APPENDIX E— TOPOBATHYMETRIC DEM DEVELOPMENT

INTRODUCTION

Production of the Apshawa Lake (South) topobathymetric digital elevation model (DEM) for Minimum Flows and Levels (MFLs) modeling involved the compilation of data from several sources. The bathymetric portion (Figure 1) was interpolated from a set of elevation points compiled from a number of sources; all elevation data were compared to MFL survey data to ensure an acceptably accurate and spatially consistent representation of the lake's bathymetry. The upslope portion of the DEM was clipped from the 2006-7 Orange County Light detection and ranging (LiDAR)-derived DEM developed for the South Florida Water Management District.

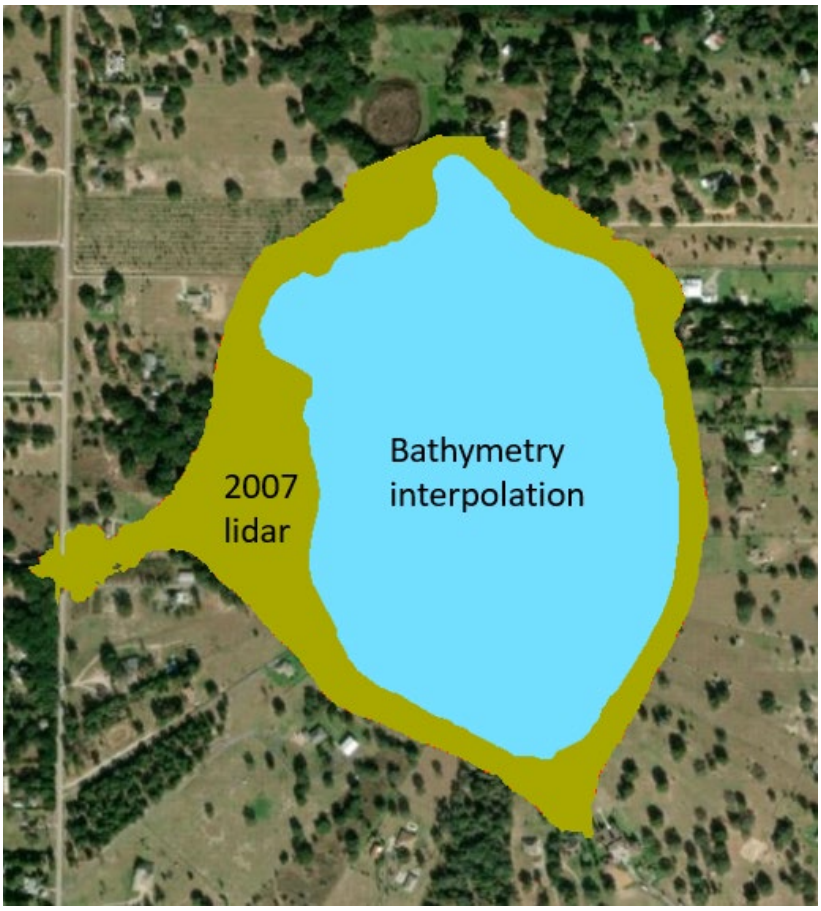

Figure 1. Lake Apshawa South topobathymetric digital elevation (DEM) development layout.

All geospatial work was completed in ArcMap 10.8.1. The final DEM is a 2 by 2-meter grid, spatial reference system NAD_1983_HARN_UTM_Zone_17N, horizontal units in meters (US). All original elevation data are in vertical units of feet (NAVD88). Two DEMs were produced, one in vertical units in feet, the other in meters.

BATHYMETRY

The bathymetric portion (Figure 1) was developed by interpolation combining several disparate bathymetry datasets that were either acquired or created using different methodologies (Figure 2). All lines (contours, digitized) were converted to points for interpolation. All data were validated against elevation survey transect data provided by the MFLs program in order to determine spatial compatibility of all data sources.

Bathymetric data list

The datasets used for the bathymetric DEM include the following:

1) Survey
    a. 2010 (2 transects collected for 2013 Apshawa MFLs report).
    b. 2020 additional field survey collected using standard MFLs methods.
2) Acoustic Doppler Profiler (ADP) data.
3) "Heads up" and automated digitized aerial photographs (source: SJRWMD and Google Earth)
    a. 2006
    b. 2013

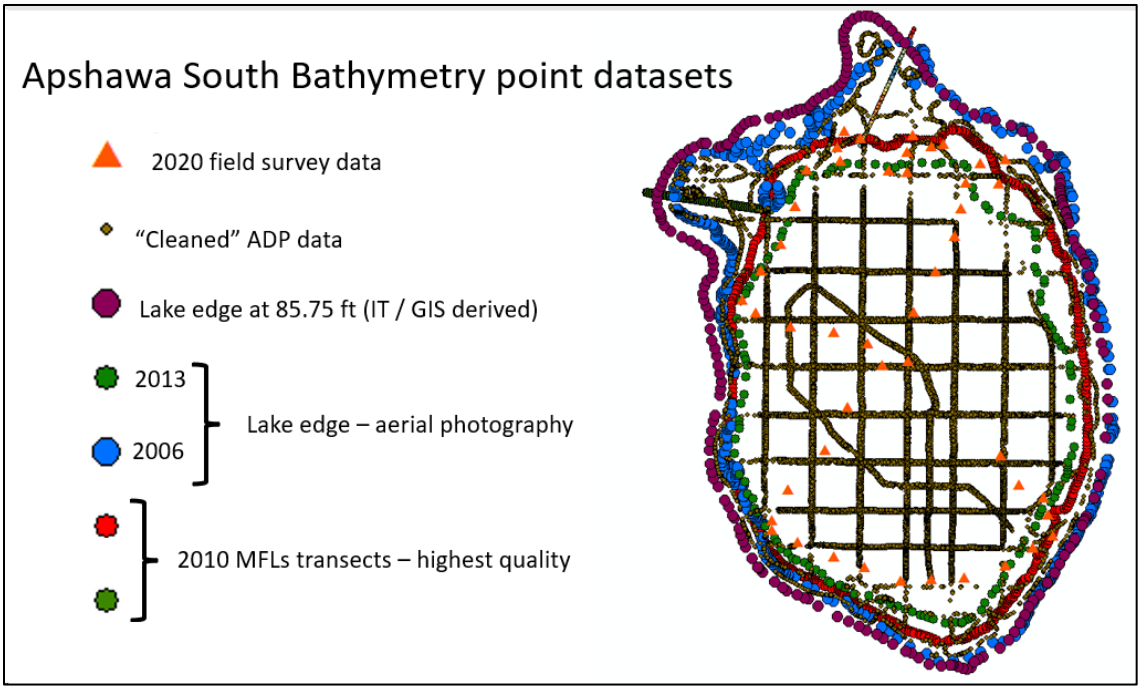

Figure 2: Bathymetry dataset details (Vertical Datum NAVD88)

Bathymetry data

The original 2010 survey data were collected by the MFLs team using standard survey techniques. This represents the standard for elevations (bathymetry) estimated for the lake and all datasets were validated or assigned elevation (digitized aerial photographs) as needed in comparison to these survey data.

Data for interpolation of bathymetry are shown in Figure 2. The original set of survey data provided by the MFLs team was collected in 2010 for the 2013 MFLs report (north and west sides of lake). A large dataset of points (depth soundings) collected using acoustic doppler profiler (ADP) methods was also available. These data were collected by the District's Water Resource Information bureau in 2018 and 2019. During collection of these data, standard survey depth measurements were conducted as QAQC. This dataset was cleaned to remove outliers (likely due to vegetation). An additional survey campaign was undertaken by the MFLs team in order to fill in gaps. Digitization of the lake edge from two years when the lake level was lower than 2010 was completed by both "heads up" digitizing and an automated method in ArcMap; these lines were assigned elevation values based on the nearest set of survey points and then converted to points for interpolation. One contour from the District's bathymetry dataset (GIS/IT) was used as the lake edge to mosaic with the lidar-derived DEM due to the agreement between that line and the DEM. The line was also converted to points for interpolation.

Interpolation of bathymetric data

Bathymetric points were interpolated to a raster surface (DEM) using the Natural Neighbor method. Natural Neighbor was chosen due to its fidelity to the elevation values of the input data, strict adherence to the range in elevation of the input data and for its comparatively simple algorithm compared to other interpolation methods.

LiDAR portion

The "upslope" portion (dark green in Figure 1) was clipped from the 2006-7 DEM produced by Kucera for the South Florida Water Management District. The quality of the LiDAR data meets the standard for creating 1 foot contour lines, 0.34-foot RMSE. A number of upslope elevation survey points were available to compare to the LiDAR portion; there was acceptable agreement between the two datasets to move forward without correction of the LiDAR data for vegetation interference. In general, the area around the lake was considered to be substantially altered by development (e.g., mowing) and therefore not heavily vegetated and thus not requiring a correction effort (Figure 1).

Mosaic to new raster

In order to ensure a smooth spatial transition (no "shelves" or "stairsteps") between the bathymetry interpolation and the LiDAR-derived DEM at the lake edge, a very small area of overlap between the two rasters was created. The "Mosaic to new raster" function in the Data Management Toolset in ArcMap was used to create the DEM. The DEM is shown in Figure 3. The "Profile Graph" tool in ArcMap 3D Analyst was used to test for a continuous and smooth transition between the two DEM sources at the lake edge (Figure 4).

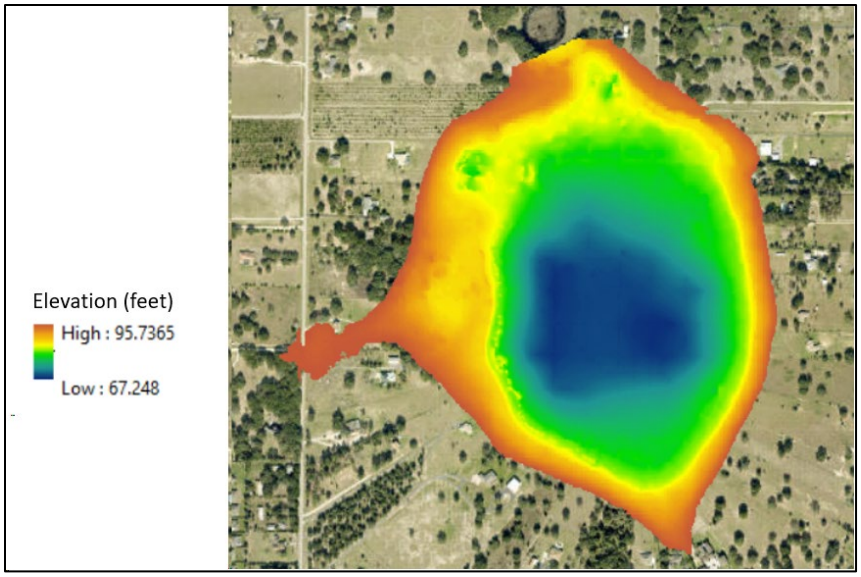

Figure 3. Completed DEM (Vertical Datum NAVD88)

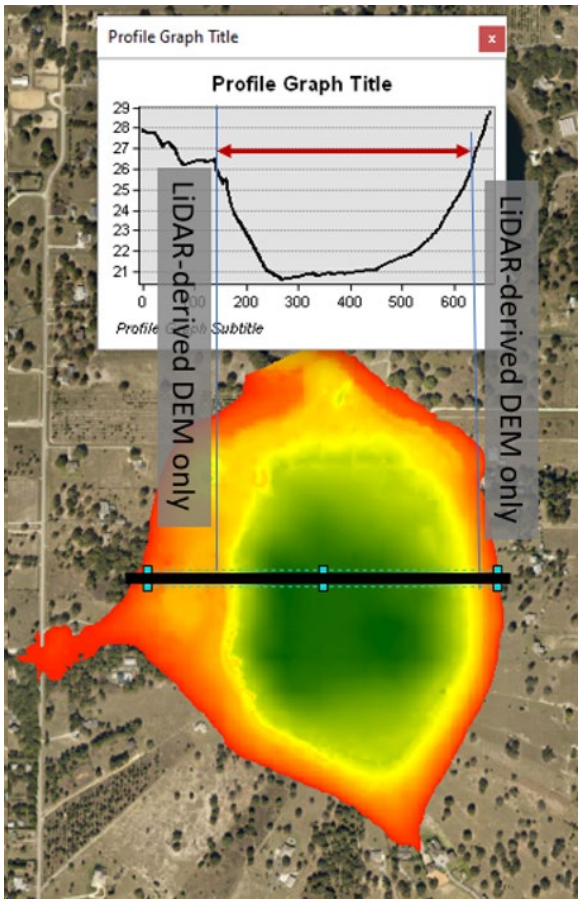

Figure 4. Final DEM with cross section (profile) demonstrating the smooth transition between the bathymetry and the LiDAR portion. Heavy black line is the location of the cross section. The red double-arrow line represents the area entirely derived from interpolation of bathymetric data.