Oregon Hydrography Data Standard

Version 2.0
September 2012

<u>Revision History</u>
Version 1.0, Endorsed by the Oregon Geographic Information Council (OGIC), March 2002
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Please address comments to:

Oregon Hydrography Framework Implementation Team
c/o Robert Harmon, GISP, GIS Coordinator
Oregon Water Resources Department
robert.c.harmon@wrd.state.or.us

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1.0   Introduction

The first Oregon Hydrography Framework standard was the product of a collaborative effort between the states of Oregon and Washington and the federal agencies in the region, primarily the U.S. Department of Agriculture Forest Service (USFS) and U.S. Department of Interior Bureau of Land Management (BLM). The group collectively is known as the Pacific Northwest Hydrography Framework (PNWHF) partnership. The standard was developed between 1997 and 2001 around the "LLID", a whole stream identifier. It was endorsed by the Oregon Geographic Information Council (OGIC) as a state GIS data standard in March 2002.

In 2005, the PNWHF made the decision to migrate to the National Hydrography Dataset (NHD). The LLID data (1:24,000-scale, and larger) was the source for the NHD "high resolution" data in the region. The transition was completed in 2009 and the NHD has entered into a maintenance and stewardship phase.

The NHD Model was updated in 2010 to version 2 and now includes the Watershed Boundary Dataset (WBD). The WBD "defines the perimeter of drainage areas formed by the terrain and other landscape characteristics" (Simley, 2010). It is a hierarchical system which is subdivided into successively smaller units that are nested within the larger units. There are currently six levels in the WBD with the smallest units, the 12-digit sub-watershed averaging 20,000-acres in Oregon. The 10 and 12-digit levels are commonly used by PNWHF partners for analysis and reporting. The PNWHF partnership has expanded as a result of the inclusion of the WBD to include the Natural Resources Conservation Service (NRCS) state offices in Washington and Oregon.

In 2009, the PNWHF updated its MOA between the partners to recognize the stewardship arrangement of the national NHD and WBD, and expand its membership. In turn, the PNWHF has another MOA with the U.S. Geological Survey (USGS), the steward of the NHD and WBD national data sets.

1.1   Mission and Goals of Standard

The purpose of the Oregon Hydrography Data Standard (OHDS) is to specify a common method for locating and identifying surface water features and nested drainage basin delineations in the state. Since it is based on national models, hydrography data maintained according to the OHDS and events tied to those features can be exchanged with entities in other states and the federal government.

1.2   Relationship to Existing Standards

Version 2 of the OHDS is tied to the NHD, data model version 2.1 (user guide; model (PDFs)) and the WBD (model (PDF); "Standards & Procedures", 3rd ed.).

All geospatial datasets developed from the OHDS must also adhere to the Federal Geographic Data Committee, Content Standard for Digital Geospatial Metadata.

1.3   Description of Standard

The OHDS includes the elements necessary to accurately identify and locate surface water features and watershed boundaries.

1.4   Applicability and Intended Use of Standard

The OHDS applies to the digital representation of surface water features and drainage basins in the state of Oregon. Both the NHD and WBD are designed to be extensible in order to support a wide array of business needs. For example, streams in the NHD are represented by routed lines that support the mapping of point and linear "events" with attributes defined by the entity that maintains those events. Likewise, the WBD specification was recently updated to accommodate further subdivision of its units for areas smaller than sub-watersheds (12-digit HUs).

1.5   Standard Development Procedures

The NHD was developed by the USGS and U.S. Environmental Protection Agency (EPA) in the 1990s to support the needs of the National Map and water quality programs. It was quickly adopted by other federal, state, local, and private entities and has become the standard for digital hydrographic data. Likewise, the WBD has developed over the past two decades through the efforts of the USGS and NRCS, and it's also become the standard for depicting drainage basins in the U.S.

1.6   Maintenance of Standard

The OHDS will be revised in accordance with any updates to the NHD and/or WBD. Representatives from the PNWHF are involved at the national level with the maintenance of the NHD and WBD models; therefore, Oregon is included in any decisions that involve changes to the NHD and WBD. Proposed changes will be reviewed by the Oregon Hydrography FIT before updating the OHDS.

2.0   Body of the Standard

2.1   Scope and Content of the Standard

The scope of the OHDS encompasses any surface water feature and drainage basin located in the state of Oregon. This includes, but is not limited to: lakes, streams & rivers, canals, springs, basins, and watersheds. More examples are included in section 2.5.9. While the OHDS includes marshes, they are not maintained in accordance with the *Oregon Wetland Mapping Standard (2.1.1)*. That is a component of integration with other themes (2.4).

2.2   Need for the Standard

The OHDS provides an elemental foundation not only for the consistent depiction of surface water features and drainage areas, but also any information tied to these features. Its use spans a wide array of functions from providing background information on maps to enabling the modeling of flow and material transportation through a stream network. Many organizations, private and public, and across all levels of government make maps and tie their data to these features. For example, StreamNet, the

cooperative fisheries information management project of the Columbia River basin, while it intends to maintain a regional hydrography dataset that uses a whole stream ID it also plans for that dataset to share the same geometry as the NHD. Since the Oregon Fish & Wildlife Department (ODFW) participates in the StreamNet project, migrating to the NHD will help to meet that need. Additionally, the geometric network capabilities of the NHD will enable them to quantify fish habitat upstream of passage barriers.

2.3   Participation in Standards Development

This standard and the process by which it will be updated or enhanced is open to all entities concerned with the development, maintenance, and application of surface water hydrography and watershed boundary delineations important to business functions. As with all Oregon framework standards, public review of and comment on the OHDS is encouraged.

The Oregon Hydrography Framework group that drafted the standard had representatives from several state and federal agencies, with review from the broader GIS community in Oregon (complete list in the Appendix). The PNW Hydrography Steering Committee also has broad representation in the region (Oregon & Washington). Likewise, it has representatives that participate on the NHD Advisory Team (national level coordination group).

2.4   Integration with Other Standards

The OHDS follows the same format as other Oregon Framework geospatial data standards. It provides the linear referencing system that other surface water related themes utilize when locating their data, such as the BLM's Aquatic Resource Information Management System (ARIMS). It provides an optional means of locating features defined by the *Oregon Fish Passage Barrier Data Standard (Ver. 1.1)*.

Updates to stream channel locations and watershed delineations are increasingly being made from the high resolution elevation layers derived from data collected from lidar sensors (*Oregon Airborne LiDAR Data Standard (1.1)*). Where crossing points (bridges and culverts) exist in the Oregon Road Centerline theme streams and/or water bodies should be present in the NHD. There should also be consistency between features in the NHD and WBD and those defined by the *Oregon Floodplain Data Exchange Standard (1.0)* and the *Oregon Wetland Mapping Standard.* Finally, features compiled and maintained according to the OHDS should coincide with terrestrial contours (*Oregon Terrestrial Vector Elevation Data Standard (1.1)*) and bathymetry.

2.5   Technical and Operation Context

2.5.1   Data Environment
The data environment for the OHDS is a vector model comprised of points, lines, and polygons as established in the NHD and WBD data models. The exchange format is the Esri file geodatabase (FGDB) since it is the download format provided by the NHD on their web site.[1]

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[1] Esri released an API for programmers for creating and maintaining FGDBs without having to obtain ArcObjects through other Esri products (ArcGIS Desktop or Engine). Updates and information about the API can be found at: http://resources.arcgis.com/content/geodatabases/10.0/file-gdb-api.

2.5.2 Reference System

The NHD and WBD are maintained by the USGS in the "geographic" (latitude & longitude) coordinate reference system in the North American Datum of 1983 (NAD83) which differs from the Oregon state standard, "Oregon Lambert" (EPSG[2] #2992). Copies of the NHD and WBD will likely be kept in the data clearinghouse at the Geospatial Enterprise Oregon (GEO) office in Oregon Lambert and refreshed when needed by the Oregon Hydrography FIT.

2.5.3 Integration of Themes

The locations of features in the OHDS are based on their relationship to features in the following framework themes (as noted in 2.4):

- transportation
- fish distribution & barriers to passage
- elevation
- floodplains
- wetlands

2.5.4 Encoding

Encoding translates user formats into standard formats, like the file geodatabase specified here for exchange. Increasing numbers of mapping applications beyond Esri's products are able to read the FGDB with the availability of the FGDB API.[1] The NHD is currently limited to the Esri geodatabase format due to the complex relationships maintained between features that aren't supported in other geospatial file formats.

2.5.5 Resolution

The OHDS dataset resolution will be 1:24,000 scale or better. Local data capture methods will vary as will the business applications that those data must support. It is the intention of the OHDS to allow for the integration of data collected at multiple spatial resolutions at 1:24,000 and larger.

2.5.6 Accuracy

As with resolution, the intention of the OHDS is to support varying levels of positional and attribute accuracy. However, it is essential to the success of the data standard that all aspects surface water and drainage basin data be completely documented (either at the feature or dataset level).

2.5.7 Edge Matching

The OHDS is intended to facilitate the compilation of a comprehensive dataset for surface water features and drainage basins in Oregon. Edge matching between jurisdictional submissions will be implemented by the Horizontal Steward according to established business rules. A memorandum of agreement is in place between the PNW Hydrography Steering Committee (PNWHSC) and the U.S. Geological Survey recognizing the PNWHSC as the steward of the NHD and WBD for Oregon and Washington. In turn, there is a MOA between the PNWHSC partners establishing stewardship roles & responsibilities and a process for handling edits to the data.

2.5.8 Feature Identifiers

The "ReachCode" is the primary feature identifier for the NHD. It is composed of the 8-digit hydrologic unit that the feature is located in concatenated to a randomly assigned sequential number.

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[2] European Petroleum Survey Group (Geodetic Parameter Registry).

It is used to tie the user's data to a feature, or locate them as events along the routed flow lines (stream centerlines) with the addition of a measure. The NHD also has a "Permanent Identifier" field. It is defined as a 40-character GUID (globally unique identifier) that uniquely identifies each feature in the national dataset and will not change while the feature exists.

The WBD has a unique number for each HU. The number's length varies by the level of nesting. For example a basin, which is a 3rd-level HU, has a 6-digit identifier (2-digits for each level of nesting). The last two digits of each HU's id uniquely identify it within the unit it's nested within.

2.5.9 Features and Attributes

There are multiple feature types with their associated characteristics. Examples are listed in 2.5.9.1 – 2.5.9.3. A complete feature guide with definitions, examples, pictures, and templates can be found on the NHD site.

2.5.9.1 Points

Point features are geospatial objects that represent dams, gauging stations, gates, locks, rapids, springs, waterfalls, rocks, and wells in the OHDS.

2.5.9.2 Lines

Line features are geospatial objects that represent streams and rivers, bridges, dams, flumes, gates, levees, rapids, tunnels, walls, and waterfalls in the OHDS.

2.5.9.3 Polygons

Polygon features are geospatial objects that represent lakes and ponds, estuaries, submerge areas, bays, ice masses, reservoirs, marshes, areas of complex channels, inundation areas, rivers, washes, the ocean, and drainage basins in the OHDS.

2.5.9.4 Associated Characteristics

Associated characteristics are any of the additional information that is collected and shared in relation to the representation of features in the OHDS. These are referred to as attributes in spatial datasets.

2.5.10 Transactional Updating

The transactional update process is a fundamental component of OHDS datasets.

The NHD has a national network of trained editors using specially designed tools to interact with the central database (USGS in Denver, CO) on a continual basis. Each transaction involves a check out and in process to validate the data.

The NHD edit process in Oregon (& Washington) is augmented by the PNWHF's stewardship roles and responsibilities. A methodology has been laid out to ensure that all proposed edits get vetted by the necessary stakeholders if the significance of the edit meets a specified threshold. The PNWHF is currently developing a database of stewards and a means for users to locate the appropriate steward in the area where they have identified an edit to the NHD.

The WBD does not accommodate continual updates. Instead, the PNW goes through a process each spring and fall to collect suggested updates from the user community in Oregon and Washington. They are reviewed by the PNW WBD stewards and submitted to the national repository (USGS in Denver, CO).

2.5.11 Records Management

In the event where OHDS feature locations change the information will be reflected in the distribution dataset available for download from the Horizontal Steward (PNW Hydro).

2.5.12 Metadata

The OHDS follows the Federal Geographic Data Committee, Content Standard for Digital Geospatial Metadata. Metadata must provide sufficient information to allow the user to determine if that dataset will meet the intended purpose, as well as telling the user how to access the data.

3.0   Data Characteristics

Since the OHDS is linked to the NHD and WBD, the data elements are not listed here. Instead, refer to the NHD model (at http://nhd.usgs.gov/NHDv2.1_poster_3_23_2012.pdf) and the WBD data model (at http://nhd.usgs.gov/WBDposter_6_30_09a.pdf) and update procedures (USGS, 2012).

References

Simley, Jeffrey D. and William J. Carswell, Jr. March 2010. *The National Map—Hydrography*, revised. U.S. Geological Survey Fact Sheet 2009-3054, 4 p. http://pubs.usgs.gov/fs/2009/3054/pdf/FS2009-3054.pdf.

U.S. Geological Survey and U.S. Department of Agriculture, Natural Resources Conservation Service, 2012, Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD) (3d ed.): U.S. Geological Survey Techniques and Methods 11–A3, 63 p. http://pubs.usgs.gov/tm/tm11a3/

Appendix
List of agencies participating in the development of the revised Oregon Hydrography Data Standard

Oregon Hydrography Framework Implementation Team

Oregon Water Resources Department
Oregon Fish & Wildlife Department
Oregon Department of Environmental Quality
Oregon Department of Geology and Mineral Industries
Oregon Department of Forestry
Oregon Department of Revenue
Oregon State Marine Board
Oregon Department of Administrative Services

U.S. Bureau of Land Management
U.S. Forest Service
U.S. Natural Resource Conservation Service
U.S. Geological Survey