

# Water Infrastructure In Crisis

by Marc Santora and Rande Wilson

**A**ccording to the Local Government Advisory Committee of the U.S. Environmental Protection Agency (EPA), if investment in drinking water and wastewater infrastructure does not increase to address anticipated needs, the funding gap by 2020 could reach \$225 billion for this infrastructure's capital costs. Additional information about this can be found on the EPA Web site at [www.epa.gov/waterinfrastructure/lgac\\_video/index.html](http://www.epa.gov/waterinfrastructure/lgac_video/index.html).

The integrity of the drinking water and wastewater infrastructure will be at risk in the United States until a concerted effort is undertaken to increase the sustainability of water sector (drinking water and wastewater industry) critical assets. Artificially low rates have historically contributed to this chronic deterioration of essential infrastructure, making full-cost pricing more important to the water sector than ever before.<sup>1</sup>

In addition, the safety, security, and resiliency of our municipal water supplies and clean water programs require adequate resources, making the incorporation of risk management into asset management essential.<sup>2</sup> The public policy leadership challenge facing local government managers is to infuse resiliency and risk management into water sector asset management in a sustainable manner.

## **ROLE OF INFRASTRUCTURE ASSET MANAGEMENT**

Infrastructure asset management is the life cycle management of a utility's physical assets to maximize the intrinsic value of ratepayers' investment. In 2004, the U.S. General Accounting Office (GAO, now called the Government Accountability Office) concluded that the implementation of infrastructure asset management programs in the water sector would provide:

- Improved decision making regarding capital assets.
- More productive relationships with governing authorities, ratepayers, and other stakeholders.

In implementing an infrastructure asset management program (see Figure 1), utility managers must include planning, design, operations, maintenance, and replacement of physical assets. Asset management business practice objectives and functions include:

- Optimize asset performance.
- Moderate capital expenditures over time.
- Extend asset life.
- Maximize value to stakeholders.
- Protect interdependent infrastructures.
- Reduce risk through understanding the consequences of loss of a critical asset.
- Develop resiliency to a variety of natural, accidental, and malevolent hazards.<sup>3</sup>

Infrastructure asset management is a relatively new concept for the water sector in the United States. In New Zealand and Australia, however, water utilities have used infrastructure asset management for more than 10 years. In Australia, water utilities are required to recover the full cost of service in their rates; and in New Zealand, water utilities are required to depreciate assets and use cost-benefit analysis in asset management.<sup>4</sup> Both full-cost pricing and cost-benefit analysis are essential elements for sustainable water infrastructure.

### INCORPORATING RESILIENCY INTO ASSET MANAGEMENT

In assessing risks and aligning risk tolerance with asset management, one can look to the water sector specific plan for guidance in applying these resiliency concepts.<sup>5</sup> The specific plan comprises four goals that drive the development of protective programs: (1) sustain protection of public health and the environment; (2) recognize and reduce risks; (3) maintain a resilient infrastructure; and (4) increase communication, outreach, and public confidence. The goals are attained through sustainable asset management practices, including but not limited to:

**Figure 1.**

### Elements of Comprehensive Asset Management



Source: U.S. Government Accountability Office (GAO).

- Maintaining current assessment of risks and consequences.
- Collaborating with interdependent infrastructures.
- Implementing a schedule for review of asset condition.
- Reassessing risks and consequences after incidents, and incorporating lessons learned from these experiences.

### ROLE OF RISK MANAGEMENT

As physical asset-intensive businesses, utilities are dealing with high-value critical facilities and equipment. Failure of these assets is disruptive and costly to ratepayers, the public, and interdependent infrastructures. One consideration in developing a resilient infrastructure—it is often missing from asset management programs—is the role of risk management.<sup>6</sup> Risk management is a continual process created to identify:

- Vulnerabilities to the utility's mission.
- Criticality and prioritization of assets.
- Consequences of sustaining a loss.
- Management of risk to maximize resiliency.

Effective risk management is an integral component of a sustainable infrastructure asset management program.<sup>7</sup> Properly designed, a risk management program assists the utility staff to manage risk levels thoughtfully in order to become more resilient. The options for management of exposure to the consequences of an incident often include risk avoidance, risk reduction measures, transfer of risk, and retention (or tolerance) of risk.

In many cases, the most practical management of risk involves the application of multiple risk management methodologies. By incorporating risk management into asset management decision making, the utility can make sound decisions resulting in a lower risk profile and can minimize loss of service caused by a range of hazards.

As utility asset management functions have taken a new course, utility leaders are navigating away from the traditional reactive model (repair or replace when it fails). The water sector is beginning to navigate toward proactive maintenance and other water sector best practices, including implementation of an active and ef-

fective protective program. Information on active and effective protective programs is available on the EPA Web site, Water Security, at <http://cfpub.epa.gov/safewater/watersecurity/index.cfm>.

Although some still regard asset management as maintenance management, it is important to recognize that reliability and resiliency will be positively impacted by linking asset management with risk management. This can be accomplished by focusing on the consequences of the loss of single points of failure, or critical assets, and by assigning a higher priority to maintenance, upgrade, physical security, or redundancy to those assets.

### **INTEGRATING RISK MANAGEMENT INTO ASSET MANAGEMENT**

Some drinking water and wastewater utilities may have implemented asset management programs that make use of predictive and preventive maintenance techniques to maximize the service life of buried infrastructure.<sup>8</sup>

Other utilities may not have invested in proactive asset management programs; therefore, a significant portion of their operating budgets is devoted to unexpected emergency repairs or remedial maintenance. This reactive approach diminishes the expected service life of the assets and in the long run results in higher maintenance costs, lower reliability, and diminished resiliency.

Incorporating risk management considerations into planning, design, repair, maintenance, and replacement of physical infrastructure is an important component of asset management; this includes:

- Bringing forward risk management considerations in the design, planning, and budgeting process.
- Combining design and construction specifications to address resiliency, redundancy, and physical hardening of critical assets.
- Adopting inherently lower-risk technologies.

In dealing with the risk aspects of asset management, a process of prioritization is established, with the risks to assets with the highest consequences and greatest probability of occurrence being given the top priority for risk reduction. Then a risk management plan is devised to lower the risk profile.

This can involve multiple measures depending on the risk, asset priority, and options available to utility management. It is neither realistic nor affordable to eliminate all risk; however, acknowledging risk levels, understanding risk in relation to the utility's mission, and deploying re-

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sources to protect the mission are the balance needed.

By integrating risk management into proactive asset management, the utility can sustain delivery of mission objectives while protecting against loss of service. This integrated approach will sustain sound utility business practices and reliable customer service while helping to identify, avoid, and mitigate the impact of myriad hazards.

### **ESSENTIAL TO PUBLIC SAFETY**

Drinking water infrastructure performs a vital public safety function, for example, by providing the commodity used to fight fires.<sup>9</sup> A water distribution system that provides reliable water at an adequate pressure and volume can be the difference between manageable fire scenarios and an urban inferno. Fire protection is supplied by miles of water mains and numerous fire hydrants that should be of sufficient size and in workable condition in order to handle peak flows needed to suppress fire incidents.

In addition, water storage tanks need to be of sufficient size and condition to provide needed water reserves, while water treatment and pumping capacity need to provide firefighting capability. Although much of this infrastructure is buried underground—out of sight and mind—it remains critical to public safety functions.

Such continual maintenance as hydrant flushing, valve exercising, fire flow testing, and replacement of fire hydrants is essential for effective fire protection. Firefighters are the principal users of fire hydrants; however, water utilities are responsible for their maintenance and repair. This maintenance and repair is primarily funded through customer water bills. Thus, an effective asset management program must reflect sufficient operational and maintenance budgets to support this essential public safety function.

In addition, other critical services, including hospitals and interdependent infrastructures that involve energy, transportation, food, and agriculture are also negatively impacted from a disruption in water sector services. A resilient and sustainable drinking water and wastewater infrastructure supports each community's economic vitality and public confidence in local government.

### **WHAT'S AT RISK**

The water sector needs leadership at the local level to obtain the necessary

funding for sustainable infrastructure asset management. The resiliency of the water sector and interdependent infrastructures also makes the incorporation of effective risk management into asset management essential.

The integrity of the nation's drinking water and wastewater infrastructure is at risk. The safety, security, and resiliency of our municipal water supplies and clean water programs require the incorporation of risk management into asset management as an essential element of effectively managing water infrastructure in a sustainable manner. **PM**

<sup>1</sup>"Case Studies of Sustainable Water and Wastewater Pricing," EPA report no. 816-R-05-007 (Washington, D.C.: U.S. Environmental Protection Agency, Office of Water (4606M), December 2005).

<sup>2</sup>*Water Infrastructure: Comprehensive Asset Management Has Potential to Help*

*Utilities Better Identify Needs and Plan Future Investments*, report no. GAO-04-461 (Washington, D.C.: U.S. General Accounting Office, March 2004).

<sup>3</sup>Richard G. Little, "Why Infrastructure Matters" (Los Angeles: University of Southern California, Keston Institute for Infrastructure, n.d.), [www.bcwaternews.com/AssetMgt/Why\\_Infrasturcture\\_Matters.pdf](http://www.bcwaternews.com/AssetMgt/Why_Infrasturcture_Matters.pdf).

<sup>4</sup>*Water Infrastructure*.

<sup>5</sup>*Water Critical Infrastructure and Key Resources Sector-Specific Plan as Input to the National Infrastructure Protection Plan*, Report no. A362574 (Washington, D.C.: U.S. Environmental Protection Agency, May 2007).

<sup>6</sup>John Woodhouse, "Finding the Right Mix of Costs, Risks and Performance," *Works Management* (May 2001), [www.theiam.org/Downloads/Costrisk%20Works%20Mgmt%20article.pdf](http://www.theiam.org/Downloads/Costrisk%20Works%20Mgmt%20article.pdf).

<sup>7</sup>John E. Cromwell III et al., "The Infrastructure 'Crisis?'" *Journal AWWA* 99, no.

4 (April 2007).

<sup>8</sup>Infrastructure Status Report: Massachusetts Wastewater Facilities (Boston: Massachusetts Infrastructure Investment Coalition, May 2007).

<sup>9</sup>Infrastructure Status Report: Massachusetts Drinking Water (Boston: Massachusetts Infrastructure Investment Coalition, May 2007).

Marc Santora is program analyst, U.S. Environmental Protection Agency, Office of the Chief Financial Officer, Trust Funds and Administration Analysis, Washington, D.C. ([santora.marc@epa.gov](mailto:santora.marc@epa.gov)). Rande Wilson is principal water sector consultant, Computer Sciences Corporation, Science, Engineering, and Mission Support, Rowayton, Connecticut ([rwilson34@csc.com](mailto:rwilson34@csc.com)).

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## **PM** Supporting a Second Century of Professional Local Government Management

This year marks the 100th anniversary of the first position legally defining the broad authority and responsibility of today's professional local government managers and administrators. Six years from now, in 2014, ICMA will celebrate its own 100-year anniversary. As we continue to celebrate the rich history of professional local government management and ICMA's contribution to its evolution, we also have a responsibility to look toward the future.

The ICMA Fund for Professional Management was created in 1985 to advance professional local government management and the council-manager form by supporting civic education initiatives as well as adoption and retention campaigns around the country. As contributions have increased in recent years, the fund's ability to effect change has also expanded.

In 2008, the fund gave approximately \$29,000 to groups advocating for the retention of the council-manager form in Decatur, Illinois; Federal Way, Washington; and Hillsborough County, Florida. It also contributed \$10,000 to the North Carolina City and County Management Association (NCCCMA) in June as it is updating and republishing its successful

textbook *Local Government in North Carolina* that can be used in classrooms from kindergarten through the 12th grade. As part of the agreement between ICMA and NCCCMA, ICMA will be able to make the text available on its Web site for use by other associations.

To further support the future of professional local government management, the fund launched the Second Century Campaign at the ICMA Annual Conference in September to raise money for the development of a nationwide public awareness campaign promoting the profession and the value it brings to communities. Donations from individuals and state associations earmarked for the Second Century Campaign will be used to develop the concept for this campaign, which will then be presented to large funders to finance its actual implementation.

The fund's contribution to the profession in general—and communities specifically—is essential, especially as we embark on the next century of professional local government. As the end of the year draws near, consider making a tax-deductible contribution by visiting [icma.org/fund](http://icma.org/fund) or contacting Abigail Lundy, manager of fund development, at [fund@icma.org](mailto:fund@icma.org).