



Threats to Clean Water in the Delaware River Basin

Insights from the Interactive Online Map and Recommendations

Tony Dutzik and Elizabeth Berg, Frontier Group
John Rumpler, Environment America Research & Policy Center

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Introduction

The Delaware River basin is unique. And uniquely important.

The Delaware River, the longest undammed river in the eastern United States, is one of America's natural treasures. Millions of people visit the Delaware or its tributaries each year to fish, hunt, watch birds, canoe, raft, boat and enjoy nature.¹ Waterfalls, hikes and campgrounds draw visitors to national protected areas like the Delaware Water Gap National Recreation Area and the Upper Delaware Scenic and Recreational River.

The Delaware River is also home to more than 200 fish species, as well as the eastern oyster, blue crab and American horseshoe crab. The basin's waterways also provide drinking water for more than 15 million people. Overall, the Delaware River basin provides \$21 billion in ecosystem goods and services per year, including recreational, commercial and water quality benefits.²

In short, preserving clean, healthy and ecologically vibrant waterways in the Delaware River basin is essential to the overall health of the region, its diverse array of wildlife, and its economy. But we haven't always treated the Delaware River basin's waterways with the respect and care they deserve.

Generations of damaging activities—from coal mining to the use and disposal of persistent toxic chemicals like PCBs—have left a legacy of pollution that continues to harm the Delaware River and its tributaries today. And while environmental laws and restoration efforts have reduced some pollution threats to the Delaware River basin and restored some of its waterways to health, a range of new threats—from pharmaceuticals and microplastics to pollution from factory farms and the dangers posed by fossil fuel production and transportation—threaten the progress we have made.

A broad view of pollution threats in the Delaware River basin demonstrates the need for a comprehensive, fully-funded approach to restoring the basin's waterways to health.

But it also reveals something larger: the need to adopt policies that prevent pollution *before* it occurs.

Protective designations can help keep inherently polluting facilities—from fossil fuel pipelines to factory farms—away from the waters where we fish and swim. Moreover, such pollution prevention tools underscore the need to keep the basin's streams and wetlands under the ambit of the Clean Water Act.

This document provides a series of recommendations—based on conclusions from a year-long effort to assess and visualize water quality threats in the basin—that would help to preserve what is unique, and uniquely valuable, about the Delaware River basin for generations to come.

Threats to Clean Water in the Delaware River Basin: The Environment America Online Map

To understand how to address a problem, it is first important to really see it.

The diverse landscapes and wide array of past and present human activities in the Delaware River basin make it difficult to understand the totality of the challenge the region faces in protecting and restoring the basin's waterways.

Environment America's online map of threats to water quality in the Delaware River basin—available at www.delawarewatershed.org—unites thousands of data points from more than a dozen sources to paint a rich picture that citizens, advocates and the region's leaders can use to grasp the magnitude of the challenge. (Details on the sources of data included in the map can be found in the methodology document available on the map website.)

The map depicts the location of several types of facilities and activities with the potential to affect water quality.

Runoff Pollution

Pollution in runoff—water flowing over farm fields, roads, parking lots, lawns and construction sites—represents one of the greatest threats to clean water throughout the Delaware River basin. Runoff from rainstorms and snowmelt can carry a stew of damaging pollutants into waterways: pesticides from lawns and farm fields; manure generated by factory farms and spread on fields; oil, metal, rubber and road salts from highways; sediment from construction sites and much more.

Sources of runoff pollution can sometimes be difficult to identify—for example, state and federal environmental agencies make public only limited information about pollution from agriculture. The online map provides two tools that citizens can use to get a sense of the contribution made to runoff pollution by farms and urban development in various parts of the basin.

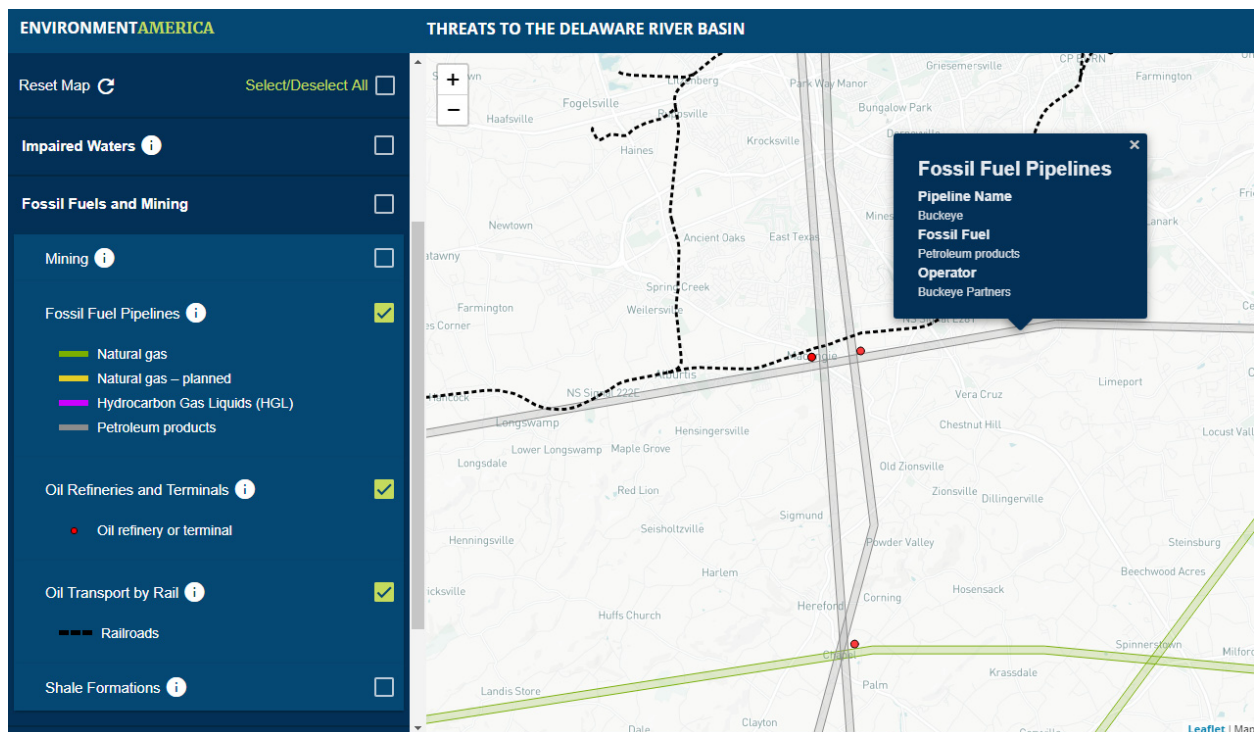
- **Impervious surfaces** – Research demonstrates that the greater the share of a watershed that is covered with pavement, roofs and other impervious surfaces, the more likely waterways are to be burdened with pollution from runoff.³ Researchers at Shippensburg University, with the assistance of the University of Vermont's Spatial Analysis Lab, have developed high-resolution land cover data that shows the existence of impervious surfaces down to the one-meter square level. Those data—completed in 2018—were used to show the percentage of local watersheds within the Delaware River basin that are most susceptible to water pollution from urban runoff, ranging from less than 1 percent in portions of northeastern Pennsylvania to more than 60 percent in parts of Philadelphia.
- **Agricultural runoff** – Runoff from farm fields can contain a variety of pollutants, including chemical pesticides and nutrients such as phosphorus and nitrogen. Sediment washing off of farm fields combines with sediment runoff from eroding streambanks, construction sites and other urban

sources—often exacerbated by flooding—to degrade water quality. The Academy of Natural Sciences at Drexel University has produced a Stream Reach Assessment Tool that models pollutant runoff from agricultural lands down to the level of individual stream catchments.⁴ The Environment America online map aggregates those pollutant estimates at the level of local watersheds, showing the portions of the basin most likely to be burdened by agricultural runoff.

Fossil Fuel Extraction and Transportation

The extraction and transportation of fossil fuels poses a variety of threats to waterways in the Delaware River basin. The legacy of coal mining continues to damage waterways, as active and abandoned mines can contaminate streams with harmful levels of acidity and metals. A U.S. Geological Survey study found that more than 3,000 miles of streams in Pennsylvania, including many miles within the Delaware basin, have been contaminated by coal mine drainage.⁵

Meanwhile, large volumes of oil are transported throughout the Delaware River basin via tanker, train and pipeline. The sheer volume of fuel being moved, stored and processed in the basin creates the potential for spills, which can have a severe impact on marine life, the fishing industry, and recreational water uses. The 2004 *Athos I* spill, in which a tanker transporting crude oil from Venezuela was ripped by



The online map depicts oil refineries and terminals (red dots) and shows the pipelines and rail lines that transport fossil fuels around and through the basin.

an anchor while preparing to dock at a refinery, resulted in the release of more than 263,000 gallons of oil into the Delaware River, requiring restoration that continued for more than 10 years.⁶

Even when fossil fuels do not pose a direct threat to waterways—as may be the case with natural gas shipped through pipelines—the construction of fossil fuel infrastructure can damage waterways by polluting rivers and streams with sediment and fragmenting natural areas needed for the protection of water quality. A 2016 analysis estimated that proposed fossil fuel pipelines in the Delaware River basin could disturb more than 1,000 acres of forest and 41 acres of wetlands, with the pipelines likely making 175 crossings of rivers or streams.⁷

The online Delaware River threats map depicts more than 1,800 miles of completed and under-construction pipelines in the basin, as well as more than 1,000 active and abandoned mines (including both coal mines and other types of mines), and 45 petroleum terminals and refineries. It also shows the extent of the Marcellus and Utica shale plays, which have not been fracked within the Delaware basin due to a longstanding moratorium, but could someday be developed, potentially posing a new and serious threat to water quality.

Industrial Pollution

Just as the legacy of coal mining has created lasting water quality problems in parts of the Delaware River basin, so too has the region's history of heavy industry. Even today, industrial facilities throughout the region continue to release pollutants to our waterways with the potential to harm wildlife and human health.

The online Delaware River basin map shows more than 600 facilities permitted to release pollutants into Delaware River basin waterways in 2017, including 62 that reported direct releases of toxic chemicals to waterways in the basin via the EPA's Toxics Release Inventory (TRI) in 2015. Among the latter group of facilities are 12 that ranked among the top 20 percent of facilities reporting to the TRI nationwide based on the toxicity of their releases to waterways.

Even this picture provides a very limited view of the dangers that industrial facilities pose to the Delaware River basin. Only a small number of facilities are required to report to the TRI. Many facilities also store toxic substances on site that pose a threat to waterways in the event of an accidental spill or a major flood. In addition, hazardous substances are transported over the region's highways every day, posing a threat to local waterways in the event of an accidental spill.

Water quality can also be threatened by contaminated industrial sites. Some sites may pose a direct threat to waterways—such as the former Cortese Landfill in New York's Sullivan County, which is located 450 feet from the Delaware River and has had contamination from the site reach the river via groundwater⁸—while others may pose a risk in the event of a flood. Still other sites are being actively managed to reduce their impact on environmental quality but have the potential to affect waterways in the future. The Environment America online map shows the location of nearly 2,700 sites managed under state hazardous waste programs or the federal Superfund program. While not all of these sites pose a direct threat to water quality, the large number of such sites illustrates the importance of hazardous waste cleanup and prevention to the health of the Delaware basin and its people.

Sewage Treatment

While improvements in sewage treatment have reduced pollution over decades, many treatment plants remain major pollution sources in the basin. A 2016 study found that nearly half (46 percent) of all nitrogen loadings in the basin came from wastewater.⁹

Sewage treatment plants today also receive various pollutants—from industrial chemicals to household chemicals and pharmaceuticals to microplastics—that they were never designed to handle and which may end up in our waterways. (See “Contaminants of Emerging Concern,” page 10.)

The online map shows the location of more than 250 sewage treatment facilities in the basin and their releases of a set of key pollutants, including nitrogen, phosphorus, solids (which can make water cloudy and harm wildlife), organic enrichment and pathogens.

It also shows more than 350 locations of combined sewer overflows—places where untreated sewage can flow into waterways during heavy rain events. Communities throughout the Delaware River basin are taking steps to reduce these overflows by adopting “green stormwater management” initiatives that reduce the flow of storm runoff into sewer systems and by investing in improvements to sewage treatment infrastructure. The Philadelphia Water Department, for example, has encouraged techniques such as green roofs and rain barrels—all tools that prevent the flow of stormwater into the sewer system and thereby reduce sewer overflows. The city intends to reduce its flow of stormwater into the region’s waterways by 85 percent.¹⁰

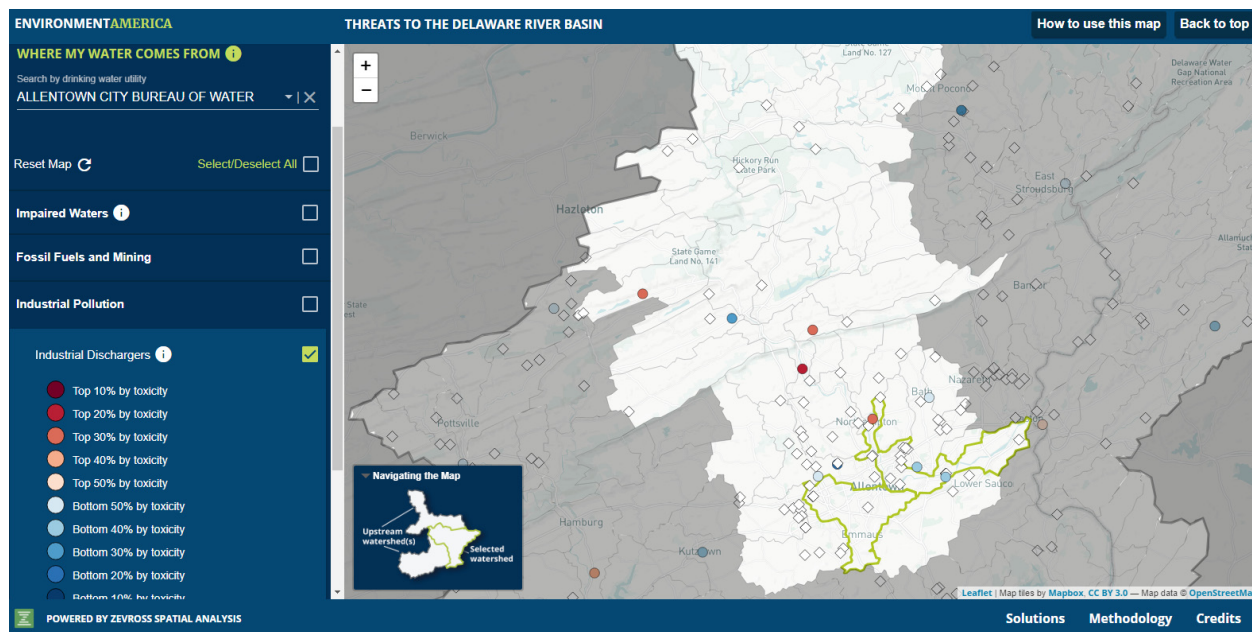
Many local governments in the basin, especially those in rural areas, struggle to obtain the funds needed to repair, upgrade and modernize existing sewer systems. A 2012 EPA analysis, for example, estimated that public sewage treatment authorities in the Pennsylvania portion of the basin alone faced more than \$2.6 billion in investments needed to meet the goals of the Clean Water Act.¹¹

A Unique View of Water Quality Threats

The Environment America online map provides several ways for residents and local officials to explore threats to water quality. Users can simply dive into the map by selecting specific categories of threats or zooming into a particular portion of the basin. Or they can search for their home address, other locations in the basin, or the name of their drinking water provider in order to view the portions of the basin that concern them most.

Two features of the map that provide unique insights are:

Ability to select local watersheds and view what is upstream – The quality of a river or stream is dictated not only by what happens along its banks, but also by what happens upstream. The Environment America online map enables users to view the local watershed that contains a particular address, but also highlights all of the watersheds upstream of that location, providing users with a visual reminder of the interconnected nature of our waterways and enabling them to identify the full range of potential threats that may affect the quality of their local river or stream.



The interactive map allows users to identify the watersheds from which their drinking water originates, as well as watersheds upstream of those sources and various pollution threats within the area.

Linkage to drinking water providers – Clean, healthy drinking water begins at the source. Clean source water requires less treatment—saving money for water utilities and reducing risks such as the formation of disinfection byproducts that can contribute to health problems. The Safe Drinking Water Act required local water utilities to assess the quality of their source waters.¹² Many utilities followed up those assessments by developing and implementing source water protection plans to reduce pollution threats to waterways.

The Philadelphia Water Department, for example, completed Source Water Protection Plans for the Schuylkill River (in 2006) and Delaware River (in 2007).¹³ The Schuylkill River study highlighted the need to address releases of treated wastewater from upstream sewage treatment plants, untreated sewage discharges from combined sewer systems, and urban and agricultural runoff as among the highest priorities to protect the quality of the water resource. These same issues were consistently raised as concerns by source water assessments throughout the Delaware River basin. The Environment America online map provides users with an up-to-date view of the sources of pollution that may threaten the health of their drinking water and make drinking water treatment and management more challenging.

A Thorough but Imperfect View

The Environment America online map aggregates more than 5,000 data points on pollution threats from around the Delaware River basin to help residents and decision-makers better understand the

threats facing the basin's waterways. Yet, it remains an imperfect view. Incomplete data make it difficult to ascertain the full range of threats created by certain types of facilities and activities, while some categories of pollution—such as illegal releases into waterways from facilities without discharge permits—are inherently untrackable using databases reliant on monitoring or reporting from permitted facilities.

Among the pollution threats not included in the online map are:

- **Contaminants of emerging concern** – Even as the region has made progress in reducing discharges of many pollutants from industrial facilities and sewage treatment plants, new pollution threats have emerged. Pharmaceuticals, natural and synthetic hormones, flame retardants, household chemicals and beauty products have found their way into Delaware River basin waterways. Water samples collected from the Delaware River between 2007 and 2009 found detectable contamination from some of these pollutants.¹⁴ While some of these contaminants have been shown to harm aquatic animals by affecting their development and ability to reproduce, the full nature of their effects is poorly understood.¹⁵ The limited monitoring and tracking of these pollutants made it impossible to include these threats in the interactive map.
- **Pesticides** –The Delaware River Basin Commission (DRBC) has identified pesticides as a water quality concern across 133 miles of the Delaware River and Delaware Bay.¹⁶ While the U.S. Geologic Survey provides modeled estimates of the use of dozens of pesticides within the basin, the sheer number of pesticides made presentation of the data in the online map difficult.¹⁷
- **Invasive species** – Invasive species can degrade the quality of the Delaware River and its tributaries. Beginning in 2007, the algae species *Didymo*, colloquially known as “rock snot,” began to appear in northern reaches of the Delaware River, coating rocks in thick mats and threatening the ecological balance of the waterway.¹⁸ While now believed to be native to the region, *Didymo*'s sudden spread and impact on the ecology of the upper Delaware are illustrative of the threats posed by invasive species. Because of the transient nature of invasive species, these could not be easily represented on the map.

The Environment America online map provides a thorough, easy-to-use and customizable view of thousands of data points depicting potential threats to water quality in the Delaware River basin. It also provides unique insights into the nature of those threats and the steps that can be most effective in restoring the basin's waterways to health.

Protecting Clean Water in the Delaware River Basin: Insights and Recommendations from the Online Map

Over the last several decades, residents of the Delaware River basin, local and state governments, businesses and nonprofit organizations have worked hand-in-hand to improve water quality in the basin—with impressive results.

In the mid-20th century, for example, high levels of nutrient pollution caused oxygen depletion in parts of the Delaware River for much of the year, harming the river's ecosystem.¹⁹ Over the course of the last half century, tighter limits on water pollution, public investments in modern sewage treatment infrastructure, and measures to reduce runoff have reduced the nutrients flowing into the river, allowing oxygen levels in much of the river to rise.²⁰ While oxygen depletion remains an issue in portions of the river, cooperative efforts across the basin have led to dramatic improvements.

Yet, as the Environment America online map shows, threats to water quality in the basin—from everyday problems such as runoff from parking lots and farm fields to the potential for catastrophic spills from oil trains or facilities storing hazardous chemicals—are pervasive. By providing a view of the scale and scope of water quality threats facing the region, the online map illustrates the need for a comprehensive and coordinated strategy for protection.

Key Insights

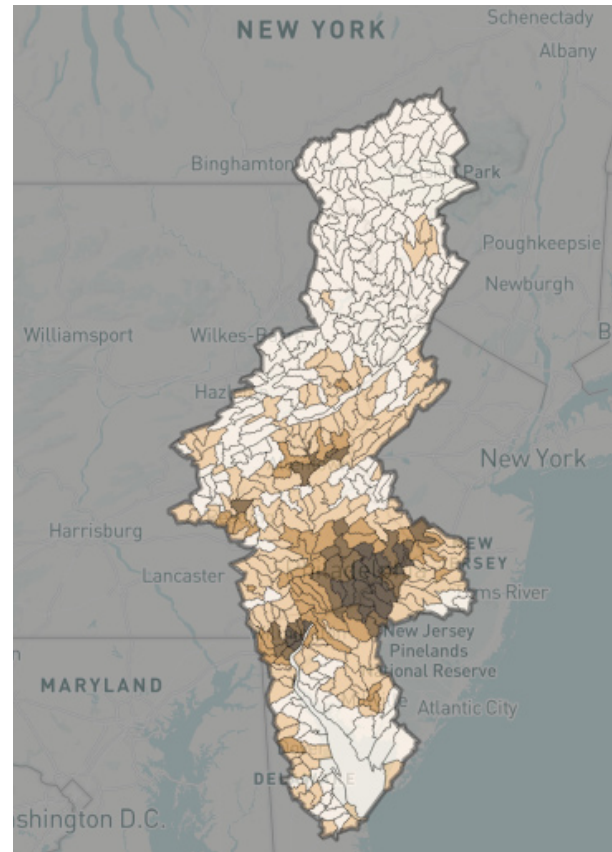
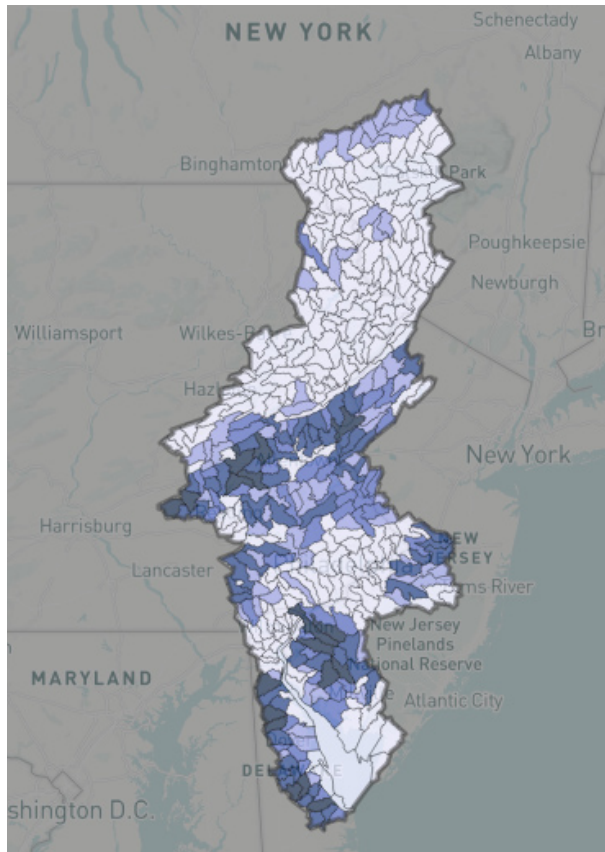
Two key insights emerge from the map:

Threats to water quality in the Delaware River basin are widespread, varied and interrelated. There is no portion of the Delaware River basin that is completely free from threats to water quality, though the nature of the threats varies throughout the region. Agricultural runoff and legacy pollution from coal mining pose water quality challenges in more rural portions of the basin, while urban areas often suffer from combined sewer overflows, industrial discharges, and urban runoff pollution.

But while the specific nature of water quality threats varies across the region, the Delaware River basin is also an interconnected system. What happens upstream is of vital importance to the quality of waters downstream. Policy approaches to address pollution may be driven by local concerns over water quality, but the success of those measures is critical to improving water quality and protecting people and wildlife throughout the Delaware River basin.

Pollution prevention is critical. The thousands of hazardous waste sites and former mines in the Delaware River basin are a testament to the long legacy of polluting activities conducted decades or even more than a century ago. Cleanup of this legacy of pollution is difficult, expensive and time-consuming.

As we clean up the environmental liabilities left to us by previous generations, it is imperative that we not saddle future generations with our own legacy of pollution. The Environment America online map depicts a region laced by infrastructure that supports environmentally unsustainable modes of



The interactive map enables users to explore the varied nature of pollution threats throughout the basin, from agricultural nitrogen runoff (left) to impervious surface coverage (right) linked to elevated levels of urban runoff pollution.

production and consumption—from the burning of fossil fuels to industrial agriculture. A holistic, pollution prevention-based approach to restoring water quality in the Delaware River basin would include policies that exist outside the typical boundaries of “water policy” but that lessen the burden on the basin from unsustainable activities.

Principles and Key Recommendations

To protect waterways in the Delaware River basin from recognized threats and to restore water quality, public officials, businesses and citizens should ensure that the following principles are applied in management of the basin:

- 1) Keep pollution threats away from waterways.
- 2) Prevent pollution before it occurs.
- 3) Set and enforce tough limits on pollution.

- 4) Improve the quality of environmental information and engage the public.
- 5) Invest in restoration.
- 6) Ensure the Clean Water Act remains strong, including federal protections for the basin's streams and wetlands.

Keep Threats Away from Waterways

Municipalities and states should endeavor to keep polluting activities at a distance from waterways, reducing the risks. This is particularly important for waterways with special value: drinking water sources and waterways with outstanding wildlife or scenic resources. New York City, for example, has an ongoing commitment to purchase land around its reservoirs in the Delaware and Catskill watersheds in order to prevent pollution and avoid the need to construct expensive filtration plants. Between 1997 and 2010, the city protected an additional 100,000 acres of land in the watersheds.²¹

There are several steps public officials can implement to keep pollution threats away from waterways:

Expand protective designations for waterways

The Delaware River basin has numerous waterways of exceptional scenic, recreational and ecosystem value, as well as waterways that provide essential services to people, such as clean drinking water. Delaware River basin states have identified such waterways (known as Category One waters in New Jersey, Exceptional Value waters in Pennsylvania and Outstanding Natural Resource Waters in Delaware) as deserving of special protection, with no backsliding on water quality permitted. In addition, the Delaware River Basin Commission has designated the non-tidal portions of the Delaware as Special Protection Waters.²² Under that program, point and non-point source discharges anywhere within the basin that would negatively affect water quality within that segment of the Delaware are not permitted.

Delaware River basin states should expand the number of rivers and streams protected by exceptional value designations and ensure that existing protections are well enforced.

Similarly, activities such as swimming, fishing, and boating require higher water quality standards to protect public health. All waterways where the public should be able to engage in these recreational activities must be officially designated for these uses in order to drive the necessary pollution reductions.

Require vegetated buffer zones along waterways

Vegetated buffer zones protect water quality by filtering pollutants before they find their way into rivers, streams and lakes. Buffers reduce the flow of nutrients and sediment into waterways, limit erosion, and slow the flow of agricultural and urban runoff of the kinds depicted in the Environment America online map. States in the Delaware River basin have already taken action to require buffers alongside their most important waterways, with New Jersey extending protection to 300-foot-wide areas on either side of Category One waterways.²³ Vegetated buffers can play a role in ensuring water quality in both rural and urban areas, while delivering a host of other benefits. Forested buffers can play an important role in stabilizing stream banks, protecting against flooding, and supporting healthy aquatic habitats.²⁴ Multi-functional buffers can even allow for the harvesting of products such as berries and nuts while also helping to protect streams from runoff.²⁵

Given the high level of agricultural activity and urban land cover in portions of the Delaware River basin, comprehensive policies to encourage the creation, management and preservation of vegetated buffers alongside waterways are essential. Special attention should be paid to the restoration of native ecosystems where possible.

Fund land conservation

Land purchase programs designed to protect critical watershed lands can make an important contribution to water quality. Water utilities can play an important role in preserving natural land around and upstream of their water intakes. New York City, for example, has invested heavily in protecting land around its reservoirs in an effort to keep drinking water sources clean and avoid additional costs for water treatment. Other entities, however, can play a critical role as well.

State-level land conservation programs such as Pennsylvania's Growing Greener program and New Jersey's Green Acres program have provided long-term support for the protection of critical watershed lands and important natural areas in those states. Growing Greener, for example, has provided more than \$360 million in grants for protection of watershed lands since 1999.²⁶ Delaware River basin states should continue to provide stable funding for land conservation and advocate for reauthorization and full funding of the federal Land and Water Conservation Fund to preserve critical lands in the basin and across the country. Local planning and zoning rules can also ensure that land near waterways is protected and that new construction is done in ways that minimize the impacts on rivers and streams.

Prevent construction of hazardous facilities near waterways

Across the United States, facilities storing, processing or transporting hazardous materials or fossil fuels are often located directly alongside waterways, creating the potential for major damage to wildlife and water resources in the event of a spill. Environment America's online map reveals numerous such facilities along the Delaware River and its tributaries. Delaware River basin states and localities should work to discourage or prohibit the location of these facilities near waterways, ensure that these facilities take all necessary steps to prevent spills and accidents, and make sure they are regularly inspected to identify problems that may compromise water quality before they occur. The Delaware River Basin Commission should use its jurisdiction to limit or regulate activities (such as fracking) that pose inherent dangers to the basin's waterways. Facilities must also be held liable for all costs resulting from any damage to water resources, including the cost of cleanup and the costs of temporary water supplies or other measures made necessary by contamination.

Prevent Pollution Before it Occurs

Many of the pollution threats facing the Delaware River basin are by-products of inherently dangerous activities. Protecting water quality in the Delaware River requires not just stopping pollution at the end of the pipe but also shifting the region's economy and way of life in ways that reduce the threat of pollution at the source.

Public officials and residents can prevent pollution in the following ways:

Require or incentivize green stormwater infrastructure

The Environment America online map shows that more than half of the land area of some local

watersheds within the basin is covered by impervious surfaces. In dense cities and suburbs, the extent of paved surfaces requires that local and state governments take action to require or incentivize the installation of “green stormwater infrastructure”—permeable pavement, rain gardens, rain barrels and other tools—in order to reduce stormwater runoff.

Tools municipalities and states can use to encourage green stormwater infrastructure include:

- Adopting comprehensive green infrastructure plans.
- Requiring developers to retain and manage stormwater onsite using green infrastructure.
- Sharing resources with and soliciting feedback from local environmental advisory councils where they exist and helping to form them where they are absent.
- Educating public officials and developers through relevant conferences such as Greenbuild, sponsored by the U.S. Green Council.

Reduce dependence on fossil fuels

The Environment America online map shows a Delaware River basin that is crisscrossed by rail lines and pipelines transporting oil and natural gas from across the region and beyond to local terminals, refineries and other fossil fuel facilities. In addition, there are numerous hazardous sites across the region fouled by spills or leaks from fossil fuel infrastructure such as underground storage tanks. At the same time, while fracking is currently subject to a *de facto* ban in the basin, rising demand for natural gas for home heating, industry, and especially electricity production can be expected to lead to continued pressure to open portions of the Marcellus and Utica shale plays within the region to gas production, and to drive the construction of additional pipelines and associated infrastructure.

Reducing the region’s dependence on fossil fuels won’t eliminate the pressure to maintain and expand fossil fuel infrastructure, gas and oil markets being regional and even international in scope, but it would reduce the threat and set an example for other regions to follow. State policies that move toward renewable and clean energy sources—especially those not dependent on water withdrawals, which carry their own impacts on aquatic ecosystems—and that encourage efficient use of energy can put the region on the right track.²⁷ States such as California and Hawaii have set an example by establishing goals to move to 100 percent clean energy for electricity generation within the next several decades. States within the Delaware River Basin should consider following suit.

At the same time, making the current moratorium on fracking within the basin permanent, as the Delaware River Basin Commission is currently considering, would continue to protect the Delaware and its tributaries from the numerous threats posed by gas drilling.

Reduce use of toxic chemicals

The use of toxic chemicals in industry and consumer products creates a host of potential threats to water quality. Toxics transported to or stored at industrial facilities can spill or leak, discharges of toxics to waterways and to sewage treatment plants can directly affect waterways, and toxics included in consumer products can find their way into waterways after being washed down the drain.

Because there is no federal requirement that toxic chemicals be proven safe before being introduced

to the public for wide-scale use, the United States has repeatedly discovered—often decades later—that chemicals widely dispersed into the environment pose dire threats to the health of humans and wildlife.

For example, perfluorinated substances were used in the United States for roughly a half century in industrial processes, consumer products such as nonstick cookware, and flame retardants. These substances are now known to cause or suspected of causing cancer and a range of other ailments.²⁸ Because they persist in the environment, they are likely to threaten public health for decades to come.

The Environment America online map depicts many toxic threats to waterways that have resulted from careless use or disposal of toxic substances, including hazardous waste sites and industrial facilities reporting direct discharges to rivers and streams. Many other threats, however, cannot be readily identified or are unknown.

Reforming federal chemical policy on the basis of the precautionary principle—that is, requiring that chemicals be studied for their safety before making their way into the market—is essential. In the meantime, however, there are steps Delaware River states can take to reduce toxic threats.

States in the region can encourage industry to reduce use of the most toxic chemicals by adopting toxics use reduction practices and strategies. New Jersey, for example, requires certain facilities to account for their use of toxic chemicals and to plan for pollution prevention. A study of the program found that between 1994 and 2004, facilities covered by the program reduced their generation of hazardous wastes by 31 percent and on-site releases of hazardous substances by 75 percent.²⁹ A 1996 study of the program found that the planning requirement led some facilities to identify new pollution prevention opportunities and enabled many to save money.³⁰ A 2007 study of similar programs nationwide came to similar conclusions.³¹

Toxics use reduction isn't just important with industry. Household use of toxic chemicals is an emerging and poorly understood source of water quality challenges. Banning especially toxic or dangerous household products, encouraging products to be reformulated in ways that reduce toxic threats, expanding and improving hazardous waste collection programs, and educating the public about safer household products can all be part of the solution.

Encourage sustainable farming practices

Industrial farming practices—from factory animal farms to fertilizer- and pesticide-intensive modes of crop production—can pose threats to water quality. Factory animal farms, for example, generate large volumes of manure that are often stored on site in lagoons or other facilities that can flood or rupture, causing manure to spill into local waterways. The manure produced by those facilities is often ultimately disposed of by spreading it on farm fields, sometimes in excess of the crops' ability to make use of the nutrients contained in the manure.

More balanced farming practices that utilize crop rotation and integrate animal and crop agriculture in sustainable ways can reduce the impact of agriculture on water resources. Encouraging organic agriculture can reduce use of chemical pesticides and any runoff that might carry them into waterways. Sustainable farming can also be encouraged by reforming federal farm subsidies to discourage damaging practices, and by ensuring strong enforcement of water pollution laws to ensure that all farms

incorporate the costs of environmental stewardship into their cost of doing business, thereby providing an inherent financial incentive for the adoption of more sustainable practices.

Reduce plastic waste

The use and disposal of plastic bags, polystyrene cups, and other single-use plastics affects the health of wildlife and the aesthetic beauty of waterways throughout the Delaware River basin. In the non-tidal segments of the Schuylkill River, plastic accounted for 56 percent of marine debris collected by the Philadelphia Water Department, with bottles making up 77 percent of that plastic debris and bags 16 percent.³² While not depicted on the Environment America online map, plastic pollution is an important and growing threat to the health of our waterways.

Research conducted by the University of Delaware detected microplastics—tiny plastic particles that are sometimes produced deliberately and sometimes result from the breakdown of larger pieces of plastics—in the Delaware River and Delaware Bay, with the largest concentrations of microplastics present in the urbanized portions of the river.³³ Microplastics have been found in a variety of aquatic organisms.³⁴ Delaware River basin municipalities and states can take action to reduce plastic pollution of waterways by banning single-use plastics such as plastic shopping bags and polystyrene containers.

Set and Enforce Tough Limits on Pollution

The Clean Water Act of 1972 set a goal of eliminating discharges to surface waters by 1985. More than three decades after that deadline, legal and illegal discharges of pollutants to waterways in the Delaware River basin and around the United States continue. The Environment America online map identifies facilities in the Delaware River basin that are permitted to discharge pollutants directly into the region's waters, as well as the volume of pollutants they release, where data are available.

Though the strategy laid out in the Clean Water Act for moving America toward a future free of water pollution was well-considered, the execution of that strategy by federal and state governments has often been lacking. States have been slow in developing “pollution diets” (or Total Maximum Daily Loads, TMDLs) for waterways that fail to meet water quality standards. States and the federal government have been similarly slow in permitting and requiring effective pollution controls on factory animal farms. State governments have often also been lax in taking enforcement actions against companies failing to comply with the law, in effect penalizing facilities that take necessary measures to prevent pollution and weakening the deterrent against fouling our waters.³⁵ And states have often interpreted existing laws to the advantage of polluters and the disadvantage of water quality.

Delaware River basin states can take several actions to tighten enforcement of water pollution laws:

Ensure consistent and strong enforcement of water protections

Timely and aggressive enforcement of environmental laws is essential to ensure that they act as effective deterrents to pollution and to hold accountable those who violate the law. Federal environmental laws often delegate enforcement authority to the states. Yet, reports by the Environmental Protection Agency's Inspector General and the Government Accountability Office have uncovered shortcomings in state enforcement of federal environmental laws and the EPA's supervision of state enforcement.³⁶ According to a 2011 report by the EPA Inspector General:

“[S]tate enforcement programs frequently do not meet national goals and states do not always take necessary enforcement actions. State enforcement programs are underperforming: EPA data indicate that noncompliance is high and the level of enforcement is low. EPA does not consistently hold states accountable for meeting enforcement standards, has not set clear and consistent national benchmarks, and does not act effectively to curtail weak and inconsistent enforcement by states.”³⁷

The same report reviewed the enforcement performance of state agencies between 2003 and 2009, finding that three of the four Delaware River basin states—Delaware, New Jersey and Pennsylvania—rated below the national average in indicators of enforcement performance.³⁸ Unsurprisingly, regulated facilities in the basin frequently release pollution in excess of their permitted discharge levels—a 2018 Environment America Research & Policy Center review of EPA enforcement data identified 633 such exceedances of permit levels in the state of Pennsylvania between January 2016 and September 2017, with an additional 473 exceedances in New York State and 34 in Delaware.³⁹

To strengthen enforcement of environmental laws, Delaware River basin states and the EPA should:

- Increase funding for environmental enforcement. States such as Pennsylvania and New Jersey have experienced significant reductions over the past decade in funding for state environmental agencies, leaving fewer staff to conduct basic agency functions.⁴⁰ States should restore cuts made to environmental budgets, hire and train additional staff to meet enforcement needs, and work to prevent cuts to the EPA budget that would further jeopardize effective environmental enforcement.
- Conduct robust and timely enforcement, with frequent and thorough inspections of polluting facilities, rapid filing of enforcement actions, and the imposition of meaningful penalties for violations of the law, especially significant and repeated violations.
- Ensure that laws are interpreted and implemented as intended to protect water quality, rather than giving the benefit of the doubt to polluters.

Mandatory minimum penalties

Often, releases of pollutants in excess of discharge permits are not met with any penalty at all or with penalties that fail to eliminate the economic benefit gained by polluting. The broad discretion given to state officials in environmental enforcement, coupled with a culture of weak or minimal financial penalties for violations, breeds an understanding among facilities that environmental laws can be violated without financial pain.

States in the Delaware River basin should adopt policies that assess mandatory minimum financial penalties for environmental violations and that ensure that civil and administrative penalties issued for environmental violations are sufficient to eliminate the financial benefit of polluting. New Jersey requires the issuance of minimum penalties for certain violations of water pollution control laws—other states should consider similar measures. In addition, a 2013 report from the Center for Progressive Reform recommended that Pennsylvania clarify its penalty policies to ensure that polluting facilities do not gain economic advantage from violating clean water protections.⁴¹

Limit permitted pollution levels to improve water quality

America has not yet reached the zero-discharge goal of the Clean Water Act, but Delaware River basin states should work to move in that direction by continually tightening permitted pollution levels to decrease discharges into waterways over time. Among the tools states can use to limit pollution are:

- Completing total maximum daily loads (TMDLs) for impaired waterways to bring them back to health and limiting pollution from polluters to ensure those loads are not exceeded.
- Ratcheting down permitted discharge levels over time as envisioned by the goal of the Clean Water Act to eliminate direct discharges to waterways.
- Requiring water pollution permits for factory farms that limit manure pollution from those facilities and reduce the risk of accidental discharge into waterways. Factory farms should be required to develop manure management plans, and compliance with those plans should be enforced by state officials. In addition, these plans should be publicly available so that others who use and benefit from clean water in agricultural areas can evaluate whether adequate steps are being taken to protect waterways from pollution.
- Revoke discharge permits of the worst offenders of clean water laws. Appropriate financial penalties and rigorous enforcement are likely to deter most illegal pollution. But the ability to discharge pollutants into waterways is not a right, it is a privilege, and state officials should have the power to withhold or deny discharge permits to facilities that have proven their unwillingness to comply with the law.

Make polluters pay

The “polluter pays” principle is a foundational principle of environmental law and policy, guaranteeing that the costs of engaging in environmentally damaging activities are borne by those who engage in those activities, and not shifted to the public. The ability to shift costs to the public encourages polluting activities by making them less expensive than they otherwise would be—putting companies who follow the law and adopt cleaner practices at a competitive disadvantage.

Strengthening adherence to the polluter pays principle can reduce the number of threats to waterways in the Delaware River basin.

- Require environmental bonds for transportation, production or storage of hazardous materials. The Environment America online map depicts numerous threats to water quality created by activities that occurred decades or generations ago—from coal mines to hazardous waste sites. Because the entities responsible for some of these pollution sources disappeared long ago, the public has picked up at least part of the cost of cleaning up these sites. Requiring individuals or companies to provide financial assurance of their ability to pay for cleanup of damage from routine or accidental environmental harm from their activities is an essential tool to reduce the risk to the public. Unfortunately, bonding requirements for activities such as oil and gas drilling have proven to be inadequate to protect the public.⁴² States should require adequate financial assurance for all activities with the potential to contaminate waterways.⁴³

- Establish graduated permit fees based on potential for harm. The polluter pays principle suggests that, in addition to being held accountable for the costs of cleaning up environmental damage from their activities, polluters should also pay for the costs of regulating their activities through the fees they pay for environmental permits. In 2015, fees and other sources of non-general fund revenue accounted for approximately 71 percent of state environmental agency budgets.⁴⁴ However, different types of facilities require different levels of resources by regulators and pose different levels of risk. Facilities storing or using high volumes of toxic substances, or those requiring more frequent or thorough inspections due to a track record of poor adherence to the law, should be required to pay higher permit fees than facilities engaged in less-dangerous practices or with a better track record of compliance.
- Require industrial facilities to remove toxic chemicals from wastewater before sending it to sewage treatment plants. Public sewage treatment systems often do not have the technology to remove these chemicals, resulting in the release of dangerous substances to waterways. Delaware River basin states should impose strong pre-treatment requirements on facilities discharging toxic pollutants to water treatment systems, and also work to reduce household releases of toxic chemicals, microplastics and other emerging contaminants through product bans, public education campaigns and other means.

Improve the Quality of Environmental Information and Improve Public Access

The Environment America online map provides a one-stop resource for information about potential threats to water quality in the Delaware River basin, uniting more than a dozen different data sets compiled by local, state and federal agencies. Environmental data provided by federal, state and local agencies is often lacking in quality, inconsistent, plagued by gaps in information, or provided in formats that are difficult to access or understand. Transparency in the environmental performance of pollution sources within the basin—and in the performance of the agencies charged with regulating them—is essential if the public is to hold these facilities and agencies accountable.

Delaware River basin states can and should do a better job of making accurate, up-to-date information about water quality threats available to the public. Specifically:

Improve access to information about factory farms

Concentrated animal feeding operations (CAFOs)—often called factory farms—are required to obtain a discharge permit under the Clean Water Act if they release pollutants to waterways. Factory farm pollution can have a devastating effect on waterways, as a result of both routine and accidental releases of pollutants from the factory farms themselves and from runoff from the spreading of manure from CAFOs on neighboring farm fields. In contrast to other pollution threats to the Delaware River basin—such as direct discharges from industrial facilities and sewage treatment plants—it can be difficult for the public to gain access to data that reveals the location of factory farms, let alone their impact on local rivers and streams.

States may not be issuing permits to all agricultural facilities that produce enough waste to affect waterways but are not large enough to meet the criteria for classification as a CAFO. Even when facilities are permitted, the public may not have ready access to information about those facilities on their own websites or report data to federal databases designed to track environmental compliance and inform the public.⁴⁵

In conducting research for the online map, it was impossible, short of a formal records request, to obtain consistent data on the location, size or potential impact of specific factory farms in the Delaware River basin. It is imperative that states provide the public with ready access to factory farm permits. States must also ensure that information exists about facilities that do not meet the technical definition of a CAFO but that have an impact on water quality.

Update source water assessments

The federal Safe Drinking Water Act amendments of 1996 required states to conduct assessments of the sources of the drinking water they provide to their customers, identifying potential sources of contamination. The assessments provide local drinking water authorities and state governments with the information they need to conduct effective programs to protect source waters and help to inform the public about the nature of threats facing drinking water.

Source water assessments conducted in the region have identified many of the pollution threats depicted on the Environment America online map as concerns and have helped to shape and direct the efforts of water authorities to improve source water quality. The Philadelphia Water Department's source water assessments for the Schuylkill and Delaware rivers, for example, have informed its strategy for improving the quality of water entering its water treatment system. Throughout the Delaware River basin, states conducted similar assessments following the passage of the 1996 amendments. Since then, however, many of those assessments have fallen out of date, while others have not been made available to the public online.⁴⁶ To ensure that local and state governments are working to identify and deal with threats to the quality of source waters, Delaware River basin states should launch a new round of updated source water assessments and reinvigorate source water protection efforts.

Improve consistency of environmental data across states and at the federal level

States are required under the Clean Water Act to issue water discharge permits, track facilities' compliance with those permits, assess the quality of waterways, and undertake many other functions designed to protect the quality of our waterways. States and the EPA collect data about many of these functions and make them available to the public online. However, environmental data reported by the states is often incomplete, out of date, or communicated in ways that make it difficult for the public to understand and interpret.

Until March 2018, for example, the state of New Jersey did not report discharge data for facilities with discharge permits to the EPA.⁴⁷ As a result, EPA tools that provided the public with access to key information from around the country (such as the Water Pollutant Loading Tool used as the basis of the Industrial Facilities and Sewage Treatment Plant layers of the Environment America online map) excluded information from New Jersey.

Similarly, the Clean Water Act requires states to submit a list of waterways that do not meet their designated uses to the EPA every two years. The EPA has made available geographic information on the location of those waterways that can be integrated into online maps like the Environment America interactive map. However, states in the Delaware River basin have not been regularly updating the geographic information in that database—for two states in the basin, the most recent data submission to the EPA was in the early 2000s.⁴⁸ By failing to update this information regularly, the public may be misinformed about the current status of waterways.

States throughout the basin should endeavor to submit complete, accurate and timely information to the EPA, whose databases and tools provide a rich view of water quality and pollution problems in a given state or region.

Collect and provide data on emerging threats

Over the past decade, new pollution threats have emerged in the Delaware River basin and around the country, including household chemicals, perfluorinated chemicals, pharmaceuticals, microplastics, road salt and plastic waste. Research in the Delaware River basin has identified several of these substances in fish and water samples, but few are the subject of routine monitoring and information on the sources of these substances can be difficult to come by. Delaware River basin states should invest in testing and monitoring for these substances and support research into determining the level of concern we should have and how we should respond.

Invest in Restoration

The federal government has an important role—working with the Delaware River basin states—in supporting efforts to restore the basin to health. Federal and state governments should continue and increase investment in restoration through efforts such as:

Delaware River Basin Restoration Program: In 2016, Congress created the Delaware River Basin Restoration Program, a federal program under the U.S. Fish and Wildlife Service, to coordinate restoration and water protection activities across the basin. Initially unfunded, the program received its first funding with a \$5 million allocation in a federal spending bill approved in March 2018.⁴⁹ The federal government should continue to consistently fund the program, while Delaware River states should make appropriate investments in land conservation (see page 14) and other programs to restore the Delaware River, its tributaries and the surrounding watershed to health.

National Estuary Program: The EPA's National Estuary Program helps to guide and organize restoration efforts in 28 estuaries nationwide. The Partnership for the Delaware Estuary is the local estuary program for the tidal Delaware River and Delaware Bay and is primarily funded by the EPA. The federal government should continue to fund the National Estuary Program, ensuring that comprehensive, science-based efforts to restore the Delaware estuary and other estuaries nationwide continue.

Delaware River Basin Commission: The Delaware River Basin Commission (DRBC) is the regional body responsible for protecting water quality in the basin and governing the allocation of the basin's waters among the states. Federal and state governments have a responsibility to fund the DRBC adequately so that it can fulfill that function and build upon the half-century of continual improvement in water quality.

Ensure the Clean Water Act Remains Strong

From protective designations to pollution limits to funding for preventing sewage overflows, many of the foregoing policy tools and funding programs are rooted in the Clean Water Act. Thus, maintaining the strength of this bedrock environmental law will be crucial to achieving a clean Delaware River basin.

In particular, given the interactive map's vivid demonstration of how waterways are interconnected, it is imperative to maintain strong federal protections for the streams that feed the Delaware River basin and the wetlands that help keep it clean. Groundwater is also connected to the basin's surface waters.

Unfortunately, the U.S. EPA is currently considering measures that would strip Clean Water Act protections from numerous streams and wetlands, and make groundwater protections more difficult to enforce. Moreover, the Trump administration has delayed tougher limits on toxic discharges from power plants and might soon allow the dumping of partially treated sewage into our rivers and streams. All such rollbacks must be rejected if we are to ensure clean water in the Delaware River basin.

Conclusion

The Delaware River and its tributaries are a critical resource for the 8.2 million people who reside in the Delaware River basin, and include natural treasures that are valuable for all Americans. Tremendous progress has been made in recent decades to restore the Delaware River basin to health, yet numerous threats to water quality remain, and new threats continue to emerge.

Environment America's interactive online map of threats to water quality in the Delaware River basin is a unique tool to enable residents, organizations and public officials in the basin to explore threats to waterways in their vicinity and across the region, as well as to understand the connections between pollution from industry, agriculture and urban development and the health of the waterways they treasure.

By providing a new way of seeing water quality threats in the basin, the map also provides an opportunity to educate the public about the need to protect it. A comprehensive approach to restoring the Delaware River and its tributaries that recognizes the cumulative effect of pollution on our waterways can help to ensure that the water quality gains of the last half-century are sustained, and that the region can take the next step in making every waterway in the basin safe for fishing, swimming and healthy populations of wildlife.

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