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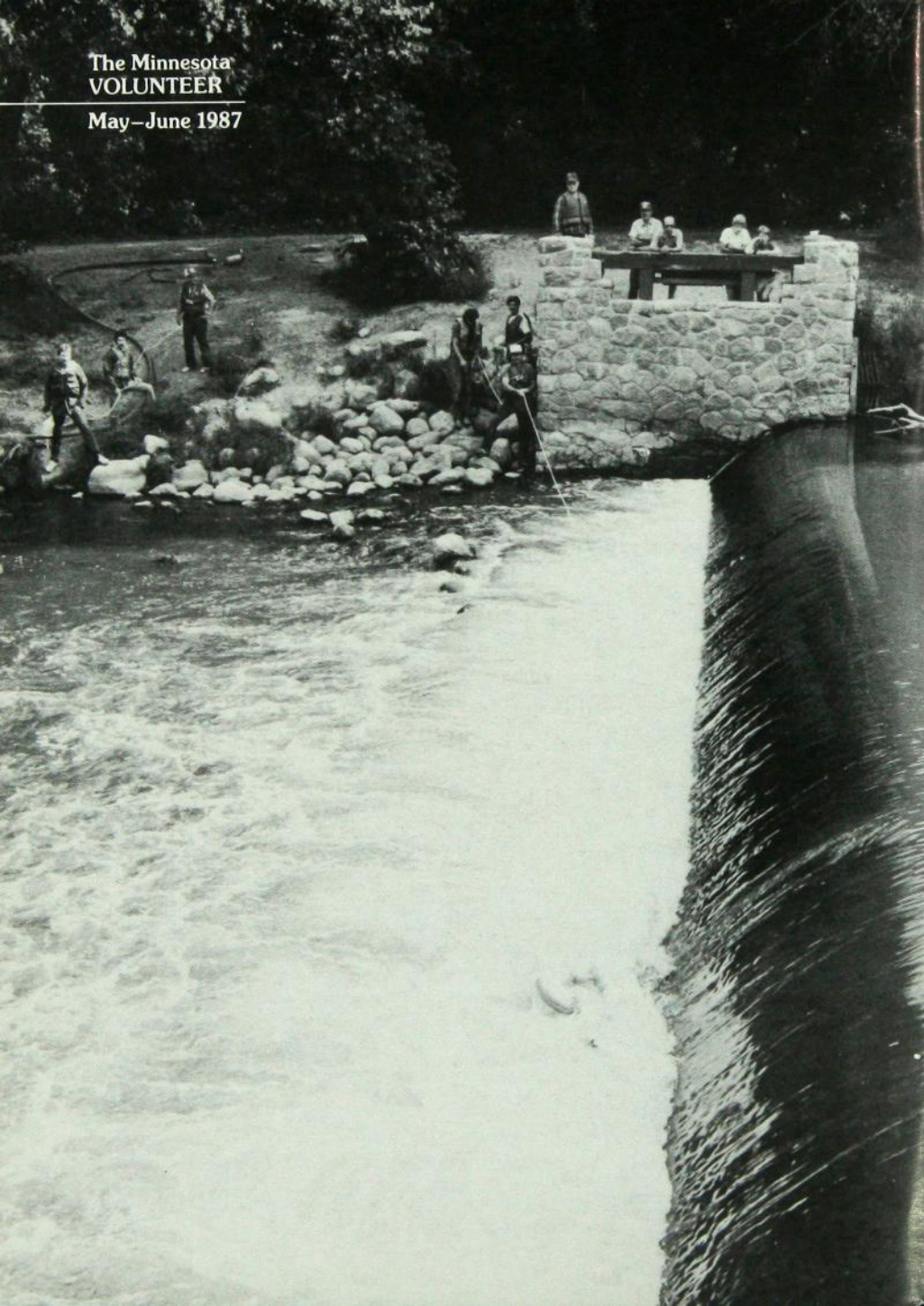


Water-safety Experts Call It

The Drowning Machine

High water alters the character of a lowhead dam. The last 10 years counted 62 men, women, and children in Minnesota killed or badly injured in encounters with these dams. Two articles on the dangers of lowhead dams, the second by an experienced canoeist who miraculously survived the deadly "hydraulic"

Mechanism of the Recirculating Current

Timothy M. Smalley

LAST YEAR in Minnesota, six people drowned at lowhead dams, close to 1975's record number of seven fatalities.

In late June 1986, a group of people riding inner tubes went over the Berning Mill Dam on the Crow River near St. Michael. Two women were trapped by the powerful recirculating current at the base of the dam and were unable to free themselves.

A fisherman on shore waded in to help. He was able to pull one woman to safety. When he tried to reach the second victim, he was caught in the churning maelstrom. Both he and the woman drowned.

Other lowhead dam drownings in 1986 included:

- A 15-year-old southern-Minnesota boy waded too close to a lowhead dam while seining minnows
- A Crookston girl at a dam on the Red Lake River tried to rescue a friend who had slipped into the current while sunning. The girl who fell in first made it to shore
- Two elderly men in a fishing boat drowned when their motor stalled and they were swept over the Sauk River Dam.

Most people recognize the dangers of large hydroelectric dams, but lowhead dams are another matter.

In drill at Buffalo River State Park near Moorhead, shore-based rescue team pulls float through boil below lowhead dam. In actual rescue, victim would grab float, be hauled to shore. *Above:* Warning sign at lowhead dam sites.

These structures usually have a drop of fewer than ten feet. Still some drops are as low as six inches. They have no gates or control mechanisms; water flows over them constantly. The dams can appear quite harmless. Often in picturesque settings, lowhead dam sites can be pleasant places to visit.

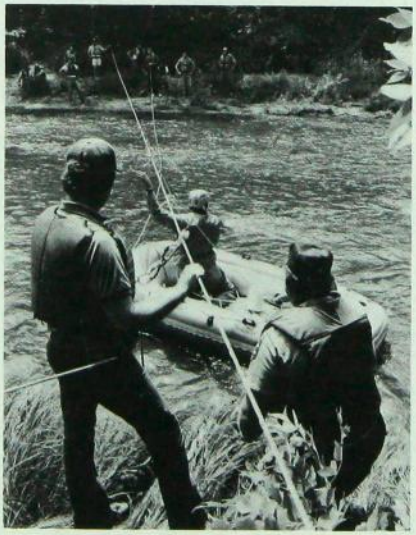
Formidable Hydraulic. But during periods of high water and spring runoff, a lowhead dam is transformed into a menacing "drowning machine." Water cascading over the dam in torrents creates a current that recirculates back toward the dam.

The current, often called a hydraulic, takes any object — including a person — to the bottom of the stream, releases it back to the face of the dam, and pushes it back to the bottom. This cycle can continue for hours — even days — before the object is expelled.

The hydraulic is formidable; it can even trap boats with powerful outboard motors. Air bubbles churning in the current cause the boat's propeller to cavitate so it can't "bite" the water and push the boat. The air bubbles also reduce the water's buoyancy by one-third. Victims have difficulty staying afloat even when wearing a personal flotation device (life jacket). Most of the 200 or so lowhead dams in Minnesota were built during the late 1800s and early 1900s to act as a source of power for mills and small factories. Most have long since been abandoned and serve no practical purpose.

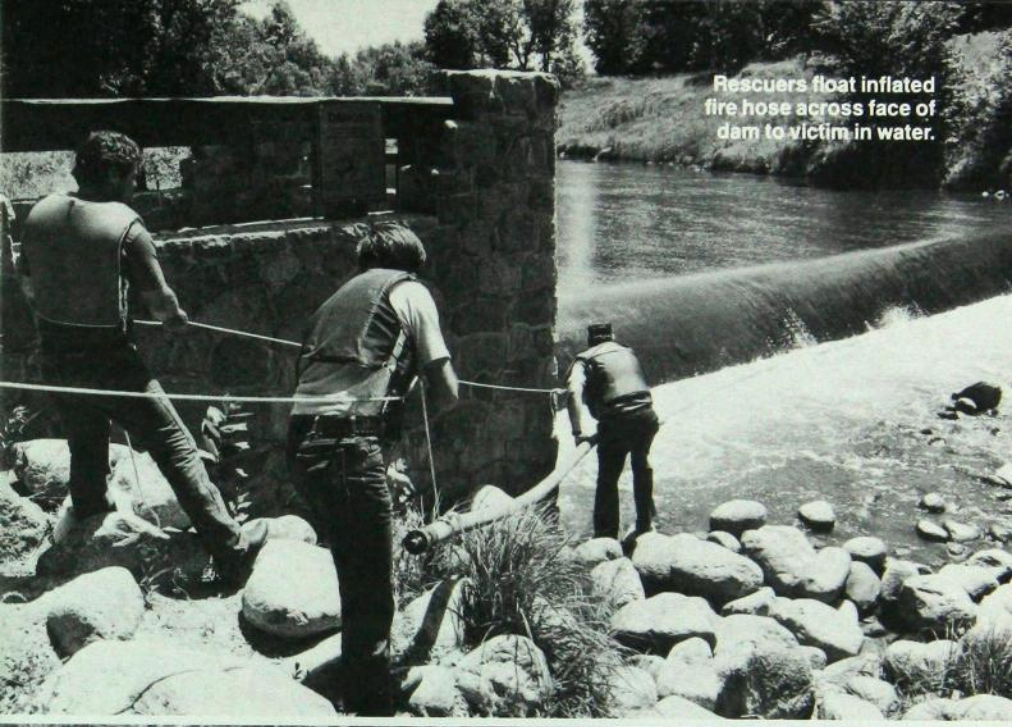
Why doesn't someone just remove the dams? Unfortunately, that can be complicated. Permission to remove a dam must first be obtained from the owners. Since most lowhead dams are quite old, ownership can be hard to establish. Sometimes, even when the owner is finally contacted, he or she doesn't want the dam removed for aesthetic or other reasons.

Removal can also be expensive. Once the dam is demolished by blasting, all rubble must be removed. If left in the river bed, the chunks of broken concrete and tangle of steel reinforcing rods would pose as great a danger as the intact dam.

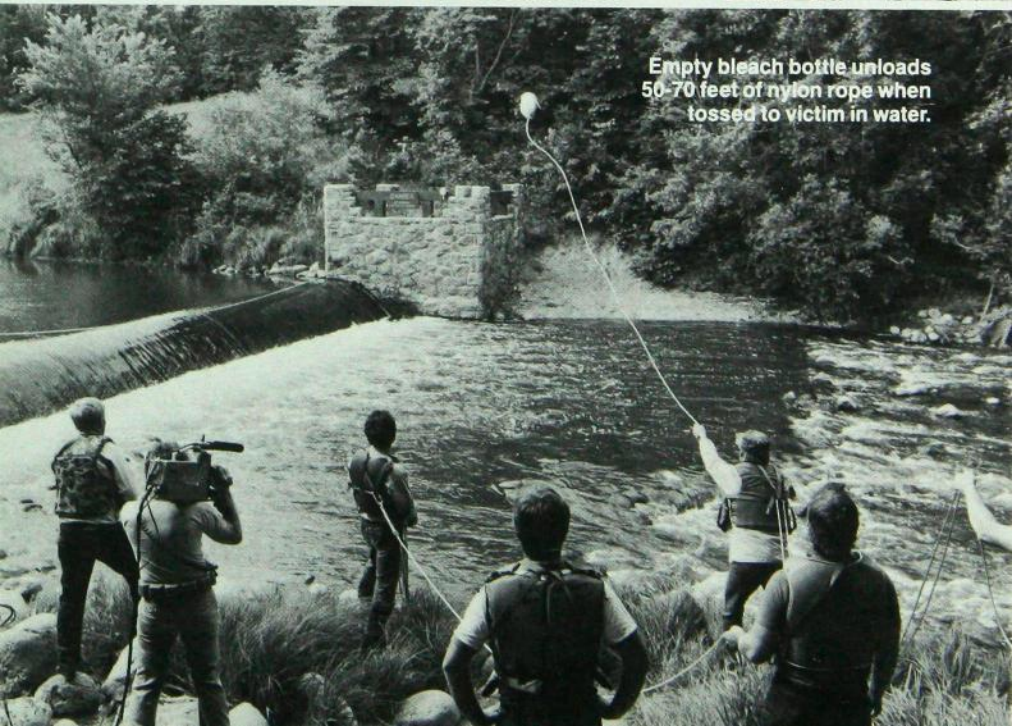


Timothy M. Smalley is boating safety specialist, DNR, St. Paul. His most recent article for the *Volunteer* was "The Hidden Factor Behind Most Boating Deaths," May-June 1986.

Participants in DNR Fast Water Rescue School practice drills at Buffalo River State Park. *Above:* Pulling boat across river. Rescuer in boat lets out line (attached to static line) to reach victim in water. Boat is pulled to shore.



Rescuers float inflated fire hose across face of dam to victim in water.

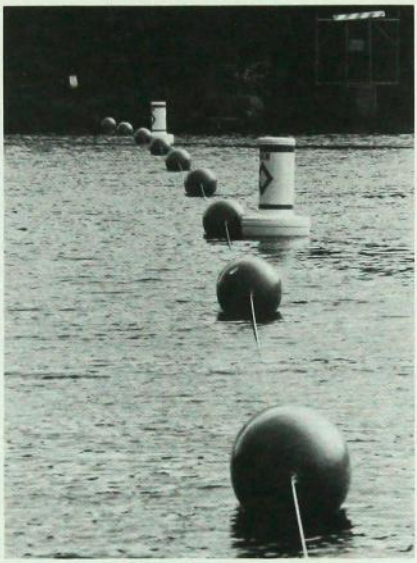


Empty bleach bottle unloads 50-70 feet of nylon rope when tossed to victim in water.

Drowning Machine

Early this year, the Department of Natural Resources started removing rubble from a lowhead dam on the Crow River at Hanover after determining the dam's ownership in Hennepin County District Court. A partial washout of the dam in 1984 had caused severe bank erosion. In 1985, the DNR had razed the dam with explosives. Bank restoration and debris removal cost about $200,000. The cost is being shared by the DNR, U.S. Army Corps of Engineers, and Hennepin County. The DNR is attempting to recover the county and state expenses from the dam's owners — about 10 percent of the total bill for the project.

In cases where no significant bank erosion involves the U.S. Army Corps of Engineers, dam owners would probably have to assume the total cost of the project.



On Kettle River near Sandstone, floats and buoys warn boaters of dam ahead.

Rescue Teams. The DNR is also actively seeking other ways to deal with the lowhead dam problem. Classes sponsored by the DNR Boat and Water Safety Section teach techniques devised specifically for lowhead dam rescues.

In these classes conservation officers, sheriffs' deputies, fire fighters, and other first responders learn how to rescue victims in a variety of situations without putting themselves in jeopardy. The two-day training session consists of extensive classroom, pool, and field practice.

The start of the second day of training finds students at a lowhead dam site. Teams are formed to practice skills learned the previous day in the classroom. In a drill, rescue teams on shore haul on ropes to pull a float through the hydraulic to rescue a mannequin "victim." They also use a special device that inflates a fire hose which is then floated to a person in trouble. Each student must also hit a floating target with a "throw bottle" — a plastic bottle holding 50-75 feet of nylon rope, one end of which is tied to a tree — before advancing to the next stage of training.

The use of inflatable boats in a dam rescue can be quite effective; when done properly, there is little risk to rescuers. In the DNR class, two boats are tethered with a long rope. The

lead boat approaches the dam and makes the rescue. The back-up boat, stationed well downstream clear of the current, then pulls the lead boat out of the hydraulic.

By successfully completing all exercises, the students demonstrate that they can handle almost any fast-water rescue situation. At their home units, they share their new knowledge with other rescue personnel.

The DNR is also taking measures to warn boaters and canoeists about the dangers of lowhead dams. Additional warning signs are being installed around dam sites; buoy systems to caution river users are being installed upstream of dams in several locations.

The DNR also has an informational brochure available titled "The Drowning Machine." Focusing on the hazards involved with lowhead dams, the brochure is distributed to boating and fishing groups, as well as to other interested people. □

Caught in the Hydraulic Below Berning Mill Dam

Sue Hix

MY STORY begins on an Indian-summer day in late September last year, the kind of day that tempts you to play Huck Finn and lie back in your boat, soak up the sun, and float to New Orleans. As we drifted down the rain-swollen Crow River from Hanover, my friends and I sensed that this would be our last warm-weather canoeing day. We stroked just enough to keep the boats in the mainstream. Casually we handed refreshments back and forth.

We were a group of five. I was paddling solo. One canoe carried two fellow Minnesota Canoe Association members who, like me, were graduates of the MCA whitewater course. The other held a member of the Cascaders (also a whitewater-canoe veteran) and a novice who had come along for the sun and scenery.

When we spotted warning signs at the north end of Crow Hassan Park, we decided to scout the portage at the Berning Mill Dam, a sufficiently frequent site of disaster to merit a "mandatory portage" sign.

We hiked to the bridge below the dam. The sight upstream was impressive. The high water obscured the dam entirely; the churning waves looked like rapids.

Whitewater veterans in the group discussed elaborate strategies for running the "rapids." Of course, we knew that even a dam one foot high could be fatal; our instructor had made a big point of that during whitewater class in May. Nevertheless, this was no longer a dam — at least it didn't *look* like one — because the water was the same level above and below it. We reasoned that, with no drop-off, the usual dangers associated with a lowhead dam would not exist.

Running the Dam. Still, the signs in Crow Hassan Park commanded "mandatory portage." I, a great re-