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framing paper

ENVIRONMENT POLICY COMMITTEE

Regional Water Management in Southwestern Pennsylvania: Moving Toward a Solution

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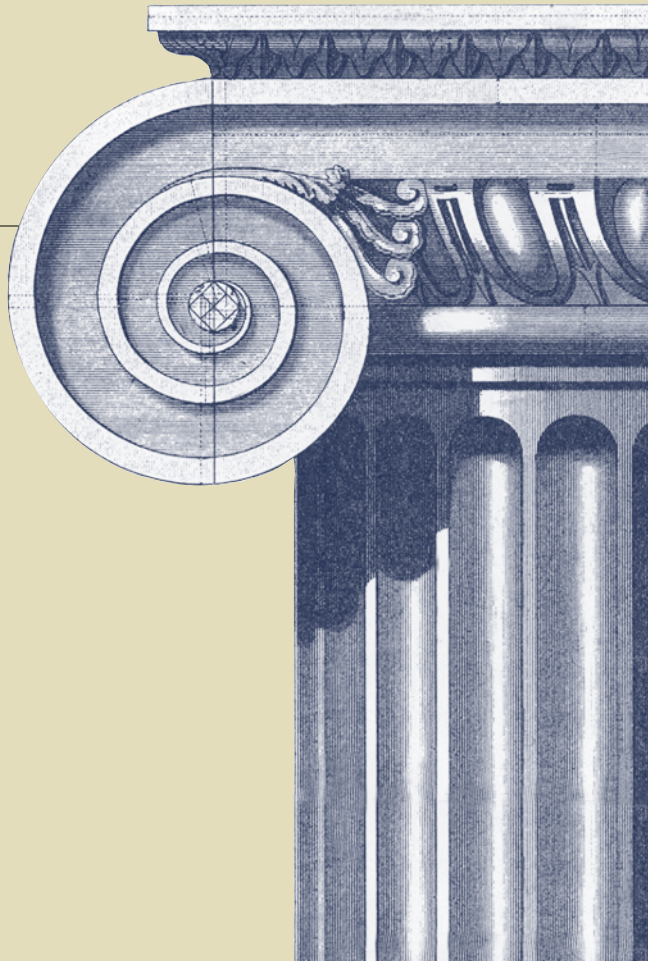

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Task Force

Introduction: It's Everybody's Problem

On January 2, 1988, the collapse of an Ashland Oil storage tank caused more than half a million gallons of diesel fuel to enter the Monongahela River upstream from the city of Pittsburgh. In the ensuing days, public officials, water authorities, and emergency personnel scrambled to respond to a serious health crisis that endangered the quality of drinking water in the faucets of more than 100,000 homes.

The response to the crisis was greatly hampered by a lack of clarity as to what action each of the agencies involved—including local water authorities, the Allegheny County Health Department, and the U.S. Army Corps of Engineers—had the authority to take. Even worse, no one had complete knowledge of the interconnections among dozens of potentially affected water systems, and no one could tell for sure whose water was contaminated and whose was not.

After the crisis passed, Allegheny County and the Army Corps of Engineers agreed to develop a comprehensive mapping of existing water systems, but they frequently encountered difficulty in obtaining information from the county's 34 separate water authorities. Eighteen years later, the mapping has never been completed.

Serious, Well-Documented Challenges

Emergencies like the Ashland Oil spill or the Hurricane Ivan floods of 2004 remind us that Southwestern Pennsylvania's water management and flood control systems are not just fine. Between 1955 and 2000—which means the exclusion of Hurricane Ivan—Pennsylvania's median yearly flood damage was about $9.5 million and its total flood damage was $4.4 billion. Much of that damage has been concentrated in Southwestern Pennsylvania, which has received seven presidential disaster declarations due to flooding since 1984.

Our water and sewage systems aren't adequate on relatively normal days either. Each year Southwestern Pennsylvania's sewer system releases enough raw sewage into our groundwater to fill Heinz Field about 100 times, due to the inadequacy of our sewage treatment infrastructure. Between May 15 and September 30 of each year, the Allegheny County Health Department issues warnings when contact with the rivers may be dangerous due to the amount of sewage in the water. In 2004, such warnings were in force 80 percent of the time during this peak recreational period.

Dilapidated pipes leak and water mains burst—sometimes spectacularly, as in the 2005 flooding of downtown Pittsburgh's Gateway Center area. Limited water and sewage treatment capacities constrain development—hindering the region's economic growth—and present a public health risk. Sixty-four sewer systems in Southwestern Pennsylvania currently have tap-in restrictions that limit new development.

In rural areas, failing septic systems or seepage from chemicals used in agricultural production can affect water sources. In the 11-county region, approximately 27 percent of 1.1 million homes use on-site septic systems. An estimated 25,000 homes still discharge sewage directly into streams. Our water bills are unnecessarily inflated by obsolete combined sewer systems that overload sewage treatment plants with stormwater and by decaying systems that fail to track water usage accurately.

The many problems facing Southwestern Pennsylvania's water, sewage, and flood control systems have been amply documented in a long series of studies and reports. In December 1999, the Southwestern Pennsylvania Commission held a day long conference to highlight sewage-related problems and solutions. Since then, reports by 3 Rivers Wet Weather (2002), the Pennsylvania Economy League of Southwestern Pennsylvania's Water and Sewer Infrastructure Project (2002), the National Research Council

(2005), and the H. John Heinz III School of Public Policy and Management at Carnegie Mellon University (2005) have all urged greater regional cooperation in water management. This framing paper incorporates and builds upon these existing reports.

The call for regional cooperation is particularly compelling in this case because water policy issues are unavoidably regional. Southwestern Pennsylvania's reliable and abundant water resources are a vital regional asset supporting our economic growth and development, an integral part of our historical identity, and a central component of our environmental culture. They are truly a shared asset. Each municipality can decide to fund and operate its own parks, but not its own streams. Water sources and supply systems flow uncontrollably across municipal boundaries. Unhealthy and unwise practices upstream affect communities downstream. Gravity, geography, and the staggering cost of needed infrastructure improvements—perhaps greatly exceeding $10 billion for the region—make it inconceivable that 800 entities working independently can solve our problems efficiently and effectively.

Yes, there really are more than 800 separate entities involved in water management across Southwestern Pennsylvania's 11 counties. This incredible level of fragmentation means that, even if agreement is reached on the need to integrate these entities' roles and responsibilities, actually achieving improved coordination remains a daunting logistical challenge.

Mission: Coordinated Regional Solutions

We have divided the regional water management challenges into three main components and have asked experts on environmental issues to write succinct, well-documented summaries on each component. Joan Blaustein, affiliated until very recently with 3 Rivers Wet Weather, Inc., presents an overview of sewage and stormwater issues. Conrad Daniel Volz, of the University of Pittsburgh Graduate School of Public Health, covers in eye-opening detail the extent of the region's water quality problems and identifies a "dirty dozen" factors contributing to them. David R. French, of L. Robert Kimball & Associates, explains why the region's flooding problems are getting worse and discusses the surprisingly wide range of resulting negative consequences.

Of course, these three facets of our water problems—sewage and stormwater management, water quality, and flooding—overlap. For example, flooding makes sewage treatment more difficult, and sewage overflows contribute to unacceptable water quality. But the division into components enables us to present three complementary perspectives and should help readers understand the situation better than if all the problems were commingled in a single chapter.

The regional leaders guiding this effort recognize that many factors besides organizational fragmentation affect our water resources. Acid mine drainage, land use practices, environmental controls placed on industrial and agricultural activity, and many other factors have an impact. Moreover, water pollution is interconnected with all other forms of pollution. Therefore, water issues must be addressed in conjunction with other environmental problems such as acid rain. But all these issues can be addressed more effectively if, along with a regional consensus that solutions must be found, we have a regional mechanism by which to attack them.

The paper closes by presenting policy options that could help Southwestern Pennsylvania move beyond simply acknowledging its water management problems and toward greater coordination and regional solutions to the benefit of all citizens. In order to efficiently and effectively confront our challenges, we believe a fundamental restructuring of the region's organization may be necessary to address water problems. Our hope is that this framing paper will serve as a catalyst for a new regional dialogue on water management.

By reading this paper and offering your carefully considered responses, you become part of the solution. We value your engagement in these issues and welcome your insights toward a regional solution.

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Sewage and Stormwater Issues

by Joan S. Blaustein

Overview: A Washed-out System

Until the second half of the 20th century, sewage was not treated in Southwestern Pennsylvania; it was simply disposed of. Since the late 1950s, the development of sewage treatment plants throughout the region has alleviated pollution in the Ohio, Allegheny, and Monongahela Rivers from the municipal sewers that previously discharged directly into local waterways. However, the conveyance system of pipes and manholes that carries waste and stormwater to the treatment plants is more than 100 years old in many locations. Because of the deterioration of that conveyance system, the region faces significant water resource management challenges today. Stormwater runoff and outdated sewage and water treatment systems pollute the region's groundwater, rivers, and streams so heavily that much of the water supply is in violation of federal Environmental Protection Agency (EPA) water quality standards. Furthermore, chronic flooding continues to result in heavy human, environmental, and economic costs to the region.

The sewer and stormwater infrastructure problems in the Pittsburgh region relate to both water quality and quantity, and are primarily a "wet weather" issue. As little as one-tenth of an inch of rain—which is the average daily precipitation in Pittsburgh's rainy climate—can cause raw sewage to overflow into our rivers and streams. During wet weather—rain or snow melt—too much additional water gets into the sewage collection system through deteriorated pipes and stormwater connections from homes. This additional water exceeds the amount that the pipes in the sewage system can carry to the treatment plant; as a result, raw sewage overflows into the rivers and streams. Annually, these overflows affect Pittsburgh's rivers for as many as 75 days during the boating season, making the water quality unacceptable for recreational contact. In addition, these overflows cause environmental and health risks for our families, including basement backups and contamination of the region's rivers, which provide a significant amount of our drinking water. Inadequate management of stormwater runoff also harms the receiving streams by changing their natural hydrologic patterns, accelerating stream flows, destroying aquatic habitats, and elevating pollutant concentrations. Groundwater resources are impacted through a decrease in the natural infiltration of stormwater.

Each year Southwestern Pennsylvania's sewer system releases enough raw sewage into our groundwater to fill Heinz Field about 100 times.

The problems we now face are the result of both engineering and political decisions, and the legacy of those decisions continues to hamper progress. There are technical solutions to the wet-weather overflow problem, which will come at a significant cost. In order to make those solutions cost effective and sustainable, they must be determined on a regional basis—considering drainage areas rather than jurisdictional boundaries, and with a significant change in the now fragmented operation and management of the region's sewage and stormwater systems.

How the System Works—or Doesn't Work

Wastewater—both storm and sanitary—is collected, conveyed, and disposed of by an interconnected series of surfaces, pipes, and structures. Source ***collection*** is generally on private property—individual plumbing facilities within a building that flow into a single pipe (house or building lateral), as well as all impervious surfaces on the lot that channel water into a pipe or other structure which will move it away from the source. In Southwestern Pennsylvania, approximately 896,000 homes have household lateral pipes. When these pipes crack, groundwater leaks in, causing excess water to enter the system. Laterals account for as much as 50 to 60 percent of the unwanted water in sewer systems. Because laterals are on private property, monitoring and regulating them is difficult.

Conveyance systems are publicly owned—sewer mains within streets and rights-of-way that individual laterals tap into, as well as storm catch basins. There are two types of conveyance systems: combined sewer systems and sanitary sewer systems.

A **combined sewer system** carries both wastewater and stormwater through a single pipe. When these systems were constructed in the 19th and 20th centuries, the pipes discharged directly to the rivers and streams. Once wastewater treatment began, those systems were connected to a larger interceptor system that took the waste to the treatment plant. However, inherent in the design are diversion structures that release mixed rainwater and sewage to surface waters when flows exceed the capacity of the sewer collection or wastewater treatment system. The diversion of high flows prevents sewage from backing up in the collection system (and thereby flooding basements or streets) and averts damage to the wastewater treatment plant from flows that exceed design capacity. These releases, known as combined sewer overflows (CSOs), have a clear negative impact on water quality but may be permitted in specific locations where the cost to eliminate them would be great. Pennsylvania has the highest number of permitted CSO structures of any state, and nearly half of these (755 of 1,671, as of the year 2001) are in the state's southwestern region. In fact, more than one out of every 13 CSOs in the nation can be found in Southwestern Pennsylvania.

As little as one-tenth of an inch of rain—which is the average daily precipitation in Pittsburgh's rainy climate—can cause raw sewage to overflow into our rivers and streams.

As this conveyance system has aged, the occurrence of CSOs has increased, due to the infiltration of additional surface runoff and groundwater that enter the system through deteriorated pipes and manholes.

A **sanitary sewer system** carries only sanitary waste from domestic, industrial, and commercial establishments to a treatment plant. Stormwater is managed separately by storm sewers, surface channels, or simply by runoff into neighboring streams. Sanitary sewer systems can overflow for several reasons, including blockages, wet-weather infiltration and inflow, power and mechanical failures, pipe cracks, and line breaks. Sanitary sewer system overflows (SSOs) are illegal under the federal Clean Water Act. Sanitary sewer systems are not engineered to handle an increase in volume due to precipitation (rain or snow melt); frequently they have no designated overflow points. While some separate sewer systems include overflow structures (because they were built before these structures became illegal), many systems do not; when excessive flows cannot be handled, these systems back up in basements, at manholes, or underground. These SSOs are difficult to repair because they are often found at points of weakness throughout the system, not at designated overflow structures like CSOs. More than 600 SSOs occur each year in Southwestern Pennsylvania, resulting in overflows of raw sanitary sewage.

Disposal and/or treatment methods include a range of systems—from centralized wastewater treatment plants that treat millions of gallons per day, to on-site sewage treatment and disposal systems at individual homes (septic tanks), to direct discharge into waterways without treatment. Of the households in Southwestern Pennsylvania reported in the 1990 U.S. Census:

- 76 percent were on public sewers connected to wastewater treatment plants;
- 23 percent were utilizing some sort of on-lot septic system; and
- 1 percent reported neither sewers nor on-lot disposal. These homes may use cesspools or straight pipes that discharge directly to surface water or groundwater; they may be served by older substandard or unknown treatment systems that predate permitting programs; or they may simply represent the residents' lack of knowledge about their treatment system.

We have already noted that many public sewer systems have inadequate or antiquated treatment facilities. Individual on-site sewage treatment and disposal systems, the usual alternative to wastewater treatment plants in sparsely populated areas where the costs of constructing centralized treatment systems are prohibitive, have frequent problems as well. If properly sited and functioning, these systems can receive, treat, and dispose of wastes in a manner that is comparable to wastewater treatment in a central facility. However, contamination of groundwater by failing or substandard septic systems is a considerable risk in much of Pennsylvania because of the commonwealth's geology, soils, land development patterns, and large numbers of aging or unknown treatment systems. Estimates suggest that there are approximately 26,000 failing septic tanks in the Southwestern Pennsylvania region.

Finally, some areas of Southwestern Pennsylvania have no wastewater treatment facility at all. Instead, "wildcat" systems discharge untreated or partially treated wastewater directly into storm sewers, nearby streams, and groundwater. Although the exact number is uncertain, it is estimated that in Southwestern Pennsylvania up to 27,000 households may use wildcat sewer systems.

Impacts

As home to one of the most reliable watersheds in the United States, Southwestern Pennsylvania has historically leveraged its abundant water supply for a competitive economic advantage. However, outdated sewage and water treatment systems, agricultural runoff, acid mine drainage, and industrial pollution residues currently pollute the region's ground water, rivers, and streams so heavily that much of the water supply is in violation of federal EPA water quality standards. Without significant investment in water resource management, the region's natural competitive advantage will be squandered.

Sewage overflows are directly restraining economic growth in many locations. As of April 2002, approximately 64 sewer systems in Southwestern Pennsylvania had tap-in restrictions limiting the number of new residential or commercial units that could access the municipal sewer system. These restrictions have stifled both residential and business growth in many communities. Development is also constrained by the lack of sewer and water infrastructure in areas that are not suitable for conventional on-lot septic systems.

Wastewater treatment problems also adversely affect the region's quality of life and its tourism industry by making many of its rivers and streams frequently unfit for use. Sewer system overflows result in the issuance of public health warnings to recreational users of Southwestern Pennsylvania's waterways for much of the boating season—up to 75 days in a single year.

The devastating floods of September 2004 illustrated another serious negative aspect of the region's overflow problems. Floods are not simply "natural" disasters—they are, in part, a result of our water management and land use decisions. For instance, as the region builds upon and paves over more land area, the chances of flooding increase. Under current conditions, the region's combined sewer systems lack the necessary capacity to carry and treat

wastewater and rainwater during wet weather. Improving the capacity of sewer systems and repairing the infrastructure can make flooding less severe by reducing overflows from seasonal rains and melting snow. Furthermore, these improvements will also reduce the amount of sewage in the water in times of flooding.

The sizable cost of addressing the region's CSO and SSO problems, estimated at multiple billions of dollars, has discouraged progress toward solutions. But this is not an investment that we can choose not to make. The costs to the regional economy will only increase further as we wait to act.

Management and Operation

Southwestern Pennsylvania's watershed, the Ohio River Basin, and its network of water and wastewater infrastructures surpass political and economic boundaries. Wastewater pollution that occurs in one municipality or county crosses freely into another via waterways with no regard for political

The management of water quality and quantity in Southwestern Pennsylvania spans community and political boundaries.

boundaries. Thus the lack of an adequate and comprehensive water resource management system affects the whole region. In contrast to the shared nature of the problem, provision of wastewater and stormwater treatment services in the region is highly fragmented, making a coordinated approach to water resource management difficult. More than 800 different governmental and private entities own parts of Southwestern Pennsylvania's water and sewer infrastructure. Furthermore, localities face wide-ranging water resource management issues depending on the predominant type of sewage treatment system, topography, industries present, and inspection norms in their area.

Even in highly populated Allegheny County, ownership and management of wastewater collection and treatment facilities is extremely fragmented. The Allegheny County Sanitary Authority (ALCOSAN) owns and operates 90 miles of major interceptors and a wastewater treatment plant that provides primary and secondary treatment of up to 225 million gallons per day. Eighty-three communities are within the ALCOSAN service area, and a total of 12 different sewer authorities serve many of these communities. Although these "partner communities" send their sewage eventually to ALCOSAN's central wastewater treatment plant, they also own and operate their own sewage collection infrastructure in the form of street sewer pipes and smaller interceptors.

Allegheny County's current water pollution problems, especially those resulting from combined sewer overflows (CSOs), are the result of a long series of decisions related to wastewater collection and disposal, dating back more than a century. These key decisions have included constructing a combined rather than a separate sewer system; using the rivers for sewage disposal, based on the presumption that running water purified itself or provided adequate dilution to disperse the sewage; resisting commonwealth orders to treat urban sewage or to change the design of the City of Pittsburgh's sewerage system; and, subsequent to World War II, creating an authority with a centralized wastewater treatment plant (ALCOSAN) but still allowing communities to own and maintain their own sewer systems.

The political relationships among ALCOSAN, the City of Pittsburgh, and Allegheny County municipalities protective of their independence have created institutional challenges just as imposing as the technical challenges. Nevertheless, recent years have seen significant progress. The 3 Rivers Wet Weather Demonstration Program (3RWWDP) was created in 1998 to improve the quality of Allegheny County's water resources by helping communities find long-term, cost-effective, sustainable solutions to water problems. Beginning in 2002, 3RWWDP acted as facilitator in the development of consensus among the 83 ALCOSAN municipalities, the EPA, the Allegheny County Health Department, and the Pennsylvania Department of Environmental Protection (DEP) on administrative consent orders to eliminate or reduce sewer overflows in these communities. As a result, all 83 municipalities have agreed to a uniform consent order that will allow them to assess their systems and gather critical data needed to achieve viable, long-lasting solutions.

This process can be replicated in other areas of Southwestern Pennsylvania. It requires a commitment to intense, long-term participation, but the results will bear fruit as sustainable solutions are developed and embraced. The ALCOSAN approach has yielded significant commonwealth and federal financial support; efficient investment of limited resources; a free flow of knowledge, technical skills and information across municipal boundaries; and more equitable solutions. A more regional approach, then, can provide and is providing concrete and valuable improvements in the involved systems.

Conclusions

Sewage and stormwater management in Pennsylvania are regulated on the municipal and county level, yet the natural organizing factor for all water-related issues is by watersheds and sewersheds. The provision of wastewater conveyance and treatment is a utility just like gas and electric service, but our water and sewer systems are managed in many cases by non-professionals whose operating decisions are affected by political concerns as well as by system requirements. The systems require regular inspection, repair, and updating, but no consistent revenue stream has been established to support these costs. To manage its water resources appropriately, Southwestern Pennsylvania must overcome these disturbing paradoxes.

While sewer infrastructure management has received—deservedly—the greatest attention, the importance of stormwater management as a regional issue cannot be ignored. It is a primary factor in combined sewer overflows, impacts water quality to a significant degree through urban runoff, and results in increased flooding.

The management of water quality and quantity in Southwestern Pennsylvania spans community and political boundaries. By its nature, water management is closely related to other regionally managed mechanisms such as transportation and land use planning; each affects the way the region develops. Thus, investments in water resources should not be made in isolation, but rather in a coordinated manner with transportation and land-use decisions. Until we view water resources as a regional asset to be protected, conserved, and managed, we will continue to squander this critical element of our prosperity.

Joan S. Blaustein is currently director of the Environment, Stewardship, and Education Division of Fairmount Park, the park system of Philadelphia. She previously served as project manager for 3 Rivers Wet Weather and as special projects manager for Pittsburgh's Department of City Planning.

The contents of this chapter are based on the following studies:

Recommendations for Coordinating Regional Water Resource Management, Carnegie Mellon University H. John Heinz III School of Public Policy and Management, 2005

Regional Cooperation for Water Quality Improvement in Southwestern Pennsylvania, Committee on Water Quality Improvement for the Pittsburgh Region, Water, Science and Technology Board, National Research Council of the National Academies, 2005

Investing in Clean Water: A Report by the Southwestern Pennsylvania Water and Sewer Infrastructure Project Steering Committee, 2002

Water Quality Problems in Southwestern Pennsylvania

by Conrad Daniel Volz

Water quality is crucial to the quality of life in and the economic revitalization of Southwestern Pennsylvania. Not only do we need safe water for daily consumption and a host of human activities, but water is also an essential support for industry, agriculture, recreation, and tourism. Imagine what would happen to Ohiopyle State Park, arguably our region's greatest single natural asset, if the falls dried up or the Youghiogheny River's water quality was deemed unsafe for whitewater rafting.

Many of our regional decisions directly affect or are affected by water quality issues:

- In many parts of Southwestern Pennsylvania, land development is constrained by the lack of ample water purification and distribution systems, or by failing or undersized wastewater treatment plants.
- Avoidance of investment in sewage systems has led to a proliferation of individual septic systems and a hodgepodge of development activities that have, in some cases, further degraded water quality.
- Removal of forested areas for development not only can increase the likelihood of flooding due to stormwater runoff, but can also pose a risk to water quality by diminishing the environment's ability to purify groundwater naturally.
- Pumping of groundwater through private wells can cause surface water levels to fall, affecting the quality and quantity of water available at other locations.
- Pollutants like pesticides and heavy metals can move from surface water into groundwater, posing a health risk for users of municipal groundwater distribution systems or private wells.

In view of the great importance of water quality to Southwestern Pennsylvania, regional decision makers should have a strong general awareness of our wide range of water problems and what we can do about them. This chapter provides an overview of our region's water quality status and identifies the major threats to our water.

Not All Bad News

First, some good news: there is growing proof that the water quality of the Allegheny, Monongahela, and Ohio Rivers is improving (National Research Council, 2005). The three main reasons for this improvement are (1) a decrease in industrial discharges (partly due to manufacturing plant closings), (2) a changing federal regulatory climate that has encouraged construction of more efficient municipal wastewater treatment plants and better industrial pollution controls, and (3) federal and commonwealth initiatives to control mine drainage.

The diversity and abundance of aquatic life is one of the surest signs of improved water quality. Studies by the Pennsylvania Fish and Boat Commission and the U.S. Geological Survey show an increase in the number of fish species in all our rivers. In 1900 the Monongahela River was almost devoid of fish, except during high-water periods; in 2005, recreational anglers at Point State Park caught 20 different species of fish, and one of the most prominent professional fishing competitions, the Bassmasters Classic, came to downtown Pittsburgh and was nationally televised.

Now, the Ugly Side

Overall, however, water quality in Southwestern Pennsylvania still ranges from extremely good to severely polluted. On the bad side, some streams in both the Allegheny and Monongahela watersheds remain so seriously compromised by mine drainage that they cannot support aquatic life (National Research Council, 2005). Oil refineries in Venango and Butler Counties impact the Allegheny River's water quality. The Monongahela, identified in 1970 as one of the nation's 10 most polluted bodies of water, starts out being polluted by mine drainage from tributaries in West Virginia and gets worse as it flows north to Pittsburgh, affected by releases from industrial production and by municipal wastewater. Data gaps make planning for and monitoring water quality improvements difficult, but we know that sediments in riverbeds can trap pollutants and hold them for long periods of time. These toxins can be churned up in high-water conditions, burdening water treatment systems and forcing other industries to carry out expensive cleansing of intake waters before using them.

Some streams in both the Allegheny and Monongahela watersheds remain so seriously compromised by mine drainage that they cannot support aquatic life (National Research Council, 2005).

Amid the attention given to the Allegheny and Monongahela, the Beaver River drainage system often gets overlooked. Its problems have come not only from within Pennsylvania, but also from notoriously high levels of toxins piped into the Mahoning River from iron and steel mills in Youngstown and Warren, Ohio. At one time the Mahoning received tons of heavy metals, oil, grease, carcinogens (cancer-causing substances), and other toxins every day. To put this into proper perspective, the Ashland Oil spill of 1988 on the Monongahela River is described as one of the most severe inland oil spills in the nation's history. The Mahoning River received the equivalent of more than four Ashland Oil spills every year for decades (U.S. Army Corps of Engineers, 1999). Toxic and carcinogenic substances in the Mahoning, combined with those deposited into the Shenango River by industries in the Sharon/Farrell, Pa. area, have caused extremely unsafe drinking water in downstream communities such as Beaver Falls, Pa. (Mahoning River Education Project, 2006).

The contamination of Mahoning riverbed sediments has been well documented—and the extent of the pollution found there should drive us to do equally thorough monitoring in other rivers that also served for decades as sewers for industrial waste. The Mahoning's sediments and riverbanks remain so severely contaminated with carcinogenic substances that the Ohio health department has issued an order banning any contact with sediment and all consumption of locally caught fish. The U.S. Army Corps of Engineers started a 20-year cleanup project on approximately 30 miles of the Mahoning in 1997. Meanwhile, two toxic waste sites in Sharon, Pa., are on the National Priorities List of the Superfund sites requiring the most immediate attention. These cleanup efforts should produce long-term improvements in water quality, although we don't know exactly how bad the situation is because the water monitoring performed to meet federal and commonwealth requirements does not test for all toxic and carcinogenic substances contained in these sediments.

The Dirty Dozen: 12 Reasons for Our Water Quality Problems

1: RAW SEWAGE

The overflow of raw sewage is probably the single greatest threat to our main rivers. As Joan Blaustein discussed in the previous chapter, raw sewage is discharged during wet weather through combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), illicit sewage connections, and overflows at wastewater treatment plants.

Raw sewage contains disease-causing bacteria, parasites, and viruses that can pose a major public health threat through skin contact or drinking water. Identification of the many human pathogens (i.e., disease-causing components) in water is time-consuming, difficult, and expensive, so common fecal bacteria are used as an indicator of the total number of pathogens in water. A 2004 study of the rivers near Pittsburgh found that up to 80 percent of the samples collected failed to meet federal water quality standards in wet weather conditions. Even in dry weather, up to 28 percent of the samples were unacceptable (Fulton and Buckwalter, 2004). From May 15 to September 30, 2000, the Allegheny County Health Department issued recreational river advisories on 71 of 139 days due to the risk of contact with pathogens in the water.

In urban areas, the drainage of animal fecal matter from impervious surfaces adds to the problem of pathogens in stormwater runoff. It has been shown that fecal bacteria loads in urban streams are dependent upon housing and population density, the amount of impervious surface area, and the domestic animal population (Young and Thackston, 1999).

Even though our region's waters are contaminated by fecal material, they are not considered impaired for use as sources of drinking water because chlorination can purify them to meet drinking water standards. Nevertheless, the presence of raw sewage burdens our treatment processes and limits our ability to supply water to new users.

Raw sewage is not only an urban problem. In rural areas, failing or illegally connected septic systems, leaching from livestock pastures, and runoff from manure storage areas add fecal matter to feeder streams. The primary contributor of pathogens to surface water and groundwater in rural areas is confined animal feeding operations. These fecal sources present risks of infection to rural residents who drink pathogen-laden well water or whose skin comes in contact with such water. Contamination levels in rural wells have ranged widely, from very low to very high.

2: ACID MINE DRAINAGE

Sulfuric acid discharge from active and abandoned coal mines is "the most pervasive and widespread water pollution problem in southwestern Pennsylvania's industrial history" (National Research Council, 2005). Acid mine drainage significantly impairs the quality of drinking water sources, and its corrosive properties have forced area water authorities to build neutralizing processes to protect water treatment plants and distribution systems, reducing the quantity of water that can be delivered.

The sulfuric acid produced by reactions during the mining process dissolves other metals found in rock and soil, such as aluminum, arsenic, barium, cadmium, cobalt, copper, manganese, and silver. As a result, the acid contains metal concentrations that are dangerous to the health of aquatic systems and pose a direct threat to public health. At high levels, sulfate, the most predictable indicator of impact from mine drainage, can cause diarrhea in sensitive populations.

Acid mine drainage has radically reduced aquatic populations in both small streams and main rivers. Federal and commonwealth regulations requiring active mining operations to treat drainage water and efforts to control drainage at abandoned mine sites have resulted in the revival of aquatic life in many streams. Despite this improvement, the region's long history of acid mine drainage—transporting large quantities of toxic heavy metals into stream and river sediments throughout Southwestern Pennsylvania—continues to pose an ongoing threat to aquatic life and human health.

In a recent study of metal levels in riverbed sediment in the Allegheny and Monongahela watersheds, zinc and chromium (a known carcinogen) were found in all 50 sampling sites, and 11 of them contained zinc concentrations in the top 10 percent nationally since 1991 (Anderson et al., 2000). Similarly, concentrations of cadmium in fish from these rivers were among the highest in the nation during the 1996-98 sampling period. Toxic metals accumulate as one moves up the food chain, so that the fish highest on the food chain can acquire metal levels over 100 times that found in the sediment, posing a health threat to humans who eat the fish. As a result, the Pennsylvania Fish and Boat Commission has issued fish consumption advisories covering Southwestern Pennsylvania's waters.

Rural residents of Southwestern Pennsylvania are at risk for increased levels of both sulfate and metal concentrations in well water if they live near reclaimed surface coal mines. Metal levels have been significantly higher than normal in wells located within 2,000 feet of reclaimed surface mines. Private wells in areas where underground mining has occurred can be heavily contaminated with sulfate and ferric iron. This hard water smells like rotten eggs and tastes foul. Ferric iron in this water precipitates as ferrous hydroxide, causing yellowish-brown stains in bathtubs and sinks just as it does in streams carrying acid mine drainage.

3: HEAVY METALS FROM OTHER INDUSTRIAL AND NON-INDUSTRIAL SOURCES

Arsenic, which is believed to cause cancer if ingested over long periods of time through drinking water, has been found in well water in northeast portions of the Allegheny River drainage system (Anderson et al., 2000). The source of this arsenic appears to be natural leaching from rock that broke up during the glacial period. Obviously, it is impossible to control this natural source; we can only remove the arsenic through water treatment. The U.S. Geological Survey and Pennsylvania Department of Environmental Protection are actively studying the arsenic problem in Southwestern Pennsylvania. Since individual wells are not routinely monitored in Pennsylvania, rural residents of Butler, Lawrence, Armstrong, and Indiana Counties with no municipal water supplies could be at risk from high arsenic concentrations in their water.

Arsenic may also be released into groundwater and surface water from iron and steel production, or from agricultural activity. Arsenic-based substances known as roxarsone and arsanilic acid are used in poultry production to promote growth and to prevent bacterial infection. Over 70 percent of this arsenic-based material is excreted by the poultry, resulting in the transport of approximately 2 million pounds of arsenic per year into the environment from U.S. poultry operations (Graham, 2005). Thus, residents of Southwestern Pennsylvania who live down-gradient from poultry operations and who use well water could be exposed to arsenic from this source.

Mercury is given off in its vapor form during the combustion of coal and oil at conventional power plants and during the incineration of some wastes. This mercury can travel long distances in air, finally dropping to earth in precipitation. When the mercury is deposited into bodies of water, it is transformed by bacteria into another form (known as methylmercury) that then accumulates as it moves up the food chain. Methylmercury contamination poses a threat to the health of birds and animals that feed on contaminated fish. Mercury exposure in the womb affects the fetus's growing brain and nervous system and can lead to problems associated with memory, attention, language, and visual-spatial skills; concentrated exposure in utero can cause severe birth defects (EPA, 2005). Methylmercury does not pose a serious risk at present to drinking water supplies, but, due to the number of conventional power plants located in West Virginia and the Ohio River Valley, regular monitoring of methylmercury in water should be performed.

Other heavy metals such as aluminum, zinc, lead, chromium, nickel, cobalt, copper, and cadmium are produced during iron and steel, foundry, and other manufacturing processes. Lead can also enter surface water through the deterioration of bridge surfaces covered with lead-based

Discharges of compounds with estrogen-like effects from sewage treatment plants into our rivers are having a shocking impact on male fish, many of which have been found to have female features including immature eggs in their testes.

paint or through faulty removal of lead-based paint. Of these metals, chromium and cadmium have been associated with the development of various cancers, and lead is known to cause neurobehavioral problems, especially in children. A comprehensive, ongoing program of water and sediment testing for heavy metals is necessary to understand the extent and severity of these problems.

4: VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds (VOCs)—industrial by-products like benzene, known to cause leukemia in humans—have been entering our water for years through industrial releases. They can also enter the environment through discharges from residential and other sources. Given the persistence of VOCs in groundwater and their ability to leach into water from contaminated soils, it is surprising that baseline data collection and regular monitoring of VOCs have not been widely performed in Southwestern Pennsylvania. VOCs can also come from non-latex paints and varnishes, cleaning solutions, dry cleaning operations, and additives used in gasoline.

In a U.S. Geological Survey study of 95 domestic wells in the region, groundwater from 92 percent of the wells contained at least one VOC, 60 percent contained two or more VOCs, and one well contained seven different VOCs (Anderson et al., 2000). The health risks from ingesting some of these VOCs remain unknown—let alone the risks of drinking seven of them in combination.

5: PESTICIDES AND HERBICIDES

Pesticides and herbicides get into our water from agricultural applications and, increasingly, through lawn and garden uses (National Research Council, 2005). Old pesticides and herbicides remain in river and stream sediments, and new ones continue to be released into the environment from residences, agricultural operations, and golf courses. A study of Deer Creek, which flows into the Allegheny River near Harmarville, Pa. in northeast Allegheny County, detected various pesticides commonly used in lawn care. The most prevalent pesticide in Deer Creek, identified by scientists as 2,4-D, is better known to most people as Weed-B-Gone (Anderson et al., 2000).

Prometon, used to clear plants from under electric lines and around roads, is the herbicide most commonly present in urban surface water and groundwater. It was found in 90 percent of all samples taken in the Deer Creek study, which also found the insecticides diazinon and carbaryl (commonly known as Sevin) in amounts that threaten animals and water plants.

Pesticides and herbicides are long-lived chemicals, and, even when they begin to decay, some of the resulting products are toxic as well. Rachel Carson may be long gone, but the pesticide against which she fought—DDT—is still present in our water sediments and can accumulate in fish tissue.

6: ENDOCRINE-DISRUPTING CHEMICALS

Endocrine-disrupting chemicals (EDCs) are a relatively newfound category of environmental contaminants. EDCs interfere with the function of glands that release hormones into the bloodstream, thereby affecting human growth, development, metabolism, and reproductive capability. EDCs in the environment have been linked to cancer, male reproductive disorders, birth defects, and neurological and behavioral problems (Sanderson and van den Berg, 2003).

EDCs appear in adhesives used in construction, as well as in some personal care products, dietary supplements, and pharmaceutical estrogens used by many women. Discharges of compounds with estrogen-like effects from sewage treatment plants into our rivers are having a shocking impact on male fish, many of which have been found to have female features including immature eggs in their testes (Eggen et al., 2003). The removal of EDCs from wastewater treatment plant discharges may eventually be necessary in order to protect aquatic life.

7: NITRATES

Nitrate pollution can affect both human drinking water quality and aquatic life. Nitrates can enter water from agricultural fertilizers (Puckett and Hughes, 2005), livestock pasturing, runoff from manure piles, faulty septic systems, and municipal waste (Anderson et al., 2000). Nitrates also are released through industrial discharges, especially from steel pickling operations (EPA, 2002; see box). Excess nitrate levels cause lakes and streams to experience the blooming of algae and a drop in the water's oxygen level (as seen in North Park Lake in northern Allegheny County), eventually resulting in the death of fish.

Ingestion of nitrates in excess of the maximum concentration level of 10 parts per million can cause methemoglobinemia, or blue baby syndrome, in infants and children. This is a serious and potentially fatal syndrome that affects the ability of hemoglobin to deliver oxygen to cells. As a result the skin turns blue and blood supply to the brain is affected. When pregnant women drink water containing nitrates, the risk of developmental problems in their offspring increases (Fan and Steinberg, 1996).

The limited available data indicate that 73 percent of samples taken from streams draining agricultural areas in Southwestern Pennsylvania have exceeded normal nitrate concentrations, and that 62 percent of all groundwater samples have detectable nitrate concentrations (Anderson et al., 2000). Thus, it appears that babies and children living in rural areas and receiving drinking water from private wells are at potential risk for the development of nitrate-related diseases. Nitrate concentrations increased by 25 percent in the Monongahela River between 1975 and 2000 (Anderson et al., 2000). This increase is partially due to changes in the form of nitrogen in the river resulting from wastewater treatment, but contributions from home and agricultural fertilizer use, manure spreading, other agricultural practices, and sewage overflows cannot be discounted.

8: OLD INDUSTRIAL CHEMICALS

Polychlorinated biphenyls (PCBs), very persistent organohalogen compounds, are associated with developmental and cognitive disorders in children and with cancer (EPA, 2006). PCBs, historically used as coolant and lubricant in electrical equipment (National Research Council, 2005), are present in significant amounts in the sediment of bodies of water in Southwestern Pennsylvania bodies of water. PCB contamination is a particular problem in the Shenango River basin due to contamination from a Superfund site in Sharon, Pa. Because of the presence of PCBs in fish tissue, the Pennsylvania Fish and Boat Commission has advised area residents to limit consumption of river-caught fish to no more than one meal per week.

Other organohalogen substances (OHSs) such as furans and dioxins, which are given off during coking operations, waste incineration, and coal burning, are associated with the development of neurological and reproductive problems,

Zero Safe Drinking Water for Zelienople

A CASE STUDY OF DRINKING WATER CONTAMINATION

Connoquenessing Creek provides well water for numerous residents living near its course, as well as drinking water for residents of Zelienople in Butler County, Pa., and (after it flows into the Beaver River) of Beaver Falls. But in June 2000, the U.S. Environmental Protection Agency declared this creek's water unsafe for drinking, forcing more than 4,000 Butler County residents to depend on bottled water (EPA, 2000).

Why? Because this modest stream was receiving a greater amount of toxic discharges than any river in the United States other than the massive Mississippi (U.S. Public Interest Research Group, 2000).

The main source of the problem was a Butler steel plant discharging nitrates used in its processing operations. An investigation prior to the EPA's emergency order found that the plant's operator, AK Steel Corp., was discharging about 20,000 pounds of nitrates per day, or 20 times the amount that the Pennsylvania Department of Environmental Protection (DEP) had deemed acceptable in order to protect downstream water intakes. Water sampling showed that more than 21 miles of the Connoquenessing and a well adjacent to the creek were contaminated with high levels of nitrates (EPA, 2002).

Over the next two years—while dangerous nitrate levels continued to plague the Connoquenessing—AK Steel, the Borough of Zelienople, neighboring water authorities, and the DEP struggled to put an acceptable filtration process in place and to develop interconnections that would provide water from other sources in case of an emergency. The reduction of nitrate discharges to permissible levels did not occur until October 2002 (Borough of Zelienople, 2004).

The presence of regional water management systems could have helped Zelienople address and perhaps avert this water crisis by providing greater engineering, public policy, and public health expertise; exerting greater public influence with pollution sources and regulatory agencies; and initiating alternative connections that could ensure ongoing delivery of safe water in case of an emergency.

endocrine disruption, immunosuppression, and cancer in humans. OHS concentration in fish fat can reach levels much higher than that of river sediment. OHSs were found in fish at 15 of 16 sampling sites and in sediment at nine of 19 sampling sites in the Allegheny-Monongahela basin (Anderson et al., 2000).

Recent studies have shown a relationship between consumption of Great Lakes fish and various illnesses, including learning and memory impairments, male fertility problems, and elevated cancer risk in premenopausal women. Many OHSs are not monitored in public drinking water supplies, and no data exist on the presence of OHSs in this region's well water.

From May 15 to September 30, 2000, the Allegheny County Health Department issued recreational river advisories on 71 of 139 days due to the risk of contact with pathogens in the water.

9: RADON GAS

Radon is a colorless, odorless, radioactive gas emitted during the decay of uranium. Underlying rock in Southwestern Pennsylvania emits significant amounts of radon, which then mixes with groundwater. The EPA has determined that the ingestion of radon in drinking water is associated with an increased risk of lung cancer and has issued regulations to control it in municipal water supplies (EPA, 2000). The 1998 National Research Council report, *Risk Assessment of Radon* in Drinking Water, outlined this risk in detail.

More than half of the groundwater samples tested in the Allegheny-Monongahela basin contained amounts of radon greater than the permissible maximum level proposed by the EPA. Two groundwater samples within the region reached the level at which the local water authority is required to initiate programs to reduce radon in indoor air and drinking water. Although municipal water sources must test for radon, there are no requirements to test for or remediate high radon levels in private wells.

10: SUPERFUND, RCRA, BROWNFIELD, AND ILLEGAL DUMP SITES

As a lasting reminder of our region's industrial past, many Superfund, Resource Conservation and Recovery Act (RCRA), and brownfield sites, as well as illegal landfills, dot the urban and rural landscape. Pollutants from these sites have contaminated surface and subsurface soils and seeped into surface and groundwater.

The most notorious toxic waste site in Southwestern Pennsylvania is the Bruin Lagoon, located on the south branch of Bear Run in Bruin Borough, Butler County. This site was considered the third most toxic in the United States by the Superfund cleanup program. The effect of contamination from this lagoon was first noticed in 1968, when a large number of fish died in the Allegheny River. The site is located within the 100-year floodplain of Bear Run, and flooding of the site has hastened the spread of contamination into surface water. Contaminants found downstream from this site have included highly acidic sulfonated compounds, volatile organic hydrocarbons, heavy metals, and hydrogen sulfide. Cleanup of the site was initiated in August 1983, but halted in May 1984 because of the release of dangerous concentrations of sulfuric acid mist and oxides of sulfur (Froehlinger and Volz, 1984), which forced residents of the surrounding community to be evacuated. Although the site was stabilized by 1991, contaminants still appeared in area residents' well water, so they were provided with water buffaloes and bottled water. Those living near Bruin Lagoon have been exposed to potentially harmful contaminants in their water for up to 50 years.

Again demonstrating the need for a watershed-based approach to water quality problems, a toxic waste site plaguing the 11-county Southwestern Pennsylvania region sits outside the region. The Osborne Superfund site, located near Grove City in Mercer County, has threatened municipal groundwater wells with high levels of lead, trichloroethene, PCBs, and the known human carcinogens benzene and vinyl chloride (EPA, 2005). Although stabilized, contaminants can potentially flow into Wolf Creek and associated wetlands which are used for fishing and also for downstream water supply. Wolf Creek then flows into Slippery Rock Creek, which passes through Slippery Rock State Park, an area used for recreation by both anglers and boaters that features unique ecological habitats. Further downstream, Slippery Rock Creek flows into the Beaver River and finally into the Ohio River, from which numerous communities draw their water.

11: NEW DEVELOPMENT

Development of housing and transportation projects can affect water quality in several ways. The grading and movement of soil during construction can lead to water degradation, because runoff from the site contains both dissolved and undissolved solids. The disruption of topsoil and the removal of trees and grasses reduce the land's natural ability to hold and clean water for recharging underground aquifers. Water runs off from developed sites more quickly, increasing the potential for flooding at lower elevations.

The increased presence of silt in surface water that sometimes results from new development threatens aquatic life and overburdens water purification plants. One well-known case of recurrent silting caused by upstream development occurred at North Park Lake, where a large-scale and costly dredging project is now required to fix the problem. The sediment replaces the lake water and adds organic compounds. The bacteria in the water digest these organic compounds and in doing so reduce the partial pressure in the water to below the survival level required by fish and other aquatic species. Sooner or later the entire system will become anoxic with sulfides, giving off a rotten egg smell. Also, the lake is now a form of flood control for Pine Creek, and if it fills with sediment, it will have less capacity to retain water during a storm.

12: GRAVEL AND SAND MINING

Commercial sand and gravel mining in the Allegheny and Ohio Rivers threaten aquatic life—particularly freshwater mussels and other fish that require a gravel river bottom to survive and breed—as well as drinking water quality. Tests performed by the Pennsylvania DEP downstream of riverbed mining have found dangerous levels of lead and other heavy metals over baseline (Clean Water Action, 2005). The process of riverbed mining can create holes in the river bottom up to 60 feet deep and can reintroduce toxic and disease-causing substances into the water. Although the DEP has addressed the situation by putting some portions of the rivers off limits for new mining activities, riverbed mining still adds to the technical and economic burden of purifying drinking water.

So What Do We Do?

For 100 years Southwestern Pennsylvania valued its water resources primarily for their contributions to the region's world-famous industrial output. Sadly, this history has left behind a set of water quality challenges that are considered to be among the most difficult in the nation. These problems now constrain regional economic development in various ways, from discouraging tourism to preventing residential, commercial, and light industrial growth.

A regional watershed approach, under the direction of a single entity with suitable authority and economy of scale, may be necessary to truly solve the region's water quality problems. This entity could effectively incorporate social, ecological, and economic concerns into an integrated water resources plan. The development of such a plan, drawing on input from stakeholders throughout the region, would make it possible to address the crucial interrelationships among development projects, water quality, wastewater treatment, and flooding risks; to treat water-based assets as important to the fulfillment of aesthetic and recreational needs; to recognize the necessity of functioning water systems for the survival of local plant and animal life; and to educate the region's residents regarding the value of protecting our water resources.

Efforts by community organizations, local governments, and commonwealth and federal agencies have resulted in significant improvement of our rivers, streams, and

groundwater. However, our legacy of industrial pollution and mining activity, antiquated wastewater treatment systems, an unfriendly topography, high levels of precipitation, the dearth of reliable water quality data, and the region's extremely fragmented fabric of governments make the task overwhelming, if not unsolvable, for this piecemeal collection of players. Establishment of a region-wide framework for managing water quality could greatly increase our capacity to bring scientific, policymaking, and financial resources to bear on the problems that currently pose significant economic, public-health, and quality-of-life threats to all of us.

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The Rising Floods: Why Southwestern Pennsylvania's Flood Problems Are Worsening

by David R. French

If you have hilly topography and periods of heavy rainfall, you will have flooding. From the submersion of downtown Pittsburgh in 1936 to the devastation wreaked by Hurricane Ivan in 2004, some storm events simply defy human mitigation.

But we can't blame all our flooding woes on nature; Southwestern Pennsylvania has not done what it could to prevent flooding. In fact, in some ways we have made the threat of flooding worse. Development in flood-prone areas, paving of hillsides that formerly restrained runoff, inadequate treatment plant capacity, and fragmented management systems all exacerbate rather than solve our flood problems. And few realize that the less severe but more frequent flooding events, those that we do have significant ability to prevent or mitigate, cause greater total damage than the catastrophic floods.

This chapter discusses the extent and impact of flooding in Southwestern Pennsylvania, along with the inadequacy of existing solutions to the problem.

> The path of floodwater is subject to the natural laws of hydrology and hydraulics, not to municipal border lines.

Why All the Flooding?

Flooding is not a new problem in Southwestern Pennsylvania. Between 1830 and 1907, there were 11 major floods of the Allegheny, Monongahela, and Ohio Rivers. The frequency and severity of these floods led to the establishment of the Flood Commission in 1908. Four years later, H.J. Heinz, the appointed chair of the commission, and his staff thoroughly delineated the causes of floods and proposed several remedies. Due to political circumstances, the commission's recommendations were largely ignored until the great St. Patrick's Day flood of 1936. After 1936, a major concerted effort was undertaken to hard engineer the rivers to prevent flooding. These efforts were largely successful on the rivers, but may have merely shifted the problem to smaller tributary streams.

Today, many watersheds in Southwestern Pennsylvania are especially prone to flash flooding because of their topography and soil content. Storm water management practices designed to control the increased runoff that occurs as the result of land development typically move water away from the development and into receiving streams as quickly as possible. This action best protects those neighbors located closest to the development. However, increasing urbanization causes these greater amounts of storm water runoff to have a cumulative effect, causing flooding at critical discharge points downstream. These critical points may be culverts, bridges, or other obstructions to the water's path.

Increased flows have made the natural correlation between storm events and flooding obsolete. Whereas a two-year rain event (i.e., a storm of the severity that occurs on average once every two years) formerly might have caused a stream to barely overflow its banks, now the same storm produces flooding of greater severity. And serious rainstorms turn into disasters at locations like the Chartiers Creek watershed.

Early development in the region took place in close proximity to rivers and streams, placing residents and infrastructure in flood-prone areas. As road networks improved and the workforce became more affluent, residential and commercial development moved upland and "bedroom communities" flourished. Not only does new development siphon off older communities' tax base, it also increases their flood risk. The development of Monroeville threatens Pitcairn; growth in Shaler spells trouble for Etna. As noted in the previous chapter, this development also exacerbates our wastewater treatment problems, since the calculations used to determine the capacity of treatment plants did not adequately account for the increased wet-weather flow levels that would result from ongoing development.

comprehensive, watershed-based approach to stormwater management. Act 167, Pennsylvania's stormwater management law, was not passed until 1978. The original pilot studies and implementation guidelines derived from this law were not completed until 1984, and the first ordinances putting the law in actual operation did not take effect until 1986. Therefore, more than 40 years of substantial urbanization occurred before any mechanism to encourage a watershed-based approach to flood control was in place. Moreover, efforts since then have moved at a snail's pace due to the paucity of funding that the Pennsylvania General Assembly has allocated for comprehensive watershed planning.

The Many Negative Consequences of Flooding

We know that catastrophic floods can threaten life and property, but much less dramatic floods can also cause disruption. Between 1955 and 2000, Pennsylvania's median yearly flood damage was around $9.5 million. Over that same period, Pennsylvania accrued total flood damage of $4.4 billion. Pennsylvania has more square miles of floodplain than any other state. Southwestern Pennsylvania alone has received seven presidential disaster declarations due to flooding since 1984. Even minor floods place strains on local economies, cause insurance premiums to rise, and stretch public resources thinner.

Volatile organic compounds (VOCs)—industrial by-products like benzene, known to cause leukemia in humans—have been entering our water for years through industrial releases.

The disconnect between political and watershed boundaries contributes to the problem. The path of floodwater is subject to the natural laws of hydrology and hydraulics, not to municipal border lines. Actions by individual municipalities to address flooding problems not only can be expensive and ineffective, but also can worsen the problems for their downstream neighbors.

Despite the dramatic changes in our region's development profile, little progress has occurred toward establishing a

Flooding has many other less noticed but still serious negative consequences. Let's start with our roads. Poorly designed or maintained storm conveyance structures create dangerous road conditions due to ponding or, in winter, icing on the roadway. Stream obstructions can cause water to overflow stream banks quickly and pour onto adjacent roadways. High-velocity water flows can erode shoulders and berms, requiring more frequent road repairs. Water flows can also wash out the bedding beneath storm or sanitary sewers; once these undermined sewers fail structurally, the street surface above them collapses.

Flooding also contributes to our region's widespread difficulties in wastewater collection and treatment. As noted previously, many municipalities in our region are under environmental consent orders due to the presence of combined sewer overflows (CSOs) or sanitary sewer overflows (SSOs). Often, to protect our aging treatment systems, excessive flows are permitted to bypass treatment and enter directly into receiving waters, thereby compromising water quality. Our wastewater treatment infrastructure is already in crisis; increased flooding just makes the crisis worse.

Heightened flooding also has a negative impact on stream geomorphology, or the naturally occurring changes in how a stream flows. Under conditions of increased water volume and velocity, stream geomorphology is accelerated—that is, the stream's course and shape are more radically and rapidly transformed by erosion. This situation can make previously unaffected areas vulnerable to dangerous flooding and can erode the bottoms of slopes on hillsides, increasing the probability of landslide activity.

Improper management of erosion and sedimentation during construction and development activities contributes further to the severity of flooding problems. Excessive buildup of sediment in streams significantly reduces carrying capacity, resulting in localized flooding during relatively minor storm events. Erosion causes debris to build up on the upstream side of culverts and bridges. During minor storms these debris dams make streams overflow more quickly; in major storms they have an even more serious impact, retaining water temporarily and then releasing it in an extremely dangerous hydraulic pulse as occurred in the Little Pine Creek flood of 1986, which resulted in nine deaths and millions of dollars in property damage.

When properties flood repeatedly, the cumulative cost of recovery soon exceeds the value of the property recovered. Add in the cost of rebuilding damaged infrastructure and the value of good stormwater management planning, based on proven engineering principles rather than convenience or politics, quickly becomes apparent.

What's Wrong with Our Current Solutions?

Due largely to the lack of coordinated planning, Southwestern Pennsylvania's response to flooding problems has numerous deficiencies:

Fragmented local government. The existence of 600 separate municipal governments in Southwestern Pennsylvania, each with its own agenda, is the top challenge facing efforts to protect our water resources through comprehensive action. Since municipal boundaries seldom coincide with watershed boundaries, upstream municipalities regularly make planning decisions without concern for the possible detrimental impact on downstream communities. Meanwhile, downstream communities must build systems capable of handling increasing flows from their upstream neighbors, even though the upstream communities are not required to contribute toward these infrastructure projects.

Inconsistent land use policy. Many communities have stormwater management ordinances aligned with Act 167 plans, but, unless these ordinances are consistently applied and enforced, they are ineffective. Moreover, disputes between municipalities are seldom arbitrated by county or commonwealth agencies, so that a municipality that believes it has been harmed by the development practices of a neighboring community must sue for relief.

Bureaucratic, compartmentalized regulatory climate. The Pennsylvania Department of Environmental Protection sometimes does not even act consistently with itself, as wastewater, stormwater, and drinking water issues are regulated by different bureaus within the department. These bureaus often have competing agendas, standards, and goals, which must be reconciled in order for us to manage our water resources properly.

Overdependence on engineering. Among experts in flood control, especially at the U.S. Army Corps of Engineers, the emphasis has been on "hard engineering" solutions, such as dams, dikes, levees, and stream lining. This perspective is definitely appropriate for large rivers, but less effective when applied to upland streams and creeks with flash flooding potential. Additionally, the hard engineering approach is extremely expensive and requires

a high degree of commitment to system maintenance by local sponsors. The general experience locally is that this maintenance does not occur, causing expensive flood control facilities to fail due to neglect. In recent years, Turtle Creek and Chartiers Creek have provided two specific examples of this unfortunate outcome.

Federal flood insurance. While it sounds compassionate in nature, the practice of offering federally subsidized flood insurance has actually encouraged poor real estate decisions. We should be discouraging people from building in floodplains, not helping them remain in harm's way with federal subsidies.

Lack of funding for watershed-based planning. This paper referred earlier to the woefully inadequate funding levels for comprehensive watershed planning in Pennsylvania. Act 167 authorizes the commonwealth to provide 75 percent of the necessary funding for the development and implementation of watershed plans. But since its enactment, Act 167 has never been funded at more than $1.5 million in any given year. This is a tiny amount compared to the recovery costs taxpayers must bear due to flooding, much of which could have been mitigated through better planning.

No one believes that, if we could start over, we would construct 800 separate entities to manage Southwestern Pennsylvania's water resources.

Fighting to attract development. The decline of Southwestern Pennsylvania's urban centers, combined with an overall stagnant or declining population, has led to increased competition between communities to attract economic development. Many communities, in their eagerness to win this competition, view imposing more stringent stormwater and floodplain management requirements as detrimental. Instead, they relax or conveniently overlook these standards. The lack of a coordinating regional water system and the disconnect between comprehensive planning and local ordinances has given land developers the upper hand as they negotiate stormwater management arrangements with municipalities. This situation is especially disheartening in that developers would generally be willing to conform to higher management standards if they knew they would experience a level playing field regardless of which municipality they selected.

A Better Way

In 1988 the Allegheny County Planning Department undertook a study to determine the most appropriate organizational construct for negotiating stormwater management on a regional basis. Functionally, the study indicated, such a regional entity should be empowered to handle the following responsibilities:

- Planning for capital improvements that would accommodate new development and mitigate existing flooding problems
- Reviewing land development plans for compliance with watershed performance standards regarding controlling excess volume and flow
- Inspecting new facilities to ensure compliance with performance standards
- Performing routine maintenance on public facilities and ensuring that private stormwater management facilities perform as designed
- Coordinating emergency response to flooding
- Implementing financial support systems to keep stormwater management systems operating properly
- Enforcing adherence to stormwater management policies and regulations

Participants in the study recognized the political difficulties inherent in creating a regional entity that would be trusted to become involved in municipal land use decisions, replace individual municipalities' autonomous role as system managers, respond promptly to local issues and problems, and arrange an equitable pattern of cost sharing among member municipalities. With these challenges in mind, they proposed the following arrangement:

- Planning emergency response and financial support functions would be performed by the regional entity. Financing would be based on a user fee model that is in effect in numerous cities and counties around the nation and is based primarily on land use.
- Plan reviews and facility inspections would be completed by the regional entity, so as to provide both consistency and economy of scale.
- Maintenance would be split between municipalities and the regional entity based on the type, size, and ownership of each facility. One possible arrangement would be a work order system, under which the municipality could contract with the regional authority for maintenance.
- The regional entity would perform enforcement functions.

Eighteen years later, the study's recommendations still sit on a shelf, awaiting a long-overdue attempt to implement them. Given our region's historical inability to address growing flood problems and other water resource challenges, there should be little doubt that such a regional entity would enhance and improve the quality, consistency, and affordability of proper stormwater management in southwestern Pennsylvania.

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Conclusion: Regional Solutions

The preceding three chapters have sought to establish conclusively the need for a new approach to water management in Southwestern Pennsylvania. Our water management challenges are well documented and defined, though data gaps continue to exist. If our problems with water quality, sewage management, and flood control do not constitute a crisis today, they are certainly progressing inexorably toward the crisis stage.

So what should we do? The Institute of Politics Environment Policy Committee and the authors of this framing paper believe strongly that simply encouraging our 800 water management entities to work harder is not the solution. The valuable contributions of these entities should not be overlooked; they have served their constituents faithfully, and in many cases they have taken creative, bold, and cooperative steps toward addressing our water management problems. But despite their best efforts, the fragmentation of leadership hinders administrative efficiency, limits our capacity to achieve technological improvements, and leaves the water resource management community with little influence in land use decisions. Water resources do not conform to municipal or other governmental boundaries, and our management practices should reflect that reality.

No one believes that, if we could start over, we would construct 800 separate entities to manage Southwestern Pennsylvania's water resources. It is time to consider fundamental restructuring if we are to achieve affordable, efficient, and effective regional solutions.

A regional water resource management entity could greatly improve Southwestern Pennsylvania's positioning for federal and commonwealth funding. It could more effectively target revenues from taxes and usage fees toward the most serious problems through collaborative planning. It could create fee structures that would contain incentives for better stormwater management. It could provide invaluable assurance to the Environmental Protection Agency—which has been forcing many of our municipalities into sewage management consent orders over the last 10 years—that a major federal investment in Southwestern Pennsylvania's water and sewage infrastructure would be well used. It could manage our water resources with a strategic emphasis on promoting regional economic development and gaining maximum advantage from this natural recreational and environmental asset.

Establishing a regional entity with the financial wherewithal and statutory authority to make a substantial, long-term difference will be an imposing task. It will require significant education and engagement of both regional leadership and the general public. It will entail sensitive interaction with existing water and sewage management authorities, so that their assets are recognized and handled equitably in whatever new arrangement emerges. The process will demand gaining the confidence of local leaders throughout the region—though by now some of them may feel anything is better than the EPA looking over their shoulder—and convincing them that entering into a strong regional partnership will benefit the communities they represent. It will most likely include state legislation to confer appropriate authority on the newly designated regional entity.

Previous studies have recommended that the Southwestern Pennsylvania Commission (SPC), as the metropolitan planning organization, expand its regional planning role (now focused mainly on transportation and economic development) to encompass water resource management. SPC has played a significant role in encouraging cooperative approaches to water and sewage management, but does not have water resource experts on its staff. Noticing the effectiveness of multi-state authorities empowered to oversee the Susquehanna and Delaware Rivers, some have suggested granting greater authority over Southwestern Pennsylvania's water resources to the Ohio River Valley Basin Sanitation Commission, or ORSANCO, which has heretofore concentrated largely on monitoring water quality. Others believe our problems call for creation of a brand new authority with regionalized responsibility, or giving the responsibility to an existing agency other than SPC. The use of contractual agreements, the creation of regional utilities, and the initiation of a regional water management pilot project have also been discussed.

With the endorsement of the Southwestern Pennsylvania Commission, the Institute of Politics and partner organizations are convening an independent task force that will be embarking on an energetic investigation of regional water management possibilities during the next year. The Regional Water Management Task Force's work will include intensive research into the work and structure of existing water, sewage, and flood-control entities; institutional analysis of current regional management and possible regional reorganizations; engagement of stakeholders such as water and sewage authority boards, watershed associations, and elected officials; an effort to gauge grassroots public opinion, deliver public education on water resource management issues, and solicit input from local and regional leaders; and closer examination of how other regions have responded to similar problems. The task force's goal is to produce recommendations—based on policy, political and legal research, and public participation processes—that can gain extensive region-wide support, perhaps as early as spring 2007.

You can expect to hear more about this ambitious initiative as the year progresses. In the meantime, however, your input and engagement are always welcome and can be provided to the Regional Water Management Task Force:

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Thank you for your interest in this pressing regional issue.

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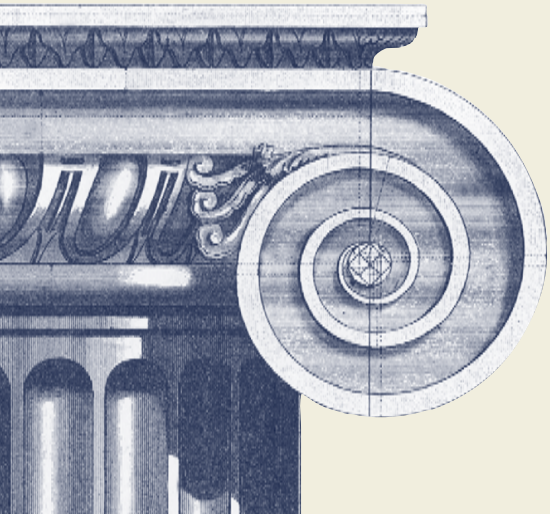

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