

Dewberry Response to USGS Review of the Virginia FEMA NRCS South Central LiDAR Project– Blocks 1 and 2 Corrections

Produced for U.S. Geological Survey

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Overview

Dewberry shipped corrections for VA FEMA NRCS block 1 on 8/23/2019 (for delivery to USGS on 8/26/2019) and corrections for block 2 on 8/28/2019 (for delivery to USGS on 8/29/2019). After reviewing the corrections, USGS has asked for additional corrections in both of these blocks.

Dewberry did find the provided QA reports somewhat confusing, so we created tables below in order to detail every call Dewberry interprets USGS as saying was not corrected. Dewberry did find some inconsistencies in the reports, particularly the DEM calls in block 2, where the same call seemed to be marked as both uncorrected (red) and corrected (green) in various parts of the report. We’ve noted these inconsistencies in the “Additional Notes” column of the tables below so that if Dewberry interpreted a comment incorrectly, USGS can provide further clarification.

Within the report, several comments were marked as “Left unchanged-Accepted as is by NGTOC management-Reviewer does not agree.” In all instances of these comments and any other comments Dewberry discussed with USGS during the webinar on July 18, 2019 where USGS agreed changes were not necessary, Dewberry has not modified the data.

For ease of reading, Dewberry color coded the tables below so that calls where Dewberry has made further adjustments are colored green and calls left as-is are colored grey.

Edit Calls

VERTICAL ACCURACY

Table 1-Vertical accuracy comments for blocks 1 and 2

Block 1 and 2		
USGS Call	Additional Notes	Dewberry Comments
Number of NVA checkpoints fails ASRPS requirements	Report states 187 NVA checkpoints and 133 VVA checkpoints are required but since only 183 checkpoints were used in the swath NVA testing, the number of checkpoints used do not meet ASRPS requirements.	<p>The size of this AOI requires 187 NVA checkpoints and 133 VVA checkpoints. Dewberry surveyed 191 NVA checkpoints and 142 VVA checkpoints.</p> <ul style="list-style-type: none"> - One NVA checkpoint had survey issues and was removed from all testing. One VVA checkpoint was surveyed in an inappropriate location and was removed from all testing. Both of these are documented in the project report. This left 190 NVA checkpoints and 141 VVA checkpoints. - There were seven (7) NVA checkpoints which were not suitable for testing against unclassified data because overhead and above ground features were not yet removed. Surveyors and data collectors have no control over where overhead powerlines and vegetation are located, nor do surveyors and data collectors have control over whether

		<p>or not a vehicle will be located on top of a survey checkpoint location at the time of lidar acquisition. As such, seven (7) points were removed from the swath NVA (and documented in the project report). A - All seven (7) NVA checkpoints that were remove from the swath accuracy were brought back into testing and used to test the NVA for the classified lidar and DEMs (also documented in the project report). As the removal was a result of the data not being classified yet and these points were used for the final testing, these points do count towards the total checkpoint requirements outlined by ASPRS. Dewberry met these requirements by testing 190 NVA and 141 VVA checkpoints against the classified lidar and DEMs.</p>
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METADATA

Since all blocks within the project were completed by the time Dewberry addressed individual block corrections, project level metadata rather than block metadata, was provided to USGS as part of the block 1 corrections shipped to USGS on 8/23/2019 for delivery to USGS on 8/26/2019.

Table 2-Block 1 and 2 metadata comments

Blocks 1 and 2		
USGS Call	Additional Notes	Dewberry Comments
State number of NVA checkpoints, how many were removed, and reason for their removal		Dewberry stated this information in the project report. Dewberry has also added this information to the lidar classified metadata file and provided the updated metadata to USGS with this document.
Number of NVA points used failed ASPRS requirements	Report states 187 NVA checkpoints and 133 VVA checkpoints are required but since only 183 checkpoints were used in the swath NVA testing, the number of checkpoints used do not meet ASPRS requirements.	Please see Dewberry's response for the Vertical Accuracy section above.
Horizontal Datum name does not include 2011		Horizontal datum name was modified in the corrections delivery-please see Figure 1.
Vertical Datum name does not include geoid model 12B		Vertical datum name was modified in the corrections delivery-please see Figure 1.
Acquisition times of reports/xmles need to be updated to match LAS GPS Timestamps of 4/14/2017 to 5/24/2018		The acquisition times were updated in the metadata provided in the corrections delivery-please see Figure 2. Dewberry missed updating a section of the report and this has now been updated and provided to USGS with this document.

Project xml and Lift xmls were not delivered		USGS provided metadata templates to Dewberry on 10/23/2018. Since those templates were received, Dewberry has used them for all projects and metadata deliverables. Those templates included a classified point cloud, breakline, intensity, and DEM xml template. Since October of 2018, Dewberry has not provided a project xml nor lift xmls, will guidance from USGS that only the provided template files were required for deliveries moving forward.
Class 18 is included in the metadata but does not exist in the LAS		Class 18 is present in block 1, but not block 2. Because the delivered metadata was converted to project level metadata, class 18 was kept in the metadata as class 18 does exist within the AOI.
Description of synthetic points need to be included within the metadata		Dewberry stated this information in the project report. Dewberry has also added this information to the lidar classified metadata file (completeness tag) and provided the updated metadata to USGS with this document.

Table 3-Additional metadata comments for block 1

Additional Comments from Block 1		
USGS Call	Additional Notes	Dewberry Comments
Accuracy is being reported per block, not project wide		Since all blocks within the project were completed by the time Dewberry addressed individual block corrections, project level metadata rather than block metadata, was provided to USGS as part of the block 1 corrections shipped to USGS on 8/23/2019 for delivery to USGS on 8/26/2019.
Final xmls not delivered in 27Aug19 corrections		Final metadata xmls were provided with this delivery but since project level xmls were being provided, they were sent in a separate folder (since the other data were organized by Mercer, South Central, and West Virginia West blocks).

Table 4-Additional metadata comments for block 2

Additional Comments from Block 2		
USGS Call	Additional Notes	Dewberry Comments
Change enddate in metadata to 20180524		The acquisition times were updated in the metadata provided in the corrections delivery-please see Figure 2.

Change end date in report on page 4 to May 24, 2018		Dewberry missed updating this section of the report and this has now been updated and provided to USGS with this document.
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```

<geodetic>
  <horizdn>North American Datum of 1983 2011</horizdn>
  <ellips>Geodetic Reference System 80</ellips>
  <semiaxis>6378137</semiaxis>
  <denflat>298.257222101</denflat>
</geodetic>
</horizsys>
<vertdef>
  <altsys>
    <altdatum>North American Vertical Datum of 1988 GEOID12B</altdatum>
    <altres>0.01</altres>
    <altunits>meters</altunits>
    <altenc>Explicit elevation coordinate included with horizontal coordinates</altenc>
  </altsys>
</vertdef>
    
```

Figure 1-In the corrections delivery, project level metadata was delivered, which included an update to the horizontal datum name and an update to the vertical datum name. 2011 was added to the horizontal datum and Geoid12B was added to the vertical datum.

```

<timeperd>
  <timeinfo>
    <rngdates>
      <begdate>20170414</begdate>
      <enddate>20180524</enddate>
    </rngdates>
  </timeinfo>
    
```

Figure 2-In the corrections delivery, project level metadata was delivered, which included an update to the time period tags.

FLIGHTLINE INDEX

Table 5-Flight line index comments for blocks 1 and 2

Block 1 and 2		
USGS Call	Additional Notes	Dewberry Comments
Flightline Index naming convention does not match the naming convention of the delivered swaths		The delivered flight line index was created by our acquisition provider. Dewberry then changed the swath names during some of our processing. Dewberry is creating an updated flight line index to match the delivered swaths.

SHAPEFILES

Table 6-Shapefile comments for block 2

Block 2		
USGS Call	Additional Notes	Dewberry Comments
Block 2 Project Boundary	Initial overview section in report states “Shapefiles: Block 2 Project Boundary” but no other information is provided within the report.	Dewberry has made no change based on this comment. As only corrections are re-delivered, the project boundary was not included

		in the block 2 re-delivery since no issues were identified with the boundary files from the full block 2 draft delivery.
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SWATH LAS

Table 7-Swath LAS comments for block 1

Block 1		
USGS Call	Additional Notes	Dewberry Comments
Five (5) cross flights have the incorrect global encoder		The global encoder for these cross flights has been updated and these files have been re-delivered to USGS with this document.

TILED LAS

Table 8-Tiled LAS comments for block 1

Block 1		
USGS Call	Additional Notes	Dewberry Comments
One (1) LAS tile (17SPA60006500) has class 0 points within it		This call for a tile with class 0 points was made in the block 1 report. However, this tile is located within block 2. Dewberry verified the classifications present and there are not class 0 points in this tile. If USGS sees something different on their end, a corruption from one of the hard drive transfers could have occurred and Dewberry can re-delivery. See Figure 3 below.

```

histogram of classification of points:
  41510644 unclassified (1)
  11176067 ground (2)
    55 noise (7)
   660 water (9)
   282 rail (10)
+> flagged as synthetic: 2807
+> flagged as withheld: 9349077
+> flagged as extended overlap: 11454199
    
```

Figure 3-This image shows the classification histogram of the tile USGS identified as having class 0 points. This classification histogram is produced from lastools. No class 0 points are present.

INTENSITY

Table 9-Intensity comments for block 1

Block 1		
USGS Call	Additional Notes	Dewberry Comments
Intensity CRS is in two formats	Commented in initial overview section of report as intensity CRS is in two different formats.	Dewberry was able to identify the discrepancy with the intensity rasters. While the label of the CRS was correct, the horizontal datum name was missing from the

		<p>“internal” datum tag on some files. Dewberry has updated this tag and re-delivered the corrected intensity rasters.</p>
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DEM

Table 10-DEM comments for block 1

Block 1		
USGS Call	Additional Notes	Dewberry Comments
All double line streams are approx. 3' too deep	Commented in report as accepted by NGTOC management but reviewer does not agree	As was discussed in our webinar with USGS on July 18 and in the response memo Dewberry provided with the corrections re-delivery, the stream network cannot be raised without introducing monotonicity and floating issues at other locations within the stream network. No modifications were made based on this comment/call.
Example of double line streams water level too deep	Commented in report as left unchanged	As was discussed in our webinar with USGS on July 18 and in the response memo Dewberry provided with the corrections re-delivery, the stream network cannot be raised without introducing monotonicity and floating issues at other locations within the stream network. No modifications were made based on this comment/call.
Remove wedge (1)	Commented in report as partially left unchanged. This call is identified in the provided shapefile.	Dewberry showed this call and data during the July 18 webinar. Dewberry cannot identify any high points causing a wedge at this location. Please see Figure 4 below. Dewberry has reviewed the DEM and the lidar point cloud; no issues could be identified.
Remove wall to water level (4)	Commented in report as left unchanged and accepted by NGTOC management but reviewer does not agree. One (1) of these are identified in the provided shapefile.	When acting as an impoundment, Dewberry classifies the main dam structure to ground (elevated portions of the dam feature such as building-like structures on top of the main dam feature are classed as unclassified) as it is retaining the water, just as a rock wall or other permanent feature would do. While man-made (but so are culverts, expressway ramps leading to bridges, retaining walls, and other features which remain classified to ground), it is a restricting or holding barrier for the water, which can be very important for modeling purposes. Dams are constructed at varying heights and water levels within dam impoundments can vary so the height of the dam structure above the water surface can be variable. Because the dam structure on the water side is often vertical,

		lidar may only capture the top of the dam structure and not the side of the dam structure. This approach was discussed with and confirmed by USGS during out July 18 webinar and during an email chain with USGS in April 2018 during the Texas Neches Basin Lidar project. No changes were made to the data based on this comment. Please see Figures 5 and 6 below.
Remove dam to ground level (6)	Commented in report as left unchanged and accepted by NGTOC management but reviewer does not agree. All six (6) are in the provided shapefile.	Please see comment above for “Remove wall to water level” USGS calls.
Remove dam to water level (11)	Commented in report as left unchanged and accepted by NGTOC management but reviewer does not agree. Ten (10) of these are identified in the provided shapefile.	Please see comment above for “Remove wall to water level” USGS calls.
Shoreline too deep (7)	Commented in report as seven (7) remain unchanged. All seven (7) are identified in the provided shapefile.	Dewberry re-reviewed these seven (7) features. When determining if a water body can be raised, all vertices must be reviewed to ensure floating is not introduced. Additionally, Dewberry determines how many contours would be “stacked” due to the elevations and if an erroneously build-up of contours would occur, Dewberry adjusts the breakline elevation where possible. Dewberry considers an erroneous build-up of contours to be at least 4-5 contours due to breakline elevations and not surrounding steep terrain. Out of these seven waterbodies, only one would have four (4) 1-ft contours. All others would only have 2-3 contours representing them. However, where possible, Dewberry did further adjust the waterbodies if the elevation could be raised any further without introducing floating. Dewberry further adjusted three (3) of these features and re-delivered the affected tiles to USGS with this document. Please see table 12 for more details.
Spikes (2)	Two (2) new spikes created by contractor	Dewberry corrected the newly identified spikes and re-delivered the affected tiles to USGS with this document.
Re-flatten (1)	This feature is identified in the provided shapefile.	This edit call identifies a 2 cm monotonicity discrepancy-please see Figure 7. While Dewberry feels the 2 cm difference is well within tolerances for QL2 lidar projects with a 1 meter DEM cell size requirement, Dewberry has re-flattened this small section of river and re-delivered the affected tile to USGS with this document.

Replace ground points on road and under bridge (1)	This feature is identified in the provided shapefile.	Dewberry showed this call and data during the July 18 webinar. Dewberry cannot identify any additional points below the bridge which could be reclassified to ground at this location. Please see Figure 4 below. Dewberry has reviewed the DEM and the lidar point cloud; no issues could be identified.
DEM Coordinate Reference System (CRS) is in two formats	Commented in report as 5021 DEM CRS do not have the Datum described as: DATUM ["NAD83_National_spatial_Reference_System_2011"] and that the DEMs delivered are in two different formats.	Dewberry has verified that all DEMs consistently state the horizontal datum as [D_NAD_1983_2011]. Dewberry has started to implement custom CRS files for DEMs delivered to USGS LBS v1.3 projects, but we have not done this for any other USGS LBS v1.2 project. As this is an easy implementation, Dewberry has performed this update for these deliverables, including all DEMs for blocks 1 and 2.

Table 11-DEM comments for block 2

Block 2		
USGS Call	Additional Notes	Dewberry Comments
All double line streams are approx. 3' too deep		As was discussed in our webinar with USGS on July 18 and in the response memo Dewberry provided with the corrections re-delivery, the stream network cannot be raised without introducing monotonicity and floating issues at other locations within the stream network. No modifications were made based on this comment/call.
Water level too deep (1)	Marked as "red" in the initial report overview, DEM section overview, and screenshot example section. Dewberry believes this is the "water level 2 deep below transition" feature in the provided shapefile.	The VA FEMA NRCS project slightly overlaps with the VA West Chesapeake project and the overlap area includes the feature identified by this call. As the two AOIs were acquired during the same time frame, Dewberry edge-matched these projects. As VA West Chesapeake was processed first, the VA FEMA NRCS breaklines in the overlap area were set to match the VA West Chesapeake breaklines. The VA West Chesapeake project has been completed and accepted. These identified breaklines in VA FEMA NRCS cannot be changed without introducing edge-match errors to VA West Chesapeake data. So no modifications were made based on this comment.
Remove dam structures located high above the water level (4)	Marked as "red" in the initial report overview, DEM section overview, and screenshot example section. No edit calls for this type of call are located within the provided shapefile.	Please see comment for "Remove wall to water level" USGS calls in the block 1 DEM calls table above and Figures 5 and 6 below.

<p>Small (below specification) waterbodies present some areas of concern, please address these hydro-flattening errors, and if they cannot be corrected, then please remove hydro-flattening treatment (16)</p>	<p>Marked as “green” in the initial report overview, marked as “red” in the DEM section overview, and marked as red in the screenshot example section. Dewberry believes these are the 16 “reflatten” features identified in the provided shapefile.</p>	<p>Dewberry has corrected and these files are re-delivered to USGS with this document.</p>
<p>Ensure flow of river is represented in a downstream manner (18)</p>	<p>Marked as “red” in the initial report overview, marked as “green” in the DEM section overview, and marked as “red” in the screenshot examples section. No edit calls for these areas provided in the edit call shapefile.</p>	<p>As no specific edit calls were provided for this comment and there seemed to be an inconsistency within the report whether or not there were still issues, Dewberry did not make any modifications to the data based on these comments.</p>
<p>Water level transition not corrected (1)</p>	<p>Marked as “red” in the initial report overview, marked as “green” in the DEM section overview, and marked as “red” in the screenshot examples section. No edit calls for this type of call are located within the provided shapefile.</p>	<p>As no specific edit calls were provided for this comment and there seemed to be an inconsistency within the report whether or not there were still issues, Dewberry did not make any modifications to the data based on these comments.</p>
<p>Bridges (53)</p>	<p>Marked as “green” in the initial report overview, marked as “red” in the DEM section overview, and marked as “green” in the screenshot examples section. No edit calls for this type of call are located within the provided shapefile.</p>	<p>As no specific edit calls were provided for this comment and there seemed to be an inconsistency within the report whether or not there were still issues, Dewberry did not make any modifications to the data based on these comments.</p>

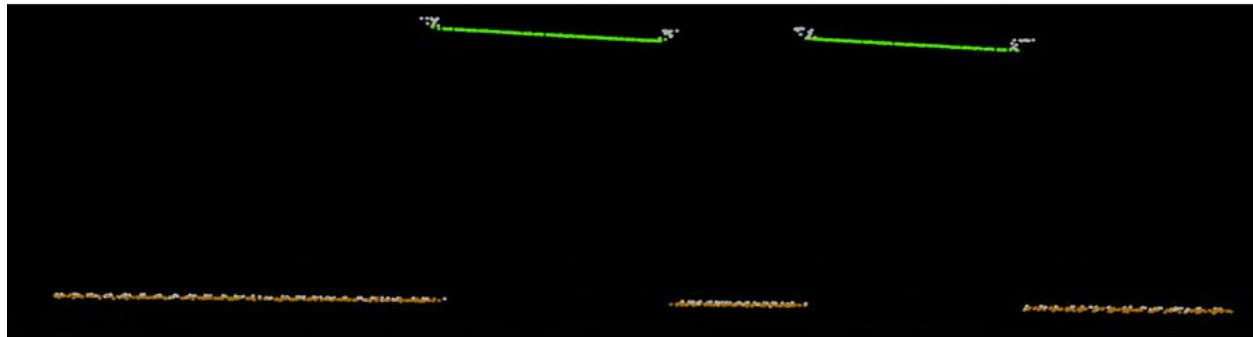
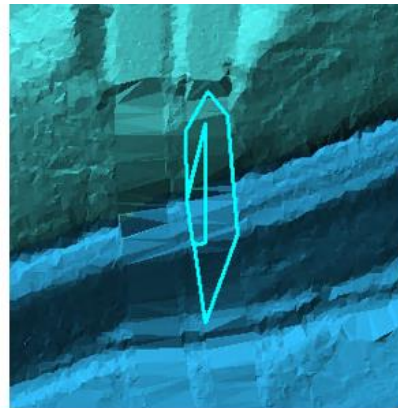


Figure 4-USGS made a call to remove a wedge and add additional points to ground below the bridge. Dewberry could not identify any wedge in the data or additional points to reclassify to ground so no changes were made at this location. Dewberry did make modifications in another portion of a tile which intersects these calls so one of these tiles was re-delivered. After reviewing the corrections, USGS made a call that a partial wedge remains but Dewberry did not make any modifications to this location. The top left image shows the call overlaid on Esri base imagery. The top right image shows the call overlaid on a terrain created from ground points. The bottom image shows a profile of this location in the point cloud (class 1-gray, class 2-orange, class 17-green). Dewberry could not identify any high ground points which would be creating a wedge nor did Dewberry identify any additional points which could be reclassified to ground.

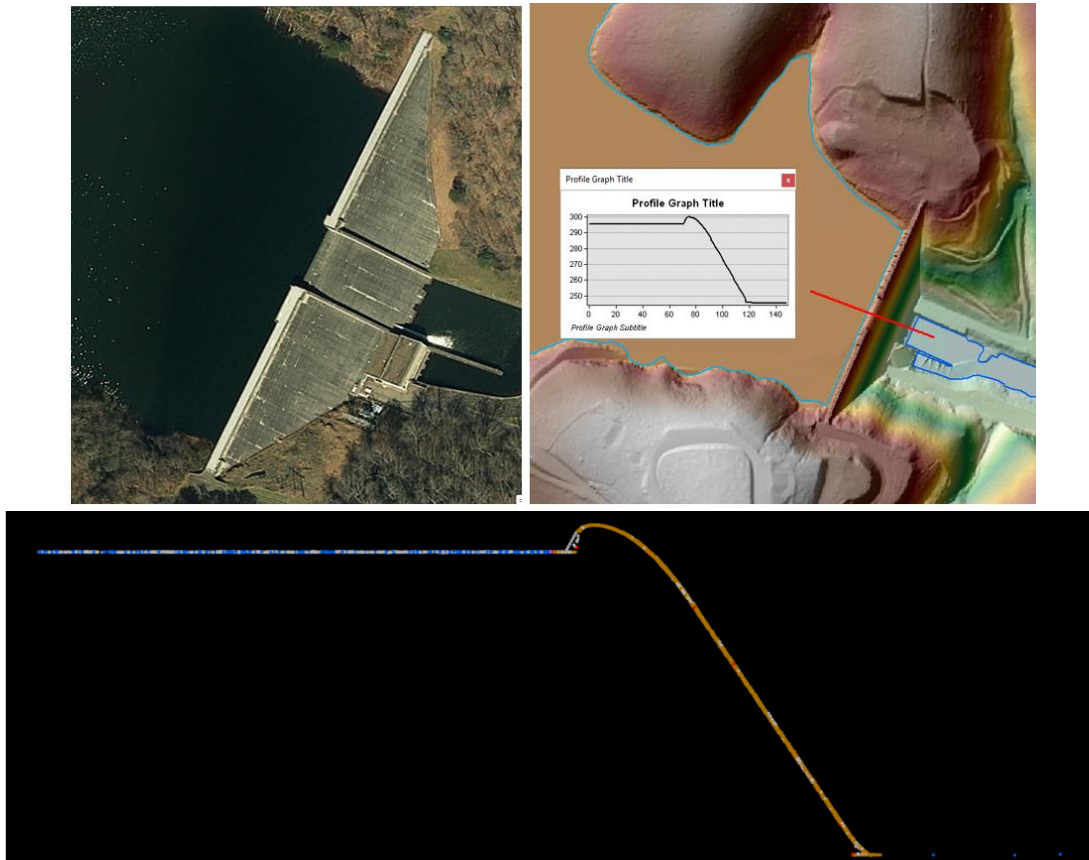


Figure 5- When acting as an impoundment, Dewberry classifies the dam structure to ground as it is retaining the water, just as a rock wall or other permanent feature would do. Dams are constructed at varying heights and water levels within dam impoundments can vary so the height of the dam structure above the water surface can be variable. Because the dam structure on the water side is often vertical, lidar may only capture the top of the dam structure and not the side of the dam structure. This approach has been confirmed multiple times by USGS. The top left image shows the dam in Esri base imagery. The top right image shows the DAM in the bare earth DEMs along with the location of a profile in red. The bottom image shows the profile location in the lidar point cloud (class 1- grey, class 2-orange, class 7-red, class 9-blue, class 10-purple).

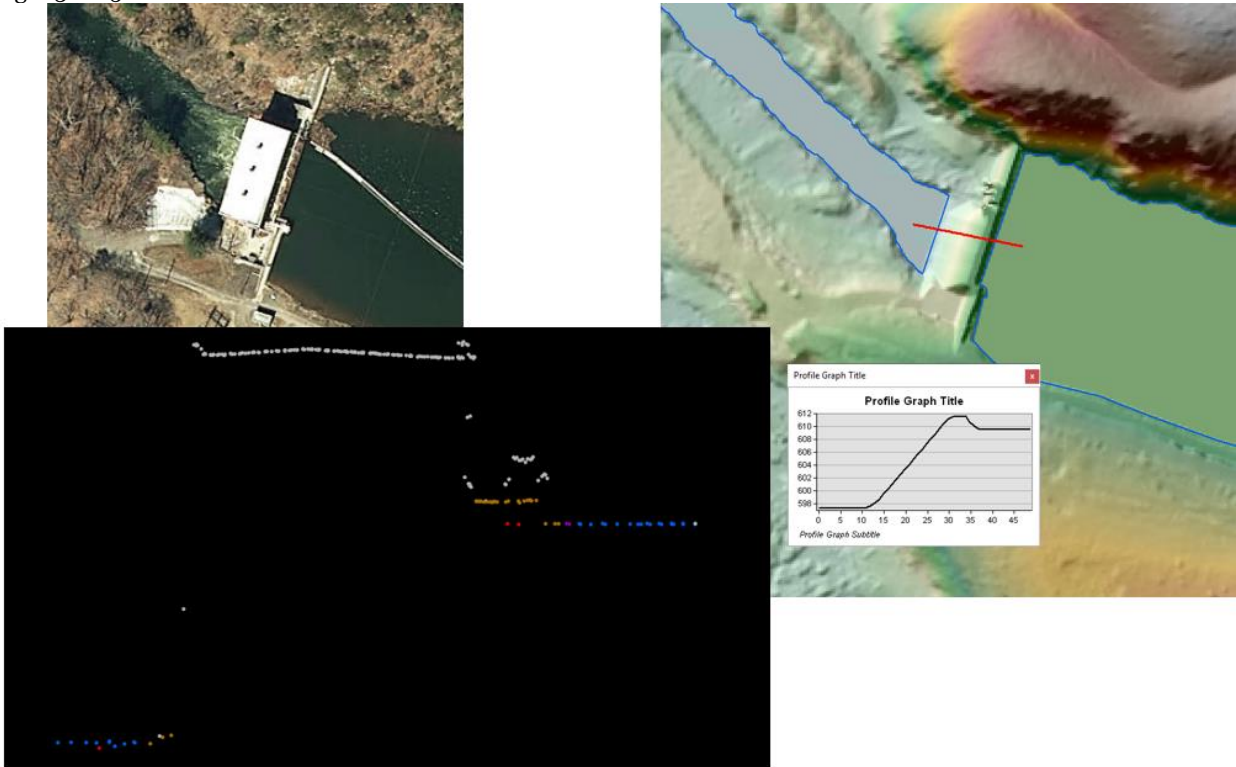


Figure 6- When acting as an impoundment, Dewberry classifies the dam structure to ground as it is retaining the water, just as a rock wall or other permanent feature would do. Dams are constructed at varying heights and water levels within dam impoundments can vary so the height of the dam structure above the water surface can be variable. Because the dam structure on the water side is often vertical, lidar may only capture the top of the dam structure and not the side of the dam structure. Building-like structures on top of the main dam feature are left unclassified (class 1). This approach has been confirmed multiple times by USGS. The top left image shows the dam in Esri base imagery. The top right image shows the DAM in the bare earth DEMs along with the location of a profile in red. The bottom image shows the profile location in the lidar point cloud (class 1-grey, class 2-orange, class 7-red, class 9-blue, class 10-purple).

Table 12-Elevation evaluation of the seven remaining water bodies identified as “too deep” in block 1.

FID # in Edit Call Shapefile	Minimum difference between breakline elevation and lidar elevation	Average difference between breakline elevation and lidar elevation	If Dewberry could modify the feature any further
1	0.7 m	1 m	Yes, Dewberry has raised the feature by 0.5 m
26	0.2 m	0.8 m	No, raising the feature may introduce floating “between” the vertices along the line. Dewberry in general does not raise elevations on breakline features which are within ~ 0.2 m of the lidar surface to allow for a buffer and ensure floating is not introduced.
27	0.1 m	0.4 m	No, see comment above
16	0.07 m	0.4 m	No, see comment above

0	0.17 m	0.5 m	No, see comment above
8	0.5 m	0.7 m	Yes, Dewberry has raised the feature by 0.3 m
5	1.3	1.5 m	Yes, Dewberry has raised the feature by 1.1 m

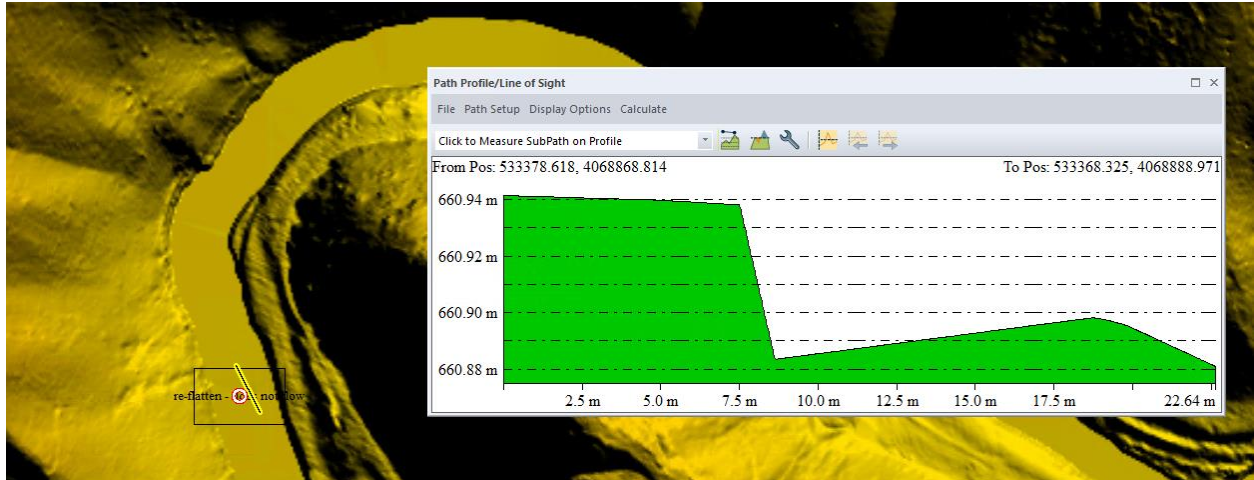


Figure 7-USGS identified a monotonicity discrepancy of only ~ 2 cm. Dewberry has re-flattened this section of river.

Summary

Dewberry has reviewed the USGS QA reports for VA FEMA NRCS blocks 1 and 2. As outlined in the tables above, we have further adjusted the data based on several of these calls, even if the call was minor and Dewberry feels the data are within thresholds for QL2 data. However, many calls were not addressed based on guidance from USGS during our webinar on July 18, 2019 or if Dewberry could not identify the issues noted by USGS.