ENTIRE COAST REPORT

FOR

CALIFORNIA COASTAL DATA MERGE QUALITY ASSURANCE

Prepared by:

GEOMATICS DATA SOLUTIONS

AS PART OF THE WOOLPERT TEAM
CONTRACT EA133C-11-CQ-0010

WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE

for:

NOAA CSC

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1. EXECUTIVE SUMMARY

A merged topographic-bathymetric dataset and products of California's shoreline were provided to NOAA CSC by Dewberry under a separate contract. The delivered dataset will be used by local, state and federal agencies, NGOs, and the public to aid in adaptation to sea level rise, mitigation impacts for natural hazards, storm surges, and flooding, and preservation of coastal habitats and resources. The Ocean Protection Council (OPC) also hopes to foster more research and to improve predictive modeling and analysis using the delivered merged dataset.

Geomatics Data Solutions, LLC (GDS) were subcontracted through Woolpert, Inc. by NOAA Coastal Services Center (CSC) to perform quality assurance (QA) for the California Coastal Data Merge project under contract EA133C-11-CQ-0010.

The coastline was split into 4 blocks, and each area was reviewed on a block by block basis. A QA report was generated for each block during this process. This report covers the final delivery of the entire data set. The document describes the QA processes conducted for the data during the project to ensure the deliverables met the requirements described within the California Coastal Data Merge Project QA SOW (March 6, 2012).

At this time, the entire dataset is complete and accepted.

Table 1: Summary of Data Acceptance

Product	Accepted (Y/N)	Comment
Merged Point Dataset (LAS)	**Y**	
Merged DEM	**Y**	
Vertical Accuracy Layers	**Y**	
Breaklines & Ancillary Data	**Y**	
FGDC Compliant Metadata	**Y**	
Report of Survey	**Y**	

2. MERGED POINT DATASET (LAS)

The merged point dataset was delivered in LAS 1.2 data format, with one file for each 1500m x 1500m tile.

2.1. FORMAT CHECK

GDS ran checks to verify that LAS files existed for every tile in the dataset, and also verified the LAS format met requirements. Checks included:

- Check file exists
- Public Header Includes all required fields
- Point Record Format = 1
- Has a GeoKey Directory Tag
- Correct Datum is defined
- Min and Max Points in the file match those in the LAS header
- Valid Classification numbers exist
- Adjusted GPS time is correct

All data are correct.

2.2. VERIFICATION OF SPATIAL EXTENTS

GDS used an in-house utility to compare the LAS file points to the associated tile extents. No issues were noted in this regard.

2.3. VERIFICATION OF CLASSIFICATION

LAS Data were compared to the seam lines provided by Dewberry, in order to ensure there were no gross errors in classification.

To do this, bounding polygons were created using the boundary and seam line feature classes provided for each area in the "Ancillary" geodatabases.

The polygon boundaries were then used to verify that:

- Class 2 (topo ground) data were shoreward of the Bathy/Topo Seamline provided by Dewberry
- Class 22 (submerged bathy data) were found between the bathy/topo seamline and the bathy/acoustic seamline provided by Dewberry
- Class 25 (submerged MBES acoustic data) were found offshore (or within) bathy/acoustic seamlines provided by Dewberry.

In addition, the following verifications were conducted:

- Verify all class 21 (non-submerged bathy) is covered by topo data or is higher than 1m. Any areas with points less than 1m in height should be covered by topo data, or are erroneous points manually classified by Dewberry.
- Verify all class 23 (ignored submerged bathy/overlap) is offshore of the bathy/acoustic seamline (i.e. in an area of acoustic data), or a standalone point inside of a valid void polygon.
- Verify class 26 (ignored multibeam acoustic/overlap) data do not fall inside void polygons.
- Verify no bare earth data (class 2, 22 and 25) fall within the void mask, unless they are standalone points.

Prior to performing any checks associated with the void mask, the void SHP file was examined to ensure no polygons with areas less than 225m^2 in size remained. No issues were noted in this regard.

Results of these checks are provided in Table 2, below. During the course of the project any erroneous points were provided to Dewberry in a geodatabase to highlight areas for correction. All identified issues have been corrected and the dataset is complete.

Table 2: Block2 - Classification Check Results

Verification Test	Points Outside Bounds	Pass (Y/N)	Comment
Class 2	N/A	**Y**	
Class 22	N/A	**Y**	
Class 25	N/A	**Y**	
Class 21	N/A	**Y**	
Class 23	N/A	**Y**	
Class 26	N/A	**Y**	
Bare Earth Data in Void	N/A	**Y**	

3. MERGED DEM

The merged DEM dataset was delivered in ERDAS Imagine format with one file for each 1500m x 1500m tile. Two sets of DEM files were delivered, one with voids and one with full interpolation between the gaps.

3.1. FORMAT CHECK

GDS ran checks to verify that IMG files existed for every tile in the dataset, and also verified the IMG format met requirements. It should be noted that format checks were run on both the 'Interpolated DEM' and 'DEM with Voids' datasets. Checks included:

- Check file exists
- Cell X Resolution = 1
- Cell Y Resolution = 1
- Band Count = 1
- IMG is a floating point raster
- Row Count = 1500
- Column Count = 1500
- Correct Datum is defined for the IMG

No format issues were apparent in either the tiled or interpolated tiled datasets.

3.2. VERIFICATION OF SPATIAL EXTENTS

3.2.1. TILE EXTENTS

To verify the DEM tile extents were contiguous and no gaps existed between tiles, polygons were created for each raster extent. This extent was then erased from the project boundary, with the result being any remaining slivers between tiles. No slivers were found.

3.2.2. COMPARISON TO VOID MASK

The Tiled DEMs should have areas of No Data in those areas identified as voids represented by the void mask.

Firstly the Void SHP file was compared to the Void raster file to ensure the two matched. This was accomplished using ArcGIS Spatial Analyst. Analysis showed that the SHP and raster files matched.

The void raster was then compared to the DEM using ArcGIS Spatial Analyst. Analysis showed that voids in the DEM correctly reflected the Void Mask.

3.3. Comparison to Input Data

3.3.1. LAS Points to DEM

Bare earth points (class 2, 22 and 25) were extracted from the LAS files for each tile. These points were then compared to the interpolated DEM and difference statistics reviewed using the Fledermaus Cross Check utility.

During the review process, each blocks overall statistics were provided in the individual block reports. Each individual tile's statistics were also reviewed, and results provided. Tiles with higher standard deviations or large mean/median difference were further inspected in ArcGIS.

No issues are evident. All results are acceptable and indicate the DEM does not deviate excessively from the input data.

3.3.2. Smoothed Zone Check

Smoothing Boundaries were initially visually checked to ensure they existed in appropriate areas and did not cross jetties or other structures. All boundaries were suitable. Smoothed zones were also checked visually in Fledermaus, using a similar method to the edge check described in Section 3.4.2.

Bare Earth points (Class 2, 22 and 25) within the smooth bounding polygons were extracted from the LAS files. They were compared to the Interpolated DEM to ensure smoothing did not greatly misrepresent the source data. Results provided in the individual Block reports show that the data are well represented and the DEM is not overly smoothed.

3.4. DEM to DEM Comparisons

3.4.1. Interpolated v Non-Interpolated DEM

Due to the methodology used to create the DEM with Voids, it is not expected that any vertical differences will occur between the interpolated DEM and the DEM with Voids. To verify this, a surface difference was created between the Smoothed Tiles (DEM with Voids) and the Interpolated Smoothed Tiles (Interpolated DEM).

Results indicate no vertical differences occur between the interpolated and non-interpolated DEM.

3.4.2. Edge Check

As each individual tile DEM was created from an overall DEM, it is not expected that there will be any edge artifacts. However in order to conduct a thorough review, tile edges were visually inspected to ensure there were no steps or other issues between each tile boundary. Each IMG tile file was loaded into Fledermaus along with its neighbors. The profile tool was then used to inspect potentially complex areas to ensure there were no errors, as shown in Figure 1. In addition the vertical scale was exaggerated to allow potential issues to stand out. No edge artifacts were identified.

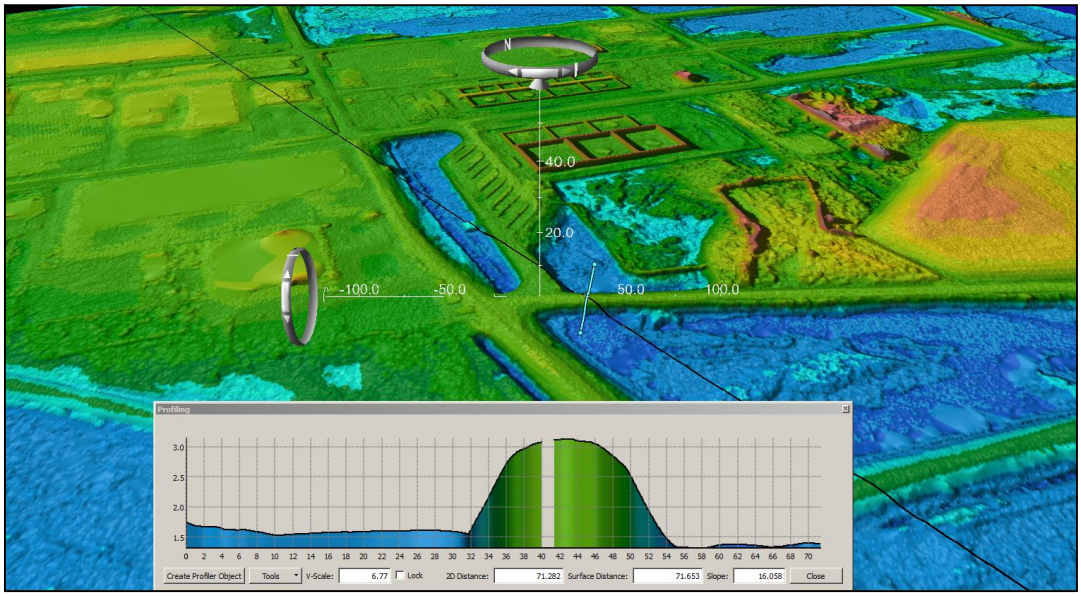

Figure 1: Tile to Tile Comparison in Fledermaus

3.5. VISUAL INSPECTION

During the edge check the DEM was also visually inspected. This highlighted issues such as edge artifacts at the limits of the topo data.

No issues remain in the dataset.

4. VERTICAL ACCURACY

Vertical accuracy layers were delivered in vector SHP file format and as 1m resolution IMG format files.

Comparisons were made between the vector and raster formats to ensure they represented the same information. No issues exist with the accuracy layers.

Additional checks were made to ensure the vertical accuracy layer matched the spatial extents of the DEM, such that every cell in the DEM with Voids had a corresponding Vertical Accuracy cell. No issues were noted.

5. BREAKLINES & ANCILLARY DATA

Ancillary data delivered included dataset seamlines (bathy-topo, bathy-acoustic and acoustic-acoustic polygons), tile grids and smoothing buffers. All ancillary data were clearly organized, in the correct spatial frame and legible in ArcGIS.

Breaklines were not used in this deliverable.

6. FGDC COMPLIANT METADATA

Metadata were delivered for the DEM, Accuracy and Void Layer products. GDS reviewed the metadata to ensure it met FGDC standards and included all mandatory fields. All metadata delivered meets FGDC standards and the information is complete.