Elevation QC Report

Project: OR_Klamath-River_2010

Contractor: Woolpert Inc. & Watershed Sciences Inc.

Data Delivery Date: 04/20/2011 **Date Data Reviewed:** 05/17/2011-05/24/2011

Reviewer: Jeremiah Vinyard-Houx **Total Square Miles Reviewed:** 2811.4

Elevation Type: LIDAR **Format:** .img **Grid Spacing:** 3X3 ft. **Tile size:** irregular

Projection: SPCS **Zone:** California 1 **Datum:** NAD83 **Units:** Feet

Licensing: Public Domain **Metadata:** Project Level

Materials Received:

- Mass Points
  - Classified; LAS files
  - Bare Earth; LAS files
- Metadata
  - autoCAD; project level xml
  - LiDAR; project level xml
  - Bare Earth Raster Arc Grid files; tile level xml
  - Data Dictionary; Word Document
  - Survey Report; PDF
- Indicies
  - Boundary; Shapefile
  - Index Map; GDB
- Terrains
  - ESRI Terrain and other ancillary layers; GDB
- Breaklines
  - Line Features; Shapefile
- Other
  - AutoCAD files: Bridges, points, contours, DTMs; DWG's, html & xml data
  - Bathymetry Data; GDB
  - DEM's by delivery; GDB
  - 3 band ortho Imagery; GDB, SID, TIFF, html & xml metatdata
  - Intensity Imagery; TIFF, html & xml metadata
  - Infrustracture dataset; GDB
  - Mapbook; mxd's, PDF's, GDB

Vertical Accuracy Test Performed: No **Test Point Source:** Contractor **RMSE:** .098 ft(.030m)

Vertical Accuracy Test Notes:

RMSE reported also from QA report.
Target Resolution= greater or equal to 0.74 points/ft^2 or 8 points/m^2
Target Vertical Accuracy (1 sigma)= <15 cm
Acheived Resolution= 0.76 points/ft^2 or 8.16 points/m^2
Acheived Vertical Accuracy=5.5 cm (0.179 ft)

NGTOC *Estimate of Density:
Average Density= 1.24 points/ft^2 or .9 NPS (ft) **see figure 2
Density Shapefile avaliable in the NED>Error folder
***(for each las tile the total number of returns divided by tile area)**
Conclusion: data is of acceptable density and vertical accuracy.

QC Review Summary:

Projection Summary:
Projection: California State Plane, Zone 1 NAD83 (HARN)
Datum: NAD83
V-Datum: NAVD88 Geoid09
Units: U.S. Survey Feet

Project Area of 2811.4 sq mi is reported in the Native Projection of CA State Plane zone 1 (from Global Mapper).

Project Level Metadata is located in the metadata>documents folder. Tile level xml files are located in their corresponding folder in Be_raster.

The data is largely free of major errors, though no hydrologic treatment was evident in the delivery. Corrections made included the leveling of large waterbodies (this includes reservoirs that maintained a constant elevation, see figures). There was also a small datavoid which was patched in Global Mapper with a method similar to that used to level waterbodies (the data void was small enough and flat so that a constant elevation fix was acceptable, see figure).

The only major issue with the data is the actual klamath river; it is evident that the dataproducer did not exclude points within this drainage feature with the use of constaining breaklines. Thereby, the river contains a large amount of noise from returns classified as Bare Earth used to grid the DEM. Moreover, due to LiDAR's interaction with water some areas of the stream have very few returns; this leaves selveral sections of the river with a very "tinny" appearance and other with a rough surface due to a larger number of returns classified as Bare Earth. See figure 10. This issue was mitigated in constant level area's by digitizing water polygons and leveling these features to a specific elevation (flat reservoirs and lake/ponds). The klamath rivers graded sections can not be completly cleaned up due to current limitations of avaliable software. These areas can be fixed with full licenses of LiDAR specific software including LP360, MARS, EarthEye, etc.. where breaklines and mass points can be easily manipulated to enforce smooth water surfaces with elevations derived from either the breaklines themselves or perpendicular shore elevations.

The final deliverable for the NED is a single .img file (with .ige support due to large file size) bounded by the project area. A project footprint file generated in arcMap is also present in the Final Deliverable to NED folder.

Provided hydrological issues are accaptable, it is recommended that this data is accepted for the NED.

LiDAR Quality Control (QC) Review Process

Preparation:

-Metadata reviewed to determine data projection, datum, format, etc.
-If ARRA contract, check for raw .LAS files, classified .LAS files, breaklines, blind control points, and DEM in Image or Grid format
-Open data in Global Mapper

Vertical accuracy testing:

-If ARRA contract, use Vertical Accuracy Test Worksheet to perform RMSE on 20 blind point positions provided by contractor

Inspection and Correction of data:

-Minimum and maximum elevations in dataset; correct if in error
-Appropriate hydro flattening as specified in V12 Lidar Specification (For ARRA/GPSC Data)
-Data void areas
-Data spikes
-Tile edge seam lines
-Non-bare earth surface artifacts (structures, bridges, vegetation, etc.)
-Elevation errors - raised/lowered areas/tiles
-Other surface treatment anomalies
-Check DRGs for correct elevations and horizontal positioning (if test points not available)
-Create footprint (project boundary) shape file and establish square miles

During Inspection, identify data errors and create "error" file folder:

-Capture geo-referenced JPG or TIFF image(s) of identified errors
-Copy to Error file

During Inspection, level elevations and remove artifacts (these two steps not done for ARRA data):

-Level smoothing to remove non-bare earth surface artifacts (structures, bridges, vegetation, etc.)
-Level data spikes where possible

Export image files and create project Elevation QC Review Report:

-Export ERDAS Imagine image files in native projection and resolution
-If ARRA, Copy Vertical Accuracy Test Worksheet into QC Report
-Place QC Review Process and Project Area Extent into QC Report
-If rejected, attach sample geo-referenced JPG or TIFF error images with an explanation of reason
-If rejected, restart QC process when replacement data is received
-Provide completed Elevation QC Review Report to Elevation Supervisor for final viewing
-Add QC Report, footprint, Imagine image(s), and Error file to original data file for final shipment to EROS

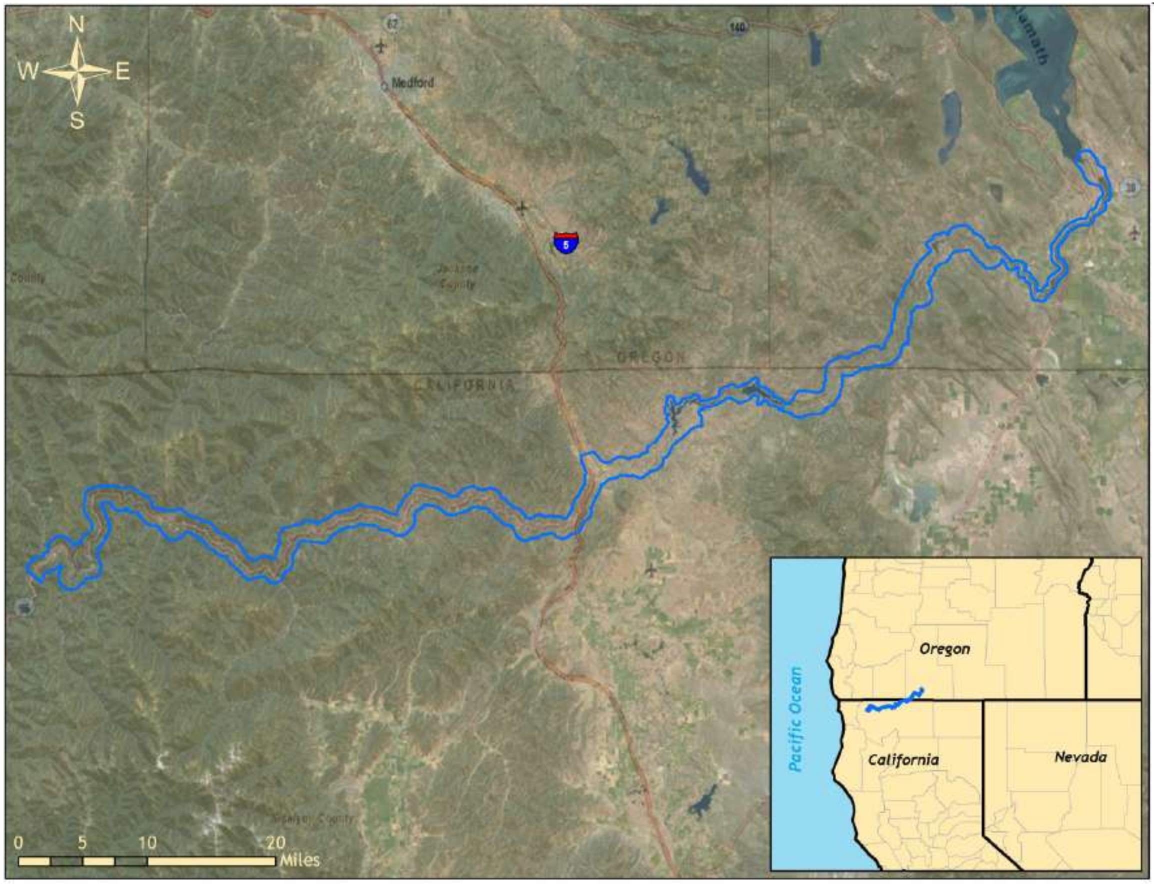

Figure 1: Project AOI

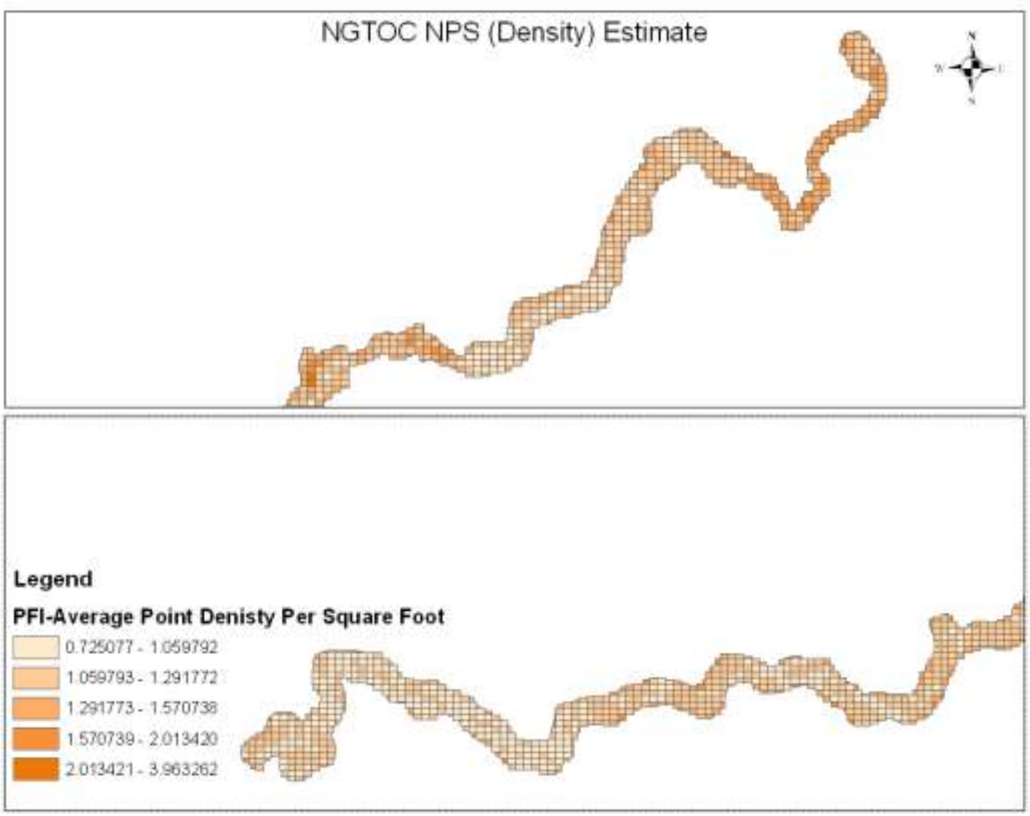

Figure 2: NGTOC Density Estimate (each polygon represents the boundary of a single .las file, i.e., estimate is calculated on a per .las file basis).

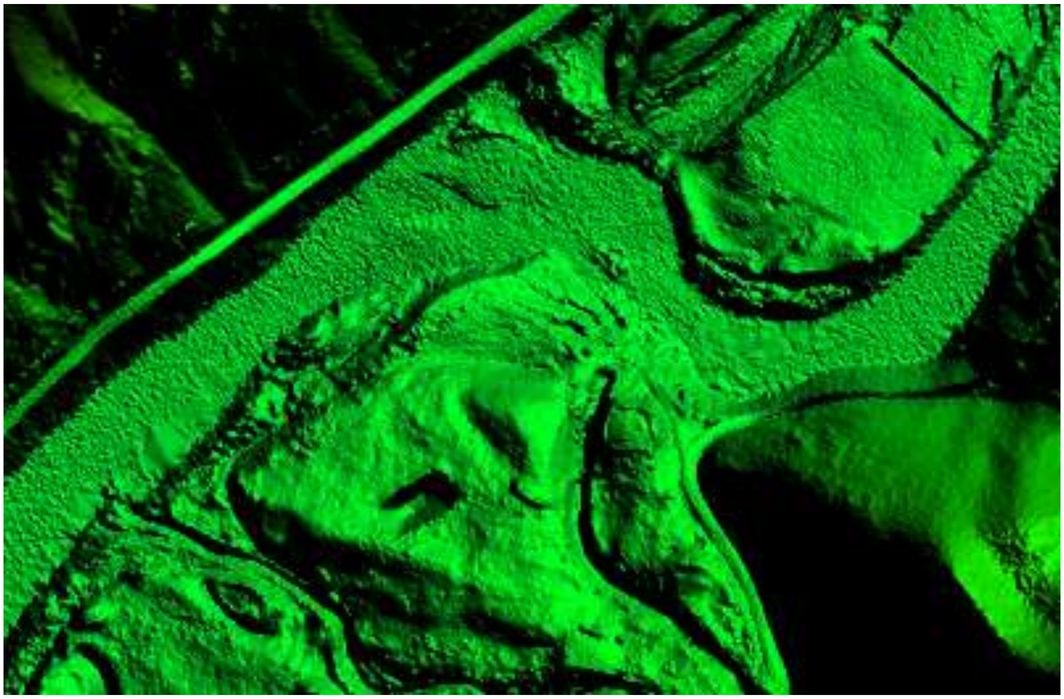

Figure 3: Klamath River (no break line enforcement on this double line stream feature)

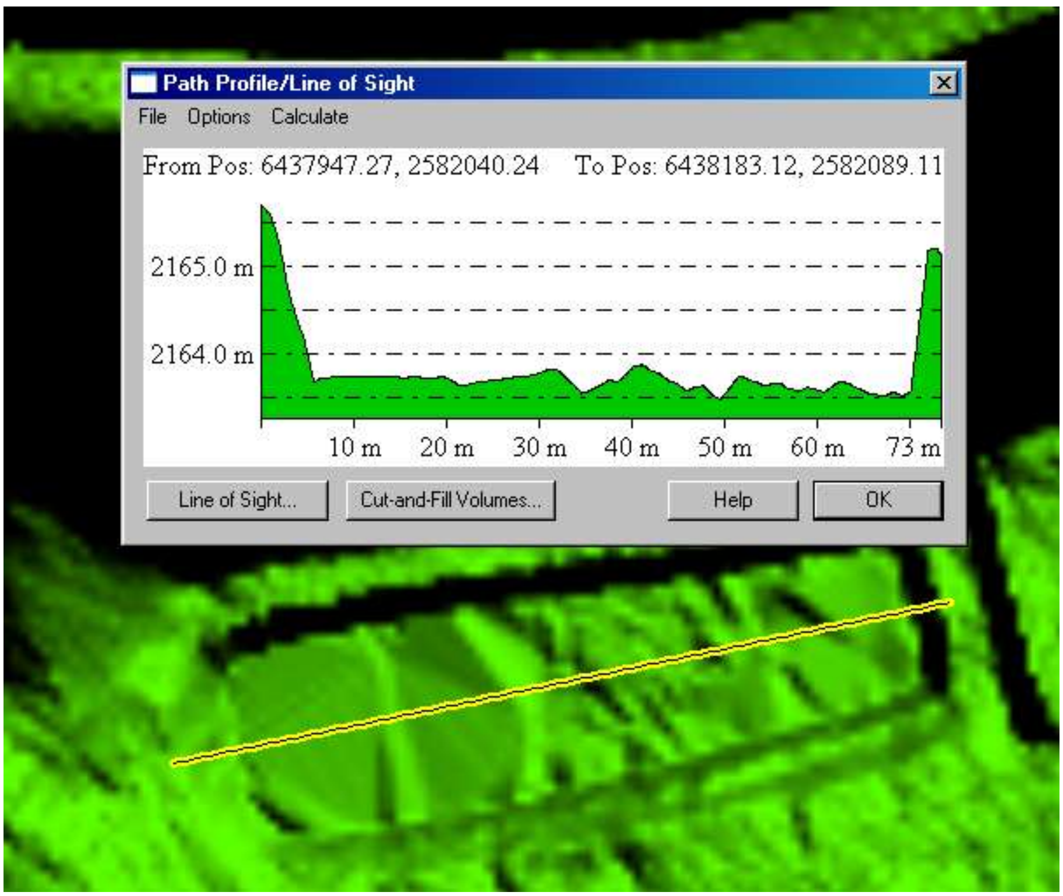

Figure 4: Waterbody not flattened

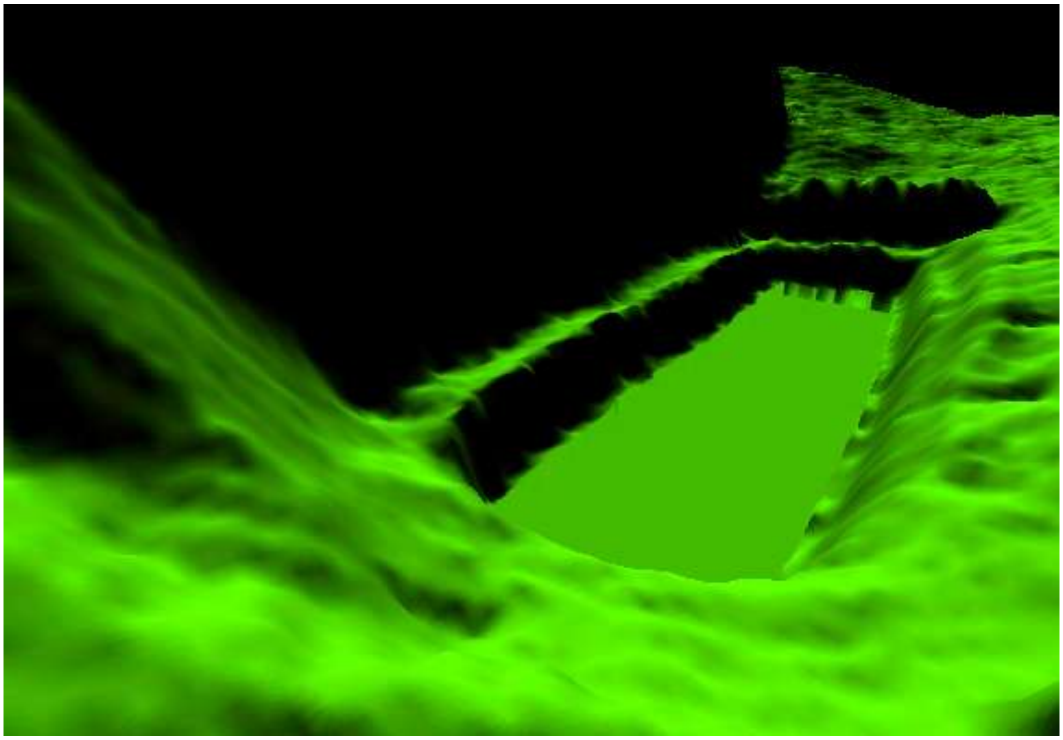

Figure 5: Waterbody After Flattening

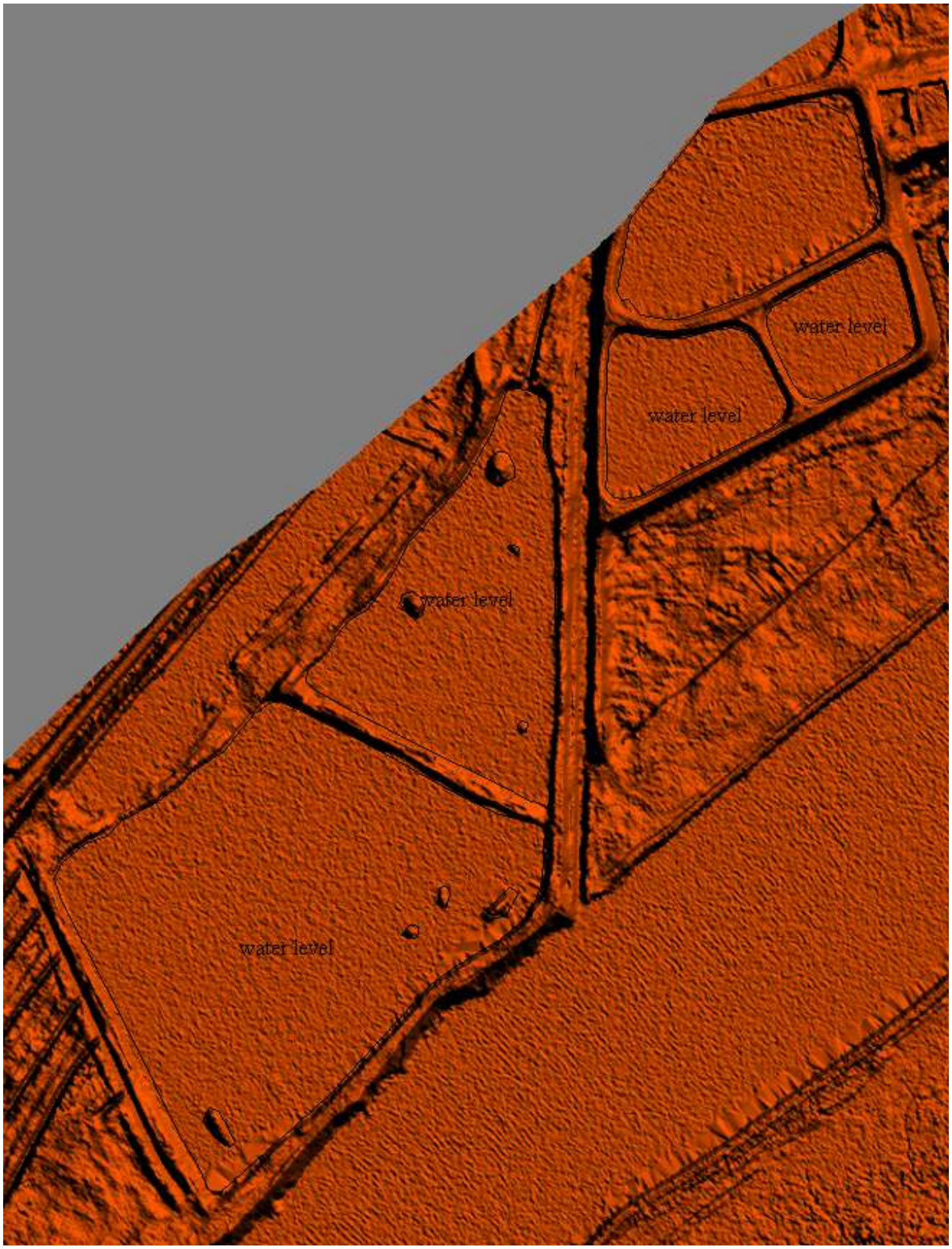

Figure 6: More Unflattened Waterbodies

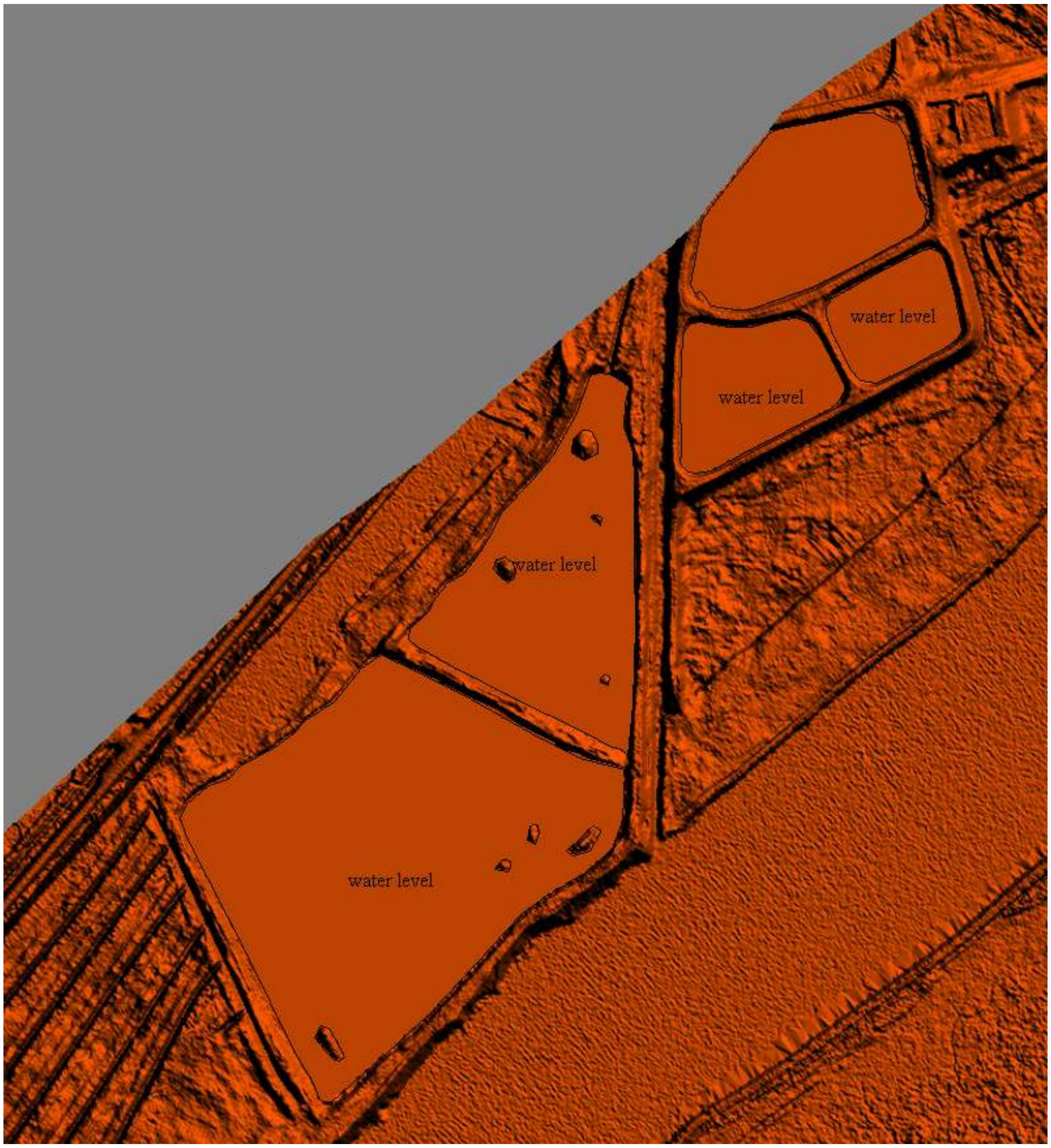

Figure 7: Waterbodies After Flattening

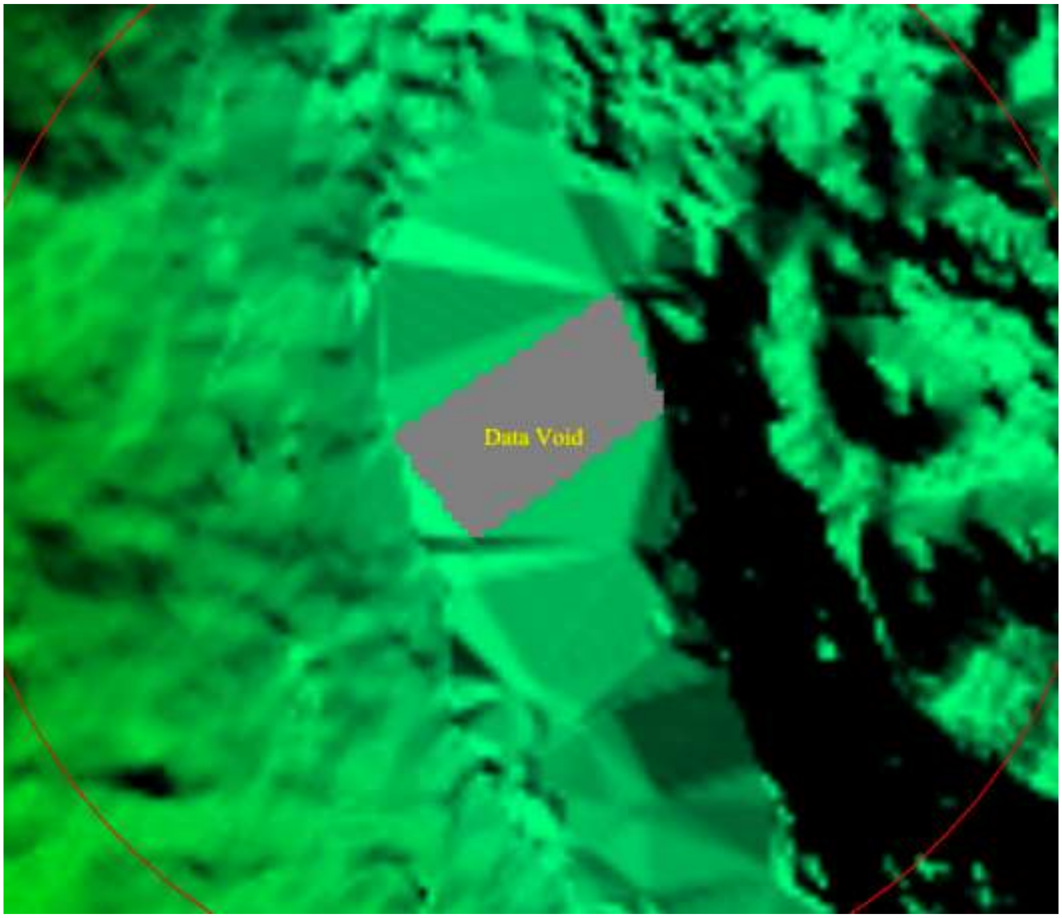

Figure 8: Data Void in Stream

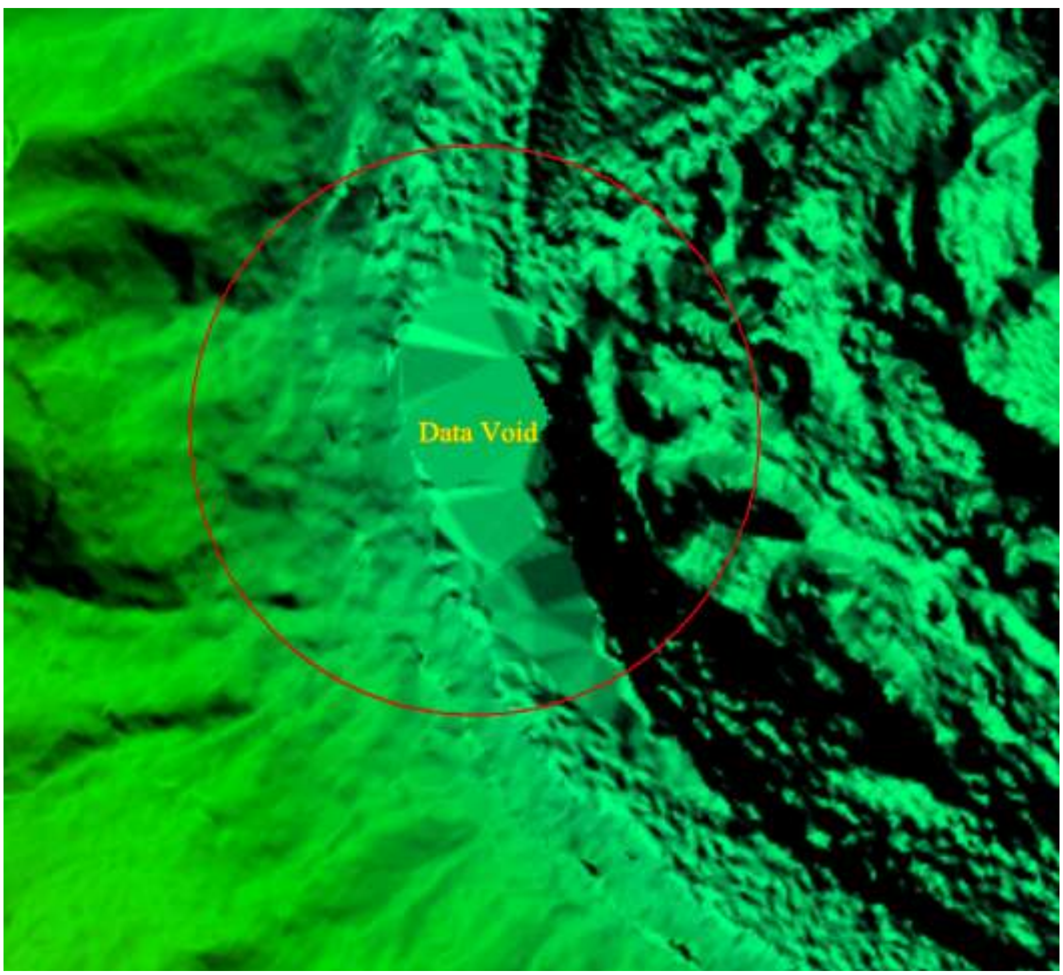

Figure 9: Filled Datavoid

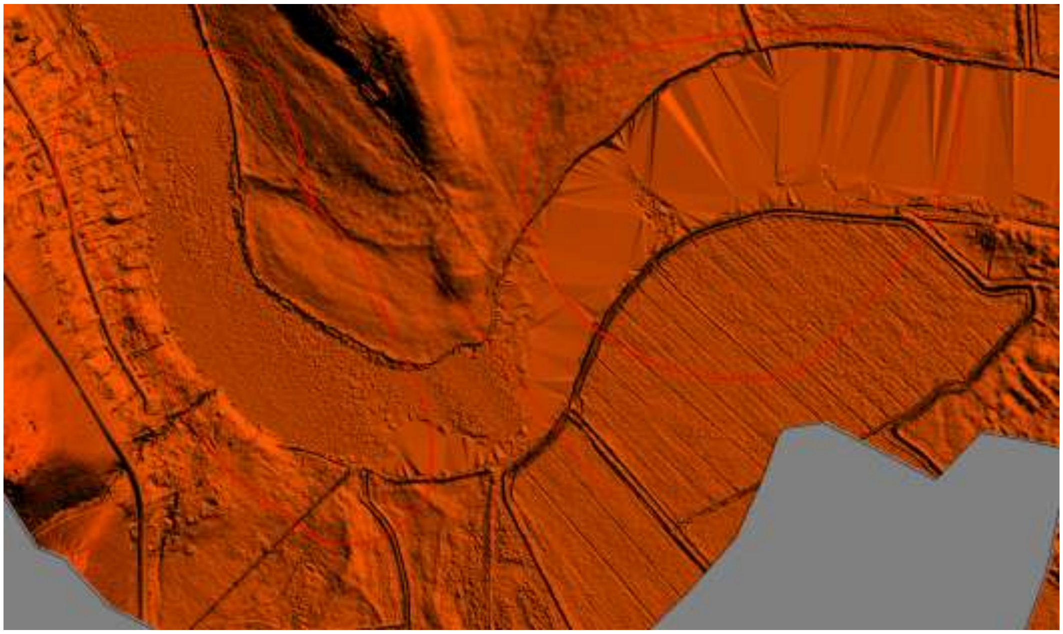

Figure 10: Surface created from points of variable density in stream area, this is why breaklines should be used.