

Title: Incorporating Local Knowledge Provides Better Hydrography Data for All

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Abstract:

The Idaho Department of Water Resources (IDWR), as the Data Steward for the National Hydrography Dataset (NHD) in Idaho, is developing an approach to make it easy for local water manager to submit changes that need to be made to the NHD. Using a custom attribute entry form and an edit dataset in ArcGIS, local agencies can review current NHD and other relevant hydrography data, and submit updates to the IDWR. The Burley Irrigation District (BID), which serves water to over 1,500 customers on over 47,000 acres, served as a case study.

Introduction:

Water managers, be it on a local or regional level, rely on accurate hydrographic data for planning, modeling and other tasks. Currently, much of this data resides in the “heads of local water managers” and on paper maps maintained by irrigation districts, city planners, and other water managers. The goal of this project is to develop an easy approach to collect this data.

The NHD is a nationwide dataset containing hydrological features such as streams, canals, lakes, ponds and swamps. Currently the NHD is available at a medium resolution (1:100,000) and high resolution (1:24,000). While the NHD is managed by the United States Geological Survey (USGS), many States have Data Stewards and have been tasked with collecting and submitting updates to the NHD in their jurisdictions. The IDWR is the Data Steward in Idaho, and in that capacity strives to improve the high resolution NHD dataset. Once the IDWR receives updates from local water managers, the IDWR will then edit the NHD and submit those edits to the USGS for inclusion into the NHD. Direct editing of the NHD requires specialized NHD GeoEditing Tools and specialized training on those tools.

The NHD consists of a variety of feature classes of which the NHDFlowlines feature class represents features such as streams, canals, and pipelines. Editing tools are designed to update the NHDFlowline feature class. It was determined that the following attributes must be captured as part of the customized tools: “FTYPE”, which indicates whether a feature is a canal, pipeline, artificial path, or a stream and the “GNIS_NAME”, which is a name that is accepted by the Board on Geographic Names (BGN), and included in the national Geographic Names Information System (GNIS).

The ESRI ArcGIS software was chosen as the development environment for the use the customized tools due to its prevalence among Irrigation Companies and other local irrigation organizations in Idaho. Although the software is prevalent, most irrigation organization staff have limited GIS skills. Given the

varying levels of licensing it was important that the tools work at a minimum of ArcView 9.x license level.

The Burley Irrigation District (BID) agreed to serve as a case study. BID provides water to irrigate over 47,000 acres through a canal system that extends through more than 60,000 acres. BID, as well as any irrigation district, will benefit from an easily editable representation of delivery system, the ability to easily create maps for ditch riders and customer service, and to eventually create an event theme of their water deliver points.

Methods:

Because local water managers with limited GIS skills are being asked to provide the updated information, the developed procedure needed to be as straightforward as possible and still produce the edits needed for Data Steward to meet the USGS requirements for NHD updates.

To keep the editing as simple as possible, local editors are only asked to draw new lines. At no point does a local editor need to delete lines, or move vertices on an existing line. Once the local editor finishes a sketch, a dialog box with listboxes appears automatically to collect all relevant information for the line that was just drawn. If the local editor makes an error, they can simply draw another line rectifying their mistake. Where there are multiple features with similar geometry, only the last line added to the table (with the highest FID number) is accepted. Once a sketch is completed, a dialog box with drop-down lists appears automatically to collect all relevant information for the line that was just drawn. It was determined that only 3 primary attributes per feature are needed to satisfy the USGS update requirements; EDIT_ACTION, FTYPE, and NAME:

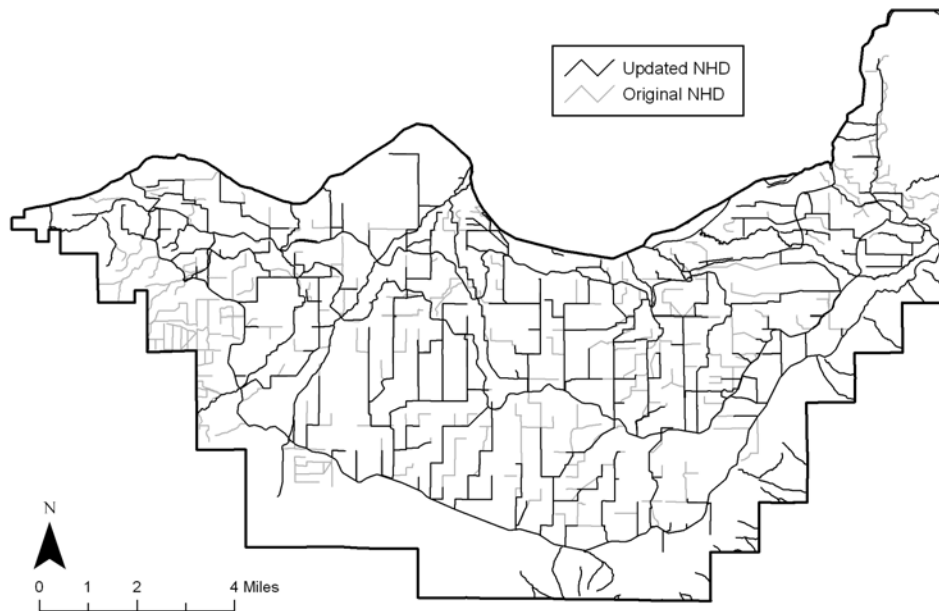
- The “EDIT_ACTION” allows users to select whether the sketch represents a line that needs to be added, deleted or modified. ArcObjects was used to populate the “EDIT_ACTION” listbox with edit options set up in a geodatabase domain.
- The “FTYPE” listbox is populated with the domain values for the most common FTYPES encountered Burley Irrigation District. The default is canal/ditch. ArcObjects code is used to populate the listbox with the description verse the numeric value that is stored.
- The “NAME” listbox is populated from a table containing the names found in the NHD for the area and the appropriate GNIS_ID. These local names are stored in a table in the same geodatabase as the empty featureclass. If a name of a feature does not currently exist in the listbox, it can be added. When a user adds a new name, ArcObject code adds the name to the name table and a negative GNIS_ID is assigned. This negative GNIS_ID allows the Data Steward to identify the additional names. Because the listbox domain is generated on form opening, the new name is added to the “NAME” listbox and is available for future edits.
- A “COMMENT” text box is also available to allow additional data about a feature to be documented.

An ArcMap project (.mxd) with the current NHD data along with the editing procedure code and feature class were provided to the Burley Irrigation District (BID). Additionally, 2006 NAIP imagery, scanned historical paper maps depicting the BID system, and GIS base layer information was provided.

After IDWR personnel trained BID staff in the use of the customized tool, BID edited their entire irrigation district and submitted those to IDWR.

Results:

BID staff successfully used the customized editing tool and submitted those updates to IDWR. The importance of the geometric updates to the NHD is apparent when comparing NHD before and after the changes submitted by BID are incorporated (see Figure 1). Over 200 canals were edited. Additionally, over 200 new names for canals and laterals were added to the NHD. An interview with the local editor revealed that the editing process was easy to learn and execute. The local editor was able to stop and start the procedure with minimal difficulty as other duties became pressing. The testing period took 2 - 3 months as the local editor was unable to dedicate full time to the process.



After incorporating the edits submitted by the BID into the NHD, it became clear that more information especially about flow direction and connectivity is required. For the BID case study, paper maps were produced by IDWR illustrating flow directions and connectivity and submitted to BID. BID manually edited the paper maps and re-submitted those to the IDWR. IDWR then completed the NHD updates and submitted those to the USGS for inclusion into the national NHD dataset.

Discussion

The first trial of the customized tool successfully captured changes in NHDFlowline names and geometry. However, it became apparent that it needs to be expanded. Local water managers need to verify and, if necessary, edit the flow direction. Additionally, they need to be able to specify and where canals or streams intersect or where they simply pass over or under each other.

It is important encourage local agencies to start using the NHD, either simply for producing maps, or as a more integral part in their day-to-day operations. Without investment in the NHD, acquiring additional updates will be difficult. To this extent IDWR is planning to work with USGS on making the point of diversion feature class in the NHD more robust and also identify events, such as pumps and weirs, that can be tied to the NHD and provide valuable information for local entities.

After additional testing, the code, feature classes, and tools designed will need to be combined into a single .dll for easy distribution. Additionally, IDWR is simultaneously working on an internet application that accepts updates to the NHD for organizations that do not have the ArcGIS software.

Simplified editing tools allow IDWR, as the NHD Data Steward, to acquire updates from local agencies and include them into the NHD. Local agencies benefit by having their most current data in the NHD for up-to-date map development and for the ability to incorporate the NHD into their business operations and for data analysis. This approach has demonstrated to be an effective way to extract data out of the “heads of local water managers” and into an easily accessible national database for better hydrographic planning, modeling, and other tasks.

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