

USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

Hydrography at the Alaska Surveying and Mapping Conference by Kacy Krieger

The 48th annual Alaska Surveying and Mapping Conference, held March 24-28 in Fairbanks, Alaska, brought together GIS experts, land surveyors and cartographers from Alaska and beyond to learn and discuss best practices, emerging technologies and research pertaining to spatial data and applications in the state of Alaska. Workshop and presentation themes ranged from land surveying, to remote sensing, to scientific research, to cartography and mapping, and although the focus of the conference was not on hydrography and water resources in Alaska, it played a prominent role. The importance of hydrography and maintaining an updated waters dataset was stressed in numerous presentations and courses throughout the conference.

Two presentations focused directly on Hydrography in Alaska, “The Alaska Hydrography Technical Working Group Overview and Panel Discussion: What You Need To Know” followed by a panel discussion and question and answer session with members of the Alaska Hydrography Technical Working Group (AHTWG), and “Statewide Hydrography Stewardship - The Alaska Hydrography Database.” These presentations stressed the importance for updated hydrography data in Alaska and presented a unified path forward to bring Alaska’s hydrography up to national standards and into the NHD. (For more information on AHTWG see: <http://seakgis.alaska.edu/ahtwg/>, and for more information on AK Hydro, see: <http://seakgis.alaska.edu/alaska-hydro-database/>)

Several presentations and workshops held during the conference discussed the importance of the NHD and hydrography data to their projects and to Alaska. These presentations showed how different groups approached working with and updating hydrography data, and how the NHD is being used in mapping applications, research and governance. Both presenters and conference attendees expressed the importance of accurate and modern streamlines and shorelines. Other presentations and workshops demonstrated how updating these features and tracking changes is becoming easier than ever thanks to innovative techniques using the growing collection of high resolution LiDAR, IfSAR and orthophotos in the state. These new resources and technologies will make current, accurate and complete hydrography data possible for an engaged mapping community in Alaska.

Using Hydrography Services by Kathy Yoder

You can use Hydrography basemap or overlay services in ArcMap, or other desktop applications such as AutoCAD, Global Mapper, and Google Earth. These instructions will be focused on using Hydrography services in ArcMap. Once you connect to a service, ArcMap will remember these service connections. They can be removed in ArcCatalog.

1. Add GIS Servers – (ESRI only)

- a. Add a basemap service to ArcMap. Basemap services are cached so features are not identifiable and you cannot turn layers on or off.

Start by loading any data to the mxd. This will set the spatial reference. Next, add the service connection. Click the “add data” button → add GIS Server → use GIS services (default option) → enter the server url:
basemap.nationalmap.gov/arcgis/services → choose the USGSHydroNHD basemap. Basemaps are cached to 1:18,000 and smaller. If you need a larger scale service use the USGSHydroNHDLarge service. This is a dynamic service (see next step).

- b. Add an overlay service to ArcMap. Overlay services are dynamic vector features. This means that you can identify features or turn layers on or off in ArcMap. Dynamic services may be slower to draw and do not contain some of the reference features that the cached services do, such as state boundaries or cities.
- Start by loading any data to the mxd. This will set the spatial reference. Next, add the service connection. Click the “add data” button → add GIS Server → use GIS services (default option) → enter the server url:
services.nationalmap.gov/arcgis/services/nhd_overlay. → choose the nhd service. This service covers all scales, however some of the layers in the service are scale dependent.
2. Add a WMS or WMTS – These are open source OGC services and can be used by non-ESRI applications. These services may be slightly slower than Arc.
- a. Add a WMS or WMTS basemap.
 Click the “add data” button → add WMS or WMTS Server → enter the url for WMS:
<http://basemap.nationalmap.gov/arcgis/services/USGSHydroNHD/MapServer/WMServer?> Or enter the url for WMTS
<http://basemap.nationalmap.gov/arcgis/rest/services/USGSHydroNHD/MapServer/WMTS/1.0.0/WMTSCapabilities.xml> → Get Layers → Ok
- b. Add a WMS overlay service. WMTS is not available as a dynamic service.
 Click the “add data” button → add WMS or WMTS Server → enter the url for WMS:
<http://services.nationalmap.gov/arcgis/services/nhd/MapServer/WMServer?> → Get Layers → Ok

This table summarizes available services Hydrography

Type	Visibility	ArcServer	WMS	WMTS
Large Scale Hydro Overlay	All	http://services.nationalmap.gov/arcgis/rest/services/nhd/MapServer/	http://services.nationalmap.gov/arcgis/services/nhd/MapServer/WMServer?	NA
Small Scale Hydro Overlay	All	http://services.nationalmap.gov/arcgis/rest/services/nhd/MapServer/	http://services.nationalmap.gov/arcgis/services/nhd/MapServer/WMServer?	NA
Hydro Basemap with Shaded relief	Global to 1:18,000	http://basemap.nationalmap.gov/arcgis/rest/services/USGSHydroNHD/MapServer/	http://basemap.nationalmap.gov/arcgis/services/USGSHydroNHD/MapServer/WMServer?	http://basemap.nationalmap.gov/arcgis/rest/services/USGSHydroNHD/MapServer/WMTS/1.0.0/WMTSCapabilities.xml
Hydro Basemap with Shaded relief (Large Scale)	1:18000 to 1:500	http://services.nationalmap.gov/arcgis/rest/services/USGSHydroNHDLarge/MapServer/	http://services.nationalmap.gov/arcgis/services/USGSHydroNHDLarge/MapServer/WMServer?	NA

Additionally, you can ingest Hydrography services in your own web applications. Click [here](#) to see examples of various web applications consuming The National Map services.

Stewardship and use of the NHD at the Missouri Department of Natural Resources by Jeff Schloss and Mike Kruse

The Missouri Department of Natural Resources began using the medium resolution NHD in 2001 and the high resolution NHD in 2005. Both were originally used for display and labeling of surface water features. As other state-produced surface water data sets were getting older and less useful, interest in using the NHD began to flourish. When the department first became interested in using the flow network

for analyses, it soon discovered problems with network connectivity. At the time, Missouri DNR submitted the forty most prominent issues to USGS staff who were gracious enough to make an edits on its behalf, but with over a thousand known network issues and a growing number of vector omissions and errors, the department realized this was not a sustainable arrangement. Staff in the department's Water Protection Program had been recording issues as comments in the Missouri Clean Water Information System, and used this information to prioritize watersheds for editing when becoming Missouri's primary steward of the high resolution NHD in 2010.

The first analytical use of the NHD in a Web application was in the Water Quality Assessment System. This system manages spatial and business data regarding water quality monitoring sites, impaired waters, use attainability assessments, acute toxicity events, and non-point source pollution areas. It uses the NHD network, flowlines, and water bodies extensively, allowing users to establish upstream event start points and optionally set downstream event points and barriers to control braid tracing before tracing the network to establish feature geometries. The application also makes use of a flow direction grid to allow overland traces to intersect with the NHD network where needed. It was found that using flowlines and watershed boundaries to reinforce the flow direction grid alleviated nearly all of the flow direction problems we previously encountered on ridges and in valleys when building the grid using only elevation data.

Missouri DNR's most recent use of the NHD in a Web application is the public-facing e-Permitting system, implemented in the summer of 2012 and designed to automate applying for and obtaining National Pollutant Discharge Elimination System (NPDES) land disturbance permits. Users input polygons depicting planned construction sites and land disturbance areas which are then intersected with the 12-digit watershed boundary data set to create one feature per subwatershed. The system then traces flow from the site over land and through the NHD network, checking for intersecting features to make determinations about the receiving water (e.g. distance to receiving water, name of feature, whether or not it is impaired, etc.). Processes that could previously take up to sixty days are now accomplished in thirty minutes or less, but with automated processing, the accuracy and completeness of the spatial data are critical to the success and expansion of this system.

The department has been using the NHD to support a growing number of business processes and has implemented Web applications that rely on NHD and WBD features to determine which surface water features receive flow from certain activities and infrastructure. In some cases, the application determines the distance from a specific point to a receiving water body. However, using NHD flowline features in major rivers does not always provide accurate distance calculations since the flowlines are often near the middle of the channel. Some of the largest rivers in Missouri are well over one thousand feet wide, so the department turned its attention to using NHD area features for these determinations. Most if not all existing NHD area features are based on 7.5-minute quadrangle maps and no longer accurately reflect the channels of large rivers. Therefore one of the department's current initiatives is to edit NHD areas beginning with the Missouri and Mississippi rivers, with plans to review all rivers bounded by NHD area features in 12-digit subwatersheds that intersect the State of Missouri.

Over the years the department has also been creating numerous event feature classes that are an integral part of Missouri DNR's approach to water data management. This originally started using the Event Maker in 2006 and now uses the successor Hydrography Event Management (HEM) tool, to create and manage a suite of event themes that have been or will be published to our state's spatial data clearinghouse. The department is currently working on managing these as versioned data sets with attribute-rich data views in our enterprise geodatabase. To date more than 100,000 HEM events referenced to the high resolution NHD have been created that include the following themes:

Cold Water Fisheries (streams and lakes)

Outstanding National Resource Waters
Outstanding State Resource Waters (streams and marshes)
Metropolitan No-Discharge Waters
Classification and Use Designations (streams and lakes)
Biocriteria Reference Segments
Losing and Gaining Streams
Waters for which Total Maximum Daily Loads (TMDL) have been calculated (streams and lakes)

Missouri DNR plans to use the HEM tools to synchronize these each quarter. Synchronizations with the NHD will ensure that these events depict the most currently available data and will help maintain consistency with the national data set. Such consistency will allow permit writers and regulated entities to better identify applicable water quality standards and allow watershed management groups to better identify targets for implementation of best management practices for improving water quality. Creation and use of these NHD-based events has provided the department with many benefits including increased transparency to the public, greater efficiencies for staff, supporting the shift to online NPDES permitting, and providing better regulatory tools to support the Clean Water Act.

The Missouri Department of Natural Resources most recently entered into an agreement making the U.S. Forest Service sub-stewards of the NHD in Missouri. Together with the USGS, USFS, and USDA partners, the department is working to ensure that the NHD and WBD are the most current, accurate, and useful data sources available of their kind.

Streamer Launched in *The National Map*

Streamer is a powerful, yet easy way to explore our major waterways. With a simple map click, anyone can trace rivers and streams from a starting point all the way downstream to where a stream drains. Even more impressive, they can click on a stream and trace all others that drain to that point. Streamer also produces a report that includes a map and information about the people and places encountered along the streams traced. See <http://nationalmap.gov/streamer/>

As good as Streamer was when it launched last summer, it just got better. Four major enhancements and dozens of small improvements have been made. These include:

- A new map layer displays the locations of real-time streamflow stations across the country. Streamer updates this information hourly and symbolizes these stations to illustrate current streamflow conditions compared with each station's observed mean streamflow on the same day of the year.
- You can tell at a glance whether conditions are above, below, or at normal levels at each station.
- Links are provided from Streamer directly to selected stations for additional information and data.
- Another new map layer has been added that shows weather radar across all 50 States.
- Useful improvements to Streamer's detailed reports have been added. One of these lists the names of waterbodies (lakes, reservoirs, etc.) along the path of your trace.
- Congressional Districts encountered along your trace have been added.
- A mouse click takes you from the Streamer report to additional information from the Census Bureau about socioeconomic conditions in each District.
- Searching for locations on Streamer's map by place name, zip code, geographic coordinates and more is greatly enhanced.

HEM Web Initial Release by Kathy Yoder and Mike Tinker

Drumroll please! HEM Web is having its initial release on April 30th, 2014!
What is USGS releasing?

- Server Object Extension (SOE) and NHD Service - Organizations will be given access to read-only NHD web map services and the necessary functionality to create and edit organization-specific HEM events. This service can be accessed through http or https.
- Sample JavaScript API code - Client side application code can be used as a proof of concept of how agencies can set up their applications.
- A configuration document that provides directions to set up HEM Web for editing organization-specific HEM events.

What do organizations need to do to set up their implementation?

- Hydrographic Data Community (HDC) - Access HEM Web configuration documentation, JavaScript API Code, and Service URL's to access NHD read-only services. This will not be posted until April 30th, 2014.
- Follow step-by-step configuration document to set up SDE Server with feature services for editing organization-specific events.

What functionality is included in this release?

- Creating and editing of organization-specific events, point, point on point, or single route line events.

What about security?

- NHD read-only services do not require a secure login for access. For individual organization implementation however, it is recommended that you secure access for your feature services. Refer to [ESRI documentation](#).

Future releases may contain:

- Ability for users to edit NHD Events (Dams, StreamGages, Diversions)
- Bug fixes and enhancements
- Updates for NHD Model v 2.2

Stay tuned for more information

As the release date approaches, USGS will do a HEM Web demo on Tuesday, April 29th 2014 on the NHD Advisory call. The USGS will also communicate the release via the HDC Blog, Twitter, and other channels. Special thanks to the development team; Diana Benedict (ATA), John Guthrie (USGS), Tim Smith (BLM), Ariel Doumbouya (USGS), the USGS Data Management Team, and the USGS Vector Web Edit Team for their work on HEM Web.

Transition of HEM Product Owner Responsibilities

Kathy Yoder is transitioning into a new position. Michael Tinker is taking over the HEM Product Owner responsibilities. For support with HEM, please contact us at hem@usgs.gov

NHD Update Tool Status by Paul Kimsey

After completing a development cycle to address issues identified with previously released version 6.1.0, NHD Update tool version 6.1x is currently being tested. The outcome of the 6.1x testing will determine if a new release can be distributed late April/early May. If no major issues are encountered we will release in that time frame, however, if issues are found that block the release, the remaining issues will be addressed in the next development sprint cycle currently planned for Summer, 2014.

Network Improvement Project Status by David Kraemer

The Network Improvement Project is to insure that the complete high resolution NHD for all 50 states and U.S. territories is ready for running the NHDPlus Value Added Attributes (VAA). The Initial phase of the Network Improvement Project is to update the high resolution NHD based on errors found by the NHDPlus QA/QC checks run at the Region (HUC 02) level on a late 2011 snapshot of the NHD. The Double Check phase of the Network Improvement Project is running the NHDPlus QA/QC checks on an

early 2014 snapshot of the high resolution NHD at the Sub-Region (HUC 04) level. The Double Check phase is correcting any additional errors that would prevent the creation of the NHDPlus VAA.

During this month Region 07 (Upper Mississippi) was completed for the Double Check phase of the Network Improvement Project. Region 06 has been run through NHDPlus QA/QC checks a third time and we are waiting for 06010105 to check-in to do the final edits before the NHDPlus VAA can be created. The current status for the Network Improvement Project phases is:

Initial Network Improvement: David Kraemer is editing Region 04 along the Canadian border and Charles Bowker is editing a couple Indiana sub-basins within Region 05. Tony Litschewski is editing Region 19 as part of preparing for the Alaska Hydro Image Integration projects.

Network Improvement Double Check: Charles Bowker is editing Region 18 and Allen Karsh is editing Region 03. David is preparing Region 12 for editing. Region 02 is complete except 02040007.

Uncompleted Initial Network Improvement Sub-Basins Checked-Out by States (Lower 48):

Indiana (05120202), Mississippi (08030202 and 08030207) – Check-in pushed back from 4/14 to 6/14. As States check-in their jobs we will edit these uncompleted Initial Network Improvement Sub-Basins.

Initial Network Improvement NHD Regions Completed: 01, 02, 03, 06, 07, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, and 22.

Network Improvement Double Check NHD Regions Completed: 06, 07, and 20.

The Network Value Added Attribute of the Month

Do you know your VAA's? This NHD Newsletter article is the third in a series to describe each of the Network Value Added Attributes. The flow network embedded in the NHD is what gives NHD its analytic power. The Network VAA's boost this power by pre-calculating a number of network characteristics to make network analysis richer and easier to exploit. This month will examine DnMinorHyd.

Last month's article looked at UpHydroSeq and DnHydroSeq. These identify the upstream mainstem path and downstream mainstem path identified using HydroSeq, the hydrologic sequence number, as the identifier. HydroSeq was described in the February 2014 NHD Newsletter. If DnHydroSeq identifies the mainstem downstream, then there must be something to identify the minor path downstream, right? That's the subject of this month's VAA. DnMinorHyd is the downstream minor hydrologic sequence number. As one navigates downstream and encounters a divergence, the main path will follow the DnHydroSeq (mainstem), while the DnMinorHyd will follow the minor path.

What about upstream navigation when a convergence is encountered? UpHydroSeq identifies the mainstem upstream. One might expect an upstream minor hydrologic sequence number, but actually there is not a need for one. When navigating upstream the user wants to navigate all paths, or just the mainstem, but rarely, if ever, just the minor path(s). If this is necessary, it is relatively easy to grab all the minor paths by doing another select searching DnHydroSeq. If the navigation is residing on mainstem HydroSeq = "45", then all paths upstream will have a DnHydroSeq = "45". All of these will be minor paths upstream except for one. The one that is the mainstem upstream is identified using UpHydroSeq.

You wouldn't want to have to figure this all out in your head, but the computer can calculate this in nanoseconds, making Network VAA navigation extremely fast and very powerful.

Downloads of NHD Data from the USGS in March

During February there were 5,734 ftp downloads. This is broken into 2,236 downloads of statewide high resolution NHD and 169 medium resolution downloads. There were 2,744 subregion-based high

resolution downloads and 585 medium-resolution downloads. Usually there are an equal number of National Map Viewer downloads, but these are no longer being reported.

2014 AWRA Spring Specialty Conference GIS and Water Resources VIII – Data to Decisions

Geographic Information Systems (GIS) are an indispensable tool in providing timely and accurate information necessary for making excellent water resources decisions. Emerging technologies in data collection, information management, web and cloud services, and visualization have opened up significant new avenues for sharing solutions across local, state, federal, and international levels. Come and discover new solutions for your organization. The conference is May 12-14, 2014 at the Snowbird Resort in Snowbird, UT. See <http://www.awra.org/meetings/SnowBird2014/>

NHD Photo of the Month

This month's photo was submitted by Duane Lund of the Montana State Library. This is a picture of Cottonwood Lake, a high alpine lake, in the Crazy Mountains of Montana. See ftp://nhdftp.usgs.gov/Hydro_Images/CottonwoodLake2.jpg. Submit your photo for the NHD Photo of the Month by sending it to jdsimley@usgs.gov.

March Hydrography Quiz / New April Quiz

Adam Oestreich of the Washington State Department of Ecology was the first to guess the March NHD Quiz as Lake Windigo, inside of Star Island, inside of Cass Lake, near Bemidji, Minnesota. See <ftp://nhdftp.usgs.gov/Quiz/Hydrography104.jpg>

Adam is employed by the Washington State Department of Ecology, which works with citizens, businesses and local governments to develop and carry out environmental permits, implements and enforces federal laws to set standards for clean air, water, and soil, and provides technical support for managing toxic waste, cleaning up spills, and general environmental monitoring. Adam works within the Water Quality Program and review data submitted to our agency's Environmental Information Management (EIM) database, as well as work with data used in the state's assessment of waters for the Clean Water Act's 303(d) list.

Others with the correct answer (in order received) were: Daniel Button, Al Rea, Laurie Morgan, Matt Rehwald, Gerry Daumiller, Steve Shivers, Jenn Crea, Rick Campbell, Janet Kellam, David Asbury, Tom Denslinger, Kitty Kolb, Stephanie, Kula, Jonathan Labie, Mark Sommer, John Kosovich, Andy LeBaron, Edwin Abbey, Dennis Dempsey, David Straub, Ken Koch, Ron Wencl, Steve Aichele, Roger Barlow, and Susanne Maeder.

This month's hydrography quiz can be found at <ftp://nhdftp.usgs.gov/Quiz/Hydrography105.jpg>. What's the name of this river? The location in the center of the image has made big news lately, currently making this river the most famous river in the United States. Be careful. The name of the river reported in the press is not the actual name of the river at this location. Send your guess to jdsimley@usgs.gov.

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The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.

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Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.