Constructing complex hybrid Digital Elevation Models (DEMs) using multiple hydrographic data sources

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The five regional Water Management Districts (WMDs) in Florida are charged with maintaining natural systems and water supply for their respective state regions. As a portion of that charge, the WMDs review, hydrologically model, and establish on a 5-year rotating basis, the minimum flows for river systems and minimum lake levels. The modeling for these Minimum Flows and Levels (MFLs) requires not only stream and lake gages, but also accurate bathymetry for the modeling.

The Southwest Florida Water Management District (SWFWMD) maintains the MFL for the entire 227km (141 linear mile) Withlacoochee River System, which includes Lake Rousseau, an impoundment formed behind the Inglis Lock & Dam. The update for this MFL is scheduled for fiscal year 2024-2025, hence, the SWFWMD has been resurveying both the floodplain and the bathymetry of the river system. The objective of this discussion is to examine the data acquisition methodologies for the topographic and hydrographic data, and how those diverse datasets were used to construct a single, seamless digital elevation model.

Dewberry promotes a "Lidar-first/Fill-in with Survey" approach to complex projects such as the Withlacoochee River MFL survey. Following this general approach, Dewberry used topobathymetric (Coastal Zone Mapping and Imaging Lidar (CZMIL-SuperNova) and aerial terrestrial lidar, then used either existing or newly collected multi- and single-beam, crewed and un-crewed surface vehicle sonar, and conventional GPS/Pole-soundings to construct and ground-truth a seamless terrestrial-hydrographic DEM.

The final, seamless digital Elevation model for the Withlacoochee River model domain was constructed using each data source to its fullest extent. In some cases, statistical kriging was used to densify the single-beam profiles, while in other cases, geometric smoothing techniques were used. The final DEM will be used for HEC-RAS modeling of the channel, ICPR-4 modeling of the floodplain, and Mass-Balance modeling of the lake to establish the 2025 MFL.