

# WBD QC Tool Manual

Matthew Morriss, Patrick Longley, and Brittany Gold

April 2021

## Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Requirements</b>	<b>2</b>
<b>3</b>	<b>Download and Install</b>	<b>2</b>
<b>4</b>	<b>General Use</b>	<b>2</b>
<b>5</b>	<b>Manual vs. Tutorial</b>	<b>3</b>
<b>6</b>	<b>Workflow</b>	<b>3</b>
<b>7</b>	<b>Tools</b>	<b>6</b>
7.1	Download Data Tools . . . . .	6
7.1.1	Download GNIS data . . . . .	6
7.1.2	Download NHD data . . . . .	6
7.1.3	Download WBD data . . . . .	7
7.1.4	Download 3DEP data . . . . .	8
7.1.5	Download workflow . . . . .	9
7.2	Elevation Derived Hydrography Tools . . . . .	10
7.2.1	Terrain Preprocessing . . . . .	10
7.2.2	Subwatershed Lines . . . . .	11
7.2.3	Create Polygons . . . . .	12
7.3	Geometry Checks . . . . .	13
7.3.1	Area change/HUC Check . . . . .	13
7.3.2	Check Snapping . . . . .	16
7.3.3	Create Topology . . . . .	16
7.3.4	Fill Depth and Polygon . . . . .	17
7.3.5	Low Relief Finder . . . . .	17
7.4	Attribution Tools . . . . .	19
7.4.1	General Check . . . . .	21
7.4.2	Line Check . . . . .	22
7.4.3	Line: HUDigit Check . . . . .	23

7.4.4	Polygon: ToHUC/HUType Check . . . . .	23
7.4.5	Polygon: Name Check . . . . .	25
7.4.6	Polygon: Name Update . . . . .	25
7.4.7	Polygon: ReferenceGNIS_IDs Check . . . . .	25
7.5	Job Checkout . . . . .	26
7.5.1	Edge match Polygons . . . . .	26

## 1 Introduction

These tools were developed by the personnel of the WBD team (Patrick Longley, Brittany Gold, and Matthew Morriss at the UT Water Science Center). They are largely written in ArcPy for use with ArcMap or ArcPro. As these two softwares use different versions of Python (2.x and 3.x respectively), we have tested these tools on both softwares. It should be noted that not all of the tools will work in ArcMap; however, they are all stable and work within ArcPro. As this Software is compatible with most of the tools, the documentation below will, where necessary, refer to the ArcPro working environment.

All of these tools are packaged into a .pyt - python toolbox - which can be added to both ArcPro and ArcMap. The tools are package into a toolbox called WBD automation tools.

## 2 Requirements

These tools were developed in Python 3 and require ArcGIS PRO. All of the tools were tested with ArcGIS Pro 2.6.3 as of March 1, 2020.

TO RUN:

- At least ArcPro GIS 2.6.X
- Python 3.X (comes with ArcPro)
- ARCHydro (<https://downloads.esri.com/archydro/archydro/Setup/Pro/>)

## 3 Download and Install

The most up to date software can be downloaded from the project GitLab page <https://code.usgs.gov/bgold/wbd-qc-tools>. As of this writing, this page is internal to the USGS and requires a USGS login to access.

## 4 General Use

The actual work flow for some of these tools is described in more detail below and visualized in several flow charts (Figure 1 and 1). However, the first step

is to add the toolbox to your ArcPro Map. This is accomplished through the *Insert* menu.

## **5 Manual vs. Tutorial**

This is a Manual, not a Tutorial. This is a document kept to be a reference for the various functions and tools developed to the aid the QC process of WBD products. We make limited suggestions as to a workflow for the tools, mostly with the use of a Flow Chart of the various functions (Figure 1 and 2).

## **6 Workflow**

Possible workflows through the functions provided are outlined in Figures 1 and 2. In the sections that follow, descriptions of each function are provided and in some cases, possible outputs are included as figures using the example datasets.

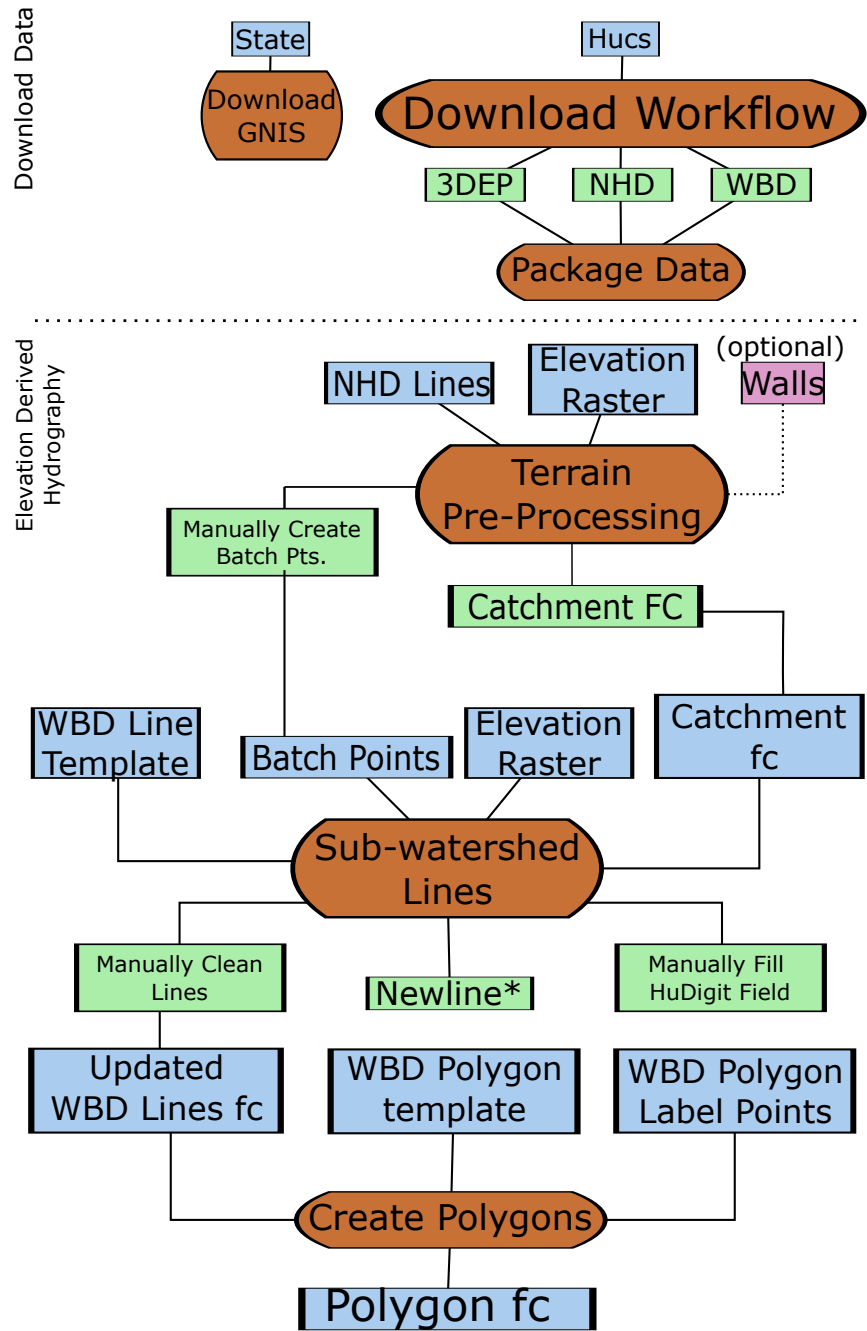


Figure 1: Two example workflows: 1) Download Data and 2) Elevation Derived Hydrography tools

# WBD QC Automation Tool Workflows

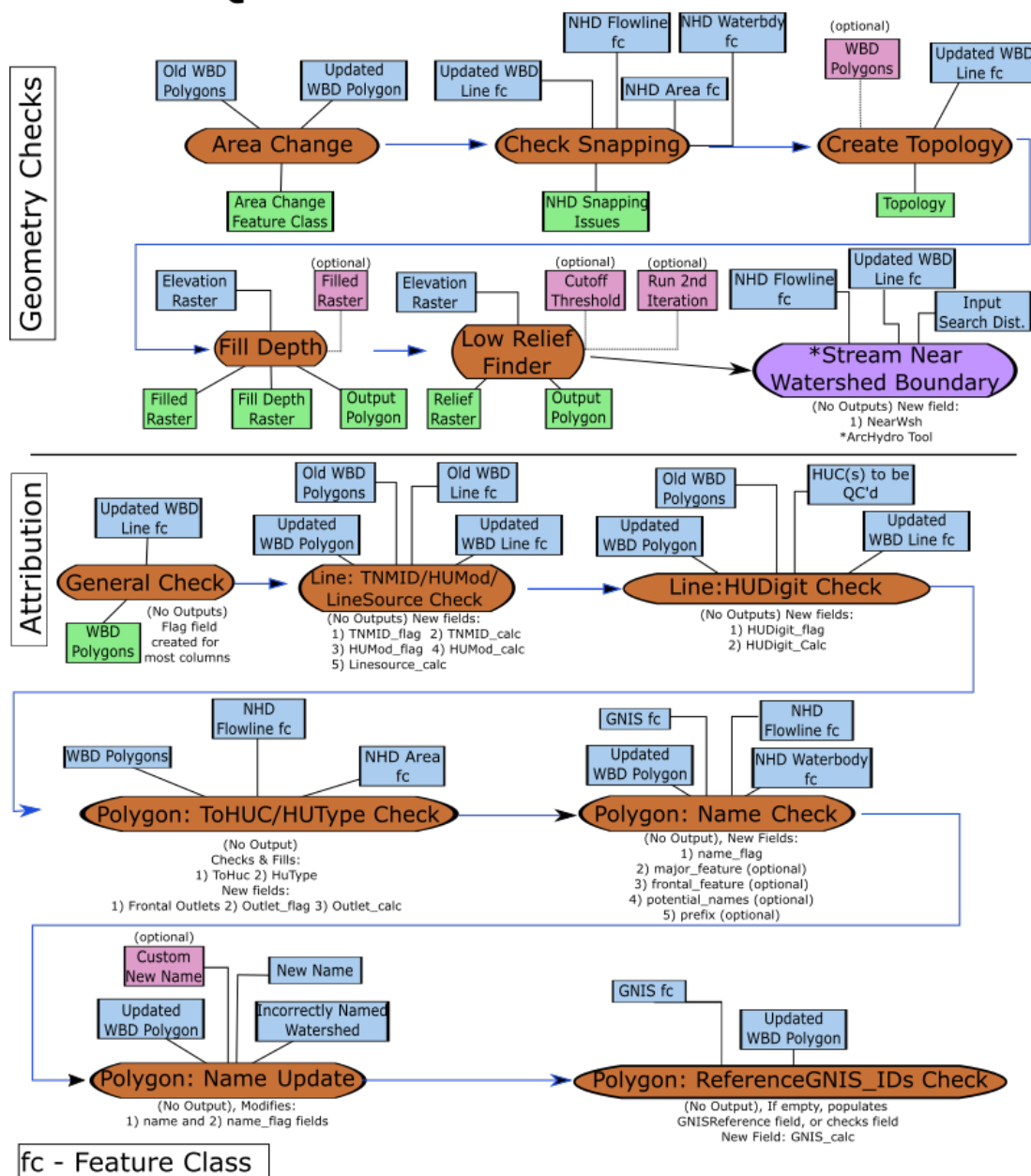


Figure 2: Two example workflows: 1) Geometry Checks and 2) Attribution Check tools

## 7 Tools

### 7.1 Download Data Tools

This toolset provides a convenient way to download data for WBD work. This toolset is often used first when beginning WBD work. This toolset’s outputs work well as inputs for the other toolsets.

This toolset contains 5 tools:

1. Download GNIS data
2. Download NHD data
3. Download WBD data
4. Download 3DEP data
5. Download workflow

“Download GNIS data” exists separately from the other tools and should be used on its own whenever the user needs to download GNIS data. “Download NHD data”, “Download WBD data”, and “Download 3DEP data” work when run individually. However, these tools are closely related and all 3 datasets are often required for WBD work. For this reason all NHD, WBD, and 3DEP data can be downloaded at the same time using the “Download workflow” tool. It is recommended that the user use the “Download workflow” tool instead of running the other tools individually when possible.

#### 7.1.1 Download GNIS data

##### *Tool Description*

Downloads GNIS by state using the National Map API.

##### *Inputs*

- States: which states will be downloaded.
- GNIS geodatabase: where the data will be saved.
- Spatial reference: The spatial reference the data will be reprojected to.

##### *Outputs*

- Feature class containing GNIS points.

#### 7.1.2 Download NHD data

*Tool Description* Downloads NHD data by HUC4 using the national map API. Reprojects the data to the selected spatial reference.

##### *Inputs*

- HUC(s): a list of hydrologic unit codes. Ex: “0101;0201;0301”. One can enter 4-16 digit HUC codes. However, since our Amazon server stores NHD data by HUC 4 region, only the first 4 digits of the HUC code will be used by the tool (i.e. “190101” is treated the same as “1901”).
- Output folder: This is a filepath to a folder where the downloaded data will be saved. The default is your Downloads folder, but you can save data into any folder on your computer or onto network drives.
- Spatial reference: The spatial reference the data will be reprojected to.

#### *Outputs*

- This tool outputs a file geodatabase named “NHD\_XXXX\_HU4.gdb”, where “XXXX” represents the 4-digit HUC-code. The geodatabase is saved to the specified output folder. The newly created geodatabase contains 2 feature datasets. The Hydrography feature dataset contains all the NHD data in the default geographic coordinate system. The Hydrography\_rpj feature dataset contains all the NHD data in the user specified projection.

### **7.1.3 Download WBD data**

#### *Tool Description*

Downloads WBD data by HUC2 using the national map API. Reprojects data to the selected projection.

#### *Inputs*

- HUC(s): a list of hydrologic unit codes. Ex: “01;02;03” or “0101;0201;0301”. One can enter 2-16 digit HUC codes. However, since our Amazon server stores WBD data by HUC 2 region, only the first two digits of the HUC code will be used by the tool (i.e. “1901” is treated the same as “19”).
- Output folder: This is a filepath to a folder where the downloaded data will be saved. The default is your Downloads folder, but you can save data into any folder on your computer or onto network drives.
- Spatial reference: The spatial reference the data will be reprojected to.

#### *Outputs*

- This tool outputs a file geodatabase named “WBD\_XX\_HU2.gdb”, where “XX” represents the 2-digit HUC-code. The geodatabase is saved to the specified output folder. The newly created geodatabase contains 2 feature datasets. The WBD feature dataset contains all the WBD data in the default geographic coordinate system. This feature dataset is used as an input for the Download\_3DEP tool and should thus not be deleted or modified if you are going to download 3DEP data using this toolbox. The WBD\_rpj feature dataset contains all the WBD data in the user specified projection. If the user does not specify a spatial reference this feature dataset will not be created.

#### 7.1.4 Download 3DEP data

##### *Tool Description*

1. Downloads WBD data for creating a buffer (if WBD data is not present in the output folder).
2. Creates a buffer dataset for the specified HUC.
3. Downloads DEM tiles for the buffered region using either the National Map API or Alaska's elevation portal.
4. Mosaics, clips, and reprojects the DEM.
5. Creates contours.
6. Creates a multidirectional hillshade raster using "whitebox\_tools.multidirectional\_hillshade".
7. Creates a polygon shapefile with the extent of each elevation tile and the year the data for each tile was obtained.

##### *Inputs*

- HUC(s): a list of hydrologic unit codes. Ex: "0101;0201;0301". One can enter 4-16 digit HUC codes. However, since our Amazon server stores NHD data by HUC 4 region, only the first 4 digits of the HUC code will be used by the tool (i.e. "190101" is treated the same as "1901").
- Output folder: This is a filepath to a folder where the downloaded data will be saved. The default is your Downloads folder, but you can save data into any folder on your computer or onto network drives.
- Spatial reference: The spatial reference the data will be reprojected to.
- 3DEP dataset: This is the elevation dataset that will be downloaded. Currently there are three options for this field: "National Elevation Dataset (NED) 1/3 arc-second", "National Elevation Dataset (NED) 1 arc-second", and "Alaska IFSAR 5 meter DEM".
- Buffer distance: This represents the buffer distance used for creating the buffer. The default value is 4000 meters. If you don't want to use a buffer don't enter "0 Meters". Instead, leave this field blank.
- Contour spacing: The spacing for a contour feature class that will be created. If a number is not entered contours will not be created.

##### *Outputs*

- Folder named "DEM\_XXXX", which contains, the DEM, hillshade raster, tile extent shape file, contour shape file, and tile metadata.

### 7.1.5 Download workflow

#### *Tool Description*

This tool combines the other tools in the Download Data toolset into a single convenient tool. NHD, WBD, and 3DEP data is downloaded and packaged into a convenient format in a single step.

1. Executes Download\_wbd tool
2. Executes Download\_nhd tool
3. Executes Download\_3dep tool
4. Packages data for WBD work

#### *Inputs*

- HUC(s): a list of hydrologic unit codes. Ex: “19010601;19010603”. One can enter 4-16 digit HUC codes. You can enter different sized HUC codes and HUCs in different regions (i.e. “190604030101; 0101000206” is a valid input).
- Output folder: This is a filepath to a folder where the downloaded data will be saved. The default is your Downloads folder, but you can save data into any folder on your computer or onto network drives.
- Spatial reference: The spatial reference the data will be reprojected to.
- 3DEP dataset: This is the elevation dataset that will be downloaded. Currently there are three options for this field: “National Elevation Dataset (NED) 1/3 arc-second”, “National Elevation Dataset (NED) 1 arc-second”, and “Alaska IFSAR 5 meter DEM”.
- Buffer distance: This represents the buffer distance used for creating the buffer. The default value is 4000 meters. If you don’t want to use a buffer don’t enter “0 Meters”. Instead, leave this field blank.
- Contour spacing: The spacing for a contour feature class that will be created. If a number is not entered contours will not be created.
- Include ditches and canals in flowline fc?: This parameter controls if ditches and canals are kept as part of the flowline feature class.

#### *Outputs*

This tool creates a new folder and two geodatabases:

- “XXXX\_prep” is the folder that contains all the data for the user specified HUC. Inside this folder there is a folder containing the DEM and related data. There is also a geodatabase with all the relevant WBD and NHD data.

- “WBD\_XX\_HU2.gdb” contains WBD data for an entire region. This can be deleted.
- “NHD\_XXXX\_HU4.gdb” contains WBD data for a HUC4. This can be deleted.

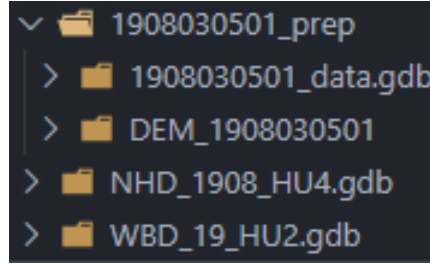


Figure 3: Output file structure example.

## 7.2 Elevation Derived Hydrography Tools

These tools help to further automate the ARCHydro process. ARCHydro is a dependency for these tools. It can be downloaded at <https://downloads.esri.com/archydro/archydro/Setup/Pro/>. These tools are only needed when the user is performing updates. If the user is reviewing someone else’s updates, these tools do not need to be used.

### 7.2.1 Terrain Preprocessing

#### *Tool Description*

This tool is used to help complete the initial terrain preprocessing tasks in ARCHydro. If the user wants to use walls in the ARCHydro process, they need to be created before this tool is used.

This tool chains the following archydro processes:

1. Converts streams to raster (createdrainagelinestructures)
2. Deletes first order streams (optional). Stream order is calculated using “arcpy.sa.StreamOrder”. First order streams are removed using “arcpy.ia.SetNull”
3. Build walls (optional)
4. Fill sinks
5. Flow direction
6. Flow accumulation

7. Stream definition
8. Stream segmentation
9. Catchment grid delineation
10. Catchment polygon processing
11. Drainage line processing
12. Adjoint catchment processing

#### *Inputs*

- NHD flowline featureclass
- DEM (raw not filled)
- internal wall feature class (optional)
- external wall feature class (optional)
- Burn in first order streams? This controls if first order streams are used when burning in flowlines. The default is to not burn in first order streams. It is recommended that first order streams are not burned in.

#### *Outputs*

- “Layers” folder: Rasters are saved to the Layers folder in the user’s workspace.
- “Layers” feature dataset: Featureclasses are saved to the user’s home geodatabase.

### **7.2.2 Subwatershed Lines**

#### *Tool Description*

This tool is used to create the watershed line feature class. The user must manually create poor points before using this tool.

1. Creates watershed polygons (ARCHydro subwatershed delineation)
2. Polygon to line: Converts watershed polygons to lines.
3. Smooths and Simplifies watershed lines
4. Converts catchments to lines and then smooths/simplifies the catchments.
5. Creates topology using newly created line feature class.

After using this tool, the user will still need to manually clean up the watershed line feature class and make sure it is snapped to the NHD.

#### *Inputs*

- Batch point feature class
- Flow direction raster
- Stream raster
- Catchment feature class

#### *Outputs*

- “Subwatershed”: watershed polygons.
- “SubwatershedPoints”: watershed points.
- “SubwatershedBackup”: backup copy of watershed polygons
- “SubwatershedLine”: watershed lines.
- “SubwatershedPaek10”: smoothed watershed lines.
- “SubwatershedPointRemove5”: simplified watershed lines.
- “CatchmentLine”: catchment lines.
- “CatchmentPaek10”: smoothed catchment lines.
- “CatchmentPointRemove5”: simplified catchment lines.
- “NewLines”: Copy of simplified watershed lines. This should be used for manual editing.
- “WBDTopology”: Line topology

### **7.2.3 Create Polygons**

#### *Tool Description*

This tool creates WBD polygons and a topology. The WBD lines used as inputs should be cleaned up and topologically corrected before using this tool.

#### *Inputs*

- Updated WBD line feature class: Topologically correct WBD line feature class (“NewLines” from 7.2.2).
- WBD polygon label point feature class (multiple can/should be entered). Polygon label points from 7.1.5.

#### *Outputs*

- WBD polygon feature classes.
- WBD topology (using polygons and lines)

## 7.3 Geometry Checks

The geometry and attribution toolsets have been designed to offer the user as much flexibility as possible. This allows the user to implement whatever workflow works best for them. However, testing has revealed some best practices that may help things run smoother:

1. These tools can be ran as scripts or through the ARCPPro interface. However, it is recommended that users run these tools through ARCPPro. This adds useful validation that does not occur when the tools are ran as scripts.
2. Some of these tools work with both shape files and featureclasses. However, these tools should only be used with featureclasses.
3. These tools generally work regardless of where the input data is saved on the user's computer. However, it is recommended that the data is save in the user's environmental geodatabase in a single feature dataset.
4. Parameters can be added in ARCPPro by dragging and dropping the dataset, selecting the dataset from the dropdown, or browsing to the dataset by filepath. However, browsing to the filepath is the most reliable way to add parameters in ARCPPro.

Users are welcome to use the workflow that works best for them. However, if they have issues the above tips may be useful.

### 7.3.1 Area change/HUC Check

#### *Tool Description*

This tool highlights areas where major changes to WBD polygons have been made, HUC codes have been retired, and new HUC codes have been created. This tool uses ESRI's symmetrical difference tool to compare the updated WBD polygons to the original WBD polygons (<https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/symmetrical-difference.htm>). The symmetrical difference represents the area that is in the old polygon, or the new polygon, but not both.

#### *Inputs*

- Old WBD polygon featureclass
- Updated WBD polygon featureclass
- Output featureclass: The filepath where the output polygons will be saved.

The HUC field in the Old WBD polygon featureclass must match the HUC field of the Updated WBD polygon featureclass. I.E. one can compare HUC10 polygons to HUC10 polygons but not HUC12 polygons to HUC10 polygons.

#### *Outputs*

- Polygon featureclass: A polygon featureclass is created where the polygons represent the symmetrical difference between the old WBD polygons and the updated WBD polygons.

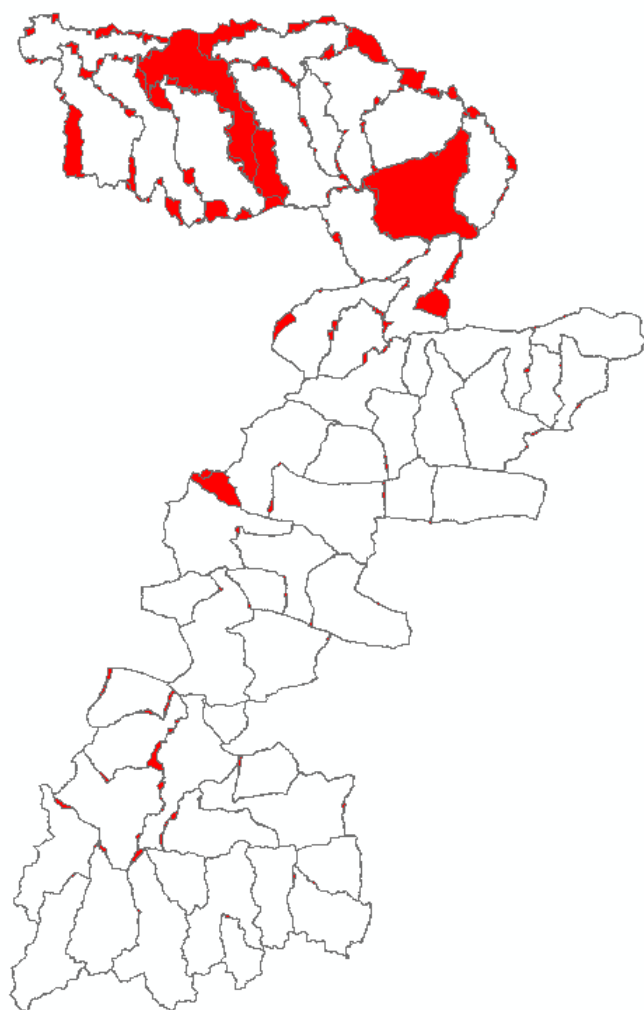


Figure 4: Example of output polygon feature class. The red areas represent areas where the updated polygon featureclass differs from the old polygon featureclass.

When a HUC code is retired, the entire old polygon is included in the output feature class and the area\_change field is set to -9999. When a new HUC code is created, the entire new polygon is included in the output feature class and the area\_change field is set to 9999 .



Figure 5: Retired HUC code.

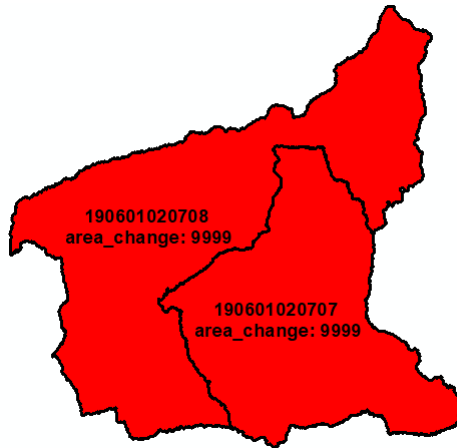


Figure 6: New HUC codes.

*Output Columns* The output feature class contains two useful columns:

- HUC: the huc code
- Area\_change This represents the area of the symmetrical difference polygon divided by the area of the original polygon. When using this tool as part of a review it is useful to look at polygons with the largest area changes. It is also useful to look at newly created HUC codes (Area\_change = 9999) and retired HUC codes (Area\_change = -9999).

### 7.3.2 Check Snapping

*Tool Description* This tool checks that the WBD is correctly snapped to the NHD using the following tests:

1. Checks that all intersections with NHD flowlines (that are not inside waterbodies) occur at the endpoint of a flowline.
2. Checks that all intersections with the boundary of NHD area and NHD waterbody polygons are also WBD line vertices.

*Inputs*

- Updated WBD line featureclass
- NHD flowline featureclass
- NHD waterbody featureclass
- NHD area featureclass
- NHD snapping issues output: This is a point featureclass that will be created to show where snapping issues occur.

*Outputs*

- NHD snapping issues point feature class

### 7.3.3 Create Topology

*Tool Description*

This tool creates a topology using the updated WBD line featureclass and the updated WBD polygon feature classes (optional). All input featureclasses must belong to the same feature dataset and must not already participate in another topology.

*Inputs*

- Updated WBD line feature class
- Updated WBD polygons (optional)

*Outputs*

- WBDTopology

### 7.3.4 Fill Depth and Polygon

#### *Tool Description*

This tool was written out of necessity to identify areas where the Arc **Fill** tool would create errors in the eventual **ArcHydro** processes. The primary case considered in this work was the presence of culverts, where filling an area upstream of a road would erroneously send the flowline around the culvert, when in actuality the flowline should go beneath the road. There are other instances wherein excessive filling could change the course of flowlines across a natural landscape (e.g. karst topography or very low relief wetland areas).

#### *Inputs*

- Input Raster - Unfilled (projected with meters as linear unit)
- **Checkbox:** Providing Filled Raster? If providing an already filled raster (e.g. from NHDPlus HR)
- Filled Raster Location

#### *Outputs*

- Filled Raster. A duplicate if a filled raster is provided.
- Fill-Depth Raster. The difference between original unfilled raster and the filled raster.
- Polygon. Polygon feature class of the areas that were filled in the original raster.

### 7.3.5 Low Relief Finder

#### *Tool Description*

This tool was developed out of a need while conducting plumbing reviews to identify areas of very low-relief where the Arc Hydro tools may not function well in their typically automated fashion. By finding areas that are significantly low-relief, this tool can guide the reviewers eyes to areas that could be problematic and need a closer inspection. This does not replace the need for the reviewer to be on the lookout for areas where Arc Hydro either crosses water-bodies or deviates from what the review determines is the drainage divide.

This tool operates through a moving window, which calculates relief across a DEM. The *default* behavior of the tool identifies areas that are 1-standard deviation below the mean relief in the landscape. This would equate to the areas with the lowest 15% of relief in the landscape. The User can provide their own custom thresholds in units of standard deviation. The tools puts out a relief raster and a polygon feature class

#### *Inputs*

- Input Raster (projected with meters as linear unit)

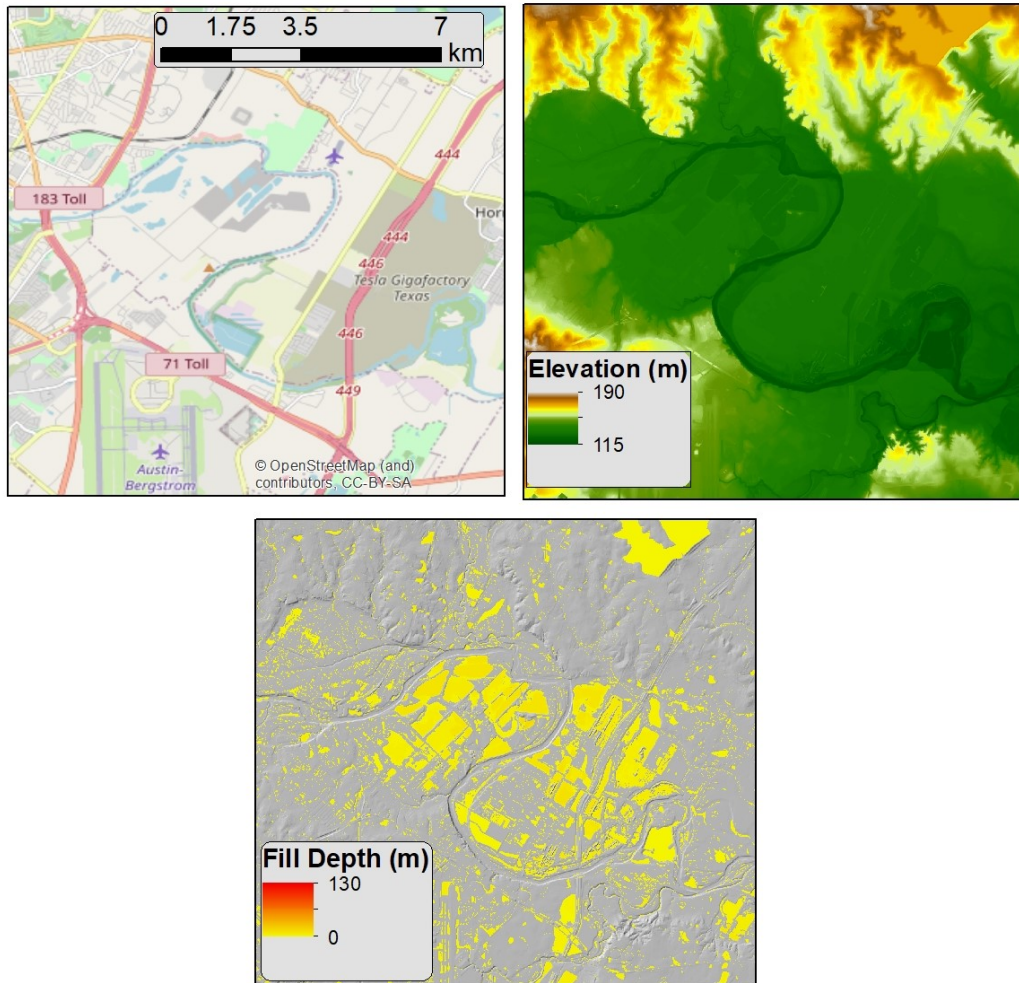


Figure 7: Fill Depth Tool Example. **First Panel)** Open Street Map view of meanders on the Colorado River near Austin, Texas **Second Panel)** Elevations of the unfilled DEM. **Third Panel)** Fill Depth result from tool across study area. The areas highlighted in this figure will also become the polygons outlined in the polygon layer output.

- Moving Window Radius (m)
- **Checkbox:** Providing Custom Threshold?
- Cutoff Threshold (standard deviations; e.g. 1, 2, 3) below the mean
- **Checkbox:** Run Second Iteration? Identify areas with even lower relief with a second pass of the tool.

## Outputs

- Output Raster - Raster and location
- Output Polygon - Polygon feature class name and location for areas of low relief.

## 7.4 Attribution Tools

Table 1: Attribution Tools.

Tool name	Input datasets	Ouput datasets	New columns
1) General Check	WBD line fc WBD polygon fc(s)	NA	“_flag” columns
2) Line Check	Old WBD line fc New WBD line fc Old WBD polygon fc New WBD line fc	NA	TNMID.calc HUMod.calc LineSource.calc HUDigit.calc
3) Line: HUDigit Check	New WBD polygon fc(s) Reference WBD polygon fc(s) New WBD Line fc	NA	HUDigit.calc
4) Polygon: ToHUC/HUType Check	New WBD polygon fc NHD flowline fc NHD area fc	Outlets Frontal Outlets	ToHUC.calc
5) Polygon: Name Check	New WBD polygon fc GNIS fc NHD waterbody fc NHD flowline fc	NA	several (optional)
6) Polygon: Name Update	New WBD polygon fc	NA	NA
7) Polygon: ReferenceGNIS.IDs Check	New WBD polygon fc GNIS fc	NA	ReferenceGNIS.IDs.calc

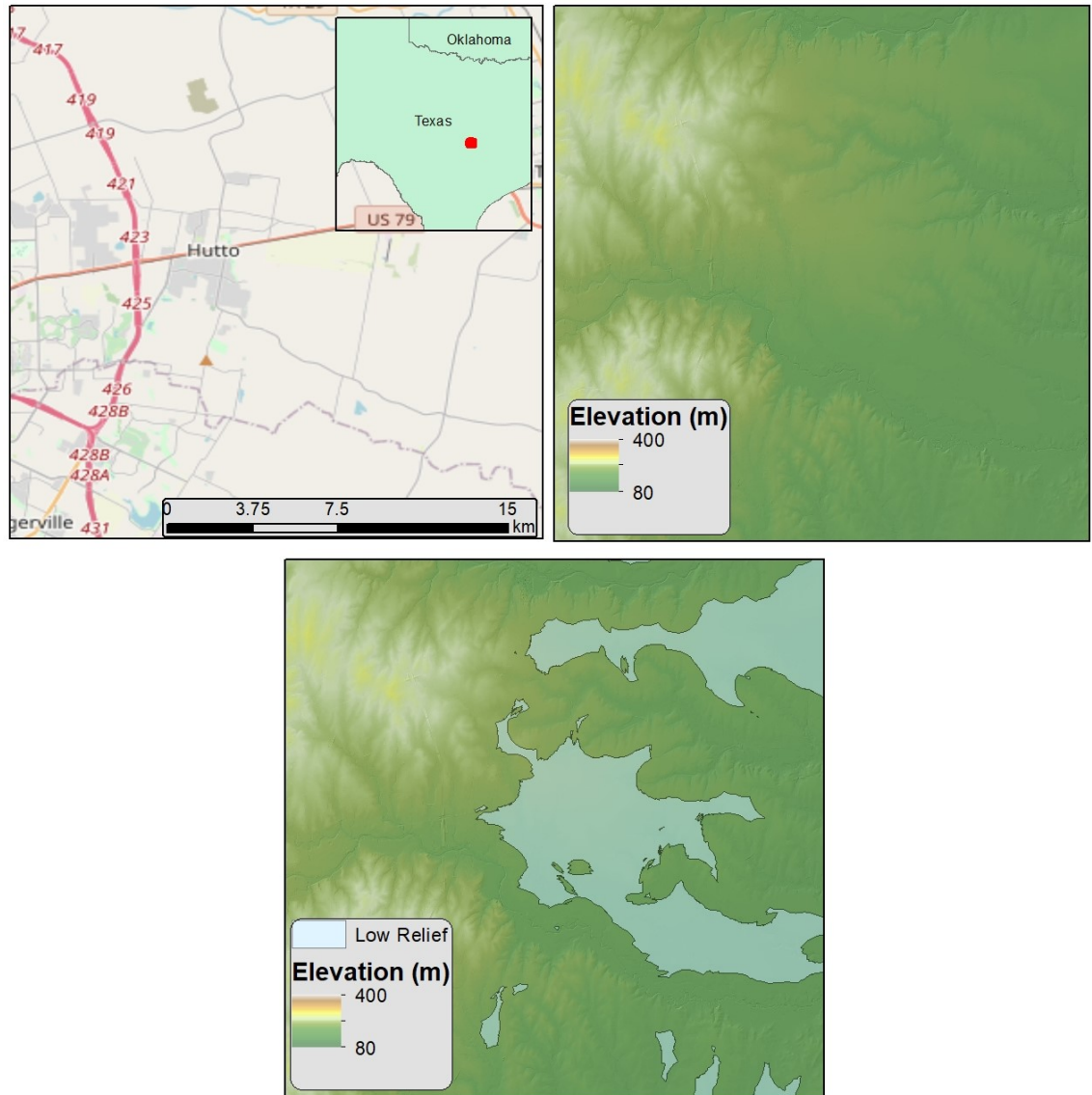


Figure 8: Low Relief Tool Example **First Panel)** Open Street Map view of example area in Central Texas, USA **Second Panel)** Elevations of DEM across example area **Third Panel)** Low Relief tool results. Areas identified as meeting tool qualifications highlighted in teal.

### 7.4.1 General Check

#### *Tool Description*

This tool performs simple checks on all fields that are edited during the EDH process. The following checks are performed:

- Checks that text fields match the correct regular expression (are generally in the correct format).
- Checks that Huc, TNMID, and Name fields are unique.
- Checks that the Huc and ToHUC fields match the Huc and ToHUC fields in the parent feature class.

#### *Inputs*

- Updated WBD line feature class.
- WBD polygon feature classes (more than one can be entered).

#### *Outputs*

None

#### *Output Columns*

##### Line

- |                |                   |
|----------------|-------------------|
| • TNMID_flag   | • LineSource_flag |
| • HUDigit_flag | • HUMod_flag      |

##### Polygon

- |                          |                                 |
|--------------------------|---------------------------------|
| • Name_flag              | • ToHUC_flag                    |
| • TNMID_flag             | • AreaSqKm_flag                 |
| • ReferenceGNIS_IDs_flag | • AreaAcres_flag                |
| • States_flag            | • NonContributingAreaAcres_flag |
| • Huc_flag               | • NonContributingAreaSqKm_flag  |

Each of these new “flag” columns will have one of three flags:

- **CORRECT:** the field is the correct format.
- **INCORRECT:** the field is not the correct format.
- **NODATA:** the field is blank, Null, or contains whitespace.

### 7.4.2 Line Check

#### *Tool Description*

This tool checks the TNMID, HUMod, LineSource, and HUDigit fields in the WBD line featureclass. This tool compares the TNMID, HUMod, and LineSource fields from the original WBD Line featureclass to the updated WBD line featureclass. If the values in the new featureclass are different from the original, they are flagged as incorrect. This tool uses the neighboring HUC polygons to calculate the HUDigit.

It should be noted that this tool is not able to check every single line segment. This tool will not preform checks in the following areas:

1. where a huc code is retired.
2. where a new huc code is created.
3. where two hucs share a boundary that did not previously share a boundary.
4. where the intersection of two hucs is made up of more than one line segment (common in coastal areas).
5. along the outer boundary.

#### *Inputs*

- Old WBD line featureclass
- Updated WBD line featureclass
- Old WBD polygon featureclass: (smallest possible HUC subdivisions. Generally HUC12; unless HUC14s or HUC16s exist for the given area.)
- Updated WBD polygon featureclass: (smallest possible HUC subdivisions. Generally HUC12; unless HUC14s or HUC16s exist for the given area.)
- Fields to check: Which fields to check. By default LineSource is not checked since this value is likely to change and still be correct.
- Fill missing values: Controls if missing values are filled (and flagged with “FILLED”) or left empty and flagged with “NODATA”

#### *Outputs*

- **None**

#### *Output Columns*

- TNMID\_calc: TNMID value transfered from the original WBD line featureclass (if selected in “Fields to check”).
- HUMod\_calc: HUMod value transfered from the original WBD line featureclass (if selected in “Fields to check”).

- **LineSource\_calc**: LineSource value transferred from the original WBD line featureclass (if selected in “Fields to check”).
- **HUDigit\_calc**: Calculated HUDigit value if selected in “Fields to check”).

This tool also updates the `TNMID_flag`, `HUMod_flag`, `LineSource_flag`, and `HUDigit_flag` fields generated by the General Check tool. If these fields are not present in the dataset they will be added by this tool.

This tool uses the following flags in the “\_flag” columns:

- **CORRECT**: the updated data matches the original data.
- **FILLED**: the field was filled by the tool (only applicable if “Fill missing values” is selected).
- **NOTCHECKED**: the field was not checked by this tool.
- **INCORRECT**: the field is wrong.
- **NODATA**: the field is blank, Null, or contains whitespace.

It should be noted that this tool compliments the general check tool and performs a more in depth check that builds upon the checks performed by the general check tool. This tool will not overwrite preexisting WRONG or NODATA flags but can change CORRECT to WRONG or NOTCHECKED. Additionally if the user has added notes to one of the “\_flag” fields the tool will not overwrite their notes (or the flag).

### 7.4.3 Line: HUDigit Check

*Tool Description*

*Inputs*

*Outputs*

*Output Columns*

### 7.4.4 Polygon: ToHUC/HUType Check

*Tool Description*

This tool is used to check the ToHUC and HUType fields. This is done by creating two featureclasses: outlets and frontal outlets. Each feature class contains a “HUC” and “ToHUC” field that is used to check the ToHUC field for each polygon. The number and type of outlets is used to check the HUType field. It should be noted that this tool does not work in the following cases:

- Outer boundary outlet: this tool cannot check the ToHuc field if the outlet is on the outer boundary.
- This tool only checks “closed”, “multiple”, “single”, and “frontal” HuTypes. Other types will be flagged with “NOTCHECKED”.

- **NHD errors:** This tool is very sensitive large NHD errors and smaller NHD snapping errors and will only perform as well as the input data allows. This tool should only be ran once the WBD geometry is finalized and agrees well with the NHD.
- **HUC issues:** If the HUC field is incorrectly filled out, this tool will be unable to accurately check the ToHUC field.

#### *Inputs*

- Updated WBD polygon feature class
- NHD Flowline feature class
- NHD Area feature class
- Outlets: name of the outlets output featureclass.
- Frontal outlets: name of the frontal outlets output featureclass.
- Fill missing values: : Controls if missing values are filled (and flagged with “FILLED”) or left empty and flagged with “NODATA”

#### *Outputs*

- Outlet point featureclass
- Frontal outlet point featureclass

#### *Output Columns Output Columns*

- **HUType\_calc:** HUType values that are determined using the type and number of outlets..
- **ToHUC\_calc:** ToHUC values that are determined using the ToHUC field in the outlet feature classes.

This tool also updates the ToHUC\_flag and HUType\_flag fields generated by the General Check tool. If these fields are not present in the dataset they will be added by this tool.

This tool uses the following flags in the “\_flag” columns:

- **CORRECT:** the updated data matches the original data.
- **FILLED:** the field was filled by the tool (only applicable if “Fill missing values” is selected).
- **NOTCHECKED:** the field was not checked by this tool.
- **INCORRECT:** the field is wrong.
- **NODATA:** the field is blank, Null, or contains whitespace.

It should be noted that this tool compliments the general check tool and performs a more in depth check that builds upon the checks performed by the general check tool. This tool will not overwrite preexisting WRONG or NODATA flags but can change CORRECT to WRONG or NOTCHECKED. Additionally if the user has added notes to one of the “\_flag” fields the tool will not overwrite their notes (or the flag).

#### **7.4.5 Polygon: Name Check**

*Tool Description*

*Inputs*

*Outputs*

*Output Columns*

#### **7.4.6 Polygon: Name Update**

*Tool Description*

*Inputs*

*Outputs*

*Output Columns*

#### **7.4.7 Polygon: ReferenceGNIS\_IDs Check**

*Tool Description*

This tool checks the ReferenceGNIS\_IDs field. This is done by making sure that the closest GNIS feature with the same name as the watershed also has the same GNIS ID. This tool can handle watersheds with multiple names/reference gnis ids.

It should be noted that this tool relies on the Name field. This tool works best if ran after using the Name check/update tools.

*Inputs*

- WBD polygons (more than one featureclass can be entered)
- GNIS feature class (only one can be entered)
- Fill missing values: Controls if missing values are filled (and flagged with “FILLED”) or left empty and flagged with “NODATA”.

*Outputs*

- **None**

*Output Columns*

- ReferenceGNIS\_IDs\_calc: Calculated ReferenceGNIS\_IDs.

## 7.5 Job Checkout

### 7.5.1 Edge match Polygons

#### *Tool Description*

This tool speeds up the job checkout process by adding the user's updated WBD polygons to the job checkout polygon featureclass and completing the edgematching process. This is done **after** the updated WBD lines have already been added to the job and have been edgematched. This tool performs the following steps:

1. Deletes the polygons from the job checkout polygon featureclass that are within the specified HUC.
2. Replaces the deleted polygons with the polygons in the updated WBD polygon featureclass.
3. Edgematches the job polygons.

#### **Warnings**

- This tool cannot handle multipart HUCs (in either of the polygon featureclasses). Caution should be used in coastal areas.
- This tool has compatability issues with ARCMAP. This tool corrupts the spatial index of the job polygon featureclass. This leads to the featureclasses not displaying properly in arcmap. This can be fixed easily by recreating the spatial index in ARCCatalog (<https://support.esri.com/en/technical-article/000011225>).

#### *Inputs*

- HUC: The HUC code that is being updated.
- Updated WBD polygon feature class: The feature class that the user updated.
- Job checkout WBD polygon featureclass: The WBD polygon featureclass in the job geodatabase.
- Job checkout WBD polygon featureclass: The WBD line featureclass in the job geodatabase. This featureclass should already contain the user's updated lines. It should also already be edgematched and topologically correct.

#### *Outputs*

- None (The job checkout polygons are modified in place).