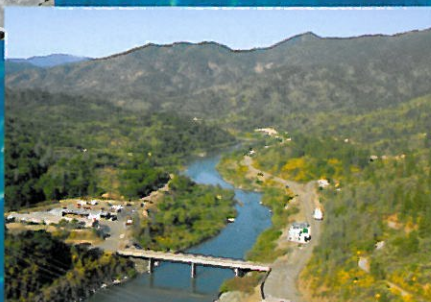
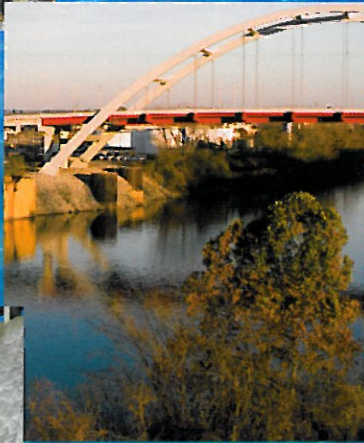


W A T E R R E S O U R C E S

# IMPACT

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**DISASTER  
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**AMERICAN WATER RESOURCES ASSOCIATION**

## THE DAM SAFETY IMPERATIVE

**Kenneth R. Wright and Bruce A. Tschantz**

As infrastructure ages and public works funds related to dams decrease, the challenges of avoiding dam failure are numerous and daunting. The dam category received a “D” on the 2009 infrastructure report card of the American Society of Civil Engineers (ASCE) (2010). The report card notes, “The number of deficient dams has risen to more than 4,000, including 1,819 high-hazard potential dams. Over the past six years, for every deficient, high-hazard potential dam repaired, nearly two more were declared deficient.” The average age of the 85,000-plus dams in the country is more than 51 years, which is especially concerning, considering the great increase in development downstream of dams.

Aging levees in poor condition are also a big concern, as demonstrated by the crisis in New Orleans in 2005 when the Industrial Canal, 17th Street Canal, and London Street Canal levees broke in the onslaught of Hurricane Katrina. The levee category was given a “D-” on ASCE’s 2009 report card (ASCE, 2010). As of September 2010, the Federal Emergency Management Agency (FEMA) had revoked accreditation to hundreds of levees across the United States (U.S.) because they no longer met standards that ensure protection during floods (Eisler 2010).

Now – before more problems occur – is the time for communities to work to ensure dam and levee safety. Governments at all levels and the public need to overcome several obstacles, such as: (1) great economic pressures on dam owners, (2) limited state budgets for dam safety, and (3) low local awareness of the hazards associated with dams.

The impact on the public from unsafe dams and levees can be high. Consider a few examples:

- A lakeside resort and farming area in eastern Iowa suffered an estimated \$150 million in damages when, on July 24, 2010, the Lake Delhi Dam sprung a 30-foot hole after heavy flooding. The earthen dam, built in 1918, was nine miles long and had a concrete spillway. Twelve thousand people were evacuated, although no injuries were reported. The dam failure caused a loss of property value when 900 lakefront and lakeside homes became homes next to a ravine with the Maquoketa River far below.

- The Lawn Lake Dam in Colorado’s Rocky Mountain National Park unexpectedly failed on July 15, 1982, releasing about 220 million gallons of water and emptying its lake, which had a surface area of 48 acres, in about a minute. The earthen dam, built in 1903, had not been routinely inspected or repaired after its access road deteriorated and became overgrown. The sudden burst of water killed three campers and destroyed the downstream Cascade Hydroelectric Dam, which added more water to the deluge. The town of Estes Park suffered millions of dollars in damage.

- On November 6, 1977, the Kelly Barnes Dam in Toccoa Falls, Georgia, broke, sending 176 million gallons of water smashing through a small college campus, killing 39 people, including 20 children living in married student housing. Experts said that a state of disrepair that allowed seepage, slides, and the growth of long-rooted trees on the dam contributed to its failure.

- An earthen dam impounding coal mine waste on Buffalo Creek in Logan County, West Virginia, gave way on February 26, 1972. One-hundred-and-thirty-million gallons of black wastewater was released, killing 125 people, destroying 4,000 homes and causing over \$50 million in property loss. Three commissions evaluated the failure and cited “ignored safety practices.”

Vigilance and awareness can save lives and property. On September 27, 2010, residents of Portage, Wisconsin, evacuated their homes in the face of indications that the town’s 120-year-old levee on the Wisconsin River was failing. After heavy rains, the river had risen to a record high and the 14-mile-long sand levee was saturated. Seepage was spewing from under its toe and water and sediment were leaking from the dike. Luckily, round-the-clock monitoring and sandbagging until the levee could dry out averted any crisis.

**In our security conscious nation, dam and levee safety problems persist ... These situations are a call to action for dam safety officials, dam engineers, those who create budgets for dam safety, and those who live near dams and levees**

### BARRIERS TO DAM AND LEVEE SAFETY

#### Great Economic Pressures on Dam Owners

Dam safety is achieved through dam maintenance and occasional upgrades and repairs, and the associated costs are the responsibility of the dam owners. Required maintenance and upgrades to dams can sometimes be accomplished economically, but have been known to cost millions. Fifty-eight percent of U.S. dams are privately owned, and many private (nonutility) dam owners are unable to afford the cost of repairs, even the most basic repairs necessary to maintain a minimum standard of safety. This problem is exacerbated as the dam ages and its hazard classification is increased.

When a dam’s hazard classification is changed to reflect a higher hazard potential because of increased development downstream of the dam, the dam usually needs to be upgraded to meet the greater need for safety (ASDSO, 2010b). Such development generally occurs without any input on the part of dam owners, yet they are solely responsible for funding required upgrades and are liable for damages.

**Limited State Budgets for Dam Safety**

Most states do not have adequate resources to inspect all of the dams that should be inspected (as shown in the table in ASDSO, 2010a). Statistics from ASDSO (2010a) show that most states do not have enough inspectors; ASDSO recommends that the ideal number of dams per inspector is 25, but presently the average number of dams that an inspector is responsible for is about 250.

According to ASDSO (2010a), budgets for dam safety range from a low of \$0 [South Carolina, although the state has 2.5 full-time equivalent (FTE) staff for dam safety] to a high of \$18,200,000 (California). Among states, the number of dams per FTE ranges from 11 for Florida to 2,260 for Iowa; the Territory of Puerto Rico has a ratio of 4 dams per FTE. Table 1 (below) was extracted from the complete table in the ASDSO (2010a) report and shows statistics from representative states.

**Low Local Awareness of the Hazards Associated With Dams**

Much of the general public is only vaguely aware of the high hazard potential dams in their communities, their status, and the potential impacts of failure. Developers have built – and zoning officials have allowed them to build – veritable villages in dambreak flood inundations areas, while the issue of potential hazards, their impacts, and how likely they are has not been addressed. Public education and awareness about dams needs to increase to keep communities safe.

Similarly, some owners of dams are not aware that they have a duty to provide proper dam maintenance and sufficient upgrades. Dam owners need to face their

responsibilities regarding public safety and stewardship of the environment.

**Other Issues Identified**

**Turnover Among Dam Operators, Engineers, and Regulatory Officials in the Dam Safety Milieu.** John Falk, Idaho Department of Water Resources Dam Safety Manager and former Dam Safety Coordinator in Oregon, says the biggest challenge to dam safety is "... the huge turnover of operators, engineers, and knowledgeable regulators in the dam safety community.

**Emergency Action Plans Are Not Always in Place.** In situations where not all dam owners can afford to maintain and upgrade their dams to the required level, emergency action plans are critical. When the Lake Delhi Dam in eastern Iowa failed this year, no deaths or injuries were reported. This good news is attributable in part to the fact that the dam had a partial emergency action plan in place. However, in general there is a lack of emergency preparedness nationwide. The ASDSO website's page, "Dam Safety 101" reports that "... only 33 percent of nonfederally owned dams considered high-hazard potential in the U.S. have emergency action plans" (ASDSO, 2010b).

**THE DAM AND LEVEE SAFETY IMPERATIVE**

Not all of the factors affecting dam and levee safety can be addressed quickly. Some issues, like state and federal budget crunches and employee turnover, are not likely to be alleviated in the foreseeable future. Is it hopeless? No. Will it be easy to ensure greater dam safety than currently exists? No. Nonetheless, with more focused

Table 1. Representative State Dam Safety Budgets and Personnel, 2009 (Source: ASDSO, 2010a).

State	Budget	Number of Full Time Equivalent Personnel	Number of Dams Regulated	Dams Per Full Time Equivalent Staff	Number of Dams Considered Deficient	Number of High Hazard Potential Dams	Number of Deficient High Hazard Potential Dams
Colorado	\$1,695,200*	14	1,935	138	9	312	3
Kansas	\$616,847	10.08	6,052	600	18	160	4
Louisiana	\$383,500*	6	540	90	20	16	13
Michigan	\$295,000	3.1	1,034	334	27	135	4
Nevada	\$207,000*	2	744	372	27	131	7
New Hampshire	\$865,000*	9	3,073	341	57	75	13
New York	\$1,597,642*	13.65	5,089	373	48	369	48
Pennsylvania	\$2,238,094*	24.5	3,196	130	529	781	263
South Dakota	\$150,000	1.5	2,349	1,566	67	51	10
Virginia	\$1,366,453*	5	1,678	336	125	138	45

\*Decrease from 2008 funding.

## The Dam Safety Imperative . . . cont'd.

awareness and diligence, the next dam or levee crisis might be averted.

Concrete steps that can be taken by dam owners, operators, and safety officials, as well as the general public, are as follows:

- **Join ASDSO.** The Association of State Dam Safety Officials is an important organization for disseminating the latest information necessary for those who deal with dams. According to its website, "ASDSO sponsors public awareness workshops designed to educate dam owners, and state and federal lawmakers about the need for strong dam safety programs" (ASDSO, no date; ASDSO, 1998).

- **Connect People With Funding.** Even in a tight economy, some funding resources exist. State water conservation boards, the U.S. Army Corps of Engineers, and, to a limited extent, FEMA, are all potential funding sources. Some states, like Ohio, have very good loan programs to assist dam owners with funding for safety-related repairs and improvements.

- **Create a National Dam Rehabilitation Funding Source.** Lori Spragens, Executive Director of ASDSO, says that low-interest loans need to be available for privately owned dams and matching grants are needed to assist with publicly owned dams. State rehabilitation funding sources need to be created.

- **Be Vigilant and Educated.** Citizens who own a dam or levee, or live below one, owe it to themselves and their communities to be educated on the status of the facility and to know the telltale signs of dam safety problems.

- **Reduce Consequences.** People should be aware of dams upstream of their homes and places of work and educate themselves on local Emergency Action Plans, escape routes and points of information dissemination to save property and lives.

- **Obtain Flood Insurance.** Flood insurance is a good idea, even for those who are not required to carry it. Between 20 and 25 percent of flood insurance claims come from people whose homes are in low- to moderate-risk areas.

In our security conscious nation, dam and levee safety problems persist. These situations are a call to action for dam safety officials, dam engineers, those who create budgets for dam safety and those who live near dams and levees.

### REFERENCES

ASCE (American Society of Civil Engineers), 2010. 2009 Report Card for America's Infrastructure.Dams: [http://www.infrastructurereportcard.org/sites/default/files/RC2009\\_dams.pdf](http://www.infrastructurereportcard.org/sites/default/files/RC2009_dams.pdf). Levees:[http://www.infrastructurereportcard.org/sites/default/files/RC2009\\_levees.pdf](http://www.infrastructurereportcard.org/sites/default/files/RC2009_levees.pdf).

ASDSO (Association of State Dam Safety Officials), 2010a. 2009-2010 Annual Report for the Fiscal Year Ending June 30, 2010. [http://damsafety.hostguardian.com/media/Documents/PDF/Annual%20Reports/ASDSO\\_2010\\_Annual\\_Report\\_Condensed.pdf](http://damsafety.hostguardian.com/media/Documents/PDF/Annual%20Reports/ASDSO_2010_Annual_Report_Condensed.pdf).

ASDSO (Association of State Dam Safety Officials), 2010b. Dam Safety 101. <http://www.damsafety.org/news/?p=d42cd061-cae2-4039-8fc6-313975f97c36>.

ASDSO (Association of State Dam Safety Officials), 1998. Model State Dam Safety Program. <http://www.damsafety.org/resources/downloads/?p=92fc7963-aa9e4f6f-9f02-2b19cdda4422>.

ASDSO (Association of State Dam Safety Officials), No date. What Does ASDSO Do? <http://www.dam-safety.org/news/?p=3d503777-3ebc-498c-818f-db0dca551905>.

Eisler, Peter, 2010. Hundreds of Levees No Longer Reliable: Ruling Means More Need Flood Insurance. *USA Today*, September 10-12, 2010.

### AUTHOR LINK

Kenneth R. Wright  
Wright Water Engineers, Inc.  
2490 West 26th Avenue, Ste. 100A  
Denver, CO 80211  
(303) 480-1700

### E-MAIL

krw@wrightwater.com  
btschant@utk.edu

**Kenneth R. Wright, P.E.**, is Chief Engineer and founder of Wright Water Engineers, Inc., of Denver, Colorado, which will celebrate its 50th year in 2011. Mr. Wright is a member of American Water Works Association (AWWA), ASDSO, and a Distinguished Member of ASCE. He is a registered engineer in 14 states and a Diplomate of Water Resources Engineering through the American Academy of Water Resources Engineers. He received the Order of Merit for Distinguished Service to the Republic of Peru and several academic awards for paleohydrologic research at Mesa Verde National Park and at the Peruvian archaeological sites of Machu Picchu, Tapon, and Moray.



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