



## LiDAR Quality Assessment Report

The USGS National Geospatial Technical Operations Center, Data Operations Branch is responsible for conducting reviews of all Light Detection and Ranging (LiDAR) point-cloud data and derived products delivered by a data supplier before it is approved for inclusion in the National Elevation Dataset. The USGS recognizes the complexity of LiDAR collection and processing performed by the data suppliers and has developed this Quality Assessment (QA) procedure to accommodate USGS collection and processing specifications with flexibility. The goal of this process is to assure LiDAR data are of sufficient quality for database population and scientific analysis. Concerns regarding the assessment of these data should be directed to the Chief, Data Operations Branch, 1400 Independence Road, Rolla, Missouri 65401.

**IL\_District4-mcdonough\_2014**

NGTOC  
2015-05-18  
Brent Marz



# Project Information

**Project:**

**Contractor:**

**Project Type:**  
Contributed

**Applicable Specification:**  
NGP LiDAR Base Specification Draft V13

**Project Points of Contact:**

<b>Name:</b>	<b>Type:</b>	<b>Email:</b>
<input type="text"/>	<input type="text" value="Select or type..."/>	<input type="text"/>

<b>REPORT QUALIFICATION SUMMARY:</b>
<b>Metadata:</b> 1 of 1 Reviews Accepted 0 Reviews Not Accepted
<b>Vertical Accuracy:</b> 1 of 1 Reviews Accepted 0 Reviews Not Accepted
<b>Swath/Raw LAS:</b> 1 of 1 Reviews Accepted 0 Reviews Not Accepted
<b>Tiled/Classified LAS:</b> 1 of 1 Reviews Accepted 0 Reviews Not Accepted
<b>Breakline:</b> 1 of 1 Reviews Accepted 0 Reviews Not Accepted
<b>DEM(s):</b> 0 of 1 Reviews Accepted 1 Reviews Not Accepted
<b>NED Review:</b> 1 of 1 DEM tile reviews recommended for NED 1/3rd 0 of 1 DEM tile reviews recommended for NED 1/9th

**Project Delivery Lots:**

**Dates Collected Range:**

**Collection Start:**

**Collection End:**

**Project Aliases:**

**Licensing:**

Public Domain

**Project Description:**

## Review Information

Reviewer:	<input type="text" value="Brent Marz"/>	Date Delivered:	<input type="text" value="2/26/2015"/>
3rd Party QA Performed:	<input checked="" type="checkbox"/> <input type="text" value="AeroMetric, Inc."/>	Date Assigned:	<input type="text" value="3/5/2015"/>

Action To Contractor Date:	Issue Description:	Return Date:
<input type="text"/>	<input type="text"/>	<input type="text"/>

### Review Complete:

Dates Project Worked:

Start:	<input type="text" value="3/5/2015"/>
End:	<input type="text" value="5/18/2015"/>

## Project Materials Received

All project deliverables must be supplied according to collection and processing specifications. The USGS will postpone the QA process when any of the required deliverables are missing. When deliverables are missing, the Contracting Officer Technical Representative (COTR) will be contacted by the Elevation Section supervisor and informed of the problem. Processing will resume after the COTR has coordinated the deposition of remaining deliverables.

### METADATA

Deliverables	Delivered	XML Metadata	Required	Format	Quantity	Additional Details
Collection Report:	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<u>PDF</u>	<input type="text" value="1"/>	Project report, collection report, and survey report were delivered as a pdf in metadata form.
Survey Report:	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<u>PDF</u>	<input type="text" value="1"/>	Project report, collection report, and survey report were delivered as a pdf in metadata form.
Processing Report:	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<u>PDF</u>	<input type="text" value="1"/>	metadata format
QA/QC Report:	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<u>PDF</u>	<input type="text" value="1"/>	1 QA/QC report delivered per county
Project Level XML Metadata:	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	XML	<input type="text" value="1"/>	Project report, collection report, and survey report were delivered as a pdf in metadata form.
Project Extent:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>.shp</u>	<input type="text" value="1"/>	Project extent does not include Warren County
Tile Scheme:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>.shp</u>	<input type="text" value="1"/>	Each county has 1 tile extent file
					<input type="text"/>	<input type="text"/>

<i>Control (Calibration) Points:</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>Select...</u>	0	not delivered
<i>Check (Validation) Points:</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>.shp</u>	1	
<i>Additional Comments:</i>	Additionally vertical accuracy reports are available for each county within dataset					

**LIDAR DATA**

<i>Deliverables</i>	<i>Delivered</i>	<i>XML Metadata</i>	<i>Required</i>	<i>Format</i>	<i>Quantity</i>	<i>Additional Details</i>
<i>Swath Data:</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>.las</u>	4,772	
<i>Classified/ Tiled Data:</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>.las</u>	52,614	For all counties
<i>Additional Comments:</i>						

**DERIVED DELIVERABLES**

<i>Deliverables</i>	<i>Delivered</i>	<i>XML Metadata</i>	<i>Required</i>	<i>Format</i>	<i>Quantity</i>	<i>Additional Details</i>
<i>DEM Tiles:</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>GRID</u>	1	1 file per county
<i>Breaklines:</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<u>.shp</u>	2	each county has 2 breakline files associated with it
<i>Additional Comments:</i>						

**OTHER**

<i>Additional Comments:</i>	
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**Geographic Information**

*Area Extent:*  Sq. Miles

*Tile Size:*  Select...

*DEM/DTM Grid Spacing:*  U.S. Feet

*Coordinate Reference System:*

NAD83(HARN) / Illinois West FIPS 1202 (ftUS), NAVD88

Projection:

Horizontal Datum: NAD83 HARN   Meters  U.S. Feet  Int'l Feet

Vertical Datum: NAVD88   Meters  U.S. Feet  Int'l Feet

**THIS PROJECTION COORDINATE REFERENCE SYSTEM IS CONSISTENT ACROSS THE FOLLOWING DELIVERABLES**

- Project Extent
- Project Tile Scheme
- Checkpoints
- Project Level XML Metadata
- Tiled/Classified LiDAR
- Swath/Raw LiDAR
- DEM(s)
- Breakline(s)

Additional Comments:

**Collection Information**

Quality Level: 3  
Configured Nominal Pulse Spacing:  
 Meters

Sensor Information:  
Sensor Type:  
Select...  
Sensor Used:  
  
Configured Scan Angle ± from nadir:  
 Degrees

Additional Comments:

**Metadata Review Accepted**

Vendor provided metadata files have been parsed using 'mp' metadata parser. Any errors generated by the parser are documented below for reference and/or corrective action.  
Parser can be found @ <http://geo-nsdi.er.usgs.gov/validation/>

**The Project Level XML Metadata parsed with errors.**

Project report, collection report, and survey report were delivered as a pdf in metadata form.  
**On page 4 of this report, required FVA is stated to meet 18.2 feet**

Check if 'Best Use' metadata for NED:

Additional Comments:

**Based on this review, the USGS accepts the xml metadata provided.**

## Vertical Accuracy Review Accepted

ASPRS recommends that checkpoint surveys be used to verify the vertical accuracy of LiDAR data sets. Checkpoints are to be collected by an independent survey firm licensed in the particular state(s) where the project is located. While subjective, checkpoints should be well distributed throughout the dataset. National Standards for Spatial Data Accuracy (NSSDA) guidance states that checkpoints may be distributed more densely in the vicinity of important features and more sparsely in areas that are of little or no interest. Checkpoints should be distributed so that points are spaced at intervals of at least ten percent of the diagonal distance across the dataset and at least twenty percent of the points are located in each quadrant of the dataset.

NSSDA and ASPRS require that a minimum of twenty checkpoints (thirty is preferred) are collected for each major land cover category represented in the LiDAR data. Checkpoints should be selected on flat terrain, or on uniformly sloping terrain in all directions from each checkpoint. They should not be selected near severe breaks in slope, such as bridge abutments, edges of roads, or near river bluffs. Checkpoints are an important component of the USGS QA process. There is the presumption that the checkpoint surveys are error free and the discrepancies are attributable to the LiDAR dataset supplied.

For this dataset, USGS checked the spatial distribution of checkpoints with an emphasis on the bare-earth (open terrain) points; the number of points per class; the methodology used to collect these points; and the relationship between the data supplier and checkpoint collector. When independent control data are available, USGS has incorporated this into the analysis.

### Required Vertical Accuracy

Yes  No

#### REQUIRED FUNDAMENTAL VERTICAL ACCURACY FOR SWATH AND DEM FILES

Confidence Interval Required:  th % CI

Required Unit:

Required # of checkpoints:

Required RMSEz:

Required Vertical Accuracy (RMSEz \* .% CI)

#### REQUIRED SUPPLEMENTAL VERTICAL ACCURACY FOR DEM FILES

SVA Statistic Required: Percentile

SVA Confidence Level/Percentile Required:

Class	# of Checkpoints	SVA Required	
		95 th Percentile	
Brush	20	1.19	U.S. Feet
Short Grass	20	1.19	U.S. Feet
Tall Grass	20	1.19	U.S. Feet
Woods	20	1.19	U.S. Feet

#### REQUIRED CONSOLIDATED VERTICAL ACCURACY FOR DEM FILES

CVA Statistic Required: Percentile

CVA Confidence Level/Percentile Required:

Total number of checkpoints:



Required CVA:  U.S. Feet  at the  th Percentile

Additional Required Vertical Accuracy Information:

### Reported Vertical Accuracy

Yes  No

#### REPORTED FUNDAMENTAL VERTICAL ACCURACY FOR SWATH LIDAR FILES

Confidence Interval Reported:  th % CI

Reported Unit:

Reported # of checkpoints:

Reported RMSEz:

Reported Vertical Accuracy (RMSEz \* .% CI)

#### REPORTED FUNDAMENTAL VERTICAL ACCURACY FOR DEM FILES

Confidence Interval Reported:  th % CI

Reported Unit:

Reported # of checkpoints:

Reported RMSEz:

Reported Vertical Accuracy (RMSEz \* .% CI)

#### REPORTED SUPPLEMENTAL VERTICAL ACCURACY FOR DEM FILES

SVA Statistic Reported: Confidence Level

SVA Confidence Level/Percentile Reported:

Class	# of Checkpoints	SVA Reported 95 th Confidence Level	
Short Grass	273	0.604	U.S. Feet
Tall Grass	502	0.791	U.S. Feet
Brush	253	0.966	U.S. Feet
Woods	248	0.657	U.S. Feet

#### REPORTED CONSOLIDATED VERTICAL ACCURACY FOR DEM FILES

CVA Statistic Reported: Percentile

CVA Confidence Level/Percentile Reported:

Total number of checkpoints:

Reported CVA:  U.S. Feet  at the  th Percentile

*Additional Reported Vertical Accuracy Information:*

In vertical accuracy report there is an error in the required FVA stating that FVA must meet 18.2 ft at 95th confidence level.  
 FVA was reported using the Open terrain class, no Open terrain classes appear in checkpoint shapefile. Furthermore, report states that RMSE of the classified points were tested against the TIN.

No reporting of Swath Accuracy

Vertical Accuracy as seen below in metadata:

The vertical accuracy of the data has a requirement to achieve a Fundamental Vertical Accuracy (FVA) of 18.2 ft at 95% confidence level based on an RSMEz x 1.960 in "open terrain" as defined by National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines. Further, the data requires a Consolidated Vertical Accuracy (CVA) of 1.19 ft at 95th Percentile and a target value for Supplemental Vertical Accuracy (SVA) of 1.19 ft at 95th Percentile.

The ground survey data included many points categorized as 'Cross Section'. These points were used in evaluation against the TIN. The results are included in graphs in the Vertical Accuracy Assessment Report.

*Quantitative Vertical Positional Accuracy Assessment:*

*Vertical Positional Accuracy Value:* 0.227 ft RMSEz .

*Vertical Positional Accuracy Explanation:*

Tested RMSE of the Classified Points 0.227 ft in open terrain as tested against the TIN.

*Quantitative Vertical Positional Accuracy Assessment:*

*Vertical Positional Accuracy Value:* 0.445 ft FVA.

*Vertical Positional Accuracy Explanation:*

Tested FVA of 0.445 ft at the 95% confidence level in open terrain as tested against the TIN.

*Quantitative Vertical Positional Accuracy Assessment:*

*Vertical Positional Accuracy Value:* 0.476 ft

*Vertical Positional Accuracy Explanation:*

Tested 0.476 ft SVA at the 95th Percentile in the Hard Ground category against the TIN.

*Quantitative Vertical Positional Accuracy Assessment:*

*Vertical Positional Accuracy Value:* 0.604 ft.

Reporting of vertical accuracy in D4\_area\_VARt.pdf (page2 of report)

Table 2 – FVA, CVA, and SVA Vertical Accuracy at 95% Confidence Level

Ground Cover Category	# of Points	FVA Fundamental Vertical accuracy Spec = 1.19 ft	CVA Consolidated Vertical accuracy Spec = 1.19 ft	SVA Supplemental Vertical accuracy Spec = 1.19 ft
Total Combined	1954		0.705	
Hard Surface	678	0.445		0.476
Short Grass	273			0.604
Tall Grass	502			0.791
Brush	253			0.966
Woods	248			0.657

## Reviewed Vertical Accuracy

Yes  No

### CHECKPOINT REVIEW

Checkpoints are well distributed?

Enough checkpoints for task order?

Checkpoints meet USGS LiDAR base-spec in quantity and quality?

### REVIEWED FUNDAMENTAL VERTICAL ACCURACY FOR SWATH LIDAR FILES

Confidence Interval Reviewed:  th % CI



Reviewed Unit:

Reviewed # of checkpoints:

Reviewed RMSEz:

Reviewed Vertical Accuracy (RMSEz \* .% CI)

**REVIEWED FUNDAMENTAL VERTICAL ACCURACY FOR DEM FILES**

Confidence Interval Reviewed:  th % CI

Reviewed Unit:

Reviewed # of checkpoints:

Reviewed RMSEz:

Reviewed Vertical Accuracy (RMSEz \* .% CI)

**REVIEWED SUPPLEMENTAL VERTICAL ACCURACY**

SVA Statistic Reviewed: Percentile

SVA Confidence Level/Percentile Reviewed:

Class	# of Checkpoints	SVA Reviewed	
		95 th Percentile	
Brush	27	1.179	<input type="text" value="U.S. Feet"/>
Short Grass	26	0.463	<input type="text" value="U.S. Feet"/>
Tall Grass	56	1.066	<input type="text" value="U.S. Feet"/>
Woods	27	0.725	<input type="text" value="U.S. Feet"/>

**REVIEWED CONSOLIDATED VERTICAL ACCURACY**

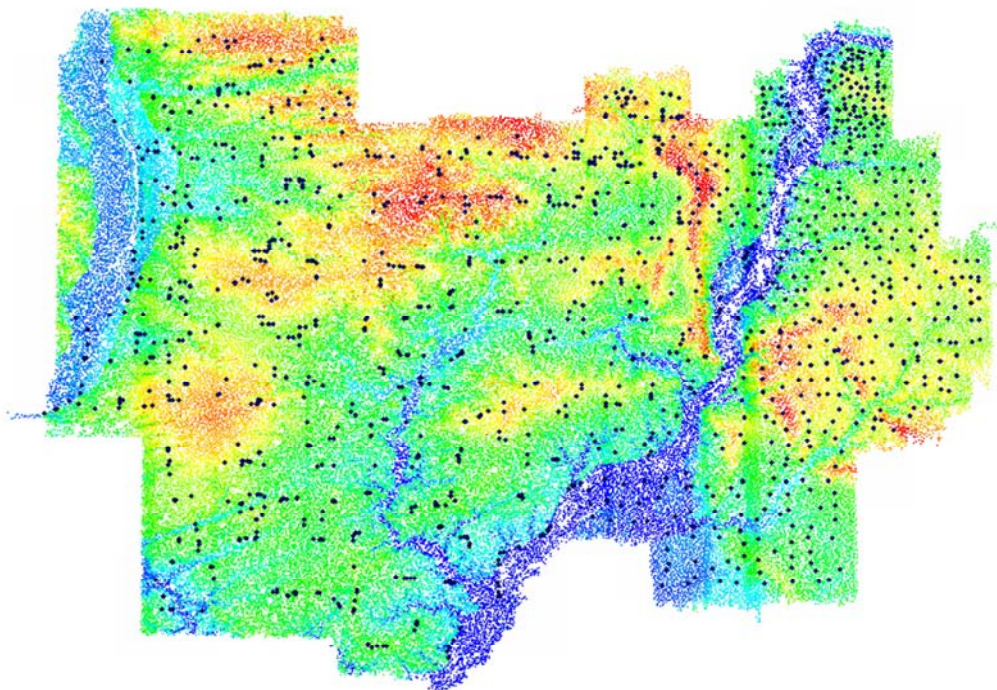
CVA Statistic Reviewed: Percentile

CVA Confidence Level/Percentile Reviewed:

Total number of checkpoints:

Reviewed CVA:   at the 95 th Percentile

Checkpoint Distribution Image



**Vertical Accuracy Results:**

above results for DEM accuracies are for Fulton county, listed below are the vertical accuracies for each of the 12 counties (as it was not possible to process vertical accuracy across the whole project at once). Swath Vertical Accuracy was able to run for full project.

*Additional Reviewed Vertical Accuracy Information:*

**Vertical Accuracy of DEM for all counties in dataset**

county:	Fulton	Henderson	Knox	Marshal	McDonough	Mercer	Peoria	Putnam	Stark	Tazewell	Warren	Woodford
FVA (US FT):	0.609	0.436	0.916	0.457	0.454	0.415	0.529	0.506	0.326	0.315	0.312	0.503
SVA (US FT)												
Brush	1.179	0.802	0.970	0.760	1.535	1.232	0.974	0.582	1.300	0.450	0.992	0.399
Short Grass	0.463	0.574	1.144	0.600	0.658	0.493	0.470	0.462	0.292	0.345	0.447	0.246
Tall Grass	1.066	0.774	1.107	0.723	0.734	0.987	0.965	0.654	0.848	0.540	0.799	0.374
Wood	0.725	0.621	1.019	0.535	0.824	0.700	0.547	0.435	0.737	0.858	0.811	0.485
CVA (US FT):	0.896	0.698	1.111	0.624	0.895	0.888	0.749	0.552	0.847	0.395	0.852	0.478

All counties pass contract spec of 1.19 ft fva, but Knox county does not pass version 13 spec of 0.8 feet fva

**Swath Accuracy does not meet requirements**

Based on this review, the USGS accepts the vertical accuracy.

End of Vertical Accuracy Review

**Raw-Swath LiDAR Review Accepted**

LAS swath files or raw unclassified LiDAR data are reviewed to assess the quality control used by the data supplier during collection. Furthermore, LAS swath data are checked for positional accuracy. The data supplier should have calculated the Fundamental Vertical Accuracy using ground control checkpoints measured in clear open terrain (see *Vertical Accuracy Review Section*).

Review Required:  Yes  No

**RAW-SWATH LIDAR FILE CHARACTERISTICS**

Separate folder for swath/raw LiDAR files

LAS Version: 1.2

Point Record Format: Select...

Each swath file ≤ 2 GB and properly segmented

Correct and properly formatted georeference information is included in all LAS file headers

- Adjusted GPS time used with the global encoder id set to 1
- Scan Angles conform to USGS base-spec recommendations
- All points set to class '0' (not classified)

Additional comments:

Swath files either contain no points, or will not load.

File	Points	Size (MB)	Map Layer	Message	Version	PDRF
2551_P.las	0	0.00	LAS Layer_1		1.2	1
3332_M.las	0	0.00	LAS Layer_1		1.2	1
0541_M.las	0	0.00	LAS Layer_1		1.2	1
0711_L.las	0	0.00	LAS Layer_1		1.2	1
0731_L.las	0	0.00	LAS Layer_1		1.2	1
0751_M.las	0	0.00	LAS Layer_1		1.2	1
0911_K.las	6703465	187.70	LAS Layer_1		1.2	1
0911_N.las	0	0.00	LAS Layer_1		1.2	1
1141_O.las	0	0.00	LAS Layer_1		1.2	1
1361_M.las	0	0.00	LAS Layer_1		1.2	1
1771_N.las	0	0.00	LAS Layer_1		1.2	1
1931_P.las	0	0.00	LAS Layer_1		1.2	1
1981_Q.las	0	0.00	LAS Layer_1		1.2	1
2031_Q.las	0	0.00	LAS Layer_1		1.2	1
2041_Q.las	0	0.00	LAS Layer_1		1.2	1
2052_Q.las	0	0.00	LAS Layer_1		1.2	1
2181_Q.las	0	0.00	LAS Layer_1		1.2	1
2531_P.las	0	0.00	LAS Layer_1		1.2	1
Sum: 6,703,465		Total: 187.71 MB				

Open Setting:  Open Read-Only  Open Read-Write  
 Load Setting:  Load Files  Load Footprints Only  
 Options:  Append to Compatible Layers  Pyramid Thinning: 16

corrected 5/8/2015  
vendor response

```

ReadME - Notepad
File Edit Format View Help
0541_M.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
0711_L.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
0751_M.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
0911_N.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
1316_M.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
1771_N.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
1931_P.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
1981_Q.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
2031_Q.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
2041_Q.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
2052_Q.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
2181_Q.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
2531_P.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
3332_M.las - this is at the end of the flight line and is an empty las tile - this can be removed from the swath files for District 4.
  
```

Redelivered Swath files 0911\_K and 1141\_N contain classes 1,2,7, 10, 12 (Fulton County)

Based on this review, the USGS accepts the swath/raw LiDAR data.

## End of Swath/Raw LiDAR Review

**Tiled/Classified LiDAR Review Accepted**

Classified LAS tile files are used to build digital terrain models using the points classified as ground. Therefore, it is important that the classified LAS are of sufficient quality to ensure that the derivative product accurately represents the landscape that was measured. Classified LAS Tiles are comprised as follows, "all project swaths, returns, and collected points, fully calibrated, adjusted to ground, and classified and cut, by tiles, excluding calibration swaths, cross-ties, and other swaths not used, or intended to be used, in product generation".

Review Required:  Yes  No

**CLASSIFIED LIDAR TILE CHARACTERISTICS**

Separate folder for classified/tiled LiDAR files

LAS Version: 1.2

Point Record Format: 1

- Classified LAS tile files conform to project tiling scheme
- Quantity of classified LAS tile files conforms to project tiling scheme
- Classified LAS tile files do not overlap
- Classified LAS tile files are uniform in size
- Correct and properly formatted georeference information is included in all LAS file headers
- Adjusted GPS time used with the global encoder id set to 1
- Classified LAS tile files have no points classified as '12' (Overlap)
- Point classifications are limited to the standard values listed below:

Code	Description	Used
1	Processed, but unclassified	<input checked="" type="checkbox"/>
2	Bare-earth/Ground	<input checked="" type="checkbox"/>
7	Noise(low or high, manually identified, if needed)	<input checked="" type="checkbox"/>
8	Model key points	<input type="checkbox"/>
9	Water	<input checked="" type="checkbox"/>
10	Ignored ground (breakline proximity)	<input checked="" type="checkbox"/>
11	Withheld (if the "Withheld Bit" is not implemented in the processing software)	<input type="checkbox"/>

Additional comments:

Classified LAS file 2398\_1604.las includes: all classes from 0 up to 31, Scan angle -128 degrees to 126 degrees, and a min elevation of -2147 feet to a max of 20992 feet (Part of the Stark County Data)

Classified LAS file 2488\_1658.las is classified as only classes 29 & 31 and does not have attributes for any point classifications listed in the metadata or reports (Part of the Putnam County Data)

Peoria Classified LAS file 2346\_1474 and 2394\_1518 have both been corrected 5/8/2015

Woodford Classified LAS file 2562\_1486 has been corrected 5/28/2015

**Based on this review, the USGS accepts classified/tiled LiDAR data.**

End of Tiled/Classified LiDAR Review

**Breakline Review Accepted**

Breaklines are vector feature classes that are used to hydro-flatten the bare earth Digital Elevation Models.

Review Required:  Yes  No

**BREAKLINE FILE CHARACTERISTICS:**

- Separate folder for breakline files.
- Breaklines contain elevation values.

Elevation values stored in Geometry (ZEnabled)

Units: U.S. Feet

- Waterbody Breaklines.

Polyline  Polygon

Single elevation value per waterbody feature.

Required.

Waterbody Elevations were created via Proprietary waterbody level techniques.

- Double Line Stream Breaklines (Streams Approximately > 100 ft).

Polyline  Polygon

Downstream DLS Flow is Proprietary

Required.

- Single Line Breaklines.

Lines are:

Single Line Streams

Bridge Cuts

Culvert Connectors

Downstream SLS Flow is Proprietary

- No missing or misplaced breaklines.

**Based on this review, the USGS accepts the breakline files.**

End of Breakline Review

## DEM Review **Not Accepted**

The derived bare-earth file(s) receive a review of the vertical accuracies provided by the data supplier, vertical accuracies calculated by the USGS using supplied and independent checkpoints (*see the prior Vertical Accuracy Review Section*), and a thorough visual review for any anomalies or inconsistencies in assessing the quality of the DEM(s).

**BARE-EARTH DEM TILE CHARACTERISTICS:**

- Separate folder for bare-earth DEM files

Raster File Type: GRID

Raster Cell Size:  U.S. Feet

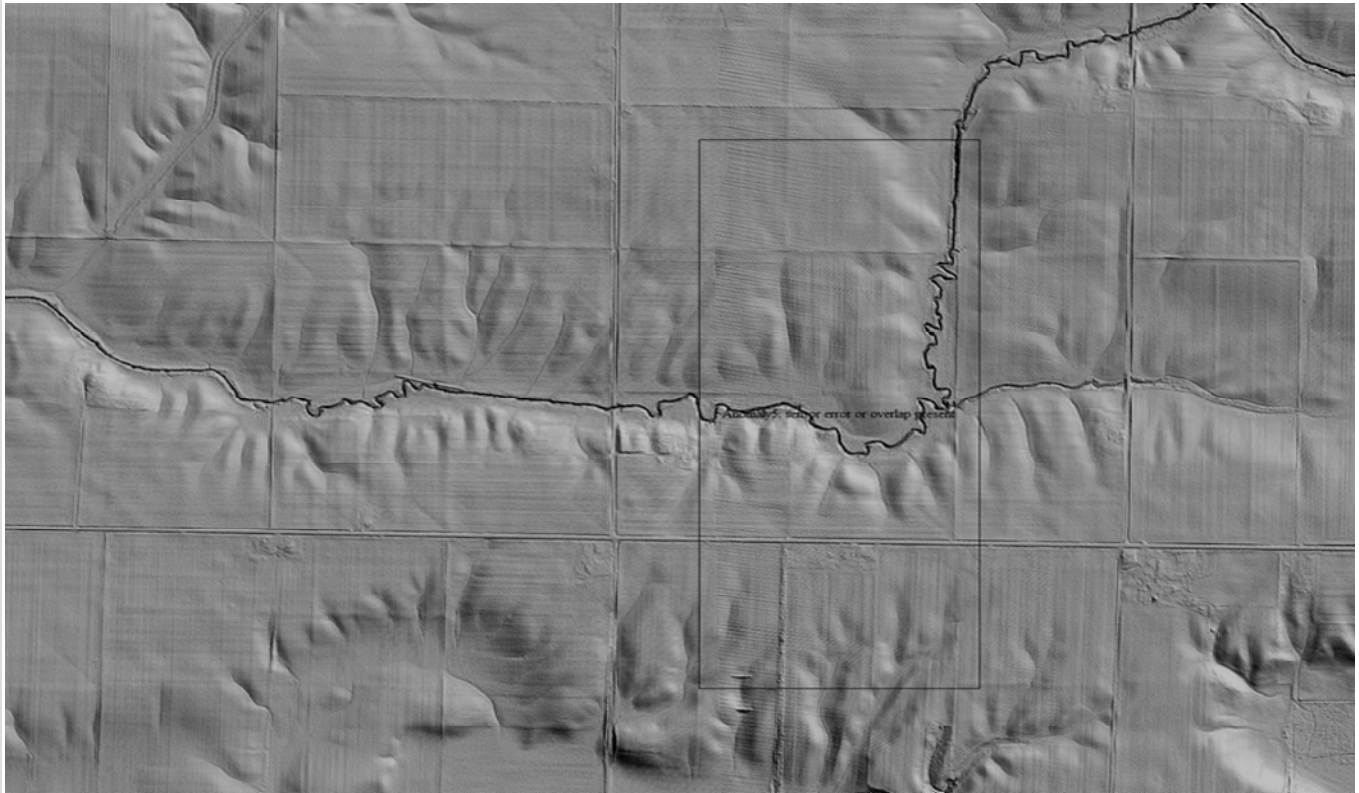
Tile bit depth/pixel Type:

Interpolation or Resampling Technique: Proprietary

DEM tiles do not overlap

Anomaly5: sensor error or overlap present

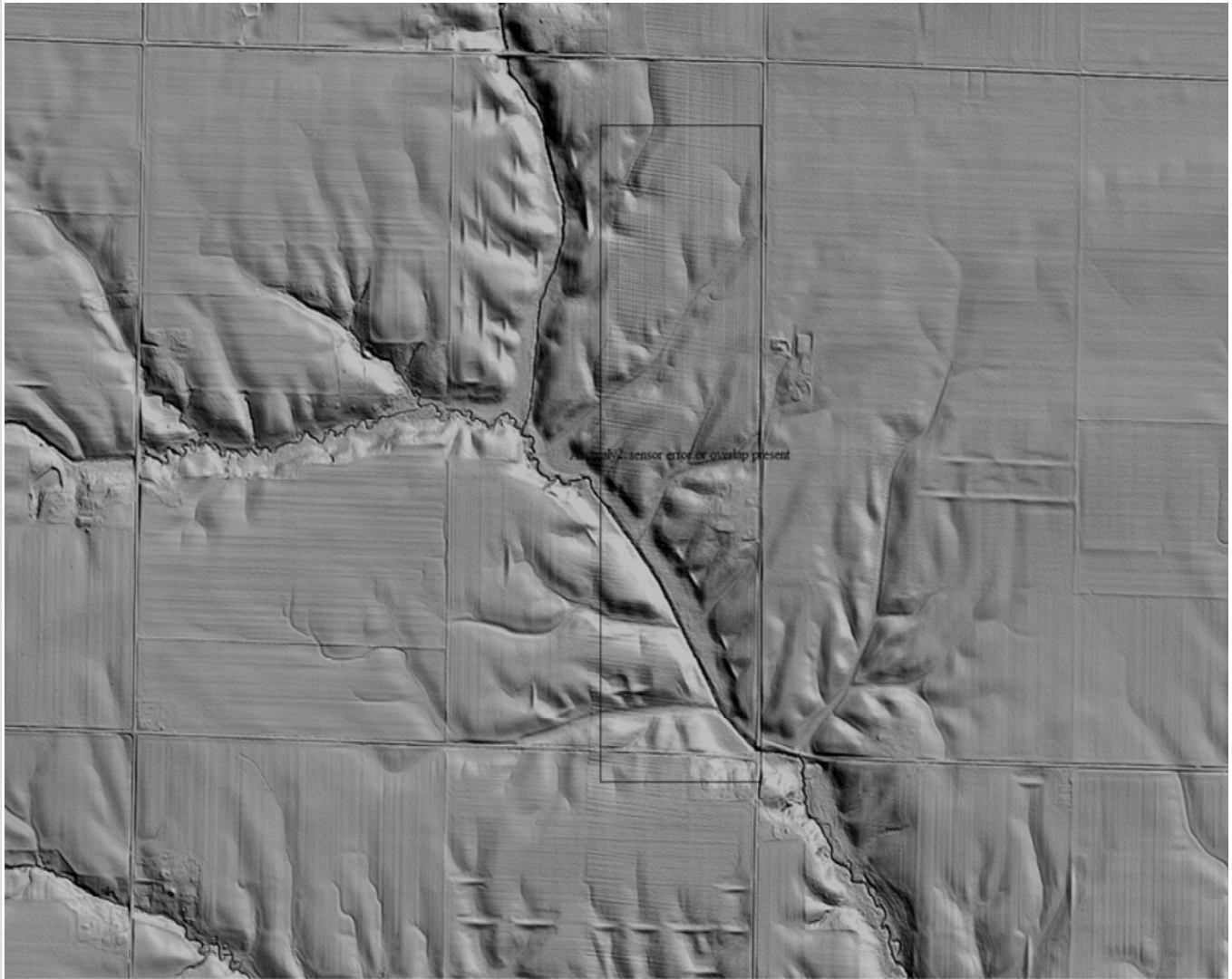
DEM errors are representative of errors in District 4 dataset.



- DEM tiles conform to Project Tiling Scheme
- Quantity of DEM files conforms to Project Tiling Scheme
- DEM tiles are uniform in size
  
- DEM tiles properly edge match and free of edge artifacts
- Tiles are free from Spikes and Pits
- Tiles are free from Data Holidays (*voids due to processing or collection errors*)
- Tiles do not exhibit systematic sensor error or corrowing

Anomaly2: Sensor error or overlap present, representative of errors in dataset  
DEM errors are representative of errors in District 4 dataset.



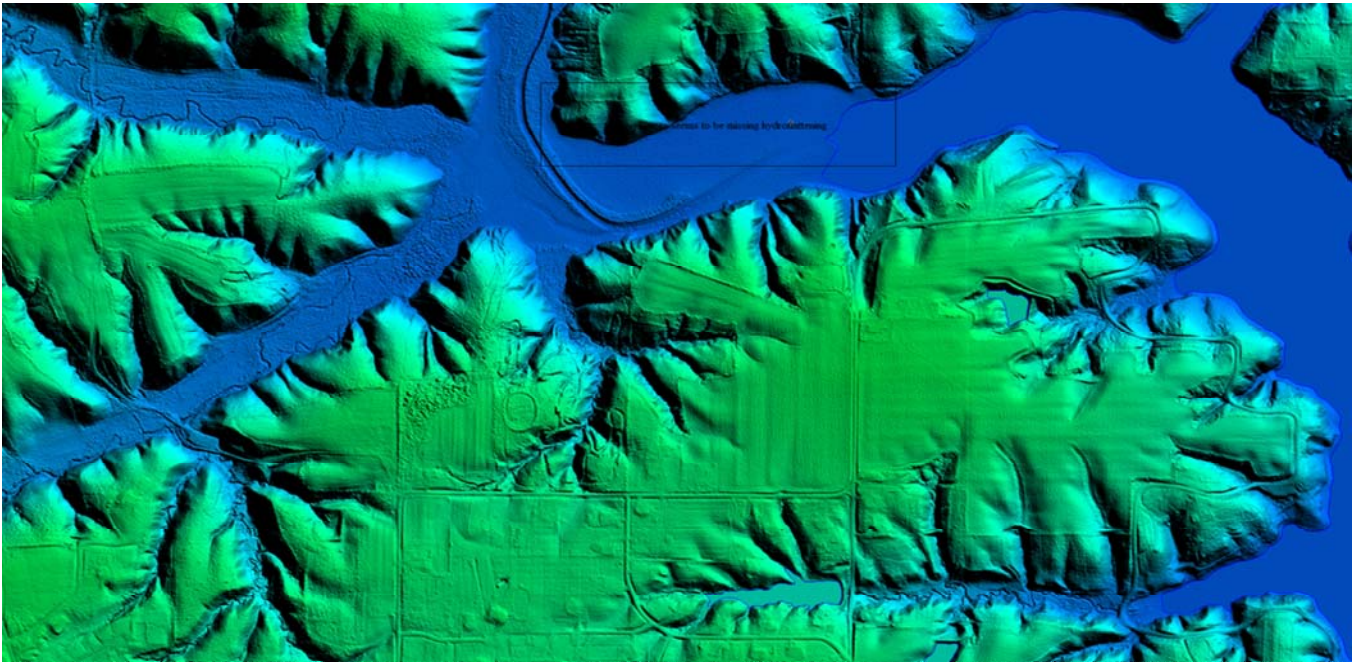


**Hydro Treatment:** hydro-flattened

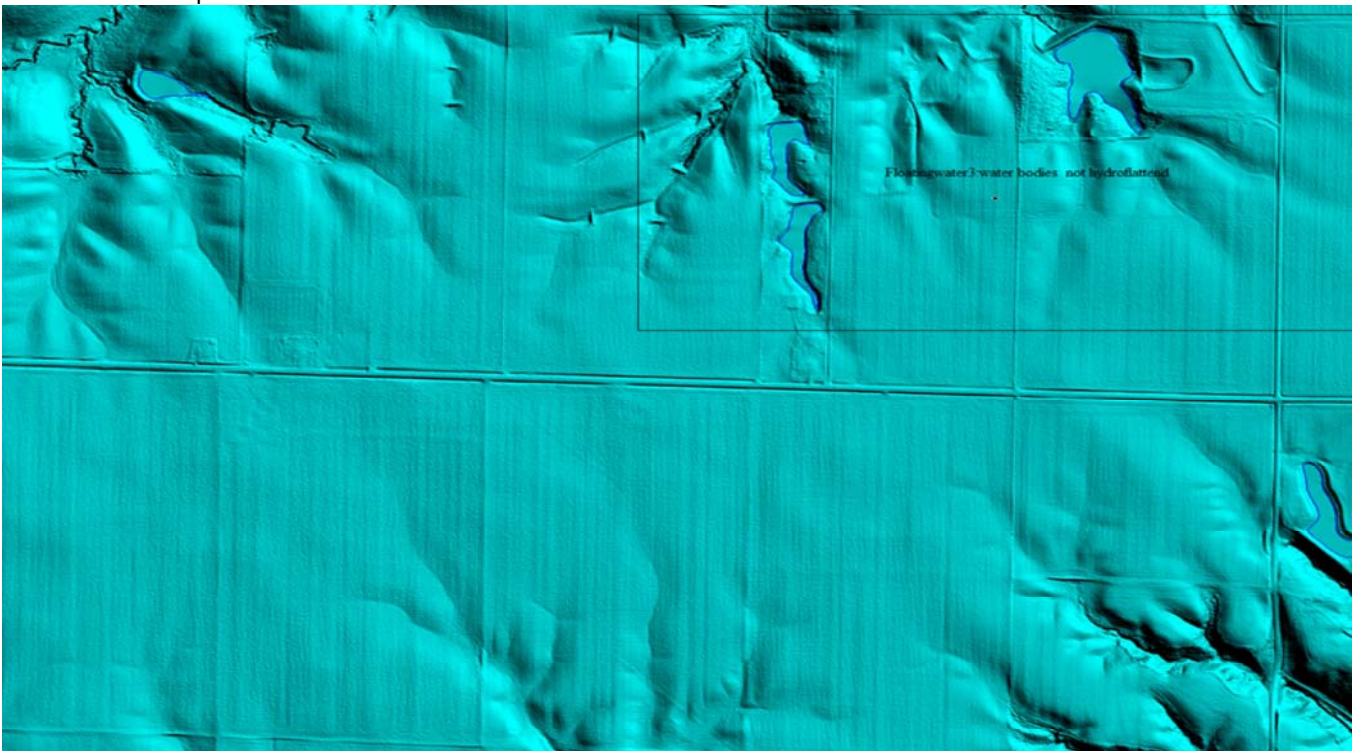
DEM tiles are properly Hydro Flattened  Yes  No

Waterbodies  or greater are flattened

water1: area seems to be missing hydroflattening; representative of errors found in dataset  
DEM errors are representative of errors in District 4 dataset.



Floatingwater3: water bodies not hydroflattened, representative of errors in dataset  
DEM errors are representative of errors in District 4 dataset.



hydroflatten24: waterbodies not flattened, in McDonough county there are many rivers lakes that have not been hydroflattened. Additionally, there is many of the hydroflattened streams in this data have been inconsistently hydroflattened in comparison to the other counties (due to river/stream sizes)  
Error representative of issues in McDonough county only

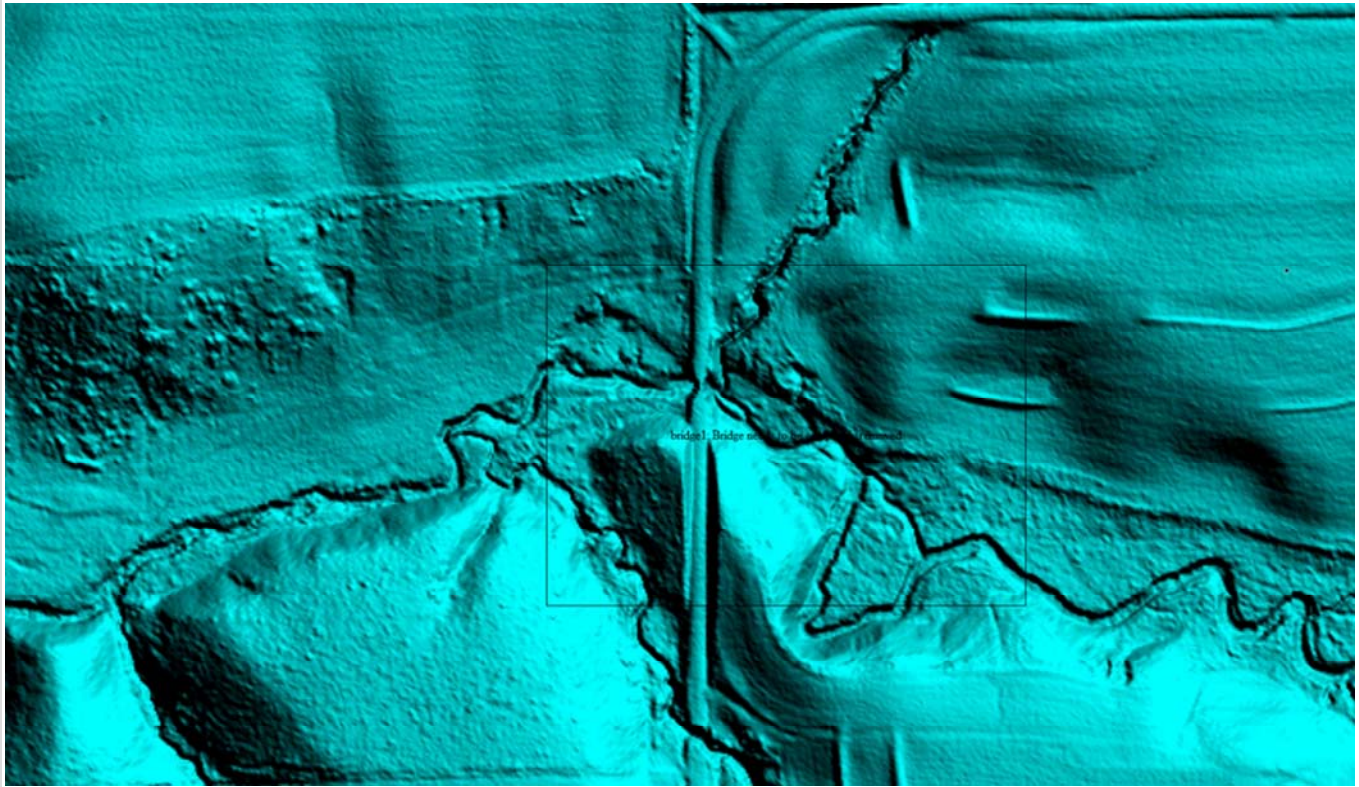




- Streams 100 ft. or greater are flattened in a downstream manner
- Tidal Boundaries/Shorelines are flattened
- No missing islands 1 Acre or larger
- Bridges/Overpasses are properly removed

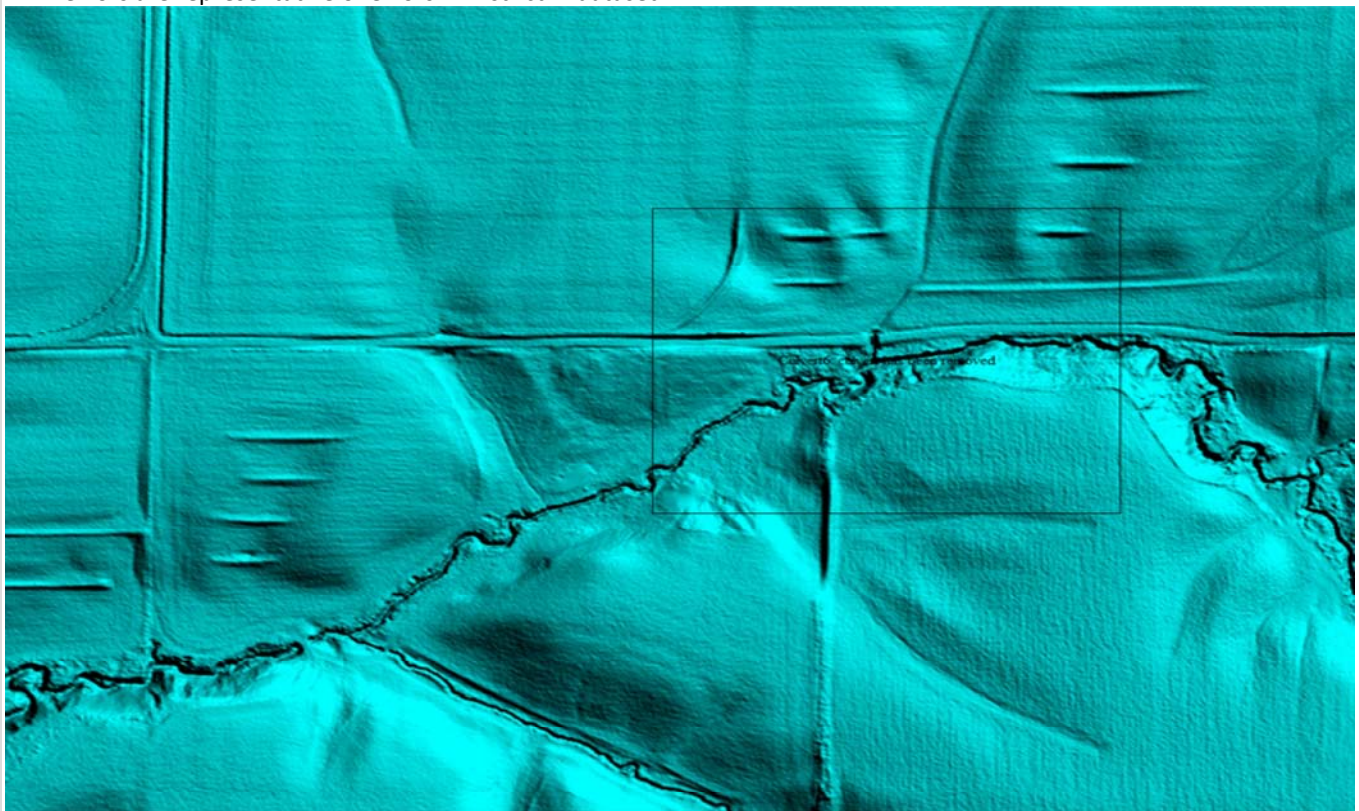
bridge1: Bridge needs to be completely removed, representative of errors in dataset  
DEM errors are representative of errors in District 4 dataset.





Culverts are maintained (Not Hydro Enforced)

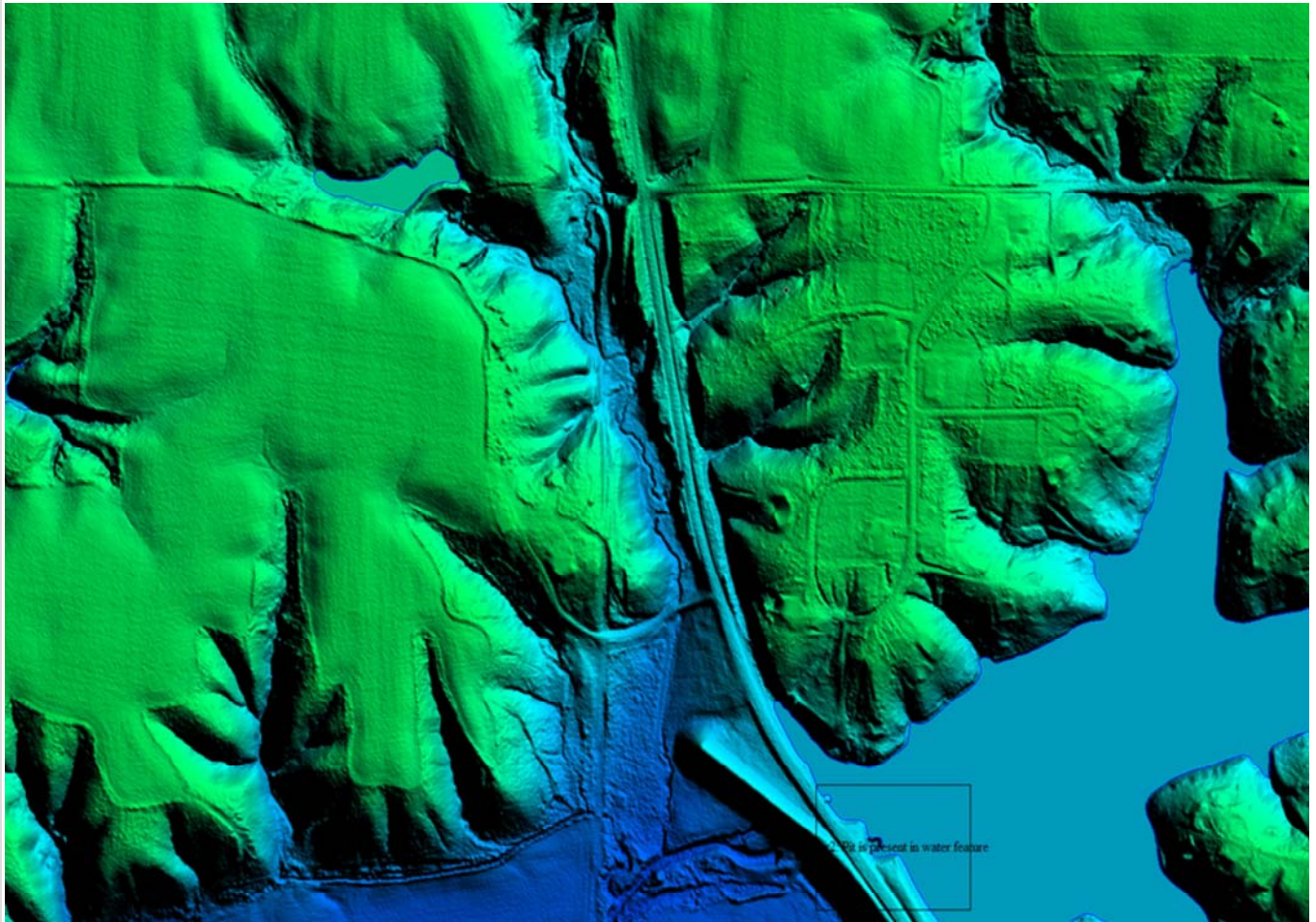
Culvert6: culvert has been removed; representative of errors within dataset  
DEM errors are representative of errors in District 4 dataset.



Depressions, Sinks, are not filled in (Not Hydro Conditioned)

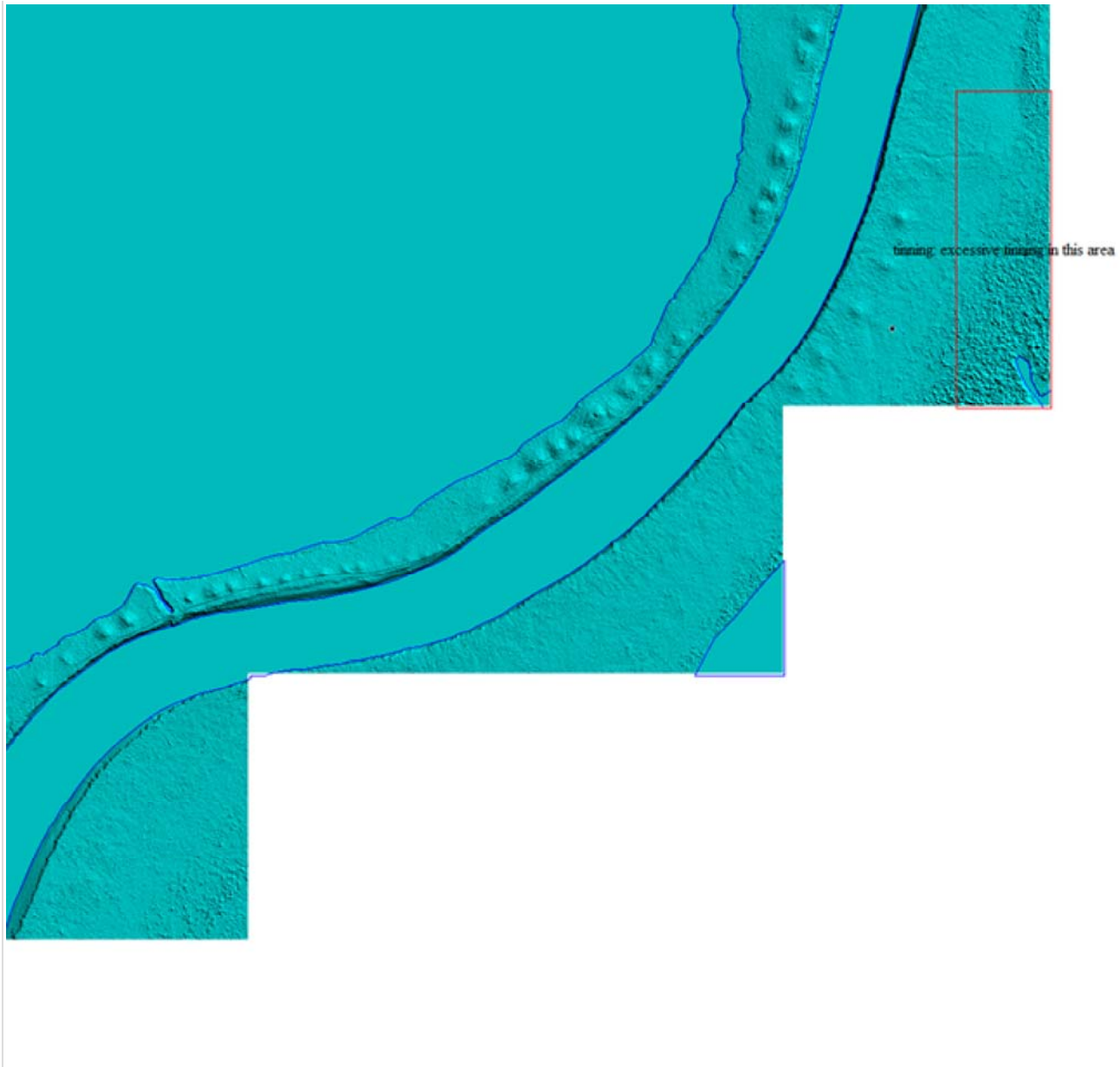
Water2: Pit is present in water.  
DEM errors are representative of errors in District 4 dataset.





Vegetation properly removed

tinny: excessive tinning in this area; error is representative  
DEM errors are representative of errors in District 4 dataset.



Manmade structures properly removed

ADDITIONAL COMMENTS, ERRORS, ANOMALIES, OR OTHER ISSUES:

Most DEM errors represented above have caused minimal elevation change and are not issues, except in: McDonough County, Stark County, and Warren County.

Tiles recommended for NED 1/3rd:  Yes.  No.

Tiles recommended for NED 1/9th:  Yes.  No.

Tiles recommended for NED 1 Meter:  Yes.  No.

LAS dataset recommended for distribution: tile classified

**Based on this review, the USGS does not accept the DEM tiles.**

End of DEM Review



**INTERNAL COMMENTS**

Project report, collection report, and survey report were delivered as a pdf in metadata form.  
On page 4 of this report, required FVA is stated to meet 18.2 feet

END OF REPORT (v2.3.0)