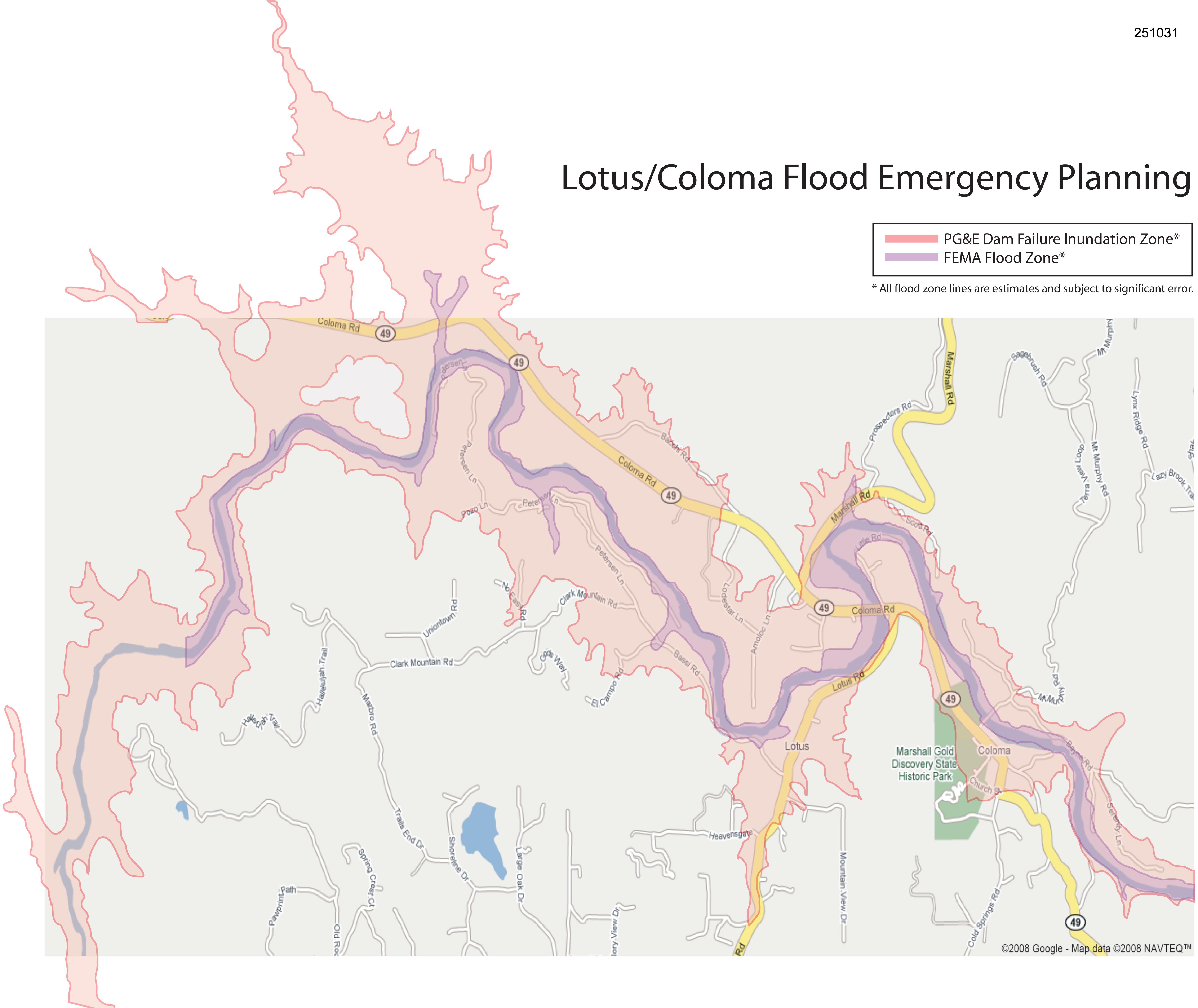
Appendix F
Attachments to Comments

Attachments to I52, I53, I54 and I55, Karen Mulvany

Lotus/Coloma Flood Emergency Planning

PG&E Dam Failure Inundation Zone*
FEMA Flood Zone*

* All flood zone lines are estimates and subject to significant error.



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TGPA-ZOU ZOU <tgpa-zou@edcgov.us>

Karen Mulvany Comments on EIR for TGPA and ZOU - 2

1 message

Karen Mulvany <kmulvany@gmail.com> Wed, Jul 23, 2014 at 3:04 PM
To: TGPA-ZOU@edcgov.us

Please find Exhibits 2 and 3 which are part of my comment letter with 6 exhibits.

Thank you,

Karen Mulvany

2 attachments

- Exhibit 2 USGS Landslide at Mill Creek 1997.pdf
  1951K
- Exhibit 3 Coloma-Lotus_ Jan 1997 Flood.pdf
  1396K

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Landslide Hazards Program

Report

Mark E. Reid, and Richard G. LaHusen, 1998, Real-time Monitoring of Active Landslides Along Highway 50, El Dorado County: adapted from: California Geology, v.51, n.3, p.17-20

Late in the rainy evening of January 24, 1997, tons of earth gave way down a steep Sierra Nevada canyon slope and slid onto a major northern California highway (Photo 1). The since-named Mill Creek landslide closed U.S. Highway 50 and briefly dammed (5 hours) the nearby South Fork of the American River, about 25 miles east of Placerville (Map) (Sydnor, 1997). The slide damaged or destroyed three cabins (Photo 2), and waters dammed by the landslide flooded two vehicles on the highway. Fortunately, there were no fatalities and the waters subsided after the river cut through the dam later that night. However, before Highway 50 could be reopened, an estimated 350,000 cubic yards of slide material (35,000 truck loads) had to be removed over a 4-week period, at a cost of $4.5 million (California Department of Transportation, 1997). Indirect economic costs due to highway closure were estimated at more than $1 million per day.

Photo 1: Aerial view of the Mill Creek landslide blocking Highway 50. Caltrans Photo courtesy of Lynn Harrison, Caltrans

Map: Location Map, Highway 50 Landslide area, California (click to enlarge)

Following the Mill Creek landslide, the U.S. Geological Survey (USGS), in cooperation with the Eldorado National Forest, acted quickly to install monitoring equipment that would measure landslide conditions and provide the results in real-time. The system was installed on the nearby active Cleveland Corral landslide which has the potential of blocking Highway 50 and possibly damming the American River if the entire slide moved rapidly. This landslide, with its downslope edge about 150 feet above the highway, had moved during the wet winter of 1996 and continued to move slowly downslope during the winter of 1997 (Photo 3).

Many other large landslides along this corridor of the South Fork of the American River have moved in the geologic past, and some may impact Highway 50 in the future (Wagner and Spittler, 1997). Although most slides in this canyon are dormant during dry times, they typically become active during or following extended periods of rain or snow melt due to increased ground-water pressures. These elevated pressures, in turn, reduce the overall strength of the slide and induce downslope movement. Many landslides along the corridor move slowly, traveling perhaps only a few inches over many days. Occasionally, however, a landslide will move rapidly, traveling hundreds of feet in a matter of minutes, as did the Mill Creek landslide in January 1997. Another occurrence upriver in 1983 closed the highway for 75 days (Kuehn and Bedrossian, 1987).

Photo 2: Cabins damaged and destroyed by the massive Mill Creek landslide that occurred on January 24, 1997. USGS Photo by Mark Reid, USGS/Menlo Park, 1997

Photo 3: Lateral scarp formed by recent movement at the edge of the monitored Cleveland Corral landslide. Sliding ground is to the right of the bare soil exposed in the scarp. Highway 50 is visible (gray, upper center) below the slide. USGS Photo by Mark Reid, USGS/Menlo Park

Prior to the installation of monitors, landslide movement patterns and associated hydrologic conditions along Highway 50 were not systematically measured. During the wet sinter of 1996, U.S. Forest Service geologists observed ground cracking in the hillslope that would later become the Mill Creek landslide. These field observations, however, were not sufficient to indicate that sudden and rapid movement would occur the following year. Elsewhere in the world, studies of landslides have shown that rapid slope failure may be preceded by gradually accelerating movement (Terzaghi, 1950; Varnes, 1983; Voight, 1989; Fukuzono, 1990). In order to detect these kinds of possible precursor movement for active landslides along Highway 50, continuous real-time monitoring was needed.

Soon after the Mill Creek landslide, the USGS installed a real-time monitoring system at the nearby active Cleveland Corral Landslide. A real-time monitoring system provides near-continuous measurements on the hydrologic conditions and ground movement of the landslide. This system is borrowed from USGS data acquisition and telemetry systems developed for remote monitoring of active volcanoes. Sensors for the system are installed in or on the landslide and the data are transmitted via radio telemetry to USGS computers (Photo 4). Data collected at such a continuous rate and in real-time will greatly increase the understanding of dynamic landslide activity and behavior in the Highway 50 corridor. The data will enable geologists to detect changes in landslide movement, monitor the rainfall and ground-water conditions, and hopefully anticipate possible catastrophic movement at the Cleveland Corral landslide.

Photo 5: Measuring landslide movement using a surface extensometer. Extensometer crosses several scarps (breaks that expose the reddish soils) at the head of the landslide. USGS Photo by Richard LaHusen, USGS/CVO

Landslide movement and hydrologic conditions are being monitored using a variety of sensors. The amount of downslope movement is recorded by extensometers, anchored to the ground surface at the edge of the landslide (Photo 5). Ground vibrations associated with slide movement are monitored by geophones buried within the landslide. (These geophones measure a wider dynamic response than standard earthquake seismometers, and have successfully detected large debris flows from volcanoes [Hadley and LaHusen, 1995; LaHusen, 1996]). Ground-water conditions within the slide are monitored by pore-water pressure sensors, and on-site rain gages record rainfall. Data are sampled from these sensors every second and transmitted to the USGS every 10 minutes. However, data are transmitted immediately in the event of strong ground vibrations associated with massive landslide movement.

Photo 4: Testing the solar-powered radio telemetry system used for real-time monitoring. USGS Photo by Mark Reid, USGS/Menlo Park

The USGS also has a cooperative project with the California Department of Transportation (Caltrans) to monitor five active landslide sites (including the Mill Creek landslide) along the Highway 50 corridor. Real-time data from the overall monitoring system, which involves 11 stations and 58 surface and subsurface instruments (Photo 6), are relayed through USGS computers to Caltrans engineers and geologists. These data may provide Caltrans with early notification of landslide activity and may also aid Caltrans engineers in the design of remedial measures to slow or halt these active landslides.

Photo 6: Caltrans drill rig installing subsurface extensometers (to measure landslide movement) and pore-water pressure sensors (to measure ground-water conditions) in the Mill Creek landslide. USGS Photo by Mark Reid, USGS/Menlo Park

Acknowledgments

We thank Steve Ellen and Richard Iverson (USGS), and Roy Bibbens (Caltrans) for their helpful reviews of this manuscript.

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January 1997 Flood

South Fork of the American River, Coloma-Lotus, California

How big was the flood?

Photo 1/2/97 by Barbara Thomas. See bottom of page for more information.

Flood Relief Information Center

Mother Lode Church - (916) 622-0686
870 Beach Court, Coloma
(Off Hwy 49, between Yosum's and Ceccardi's)
If busy, leave message at (916) 642-9720
If you have no phone, leave your address and we will visit the site.

Flood relief needs:
Work crews
Volunteer coordinators
Donations of goods, services, money
Location of salvaged goods

Flood assistance available:
Information or counseling
Work crews
Clothing, other goods
Lost and found service

Donations
If you want to donate, please

Flood Relief Meeting

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send checks to The American Red Cross and designate Coloma-Lotus area.

Tuesday, January 14, 7:00 p.m.
Mother Lode Church

1/31/97: There's lot's more cleanup to do, and opportunities for everyone to help. See the flood volunteers page for more information.

1/25/97: The Coloma Valley was evacuated last night when a **landslide** near Kyburz blocked the upper South Fork of the American River. One home was destroyed in the slide, and Highway 50 is closed again from Pollock Pines to Meyers.

Water began backing up behind the temporary dam, and officials feared that when it broke through there could be a wall of water that could destroy Slab Creek Reservoir and cause massive damage downstream. Fortunately the water worked its way through more politely and residents were allowed to return to their homes this morning.

For more details, see articles posted by the Sacramento Bee (detailed text). See the Coloma Weather Page for links to current weather and highway conditions.

1/23/97: **The numbers are in.** They have been able to take readings from the Chili Bar spillway, to determine the peak flows on January 2, 1997. They have determined the peak volume at Chili Bar to be 71,000 cubic feet per second (cfs). With all the runoff and side creeks, downstream volumes would be higher.

We've been told that the 100-year flood level at Chili Bar is estimated at 70,000 cfs, so this was in fact a 100-year flood. Note that for the upper South Fork (Kyburz area) it was more of a 200-300-year flood.

1/20/97: **THANK YOU** to all the **volunteers** who helped with cleanup the past two weekends! If you're feeling left out of the action, you can relax -- there's more to be done, and work parties will continue at least through the next two weekends.

A special **THANKS** goes to **John Tillman**, local resident and owner of Sierra Disposal. John donated two large dumpsters for river clean-up projects.

For more information on how you can be a part of the recovery effort, check the volunteers page or contact the Mother Lode Church at (916) 622-0686.

If you find **salvage** along the river, please remember that someone may be looking for it -- "finders keepers" doesn't apply when someone's belongings have been washed downstream. You can turn useable salvage in to Mother Lode Church or just give them a call with of the description of what you found, and they will try to match the lost with the found. Likewise if you've lost something,

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contact the church.

Do you have **high-water photos** of the "blue house" on river left just above the Hwy 49 bridge? The owners need photos for insurance. If you have photos of this house or others inundated, please contact us and we'll try to connect you with the homeowners.

Current South Fork River Conditions

Great Flood Resource!
Floods of 1997, Northern California Information Resources

Bruce Lewis' 1/10/97 email to Gold Country Paddlers

Rich Shipley's 1/7/97 email to Gold Country Paddlers

Boaters' Report 1/6/97 from The River Store

Would Auburn Dam Have Helped?

Although the Auburn Dam would not have prevented any of the flooding and devastation that occurred this past week, lawmakers may try to use these incidents to revive that project. Friends of the River calls for a review of the existing flood protection system and asks you to get involved.

Photographs

Chili Bar Dam, the Nugget, and the Chili Bar put-in

Troublemaker Rapid and Highway 49 area

Henningsen-Lotus Park and Camp Lotus

Flood photos by Jeff Lohse

Other 1997 Flood-Related Sites

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The Mountain Democrat

The Sacramento Bee

KOVR Channel 13 Storm Watch

The panoramic photo of Coloma and Marshall Park at the top of the page was taken from Mt. Murphy Road on 1/2/97, by Barbara Thomas. In the center of the picture you can see the one-lane bridge that connects Hwy 49 with Mt. Murphy and Bassi Roads. To the right of the bridge, the rear 1/3 of the Grange is inundated. Highway 49 in the park was closed for most of that day. (Click on the photo to see an enlargement.)

South Fork of the American River

The River Store

Coloma Valley
Home Page

Last update 7/8/98
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TGPA-ZOU ZOU <tgpa-zou@edcgov.us>

Karen Mulvany Comments on EIR for TGPA and ZOU - 3

1 message

Karen Mulvany <kmulvany@gmail.com> Wed, Jul 23, 2014 at 3:05 PM
To: TGPA-ZOU@edcgov.us

Please find Exhibit 4 out of 6 Exhibits that go with my comment letter on the EIR.

Thank you,

Karen Mulvany

Exhibit 4 2013 FEMA Living With Dams.pdf
13564K

Living With Dams

Know Your Risks

FEMA P-956 / February 2013

FEMA

Mulvany TGPA EIR CommentsExhibit 4 FEMA Living With Dams

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Mulvany TGPA EIR CommentsExhibit 4 FEMA Living With Dams

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Common Beliefs About Dams

FICTION *"The Army Corps of Engineers is responsible for most dams in the U.S."*

FACT State dam safety programs have oversight of most dams in the United States.

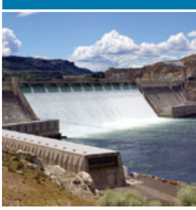
State agencies regulate more than 80% of the Nation's dams.

FICTION *"Dams are like roads and bridges. The government takes care of them."*

FACT Most dams are privately owned. Dam owners are responsible for maintenance and upgrades.

Private dam owners are responsible for more than 65% of the Nation's dams. Many lack the financial resources necessary for adequate dam maintenance.

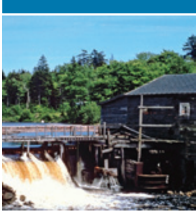
FICTION *"There are only a few dams in my State."*



FACT There are more than 84,000 dams in the United States (as of 2010). Most States are home to hundreds—or thousands—of dams, and each must meet regulatory criteria.

- Texas has the most dams—more than 7,000—followed by Kansas (6,087), Missouri (5,099), Oklahoma (4,755), and Georgia (4,606).
- Mississippi, North Carolina, and Iowa each have more than 3,000 dams.
- Five States—Alabama, Montana, Nebraska, South Carolina, and South Dakota—each have more than 2,000 dams.
- Fifteen other States have more than 1,000 dams each.
- Delaware has the fewest number of dams, with 86.

FICTION *"That dam has been here for years—it's not going anywhere."*

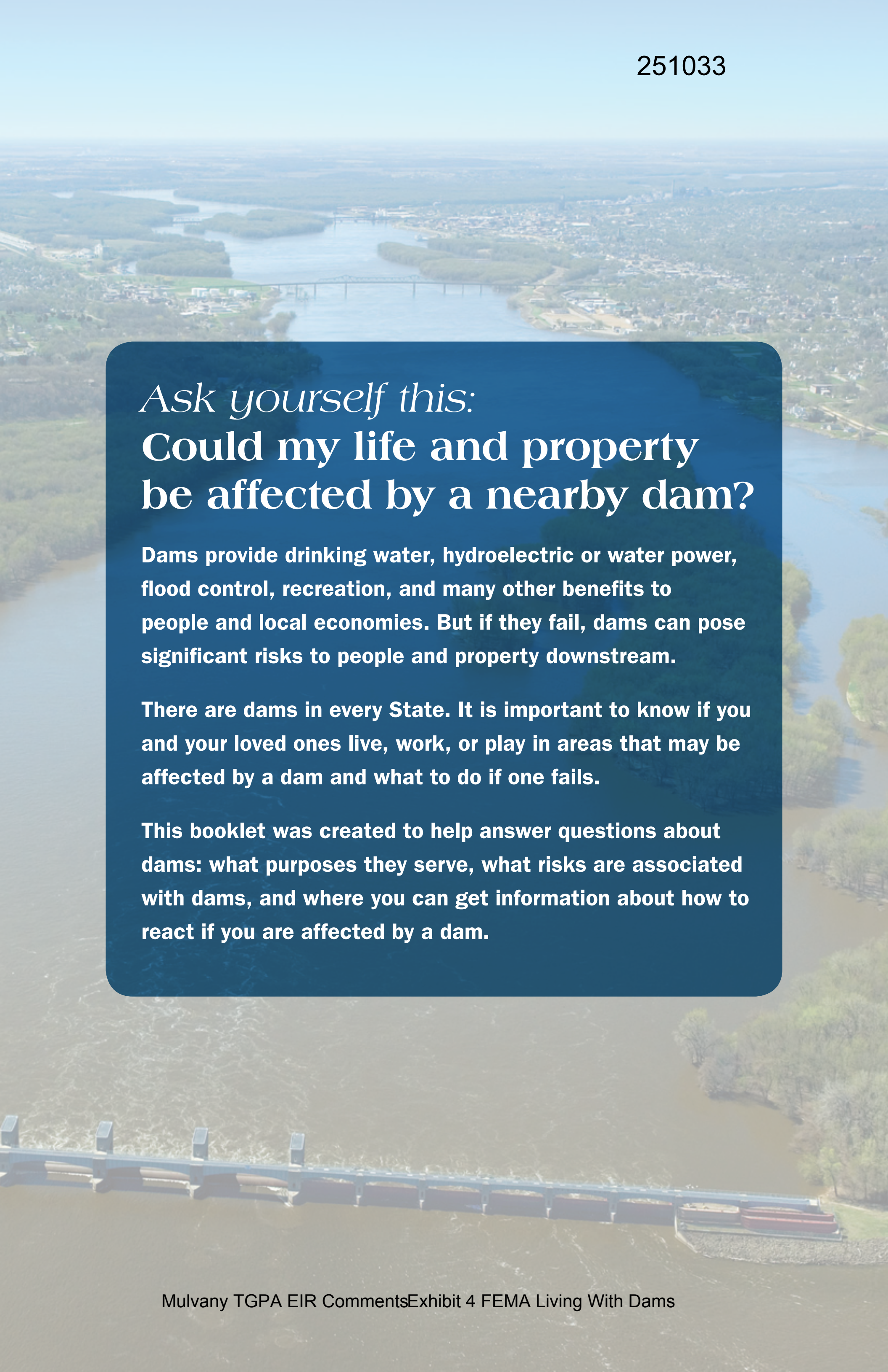


FACT Advancing age can make dams more susceptible to failure.

The average age of dams in the United States is more than 53 years.

As dams get older, deterioration increases and repair costs rise. Some common problems of older dams are:

- Deteriorating metal pipes and structural components; metal rusts over time, and after 50 years it can fail completely.
- Sediment-filled reservoirs. Some sediment may have contaminants from chemicals in runoff from upstream.
- Runoff from subdivisions and businesses built upstream. Roofs and concrete streets and sidewalks increase the volume of runoff to the reservoir.



Ask yourself this:

Could my life and property be affected by a nearby dam?

Dams provide drinking water, hydroelectric or water power, flood control, recreation, and many other benefits to people and local economies. But if they fail, dams can pose significant risks to people and property downstream.

There are dams in every State. It is important to know if you and your loved ones live, work, or play in areas that may be affected by a dam and what to do if one fails.

This booklet was created to help answer questions about dams: what purposes they serve, what risks are associated with dams, and where you can get information about how to react if you are affected by a dam.

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Why should I care about dams?

Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events.

What Dams Provide

Dams are assets, but they can also be hidden liabilities.

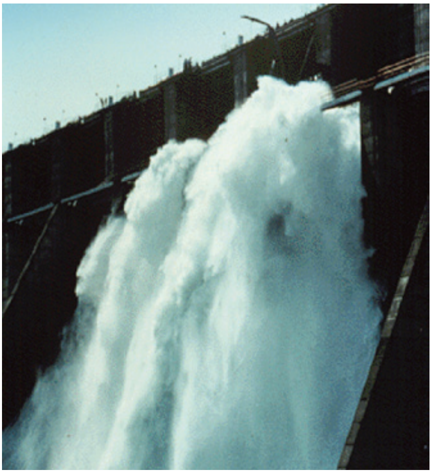
Dams provide vital benefits, including flood protection, water supply, hydropower, irrigation, and recreation. Imagine the impact of losing a major reservoir or flood control dam.

Mulvany TGPA EIR CommentsExhibit 4 FEMA Living With Dams

- Would there be catastrophic flooding? How many homes and businesses might be flooded? How many people would be displaced?
- Would there be adequate water for domestic use? Irrigating crops? Caring for livestock? Fighting fires?
- Are local utilities dependent on hydropower? How many lives and jobs would be affected by temporary shutdown or closure of an industry dependent on hydropower?
- How would transportation systems—roads, railroads, navigable waterways—be affected?
- How would local economies, jobs, and areas dependent on recreation be affected if a reservoir is lost?

If they are not maintained and operated correctly, dams can pose risks to those living downstream. When dams age, deteriorate, or malfunction, they can release sudden, dangerous flood flows. Dam failures can pose safety risks to an often unaware public.

Many communities in the United States are in the vicinity of at least one dam. In many cases, large populations, vital elements of our infrastructure, jobs, and businesses are located downstream of dams.



Dam failure floods are almost always more sudden and violent than normal stream, river, or coastal floods. They often produce damage that looks like tornado damage.

Dams are owned and operated by many different types of owners. Sometimes they serve a limited

purpose—for instance, a neighborhood association that wants its homes built around a lake—and sometimes they serve larger interests—for instance, a water supply utility.

Downstream development increases the potential consequences of a dam's failure. Dams built in once rural areas that would have affected nothing but open fields if they failed, are now capable of affecting neighborhoods and industrial areas. As a result of both new dam construction and development downstream of existing dams, the number of dams that could pose a risk to human life if they fail is steadily increasing. In the last decade, that number has increased by over 1,000 to a total of about 14,000 dams.

- **Any dam has the potential to adversely affect downstream areas and lives; and**
- **Many dams, should they fail, can also affect the delivery of essential utilities or flood control.**

Facts About Dams

Purposes

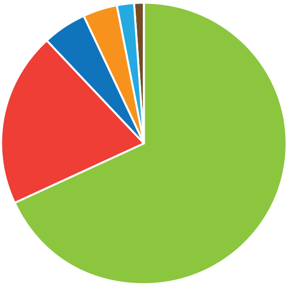
The purpose of a dam is to retain or store water or other liquid-borne materials for any of several reasons, such as human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, and pollution or flood control. Many dams fulfill a combination of these functions.

Ownership

Dams are unique components of our infrastructure because most dams are privately owned.

Dam owners are solely responsible for keeping their dams safe. Owners must finance maintenance, repairs, and upgrades, which can be expensive. Costs for non-Federal dam rehabilitation projects commonly range from hundreds of thousands to millions of dollars per dam. Such high price tags place a huge burden on dam owners, many of whom cannot afford to maintain their dams.

U.S. Dam Owners



Regulation

Dams are regulated for safety by the government in much the same way as bridges, factories, etc. States regulate the majority of dams in the United States (about 80 percent); the Federal government regulates the remaining 20 percent.

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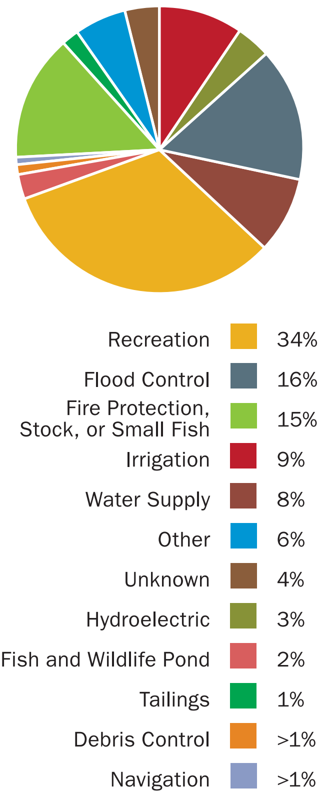
Main Types of Dams

Manmade dams may be classified by the type of construction material used, the methods used in construction, the slope or cross-section of the dam, the way the dam resists the forces of the water pressure behind it, the means used for controlling seepage, storage characteristics (on a watercourse, off-stream, above or below ground level), and occasionally, according to the purpose of the dam.

Dams can be constructed from a variety of materials, including soil, rock, tailings from mining or milling, concrete, masonry, steel, timber, miscellaneous materials (such as plastic or rubber), and combinations of these materials.

Embankment dams are the most common type of dam in use today. Materials used for embankment dams include natural soil or rock or waste materials obtained from mining or milling operations. An embankment dam is termed an "earthfill" or "rockfill" dam, depending on whether it comprises compacted earth or mostly compacted or dumped rock. The strength of an embankment dam is primarily a result of the type of materials from which the dam is made.

Dams by Primary Purpose



Embankment dam

Mulvany TGPA EIR CommentsExhibit 4 FEMA Living With Dams

Concrete dams may be categorized as gravity and arch dams depending on how they resist water pressure from the reservoir. The most common type of concrete dam is a concrete gravity dam. The mass weight of concrete and friction resist the reservoir water pressure. A buttress dam is a specific type of gravity dam in which the large mass of concrete is reduced, and the water pressure forces are diverted to the dam foundation through vertical or sloping buttresses. Gravity dams are constructed of vertical blocks of concrete with flexible seals in the joints between the blocks.


Concrete dam

Concrete arch dams are typically thinner in cross-section than gravity dams. The reservoir water forces acting on an arch dam are carried laterally into the abutments. The shape of the arch may resemble a segment of a circle or an ellipse, and the arch may be curved in the vertical plane as well as the horizontal plane. Such dams are usually constructed of a series of vertical blocks that are keyed together; barriers to stop water from flowing are provided between the blocks. Variations of arch dams include multi-arch dams, in which more than one curved section is used, and arch-gravity dams, which combine some features of the two types of dams.

Other Types of Dams

Tailings dams impound industrial waste materials from mining operations or mineral processing.

Ash impoundments, or ponds, are used to store or dispose of ash generated primarily from the combustion of coal. These impoundments are a type of waste management facility consisting of an excavated, dammed, or diked reservoir in which coal ash is stored for future removal or disposed of as slurry or sludge. The coal ash solids settle out, and the water at the surface is discharged through a designed and managed outlet structure to a nearby stream, surface water, or plant process water system.

Spillway Discharge and Seepage

Water may pass from the reservoir to the downstream side of a dam by:

- Passing through the main spillway or outlet works
- Passing over an auxiliary spillway
- Overtopping the dam
- Seeping through a dam or abutment, or under a dam

Water normally passes through the main spillway or outlet works; it should pass over an auxiliary spillway only during periods of high reservoir levels and high water inflow.

A number of concrete dams have been designed to be overtopped. However, overtopping of an embankment dam is detrimental because the embankment materials may be eroded.

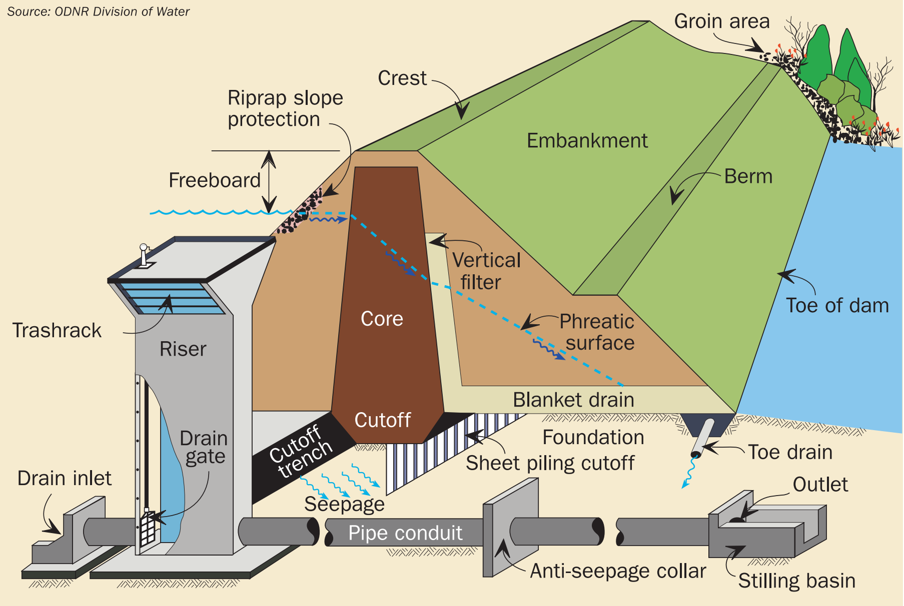
All embankment and most concrete dams have some seepage; controlling the seepage using proper dam construction, maintenance, and monitoring is important to prevent internal erosion and instability.

Release of Water

Intentional releases of water from dams are confined to spillways and outlet works. A dam typically has a principal or mechanical spillway and a drawdown facility. Additionally, some dams are equipped with auxiliary spillways to safely pass extreme floods.

Even when operated as designed, many dams will pass huge volumes of flood water into downstream areas.

Spillways are designed to prevent overtopping of dams. The most common type of spillway is the free-overflow spillway. This spillway may be constructed over or through the dam or an abutment. To permit maximum use of storage volume, movable gates are sometimes installed above the spillway crest to control discharge. Many smaller dams have a pipe and riser spillway to carry most flows and a vegetated earth or rock-cut spillway through an abutment to carry infrequent high flood flows. In dams such as those on the Mississippi River, flood discharges are of such magnitude that



Parts of a dam

the spillway occupies the entire width of the dam and the overall structure appears as a succession of vertical piers supporting movable gates. High arch-type dams in rock canyons usually have downstream faces too steep for an overflow spillway. In Hoover Dam on the Colorado River, for example, a shaft spillway is used. In shaft spillways, a vertical shaft upstream from the dam drains water from the reservoir when the water level becomes high enough to enter the shaft or riser; the vertical shaft connects to a horizontal conduit through the dam or abutment into the river below.

Outlet Works In addition to spillways, dams contain outlet works that allow water to be drawn, either continuously or as needed, from the reservoir, and provide a way to draw down the reservoir for repair or safety concerns. Water may be discharged into the river below the dam, run through generators to provide hydroelectric power, or used for irrigation. Dam outlets usually consist of pipes, box culverts, or tunnels with intake inverts near the minimum reservoir level. Such outlets are provided with gates or valves to regulate the flow rate.

What are the risks associated with dams?

Dam failures are low probability but high consequence events. Even so, they typically occur somewhere in the United States every year.

Although thousands of lives have been lost and substantial property damage has occurred as a result of dam failure, good planning and improved dam safety programs, as advocated in this brochure, have reduced loss of life and property damages dramatically in recent years.

Dam failures or partial failures are not usually caused by storm events. Most failures fall into one or more of the following categories:

Structural failures Foundation defects, including settlement and slope instability, or damage caused by earthquakes, have caused about 30 percent of all dam failures in the United States.

Mechanical failures Malfunctioning gates, conduits, or valves can cause dam failure or flooding both upstream and downstream and account for about 36 percent of all dam failures in the United States.

Hydraulic failures Overtopping of a dam is often a precursor to dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest accounts for approximately 34 percent of all dam failures in the country.

These problems can lead to dam failure:

- Inadequate design criteria
- Malfunction of dam components
- Spillway damage or malfunction
- Seepage problems
- Embankment stability problems
- Damage from vandalism
- Improper operation

Thousands of dams nationwide are considered deficient and susceptible to failure because of these problems.

Planned Releases

Operation of spillways, either planned or in response to emergency situations, can create flooding and public safety hazards, even in the absence of a dam failure. During periods of extreme flow, dams may fill to capacity, necessitating emergency releases that can flood downstream areas. People swimming and fishing downstream of dams have been caught in spillway releases, at times with tragic results. Many dams incorporate sirens to warn the public of an impending release.

Recent Dam Failures

July 25, 2010 – Lake Delhi Dam, Delaware County, IA

The dam failure drained a 9-mile recreational lake and damaged or destroyed up to 300 homes.

January 6, 2009 – Private Dam, Etowah County, AL

After floodwaters washed away a culvert, a private dam broke and produced up to 12 feet of flooding in the area, which caused residences to be evacuated. A dozen roads were also closed as a result of floodwaters and property damage was reported to be $100,000.

December 22, 2008 – Kingston Coal Waste Dam, Roane County, TN

The Kingston Dam was a 40-acre pond used by the Tennessee Valley Authority to hold a slurry of ash generated by the coal-burning Kingston Steam Plant. The dam gave way just before 1 a.m., burying a road and railroad tracks leading to the plant under 5.4 million cubic yards (more than 1 billion gallons) of sludge, which damaged 12 homes and covered hundreds of acres. The cleanup cost was $1 million per day.

March 14, 2006 – Ka Loko Dam, Kauai, HI

The failure of an embankment dam in this relatively undeveloped area killed seven people and caused extensive environmental damage.

December 14, 2005 – Taum Sauk Dam, Lesterville, MO

The failure of this off-stream hydropower facility located high above Johnson's Shut-Ins State Park destroyed the home of the park superintendent and swept his family downstream. Miraculously, all survived. The flood washed out part of a State road and caused extensive environmental damage to the East Fork of the Black River and to the park, which in warm weather months is typically populated with hundreds of campers and hikers.

Historically Significant Dam Failures

February 26, 1972 – Buffalo Creek Valley, WV

The failure of a coal-waste impoundment at the valley's head took 125 lives and caused more than $400 million in damages, including the destruction of over 500 homes. This disaster wiped out 16 communities.

June 9, 1972 – Rapid City, SD

The Canyon Lake Dam failure took an undetermined number of lives (estimates range from 33 to 237). Damages, including the destruction of 1,335 homes, totaled more than $60 million.

June 5, 1976 – Eastern Idaho

Eleven people perished when Teton Dam failed. The failure caused an unprecedented amount of property damage totaling more than $1 billion. The failure flooded at least six communities and tens of thousands of acres.

July 19–20, 1977 – Laurel Run, PA

Laurel Run Dam failed, killing more than 40 people and causing $5.3 million in damages.

November 5, 1977 – Toccoa Falls, GA

Kelly Barnes Dam failed, killing 39 students and college staff and causing about $2.5 million in damages.

May 31, 1889 – Johnstown, PA

The deadliest dam failure in U.S. history took the lives of more than 2,200 people.

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Am I or could I be affected by a dam and what area would flood if the dam failed?

Many people who live in dam breach inundation zones are completely unaware of the potential hazard lurking upstream.

The "inundation zone" is the area downstream of the dam that would be flooded in the event of a failure (breach) or uncontrolled release of water, and is generally much larger than the area for the normal river or stream flood event.

The "dam breach inundation zone" is larger than the 1-percent-annual-chance flood used on FEMA's Flood Insurance Rate Maps (FIRMs).

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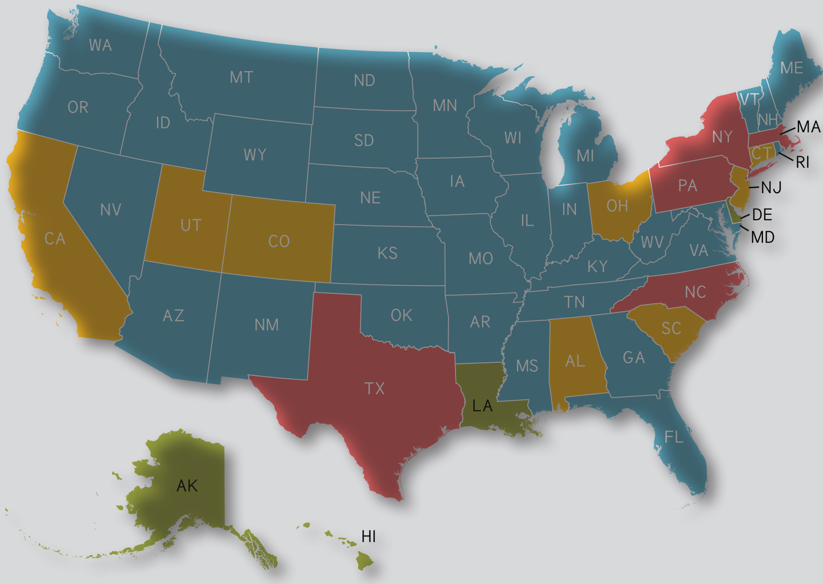

Number of high- and significant-hazard potential dams, i.e., those that have the potential to cause loss of life (high) or extreme property damage (significant) if they fail.

RED = More than 1,000 dams
YELLOW = Between 500 and 1,000 dams
BLUE = Between 100 and 500 dams
GREEN = 100 dams or less

NOTE:
Since Alabama is the only State that does not have a regulatory program, the number of reported dams may be low.

How do I find out if I live in a dam breach inundation zone?

- Contact your local emergency management agency (a simple Internet search will most likely locate the appropriate office).
- Contact your State dam safety program (see the U.S. map at www.damsafety.org).

Before buying:
Do some research, Know the facts

Before buying a home or business, determine whether it is in a dam breach inundation zone. This determination is the buyer's responsibility.

Prospective buyers should know whether there is an existing upstream dam or the potential for an upstream dam to be built. This is sometimes difficult to determine while standing on the property because the upstream dam may not be in sight. In some cases, the dam site may be several miles upstream of the property and the view may be obscured. Here are some resources that will assist your research:

- 7.5 minute U.S. Geological Survey topographic maps: http://topomaps.usgs.gov
- Google Earth
- The State dam safety agency office, the local emergency management office, or the local soil and water district office

Likewise, buying property on or near a manmade lake requires an understanding of what that proximity entails. Such properties tend to have higher values than similar sized properties not associated with a lake. The removal of the lake or a permanent lowering of the lake's water level can dramatically reduce property values on or near the lake. The fluctuation of the lake levels from normal pool to flood pool elevations can hinder or eliminate the use of the property and associated structures. In many cases the dam is owned by a neighborhood association of lakeside property owners who are responsible for the dam's maintenance and are liable for any risk posed by the dam.

Prospective buyers should learn of the risks, legal and financial liabilities, and other issues associated with the lake, dam, and control structures prior to the purchase of a home.

Changing weather patterns, erosion, and development can affect areas at risk from dam failure. FEMA is currently updating and modernizing its FIRMs (www.fema.gov/hazard/map/firm.shtm) to help the public better understand flood risk. FEMA has published almost 100,000 individual FIRMs. You can find your map and learn how to read it so you can make informed decisions about protecting your property, both financially and structurally at the FEMA Map Service Center (www.msc.fema.gov).

Currently, the dam breach inundation zones are NOT shown on Flood Insurance Rate Maps maps as areas requiring flood insurance. Even though it is not required, buying flood insurance to protect a financial investment in homes and businesses located below dams may be wise.

Visit www.FloodSmart.gov for more information on flood insurance.

Once I determine that my property is in a dam breach inundation zone, what's next?

Find out the dam's condition. Does it meet Federal or State safety criteria?

Contact your county emergency management coordinator or State dam safety program office to find out who owns the dam and which agencies regulate it. Contact information for State Dam Safety Programs is listed online at www.damsafety.org.

Ask questions about the dam's condition and hazard potential

State officials and the dam owner should be able to answer questions such as:

- ***What is the dam's hazard potential classification?***
- ***When was it last inspected?***
- ***What is its condition?***
- ***Is the owner financially capable of properly maintaining the dam?***
- ***Is there a plan in place in the event of a dam failure?***

Emergency Action Plans

One of the most important questions to ask State dam safety officials or dam owners is whether there is an up-to-date Emergency Action Plan (EAP) for the dam in question. An EAP is a formal document that identifies potential emergency conditions at a dam and specifies actions to reduce property damage and loss of life. The EAP includes actions the dam owner should take to mitigate problems at the dam and issue warnings to responsible emergency management authorities.

If you live or work in a dam breach inundation zone, find out your evacuation route so that you can quickly get out of harm's way in the event of a dam incident. To obtain this information, contact your State and local emergency management officials, who are responsible for evacuation planning and implementation.

Communication with emergency managers is key. Points to remember:

- Find out if there is an up-to-date EAP for the dam.
- Determine what types of warning systems are in place to warn residents of a dam incident. For example, are there sirens, a Reverse-911 phone

messaging system, bullhorns, or door-to-door warning procedures in place? Always heed warnings to leave.

- Find out how to get to a place of safety and what evacuation routes will be open.
- Ask about the location of community emergency shelters.
- Inform emergency management officials of family members who are handicapped or may need special assistance.

Prepare your home and your family

- Inform your family of dam failure flood risks, and make sure each family member knows what to do in the event of an emergency.
- Elevate your furnace, water heater, and electric panel if they are susceptible to flooding.
- Install "check valves" in sewer traps to prevent floodwater from backing up into drains.
- Seal basement walls with waterproofing compounds to avoid seepage.
- Keep valued possessions and important papers on an upper level of your home or in a safety deposit box.
- Prepare an emergency kit.

What should you do in the event of an emergency?

If a flood is likely in your area, you should:

- Listen to the radio or television for information.
- Be aware that dam failure or operational flooding can occur. If there is any possibility of a flash flood, move immediately to higher ground. Do not wait for instructions to move. Get to high ground if flooding is imminent.
- Be aware of streams, drainage channels, canyons, and other areas that may flood suddenly. Flash floods can occur in these areas with or without such typical warnings as rain clouds or heavy rain.

If you must prepare to evacuate, you should:

- Secure your home. If you have time, bring in outdoor furniture. Move essential items to an upper floor.
- Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances. Do not touch electrical equipment if you are wet or standing in water.

If you have to leave your home, remember these evacuation tips:

- Do not walk through moving water. Six inches of moving water can make you fall. If you have to walk in water, walk where the water is not moving. Use a stick to check the firmness of the ground in front of you.
- Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely. You and the vehicle can be quickly swept away.

Do I need to buy flood insurance?

Because standard homeowners insurance doesn't cover flooding, it's important to have protection from the floods associated with hurricanes, tropical storms, heavy rains, dam failures, and other conditions that can affect your home or business.

In 1968, Congress created the National Flood Insurance Program (NFIP) to help property owners to financially protect themselves from floods. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding.

Flood insurance is highly recommended but not required for those living in dam breach inundation zones.

Just because you haven't experienced a flood in the past doesn't mean you won't in the future. Flood risk isn't based just on history. It's also based on a number of other factors: potential dam failure, rainfall, river-flow, topography, flood control measures, and changes due to development.

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Dam Safety, Flood Risk, and Emergency Management Responsibilities

The Public

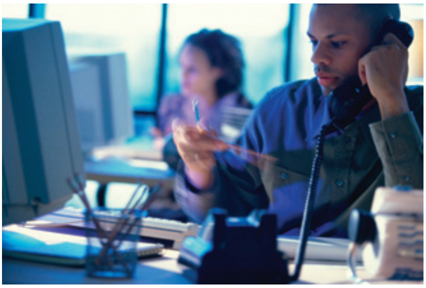
- Understand that you are at risk and that there are steps you can take now to protect yourself from floods should a dam fail or release flood waters.
- Know your evacuation routes.

Dam Owners and Operators

- Maintain and operate the dam properly to ensure that the dam does not fail.
- Work with State and local officials to mitigate the consequences of dam incidents.
- Maintain an EAP. Inform local officials of risks associated with the dam.
- Work with the Federal or State regulator to comply with safety standards.

State and Local Governments

- State governments are responsible for public safety regulation for more than 80 percent of the Nation's dams (non-Federal dams).
- State and local governments are responsible for determining how land is used in floodplains and for enforcing floodplain management regulations.
- Local governments are responsible for emergency response and evacuation in a flooding situation.



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What is the 1-percent-annual-chance flood?

FEMA uses the 1-percent-annual-chance flood standard (the flood that has a 1 percent annual chance of being equaled or exceeded) to define floodplain boundaries on FIRMs, which are used for insurance purposes, floodplain management, and planning efforts. Areas within the 1-percent-annual-chance floodplain are known as Special Flood Hazard Areas (SFHAs).

- Within an SFHA, you have a 26 percent chance of experiencing a flood of that magnitude or greater during the life of a 30-year mortgage. You would have a 4 percent chance of experiencing a fire during the same period of time.
- Dam breach inundation zones may far exceed the 1 percent flood zones mapped by FEMA.
- Floods greater than a 1-percent-annual-chance flood can and do happen; the Midwest experienced two 0.2-percent-annual-chance floods in a 15-year period (in 1993 and 2008).
- Dam failure floods are almost always more violent than the normal stream, river, or coastal floods.

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Federal Dam Safety, Floodplain, and Emergency Management Programs

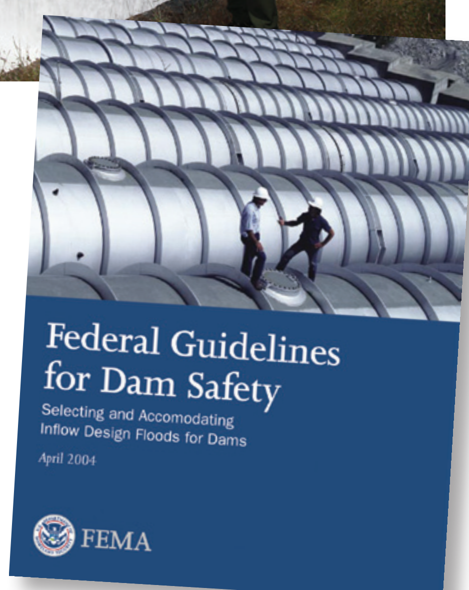
- Several Federal agencies have built or own dams, including the U.S. Army Corps of Engineers, the Department of the Interior, the Tennessee Valley Authority, and the Department of Agriculture. Collectively, the Federal Government owns 3,225 dams (2010 data). The Department of Agriculture's Natural Resources Conservation Service helped build more than 11,000 dams now owned by local watershed districts.

- Some Federal agencies, including the Federal Energy Regulatory Commission (FERC) and the Mine Safety and Health Administration (MSHA), regulate privately owned dams. According to the National Inventory of Dams, FERC and MSHA collectively regulate more than 2,200 dams (2010 data).

- FEMA provides Federal, State, and local governments with valuable data for assessing and reducing flood risks to people and their homes and businesses.

- FEMA analyzes and identifies the flood hazards near levees and dam breach inundation zones and helps communities identify the risks associated with levees and dams.

- FEMA does not own, operate, maintain, or certify dams or levees for safety.



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RESOURCES for Citizen Involvement

Association of State Dam Safety Officials:
www.damsafety.org

Dam Safety Action:
www.damsafetyaction.org

National Dam Safety Program:
www.fema.gov/plan/prevent/damfailure/ndsp.shtm

National Inventory of Dams:
http://nid.usace.army.mil

American Society of Civil Engineers Infrastructure Report Card – Dams:
www.infrastructurereportcard.org/fact-sheet/dam

FEMA FloodSmart:
www.floodsmart.gov

USDA Natural Resources Conservation Service Watershed Rehabilitation Information:
www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wr

National Weather Service, River Observations and Forecasts:
http://water.weather.gov/ahps/

The National Emergency Management Association:
www.nemaweb.org

The International Association of Emergency Managers:
www.iaem.com

Find out more about the maps used to determine flood risk:
National Flood Insurance, Program Customer Service
888-379-9531
TTY: 800-427-5593
Fax: 202-646-2818
E-mail: FloodSmart@dhs.gov
Mail: FEMA, 500 C Street SW, Washington, D.C. 20472

Contacting FEMA:

For a comprehensive list of contact information, please see the FEMA Web site: www.fema.gov

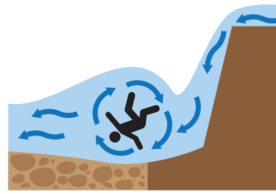
FEMA publishes maps indicating a community's flood hazard areas and the degree of risk in those areas. Flood insurance maps are usually on file in a local repository in the community, such as the planning and zoning or engineering offices in the town hall or the county building.

In addition, you can order maps online or by writing, telephoning, or faxing a request to the FEMA Map Service Center: www.msc.fema.gov, P.O. Box 3617 Oakton, Virginia 22124-9617 Tel: (877) 336-2627 Fax: (703) 212-4090 E-mail: MSCservices@riskmapcds.com

Public Safety

Aside from the possibility of floods due to dam failure, dams also pose risks to swimmers, fishermen, and boaters.

Small dams, also known as low-head dams, "killer dams," or "drowning machines," are deceptively dangerous. These dams are especially dangerous to swimmers and boaters because they are often hard to see, especially from the upstream side. Boaters who go over a low-head dam are often trapped in a submerged hydraulic jump or "roller" formed just below the dam. Likewise, swimmers and fishermen who get too close to dams can be caught in this dangerous circulating current.



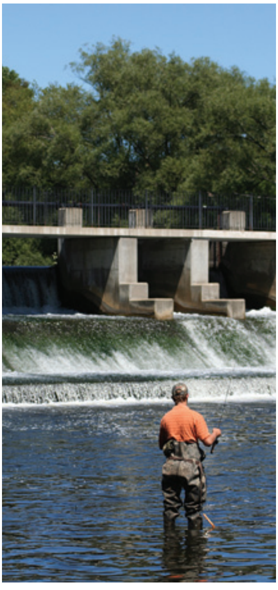
Hundreds of people have been killed at low-head dams, but few States regulate these dangerous structures.

Stay safe around dams

SOURCE: Ontario Ministry of Natural Resources Web site, 2012.

Summer

- Always stay outside booms and away from all dam structures.
- Never swim above a dam or dive from a dam structure. Currents can pull you through the dam or pull you against flow structures with such force that you cannot escape.
- Never fish, boat, or swim below a dam. Water levels and flows can change very quickly, and you may not be able to react in time to avoid the danger.
- Never moor, tie, or anchor your boat below a dam. Always keep personal watercraft and boats clear of dams.
- Never sunbathe, picnic, or camp in an area that may flood as a result of dam operations.



Autumn

- Be aware of possible changes in water flows or levels from dam operations when operating an All-Terrain Vehicle (ATV). ATVs should be used with caution around water.
- Always obey posted signs, and do not enter fenced areas to hike or access hunting or nature viewing areas.

Winter

- Beware of thin ice that may develop as a result of dam operations.
- Never venture out on the ice alone. Always wear a life jacket and carry a throw rope.
- Always be aware of the potential for slush under the snow when venturing out on the ice. Dam operations often result in lowering of water levels throughout the winter and spring. However, this can result in ice collapsing onto lower water levels and then water seeping up under the snow. Travel in slush conditions is very difficult regardless of the mode of travel.

Spring

- Stay clear of dams when fishing. Water flows and levels can change quickly.
- Always stay clear of dams when canoeing and kayaking.

General

- Stay off the dam structures unless the area is clearly marked for public travel.
- Be alert to changes in water levels.

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