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BWSC Barge Waggoner Sumner & Cannon, Inc.

M E M O R A N D U M

TO: Jon Riley, TVA

FROM: Adrian Ward

DATE: 9/24/2012

RE: **Pond Creek Flood Study Results and Inundation Maps**

Barge, Waggoner, Sumner & Cannon, Inc. (BWSC) has completed the flood study of Pond Creek in the Muscle Shoals TVA Reservation. TVA requested that BWSC conduct a flood study to determine the 100-year and 500-year flood elevations and develop the associated inundation maps to support a future property transfer. Additionally, during the course of project completion, TVA Environmental Engineering requested velocity information and elevations along the Solid Waste Management Unit (SWMU) 108 site to support planning for future modifications to protect the streambank along the length of the site.

Inputs used to perform the flood study included field survey data collected by BWSC and LIDAR data for Colbert County taken between January and February 2011 and provided by the State of Alabama, Office of Water Resources. These data sets were used to develop a HEC-RAS model representing the current conditions as of the date of this memo. Simulations were performed to establish flood elevations and develop inundation maps. The previous TVA model results and historic flood data (Roger Milstead – 6/1/12 and 8/27/12, respectively) were used to support development of the final 100- and 500-year flood profiles.

ACTIONS COMPLETED

The following actions were completed in the flood study effort.

Site Visits and Field Survey

While LIDAR data was available for Pond Creek and the surrounding area, site visits were conducted and a field survey performed to confirm the data and to pick up additional bridge information and measurements at key locations that are most closely representative of the creek.

Trips were made to the site for the following purposes:

- Initial Engineer field visit – The team met with Jon Riley and Stacey McCluskey on separate days to discuss areas of concern and access locations to Pond Creek. The team walked Pond Creek as feasible to mark cross section locations which included identification of narrow sections, changes in slope, bridge/culvert locations and data needs, and/or other features which could impact flow through Pond Creek. Drainage structures were also located and measured. Observations were noted related to land use and ground cover to aid in development of a hydraulic model of the creek.

- Field Survey visits – Survey crews collected data on channel bottoms, changes in slope, bridge/culverts, remnants of an old levee, and additional key features to confirm LIDAR data in areas of safe access.
- Final Engineer field visit - Team confirmed bridge and culvert data used in the HEC-RAS model, and evaluated the inundation areas determined by model results. A large inundation area along the left bank (looking downstream) between Pond Creek Miles 2.207 and 2.518, was examined to determine if it was reasonable given the nature of the terrain. It was determined that in this rolling terrain that there would be a range of flood depths over the area and the flood levels from Pond Creek should be used to guide future development of the area. The Team met with Jon Riley and Bill Adams to discuss the preliminary results and review potential future development plans for the site.

Model Development

Cross section geometry for HEC-RAS model development was based primarily on the LIDAR data. Field survey data collected of the channel below the water surface, channel bottom elevations, bridge/culvert data and remnants of an old levee were used to modify the cross sections taken from the LIDAR data to more accurately represent field conditions. Because Pond Creek is inaccessible in many areas, surveying of the underwater portion of the channel was performed at selected locations where access was available. This information was used to determine slope between cross sections and the shape of the channel bottom. The surveyors were not able to access the stream north of Wilson Dam Road due to the steep topography. The absence of channel bottom data in this portion of the reach should not affect the results of the model since the culvert at Wilson Dam Road drops off at the downstream end of the culvert which forces the flow to go through critical depth at this location. This critical depth is what all elevations upstream from this point are based on. Manning's n values were assigned to the cross sections based on observations from site visits and aerial photography.

Inflows for the HEC-RAS model were input at cross sections along the creek. Additional information about inflow determination is provided in Attachment A, Pond Creek discharge estimate memo dated August 17, 2012.

The model results were compared to previous study results, historic flood elevations through the site and compared to the Colbert County FIS at the upper most cross section (mile 2.685). Both the old and new model results were higher than the historic floods. However, the frequency of the historic floods has not been determined. The new model results track along the previous TVA model results well but are up to one-foot higher in some locations. The increase in flood elevations can be attributed to updated cross-sections and increased Manning's n values due to current ground cover.

Model Results

Results from simulations of the subcritical, steady state model for the 100-year and 500-year events provided flood levels for Pond Creek. Final flood frequency profile elevations and velocities and a location map are presented in Attachment B. Inundation maps for both the 100-

year and 500-year flood frequency events with flood depths are presented in Attachment C. These flood results and inundation maps represent existing conditions as of the date of this memo. The computed flood profiles do not reflect any modification of the channel or streambank in the vicinity of SWMU site 108.

We have enjoyed this opportunity to be of service to you. If there are any outstanding questions feel free to contact me directly at 615-252-4329.

Sincerely,

Adrian Ward

Adrian Ward, PE, CFM, CPESC

Cc: Carrie Stokes, BWSC
Greg Lowe, BWSC