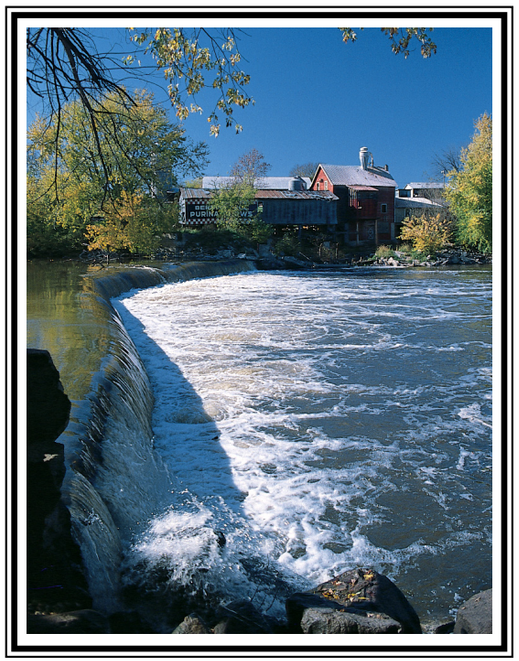
In late September 1975, a tragic chain of events in Binghamton, New York, taught river users and rescue teams valuable lessons in dam safety. By the time the episode ended a day later, three people were dead and four had been injured.

An early fall storm had made the Susquehanna River unusually high. One evening, two rafters were swept over the Rock-bottom Dam and trapped in the current below the structure. Witnesses to the accident summoned help, and a rescue boat was launched with three firefighters on board. In the turbulent water, the craft capsized. All three were thrown into the river. One firefighter drowned; the other two, along with the two rafters, were pulled from the water.



The Berning Mill Dam on the Crow River near St. Michael, Minnesota was typical of a lowhead dam. Water flowing over the top creates a recirculating current drawing objects back toward the face of the structure. Even boats with powerful engines have been trapped and capsized by lowhead dams such as this one. The dam has now been removed as part of a state dam safety program.

The next day, on a body recovery operation for the lost firefighter, the fire chief and two firefighters approached the dam from downstream. As their outboard-powered boat reached the base of the dam, the current caught it and the boat turned over in the roiling water. Desperate attempts to rescue the trio failed, including a try with the fire department's extension ladder.

Twenty minutes later, a rescue boat carrying two sheriff's deputies arrived on the scene. By this time, two of the firefighters had disappeared, the third was bobbing in the maelstrom.

As if to add horror to horror, this attempt once again ended in tragedy as the third rescue craft overturned in the turbulent water. Luckily, the two deputies and the remaining firefighter were swept clear of the dam and eventually rescued.

Why did this tragedy occur? Are these small dams that dangerous? Was this just a freak accident or could it happen in other places, including Minnesota? What can be done to prevent these tragedies?

DROWNING MACHINE

Dams come in many sizes and shapes, everything from huge lock-and-dam structures on the Mississippi River to small, "lowhead" dams. Although there are safety problems with larger dams, their size and design do not present the type of threat involved in the seemingly harmless lowhead dams.

Lowhead dams are generally small structures usually no more than 10 feet high, although some are as low as six inches. They have no gates or water-control devices; water flows constantly over them. Most were built to provide water for grain mills or early hydroelectric generators, and to control lake levels.

Because of their small size, they do not appear to be dangerous, especially when viewed from a boat or canoe upstream. They can be pleasant places in the summer when water drops over them and gently flows downstream.

In the spring and during other periods of high runoff, however, the dams become very dangerous. Torrents of water pouring over the dam create a churning backwash or current. This "hydraulic," as it is often called, is really a recirculating current. The roiling water takes any object — including a person — to the bottom of the stream, releases it to the surface, sucks it back to the face of the dam, and pushes it back to the bottom. This cycle can continue indefinitely.

In addition to the current, other hazards are inherent in most lowhead dams:

◊ Both faces of the dam usually consist of a vertical concrete abutment. Even if a victim struggles to the edge of the structure, chances are poor that he or she will have enough strength to climb the wall.

◊ Branches and other debris trapped in the hydraulic pose an additional hazard to the victim.

◊ Temperature of the water at times of high runoff is usually cold, which decreases survival time.

◊ Finally, air bubbles mixing in the water decrease its buoyancy by one-third. The victim has a hard time staying afloat, even with a life jacket.

In sum, these factors combined with the hydraulic current create a nearly-perfect drowning machine.

OUR LOWHEAD DAMS

Problems with these dams are not confined to New York. Deaths of victims and rescuers have occurred in nearly every state, including our own. Most of the several hundred lowhead dams in Minnesota were built during the late 1800s and early 1900s. Many have been abandoned or are no longer used.

One such dam which was removed was located on the Crow River, which forms the boundary between Hennepin and Wright counties. In July 1979, events nearly as tragic as the Binghamton incident began with what was alleged to have been a dare.

A 25-year-old man wearing a boat cushion on his back plunged over the Berning Mill Dam on an air mattress. The river was unusually high for the summer and the man was trapped in the hydraulic.

Occupants of two canoes below the dam attempted to rescue him, only to become victims of the current themselves. The first canoe capsized. Fortunately, the canoeist was washed clear of the dam and reached shore safely. The second canoe with two men and a woman was pulled into the spillway. It broke in two throwing all three occupants into the river.

A state trooper arrived on the scene, but was unable to rescue the man wearing the boat cushion trapped below the dam. Instead, the trooper turned his efforts to the woman from the second canoe who had been brought ashore by two fishermen. He and two bystanders managed to keep her breathing until more help arrived. That evening she died at the hospital.

Two days later, the bodies were recovered. The final toll: three deaths.

The Minnesota DNR teaches rescue techniques at a Fast-Water Rescue School. In a drill, a rescue team pulls a float through the boil. A victim caught in the boil could hang onto the float and be pulled free.

As tragic as these deaths were, however, they were not unique. The dam which has claimed the most lives is the Red River's Drayton Dam located on the Minnesota-North Dakota border 40 miles north of Grand Forks. Since it was built in 1964 over a dozen people have died in its spillway. Despite warning signs, ordinances, and city and state police officers patrolling the site, fishermen and canoeists continue to press their luck at the base of the dam.

RESCUE

In 1980, officials of the Ohio Department of Natural Resources were dismayed to learn that, in two years, nine firefighters and police officers in that state had lost their lives, and others had been injured, in fast-water-rescue attempts. Additional checking revealed the same type of deaths and injuries had occurred in other states.

These accidents involved rescue personnel who were injured or killed in what had been considered routine water emergencies. Typically, the rescue personnel, like adventuring river users, were confident of their equipment, knowledge, and experience.

Only a few fortunate rescuers have survived a trip through the current below a lowhead dam. Dennis Lutz, a Miamisburg, Ohio, firefighter, described his experience attempting to rescue a teenager:

"You can't believe how powerful the current is. As my buddy and I approached the dam, the boat seemed to rise and move rapidly forward. It's like being caught by a monster. It just won't let you go."

The rescue boat filled with water and capsized as the strong current sucked it into the dam. Lutz was dragged down into the hydraulic, battered along the bottom, caught in a submerged tree, wrenched free, and pushed to the surface, only to have the cycle repeated. Lutz was finally rescued, but his companion and the teenager drowned.

In response to these tragedies, the Ohio DNR Division of Watercraft, with the assistance of firefighters, the Red Cross, and canoeists, developed techniques that can help anyone faced with a fast-water rescue problem.

This sign, installed at many dam sites around the state, warns people of the potential danger of a lowhead dam.

The techniques that Ohio devised have been put into practice across the U.S.

Lowhead dam rescues are either shore- or boat-based. Shore-based rescues are used on dams up to 300 feet wide which have accesses at both ends. If rescue by a throw-line is not possible, a line with a rescue buoy in the center is placed across the river. This can be done with a line gun, or by using a boat downstream from the dam. Rescuers on both sides of the river then work the line up to the victim and pull the victim to shore.

Dams where access to both ends is not possible, or dams that are wider than 300 feet, generally require a boat-based rescue. This method requires two boats which are connected by a safety line.

The first boat approaches the dam from downstream, being careful not to enter the hydraulic. A flotation device on a line is then cast to the trapped person. The second boat remains 100-150 feet downstream. Its purpose is to assist in the rescue and keep the first craft from being pulled into the dam.

Other techniques have also been used successfully, including specialized watercraft and a coupling which allows an ordinary fire hose to be inflated with compressed air and pushed out to the victim.

Rescue techniques must be realistic and simple. Rescue agencies must know the dams in their area, take measures to prevent accidents, and plan and practice rescue methods.

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Front cover: This sign is placed along rivers across the U.S. To boaters, the sign's diamond shape indicates danger ahead.

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