

Levee Safety and Risk: Status and Considerations

Levees can reduce or exacerbate flood risk. Prior to Hurricane Katrina in 2005, there was little public attention to the safety of the nation's levees. The failure of floodwalls (which were designed and constructed by the U.S. Army Corps of Engineers, or USACE) and breaching of levees in and around New Orleans contributed to significant loss of life and economic damage. The events of 2005 led to the enactment of legislation and ongoing efforts to inventory, inspect, and assess U.S. levees. Although these efforts have improved understanding of levee safety, significant data gaps remain for many levees in the United States, and many measures to correct identified safety concerns remain uncompleted. Recent floods and dam safety concerns (e.g., Oroville Dam in California) have increased interest in flood risk among policymakers, including those concerned about federal disaster response and recovery spending. This In Focus covers the evolution of efforts to inventory U.S. levees and assess their risks, and policy considerations for decisionmakers.

Safety and Risk: Introduction and History

Levees (i.e., engineered earthen embankments), engineered coastal dunes and berms, and floodwalls (which are constructed of metal or reinforced concrete) are built to reduce flood losses. Herein these structures are collectively referred to as levees. Risk associated with levees is a function of the *hazard* (e.g., level and duration of floodwaters), the *performance* of the levee (both prior to overtopping and after being overtopped), and the potential *consequences* (i.e., what is exposed to loss, damage, and disruption). Some risk, referred to as *residual risk*, remains behind a levee. Larger flood events can overwhelm levees; also, levees that are poorly designed, constructed, or maintained can fail. **Figure 1** illustrates the components of levee risk and some levee performance concerns.

Many of the nation's early levees were privately constructed to protect agricultural lands and rural communities. As early as 1917 and regularly thereafter, Congress authorized and funded USACE to construct numerous flood control projects that included levees; the agency continues to own, operate, and maintain some early USACE-constructed levees. Since the late 1980s, USACE-built levees are cost-shared 65% federal and 35% nonfederal during construction, and then transferred to

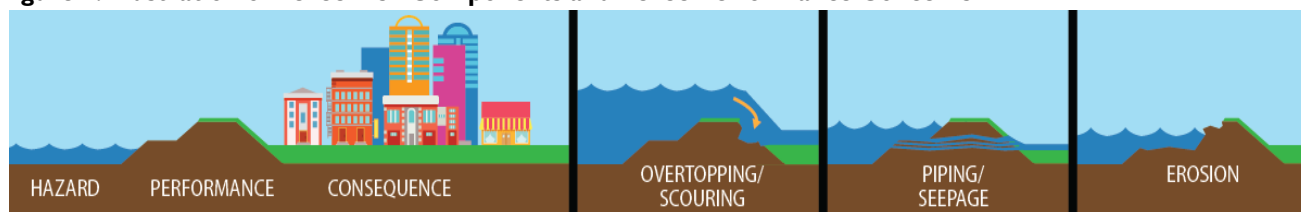
nonfederal entities (e.g., municipalities, water utilities, levee districts) for operation, maintenance, repair, and rehabilitation. Other federal agencies also have constructed levees for their own missions (e.g., International Boundary and Water Commission) or assisted in the construction of levees that are now operated by nonfederal entities (e.g., U.S. Department of Agriculture). Since its establishment in 1968, the National Flood Insurance Program (NFIP) has encouraged levee construction, operation, and maintenance; this encouragement results from the elimination of flood insurance purchase requirements and reduced premiums for structures that are mapped as removed from the 100-year floodplain due to the levee's protection. The Federal Emergency Management Agency (FEMA) is responsible for accrediting levees to appear on NFIP insurance rate maps (for more on NFIP, see CRS Report R44593, *Introduction to the National Flood Insurance Program (NFIP)*, by Diane P. Horn and Jared T. Brown).

There may be as many as 100,000 miles of levees in the United States. Nonfederal or private entities are responsible for maintaining most existing levees and often have few if any local or state requirements to satisfy regarding levee design and safety. Federal agencies are responsible for maintaining their own levees in good condition. USACE owns and maintains 4,200 miles of levees, and it also regularly inspects 8,200 miles of levees that participate in its Rehabilitation and Inspection Program (RIP). If the RIP-participating nonfederal levee owner has maintained the levee in good condition, USACE uses RIP to *repair* levees damaged from a flood or other natural event at a federal cost share of 80% to 100%.

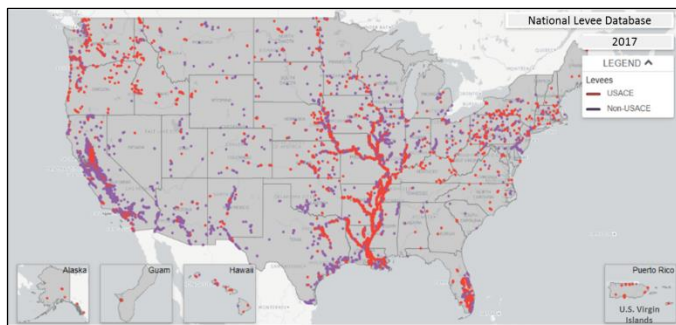
Levee Safety and Risk: 2005 to Present

In 2005, when Hurricane Katrina focused public attention on levee safety, there was no effort for levees equivalent to the National Inventory on Dams or the National Dam Safety Program. (See CRS In Focus IF10606, *Dam Safety: Federal Programs and Authorities*, by Charles V. Stern et al.) Through P.L. 110-114, in 2007 Congress charged the USACE with developing a National Levee Database (NLD). The NLD is a partial inventory of U.S. levees; it currently covers 29,000 miles of levees (see **Figure 2**). Nonfederal levee data are provided voluntarily.

Figure 1. Illustration of Levee Risk Components and Levee Performance Concerns



Source: CRS, adapted from Zina Deretsky, National Science Foundation, and USACE, *Risk Assessment for Flood Risk Management Studies*, 2017.

Figure 2. Levees in National Levee Database in 2017

Source: National Levee Database.

Notes: Levees in red are USACE-owned levees and Rehabilitation and Inspection Program levees; other levees are shown in purple.

No federal agency is broadly responsible for levee safety, although various agencies participate in aspects of levee safety. Ultimately, levee owners are responsible for maintaining their levees. There also is no broadly applicable national standard or requirement for levee construction or maintenance. Federal agencies are working toward consistent federal levee guidelines for their use as an intermediary step toward the voluntary national levee safety guidelines called for in Section 3016 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014; P.L. 113-121). USACE also has developed the Levee Safety Action Classification system to characterize a levee's risk and is working to incorporate "tolerable risk guidelines" into risk screening. These tools help identify levees of particular concern, such as those that protect concentrated populations or those that protect smaller concentrations of people but are in particularly poor condition. Although identifying levee risk has improved, a clear path to act on risk assessments for federal and nonfederal levees has not emerged, nor has there developed a consistent policy for the federal role in investments to improve levee safety for various types of nonfederal levees. Instead, as described in CRS Report R45017, *Flood-Risk Reduction and Resilience: Federal Assistance and Programs*, by Nicole T. Carter et al., levee-related improvements may be eligible to be selected or to compete for differing types of assistance under various federal programs. Also, some states have flood-control or infrastructure-assistance programs that may provide some financial support. No authoritative estimate of the total costs to improve U.S. levee safety exists. USACE is developing cost estimates to address safety issues for USACE-owned and RIP levees.

Unlike state dam safety programs, which operate at some level in every state except Alabama, there is little indication that the majority of states have levee inventories or have attempted to advance their levee safety oversight efforts in recent years. Congress in Section 3016 of WRRDA 2014 authorized a national levee safety initiative (NLSI); as part of the NLSI, Congress authorized FEMA to support the establishment or improvement of state and tribal levee safety programs. This initiative has remained unfunded in

subsequent appropriations cycles. USACE is attempting to complete by 2018, at a minimum, a one-time inspection and risk screening for all NLD levees; this effort may facilitate state levee safety efforts. States working with USACE on the NLD include California, Illinois, Ohio, Pennsylvania, and Texas.

Federal agencies continue working to advance levee safety efforts. These activities include clarifying guidelines and developing manuals (e.g., funding a 2015 *Guide to Public Alerts and Warning for Dam and Levee Emergencies* for emergency managers) and participating in outreach and technical assistance efforts (e.g., the interagency Silver Jackets program to assist with state flood-risk reduction priorities). Direction in WRRDA 2014 and other legislation (e.g., P.L. 112-141, §100226) led to efforts by FEMA and USACE to better coordinate their data sharing on levees and levee inspections to assist with FEMA levee accreditation. Congressional direction also led to FEMA altering how levees appear on NFIP insurance rate maps. Levees that provide lower levels of protection (e.g., the levee's level of protection does not remove the area behind it from the 100-year floodplain) may now be mapped. Proposals to require that the insurance maps identify residual risk behind levees have not been enacted.

WRRDA 2014 called for USACE to report biennially on the nation's levees; USACE is preparing a report focused on USACE-owned and RIP levees. WRRDA 2014 also called for a report on levee liability issues; no information is available on the report's status. After Hurricane Katrina, levee liability concerns contributed to various interests being wary of involvement in design, construction, and inspection of levees and other flood-control projects.

Policy Considerations

Numerous postdisaster proposals for the construction of new levees and floodwalls are being advanced as part of disaster recovery efforts in 2017. In addition to funding considerations, the responses of the 115th Congress and other decisionmakers to recent floods and hurricanes may be informed by many factors, as well as interest in rebuilding and long-term flood resilience. For example, levee safety efforts since 2005 have improved understanding of residual risk behind levees and identified safety issues at existing levees. Much of the analysis of U.S. levee risk to date has been based on hydrologic data that have not been updated recently. Research efforts are under way to not only improve these data but also better understand extreme flood hazards. There also is information on the impact that levee design and construction have on riverine and coastal ecology, challenges experienced with managing land use behind levees, and efforts to use and protect natural or distributed flood retention in watersheds. A question for policymakers is whether—and if so, how—to integrate new and existing levees into more comprehensive water and flood-risk management systems.

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