

USGS National Hydrography Dataset Newsletter
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By Jeff Simley, USGS

Seventh Year of the NHD Newsletter

This issue marks the beginning of the seventh year for the monthly NHD Newsletter. Since November 2001, 72 newsletters have been sent out totaling 202 pages of information useful to the NHD community. Over 400 people receive the Newsletter each month and many of them forward it to their colleagues. You can see past NHD Newsletters at http://nhd.usgs.gov/newsletter_list.html.

Canada's National Hydro Network

Canada has launched a major initiative to provide a freely accessible intelligent hydrography dataset to cover the nation in the next few years. The dataset, called the National Hydro Network NHN, will look familiar to anyone who uses the U.S. National Hydrography Dataset. Although the NHN was developed as a home-grown Canadian product, the underlying graphic principles are based on fundamental and universal concepts shared between the NHN, NHD, Mexican National Hydrographic Network, and ArcHydro. The big difference is in the approach to the data model, which is quite distinct from the NHD, yet easily understood by the NHD user who will appreciate the fresh perspective on how the model organizes information. The NHN is a component of the Canadian GeoBase, a multi-theme initiative not unlike The National Map program of the USGS. GeoBase themes are being implemented in a phased approach based on the maturity of development. The NHN was given the green light in July, 2007 to join the GeoBase family. GeoBase is sponsored by Natural Resources Canada and is run as a national versus federal program where it is a joint initiative of the provinces and the federal government. This philosophy is reflected in the NHN which uses provincial base mapping as the source of the NHN and builds it into a jointly developed national program to provide national uniformity. The NHN was born of the same basic philosophy as the NHD, in that the vision for the product is to serve as an analytical and modeling tool for scientific investigations and decision making. That sets the tone for the design of the NHN to be rooted in a robust model with enough horsepower to satisfy the most complex queries in cause and effect analysis in the spatial and network domains. But at the same time, mapmaking is fully supported and is easily achievable. Canada is a big country and production of the NHN is a daunting task, particularly considering the production of 1,167 watersheds, 40% of which will use larger scale 1:10,000 or 1:20,000-provincial data. The Canadians have taken an innovative approach to the problem by phasing-in the sought-after complexity to the data. This is done using four levels of complexity. The first phase, called Completeness Level – 1 or CL1, creates a basic connected network. CL1 is created using automated processes. Through the CL1 processing 70% of the flow directionality is defined and approximately the same percentage of names is tagged to the topographic hydro entities. CL2 expands upon this through light manual processes to fix basic problems leftover from CL1 such as stabilizing the network by closing the basic polygon of independently named waterbodies. The roughly 60% of the country not covered by the higher scale provincial data will be covered using 1:50,000-scale source federal data. Before this is done, the CL3 program will already be underway to upgrade the data further by performing temporal updating where possible, completing network directionality and the linkage of names to features and fully edgematching the data by watershed. This will be followed by CL4, which will add the non topographic named features – such as bays, improve separating delimiters on polygons and update names to reflect the latest information from the official names database. As a result of the experimental production of the last few years, CL4 data is already available for 287 NHN watersheds. CL1 data from federal data will complement it to achieve national coverage in 2008. CL2 coverage is planned within 2 years of the first national coverage. Starting next year, the original coverage will start to be enriched as better provincial or

updated data becomes available. By the end of fiscal year 2008-09, the NHN coverage will present an ever improving combination of CL1 to CL4 watersheds. The program should deliver fully up-to-date CL4 NHN data nationwide within a ten year horizon. The data model is organized into five interrelated modules or “packages”. The first is the Hydrographic Package with several feature types; such as single-line watercourse (stream), waterbody (lake), obstacle (waterfall), and man-made feature (dam); falling under Hydrographic Entity labeled with a unique (UUID) called National Identifier (NID). The second is the Network Package providing the hydrography network. This consists of feature types including junctions, artificial paths, linear stream network, banks (shorelines), coastlines, and polygon delimiters (to segregate separately named lakes). Third is the Events Package. The NHN, like the NHD, heavily incorporates linear referencing into the data concept, but the NHN more aggressively uses linear referencing as an attribute descriptor such as a linear Flow Property event. Obstacles and man-made features are routinely linear referenced as events. Fourth is the Toponymic Package or names. Names have an origin in a particular official geographic names database. A particular feature can have more than one name – i.e. a lake name and a river name for a waterbody – in up to 3 different languages: English, French and aboriginal. Fifth is the Metadata Package, which allows for feature-level metadata. Each dataset is also attached its own FGDC metadata file. Natural Resources Canada, and its Center for Topographic Information located in Sherbrooke Quebec where the NHN is managed, is very interested in creating whole hydrologic units, which cross the Canada-U.S. border and are populated jointly with both the NHN and the NHD. The USGS shares this vision and further collaboration will hopefully lead to this goal in the next few years. NHN data along with supporting documentation and program information is available freely on the national GeoBase portal at www.geobase.ca.

NHDGeoEdit Tool 9.2 Release

Efforts have been underway for some time to upgrade the NHDGeoEdit Tool to work under ArcGIS version 9.2. The USGS is now close to releasing this to its stewardship partners. The USGS encountered a significant delay in obtaining and making operational ArcGIS 9.2. That immediately put the process out of synchronization with stewardship partners who upgraded quickly. Many stewards with 9.2 platforms were at a standstill with an NHDGeoEdit tool that did not work. The 9.2 tool upgrade went through three stages. First the tool was run on 9.2 to determine failure points. These were detected and resolved. In the second phase the new tool was tested in an operational environment to identify and resolve problems found in actual production. In the third and final phase the production ready version is being certified for operations. One lingering problem was detected and will soon be fixed, clearing the way for release. One of the issues was a major change to error tracking. Problems that slipped through the 9.1 version now were getting caught in 9.2. The feature-to-feature rules had to be modified to now work in 9.2. Also, many associated utilities such as build flow, M-values, shapefile to personal geodatabase, XML to personal geodatabase, and XML extract had to be changed to now run in 9.2 and then subsequently tested. New capabilities such as flow check and NHD tools toolbox have been added and needed to be tested. The version 1.06 of the NHD model was also implemented, but did not present problems. Fortunately, ArcGIS 9.2 has resolved a lot of previous problems related to precision and extent. So the 9.2 version of the NHDGeoEdit tool yields a significantly improved product although leaving behind a large delay to the NHD stewardship process.

Coastline in the NHD

The NHD uses the NHDFlowline feature Coastline to delineate the coastline of the oceans in the NHD. This line will also be coincident with the perimeter of the NHDArea feature Sea/Ocean. Typically the NHD was digitized from USGS or joint USGS/USFS 7.5-minute series topographic maps. The coastline

on these maps appears as a solid blue line. This line has an interesting background. The topographic maps were made from aerial photographs using photogrammetric techniques. These aerial photos captured the position of the coastline at the instant the photo was taken on a certain date and at a certain time. Using records from local tidal stations, USGS cartographers determined the tidal level at that instant. Again using the tidal records, they then determined the height of the mean high tide above the captured tidal level. For example, the coastline captured on the photo might have been at a stage of six feet, and the mean high tide listed at 14 feet. That means that the mean high tide is eight feet above the coastline captured on the photo. Using their photogrammetric instrumentation, the cartographers then plotted the mean high tide line in their stereo model similar to the plotting of a contour. This line then formed the coastline on the topographic map. If the range of the tide at the mapping location was minimal and within the plotting accuracies of the compilation instruments, the coastline was plotted at the waterline that appeared on the photography. If the horizontal differential between mean high tide and mean low tide was great enough, the mean low tide was shown as a black line forming the perimeter of the inter-tidal zone, often portrayed as mudflats. However, normally there was no significant inter-tidal zone and only one coastline was portrayed. In the NHD, the mean low tide is implied from the perimeter of NHDArea feature Foreshore. The NHD uses the feature Coastline to represent the mean high tide. This feature has a flow direction running counter-clockwise, which allows modelers to easily find flow paths inland from the ocean by picking just one navigation start location.

NHD Model Upgraded

Version 1.06 of the NHD model has now been implemented in the NHD data. The model now allows (1) Underground Conduit - or underground stream, (2) Canal/Ditch=Stormwater, (3) Pipeline=Stormwater, (4) Swamp/Marsh=Perennial or Intermittent, and (5) Feature Class: NHDAreaEventFC.

October Hydrography Quiz / New November Quiz

Zoe Zaloudek, a GIS Analyst with the Illinois State Water Survey in Champaign, Illinois, was the first to correctly guess last month's hydrography quiz <ftp://nhdftp.usgs.gov/Quiz/Hydrography28.pdf>. Zoe says, "We're looking at Yuma, a town on the borders of California, Arizona and Mexico. The major stream to the north of Yuma is the Colorado River. The blank areas can be attributed to the desert and the fact that some of what we're looking at is outside of the United States." Others with the correct answer were Steve Char, Ed Carter, and David Asbury.

David Asbury notes: "The 'unnaturally' straight features on the left side of the image are the All-American Canal (running east-west) and the Coachella Canal (running southeast-northwest). The forerunners to these canals was the Imperial Canal which after being built around the turn of the century quickly silted in due the high sediment loads carried by the Colorado River. An attempt was made to create a diversion around the silt blockages - on Mexican territory - in order to be out of the reach of the then-new U.S. Bureau of Reclamation. However, the new route was ill-advised as it crossed unstable river delta that was regularly reshaped during floods. Winter flooding in 1905 overtopped the diversion canal and the whole of the Colorado River poured into the Salton Sink, forming the Salton Sea. The area was a scene of flood for two years until the canal breach was mended. The dense dark blue line is the upper-ent of the image include a series of lakes formed by the Imperial Dam and are partially within the Imperial National Wildlife Refuge. The network of orange lines (representing canals) show the extensive irrigation and water supply required for humans to inhabit this arid desert region."

This month's hydrography quiz can be found at <ftp://nhdftp.usgs.gov/Quiz/Hydrography29.pdf>. The main feature of interest is the large meandering river. It was named after a mountain range with a big gap in it. The pink shaded area is a big city famous for something pretty unique to America. Where is this?

American Water Resources Association

Be sure to mark your calendar for the 2008 AWRA Spring Specialty Conference – GIS and Water Resources V in San Mateo, California on March 17-19, 2008. See http://www.awra.org/meetings/San_Mateo2008/index.html

Upcoming NHD Geo Edit Tool Training

December 4-6, Lacey, Washington, Contact Paul Kimsey pjkimsey@usgs.gov or Allyson Jason at ajason@usgs.gov

December 3-7, Baton Rouge, Louisiana, Contact Bill Smith at wjsmith@usgs.gov or Christopher Cretini at cretinic@usgs.gov

January 7-10, Denver, Colorado (tentative), Contact Bill Smith or Mark Eaton at maeaton@usgs.gov

January 15-16, Montgomery, Alabama, Contact Carl Nelson cwnelson@usgs.gov or Phillip Henderson at Phillip.Henderson@adeca.alabama.gov

February, 2008, Anchorage, Alaska (tentative), Contact Paul Kimsey pjkimsey@usgs.gov or Carl Markon markon@usgs.gov

Upcoming NHD Applications Training

February 11 (tentative), Michigan, contact Steve Aichele at saichele@usgs.gov

February 27, 2008 (tentative), Wisconsin, contact Dick Vraga at rsvraga@usgs.gov

March 5, 2008, Richmond, Virginia, contact Diane Eldridge at deldridge@usgs.gov

March 6, 2008, Reston, Virginia, contact Diane Eldridge

April 21, 2008, Kansas City, Missouri, (stewardship), see

<http://www.magicgis.org/magic/symposiums/2008/index.cfm>

Hawaii in planning stages, contract Henry Wolter at hwolter@usgs.gov

California in planning stages, contact Carol Ostergren at costergren@usgs.gov

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

You can view past NHD Newsletters at http://nhd.usgs.gov/newsletter_list.html

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