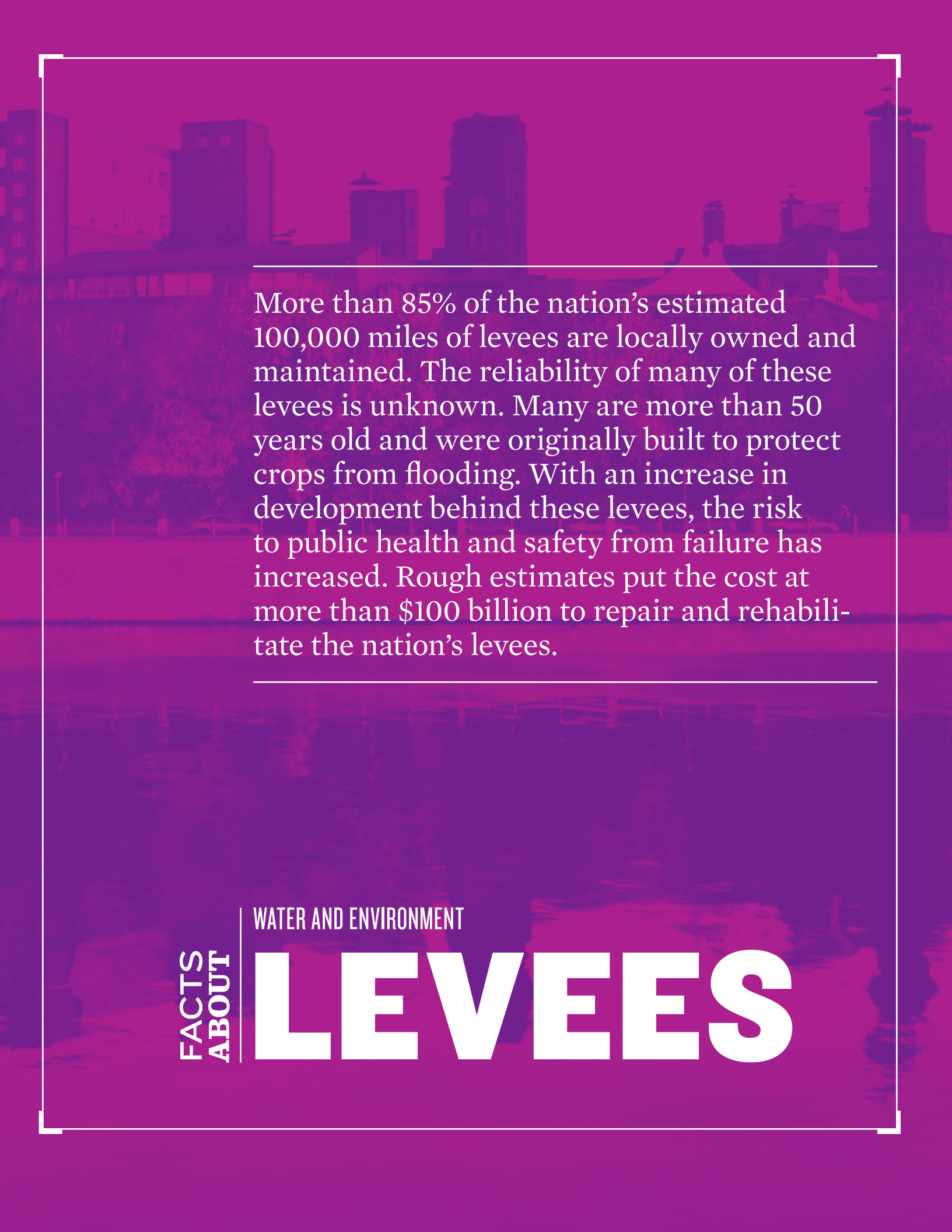
2009

INFRASTRUCTURE FACT SHEET

ASCE American Society of Civil Engineers



More than 85% of the nation's estimated 100,000 miles of levees are locally owned and maintained. The reliability of many of these levees is unknown. Many are more than 50 years old and were originally built to protect crops from flooding. With an increase in development behind these levees, the risk to public health and safety from failure has increased. Rough estimates put the cost at more than $100 billion to repair and rehabilitate the nation's levees.

WATER AND ENVIRONMENT

FACTS ABOUT

LEVEES

WATER AND ENVIRONMENT

LEVEES

2009 GRADE **D-**

RAISING THE GRADES

SOLUTIONS

THAT WILL WORK **NOW**

A = Exceptional
B = Good
C = Mediocre
D = Poor
F = Failing

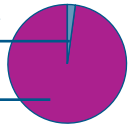
AMERICA'S INFRASTRUCTURE G.P.A. **D**

ESTIMATED 5-YEAR FUNDING REQUIREMENTS FOR **LEVEES**

Total investment needs
$50 BILLION

Estimated spending
$1.13 BILLION

Projected shortfall
$48.87 BILLION



★ **ADOPT** the following recommendations from the 2009 National Committee on Levee Safety:
ESTABLISH a National Levee Safety Commission;
COMPLETE the National Levee Inventory for both federal and nonfederal levees. The inventory must be regularly updated and maintained;
ADOPT a hazard potential classification system;
CREATE a strong education and outreach program to inform local leaders and residents about the level of protection they can expect from a nearby levee;[5]

★ **PHASE** in mandatory purchase of flood insurance with risk-based premiums for structures in areas protected by levees;

★ **INCREASE** funding at all levels of government to address structural and nonstructural solutions that reduce risk to people and property. Additionally, investments should be targeted to address life-cycle costs and research;

★ **REQUIRE** the development and exercising of emergency action plans for levee-protected areas;

★ **ENSURE** that operation and maintenance plans cover all elements of the system, recognizing that levees are part of complex systems that also include pumps, interior drainage systems, closures, penetrations, and transitions;

★ **ASSESS** levees using updated hydrology and hydraulic analyses that incorporate the impact of urbanization and climate change, particularly for coastal levees.

CONDITION

The state of the nation's levees has a significant impact on public safety. Levees are man-made barriers (embankment, floodwall, structure) along a water course constructed for the primary purpose of providing hurricane, storm and flood protection. Levees are often part of complex systems that include not only levees and floodwalls, but also pumps, interior drainage systems, closures, penetrations, and transitions. Many levees are integral to economic development in the protected community.

Federal levee systems currently provide a six-to-one return on flood damages prevented compared to initial building cost.[1] Despite this, baseline information has not been systematically gathered through inspections and post-flood performance observations and measurements to identify the most critical levee safety issues, quantify the true costs of levee safety, prioritize future funding, and provide data for risk-based assessments in an efficient or cost-effective manner.

There is no definitive record of how many levees there are in the U.S., nor is there an assessment of the current condition and performance of those levees. Recent surveys by the Association of State Dam Safety Officials and the Association of State Floodplain Managers found that only 10 states keep any listing of levees within their borders and only 23 states have an agency with some responsibility for levee safety. The Federal Emergency Management Agency (FEMA) estimates that levees are found in approximately 22% of the nation's 3,147 counties. Forty-three percent of the U.S. population lives in counties with levees.[4] Many of those levees were designed decades ago to protect agricultural and rural areas, not the homes and businesses that are now located behind them.[4]

In the aftermath of hurricanes Katrina and Rita in 2005, Congress passed the Water Resources Development Act (WRDA) of 2007. The Act required the establishment and maintenance of an inventory of all federal levees, as well as those non-federal levees for which information is voluntarily provided by state and local government agencies. The inventory is intended to be a comprehensive, geospatial database that is shared between the U.S. Army Corps of Engineers (USACE), FEMA, the Department of Homeland Security (DHS), and the states.

While the USACE has begun the inventory of all federal levees, to date few states or local agencies have provided any formal information, leaving the inventory far from complete. In addition, there is still much to be determined about the condition and performance of the nation's levees, both federal and nonfederal. As of February 2009, initial results from USACE's inventory show that while more than half of all federally inspected levees do not have any deficiencies, 177, or about 9%, are expected to fail in a flood event. The inventory data collection process is ongoing and these preliminary findings are expected to change as the process continues.[1, 6]

WRDA 2007 also created a committee to develop for the first time recom-

TABLE 4.1 ★ Damages from Flooding in Levee-Related Areas

LOCATION/YEAR	DAMAGES IN DOLLARS
Midwest 1993	$272,872,070
North Dakota/Minnesota 1997	$152,039,604
Hurricane Katrina 2005	$16,467,524,782
Midwest 2008	$583,596,400

SOURCE National Committee on Levee Safety

mendations for a national levee safety program. The National Committee on Levee Safety completed its work in January 2009 and the panel recommended that improvements in levee safety be addressed through comprehensive and consistent national leadership, new and sustained state levee safety programs, and an alignment of existing federal programs.[1]

Often, the risk of living behind levees is not well-known, and the likelihood of flooding is misunderstood. For this reason, little focus is placed on measures that the public can take to mitigate their risks. Though the 1% annual chance flood event ("100-year flood") is believed by many to be an infrequent event, in reality there is at least a 26% chance that it will occur during the life of a 30-year mortgage. The likely impacts of climate change are expected to increase the intensity and frequency of coastal storms and thereby increase the chance of flooding.[5]

In 1968, Congress enacted the National Flood Insurance Program (NIFP). One of the primary purposes of the NFIP was to address the inability of the public to secure privately backed insurance for economic losses from flooding. The NFIP designated the 1% annual chance event ("100-year flood") as a special flood hazard area in which those holding federally backed mortgages would be required to purchase flood insurance.

Never intended to be a safety standard, the 1% annual chance event became the target design level for many levees because it allowed development to con-

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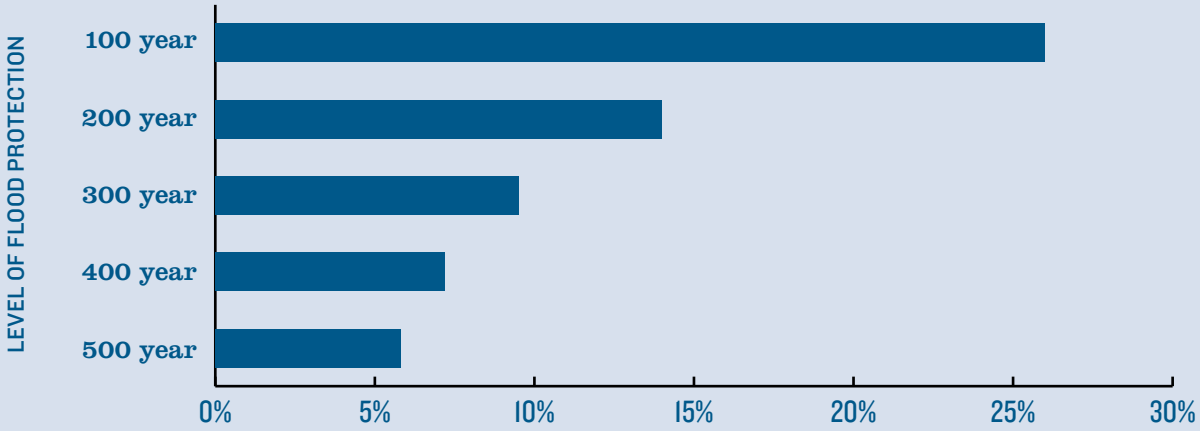
FIGURE 4.1 ★ Likelihood of Levee Failure/Flooding Over a 30-Year Residential Mortgage



SOURCE National Committee on Levee Safety

tinue while providing relief from mandatory flood insurance purchase for homeowners living behind accredited levees. Allowing levees to simply meet the minimum requirements of the NFIP has created an unintentional—and potentially dangerous—flood insurance standard that is now used as a safety standard.

During the past 50 years there has been tremendous development on lands protected by levees. Coupled with the fact that many levees have not been well maintained, this burgeoning growth has put people and infrastructure at risk—the perceived safety provided by levees has inadvertently increased flood risks by attracting development to the floodplain. Continued population growth and economic development behind levees is considered by many to be the dominant factor in the national flood risk equation, outpacing the effects of increased chance of flood occurrence and the degradation of levee condition. Unfortunately, lands protected by levees have not always been developed in a manner that recognizes the benefits of the rivers and manages the risk of flooding.

Additionally, in the absence of a comprehensive levee inventory, there are many uncertainties regarding location, performance, and condition of levees. There has been a lack of formal government oversight, sufficient technical standards, and effective communication of the risks of living behind a levee, further placing people and property in danger of floods.

Finally, FEMA's Flood Map Modernization Program, which remaps floodplains using modern technologies, is resulting in a reexamination of levees throughout the United States to determine if they can still be accredited. Before accrediting a levee, FEMA is requiring many communities to certify that their levees meet the 1% criteria.

RAISING THE GRADES
CASE STUDIES

UNITED STATES ★ National Levee Safety Commission

After decades of ignoring the safety and condition of the nation's levees, the U.S. Congress in 2007 recognized the dangers that a lack of a federal levee safety program posed to the nation. As part of the Water Resources Development Act, the USACE was charged with developing guidelines for a program and released its report in January 2009. This, in conjunction with the national levee inventory, is an important first step to protecting lives and property behind the nation's levees.

CALIFORNIA ★ Investment in Levees

There are more levees in California than in any other state. The levee systems in California are fragile and subject to the risk of failure. Estimates put the cost of bringing the state's levees and flood control system up to good condition at $42.2 billion. In February 2006, Governor Arnold Schwarzenegger proclaimed a state of emergency for the California levee system to address the problems. Voters in the state agreed with the need for comprehensive repairs and modernization and approved a multibillion-dollar bond issue to begin the funding process in 2006. *Photo courtesy of the California Department of Water Resources, Division of Safety of Dams.*

RAISING THE GRADES
CASE STUDIES

MISSISSIPPI RIVER ★ Levee Protection

Since 1885, the USACE has been armoring more than 1,000 miles of levees on the Mississippi River to prevent scour and protect the population behind the levee. Over the years, the Corps has developed a process of plating the levees with concrete mats that prevent erosion. To date, about 95% of the levees under the New Orleans District jurisdiction, which reaches as far north as Cairo, Illinois, have been armored and the bulk of work performed today is maintenance on the work completed in the last century.[7] **BELOW:** USACE mat sinking unit, placing concrete revetment mattresses along the Mississippi in Poydras, Louisiana. *Photo courtesy of Angelle Bergeron, New Orleans Correspondent,* Engineering News-Record.

Flood insurance is one of the most effective ways to limit financial damages in the case of flooding and speed recovery of flood damaged communities. Currently, many people who live behind levees do not believe that they need flood insurance, believing that they are protected by a levee structure. Requiring the purchase of mandatory flood insurance is intended to increase the understanding that living behind even well-engineered levees has some risk. This may encourage communities to build levees to exceed the 1% annual-chance protection standard that has mistakenly become a target minimum.

RESILIENCE

Levees serve to protect the public and critical infrastructure and to prevent flooding. With increasing development behind existing levees, the risk to public health and safety from failure has increased. To address the current lack of resilience in the nation's levee system, DHS has included levees within the critical infrastructure protection program in an attempt to identify those levees that present the greatest risk to the nation. DHS has also funded research to increase the robustness of levees—for example, armoring the slopes to resist erosion should floodwaters exceed the design elevation—and technologies are currently under study to rapidly repair any breaches that may occur in a levee. To ensure system integrity, future investments must also focus on life-cycle maintenance, research, development of emergency action plans for levee-protected areas, and security.

CONCLUSION

Much is still unknown about the condition of the nation's tens of thousands of miles of levees. The residual risk to life and property behind such structures cannot be ignored. Due to their impact on life and safety issues, and the significant consequences of failure, as well as the financial burden of falling property values behind levees that are not safe and are being decertified, the nation must not delay addressing levee issues. ★

SOURCES

1 U.S. Army Corps of Engineers, Summary Information from U.S. Levee Inventory.

2 Lee Bowman and Thomas Hargrove, Scripps Howard News Service, "America's Neglected Levees Put Millions in Danger," July, 2008.

3 U.S. Senate Testimony by Gerald Galloway, October 2, 2007.

4 Federal Emergency Management Agency, "The National Levee Challenge: Report of the Interagency Levee Policy Review Committee," September 2006.

5 National Committee on Levee Safety "Recommendations for a National Levee Safety Program," January 2009.

6 Peter Eisler, "Army Corps Cracks Down on Flunking Levees," *USA Today*, February 24, 2008.

7 Angelle Bergeron "Technique Conquers All as Long-Running Job Nears End," *Engineering News-Record*, January 19, 2009.