



Out of Sight, Out of Mind

**America's Aging Infrastructure
Desperately Needs an Overhaul**

By Mark Kemp-Rye,
On Tap Editor



Few things are as dramatic as a levee break or a bridge collapse. Over the last few years, the tragedies associated with Hurricane Katrina and the I-35 bridge failure in Minneapolis, as well as a series of less catastrophic events, have put the serious state of America's public works in the spotlight and sparked renewed discussions about the country's aging infrastructure.

Meanwhile, though, another infrastructure crisis is happening largely out of sight and out of mind: the country's drinking water and wastewater systems are deteriorating. And while these systems rarely make the national news, the threat that deteriorating facilities poses to hard-won environmental and public health improvements is no less real.

"The economic well-being of the United States is dependent on the reliability, safety, and security of its physical infrastructure," says Patricia Dalton, managing director of the Government Accountability Office's (GAO) Physical Infrastructure Issues, in recent testimony before Congress. "The nation's infrastructure is vast and affects the daily lives of virtually all Americans."

Resting on Our Laurels

Historically, water system growth has paralleled population increases and urbanization. The most significant of these periods occurred in the late 19th century, during and after World War I, and in the post-World War II era. Much of the infrastructure we rely on today is from the latter boom, although many cities still have pipes in the ground dating back to the 1800s. (See the sidebar on page 18 for lifespan of typical distribution pipes.)

Half a century after the last massive investment, a significant proportion of the drinking water and wastewater infrastructure currently in use is reaching the end of its life expectancy. "We cannot ignore the arriving wave of infrastructure rehabilitation and replacement we will face over the next several decades," the U.S. Environmental Protection Agency (EPA) says on its Web site devoted to sustainable infrastructure.



Philadelphia began replacing wooden pipes (top, wooden pipes uncovered ca. 1900) with cast iron ones (middle, 1904) in the 19th century. Besides being more durable, the cast-iron pipes made it easier to maintain water pressure throughout the system. Today's distribution system contains pipes made of cast-iron, ductile iron, steel, and concrete. The large concrete Queen Lane pipe shown above (bottom, 1950) carries water from one reservoir to another.

Photos and caption courtesy of <http://phillyh2o.org>

"To do so would be to put the achievements of the last 30 to 40 years and our nation's waters and public health at risk." While it wouldn't be fair to say we've completely ignored the situation, we haven't exactly kept up with it either.

Water System Life Expectancy

According to U.S. Environmental Protection Agency, a water treatment plant can be expected to last between 25 and 50 years. Here are the “average useful lifespans” of different distribution line materials:

Cast Iron Pipes

120 yrs

Used during the late 19th and early 20th centuries, have an estimated lifespan of 120 years.

Iron Pipes

100 yrs

Introduced in the 1920s and thinner than their predecessors, have an average life of about 100 years.

Ductile Iron Pipes

100 yrs

In use beginning in the 1950s, these pipes also have a 100-year estimated lifespan.

Polyvinyl Chloride (PVC) and High-density Polyethylene

70 yrs

The former popular in the 1970s and the latter from the 1990s on, both can be expected to last 70 years.

“You wouldn’t let your house be a hundred years old and not ever do any maintenance to it. You would make sure that it was safe,” says Linda Kelly, the Water Environment Federation’s managing director of public education in the documentary *Liquid Assets* coming to PBS this fall. (See the article on page 19 for more information about *Liquid Assets*.) “The problem we have is that our water infrastructure is old—a hundred, two hundred years old. It’s not been upgraded or fixed or replaced. It really demands attention by a community [just] as your home does for an individual.”

Huge Needs

The magnitude of the water infrastructure challenge is mind-boggling. Consider the following numbers:

- EPA estimates that a \$1 trillion investment is needed in drinking water and wastewater systems over the next two decades.
- The GAO reports that one-third of utilities “deferred maintenance because of insufficient funds, had 20 percent or more of their pipelines nearing the end of their useful life, and lacked basic plans for managing their capital assets.”
- For drinking water alone, EPA estimates that \$151 billion is needed to repair, replace, and upgrade the nation’s 55,000 community systems.
- Currently, there is an \$11 billion annual shortfall to replace aging drinking water systems and comply with Safe Drinking Water Act regulations. This number does not account for population growth.
- Federal funding for drinking water improvements has averaged less than 10 percent of total need for the last several years. The 20-year funding gap for drinking water capital, and operations

and maintenance ranges from between \$45 billion and \$263 billion, depending on spending levels.

- According to a 2007 study by the American Water Works Association, water main breaks will become more common and “there will be a three-fold increase in repair costs by the year 2030 despite a concurrent increase of 3.5 times in annual investments to replace pipes.”

The Congressional Budget Office, in a classic understatement, has noted, “Current funding from all levels of government and current revenues generated from ratepayers will not be sufficient to meet the nation’s future demand for water infrastructure.” The GAO is even more forceful, stating, “Calls for increased investment in infrastructure come at a time when traditional funding for infrastructure projects is increasingly strained, and the federal government’s outlook is worse than many may understand.”

Given the huge needs we face, what can be done? EPA advocates a four-pillar approach as part of their Sustainable Infrastructure Initiative, which “guides our efforts in changing how the nation views, values, manages, and invests in its water infrastructure.” The four pillars are:

1. “Better management of water and wastewater utilities can encompass practices like asset management and environmental management systems. Consolidation and public/private partnerships could also offer utilities significant savings.
2. Rates that reflect the “full cost pricing” of service and rate restructuring can help utilities capture the actual costs of operating water systems, raise revenues, and also help to conserve water.

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Big Plans in the Big Peach

Over the last decades, Atlanta has been one of the fastest growing cities in the U.S. And the boom continues, with the Georgia capital lagging behind only Dallas-Fort Worth for metropolitan area population increase between 2006 and 2007.










However, this growth has meant significant challenges for the city's leaders. Because Atlanta is an old city, much of the infrastructure needs to be replaced and increasingly scarce water resources demand better efficiency.

To meet these challenges, Atlanta is in the midst of a nearly \$4 billion overhaul of its drinking water and wastewater systems. Part of the funding has come in the form of water and sewer rates being increased an average of 10 percent per year, making them among the nation's highest.

Many experts look at Atlanta's plan as being a model for other communities in the U.S. "The lesson in Atlanta's story is not just that we paid for it," said Mayor Shirley Franklin at a March 2007 U.S. Environmental Protection Agency conference, "but that we turned the corner in people understanding the value of investment in water infrastructure."

To learn more about the Clean Water Atlanta initiative, visit the city's Department of Watershed Management Web site at www.atlantawatershed.org/cwa/index.htm.

Main Replacement Program F.Y.2005 - F.Y.2011

-  FY2005
-  FY2006
-  FY2007
-  FY2008
-  FY2009
-  FY2010
-  FY2011
-  FY2005 INPROGRESS
-  FY2005 COMPLETED

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3. Efficient water use is critical, particularly in those parts of the country that are undergoing water shortages. We need to create market incentives to encourage more efficient use of water and to protect our sources of water.
4. Watershed approaches look more broadly at water resources in a coordinated way, which is challenging because we have not traditionally thought of infrastructure management within the context of water quality protection."

EPA believes that better management practices, efficient water use, full-cost pricing of water, and a watershed approach to protection can all help utilities operate more sustainably now and in the long-term.



To read articles related to rate setting, conservation, and watershed approaches, visit the NESC Web site at www.nesc.wvu.edu. The site also has a section devoted to capacity development that has numerous articles about water utility management.

The GAO, following an analysis of existing infrastructure programs, urges that discussions and plans consider the following principles:

- creating well-defined goals based on identified areas of national interest,
- establishing and clearly defining the federal role in achieving each goal,
- incorporating performance and accountability into funding decisions,
- employing the best tools and approaches to emphasize return on investment, and
- ensuring fiscal sustainability.

"It's unrealistic to think that it will all happen at once," says Jeannette Brown, a fellow with the American Society of Civil Engineers and executive director of the Stamford [Connecticut] Water Pollution Control Authority. "However, it absolutely needs to

become a top priority for this country. If we don't make a commitment to improving our infrastructure, the consequences will be significant."

Dr. Gerald Iwan, former chief of the Connecticut Department of Health's Drinking Water Section and now executive director of the National Environmental Services Center agrees. "What it boils down to," he says, "is that communities are going to have to take stock of what they have and develop strategies for maintaining and improving the resilience of their infrastructure."

Small Systems Are Not Immune

When drinking water and wastewater infrastructure does make the news, it's most often about a problem in an urban area. But small systems are not immune to these problems and, in fact, face unique challenges associated with economies of scale and population density.

"Because small communities have limited resources, the cost of maintaining and improving infrastructure per capita is much greater than in a city and may impact a population less able to afford those costs," Brown observes. "Furthermore, the infrastructure may be spread out over longer distances and may require more pumping stations to either distribute water or assist in the conveyance of wastewater, all of which significantly adds to the costs."

Regardless of your community's size, politics are part of the equation and buried infrastructure is a tough sell. "Elected leaders love to support visible projects that they can point to and say, 'look what we've accomplished,'" observes Iwan. "That's why a new park or a new road is more politically appealing: It's tangible. With drinking water and wastewater investments, the final product, while critical, is harder for the general public to see and therefore appreciate the results."

Final Thoughts

Like it or not, your community will have to address aging infrastructure, probably sooner than later. What, then, can communities do to tackle this issue?

The GAO strongly suggests that communities develop a comprehensive asset management program, "whereby water systems systematically identify their needs, set priorities, and better target their investments," thereby helping utilities make better use of available funds.

Iwan agrees and says, "Communities, to move progressively in addressing contemporary issues of growth and sustainability, will have to take ownership of the infrastructure issue. The recent GAO report *Physical Infrastructure: Challenges and Investment Options for the Nation's Infrastructure*, emphasizes the need for prioritization of infrastructure improvements in our water sector as a matter of national importance and even security."

Of course, understanding the issues is an important first step. "Learn all you can about water and wastewater treatment," Brown advises. "Visit the treatment plant, listen to the issues stated by the plant managers, understand the regulations and most importantly, fight for money to improve infrastructure. Make sure your town has a user charge that will support all of the wastewater infrastructure needs. As a House Transportation and Infrastructure Committee report stated: 'Without increased investment in [water and] wastewater infrastructure, in less than a generation, the U.S. could lose much of the gains it made thus far in improving water quality, and wind up with dirtier water than existed prior to the enactment of the 1972 Clean Water Act.'"

References

- American Water Works Association. 2006. *Water Infrastructure at a Turning Point: The Road to Sustainable Asset Management*. AWWA: Denver, CO.
- Congressional Budget Office. 2007. *Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004*. CBO: Washington, DC.
- Dalton, Patricia A. 2008. *Physical Infrastructure: Challenges and Investment Options for the Nation's*


Infrastructure. Testimony before the Committee on the Budget and the Committee on Transportation and Infrastructure, U.S. House of Representatives (May 8). Washington DC: Government Accountability Office.

The National Academies Press. "Trends Relevant to the Deterioration of Drinking Water in Distribution Systems." Available at <http://books.nap.edu>. Accessed on April 13, 2008.

U.S. Environmental Protection Agency. "Sustainable Infrastructure for Water and Wastewater." Available at www.epa.gov/infrastructure/index.html. Accessed between March 1 and May 23, 2008.

More Information

To learn more about aging infrastructure, visit the following Web sites:

- EPA's Sustainable Infrastructure Initiative is online at www.epa.gov/water-infrastructure/.
- The American Water Works Association has developed "Only Tap Water Delivers," a grassroots and media campaign to help utilities and public officials communicate the value of tap water service and the need to reinvest in water infrastructure to consumers, media and other stakeholders. Learn more about Only Tap Water Delivers on the AWWA Web site at www.awwa.org.
- The American Society of Civil Engineers maintains a critical infrastructure Web site at <http://ciasce.asce.org/>. 



On Tap Editor Mark Kemp-Rye serves on the advisory board for *Liquid Assets*, a documentary

about America's aging drinking water, wastewater, and stormwater systems.

PBS Documentary Examines Infrastructure

Liquid Assets Tells the Story of Our Aging Water Systems

Liquid Assets, a 90-minute documentary, tells the story of essential infrastructure systems: water, wastewater, and stormwater. These systems—some in the ground for more than 100 years—provide a critical public health function and are essential for economic development and growth. Largely out of sight and out of mind, these aging systems have not been maintained, and some estimates suggest that this is the single largest public works endeavor in our nation's history.

Exploring the history, engineering challenges, and political and economic realities in urban and rural locations, the documentary provides an understanding of the hidden assets that support our way of life. Topics covered include public health, watershed protection approaches, the engineering involved, and the challenges that lie ahead. *Liquid Assets* presents the challenge of how we can come up with the hundreds of billions of dollars required to restore America's infrastructure.

National Environmental Services Center (NESC) staff members Zane Satterfield and Mark Kemp-Rye have served as advisors on the project and NESC is a *Liquid Assets* outreach partner.

Liquid Assets is slated for release in October 2008. Check your local PBS Station for air times in your area or use the PBS Web site at www.pbs.org.

Coming in October 2008



Liquid Assets

THE STORY OF OUR
WATER INFRASTRUCTURE

produced by
Penn State Public Broadcasting **WPSU**