

# Chapter 10: Reducing the Consequences of Dam Failure

## 10.0 Supplements to a Dam-Safety Program

This manual has stressed safety as both a fundamental need and a prime responsibility of the dam owner. Developing an effective safety program is the single most important measure you, the owner, can take to reduce the possibility or consequences of dam failure. However, on a national scale, the level of dam safety is still far from acceptable. Losses are continuing to increase and may intensify as population growth and migration continue. From the perspectives of the nation and the dam owner alike, other steps are needed to reduce the risk of loss of life and property and minimize the potential subsequent liability.

Liabilities that arise following a dam failure strongly affect both organizations and people, governments and dam owners. Determination of liability is the legal means developed by society to recover damages due to a wrong (in this case, lack of dam safety). A thorough understanding of this legal process can help you decide on measures to reduce liability.

A discussion of liability and its relation to a dam owner is presented below, followed by a discussion of three important measures beyond that of individual dam safety that dam owners can promote to reduce liability—the use of insurance, the provision of governmental assistance, and the use of consultants.

## 10.1 Liability

The following discussion reviews general principles concerning liability and the operation of reservoirs. Liability in specific instances, however, is highly dependent upon the nature and construction of the dam, the particular circumstances surrounding the accident, the owner's action or failure to act, and the jurisdiction in which the reservoir is located.

In the event of a dam failure, the most commonly used theories to be pursued in litigation are negligence and strict liability. The choice will depend upon the law of the particular jurisdiction.

The liability of an owner of a reservoir is considered general civil (“tort”) liability. A tort is simply a civil wrong for which an injured party may recover damages from the responsible party. In most circumstances, simply causing damage is not a sufficient basis for the imposition of liability. Negligence must accompany the injury before liability is incurred. However, negligence is not a fixed concept; it has been modified and changed by court decisions over the years. In simplest terms, it has been described as the violation of a duty to act as a reasonable and prudent person would act; a violation which directly results in damage to another.

The questions of what duty is imposed by society and what standard of reasonable care is imposed by that duty have undergone enormous scrutiny and changes over the past 40 years. In many instances the duty to make a product safe

or the duty to ensure that one's property does not pose a danger to others has significantly increased.

While the concept of negligence has substantially broadened, changes in the limits of negligence do not directly affect dam owners in those jurisdictions where a separate basis of liability has long been imposed upon them. This standard, “strict liability,” is based not on fault or negligence, but solely upon resulting damage, regardless of fault. Strict liability is generally applied to activities deemed extremely hazardous and not capable of being rendered reasonably safe.

The whole concept of strict liability was first established in a case involving a reservoir—the 1866 English case *Fletcher v. Rylands*, L.R. 1, Ex. 265. A reservoir was built in the vicinity of abandoned coal mines; the water from the reservoir found its way into the abandoned shafts and from there into active shafts, causing damage. Under present legal thought, the basis of liability for such an occurrence may well be negligent design (i.e., failure to adequately investigate the surrounding circumstances at the time the reservoir was built). However, the actual decision assumed that no one could have known the abandoned mine shafts existed and specifically determined that the owner was not negligent. Nonetheless, the English court established the concept of strict liability for reservoir owners, and the owner of the reservoir was found liable for the escape of water from the reservoir, regardless of fault.

The holding in *Fletcher v. Rylands* has subsequently been adopted by many, but not all, U.S. courts and has been cited when similar circumstances are considered. It is the basis for imposing liability on the owner of a reservoir for all damages caused, regardless of fault and without a need to prove negligence.

Thus, with a very limited number of exceptions, the general principle regarding liability for the owner or operator of a reservoir (in a jurisdiction which recognizes strict liability) is:

**If water escapes from a dam, regardless of fault, the owner is responsible for all damages sustained.**

Note, however, that all of the discussion concerning compensation for damages due to release of water from a reservoir deal solely with water that has previously been stored. In all circumstances to date—and in most states by specific statute—a dam owner may pass on all natural flood waters without incurring any liability downstream.

Strict liability has two relatively narrow exceptions: acts of God and intentional acts of third parties over whom the owner had no control. While acts of God are recognized as a defense, they do not include all natural occurrences over which the owner had no control, but are more narrowly limited to over which the owner had no control and could not have anticipated using available expertise. The other exception—intentional acts of third parties—was established by the Wyoming Supreme Court in the *Wheatland* case [*Wheatland Irrigation District v. McGuire*, 537P.2d 1128 (1975)]. An irrigation district asserted that its reservoir had been damaged by saboteurs, and the Wyoming Supreme Court recognized that illegal, intentional acts by third parties which the owner

could not protect against or anticipate were a viable defense to strict liability.

Still, where there is no remedial legislation, the circumstances in which the reservoir owner is not liable for all damages caused by the leaking or breaking of a dam are severely limited.

While the standard of strict liability imposed on a reservoir owner affords extremely limited relief, several states have enacted legislation that limits liability for damages in many instances. In many other states, by statute or under common law, the owner of a reservoir is entitled to release water to the “normal high water line” of a stream without incurring liability for property damaged within the “normal” flood area. However, the definition of the limits within which no liability is imposed vary from place to place and may not be clearly designated on maps. Nonetheless, the right to release water to defined or “historic” floodplain regions downstream from a reservoir can provide substantial relief from strict liability for a reservoir owner.

Statutory modification of the basis of a reservoir owner’s liability, as passed in some states, could have a significant effect. However, as noted above, the trend during the past 25 years has been to widen, not narrow, the scope of negligent behavior by imposing broad expectations of prudence and foresight. Even if standards of “strict liability” are replaced by standards of “negligence,” in the case of a reservoir owner—because the criteria of reasonable care and foresight are broadly interpreted—the change may not greatly affect the actual outcome.

In summary, existing law holds a reservoir owner to the highest standard of care. The owner may be held liable for all damages caused by water escaping from a reservoir—despite the best efforts of the owner and regardless of when downstream development occurred relative to the date of completion.

## 10.2 Measures to Reduce the Consequences of Dam Failure

You, the owner, can directly and indirectly influence the introduction and use of a variety of measures that will reduce the consequences of dam failure. You should buy insurance, thus pooling your individual risk with others’. Land-use measures, although difficult to institute, can be an even better means of mitigating future disasters. (Restricting people from living in inundation zones obviously will radically improve safety.) Increasing public awareness and better governmental planning also can reduce the consequences of dam failure.

A dam owner can and should obtain insurance directly. The other measures discussed here—land use, public awareness and preparedness planning—are essentially controlled by local governments. Therefore, you would be wise to encourage, as strongly as possible, awareness and action within the public sector. Finally, you may also wish to hire consultants from the private sector when the information needed for prudent decisions exceeds your expertise.

### 10.2.1 Insurance

In many states a minimum level of insurance coverage is mandated by law; in Texas it is not. In either case, the level of insurance you carry should be based on state law, the value of facilities at risk, potential downstream impacts, the condition and age of the dam, the likelihood of a claim and the cost of available insurance. Because insurance spreads risk among a large group of people, it can not only protect you or your organization, but also your employees and members of governing boards who may be held personally liable. Types of coverage, availability, and cost will vary

from time to time, you would do well to seek professional advice when purchasing insurance. Some insurance companies and brokers specialize in issues related to dam failure. Industry representatives can recommend insurers. A policy can cover not only damage and liability, but also the cost of business interruption, lost income, and workers' compensation.

Insurance should be considered an accepted cost of doing business or enjoying the amenities a dam provides. Many have avoided this cost and have paid severely for their shortsightedness.

### 10.2.2 Governmental Assistance

A fundamental function of government is to protect citizens from threats to their health, safety, and general welfare. Reducing the consequences of dam failure is clearly a duty of federal, state, and local governments, which have joint and separate responsibilities to the public concerning dam safety.

Land-use planning, public-awareness programs, and emergency-preparedness planning are typically conducted locally, at the level of government most immediately available and responsive to the dam owner (usually the city or county). Federal agencies have technical expertise and can normally supply technical assistance when requested, but ultimately each state is responsible for its own dam-safety program.

*Local-government roles*—settlement pattern and population growth strongly affect the costs of dam failures. More simply, if no one were allowed to settle in hazardous areas, few, if any, lives would be lost and little property damaged. Conversely, as settlement continues near dams and in inundation zones, the potential for disaster increases commensurately. “Low-hazard” dams are continually being transformed into “significant-hazard” and “high-hazard” dams as this settlement

continues. Increased losses are inevitable unless significant land-use measures are enacted to restrict the use of land in inundation zones. The strategies used will reflect federal, state, and local efforts, but local government must make the critical decisions and only rely on state and federal government for support. All elements of mitigation planning are based on, or affected by, the way in which the affected land is used.

If the land has not been developed, the establishment of open space areas in potential inundation zones is a particularly effective—indeed, the best—way to reduce future costs of dam failure. Nonetheless, few states have organized programs or strategies of land acquisition or settlement restriction, usually because of strong opposition among developers and landowners.

If land is already under development, zoning measures to limit high population density can be useful. Also, the establishment of “green areas”—parks or golf courses—can be low-cost means of limiting settlement in inundation zones. In some fully developed areas, flood-proofing devices (walls, barriers) may prove useful, but must also be maintained.

In much of the nation’s inundation zones, land has already been developed and housing is already in place. People who live in such areas may have a false sense of security, unaware that a hazard even exists.

Experience has clearly shown that simple warning and evacuation procedures can save a significant number of lives. Table 10.1 demonstrates this success and the corresponding failure when early detection and warning are not available. Clearly, communities downstream from a dam should establish a system for early notification and warning.

Awareness varies across the nation. Some people are fully aware of their exposure to this hazard while many do not even realize that they reside in an inundation zone. Obviously, tourists are usually less aware than permanent residents; campgrounds, for example, are not normally posted with signs that point out the existence of a dam hazard. Clearly, awareness is the first step in mitigating the hazard and increasing safety.

Thus, counties, cities, towns and smaller unincorporated communities urgently need:

**Table 10.1  
Comparison of Warning Success for  
Selected Dam Failures and Flash Floods**

Event	Early Direction & Warning	Potential Loss of Life	Actual Loss of Life	Fatality Rate (%)
Big Thompson, CO. (flash flood)	No	2,500	139	5.6
Laurel Run Dam, PA	No	150	39	25.0
Kelly Barnes Dam, GA	No	200	39	20.0
Buffalo Creek, WV	Some	4,000	125	3.1
Teton Dam, ID	Yes	35,000	11	<0.1
Southern CT 6/82 (20 dams failed)	Yes	Unknown	0	0
Lawn Lake, CO	Yes	4,000	3	<0.1
D.M.A.D., UT	Yes	500	1	0.2
Big Bay Lake Dam, MS	Yes	300	0	0

- to develop programs to increase awareness of existing dam failure hazards, and more specifically, of who is in danger.
- to develop plans for warning and evacuating the population.

- to increase public familiarity with plans through publications, well publicized exercises and other means.

A public-awareness program will usually be well received and generate confidence in government. Media—radio,

television, and newspapers—are potentially the most effective means of educating the public. Encourage public awareness as well as warning and evacuation planning.