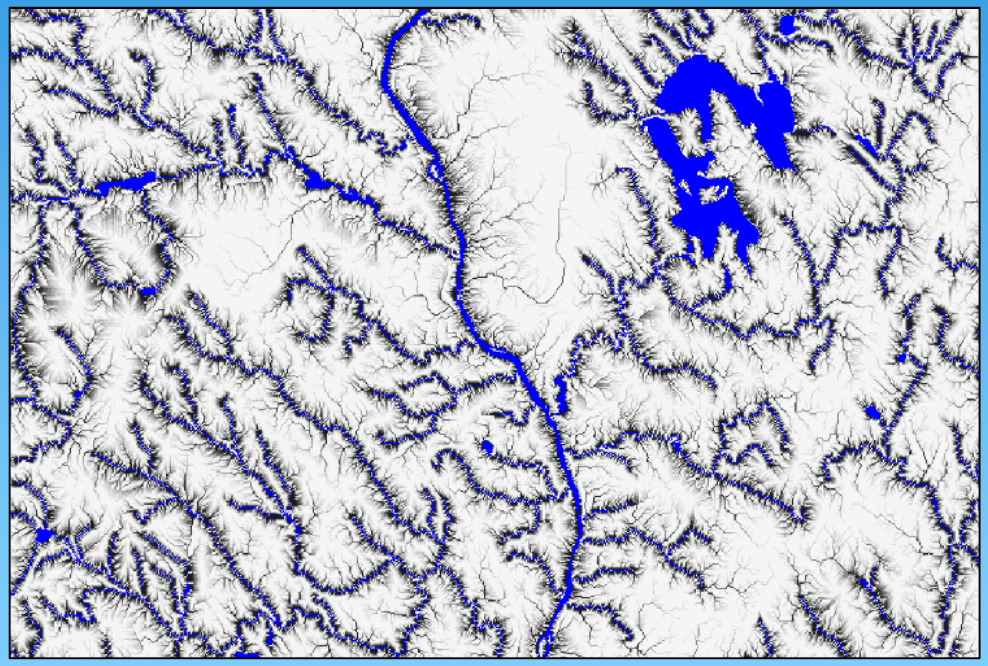
Innovative Applications of the NHD*Plus*

(National Hydrography Dataset *Plus* Version 2)



EPA Office of Water

May 1, 2014
National Water Quality Monitoring Conference

Acknowledgements

* Elizabeth Jester Fellows / EPA Office of Water
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* Karen Hanson / USGS WBD Technical Lead
* NHD*Plus* Team
  * Tommy Dewald / EPA Office of Water
  * Cindy McKay / Horizon Systems Corporation
  * Tim Bondelid / Consultant
  * Craig Johnston, Rich Moore, Al Rea / USGS Water
  * (Greg Schwarz, Kernell Ries, Dave Wolock / USGS Water)

Overview

* NHD*Plus* Concepts
* Introducing NHD*Plus* Version 2
* Applications Sampler

Why NHD*Plus*?

Understanding flow
Where and when the water is …
Important to know!
- NHD*Plus* Haiku

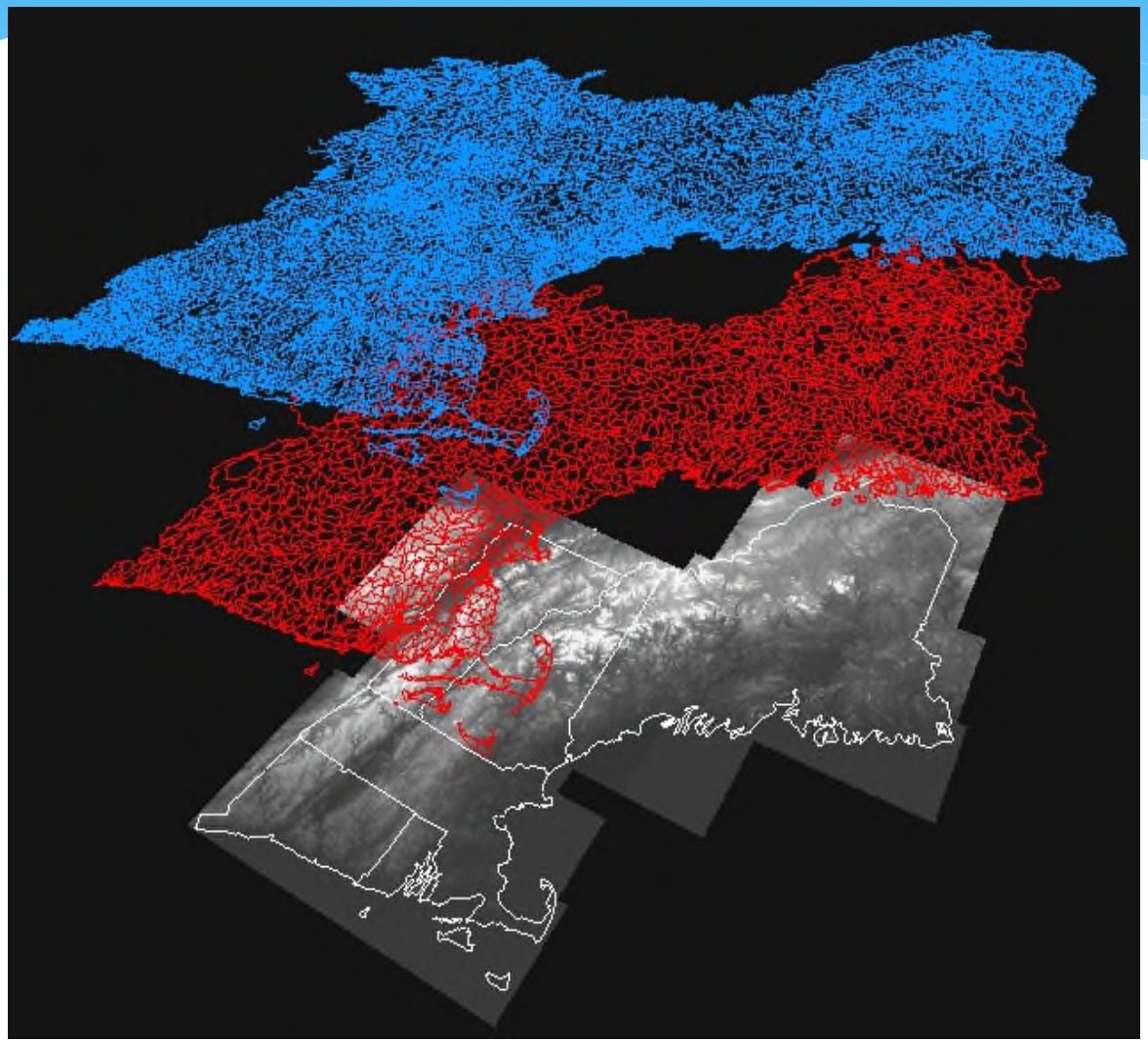
"What I think NHD*Plus* offers that is unique is in the full characterization of the flow network, identification of unregulated and regulated gages and reaches, and network-based interpolation and adjustment of flows."

- Al Rea, USGS

National Hydrography Dataset *Plus* (NHD*Plus*)

* Developed by EPA and USGS-Water (2006) to provide flow volume and velocity estimates for pollution dilution modeling
  * Builds upon NHD stream network – integrated with elevation and HUC12s
  * Additional stream attributes (stream order, flow, etc)
  * Catchments and attributes (precipitation, temperature, land cover)
* Success of initial version led to Version 2 production by EPA and USGS-Water (2012)

NHDPlus Concepts: Integration of NHD, WBD, and NED



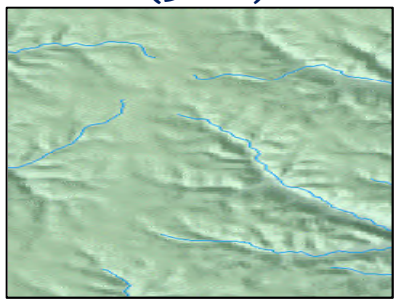
National Hydrography Dataset (NHD)

Watershed Boundary Dataset (WBD)

National Elevation Dataset (NED)

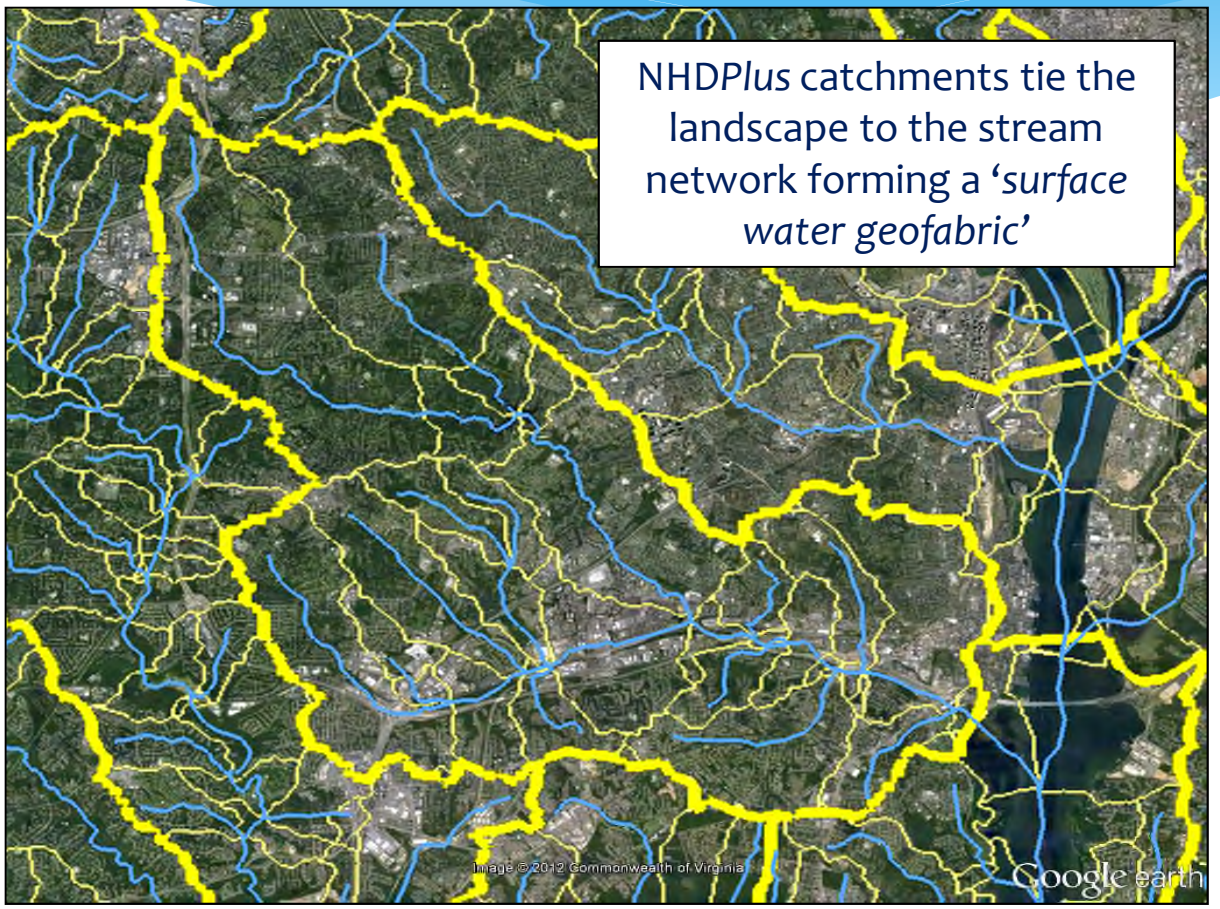
NHD*Plus* provides the Surface Water Geospatial Framework

Elevation (30m)



Hydrologic Units (HUC12)

Stream Network



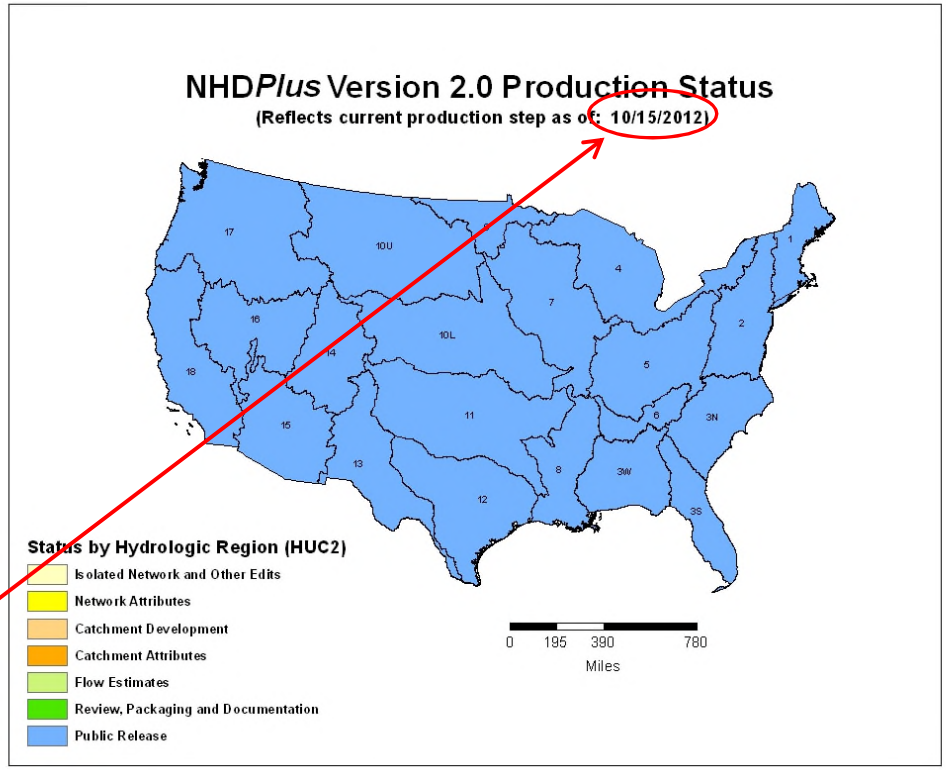
NHD*Plus* catchments tie the landscape to the stream network forming a '*surface water geofabric*'

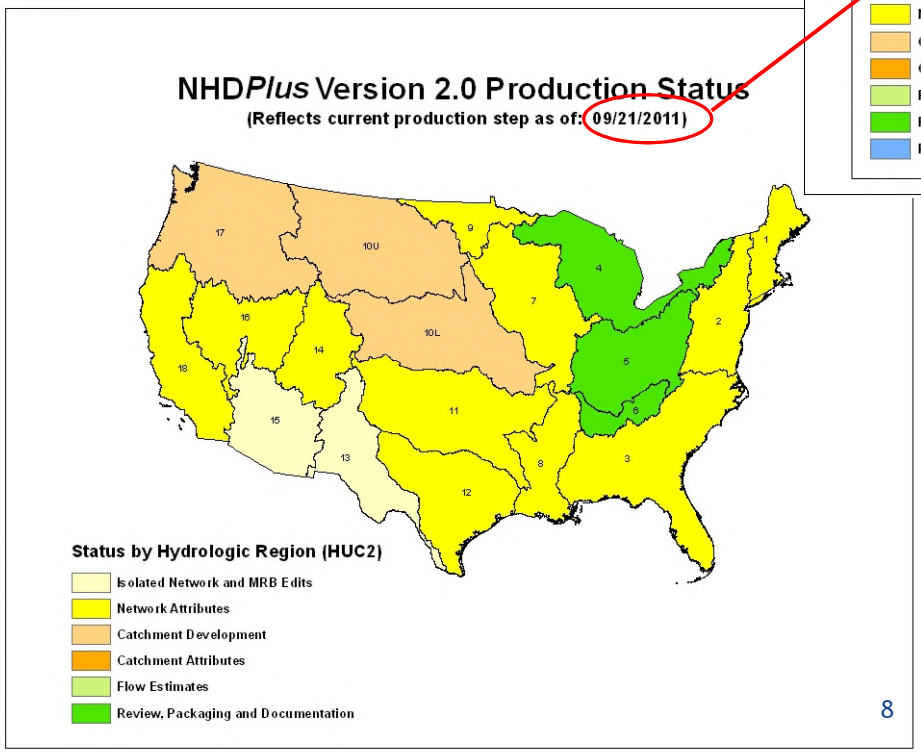
Stream Network	Map Scale	Map Accuracy	Total Stream Miles (mi)	# of Stream Segments	Stream Segment Average Length (mi)	# of Lakes	Catchment Average Area (sq mi)
Reach File Version 1 (RF1)	1:500K	+/- 254m	600,000	60,000	10	4,100	50
Medium Resolution NHD	1:100k	+/- 50m	3,200,000	2,600,000	1.2	38,000	1.1
High Resolution NHD	1:24K or better	+/- 12m	7,500,000	20,000,000	0.37	537,000	do not exist

(These figures are approximations (+/- 10%) provided for purposes of comparison.)

NHD*Plus* Version 2

"By Endurance We Conquer"
(Sir Ernest Shackleton)





Significant Version 2 improvements:

- Over 5,000 isolated networks connected
- Over 60% enhanced elevations nationally
- Now-completed national HUC12s
- More robust flow estimation method
  - Runoff (USGS water balance model)
  - Excess evapotranspiration
  - Reference gage regression
  - Flow additions and removals
  - Adjustment using gaged flows

Notable Quotes - NHD*Plus* Production

85. "We can't afford to be perfect."
(P.Wiese, 6/8/00)

93. "Trust me, I'm an experienced burner."
(D.Maidment, 12/13/00)

131. "... everything that you can imagine happening, does happen."
(T.Bondelid, 7/5/05)

154. "Working 7 days a week … in China, it's communism (you have to do it); in Herndon VA, it's NHDPlusism (you want to do it)"
(NHDPlus team, 11/2/06)

191. "No worries since we have unlimited minutes on nights and weekends!"
(C.Johnston, 7/1/10)

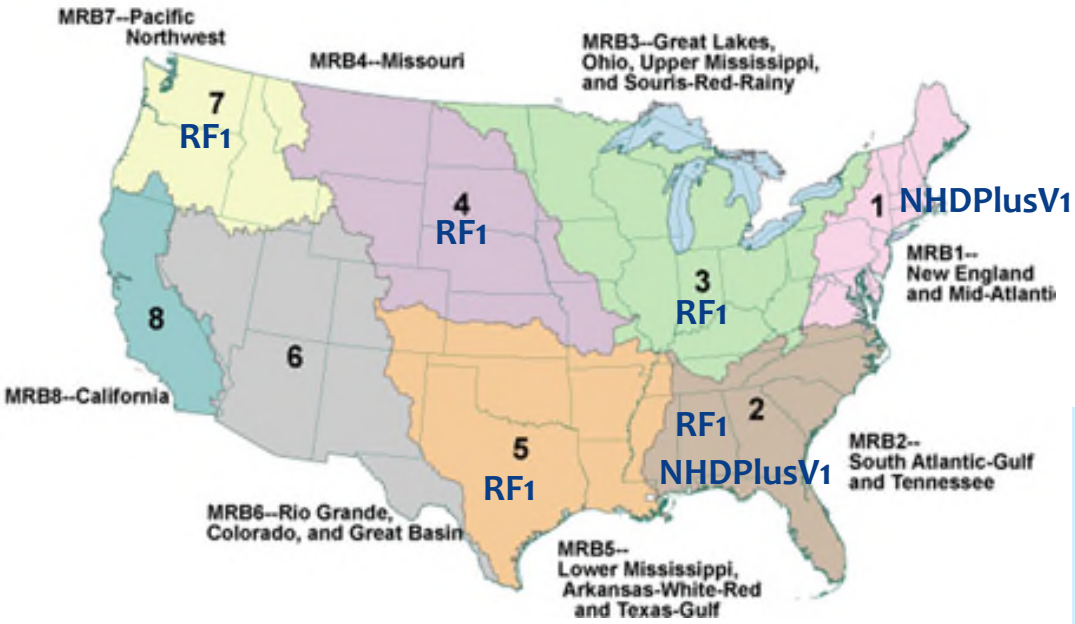
198. "Are we allowed to sleep or what?"
(A.Rea, 10/7/10)

NHD*Plus* Release Announcement (March, 2014)

* Documentation - new NHDPlusV2 User Guide, metadata, training exercises, technical papers, more presentations
* Data - component updates
* Tools - NHDPlusV2.1 Flow Table Navigator, NHDPlusV2.1 Toolbox (includes a tool that will compare your local data holdings with the versions available on the web site)

USGS NAWQA Cycle 2 SPARROW Nutrient Models (released August, 2011)

Regional SPARROW Models



Online Decision Support System

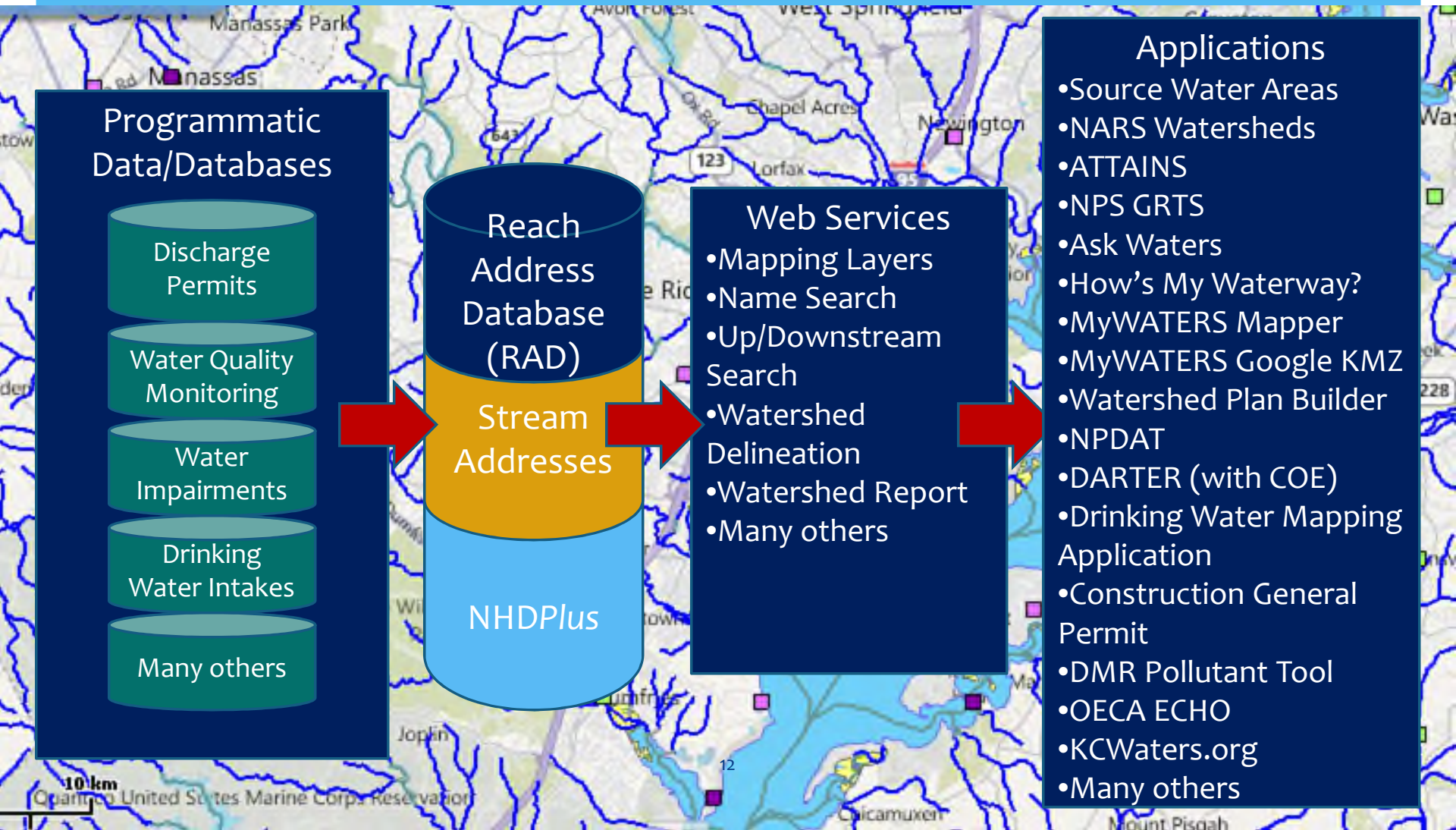
Water managers, researchers and the general public can access SPARROW models and map predictions of long-term average water-quality conditions, track transport to downstream receiving waters, and evaluate management source reduction scenarios.

(cida.usgs.gov/sparrow)

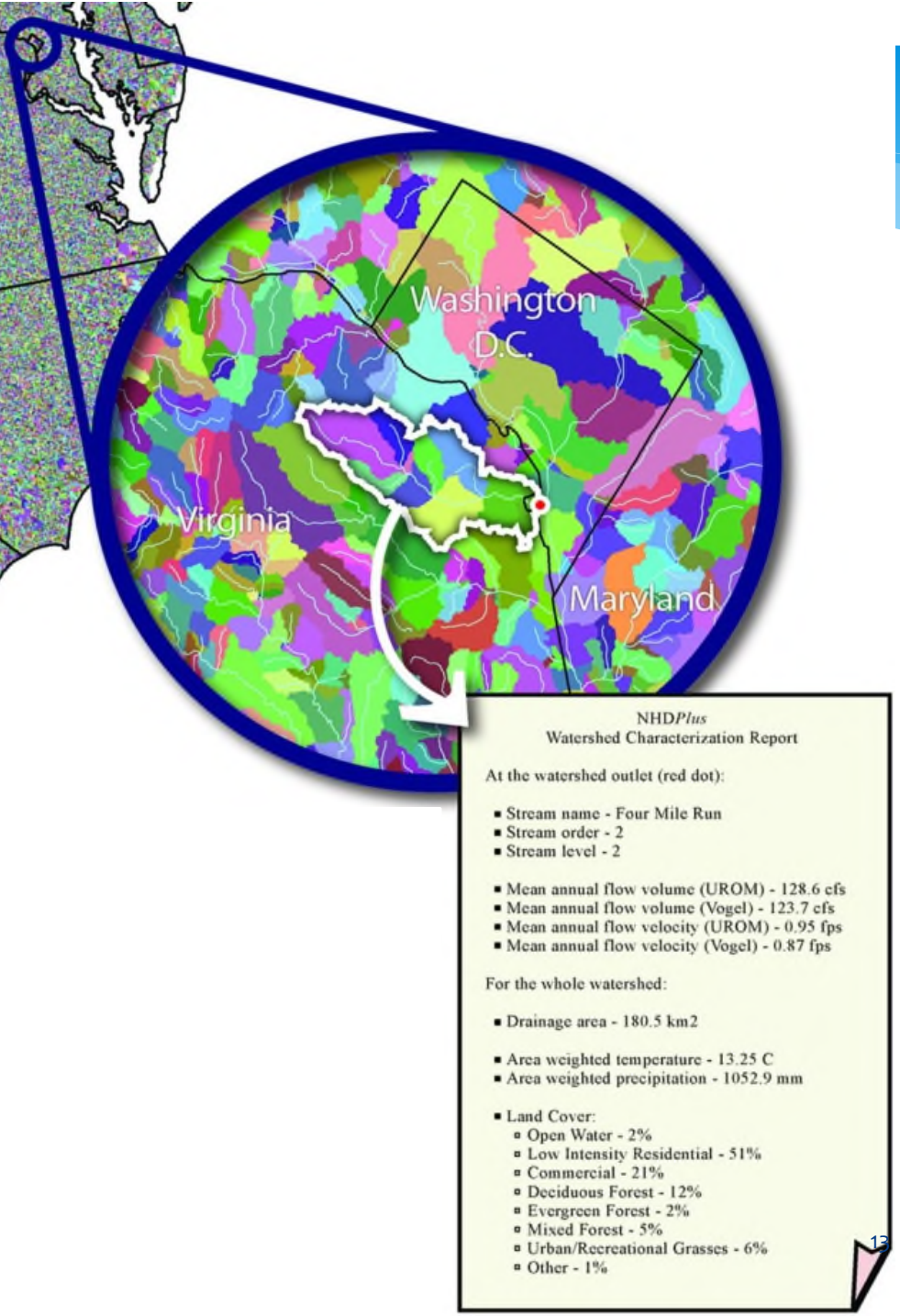
Next generation of NAWQA regional SPARROW models is using NHD*Plus* Version 2 stream network and catchments

EPA Office of Water Geospatial Architecture

Watershed Assessment Tracking and Environmental ResultS (WATERS) (www.epa.gov/waters)



NHD*Plus*



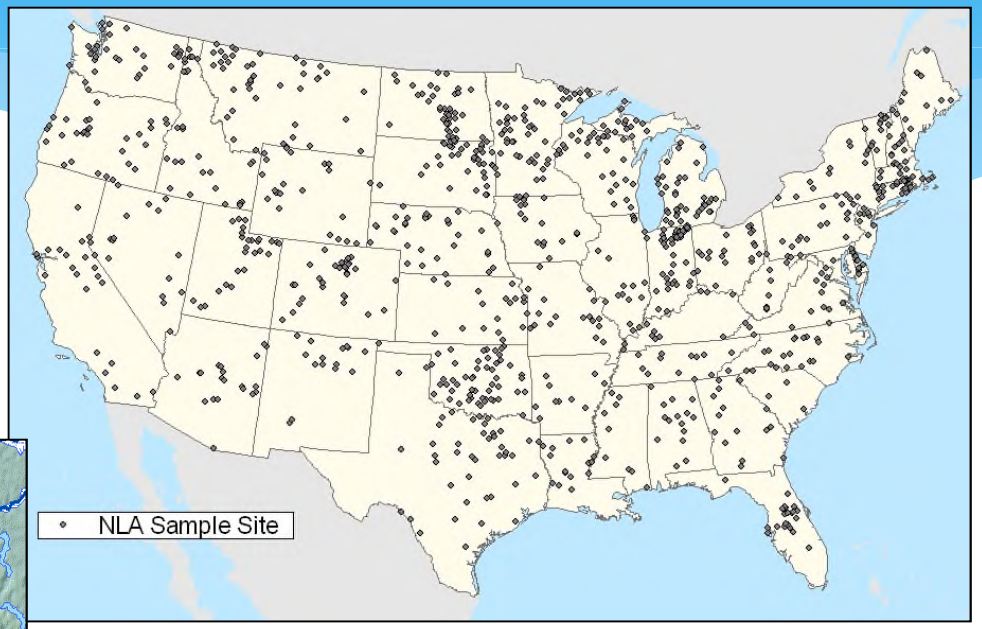
The inset map shows the watershed (white boundary) defining the drainage area upstream from the mouth of Four Mile Run (red dot) and a report of associated watershed characteristics – both produced using NHD*Plus*.

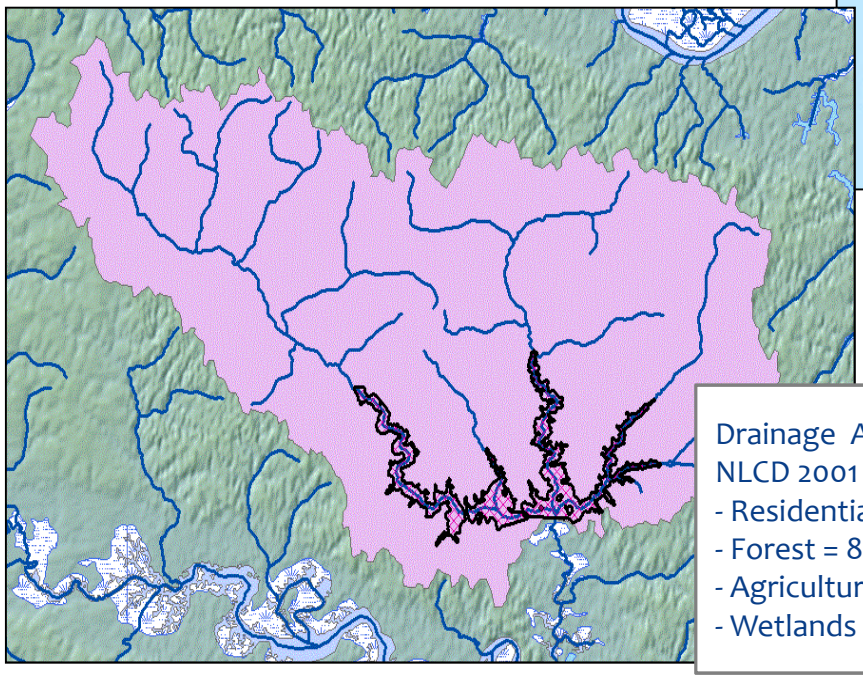
Notable Quote – NHD*Plus* Distribution

36. "So we're going to give them canned green beans instead of fresh green beans.“ (J.Plasker, 8/12/96)

EPA National Aquatic Resource Surveys

NHD*Plus* serves as the basis for establishing the NRSA and NLA survey sample frames – from which a representative set of sample sites are randomly selected.





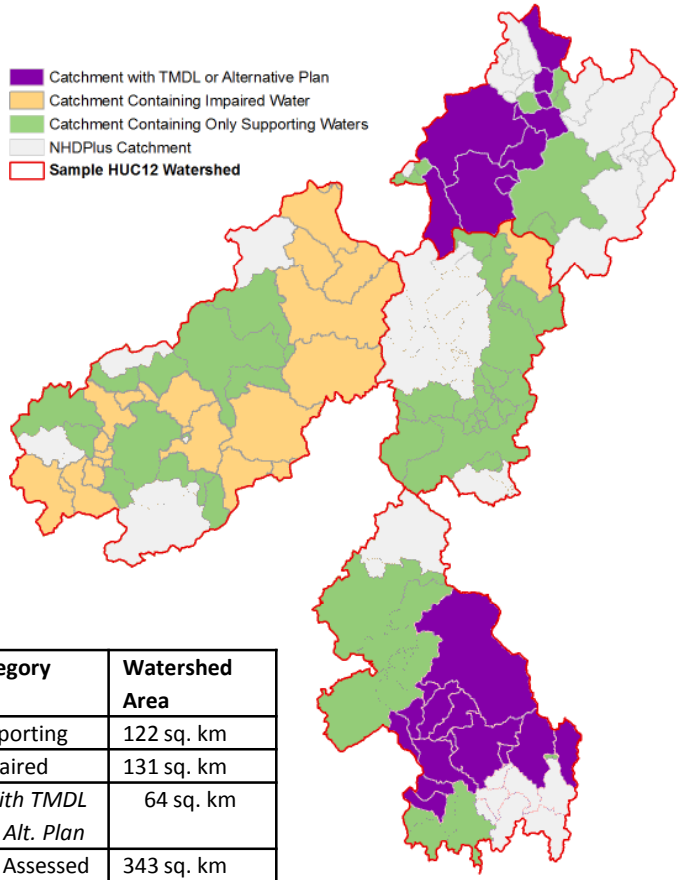
Drainage Area = 114.24 km²
NLCD 2001 Land Cover :
- Residential = 7.86 km²
- Forest = 86.42 km²
- Agriculture = 12.64 km²
- Wetlands = 7.32 km²

NHD*Plus* is also used to support data analysis, such as delineating drainage areas and associated attributes for sampled sites.

(www.epa.gov/owow/lakes/lakessurvey)

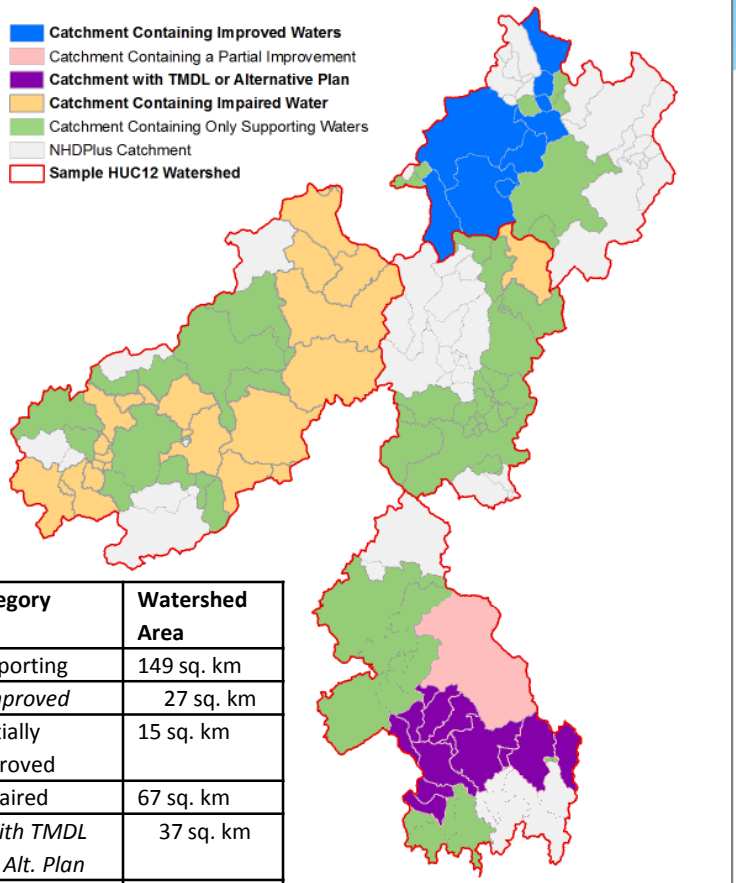
(Draft)
Using the Catchments to Track Progress

2010 303(d)/305(b) Integrated Report



Category	Watershed Area
Supporting	122 sq. km
Impaired	131 sq. km
With TMDL or Alt. Plan	64 sq. km
Not Assessed	343 sq. km
Total Size	**596 sq. km**

2012 303(d)/305(b) Integrated Report



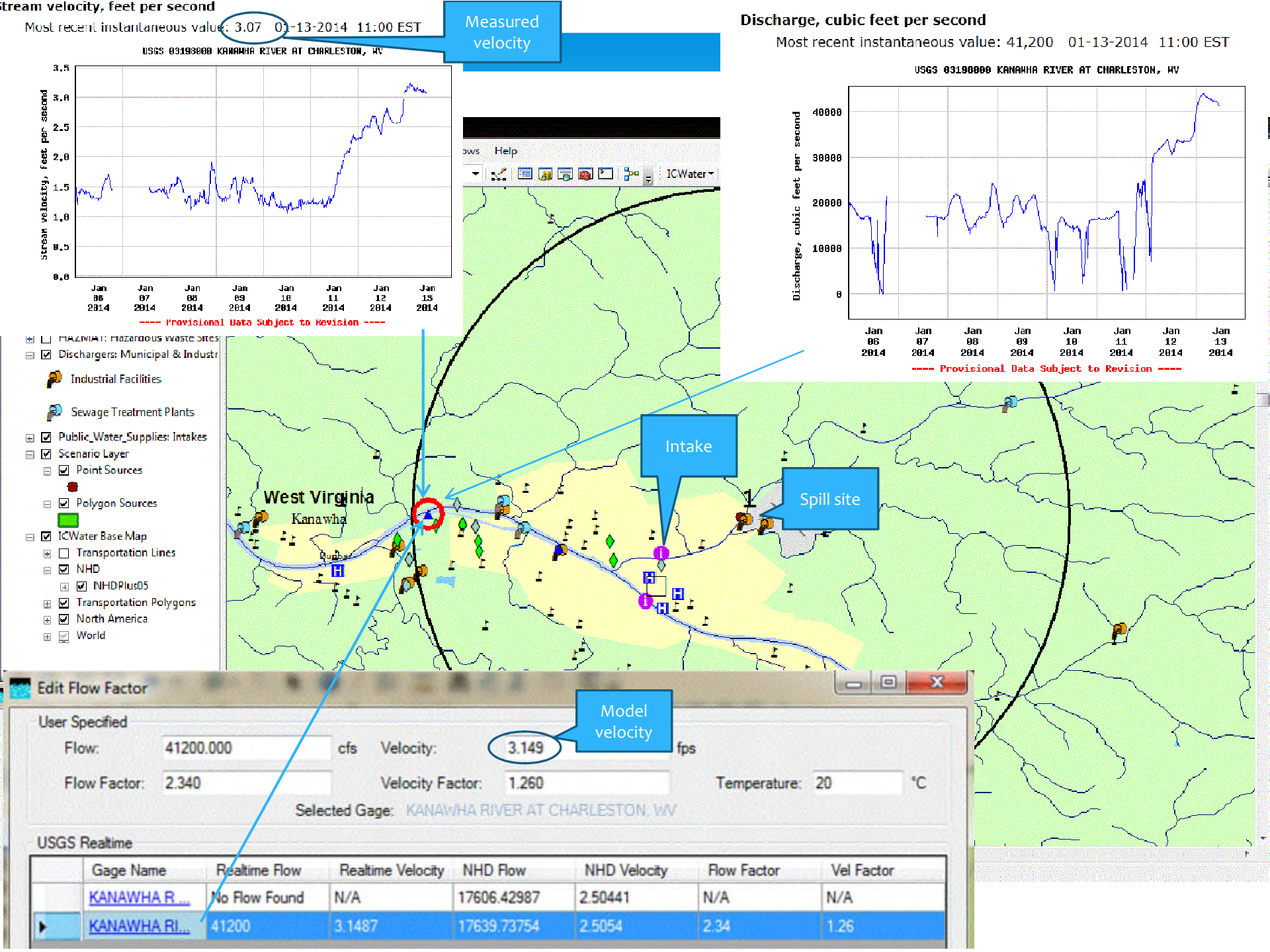
Category	Watershed Area
Supporting	149 sq. km
Improved	27 sq. km
Partially Improved	15 sq. km
Impaired	67 sq. km
With TMDL or Alt. Plan	37 sq. km
Not Assessed	343 sq. km
Total Size	**596 sq. km**

(young.dwane@epa.gov, reid.wendy@epa.gov)

West Virginia Chemical Spill

* Spill of thousands of gallons of coal-washing chemical MCHM—4-methylcyclohexane methanol into the Elk River, WV
* Spill one mile upstream from water treatment plant
* Incident Command Tool for Drinking Water Protection (ICWater) used to warn downstream water suppliers
  * Uses NHDPlus flows and velocities
  * Adjusts with real-time gage data
  * Provided accurate travel-time estimates
  * Protected Cincinnati water supply and others

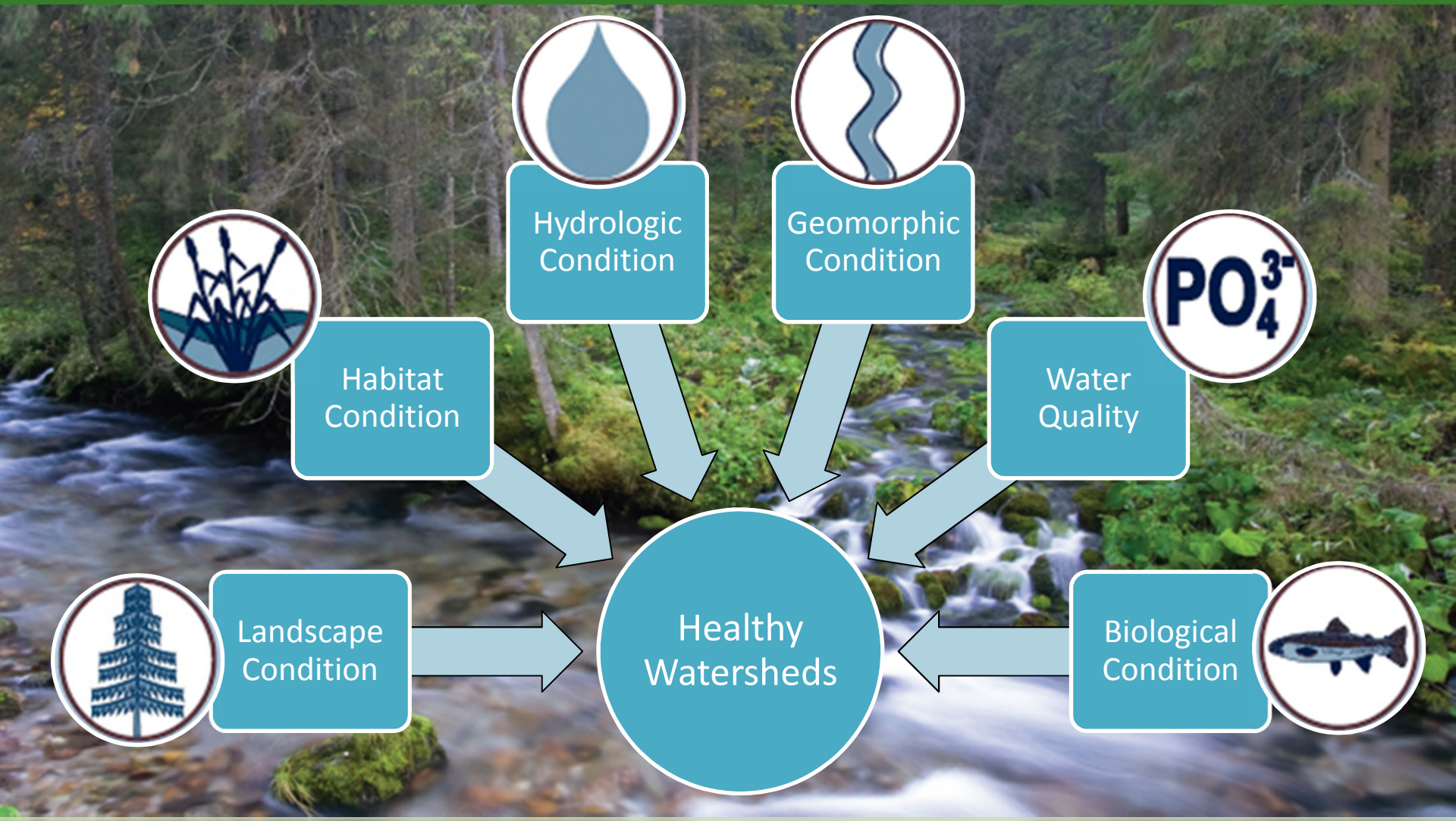
(william.b.samuels@leidos.com)


Stream velocity, feet per second
Most recent instantaneous value: 3.07 01-13-2014 11:00 EST
Measured velocity
USGS 03198000 KANAWHA RIVER AT CHARLESTON, WV
Stream velocity, feet per second
---- Provisional Data Subject to Revision ----
Discharge, cubic feet per second
Most recent instantaneous value: 41,200 01-13-2014 11:00 EST
USGS 03198000 KANAWHA RIVER AT CHARLESTON, WV
Discharge, cubic feet per second
---- Provisional Data Subject to Revision ----
Help
ICWater
Dischargers: Municipal & Industr
Industrial Facilities
Sewage Treatment Plants
Public_Water_Supplies: Intakes
Scenario Layer
Point Sources
Polygon Sources
ICWater Base Map
Transportation Lines
NHD
NHDPlus05
Transportation Polygons
North America
World
West Virginia
Kanawha
Intake
Spill site
Edit Flow Factor
User Specified
Flow: 41200.000 cfs
Velocity: 3.149 fps
Model velocity
Flow Factor: 2.340
Velocity Factor: 1.260
Temperature: 20 °C
Selected Gage: KANAWHA RIVER AT CHARLESTON, WV
USGS Realtime
Gage Name | Realtime Flow | Realtime Velocity | NHD Flow | NHD Velocity | Flow Factor | Vel Factor
KANAWHA R... | No Flow Found | N/A | 17606.42987 | 2.50441 | N/A | N/A
KANAWHA RI... | 41200 | 3.1487 | 17639.73754 | 2.5054 | 2.34 | 1.26

Building State Capacity to Identify Healthy Watersheds

Owen McDonough, EPA ORISE Fellow

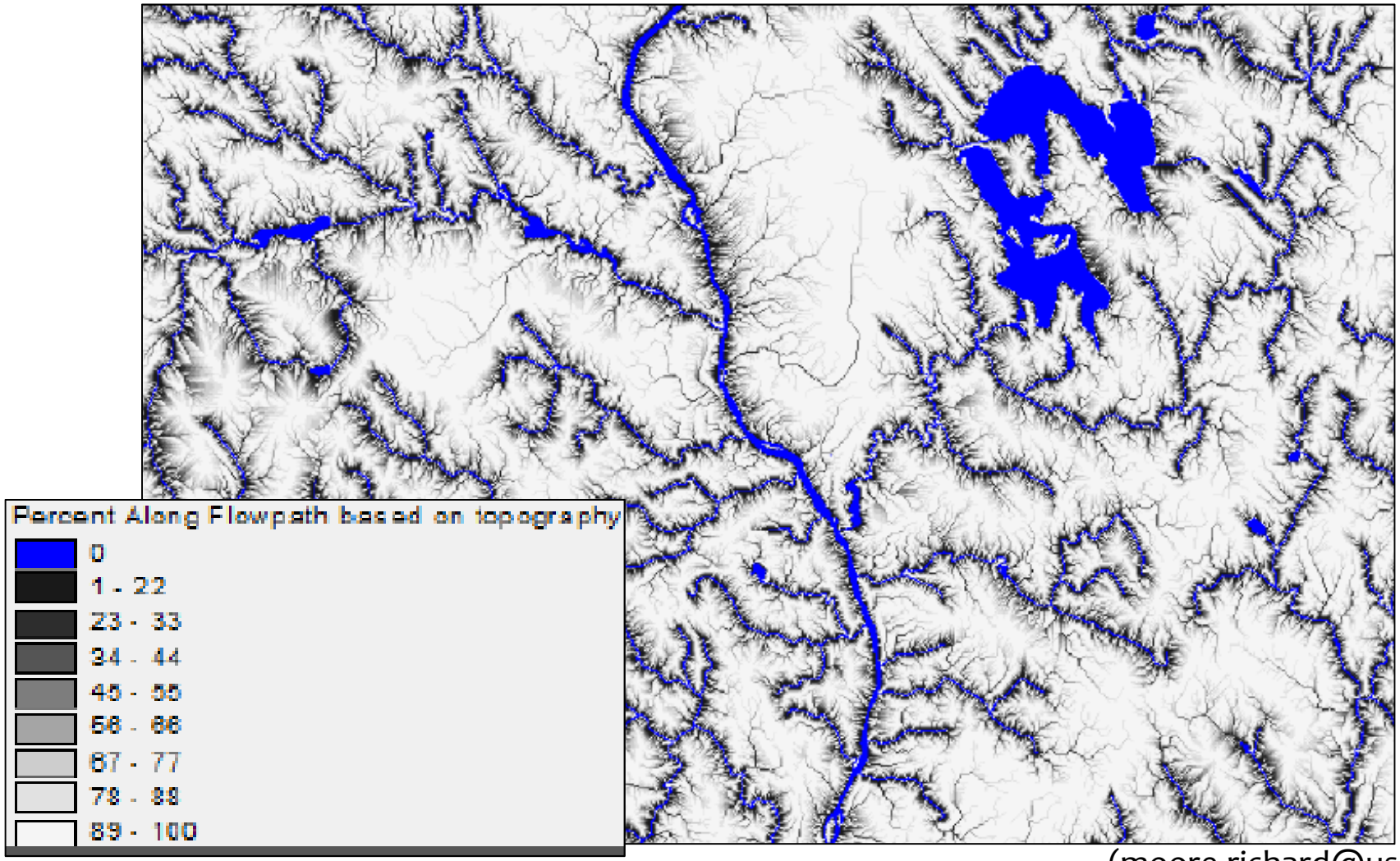
30 April 2014



(water.epa.gov/polwaste/nps/watershed)

(gabanski.laura@epa.gov)

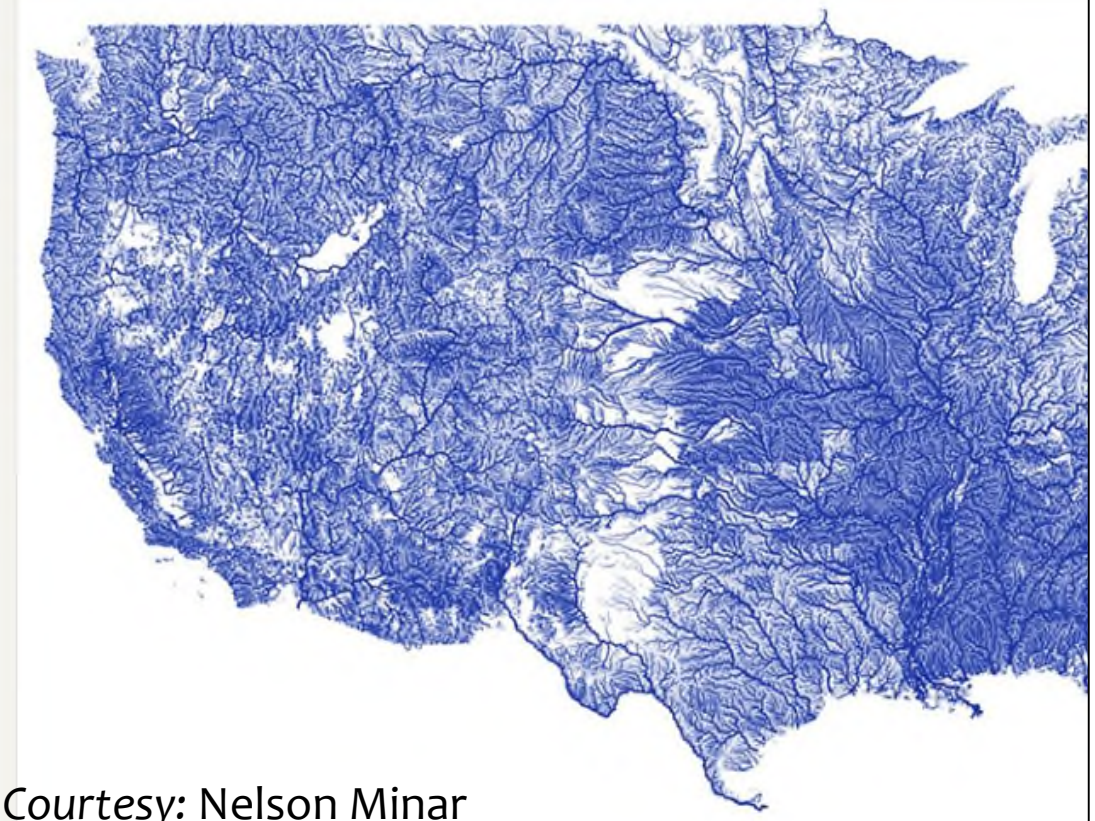
DRAFT - For many shallow groundwater systems, groundwater flowpaths closely follow the downward directions expressed by the land-surface topography



(moore.richard@usgs.gov)

WIRED and Popular Science Magazines (June, 2013)

ALL the rivers in the United States on a single beautiful interactive map!



Courtesy: Nelson Minar

Treehugger.com (January, 2014) – **A recent report by the U.S. Environmental Protection Agency concluded that 55 percent of U.S. rivers and streams are in poor condition[1]. Most of us don't go to that many different rivers in our lives, so when we see a number like that we might not realize just how many rivers and streams there are in the United States. Well, the map above gives you an idea of how many there are. All river data comes from the NHD*Plus* dataset, a geo-spatial, hydrologic framework dataset envisioned by the USEPA.**

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[1]Draft National Rivers and Streams Assessment 2008-2009 (March, 2013)

'All the water that will ever be is, right now.'

- National Geographic Magazine, October 1993

'We forget that the water cycle and the life cycle are one.'

- Jacques Cousteau

Questions?

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(On the Web - Google 'nhdplus')