USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

NHD Version 2.0 Implemented

The U.S. Geological Survey (USGS) periodically revises the data model used by the National Hydrography Dataset (NHD) to incorporate improvements designed to keep the NHD relevant to the needs of its users. A new 2.0 version of the model is now being released to provide many enhancements over the previous model 1.06. These enhancements fall into two major categories:

The first is that the NHD will now be based on an entirely new Watershed Boundary Dataset (WBD) co-developed by the USGS and the Natural Resource Conservation Service in cooperation with many other federal and state agencies. This new WBD provides nine major advantages over its predecessor: (1) It is based on 1:24,000-scale criteria and therefore has considerably improved resolution accuracy, (2) The methodology and standards used greatly improve the quality of the drainage units, (3) The WBD was produced using the input from various organizations to maximize the knowledge used in building the units, (4) The four level hierarchy has been expanded to six providing finer classifications, (5) an additional seventh and eighth level exist for use as needed, (6) The WBD is in the same model as and can be packaged with the NHD, (7) The WBD and NHD are better integrated and more directly compatible, (8) The WBD is in a new model with enhanced functionality, and (9) The WBD can be maintained in a data stewardship environment. To clarify this change, the "Hydrologic Units" feature dataset in the NHD model will be renamed the "WBD" feature dataset.

The second involves five data enhancements to include: (1) A Permanent Identifier field using a Globally Unique ID (GUID), in addition to the existing Common Identifier field (ComID), enabling an instant and permanent feature identifier when editing, (ComID field will be retired in approximately one year), (2) An External Crosswalk table to accommodate the linking of NHD ID's and source ID's, enabling a more direct link between the NHD and source datasets used to build the NHD, (3) A Metadata Process ID and related new domain values to allow for and improved functionality in the use and editing of metadata, (4) new NHDPointEventFC codes to identify Diversion Structures as "General", "Withdrawing", and "Contributing", allowing a more complex modeling of diversions, and (5) a new NHDPointEventFC feature "Water Quality Station" to allowing the integration of USGS NWIS water quality sites to The National Map.

The version of NHD being used can be verified by going to the NHDProcessingParameters table and checking the Schema Version attribute. I using the previous model, it will be populated with "1.06." If using the new model, it will be populated with "2.0." Pre-staged Subregions will be rebuilt in Model 2.0 as soon as possible. Please check the date of the zip file prior to use. NHD stewards downloading data in Version 2.0 will be required to update using 2.0 templates and associated maintenance tools. For more detailed release notes and a diagram of the new model go to
ftp://nhdftp.usgs.gov/model/NHD_06_02_10_v2.0/

New Location for NHD Downloads - by Gary Ott

The USGS is in the process of building new pre-staged state and subregion files that incorporate the WBD and the 92v200 template. The new files will be located in the new directories listed below. Customers may have to look in both the old and new locations to find what they need until all of the files are rebuilt.

New locations:
ftp://nhdftp.usgs.gov/DataSets/Staged/States/
ftp://nhdftp.usgs.gov/DataSets/Staged/SubRegions/

Old locations:
ftp://nhdftp.usgs.gov/StateExtracts/
ftp://nhdftp.usgs.gov/SubRegions/

Success Story: New Jersey's Statewide NHD Conflation – by Seth Hackman

In January, 2009, New Jersey's NHD stewards embarked on a project to conflate existing high resolution 1:24,000-scale NHD data to 1:2,400-scale local resolution hydrographic data delineated by aerial photo interpretation. With the help of some local vendors and the USGS stewardship program, New Jersey's statewide conflation was completed in July 2010 and is available on the NHD viewer. The contrast between the 1:24,000-scale NHD and the local resolution (1:2,400-scale) dataset is stark. In all, just short of 6,000 new miles of NHDFlowline were added to the dataset, as well as 90,000 new ComID's and approximately 3,000 new NHDWaterbody features statewide.

Conflation using the NHD model requirements, and incorporated provisionally certified WBD hydrologic unit data, was done by subbasin (8-digit HU) of which there are 13 in New Jersey; some of these spanning adjacent states. State-contracted vendors were selected to do the actual conflation work, while rigorous QA/QC's were conducted by the State Stewards and USGS. The NHDGeoConflation Tool was crucial in indentifying target features for conflation, which were later rectified in each subbasin prior to submitting the data. QA/QC was conducted by the state steward using all available tools, including NHD FlowCheck, ArcToolbox Tools and Utilities and included some additional checks outside the normal workflow.

New Jersey's State Stewards are now planning on phase II of the statewide hydrography update which will include using the HEM tool to build events that intersect the state's network. The events being evaluated include NJDEP, USGS and EPA water quality monitoring stations, surface water quality classification codes and updated dams. NJ has also acquired LiDAR elevation data and 1 to 3 meter DEM's for the entire state. The plan is to use the improved DEM's to update the State's WBD subwatershed boundaries and further enhance the NHD/WBD dataset in NJ. Finally, NJDEP just released the 2007 landuse/landcover update which is the source of some NHDWaterbody and Area features. A project is underway to incorporate FTypes and FCodes into this dataset to facilitate future updates to NHD.

Lessons Learned: New Jersey's Statewide NHD Conflations Effort – by David Anderson

The New Jersey NHD conflation effort is a tremendous success and should be considered a major step for the NHD stewards in New Jersey. New Jersey will be the first state that has local resolution data in the multi-resolution repository, and the second state with complete large-scale resolution data for the entire state. During the process many lessons were learned and should be heeded by future conflation efforts by state stewards.

The first and foremost lesson learned is to keep the USGS team involved, including the NHD technical points of contact and the geospatial liaisons for the state. These resources are invaluable when selecting contractors and developing a workflow that meets the USGS requirements for the NHD. These resources can provide assistance in developing RFP/RFI for initial contract support if needed by the state stewards, provide training and support for in-house technicians or vendors, and provide additional workflow assistance.

The second lesson learned is preparation. The NHD Conflation process works with two datasets – the source (1:24,000-scale) data and the target (local-resolution) data. The target data needs to be in the format used by the NHD geodatabase model and should include attributes for feature type and specific code (FType/FCode). GNIS ID and Name may be included but is also transferred during the conflation process. The target dataset should also be "clean." The geometric network should be quality checked with the same tools used when checking the NHD data for loading – topology is clean, no artificial paths outside water bodies, no stream/rivers in water bodies, limit pseudo-nodes to only those that must be there, etc. As part of the preparation – transfer ALL features from each feature class that does not have reach codes to the target dataset. Since NHD conflation works only on reached features, these features could be tracked as deletions by accident, so be prepared.

The third lesson is never make assumptions. The NHD conflation workflow is pretty automated; however, never assume everything goes perfect the first time around. Data preparation and understanding of the NHD model is essential in moving forward with the process. As an old carpenter once said "Measure twice, cut once." In the case of conflation, double check your target data, when completed double check your completed conflation data, then submit it once.

The final lesson learned – NHD Conflation can be resource intensive because of the number of changes happening to the target dataset. There can be thousands of features in the target data, and for the most part the automated portion of the NHDGeoConflation tool will handle 80-90% or more, but there are checks and balances to getting through the rest of the data. Also, extracting the transactions (XMLExtract/XML2GDB) can be intensive on the hardware. One item that helped was increasing the ARCMEMSIZE environment variable and the Windows swap (page) file to over 8GB. Smaller hydrologic units will run faster through the process; however, it does not take any more time to do one subbasin that it does to do 20 or more watersheds.

In summary: 1) Keep your USGS contacts close at hand when going through this process. 2) Prepare your target data correctly and within the NHD geodatabase model. 3) Never make assumptions about quality control. 4) The process is resource intensive, but if the target data is readily available the conflation process takes much less time than the maintenance process.

Congratulations to the New Jersey Stewards – Craig Coutros andSeth Hackman!

NHD - WBD Integration Update and Temporary Problems – by Stephen Daw

Another major step in the integration of NHD and WBD is now complete! With the release of version 2.0 of the NHD data model on July 8th users are now requesting data by WBD boundaries rather than the old 250K HUC boundaries. Also, when NHD data is delivered, WBD data is included in the delivery. This includes 12-digit and 10-digit HU's for the entire US.

There are, as with all major integrations, a few problems that users need to know about:
Gapped Reaches - Due to a minor error in the programs that actually update the reach codes in the database, about 4000 gapped reach segments were created. The gap in most cases is rather wide and quite obvious. There is a plan to run a fix as soon as possible.
Duplicate Flowlines and Waterbodies: - Check-outs of data are based not only on subbasin but also on reach code. This process ensures that all the needed reaches for an area are included in a check-out. As part of reach migration, all misplaced segments were re-reached to their proper location. However a bug has created duplicate flowline segments and waterbodies. A fix is being work on and will be in place in the coming months.

Downloading Checked Out Subbasins - This problem occurs only in areas where reach migration has not yet been performed because the subbasin is checked out for NHD maintenance. Since data is downloaded based not only by subbasin but also by reach, this creates a problem in areas that have not had the reach codes updated to match the new WBD boundaries. Currently there are 130 subbasins still checked out for maintenance that have not had reach migration completed. As these subbasins are checked in and migrated, this problem will diminish and when reach code migration is complete, it will go away completely.

The current complete WBD can be found at: ftp://gateway2.ftw.nrcs.usda.gov/Gateway/WBD/ and finding the file: WBD_archive_09Jul2010_9.2_File.gdb.
Contact Stephen Daw at sgdaw@usgs.gov if you have any questions or concerns.

NHD Image Update Status - by Charles Bowker

Idaho is currently being updated to ensure major NHD features are up-to-date based on contemporary imagery. There are 1,696 1:24,000-scale quads that are all or partially in the state of Idaho. Errors were found on 44, or 2.6%, of the quads. Most of the errors are where rivers have moved around on floodplains. There are eight lakes that have been added. There are six lakes that have contracted, and three lakes have disappeared. In all Idaho NHD is very clean, likely due to an active data stewardship program.

Colorado has been updated. There are 1,914 1:24,000-scale quads that are all or partially in Colorado. There are errors on 93, or 4.9%, of the quads. Twenty of these errors were caused by a missing NHDArea stream. Like Idaho, most of the errors are because of rivers moving around on floodplains. There were 12 missing lakes, while three lakes had to be deleted, and 15 lakes that have changed size. Colorado is also very good, and again this is likely due to an active data stewardship program.

NHD/WBD Technical Architecture Planning Meeting – Part II

The NHD/WBD Management Team composed of the USGS and a number of principal partners held a Technical Architecture Planning Meeting May 11-13, 2010 in Denver, CO. Part I of the meeting was reviewed in last month's Newsletter. Part of the meeting's objective was to strategize for 1-2 (short), 3-5 (mid), 6-10 (long) year time windows. This Part II review of the meeting is a sampling of ideas that were brainstormed for future goals of the NHD and WBD. They are in no particular order. Next month will review more ideas.

*Simplify the data model to facilitate processing large volumes of transactions. *Provide a version of the NHD of just geometry and simple attributes for those that don't need the whole data model for their apps. *Provide just the simple building blocks of the NHD for users that don't use it all. *Design multiple data access portals specific to a user needs. *Provide various derived NHD/WBD products. *Simplify editing for the consumer. *Simplify the overall NHD maintenance processes. *Improve ability to understand flow estimates and seasonal variations in water volume. *Better understand urban waters. *Groundwater connections. *Support the National Water Census initiative. *Need to improve data accessibility. *Make it possible that users shouldn't need to replicate the data. *Need web geoprocessing services - technology is here today, but the money/resources to convert to this newer technology are not. *Improve data delivery/packaging – pre-staging for immediate download, custom download. Provide web service beyond WMS, WFS, KML. *Improve Data discovery - locator services, discoverable services (cataloguing, data.gov, etc). *Create better integration between the raster/vector sources to the NHD. *Discovery of hydro information services related to the NHD. *Improved tools for network functionality and improved performance (pre-computed). *Improved tools for analysis, i.e., linking linear events to network tracing. *Improved computing speed may preclude pre-computation, i.e., on-the-fly analysis.

*Ability to have the network in different 'states', i.e., winter/summer, in different conditions; revisable and switchable (i.e. complex junctions). *Similarly, 'states' of events, i.e., in flood conditions, under precipitation conditions/others. *Adopt IC waters-type projections - model the water in a web service; real-time flow measurements. Estimates for each flow line. Forecasting tied to NHD (i.e., weather service). *NHD as the infrastructure for other agency missions, i.e., FEMA, weather service. *A redesigned model to carry the info in different 'states', more efficiently, with easier access by others. *NHD as the infrastructure to carry the information, produce the information, and to support the science, but not attempt to "do it all". *Have data layers that are integrated (terrain, climate, groundwater, Landuse, etc). *Integrate with other water information and with other themes. *Integrate with other water databases such as NWI - integrate models and do stewardship jointly. *Elevation integration - Integrate Z values - 3D NHD, Contours, Catchments (Companion dataset to NHD). * Re-engage the elevation program. *Integration between catchments from NHDPlus and WBD - where do they meet? *Derive stream channels from LIDAR (requires coordination w/ elevation program). *The future of the NHD is NHDPlus i.e. integration w/ elevation. *Integration with DFIRM. *Incorporate flood flow regimes. *NHD needs to continue to serve the science. *Should the incorporation of things like streamflow and catchments be done by USGS NGP or outside organizations. *Need change management for web tools, open source code. *Volunteer Geographic Information (VGI) opportunities can play a better role particularly with Web edit tools / simplified data model. *Will always need a desktop capability for maintenance. *USTopo - better integrated with hydro, i.e. attribute discovery. *USTopo need to add WBD. *Further hydro-enforced elevation. *Adopt official coastline from NOAA – if they have one. *Reinvent the NHD approach to coastline. *More and better tools for generalization, conflation, editing and markup, enhanced usability. *More and better data for stormwater, LiDAR, High Resolution NHDPlus. *Enhanced analysis capabilities for network traversal, model integration - for non expert user. *NHDGeoEdit, NHDGeoConflate - Simplify Tools and Entire Update Process to extent practicable. *Web reporting of errors. *HEM Desktop Tool - Need robust HEM Tool for creating local events. *Periodic re-evaluation, continued outreach, expand international applications. *Need effective tools and enhanced usability in order to do more with fewer staff.

NHD Photo of the Month

This month's photo was submitted by Jeff Simley of the USGS and shows Upper Monarch Lake in the Colorado Rockies. It is a typical alpine lake located above timberline and is a direct remnant of the Wisconsin Ice Age which scoured the depression of the lake. The rocks to the left of the lake were scraped smooth by the glacier while the jagged rocks in the foreground were left exposed. To see the photo of the month go to ftp://nhdftp.usgs.gov/Hydro_Images/Upper_Monarch_Lake.jpg. Submit your photo for the NHD Photo of the Month by sending it to krisham@usgs.gov.

June Hydrography Quiz / New July Quiz

Steve Shivers was the first to correctly guess the May hydrography quiz as the Suwannee River drainage in Northern Florida. See ftp://nhdftp.usgs.gov/Quiz/Hydrography59.pdf. Steve is the USGS Geospatial Liaison for North and South Dakota. Liaisons engage and support State, local, Tribal, regional, Federal and other partners in improving timeliness, quality and accessibility of geospatial data for the community, The National Map and the NSDI. Steve is currently working with USFWS and NRCS to find partners for a LiDAR project that eventually will cover much of the prairie potholes region in North and South Dakota. This project should lead to an improved the NHD in this hydrologically "confused" area.

Others with the correct answer were (in order received): David Asbury, Ed Carter, David Anderson, Richard Patton, Joe North, David Straub, Matt Rehwald, Jeff Perreault, Edwin Abbey, Ian Reid, Keith McFadden, Roger Barlow, Ellen Finelli, and Tia Morita.

Why is there an almost complete lack of hydrography surrounding the Suwannee? Most people determined than it is a result of underlying Karst formations. Others noted it is the result of highly permeable soils. Some believe it is the result swamp drainage. A number of people noted that the water feature in the southwest corner was the Gulf of Mexico and not the Atlantic Ocean. In the geographic names world the Gulf of Mexico is a subset of the Atlantic Ocean. In the NHD it's labeled at the highest level of the hierarchy, which is the Atlantic Ocean.

This month's hydrography quiz can be found at ftp://nhdftp.usgs.gov/Quiz/Hydrography60.pdf. It is the opposite corner of the country from the June quiz. It is the delta to one of the nation's largest rivers. On August 3, 2010 it was flowing at 392,000 cfs. Send your guess to jdsimley@usgs.gov.

Upcoming NHD Training

August 4-5, 2010: HEM 2 Day Classroom - Denver, CO, Contact HEM@usgs.gov, registration information at http://nhd.usgs.gov/tools.html#hem
August 24-26, 2010: Conflation - Indianapolis, IN, Contact Elizabeth McCartney (emccartney@usgs.gov) or Jim Sparks (jsparks@iot.IN.gov)
September 13-16, 2010: NHDGeoEdit Tool - Waterbury, VT. - Contact David Anderson danderson@usgs.gov
September 8-9, 2010: NHD Applications - Pennsylvania Hydrographic Committee - Contact David Anderson danderson@usgs.gov or David Terrell dterrell@usgs.gov
September 17, 2010: HEM Basic/Advanced short course - Waterbury, VT - Contact David Anderson danderson@usgs.gov

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