

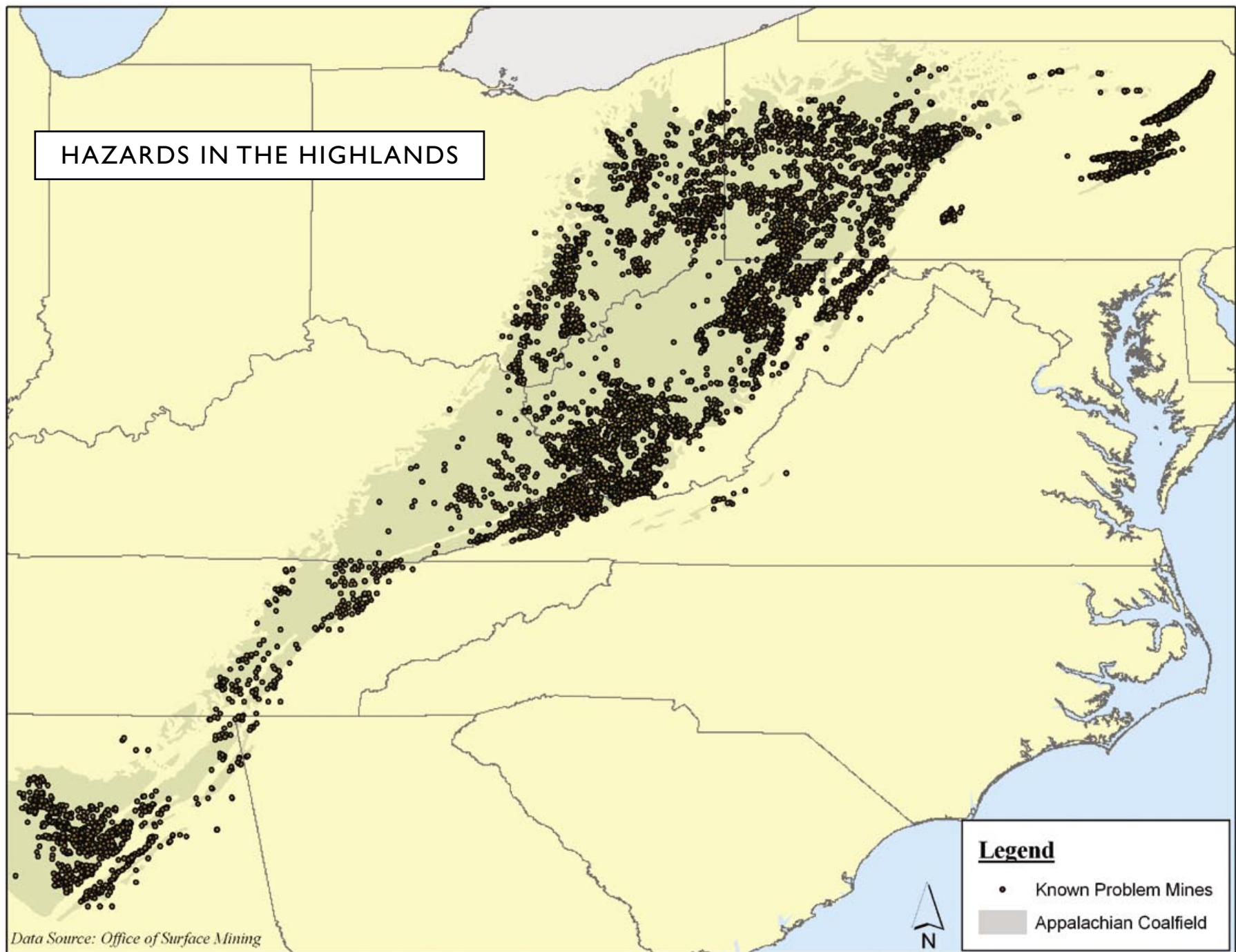
Restoring the Wealth of the Mountains

CLEANING UP APPALACHIA'S ABANDONED MINES



A REPORT PRODUCED BY TROUT UNLIMITED

HAZARDS IN THE HIGHLANDS



No one knows for sure just how many coal mines were shoveled and drilled in Appalachia.

What we do know is that the highland regions of states such as Pennsylvania, West Virginia, Ohio, Maryland, Virginia, Kentucky, Alabama and Tennessee today are affected by pollution that emanates from many of these mines, long after the mines themselves were abandoned.

The drainage from abandoned coal mine sites is the single largest threat to the Appalachian environment, according to the Environmental Protection Agency.

Often laced with toxic metals and sediments, abandoned mine drainage degrades drinking water, diminishes aquatic habitat, and robs rivers of their abilities to support fish and wildlife. It also frequently causes orange and blue plumes of pollution to stain once-clear rivers and streams.

To highland communities, this translates to more than ugly views and bad fishing; it means the loss of clean drinking water supplies; it means chronic public health woes, and it means lost jobs.

According to the U.S. Geological Survey, abandoned mine drainage in Pennsylvania alone has contaminated more than 3,000 miles of streams, costing the state almost \$70 million each year that could be generated if sport fishing were restored in the affected waters.

Official estimates place the cost for restoring the

damaged Pennsylvania watersheds at about \$15 billion. This jaw-dropping number becomes all the more daunting when compared to the fact that the Abandoned Mine Reclamation Fund, created by in 1978 to address abandoned mine drainage and other hazards presented by abandoned coal mines, has collected only \$7 billion nationwide in its life.

The fund's future is uncertain at best. To date, our elected leaders have failed to reauthorize the long-term funding so crucial to providing for workers

The drainage from abandoned coal mine sites is the single largest threat to the Appalachian environment, according to the Environmental Protection Agency.

and communities suffering the long-term effects of coal mining in Appalachia.

Trout Unlimited believes that coalfield communities, having given so much for so long, deserve better. Uncertainty over the source of their next cup of clean water, the return of intact landscapes, and financial and outdoor opportunities should not be held hostage by politics. We need to find more ways to deliver more resources to cleaning up abandoned mine sites and the rivers and streams they pollute; not cut the few that remain.

Restoration works. We know this because we've seen it

in places such as Pennsylvania's Kettle Creek, where a broad partnership made possible in part by the Abandoned Mine Reclamation Fund has brought long-dead fisheries back to life. Trout Unlimited is working with the Commonwealth of Pennsylvania, the Office of Surface Mining, and other state and federal partners to extend the lessons learned on Kettle Creek to the entire West Branch Susquehanna watershed. This ambitious project would restore a watershed that drains 20 percent of the state and drive regional economic revitalization.

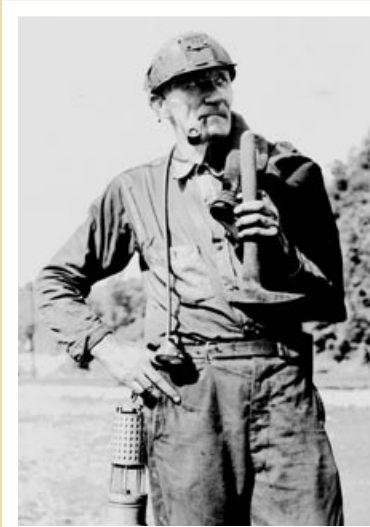
Building on this experience, in the following pages, we:

- > outline the history of Appalachian mining and the science of abandoned mine drainage;
- > explore the creation and evolution of the Abandoned Mine Reclamation Fund; and
- > provide case studies that illustrate what the combination of federal responsibility, citizen involvement and state support has accomplished under the fund.

This report is not intended to recount or bemoan the woes of the coalfields, but rather to examine closely one of the region's foremost problems while trying to fix it. By focusing on success and pledging to be dedicated contributors to progress, we at Trout Unlimited hope that Congress and coalfield citizens alike will join us in this effort.

Coal: Blessing and Curse

The coal-lined spine of the ancient Appalachians carried a country. Our sustained and rapid national technological advance, from pioneer settlement to the Industrial Revolution through the World Wars to present day,



A miner ready to descend into the Mullens Mine in Wyoming County, West Virginia.

was largely powered by the eastern coalfields and the people who lived among them.

Coal in Appalachia was so prevalent that its mining was inevitable. By 1900 some 30 million tons were being mined annually in four mountain states. Stephen Crane wrote of the “grim, strange war that was being waged in the sunless depths of the earth.” Miners descended into the ground armed with ten-pound sledgehammers, steel wedges, picks and a set of drilling tools. A skillful miner

would deliver 40 to 50 blows with his pick in a minute. Two miners could in several hours “undermine” a void in the earth 25 feet wide and five feet deep.

Appalachia’s mountainous geography made it expensive to get equipment into the region, and coal out of it. Roads and railroads involve both many parts and lots of labor, as do the trucks and trains that travel them. Many coal companies offset overhead costs by keeping wages and benefits for workers low. Towns sprung up wherever men were able to tunnel into black seams and remove the wealth of the moun-

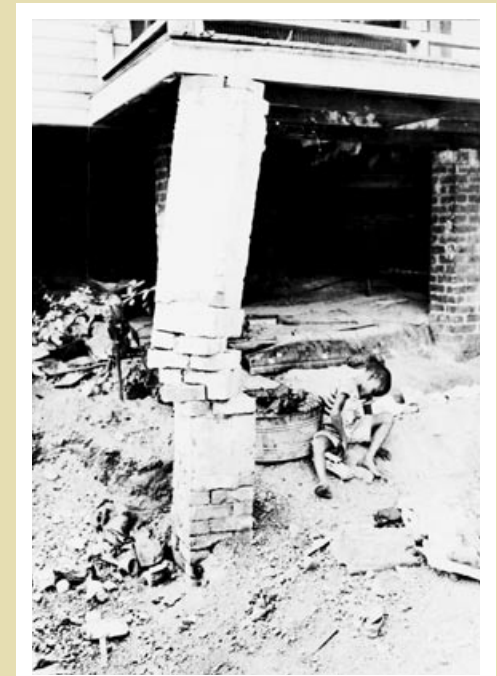
With a hand auger, a miner drills a void for powder charges at the Wheelwright Mine, Floyd County, Kentucky.



tains. Quickly constructed houses owned by coal companies dotted the company-owned streets of company-owned towns. Families shopped in company-owned stores. Miners were paid in company money, called scrip.

Children learned in company-owned schools. The little medical care available was provided by company-provided doctors. Payments for these services often lagged behind the wages paid by coal companies. Perpetual debt to one’s employer was common.

Mining wasn’t the work of men alone. Small children were employed as slate-pickers. As coal slabs were removed from the ground on moving railed-troughs, boys would separate pieces of slate and rock from the coal.



A child plays under the front porch of a home in a coal company housing project, Harmco, West Virginia.

Above the mines, mothers and wives would anxiously await the return of their men and boys. One in 250 miners was killed every year, and perhaps seven times that number injured in mining-related accidents. On December 6, 1907, for example, an explosion at a coal mine in Marion County, West Virginia killed 362 miners. Safety and wage issues drove many of the workers in Pennsylvania and Ohio to unionize by 1900. West Virginia’s would continue to suffer through a series of violent and often deadly confrontations with coal company management,

culminating in 1921 with President Warren Harding's dispatch of federal troops to southern West Virginia, after more than 5,000 miners wearing red bandanas around their necks (earning them the nickname "red-necks") took over several coal communities.

The demands of World War I and the devastation that the war wrought on Europe ushered in a boom-town era to the coal mines. Men descended from mountain farms and hollows across Appalachia to work the mining camps. One coal county in Kentucky tripled its population between 1910 and 1920, and doubled it again between 1920 and 1930. Eventually, however, Europe began to meet her own coal production needs, and coal prices fell as the world demand for Appalachian coal declined. The Reverend and writer Edwin E. White, in *Highland Heritage*, describes the decline:

By the middle of the 1920s the boom was a thing of the past and suffering gripped the coal country. Mines once fabulously rich went into receivership ... operators took terrible losses. Pathetic populations were left in mining towns when mining companies moved out, men trying to raise a little food on old



Slate pickers outside a Pennsylvania mine.

... [A] new boom rose rapidly after the bombing of Pearl Harbor. In the remarkable manner so often experienced in the coalfields the [Cumberland] Plateau suddenly found itself in a situation wholly different from that of a short time before. Whereas its hotels had stood nearly empty during the long Depression they now filled with an assortment of coal brokers and their agents, would-be operators in quest of mineral tracts and lumber buyers seeking stands of timber for conversion into barracks and gun stocks. A land long deserted and ignored found itself swarming again with "outsiders" come to exploit or expropriate its wealth.

On the whole the industry awakened with startling speed and performed wartime production miracles. In a market in which heavy machinery of all kinds was extremely difficult to obtain, in which competition for labor was sometimes almost insane, the coal corporations managed to assemble the labor crews and find the essential equipment required to send the black rivers flowing from the hills.

Along countless streams there was a sound of hammering, sawing and clanging as men labored to reactivate rusty tipples. Dirt flew from caved-in driftmouths.

Eighteen months after the American participation in the war began, the plateau was humming with powerful new industrial life. Growing numbers of coal trains clanked and clattered along the railroads and the men who stayed behind were toiling with Herculean determination to provide the fuel and weapons needed by their sons and brothers in the training camps. The industry was mounting the second, and in some respects the more dynamic, of its two vast booms. During the war years the production of rail mines soared nearly 500 percent over the output of such mines in the last peace-time year.

From Night Comes to the Cumberlands by Harry M. Caudill, 1963

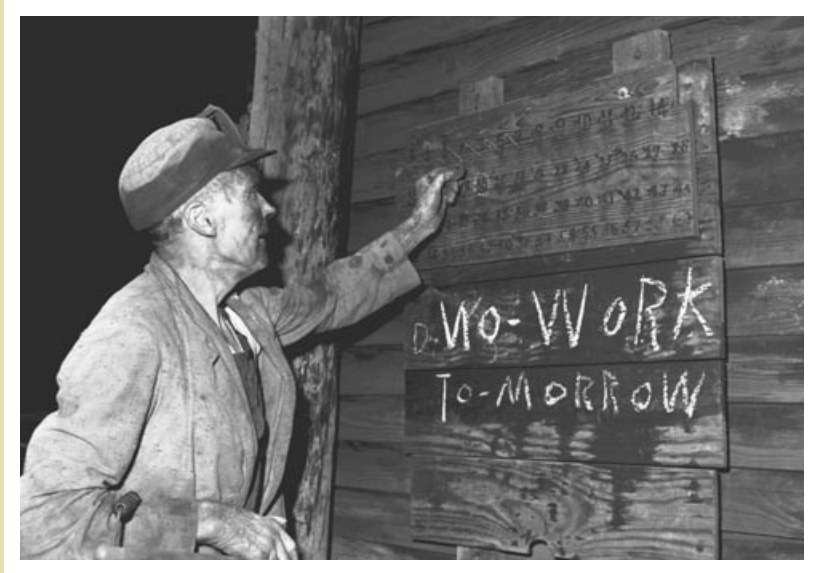


Naval officers thank miners returning from their shifts at the Frick Coke Company Mine, Washington County, Pennsylvania.

house lots, men frantically hunting any job, willing to work in little "wagon mines" for a dollar a day, men too old or too disabled to work, women and children whose husbands and fathers were far away working or on the heartbreaking hunt for work, women and children deserted, whole communities on relief.

The Appalachian coal economy limped along through the Great Depression until the American entry into World War II (see sidebar), when it experienced a second, more-expansive boom. Coal became a strategic mineral of great importance in winning the war. It was used to take up the slack in home heating and transportation that followed gas shortages. It fired the steel mills that supplied our armaments industry. Coal was also crucial because the Japanese had taken over most of the natural rubber producing areas in the world, and coal was used in making synthetic rubber.

Following World War II, mining in Appalachia again declined. Although not as dramatic as the earlier decline following World War I, its effects were just as acute. Low coal prices caused company owners to use savings from earlier years. Companies with outdated equipment could not keep pace with the combination of increasing costs and lower prices. Many



A coal loader gets unwelcome news at the end of his shift at the Clover Gap Mine, Harlan County, Kentucky.

of the companies that were able to keep their doors open dramatically reduced employment and began to mechanize more and more of their mining operations.

Over time the automation allowed production to increase even as payrolls fell. As miners were laid off, small businesses in the region closed shop behind them. In relatively few years, mining in Appalachia moved from an industry wholly reliant on manpower to one that was almost fully automated. Population in many areas of coal country declined dramatically as workers moved to urban areas to find better paying and more secure work in places such as auto plants or steel companies. What remained, and what persists on the landscape today, is the ecological damage that more than 100 years of coal mining has had on the fish and wildlife, and the lands and waters of the Appalachian region.

Hollows and Coves, Fish and Wildlife

While weathering to about half their original height during the last 200 million years, the Appalachians' rugged terrain made them a laboratory of species evolution. A remarkable diversity of animals and plants thrived in its deep cove forests, the oldest in North America, including oak, walnut, hickory, magnolia, elm, ash, maple, basswood, pine, chestnut, cherry and locust, to name only a few. As many as a dozen species of non-woody plants and herbs can also grow with understory trees, shrubs, fungi and mosses in one square yard of Appalachian forest.

photo by Matt Handy



At the midpoint of the 19th century, the travels of a band of explorers to the Blackwater Canyon in north-central West Virginia were chronicled by P. Pendleton Kennedy. He reported that en route to the Blackwater it was frequently impossible to read a map in the daytime because the overhead

foliage was so dense. His team also found streams so fertile that native brook trout were caught as fast as the men could bait their bone hooks.

The region's rugged geography repelled pioneer settlement for many years, but in the five decades that followed Kennedy's travels, the forests were cleared and the coal veins tapped. By 1900, the densely forested ridges through which Kennedy's band picked with the utmost difficulty were largely denuded by timbering, and the underlying ground was extensively bored for coal. For much of the 20th century, this process was replicated in watershed after watershed. In the century's second half, strip mining began to replace deep mines, and the ecological damage quickened its pace.

In the 1960s and 70s, several concurrent events began to change this reality. A growing national ecological consciousness led to the passage of several far-reaching environmental protection laws, including the

National Environmental Policy Act of 1969, the Clean Water Act of 1972 and the Endangered Species Act of 1973.

In 1972, the American public also witnessed a terrible coal mining tragedy. In what is commonly called the Buffalo Creek disaster, a poorly designed coal waste impoundment burst after several days of rain, loosing a wall of water that washed out a succession of small coal towns spread over 15 miles, killing 125 people, injuring 1,000 and leaving 4,000 homeless. Thirty businesses, 1,000 vehicles, 10 bridges, and power, water and telephone lines were all destroyed. Roads and rails were rendered useless.

In the weeks and months that followed, the American public learned that the tragedy could have been prevented had the company heeded warnings about the dam's design flaws, or had it warned local residents at the first sign of danger. The public also learned that state and federal regulators could and should have acted more decisively to head off the catastrophe.

The resultant public outcry led to lasting change.



photo: West Virginia State Archives, James Hagood Collection

The New Law of the Land

From the earliest days of Appalachian mining in the 18th century, there existed little to no government oversight of coal mining procedures and practices. According to federal estimates, by the late 1970s, there were more than 1 million acres of abandoned coal mine sites in the United States.

The Surface Mining Control and Reclamation Act of 1977 signaled a new era. The act established a nationwide program to protect people and the environment from coal mining's adverse effects. It required restoration of abandoned mines that were not reclaimed, and future coal mining operations to establish reclamation plans and standards.

The act also called upon states to develop strong mining regulations and vested the responsibility for monitoring state-level enforcement of mining laws within the federal government.

The act established the Office of Surface Mining Reclamation and Enforcement (OSM) within the Department of the Interior and charged it with implementing the law. One of the principal tools given OSM was the Abandoned Mine Reclamation Fund.

The fund may be used to carry out a broad range of projects, including the reclamation and restoration of land and water resources degraded by abandoned surface mines, control of water pollution caused by coal mine drainage, and the prevention of landslides.

The fund also covers the plugging of old open mine shafts, tunnels and voids. It is allocated by OSM according to a system of priorities, with immediate threat to human life at the top of the list, followed by damage to natural environment.

The fund is supported by a tax on present-day mining operations at a rate of 35 cents per ton of coal from surface mines and 15 cents per ton from underground mines.



photo by Richard Bernabe

A Framework for Citizen Involvement

A particularly important component of the abandoned coal mine cleanup programs administered by OSM is the Appalachian Clean Streams Initiative, which recognizes the value of pure highland watersheds and works to return to damaged rivers and streams a substantial measure of their pre-mining integrity. Begun in 1994, the Appalachian Clean Streams Initiative focuses on eliminating abandoned coal mine drainage and aspires to be a true citizen-government-industry partnership, bringing together a unique combination of manpower, funding and know-how. The initiative has to date funded 77 projects in 10 states, combining the skills of university researchers, coal industry figures, citizen groups, the business community, environmentalists, and local, state and federal representatives. The initiative has proven to be a particularly effective method of empowering volunteer-led restoration work, including several of the projects involving the Trout Unlimited volunteers profiled later in this report.

The Creation and Correction of Abandoned Mine Drainage

Water accumulates in and flows out of most every abandoned coal mine. This water is often highly acidic and laden with dissolved metals, a deadly combination for aquatic life.

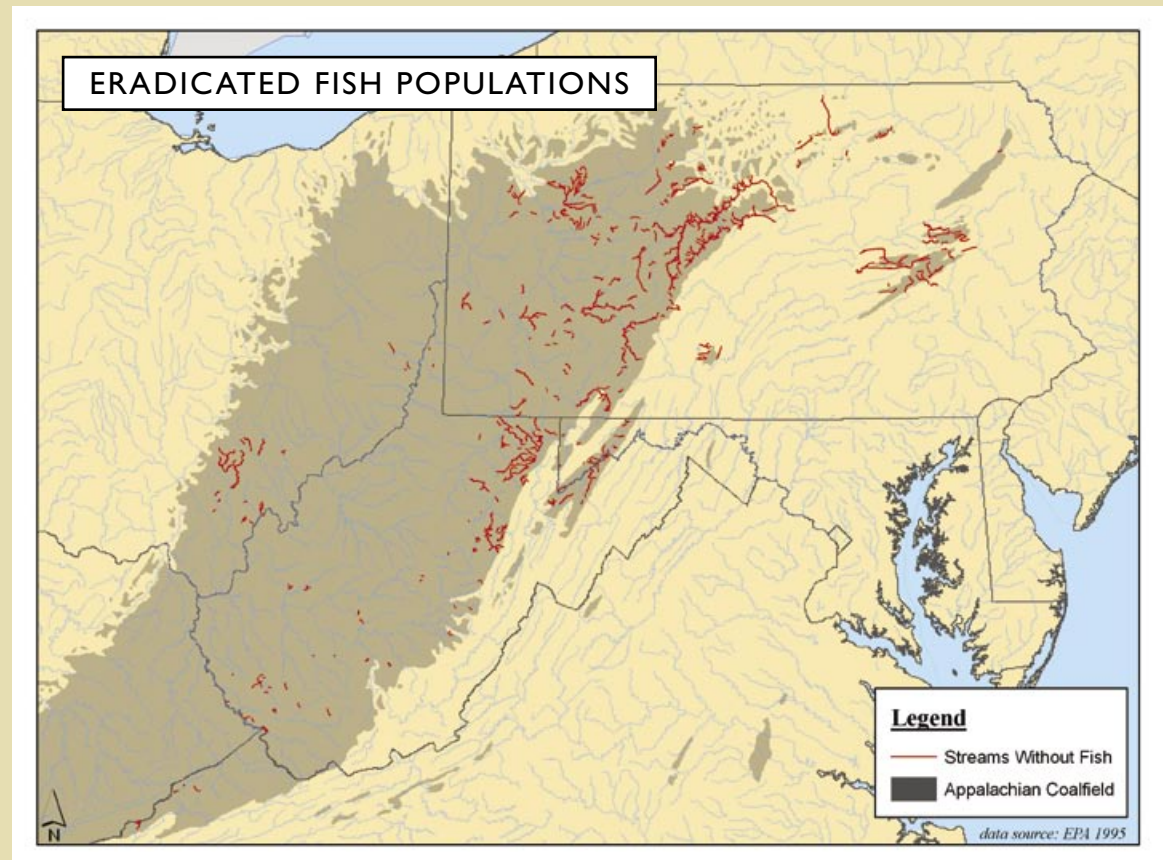
Fortunately, various technologies can help cleanup these pollutants in highland rivers and streams. Several of these technologies are described on the following pages, with special detail placed on those in the case studies appearing later in this report.

Acid and Heavy Metals

When surface- or groundwater comes into contact with pyrite (fool's gold), which is common in coal seams and the waste rock left behind in mines, a chemical reaction occurs in the presence of oxygen, creating sulfuric acid. The acid water often leaches out heavy metals from the surrounding environment and the streambed, which can clog the gills of fish and create slippery coatings on stream bottoms, which prevents insects from living on the rocks. Ultimately, this causes both fish and insect populations to spiral downward.



photo by Amy Wolfe



Mine drainage often assumes unnatural colors that indicate the nature of its pollutants. In some cases, however, even highly polluted water can be perfectly clear.

According to state and federal water quality inventories, tens of thousands of miles of streams are badly polluted by mine drainage. Problems have been documented in Indiana, Illinois, Oklahoma, Iowa, Missouri, Kansas and Georgia. The worst pollution emanates from decades-old abandoned coal mines in the heart of Appalachia, with Pennsylvania and West Virginia suffering the nation's worst problems.

Active Treatment Systems

Abandoned mine drainage with high flows and severe chemistry is typically addressed by active treatment systems. The most common type of active treatment system is placed on tributaries upstream of mainstem rivers. It utilizes a water-powered wheel to dispense alkaline material that neutralizes the mine drainage in streamflow and causes suspended metals to drop out of the water. The alkaline material commonly used for these systems is calcium oxide, which is also called pebble quick lime. Large amounts of calcium oxide can be stored in a silo attached to a water wheel. The amount of calcium oxide dispensed is determined by the rate of water flow through the wheel.

Water treated by this type of system is typically routed down a channel to allow for aeration and further mixing of the calcium oxide and water, which collects the accumulated metals in a type of sludge. The metals sludge is then periodically removed.

A chain of active treatment systems is credited with triggering a renewal of aquatic life in the North Branch of the Potomac River along the Maryland-West Virginia border, whose highland watershed was once so badly affected by abandoned mine drainage that it was effectively rendered sterile.

The success of active treatment systems can come at a high financial cost. The price tags for their operation and maintenance can be prohibitive, making a second type of treatment technology, known as passive treatment, more commonly used.

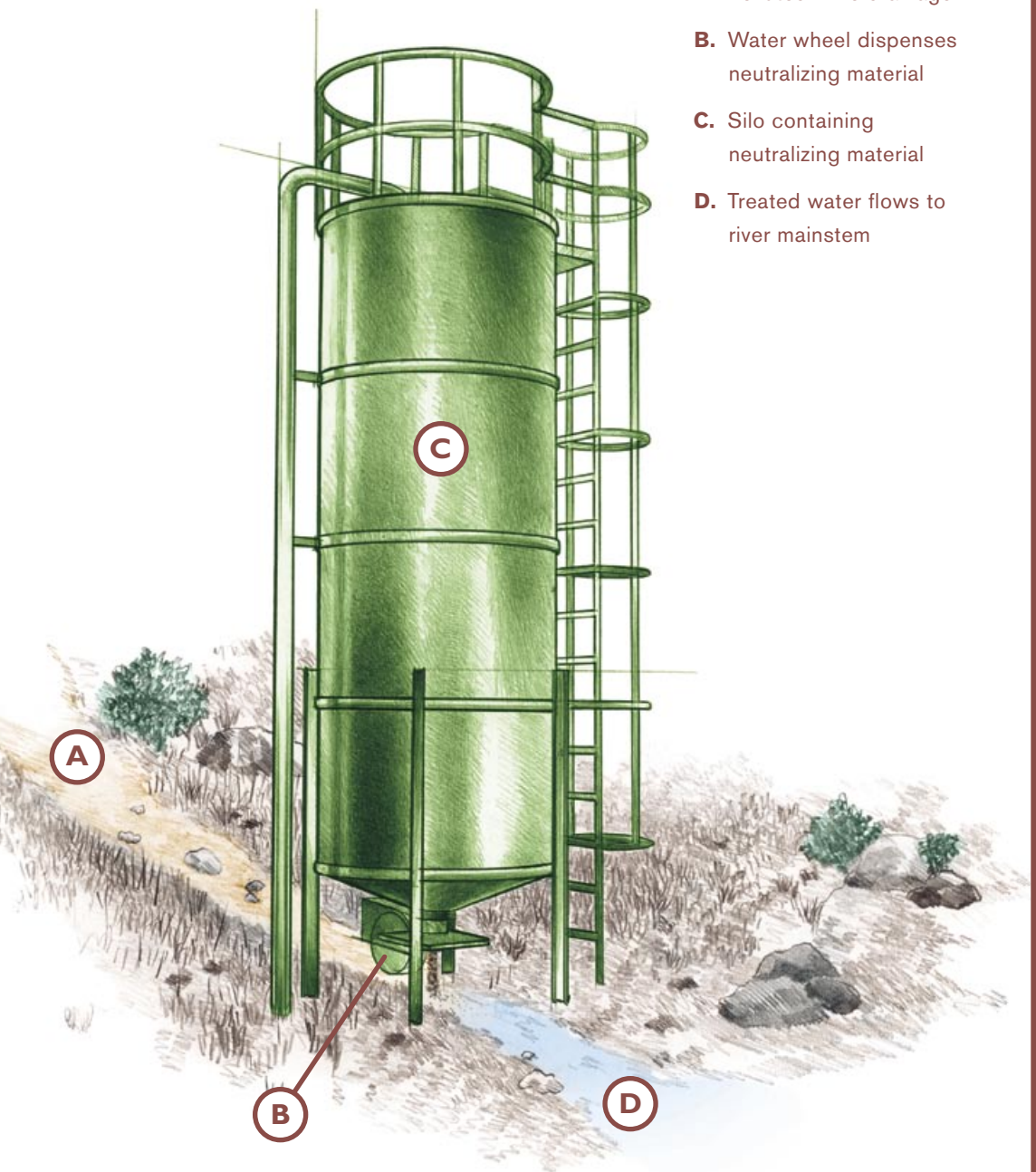


illustration by Bob Bredemeier

A. Polluted mine drainage

B. Organic matter, which removes oxygen and prevents iron from coating limestone layer

C. Limestone, which cuts the water's acidity, allowing metals to precipitate here and collect in lower settling ponds

D. Perforated drainage pipe, which delivers water to settling ponds

Passive Treatment Systems

Most sites with low to medium flows and acidity are best addressed by passive treatment systems. This illustration shows a generalized example of a gravity-driven passive treatment system. Mine drainage flows downhill through a series of ponds. Each allows the drainage's toxic heavy metals to fall out and collect incrementally as the flow progresses through the treatment zone. Mine drainage is directed over and through crushed limestone, which helps to neutralize acidity as the water progresses. Propagation of wetland vegetation in and around these settling ponds stabilizes soils and filters toxic materials and acidity.

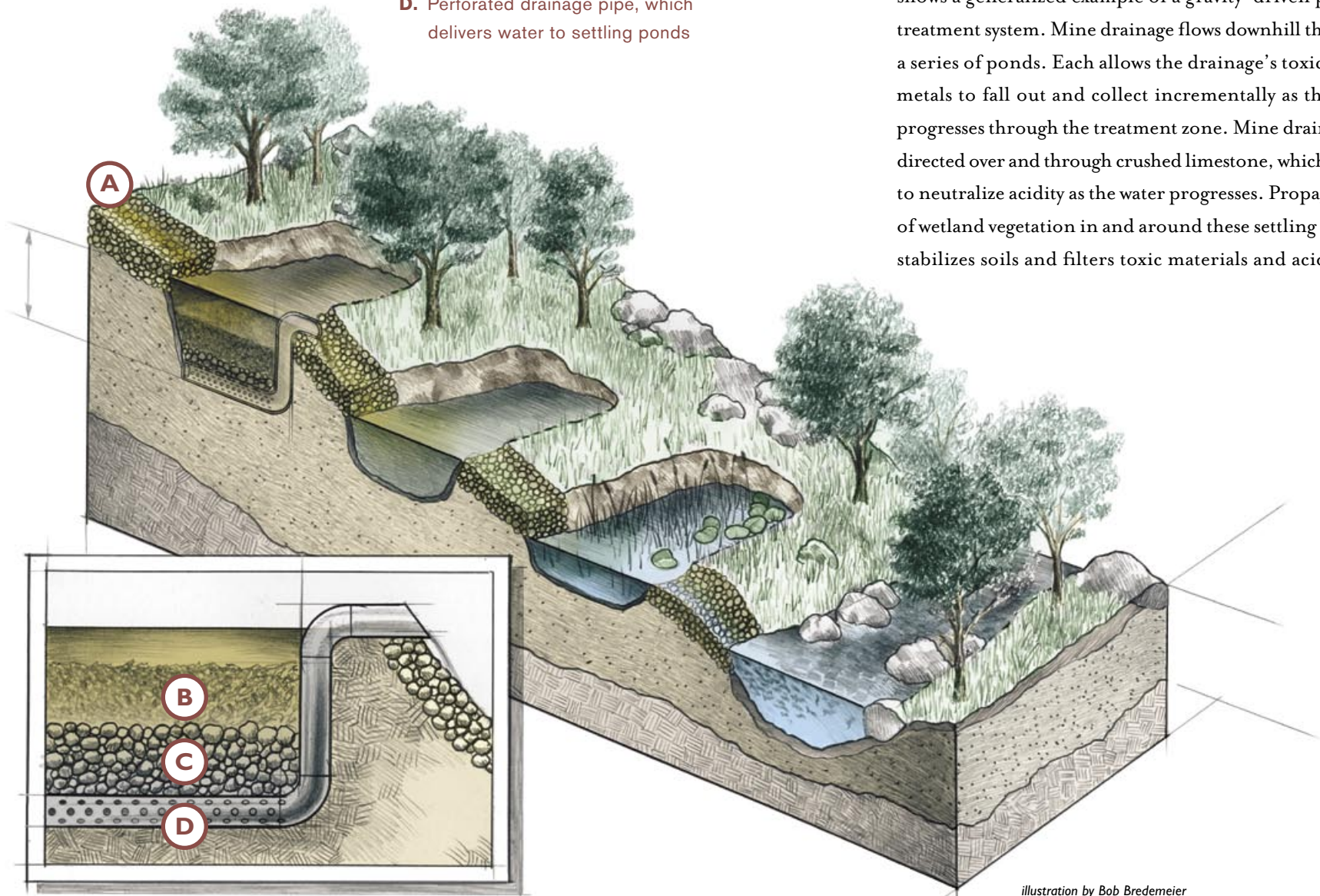


illustration by Bob Bredemeier

The Upper Potomac River, pictured here at its confluence with the Shenandoah at Harpers Ferry, West Virginia, has mounted a recovery in recent decades thanks in part to the Abandoned Mine Reclamation Fund.

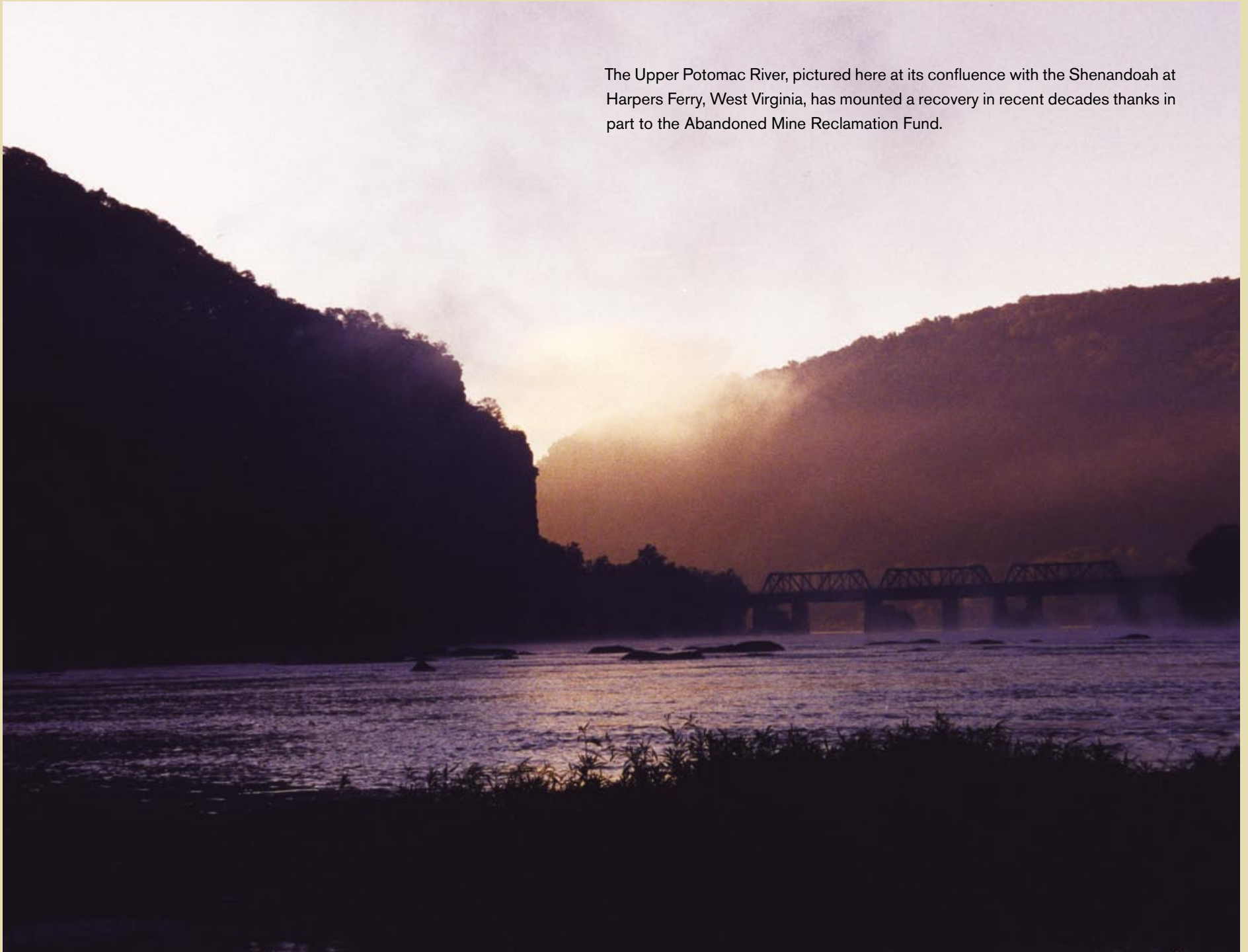


photo by Tim Zink

Stonycreek - Conemaugh Rivers

The Place: The main-stem Conemaugh River is formed by the Stonycreek and Little Conemaugh rivers, which converge in Johnstown, Pennsylvania.

The Stonycreek's eastern headwaters begin on Allegheny Ridge, and its western headwaters on Laurel Ridge, both classic 3,000-foot ridgelines. The Stonycreek River watershed drains a total of 467 square miles.

The Little Conemaugh headwaters also begin on Allegheny Ridge, north of the Stonycreek's, and its watershed drains a total of 189 square miles.

The Problem: A three-year-long U.S. Geological Survey study of abandoned mine drainage sources in the Stonycreek River watershed published in 1994 found and tested 270 abandoned coal mine discharges. Of these, 193 were dangerously acidic, 122 exceeded effluent standards for total iron concentration, and 141 discharges exceeded standards for manganese.

A state-funded study of the Little Conemaugh watershed completed in 1995 found 197 discharge points, with seven major discharges contributing 73 percent of the watershed's total load of heavy metals pollution and 94 percent of its total acidic load.

The Price: Approximately \$8 million

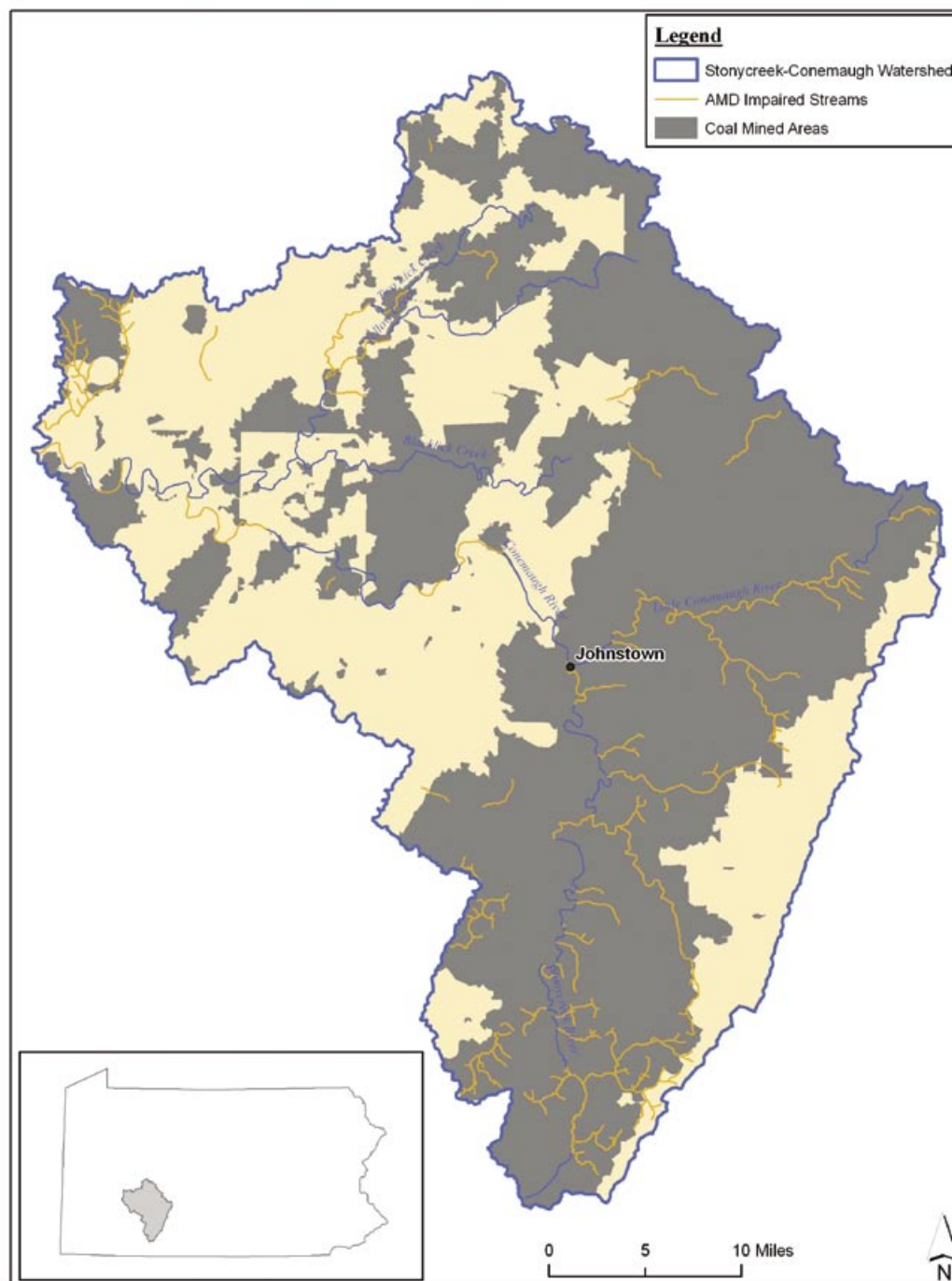




photo by Len Lichvar

Since 1990, the Stonycreek-Conemaugh River Improvement Project, a coalition of grassroots groups and local resource agencies, has worked to heal what many experts consider to be the worst abandoned mine drainage in a state known to have the most abandoned mine drainage.

Spearheaded by Len Lichvar, the stream improvement chair for the Mountain Laurel Chapter of Trout Unlimited and the executive director of the Southern Alleghenies Conservancy, the project has achieved the once-unthinkable, bringing life back to streams and rivers that were dead for so long that their neighbors assumed them to be flat-lined forever.

"I grew up on Quemahoning Creek, a lifeless part of the Stonycreek," Lichvar said, "and as a kid I couldn't ever walk across the street and fish. But today's kids on the Quemahoning can do just that."

Lichvar is referring to a trout re-introduction in a four-mile-long stretch of the Quemahoning completed in April 2005, "a great cooperative effort" made possible by substantial recent gains in water quality, which will breathe life back into a stretch of the creek.

"We've already brought back pieces of this creek that used to be orange and managed to do some other things few people thought we'd actually see when we started out doing them," Lichvar says.

The skepticism of the local communities isn't so surprising when one realizes just how entrenched coal once was – and is – in the locale. The world's largest viaduct and coal tipple, constructed by the Merchant's Coal Company, spanned the creek for almost 40 years in the early 1900s. Most everyone's family once somehow worked or lived in connection with the mines.

But those who are now energized by the resurgence in aquatic life find themselves in fine company. In 1998, then-Secretary of the Interior Bruce Babbitt, after touring the first abandoned mine drainage passive treatment site in the Quemahoning watershed, called the region's water quality improvement efforts "among the finest in the nation."

The project visited by the secretary is commonly called the Jenners Passive Treatment System. Completed in 1997 at a cost of \$175,000, the system treats a discharge on a municipally owned property in the town of Jenners. It combined the efforts of the OSM Appalachian Clean Streams Initiative, the EPA, the Southern Alleghenies Conservancy, AmeriCorps and the Natural Resource Conservation Service, and proved that interagency and volunteer cooperation could accomplish significant and lasting results.

The project's success snowballed, leading to a second, more ambitious cleanup project located a mile downstream. After the Jenner Rod and Gun Club donated the \$25,000 necessary to purchase a tract of mine-drainage-impacted land, the OSM and Pennsylvania Department of Environmental Protection provided more than a half-million dollars to build a treatment system that now annually removes more than 160 tons of iron from Quemahoning Creek.



photo by Len Lichvar

Pennsylvania's Growing Greener grant program also has contributed to a healthier Quemahoning. A \$225,000 grant has made possible work with local landowners to plan, design and install best management practices along the creek, and a \$60,000 grant corrected a severe source of erosion along a mile-long stretch of creek frontage.

Cooperative projects like those on the Quemahoning Creek, replicated several times over in other headwater streams, allowed the Stonycreek River to regain a measure of its health. A viable trout fishery was effectively re-established in its upper reaches by the close of the 1980s. But the abandoned mine drainage in one tributary was so severe that aquatic life ceased below its mouth on the Stonycreek. This tributary, Oven Run, once produced 3 million tons of coal from the underlying Lower Kittanning seam – at just one of the dozens of mines that once dotted its watershed.

Those mines produced 720,000 gallons of abandoned mine drainage every single day. In an attempt to thwart their devastating effects on and downstream from Oven Run, Mountain Laurel Trout Unlimited joined a wide coalition in a six-site, \$5 million restoration program largely driven by NRCS funding.

"Mountain Laurel Trout Unlimited tries to keep everyone energized and motivated in the cleanup process," Lichvar says. He points out elements of the project, like an interpretive trail that explains to visitors how passive treatment technologies work, would not exist but for a TU Embrace-A-Stream grant from TU National and matching funds from the Mountain Laurel Chapter. He sees efforts like building the interpretive trail as evidence of the organization's leadership in terms of education and information sharing, an essential function. "Without the transfer of knowledge on what is required in these cleanups," Lichvar says, "we wouldn't have the glue that holds coalitions together."

The strength of the coalition's bonds will surely be tested as it turns its attention to the headwaters of the Little Conemaugh, where the abandoned mine discharges, though fewer in number than those on the Stonycreek, are far larger in size and therefore far more difficult to treat. One site in particular, the Hughes Borehole, presents an incredible array of challenges.

Often compared to the Mud Pots in Yellowstone National Park for its contemporary other-worldly appearance, the Hughes Borehole was drilled during the 1920s to drain water from hundreds of interconnected miles of underground mine shafts. Capped in the 1950s, the borehole blew out in the 1970s and has since spewed between 800 and 3,500 gallons of metals-laden water every single

photo by Len Lichvar

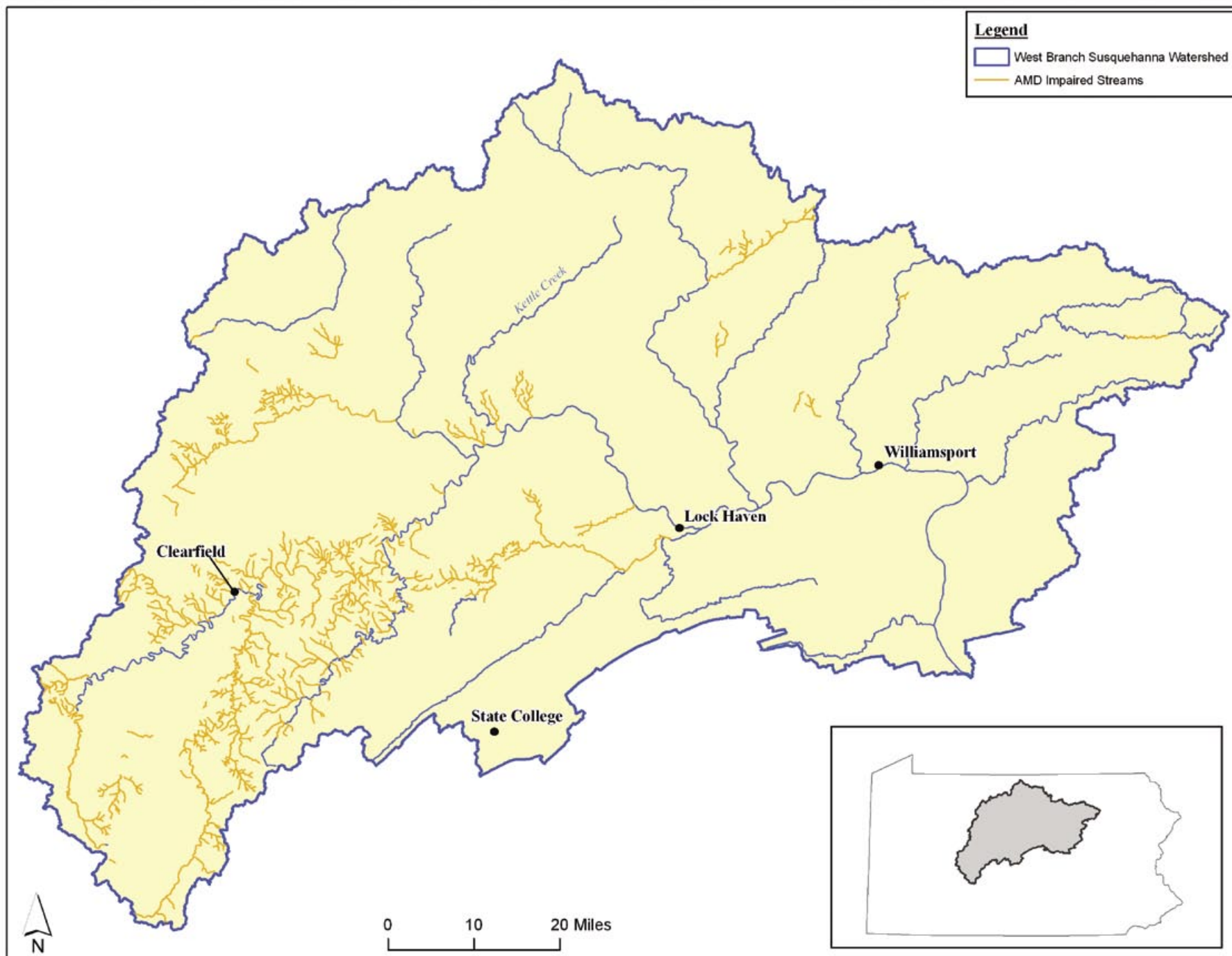


minute. Each day, about 8,000 pounds of dissolved metals reach the surface, and during spring runoff, a type of artesian well develops, as the discharge shoots 15 feet into the air.

"A cleanup of the borehole site would be costly and difficult because it's remote, wooded, and has such a huge level of pollution," Lichvar says. "It would require the building of roads and the installation of multiple active treatment systems, meaning huge costs and logistical hurdles, so those that could launch a massive restoration operation have placed it on the back burner until smaller, successful abandoned mine cleanups helped generate enough momentum to try to beat something like the borehole. And we're finally getting to that point."

Lichvar points to the Abandoned Mine Reclamation Fund as absolutely necessary for meeting the technical needs that would be incurred in a Hughes Borehole-sized project: "If the fund dries up, we might as well all throw our hands up in the air and go home."

kettle creek & the west branch susquehanna



Kettle Creek and West Branch Susquehanna

Kettle Creek

The Place: Kettle Creek is a 42.5-mile-long stream draining 246 square miles of the deep valleys section of the Appalachian Plateau in north-central Pennsylvania. It contains 5 percent of the commonwealth's total mileage of Class A wild trout streams, and its headwaters are known for exceptional water quality.

The Problem: In the lower reaches of the watershed, about 15 miles of Kettle Creek's main stem and coldwater tributaries are essentially lifeless, rendered so by drainage from abandoned mine sites that date to the late 1800s. Some sites have acidity levels more than 200 times higher than are acceptable, and iron and aluminum levels 50 times higher than EPA concentration standards allow.

The Price: More than \$1.2 million has been spent on abandoned mine cleanup on Kettle Creek in the last six years, and a projected \$12 million more is necessary to restore the entire lower watershed.

Dean Mertz remembers the Kettle Creek watershed of 1948, the year he started angling. "Brook trout fishing in Twomile Run was fantastic," he says, referring to one of Kettle Creek's larger tributaries. "But then sometime in 1952, the stream started to deplete rapidly because of the coal mining that was going on around it. Within a few months, the stream was completely devoid of anything."

Nowadays Mertz is often spotted streamside with his grandson Josh, who serves not only as a fishing buddy, but also as the reason Mertz has devoted countless volunteer hours to a community-based organization called the Kettle Creek Watershed Association.

"I want him to be able to fish the same streams I did when I was his age," says Mertz, who chairs the watershed association's abandoned mine drainage committee, illustrating the same concern for future generations that led other local citizens to band together and form the association in 1997.

Subsequently, in early 1998, the association proposed to Trout Unlimited that the Kettle Creek watershed be included in its Home Rivers Initiative, a multi-year program that devotes significant staff and financial resources to watersheds in acute need of restoration. Extreme care is taken in Home Rivers Initiative projects to ensure that their

photo by Amy Wolfe



efforts are solidly grounded in science, are supported within the community, and are collaborative in nature.

That spring, TU formally accepted Kettle Creek as its third Home Rivers project, and it set to work developing a comprehensive restoration plan. The process of developing the action plan was made extremely difficult, however, by the fact that most of the maps of the region's underlying mines no longer existed. Without these maps, assessing how and where deep mine workings were contributing to the mine drainage problems was extremely difficult.

TU and the watershed association identified a solution – and an eager partner – in the Department of Energy's National Energy Technology Laboratory in Pittsburgh, which was capable of conducting airborne remote sensing surveys of the lower watershed.

Using thermal infrared components mounted to airplanes, researchers were able to locate groundwater seeps of abandoned mine drainage by working on the principle that when the ground is frozen, groundwater remains warmer and

shows up as a hot spot on the imagery. While they cannot tell if the water is clean or polluted, the thermal infrared studies save a lot of time and money that would otherwise be spent on manpower while searching for diffuse and isolated seeps. In addition, using geophysics equipment flown over on a helicopter, researchers were able to take advantage of physical characteristics of mine drainage, such as electrical conductivity, to locate deep mine pools, allowing them to better understand the root cause of much pollution.

These surveys marked the first time such cutting-edge observation techniques were used across such a large area to assess abandoned mine drainage problems. They allowed the watershed association to set clear cleanup priorities based on need and the likelihood of success.

Volunteers have helped install four small passive treatment systems in the headwaters of Robbins Hollow, a Twomile Run tributary, to treat highly acidic discharges from abandoned surface and deep mines that pollute Robbins Hollow.

A recently completed 57-acre surface reclamation project should address the first major source of abandoned mine drainage to Twomile Run. Re-grading and re-vegetation are expected to significantly reduce the harmful flows from this site, and monitoring is under way to collect the information necessary to design a follow-up treatment system.

Huling Branch is the largest tributary and the largest contributor of acidity and metals loading to Twomile Run. Although a complex of abandoned mines exists



photo by Amy Wolfe

within its watershed, remnant populations of native brook trout are still found in its headwaters. The current remediation plan incorporates the mining of coal that was left by earlier operations, including both crop coal, the low-quality coal on the edges of coal veins that can now be used in power plants, and high-quality coal reserves that were left in deep mines to support walls and roof rock. The plan also incorporates conventional reclamation techniques and the addition of alkaline substances to counteract acidity. Such a combination will virtually eliminate abandoned mine drainage and render cost-prohibitive active treatment unnecessary.

The work of the residents of the Kettle Creek watershed has garnered no small amount of praise. In 2001, then-Gov. Tom Ridge presented the inaugural Governor's Award for Watershed Stewardship to Trout Unlimited and the Kettle Creek Watershed Association, crediting the partners for "protecting and restoring our valuable watersheds and reaching out to our communities to educate them about the importance of Pennsylvania's natural resources."

For Mertz, progress is measured in different terms.

"I'm starting to see fish in streams where I haven't seen them in a while, and I can't wait to take Josh fishing for them."

The West Branch Susquehanna

The Place: The West Branch Susquehanna watershed drains an area of about 7,000 square miles, an area twice the size of Yellowstone National Park. It contains more than 1.4 million acres of state forest land, more than a quarter-million miles of state game lands and almost 30,000 acres of state park land.

The Problem: More than 1,100 miles of the main-stem West Branch and its cold-water tributaries suffer documented abandoned mine drainage impairment.

The Price: The capital cost for water quality restoration and abandoned mine land reclamation for the entire West Branch Susquehanna watershed ranges from \$567 million to \$752 million. This does not include the annual cost for operation and maintenance, which could run to \$50 million annually.

Trout Unlimited is expanding its successful efforts in the Kettle Creek watershed to the entire West Branch Susquehanna basin. The West Branch was recently named



photo by Amy Wolfe

the “River of the Year” by the Pennsylvania Department of Conservation and Natural Resources, which pointed to the unlimited recreational and tourism potential the river holds, while applauding the wide-ranging partners working to restore the river.

Trout Unlimited's West Branch Susquehanna restoration work is modeled on the methods that TU and its partners have developed for the Kettle Creek watershed in the past six years. Trout Unlimited's main objective is to act as a catalyst toward establishing a comprehensive plan aimed at the restoration of coldwater streams while building a coalition that is representative of all stakeholders, including private landowners, watershed groups and TU chapters, local businesses and government agencies.

The benefits of eliminating abandoned mine drainage in the West Branch watershed are numerous, with one of the most obvious being improved fishing opportunities. The potential for fishery restoration on all degraded streams throughout the West Branch is phenomenal, because most of these are potential trout streams.

The current economic losses caused by abandoned mine pollution are incredible: The Pennsylvania Fish and Boat Commission estimates the total recreational-use loss at \$16,404,228 per year.

In addition to the fishing, the West Branch watershed has tremendous potential for other uses. Nearly 2 million acres of publicly owned land is located within this watershed. Pennsylvania's restored elk herd roams the West Branch watershed, and interest in hiking, wildlife photography, bird watching, picnicking and camping are rising nationwide. Swimming, kayaking, canoeing, picnicking and camping are dependent upon, or enhanced by, high-quality water resources. Reclamation of abandoned mine lands can open up many new recreation areas.

Other benefits from abandoned mine restoration include increased property values and quality of life for those living in the area, improved wildlife habitat and hunting opportunities, and job creation. Pennsylvania estimates that for every million dollars spent on abandoned mine land restoration construction contracts, about 27 people are employed directly or indirectly.

The challenges of restoring the West Branch watershed are enormous. There are approximately 36,800 acres of unreclaimed abandoned mine land features within the West Branch watershed. These features include surface mine pits, highwalls, spoil piles, refuse piles, mine openings, subsidence-prone areas and other miscellaneous mine features. There are approximately 887 known mine drainage discharges with a combined flow of just over 300,000 gallons per minute.

Remining in the watershed may also reduce the cost of restoration efforts. Remining, which involves extracting remaining coal reserves from previously mined lands and is made possible by advanced mining techniques, may significantly contribute to restoration activities within the West Branch watershed. Remining operations must reclaim abandoned mine lands to current-day standards, and remining operations that affect pre-existing mine discharges must use best management practices designed to reduce pollution loads. These practices include regrading and revegetation of abandoned surface mines, removal of coal refuse piles, the addition of lime and other alkaline rock to neutralize acidity, and other techniques designed to reduce water pollution.

Amy Wolfe, who has spearheaded Trout Unlimited's work on Kettle Creek, looks forward to the opportunity to build on past successes. “Restoring the West Branch Susquehanna watershed will at times seem daunting,” Wolfe says, “but I'm constantly encouraged by what can be accomplished through a diversity of partnerships and a love for this area.”

Coal Creek

The Place: Coal Creek is a tributary of the Clinch River, the most popular trout fishery in Tennessee, which it joins about five miles downstream of Norris Dam. It is just over a ridge from the Oak Ridge National Laboratory, a half-hour's drive from Knoxville, Tenn., and an hour's drive from the northern edge of Great Smoky Mountains National Park. The Coal Creek watershed drains a total of 36 square miles and holds more than 30 miles of potential spawning streams for trout.

The Problem: There are four abandoned mine drainage sites in the watershed, three deep mine discharges and a large refuse pile. The refuse pile is the most significant source of pollution.

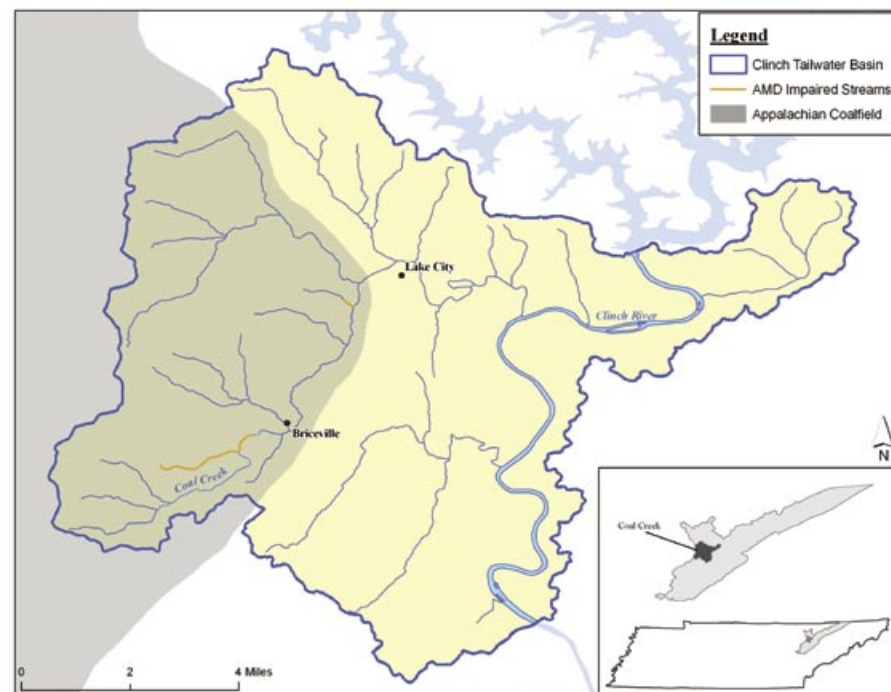
The Price: An estimated \$1.5 million is required to properly deal with the sources of abandoned mine drainage in the watershed.

Most abandoned mine drainage cleanups do not include scenes like those at last year's Coal Creek Health Day. Biologist John Thurman spent the day waist-deep in Coal Creek, showing children how to find life in a waterway where some still dump garbage. Physicians Hiroshi Toyohara and Robert Casey and dentist Bob Greer were inside the Briceville Elementary School gymnasium, providing free medical examinations for kindergartners through fifth graders.

And wandering through the crowd, greeting friends and talking conservation, was the event's originator, Barry Thacker – professional engineer, TU volunteer and most recent winner of the Hoover Award, the highest humanitarian honor given to members of the engineering profession. The award recognizes engineers whose personal and professional achievements have made the world a better place. Past winners include three presidents and business leaders like David Packard, co-founder of Hewlett-Packard Corp.

Thacker earned the award for recognizing that events like Coal Creek Health Day can be part of a vital conservation strategy, one that takes into account the needs not only of the fish but also of the local community. With the help of TU and the Coal Creek Watershed Foundation, a nonprofit he founded, Thacker is demonstrating that protecting a river sometimes means investing time and resources in activities that have nothing to do with fish, but everything to do with improving the quality of life for local people.

Although most Briceville citizens now consider Thacker a friend, it wasn't always that



way. Protest signs and angry finger-pointing prevailed the first time he approached the townspeople to enlist their help cleaning up abandoned mine damage to Coal Creek, a tributary of the Clinch River located on the edge of the Cumberland Mountain range.

"Folks told me in no uncertain terms that they had far bigger problems than trout," Thacker recalls. Once an affluent coal town, Briceville now struggles with a host of ills, including flooding, poverty, inflated school dropout rates and a chronic lack of access to health care. Poor water quality caused by abandoned mine drainage compounds these problems.

A mining and industrial consultant in his professional life, Thacker admits to feeling daunted as residents listed their complaints. "At first I was thinking, 'I'm no social worker,'" he says. Thacker had come to know the creek while fishing it with his son, however, and he believed he could help restore it. More importantly, he wanted his children to understand just how much people could accomplish if they worked together.

So he struck a deal with the townspeople. "I agreed to help them to the degree that I could, if they would eventually help me," he recalls.

Thacker's first step was to assemble – from scratch – a core group of willing hands. He turned to the groups for which he had volunteered in the past, the Boy Scouts of America and Trout Unlimited.

"I simply couldn't have done this without the help of the Clinch River TU boys," Thacker says. "Their support was the critical component in making all this happen."

Recognizing that "you gotta do what people care about," Thacker choose to tackle one of Coal Creek's most pressing problems: flooding. More than 130 volunteers, including many TU members, showed up in 2000 to clear deadwood and debris from the pilings of 13 old railroad bridges. They hoped that removing pinch-points would enable the creek to handle significantly more water without overflowing.

A related problem was that Coal Creek, in Thacker's words, "didn't like to run in one place too long"—years of alteration to the natural streambed had caused the creek to carve new routes, imperiling residents' property holdings, mobilizing large loads of sediment and increasing the likelihood of flooding. Thacker engineered several stream-bank-stabilization strategies to encourage the creek to run deeper rather than wider, and volunteers devoted scores of hours to install them.

Their efforts paid off: Coal Creek hasn't flooded in a while. When a 100-year storm ravaged the Southern Appalachians in 2003, Coal Creek stayed within its banks for the first time in years.

In 2001, Thacker took the next step, mobilizing CCWF and TU volunteers to hold the first Coal Creek Health Day. Clinch River Chapter members like Dr. Toyohara recall Thacker telling them, "Boys, you can't fish every day."

The medical professionals in the group didn't need much prodding. "For many children, it was the first time they had seen a doctor or dentist," Toyohara says. "It was very rewarding to be able to help them ... and to begin teaching them basic things they could do to improve their health."

The sentiment was echoed by Thurman, the biologist, who was trying to impress upon the kids the connections between their health and the vitality of Coal Creek, and ended up being impressed by the children's interest and aptitude. "Some of the kids were starting to identify difficult insect species on sight. The amount of knowledge they can retain is really remarkable. ... [This work] is gratifying on so many levels."

To encourage the kids to continue learning, the CCWF started the Coal Creek Scholars Program, which has provided more than \$20,000 in scholarships to high school students since 2001. The scholars program also works directly with Briceville Elementary, taking kids on field trips to local sites of historical importance and teaching them to take pride in their coal mining heritage.

"History really runs deep in and around Briceville," explains Carol Moore, who doubles as Thacker's professional assistant at work and public relations manager for the CCWF and Clinch River Chapter. "There's any number of places to learn from," she says,

photo by Richard Bernabe



pointing to the sites where rival sides encamped during the Coal Creek War, an 1891-92 conflict over the use of convict labor in private industry that led to the nationwide abolition of the practice.

"When the kids we take out start to see these places and learn from them, they realize that many of the bad stereotypes about coal miners just aren't true. They really do have something to be proud of here," Moore says.

"They're the best field trips we've ever taken," says Tom Braden, principal and alumnus of Briceville Elementary. "The kids get very excited, but they're well-behaved. They seem fascinated with this stuff because it's all around them, but they never knew about it."

Braden further praises the CCWF because, "It teaches the kids about the past, and it points them toward the future." He calls Thacker "a blessing," saying, "I can't really express in words what all this has meant to the school." Braden lists a new computer lab and a huge boost in donations of toys, clothing and supplies as results of the public exposure the CCWF has brought to Briceville.

With many new programs to boost the quality of life in Coal Creek now in place, Thacker plans to devote more time in the near future to the technical aspects of elevating Coal Creek's water quality. He believes that the creation of four new wetlands near abandoned mine sites will filter out the majority of pollutants that currently reach Coal Creek.

To make the wetlands a reality, Thacker hopes to use two things: his professional reputation within mining-industry circles and the Appalachian Clean Streams Initiative.

The Cheat

The Place: The 157-mile-long Cheat River's watershed drains 1,420 square miles in north-central West Virginia.

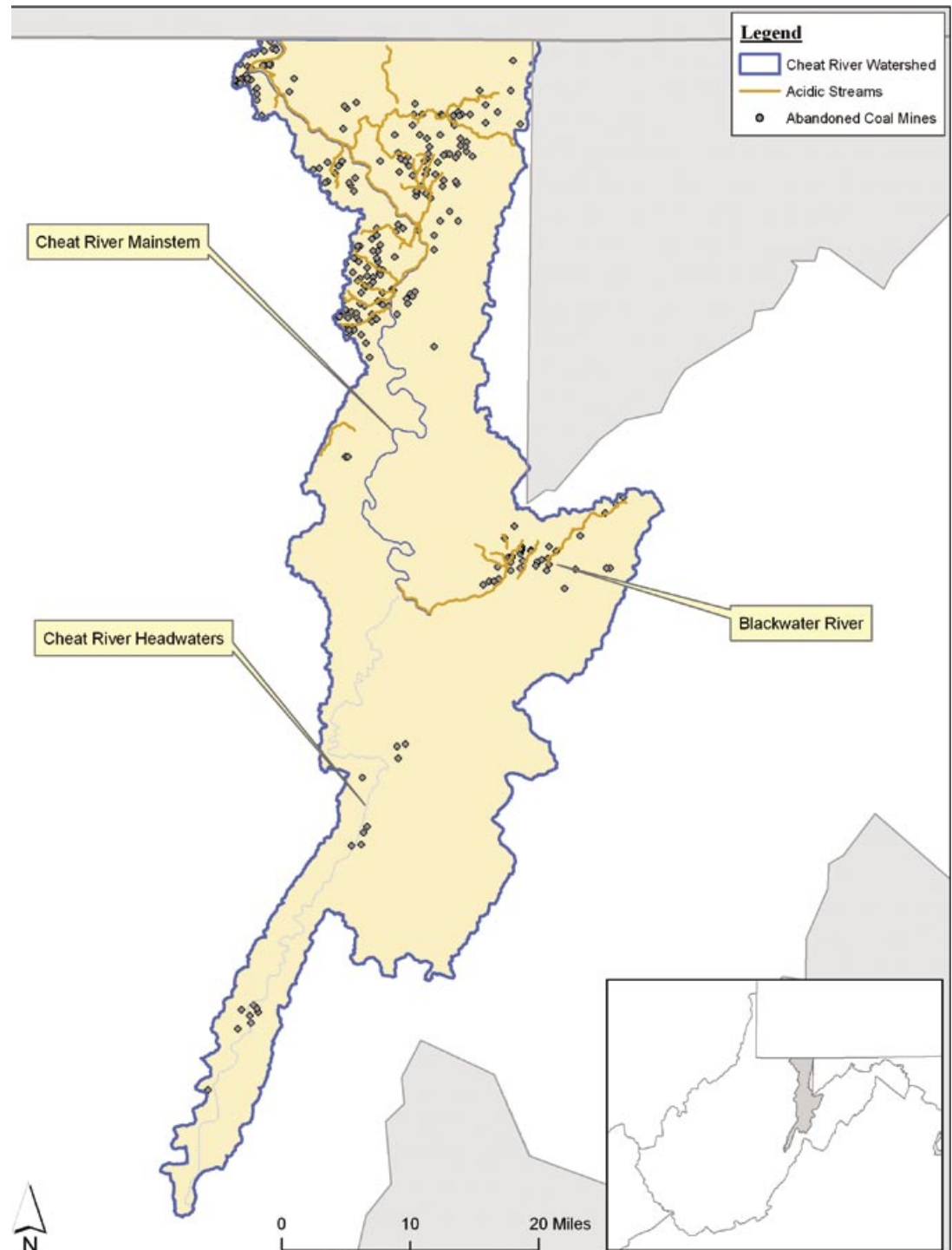
The Problem: The West Virginia Department of Environmental Protection considers 53 streams in the Cheat watershed to be impacted by abandoned mine drainage. This includes 73 miles of surviving trout habitat.

Owing to acute acid rain events in the watershed – prevailing winds carry the emissions from coal-burning power plants sited locally and in the Ohio Valley directly into the Cheat watershed – many streams regularly receive double-doses of acidic runoff. The effects of the acidic runoff are particularly damaging because the watershed's predominant bedrock offers little buffering capacity.

The Price: About \$20 million.

The Cheat watershed proves that a river system can come back from a death induced by a thousand cuts. So many of its headwater streams were rendered lifeless that a full accounting quickly becomes painful for the locals who love them: Pendleton Run, Pringle Run, Lick Run, Heather Run, Greens Run, Muddy Creek, Bull Run, Sovern Run, Cherry Run...

The first major source of abandoned mine drainage into the Cheat is from Beaver Creek, a tributary of the Blackwater River. The acidic water from the Beaver killed the same fishery in which P. Pendleton Kennedy's team of exploration had once revealed. But it has been brought back to life by a cooperative conservation effort. The benefits of an expansive drum liming station jointly installed in 1994 by the West Virginia Department of Environmental Protection and Division of Natural Resources, made possible by the Abandoned Mine Reclamation Fund, are augmented by Trout Unlimited members, who dump crushed



limestone directly into headwater streams to help counteract the effects of acidity. This had led to a comeback in fish and insect populations in the Blackwater proper, and aided the recovery in 18 miles of the Cheat's main stem.

The largest contributor to the acid load in the Cheat is Muddy Creek, the source of 45 percent of the total acidity and metals to the river. In 1994-95, a chain of events at a non-operational mine that had improperly diverted the flow of its drainage caused the side of a mountain to blow out and the main-stem Cheat River to run orange for weeks on end. The resultant fish kill spanned more than 16 miles, and whitewater paddlers reported that their eyes were burned by the water's acidity. The owner, eventually held accountable under the Clean Water Act and other standards, was forced to forfeit the bonding for the site, making the state responsible for the cleanup and treatment.

These events led to the formation of the Friends of the Cheat, a stakeholder group responsible for organizing the River of Promise, which involves state and federal agencies, industry, researchers, academia and conservation groups, including Trout Unlimited. The River of Promise plans restoration projects, collects the data necessary to make them possible, and attempts to unify the restoration efforts of the different agencies working in the watershed.

These groups have been closely involved in the cleanup of the Little Sandy subwatershed of the Cheat. "The Little Sandy doesn't look like most streams polluted by mine drainage," says Bill Thorne of the TU P. Pendleton Kennedy Chapter. "It looks like a healthy stream lined with boulders, riffles and good forest canopy." The Little Sandy used to hold thriving trout populations, but extensive mining in the middle of the 20th century led to their demise.

"A lot of people looked at us like we were crazy for trying to bring back Little Sandy, because they thought the stream would be dead forever," says Thorne. "But a few of us saw that the water's worst was in its past and that we could help it in the future."

Working through the River of Promise framework, several mine drainage treatment technologies were installed along the Little Sandy and its feeder streams during the late 1990s. Notably, several of these projects were made possible by the OSM Appalachian Clean Streams Initiative. The National Mine Lands Reclamation Center at West Virginia University was also a key player, adding both the experience and ability that come from years of exploring mine drainage issues.

These combined efforts paid off. In 2002, state fisheries biologists discovered many young-of-the-year brook trout in a Little Sandy tributary to which a team of

photo by Bill Thorne



volunteers, including many TU members, had transferred brook trout during the preceding year. Because brook trout cannot survive without clean, cold water, the fact that natural reproduction was occurring was a significant sign of progress for the watershed.

Dr. Paul Ziemkiewicz, who directs the reclamation center, reports that he was a bit skeptical of the brook trout's survival chances. "But the transformation surely has been remarkable," he says.

Ziemkiewicz looks anxiously at the future of the Abandoned Mine Reclamation Fund. "Successful watershed cleanups like those in the Cheat require three things: political will, money for restoration technology and organization," Ziemkiewicz explains. "We finally have all three of those things, and it took us 10 years to get them. To suddenly lose the political will would be tragic, and the victim would be the environment. If the fund lapses and there's no longer federal resources to drive cleanups, it would mean that 10 years from now, it would look like nothing was ever done to heal this landscape."

Legislative Recommendations

The future of the Abandoned Mine Reclamation fund remains tenuous – only a long-term reauthorization of the fund will provide the stable foundation on which coalfield communities can base sustained improvements.

Reauthorization of the fund is more than good policy, it is an ethical imperative. For all the sacrifices they have made to elevate our country to its current level of strength, we must now give the Appalachian highlands what they need to heal. We simply cannot forget the constant dangers faced by the 3.5 million people who live within a mile of an abandoned coal mine.

In its first 27 years, the fund has reclaimed vast stretches of compromised land, restoring its functionality, integrity – even its beauty. The fund has made it possible to extinguish burning slag piles, fill dangerous gaping holes in the ground, and re-grade standing highwalls that presented omnipresent landslide and flood risks. But much work remains to be done: An estimated 7,000 abandoned mine sites remain in need of cleanup nationwide. Less than 25 percent of the inventoried abandoned mine problems in West Virginia have been reclaimed, and another \$1 billion worth of cleanup waits. Pennsylvania maintains a \$5 billion restoration backlog. Additional sites in Virginia, Kentucky and other states add hundreds of millions of dollars more in anticipated costs. Meanwhile, thousands of miles of



photo by Bill Thorne

Appalachian mountain streams are damaged by mine drainage from abandoned coal mines every day.

Expand the funding for abandoned mine cleanup

Fixing high-priority public health hazards alone will require more than \$6 billion. Making water drinkable and watersheds healthier will likely exceed \$15 billion. Watershed restoration, however, is more than repairing broken lands and degraded streams. It can also serve as an economic engine to help revitalize local economies throughout Appalachia. Pennsylvania, for example, is hoping that watershed restoration efforts on the West Branch Susquehanna will bring quality, family-wage restoration jobs to the area, spur recreation, revitalize a depressed real estate market and generally lift the fortunes of a depressed area.

The restoration of Kettle Creek, a subwatershed of the West Branch Susquehanna, would not be possible but for the existence of programs such as the Appalachian Clean Streams Initiative. Increased funding is essential for programs such as these that coordinate the activities of citizen groups, researchers, the business and industrial community and government agencies that are involved in cleaning up streams polluted by abandoned mine drainage. Increasing the Appalachian Clean Streams Initiative funding from its current level of \$7 million would dramatically assist in fostering community-based watershed restorations of abandoned mines.

Extend the reauthorization of the Abandoned Mine Reclamation Fund to 25 years

Everyone agrees that we need to “finish the job” of making communities safer and cleaner. Bills considered by Congress would only ensure the viability of the Abandoned Mine Reclamation Fund for 15 years. Most experts agree that given the complicated nature of many of the remaining challenges, a horizon of 25 years is more likely needed to complete the tasks before us. New legislation should extend the life of the fund for the same time-frame.

Maintain the existing priority setting system for abandoned mine cleanup

One of the bills Congress is considering would limit the ability of states to decide how best to allocate Abandoned Mine Reclamation Fund resources. Current law prioritizes areas that pose the greatest risk to health and human safety for cleanup,



photo by Amy Wolfe

including a provision that allows for the consideration of the “protection of general welfare” from adverse effects of past coal mining. The general welfare provision has been used by states for watershed restoration and drinking water protection. The efforts of states to best decide how to attend to abandoned coal mine problems within their boundaries should not be unduly restricted by the Congress. Governors are better suited to meet the needs of their citizens, and should be allowed to set priorities for health, human safety and restoration.

To be certain, health and human safety should remain the top priorities for Abandoned Mine Reclamation Fund expenditures, but efforts to divorce community well-being from the health of the lands and waters damaged by past coal mining miss a crucial point. We cannot separate the needs of people from the well-being of their lands and waters. In the final analysis, they are the same.

Take the Abandoned Mine Restoration Fund off budget

Although the needs are great and the funding for abandoned mine cleanup is generated by an excise on coal companies, actual funding is allocated through the annual congressional appropriations process. Presently more than \$1.5 billion in collected money remains un-appropriated by Congress, and unspent. Given federal budget woes, it is arguable whether that \$1.5 billion will ever be spent on abandoned mines. Rather than making mine reclamation funding subject to the whims of annual appropriations, Congress should allow fees collected from

coal companies to be directed into a trust fund where they would be allocated to the states.

Provide states and third parties with an incentive to leverage federal funding for abandoned mine cleanup

Certain states have created funding mechanisms to bolster federal funding for cleaning up after coal mining. Pennsylvania’s Growing Greener Program, for example, has allocated \$156 million for watershed restoration, mine reclamation, and abandoned oil and gas well plugging. Nearly a million dollars of Growing Greener money is being used to restore Kettle Creek’s water quality, quality of life and fisheries.

The Surface Mining Control and Reclamation Act also authorized funding for a program to cleanup rural abandoned mines. Although the Rural Abandoned Mine Program, administered by the Natural Resource Conservation Service, qualified for more than \$700 million in potential funding, it received only \$100 million from Congress, and has been discontinued since 1995. Congress should revive and reconstitute the Rural Abandoned Mine Program, making its new incarnation a federal matching program that will provide additional incentive for states and organizations such as Trout Unlimited that are committing resources to the cause of abandoned coal mine cleanup.



photo by Amy Wolfe

We cannot separate the needs of people from the well-being of their lands and waters. In the final analysis, they are the same.



photo by Tim Zink



photo by Tim Zink

Trout Unlimited staff Tim Zink, Amy Wolfe and Keith Curley produced this report.

Join Trout Unlimited on-line at <http://www.tu.org> or call (800) 834-2419.

Cover photo credits (left to right): photo by Matt Handy; photo courtesy National Archives and Records Administration; photo by Tim Zink

Historical photos in this report courtesy of the National Archives and Records Administration

For additional information on the restoration efforts in the Appalachian Region, please contact Amy Wolfe (awolfe@tu.org). For information on specific projects within this report, please contact the following Trout Unlimited members or staff:

The Stonycreek-Conemaugh River Improvement Project

Len Lichvar, 814-629-7283

The Kettle Creek/West Branch Susquehanna Home Rivers Initiative

Amy Wolfe, 570-726-3118

The Cheat River Watershed River of Promise Collaboration

Bill Thorne, 304-864-5529

The Coal Creek Watershed Association

Carol Moore, 865-291-2898

With media inquiries or to request additional copies of this report, please contact Tim Zink, TU Media Relations Manager, at 703-284-9427.



West Branch Susquehanna River. Note reddish hue from iron precipitation. photo by Amy Wolfe