



STATE OF OUR WATER

Despite improvement in the quality of our drinking water supply, its sources are still polluted to varying degrees. Here are the sources, the threats and a few ways to keep water safe and plentiful.

BY DAN LINEHAN

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Drinking water for 600,000 Delawareans falls to the ground in the Christina Basin Watershed, a 563-square-mile area that slices through the northern part of the state from The Wedge to the Delaware River.

That rain is funneled southeast before finishing its journey in the Christina River and its three tributaries: the White Clay, Red Clay and Brandywine creeks.

On its course to sea level, the water

from these four streams is imprinted by the land it passes through. Farms, which cover about a quarter of the land, add nitrogen fertilizer and, in some cases, microorganisms from livestock waste.

Towns and cities make up another quarter of the land. Residents, chasing lush lawns and gleaming cars, add fertilizer and soap to the water.

The remaining half is comprised of forests, where the trees filter water before it hits the creeks and tree roots anchor soil along stream banks.

Southern Delaware taps a different drinking water source. Instead of snaking into streams, rainfall there settles into the sandy soil, creating vast underground water stores. But pollutants have settled in, too, at times entering the topmost aquifer, the Columbia, the one chiefly relied upon by farmers and rural wells because it is easiest to reach.

Everywhere in Delaware, water quality has improved. Landmark environmental legislation from the 1970s has led to tremendous reductions in water contam-

ination from major industrial sources. The tidal portions of the Christina and Brandywine, for example, long among the state's dirtiest waters, have seen their concentrations of the industrial chemical PCB halved in the past eight years.

In the midst of this progress, the next generation of water stewards is asking a thorny question:

If most remaining pollutants come from farms, how can we enlist farmers in the cause, and how can we pay for it all?

The most effective solutions borrow

from nature's toolkit. They include planting crops to hold the soil in place and restoring vegetation along rivers to filter out nutrients.

Led by The Nature Conservancy in Delaware and funded by the William Penn Foundation, a coalition of nonprofits has begun a first-in-the-nation effort with the ambitious goal of raising \$10 million to build a water fund to protect the Christina Basin.

Water is among nature's most stark reminders of ecological connectedness. Drinking water is perhaps our most practical concern, but cleaner water also helps wildlife, recreational users and businesses. After drinking water disasters in Flint, Michigan, and locally in Blades, water has risen in the public consciousness.

Here is a survey of where we get our drinking water, major threats to its integrity and the most promising solutions to those threats.

Source: Brandywine Creek

The drinking water source for Wilmington, Brandywine Creek drains, by far, the largest area of the four major rivers in the Christina River Basin. Of the 324 square miles from which the Brandywine collects rain, 85 percent are in Pennsylvania, including its headwaters, and they are also the source of drinking water for the cities of Coatesville, Downingtown and West Chester. Delaware is home to the remaining 15 percent of the land that feeds the Brandywine.

More than any other natural feature of the landscape, Brandywine Creek and its confluence with the Christina River was the reason for the settling and growth of Wilmington. Descending from 160 feet above sea level in Chadds Ford to sea level at the Christina, the Brandywine provided drinking water, allowed for navigation and powered mills. With these industries comes a legacy of contamination.

Forty years ago, Wilmington residents would watch colored ink run down the Brandywine, says Gerald J. Kauffman, director of the Water Resources Center at the University of Delaware. Since then, the stream has seen impressive improvement, including a 50 percent reduction from 1980 levels of phosphorus, a nutrient found in fertilizers. Nutrient contamination can lead to algae buildup that is fueled by dissolved oxygen, which can kill

fish. The reduction in nutrient pollution has helped raise levels of dissolved oxygen and boost fish populations.

Overall, Kauffman gives the Brandywine a B- for environmental health: It is improving, but major problems remain.

Threats: Upstream contamination, especially nitrogen runoff from fertilizer and sediment erosion

Levels of nitrogen, though reduced, remain high along much of its course at least some of the time. A hard rain can wash soil from farms fields, which is not stabilized by the roots of year-round vegetation, into the river, increasing E. coli bacteria to dangerous levels and, perhaps a dozen times a year, forcing Wilmington to tap its reservoir for drinking water. Many of the Brandywine's problems are seen in each of the other three rivers in the watershed.

Solution: Upstream watershed protection

Because cities are equipped to make investments within their boundaries, they have historically favored infrastructure solutions. Some would prefer to look upstream for water improvements, to where pollutants enter the water supply, but their authority to do so is limited.

Kelly Williams, Wilmington's commissioner of public works, says the city has been waiting to make these upstream investments, calling it "where we'll have to go in the future." But without a specific analysis laying out how spending will result in cost savings, the city's overriding concern is for its most vulnerable rate-payers, she says.

Sen. Bryan Townsend of Newark wrote a bill that would authorize cities and water companies to use money from water bills on watershed protection. "The framework is clear, the merits of it are clear," he says. He describes the idea as "spending less money to stop a problem from happening."

Some of his colleagues opposed the bill because it involved Delawareans' money to clean water in Pennsylvania. But because we live downstream from Chester County water users, Delawareans are forced to play the hand they're dealt.

"If you live in the tailpipe in terms of air or downstream in terms of water, you have got to find ways to innovate," Townsend says.

Another Solution: The Water Fund and Pay-for-Success

One promising new approach to improving water quality in Delaware is called a “water fund”—a public-private partnership that invests in watershed restoration. The Nature Conservancy pioneered the water fund model in Latin America and recently expanded into the United States. At a basic level, a water fund pools resources from downstream water users—think cities and business—and invests them in cost-effective upstream conservation measures that improve water quality and/or reduce quantity.

Over the past four years, with grants from the William Penn Foundation in Philadelphia, TNC Delaware and the University of Delaware Water Resource Center have developed the Brandywine-Christina Healthy Water Fund. The fund is designed to create a revolving funding mechanism by which upstream pollution-reduction activities—mainly changed practices on agricultural lands—are quantified in marketable units called environmental impact units. EIUs can be purchased by municipalities and drinking water producers to help meet regulatory obligations or reduce operating costs. The Water Fund then reinvests revenue generated from the sale of EIUs into more agricultural restoration projects, thereby generating more pollution reductions, more EIUs and more revenue. The result is a sustainable, revolving fund for healthier water that tends to be more economical than gray infrastructure solutions.

“It’s an innovative strategy, and it’s never been done before,” says Richie Jones, TNC’s Delaware state director. “But if we get it right—and we think we can—we’ll have created a model that can help restore watersheds across the country and around the world.”

The Brandywine-Christina Healthy Water Fund is attracting national attention. In 2017, the Natural Resources Conservation Service of the U.S. Department of Agriculture awarded a large Conservation Innovation Grant—one of only 32 awarded in the country—to i2 Capital, a Washington, D.C.-based impact investment firm. The NRCS grant allowed i2 Capital to assemble a team of national conservation-finance experts around the water fund. i2 Capital hopes to raise up to \$10 million in private investment capital

to increase the water fund’s scale.

“As a business model, it makes tremendous sense,” says Ashely Allen, CEO of i2 Capital. “It solves a whole host of problems—healthier drinking water, more cost-effective stormwater solutions for towns and cities, more sustainable agricultural food production—and it can generate financial returns for impact investors.”

Partnerships are critical to success. Thanks to unprecedented funding from the William Penn Foundation and others, partnerships in the Brandywine-Christina watershed are at an all-time high. For the past four years, as part of its Delaware River Watershed Initiative, the William Penn Foundation has been funding water-quality work by several local conservation organizations, including Stroud Water Research Center, Brandywine-Red Clay Alliance and the Brandywine Conservancy. The foundation requires collaboration as a condition of funding.

“There’s no question—the Water Fund would not be where it is now without the William Penn Foundation,” says Jones.

The Water Fund’s pilot project, completed in spring, exemplifies the collaborative approach. In 2017, the City of Newark made a modest contribution to the water fund with money earmarked for source-water protection. TNC matched Newark’s contribution with funds donated through DuPont’s Clear Into the Future program. The Water Fund then contracted with the Brandywine Conservancy, which had a relationship with a farmer in the Pennsylvania portion of the White Clay Creek, to implement agricultural practices designed to reduce soil and nutrients flowing from the farm into the river during heavy rains. The water fund staff is now working with the Delaware Department of Natural Resources and Environmental Control to secure Newark regulatory credit for the project.

Working with partners such as Brandywine Conservancy and Stroud, the water fund intends to implement at least three more pilot projects over the next two years. Not only are the projects expected to improve water quality, they will also allow water fund staff to test and refine the EIU, get regulators in Delaware and Pennsylvania comfortable with a new approach to restoring impaired waterways and, if successful, generate a new market for EIUs.

Sources: White Clay, Red Clay creeks and Christina River

White Clay Creek pulls in water from 108 square miles in northwestern Delaware and eastern Maryland. It’s the biggest source of water for Newark, which relies on it for two-thirds of its supply, or about 2 million gallons a day.

The Red Clay drains an area just to the east about half the size of the White Clay watershed. The two creeks converge near Stanton, where SUEZ Water’s treatment plant draws enough drinking water—two-thirds from the White Clay and one-third from Red Clay—to supply its more than 100,000 customers.

Of these three waterways, the Christina River drains the most urbanized watershed and bears some of the worst legacies of industrial pollutants. Despite its reductions in PCBs, harvesting and consuming fish from the tidal portion is still unsafe. Concerns linger over industrial chemicals like PCBs, dioxins, and the banned pesticides and insecticides dieldrin, DDT and chlordane.

Threats: Cryptosporidium, Giardia and other parasites from cow manure

These microorganisms are resistant to the chlorine disinfectants often used in treatment plants. In 1993, 400,000 Milwaukee residents were sickened—1,000 killed—by cryptosporidium in the city’s drinking water, the largest outbreak of a waterborne pathogen in U.S. history. Waterborne parasites often live in the guts of farm animals and enter rivers through the animals’ manure. If swallowed by people, they can cause a host of unpleasant gastrointestinal symptoms.

Solution: Get the cows out of the water

Detecting and removing crypto at a water plant is expensive. SUEZ Water could have spent up to \$20 million on plant upgrades to meet EPA regulations on removing these microorganisms, says Tom Hubbard, its public affairs manager. Instead, the company spent \$70,000 over five years to cut off the crypto at its source.

Working with a cooperative farmer, the project erected fencing to keep the cows out of the water and planted trees along the riverbank to prevent sedimentation. Because it draws from the same sources, the city of Newark contributed 20 percent of the cost. “With a project in the tens of

thousands, we got a pretty good bang for our buck,” says Tom Coleman, acting city manager for Newark.

Last year, Newark’s council created a \$20,000 fund for source water protection. Raising money from local rate-payers to clean upstream waters on a large scale, however, remains difficult, Hubbard says. “Right now, no state that we’re aware of has a mechanism to let a utility get money from its rates to invest upstream,” he says. “It’s not that they don’t want to. It’s that there’s no mechanism carved out.”

Threat: Complacency from consumers who believe water is plentiful and safe

The Northeast’s abundant freshwater and progress in removing the most visible of industrial pollution has made us complacent. “Honestly, I think we’re spoiled here,” says Williams. From that perspective, recent disasters in Flint, Michigan, and Sussex County have a silver lining: They are getting people to not take water for granted.

In addition to their work in the field, nonprofits such as the Delaware Nature Society are trying to educate the public, get them outdoors to increase their appreciation. People are unlikely to protect a resource they don’t value. The William Penn Foundation’s strategy is to tap into our collective attachment to specific natural areas, though Delaware is at a disadvantage without an iconic resource such as the Chesapeake Bay. The foundation is trying to build the public’s attachment with specific natural places such as the Brandywine Valley and, elsewhere in the Delaware River Watershed, the Poconos, appealing to our sense of stewardship over exceptional landscapes.

Threats: Green lawns, clean cars and everyday pollution

It’s easy for city dwellers to call out farming and heavy industry for befouling a shared resource, but the choices made in our neighborhoods and cities have played a role, too. Our desire for green lawns and clean cars sends fertilizer and chemicals down stormwater drains and, in most places, directly into rivers and streams.

Though it’s relatively easy to regulate industrial pollution coming out of a pipe, it’s much harder for government to tell people how to fertilize their lawns.

As Townsend, puts it, “We don’t have a framework right now for broader issues of a lot of little polluters like you and me.”

Solution: Education

Brenna Goggin, director of advocacy at the Delaware Nature Society, says the best way to change minds is to educate people about the consequences of their actions. For example, grasses absorb fertilizer better in the fall, so spring application is generally discouraged. If enough people learn about their water, many will take action, she says. “We would like for people to think about their impact. You don’t need to have knee-high grasses” or make radical changes.

Source: The Columbia Aquifer

As the Appalachian Piedmont gives way to the Atlantic Coastal Plain, sandy soil starts to predominate. The topmost layer of sand was laid down over the past few million years with the advance and retreat of glaciers and the ocean. It is called the Columbia Aquifer.

Though groundwater is often assumed to resemble an underground river or lake, it is more like water coursing among soil and gravel. Unlike clay, which consists of tiny particles that can pack into hard barriers, sand is ideal for creating aquifers because there is plenty of space for water to flow between the large grains.

Because it is the aquifer closest to the surface, the Columbia is the one most often tapped for wells. This convenience comes with drawbacks, however. Among them, there is little to stop rainfall from carrying pollutants into the water.

“We live in a special place because our groundwater resources are highly susceptible to contamination,” says Chris Bason, executive director of the Delaware Center for the Inland Bays. “That’s one of the reasons why, in Sussex County, we have pervasive contamination of drinking water with nitrates.”

The Columbia is also important in northern Delaware. Newark depends on it for one-third of its drinking water.

Threat: Contamination from spray irrigation of wastewater and other sources

A U.S. Geological Survey study in 2010 found a high median nitrate concentration in the Columbia aquifer. Two of the

30 wells exceeded the EPA’s contaminant maximum. The study also found an insecticide called dieldrin, banned on farms since 1974, in unhealthy levels at nine sites. Bason says a separate analysis of 200 wells in the Indian River Bay Watershed found a third of them exceeded the standard.

Consuming too many nitrates can cause a condition called methemoglobinemia, in which the oxygen-carrying hemoglobin in blood is converted to methemoglobin, which can’t carry out that task. It is an especially serious condition in infants.

Nitrates also contaminate the bays and lead to growth of sun-blocking algae, which in turn shades out bay grasses and decreases biodiversity. Agriculture is not the only source of nitrates—others include land application of wastewater and failing septic systems—but it is likely the largest cause in rural areas.

Solution: Regulation and cleanup

Bason says pollution at a chicken processing plant near Millsboro is an example of regulatory failure. The facility had been ordered since 2003 to reduce its nitrate levels, but there were no penalties when it didn’t happen, he says. Regulators seem committed, he adds, to address the shortcoming that led to the contamination.

There are wider regulatory issues at work, too. For example, sellers of a property surrounded by nitrates are under no obligation to disclose the fact to prospective buyers. But when pollutants are discovered, the state could use a reliable funding stream for cleanup, says Townsend. In addition to the bill authorizing utilities to spend money upstream, he introduced another, more controversial bill intended to raise about \$20 million a year to clean water and reduce flooding through surcharges on income taxes and business licenses.

The bill resulted from the recommendation of a legislative task force that formed in 2015 to identify potential funding mechanisms for improving water quality and preventing flooding. The bill was tabled in a legislative committee.

To Townsend, taxing a wide swath of residents has the virtue of charging regular citizens for their individually small but cumulatively big contribution to the problem. The idea that only big polluters are worth talking about is false, he says. “We cannot possibly solve our water problems by only going after big producers.” ▣