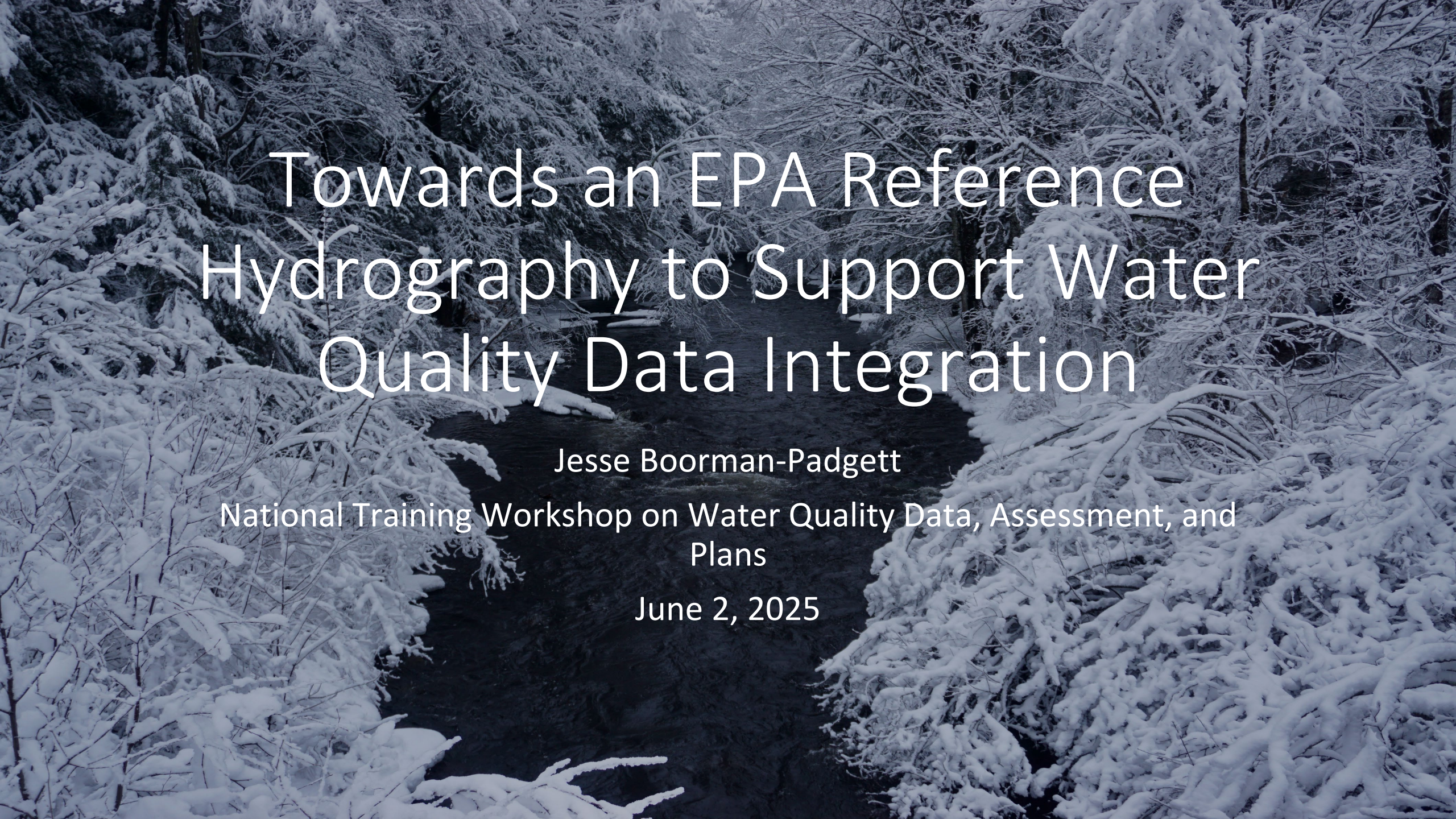


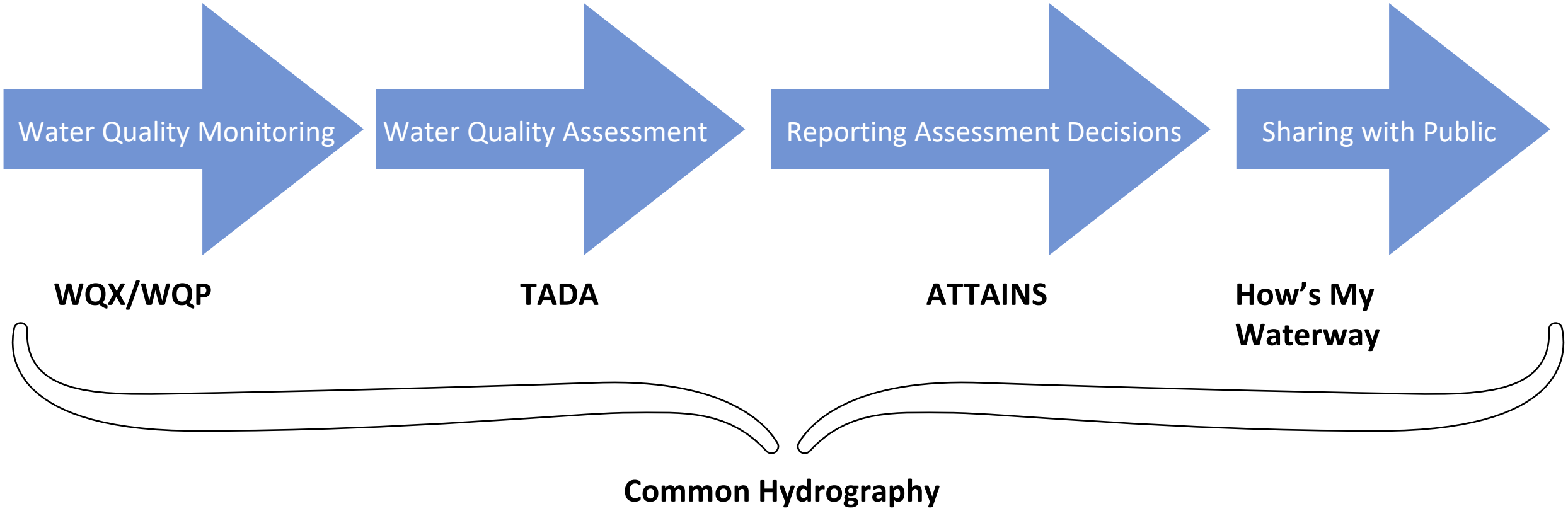
Towards an EPA Reference Hydrography to Support Water Quality Data Integration

Jesse Boorman-Padgett

National Training Workshop on Water Quality Data, Assessment, and Plans

June 2, 2025

Water Quality Data Lifecycle



National Hydrography Products: Current

National Hydrography Dataset (NHD)

Watershed Boundary Dataset (HUC12)

NHDPlus

NHDPlus V2

1:100,000 resolution product (*original*)

2.7 million catchments

Developed by EPA and USGS

widely used for modeling

connects landsurface activities to downstream effects

upstream/downstream navigation

flow volume and velocity, time of travel

“NHDPlus V2” in 2013 (V1 in 2006)

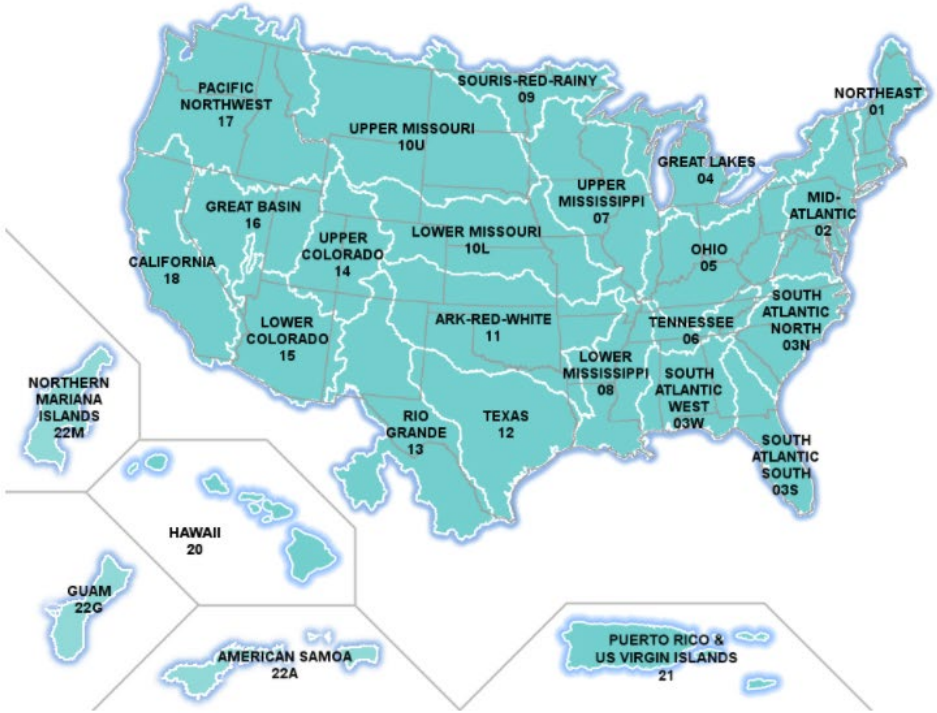
NHDPlus V2 Data

https://www.epa.gov/waterdata/get-nhdplus-national-hydrography-dataset-plus-data

NHDPlusV2 Data Map

Select the data region of your choice by clicking on the map below or selecting the name from the list.

National Data | Global Data



List of Areas by Number

- 01 Northeast
- 02 Mid Atlantic
- 03N South Atlantic North
- 03S South Atlantic South
- 03W South Atlantic West
- 04 Great Lakes
- 05 Ohio
- 06 Tennessee
- 08 Lower Mississippi
- 09 Souris-Red-Rainy
- 10U Upper Missouri
- 10L Lower Missouri
- 11 Ark-Red-White
- 12 Texas
- 13 Rio Grande
- 14 Upper Colorado
- 16 Great Basin
- 17 Pacific Northwest
- 18 California
- 20 Hawaii
- 21 Puerto Rico/U.S. Virgin Islands
- 22A American Samoa
- 22G Guam
- 22M Northern Mariana Islands

NHDPlus High Resolution (HR)

- Same data model and methods as original NHDPlus
- Improved spatial resolution 1:24,000 or greater
- 30 million features
- Version 1.0 released in 2022
- EPA Snapshot available now

NHDPlus HR Data

https://www.epa.gov/waterdata/get-nhdplus-national-hydrography-dataset-plus-data#DownloadHR

Download NHDPlus High Resolution EPA Snapshot 2022 Data

National:

- Esri File Geodatabase (39.4 GB)
- OGC GeoPackage (72.7 GB)

State and State-Equivalent:

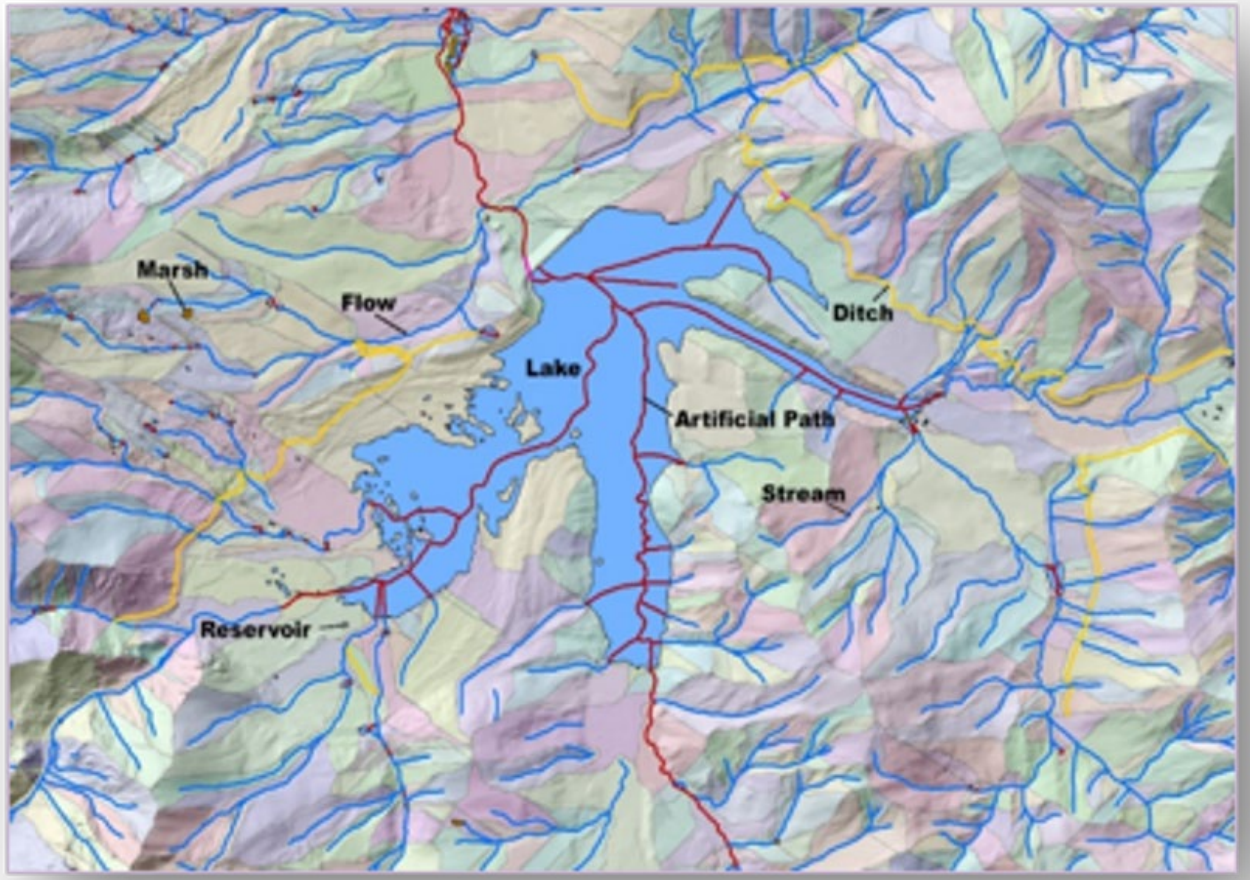
Alabama

- Esri File Geodatabase (562 MB)
- OGC GeoPackage (1.3 GB)

Release notes and metadata forthcoming.

NHDPlus HR National Release 2

- Final version of NHDPlus
- Released in February 2025
- Fixes issues in NHDPlus HR
- Will become EPA's common hydrography

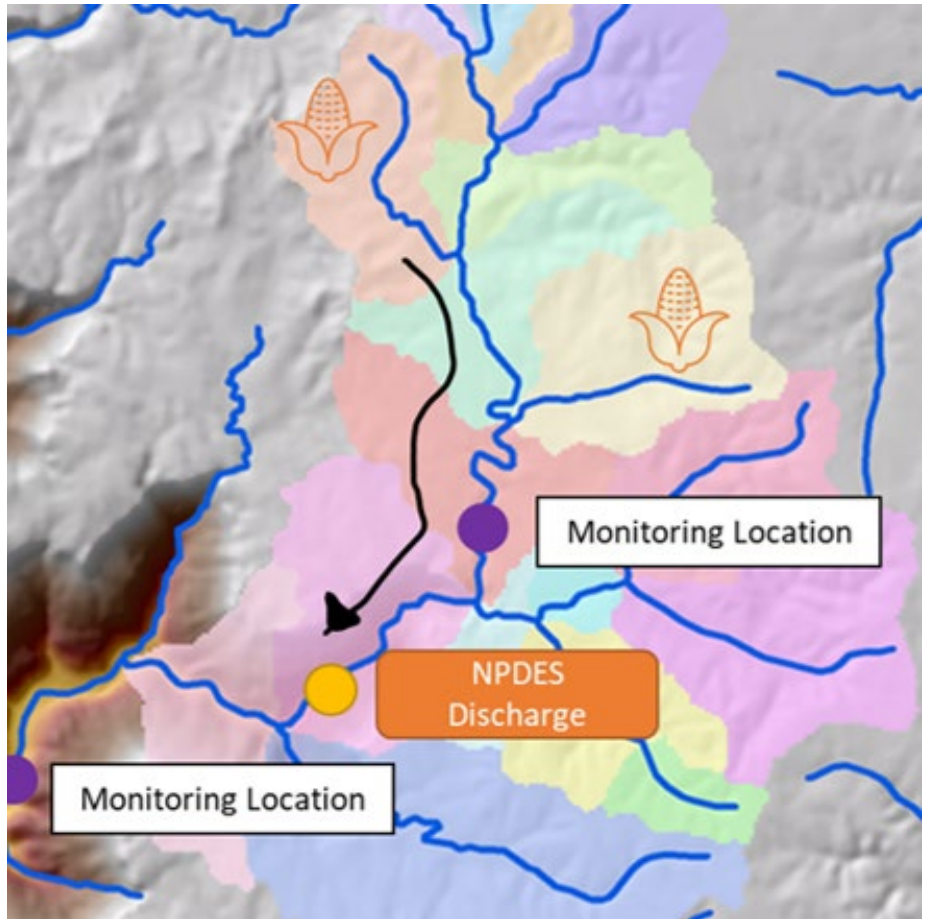


EPA “Geofabric”

A continuous surface layer that serves as the spatial/hydrographic reference framework for water data locations from headwater to oceans.

Based on snapshot of **NHDPlus High Resolution**

- ~30 million catchments
- Ocean ‘catchments’ (H3 hexagons)
- Alaska catchments (H3 hexagons)
- State boundaries, state clipped catchments with adjusted areas
- Federal boundaries
- Territories
- *EPA ID?*



EPA Activities Vary in Spatial Resolution

Map Scale

1:100,000

EPA National Programs

Water, Research and Development, Pesticides, Compliance, Others
national level monitoring, modeling, tracking, reporting, etc.

EPA Regional Offices

1: 24,000

EPA State and Tribal Partners

County, Municipal Partners, Public

Permitting, field visits, compliance, emergency response

1: 500

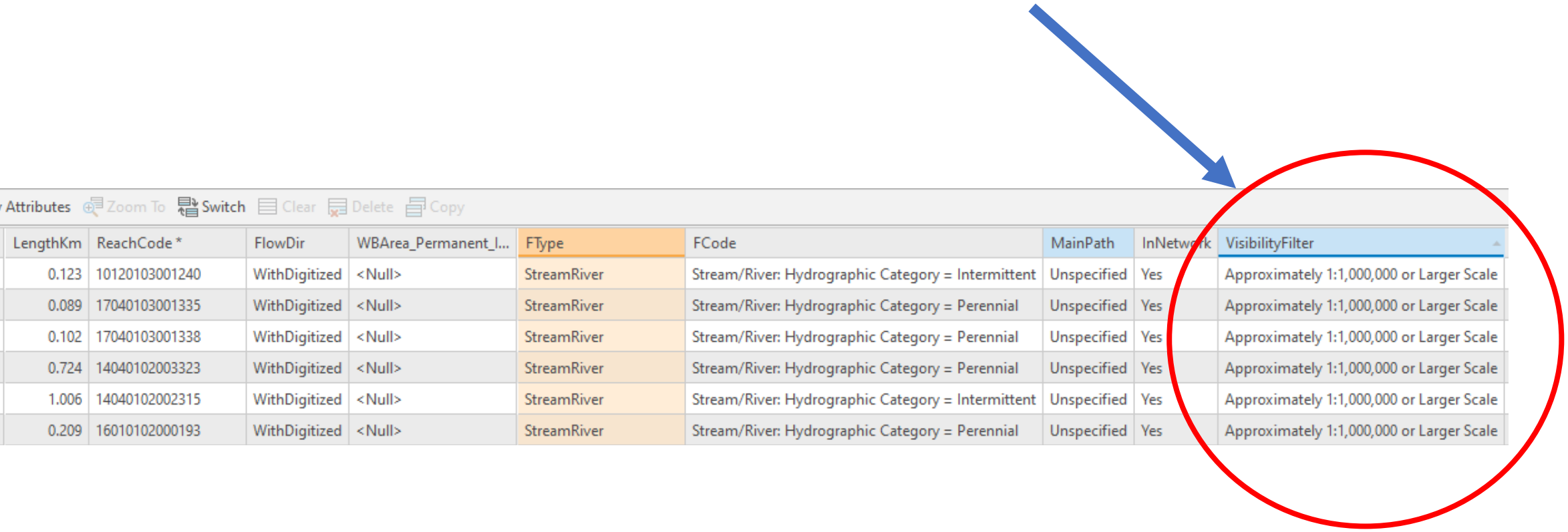
CWA Jurisdictional Determinations

NHDPlusVFGen

- Based on new NHDPlusHR
- Pruned back to 1:100,000 network
- Regenerates all Value-Added Attributes (VAAs)
- Retains all crosswalk information
- Available in beta now

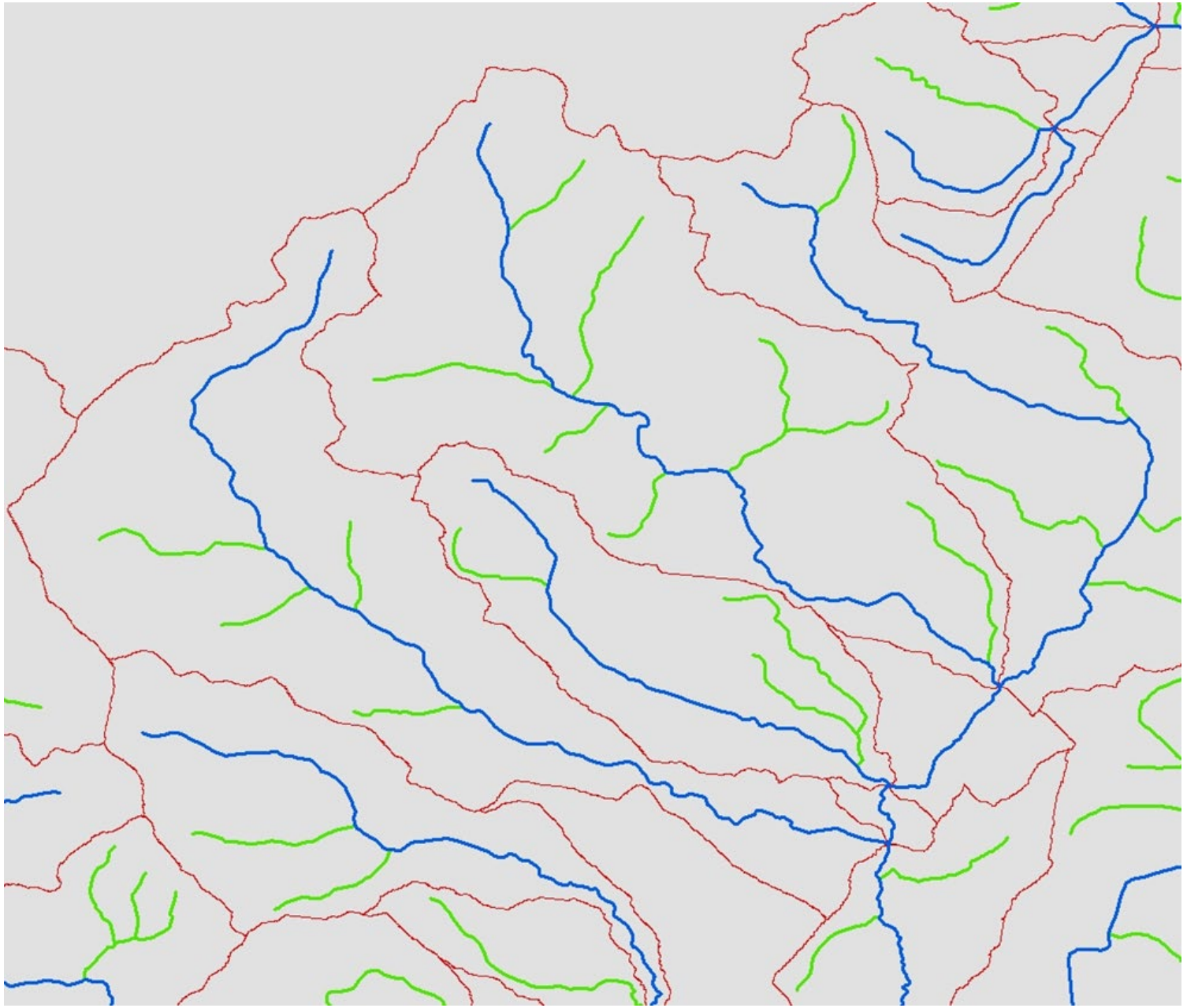
NHDPlus High Resolution or NHDPlus HR

Newly populated **VisibilityFilter** attribute



Attributes | Zoom To | Switch | Clear | Delete | Copy

LengthKm	ReachCode *	FlowDir	WBArea_Permanent_I...	FType	FCode	MainPath	InNetwork	VisibilityFilter
0.123	10120103001240	WithDigitized	<Null>	StreamRiver	Stream/River: Hydrographic Category = Intermittent	Unspecified	Yes	Approximately 1:1,000,000 or Larger Scale
0.089	17040103001335	WithDigitized	<Null>	StreamRiver	Stream/River: Hydrographic Category = Perennial	Unspecified	Yes	Approximately 1:1,000,000 or Larger Scale
0.102	17040103001338	WithDigitized	<Null>	StreamRiver	Stream/River: Hydrographic Category = Perennial	Unspecified	Yes	Approximately 1:1,000,000 or Larger Scale
0.724	14040102003323	WithDigitized	<Null>	StreamRiver	Stream/River: Hydrographic Category = Perennial	Unspecified	Yes	Approximately 1:1,000,000 or Larger Scale
1.006	14040102002315	WithDigitized	<Null>	StreamRiver	Stream/River: Hydrographic Category = Intermittent	Unspecified	Yes	Approximately 1:1,000,000 or Larger Scale
0.209	16010102000193	WithDigitized	<Null>	StreamRiver	Stream/River: Hydrographic Category = Perennial	Unspecified	Yes	Approximately 1:1,000,000 or Larger Scale



VFGen: VisibilityFilter >= 1:100,000

GREEN >= 1: 24,000 (HR)

BLUE >= 1:100,000 (VFGen)

RED VFGen Catchments

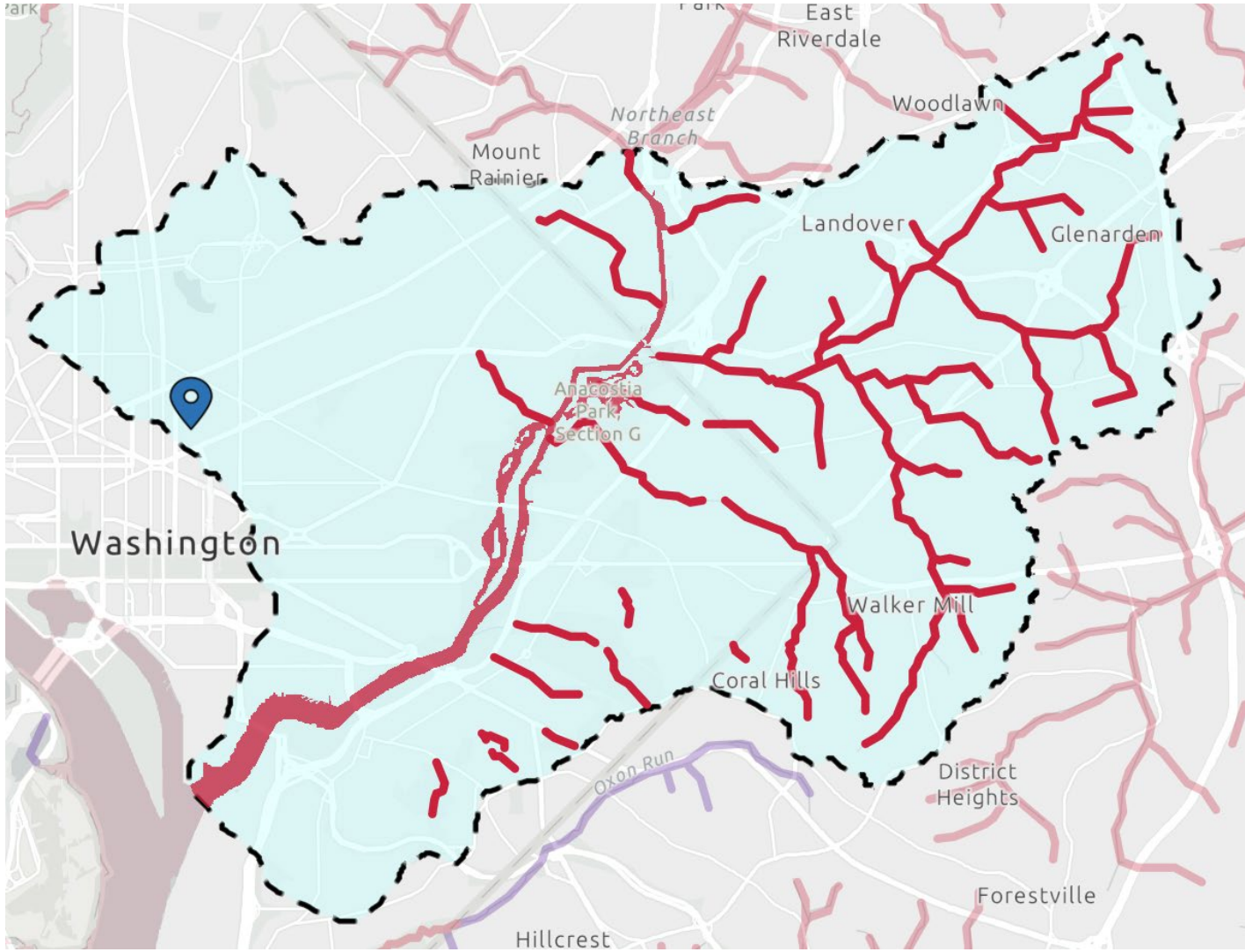
HR and VFGen have same data model but VFGen has an extra table.

FlowlineXWalk

OBJECTID *	NHDPlusID	RcvingFlowline	Distance
22121	25000300000028	25000300000027	0.978
1190	25000300000029	25000300004758	1.57
3270	25000300000030	25000300016396	0.266
18662	25000300000032	25000300000033	1.077
22035	25000300000038	25000300035147	1.446
19365	25000300000039	25000300035147	0.956
19017	25000300000040	25000300000060	2.432
10365	25000300000045	25000300009447	1.893
19757	25000300000046	25000300032759	0.027

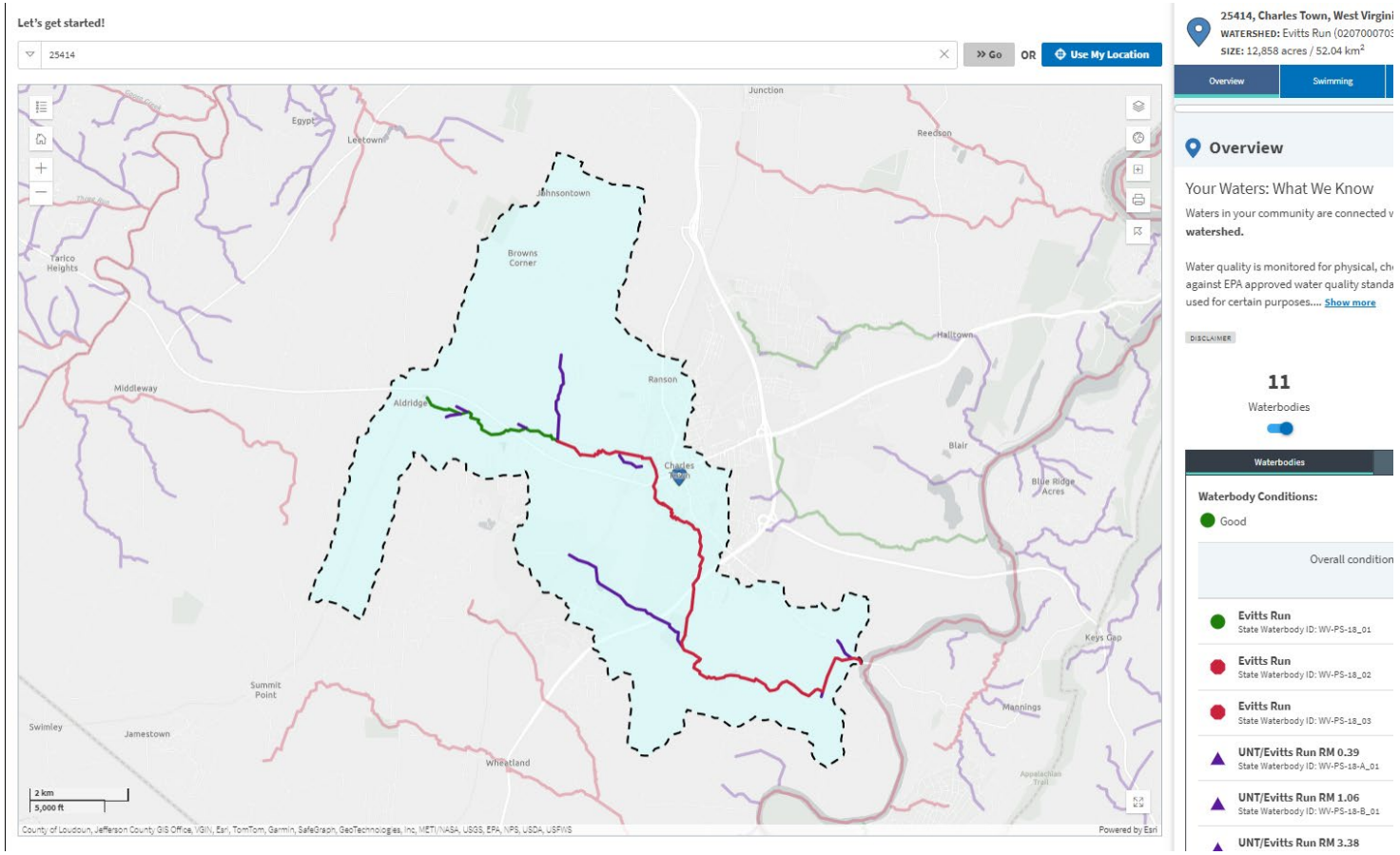
Watershed Boundary Dataset (WBD)

- Dataset containing watershed-like features called HUCs
- Different levels of HUCs from HUC2 to HUC12
- Some places have HUC14s and HUC16s
- HMW uses version that aligns with NHDPlus V2
    - HMW's common hydrography
- USGS released the final WBD in January 2025
    - HMW will move to this version



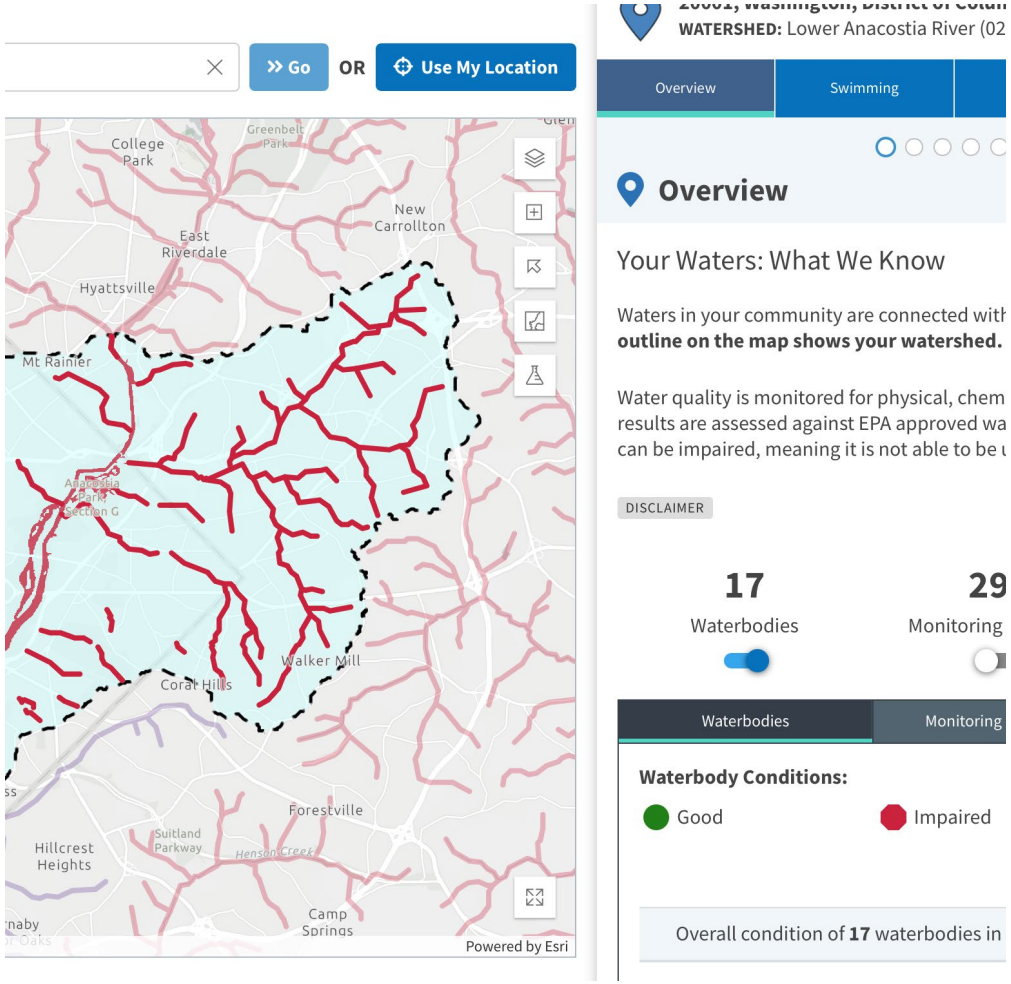
NHDPlus and ATTAINS

- State-submitted GIS
  - No constraints on source hydrography
  - Primarily NHD (HR)
  - Indexed to catchments to create layer
- ATTAINS HUC12 summary report API
- One of most accessed data layers produced by EPA

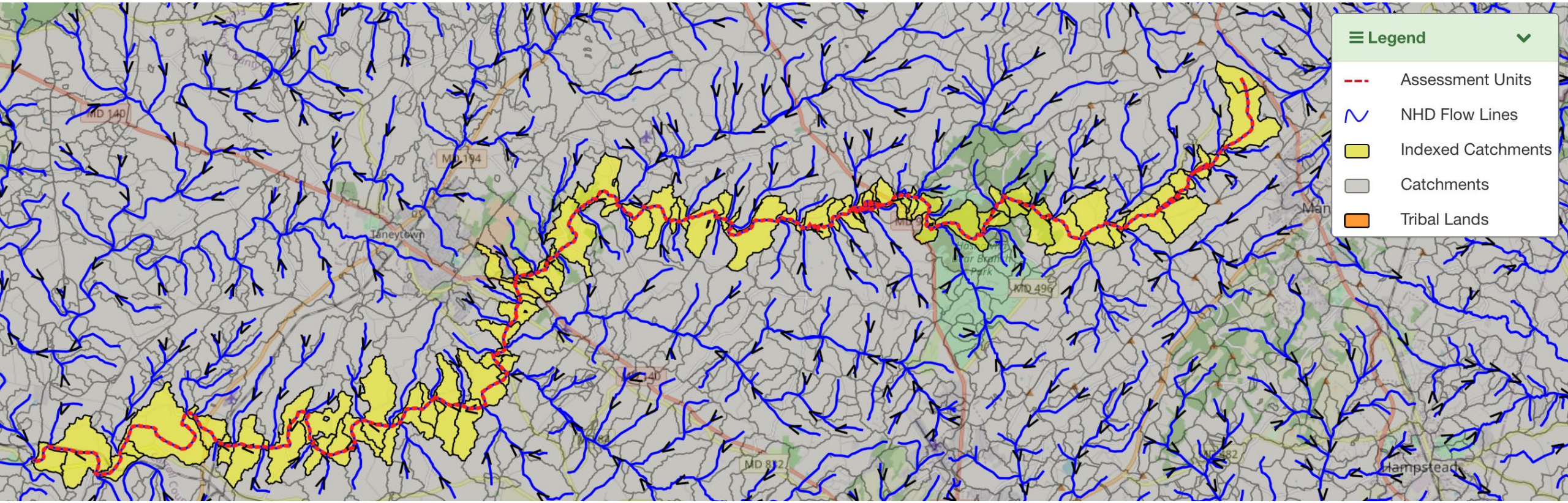


NHDPlus and ATTAINS (cont.)

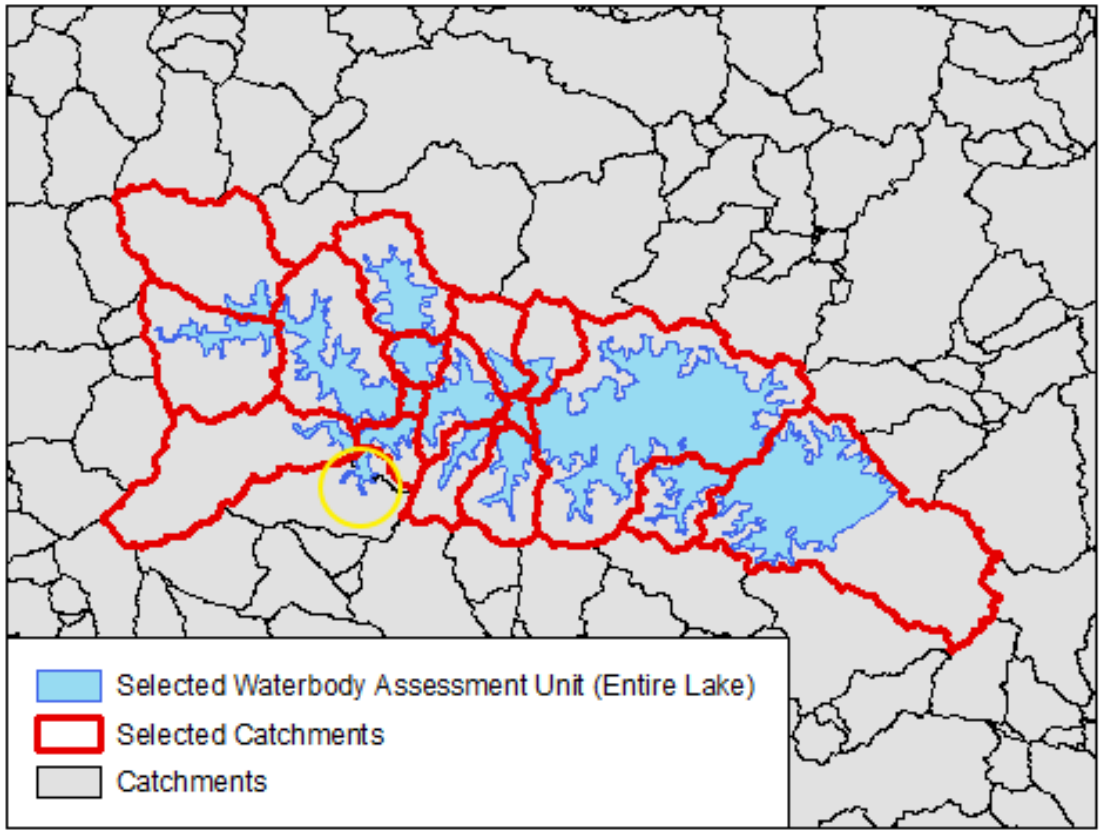
- ATTAINS transitioned to NHDPlus High Resolution in 2022
    - Involved reprocessing all state and tribal data through the Catchment Index Process (CIP) tool
    - All reprocessed data was QA'ed
- ATTAINS uses H3 hexagons for Alaska and ocean catchments (geofabric)
- Measures use high resolution catchment area

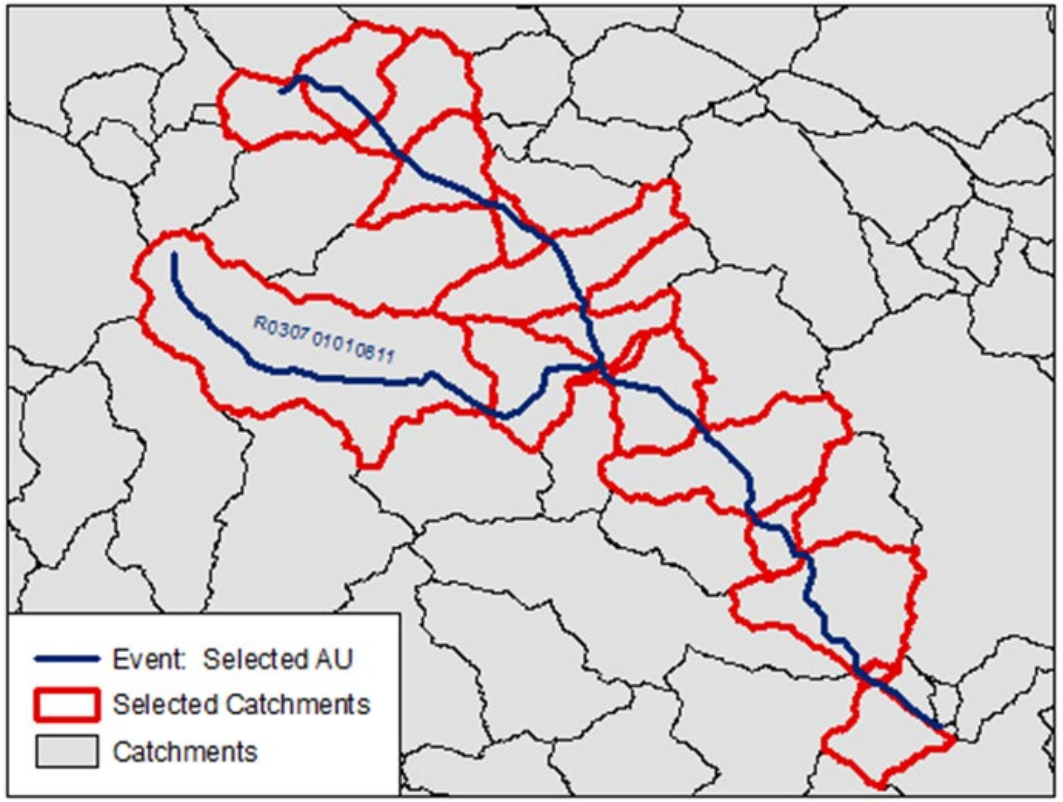


NHDPlus and ATTAINS (cont.)



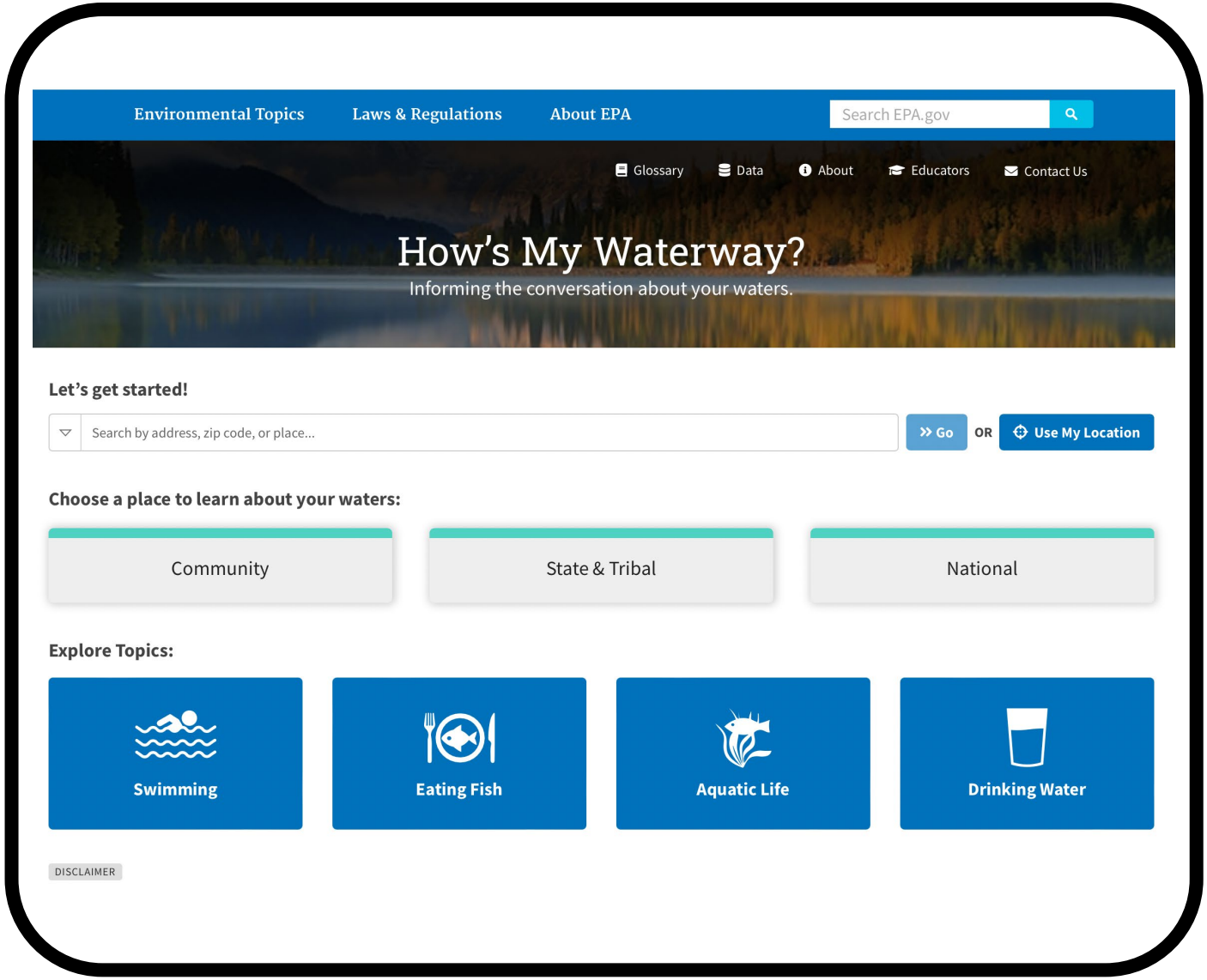
NHDPlus and ATTAINS (cont.)



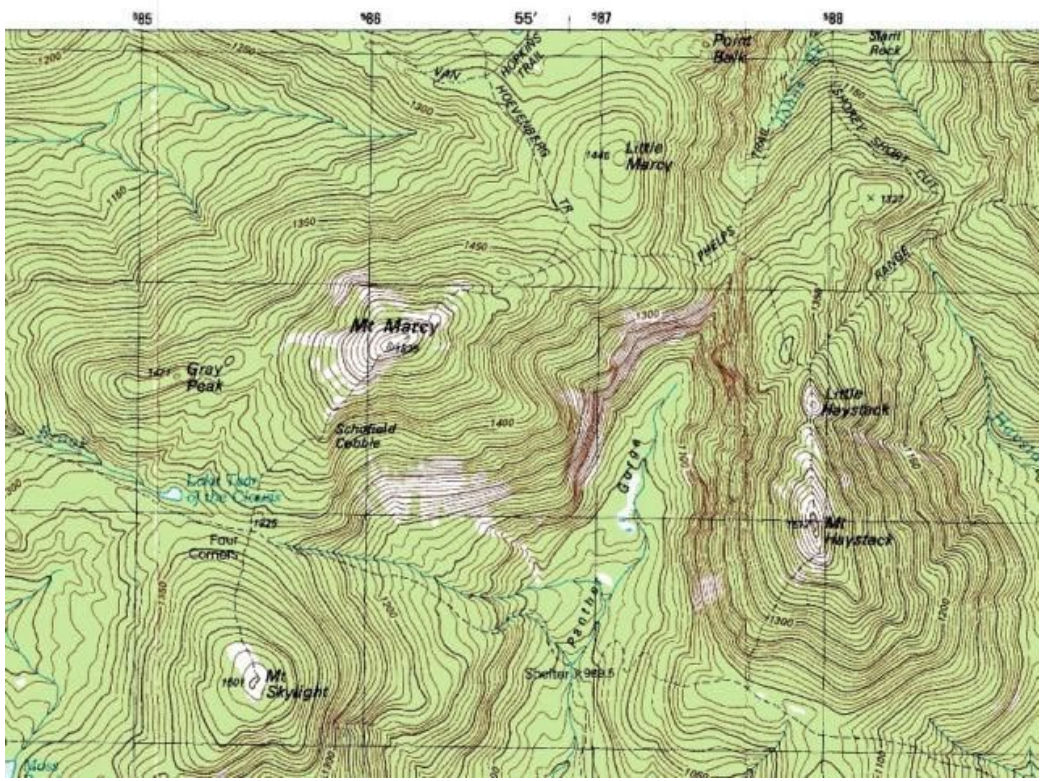


How's My Waterway?

- EPA's flagship tool to provide the general public with information about the condition of their local waters
- Pulls information from dozens of data systems within EPA and outside the agency
- Lightweight application that uses APIs to pull data
- Displays water quality information on 3 different levels: Community (HUC12), State and Tribal, and National



Future of Hydrography: LIDAR derived Hydrology



3DHP: The New Hydrography

- ❑ What are EPA specific requirements?
- ❑ What are the use cases and how does the new data model address them?
- ❑ What is the right spatial resolution?
- ❑ What are the potential gaps?


Thank You