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Dewberry Response to USGS Review of the Commonwealth of Puerto Rico QL2 Lidar Project

Produced for U.S. Geological Survey

USGS Contract: G10PC00013

Task Order:G15PD00885

Report Date: 7/9/2018

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Executive Summary

The primary purpose of this project was to develop a consistent and accurate surface elevation dataset derived from high-accuracy Light Detection and Ranging (Lidar) technology for the USGS Commonwealth of Puerto Rico Lidar Project Area.

The lidar data were processed to bare-earth digital terrain models (DTM). Detailed breaklines and bare-earth digital elevation Models (DEMs) were produced for the project area.

Deliverables for this project included classified point cloud data, bare earth hydro-flattened digital elevation models, intensity images, breaklines, control points, metadata, project report, and project extent shapefiles.

The USGS' review of these deliverables resulted in one metadata call, twenty bridge error calls, three elevational oddity calls, sixteen hydro issue calls, four building removal calls, and three vegetation calls.

PROJECT AREA

Data was formatted according to tiles with each tile covering an area of 1500m by 1500m. A total of 1995 tiles were produced for interim delivery of this project.

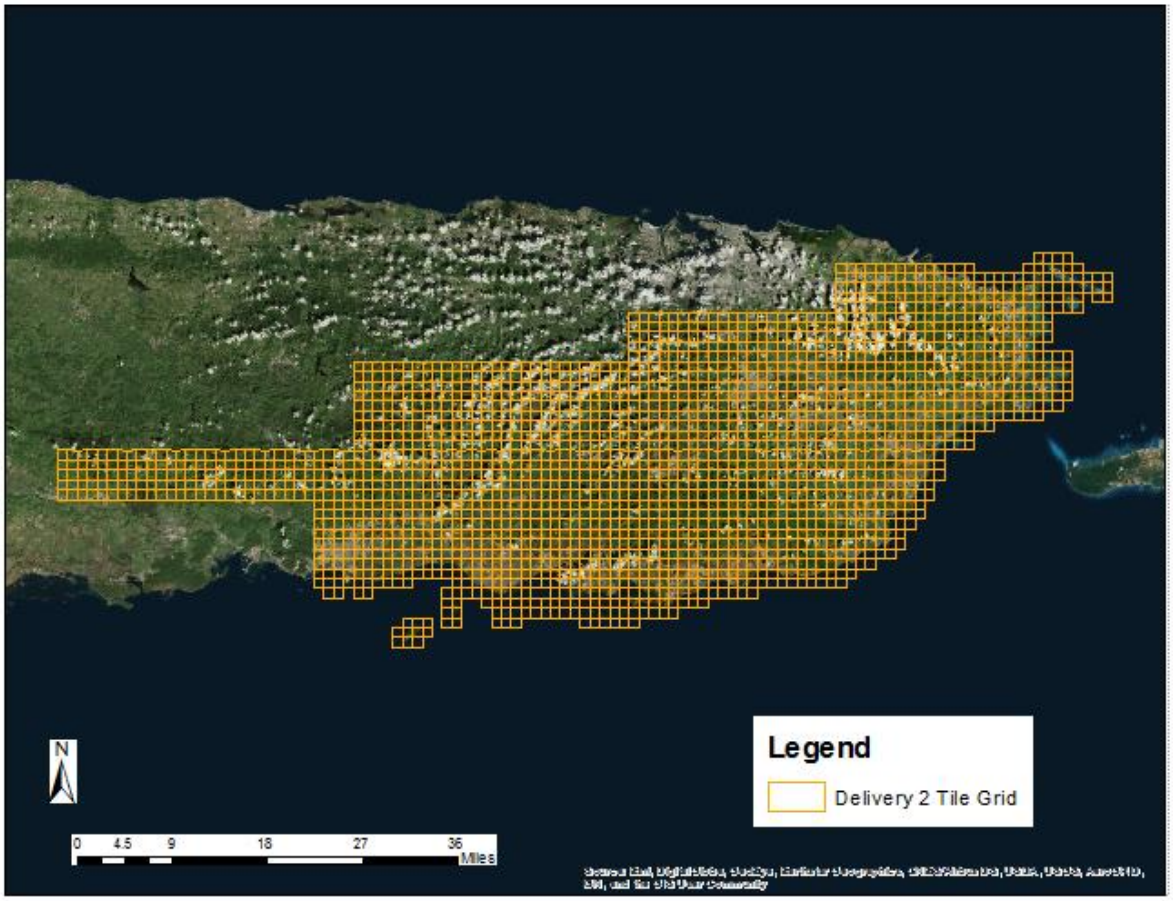


Figure 1- Project Map

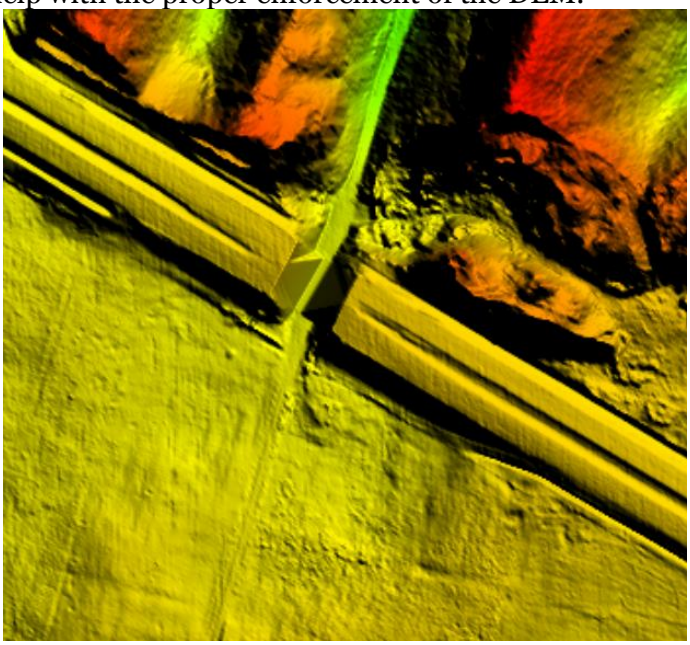
Edit Calls

METADATA CALL

USGS' Quality Assessment report states that the reports and metadata reference NAVD88 instead of PRVD02. Changes were made to the metadata and reports to reflect this. The data was left as is because it was already in PRVD02 Geoid 12B.

BRIDGE CALLS

USGS identified several areas where bridges did not get removed completely or still had saddles in the DEM. Dewberry reviewed each location, removed more ground if needed, and added bridge breaklines to help with the proper enforcement of the DEM.



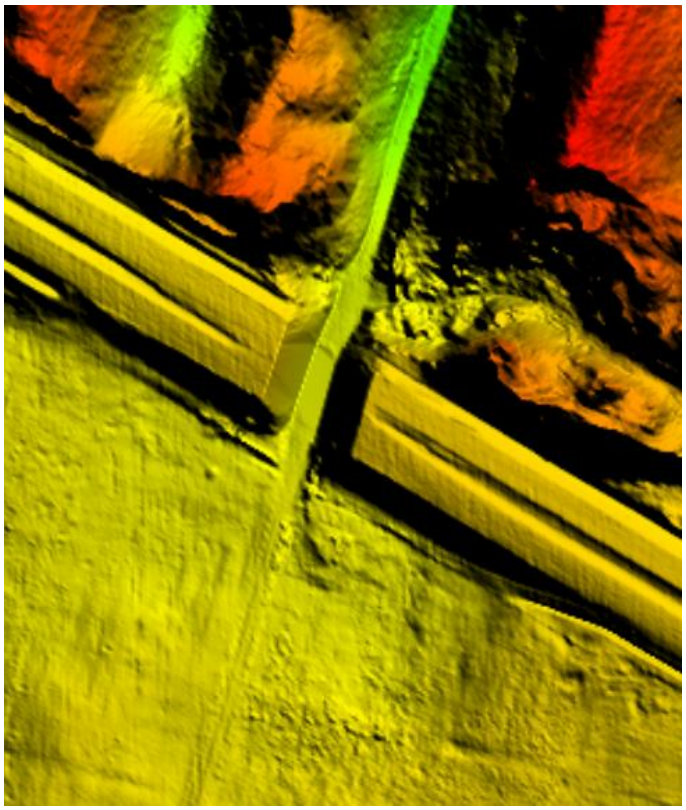


Figure 2- Incomplete bridge removal in top DEM. Bottom DEM has been enforced with bridge breaklines to help remove saddle.

ELEVATION ODDITY

USGS identified three locations that had odd elevation shifts. In addition to these three areas, Dewberry performed a close review of all the data to identify any other areas that might have this problem. Two other locations were also identified and all areas were sent to the acquisition provider to perform calibration adjustments to the data to remove the issues. In addition to these areas many other smaller areas where identified where edits needed to be made to remove small difference between flight lines of data. All these areas had localized offsets which only needed to be trimmed due to edge of flight line variability and re-grounded to make a complete and continuous data set. Because some of the edits occurred in delivery 1, a full delivery of both parts was provided.

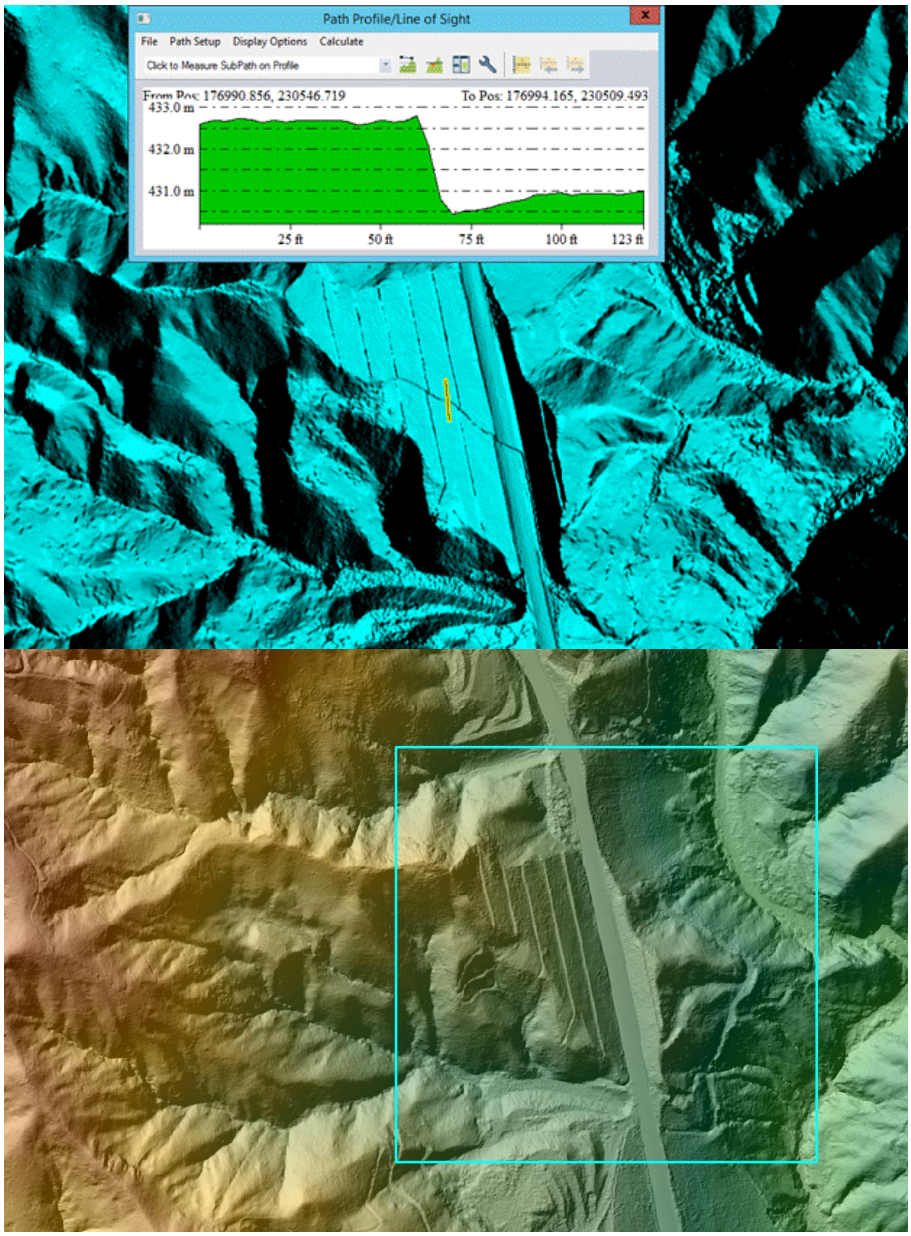


Figure 3- Top image shows the identified data shift in the DEM. Bottom image shows the corrected area with no shift present in the DEM.

HYDRO-FLATTENING OF THE DEM

The USGS review identified 16 water body issues. They ranged from tinning in rivers along with unexpected drops and monotonicity errors. Also a few river areas over 100ft and a lake over 2 acres where identified to be collected.

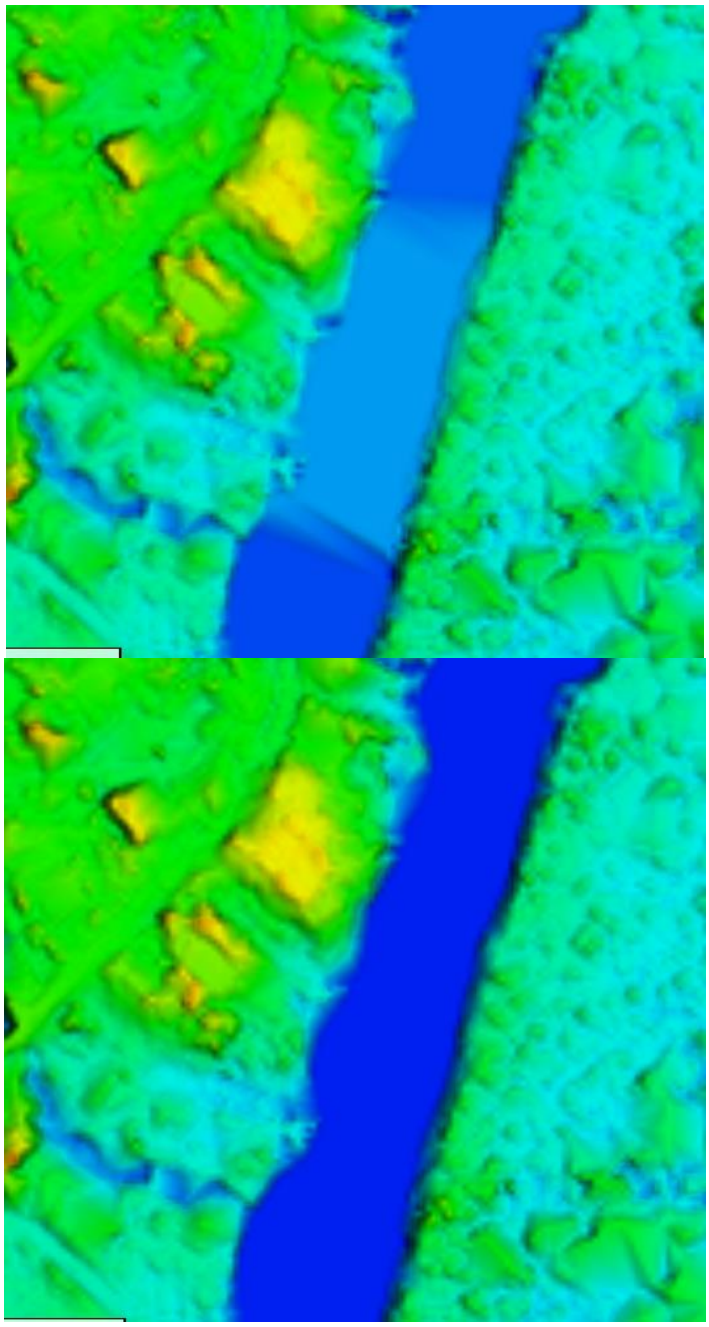


Figure 4- Top image shows one feature identified by USGS- it has a tinning and monotonic flow issue. The bottom image shows it smoothed out and correctly flattened.

Some of the USGS hydro calls were for tinning along river features. While Dewberry tried to minimize these areas of tinning or make adjustments to them, not all tinning could be completely removed. Most of tinning that is still present occurs in locations with a sudden change in flow or sudden drop in elevation. To try to maintain consistency along the banks and prevent the river edges from floating or digging excessively, the breaklines' elevation must closely follow the shore. This can lead to some parts of the river looking like Figure 5. In all

cases if the tinning could not be removed it at least needs to be monotonic. In order to completely smooth these areas would require using additional breaklines at the top and bottom of the elevation change and split the river into two parts. This would also create a hard drop from one elevation to the next instead of the more continual flow. Dewberry opted for more continual flow instead of large, hard elevation drops in some of these locations.

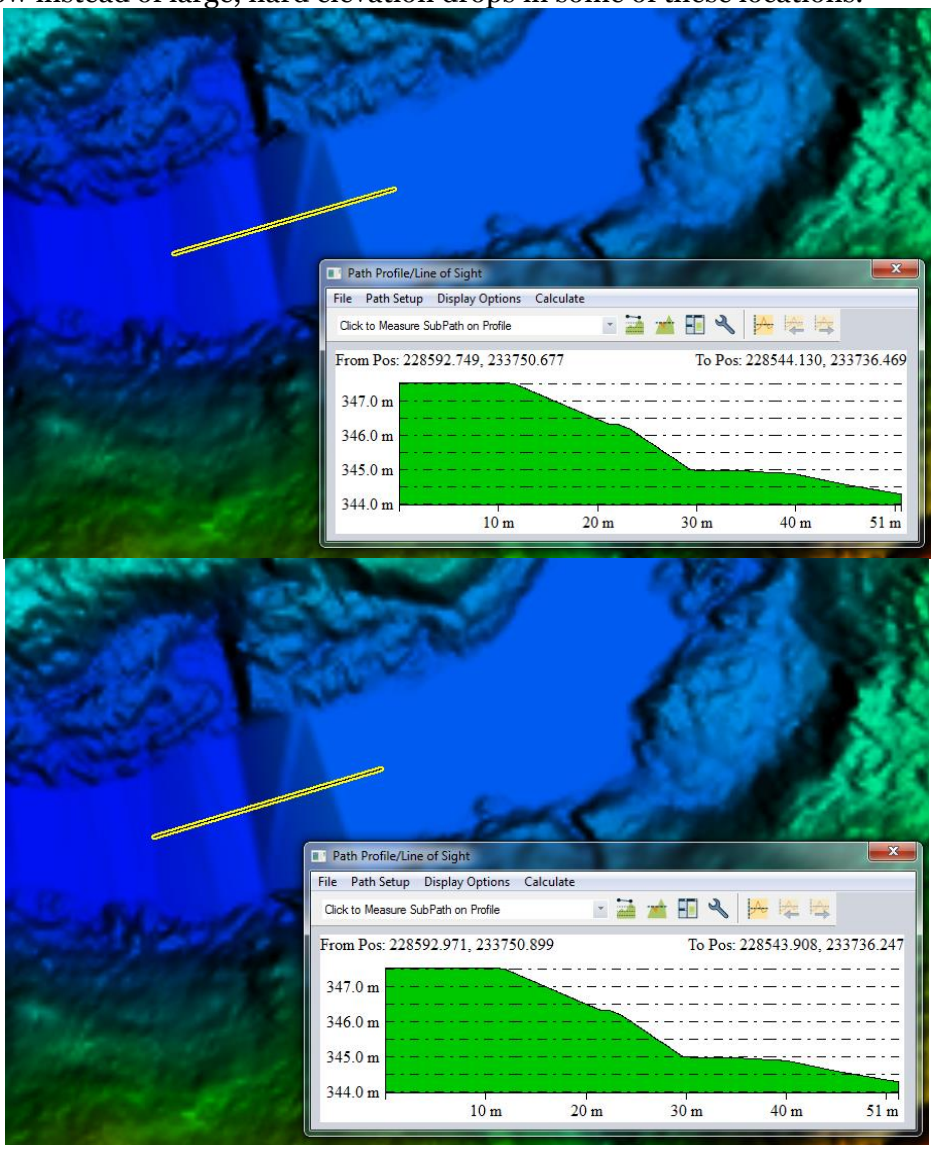


Figure 5- Top image shows one feature identified by USGS as exhibiting tinning. The bottom image shows the DEM after attempts to remove some tinning. Both still model almost identical and as noted in the cross sections, still flow in the proper direction with no unexpected rise or sinks.

MAN-MADE FEATURE

USGS identified four buildings still left in the ground classification. Three of the buildings were re-classified from ground (class 2) to unclassified (class 1) and new DEMs were created. The last one was left as is because the identified features are bunkers. Normally, bunker structures are treated as the ground since they are earth covered and mostly in-ground.

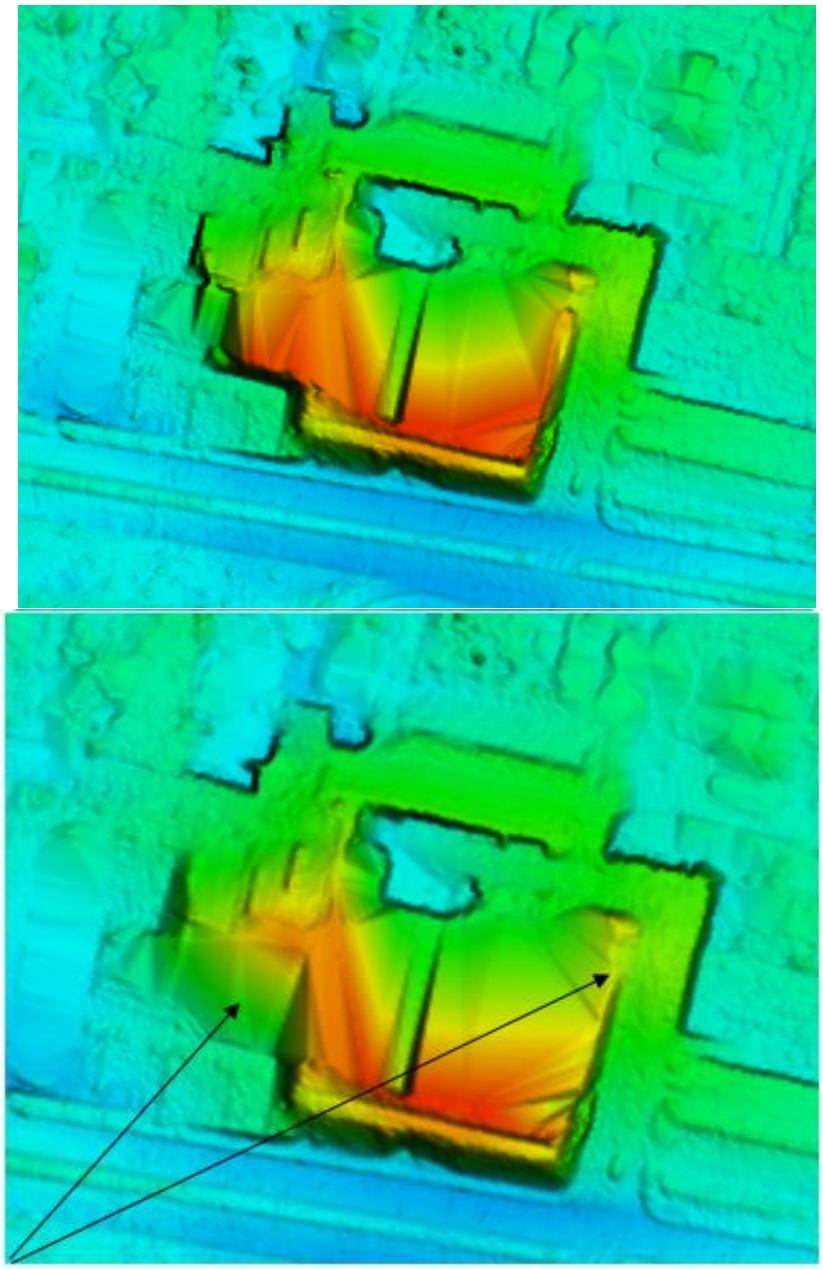


Figure 6- Top image shows a man-made feature was visible in the bare earth DEM. Bottom image is the corrected DEM and shows the man-made features (black arrows) have been re-classified from ground to unclassified. Because this structure is built on top of and next to raised ground some higher points are still present since aggressive removal would result in some of the valid ground next to the edge of the building being removed.

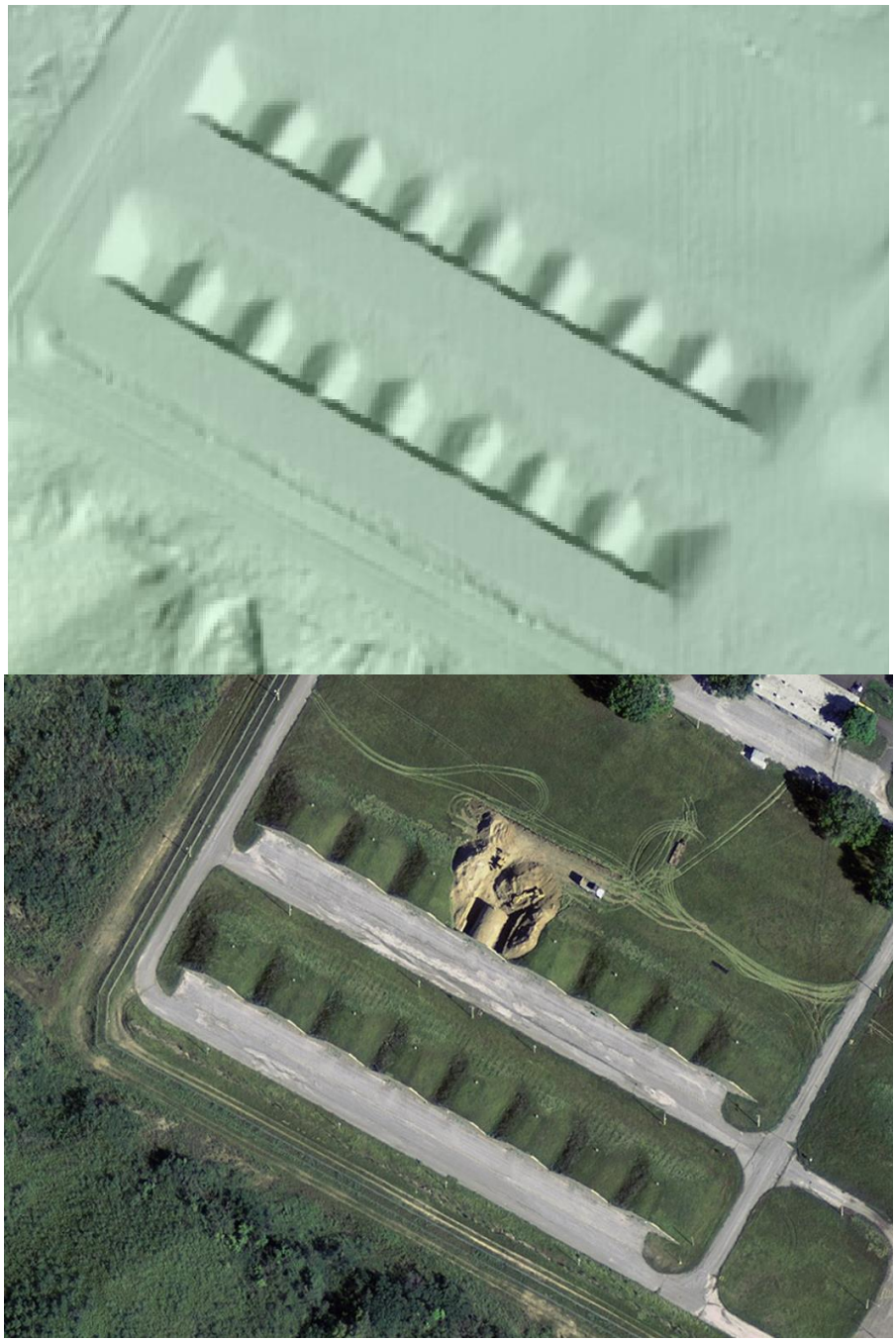


Figure 7- Top image shows man-made bunker features were visible in the bare earth DEM. Bottom image is the aerial image showing them as ground covered bunkers that should remain as ground.

VEGETATION CALLS

USGS identified three places that still had vegetation classified as ground. Dewberry went into each location and classed any remaining vegetation found from ground (class 2) to unclassified (class 1) and new DEMs were created.

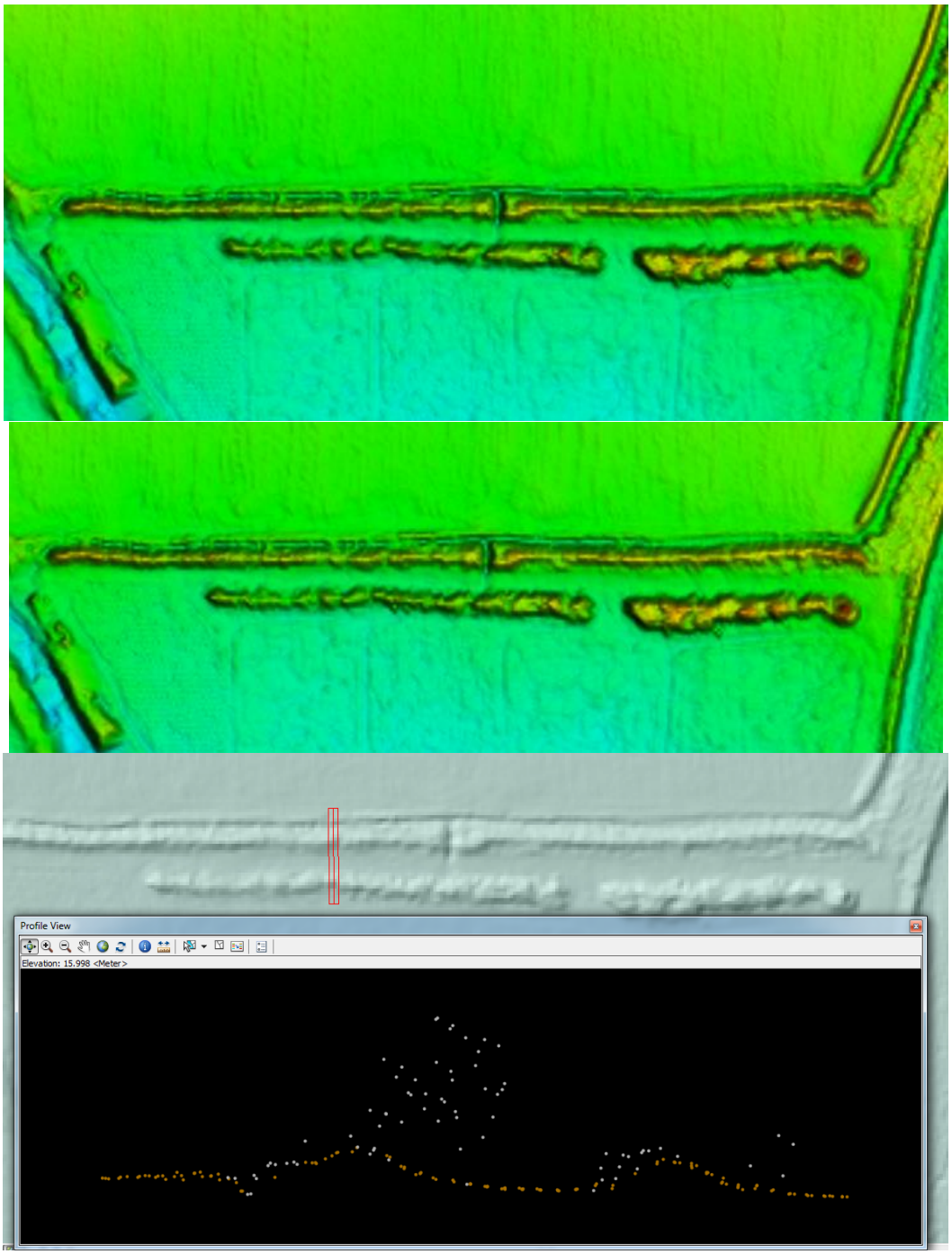


Figure 8- The classification of vegetation on top of two berms. The top image shows the original DEM. The central image is the redone DEM after reworking the berms and vegetation in the areas. The bottom image shows a cross-section of the berms with the re-classed points. In the cross-section ground class 2 is orange, and unclassified class 1 points are grey.

Summary of Edit Calls

- There was one metadata edit call to change the name of the vertical datum from NAVD88 to PRVD02. This change has been applied to the project report, metadata, and survey report.

- There were twenty bridge calls; all have been adjusted and corrected.

- Three elevation issue calls have been adjusted and corrected.

- Sixteen hydro issue calls have been adjusted and corrected as much as possible; some tinning still remains due to rapid and large elevation changes along some portions of streams.

- Three of the four man-made feature calls have been adjusted to remove the structures from the ground classification. One call has been left as is because it represents earthen-covered bunkers.

- Three vegetation call were reclassified as best as the point cloud allowed and are corrected.