USGS National Hydrography Dataset Newsletter
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By Jeff Simley, USGS

File-Based Geodatabase Now Available

You can now download the NHD as a file-based geodatabase. File sizes are about one-third of personal geodatabase file sizes. For example, subbasin 13010004 produces a 27.0 MB high resolution personal geodatabase, but a 10.5 MB file-based geodatabase. After selecting and downloading the file you need to unzip it. Unzipping it results in a folder full of many files rather than the familiar single .mdb file produced by personal geodatabases. Many users like to rename the downloaded file to a more meaningful file name. If this is done, do it in ArcCatalog rather then Windows Explore to prevent corrupting the file structure. To the user, file-based geodatabases work exactly the same as personal geodatabases in ArcMap, ArcCatalog, and ArcToolbox.

The NHD in Mexico

The Mexican Mapping and Census Bureau, Instituto Nacional de Geografia e Informatica (INEGI), has launched an aggressive program to provide a complete NHD-like dataset for Mexico. The dataset, known as Red Hidrografica Nacional (1:250,000-scale and 1:50,000-scale), or also referred to in English as the National Hydrographic Network, will be produced in two parts. First to be produced is a 1:250,000-scale version to be completed in November 2007. It is based on a prototype dataset produced in 2005. Although initially designed for cartographic purposes, the program will produce an analytical dataset featuring a complete nationwide network including artificial path flow through waterbodies and flow through canals. The data will be managed in 37 hydrologic units covering the country. An excellent data structure has been developed that includes names, stream order, from/to nodes, and flow direction. Eventually the dataset will also include gaging stations and monitoring points. Documentation includes methodology used for defining the networks in both mountainous and flat areas. Output will be available in shapefile format. A second major development is a nationwide coverage at 1:50,000-scale to be completed in six months by a workforce of 100 specialists. This dataset is expected to contain six-million lines and 160,000 polygons. The source of this dataset is 1:50,000-scale topographic maps supplemented with orthophoto and DEM data. A future development will align the data to orthophotos. The data will be managed in 983 subbasin-like hydrologic units. To date 115 units are already done. The rapid pace of production is not only due to a large and dedicated workforce, but also to an extensive production tool set featuring capabilities for (1) administration, (2) centerlining/generalization, (3) diagnostics, (4) flow connections, (5) incorporation of canals, and (6) DEM assisted flow direction determination. Special emphasis will be placed on locating all network disconnects and making proper flow connections. Special cases to be dealt with include lack of stream connectivity in urban areas and disappearing streams (sinks and karst topography). Other issues such as stream density, correction of watershed boundaries, and permanent IDs will be dealt with in another version. Also contributing to a successful production program is an extensive training program, strong supervision, and a good quality control/feedback system. Interestingly, complex hydrographic problems are investigated using Google Earth. The production environment will be in ArcMap, with distribution in Shapefile, but it is hoped a neutral distribution format can be provided. The dataset is being designed to serve both cartographic and analytic purposes. A strong emphasis is being placed on applications of the data with a large user base expected. On top of all this great news is an agreement that the data along the U.S.-Mexico border can be shared with the U.S., which should lead to full cross-border NHD data. Preceding this will be an effort to jointly define the subbasin equivalent units across the border. Work on these units will begin in December. From the above description it is obvious that INEGI understands the issues and no doubt will achieve great success with their program.

Generalization of the NHD – by Larry Stanislawski

Since 2005, the USGS Center of Excellence for Geospatial Information Science (CEGIS) has been conducting database and cartographic generalization research to support *The National Map*. Primary objectives of the project include the design and demonstration of a system for producing lower resolution layers of data from the best available, most accurate resolution layer of data. Two goals are the generalization of the high resolution NHD layer, which is actually a multi-resolution layer, to a consistent 1:24,000-scale layer, and also to a 1:100,000-scale resolution layer. The generalization system should function in an automated manner that maintains the integrity of the associated data model. Upon reviewing various alternatives and considering future organizational uses for USGS geospatial databases, a basic strategy for generalization has been outlined that involves deriving a subset of more prominent features from the highest resolution data layer through two processes: data pruning and simplification. The two stage strategy provides some flexibility to tailor the generalized product somewhere between a functional database model and a simple graphic rendition. Initial investigations have focused on generalizing the NHD because of the relative maturity and complexity of this database compared to other USGS geospatial databases. At this time, it is not feasible to acquire flow volume estimates for all high-resolution NHD network features. Therefore, prominence, or relative importance, of each flow network feature is being based on upstream drainage area estimates, which are currently being associated to each network feature in the high-resolution NHD layer. The automated process estimates upstream drainage area by using Thiessen polygons to associate an approximate drainage area, or "catchment", with each linear network feature. Catchment areas are then accumulated downstream through a special graph traversal algorithm. Once pre-generalization estimates are assigned, network and associated area features can be iteratively pruned by upstream drainage area until a drainage density, appropriate for a desired map scale, is achieved. Recently (October 2007), this research has been broadened to a collaborative effort. Charlie Frye of ESRI and Dr. Barbara Buttenfield of University of Colorado at Boulder plan to test and further develop the latest ESRI generalization tools that are geared to prune and simplify polygon features. Tentative plans are being arranged to distribute the polygon simplification work among several universities. This complementary assistance is well-timed and should enhance the success and credibility of the generalization research.

Complete Revision of the NHD

The NHD may not be fully up-to-date to meet the types of mapping and analysis work users wish to pursue. This is the result of landscape change from the time the source data was collected, the criteria used in the original collection, the degree of knowledge of the local hydrology, and advances in technology that have raised user expectations. A general program of maintenance is adequate to bring much of the NHD up to requirements, usually a process pursued through stewardship. However, in some parts of the country an even larger effort is deemed necessary. Some states began their NHD program from scratch, and derived their original NHD based on contemporary orthophotography. Texas is a notable example. Now a number of states have reached the decision point where change, technology, costs, funding, and requirements are at a threshold where the existing NHD coverage needs a complete revision. Efforts are now ongoing to completely revise specific subbasins in Kansas, Utah, New York, and Delaware. New Jersey, West Virginia, and North Carolina are in the process of statewide revisions that will see the effective resolution improve from the 1:24,000-scale baseline to 1:2,400 and 1:4,800-scales. Florida is now moving forward with plans for a statewide revision and Iowa is expressing interest. This is a normal part of the mapping process and inevitably all of the NHD will cycle through revision efforts based on the balance between costs and benefits.

September Hydrography Quiz / New October Quiz

Matthew Starry, a GIS Specialists with the U.S. Environmental Protection Agency in Duluth, MN, was the first to correctly guess last month's hydrography quiz ftp://nhdftp.usgs.gov/Quiz/Hydrography27.pdf as Upper and Lower Red Lake, Minnesota. Matthew is an EPA contractor working for Computer Sciences Corporation on the FAIR II contract to the USEPA Office of Research and Development at the Mid-Continent Ecology Division Laboratory in Duluth. The mission of the lab is to "provide scientific information for use in assessing and forecasting the effects of pollutants and other stressors on the nation's freshwater resources." Matthew says: "The NHD is a valuable resource for our GIS team and we use it extensively in support of research projects. We use NHDPlus data and tools to assist with GIS tasks ranging from making field maps to landscape characterization." Others with the correct answer were Jim Sherwood, Joanna Wood, Jory Hecht, Bob DenOuden, Ken Koch, Sue Ann Hanson, Richard Patton, Andrew LeBaron, Tatiana Nawrocki, and Alan Springett.

Andrew LeBaron notes: The location in this months hydrography quiz is Red Lake, Minnesota. Hydrologically one body of water, the basins are referred to as Upper and Lower Red Lake. To fishermen, Red Lake is known for its fantastic crappie fishery, as well as for a story of an incredible collapse and recovery of the walleye fishery. A world-class walleye fishery was severely depleted through the 1980s due to tremendous commercial fishing pressure, before drastic management changes allowed for a remarkable comeback of the popular sportfish. The relatively shallow Red Lake sits in a vast area called the Big Bog, which is geomorphologically the last remains of glacial Lake Agassiz, an inland sea formed by the melting of the Pleistocene Glacier.

A NHD quiz "Hall of Fame" has been established for prolific quiz winners. The inductees are Ken Koch, Al Rea, and Jim Sherwood.

This month's hydrography quiz can be found at ftp://nhdftp.usgs.gov/Quiz/Hydrography28.pdf. The blank areas are the result of two factors. One is that there is simply nothing on the landscape that could be mapped as hydrography. Where is this?

Upcoming NHD Geo Edit Tool Training

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

February, 2008, Anchorage, AK, Contact Paul Kimsey pjkimsey@usgs.gov or Carl Markon markon@usgs.gov

Upcoming NHD Applications Training

(Possibility), Hawaii, contract Henry Wolter at hwolter@usgs.gov
(Possibility), Michigan, contact Steve Aichele at saichele@usgs.gov
(Possibility), California, 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.