NHDPlus High Resolution (NHDPlus HR)—
A Hydrography Framework for the Nation

Introduction

Fresh water is a vital natural resource, essential for the health of communities and ecosystems and critical for agriculture, industry, and commerce. Availability of fresh water is increasingly strained by the demands and impacts of natural and human-caused events. Too much water in the wrong place is also a problem. In 2019 alone, the combined cost of flooding in the Missouri, Arkansas, and Mississippi River basins was $20 billion (Smith, 2020). Information about water is fundamental to national and local economic well-being, protection of life and property, and effective management of the Nation's water resources (U.S. Geological Survey, 2020).

Floodwaters surround houses in Craven County, North Carolina.

Reliable and accurate high-resolution mapping of the Nation's waters are critical inputs to models and decision support systems used to predict risk and enable response to impacts on water resources. It is necessary to know where the water is and how it relates to features beyond the stream network like forests, cities, and infrastructure. An up-to-date, high-resolution national hydrography framework is required to support these important needs.

Building a National Hydrography Framework

In 2006, the U.S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (EPA) developed the first medium-resolution version of the National Hydrography Dataset Plus (NHDPlus) to support modeling the occurrence of water and to provide the ability to connect detailed information from the surrounding landscape to the stream network.

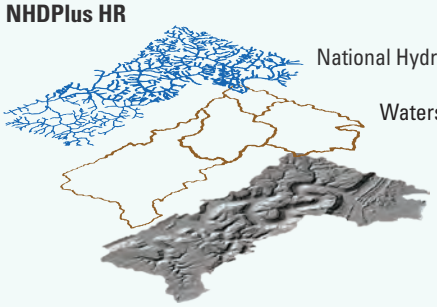
In 2016, the National Hydrography Requirements and Benefits Study (Dewberry, 2016) found that an updated, high-resolution version of the NHDPlus was needed to support multiple uses ranging from scientific research to water resources management. In response to the study, the USGS is developing **NHDPlus High Resolution (NHDPlus HR)**, the next generation of NHDPlus using updated, high-resolution datasets to create a modern, scalable, and openly accessible hydrography framework for the inland waters of the Nation.

NHDPlus HR is built by integrating high-resolution National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD) data with 3D Elevation Program (3DEP) 10-meter digital elevation model (DEM) data into a suite of vector, raster, and tabular datasets.

NHDPlus HR datasets include the following:

- Snapshots of the NHD, WBD, and DEM data used to build NHDPlus HR.
- An elevation-based catchment (drainage) area for every flowline in the stream network, delivered in raster and vector formats.
- Elevation-based flow direction and flow accumulation rasters, and the elevation data used to calculate them.
- Tables containing value-added attributes that enhance stream network navigation, analysis, and display.

NHDPlus HR



NHDPlus HR Adds Value

NHDPlus HR value-added attributes (VAAs) enhance navigation and analysis functionality of the core NHD stream network. VAAs include hydrologic sequencing; stream order; cumulative drainage area; flow withdrawals, transfers, and augmentation; elevations and slopes for network flowlines; and mean annual flow and velocity estimates for each flowline. More details are available on the VAA web page (https://www.usgs.gov/NatHydroVAAs).

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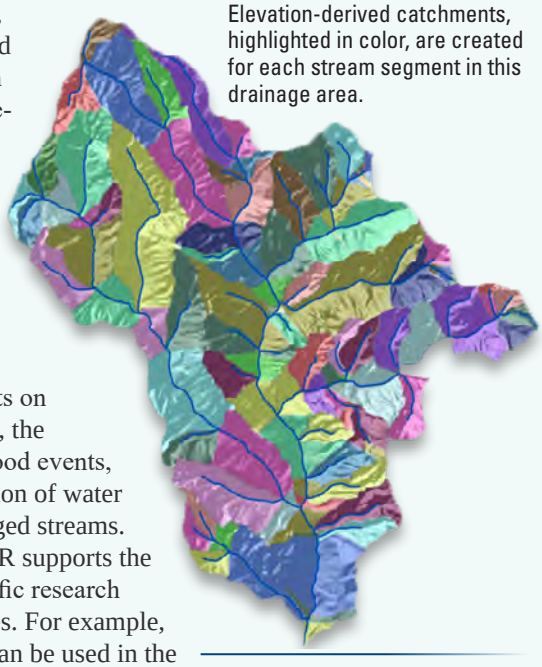
The Power of NHDPlus HR

In addition to leveraging the high-resolution NHD surface water network and addressing capabilities and the WBD hydrologic unit reporting system, NHDPlus HR includes a seamless fabric of local drainage areas known as "catchments."

NHDPlus HR catchments are used to associate landscape characteristics such as precipitation, temperature, and runoff data with each confluence-to-confluence stream segment. This enables the calculation of streamflow estimates, the evaluation of landscape effects on aquatic habitats, the prediction of flood events, and the estimation of water quality in ungaged streams.



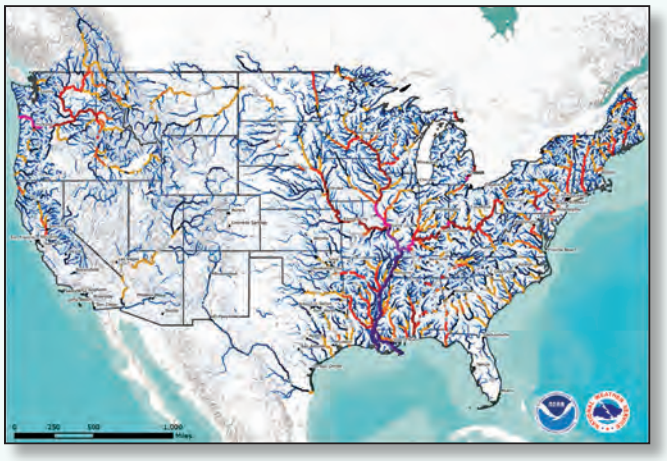
Elevation-derived catchments, highlighted in color, are created for each stream segment in this drainage area.

NHDPlus HR supports the needs of scientific research for multiple uses. For example, NHDPlus HR can be used in the USGS StreamStats program, which provides regression-based streamflow statistics such as peak flows used for bridge or culvert engineering designs and low flows used for studies of biological resources in times of drought (Ries and others, 2017).

Once complete nationally, NHDPlus HR will provide a consistent modeling framework to enable a better understanding of the water quality and contaminant transport in the Nation's streams by models such as SPARROW (SPAtially Referenced Regression On Watershed attributes). NHDPlus HR will also provide the hydrography base for the National Water Model, which simulates streamflow volume and velocity over the entire continental United States to help forecasters predict when and where flooding can be expected.

Scalability: the VisibilityFilter Attribute

The VisibilityFilter attribute enables users to prune the stream network to represent individual features in NHD and NHDPlus HR datasets at eight different map scales while keeping the underlying geometry intact. The VisibilityFilter attribute is available in all NHD staged products for the conterminous United States and in a limited subset of the NHDPlus HR Beta datasets. The VisibilityFilter attribute will be included in all updated NHDPlus HR data. For more information, please visit the VisibilityFilter web page (https://www.usgs.gov/core-science-systems/ngp/national-hydrography/visibilityfilter).



National Water Model streamflow simulation for April 23, 2019 (https://water.noaa.gov/about/nwm).

Local Knowledge Needed

Corrections or improvements to the NHD, WBD, and NHDPlus HR can be submitted using the USGS web-based Markup Application. To learn more, please visit the National Hydrography Tools web page (https://www.usgs.gov/NatHydroTools) or email nhd@usgs.gov.

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Learn More about NHDPlus High Resolution: https://www.usgs.gov/NatHydro; visit NHDPlus High Resolution web page. For questions or more information, email nhd@usgs.gov

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