WATER & WASTES DIGEST

40 Feet Deep & About to Fail

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November 11, 2013

Tomhannock Reservoir, located in the state of New York, is more than 5 miles long and holds 12.3 billion gal when full. Parts of the reservoir's earth-filled dam date back to 1900, which means that repairs often are needed. Because the reservoir is the only water source for the nearby city of Troy, repairs are complicated—draining the reservoir is impractical for many reasons.

This was especially true in early 2013, when the dam's bottom outlet began to fail. The 310-ft-long, 60-in.-diameter riveted steel pipe surrounded by earth was leaking at all seams, and threatening to give way entirely. On the reservoir side, the inlet is about 40 ft below the reservoir surface, and closed off by a gate that can be opened to release water. On the downstream side, to prevent erosion, the pipe opens into a diffusion chamber that diverts water to four short 30-in. pipes.

A Unique Scenario

This difficult configuration effectively ruled out most pipe rehabilitation techniques. Because there was no access from the reservoir side, all work would have to be done from the diffuser chamber. It was a small space—about 4.5 ft wide, 5 ft high, and 12 ft long—so there was no room for staging cured-in-place pipe equipment, and the 30-in. pipe prevented the use of high-density polyethylene sliplining. And one cannot dig a trench in a dam.

Ryan Arold, vice president of trenchless at Arold Construction Co. Inc., had an idea. "We're CentriPipe contractors, and that was fortunate," he said. "Because when we did the initial inspection for CDM Smith Inc., the city's engineers, it seemed like CentriPipe was the only solution that could work in this situation."

CentriPipe is a centrifugally cast concrete pipe (CCCP) technology that repairs failing pipe by inserting a spincaster into a pipe, and withdrawing it while it sprays thin layers of high-strength cementitious grout onto the pipe interior—basically, a

A complex pipe repair in New York's Tomhannock Reservoir

new concrete pipe is cast inside the old pipe. The new pipe is structurally sound and waterproof, and because it adheres tightly to the old pipe, no annular space is created for water to move along. Staging areas are minimal; bends are not an issue; work can be interrupted and resumed without leaving seams; and flow reduction is minimal (final cast pipe thickness can be as thin as 1 in. and rarely exceeds 2 in.).

The minimal staging area needed, in particular, was key for the Tomhannock project. Arold realized that he could set up the spincaster's withdrawal winch in the diffusion chamber and run in power, air and concrete hoses from outside the dam and through the 30-in. diffusion pipes.

It was conceptually simple, but complicated in practice. For one thing, the 30-in. pipe exits the dam about 10 ft above ground. Therefore, Arold Construction built substantial scaffolding that gave it safe access to the outlets. Because the spincaster and withdrawal winches were both too big for the 30-in. pipe, they had to be disassembled, taken through the diffusion pipe in pieces, and reassembled inside the diffusion chamber. To ensure good air quality throughout the project, blowers were used periodically. But, aside from the low ceiling, space was not a big issue. "It was fairly roomy in there," said Nathan Baldwin, Arold's operating superintendent and onsite foreman for the Tomhannock project.

Dewatering was a bigger problem, however. At the upstream end, "I'd say 20 to 25 gal were coming through the gate every minute, and the steel pipe was leaking at every seam," Baldwin said.

Pipe rehabilitation began with seam repair using oakum and hydraulic cement—this did not actually prevent leaks, but it slowed them down enough to work in the pipe. Invert repair is needed on many similar projects—in order to provide a smooth surface for spincaster withdrawal—but was not needed in this case because, even though the thick steel invert was corroded, it was mostly intact.

The upstream gate could not effectively be repaired, so Baldwin installed a sandbag and poly sheet cofferdam that would hold back water for about five hours—long enough for one CentriPipe layer to be applied.

With the 60-in. pipe repaired and dewatered, the actual CCCP process was relatively straightforward. In this case, the design called for a 1-in. application of AP/M Permaform's PL-8000, a cementitious grout mixed with fibers for high tensile strength. That would have been more than sufficient, but Baldwin actually went a bit thicker.

The minimal staging area required made CCCP technology an ideal solution for this project.

"We ended up taking five passes, and applying a little over 1.5 in.," he said. "Coverage or structural integrity wasn't a problem, but the riveted pipe has thick bolt heads, and we wanted to be sure we were covering them completely—on some projects, we want to be extra sure we won't be coming back."

To check coverage and provide quality control, one crew member stays with the spincaster and talks with the winch operator—by adjusting withdrawal speed, the spincaster operator can make sure that coats are applied evenly, with no slumping or thin spots. Coverage also can be checked with depth gauges before the grout cures, and by monitoring the amount of product applied. Normally, Arold Construction has a four- or five-person crew on hand for CentriPipe projects, but on this project there were seven because additional hands were needed to move hoses through the 30-in. access ways.

CCCP work is a new initiative for Arold Construction, and this was one of the more complicated projects undertaken—limited access at one end of a pipe and 40 ft of overhead water at the other end guaranteed complicated logistics. Arold said he appreciated the challenge.

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