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December 14, 2017

TO: NHD Stakeholders of West Virginia

FROM: Maneesh Sharma, Project Leader, WV GIS Technical Center, WVU

SUBJECT: Progress Report for Updating National Hydrography Dataset (NHD) in West Virginia for areas affected by surface disturbance and hydrologic change. Project funded by EPA Grant OS83585101-0. Project Duration: 01/01/2016 to 12/31/2018

TIME PERIOD: April 2017 - October 2017

Dear NHD Stakeholders:

Here is the progress report regarding updates to the National Hydrography Dataset (NHD) in West Virginia. Both the National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD) are used to represent surface water on the National Map (http://nhd.usgs.gov/). The USGS is the primary steward for NHD, while the NRCS is the principal steward for WBD.

Highlights

- All watersheds checked for stream modification due to surface disturbance with emphasis on coal mining
    - 27,773 stream segments checked
        - 3,476 segments added/replaced
        - 2,290 stream segments modified
        - 1,594 stream segments deleted
- 20 watersheds checked for floodplain error
    - 25,516 segments checked
        - 1,684 segments modified
- USGS has incorporated submitted NHD surface disturbance edits in the national database. Geodatabase for the entire state can be downloaded from the following website.

NHD Editors in State

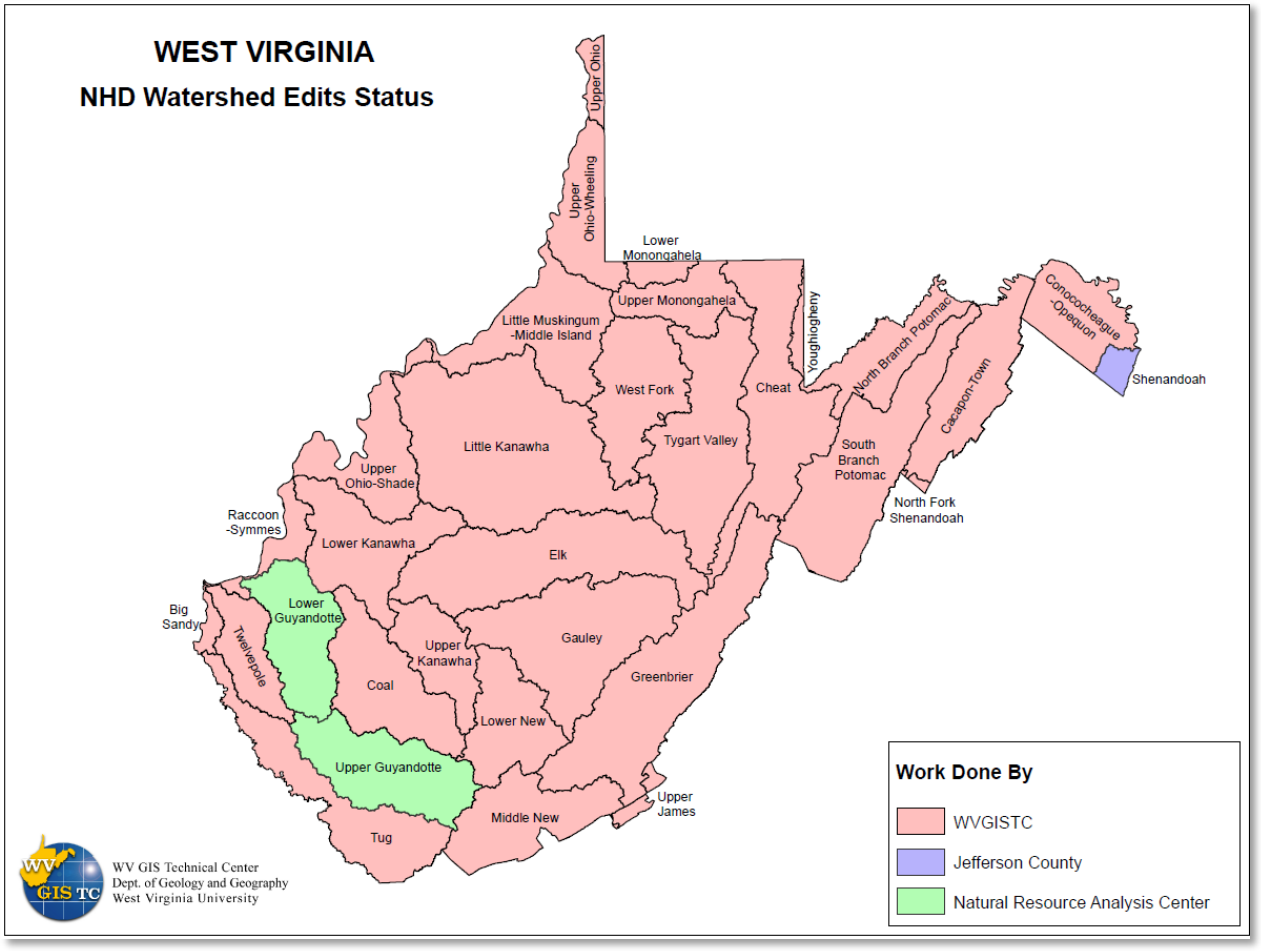
WVU WVGISTC:

1. Stream segment editing to reflect stream modification due to surface disturbance - Final editing of all watersheds has been completed and 27,773 stream segments have been verified. Water bodies a the stream segments area were revised and modified as needed. A total of 7,360 stream segments have either been digitized, modified or deleted. We have added/replaced 3476, modified 2290 and deleted 1594 stream segments. Table 1 shows the details of work done for each watershed. Figure 1 shows status of edits in each watershed. USGS has already incorporated edits in the national database. For more details about the NHD editing process and methodology see Appendix 1 at the end of the report.

Table 1: Details of NHD edits for reviewed watersheds for surface disturbance

Watershed	Type	Checked	Replaced/Added	Modified	Deleted
LOWER NEW	Stream	950	8	169	32
	Water Body		27	3	8
GAULEY	Stream	2305	126	421	58
	Water Body		520	3	50
UPPER KANAWHA	Stream	1022	73	250	21
	Water Body		75	3	4
LOWER KANAWHA	Stream	1244	2	110	16
	Water Body		0	0	0
MIDDLE NEW	Stream	193	2	42	27
	Water Body		39	1	33
ELK	Stream	1582	88	218	62
	Water Body		165	0	11
COAL	Stream	3132	109	251	179
	Water Body		126	0	0
TWELVEPOLE	Stream	473	235	163	13
	Water Body		192	0	9
RACOON SYMMES	Stream	229	0	8	4
	Water Body		0	0	0
BIG SANDY	Stream	23	0	3	3
	Water Body		0	0	0
GREENBRIER	Stream	224	1	9	1
	Water Body		38	1	4
TUG	Stream	1378	588	271	49
	Water Body		327	6	68
UPPER JAMES	Stream	47	0	0	11
	Water Body		1	0	0
WEST FORK	Stream	1139	26	30	22
	Water Body		276	2	231
UPPER OHIO	Stream	76	0	0	2
	Water Body		6	1	11
LOWER MONONGAHELA	Stream	361	11	12	2
	Water Body		57	2	19
UPPER MONONGAHELA	Stream	327	3	21	12
	Water Body		39	10	0
UPPER OHIO-SHADE	Stream	522	2	15	15
	Water Body		17	0	0
UPPER OHIO-WHEELING	Stream	502	0	10	42
	Water Body		7	0	0
LITTLE KANAWHA	Stream	972	2	16	37
	Water Body		1	0	0
LITTLE MUSKINGUM	Stream	667	0	6	24
	Water Body		3	0	0
TYGART VALLEY	Stream	1326	4	50	34
	Water Body		62	0	13
CHEAT	Stream	1088	2	49	104
	Water Body		24	2	2
NORTH BRANCH POTOMAC	Stream	862	4	12	55
	Water Body		27	1	28
SOUTH BRANCH POTOMAC	Stream	2760	16	50	110
	Water Body		9	0	16
YOUGHIOGHENY	Stream	91	2	0	2
	Water Body		7	1	4
CONOCOCHEAGUE-OPEQUON	Stream	883	6	45	71
	Water Body		53	5	22
CACAPON-TOWN	Stream	800	13	18	18
	Water Body		55	0	35

Figure 1: NHD edit (surface disturbance) status map

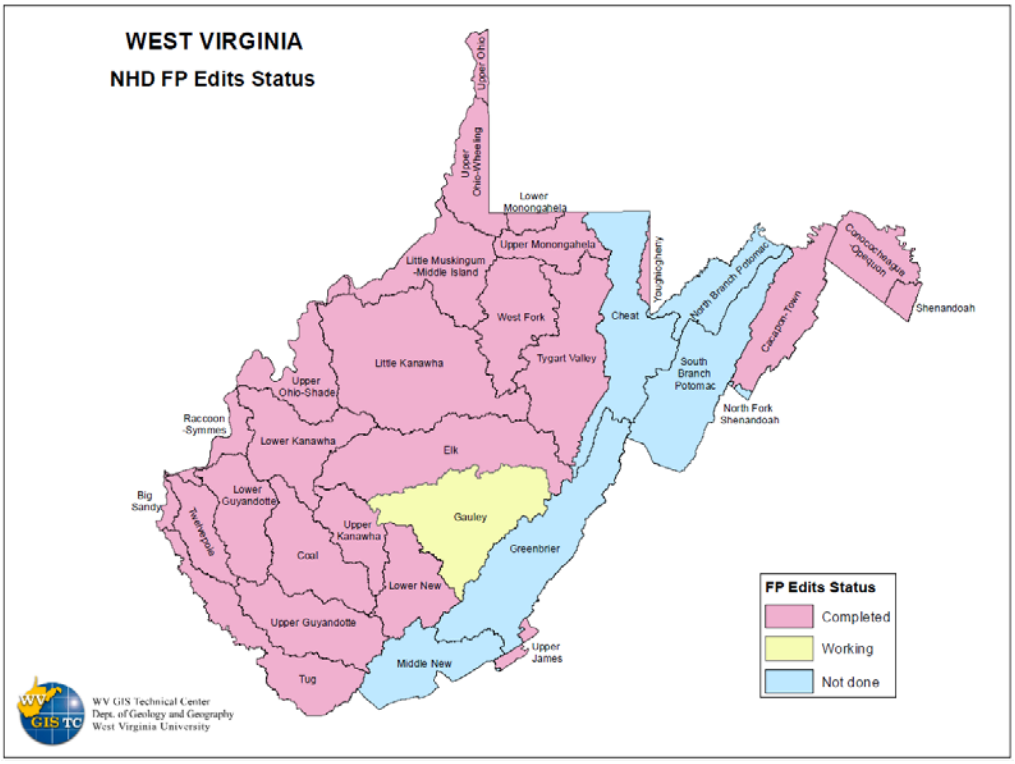


2. <u>Stream segment editing for floodplain errors</u> – We have also worked to edit the stream segments that are outside of the floodplain areas. We used FEMA floodplain polygons to cross-check the stream segments. We have already checked 25 watersheds and modified stream segments that were outside of floodplain. We have reviewed 26,621 stream segments and modified 1,736 segments. Table 2 shows details about editing of stream segments in floodplain. Figure 2 shows the status of edits in each watershed.

Table 2: Details of edits for reviewed watersheds for floodplain error

Watershed	MODIFY	NO CHANGE	Total
Cacapon-Town	80	1602	1801
Conococheague-Opequon	25	1076	1127
Shenandoah	0	113	114
Upper Monongahela	106	410	563
Lower Monongahela	57	240	308
Upper Ohio Wheeling	42	769	825
West Fork	144	1260	1492
Raccoon-Symmes	0	0	4
Lower Kanawha	205	829	1038
Upper Kanawha	230	623	861
Tygart Valley	72	2324	2520
Elk	66	1753	2168
Upper Ohio Shade	54	1502	1577
Coal	80	1174	1438
Lower Guyandotte	99	1104	1299
Upper Guyandotte	43	690	825
Little Muskingum	15	1348	1427
Little Kanawha	106	3837	4418
Twelvepole	133	813	1042
Tug	127	428	673
Lower New	28	610	688
Big Sandy	16	79	120
Youghiogheny	0	6	7
Upper Ohio	8	77	108
Upper James	0	174	178

Figure 2: NHD edit (floodplain error) status map



Jefferson County GIS/E911: Todd Fagan, GIS Director of the Jefferson County GIS/Addressing Office, was interested in refining the NHD streams in their county since the NHD does not match their local aerial photography very well. Jessica Gormont has finished Shenandoah watershed for Jefferson County and the edits have already been updated in USGS production database.

USGS NHD Point of Contact: William Smith and Tatyana Dimascio have been extremely helpful in troubleshooting when we have faced issues in editing HR-NHD in production database.

Priority of Work

At present, our focus is to finish watersheds for floodplain errors. We will also work on creating a web service of the downloaded USGS NHD data and share it with stakeholders for review of the edits. We will update NHD with further edits once we receive feedback from stakeholders.

Please contact me or Kurt Donaldson (kdonalds@wvu.edu) if you have any questions.

Stakeholders

Following is a list of stakeholders in West Virginia

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Appendix 1

NHD Editing Methodology

The NHD edits were done in two major steps. In the first step, we created a shapefile of flagged stream segments for West Virginia to be reviewed. Streams for verification and modifications were identified using pre-existing reference data from FEMA, WV DEP, WV DOT, and the Natural Resources Analysis Center (NRAC) and WV GIS Technical Center (WVGISTC) located at West Virginia University. The flagged streams denote cases like streams going through highways, streams outside of floodplain, streams' course change due to surface mining, braided streams, and streams that no longer exist. For Instance, the streams going through highways, bridges and roads were flagged by intersecting the stream layer with a Highway layer from WV DOT, the streams in surface mining areas were flagged by intersecting the stream layer with Valley Fill and Permit Boundary layers from WV DEP, and the streams outside of floodplains were flagged by intersecting stream layer with Floodplain layer from FEMA. All flagged streams were reviewed for each watershed and edits were made accordingly. Review of all flagged stream segments and necessary edits were done using ArcGIS tools and local shapefiles. Specifically, we used the Flow Accumulation layer, Local Hydrolines, U.S. Census/WV DOT roads, Floodplain layers, Permit Boundary and Valley Fill area layers, 3D Elevation layer, and best available leaf-off Aerial Imagery for edits. The edits were categorized into five categories: MODIFY, REPLACE, DELETE, FP-ERROR (floodplain error), NO CHANGE. The segments categorized as MODIFY, REPLACE, DELETE, and FP-ERROR were exported as a separate shapefile to be used for the second step.

In the second step, we used the NHD Update Tool (version - 6.3.3.2) for ArcGIS 10.3.1 for the edits. The NHD production data for each watershed were downloaded from the NHD/WBD steward website (https://usgs-mrs.cr.usgs.gov/usgssteward/). Using NHD tools in ArcMap, the changes were made in the downloaded dataset with the help of an exported shapefile in the previous step. After making the edits and successfully executing a quality control check, the NHD data was submitted back to USGS for further review.

Below is a brief description about some of the modifications that were made in NHD Flowlines of the NHD database.

Stream modification in Surface Mining Areas

Figure 1 shows an example of a surface modification due to surface mining. This surface modification has resulted in an altered stream flow pattern. Red lines show the existing stream segments in the NHD database. These stream segments do not represent the correct stream flow. We modified the streams to represent the current flow pattern. Blue lines show the current stream pattern.

Figure 1: Example of deleted and modified stream segments in a part of Gauley watershed

Other example of changes in surface mining affected areas can be seen in Figure 2. This figure represents a flagged stream, symbolized as red line, running in the middle of two side rip-raps in a coal mining area in Coal watershed. Due to the surface disturbance the original course of the stream was changed by creating rip-raps. New stream segments were added to represent the modified flow pattern. These are symbolized as blue lines.

Figure 2: Example of modified stream segments in a surface mining area in a part of Coal watershed

Stream Modification due to Urban Development

Urban development can also cause stream modifications to occur. Typically, these stream segments were either removed or water course completely changed due to the construction in urban or suburban areas. These kinds of stream segments were deleted and new stream segments were added. Figures 3 and figure 4 represent examples of such condition. The deleted stream segments are symbolized as red lines and added or modified stream segments are symbolized as blue lines.

Figure 3: Example of deleted and added stream segments in a part of Little Muskingum watershed

Figure 4. Example of a modified stream segment in a part of Lower Kanawha watershed

In many cases, new stream segments and connected waterbodies were added. These waterbodies include naturally occurring waterbodies as well as human-made waterbodies. Figure 5 shows a newly added stream segment and connected waterbody in a part of North Brach Potomac watershed. The newly added stream segment is represented as blue line. The red lines represent flagged streams for review.

Figure 5: Example of an added stream segment and connected waterbody in a part of North Brach Potomac watershed

Generally, USGS expected us to modify streams if they were more than 30 meters away from their actual location on the aerial imagery but, in some cases, the streams were going through the houses or other infrastructures. In such cases, the streams were modified even if they were less than 30 meters away from their actual location. Figures 6 and 7 represent examples of such conditions. The flagged streams are represented as red lines and modified streams are represented as blue line.

Figure 6: Example of modified stream cutting through a house in a section of Cheat watershed

Figure 7: Example of modified stream cutting through infrastructures in a part of Cheat watershed