USDA Service Center Agencies
Geospatial Data Management Team
Data Management Plan For

Hydro Unit-Watershed Boundary Data

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Laura Davenport, Rob Vreeland, Mike Hart and Kenny Legleiter

I. Purpose and Scope (business case)

A. Purpose

The intent of defining hydrologic units (HU) for the Watershed Boundary Dataset is to establish a base-line drainage boundary framework, accounting for all land and surface areas and to create a national, consistent, seamless, and hierarchical watershed boundary dataset based on topographic and hydrologic features across the country. The hydrologic unit boundaries in this dataset define the extent of surface water drainage to a specified point. The selection and delineation of hydrologic boundaries are determined solely upon science-based hydrologic principles, not favoring any administrative or special projects nor particular program or agency.

The database will assist in planning and describing water use and related land use activities.

B. Scope

This dataset is being delineated and geo-referenced to the USGS 1:24,000 scale topographic base map meeting National Map Accuracy Standards (NMAS). A hydrologic unit has a single flow outlet except in coastal or lakefront areas as stated by the Federal Standard for Delineation of Hydrologic Unit Boundaries. The map extent is typically a hydrologic unit.

The Watershed Boundary Dataset is being developed under the leadership of the Subcommittee on Spatial Water Data, which is part of the Advisory Committee on Water Information (ACWI) and the Federal Geographic Data Committee (FGDC). The USDA Natural Resources Conservation Service (NRCS), along with many other federal agencies and national associations, have representatives on the Subcommittee on Spatial Water Data.

As watershed boundary geographic information systems (GIS) coverage's are completed, statewide and national data layers will be made available via the Geospatial Data Gateway to everyone, including federal, state, local government agencies, researchers, private companies, utilities, environmental groups, and concerned citizens.

II. Acquisition

A. Data Source

1. Producer Information
    a. Name

The Natural Resources Conservation Service (NRCS) State Offices, following national delineation and digitizing guidelines, are producing the 8-12-digit hydrologic unit coverages. In many cases, state and other federal partners are involved. NRCS' National Cartography and Geospatial Center is certifying completed coverages. Entities can derive the HU2, HU4, and HU6 codes and names by dissolving the WBDHU12 layer and joining to the USGS HUC250K layer in order to calculate for coding and naming purposes.

b. Location of Headquarters

NRCS State Office for the state of coverage

c. Internet Address

http://www.state.nrcs.usda.gov where ***state*** is replaced with the 2-letter abbreviation of the state of coverage

2. Publisher Information

a. Name

Each state will publish their 8-12-digit HU data on their NRCS state home page and/or on the state's spatial data clearinghouse. In addition, the Natural Resources Conservation Service's National Cartography and Geospatial Center will publish certified data.

b. Location of Headquarters

Natural Resources Conservation Service
National Cartography and Geospatial Center
P. O. 6567
501 Felix St., Bldg. 23
Fort Worth, TX 76115-3405

c. Internet Address

http://www.ncgc.nrcs.usda.gov

3. Acquisition Information

a. Delivery Media

Certified data is available by request from:

Natural Resources Conservation Service
National Cartography and Geospatial Center
P. O. 6567
501 Felix St., Bldg. 23
Fort Worth, TX 76115-3405

b. Download URL

Certified data is available from the USDA Geospatial Data Gateway
http://datagateway.nrcs.usda.gov/GatewayHome.html

c. Projected Data Availability Schedule

National status map is available at:
http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html

B. Standards Information

1. Geospatial Data Standard

a. Standard Name and Steward Information

Standards and instructions for the development and certification of the WBD can be found at:
http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html

United States Department of Agriculture (USDA) Service Center Agencies (SCA) Standard For Geospatial Data

b. Standard Version

SCI Std 003-02
October 15, 2003

c. Standard URL

http://www.itc.nrcs.usda.gov/scdm/docs/SPG-GeospatialDataStandard.pdf

2. Metadata Standard

a. Standard Name and Steward Information

Metadata are compliant with:
Federal Geographic Data Committee (FGDC)
Content Standard for Digital Geographic Metadata FGDC
STD-001-1998 Version 2 revised June 1998

And:
United States Department of Agriculture (USDA) Service Center Agencies (SCA)
Standard For Geospatial Dataset Metadata
SCI Std 003-02 October 15, 2003

http://www.itc.nrcs.usda.gov/scdm/docs/SPG-GeospatialDatasetFileMetadata.pdf

b. Description of Metadata Captured

Metadata for the WBD is at data-set level implementation and will not be in place until file-specific information for individual maps is available.
http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html

c. Metadata Accuracy and Completeness Assessment

None

C. Acquired Data Structure

1. Geospatial Data Format

a. Format (raster, vector, etc.)

Vector.

b. Format name

Data will be acquired as ESRI shape files, ARC/INFO coverages, and ARC/INFO exchange files.

c. Data Extent

The data extent is statewide for each state or by hydrologic unit region and sub-basin. Currently, a national coverage is being developed.

A current status graphic of data development may be viewed at: http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html

d. Horizontal and Vertical Resolution

Horizontal resolution is the same as 7.5-Minute USGS Quadrangle.

Vertical resolution is not measured.

e. Absolute Horizontal and Vertical Accuracy

7.5-Minute USGS Quadrangle Accuracy

Horizontal positional accuracy is based upon the use of USGS source quadrangles, which are compiled to meet National Map Accuracy Standards (NMAS). NMAS horizontal accuracy requires at least 90 percent of points tested are within 0.02 inches of the true position. The digital data are estimated to contain a horizontal positional error of less than or equal to 0.003 inches standard error in the two component directions relative to the source quadrangle.

Vertical positional accuracy is not measured.

f. Nominal Scale

1:24,000

g. Horizontal and Vertical Datum

The reference data may be North American Datum of 1927 (NAD 27), North American Datum of 1983, (NAD 83), Old Hawaiian Datum (OHD), or Puerto Rico Datum (PRD) of 1940. Completed data will be projected to NAD83.

h. Projection

Geographic

i. Coordinate Units

Decimal Degrees

j. Average Data Set Size

Depending upon the size of the state, it is estimated that the average will be about 40mg.

k. Symbology

None

2. Data Model

a. Geospatial Data Structure

The WBD consists of polygons and lines in a seamless, consistent, nested dataset for the nation. The layer will be delineated for 1st-6th levels of hydrologic units (2 through 12 digits).

b. Attribute Data Structure

Varies depending on whether source is shape file, coverage or exchange file.

c. Database Table Definition

Varies depending on whether source is shape file, coverage or exchange file.

d. Data Relationship Definition

Varies depending on whether source is shape file, coverage or exchange file.

e. Data Dictionary

Appendix of Interagency document Federal Standards for Delineation of Hydrologic Unit Boundaries.
http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html

D. Policies

1. Restrictions

a. Use Constraints

None

b. Access Constraints

None

c. Certification Issues

None

2. Maintenance

a. Temporal Information

Range of Dates/Times:
Beginning Date: 1979-2007
Ending Date: present

b. Average Update Cycle

As needed

E. Acquisition Cost

1. Cooperative Agreement
   a. Description of Agreement

      None

   b. Status of Agreement

      None

2. Cost to Acquire Data

   None

III. Integration

A. Value Added Process

1. Benefit to the Service Center

   Integration will allow service centers to consider all landscape within their service center area in the context "watersheds", including those completely in the service area and those flowing into or out of the service area. "Watersheds" are useful for ecological context areas for water quality assessments.

2. Process Model
   a. Flow Diagram

Steps to create the Watershed Boundary Dataset (WBD) 23-April-2008

Before you begin, ensure that there are no duplicate OBJECTID columns for polygons or pre-existing Left or Right FID columns in the linework attribute fields.

1. Process to Populate LEFT_HUC_8 and RIGHT_HUC_8 columns in linework {if state submits data in a geodatabase (linework (<st>_hu12_line) and polygons (<st>_hu12_poly) in separate layers)}:

   a. Use <st>_hu12_poly layer: in ArcToolbox use tool "Polygon to Line" resulting in (<st>_line_polytoline); this command creates a line feature with the right and left fid of the polygon layer <st>_hu12_poly.
   b. Run a spatial join of the <st>_hu12_line to the <st>_line_polytoline (resulting in <st>_wbd_line_join layer).
   c. Run an attribute join of <st>_hu12_poly (objected) to the right_fid of the <st>_wbd_line_join layer.
      1. Calculate the huc8 from the <st>_hu12_poly to the RIGHT_HUC_8 of the <st>_wbd_line_join.
      2. Remove all joins.
   d. Run an attribute join of <st>_hu12_poly (objected) to the left_fid of the <st>_wbd_line_join layer.
      1. Calculate the huc8 from the <st>_hu12_poly to the LEFT_HUC_8 of the <st>_wbd_line_join.
      2. Remove all joins.

e. **<st>_wbd_line_join** is now the official linework to import in to SDE instead of <st>_hu12_line.

2. Copy previous certified WBD dataset into temporary working database on NCGCCERT01(wbd).

   a. Load <st>_hu12_poly and <st>_wbd_line_join in to same feature dataset (but don't append, or merge data at first, keep them separate as four layers in order to run a preliminary topology test).
   b. Create topology and validate in ArcMap.
   c. Check for errors. If errors consist mainly of pseudo nodes, continue; else consider number of errors before correcting.

3a. Importing <st>_hu12_poly and <st>_wbd_line_join into the rest of the certified WBD SDE layer: {This description pertains to when a state submits a dataset that polygon attributes disagree across the state border}

   A. Prepare state line data (<st>_wbd_line_join) to merge with wbd data:
      1. Use the state100k (or a later, updated version) layer in gdwsde1b to select states surrounding the new state data and create selection layer.
      2. Use the state100k (or a later, updated version) layer in gdwsde1b to select the new state and create a selection layer.
      3. Run the Erase tool (Analysis Tools) on the state data and the adjoining state (hu_l_st_erase).
      4. Trace the state line from the selection layer into the newly created erased layer (hu_l_st_erase).
      5. Create a checkout of the wbd_l_us data around the stateline of the new data on which to run the erase command.
   B. Prepare the state polygon data to merge with the wbd data.
      1. Use the state100k (or a later, updated version) layer in gdwsde1b to select the states surrounding the new state data and create selection layer.
      2. Use the state100k (or a later, updated version) layer in gdwsde1b to select the new state and create a selection layer.
      3. Run the Erase tool (Analysis Tools) on the state data and the adjoining state (hu_l_st_erase).
      4. Create a checkout of the wbd_a_us data around the stateline of the new data on which to run the erase command.
      5. Run the Erase tool on the state100k selection and the checkout of the wbd_a_us.
      6. Edit the original checkout data, delete all features. Select all features in the new checkout_st_erase layer and copy and paste into the original checkout_st featureclass.
      7. Checkin the checkout_st feature class.
   C. Create and validate topology; edit errors.

3b. Importing <st>_hu12_poly and <st>_wbd_line_join into the rest of the certified WBD SDE layer: {This description pertains to when a state submits a dataset that polygons overlap across the state border and both states agree that these polygons will replace the border state's (previous submission) polygons.}

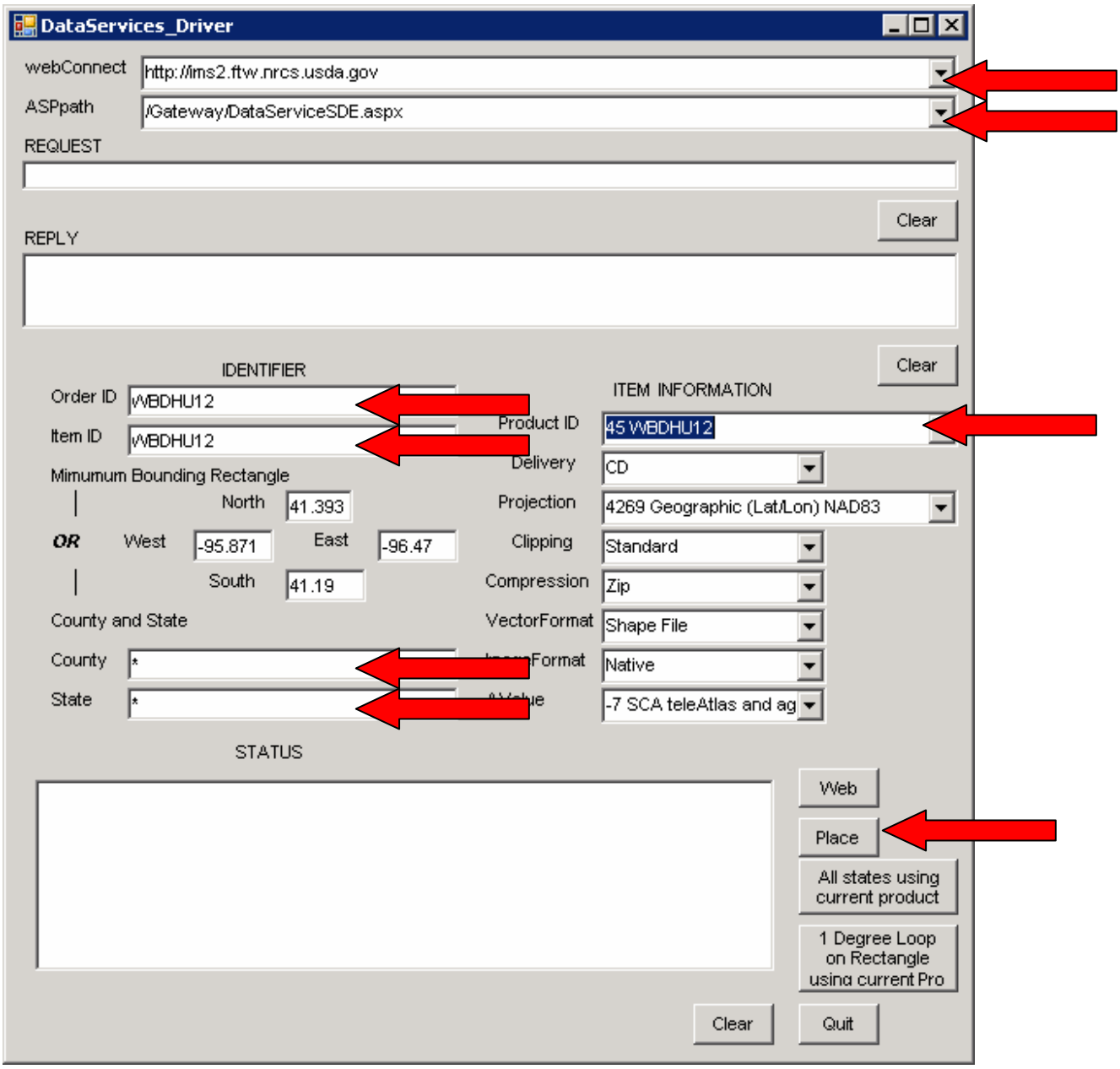
   A. Do same steps as 4a (A), but leave out the state line that was traced above.
   B. Do same steps as 4a (B), but clip the polygons using the submitted dataset as the cookie cutter instead of using the state boundary for the Erase command.
   C. Create and validate topology; edit errors (there will probably be hundreds).

3c. Importing <st>_hu12_poly and <st>_wbd_line_join into the rest of the certified WBD SDE layer:

{This description pertains to when a state submits a dataset that was not clipped properly and gaps occur between linework and polygons when imported in to the rest of the certified WBD}.

A. Import entire state's polygon and linework features in to the SDE layer, even where there are overlaps or gaps. Run initial topology to assess the damage.
B. Create a selection set along the state border and do a check out of linework and polygons selected.
C. Create and validate topology on the checked out version; edit errors (there will be hundreds). After all errors have been edited and topology is clean, check data back in to SDE layer and validate topology once again.

4. Check and ensure there are NO duplicate huc12 polygon codes in the newly added state's dataset with the rest of the National layer in SDE; run a summary on hu12 codes for frequency and join that result with the WBD layer to check areas that have a frequency count higher than 1; some will be legitimate duplicates, but some will not. Coordinate with the state office to correct problem duplicates.
5. Check for and edit out any sliver polygons that don't show up using the topology rules; you identify them by labeling hu12 polygons with the last 4 digits of the hu12 code and looking for duplicates in newly added states' data (normally around borders).
6. Update Metadata (SDE Layers as well as individual state file (<st>_hu12.met)) in the document wbd_state_metadata.html under: \\gateway2\ftp\GatewayCatalogDetails\ThumbNailPreview\WBDHUdocs .
7. Dissolve subwatershed SDE layer using HUC_8 attribute field in ArcMAP and create subbasin index shapefile (wbd_subindex.shp); Only one record per HU subbasin.
8. Run fips (use Rob's Add_FIPS.mxd script) and MBR (Randy's script on ims2) scripts and add these fields to the dissolved subbasin index. Use county map on GDWSDE1A for subbasin index.
9. For Gateway- load the index maps for subbasin into ims2 footPrints/fpSource folder with the map named wbd_subindex (double check and make sure there are no duplicate huc8 polygons (CATID). Put wbd_subindex.dbf into **\\ims2\D\GatewayDBs\ZoneMBRdb.mdb** so the dataservices know of the new area features; use the wbd_subindex.shp and call it wbdhu12 in the database (after renaming the old one).
10. If the SDE layer names change, update the ExtractWBD AXL on "imsgw" server. Refresh the ArcIMS service.
11. Run DataServices_Driver.exe (**\\ims2\D\GatewayWeb\bin\DataServicesDriver.exe**) using the "Place" button; errors are written to **\\ims2\D\GatewayLogs\DataServicesDriver.log** (see red arrows for what to change in the graphic below). Data is written to **\\gateway2\ftp\Gateway\WBDHU12\hydrologic_units**.



12. Run gateway CatalogFP_Maker program using dissolved subbasin shapefile in fp_archive on the newly created individual subbasin shapefiles from the step above. This step creates the shape file for the gateway catalog and for the status map.
13. Create the Status Maps (link from "Status Maps" page) for each product
14. Run gateway MakePreviews (using the "Modified" option for layers from SDE) for each product to generate the preview images for step two of the gateway ordering process. There is no individual metadata for each map so there is no need to use that option.
15. Notify gateway Fort Collins team to load the catalogs, status maps and news.

b. Process Description

- Obtain the data from the approved source

- Overlay the data on the Service Center Area
- Identify all subwatersheds coincident
- Include areas outside the Service Center when the areas flow into or out of the Service Center.
- Produce file of appropriate subwatershed features and attributes for the Service Center.

3. Technical Issues

a. Tiling

Seamless dataset.

b. Compression

None

c. Scale

The data are appropriate for use at 1:24,000.

d. Tonal Matching

None

e. Edge-matching

State coverages are edge matched from the 1:24,000-scale source material to a statewide coverage. Edgematching is accomplished across state lines to the degree possible. Eventually, a national seamless dataset will be made.

4. Quality Control

a. Procedures

Quality control procedures are described in the Federal Standards for Delineation of Hydrologic Unit Boundaries.

b. Acceptance Criteria

Data meet National Map Accuracy at 1:24,000 and were developed and attributed as per the Federal Standards for Delineation of Hydrologic Unit Boundaries.

5. Data Steward

a. Name and Organization

For Archiving and distribution
National Cartography and Geospatial Center
Natural Resources Conservation Service
US Department of Agriculture
501 Felix Street, Building 23
P. O. Box 6567
Fort Worth, Texas 76115-0567 **USA**

The originating state office is the steward for maintenance, updating and changing archived copy.

b. Responsibilities

Makes any revision to the data set and notifies National Cartography and Geospatial Center.

D. Integrated Data Structure

1. Geospatial Data Format

a. Format (raster, vector, etc.)

Vector

b. Format Name

ESRI shape file

c. Data Extent

Service Center Area, with overedge for watersheds flowing into or out of the service area.

d. Horizontal and Vertical Resolution

Same as source data.

e. Absolute Horizontal and Vertical Accuracy

Same as source data.

f. Nominal Scale

Same as source data.

g. Horizontal and Vertical Datum

The datum is North American Datum 1983 for all appropriate areas (UTM zone 3 through 22) and World Geodetic System 1984 elsewhere. The vertical datum is mean sea level

h. Projection

Geographic.

i. Coordinate Units

Decimal Degrees

j. Symbology

None

2. Attribute Data Format

a. Format Name

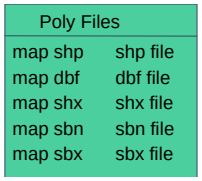
Dbase IV, as part of an ESRI shape file.

b. Database Size

Depends on extent

3. Data Model

a. Geospatial Data Structure



b. Attribute Data Structure

Dbase IV files as associated with shape files. All attributes are character except that the area value is numeric.

c. Database Table Definition

Each level 4-6 (HU8, HU10, and HU12) of the WBD will have the same attribute fields with the 2-digit code to identify the level. For example, the hydrologic unit name field for sub-basins is called "hu_8_name".

Field Name	**Example**	**Description**
* Hydrologic unit code	010802010308	Unique identifier for each hydrologic unit
* Acres	26739	Acres calculated from the area field
* States	KS,MO,OK	State(s) that the hydrologic unit resides
* Non-contributing area	357	Drainage areas that do not contribute to the outlet of the hydrologic unit
* Downstream HU	010801010309	hydrologic unit that is receiving the flow from the hydrologic unit
* Hydrologic unit name	Upper Blue River	Officially recognized names as specified in the interagency guidelines
* HU Modification	CD,LE,IT	Any modification(s) of overland flow that affect location of the HU boundary
* Hydrologic unit type	S	Hydrologic unit type that most closely identifies the drainage form

d. Data Relationship Definition

Standard .dbf file that goes with shape file.

e. Data Dictionary

In Appendix

http://www.ncgc.nrcs.usda.gov/products/datasets/watershed/index.html

E. Resource Requirements

1. Hardware and Software

Refer to the Common Computing Environment (CCE).

www.sci.usda.gov

2. Staffing

This is unknown at this time.

F. Integration Cost

1. Hardware and Software

To reformat, reproject, and subset the dataset a minimum the following is required:
ArcGIS
Arc/Info on UNIX or NT platform
ArcView on XP platform

2. Staffing

This is unknown at this time.

IV. Delivery

A. Specifications

1. Directory Structure

a. Folder Theme Data is Stored In

F:\geodata\ hydrologic_units

http://www.itc.nrcs.usda.gov/scdm/docs/SPG-GeospatialDataSetFileNamingStandard.pdf

2. File Naming Convention

http://www.itc.nrcs.usda.gov/scdm/docs/SPG-GeospatialDataSetFileNamingStandard.pdf

a. List of Theme Files and The File Naming Convention

Areas shown at the 8-digit level by regionat 1:250K:	huc250k_a_<xx>
Lines shown at the 8-digit level by region:	wbdhu8_l_<xx>
Areas shown at the 8-digit level by region:	wbdhu8_a_<xx>
Lines shown at the 12-digitlevel by sub-basin:	wbdhu12_l_<xxxxxxxx>
Areas shown at the 12-digit level by sub-basin:	wbdhu12_a_<xxxxxxxx>

<xx> hydrologic region number
<xxxxxxxx> hydrologic sub-basin number

B. User Information

1. Accuracy Assessment

a. Alignment with Other Theme Geospatial Data

The data are captured at a scale of 1:24,000 and are intended for use 1:24,000 or smaller scales.

b. Content

Data are sufficiently detailed for use at 1:24,000 or smaller scale.

2. Appropriate Uses of the Geospatial Data

a. Display Scale

1:24,000 or smaller

b. Plot Scale

1:24,000 or smaller

c. Area Calculations

As accurate as the source data and capture scale and the algorithm used by ArcGIS,ArcInfo/ArcView.

d. Decision Making

None

C. Maintenance and Updating

1. Recommendations and Guidelines

a. Original data location and structure

The original WBD layer for distribution will reside in the Geodata Warehouse (GDW). At SCA field offices a working copy will be placed in **F:\geodata\hydrologic_units** with the standard naming convention. It should be in ArcView shape file format until other formats are needed.

b. Update Cycle

Certified datasets will be updated at the national level on a semi-annual or longer basis (depending on workload at NCGC) with coordination thru the national WBD dataset manager. Newly certified WBD state datasets will be posted immediately upon certification. Update issues arising during the update period will be logged with the State WBD dataset manager, who upon validation will notify the national WBD dataset manager for posting to the national inventory and GDW during the next update cycle.

c. Availability

The complete layer will be made available to anyone thru the GDW. State WDB contacts and the state FAC Geodata sub-committees will determine what part of the layer will need to be downloaded from the GDW for each service center and application in the state. An automatic refresh utility to update SCA datasets has not been developed at this time.

d. Change Control

As new WBD data are refreshed on SCA systems and other agency servers, previous versions should be moved to an archive folder and renamed to wbdhu8_l <xx>av1, wbdhu8_a <xx>av1, wbdhu12_l <xx>av1, wbdhu12_a <xx>av1 (av1 stands for archived version 1, 2, etc..). There should be no more than two previous versions of the dataset stored on SCA servers. The original national WBD served from the GDW should be moved to an archive folder and renamed wbdhu8_l <xx>av1, wbdhu8_a <xx>av1, wbdhu12_l <xx>av1, wbdhu12_a <xx>av1 as above example. The national data steward will maintain two previous copies of the original data set online and indefinite copies on storage media. The metadata should be updated to reflect the date and other particulars about how and why it was archived.