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WINNERS ■ **BEST PROJECTS AWARDS**

BEST PROJECT **ENERGY/INDUSTRIAL** ■ Submitted by MWH Global

WANAPUM DAM SPILLWAY PROJECT

Vantage, Wash.

KEY PLAYERS

OWNER/DEVELOPER Grant County Public Utility District No. 2

LEAD DESIGN FIRM/STRUCTURAL ENGINEERING/CIVIL ENGINEERING MWH Global

GENERAL CONTRACTOR Max J. Kuney Construction

SPECIALTY SUBCONTRACTOR Nicholson Construction

QUALITY CONTROL AND INSPECTION CONSULTING MacKay & Sposito

PHOTOS BY MWH GLOBAL; NICHOLSON CONSTRUCTION; GRANT COUNTY PUBLIC UTILITIES DISTRICT

In late February 2014, a 2-in.-wide crack was discovered at a horizontal lift joint spanning a 65-ft-wide monolith at the Wanapum Dam Spillway that had resulted in about 1 and 1/2 in. of differential movement across the lift joint. Owner Grant County Public Utility District began lowering the water level by 26 ft and quickly assembled the construction team.

In order to determine the extent and orientation of the crack, the team drilled through the spillway to capture data, which was then inserted into computer models developed to assess the behavior of the monolith. The models also identified potential failure modes and evaluated the effectiveness of potential remedies. Several models were used during the design process to gain a better understanding of the structure's behavior—including response to thermal load conditions and installation of a dewatering bulkhead.

The team developed a multitask strategy to analyze, design and apply remedial measures while restoring the reservoir in stages. It selected installation of post-tensioned anchors as the preferred method to repair the cracked monolith and to mitigate the potential for cracking in the rest of the spillway.

The restraining force necessary to stabilize the dam required the installation of 35 post-tensioned tendons, with lengths up to 260 ft. Additionally, 69 solid bar anchors were installed, including 30 that were installed under about 60 ft of water through the crest of the ogee spillway upstream of the radial gates.

Drilling to advance 16-in.-dia boreholes necessary to install the 61-strand tendons particularly challenged the construction team. The trajectory of the tendon holes required tight alignment tolerances to avoid intersecting the gallery and other obstacles in the structure. To achieve an on-target borehole, a smaller pilot hole was first advanced using a stabilized coring system. Using specialized azimuth alignment and gyro equipment, pilot hole alignment was verified at 5-ft intervals throughout the drilling operation. After the pilot hole was established and the alignment of the borehole verified, the hole was advanced in two stages to the final diameter of 16 in.

Soon after determining the remediation plan, the water level was raised 17 ft from its lowered level to allow normal operation of the fish passage facilities and reduce impacts to the mid-Columbia River system. The Wanapum pool was filled to its normal operating level in March 2015.

The $55-million project was completed in April.