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Damned if we don't

Too costly to repair and hard to remove, America's 80,000 dams just keep getting older.

BY KEN OLSEN

Hours after an Atlantic storm system began pummeling New England in October 2005, the reservoir behind Lake Wyola Dam in northwestern Massachusetts started rising fast. A worried dam keeper, who had drained water from the lake in anticipation of the deluge, monitored the 122-year-old structure throughout the night, regularly updating local emergency-management officials. The earthen and stone dam holding back the swelling reservoir had no emergency spillway. If floodwaters breached the top, it could easily collapse, sending a 12-foot wall of water surging through the towns of Leverett and Shutesbury.

The rain persisted. By 2 a.m., the water drew within an inch of the dam's top.

A quarter-mile downstream, Kenyon Fairey and her family slept through what they assumed was just another fall rainstorm. Like more than 70 homeowners living in the dam's flood zone, she was completely unaware of the peril.

One hundred miles to the southeast, officials in Taunton, Mass., scrambled to evacuate 2,000 people as a 173-year-old dam upstream from the town threatened to rupture from the same foul weather. Ultimately, both communities were spared. Although more than 100 dams across New England were overtopped, breached or otherwise damaged that stormy weekend, the dams threatening Leverett, Shutesbury and Taunton remained intact. No lives were lost. Six months later, another spring storm flooded New England and broke through another 300 or so dams. Again, miraculously, no one was killed.

These near-catastrophes illustrate a deadly threat tucked in the backwoods of America's aging infrastructure. More than 11,000 high-hazard dams in the United States, many of them rarely inspected and poorly maintained, have the potential to injure or kill thousands. As alarming as the Interstate 35 West bridge collapse was in Minneapolis last August, the American Society of Civil Engineers gives better ratings to bridges than dams on its Report Card for America's Infrastructure. Bridges earn a grade of "C." The nation's dams consistently rate a "D."

The news gets worse. More than half of the high-hazard dams lack emergency evacuation plans, much less maps showing the areas that would be inundated if a dam were breached. Most people have no idea they live in the path of the torrent a failing dam would unleash. Moreover, the nation's dams need more than \$40 billion in repairs, and there's not nearly enough money to start fixing them.

"We started building dams as soon as we got off the Mayflower," says Laura Wildman, a civil engineer at American Rivers, a non-profit organization that focuses on healthy streams in the nation. "But we didn't come up with a system for dealing with dams in a country that is this big, this developed and this complex. As a result, no one thinks they are responsible for letting the people below a dam know they are at risk. So the job goes undone and countless millions live below dams - often crumbling - without a clue, until they see a large wall of water approaching their home."

The United States has a considerable history of fatal dam and levee failures. The most tragic is the collapse of the South Fork Dam that killed 2,209 people in Johnstown, Pa., in 1889. Serious flooding again visited havoc on the community in the 1930s. The U.S. Army Corps of Engineers was summoned to perform flood-control work.

"Afterward, the Corps of Engineers identified the community as flood-free," says Larry Larson, executive director of the Association of State Flood Plain Managers. Two more dam failures killed 45 people in the

Johnstown area in July 1977, and changed the way the Corps works, Larson adds. It no longer tells communities that flood-control measures, such as dams and levees, eliminate flood risk.

Almost every region has suffered. Between 450 and 600 people died from the 1928 St. Francis Dam failure in California, leading the state to start a dam-safety program. The National Dam Inspection Act was passed in 1972 after debacles in West Virginia and South Dakota killed 363 people. But Congress didn't fund the program until a fatal dam disaster in Georgia in 1977 prompted President Jimmy Carter to intervene.

The U.S. Army Corps of Engineers finally inspected some 9,000 non-federal dams in the late 1970s and early 1980s and rated about 2,900 of them as unsafe. It turned that information over to the states, which were responsible for making sure dam owners (mostly private individuals or companies) made necessary repairs. The inspection program soon faded, likely because of political pressure, a former Corps of Engineers official says.

"The governors were getting a list of dams every 30 days that they should take care of," says Charles Karpowicz, who performed dam safety work for the National Park Service and the Corps of Engineers. "In my experience, upper management - in this case, chief state executives - doesn't like getting lists of things that are unsafe and need to be dealt with immediately. It can take money away from (other) priorities."

More federal legislation followed, including the 1996 National Dam Safety Act. Another 140 dams have collapsed in the 12 years since its passage, including the Ka Loko Dam failure in Hawaii in March 2006 that killed seven people and caused more than \$50 million in damages.

"The Dam Safety Act hasn't made the nation's dams safer," Larson says. "It's a pretty minor program that has provided state legislatures with an excuse not to fund state dam-safety programs, by creating this false notion that the federal government has that covered."

State and federal officials say they need at least \$40 billion to repair the nation's dams. Some \$10 billion alone is needed for the most critical dams, the failure of which threatens human life. At best, Congress may provide \$200 million over the next five years to begin a fraction of that work. That's paltry compared to money the federal government spends to rehabilitate roads and bridges. Why the discrepancy? Lack of visibility. No one drives a dam to work.

In addition, there are government agencies dedicated to highways and bridges. The majority of dams, by contrast, are privately owned. And some 3,700 dams have no known owner - no one to hold responsible for keeping them safe.

Every state except Alabama has a dam-safety program that is supposed to oversee private and municipal dams. The majority of the dams under the states' jurisdiction aren't even inspected, because state programs are under-funded and under-staffed. For example, Texas has seven engineers to keep watch over 7,400 dams. Oregon has two engineers to track 1,200 dams, according to the Association of State Dam Safety Officials. These estimates are conservative, considering there's no accurate tally of the nation's dams and, therefore, no way to know the total number of unsafe structures.

"Even federal agencies haven't been maintaining their dams appropriately," says Stephanie Lindloff of American Rivers. "We're learning that some federally owned dams are in need of extensive repair." Federal dams are some of the nation's largest and have the potential to do the most damage.

The Corps of Engineers, which operates 610 dams, screened 200 of its highest-risk structures over the past three years as part of its "risk-informed" safety program. The agency identified six flood-control dams that urgently need work because they are critically close to failing, even under normal operations, and pose a threat to human life. These include the Center Hill Dam in Tennessee and the Wolf Creek Dam in Kentucky, either of which could flood Nashville, and are leaking because they are anchored in eroding limestone. Four navigation dams also made the Corps' most hazardous list, including the massive John

Day Dam on the Columbia River along the Washington-Oregon state line, which needs as much as \$1 billion in repairs.

Another group of Corps dams are classified as "unsafe or potentially unsafe." The list includes Dworshak Dam in northern Idaho, one of the tallest concrete dams in North America, which is leaking around the joints and foundation.

"Many of the dams in the Corps portfolio are more than 50 years old," says Eric Halpin, special assistant for dam and levee safety at the Corps of Engineers. "Materials and structures degrade over time. The bill is coming due." The costs of not addressing such problems are massive. "The consequences of the New Orleans levee failures totals between \$100 billion and \$200 billion," Halpin says. "What Hurricane Katrina informed the nation is, we can't afford not to do it."

Maintenance and safety are not the only issues. Housing developments constructed downstream from dams, or too close to inadequate levees, are known as "hazard creep," and it's usually caused by a lack of awareness of dams upstream, or the assumption that they are built to withstand anything forever.

"Hazard creep is especially common in densely populated areas like the Northeast," Wildman says. California alone requires that real-estate buyers be informed when they are acquiring property down-river from a dam. That should become a national mandate, she says.

Likewise, dam owners should be informed when a development is proposed downstream, because it potentially changes the dam's hazard classification from low or moderate to high. That means the dam must meet more stringent safety requirements, including possession of a larger emergency spillway and the capability to handle a more significant flood - extremely costly improvements.

"We need to incorporate the long-term costs of maintaining our infrastructure in our planning process, so we're prepared when the time comes to make repairs," Lindloff says. "If there's enough interest in building a piece of infrastructure, you would think there would be enough interest in maintaining its safety and structural integrity."

One solution often suggested is the removal of old dams built a century or more ago to provide power for sawmills, grist mills, textile mills and defunct factories. Proponents of dam removal argue that the cost of repairs and safety upgrades far exceed the economic benefits an older dam provides, and that equally important economic benefits can be derived from unobstructed runs of herring, salmon, shad and other fish. Such was the argument when Edwards Dam in Maine was removed in 1999. Pennsylvania is a leader in this effort, funding the removal of more than 30 small dams a year. But that takes money. In the meantime, public awareness of dam conditions, locations and their place on the "hazard" hierarchy is a tool with more impact.

Congress is considering legislation that requires "any area that could be inundated as a result of the failure of a levee, dam or other manmade structure" be added to the flood-plain maps produced by the Federal Emergency Management Agency.

"Let's be honest - there's never going to be enough money to fix all of the dams," says James Demby, a civil engineer in FEMA's dam-safety program. So what can we do to reduce the risk to people living in the dam-breach inundation zone? "We can have a really aggressive public outreach and public information strategy to educate people, and give them the knowledge and awareness, so they can take action to minimize their personal loss."

That appeals to Kenyon Fairey, who had no idea as she slept, that storm waters came within an inch of spilling over the Lake Wyola Dam. It was an entire year before she and her family learned of their peril on that storm-tossed night in Massachusetts.

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