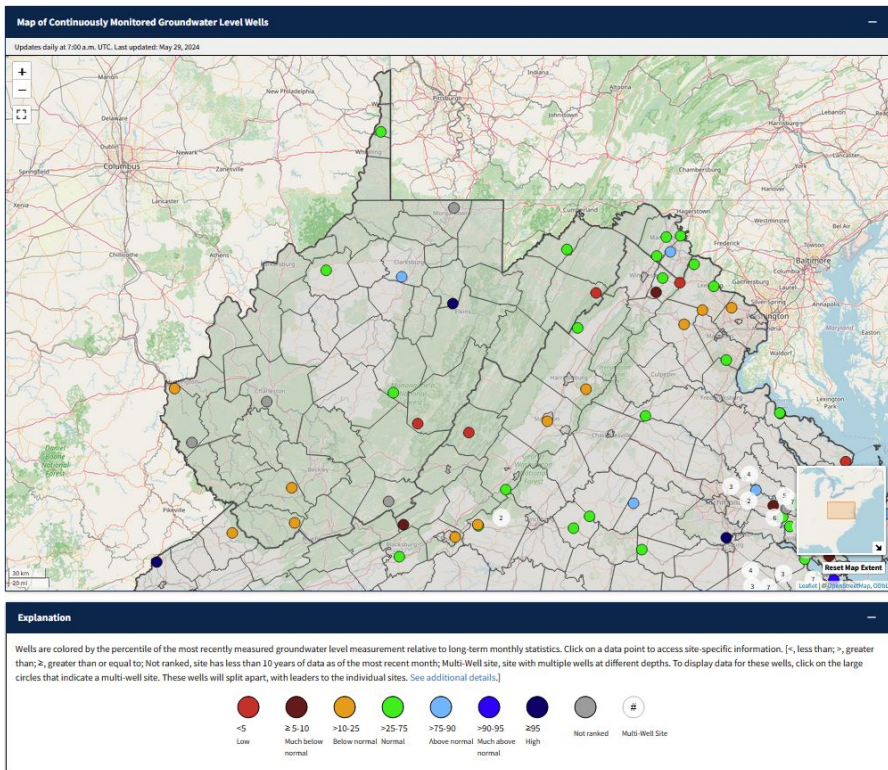
# West Virginia Spring Conditions - El Nino weakens



# West Virginia Past 30 Days - El Nino fades to La Nina



# West Virginia Past 30 Days - El Nino fades to La Nina



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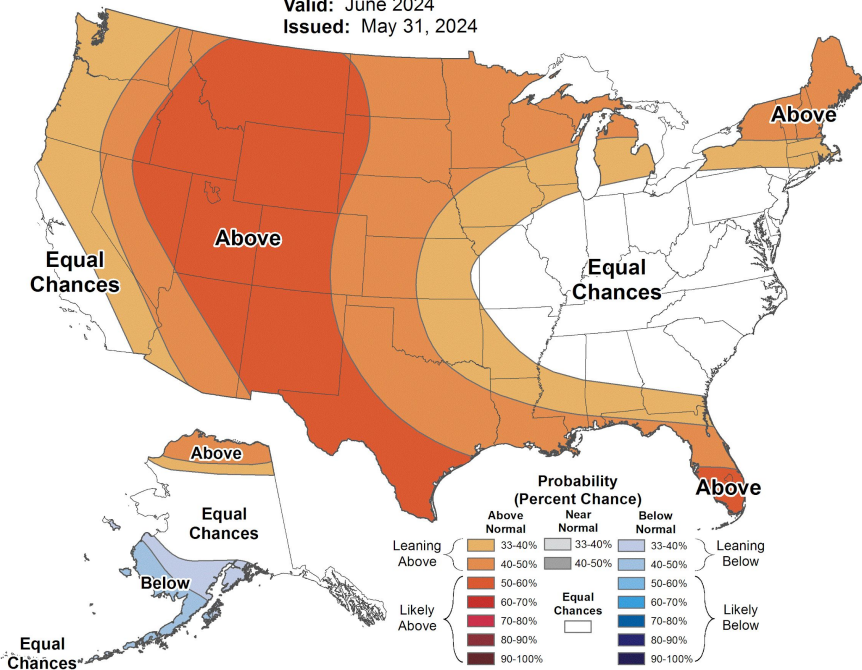
# Ohio Valley Monthly Outlooks - El Nino fades to La Nina



## Monthly Temperature Outlook



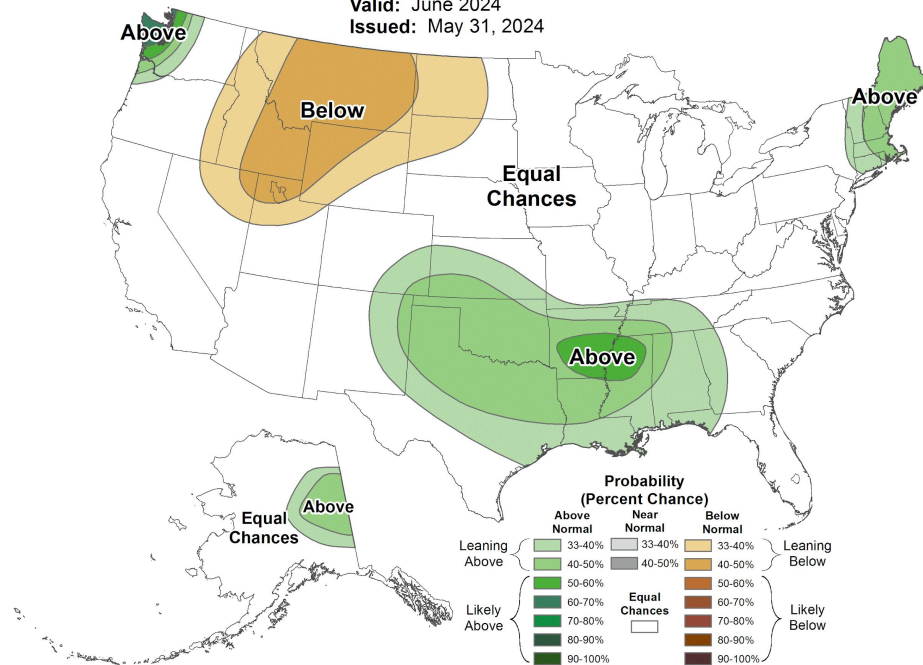
Valid: June 2024  
Issued: May 31, 2024



## Monthly Precipitation Outlook



Valid: June 2024  
Issued: May 31, 2024



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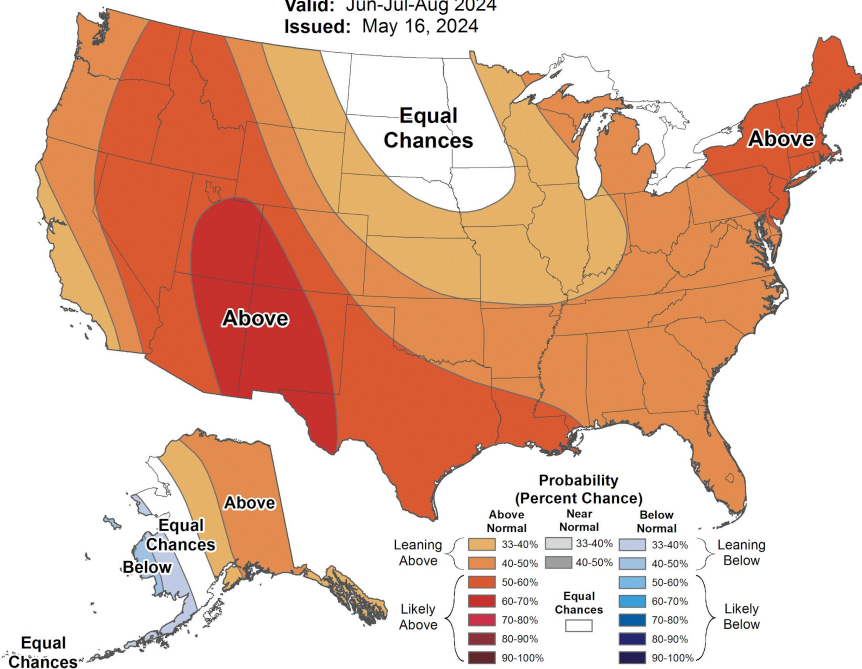
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# Ohio Valley Summer Outlooks - El Nino fades to La Nina



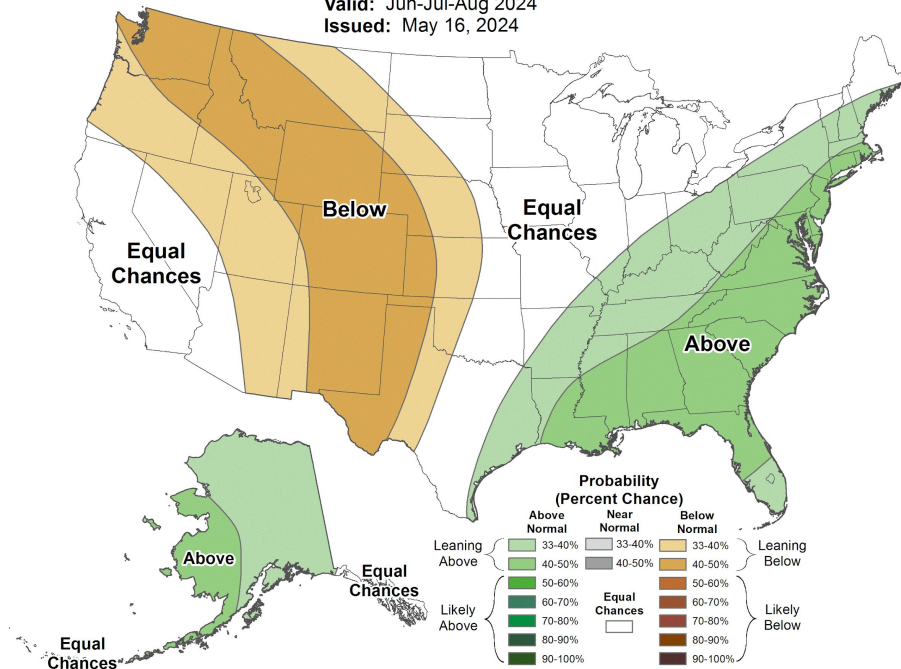
## Seasonal Temperature Outlook

Valid: Jun-Jul-Aug 2024  
 Issued: May 16, 2024



## Seasonal Precipitation Outlook

Valid: Jun-Jul-Aug 2024  
 Issued: May 16, 2024



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# Updated NWS River Webpage National Water Prediction Service

National site:

<https://water.noaa.gov>

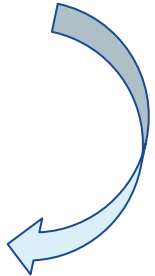
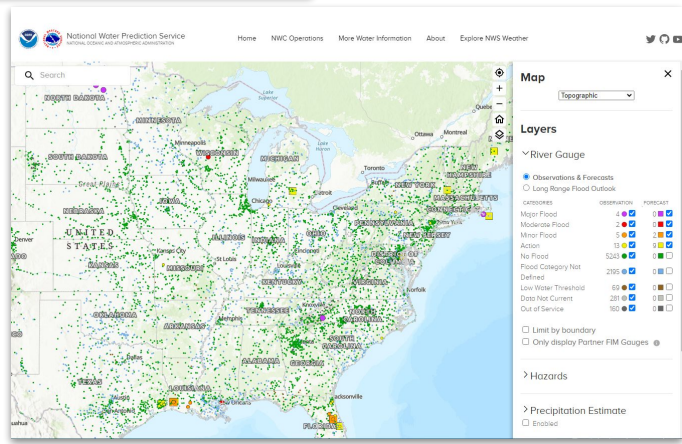
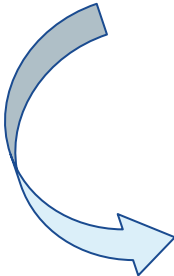
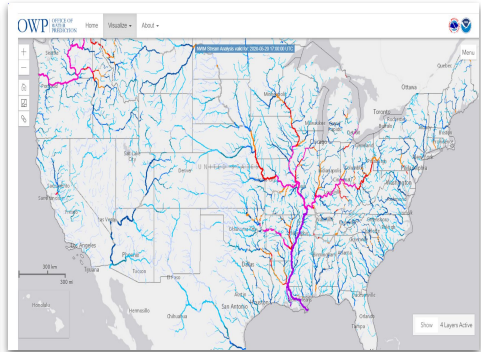
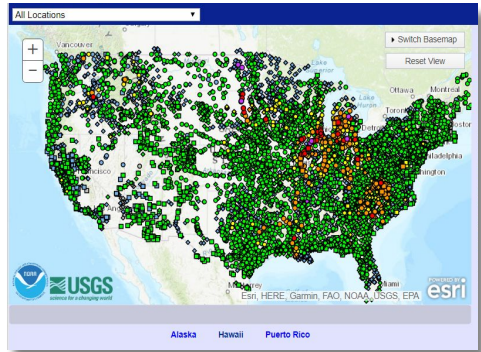
NWS Charleston site:

<https://water.noaa.gov/wfo/rlx>

WV state page site:

<https://water.noaa.gov/state/wv>

*Combines official NWS River Forecasts + National Water Model simulations + GIS layers/REST data*



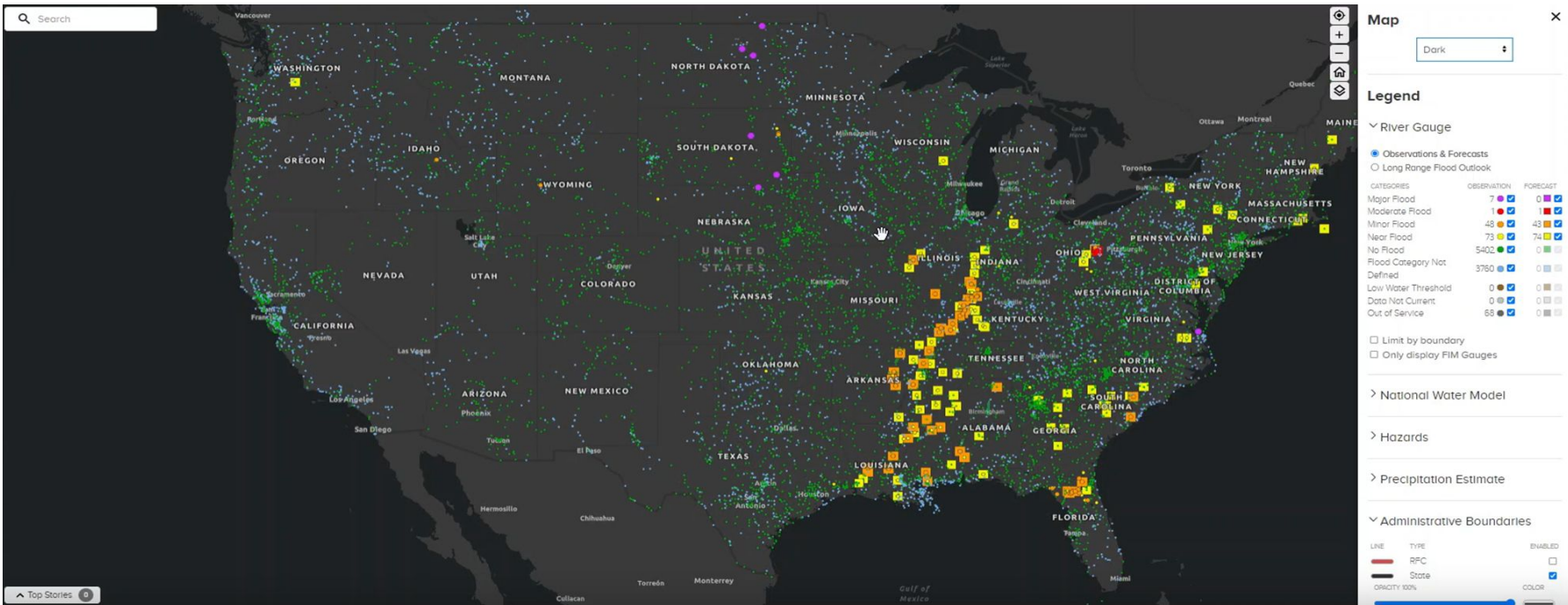
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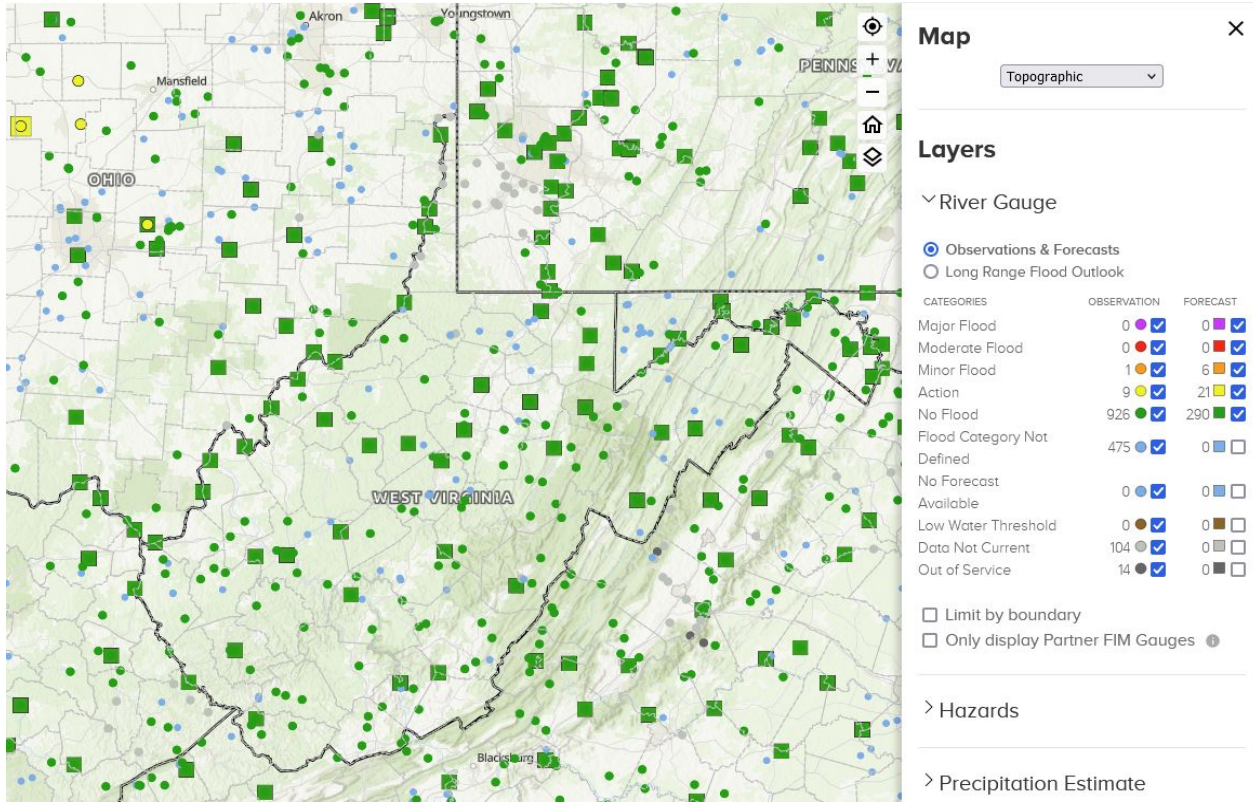
# Updated NWS River Webpage National Water Prediction Service



- Change the background layer
- Update display and table for area limited by boundary
- Turn layers on and off for Watches/warnings/etc, precip estimates, and NWM data

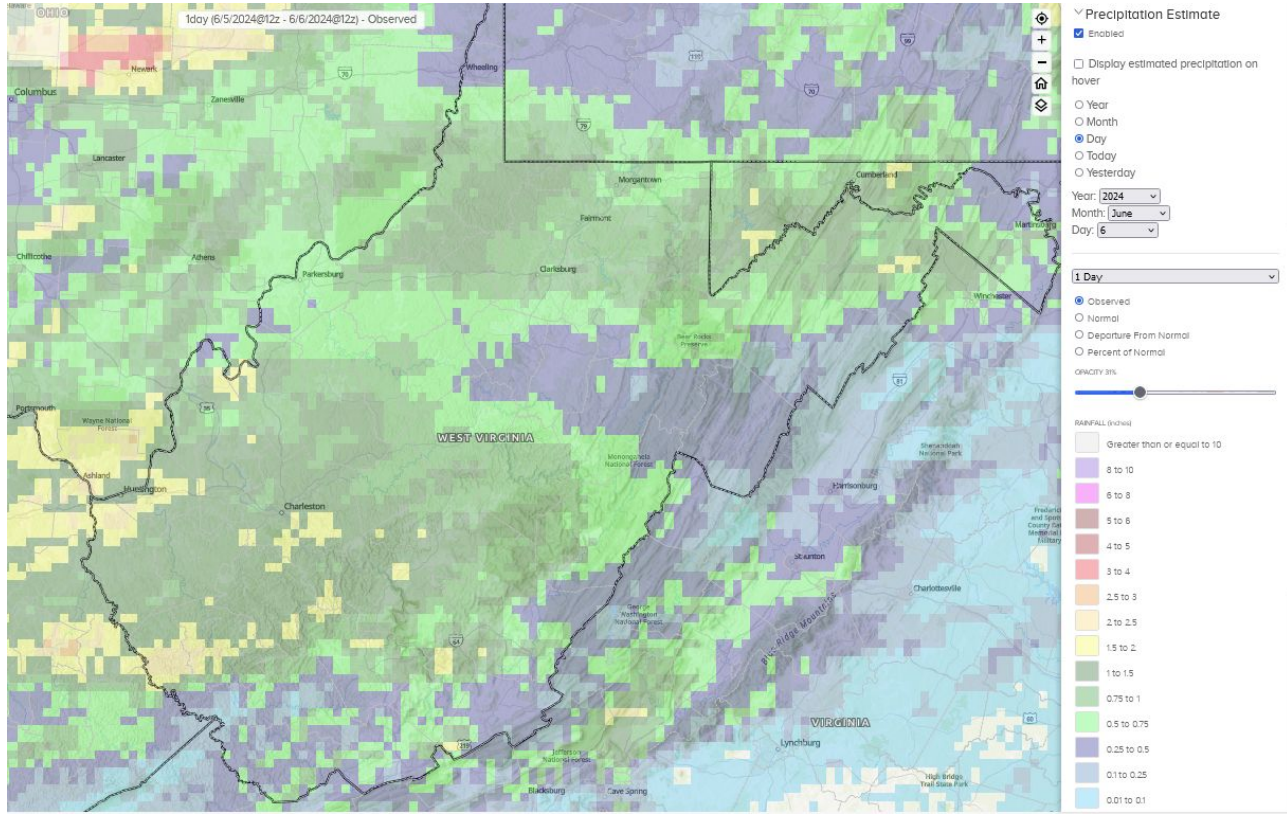
# Updated NWS River Webpage National Water Prediction Service

- Observations (inner circle) and Forecasts (outer square) on same map
- Can turn each flood category on/off (ie filter for only moderate and major flooding and only see those symbols on the map)
- In this example, flood warnings (Hazards) are turned on as well. Can click on them to see the warning product



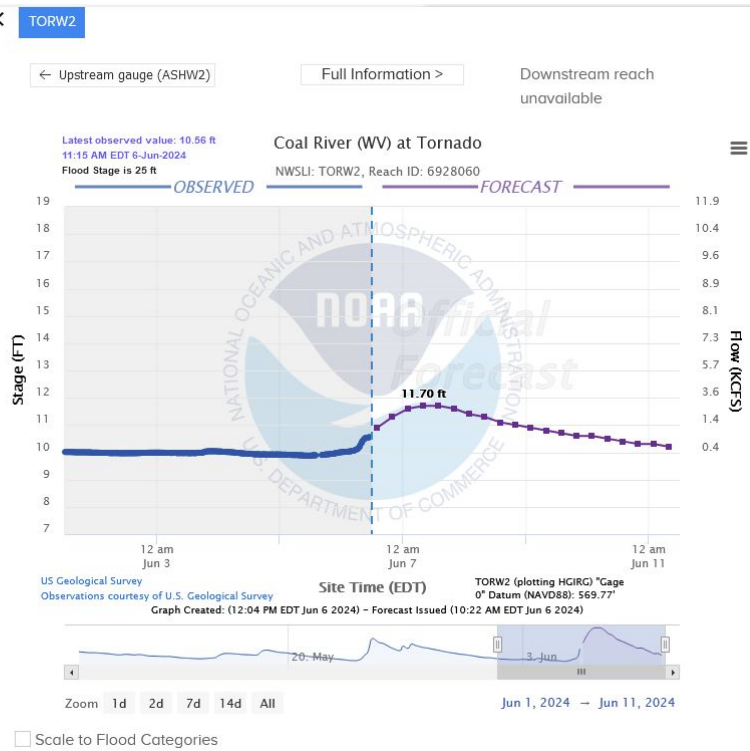
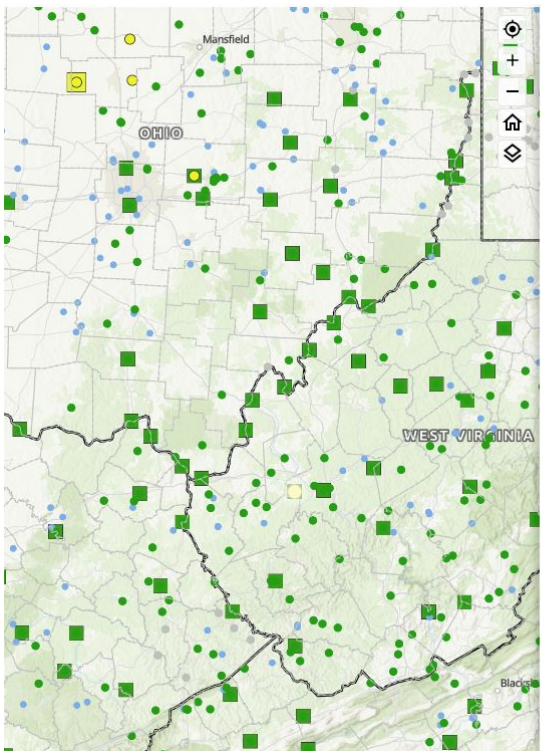
# Updated NWS River Webpage National Water Prediction Service

- Radar/Rain Gage Merged Precipitation
- Download of recent Precipitation Estimates still available
- Longer term precip history moves to NCEI

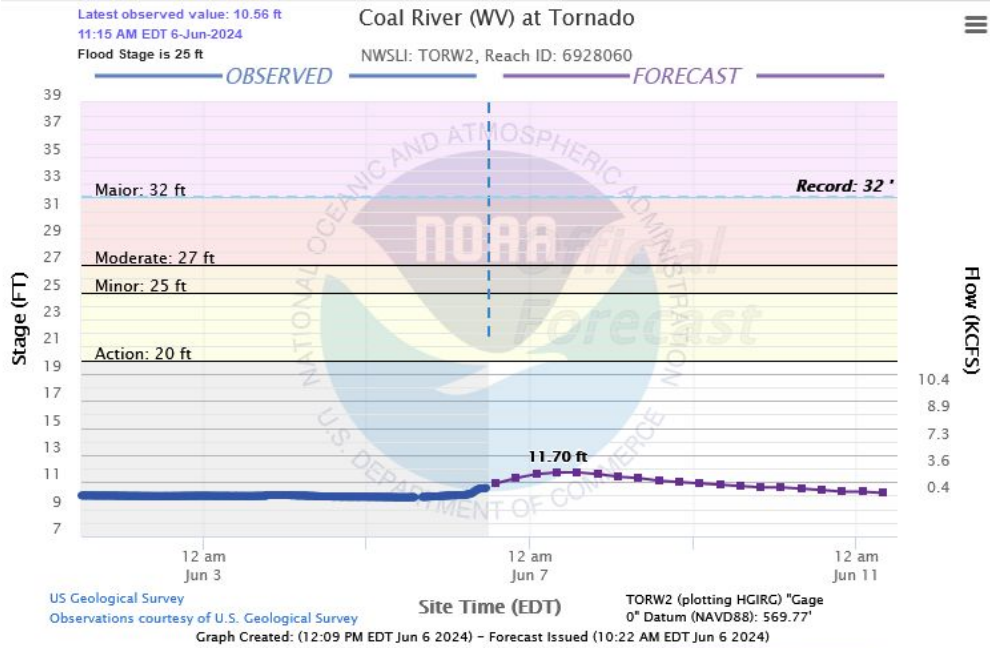
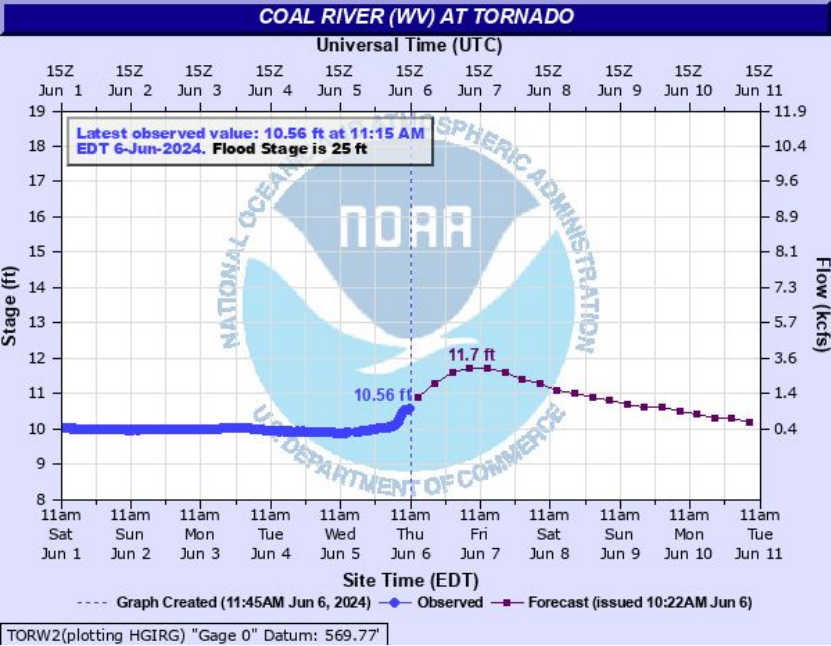


# Updated NWS River Webpage National Water Prediction Service

- Pop-up Hydrograph
- Slider to move back and forth in time



# Updated NWS River Webpage National Water Prediction Service



Static Image vs Dynamic Image

# Updated NWS River Webpage National Water Prediction Service

### Flood Impacts ●

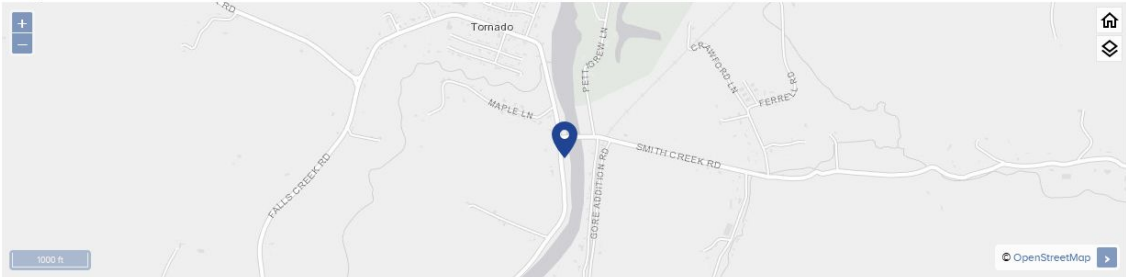
32 - Major flooding all along the Coal River. Several homes and buildings are affected. Access to Meadowood Park and the area along the river in the park are flooded.

30 - Water floods golf course and homes along low sections of river. Roads flooded and closed throughout Tornado and surrounding areas.

29 - Bridge over Falls Creek on Coal River Road, located approximately 250 yards north of intersection with Smith Creek Road, floods.

[SHOW MORE FLOOD IMPACTS](#)

### Gauge Location



- Display TORW2 marker
- Display FEMA's National Flood Hazard Layers

### Gauge Info

Coordinates	38.3390, -81.8415
RFC	OHRFC
State	WV
WFO	RLX
County	Kanawha
Data Provider(s)	
US Geological Survey	<a href="#">USGS--Water Resources of the United States</a>
USGS	03200500

### Recent Crests

- 25.31 ft on 02-18-2023
- 30.79 ft on 03-02-2021
- 21.73 ft on 02-12-2020
- 22.38 ft on 12-22-2018
- 21.98 ft on 02-12-2018

[SHOW ALL](#)

### Historic Crests

- 31.98 ft on 03-07-1967
- 30.89 ft on 12-31-1969
- 30.79 ft on 03-02-2021
- 30.61 ft on 04-16-2007
- 30.14 ft on 03-13-1963
- 29.65 ft on 12-09-1978
- 29.57 ft on 01-26-1978
- 29.00 ft on 02-28-1962
- 28.98 ft on 11-20-2003
- 28.45 ft on 03-05-2015

[SHOW ALL](#)

(P) - Preliminary values subject to further review  
 \* - Gauge datum changed during this year

# Updated NWS River Webpage National Water Prediction Service

### Vertical Datum Table

TYPE	NAVD88
Major Flooding	601.77 ft
Moderate Flooding	596.77 ft
Minor Flooding	594.77 ft
Action	589.77 ft
Latest Value	580.33 ft
Gauge Zero	569.77 ft

### Gauge Photos

Photo 1 of 4



Smith Creek Road floods at 20-25 feet



● ○

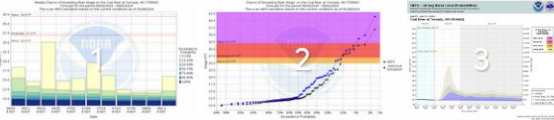
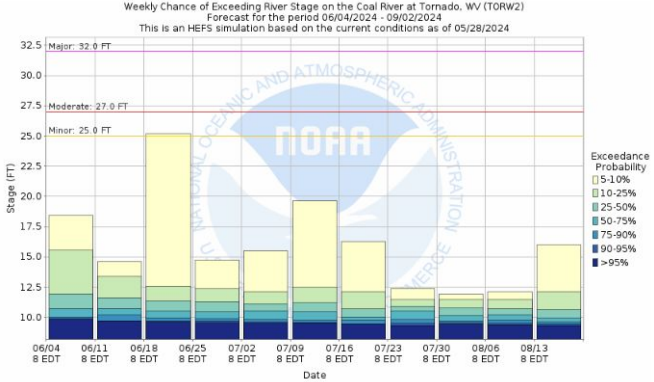


# Updated NWS River Webpage National Water Prediction Service

## Weekly Chance of Exceeding Levels

[About this graph](#)

Stage ▾



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# Updated NWS River Webpage National Water Prediction Service

- More **Mobile ready** interface

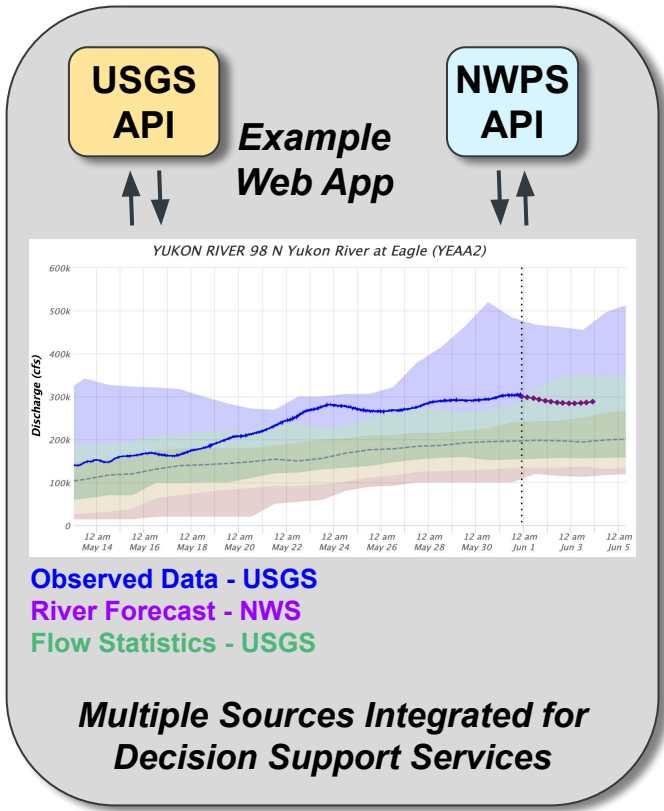
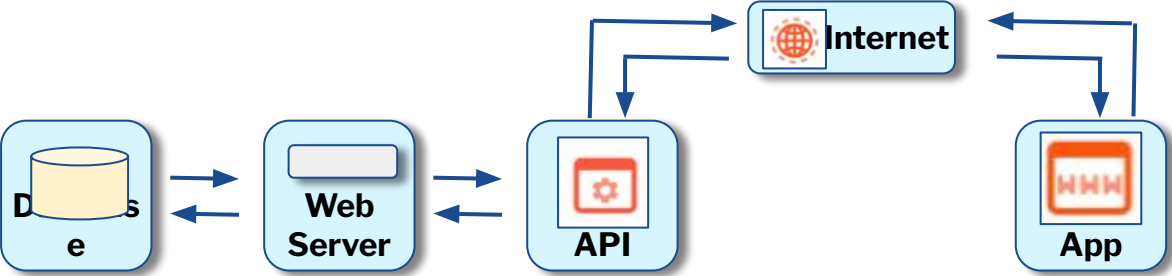
NWPS display in mobile device (Android)

NWPS display in mobile device (iOS)

# Updated NWS River Webpage National Water Prediction Service

*NWPS is an API driven Web App for the dissemination of integrated water information across the NWS*

Core Partners, Third Party APIs and Web Apps can leverage the NWPS API to integrate observations and forecast data into **their own** decision support tools.



# Flood Inundation Mapping

## NEIGHBORHOOD LEVEL FLOOD INUNDATION MAPS:

Transforming NWS Water  
Prediction Across the U.S.

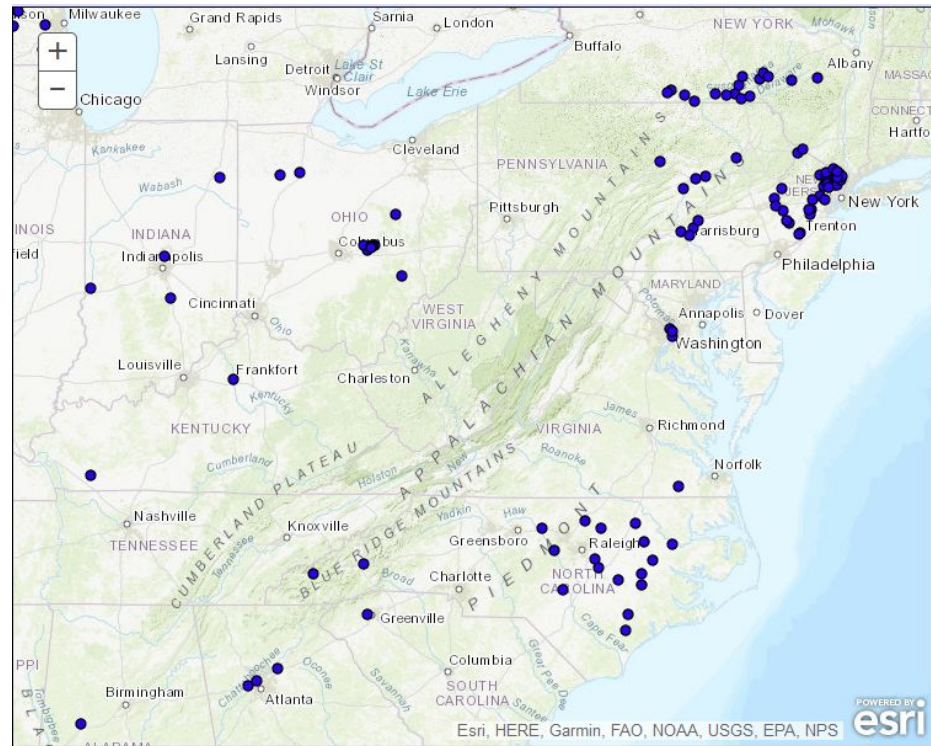


- Demand for event driven flood inundation mapping (FIMs)
- Provide actionable information for emergency and water resource managers to prepare, mitigate and respond to flood impacts.
- NWC (National Water Center) in coordination with RFCs (River Forecast Centers) and WFOs (Weather Forecast Offices) are coming together to meet that need and deliver NWS FIM IDSS.



# Current Sources of Flood Inundation Mapping

- **USACE**
  - Primarily downstream of flood control projects
  - Based on specific releases, not tied to NWS flood categories
  - Some are publicly available
- **USGS/Partner/NWS**
  - Produced through NWS partnerships
  - Lengthy and strict process
  - Costly to develop
  - Very few across the country (none in WV)
- **Private**
  - Usually developed through contracts with local municipalities
  - Can be very costly



# NWS Flood Inundation Mapping (FIM) Overview

- Multi-year effort to provide near real-time analysis and forecast maps at a community level scale.
- FIM produced/developed at the NWS National Water Center (NWC)
  - Local field offices assess accuracy, provide feedback
  - Improvements/future developments continuing
- Provides Inundation extent, **not depth**
- Available through the National Water Prediction Service (NWPS)
  - REST Services also available
- **Currently Available for NWS Pittsburgh area**
  - **NWS Charleston, Blacksburg, Sterling areas available by early October 2024**



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# Map Legend



Population served by **October 2023.**



Population served by **October 2024.**



Population served by **October 2025.**



Population served by **October 2026.**

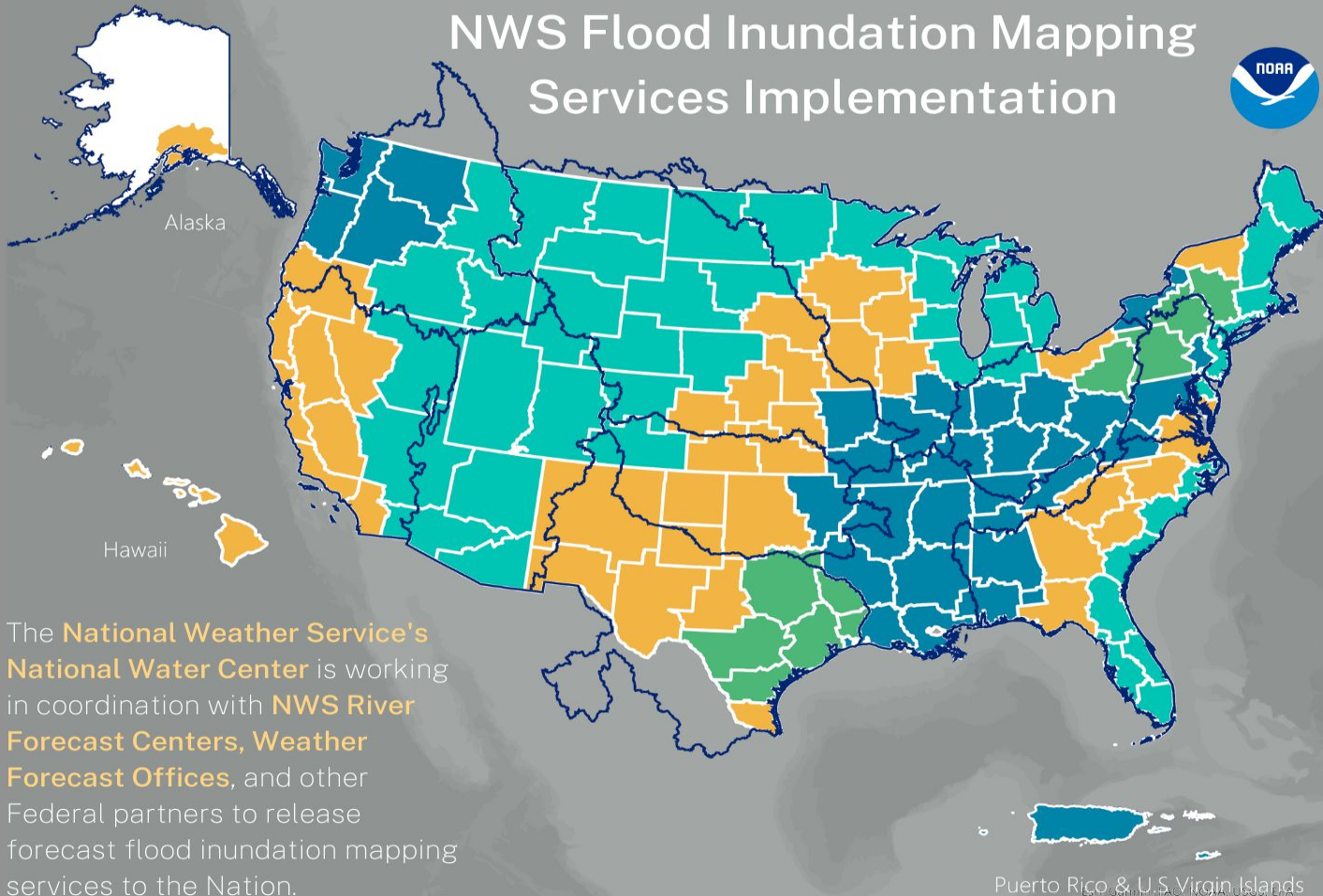


NWS County Warning Areas



NWS River Forecast Center Boundaries

# NWS Flood Inundation Mapping Services Implementation



The **National Weather Service's National Water Center** is working in coordination with **NWS River Forecast Centers, Weather Forecast Offices**, and other Federal partners to release forecast flood inundation mapping services to the Nation.

\*100% is approximate. Does not include all parts of Alaska, American Samoa, and Guam. Implementation areas are subject to change.



# OWP

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# Available Products by Oct 2024

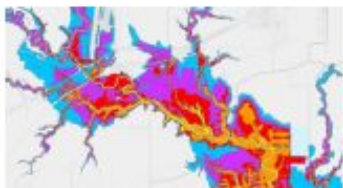
## STATIC



Advanced Hydrologic Prediction Service FIM Libraries (AHPS FIM)

< 1,000 river miles

Static maps at ~ 200 RFC forecast locations. Maps derived from engineering scale hydraulic models.



NWS Flood Categorical HAND FIM Libraries (CatFIM)

~ 20,000 river miles

Static maps at ~3,600 RFC forecast locations. Maps derived from 10-m Height Above Nearest Drainage (HAND) solution.

## DYNAMIC



River Forecast Center FIM (RFC FIM)

~ 100k river miles

Dynamic maps downstream of ~ 3,600 RFC forecast locations. Maps derived from RFC forecast and 10-m Height Above Nearest Drainage (HAND) solution.



National Water Model FIM (NWM FIM)

~ 3.4M river miles

Dynamic maps along NHDPlus reach locations. Maps derived from NWM forecast and 10-m Height Above Nearest Drainage (HAND) solution.



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# NWS RFC and NWM FIM - Dynamic

*DYNAMIC ONLY - visible only when high water expected*

*NWM = National Water Model*

## NWM Latest Analysis

A snapshot of the most recent NWM modeled flooding

Adjusted to Observations

Generated only when/where the NWM analysis indicates flooding may be occurring

[Updates](#) every ~55 minutes

[No future rainfall](#) - only radar/rain gage observed rain

## NWS RFC 5-Day Max Forecast

Based on 5-day NWS RFC forecasts

Available only near/downstream of NWS River forecast points

Generated when RFC forecast reaches “action stage.”

[Updates](#) ~45 minutes of RFC forecast updates.

[Future rainfall](#) - 48 to 72 hour human created rainfall forecast.

## NWM 18 hour and out to 10-Day Max Forecast

Based on peak streamflow forecast over next 18 hours or 3, 5, 10 days (model dependant)

Used for rivers and streams not covered by an RFC forecast

Generated only where NWM forecasts indicate flooding may occur.

[Updates](#) with every 6 hours

[Future rainfall](#) raw output out to 18 hours or 3,5, 10 days (model dependant)



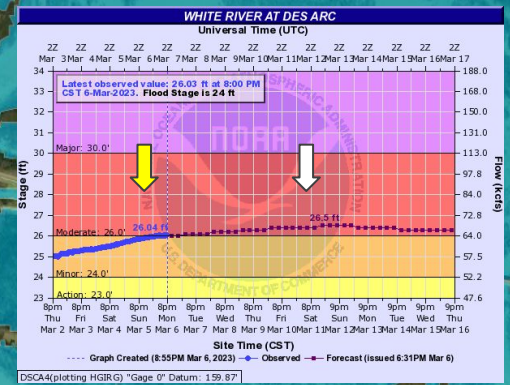




# RFC 5 Day Inundation Extent Forecast (dynamic)



- 1) Replaces NWM flow with NWS Forecast Flow
  - 2) Represents the **maximum** flow over next 5 days
  - 3) Includes 2-3 days of future rainfall
  - 4) Available near/downstream of NWS forecast points for Action-Stage or higher flow threshold category forecasts
  - 5) Latency ~45-75 min from RFC Forecast Issuance
- When to Use...**most likely the preferred FIM near official NWS forecast points/USGS gage.



I am Legend

Critical Infrastructure

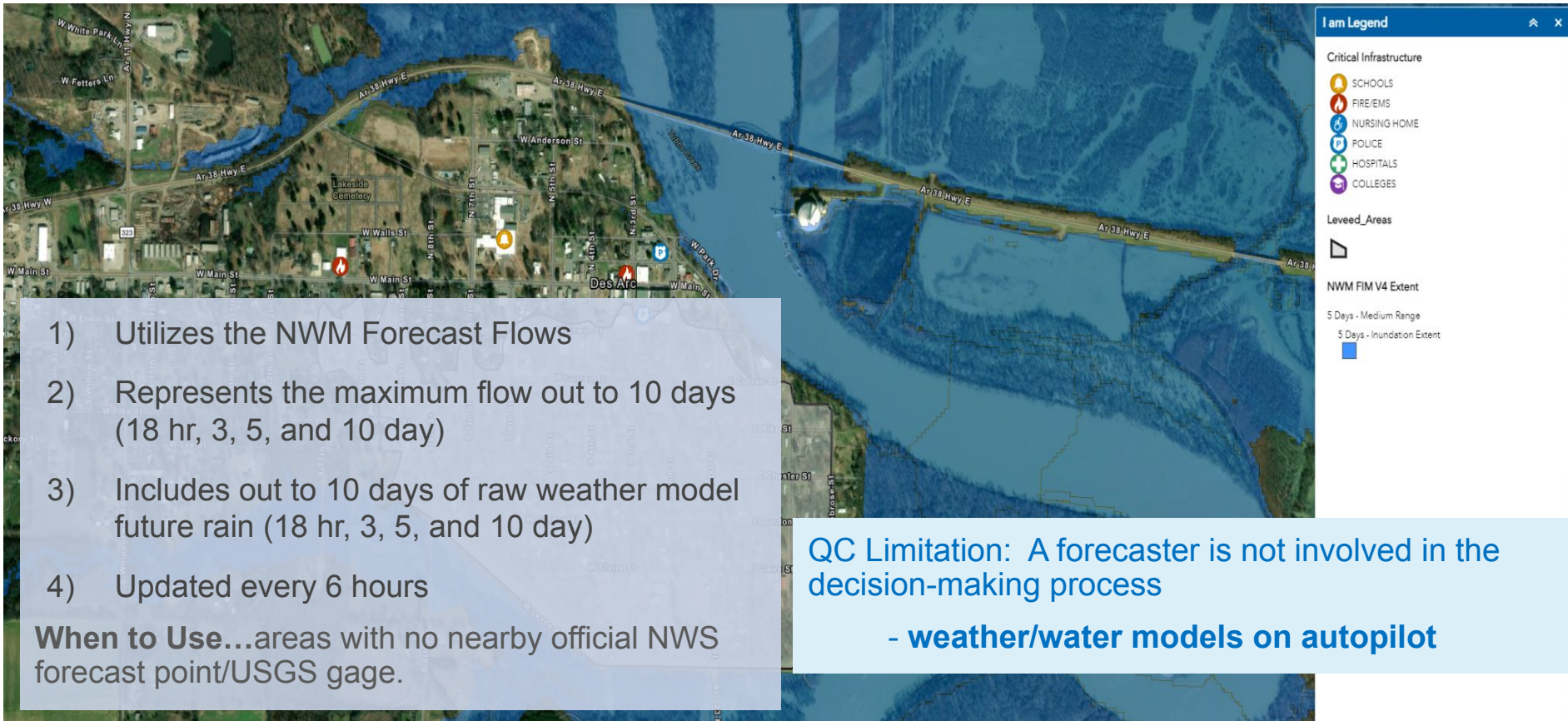
- SCHOOLS
- FIRE/EMS
- NURSING HOME
- POLICE
- HOSPITALS
- COLLEGES

Leveed\_Areas

RFC 5 Day R@R FIM V4 Extent

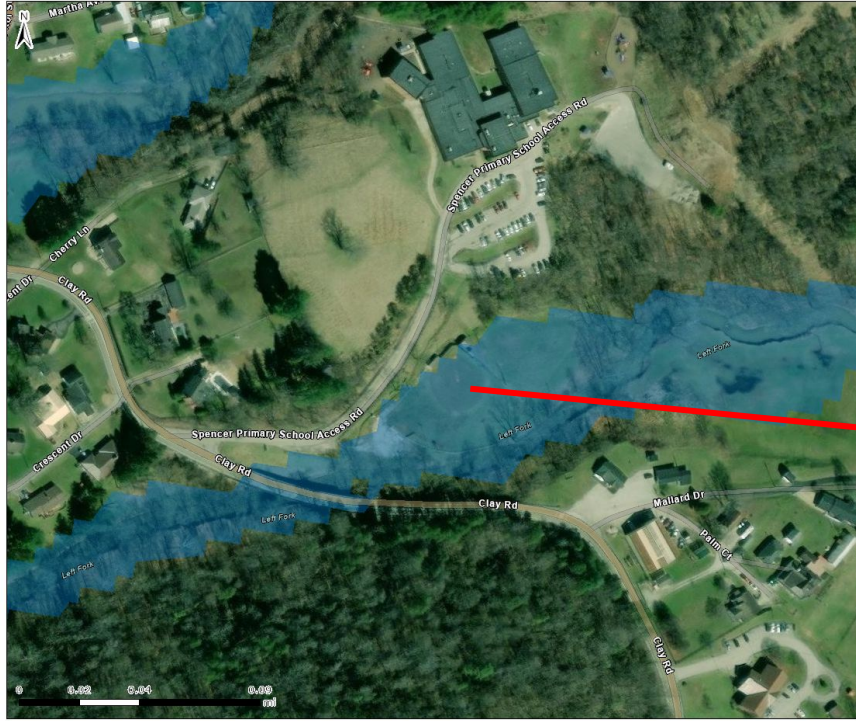
5 Days - Inundation Extent

# NWM Inundation Extent Forecast (dynamic)



# Some places where NWM FIM has performed well

Left Fork



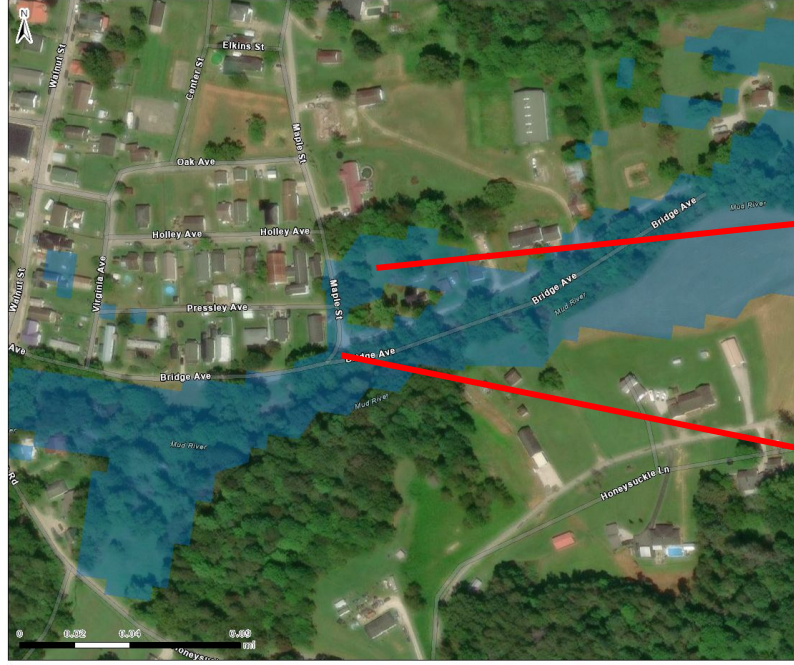
- Smaller rivers and streams, many of which are ungauged.
- Your flood reports/images will be helpful in QC!

*Ungauged FIM Review: February 12, 2024 Spencer WV Left Fork*

*Person who was sleeping in the dugout of ball field was swept away overnight and drowned.*

# Some places where NWM FIM has performed well

February 12, 2024 Hamlin WV Mud river



Gaged FIM Review: February 12, 2024 Hamlin WV Mud River at 13.6 feet

Flood Stage: 13 feet



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# Some places where NWM FIM has performed well

February 12, 2024 Hamlin WV Mud river



Gaged FIM Review: February 12, 2024 Hamlin WV Mud River at 13.6 feet

Flood Stage: 13 feet

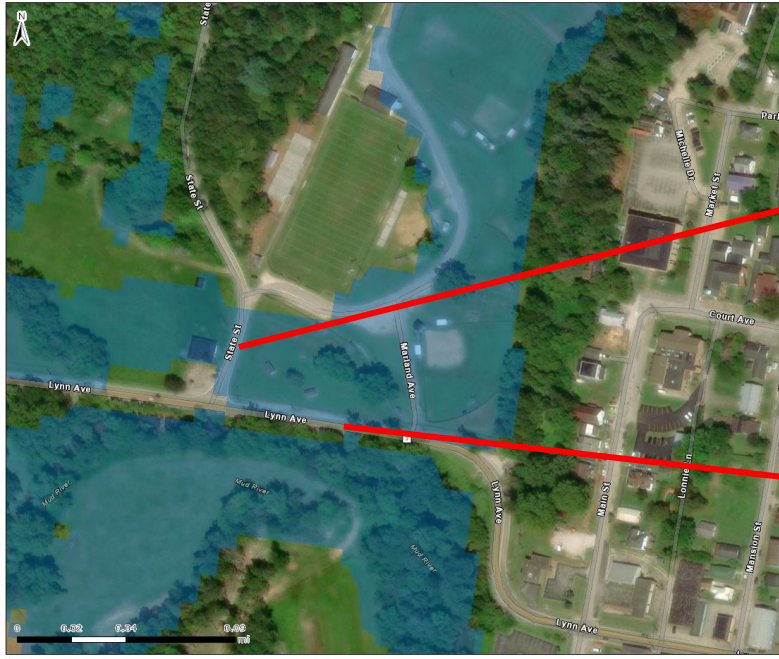


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# Some places where NWM FIM has performed well

February 12, 2024 Hamlin WV Mud river



Gaged FIM Review: February 12, 2024 Hamlin WV Mud River at 13.6 feet

Flood Stage: 13 feet

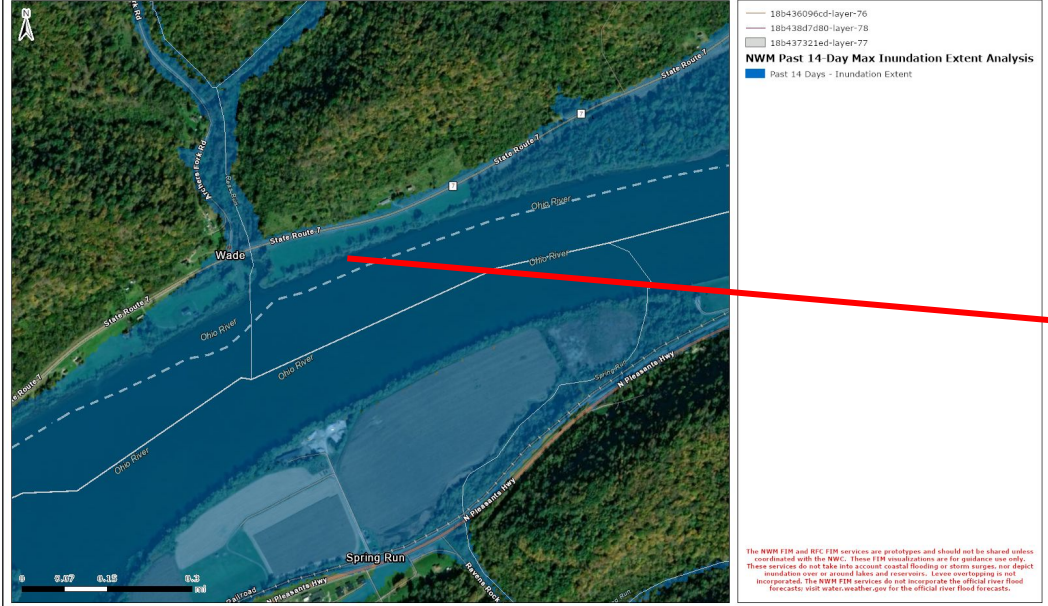


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# Some places where NWM FIM has performed well

Wade Ohio River Drowning April 05, 2024



Person drove into this on Route 7, 7 miles upstream from Willow Island Locks gage. Water was so deep officials used underwater sonar to locate this person and their vehicle.

Willow Island Gaged FIM Review: April 5, 2024 Wade OH Ohio River at ~41.5 feet

Moderate Flood Stage: 41 feet

Existing Impact Statement: 37 feet - Ohio State Route 7, Township Road 443, and Township Road 19 at Newell Run and Lenards Landing floods.



# Some places where NWM FIM has performed so so



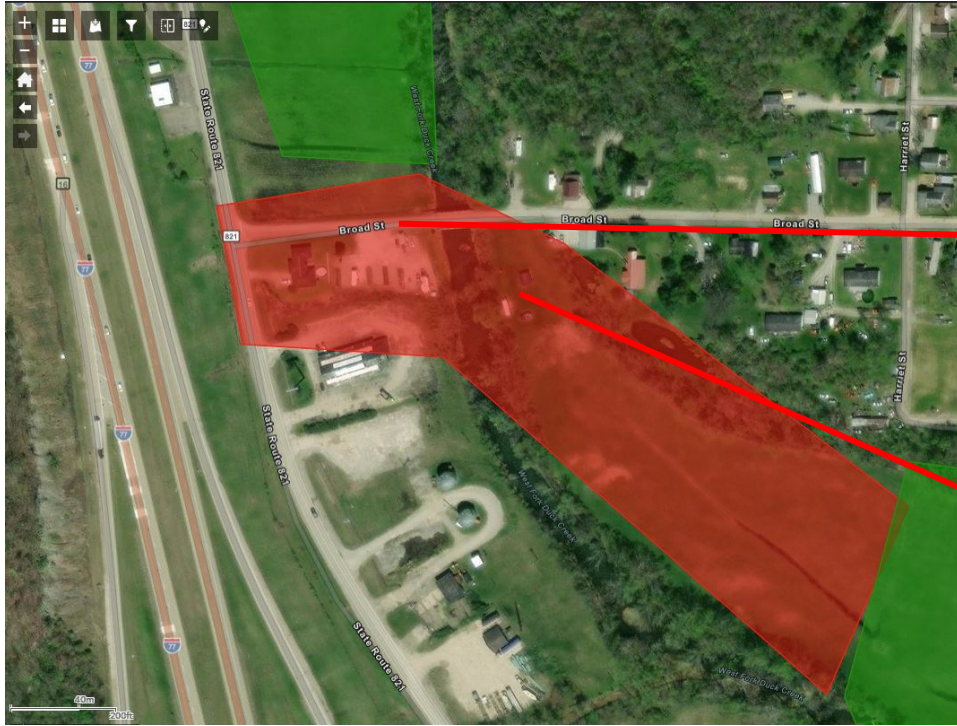
Gaged FIM Review: January 10, 2024 Macksburg Duck Creek at 13.8 feet  
Flood Stage: 13 feet



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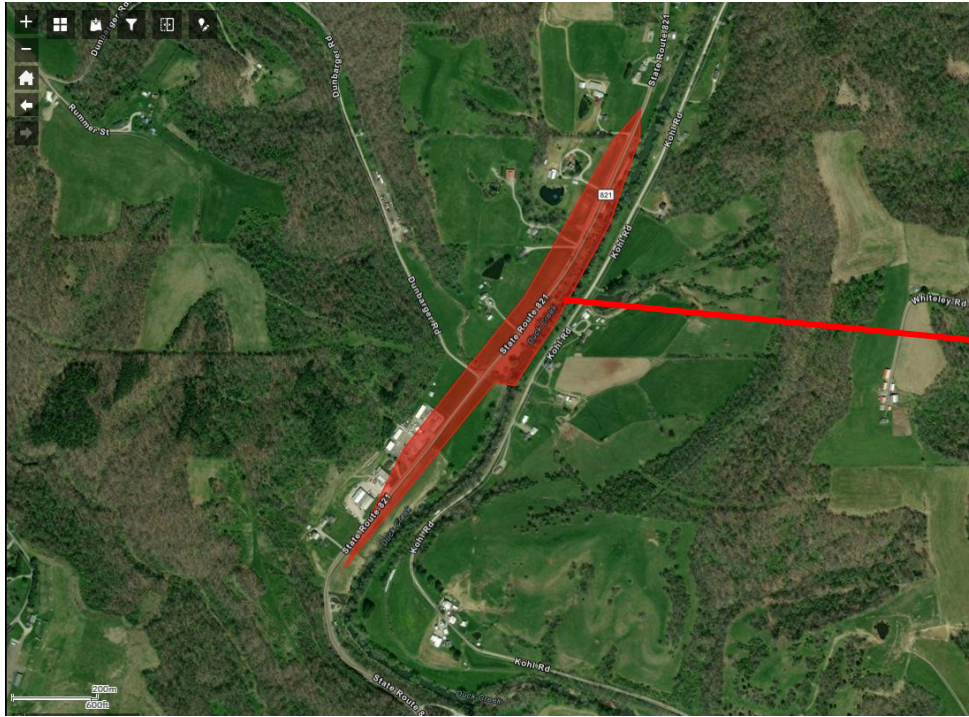
# Some places where NWM FIM has performed so so



Gaged FIM Review: January 10, 2024 Macksburg Duck Creek at 13.8 feet  
Flood Stage: 13 feet



# Some places where NWM FIM has performed so so



Gaged FIM Review: January 10, 2024 Whipple Duck Creek at 13 feet  
Flood Stage: 13 feet



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# Some places where NWM FIM has performed so so



Gaged FIM Review: January 10, 2024 Whipple Duck Creek at 13 feet

Flood Stage: 13 feet

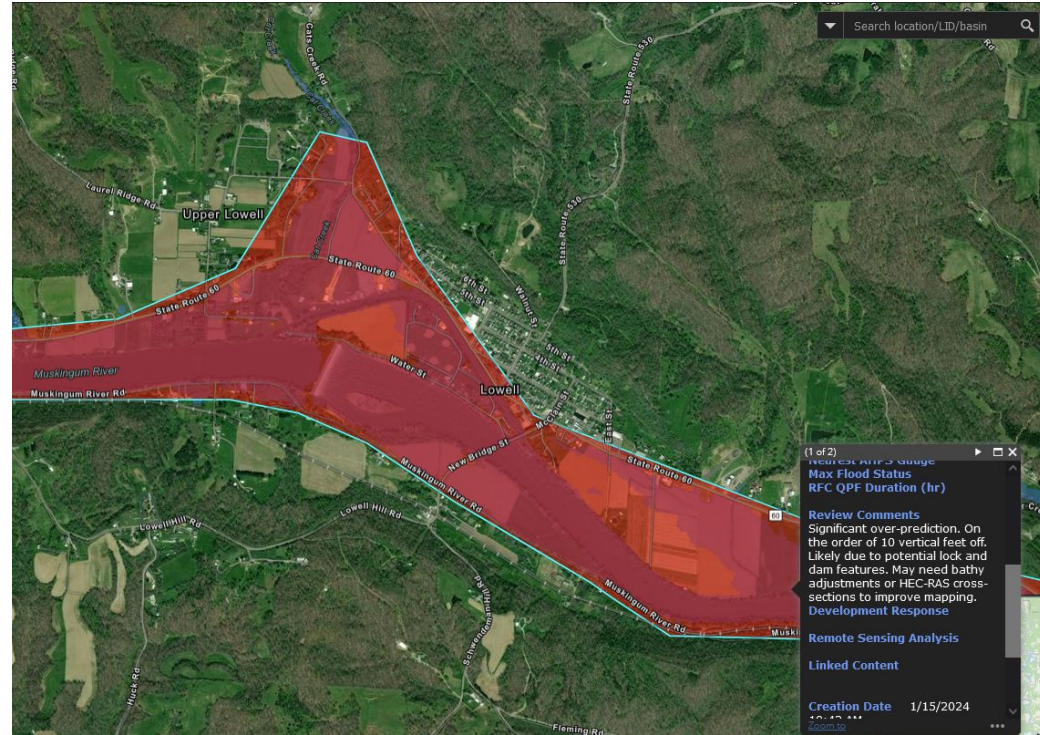


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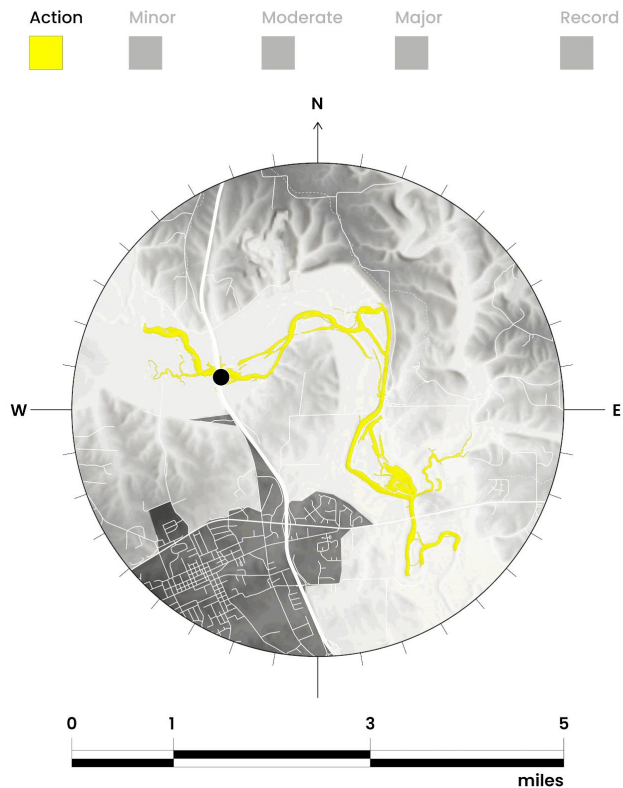
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# Some places where NWM FIM has struggled

- Mainstem Rivers - Muskingum
  - Significant overestimation due to locks note from recent event
  - May need bathymetry to improve performance



# Categorical FIM (CatFIM) - Static



- Static flood extent area for official NWS flood category thresholds [Action, Minor, Moderate, Major, Record]
  - Only available ~5 miles upstream and downstream of a forecast point
- **When to use...** For planning practices on 'blue-sky' days ahead of potential flood events
- **Possible Use Examples:**
  - Where are 'go to' places for resource staging?
  - Which bridges may be at risk of flooding?
  - Which evacuation routes are preferred?

*Planning tool near existing NWS forecast points*

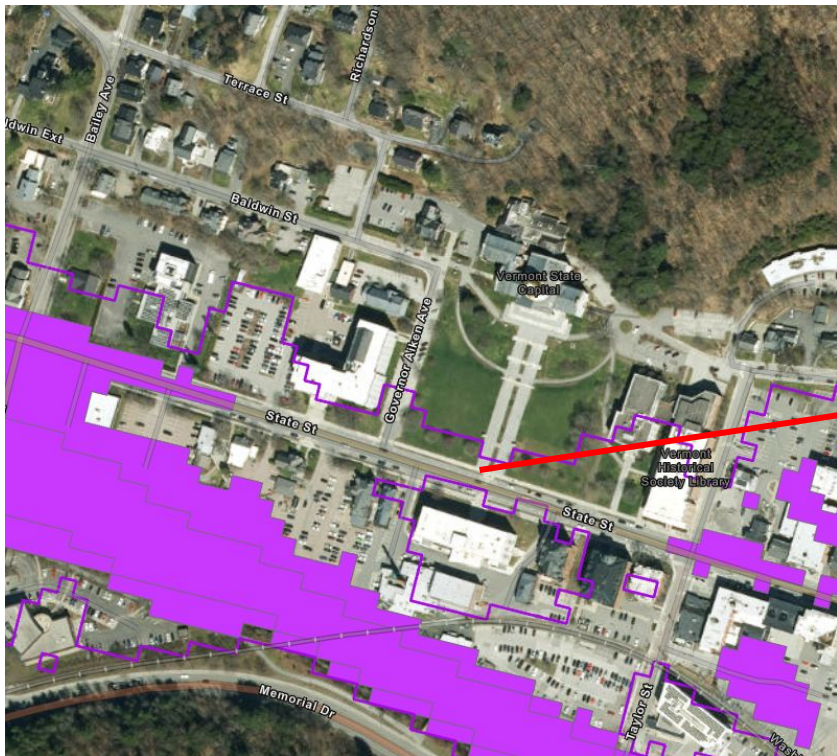
# CatFIM Example - Weston West Fork River



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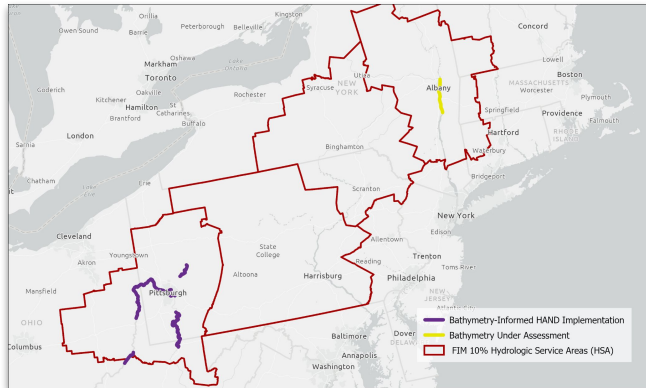
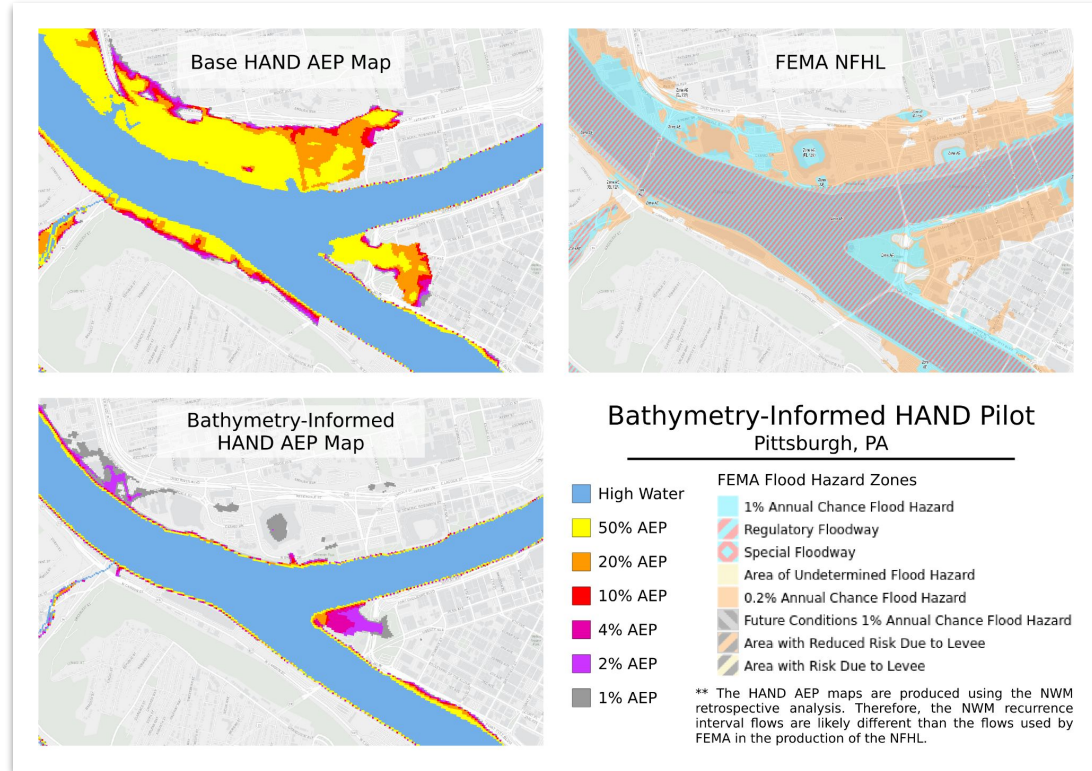
# Recent CatFIM Success - Montpelier, VT Major Flood





# Some places where CatFIM has struggled

- **Mainstem Rivers - Monongahela, Allegheny, and Ohio**
  - Originally was overestimating locations where there were locks and other man-made structures
  - Fix being implemented along the Ohio River



# FIM Use Before, During, and After a Flood Event

Forecasts & Data:

- Probabilistic forecasts
- River ensembles (MMEFS & HEFS)

Day 4-7+  
Pre-Flood  
or "Blue Sky" Planning

- NWPS Partner FIM
- CatFIM

- NWS River Forecasts

Days 1-3  
Pre-Flood

- NWPS Partner FIM
- CatFIM
- RFC FIM
- NWM 5-Day FIM

- Current Conditions (Gage Observations)
- NWS River Forecasts

Flood

- NWPS Partner FIM
- CatFIM
- RFC FIM
- NWM Latest Analysis FIM
- NWM 5-Day FIM

- High Water Marks
- Flood Photos/Videos
- Damage Assessments

Post-Flood

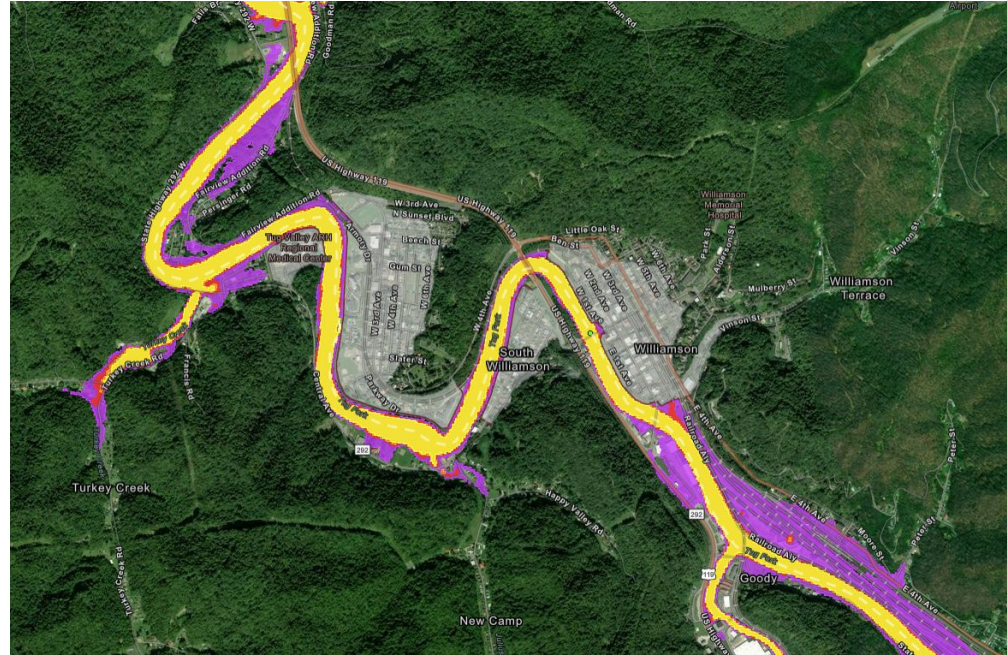
- NWPS Partner FIM
- CatFIM
- NWM Latest Analysis FIM

Flood Inundation Maps (FIM):



# NWS FIM Limitations and Caveats

- This first iteration only includes maps of the extent of flooding
- Each service is based on one weather and water forecast or model - no range of possible outcomes
- **Levee areas are always masked, even if overtopped**
- Most bridges are not currently masked
- **NOT** regulatory/NOT related to FEMA maps
  - These are maps of observed and forecast flooding produced on an event basis
- No account for backwater effects
- Does not depict inundation around lakes and reservoirs
- Of limited use for urban areas away from river reaches



# NWS FIM Future Developments/Improvements

## RAS2FIM Domain

- Incorporating existing channel modeling from partner agencies (HEC-RAS)

## Bathymetry Data

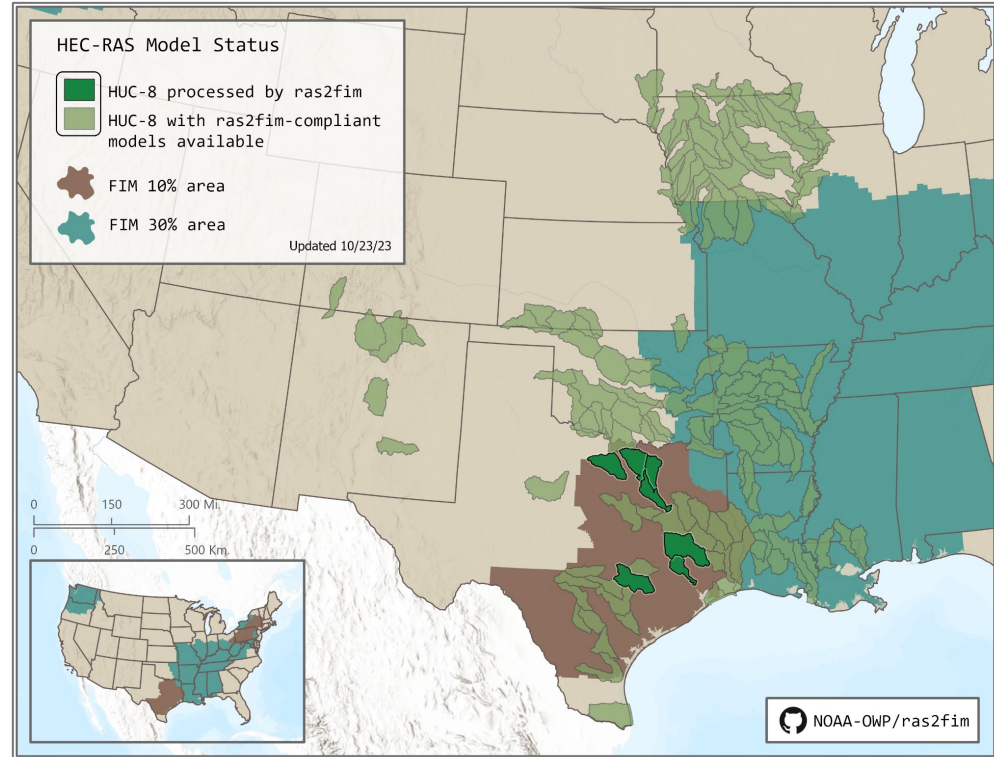
- USACE source for Ohio, Allegheny, Kanawha, and Monongahela Rivers

## Bridge Improvements

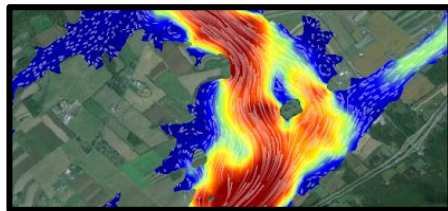
- Clipping based on approach elevation

## Finer resolution DEM (select locations)

- Effort to improve land model accuracy, but still allow for timely updates



# HEC-RAS Derived FIM Capabilities



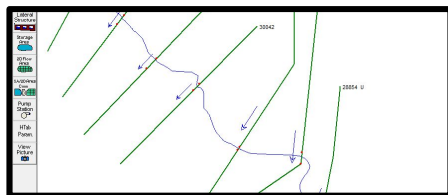
## Calibrated 2D Models

(HEC-RAS 2D // LISFLOOD // InfoWorks // etc..)



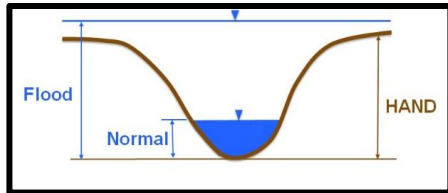
## Flood Insurance Models

(HEC-RAS – 1D Typical)



## Base Level Engineering

(1D Typical // 2D Coming)  
HEC-RAS



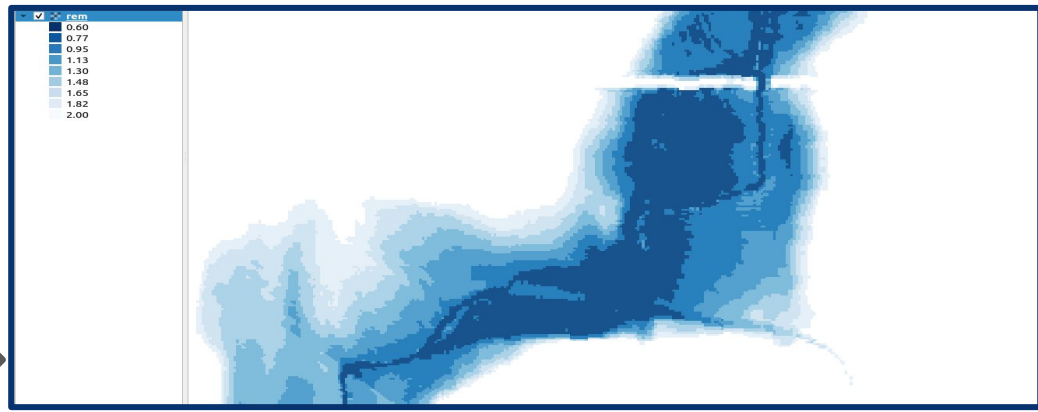
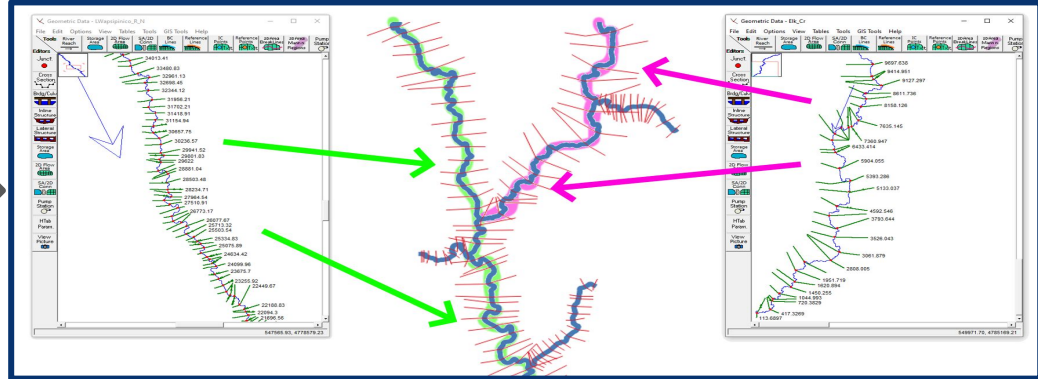
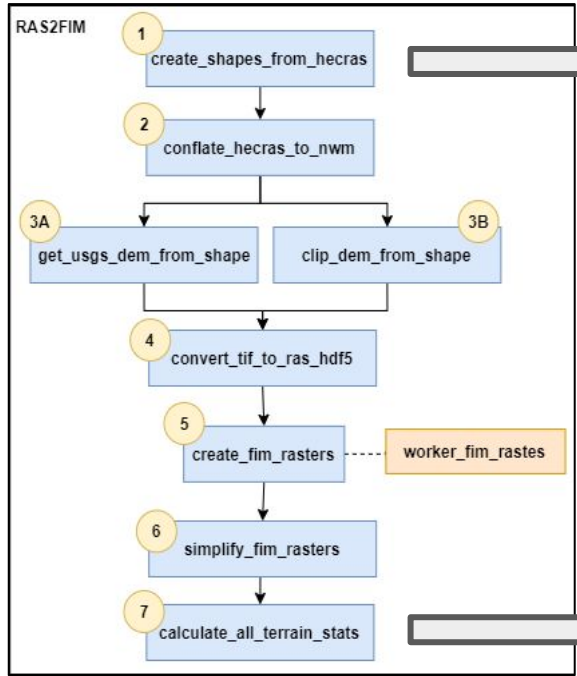
## Height Above Nearest Drainage



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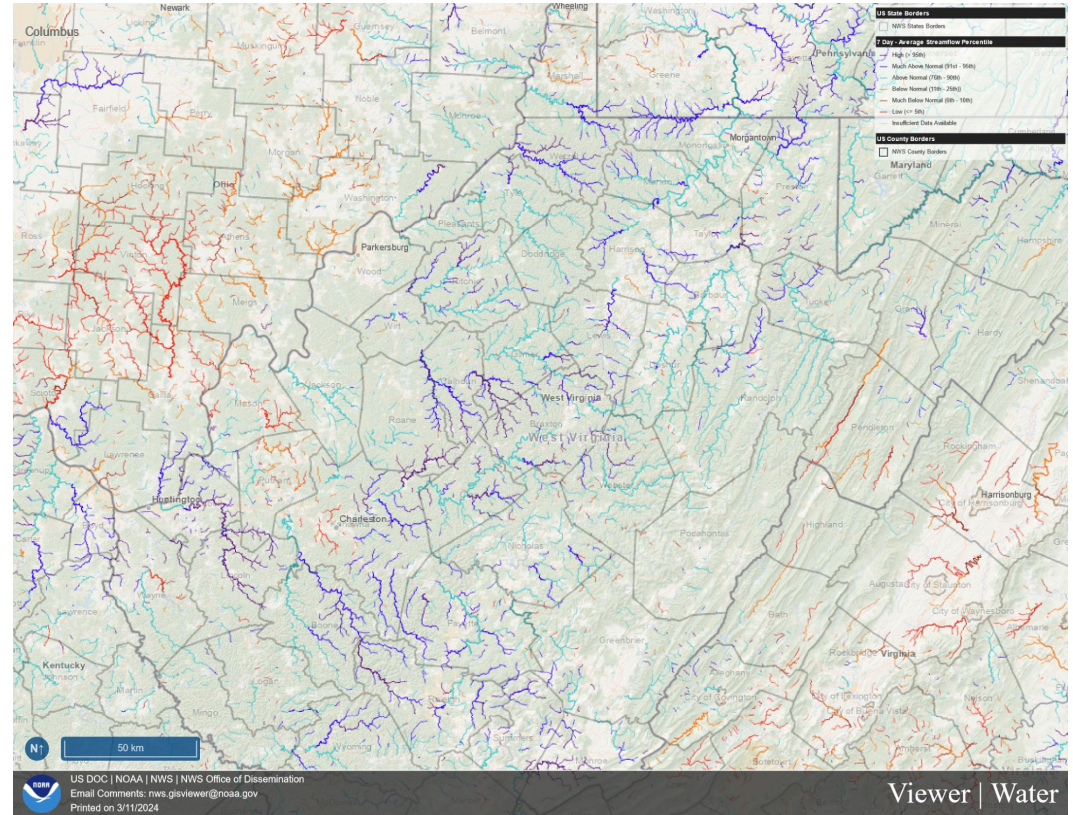
# FIM Development RAS2FIM





# FIM Access - National FIM Viewer

<https://viewer.weather.noaa.gov/water>



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# Questions / Comments

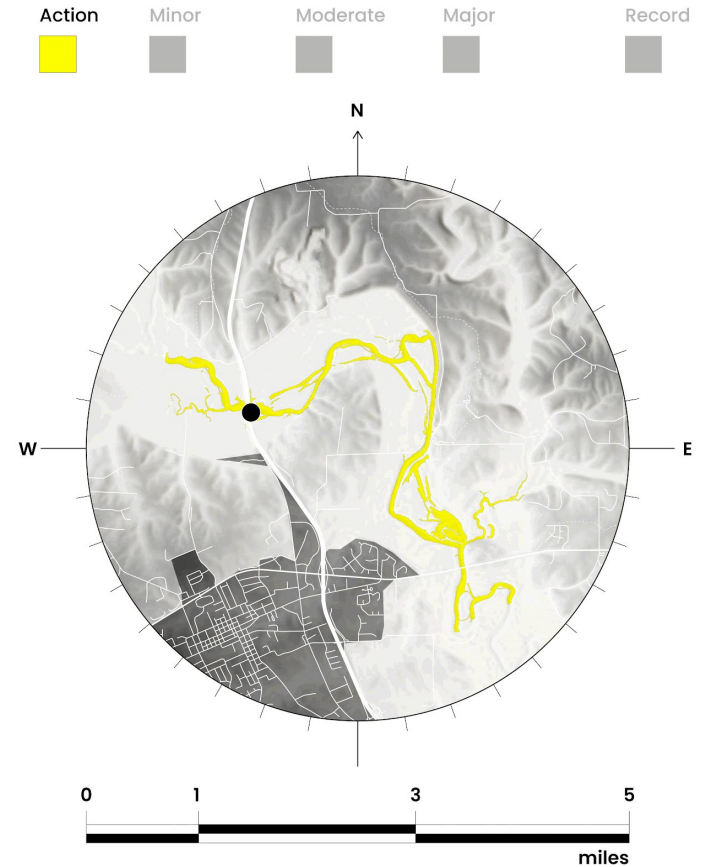
NWS Flood Inundation Mapping

*“Putting Water on the Map”*

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