Lake Tishomingo Dam Repair

by Rich Hirsch, Dam Committee

Drilling of the exploratory holes began Wed, May 28, 2008 and ended Fri, May 30. In all 11 holes were drilled. Dave Taylor (DT, Strata Services) felt that he had enough holes to proceed with the analysis phase of the project. To summarize, holes 3, 4, and 5 "communicated" with the leak in a major way (that is, 150 gpm of water forced into the drill hole exited out the leak). There were more holes that also had a connection to the leak (there was a discoloration of the leak water at some point during the drilling), but these holes consumed only a small fraction of the water that holes 3 - 5 did. That meant that those holes were probably minor contributors to the leak. DT said he thought that holes 3 - 5 supplied about 90% of the water to the leak.

Weir box, constructed by Mike Leiweke, capturing leak flow at 300 gpm, before repair

Drilling exploratory holes.

On Mon June 2 DT and James David, a geophysicist from Don Eskridge's (DE, Reitz & Jens) office, completed testing to develop a profile of the fissure in the rock responsible for the leak.

Temperature Testing

This involved developing temperature profiles of the 11 test holes. That is, for each hole they constructed a water depth vs. temp graph. The leak pool had a temp of 45.9 deg, so if a hole was connected to the leak it should have had a temp in this range (46 deg). This was the case for holes 3 thru 5, which penetrated the leak. Most of the other holes had temps in the mid 50s.

Water Testing

DT also did "water" testing, which works this way:

1) Water is added to the test hole to the top of the casing (each hole has a 4-inch casing down to where it enters rock).

2) A measured amount of water is added to the hole to maintain the water level at the top of the casing.

3) In this way the amount of water "consumed" is mea-

Successful Repair of the Dam, June 2008

Water flow from leak collector, 300 gal/min, January 2008.

Water flow from leak collector, 0.6 gal/min, June 2008.

sured.

So, if a hole has no connection to the leak or the lake, no water will be consumed. If the hole has a significant connection to the leak (or lake), like holes 3-5, large amounts of water will be consumed. This test determined that holes 3-5 needed to be grouted. (As it turned out, all holes were grouted to at least slightly above the level of the fissure.)

Dye Testing

A visible dye was introduced into hole 4 and the time it took to show up at the leak was measured. This helped to determine the formulation of the grout that would be used. (The viscosity of the grout had to be carefully adjusted so it was pumpable and spread out to fill the fissure in the rock and yet not be so thin that it would be washed out by the flowing water.)

Grouting

On Friday June 6 at 1 p.m. at the Community House, DT presented the grouting plan. In attendance were DE, Gene Eime, Ken Jost, Janet Hirsch, Clarue Holland, Marilyn Meyer, and Rich Hirsch.

Prep work for grouting the dam was done Tuesday, June 10. The actual grouting took place on Wed and Thurs (June 11 – 12).

Although there were three drill holes (3, 4, & 5) that penetrated the fracture that caused the leak, only hole #4 was grouted. Four concrete truck loads of grout (with coarse sand added) were pumped down drill hole #4. Holes 3 & 5 were checked and grout was present in those pipes also, above the level of the fissure.

The output from the leak pipe dropped from 300 gpm to less than 1 gpm in less than 30 minutes. (see photo on p. 1. Left image is normal leak flow in Jan. 2008; right image is after grouting was complete. The difference is incredible.)

DT said that the grouting could not have gone any better. It was a "textbook" example of how grouting should go, but seldom did.

DE said that the interior of the seepage collector looked clean. (There was a possibility that grout could have flowed into the collector and plugged it. It did not.)

On Thursday, June 12, DT pumped one concrete truck load of grout into the remaining exploratory drill holes.

While DT was grouting the pipes, I visited the leak pipe to make sure the leak flow was still just a trickle. It was. I measured the flow rate at 0.6 gpm. This reduction, from approximately 300 gpm to 0.6 gpm is a rate reduction of 99.8%.

View the video of the flow rate reduction during the grouting operation at YouTube:

http://www.youtube.com/watch?v=HTEw2Me0QcU