

TREVI

# The Boone Dam Project

Boone Dam, located upstream of Kingsport, TN (USA) is owned and managed by TVA. Built in 1953, the barrier has an 850-ft long concrete gravity dam section, and an 850-ft long earthen embankment dam. The resulting Boone Lake has a capacity of 75,800 acre-feet. A sinkhole was discovered near the downstream toe of the dam in October 2014, and soon after TVA observed turbid discharge exiting from the riverbank downstream of the dam, indicating potential dam safety issues. In July 2015, TVA announced plans to construct the Boone Dam Internal Erosion Remediation Project, an erosion barrier through the dam and its foundation, consisting of works aimed to mitigate the risk of potential dam failure due to internal erosion and safely return the dam and reservoir to normal operations. The program included five components: Low mobility grouting, high mobility grouting, stability berms, cutoff wall, crest floodwall.

## The jobsite

After the completion of the preliminary enabling grouting



works, in 2018 TNJV, a Joint Venture formed by Treviicos and Nicholson, was awarded the contract for the installation of the cutoff wall. With the working platform at approximately elevation 1,400 feet and the bottom elevation of the cutoff wall as low as 1,230 feet, the wall has a resulting maximum depth of approximately 170 feet, and is formed by a single row of secant piles extending through embankment, foundation soils, and weathered rock into intact rock up to 170 feet below crest, including tie-in of wall on sloping face of existing concrete dam. The technology of the secant piles was chosen after consideration of a number of cutoff

wall construction methods for having lower dam safety concerns, and to maintain strict alignment and overlap requirements while penetrating through a challenging mixture of soil and highly weathered rock within the upper portions of the dam's foundation. The cutoff is keyed into the sloping face of the existing concrete dam, forming a continuous composite seepage barrier along the entire alignment of the earthen dam. Over 300 50-in dia. secant piles were installed to create 850-ft long secant pile barrier, totaling 113,000 square feet of cutoff wall, and 27,000 cubic yards of concrete for backfilling.

Verification of the verticality, embedment and concrete quality of each element forming the wall was critical. The secant piles were installed using a combination of equipment and techniques: piling rigs were used to drill through the embankment and the alluvial, to depth of approximately 100 ft, using segmental casings. Reverse circulation top pile rigs then completed every pile, to a total maximum depth of circa 170 feet, into a rock with peak UCS values as high as 36,000 psi (240 MPa). The concrete for the piles was manufactured in an onsite batch plant operated and controlled by TNJV. The quality of the joints between the elements was of paramount importance for the integrity of the wall. An extensive quality control program provided TVA with an accurate validation of the installed final product for their acceptance. This, in conjunction with an equally extensive quality assurance program, ensured that the cutoff wall was installed meeting or exceeding the stringent requirements of the Project. For instance, as part of this program, vertical deviation was checked by measuring with different instruments and piles were brushed to grant quality joints. ■

