

How risky will diversion dam be? Depends who you ask

By [Tu-Uyen Tran](#) on Feb 16, 2017 at 9:17 p.m.



1 / 2



SOUTHWEST CLAY COUNTY — From a distance, it will probably look like an elevated road stretching from beyond the line of trees that marks the path of the Red River.

But up close, its purpose will be pretty obvious.

The high-hazard dam the U.S. Army Corps of Engineer plans to build through here will be about 18 feet high measured from low ground near the river, which includes 6 feet of freeboard. If the dam were to suddenly breach at maximum capacity, a wall of water 12 feet high would come rushing out.

Because it would be holding back floodwater instead of a reservoir, and protecting a sparsely populated rural area, a breach in the diversion dam wouldn't cause the kind of

devastation that could have happened in California earlier this week when the Lake Oroville Dam, the tallest in the U.S., was dangerously close to failing.

But the potential deadliness of the dam portion of Fargo-Moorhead's \$2.2 billion flood control plan is one of the reasons Minnesota regulators oppose the project. The Minnesota Department of Natural Resources denied the Fargo-Moorhead Diversion Authority's application for a dam permit partly because they consider the solution too risky for the problem at hand.

The corps says the dam is needed to reduce flood impact on communities downstream of the diversion and is much safer than emergency levees erected during flood fights.

What everyone can agree on is the dam will kill at least one person if it were to fail, the criteria for being classified as high hazard. According to the corps, that classification increases the level of safety its engineers must design into the dam, a level that exceeds what's built into the dikes that run through Fargo-Moorhead.

"If people have faith in floodwalls and levees they should have equal faith in a dam that we're building," said Terry Williams, the corps official managing the diversion project. "There should be no difference."

While the diversion project, which includes in-town dikes, is designed to handle a 100-year flood without major intervention and a 500-year flood with emergency levees, the dam would be designed to withstand the equivalent of a 100,000-year flood, according to the corps.

DNR officials declined to comment because the department is involved in a lawsuit against the Diversion Authority that seeks to halt the project until Minnesota issues a permit for the dam. Diversion and corps officials are moving forward with construction, which is expected to begin this week.

Deadly quarter mile

Corps plans call for an L-shaped earthen dam about three-quarter miles south of Fargo city limits. The longest part of the L would stretch 12 miles from southeast of Horace, roughly following the route of 124th Avenue South, crossing the Red River and merging into high ground west of the South Branch Buffalo River in Minnesota.

The short part of the L would stretch about six miles to the south, merging into high ground there.

At its tallest, the dam would be 21 feet tall above the low ground just west of the Red River.

That's about the area where the corps simulated a catastrophic breach of the dam, which would hold back a volume equivalent to a foot of water spread out over 225,000 acres.

In a report to the DNR, the corps said its simulation showed that a breach during a 100-year flood would kill at least 2 and at most 31 out of a population of 19,000 that could be inundated. That's a death rate of 0.01 percent to 0.2 percent.

Why so low?

It's because the terrain is so flat that the wall of water gushing out of a breach would very quickly spread out, dropping in depth and velocity, key factors that can make floods deadly. The lower velocity also gives residents more time to get out of harm's way. If the Red River Valley were like a gorge with steep walls, a dam breach would be far deadlier.

The deadliest place to be during a dam breach would be within a quarter mile of the breach and in the river and drainage channels, according to the simulation. Almost everywhere else, the risk of death drops significantly.

"That doesn't mean the hazard is completely gone past a quarter mile but beyond a quarter mile the depths are shallow enough where it's surprising how quickly the risk goes down," said Aaron Buesing, the corps' lead hydraulic engineer for the diversion project.

- **Authorities say fiery, fatal Minn. crash one of the worst they've ever seen**

In most areas downstream of the dam, the water would flow at 2 feet per second or slower at a depth of 2 to 6 feet. Some low-lying areas might see 6 to 15 feet of water. The simulation assumes that anything less than 13 feet is 100 percent survivable because people would be able to climb on the roof of their house or get to an upper story. The death rate rises to 12 percent at 12 to 15 feet and 91 percent when deeper than that.

Given the water velocity, the corps says most residents would have more than an hour to evacuate. At 2 feet per second, it'd take water from the breach nearly 2½ hours to reach the nearest neighborhood in rural Cass County south of the city. There are some farmsteads right by the dam, however.

Doubts voiced

The DNR doesn't believe the corps' estimated death toll is reasonable.

In denying the dam permit, it says that the number of people that would have to evacuate, the distance they must travel and the ice-cold water in the way means evacuation would be difficult. "The DNR concludes that it is not feasible to evacuate the F-M metropolitan area within a 60-minute timeframe."

- **Tense meeting ends in corps getting access to its land**

In addition, the agency says it doesn't see how the diversion and dam would be less risky than just fighting floods the same way they've been fought before. "The existing flood control system, including emergency measures, in the F-M metropolitan area have successfully handled numerous floods at and above the 10-year event," it says. "The risk of the proposed Project during a 10-year event appears to be similar to or possibly even greater than existing conditions because an impoundment of water would be created upstream of the dam."

In a written response, the corps says the DNR seems to "ignore the much higher risk associated with flood fighting along an 80+ mile levee system that relies on emergency measures constructed hastily under adverse conditions."

A dam engineered to safety standards required of a high-hazard dam can't be less safe than emergency levees built with frozen materials and limited freeboard, meaning they couldn't withstand high waves, the corps says.

In 2009, the biggest flood fight Fargo-Moorhead ever fought, there were 42 miles of emergency levees, 8 miles of Hesco barriers and 19 miles of sandbags.

There is no analysis of what would happen if temporary levees, built in town and not miles upstream like the dam, were to breach. But there are breach analyses of permanent levees that were involved in past flood fights.

In 2011, when the corps conducted an environmental review of the diversion project, it looked at what would happen during a breach of the dike by Island Park, the tallest in Fargo-Moorhead. If it were to breach during a 100-year flood, it would kill at least 4 and at most 200 out of a population at risk of 18,000, the corp simulation says.

- [Three top UND administrators to leave positions as part of budget cuts](#)

Learning from failures

Despite the various breach analysis—more are expected at other locations—the corps contends the dam will be designed to be practically impossible to breach.

"We've taken the most conservative route, looking at what they call a probable maximum flood" said Doug Crum, the dam safety manager for the corps' St. Paul District.

That's essentially the worst flood possible based on statistical analysis of weather and river gauge records. Imagine high snow packs and 20 inches of rain or more, which has never occurred here during spring flooding, leading to a flow seven times bigger than

the record flood of 2009. The water would spread from Mapleton, N.D., to 20th Street in Moorhead, a distance of about 14 miles.

Where the 2009 flood was considered a 50-year flood, meaning it had a 1-in-50 or 2-percent chance of happening each year, this worst flood ever has around a 0.001 percent chance, a 100,000-year flood.

Buesing said a dam that can handle that kind of flood must be strong enough and must never be overtopped, which is dangerous because the water erodes away the dam material.

The fail-safe is the north-south section of the dam that will serve as the spillway. Because it's lower than the main part of the dam, it would always overflow first and will be designed to withstand the erosion.

- **Cargill to close one of its Fargo offices**

But there's an additional safety feature built into the dam's operational procedures.

While it would take a 1,000-year or 5,000-year flood for water to overflow into the spillway, the dam gates would open at some point past a 500-year flood, Buesing said. This would flood Fargo-Moorhead, but by that point the flood fight likely will have been lost.

Dam designers today have the advantage of learning from failures of the past, and many dams that breach are older dams, Crum said. About one-third of earthen dams that fail do so because there's more water than they can handle. One-third fail because of defects in their material. The remaining one-third fail for miscellaneous factors, such as operational errors or mechanical problems, he said.

There is also the question of maintenance. When more than a dozen dams failed in South Carolina in 2015 and last year after heavy rains, many blamed the state's threadbare dam inspection and maintenance program. When nearly 200,000 Californians were evacuated as heavy rains threatened the Oroville Dam, observers

there pointed to the state's failure to upgrade the dam's emergency spillway to modern standards. Water flowing over the spillway threatened to erode the dam.

That suggests dam safety requires both good design and vigilance. But that's also true of levees and floodwalls.

- [Old friends helped lure top reliever to Twins](#)

About high-hazard dams

While most dams are not classified at the highest risk level, high-hazard dams are far from rare.

Out of 1,097 dams in Minnesota, 55 are high-hazard dams, according to the national dam inventory maintained by the U.S. Army Corps of Engineers. Out of 898 dams in North Dakota, 49 are high-hazard dams. Out of 90,580 dams nationwide, 15,498 are high-hazard dams.

The corps doesn't specify which are high-hazard for fear of providing targets for terrorists, but some have been reported by state agencies and by media.

Among those near Fargo-Moorhead are the 57-year-old earthen dam on the Elm River in Hunter, N.D., the 147-year-old dam on the Pelican River in Pelican Rapids, Minn., and the 76-year-old Browns Valley (Minn.) Dam.

The Federal Emergency Management Agency three-tier classification system was part of a response in the late 1970s to some of the deadliest dam failures in the U.S.

In 1972, the Buffalo Creek Dam in West Virginia failed, unleashing a wall of water 30 feet high and killing 125. A few months later, the Canyon Lake Dam in Rapid City, S.D., failed killing as many as 238. These and several other dam failures that followed led Congress to create a national dam inspection and classification program, according to FEMA.

Since then, there have been relatively few deaths caused by breached dams in the U.S. Out of 125 dam breaches the ASDSO has catalogued between 1979 and 2010, 37 have died. The list includes only actual dam breaches not damage that don't lead to failure.

Explore related topics:

[NEWS](#)

[FLOOD](#)

[DIVERSION](#)

[DAM](#)