THE WALL STREET JOURNAL.

The Fault Line Threatening Dams

Deficient structures, earthquake risks raise possibility of potentially catastrophic flooding

By Jim Carlton
June 23, 2017

FREMONT, Calif.-The coastal mountains that frame this working-class city next to San Francisco Bay harbor a hidden menace: a reservoir 10 miles away that sits next to an active earthquake fault, which experts say could cause a dam break and flood thousands of homes.

The potential threat is so severe, the owner of the Calaveras Reservoir decided to build a replacement dam. But seven years after that work began, the dam is unfinished and isn't expected to be complete until 2019 -- four years behind schedule.

The issues hampering the Calaveras Reservoir project show how difficult it can be to repair or replace an old dam, which is of growing concern nationally.

An estimated 27,380 dams, or 30% of the 90,580 listed in the latest 2016 National Inventory of Dams, are rated as posing a high or significant hazard. Of those, more than 2,170 are considered deficient and in need of upgrading, according to a report by the American Society of Civil Engineers. The inventory by the U.S. Army Corps of Engineers doesn't break out which ones are deficient.

But funding and inspection staffing are considered inadequate, the civil engineers' report said. An estimated $64 billion is needed to upgrade those dams, including $22 billion for those posing the highest hazard, according to the Association of State Dam Safety Officials, a nonprofit group in Lexington, Ky.

"It's a huge problem with limited resources," said Ivan Wong, a consulting seismologist from Walnut Creek, Calif., who works on dam projects nationally. "We can barely pay for our schoolteachers, but if a dam fails and there's a population downstream, we're talking about a disaster. We have to fix our dams, there's no doubt about it."

At the Calaveras dam, California's Division of Safety of Dams in 2001 ordered the San Francisco Public Utilities Commission to keep its 31 billion-gallon capacity Calaveras Reservoir no more than 40% full.

Utility officials say the extra time is needed to make the dam -- with a 1,200-foot- wide base and spillway walls up to 4 feet thick -- hopefully fail-proof.

"It's better to plan for the worst and hope for the best," Dan Wade, who oversees the $800 million project, said on a tour on Wednesday. The cost is double the original $400 million estimate.

Earthquakes pose especially big risks for dams. The seismic threat is highest along the West Coast, including Washington and Oregon, which scientists say could see rare but potentially catastrophic quakes.

Few states face as much of an earthquake threat as California, where nearly three- fourths of the state's 1,585 dams are rated as having high or significant risk of failure.

Like its predecessor and many others in California, the new Calaveras dam is being constructed largely out of rock, dirt and other natural materials. Engineering experts say earthen dams of sufficient size are designed to withstand most earthquakes. The Calaveras dam is being strengthened, in part, by having zones of compacted material, including a thicker core of impermeable clay.

One problem, experts say, is that many were built decades ago, when less was known about what a strong earthquake could do.

Engineers didn't realize then that the loose rock and soil they used to form the base of some dams could liquefy in a strong earthquake, potentially causing the top of the structure to deform and spill.

State officials have determined the 220-foot- high Calaveras Dam poses a flooding threat because the base of the 92-year- old structure was built atop loose earth on the site of a previous failed dam. About 300,000 people live in a flood zone along Alameda Creek below.

"It would be disastrous if this thing were to fail, because you have huge urban areas downstream," said Jeff Miller, executive director of the Alameda Creek Alliance, a nonprofit environmental group.