Geophysical evaluation of erodibility from overtopping at Bull Shoals Dam, Marion County, Arkansas

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Bull Shoals Dam is a concrete gravity dam located on the White River in northern Arkansas that is owned and operated by the U.S. Army Corps of Engineers. Construction was completed in July 1951 for the purpose of flood management, hydropower generation and recreation. The dam is composed of 47 concrete gravity monoliths, each 13.6 m (45 ft) wide, having a maximum height of 78 m (258 ft), at total length of 688 m (2,256 ft) with water level controlled by a 17 Tainter gates that regulate water flowing into the spillway system. The dam impounds Bull Shoals Lake that has a total capacity of 7.1 km3 (5,408,000 acre-ft) and a catchment area of 15,630 km2 (6,036 mi2).

Recent risk analyses indicate a potential failure mode of scour along the downstream toe on the right abutment from overtopping causing scour of the abutment rock resulting in potential sliding failure of the non-overflow monolith. The foundation in this area is composed of dolomite with minor interbeds of chert and shale and minor karst development. The upper surface of the bedrock is weathered and fractured, making it potentially susceptible to scour and plucking during an over topping event. To help constrain bedrock conditions along the right abutment, a geophysical investigation was carried out in July 2021 in conjunction with a field mapping and data analysis effort. The geophysical investigation consisted of seismic refraction, electrical resistivity and induced polarization. Four (4) locations were identified for geophysical data collection: three (3) along cut benches oriented roughly perpendicular to the dam’s alignment, and one (1) oriented roughly parallel to the dam’s axis about 33 m (100 ft) from the dam groin along the downstream toe. This talk will describe the geophysical investigations and how the Risk Cadre utilized these data in evaluating foundation erodibility.

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