



# Valuing Clean Water


Ecosystem Service Values in the  
Loyalhanna-Conemaugh and Youghiogheny River  
Watersheds of the Laurel Highlands Region

**Executive Summary**  
October 2019

This study was prepared for Saltlick Township and Mountain Watershed Association in partnership with the Water Committee of the Laurel Highlands Conservation Landscape. It was conducted by KeyLog Economics. The Executive Summary has been condensed. The data used in this document was based on the data available and aspects of this report used data based on predictive modeling. When new data becomes available, addendums will be developed as resources permit.

# The Laurel Highlands

A Pennsylvania outdoor treasure, created by its water resources



Pennsylvania's Laurel Highlands, one of America's most beautiful regions for outdoor recreation, country living, cultural attractions, and economic opportunity, is defined by its natural abundance of water resources.

*Photo by Mountain Watershed Association*

Six thousand miles of streams and rivers that meander through the forests and towns of the Allegheny Mountains provide the foundation for **\$3.7 billion in ecosystem service benefits**. Included within the total ecosystem service benefits are \$897 million in flood/extreme event protection, \$592 million in recreational value, and \$587 million in aesthetic value.

Few regions of the United States can lay claim to such abundant and high-quality natural resources that translate into such economic impact.

This report identifies strategies for leveraging and increasing those benefits, through environmental protection and remediation, natural resource protection and improvement, and land use planning and management. For example, remediation of streams and waterways impacted by abandoned mine discharge can produce an additional \$16.8 million a year in recreational fishing and \$36-\$765 million in increased property values. Other measures aimed at sustaining clean water resources in the region are directly attributable to economic impacts that provide a roadmap for policy-making and capital investments.

## About This Report

Valuing Clean Water, written by Key Log Economics, LLC, examines five resource management and action scenarios focused on water quality and changes to ecosystem service values associated with water resources in the Laurel Highlands and its watersheds. The process of developing these scenarios and results involved concept mapping which helps convey the idea that land management and policy decisions work their way through ecosystem processes and ultimately affect the well-being of people. The results of these actions produce changes in ecosystem services that are estimated in scientific and/or monetary terms.

The five major focus areas identified for ecosystem service valuation in the study area watersheds are:

1. Gains in recreational value from improved water quality and quantity
2. Abandoned Mine Discharge (AMD)
3. Natural gas well pad construction, mining, and resource conservation
4. Agricultural and stormwater runoff
5. Sewage treatment and potable water

# By the Numbers

**1.9**  
Million  
Acres  
over 5 counties

**100 sq. miles**  
of state game lands

**5** national parks

**191**  
natural heritage areas

**9** state parks

**8** important bird areas

**1** world heritage site

**44** million potential visitors

**85% of land** in the Laurel Highlands is farmland or forest

**11** major watersheds

**21** sub-watersheds

**6000 miles** of streams and waterways

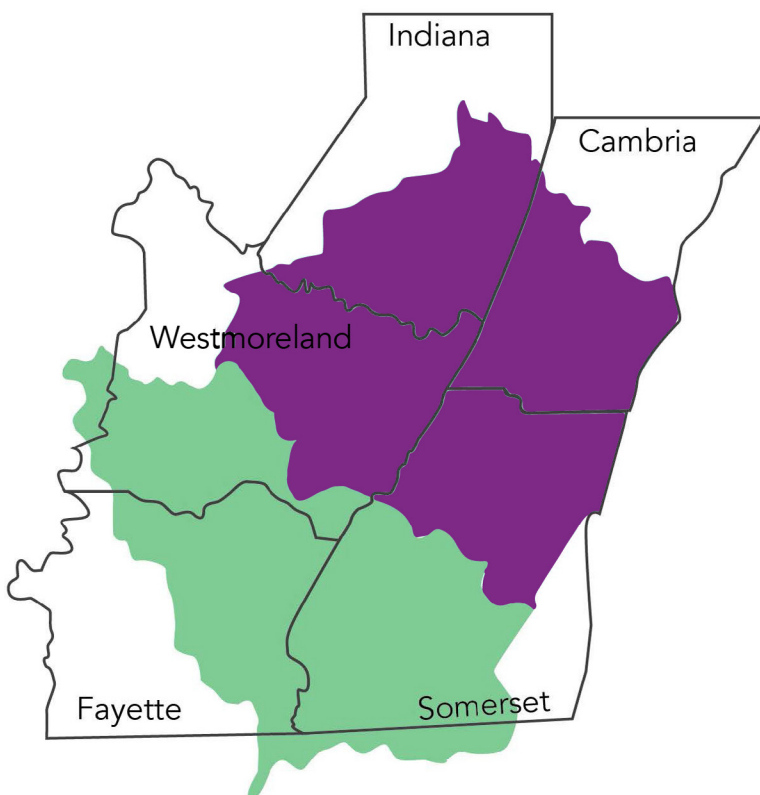
**300 miles** of high quality and exceptional value streams

**100 miles** of Class-A wild trout streams

**14,846 jobs** directly related to recreation and tourism

**\$1.82 billion** in visitor spending (2017)

**\$338.5 million** spent on recreation



Project Study Region

 Loyalhanna-Conemaugh Watersheds  
 Youghiogheny Watersheds



# Ecosystem Service Benefits

This report evaluates the impact of clean water on the Laurel Highlands region on the basis of “ecosystem service benefits,” which are the effects on human well-being resulting from the flow of benefits from ecosystems to people over given extents of space and time. In other words, ecosystem services are about human welfare, not nature for its own sake. A reasonable conclusion from these findings is that clean water is highly valued not only by year-round residents of the Laurel Highlands, but visitors to the region as well. The value they assign to this natural asset can be both measured and predicted and should be considered an important element in conservation and stewardship as well as in safeguarding against potential threats and impacts.

Ecosystem services include clean air, clean water, scenic views, experiences in nature, and fertile soil to grow food.

By incorporating ecosystem service values into funding priorities, policymaking and resource management planning, decision makers get a more complete picture of the cost and benefits of any restoration effort and can make better informed decisions. Examples of ecosystem services are clean air, clean water, scenic views, experiences in nature, and fertile soil to grow food. We receive these benefits for free; our ecosystems are filtering our air and water, absorbing harmful toxins and providing a natural buffer to extreme weather events at no cost to us.

Stressors on the ecosystem, such as development and pollution, can reduce or disrupt the supply of these services. This disruption results in an economic cost to society. For example, when clean water is polluted we pay more in water treatment costs and can suffer from sickness and lost recreational experiences. These losses can be quantified in dollar terms, which helps us understand the benefit of clean water.

Forested land has significant value for services such as recreation and air quality, while wetlands are valued for their natural protection from extreme weather events. Agricultural lands provide food, much of which is reflected as market values because the benefit is directly consumed by people. As shown in the following table, the region has an annual value of more than \$1 billion for food and nutrition, followed by nearly \$900



*Photo by Mountain Watershed Association*

## Baseline Ecosystem Service Values in the Laurel Highlands

The table below lists the various ecosystem benefits available in the Laurel Highlands and their associated annual economic impact as measured in the baseline year of 2017. Each of these benefits is directly impacted by the availability of clean water. Through this analysis, this study has determined that clean water creates approximately \$3.68 billion in economic impact to the region.

ECOSYSTEM SERVICE	BASELINE ESTIMATE (2017 \$/year)
Aesthetic	\$587,090,772
Air Quality	\$374,130,045
Biodiversity	\$6,312,648
Climate regulation	\$90,459,688
Cultural, Other	\$1,356,191
Erosion control	\$3,160,768
Food/Nutrition	\$1,019,106,557
Medicinal	\$6,455,425
Pollination	\$954,120
Protection from extreme events	\$897,295,964
Raw materials	\$2,248,729
Recreation	\$591,935,690
Renewable energy	\$721,578
Soil formation	\$929,132
Waste assimilation	\$11,449,856
Water supply	\$87,125,968
<b>Total</b>	<b>\$3,680,733,131</b>

This analysis illustrates those areas that hold the potential for even greater economic impact. For example, increased protection of wetlands or creation of new wetlands in flood-prone areas would directly impact multiple ecosystem services, effectively adding greater economic benefits.

## Ecosystem Benefits by Regional Watershed (in 2017 dollars)

	TOTAL ACRES	ESTIMATED ECOSYSTEM BENEFITS
Youghiogheny River	905,532	\$1,528,132,302
Loyalhanna Creek	191,240	\$279,532,710
Conemaugh River	898,288	\$1,872,579,055
<b>Total</b>	<b>1,995,060</b>	<b>\$3,680,244,067</b>

# Water-based Recreation

The Laurel Highlands is one of Pennsylvania's most treasured outdoor recreation destinations. The watersheds in the region offer some of the finest whitewater rafting, hiking, fishing, boating, paddling, swimming, and camping in the United States and attract millions of visitors each year.

Not surprisingly, these recreational opportunities have given rise to a number of local businesses in small towns throughout the area and tourism has become a vital economic cornerstone of sustainable development in these communities.

For example, fishing enthusiasts engage in 844,000 recreational fishing days per year on Laurel Highlands waterways. That translates into \$31.7 million in regional spending and an additional \$41.9 million in net economic benefit to anglers. Certainly, these impacts are driven by high-quality water resources, as well as the perception of high quality.

Conversely, water that is unsafe or simply unavailable has a negative impact on recreation and its economic value to the region. Those who use the outdoors for recreation, as well as those who do not, have been found to be willing to pay more for improved water quality. In communities along the Loyalhanna Creek and the Conemaugh River, residents are willing to pay between \$57 and \$82 per household per year over a five-year period for stream improvements. For more heavily-polluted streams, those households would be willing to pay even more, from \$140-180 per year for five years. As a region, water quality improvements across streams currently classified as impaired yield a benefit of at least \$1.1 million for people who participate in water-related recreational activities.

Fishing enthusiasts generate \$31.7 million in regional spending and \$41.9 million in net economic benefit.

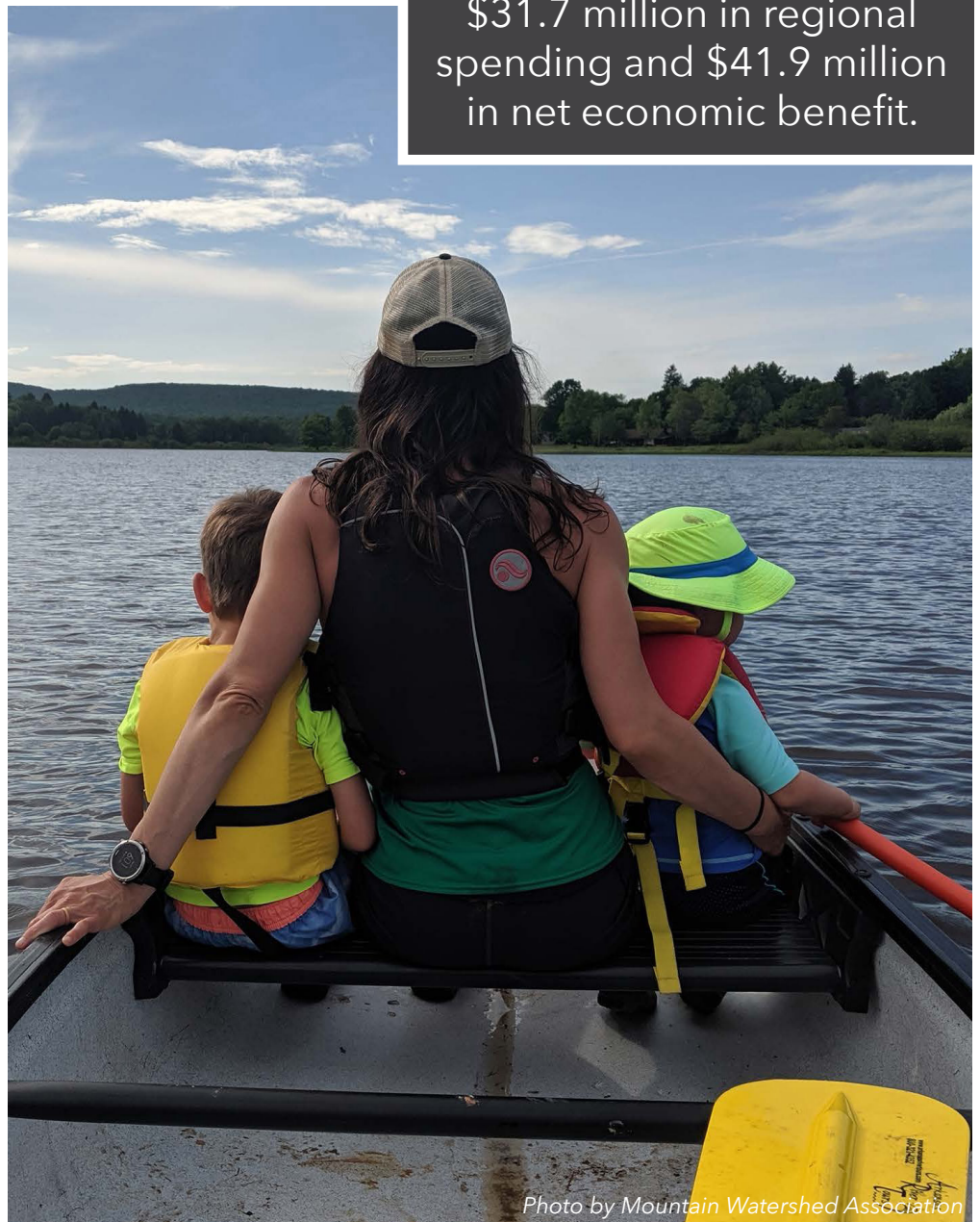


Photo by Mountain Watershed Association

# Abandoned Mine Discharge

Abandoned mine discharge (AMD) represents one of the most pervasive and daunting environmental challenges facing Pennsylvania. There are approximately 912 miles of streams in the Loyalhanna, Conemaugh, and Youghiogheny watersheds that remain impacted by the runoff of heavy metals from abandoned coal mines. These impacts affect property values, recreational opportunities, and a number of other community assets.



*Photo by Mountain Watershed Association*

An aggressive AMD treatment program led by the Pennsylvania Department of Environmental Protection, conservation districts, and nonprofits has had a significant impact on affected watersheds. Water treatment facilities have been constructed and operated under this program since 1970 and water quality improvements have been realized in a number of locations throughout the Commonwealth. In many streams and waterways, fish and wildlife have returned to what were once severely impaired ecosystems.

On average, each passive water treatment system costs \$415,000 and requires an additional \$16,600 per year in maintenance costs. Active treatment systems, on the other hand, can vary widely in their



## Abandoned Mine Discharge, Cont.

capital cost, ranging anywhere from \$50,000 to \$12 million, depending on their complexity and treatment type. These treatment systems are supported by local organizations, which identify and analyze the scope of the problem, provide engineering and construction oversight, and provide maintenance and operational support. Many watersheds require multiple treatment systems to contain AMD impacts.

The return on these investments is significant. Continued AMD remediation captures economic benefits otherwise lost to stream impairment, enabling wildlife and fisheries to return along with the associated recreational opportunities they attract. The study found that AMD remediation measures in the Laurel Highlands could bring an additional \$16.8 million in recreational fishing and raise property values by 5-13% for households within a quarter-mile of an impacted stream. This translates into a one-time economic benefit of \$41,133 for each mile of restored stream and an annual benefit of \$19,131 per restored stream mile.

Willingness-to-pay (WTP) studies for AMD remediation and water quality improvements in several mid-Atlantic watersheds have provided a predictive model on how much value residents or communities place on remediation efforts. These values range from \$30-\$157 per household per year and reflect WTP values for AMD remediation and general water quality improvements. The amount a household is willing to pay for these water quality improvements illustrates the perceived benefit people derive from the environmental change without any money being exchanged, also known as consumer surplus.

Residents of the Laurel Highlands both recognize and value the importance of AMD remediation and surveys reveal that these residents are willing to participate in such investments, translating into a return of \$20-32 per household. Applied against the 257,000 households in the region, resident-supported AMD stream restoration could amount to an additional \$5.67 million in ecosystem service value.

AMD remediation translates into an annual benefit of \$19,131 per restored stream mile.



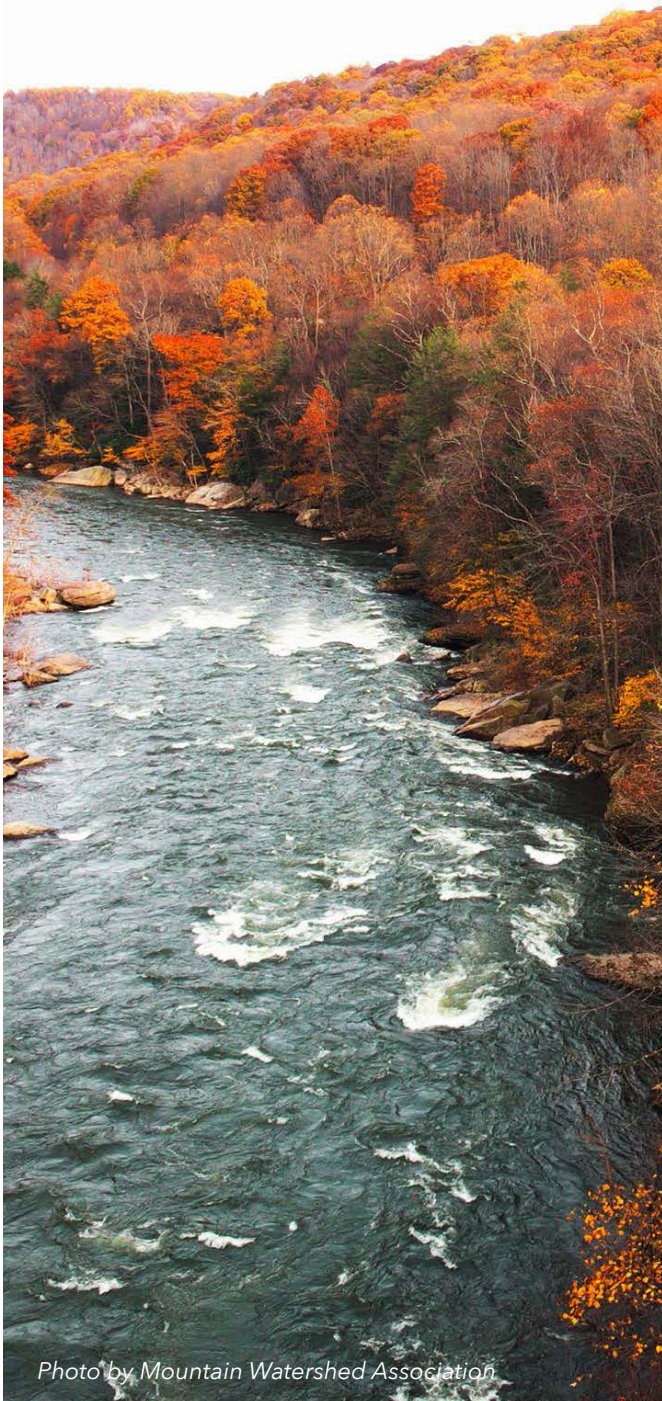
# Natural Gas Development

Throughout the Appalachian Basin, vast natural gas reserves have been under development for over a decade. In the Laurel Highlands, unconventional gas development is as commonplace as in most other Western Pennsylvania communities. Hydraulic fracturing, or “fracking,” a process that releases gas trapped in deep shale formations, can pose an environmental hazard to groundwater due to the risk of the proprietary fluids used in extracting the gas from tight underground formations.

During that same period, the Pennsylvania Department of Environmental Protection has established a regulatory framework to control natural gas exploration and development and has enacted some of the most stringent environmental safeguards for fracking anywhere in the United States. Additionally, the industry and environmental community have worked together to develop standards of stewardship that have become models for the rest of the industry to achieve.

At the time of this report, there is significant instability in the fossil fuel markets, including oil, coal, and natural gas. However, the most current forecasting models project an increase in natural gas development in the Appalachian Basin over the coming decade. The rate of projected development would result in nearly 1,500 new well pads in the Loyahanna, Conemaugh, and Youghiogheny watersheds, and potentially the loss of 30,000 acres of forest and agricultural lands. Almost half of these lands are found in state parks, state game lands, and fisheries and are located within a half-mile of exceptional- or high-value waters. As such, they are considered important for their ecosystem value, primarily as wildlife habitats and recreational areas.

If these projections hold true, the loss of these forest and agricultural lands would translate into a degraded habitat for native species and an impact on water resources. Ecosystem service losses from a natural gas development scenario could total anywhere from \$23.3 to \$57.4 million by 2030.



*Photo by Mountain Watershed Association*

# Controlling Runoff

Stormwater runoff, especially from impervious surfaces like roads, roofs, paved driveways, and parking lots, is a major challenge in maintaining high-quality streams and waterways. Soil and sediment, along with agricultural chemicals and waste, flow uncontrolled during periods of wet weather, upsetting the natural balance of a watershed ecosystem and degrading the quality of the stream.

Natural buffers reduce sedimentation and improve water clarity, which can have a positive benefit on aesthetics, recreation, and the overall quality of a waterway. Vegetation along a stream holds the soil in place and reduces the amount of sediment entering a stream as well as the property lost due to erosion.

More than 650 miles of streams in the Laurel Highlands region are impaired by excessive siltation, largely due to stormwater runoff from agricultural land, residential areas, roads, and other developed properties. In the table below, a riparian buffer converts nearly 1,500 acres of agricultural land to forests within 100 feet of 176 impaired stream miles. This scenario provides an annual net ecosystem service benefit of \$2.9 million.

State and federal programs provide assistance to agricultural property owners to assist in mitigating and minimizing runoff into streams and waterways. Best management practices advocated by state agencies further assist in soil conservation and pollution prevention. Stormwater management practices are helping property owners address streambank erosion and its associated siltation impacts, particularly on largely uncultivated agricultural lands.

## Summary of Ecosystem Service Benefits and Establishment, Opportunity Costs for Forested Buffers

<b>Increased Riparian Forest Buffer: Annual Benefits and Costs</b>	
<b>Ecosystem Service</b>	<b>Estimated Annual Benefit/Cost</b>
Benefit: Nutrient Retention	\$1,262,424
Benefit: Recreation	\$86,619
Benefit: Carbon Storage	\$2,210,467
Opportunity Cost: Forgone Agricultural Production	\$650,998
<b>Annual Net Benefit</b>	<b>\$2,908,512</b>

<b>Increased Riparian Forest Buffer: One-Time Benefits and Costs</b>	
<b>Ecosystem Service</b>	<b>Estimated Annual Benefit/Cost</b>
Benefit: Aesthetics	\$4,650,531
Establishment Cost	\$2,545,475
<b>One-Time Net Benefit</b>	<b>\$2,105,056</b>

# Sewage Management

Throughout much of Pennsylvania, aging sewer and septic systems can pose a threat to natural streams and waterways. Overall, about one in five residential sewage systems in Pennsylvania are failing, and the rate of failure is even higher in rural communities. Throughout Pennsylvania, crumbling infrastructure in many cases no longer provides the level of containment it once afforded. In the Laurel Highlands region, 124,000 homes use a private septic system and 27,000 homes rely on “wildcat” sewers that unlawfully discharge household sewage directly into streets, gullies, and streams.

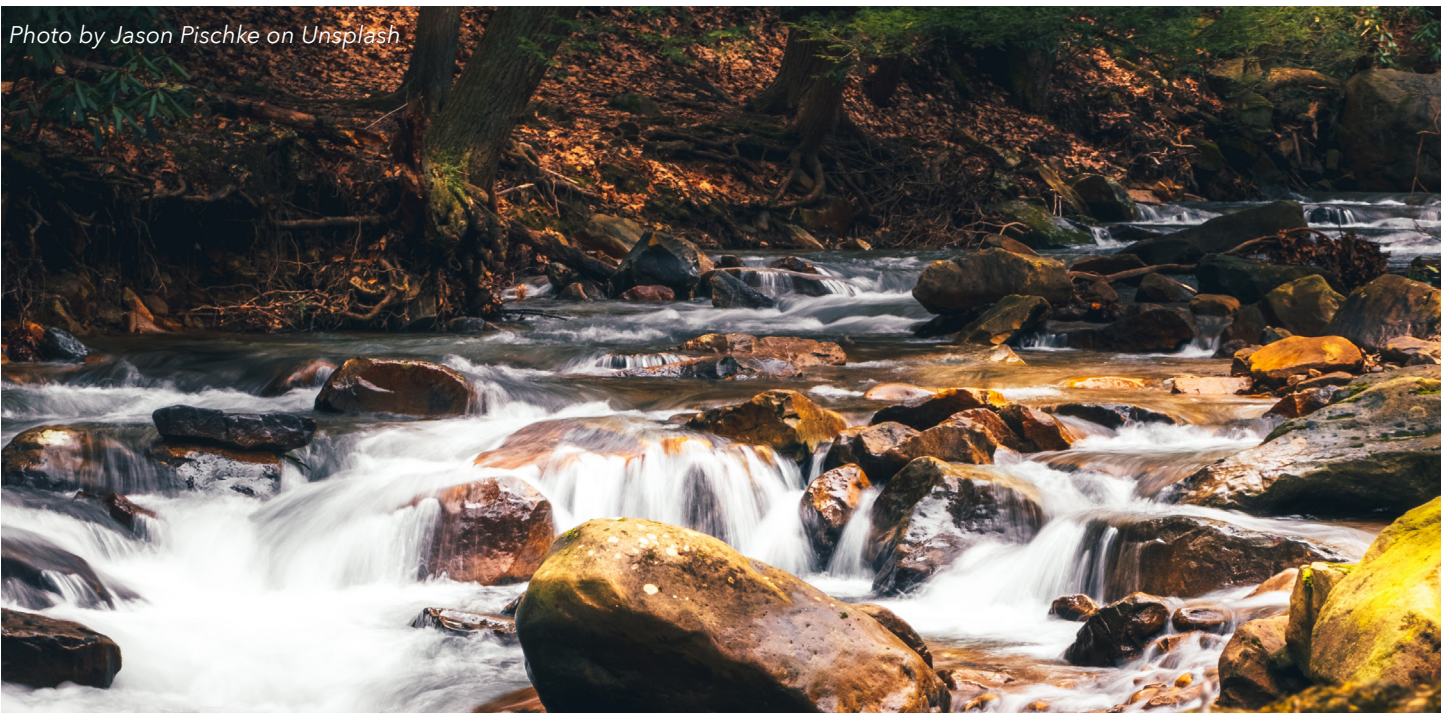
The problem is made more complex by periods of wet weather, when precipitation overwhelms these antiquated sewer systems and causes them to overflow. Many municipalities have multiple water and sanitary authorities, and each authority has its own operations and financial models, making regional collaboration challenging.

The impacts of this problem are obvious, as is the pressing need to address it. Sewage management caused by aging, inadequate, or nonexistent infrastructure is a costly problem that will take decades to correct, but those impacts are significant today.

Antiquated public sewage treatment facilities and septic systems are failing, Raw sewage pollutes our streams throughout rural communities like the Laurel Highlands; it is a public health concern for people who fish, swim, and boat in the streams.

Cities and large metropolitan areas in Pennsylvania are working with state and federal environmental agencies to develop sewer infrastructure plans aimed at addressing the challenge of sewage management. Smaller and rural communities, however, often lack the necessary resources to address the problem and will require different solution sets that are effective, yet affordable.

*Photo by Jason Pischke on Unsplash*



# Recommendations

The results of this study provide an economic case for productive initiatives that communities, agencies, and individuals can pursue. These initiatives include funding for continued, more extensive, and more effective watershed protection measures such as AMD remediation, expanded riparian buffers, and measures to mitigate the impacts of fossil fuel development.

Additionally, organizations, local governments, and state agencies can continue their research, collecting new information to inform the next round of strategies and actions to protect habitats and improve water quality in the Laurel Highlands watershed.

The following are cost-effective actions supported by the findings of this study regarding the economic value of clean water and related ecosystem service benefits in the region:

- **Prioritize funding for maintenance of existing AMD treatment systems**

Restored streams result in significant ecosystem service benefits, and the costs for passive treatment systems should be considered in the context of those benefits. Similarly, those areas with greater population density and higher-quality fisheries will realize greater property value and recreational benefits. This translates into a one-time economic benefit of \$41,133 for each mile of restored stream, and an annual benefit of \$19,131 per restored stream mile.

- **Consider ecosystem service values in resource extraction permitting process**

Require an ecosystem services impact assessment as part of the natural gas well permitting process as well as in coal and gravel mining operations, since not all coal is used in energy production. Forecast water demand to 2030 to determine the region's capacity for additional unconventional gas development, coal and limestone mining, etc.

- **Focus on water quality/quantity when promoting outdoor recreation**

Take steps to improve degraded water quality and quantity that is threatening the resilience of regional watersheds and ensure the continued stewardship of existing high-quality water resources.

- **Require cost-benefit analyses for riparian buffer projects**

Incentivize forested riparian buffers along all streams that offer the potential for the greatest return on ecosystem service values. Explore a "payment for ecosystem service benefits" model between upstream landowners and downstream municipalities. State and federal grants are currently available for such programs, which help to offset the costs of riparian buffers for landowners supporting region-wide water quality improvements.

- **Foster regional collaboration on sewage data and water quality monitoring**

Research is needed to provide additional data on the number, location, and failure rates of on-lot septic systems in the region as well as the absence of any treatment system.

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Somerset Conservation District

Trout Unlimited, Chestnut Ridge Chapter

Trout Unlimited, Forbes Trail Chapter

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